Central Bering Sea Pollock Workshop

conducted under the

Convention for the Conservation of Pollock Resources in the Central Bering Sea

17-21 July 2000

held at

NOAA Regional Center
7600 Sand Point Way NE
Seattle, Wa 98115-0020

Report of the Central Bering Sea Pollock Workshop
conducted under the
Convention on the Conservation and Management of Pollock Resources
in the Central Bering Sea

17-21 July 2000
Seattle, Washington

Final, 21 July 2000

Delegations from the People's Republic of China (China), Japan, the Republic of Korea (Korea), the Republic of Poland (Poland), the Russian Federation (Russia), and the United States participated in the Central Bering Sea Pollock Workshop held at the National Marine Fisheries Service (NMFS) Alaska Fisheries Science Center in Seattle, Washington, from 17-21 July 2000.

Purpose of the Workshop

At the 4th Annual Conference of the Parties to the Convention on the Conservation and Management of Pollock Resources in the Central Bering Sea (the Convention) held 8-12 November 1999 in Pusan, Korea, the Parties to the Conference agreed under item 6.D.17 of the Conference Report:

> *"...to hold a "Central Bering Sea Pollock Workshop" prior to the year 2000 Annual Conference to review the status of the Aleutian Basin pollock stock, factors affecting the recovery of the stock including prey-predator relationships, and the effects of the moratorium and its continuation. The Workshop will also consider proposals for strategies to rebuild and/or reassess the Aleutian Basin stock with a shared goal of resuming fishing operations as soon as possible consistent with sound biological principles, and to consider methodologies to determine allowable harvest levels (AHL), including the proposals made by Japan and Korea, among others.*
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> *The United States will develop the agenda in consultation with a designated contact from each Contracting Party via email. The Workshop would be held in the United States or Japan. The designated contact persons are Loh-Lee Low (U.S.), Boris Kotenev and Vladimir Radchenko (Russia), Ichiro Kanto (Japan), Chong-Guk Park (Korea), Jerzy Janusz (Poland), and Liu Xiaobing* (China)."

The Parties also agreed pursuant to item 6.G.14 of the Conference Report to add trial fishing as a topic of discussion for the proposed Central Bering Sea Pollock Workshop and to present recommendations during the 2000 Annual Conference.

Opening

The Workshop Chair, Dr. Richard Marasco (United States), opened the Workshop at 0940 on Monday, 17 July 2000. Mr. Jim Coe, Acting Director of the Alaska Fisheries Science Center, welcomed Workshop participants. The agreed Workshop agenda and format is provided in Attachment 1. A list of the participants is provided in Attachment 2. Mr. Paul Niemeier (United States) was appointed rapporteur for the Workshop.

1. Review status of Aleutian Basin pollock stock

Dr. Vladimir Radchenko, Session Chair, provided an historical overview of the Bering Sea pollock stocks. He discussed the current hypothesis that there are only two large self-reproducing pollock stocks in the Bering Sea (BS)--Eastern Bering Sea (EBS) and Western Bering Sea (WBS) stocks (Attachment 3). These stocks reached their apex in the 1980s when the biomass of the EBS stock reached 12-14 million metric tons (t) and the WBS stock was estimated at 2.5-3 million t. As the result of the great abundance of pollock on the eastern and western shelves and intense competition for food, pollock from these stocks may have migrated into the Aleutian and Commander Basins to forage. Consequently, their distribution overlapped. Information from pollock surveys and catch history in the BS from as early as the 1950s indicate that pollock year classes as large as the 1978 and 1982 year classes, which are responsible for the great abundance, appear infrequently. By the mid-1990s, pollock biomass in the EBS and WBS fell to 6-7 million t and 0.4-0.5 million t, respectively, and distribution of the stocks to deep water basins no longer occurred. The scope of pollock spawning also decreased in the Aleutian region. Dr. Radchenko stated that although a natural cause may be the primary reason for interannual variability in the rate of pollock reproduction, recruitment, and total abundance, fisheries may also have negatively impacted the pollock stocks' reproductive potential.

Dr. Radchenko noted that in the 1990s, significant ecosystem changes took place in the North Pacific Ocean and BS, initiated by environmental changes. There are signs indicating a climate shift to a colder period. These changes may have affected the variability of pollock reproduction and recruitment. Dr. Radchenko emphasized the need to conduct extensive research on pollock stock conditions to understand if such variability exhibits a regular trend.

Dr. Radchenko reviewed the results of research surveys conducted in the Central Bering Sea (CBS--also known as the "Donut Hole") and Aleutian Basin (AB) and trial fishing in the CBS in the mid-1990s. He observed that the decrease in the pollock catches in the AB seen in the late 1980s–early 1990s proceeded at the same time as the reduction in the EBS stock biomass and hypothesized that there is a relationship between the pollock biomass on the EBS shelf and the pollock catch in the AB. Although there was considerable discussion among the participants regarding this possible relationship, no consensus emerged.

Concerning the current status of BS pollock stocks, the EBS stock biomass has stabilized at approximately 6 million t, however no strong year classes have emerged. The Bogoslof Island spawning pollock stock, which is used as an indicator for Aleutian Basin pollock biomass, remains at a low level. The AB pollock biomass has not reached a level that would allow a commercial harvest under the regime provided for in the Convention. WBS pollock stocks are currently in poor condition with a biomass of approximately 150,000 t. Because there has been a lack of strong year classes in the WBS in recent years, the earliest a strong year class could recruit into the fishery would be 2005 or 2006. Due to the current "herring epoch," a phenomenon whereby herring stocks have nearly replaced pollock stocks in the WBS deep sea zones, there is little hope of WBS pollock migrating to these zones in the near future.

Dr. Radchenko predicted that, given the low abundance of EBS and WBS pollock stocks in the 1990s, and the lack of any strong year classes emerging in recent years, there is no probability of large-scale expansion of adult pollock into the AB and CBS until at least 2005-2006.

Presentations

Dr. Akira Nishimura (Japan) reviewed the status of the AB pollock stock based on Japanese midwater trawl fisheries and research surveys (Attachment 4). He provided information from the late 1970s to the early 1990s documenting the decrease in pollock in the western and central areas of the CBS in winter and summer, respectively, and the increasing aggregation of pollock in the southeastern and eastern areas of the CBS during these seasons. He also discussed interannual variability in the growth of pollock in the AB. Japanese data showed that changes occurred in pollock distribution, pollock age composition, and pollock growth rates from the 1970s through the 1990s. Pollock collected in the 1970s and 1980s showed smaller lengths-at-age than pollock collected in the 1990s. Participants speculated on the reasons for these changes, but arrived at no specific conclusions. Changes in oceanographic conditions were presented as one possible reason.

Dr. Seok Gwan Choi presented the preliminary results of Korea's 2000 echo integration and midwater trawl survey in the CBS and Bogoslof Island area by the R/V *TAMGU 1* (Attachment 5). The biomass of pollock in the entire survey area was 487,000 t; 455,000 t in the Bogoslof Island area and 32,000 t in the continental shelf area. The pollock biomass for Area 518/CBS Convention area was 257,000 t, down from the 1999 biomass estimate of 392,537 t. Dr. Choi noted that lengths of pollock differed over the survey area. West of the Bogoslof Island area, the pollock fork length mode was 55 cm, versus 35 cm on the continental shelf and 34 cm and 42 cm in the area east of Bogoslof Island.

Dr. Bill Karp (United States) reported that these results were similar to preliminary results obtained from the research cruise of the F/V *MILLER FREEMAN* in March 2000. The U.S. pollock biomass estimate for Area 518/CBS Convention area was 270,000 t. Dr. Karp also noted that pollock size differences were seen in U.S. surveys.

Dr. Jerzy Janusz (Poland) presented the results of Poland's August 1999 trial fishing operations by the stern trawler *HOMAR* in the CBS (Attachment 6). Only two specimens of pollock were taken in a total of 10 hauls. The two pollock were taken in the eastern central part of the CBS.

The Korean delegation reported that preliminary results of Korean trial fishing in the CBS in January-February (20-25 January and 31 January-3 February) and 11-20 May 2000 produced no pollock.

Dr. Radchenko briefly recapped the presentations. **Participants requested that the record of the Workshop note that the AB pollock stock biomass has still not reached the level that would trigger a commercial pollock fishery in the CBS under the regime provided in the Convention. The pollock biomass estimate for the Area 518/Convention area from research surveys is less than in past surveys; only 257,000-270,000 t. The estimated biomass for this area in 1999 was 392,537 t.**

2. Factors affecting recovery of the stock, including prey-predator relationships

The Chair for this session was Dr. Jerzy Janusz (Poland). The question of why the pollock catch declined and has not recovered in the CBS was the discussion topic for this session. Overfishing in the CBS, as well as in neighboring areas, natural population declines, and environmental and ecological changes were mentioned as possible reasons. Two categories of predators were identified--human (fisheries) and marine birds and mammals.

The U.S. delegation handed out without discussion a paper (Attachment 7) on including predation mortality in stock assessments.

Presentations

Dr. Hidehiro Kato (Japan) gave a presentation on the assessment of impacts by marine predators on fish stocks and the ecosystem (Attachment 8). Dr. Kato stated that knowledge of three major things is needed in order to assess predator impacts: prey consumption, prey preferences, and modeling. He provided statistics showing that the consumption of all prey types by seabirds in the Bering Sea continental region during the summer (92 days) was estimated at 655,754-1,530,092 t. In the Bering Sea pelagic region, sea birds and marine mammals consume a minimum of 333,066-777,155 t and 487,000 t, respectively, during the summer period. Andrew Trites (1997) estimated that marine mammals alone consumed 9,330,000 t of food per year in FAO Area 67 and 20,380,000 t per year in FAO Area 61.

Pollock is an important prey species for top predators in the Bering Sea ecosystem, in particular several seabird species, minke whales, northern fur seals, and Steller sea lions. Dr. Kato also mentioned cases of "indirect predation" where whales and seabirds feed on organisms that pollock consume, thereby reducing the available food resource for the pollock. Dr. Kato stressed the need to model the predator-prey relationships in the Bering Sea and said that a PICES Marine Mammal and Seabird Advisory Panel has been formed to address this issue. A workshop will be held in Hakodate, Japan, in October 2000 during the PICES Annual Meeting to discuss methodology for assessing impacts of marine predators. One of the largest problems facing the group is the lack of information on the abundance of predator populations.

Differing approaches to managing predator-prey interactions were discussed. The U.S. delegation explained that U.S. fishery managers are required by law to take into account the needs of seabirds and marine mammals in the management process. U.S. managers are being required to redraw fishing areas to separate fishermen from the areas where marine mammals and seabirds are concentrated (no-fishing zones around Steller sea lion rookeries, for example). The United States has not directly fished for pollock in the Bogoslof Island area for some time and recently the entire Aleutian Island area has been closed to commercial fishing because of potential impacts on the recovery of Steller sea lion populations. Japan supports a different approach to protecting seabirds and marine mammals. Japan believes that controlling predation on pollock and focusing on the recovery of the pollock stocks will ultimately ensure the well being of seabird and marine mammal populations. The Japanese delegation conceded that enhancing the pollock resources while still preserving seabird and marine mammal populations is a difficult balancing act and much research remains to be done. The Russian delegation commented that restricted zones to protect marine mammals and seabirds in the Russian zone have had little effect on these groups.

Participants discussed the possible effects of climate change and regime shifts on BS pollock stocks. Dr. Loh-Lee Low (United States) showed the results of a paper by Hare and Mantua (1999) showing 3 different regimes occurring from 1965-1977, 1978-1988, and 1989-1997. Regime changes were determined by looking at 31 physical climatic indices and 69 biological indicators. The study showed that a fourth regime shift may be currently underway. Changes in pollock abundance in the BS correlate well to these regime shifts. Participants speculated that such shifts could account for fluctuations in the herring/pollock balance in the WBS and the decline of Steller sea lion and seabird populations in the Aleutians and EBS.

Dr. Choi (Korea) gave a presentation on factors affecting the distribution of pollock in the AB (Attachment 9). He determined that water temperature may have indirectly limited pollock distribution in the CBS in 1999 by limiting zooplankton production. A cold water band extended from the Bogoslof area into the CBS in 1999. This band may have negatively affected zooplankton production and hence aggregation of adult pollock in the area. In 1997, the cold water band did not extend into the CBS and zooplankton production was higher in the CBS, as were aggregations of pollock.

Dr. Nishimura (Japan) presented results of sea ice concentration (SIC) and sea surface temperature (SST) data analysis (Attachment 4). SST data series show an increase in SST in the southeastern BS from the 1970s to the 1990s. Over the same time period, SIC retreated northward in the winter. Changes in the oceanographic temperature and ice concentrations could be an important cause of ecosystem change.

3. Effects of the moratorium and its continuation

Dr. SungKwon Soh (Korea) chaired this session. Dr. Soh reviewed the history of fishing and the fishing moratorium in the CBS. He reminded participants that there has been no directed commercial pollock fishing in the CBS since 1993, but despite this action, pollock stocks have still not recovered. He called on participants to provide their economic and ecological or natural resource perspectives on the effects of the moratorium on their countries.

Mr. Ichiro Kanto presented Japan's viewpoints on this issue (Attachment 10). Japan classified the effects of the moratorium into biological, economic, and social categories. Biological effects include the fact that the moratorium has not produced an improvement in stock conditions. Japanese fishermen and persons in related industries expected to see the stocks begin to recover after 4-5 years of the moratorium. Consequently, Japan's fishing industry has been economically damaged. Socially, Japan's fishing and related industries have begun to lose their trust in the existing framework of the Convention.

The United States delegation reminded participants that it has taken some fisheries many years to recover. The California sardine fishery has taken 70 years to recover, and it is still at a much lower level than it was originally.

Dr. Low reviewed the effects of the moratorium on the United States. He reiterated that U.S. fishermen have foregone fishing on the Bogoslof Island pollock spawning concentrations for many years, even though the area is within U.S. waters. U.S. fishermen have also stopped pollock fishing in the Aleutian Basin area because of potential impacts on marine mammal populations. He said that, in economic and conservation terms, the United States may have suffered more than any of the Parties.

Dr. Radchenko (Russia) said that Russian fishermen also suffered large pollock harvest losses from the time of the moratorium (mostly due to overfishing in the CBS area)--approximately 600,000 t annually. Russia has made a significant effort to manage pollock stocks in the WBS in such a way as to support the recovery of these stocks. He mentioned a number of management measures Russia has taken, such as the use of pelagic trawls with mesh size in the codend no less than 110 mm, the introduction of square mesh before the codends of trawls to allow juveniles to escape, increasing the minimum size of pollock in the catch from 34 cm to 37 cm in 2001, prohibition of fisheries in areas of high juvenile concentrations, and prohibition on bottom trawling. The Russian Government also plans to prohibit directed pollock fishing in the WBS westward of 178°E in 2001. The pollock quota for the small boat groundfish fishery in the coastal zone will be capped at 30,000 t.

Mr. Tae-Won Kim (Korea) presented a Korean industry perspective on the moratorium (Attachment 11). Bering Sea fishing industries in Korea suffered tremendous economic losses when they could no longer fish in the CBS. Since 1992, the number of fishing companies and fishing vessels has been reduced to 15 and 32, respectively, from a total of 20 companies and 46 vessels prior to moratorium. Mr. Kim said that from 1993 to 1998, 10 fishing companies have been dishonored or bankrupted due to the moratorium. Other results of the moratorium include a greater dependence on foreign imports to meet domestic demand, a decrease in price of domestically produced pollock due to the cheaper imports, and loss of a major source of protein for the Korean people.

There was some discussion over whether the hardships suffered by Asian fishing companies could be attributed solely to the decline of the CBS pollock fishery and the moratorium. A number of other factors had significant impacts on the economic situation in Asia, such as the stock market crash in Asia and exclusion of foreign fishing vessels from the U.S. and Russian zones.

Dr. Janusz reported that Polish companies suffered the same hardships as the other countries. Approximately 30 Polish fishing vessels were displaced from the CBS when the pollock fishery failed.

Dr. Kotenev (Russia) commented that the social consequences of the moratorium are difficult to separate from other problems. Approximately 78 percent of Russian fishing companies have a negative balance. Although the Russian Government has been supporting these companies, in the next few years a decision will be made to allow them to go bankrupt if they do not show a positive balance. Dr. Kotenev also noted a trend in migration of the population away from coastal areas, largely due to the decrease in pollock fishing.

Participants agreed that all Parties suffered economically from the moratorium on fishing and that a shared goal is to resume pollock fishing in the CBS. They also agreed that the moratorium has not been successful in restoring pollock stocks in the CBS and that other factors must also be affecting the recovery. These factors could include predator-prey interactions and oceanographic variability.

Dr. Low (United States) observed that for a recovery to take place, three things are needed: (1) adequate spawning biomass, (2) good oceanographic conditions, and (3) a reappearance of the pelagic pollock type. Unfortunately, neither the optimum spawning biomass nor the parameters for "good conditions" are known. The spawning biomass responsible for the strong 1978 year class was relatively small--perhaps 2 million t. By this standard, there would appear to be an adequate spawning biomass for pollock recovery when environmental conditions are favorable.

Several delegations pointed out that when the Parties consider rebuilding the AB pollock biomass, they must also consider the management of pollock stocks surrounding the Basin. Intensive fishing in areas adjacent to the AB may impact pollock recovery. The U.S. delegation reminded the participants that U.S. EEZ pollock stocks are dominant stocks and little is known about how much they contribute to the AB area. U.S. fishery scientists believe there is a tendency for the stocks to remain in "good condition" areas. They do not believe that the CBS is such an area; it is not a preferred feeding area for pollock. Pollock may only use the CBS as a migration route or as a "spillover" area from the EBS shelf. They don't believe that the "spillover" effect is a common occurrence.

4. Proposals for strategies to rebuild and/or reassess the Aleutian Basin stock with a shared goal of resuming fishing operations as soon as possible

Dr. Tokimasa Kobayashi (Japan) chaired the session. He began by outlining the three main activities for the session: (1) a review of pollock stock structure in the BS, (2) clarification of the migration routes of the stocks distributed in the BS, and (3) a proposal for an appropriate fisheries management system based on the scientific data (Attachment 12).

Dr. Kobayashi explained that Japanese data supports the hypothesis that there are three distinct stocks in the BS--the WBS stock, EBS stock and AB stock. Strategies to rebuild the AB stock are dependent upon whether its migration routes overlap with neighboring pollock stocks. If migration routes overlap, then appropriate fisheries management action may be needed in neighboring areas to protect the AB stock. If migration routes don't overlap, then a continuation of the moratorium may be necessary until the AB stock has sufficiently recovered. In either of the above cases, a continuation of the moratorium may prove necessary. A third strategy for rebuilding the AB stock is to restore essential fish habitat favorable to pollock production. Participants agreed that assessment and monitoring is necessary to study recruitment success. To achieve this, Parties need to conduct studies of pollock population structure, collect more biological and environmental data, and continue to conduct surveys to estimate spawning stock biomass and age composition and to detect the emergence of strong year classes.

There was general discussion on the size and nature of the pollock spawning ground. The United States and Korea believe that the spawning grounds for AB pollock are narrow and well defined. Japan believes that the size of the spawning area is dependent on the abundance of the spawning stock; i.e., the greater the abundance, the broader the spawning grounds.

There was also discussion about the hypothesis that there is no distinct AB stock.

The Russian side reiterated its belief that the AB stock is not separable from the EBS stock, but may consist of pelagic-type pollock from the EBS stock. Russia also stated that the success of year class survival is dependent on whether the ocean currents transport eggs and larvae on- or offshore. If onshore, the year class is usually successful. If offshore, along the slope, then the year class is only average or below average because of inadequate food supply. Dr. Radchenko (Russia) gave a detailed presentation on the ocean currents in both the EBS and WBS and their effects on pollock spawning and survival.

The U.S. delegation supported the stock hypothesis that there is no self-sustaining pollock stock in the Aleutian Basin. The United States believes that food resources are not adequate in the CBS to support a large population of pollock.

Russia commented that it difficult to survey the pollock spawning areas in northern waters because of the ice coverage, but said that Russia has evidence of pollock spawning in the Navarin Basin area.

Dr. Kobayashi emphasized to the participants the need to agree on the migration route of the AB pollock stock in order to discuss appropriate management measures. Participants did not reach a consensus on the migration route. The U.S. delegation commented that once the fish reach age 1, no one really knows where they go. Dr. Kobayashi said that it appeared from the discussion that the AB pollock stock migration route overlaps the EBS pollock stock migration route. If that is the case, participants will need to consider management measures in adjacent waters. Dr. Low reiterated the management actions the United States takes on pollock stocks in its waters (aspects of U.S. management were discussed in earlier sessions). He added that the exploitation rate on the EBS stocks is low--only about 16-18 percent. Even in early years, when the abundance of pollock was quite high, the U.S. exploitation rate was only about 10 percent. The United States believes that this is a sustainable exploitation rate. Despite this fact, the U.S. environmental lobby is asking fisheries managers to further slow down the fishery and spread it out over time. Dr. Marasco described an area in the Bering Sea/Aleutian Islands which has recently been designated critical habitat for Steller sea lions. Fishing by large factory trawlers has been restricted and a court will likely decide by 1 August whether fishing will be prohibited in the entire area.

Dr. Radchenko reiterated the management measures taken in the Russian zone to conserve pollock (also discussed in Session 2). In addition to the measures mentioned earlier, he said that as of 2000, satellite monitoring systems are mandatory on all vessels, foreign and domestic, as a prerequisite to fish in the Russian zone.

The Korean delegation supported the use of square mesh in the upper panels of trawl cod ends as a very efficient way to allow juvenile fish escapement (Figure 1). Korea asked the United States if such mesh is employed in U.S. trawls. The United States responded that there are no restrictions on mesh size in U.S. pollock trawl fisheries. Catches of small fish are counted against fishermen's quotas, therefore, there is considerable incentive not to fish in areas with high concentrations of juveniles. U.S. research has shown that mesh size regulations are not efficient because of the high volume of fish entering the net.

Japan asked the United States if it had any information about the 1989 pollock year class, which was anticipated to be a strong year class but never materialized as such. Using year class indices, Dr. Low showed that the 1989 year class was much weaker than the 1978 year class (index of 47 vs 67). The 1996 year class had an index of only 36.

Dr. Choi presented the results of Korea's 1999 survey regarding the relationship between pollock distribution in the CBS and water temperature. Dr. Choi pointed out that because of colder in 1999, the pollock moved north and eastward as compared to 1997, when there was greater dispersal in the CBS.

<u>Summary</u>

Dr. Kobayashi briefly recapped the discussion during the session.

Participants confirmed that it is important to clarify the migration route of the AB pollock stock in order the propose strategies to rebuild this stock.

It appears that the migration route of young pollock from the AB stock overlaps with neighboring areas. The United States and Russia described the management measures that they have introduced to conserve juvenile and young pollock.

Korea noted that the introduction of square mesh windows in trawls is a highly efficient method to avoid bycatch of juvenile pollock. The United States stated that U.S. research has shown that mesh size regulations are not efficient because of the high volume of fish entering the net.

All participants reconfirmed the need to continue monitoring and assessment to study pollock recruitment success in the Bering Sea.

5. Methodologies to determine allowable harvest levels

Dr. Richard Marasco (United States) chaired the session. Dr. Marasco reviewed the Convention procedures for determining the allowable harvest level (AHL), which are found in Article VII.1 and Article VII.2 and Annex Part 1(a)-1(d). He also reviewed proposals for alternate methods for determining the AHL submitted by Korea and Japan to the Parties at the 4th Annual Conference in Pusan, Korea.

The Korean delegation questioned the utility of discussing alternative methodologies of determining AHLs if the coastal states refuse to deviate from the AHL methodology provided in the Convention. The U.S. delegation defended the procedure outlined in the Convention, stating that it is the clearest methodology and that it was the result of compromises by all Parties when they were negotiating the Convention. It also parallels the U.S. fisheries management philosophy that there is no fishing when there is low fisheries biomass. The U.S. side said that it doesn't see how it can deviate from the Convention AHL methodology when the pollock stock biomass is so low, and the discussion of alternative methods may be premature. However, the U.S. side made it clear that it was not precluding consideration of alternative methodologies forever, only until the pollock stocks show signs of recovering. It commented that there is still a lack of information about BS pollock stocks. Migration patterns, stock overlap, and biomass is still not clear. Parties don't know much more now about the resource than they did when the Convention entered into force.

The Japanese delegation said that its view of the value of the session was much the same as the Korean side. Dr. Kobayashi reiterated the Japanese view that even if the biomass in the specific area is less than 1 million t, the Parties can still establish a safe AHL. Such an AHL may be very small.

In an effort to focus participants on the types of information needed to come up with new AHL methodology, the Chair identified three things managers need: (1) a biomass estimate, (2) an appropriate fishing mortality rate, and (3) an appropriate management approach. Under (3), there are two alternative philosophies--allow a fishery irrespective of the stock biomass, or set a threshold biomass level below which the quota would be set to zero (currently 1.67 million t pursuant to the Convention).

Dr. Janusz (Poland) remarked that the Convention was established by politics; that the 1.67 million t threshold was not based on scientific data, but resulted from the willingness of Parties to reach a compromise. He acknowledged that research cruises and trial fishing in the CBS show that there are no fish and that the biomass is below the threshold level. However, he said that a cautionary AHL should be established based on the current estimated biomass. If pollock do not appear in the CBS in commercial concentrations, then economics will force a cessation of commercial fishing.

The Korean delegation supported the Polish delegation's views on the origin of the threshold number. Dr. Soh remarked that, from the social perspective, fishing companies need hope that they can still catch fish in the CBS. Without research the entire CBS area, scientists really don't know if there are any fish. Any recovery of the stocks would be quickly discovered if many companies' vessels are deployed in the area for a limited time.

Dr. Kobayashi mentioned the Japanese view of the two management philosophies identified by the chair from the scientific viewpoint, pointing out the positive and negative aspects.

Dr. Radchenko illustrated the Russian view of this issue with the following table:

Year	Biomass in Bogoslof Region (million metric tons)	Catch in the CBS (million metric tons)
1988	2.4	1.40
1989	2.1	1.45
1990		0.92
1991	1.3	0.29
1992	0.88	0.01
1993	0.68	0.002

He said that from the political viewpoint, the Convention was signed by all Parties. Use of the 1.67 million t level that was established by the Parties could be considered application of the precautionary approach. This number is a target reference point as defined in Annex II (Guidelines for the Application of Precautionary Reference Points) of the Agreement for the Implementation of the Provisions of the United Nations Convention on the Law of the Sea of 10 December 1982 Relating to the Conservation and Management of Straddling Fish Stocks and Highly Migratory Fish Stocks. From the chart above, the biomass level of 2.4 million t is the level where the catch is sustainable. Below this threshold, the catch falls rapidly. Therefore, we have a threshold reference point below which the pollock stock declines. If Parties desire to revise the level of 1.67 million t, the table suggests that it may need to be increased, rather than decreased.

Russia agreed that from the biological point of view, the 1.67 million t threshold is the result of consensus. There is a good correlation between the biomass in the Bogoslof Island area and the catch level in the CBS. If the biomass falls, the catch level also falls. A revision of the threshold level may upset recovery chances. From an economic point of view, establishing an AHL now would lead only to economic losses and increase the dissatisfaction of the fishermen with the Convention process. It, too, would complicate the process of stock recovery.

The Korean delegation agreed with Russia's point that sustained economic losses could completely alienate the fishermen from the Convention process, but said that companies expect some probability of success and some fishing companies are willing to risk economic loss for this small probability. The Korean side suggested that perhaps Parties could allow a fishery to occur for a limited time--one year for example. This could allow scientist to take advantage of the data collected by the companies. Dr. Soh said that fishermen want first-hand knowledge of the pollock situation.

Dr. Low (United States) brought the discussion back to the point made by Russia about the biomass/catch relationship. He said that Russia may be right that the threshold needs to be revised upward. The 1.67 million t figure is not so arbitrary as some Parties believe. It was reached in the past and can be reached again. AB biomass almost reached the threshold point in 1997.

To stimulate discussion, it was suggested that the pros and cons of the two management approaches identified (threshold versus quota at any biomass) be described. This line of discussion was abandoned during the second half of the Session when it became apparent that participants were unable to make any progress on closing the gaps between the two approaches. It was suggested that in order to get a better biomass estimate, it might be productive to try to time trial fishing by the Parties with the annual surveys conducted by the R/V *MILLER FREEMAN* and other countries' research vessels. This would provide scientists with additional data and allow the fishermen an opportunity to see for themselves whether there are any fish, thereby lessening the political pressure on Parties. The idea would be to incorporate trial fishing in a research plan. It was suggested that a subgroup of the Parties be formed to design a plan to carry out a synoptic survey. The plan could be presented to the Parties at the Annual Conference in Shanghai in November 2000. This approach would require cooperation and support from all Parties.

Dr. Soh (Korea) pointed out the potential for changes in the spawning grounds in the Aleutian area beyond Area 518 due to regime shifts or other environmental factors. He suggested that Parties reassess the use of Area 518 in the current management approach and consider expanding the area surveyed.

Dr. Low (United States) responded that he believed that Area 518 encompasses most of the area where spawning occurs. Surveys have found that the fish disappear very quickly as the survey vessels move westward. He speculated that the Aleutian Basin spawning stock may not actually represent 60 percent of the CBS biomass, but some other percentage.

The Chair said that coordinated trial fishing and surveys could help answer such questions and concerns. It would require the participation in an integrated comprehensive activity at a limited point in time. Parties may also need to be willing to do this for more than one time.

The Russian delegation made a concerted effort to try to find a way to bring the two management points of view closer together by identifying the main gaps in the assessment of the AB pollock stocks. Regarding the fact that the history of pollock stock evolution is unknown, in terms of both time and spawning ground location, Russia said it has fragmented information but believes that if the Parties combine all their data under the framework of a new research program, a relatively complete picture as far back as the early 1980s can be developed. Another gap identified is that there is no retrospective analysis of AB pollock stock fluctuations. There are now many new methods to analyze stock fluctuations. Russia believes that perhaps the Parties can delineate in the new research program appropriate methods for studying the retrospective studies of the analysis of stock fluctuations and obtain new data. Regarding the question of the main causes for strong and weak year class occurrences, Russia thinks that the Parties must focus on this in future years. To address the question of when the next period of strong year classes will appear, Russia believes that Parties need to carefully study the periodicity of productive and unproductive periods in the BS. Concerning the question of what proportion of the pollock stock contributes to the spawning aggregation in the Bogoslof area, Parties should determine if it is possible to separate the slower (pelagic) growing part of the stocks.

Two additional gaps include the questions of where age 0-4 AB pollock feed, and where pollock migrate from to the AB for feeding and spawning. It is common knowledge that pollock move onto the shelf to feed, but Parties have also received new information at this workshop that dense concentrations of young pollock occur in bays along the Aleutian Islands.

The Russian delegation suggested that Parties specify in the new research program that the program's main objective is to solve the problem of establishing an AHL for the CBS.

It was agreed that a draft research plan would be developed in time for introduction and discussion at the next Annual Conference. The plan would focus only on the most important questions about the AB pollock stock. The steering committee responsible for this workshop will be tasked to develop the draft research plan. Once there is a draft plan, participants will need to seek the support of all the Parties to implement the plan.

Dr. Low (United States) suggested that Parties time their surveys so that they are synoptic. Synoptic surveys could address the questions of spawning locations in the AB and the migration and geographic distribution of the stocks. Dr. Low suggested that in the near term, Parties limit coordinated research to conducting such a survey and look for pollock sign. Dr. Marasco added that biological samples could be collected at the same time.

Dr. Soh reiterated the Korean desire to incorporate commercial fishing vessels in such an effort.

Dr. Nishimura (Japan) cautioned the participants that some Parties may have difficulties with accepting a new research plan.

Delegations were urged to go back to their countries and discuss what is planned and what is intended. The members of the group charged with developing the plan should communicate with each other within the next few weeks to exchange information on what their countries see as feasible.

Japan emphasized that the continuous research on the status of pollock spawning locations in the AB and migration patterns and geographical distribution of pollock stocks is indispensable, because those factors can change dynamically in accordance with fluctuations in stock abundance and oceanic environmental conditions.

Summary

Parties agreed that there are still differences in opinions relative to the procedures and approaches that should be used to establish pollock AHLs. There is support among some Parties to the Convention to establish pollock quotas at pollock biomass levels below the 1.67 million t threshold. Other Parties are of the opinion that the methods outlined in the Convention are appropriate, given the current condition of the pollock stocks. In light of the fact that these differences exist, the Parties believe that the best approach to narrowing these differences is to institute a research plan that begins to address some of the important questions that they have about pollock stocks in the Aleutian Basin. Parties recognize that this is a large undertaking that would require many years and a lot of money, staff, and research resources. Therefore, instead of coming up with a comprehensive list of questions to focus attention on, Parties decided to narrow the scope down to two questions to initiate such a research program:

(1) What are the polllock spawning locations in the Aleutian Basin?

(2) What are the migration patterns and geographical distribution of pollock stocks?

Parties decided to provide these questions to a subgroup consisting of the organizers of the Bering Sea Pollock Workshop (Loh-Lee Low (United States), Boris Kotenev and Vladimir Radchenko (Russia), Ichiro Kanto and Tokimasa Kobayashi (Japan), Chong-Guk Park (Korea), Jerzy Janusz (Poland), and Liu Xiaobing (China)). This subgroup will be charged with developing a research plan to address the two questions above. The use of both industry (commercial fishing vessels) and government resources would be considered in the development of this plan. These resources would be used to comprehensively survey the Aleutian Basin. During the process of conducting such a survey, emphasis would be placed on the collection of both data that would provide information on biomass and distribution, as well as biological samples, such as otoliths, scales, and other measures that would help Parties better define the biological characteristics of the stocks.

The goal of the subgroup is to have a draft research plan available for introduction and discussion at the 4th Annual Conference in Shanghai, China, in November 2000. Preliminary information from the Parties on project feasibility should be submitted to Dr.Loh-Lee Low no later than 15 August 2000.

Dr. Low will consult with U.S. fisheries survey scientists to get their input on what type of research program might be possible. He will then draft an initial research plan and distribute it to all Parties for comment no later than 15 August 2000.

6. Terms and Conditions for Trial Fishing

Dr. Loh-Lee Low (United States) chaired the sixth session. Dr. Low began the session by reviewing Article X.4 of the Convention regarding the authorization of trial fishing operations in the Convention area for years in which the AHL is zero. He also reviewed the requirement for a research plan for trial fishing and emphasized the need for the Parties to agree on when such plans should be submitted to the Scientific and Technical (S&T) Committee for evaluation and approval. Dr. Low identified a number of issues that still need to be resolved by the Parties under the umbrella of terms and conditions for trial fishing. These include observer coverage, data collection and analysis, and the submission of trial fishing reports. In regard to the last issue, Dr. Low commented that the Parties have been very good about reporting.

<u>Trial Fishing</u>

Mr. Kanto presented Japan's view on the key issues under this session (Attachment 13). He commented that Japanese fishermen are highly interested in conducting trial fishing, despite the fact that they have never done so in the past. Japan believes that trial fishing can help fill in many of the existing information gaps regarding the pollock stocks in the CBS. However, to promote trial fishing, Japan believes that some technical changes need to be made in the timing of the requirements for submitting trial fishing plans and information on fishing vessels participating in trial fishing. Regarding the current requirement for fishing companies to notify the Parties 1 month in advance of beginning trial fishing, he said that Japanese companies find this difficult to comply with because vessel schedules are influenced by catch conditions and other factors. He proposed that fishing companies be allowed confirm trial fishing intentions or changes in plans no less than 2 weeks prior to beginning trial fishing. In summary, Japanese companies would still submit preliminary trial fishing information 1 month in advance, but would confirm or revise this information, if necessary, to the Parties no less than 2 weeks before trial fishing actually commences.

The Korean and Polish delegations supported the Japanese proposal for changing the notification requirements. Both delegations said that their fishing companies had experienced similar difficulties in complying with the notification requirements.

Captain Vince O'Shea (United States) commented that in the past, the United States has tried to deploy a monitoring and compliance vessel to the Convention area during the trial fishing periods.

Japan and Russia have also dispatched patrol vessels. He asked the other delegations what impact a 2-week notice would have on their countries' ability to have a patrol vessel present in the Convention area during trial fishing.

The Japanese side explained that it would have little effect on Japan's ability to deploy a patrol vessel to the area. The Fisheries Agency of Japan (FAJ) determines patrol plans before starting each fiscal year, so the decision to dispatch a patrol vessel to the CBS is decided before implementing the fiscal plan. Japanese patrol vessels spend approximately 1 month of the year in the BS. The timing of deployment in the BS depends on other control plans and the availability of vessels. Japan said it understands that the possible cooperation of patrol activities with other Parties is useful and makes enforcement efforts more efficient.

Dr. Low asked the Japanese delegation if Japan intends to present trial fishing plans to the S&T Committee for review and approval. Japan said it would do so if trial fishing plans are solidified at the time of the Committee meeting. If trial fishing is still uncertain at that time, then Japan would like to submit them no less than 1 month in advance of trial fishing.

Dr. Janusz (Poland) stated that Parties should provide some general information to the S&T Committee to indicate that they are interested in conducting trial fishing. More specific information could be sent to the Parties 1 month prior to beginning trial fishing. He used Poland's submission for trial fishing for 2000 as an example. He said that Parties need to be realistic and not set too tight a schedule.

Dr. Low summarized the Japanese proposal and used the 2000 Cruise Plan for Polish Fishing Trial Operations submitted to the S&T Committee at the 4th Annual Conference as an example of the kind of detail that is required.

Mr. Kanto (Japan) commented that the actual names of the vessels to be deployed may not be known at the time of the S&T meeting, so Japan could only notify the other Parties of its intent to conduct trial fishing at that time. Dr. Janusz said that there is no need to specify vessel names and the precise timing of trial fishing operations at the Annual Conference. An indication of intent is sufficient. He endorsed the procedure used by Poland.

Parties examined the example form provided by Poland and agreed that the type of information provided on the form appeared adequate. Captain O'Shea asked the participants if the form could include the proposed number of vessels companies planned to use in trial fishing operations. The majority of participants felt that the number of vessels could be supplied at a later time; the form was intended as a general notification only. Poland pointed out that the actual number of vessels allowed to fish at any one time from each Party is determined on an annual basis at the Annual Conference, so it is difficult to predict how many vessels will be involved. The Terms and Conditions for Trial Fishing for 2000 specify that only two vessels from each party will be allowed to conduct trial fishing operations in the CBS at any one time. Terms and Conditions for 2001 will be determined at the 5th Annual Conference in Shanghai.

Captain O'Shea (United States) observed that the Terms and Conditions provides an opportunity for a Party to obtain additional scientific information if it places an observer on a trial fishing vessel of another Party. He asked the participants how such arrangements might be made to do this.

Dr. Janusz (Poland) responded that the short notice period did present some problems. Prior agreement between the two Parties concerned would be a solution.

Dr. Low suggested that several additions be made to Poland's trial fishing form--the addition of a statement that the number of trial fishing vessels will be determined at the Annual Conference; the addition of a new row titled "Notification," under which Japan's notification proposal can be described; and the addition of a statement under the "Scientific Observer" heading saying that if one Party wants to place an observer on the trial fishing vessel of another Party, such arrangements need to be made between the two Parties.

The Japan delegation reminded participants that the form can only be adopted formally at the next Annual Conference. It noted that China was absent from the session and that Japan would need some time to review the form.

Parties agreed to informally adopt the format of Poland's trial fishing plan (Attachment 14) at the Workshop and to seek formal adoption of the form at the 5th Annual Conference. Parties also agreed to make an effort to prepare trial fishing plans in accordance with this format for the 5th Annual Conference. The Parties will still need China's concurrence.

Number of Trial Fishing Vessels

Korea reviewed the discussion in Session 5 of the Workshop about the potential use of commercial fishing vessels to collect scientific data on pollock stocks in the CBS. Dr. Soh said that fishing companies have two main reasons for cooperating with this scheme: (1) to confirm whether or not there are any pollock in the CBS, and (2) to profit by catching them if there are enough. He said that scientific surveys can cover only a small portion of the CBS. There is a need to increase the number of survey vessels to get better coverage of the area and commercial fishing vessels could fulfill this need. Dr. Soh said that Korea would be willing to consider placing limitations, either in terms of catch or effort, on the additional vessels.

Captain O'Shea (United States) asked Dr. Soh what the Korean Government's position was on the purpose of trial fishing, for scientific purposes or for the two reasons he mentioned. Dr. Soh said he was presenting the view of the fishing companies. Captain O'Shea said that U.S. fishermen fish for profits as well. However, U.S. fishermen are not even allowed to fish in the Bogoslof region. Dr. Soh responded that, setting aside profits, the other purpose is to verify the status of the pollock stocks. Captain O'Shea asked if such an effort should entail a detailed research plan to make sure that the CBS is sampled in a systematic way. Dr. Soh reviewed the conclusions of Session 5 and the intention to incorporate commercial fishing vessels in a coordinated research plan.

The Chair reminded participants that the area under consideration is the CBS, not the U.S. or Russian zones. A question that needs to be addressed is how many vessels are needed in the CBS to enhance the data. The answer may be quite different than what the Parties come up with in a coordinated research plan.

Dr. Radchenko presented the Russian view on the issue. He said that Russia has conducted a number of research cruises in the CBS. Among other things, a single scientific survey vessel can sufficiently cover the entire CBS area (50,000 square miles) in about 25 days. It's slightly better if two survey vessels are involved in terms of more information, more samples, more transects, etc. It is Russia's opinion that the inclusion of a third research vessel adds only marginally to the data base. Dr. Radchenko continued with a discussion of the potential harm an increased trial fishing fleet could inflict on the recovery of the pollock stock. The number (12) of trial fishing vessels allowed into the CBS under the current Terms and Conditions could potentially harvest 300,000 t of pollock, enough to ensure that the pollock stock never recovers. The Russian side suggested that the number of trial fishing vessels remain at two per Party, even though this number may be too large.

The Chair asked the Parties how many vessels it would take to cover the entire CBS and if that number is greater than two per Party, what limitations should be placed on them.

Dr. Soh, after consulting with an industry representative, said that an increase in the number of trial vessels is desirable for a three reasons: (1) the sonar on a typical Korean fishing vessel can only cover an 600-700 m swath--a very small area in comparison to the size of the CBS; (2) as a safety consideration, two vessels is not enough to cover emergency situations that may occur in the CBS; and (3) it is not economically feasible for Korean fuel vessels to make the long run to the CBS to refuel only one or two fishing vessels. Dr. Soh offered a proposal to the Parties to allow sufficient numbers of vessels to search for fish in the CBS at any one time, regardless of flag, with a quota limitation. The quota limitation would be negotiated by the Parties, however, Korea envisions the limitation to be 10,000-20,000 t per year. Currently, up to a total of 12 vessels from all Parties are allowed to trial fish without any limitations on catch if they find schools, but there are seldom more than two vessels fishing at any one time. Under the proposal, one Party could send more than two trial fishing vessels if some of the other Parties are not trial fishing.

Captain O'Shea asked the Korean side how long it would take for 10 Korean fishing vessels to cover the entire CBS. The Korean delegation said it would depend on the precision of the track line and the number of tows (if a trawl survey), among other things. If no pollock schools were detected, it would take 10 Korean fishing vessels approximately 2-3 weeks to cover the entire CBS area. Captain O'Shea commented that perhaps number of vessel days could be used as the limitation. Dr. Soh added that Korean companies normally would want to conduct trial fishing in the CBS early in the year.

Dr. Low summarized the Korean proposal. He reiterated the need to have a research plan to help determine the number of vessels that would be needed. He also agreed with the need to place catch limitations on the vessels if they should actually run into fish.

Russia commented on the great difficulty of calibrating acoustic survey equipment for 10 fishing vessels. It is a great problem for only two vessels in the U.S.-Russian cooperative research surveys. The Russians believe that the acoustic data from 10 commercial fishing vessels would be unusable.

The Japanese delegation said that it would like to take Korea's request back to Japan to discuss internally. Japan will provide comments on the request at the next Annual Conference.

Russia said that it could not accept an increase in the number of vessels regardless of flag. Such a practice would have harmful ramifications for the future, when pollock stocks begin to recover.

Parties agreed to take up the issue of the number of trial fishing vessels again at the 5th Annual Conference in Shanghai.

Observer Coverage

Captain O'Shea reiterated that trial fishing activities provide opportunities for Parties who don't engage in trial fishing to gather additional scientific information. He said that this is an important consideration.

Russia spoke on the advantages of having observers. It is Russia's experience that combining the observer's data with other data provides better results. Such results are easier to accept during meetings and recommendations which incorporate observer data can be more easily accepted. Russia supported the U.S. appeal for more observers for trial fishing in the CBS.

Compliance and Monitoring Issues

Captain O'Shea (United States) said that in the past, Parties had agreed to apply the monitoring and compliance provisions for fishing in the CBS to trial fishing. The United States thinks this is a useful concept. It allows fishermen to become familiar with the procedures (and compliance officials) that will be used when a fishery resumes in the CBS. The United States hopes that Parties will continue to use these procedures when they approve trial fishing terms and conditions at the next Annual Conference. This will be the U.S. position at the next Annual Conference.

Captain O'Shea said that several Parties have asked who the proper U.S. official is to receive notices when trial fishing vessels enter the CBS. The United States has also encountered problems providing information to Parties because previous information on contact persons is incorrect. Captain O'Shea asked the Parties to review the list of contact persons for compliance and monitoring issues (Attachment 15) and correct it if necessary. He asked that any corrections be given to him at the Workshop or faxed to the U.S. Coast Guard at the facsimile number on the list. If available, e-mail addresses should be included. The preferred communication method is by facsimile, however, e-mails can be used as a secondary method.

Transponders

Captain O'Shea reminded participants that provisions of the Convention and Terms and Conditions for Trial Fishing require vessels to have transponders and that this information be made available to the other Parties. He described a problem that arose this year in regard to access to transponder data. In the past, fishing vessel transponders sent information to an INMARSAT receiving station, and the station made the data available to Parties for a fee. However, this year INMARSAT said it will not release the data unless it has written permission from the fishing vessel. Captain O'Shea asked Parties to ask their fishing vessels to provide such a letter to their Governments when they desire to fish. When the Government notifies the Parties of the fishing, it should provide the Parties with a copy of the letter. The Parties can then send the letter to INMARSAT, who will then release the data. Captain O'Shea provided participants with a sample letter showing the kinds of information INMARSAT requires (Attachment 16).

The Korean delegation said that the form appears to be acceptable but that Korea would need more time to study it. Korea would like to discuss the new procedure again at the next Annual Conference. Japan and Poland indicated that they had already received a sample letter.

Data Collection and Reporting

Parties expressed satisfaction with the level of trial fishing data collection and reporting to date

Central Bering Sea Pollock Workshop

conducted under the

Convention for the Conservation of Pollock Resources in the Central Bering Sea

2000 July 17-21

held at

NOAA Regional Center
7600 Sand Point Way NE
Seattle, Wa 98115-0020

(206) 526-4190

Central Bering Sea Pollock Workshop
NOAA Regional Center, 7600 Sand Point Way NE, Building 4, Room 2079
2000 July 17-21

At the 4th annual conference of the Parties to the Convention on the conservation and management of pollock resources in the central Bering Sea held during November 8-12, 1999 in Pusan, the Conference agreed to thefollowing proposal under item 6.D.17 of the conference report:

> *"The Parties agree to hold a "Central Bering Sea Pollock Workshop" prior to the year 2000 Annual Conference to review the status of the Aleutian Basin pollock stock, factors affecting the recovery of the stock including prey-predator relationships, and the effects of the moratorium and its continuation. The Workshop will also consider proposals for strategies to rebuild and/or reassess the Aleutian Basin stock with a shared goal of resuming fishing operations as soon as possible consistent with sound biological principles, and to consider methodologies to determine allowable harvest levels (AHL), including the proposals made by Japan and Korea, among others.*

Members of the Organizing Committee are: Loh-Lee Low (U.S.), Boris Kotenov and Vladimir Radchenko (Russia), Ichiro Kanto (Japan), Chong-Guk Park (Korea), Jerzy Janusz (Poland), and Liu Xiaobing (China)." Under item 6.G.14 of the conference report, the Parties also agreed to add trial fishing as a topic of discussion for the proposed CBS Pollock Workshop and present recommendations during the 2000 Annual Meeting.

Proposed Agenda
Workshop Chair: Dr. Richard Marasco
Rapporteur: (Paul Niemeier)

July 17 -- Monday 9:00 am
1. Review status of Aleutian Basin pollock stock
(Session Chair: Vladimir Radchenko)
Summary of Issues by Session Chair
Papers and/or Comments by Contracting Parties
Discussion led by Session Chair

July 17 -- Monday 1:30 pm
2. Factors affecting recovery of the stock including prey-predator relationships
(Session Chair: Jerzy Janusz or Alternate)
Summary of Issues by Session Chair
Papers and/or Comments by Contracting Parties
Discussion led by Session Chair

July 18 -- Tuesday 9:00 am
3. Effects of the moratorium and its continuation
(Session Chair: SungKwon Soh)
Summary of Issues by Session Chair
Papers and/or Comments by Contracting Parties
Discussion led by Session Chair

July 18 -- Tuesday 1:30 pm
4. Proposals for strategies to rebuild and/or reassess the Aleutian Basin stock with a shared goal of resuming fishing operations as soon as possible
(Session Chair: Tokimasa Kobayashi)
Summary of Issues by Session Chair
Papers and/or Comments by Contracting Parties
Discussion led by Session Chair

July 19 -- Wednesday 9:00 am
5. Methodologies to determine allowable harvest levels
(Session Chair: Richard Marasco)
Summary of Issues by Session Chair
Papers and/or Comments by Contracting Parties
Discussion led by Session Chair

July 20 -- Thursday 9:00 am
6. Terms and Conditions for Trial Fishing
(Session Chair: William Hines)
Summary of Issues by Session Chair
Papers and/or Comments by Contracting Parties
Discussion led by Session Chair

July 21 -- Friday 9:00 am
Continuation of Previous Discussions
Wrap-up and Overview (Richard Marasco)

Hotel Information:

The following hotels are suggested:

Edmonds Meany Hotel (University District)
4507 - Brooklyn NE, Seattle Wa 98105
206-634-2000 Fax (206) 547-6029
Website:
http://www.meany.com/

Silver Cloud Hotel (University Village District)
5036 - 25th Ave NE, Seattle, Wa 98105
(206) 526-5200 Fax (206) 522-1450
Website:
http://www.scinns.com/universi.htm

Seattle University Travel Lodge (University Village District)
4725 - 25th NE, Seattle, Wa 98105
(206) 525-4612 Fax (206) 524-9106
Website:
http://www.ahoteldeal.com

Suggested Slides that would be used by Session Chairs to Introduce Discussion Topics

Introduction Session

Session 1: Review the Staus of the Aleutian Basin Pollock

Session 2: Factors Affecting Recovery of the Stock, including Prey-predator Relationships

Session 3: The Effects of the Moratorium and Its Continuation

Session 4: Proposals of Strategies to Rebuild and/or Reassess the Aleutian Basin Stock with a shared Goal of Resuming Fishing Operations as soon as possible

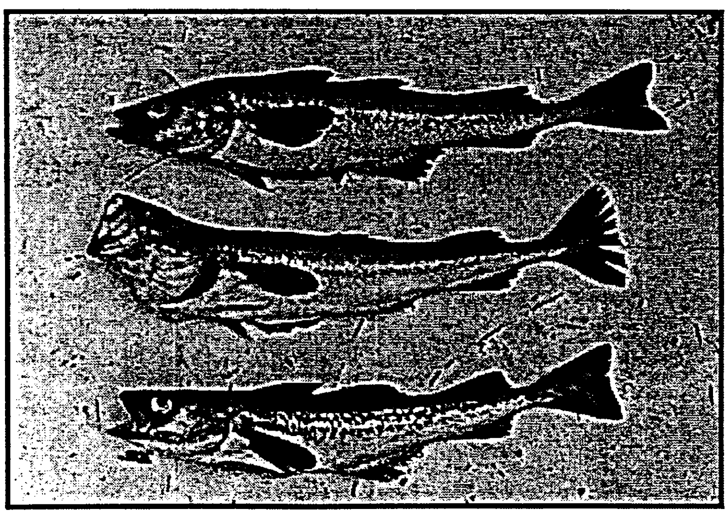
Session 5: Methodologies to Determine Allowable Harvest Levels

Session 6: Terms and Conditions for Trial Fishing

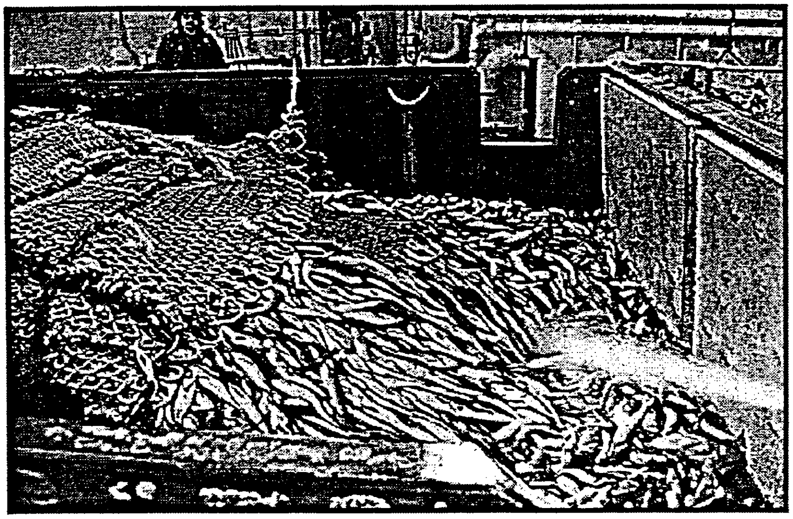
Central Bering Sea Pollock Workshop, July 17-21

- Workshop Chair: Richard Marasco
- Organizing Committee -- Low, Kotenov, Radchenko, Kanto, Park, Janusz, Liu
- 5-Day Workshop
- 6 Sessions -- Conducted by Session Chairs
- Summary & Closing Session

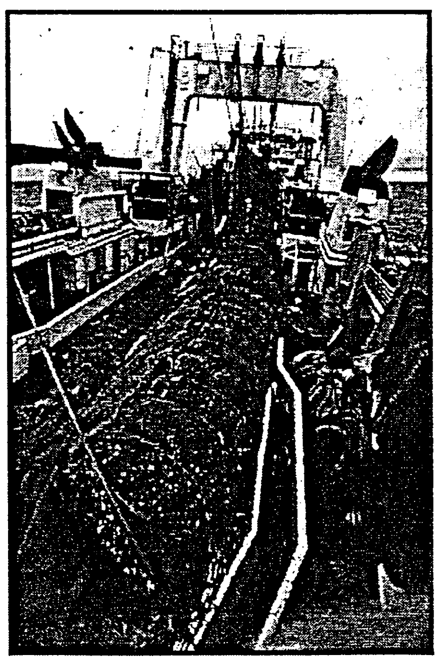
Pollock



Commercial Fishery

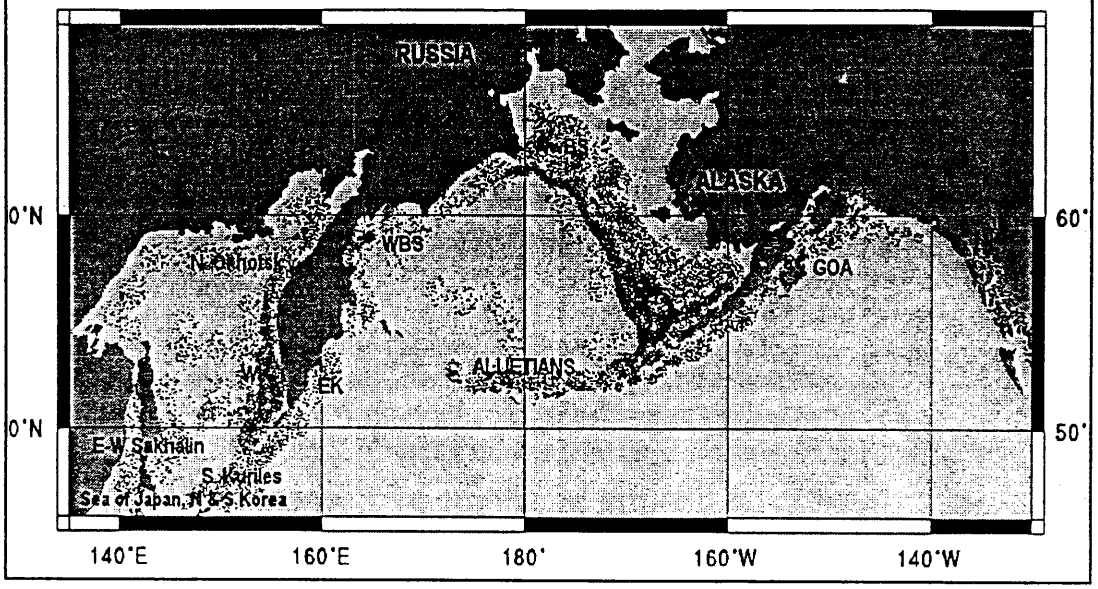


Cod-End of Trawl Net

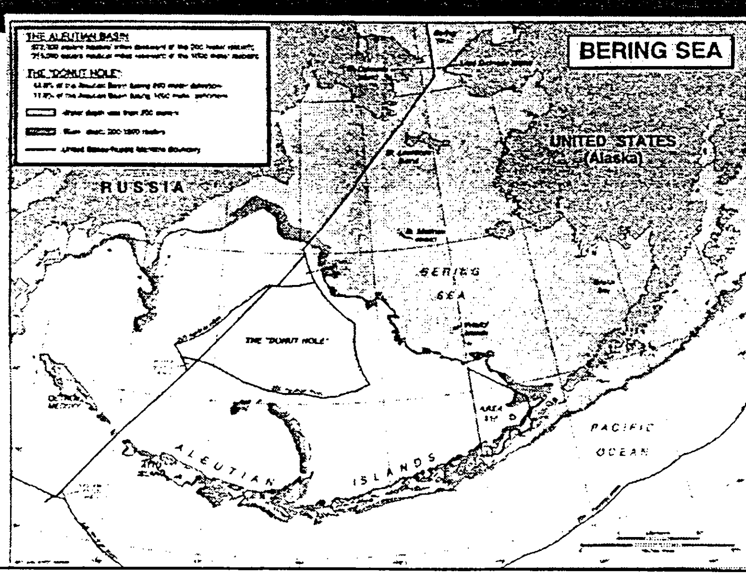


170-Ton Catch

Distribution of Pollock



Donut Hole Area



Instructions from Annual Conference

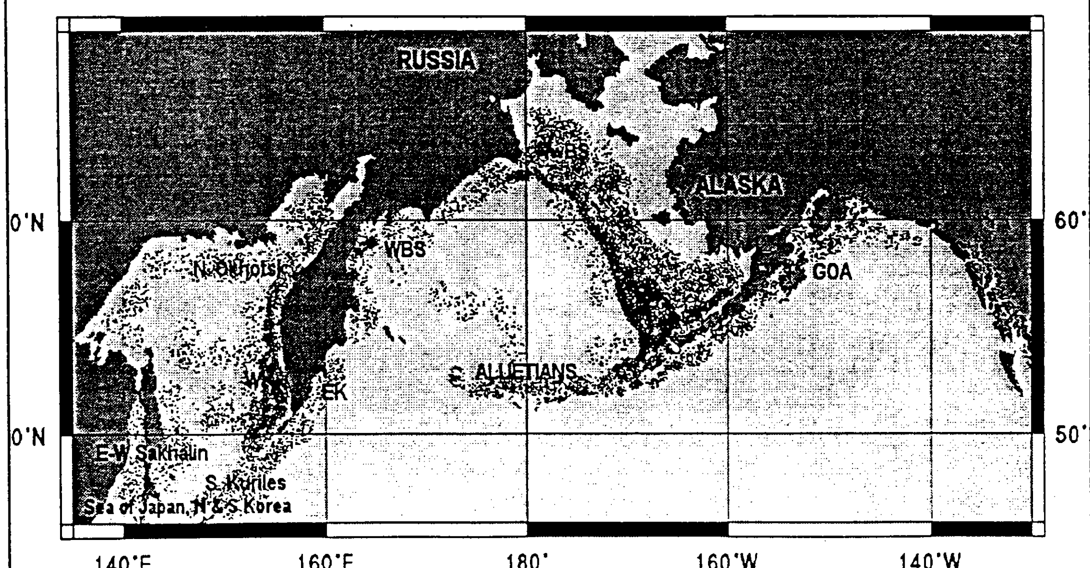
Organize Workshop prior to 2000 Annual Conference

- 1. Purpose is to Review:
  - Status of Aleutian Basin pollock stock
  - Factors affecting recovery of the stock, including pre-predator relationships
  - Effects of the moratorium and its continuation
  - Consider proposals for strategies to rebuild and/or reassess the Aleutian Basin stock with a shared goal of resuming fishing operations ASAP consistent with sound biological principles
  - Consider methodologies to determine AHL
- 2. Add Trial Fishing as a topic of discussion

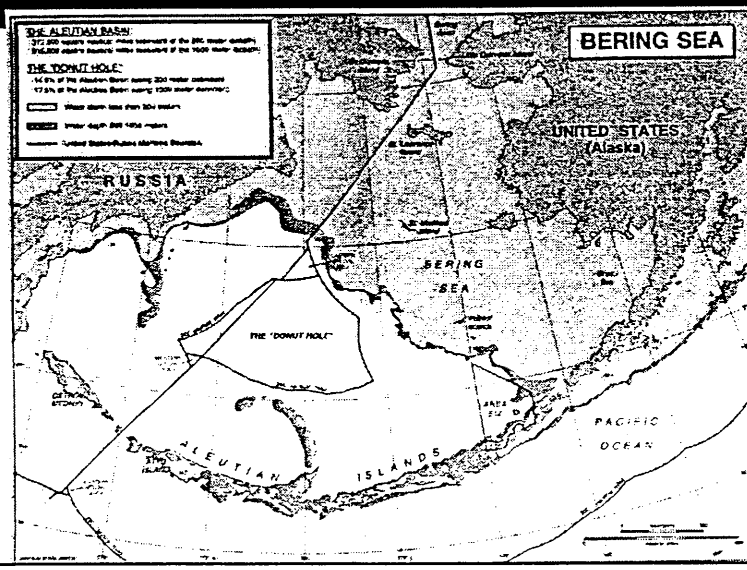
Session 1

- **Review the Status of the Aleutian Basin Pollock Stock**
- **Session Chair: Vladimir Radchenko**

Distribution of Pollock

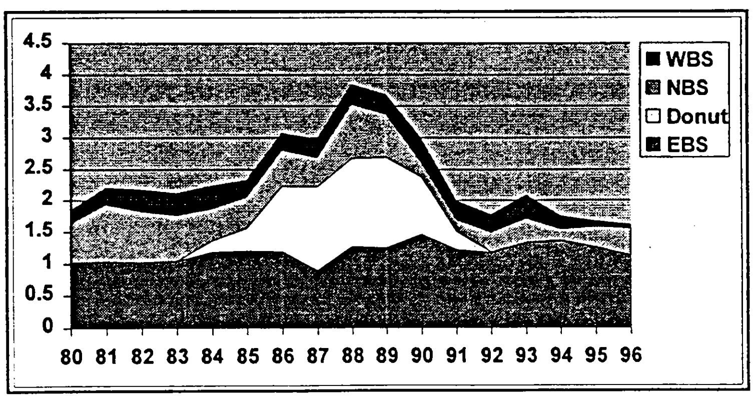


Donut Hole Area



Pollock Catch History Bering Sea 1980-96

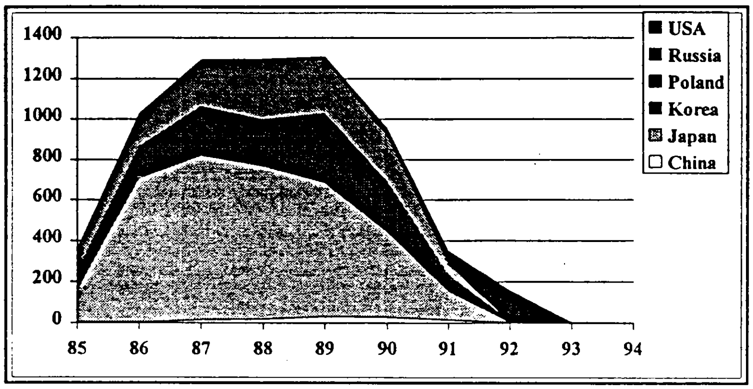
Catch in MMT



YEAR

Pollock Catch History Donut Hole Area 1985-94

Catch in 1,000 T



YEAR

Stock Assessment Procedures for Donut Hole Area

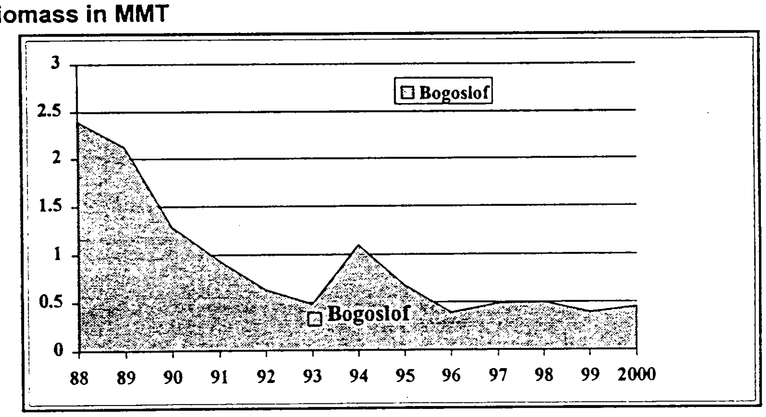
- 1. Hydro-acoustics Surveys
  - In Donut Hole Area and Aleutian Basin
  - In Bogoslof Area
- 2. Catch History Analyses
  - Limited Catch History and Details
- 3. Bering-Sea wide Age Structured Model
  - Subject of 3 Pollock Workshops (1991, 1992 & 1994)
- 4. Trial Fishing

Historical Surveys Conducted by the Parties in Donut & Vicinity

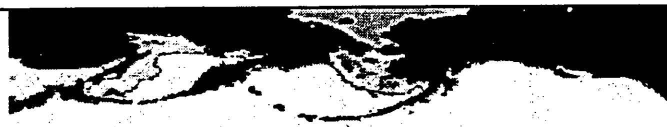
- 1. China -- One time by Bei Dou
- 2. Japan -- Various Years & Vessels
- 3. Korea -- Various Years & Vessels
- 4. Poland -- Annually be Trial Fishing Vessels
- 5. Russia -- In Russian EEZ only
- 6. U.S. -- Various years in Bogoslof Area by Miller Freeman and annually in U.S. EEZ

Bogoslof Pollock Survey Biomass 1988-2000

Biomass in MMT



YEAR

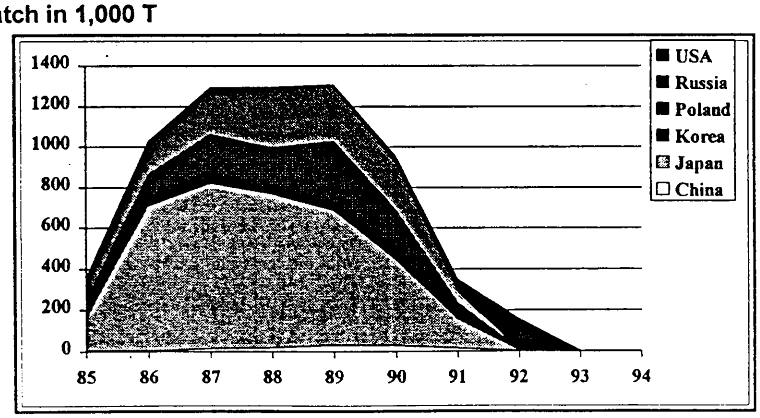


Session 2

- Factors Affecting Recovery of the Stock -- Including Prey-Predator Relationships
- Session Chair: Jerzy Janusz
- Assisted by: Pat Livingston

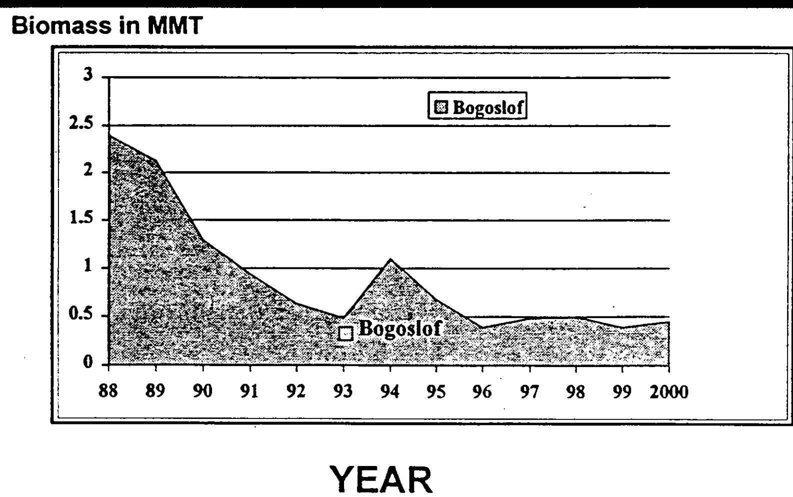
Donut Hole Area Pollock Catch History
Moratorium Since 1994

Catch in 1,000 T

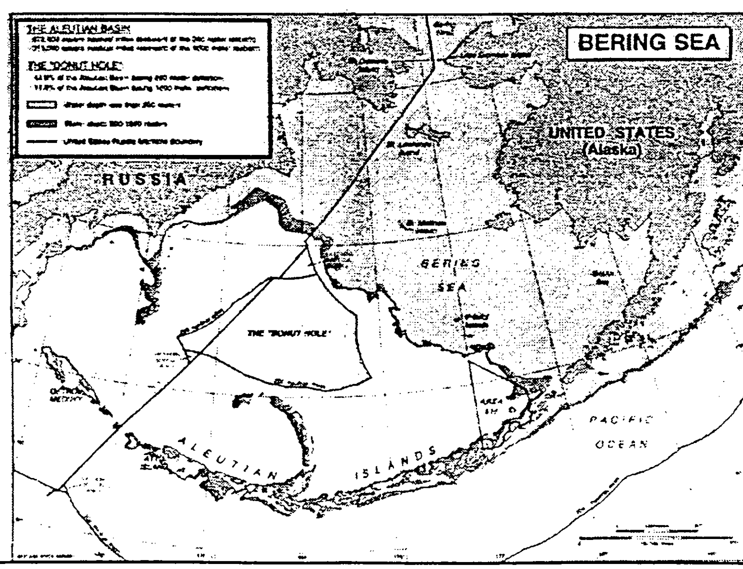


YEAR

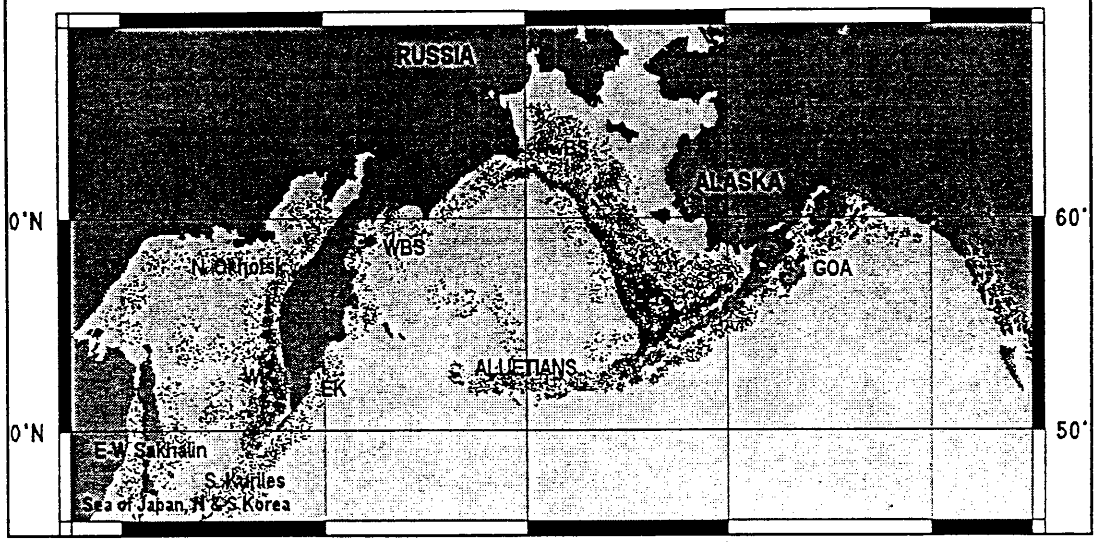
[illegible] Bogoslof Survey



Why Has Stock Not Recover in Donut Hole Area ?



When Pollock Resources in Donut Vicinity are still Relatively abundant (except for WBS)



What Are Possible Reasons of Pollock Catch Decline in Donut Hole Area ?

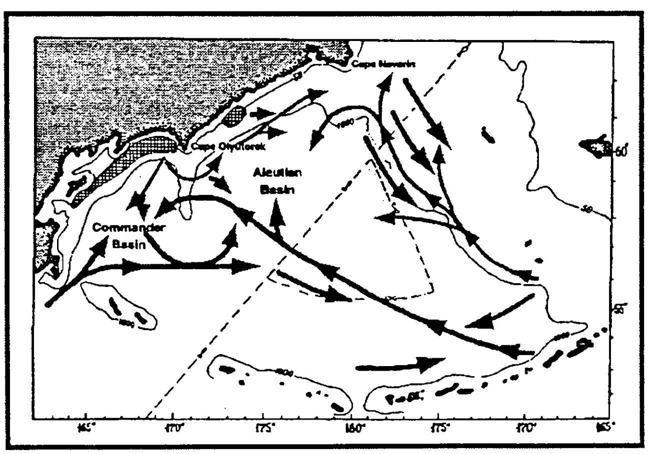
- 1. Overfishing
  - In Donut Hole Area
  - In Bogoslof Area
  - In Neighboring Shelves
- 2. Natural Population Declines
  - Phasing out of Strong Year Classes (1977-78)
  - Subsequent Poorer Recruitment
- 3. Environmental & Ecological Changes

What Are Major Factors that would affect Pollock Recovery in Donut Hole Area ?

- 1. Environmental & Ecological Changes
  - that would Produce strong year classes
  - that would Change Migration & Intermixing of Stocks
  - that would Change Prey-Predator Relationships
- 2. Continued No Fishing Policy
  - In Donut Hole Area
  - In Bogoslof Area and Aleutian Islands Area
- 3. Intensive Fishing in Neighbouring EEZs

Movement of Pollock

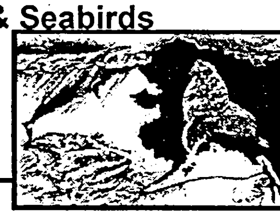
Red – Young
Blue – Adults



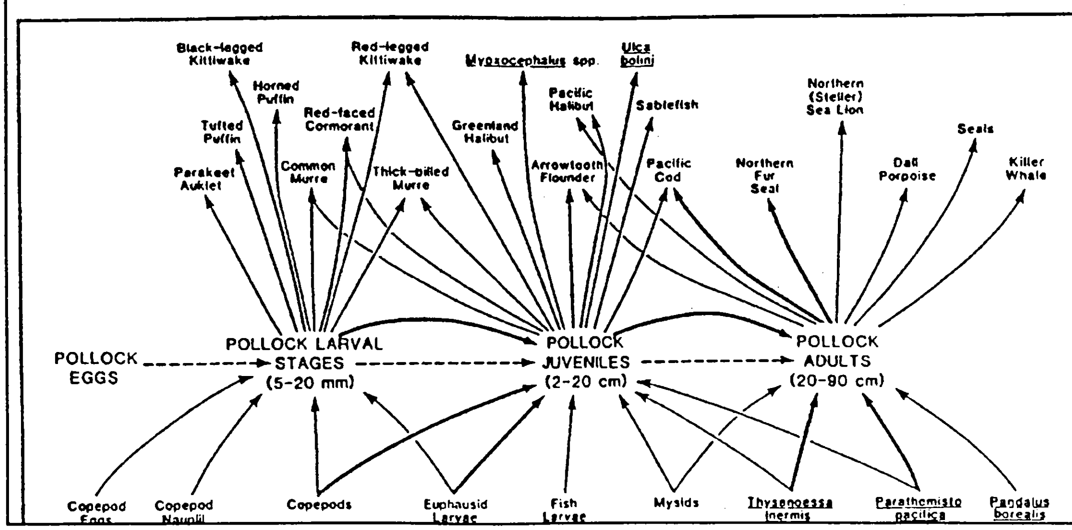
What are Effects of Top Level Pre-Predator Relationships On Pollock Abundance

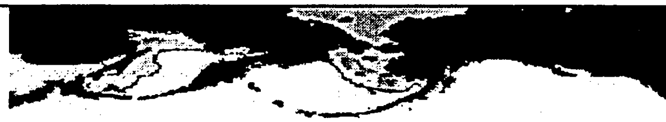
- **Effects of Fisheries**

- **Effects of Ecology**
  - **Prey-predator relationship**
  - **Highlighted by Stellar Sea Lions & Seabirds**



Pollock Is A Principal Component of the Marine Food Web





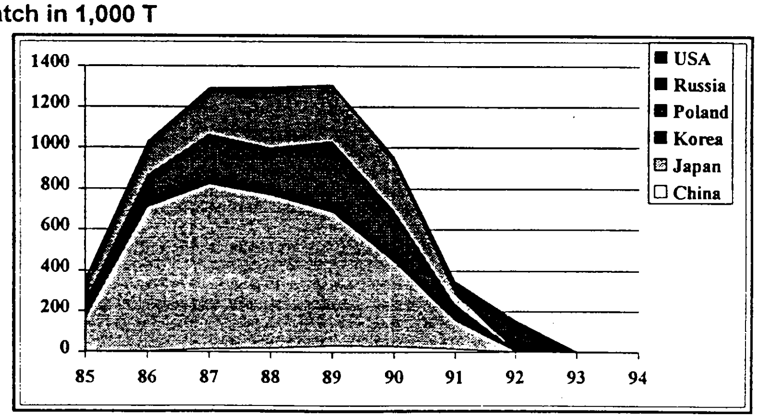
Session 3

- The Effects of the Moratorium and Its Continuation

- Session Chair: SungKwon Soh

History of the Donut Hole Area Pollock Fishery

Catch in 1,000 T



YEAR

History of the Moratorium

- 1. Started Voluntarily in 1983 during Negotiations of the Convention
- 2. Moratorium was replaced by "No AHL" Determination after Implementation of the Convention
- 3. Thus No Directed Fishing in Donut Hole Area Since 1983.
- 4. Directed Fishing Continued in Russian EEZ in the WBS, although declining in recent years
- 5. Directed Fishing Terminated in U.S. EEZ Bogoslof Area from 1995 and in Aleutian Region from 1999.

Parties Affected by the Moratorium

- 1. Parties that Operated in the Donut Hole area:
  - China, Korea, Japan, and Poland
  - All 4 Parties Stopped Fishing in Donut Hole
- 2. Coastal Parties (U.S. and Russia) conducted little or no fishing in the Donut Hole Area
  - U.S. stopped fishing in the BogoslofArea and the Aleutian Region
  - Russia reduced fishing in WBS

Effects on Non-Coastal Parties due to the Moratorium

- 1. How Many Fishing Vessels were Affected ?
- 2. How Many Processors were Impacted?
- 3. How Many Fishermen and Associated Industry Workers were Impacted?
- 4. What were the Annual Economic Loss ?
- 5. What were Other Associated Impacts?

Effects on Coastal Parties due to the Moratorium

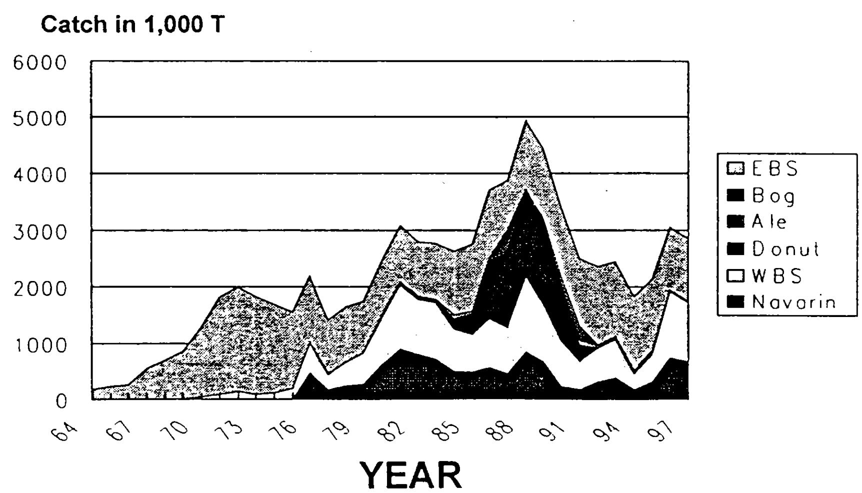
- 1. How Many Fishing Vessels were Affected ?
- 2. How Many Processors were Impacted?
- 3. How Many Fishermen and Associated Industry Workers were Impacted?
- 4. What were the Annual Economic Loss ?
- 5. What were Other Associated Effects?

Session 4

- Proposals of Strategies to Rebuild and/or
- Re-assess the Aleutian Basin Stock with a shared Goal of Resuming Fishing Operations as soon as possible

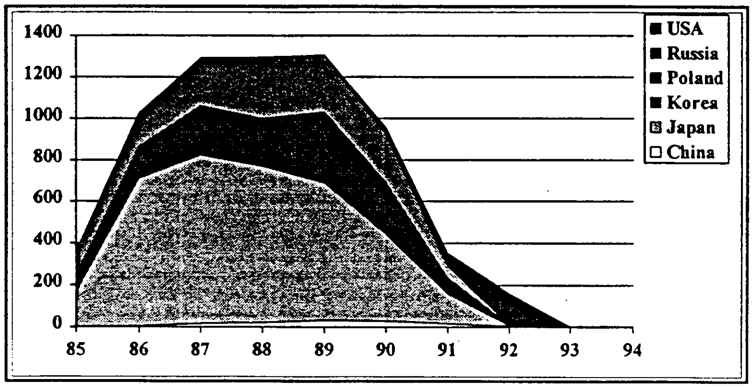
- Session Chair: Tokimasa Kobayashi

History of the Pollock Fishery in Bering Sea



History of the Donut Hole Area Pollock Fishery

Catch in 1,000 T



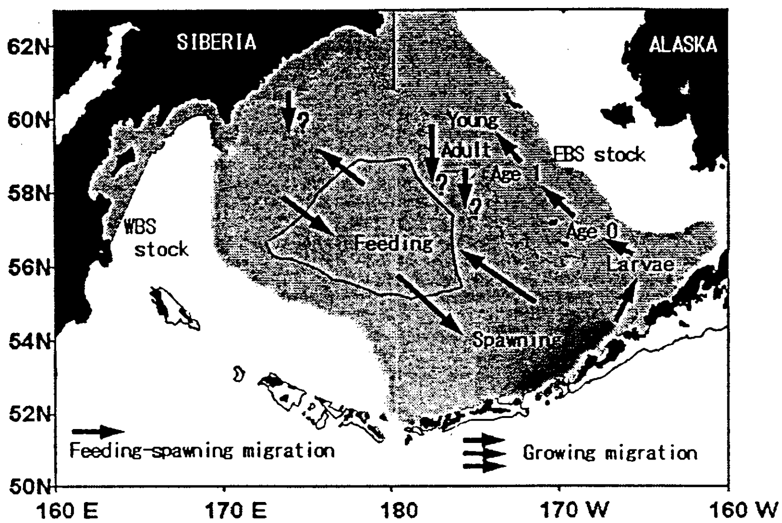
YEAR

Before Listing of Procedures to Monitor and Assess Strategies to Rebuild Aleutian Basin Stock

- **Review Migration Routes**

- Based on the Tagging Experiment
- Biological Characteristics
- Distribution of Fishing Grounds in Central Bering Sea

Estimation of Migration Routes of Aleutian Basin Stock



Listing of Strategies to Rebuild Aleutian Basin Stock

- **1. In the case of Overlapping Migration Routes of Aleutian Basin Stock with Neighboring Stocks**

- Appropriate Fisheries Management
  in Neighboring Areas for Aleutian Basin Stock
- Continue of Moratorium or Reduction of Fishing
  in Donut Hole Area till the Recovery of Aleutian Basin Stock

Listing of Strategies to Rebuild Aleutian Basin Stock

- **2. In the Case of No Overlap of Migration Routes of Aleutian Basin Stock with Neighboring Stocks**

- Continue of Moratorium or Reduction of Fishing in Donut Hole Area till the Recovery of Aleutian Basin Stock (Excluding Trial Fishing and Scientific Research)
- Appropriate Fisheries Management in Neighboring Areas for Aleutian Basin Stock

Listing of Strategies to Rebuild Aleutian Basin Stock

- **3. Restore Essential Fish Habitat Favorable for Pollock**

- Quantitative Estimation of Predation for Pollock
- Regime Shift Toward Better Environmental Condition for Appearance of Strong Year-class

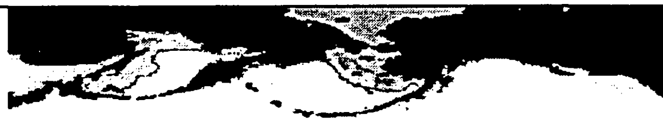
More Listing of Procedures to Assess Strategies to Rebuild Aleutian Basin Stock

- Assessment

- 1. Population Structure
- 2. Migration Routes

More Listing of Procedures to Monitor Strategies to Rebuild Aleutian Basin Stock

- Monitoring
- Continuation of EIMT Survey
- Estimation of Spawning Stock Biomass
- Collection of Biological Data
- Detection of Strong Year-class



Session 5

- Methodologies to Determine Allowable Harvest Levels (AHL)

- Session Chair: Richard Marasco

Convention Procedures to Determine AHL

- Article VII.1 -- The Annual Conference shall establish by concensus the AHL ...based upon an assessment of the Aleutian Basin Pollock Biomass by the S&T Committee.

- Article VII.2. -- If every effort to achieve consensus has failed, the AHL shall be determined in accordance with the provisions of Part 1 of the Annex.

Convention Procedures to Determine AHL - Continued 1

- Annex Part 1 (a) -- Based on S&T information reviewed by the S&T Committee, one institution each designated by the Russian Federation and the USA, as the coastal States of the Bering Sea, shall jointly establish the Aleutian Basin pollock biomass.
- Annex Part 1 (b) -- If there is insufficient S&T information available to allow the 2 institutions designated pursuant to paragraph (a) above to establish the Aleutian Basin pollock biomass, the Parties agree that for the purpose of this Convention, the pollock biomass for the Specific Area (note) as determined by the United States institution shall be deemed to represent 60 percent of the Aleutian Basin pollock biomass.

Convention Procedures to Determine AHL - Continued 2

- Annex Part 1 (c) -- If the Aleutian Basin pollock biomass is less than 1.67 million mt, the AHL shall be zero and therefore, there shall be no directed fishing on the Aleutian Basin pollock stock.
- Annex Part 1 (d) -- If the Aleutian Basin pollock biomass is equal to or above 1.67 million mt, the AHL shall be determined in accordance with the following table:

Aleutian Basin pollock biomass	AHL
1.67 to less than 2.0 million mt	130,000 mt
2.0 to less than 2.5 million mt	190,000 mt
2.5 million mt or more	Determine by Consensus

Previously Suggested Procedures to Determine AHL for 2000

--- by Korea, Option 1 of 2 --

- Overall Assumption -- Set AHL > 0 even though Aleutian Basin pollock biomass is below Annex Trigger Level

- 1. AHL = 0.13 mmt (= A) when AB Biomass = 1.67 mmt (=B) according to Annex Part 1(d)
- 2. Specific Area Biomass = 0.39 mmt in 1999
- 3. Therefore AB Biomass = 0.651 mmt (=C)
- 4. AHL = (C/B) * A = 0.39 * 0.13 = 50,700 mt

Previously Suggested Procedures to Determine AHL for 2000

--- by Korea, Option 2 of 2 --

- Overall Assumption -- Set AHL > 0 even though Aleutian Basin pollock biomass is below Annex Trigger Level
- 1. Assume Exploitation rate = 25% (=A)
- 2. AHL = 0.13 mmt (= B) when AB Biomass = 1.67 to 2.0 mmt (=C) according to Annex Part 1(d)
- 3. Specific Area Biomass = 0.39 mmt in 1999, therefore AB Biomass = 0.651 mmt (=D)
- 4. A * C = 0.418 to 5.0 mmt (=E)
- 5. A * D = 0.163 mmt (=F)
- 6. B/E = 31.1% to 26% range (=G)
- 7. AHL = (F * G) = 50,693 to 42,380 mt range

Previously Suggested Procedures to Determine AHL for 2000

--- by Japan, 2 Options --

- Overall Assumption -- Set AHL > 0 even though Aleutian Basin pollock biomass is below Annex Trigger Level
- Bogoslof ABC is derived from Tier 3(b) of NPFMC
- F abc = F40% (B2000/(B40% - 0.05))/(1-0.05)
- B2000 = R2000 + (B1999 decayed by mortality)
- ABC for Bogoslof = Exploitation rate * B2000 of Bogoslof
- ABC for for Entire Basin = ABC for Bogoslof / 0.6
- AHL for Donut = ABC for Basin / 3
- Option 1 ... If R = 27,000 mt, AHL = 5,300 mt
- Option 2 ... If R = 86,000 mt, AHL = 9,700 mt

Previously Suggested Procedures to Determine AHL for 2000

--- Comments by China --

- Overall Assumption -- Set AHL > 0 even though Aleutian Basin pollock biomass is below Annex Trigger Level

- 1. China stated that it is possible that the 1.67 mmttrigger biomasss specified in Annex Part 1 (C) was established at a time when there was insufficient scientific information available.
- 2. After 7 years of moratorium and data gathering, the scientific information is now available to adjust that 1.67 mmt trigger figure.

Previously Suggested Procedures to Determine AHL for 2000

--- Comments by Poland --

- Overall Assumption -- Set AHL > 0 even though Aleutian Basin pollock biomass is below Annex Trigger Level
- 1. Poland generally agreed with the AHL procedures suggested by Korea and Japan.

Previously Suggested Procedures to Determine AHL for 2000

--- Comments by Russia --

- Overall Assumption -- Set AHL according to the Annex of the Convention
- 1. Russia estimated that at the present time, there is no evidence that the Bogoslof Island pollock biomass would increase significantly over the next 3 to 5 years.
- 2. Russia suggested that is the responsibility of fisheries managers to explain to fishermen of all Parties that until the pollock stocks recover, the AHL should continue to be set at zero.

Previously Suggested Procedures to Determine AHL for 2000

--- Comments by the U.S. --

- Overall Assumption -- Set AHL according to the Annex of the Convention
- 1. The U.S. considers a minimum stock size biomass below which the U.S. would not allow fishing.
- 2. This minimum stock size biomass is specified in Annex Part I of the Convention.
- 3. The NPFMC has determined that the stock in the Bogoslof Island Area and its relationship to the Aleutian Basin stock is too low to allow fishing without adverse impact on related marine resources in the area.

Session 6

- Terms and Conditions for Trial Fishing

- Session Chair: Loh-Lee Low

Convention Terms and Conditions for Trial Fishing

- Article X.4 -- For any year in which the AHL is zero, the Annual Conference may authorize trial fishing operations for pollock in the Convention Area to be conducted by the fishing vessels of the Parties in accordance with a research plan that is submitted by any Party concerned and is approved by the Annual Conference, based upon the recommendations of the S&T Committee. The terms and conditions for such operations shall be established by the Annual Conference.

Trial Fishing
-- Key Issues --

- 1. Requires a Research Plan
  - What Content
  - When to Submit Plan so S&T can evaluate and Recommend
  - Requires Approval by Annual Conference
- 2. What are Terms & Conditions Established by Previous Annual Conferences ?

Research Plan for Trial Fishing

- 1. Content
  - generally has been agreed to by all parties
- 2. When to Submit
  - no agreement as to when to submit
  - desirable to submit to S&T for evaluation prior to annual conference
- 3. Need Approval by the Annual Conference

Terms & Conditions Established by Annual Conferences

- 1. How many Trial Fishing Vessels
    - No more than 2 per Party at any time
- 2. Observer Coverage -
    - Number & Priority Placement
- 3. Monitoring & Compliance
- 4. Transponders
- 5. Data Collection and Analyses
- 6. Submission of Reports

Attachment 2

CENTRAL BERING SEA POLLOCK WORKSHOP

NOAA Regional Center, 7600 Sand Point Way NE, Building 4, Room 2079
2000 July 17-21

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Status of the Aleutian Basin pollock Stock

(Summary for first session – Dr. Vladimir Radchenko)

According to conceptions developed in 1990s, there are two large self-reproducing pollock populations in the Bering Sea: eastern and western. These populations are isolated from each other during period of spawning but after that distribution of both ones greatly expands. There is usually observed considerable interannual variability in extent of pollock distribution primarily conditioned by total species biomass, abundance of several generations and interannual variability of the oceanologic environment.

While being high abundant pollock widely distributed over the shelf and deep-sea Aleutian and Commander basins, where it became one of the most common fish. Such situation was observed in 1980s when total biomass of the eastern Bering Sea pollock population reached about 20 mln.t and 5 mln.t – of western one. According to American scientists' estimations, these values were at 12-14, and 2.5-3 million metric tons, accordingly. An extension of pollock distribution during feeding period is supposed to be caused by food deficit in the shelf waters in the presence of highly abundant population. So pollock migrated to the waters over the deep basins to feed on huge planktonic resources as well as on small mesopelagic fishes and squids. In such periods distribution of the fishes from both populations widely overlapped over the Aleutian and Commander basins. In the central part of the Bering Sea pollock was the most abundant in summer and early in fall.

Direct surveys of the pollock stocks condition conducted by several countries in the Bering Sea from early 1950s also as fisheries history revealed that appearance of so high abundance which has taken place in 1980s is quite infrequent event resulted from originating of the pool of very high abundant year classes comparable with ones of 1978 and 1982.

By the mid of 1990s after the historical peak of pollock biomass was over, its abundance has decreased up to 6 - 7 mln.t in the eastern Bering Sea and 0.4 - 0.5 in the western one simultaneously with the reduction of its area. First of all the wide distribution of fishes to the deep-sea waters has interrupted and also a scope of spawning has noticeably decreased in Aleutian region.

Undoubtedly, main reason of the interannual variability in the rate of reproduction, recruitment and total pollock abundance has a natural character. Nevertheless, fisheries could also negatively influence on pollock stock under decreased reproduction potential.

In the late of 1990s significant ecosystem changes have taken place in the northern Pacific and Bering Sea initiated by the large-scale variability in the climate-oceanologic environment. There are many evident signs indicating climate shift to the next regular cold period having duration about 20 years. Considerable variability of the pollock reproduction and recruitment is also registered. It's impossible now to define whether this variability has a character of regular trend, but assuredly it's necessary to prolong intensive investigations of the pollock stocks conditions and its ecosystem status and to strengthen measures for preserving this species resource.

Pollock stock condition in the Aleutian basin.

In 1990s pollock abundance has considerably decreased in the Bering Sea in comparison to 1980s and fishes from the western Bering Sea population ceased their seasonal migration to the deep-sea area for feeding while the distribution extent of the eastern Bering Sea population has decreased up to minimum. Marine surveys carried on aboard of Korean and Japanese r/v in the mid-1990s ("Pusan-851" and "Kayo-maru" in 1996) in the Aleutian basin revealed extremely low pollock abundance during both pre-spawning and after-spawning period. Korean scientists assessed only 1.6 th.t of mature, already spawned pollock in the Donut Hole in the late spring 1996. In February of the same year aboard of "Kayo-maru" there was not recorded any pre-spawning fish in the southeastern part of the Aleutian basin.

Experimental pollock fishery conducted in the central Bering Sea area in spring and fall 1999 by the Polish large trawlers reported very low abundance of the fish – only 2 adult specimens were caught in May and September. Decrease of the pollock catches in the Aleutian basin observed it the late 1980s – early 1990s was proceeding at the same time as the eastern Bering Sea population reduces its biomass (tab. 1 & 2). It's quite evident that a relation between pollock biomass in the eastern Bering Sea shelf and pollock catch in the Aleutian basin has a cause-effect character.

As known, mainly mature pollock, reproducing in the Bogoslov area, migrates to the Aleutian basin. So there is quite probable dependence supposed to be between pollock biomass in the eastern Bering Sea shelf, biomass of the spawning fishes in the Bogoslov area and extent of spawned fishes distribution to the deep-sea region.

High abundance of the spawning pollock was registered in the Bogoslov area in those periods when its biomass over the eastern Bering Sea shelf exceeded 9.0 – 9.5 mln.t (fig.1). Therefore, in this time large-scale migration to the Aleutian basin including central Bering Sea region were also possible. Such situation was recorded in the second half of 1980s, when pollock biomass in the EBS shelf was 12.0 – 14.0 mln.t, in Bogoslov area – 2.1 – 2.4 mln.t and catch in the CBS region reached 1.3 – 1.4 mln.t. For example, in 1988 pollock biomass of the EBS population was about 12.5 mln.t, biomass of the adult fishes in Bogoslov area – 2.4 mln.t and catch in the CBS region – 1.45 mln.t. However, in 1991 pollock abundance has seriously decreased: in EBS – up to 7.8 mln.t, in Bogoslov area – 1.29 mln.t causing an abetment of fish number migrating to the Aleutian basin and multiple decline of the catch in the CBS region – up to 10 th.t.

In 1990s the EBS population biomass has stabilized at the level 7.0 – 7.5 mln.t. Because of an absence of abundant generations, adult pollock biomass ranged 0.4 – 0.6 mln.t in the spawning ground in the Bogoslov area. In the late 1990s usually it did not exceed 0.5 mln.t and in 2000 was estimated as 0.32 mln.t.

In the late 1990s there was appeared a trend toward increase of the EBS population biomass due to relatively high abundant generations born in 1995-1997. Fishes from these three year classes composed almost half (46.5%) of the total pollock biomass estimated on the EBS shelf and adjacent continental slope.

A stable tendency toward rise of the pollock biomass in the Bering Sea usually occurs when some very numerous generations join to population or more often when highly or averagely abundant year classes enter to the stock during 2-3 successive years. That was observed in the first half of 1980s when one very numerous generation (1978) and several averagely numerous (1979, 1980 and 1982) replenished pollock stock.

In the second half of 1990s relatively abundant year classes (1995-1997) also occurred, however they were quite scarcer comparing to ones born in the late 1970s – early 1980s. Preliminary data revealed the abundance of generations of 1998-1999 are low. Therefore, an absolute growth of the EBS population looks like probable in 2000-2001 but it's expected to be small (fig.2). If some abundant generations do not occur in the close future, trend to decline of the population biomass will appear in the first half of coming ten of years.

The western Bering Sea pollock conditions remained very poor during second half of 1990s. The stock biomass has gradually decreased up to 150 thousand tons in 1999. In such conditions it is difficult to expect the western Bering Sea pollock migrations in the deep-sea zone. Furthermore, there are some evidences that the western Bering Sea deep-sea zone is actively occupied now by the Korf-Karaginsky herring stock during their feeding migration.

Taking into account that abundance of the WBS and EBS pollock population was low in the late 1990s and growth is possible only due to relatively numerous generations of 1995-1997, there is not a probability of the large-scale expansion of adult pollock to the Aleutian basin and Donut Hole at least up to the mid of 2000 – 2010 period.

Table 1

Biomass of the EBS Pollock population in 1979-1999 (million metric t) in US EEZ (according to AFSC information)

Year	*Results of surveys*				*Modeling*	
	bottom, shelf	*trawl-acoustic, shelf*	*trawl-acoustic, Bogoslov*	*Total biomass*	*Cohort analysis*	*Synthesis model*
1979	2.00	1.550	-	3.55	4.506	4.07
1980	0.99	-	-	-	6.756	5.05
1981	2.27	-	-	-	10.627	8.59
1982	3.54	4.640	-	8.18	12.029	10.46
1983	4.81	-	-	-	13.165	11.86
1984	3.96	-	-	-	12.868	11.81
1985	4.36	5.450	-	9.82	14.232	13.37
1986	4.31	-	-	-	12.954	13.03
1987	5.03	-	-	-	13.108	13.25
1988	5.94	4.160	2.400	12.50	11.968	12.44
1989	4.78	-	2.100	-	10.020	10.82
1990	7.70	-	-	-	7.960	8.82
1991	5.10	1.400	1.300	7.80	6.660	6.91
1992	4.30	-	0.980	-	8.470	7.84
1993	5.50	-	0.680	-	8.600	7.86
1994	4.98	2.760	0.540	8.28	8.080	7.17
1995	5.41	-	1.020	-	7.570	7.67
1996	3.20	2.239	0.682	6.12	7.100	6.63
1997	3.03	2.590	0.390	6.01	5.710	5.30
1998	2.21	-	0.490	-	5.960	5.13
1999	3.57	3.290	0.480	7.34	7.500	-

Table 2

Catches of the EBS population Pollock in 1984-1999 (thousand tons)

Year	*EBS shelf & slope*	*Bogoslov*	*Navarinsky region*	*Aleutian basin*	*Aleutian Islands*	*Total*
1984	1092.05	-	503.0	363.40	81.80	1858.0
1985	1139.67	-	488.0	1039.00	58.70	2049.8
1986	1141.99	-	570.0	1326.30	46.60	2797.6
1987	859.41	377.40	463.0	1395.90	28.70	3054.8
1988	1228.72	87.80	852.0	1447.60	30.00	3594.4
1989	1229.60	36.00	684.0	917.40	15.50	3412.7
1990	1455.19	151.60	232.0	293.40	79.00	2835.2
1991	1217.30	264.70	178.0	10.00	78.60	2037.3
1992	1164.44	0.160	315.0	1.95	48.70	1538.3
1993	1326.60	0.886	389.0	-	57.10	1775.4
1994	1363.45	0.566	178.0	-	58.60	1600.6
1995	1262.76	0.264	320.0	-	64.40	1647.4
1996	1192.77	0.387	700.8	-	29.06	1922.2
1997	1124.59	0.168	680.0	-	25.94	1830.6
1998	1101.16	0.136	643.6	-	23.82	1768.7
1999	992.00	0.111	632.7	-	1.00	1625.8

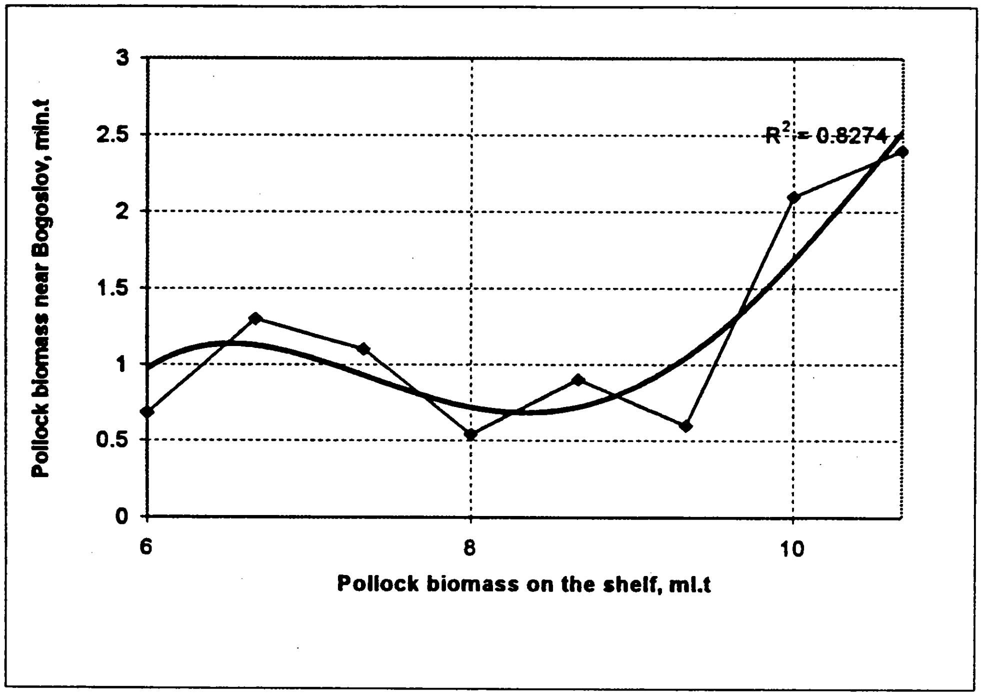
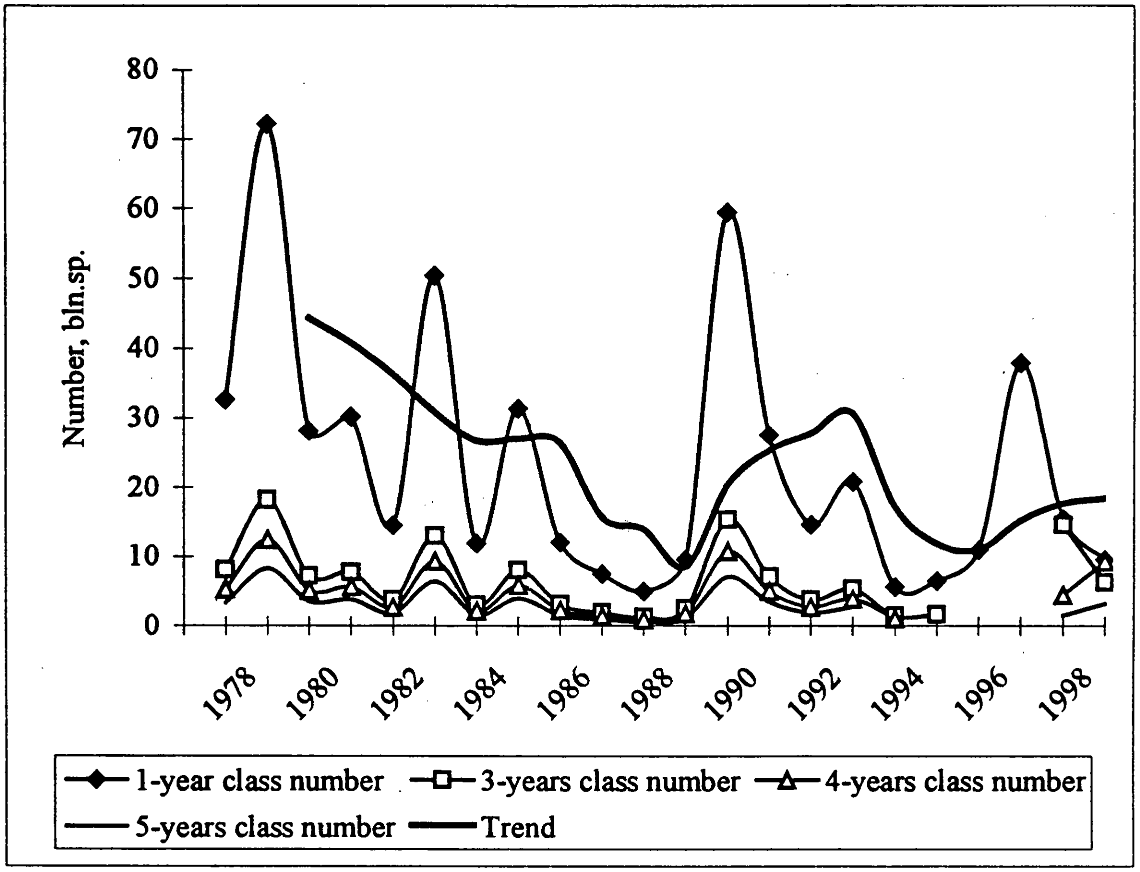


Fig.1 Correlation between Pollock biomass on the EBS shelf and near Bogoslov Island in 1988-1997

Fig.2 Interannual variability of Pollock generation number composed with fishes aged 1-5 and its trend in 1977-1999



Presentations prepared by HNF, Japan

Hokkaido National Fisheries Research Institute, JFA

Session1: Review the status of Aleutian Basin pollock stock

Review of the Japanese pollock fisheries in the Aleutian Basin

The Japanese midwater trawl fisheries targeting on pelagic pollock in the Aleutian Basin had been operating since 1980s. In conjunction with the increase of fishing effort since 1980, the catch increased to 804,000 tons in 1987. However, the catch decreased from 1988, and it decreased to 417,000tons in 1990. Consequently, CPUE declined from 8.58 tons/hour in 1986 to 3.08 tons/hour in 1990. The primary fishing seasons were winter. Fishing grounds with high CPUE were generally located at the western edge of the Donut Hole in autumn and extended eastward mainly in the southern part of the area in winter, but fishing grounds with high CPUE were rare in February and March. In 1990, the catch in April was greatest but the catch in winter decreased dramatically. In this presentation, we look back over a distance of 10 years, when there were huge pollock fisheries in the area.

Nishimura, 1991. Summary of the Japanese pollock fishery in the international waters of the Bering Sea (1986-1990). *INPFC Doc.*, **3643**, NRIFSF, Shimizu.

Review of Japanese historical surveys in the Aleutian Basin

Japanese institutes have been conducting MWT and/or EIMWT surveys in the Aleutian Basin since late 1970s. Before 1990, pelagic pollock distribution was observed entire Aleutian Basin including Donut Hole in summer (no available data from Russian EEZ). There are some observations that the fish aggregations concentrate in the eastern side of the basin in winter, and some spawning activities were also took place in the Donut Hole. After 1990, the distribution has been limited in the southeastern Basin, and most of the fish aggregations have been observed around CBSC specific area in winter.

Okada, K. 1986. Biological characteristics and abundance of pelagic pollock in the Aleutian Basin. *Int., North Pac. Fish. Comm. Bull.*, **45**: 150-176.

Traynor et al., 1990. Methodology and biological results from surveys of walleye pollock (*Theragra chalcogramma*) in the eastern Bering Sea and Aleutian Basin in 1988. *Int. North Pacific Fish. Comm., Bull* 50: 69-100.

Sasaki et al., 1992. Report of cooperative Japan-U.S. pelagic pollock investigation in the Aleutian Basin during August-October in 1988. *Spec. publication of Nat. Res. Inst. Far Seas Fisheries.*, 21: 103p.

The other survey reports are available from INPFC documents.

Interannual variability in growth of pollock in the Aleutian Basin

Adult walleye pollock were collected from the Aleutian Basin during 1978 and 1999. Average fork length were observed at around 47cm during 1970-1980s, and it increased to 56 cm in 1990s. Age was determined for 4805 individuals by using otolith break and burn method. Ages ranged between 5 and 23, and the year class of 1965, 1978 and 1989 was dominant in 1970s, 1980s and 1990s, respectively. Fish had significantly larger length-at-age in 1990s than average during 1970s and 1980s. Interannual variability in growth observed in the area had a significant effect on the larger average length in 1990s. Taking into consideration recent decreasing of the walleye pollock biomass in the central Bering Sea, density dependent growth was supported as one possibility of the growth variability. At the same time, we could not entirely rule out the possibility that the oceanographic variability affected to the growth of the walleye pollock in the area. Possibility was also suggested that the growth variability took place in their younger age before they migrate to the basin area.

Nishimura, Interannual variability in growth of walleye pollock, *Theragra chalcogramma*, in the central Bering Sea. (In Prep.)

Session 2: Factors affecting recovery of the stock including prey-predator relationships

Results of sea ice concentration and SST data analysis

Sea surface water temperature (SST) analysis in the southern Aleutian Basin showed that the lowest and highest water temperature was observed on March and August, respectively. SST ranged between 2 to 4 °C on March, and it increased to 8-10 °C on August. SST data series shows a gradual increase during 1970s and 1980s, followed by a dramatic increase in the 1990s. Sea Ice Concentration (SIC) in the southern area of the EBS also showed interannual variability. Values of SIC for the period of 1960-1970s were higher than those after 1980, suggesting that the sea ice extended far south on the EBS before 1980.

Feeding habits of major fish species in the CBS

Juvenile walleye pollock preyed primarily on zooplankton such as euphausiids and copepods in the shelf area. Adult pollock preyed mainly on small pollock in the EBS, but on euphausiids and copepods in the Aleutian Basin. Pacific cod, piscivorous flatfish preyed primarily on pollock. Juvenile pollock occupy a key position in the Bering Sea ecosystem by transmitting energy from zooplankton to large-sized fishes.

The myctophids, northern lampfish (*Stenobrachius leucopsarus*), is widely and abundantly distributed in the basin area. Fish echo-sounder observations revealed that the myctophids migrated abruptly from depths of more than 200 m after sunset and occupied at around 50 m in depth at night. This species fed primarily on copepods in the near-surface layer. Small fish (mode: 38-58 mm) fed on copepods and ostracods, whereas large fish (mode: 78-84 mm) preyed mainly on copepods and euphausiids. In the basin area, northern smoothtongue and squids are also distributed abundantly. We can not ignore these components in the basin ecosystem.

Mito et al., 1999. Ecology of groundfishes in the Eastern Bering Sea, with emphasis on food habits. In "Dynamics of the Bering Sea" PICES WG5 Book, Univ. Alaska Sea Grant.

Nishimura et al., 1999. Age, growth, and feeding habits of lanternfish, *Stenobrachius leucopsarus* (Myctophidae), collected from the near-surface layer in the Bering Sea. Fisheries Science, 65(1)

Session 4: Proposals for strategies to rebuild and/or reassess the Aleutian Basin stock with a shared goal of resuming fishing operations as soon as possible

Does the basin spawning stock contribute to the newly recruitment on the EBS?

NRIFSF & FOCI corroborate larval pollock surveys were conducted by Kaiyo Maru (JFA) in 1993, 1995 and 1997, in the southeastern basin and the adjacent EBS area. During these surveys, significant larval aggregations were observed on the shelf area, though the larval distributions in the basin were rare. In 1993, bimodal length frequency of larval fish was observed, and these larvae were composed from early (EHG) and late hatch group (LHG). With considering 25-30 days from spawning to hatching, the major spawning periods of early and late hatch group were estimated to be mid-March and mid-April, respectively. The estimated spawning period of EHG fairly well coincided with observed spawning period in the basin area. The larvae spawned in the basin area might move to the outer-mid shelf zone or they did not survive in significant numbers in the basin. In 1997, the EHG was not observed.

Information about first year growth of the basin pollock collected in early 1990s

Age 1 fish collected in the southern EBS domain had a larger size range than those from the northern domains including the Chukchi Sea. Geographical difference was also observed in the frontal section of the otolith. Inner diameter of the 1st annulus of the fish from the southern domain was larger than that from the northern fish. Maximum likelihood estimation was carried out to discriminate the age 1 fish between domains, by using the inner diameter and the width of 1st annulus as the classifying variables. The meristic characteristic of the 1st annulus is thought to be useful as a natural tag to identify their nursery areas. With using this criterion, most of the adult pelagic pollock collected in the basin area were estimated to originate from southern domain of the EBS.

Nishimura, 1998. 14. Growth of age 0 and age 1 walleye pollock in the different domains of the Eastern Bering Sea. Ohtani et al., edit., "Oyashio region and Bering Sea ecosystems", *Mem. Fac., Fish., Hokkaido Univ.*, **XXXXV(1)**

Consideration about recruitment strength and oceanographic environment

MACE age-biomass data series from winter EIMWT survey indicate the possibility that the recruitment (age 7 biomass) to the basin stock was very strong in 1970s. After 1980, the recruitment became relatively low. This time series change shows the same tendency with the oceanographic variability such as sea ice concentration. Values of SIC for the period of 1960-1970s were higher than those after 1980, suggesting that the recruitment to the basin is strong when sea ice extended far south on the EBS ?

Central Bering Sea Pollock Workshop

(Seattle NOAA Sand Point Facility, 17-21 July 2000)

Results from the 2000 Echo Integration and Midwater Trawl Survey on the Bering Sea Walleye Pollock by the *R/V Tamgu 1*

Seok Gwan CHOI, Jin-Yeong KIM, Yeong-Seung KIM,

Joo-il KIM, Jong Bin KIM and Hyun Su JO

National Fisheries Research and Development Institute

1. Introduction

The National Fisheries Research and Development Institute (NFRDI) conducted an echo-integration and midwater trawl survey of walleye pollock from the Bogoslof Island area to the Donut Hole area in the Bering Sea by the Korean *R/V Tamgu 1* during February~April 2000. The purposes of the survey were to determine the geographical distribution of walleye pollock, to collect echo integration data and biological information of walleye pollock to estimate the biomass, to collect the oceanographic and biological environments during the winter in the survey area.

The itinerary of the *R/V Tamgu 1* was as follows;

Feb. 10~17, 2000 : Departure from Pusan port and navigation of *R/V Tamgu 1*
Feb. 18~19 : Anchor near the Attu Islands and Sphere Calibration
Feb. 20~29 : Change the survey plan due to the bad weather
Mar. 1~4 : Inport Dutch Harbor and supplies
Mar. 5 : Transfer to the Captain Bay and confirm sphere calibration
Mar. 6~27 : Acoustic-midwater trawl surveys from the Bogoslof Island area to the Donut Hole area
Mar. 28~Apr. 4 : Navigation of *R/V Tamgu 1* and arrival in Pusan port

2. Materials and Methods

1) Research vessel and fishing gear

The *R/V Tamgu 1* is a stern trawler with 90.2 m long, 2,550 gross tonnage, and 7,500 horsepower. Midwater trawl net was employed to identify the detected echosigns and to collect biological samples. The codend mesh size of midwater trawl net was 100 ㎜. Both headrope and footrope lengths were 53.2 m, respectively.

2) Survey area, oceanographic and biological environments

The survey areas in the Bering Sea were covered from the Bogoslof Island area to the Donut Hole area (Fig. 1). A total of 37 research stations were selected to collect oceanographic and biological environments. Water temperature and salinity profile data were collected from surface to 500 m in the stations with a CTD system. Bongo net was used for collection of fish larvae and zooplankton samples from surface to 100 m layer in each stations. Seawater samples for chlorophyll *a* determination were collected at sixth layer (0, 25, 75, 100, 200, 400 m) with a Losette Sampler.

3) Echo intergration

Scientific quantitative echo-sounding system, Simard EK500, was used in acoustic data collection (Bodholt et al. 1989). Data from the SIMRAD EK500 sounder were stored and processed using a SIMRAD BI500 Integrator with the graphic workstation, SUN sparc 5 workstation compatible with the SUN workstation, installed an echo integration and target strength data analysis software (Foote et al.1991).

Transects were spaced 5 or 10 nautical miles in the Bogoslof Island area and 50 or 60 nautical miles in the other areas apart in parallel north-southward. The survey cruise was started from near Dutch Harbor and proceeded to the westwards with speeds of 8~12 knots. Echo integration data were logged each 1 nautical miles in the Bogoslof area and 5 nautical miles in the other areas during the survey.

Echo integrator output, S_a, was reintegrated with a SV threshold of -69 dB currently used in the Alaska Fisheries Science Center. To convert S_a into absolute density, the above equations were used in length-target strength relationship (TS= 20 log FL- 66; Traynor 1996).

4) Midwater trawl and biological sampling

Midwater trawl hauls were made to identify fish species and biological sampling at the selected location where a good echosign was encountered in day time. In each trawl haul, all species caught were counted and weighed. Samples of walleye pollock were treated to analyze sex ratio, maturity stage (five stage), gonad weight, fork length and body weight. Lengths were measured on the measuring board with a caliper scaling in 1 mm and body weight was scaled in gram. At the same time, otoliths, female gonad, and stomach were collected.

3. Results

1) Standard sphere calibration

Calibration procedures were conducted in the near the Attu Islands. The values of the split beam target strength were corrected repeatedly to find the known value of -33.6 dB/-40.5 dB and the TS transducer gain parameter. The values of the echo integration for the sphere were corrected repeatedly to find the value identical to the theoretical value and the Sv transducer gain parameter. Transducer beam pattern characteristics (longitudinal offset, transversal offset and

3 dB beam width of the beam) were used to obtain the values from EKLOBES software. Calibration results and overall system parameters were presented in Table 1.

2) Oceanographic conditions

The surface water temperature was 0.7~3.8℃ in the whole survey areas. It was higher than 2.6 ℃ in the Bogoslof Island area and lower than 2.0℃ in the Donut Hole area. Water temperature was little changed from surface to 120 m layer, increased rapidly from 120 m to 210 m, and variated a little over 210 m. In spring 1999, there was a cold water mass of 1.0 ℃~3.0 ℃ at the 50~180 m layer from the Donut Hole area through the Bogoslof Island area. It can be suggested that the cold water mass is isolated at 50~180 m due to increase the surface water temperature and air temperature as the season is transformed winter into summer. It may influence the distribution of walleye pollock in the Central Bering Sea by intensity of the cold water mass.

Salinity was fluctuated from 31.93 to 34.75 PSU in the survey area. It was presented about 33.2 PSU at the 20~120 m layer and increased as deeper as depth at over 120 m layer (Fig. 2).

3) Catch and CPUE

A total of 7 hauls were made in the cruise; six hauls in the Bogoslof island area, one haul in the Continental Shelf area. The total catch and Catch Per Unit Effort (CPUE ; kg/hour) of walleye pollock was 14,789.4 kg and 5,153.1 kg. The CPUE of pollock was larger than 4,000 kg/hour in Bogoslof island area except the haul station 3 was conducted to identify the fish species of non-pollock echo sign. The highest CPUE of pollock was obtained from haul station 4 (Table 2).

4) Length and weight of pollock

Fork length compositions of walleye pollock were described in Figure 3. Two modes of 34 cm and 42 cm in FL were shown in the east of Bogoslof Island area (east of W167°), one mode of 55 cm in the west of Bogoslof Island area (west of W167°), and one mode of 35 cm in the Continental Shelf area. The large sized group, over 55 cm, were distributed in the west of Bogoslof Island area in winter. The mean fork lengths of female and male were 56.6 cm and 54.2 cm in the west of Bogoslof Island area, 40.6 cm and 39.4 cm in the east of Bogoslof Island area, and 35.7 cm and 34.8 cm in the Continental Shelf area.

The patterns of weight compositions of pollock were similar with the fork length compositions (Fig. 4). The mean body weights of female and male were 1,526 g and 1,192 g in the west of Bogoslof Island area. In the Continental Shelf area it was smaller than that in the Bogoslof Island area.

Relationships between fork length and body weight by area were expressed as follows (Fig. 5);

Female of east Bogoslof Island area : $BW = 0.0111 \times FL^{2.8714}$ (r^2=0.93)
Male of east Bogoslof Island area : $BW = 0.0067 \times FL^{3.0052}$ (r^2=0.97)
Female of west Bogoslof Island area : $BW = 0.0239 \times FL^{2.7326}$ (r^2=0.71)

Male of west Bogoslof Island area : $BW = 0.0128 \times FL^{2.8615}$ (r^2=0.65)
Female of Continental Shelf area : $BW = 0.0133 \times FL^{2.7934}$ (r^2=0.92)
Male of Continental Shelf area : $BW = 0.0043 \times FL^{3.1076}$ (r^2=0.82)

where, FL is fork length in cm and BW is body weight in g.

5) Sex ratio and maturity of pollock

Data from 6 hauls showed that female percentages by area was 53.8 % in the east of Bogoslof Island area, 59.6% in the west of Bogoslof Island area, and 53.5 % in the Continental shelf area. Haul station 4, located at the edge of high-density aggregation of spawning pollock, had a percentage of female pollock that was 35.9%.

Maturity composition data revealed differences among three area (Fig. 6). Maturity for females were 90.7% immature/developing/pre-spawning in the east of Bogoslof Island area, 99.4% pre-spawning/spawning/post-spawning in the west of Bogoslof Island area, and 98.5% immature/developing in the Continental shelf area. Maturity for males were very similar to females. In the west of Bogoslof Island area, maturity for females were 46.8% pre-spawning, whereas males were 56.2% post-spawning.

6) S_a distribution and biomass estimation

Density (S_a) distribution of pollock was presented in Figure 7. Higher density was observed the inshore of the survey area from W164° 55′ to W166° 5′ , the east of Umnak Island, and an area between Umnak Island and Islands of Four Mountains. The highest density of the pollock echo sign was distributed in the area between Umnak Island and Islands of Four Mountains. Vertical distribution of pollock echo sign was dense at 300~600 m depth layer in the area of over 200 m bottom depth, at 80~150 m depth layer in the area of below 200 m bottom depth. Pollock echosigns were never appeared in the Central Bering Sea and middle area between Bogoslof area and Central Bering Sea except the Continental shelf area.

The results of pollock biomass was shown in Table 3. Biomass of pollock in the whole survey areas was 487 thousand tons; 455 thousand tons in the Bogoslof Island area, 32 thousand tons in the Continental Shelf area. Inside the area 518/CBS convention area, pollock biomass was 257 thousand tons and pollock numbered 192 million.

Table 1. The results from the standard sphere calibration conducted in the near Attu Island in February 18~19, 2000 for echo integration and midwater trawl survey by the *R/V Tamgu 1* in the Bering Sea

CALIBRATION REPORT EK500

VESSEL : **R/V TAMGU 1** DATE : Feb. 19, 2000
PLACE : **Near Attu Island** BOTTOM DEPTH : 43.8 M
SST : 2.1 ℃. SALINITY : 33.18 PSU. SOUND VELOCITY: 1,460 M/SEC

FREQUENCY	38	120	kH
ABSORPTION COEFFICIENT	10 dB	38 dB	dB/km
TRANSDUCER	ES38B	ES120-7	Sensor type
ANGLE SENSITIVITY	21.9	21.0	
PING INTERVAL	1.0	1.0	sec
TRANSMIT POWER	Normal	Normal	
MAX. POWER	2000	1000	W
PULSE LENGTH	Medium	Medium	
BANDWIDTH	Wide	Wide	
TS OF SPHERE	-33.6	-40.4	dB
DEFAULT TS TRANSDUCER GAIN	26.5	26.5	dB
MEASURED TS	-32.1	-42.0	dB
ADJUSTED TS TRANSDUCER GAIN	**27.21**	**25.32**	dB
CALIBRATED TS	-33.6	-40.4	dB
DEFAULT EQUIVALENT 2-Way Beam Angle	-20.6	-20.8	dB
Transducer Data 2-Way Beam Angle	-20.6	-20.8	dB
Depth to Sphere	**28.2**	**25.3**	m
Default Sv Transducer Gain	26.5	26.5	dB
Theoretical Sa	2,721	721	m^2/nm^2
Measured Sa	3,079	439	
Calibrated Sv Transducer Gain	**26.79**	**24.90**	dB
Calibrated Sa	≒2,747	≒712	m^2/nm^2
Default -3dB Beamwidth Fore-Aft*	7.1	7.1	degrees
Default -3dB Beamwidth Athwart*	7.1	7.1	degrees
Calibrated -3dB Beamwidth Fore-Aft*	7.01	7.40	degrees
Calibrated -3dB Beamwidth Athwart*	6.79	7.62	degrees
Fore - Aft. Offset*	-0.11	-0.90	degrees
Athwartship Offset*	-0.04	-0.27	degrees

Table 2. The summary of midwater trawl results for walleye pollock form the survey of *R/V Tamgu 1* in the Bering Sea during March 2000

Haul No.	Date (LST)	Haul: Position	Haul: Duration time (min.)	Haul: Vessel speed (knots)	Depth (m)	Catch Total: Catch (kg)	Catch Total: CPUE (kg/hr)	Catch Pollock: Catch (kg)	Catch Pollock: CPUE (kg/hr)
1	Mar. 8	N54° 41.8′ W166° 05.4′	45	4.4	170	3,034.0	4,045.3	3,034.0	4,045.3
2	Mar. 10	N53° 33.9′ W167° 42.4′	5	4.0	400	3,778.5	45,360.1	3,628.0	43,710.8
3	Mar. 11	N53° 45.3′ W168° 32.1′	35	4.2	300	1.4	2.4	-	-
4	Mar. 12	N53° 05.8′ W169° 23.6′	1	3.5	430	1,647.6	98,658.7	1,640.0	98,203.6
5	Mar. 13	N53° 12,.1′ W169° 32.9′	5	3.7	420	757.9	9,098.4	746.4	8,960.4
6	Mar. 14	N54° 26.5′ W165° 36.5′	41	4.0	100	4,059.0	5,940.3	4,059.0	5,940.3
7	Mar. 17	N56° 48.3′ W172° 40.7′	40	3.9	130	1,682.0	2,521.7	1,682.0	2,521.7
Total			172			14,960.4	5,212.7	14,789.4	5,153.1

Table 3. Estimated biomass of walleye pollock from the survey of *R/V Tamgu 1* in the Bering Sea during March in 2000

Item	Bogoslof area	CBS 518 area	Middle areas (including C. Shelf)
Area swept (n.mile^2)	1,119	699	56,002
Transect length (n.mile^2)	10,755	6,555	31,350
Mean Sa (m^2 /n.mile^2)	417	371	8
Population (x10^6)	563	192	108
Biomass (thousand tons)	455	257	32

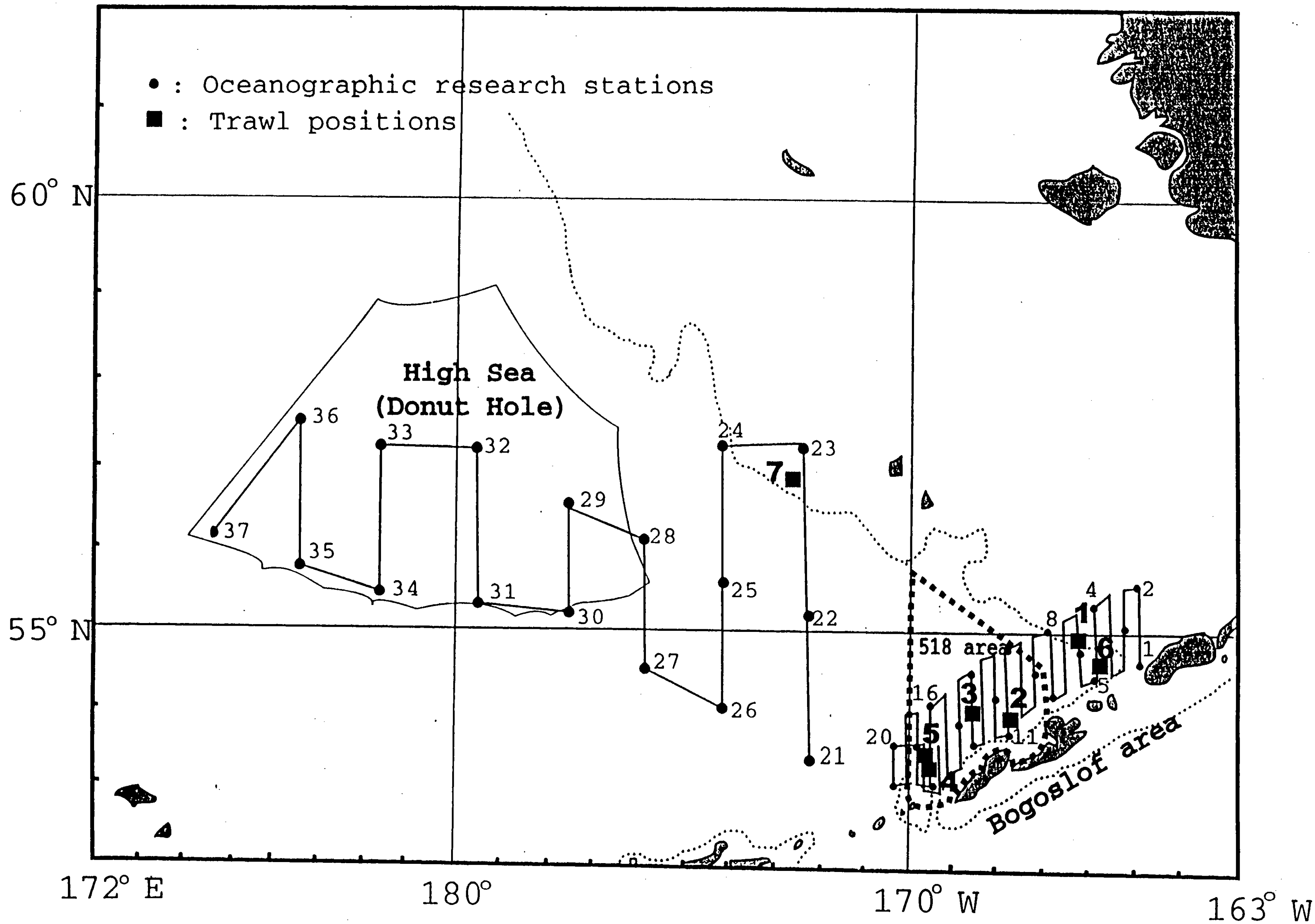


Fig. 1. Trackline and oceanographic research stations for the Echo Integration and Midwater trawl survey on the Bering Sea walleye pollock by *R/V Tamgu 1* during March in 2000.

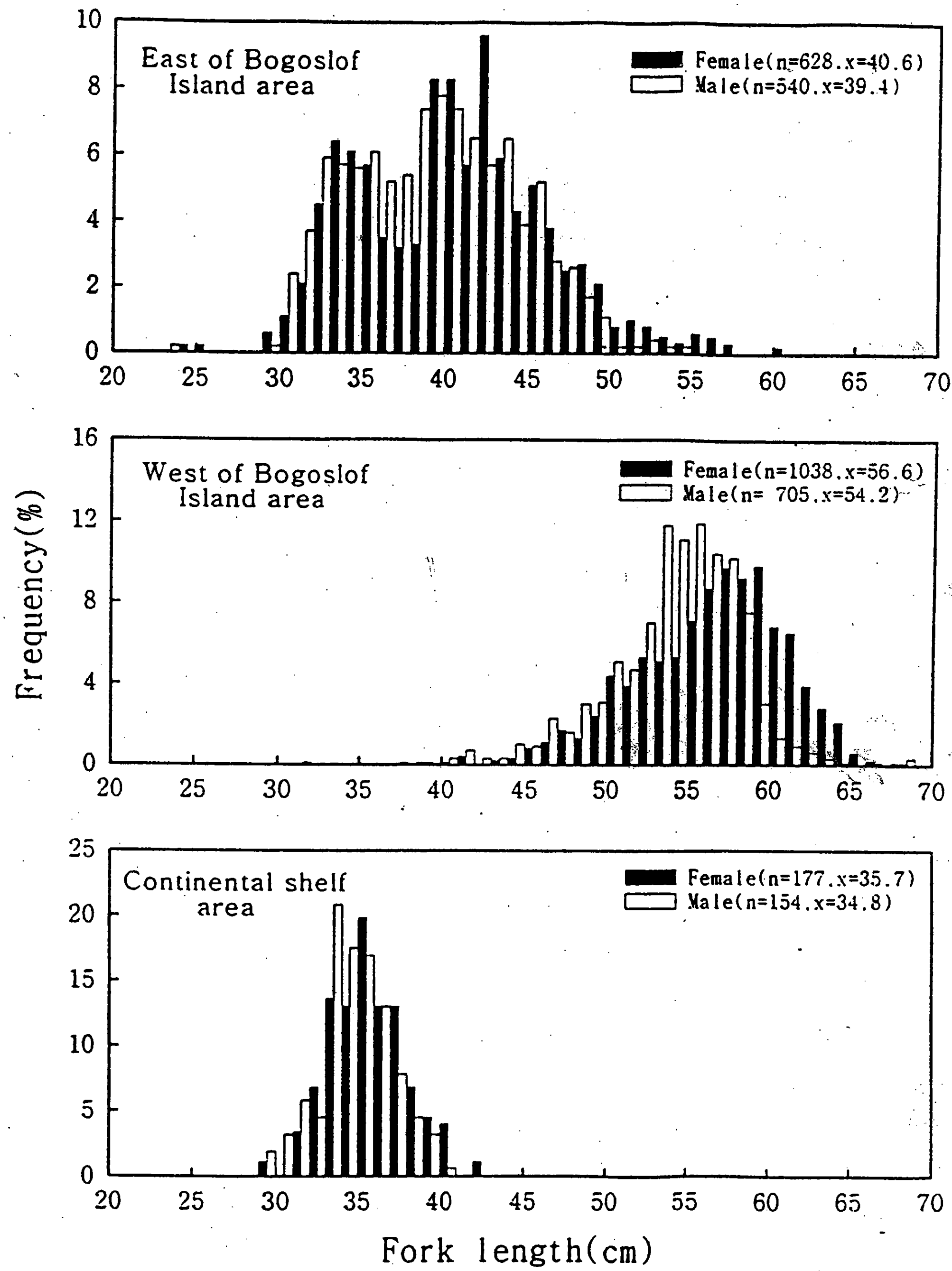


Fig. 3. Length composition of walleye pollock caught by midwater trawl in the Bering Sea during March in 2000.

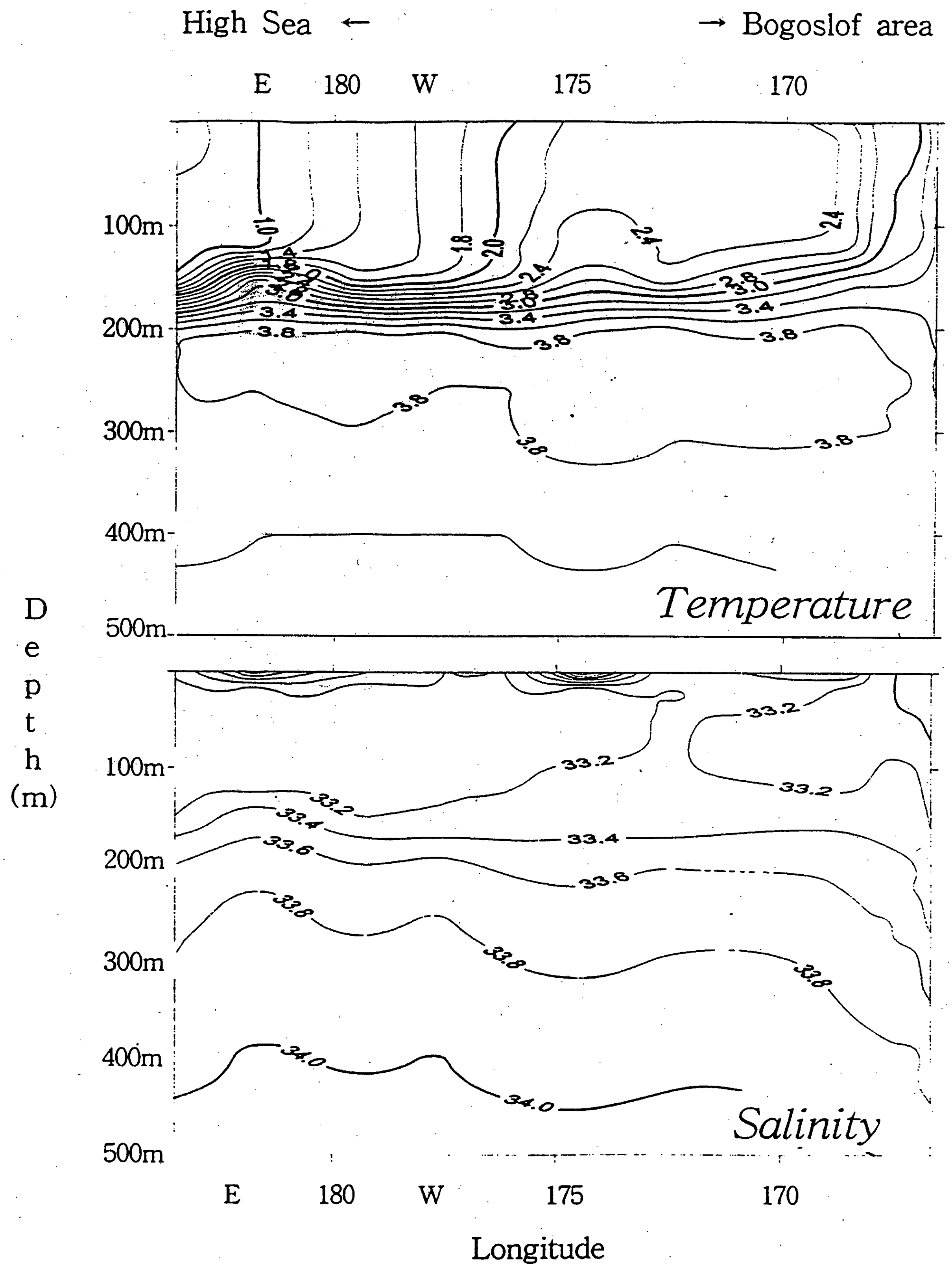


Fig. 2. Vertical distribution of Water temperature and Salinity in the Bering Sea during March in 2000.

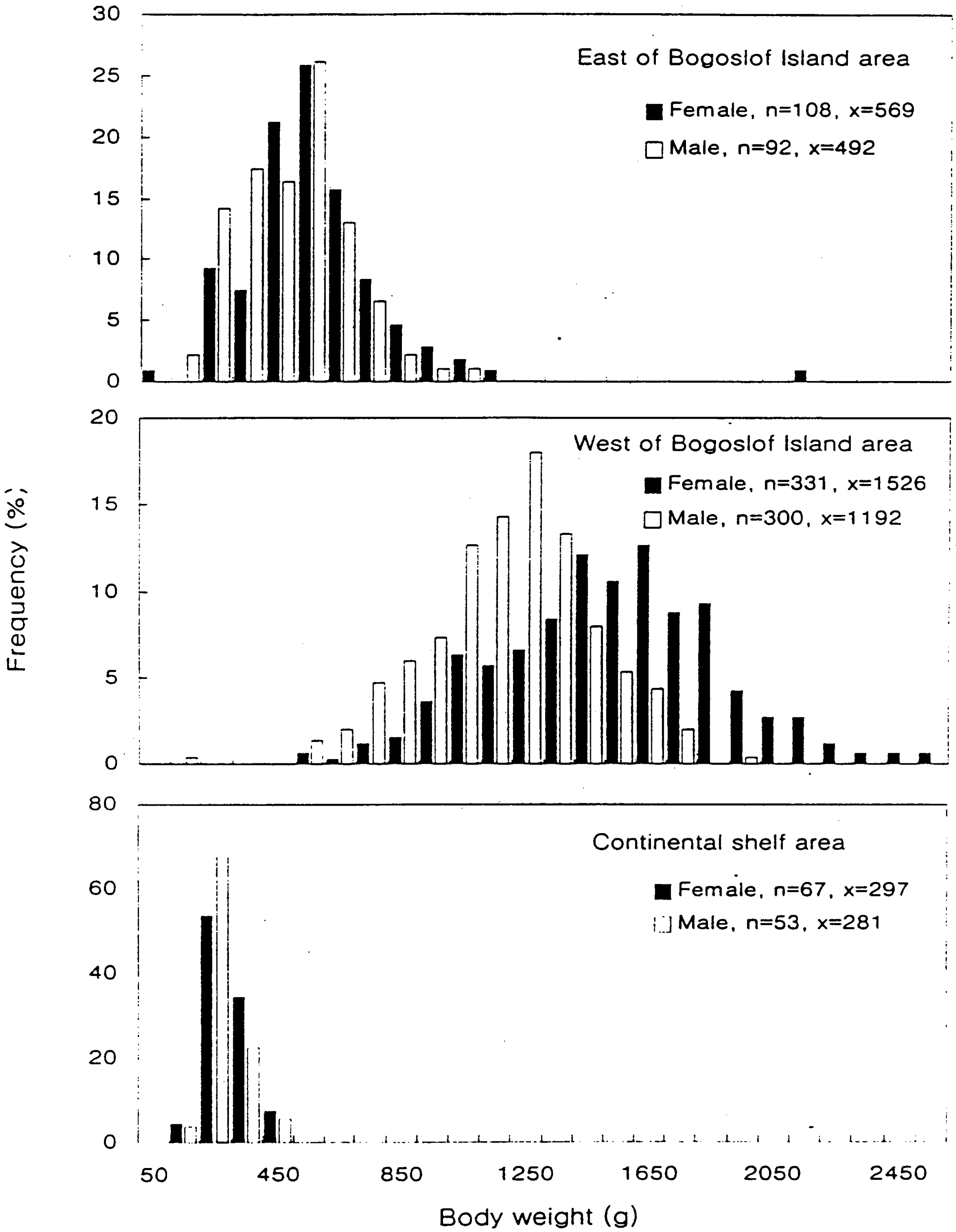


Fig. 4. Body weight composition of walleye pollock caught by midwater trawl in the Bering Sea during March in 2000.

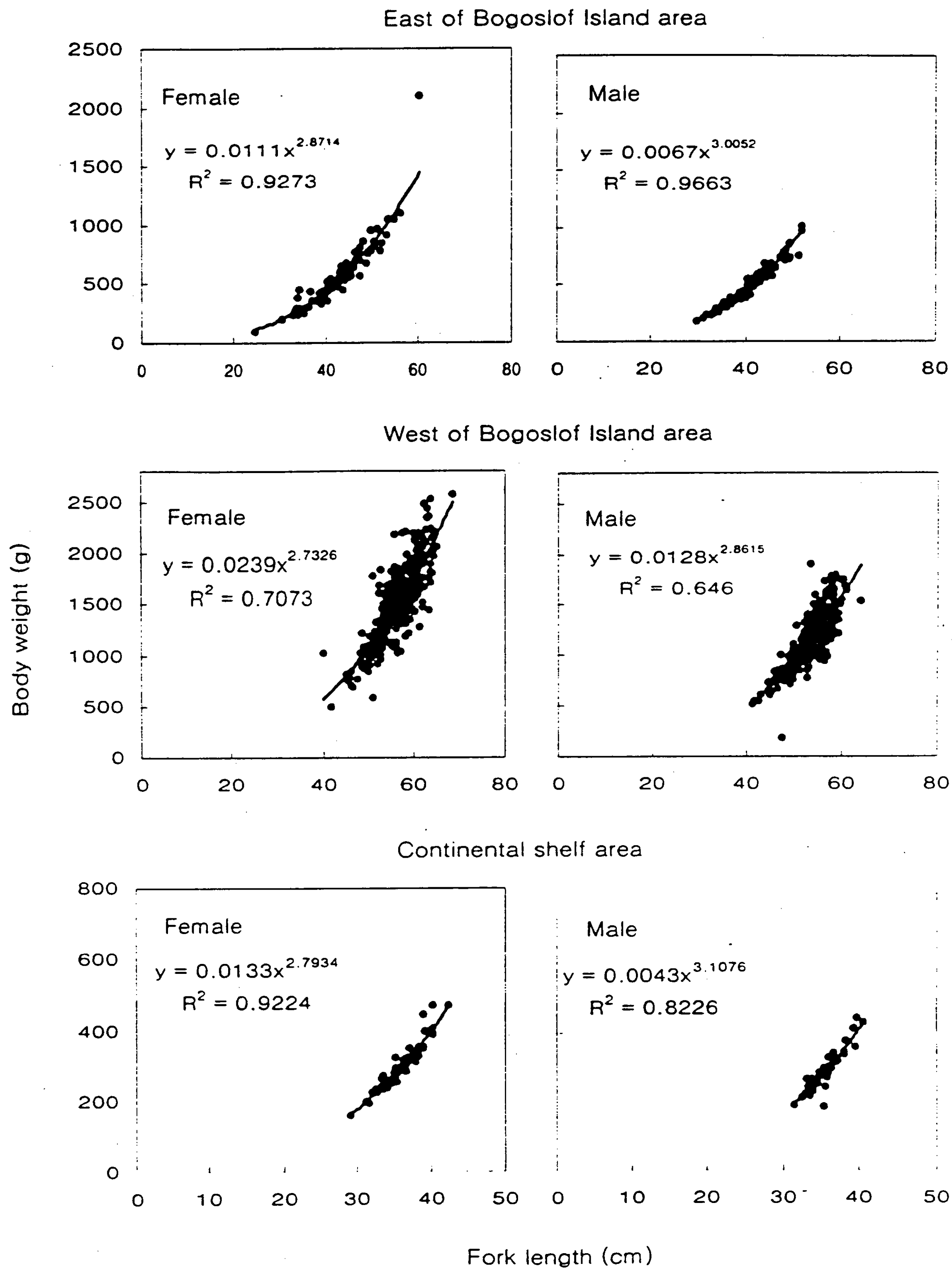


Fig. 5. Relationship between fork length and body weight of walleye pollock caught by midwater trawl in the Bering Sea during March in 2000.

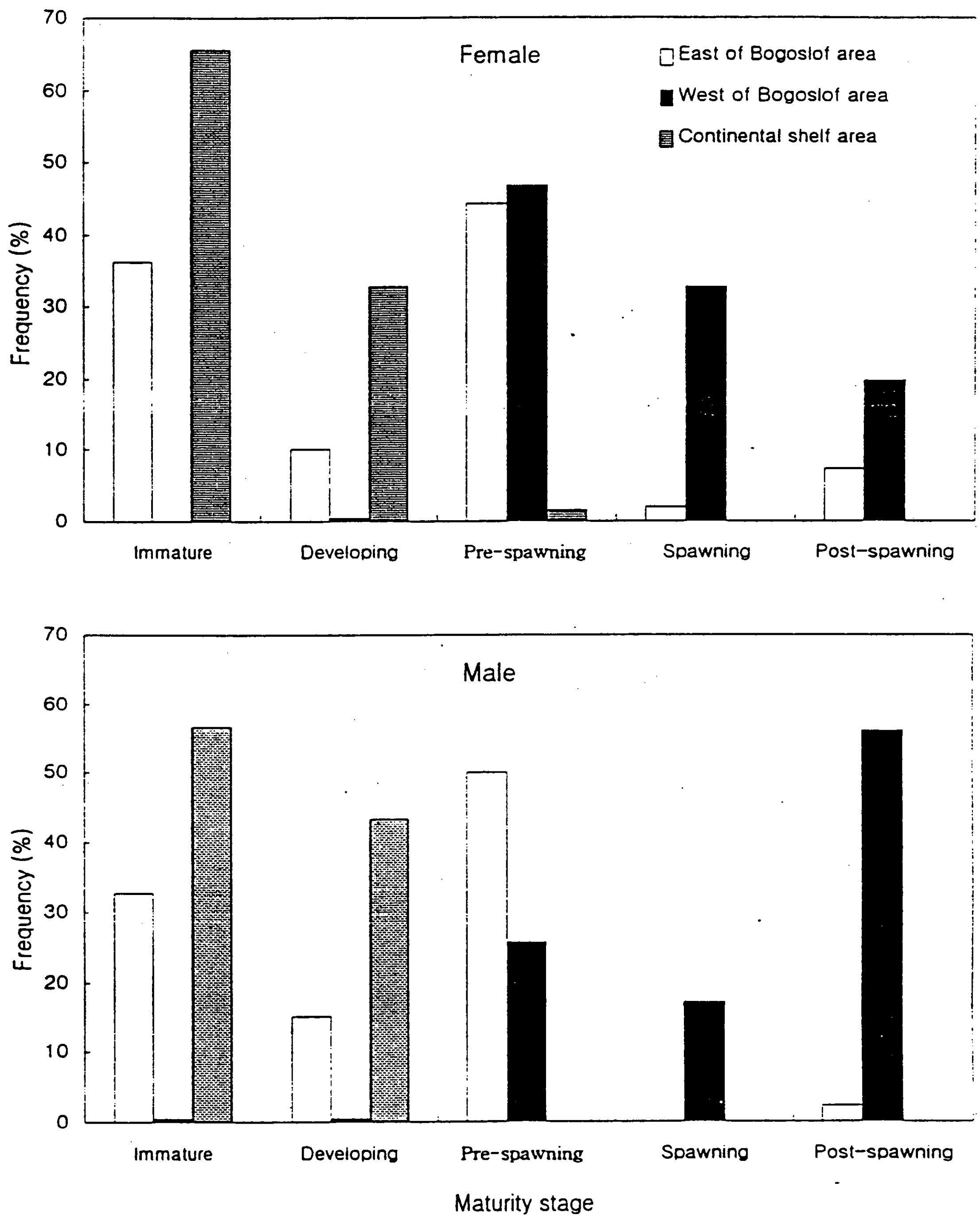


Fig. 6. Maturity stages of pollock observed from the survey of *R/V Tamgu 1* in the Bering Sea during March in 2000.

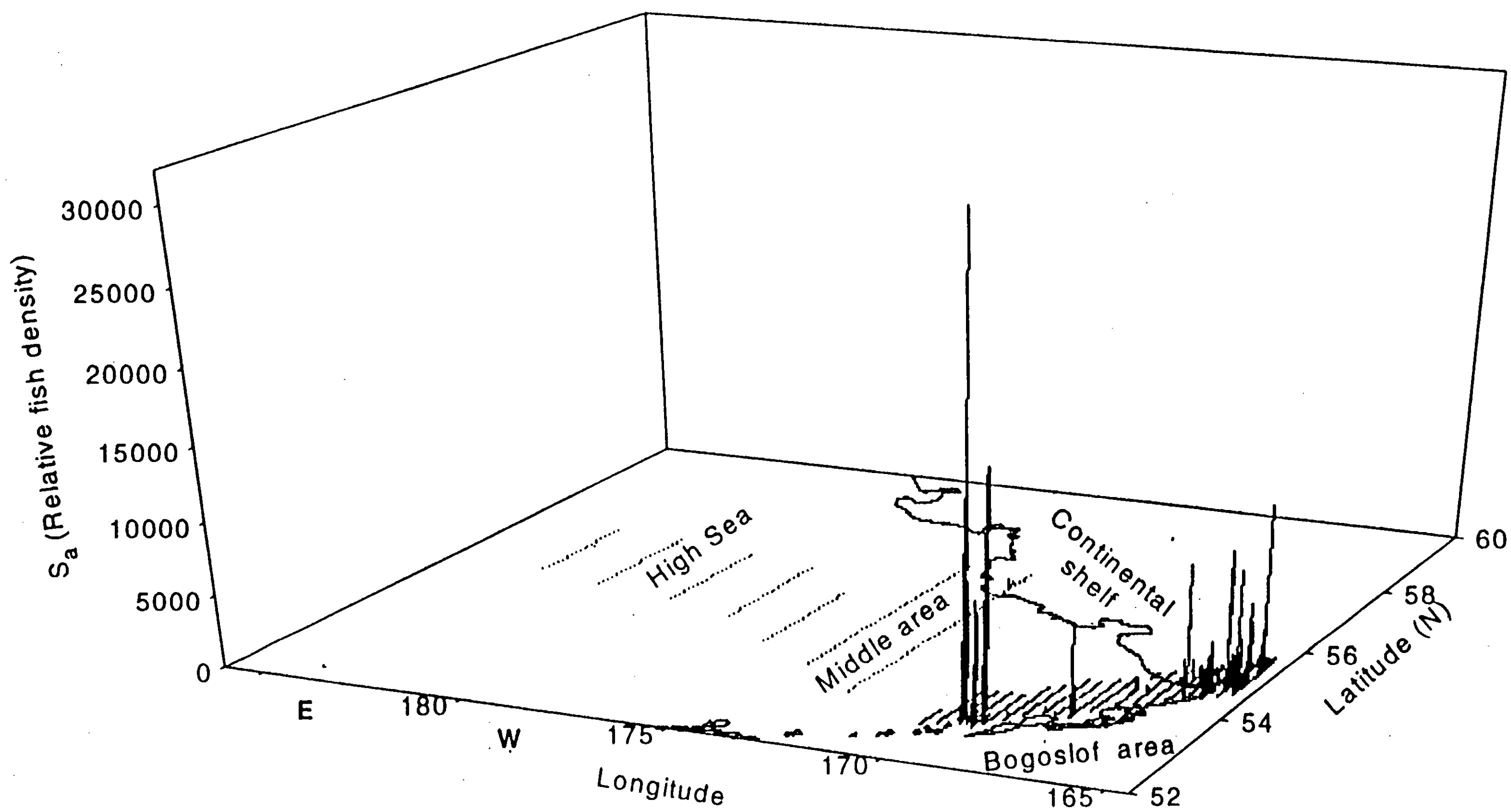


Fig. 7. Relative density of walleye pollock along trackline from the echo integration and midwater trawl survey by R/V Tamgu 1 in the Bering Sea during March in 2000.

POLAND

REPORT ON THE POLISH TRIAL OPERATION ON POLLOCK IN THE BERING SEA CONVENTION AREA IN AUGUST 1999

In 1999 second trial fishing cruise in the Bering Sea Convention area (Donut hole) was conducted by Polish vessel in summer 1999.

Trial fishing was carried out by stern trawler HOMAR (length – 95 m, tonnage – 3708 GRT) in the period from August 17 through August 30, 1999. The main purpose of the trial was to determine the geographical distribution of pollock in Convention area and to collect biological data. Scientific observer was placed on board of the vessel.
During the searching time about 1700 Nm of hydroacoustic trackline were conducted (Fig. 1).

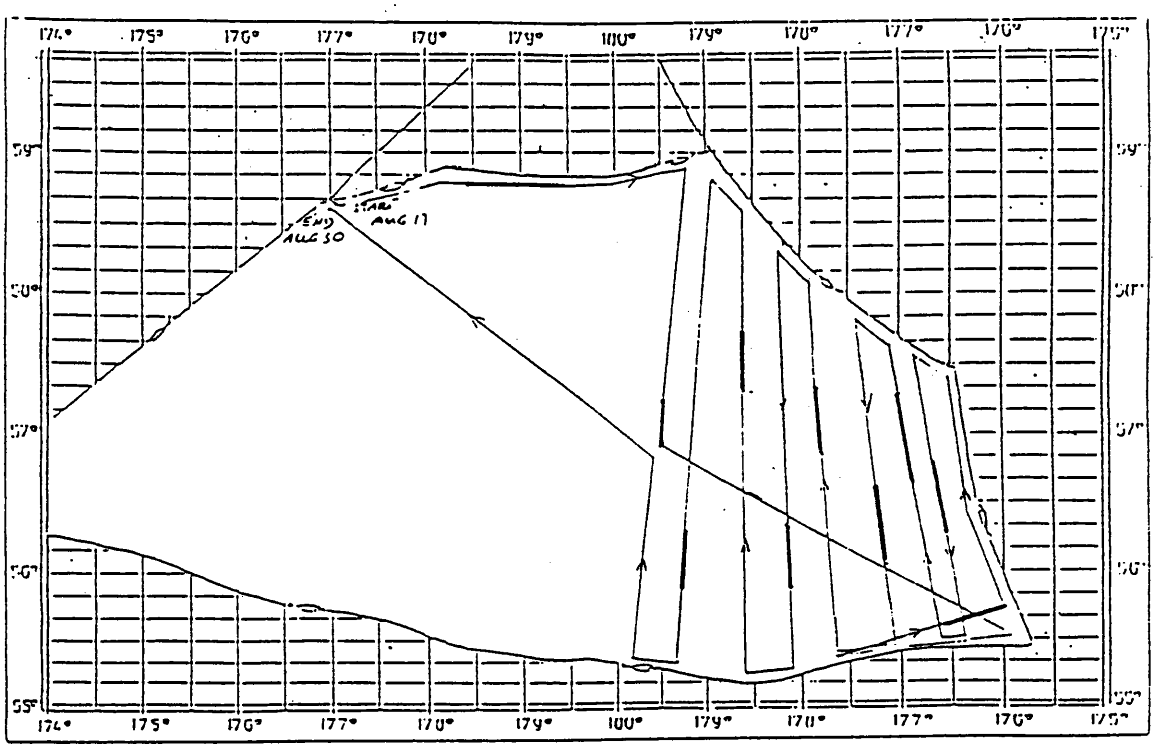


Fig. 1. Hydroacoustic trackline and the site of hauls (solid line) of m/t HOMAR During trial fishing i the Convention Area of Bering Sea (summer 1999)

During the echosounding there were no indications of pollock. At depths 80 – 180m the layer of small indications was observed (Fig. 2). It consisted mainly of lanternfish (Myctophide) which were found in the mesh of codend.

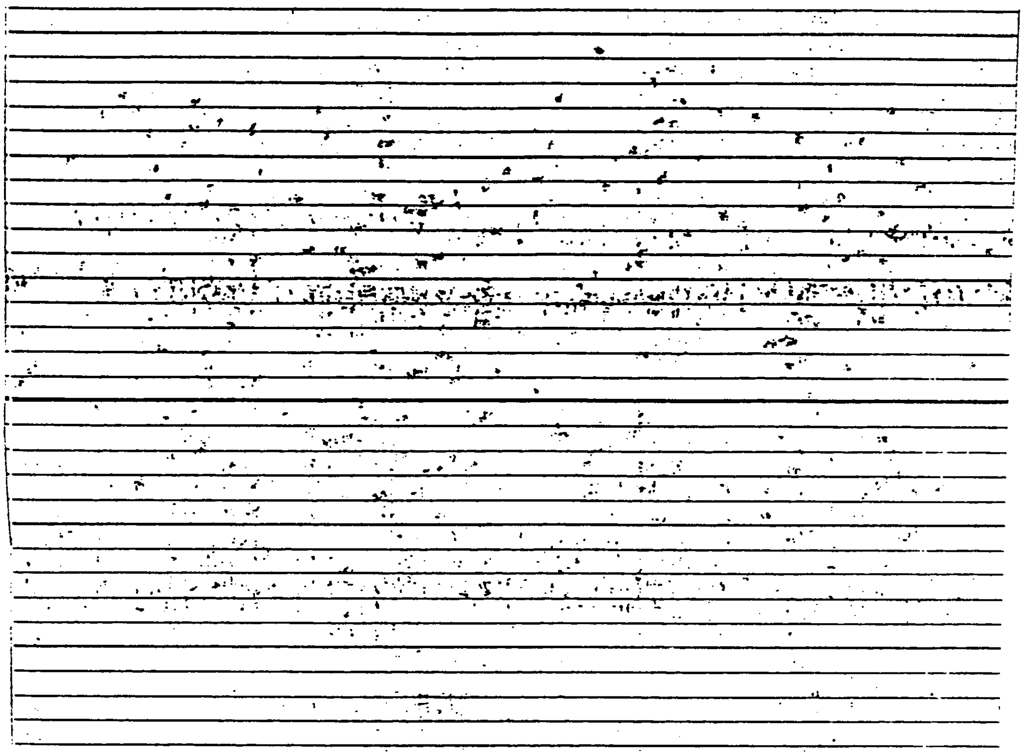


Fig. 2. Fragment of typical print-out from net sounder recorder

Ten hauls were performed at depth between 30 to 180m, and 31.4 kg of fish were caught. Only two specimens of pollock (*Theragra chalcogramma*) were caught in central-eastern (hauls 6 and7) part of the Donut hole. Pollock specimens measured 55.0 and 47.0 cm in length. Both of them were male.

In the last two hauls (9 and 10) 23 specimens of sockeye salmon (*Oncorhynchus nerka*) were caught.

Sea surface temperature of water varied between 8.0°C to 9.0°C.

The data forms were completed by scientific observer and are attached to the report.

Jerzy Janusz
Sea Fisheries Institute
Kollataja 1, 81-332 Gdynia, Poland

HAUL SUMMARY FORM

CRUISE #			VESSEL CODE					YEAR	
1	2	3	4	5	6	7	8	9	10
-	2	0	S	N	V	X		9	9

OBSERVER NATION
1 2 3 ④ 5

VESSEL NATION
1 2 3 ④ 5

OBSERVER NAME
WOLICKI WIESŁAW

VESSEL NAME
M/T HOMAR

HAUL SAMPLED	DATE		HAUL #	GEAR TYPE	GEAR PERFORMANCE	HAUL POSITION			FISHING TIMES IN GMT		FISHING DURATION IN MINUTES	AVERAGE FISHING DEPTH	AVG. SPEED KNOTS	OBSERVER TOTAL CATCH ESTIMATE (MT)	VESSEL TOTAL CATCH ESTIMATE (MT)	SEA SURFACE TEMP. (C)	FISHING DEPTH TEMP. (C)	SEA STATE
	MONTH	DAY				LATITUDE (NORTH)	1/2	LONGITUDE	NETS AT DEPTH	BEGIN RETRIEVAL								
	11 12	13 14	15 - 17	18	19	20 - 23	24	25 - 29	30 - 33	34 - 37	38 - 40	41 - 43	44-45	46 - 50	51 - 55	56 - 59	60 - 63	64
	08	17	1	1	1	5847	1	17930	08.10	14.30	380	30	5,0	.	0.	8,3		3
	08	20	2	1	1	5653	2	17945	00.30	03.30	180	150	4.5	.	0.	8,3		6
	08	21	3	1	1	5544	2	17600	20.30	01.50	320	180	4,5	.	0.	8,6		4
	08	22	4	1	1	5617	2	17635	02.30	08.30	360	150	4,5	.	0.	8,4		3
	08	24	5	1	1	5715	2	17705	00.50	08.10	440	80	5,0	.	0.	8,0		2
	08	24	6	1	1	5558	2	17717	21.50	02.30	285	120	4,2	0.001	0.	9,0		2
	08	25	7	1	1	5733	2	17752	20.00	02.10	370	120	4,1	0.001	0.	8,8		2
	08	26	8	1	1	5552	2	17815	19.45	01.30	345	100	4,1	.	0.	8,5		2
	08	27	9	1	1	5743	2	17845	19.40	01.30	350	90-120	4.1	0.024	0.	8,2		3-2
	08	28	10	1	1	5552	2	17910	19,45	01.30	345	80-120	4,1	0.005	0.	8,1		2
														.	.			
														.	.			
														.	.			
														.	.			
														.	.			
														.	.			
														.	.			
														.	.			
														.	.			

SPECIES COMPOSITION FORM

Observer Name WOLICKI WIESŁAW

Observer Nation 1 2 3 4 5

Vessel Name M/T HOMAR

Vessel Nation 1 2 3 4 5

Species:						
Wt. of above:						
No. weighed:						
Avg. weight:						

CRUISE #			VESSEL CODE					YEAR		MONTH		DAY	
1	2	3	4	5	6	7	8	9	10	11	12	13	14
-	2	0		S	N	V	X	9	9	0	8	2	4

ST = Sampling Type
1 = whole haul
2 = partial haul
3 = weighed sample

Haul (15 - 18)	Species name	Species code	ST	Number	Species weight in kg. w/ decimal	Sample weight in kg. w/ decimal
6		19 - 21	22	23 - 28	29 - 37	38 - 46
	(keypunch check)	999				
	T. chalcogramma	30	1	1	1,3	1,3

Haul (15 - 18)	Species name	Species code	ST	Number	Species weight in kg. w/ decimal	Sample weight in kg. w/ decimal
7		19 - 21	22	23 - 28	29 - 37	38 - 46
	(keypunch check)	999				
	T. chalcogramma	30	1	1	1,0	1.1

SPECIES COMPOSITION FORM

Observer Name WOLICKI WIESŁAW

Observer Nation 1 2 3 4 5

Vessel Name M/T HOMAR

Vessel Nation 1 2 3 4 5

Species:						
Wt. of above:						
No. weighed:						
Avg. weight:						

CRUISE #			VESSEL CODE					YEAR		MONTH		DAY	
1	2	3	4	5	6	7	8	9	10	11	12	13	14
	2	0		S	N	V	X	9	9	0	8	2	7

ST = Sampling Type
1 = whole haul
2 = partial haul
3 = weighed sample

Haul (15 - 18)	Species name	Species code	ST	Number	Species weight in kg. w/ decimal	Sample weight in kg. w/ decimal
		19 - 21	22	23 - 28	29 - 37	38 - 46
9	(keypunch check)	999	X			X
	Oncorhynchus nerka	20	1	19	24,40	24,40

Haul (15 - 18)	Species name	Species code	ST	Number	Species weight in kg. w/ decimal	Sample weight in kg. w/ decimal
		19 - 21	22	23 - 28	29 - 37	38 - 46
10	(keypunch check)	999	X			X
	Oncorhynchus nerka	20	1	4	4,65	4,65

LENGTH FREQUENCY FORM

CRUISE #			VESSEL CODE					YEAR		MONTH		DAY	
1	2	3	4	5	6	7	8	9	10	11	12	13	14
-	2	0	S	N	V	X		9	9	0	8	2	4

OBSERVER NATION
1 2 3 4 5

OBSERVER NAME
WOLICKI WIESŁAW

VESSEL NATION
1 2 3 4 5

VESSEL NAME
M/T HOMAR

5 mm SIZE GROUPS:

0-5 mm rounded down to 0 mm
5-10 mm rounded down to 5 mm

SPECIES NAME	SPECIES CODE	HAUL NUMBER	SEX CODE	SUM OF ROW	LENGTH	NUMBER	LENGTH	NUMBER	LENGTH	NUMBER	LENGTH	NUMBER	LENGTH	NUMBER	LENGTH	NUMBER	LENGTH	NUMBER
	15-16	17 - 19	20	21 - 24	25-28	29-31	32-35	36-38	39-42	43-45	46-49	50-52	53-56	57-59	60-63	64-66	67-70	71-73
T. chalcogramma	30	6	1		550	1												
T. chalcogramma	30	7	1		470	1												

BIOLOGICAL SAMPLE FORM

OBSERVER NATION 1 2 3 4 5

OBSERVER NAME WOLICKI WIESŁAW

VESSEL NATION 1 2 3 4 5

VESSEL NAME M/T HOMAR

CRUISE #			VESSEL CODE					YEAR		MONTH		DAY	
1	2	3	4	5	6	7	8	9	10	11	12	13	14
-	2	0	S	N	V	X		9	9	0	8	2	3

	SPECIES NAME	SPECIES CODE	HAUL NUMBER	SEX CODE	SPECIMEN NUMBER	SPECIMEN TYPE	SAMPLING SYSTEM	LENGTH	WEIGHT (kg)	MATURITY CODE	REMARKS
		15-16	17 - 19	20	21 - 24	25	26	27 - 30	31 - 34	35	
1	T. chalcogramma	30	6	1	1	1		550	1.30	3	
2	T. chalcogramma	30	7	1	1	1		470	1.01	3	
3									.		
4									.		
5									.		
6									.		
7									.		
8									.		
9									.		
10									.		
11									.		
12									.		
13									.		
14									.		
15									.		
16									.		
17									.		
18									.		
19									.		

Attachment 7

ICES Journal of Marine Science, 57: 279–293. 2000
doi:10.1006/jmsc.1999.0637, available online at http://www.idealibrary.com on IDEAL®

Including predation mortality in stock assessments: a case study for Gulf of Alaska walleye pollock

Anne Babcock Hollowed, James N. Ianelli, and
Patricia A. Livingston

Hollowed, A. B., Ianelli, J. N., and Livingston, P. A. 2000. Including predation mortality in stock assessments: a case study for Gulf of Alaska walleye pollock. – ICES Journal of Marine Science, 57: 279–293.

A separable catch-age stock assessment model that accommodates predation mortality is applied to the Gulf of Alaska walleye pollock (*Theragra chalcogramma*) assessment. Three predators are incorporated in the model: arrowtooth flounder (*Atheresthes stomias*), Pacific halibut (*Hippoglossus stenolepis*), and Steller sea lion (*Eumetopias jubatus*). The effect of these predators is examined by defining the predation mortality as a type of fishery. The model is used to quantify changes in the relative fit to the survey, fishery, and predator data when the assumption of constant natural mortality is relaxed. Specifically, we examine the effect of assumptions regarding the functional feeding response, residual naturaly mortality, and uncertainty in predator biomass on stock assessment. Total natural mortality rates (including predation) tended to be higher than estimated from life history characteristics of the stock. Models that did not account for uncertainty in natural mortality underestimated uncertainty in current stock biomass by as much as 20%. Our results indicate that independent estimates of survey selectivity, additional food habits data, and estimates of the feeding responses of predators to different prey densities are all needed to improve our ability to develop stock assessment models that address ecosystem concerns.

Key words: predation, stock assessment, uncertainty, walleye pollock.

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Introduction

A long-term goal of fisheries management is to employ harvest practices that sustain the diversity and productivity of fish stocks. To provide appropriate advice, stock assessment scientists must account for changes in the physical and biological factors that influence production (Botsford *et al.*, 1997). Shifts in predation mortality are one biological factor that can impact stock assessments. Recent developments in catch-age assessment models provide an analytical framework for incorporating predator–prey interactions to account for age-specific variability in natural mortality (Larkin, 1996). In this paper, we present a catch-age modelling framework that incorporates predator–prey interactions and employ this model for the assessment of the walleye pollock (*Theragra chalcogramma*) stock in the Gulf of Alaska.

Although numerous studies have identified the potential for biased stock projections caused by erroneous assignment of a constant natural mortality rate (e.g., Sims, 1984; Lapointe *et al.*, 1989; Mertz and Myers, 1997), predation mortality is still commonly assumed to be constant. The assumption of constant natural mortality has been relaxed by modelling age-specific predation mortality in stock assessments (e.g. Macer and Shepherd, 1987; Gislason, 1991; Sparholt, 1991; Sparre, 1991; Magnússon, 1995; Mohn and Bowen, 1996; Livingston and Jurado-Molina, 1999; and Livingston and Methot, in press), and by developing stochastic simulation models that account for errors in estimation of natural mortality (e.g. Schnute and Richards, 1995). Simulation approaches are often favoured in producing harvest recommendations because of the uncertainty surrounding the interaction parameters, such as consumption rates, diet preference, and daily ration. When reasonable estimates of interaction parameters exist, information regarding trends in predator abundance should be used to account for interannual variability in age-specific natural mortality rates.

In the Gulf of Alaska, walleye pollock is an important component of the diet of several marine fish, birds,

How much organisms consumed by Marine Mammal and Birds in Bering Sea?

- PICES WG 11(1999)

Bering Sea Continental Region (BSC):

Marine Mammals; insufficient information

Marine Birds; 655,754 - 1,530,092 mt/ summer (92days)

Bering Sea Pelagic Region (BSP):

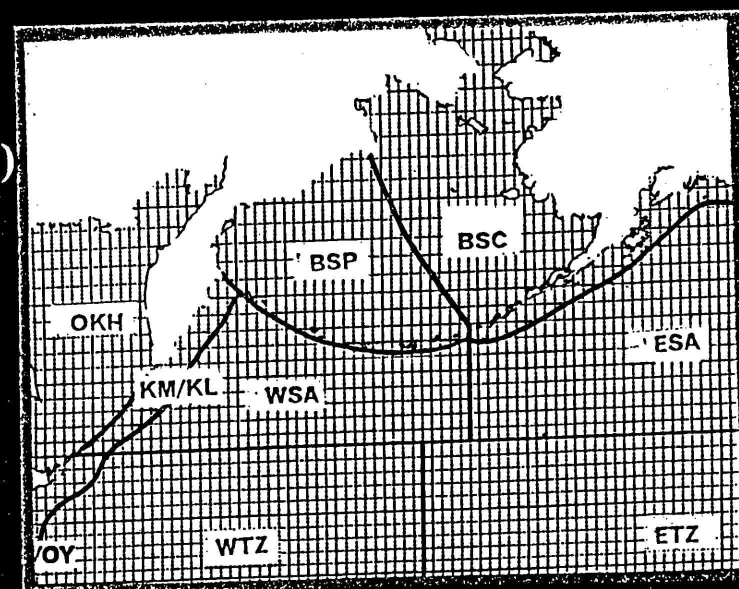
Marine Mammals; 487,000mt + / summer (92days)

Marine Birds; 333,066 - 777,155 mt/ summer

- Trites (1997)

FAO 67: 9,330,000mt/ year by Marine Mammals

FAO 61: 20,380,000mt/ year by Marine Mammals



How Correlate Wall-eye Pollack with Marine Mammals and Birds?

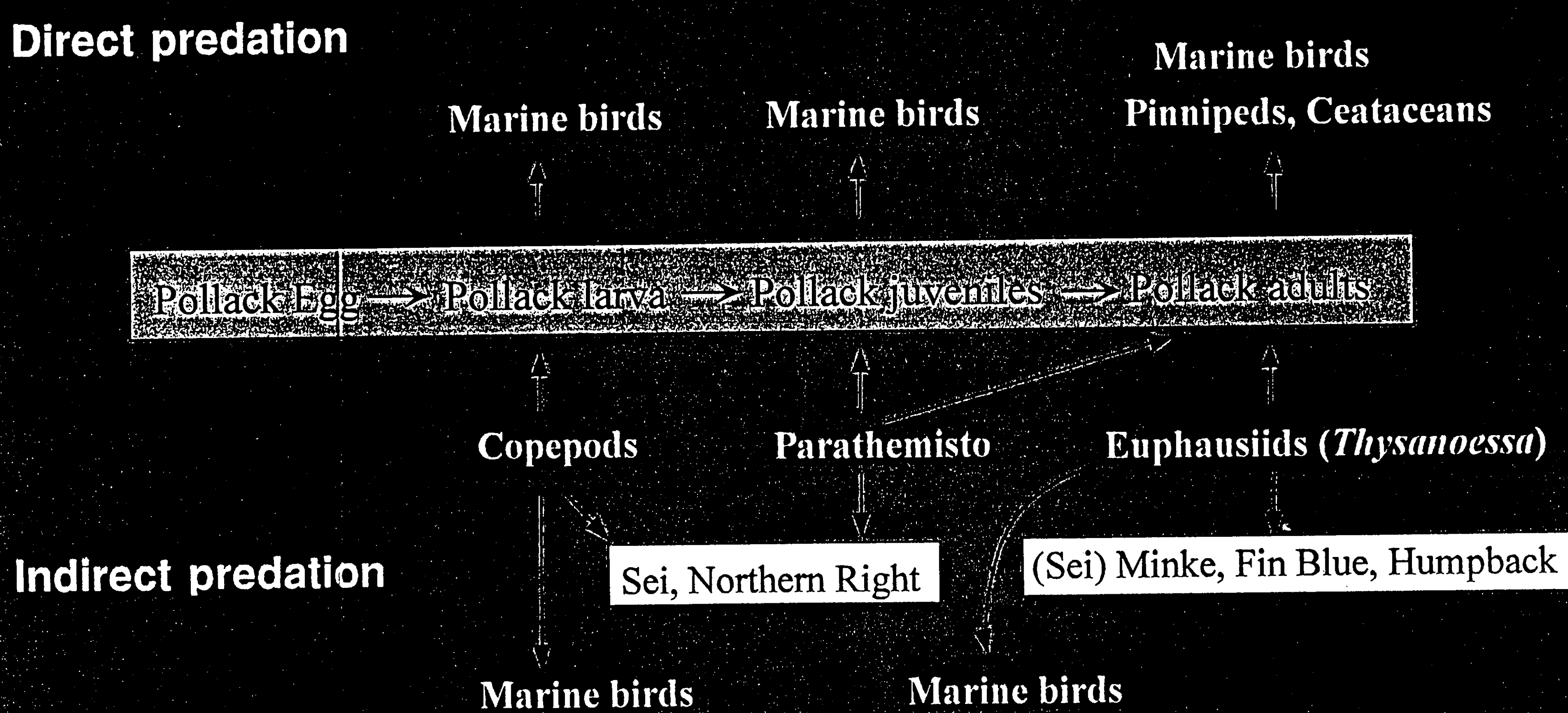


Table 1. Estimated daily food consumption of cetaceans based on three methods in the Bering Sea.

Species	Average body weight (kg)	Method-1 (kg)	%	Method-2 (kg)	%	Method-3 (kg)	%
Baleen whales							
Blue whale	102,737	957	0.93	1,332	1.30	3,596	3.50
Fin whale	55,590	634	1.14	824	1.48	1,946	3.50
Sei whale	16,811	285	1.69	323	1.92	588	3.50
Minke whale	6,566	152	2.31	155	2.36	230	3.50
Humpback whale	30,408	423	1.39	514	1.69	1,064	3.50
Northern right whale	23,383	355	1.52	418	1.79	818	3.50
Bowhead whale	31,076	430	1.38	522	1.68	1,088	3.50
Gray whale	15,372	268	1.74	301	1.96	538	3.50
Toothed whales							
Sperm whale	18,519	304	1.64	348	1.88	648	3.50
Baird's beaked whale	3,137	92	2.95	87	2.77	110	3.50
Cuvier's beaked whale	829	38	4.57	31	3.69	29	3.50
Stejneger's beaked whale	455	25	5.57	19	4.20	16	3.50
Killer whale	2,281	75	3.27	68	2.96	80	3.50
Dall's porpoise	61	7	10.82	4	6.50	2	3.50
Harbour porpoise	31	4	13.52	2	7.53	1	3.50
White whale	313	20	6.31	14	4.56	11	3.50

Table 2. Assumed prey composition (% of weight) of cetaceans in the Bering Sea.

Species	Fish	Cephalopoda	Crustacean	Others	Source
Blue whale			100.0		Nemoto and Kawamura 1977
Fin whale	5.0	1.7	93.3		Nemoto and Kawamura 1977
Sei whale	3.4	1.2	95.4		Nemoto and Kawamura 1977
Minke whale	70.0		30.0		Tamura and Fujise 2000a
Humpback whale	17.2		82.8		Nemoto and Kawamura 1977
Northern right whale			100.0		Nemoto and Kawamura 1977
Bowhead whale			100.0		Nemoto 1959
Gray whale	5.0		95.0		Pauly *et al*. 1998
Sperm whale	25.0	5.0	70.0		Pauly *et al*. 1998
Baird's beaked whale	35.0	55.0	10.0		Pauly *et al*. 1998
Cuvier's beaked whale	30.0	60.0	10.0		Pauly *et al*. 1998
Stejneger's beaked whale	5.0	95.0			Pauly *et al*. 1998
Killer whale	50.0	10.0		40.0	Pauly *et al*. 1998
Dall's porpoise	55.0	40.0	5.0		Pauly *et al*. 1998
Harbour porpoise	75.0	20.0	5.0		Pauly *et al*. 1998
White whale	70.0	10.0	20.0		Pauly *et al*. 1998

Table 3.1.a. Metric tons of prey consumed by marine birds: Bering Sea Continental Shelf & Shelfbreak (PICES area BSC), Summer (June-August).

Species	Miscellaneous Invertebrates (mt)	Gelatinous Zooplankters (mt)	Crustacean Zooplankters (mt)	Small Cephalopods (mt)	Large Cephalopods (mt)	Fish (Low Energy Density) (mt)	Fish (Medium Energy Density) (mt)	Fish (High Energy Density) (mt)	Birds & Mammals (mt)	Carrion, Offal & Discards (mt)	Unknown (mt)	Total (mt)
Northern Fulmar	0.0	+	1,261.9	4,458.7	0.0	12,745.2	2,544.8	0.0	0.0	0.0	21.0	21,031.6
Short-tailed Shearwater	0.0	0.0	322,928.0	370.3	0.0	0.0	46,661.6	0.0	0.0	0.0	370.3	370,330.2
Red-faced Cormorant	0.9	0.0	131.1	0.0	0.0	132.8	594.1	0.0	0.0	0.0	3.4	862.3
Black-legged Kittiwake	0.0	0.0	2,725.8	373.4	0.0	16,914.6	12,135.2	4,219.3	0.0	0.0	970.8	37,339.1
Red-legged Kittiwake	0.0	0.0	71.7	136.3	0.0	1,707.5	1,040.3	4,103.7	0.0	0.0	114.8	7,174.3
Common Murre	0.0	0.0	4,920.6	1,595.9	0.0	74,739.2	51,865.3	0.0	0.0	0.0	0.0	133,120.8
Thick-billed Murre	192.7	0.0	33,906.4	10,210.5	0.0	76,289.5	69,354.1	770.6	0.0	0.0	1,926.5	192,650.3
Parakeet Auklet	972.5	0.0	2,007.2	16.6	0.0	186.2	914.6	0.0	0.0	0.0	41.4	4,138.5
Crested Aulket	0.0	0.0	29,713.1	0.0	0.0	0.0	241.8	0.0	0.0	0.0	272.0	30,226.9
Least Auklet	0.0	0.0	15,045.8	0.0	0.0	48.7	64.9	0.0	0.0	0.0	1,071.2	16,230.6
Horned Puffiin	98.4	0.0	280.0	17.7	0.0	1,026.5	983.6	0.0	0.0	0.0	116.0	2,522.2
Tufted Puffin	1,062.6	0.0	303.5	151.7	0.0	1,517.4	5,748.2	0.0	0.0	0.0	142.8	8,925.7
Total*	2,327.1	0.0	413,295.1	17,331.1	0.0	185,307.6	192,148.5	9,093.6	0.0	0.0	5,050.2	824,552.5

* Prey totals represent 98.4% of the known summer biomass of marine birds in the area
(Sum of Occuupancy x Body Mass from Table 2.1.a divided by Sum of Occupancy x Body Mass from Table 1.1.a).

Table 3.2.a. Metric tons of prey consumed by marine birds: Bering Sea Pelagic/Russia/Aleutian Islands (PICES area BSP), Summer (July-August).

Species	Miscellaneous Invertebrates (mt)	Gelatinous Zooplankters (mt)	Crustacean Zooplankters (mt)	Small Cephalopods (mt)	Large Cephalopods (mt)	Fish (Low Energy Density) (mt)	Fish (Medium Energy Density) (mt)	Fish (High Energy Density) (mt)	Birds & Mammals (mt)	Carrion, Offal & Discards (mt)	Unknown (mt)	Total (mt)
Short-tailed Shearwater	1,062.2	0.0	303.5	151.7	0.0	1,517.4	5,748.2	0.0	0.0	0.0	142.8	8,925.7
Parakeet Auklet	0.0	0.0	1,341.8	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.3	1,343.1
Crested Auklet	0.0	0.0	65,264.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	65,264.1
Least Auklet	15.2	0.0	15,167.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	15,182.3
Whiskered Auklet	+	0.0	39.5	+	0.0	0.0	+	0.0	0.0	0.0	0.1	39.6
Total*	1,077.4	0.0	82,116.0	151.7	0.0	1,517.4	5,748.20	0.0	0.0	0.0	144.2	90,754.8

* Prey totals represent 44.8% of the known summer biomass of marine birds in the area
(Sum of Occupancy x Body Mass from Table 2.2.a divided by Sum of Occupancy x Body Mass from Table 1.2.a).

Table 5. Summary of Important Prey Species

Region	Zooplankton	Cephalopod	Small Fish
BSC	Euphausiid	Sm. Cephalopod	Walleye Pollock
BSP	Copepods	Sm. Cephalopod	Sandlance Capelin
ASK	Euphausiids	Sm. Cephalopod	Capelin Sandlance
CAN	Copepods Euphausiids	Loligo opalescens	Sandlance Sebastes spp. Myctophids
ESA	No Data	No Data	No Data
WSA	?	Sm. cephalopod	*Sardinopes melanostia* *Pleurogrammus monopterigius*
KM/KL	Euphausiids	?	*Pleurogrammus*
OKH	Euphausiids	?	?
CAS	Euphausiids	*Loligo opalescens*	Engraulis mordax
ETZ	*Lepus fascicularis*	*Ommastrephes bartrami*	*Cololabis saira*
WTZ	*Lepus fascicularis*	*Ommastrephes bartrami*	*Cololabis saira*
KR/OY	?	?	*Pleurogrammus monopterigius*
SJP	No Data	No Data	No Data
ECS	No Data	No Data	No Data

Table 8.2. Metric tons of prey consumed by marine birds: Bering Sea Pelagic/Russia/Aleutian Islands (PICES area BSP), Summer (July-August).

Species	Miscellaneous Invertebrates (mt)	Gelatinous Zooplankters (mt)	Crustacean Zooplankters (mt)	Small Cephalopods (mt)	Large Cephalopods (mt)	Fish (Low Energy Density) (mt)	Fish (Medium Energy Density) (mt)	Fish (High Energy Density) (mt)	Birds & Mammals (mt)	Carrion, Offal & Discards (mt)	Unknown (mt)
Short-tailed Shearwater	0	0	8,930	93,327	0	0	6,534	0	0	0	109
Parakeet Auklet	343	572	606	239	0	113	74	12	0	0	0
Crested Auklet	177	0	77,019	10,675	0	352	0	0	0	0	0
Least Auklet	222	0	19,919	0	0	0	0	0	0	0	40
Whiskered Auklet	+	0	69	+	0	0	+	0	0	0	0
Total*	742	572	106,544	104,241	0	466	6,609	12	0	0	149

* Prey totals represent 36% of the known summer energy demands of marine birds in the area
(Sum of Occupancy x daily energy demands of species listed above divided by Sum of Occupancy x daily energy demands of species from Appendix Table 6.2)

Appendix 7. Marine Bird Prey Preferences

Table 7.1. Marine bird prey preferences: Bering Sea Continental Shelf & Shelfbreak (PICES area BSC), Summer (June-August). Approximate percent composition of diet is given for each prey category.
Unidentified Fish were assumed to be of medium energy density.

Species	Miscellaneous Invertebrates ~4kj/g	Gelatinous Zooplankters ~3kj/g	Crustacean Zooplankters ~4kj/g	Small Cephalopods ~3.5kj/g	Large Cephalopods ~4kj/g	Fish (Low Energy Density) ~3kj/g*	Fish (Medium Energy Density) ~5kj/g*	Fish (High Energy Density) ~7kj/g*	Birds & Mammals ~7kj/g	Carrion, Offal & Discards ~5kl/g	Unknown ~5kj/g	Major Prey Species (also see footnotes)	References (also see footnotes)
Northern Fulmar (1/)		+	0.06	0.212		0.606	0.121			+	0.001	*Theragra chalcogramma*	Hunt et al. 1981
Short-tailed Shearwater(1/), (2/)		+	0.872	0.001			0.126				0.001	*Parathemisto libellula*	Ogi et al. 1980
Fork-tailed Storm-Petrel	+	+	+++	++			+	+					Harrison 1984
Red-faced Cormorant	0.001		0.152			0.154	0.689				0.004	Miscellaneous fish	Hunt et al. 1981
Black-legged Kittiwake (1/), (3/), (4/)		+	0.073	0.01		0.453	0.325	0.113			0.026	*Theragra chalcogramma*	Hunt et al. 1981
Red-legged Kittiwake (1/), (5)	+	+	0.01	0.019		0.238	0.145	0.572			0.016	*Myctophidae*	Hunt et al. 1981
Common Murre (3/), (4/), (6/), (7/)	+		0.037	0.012		0.562	0.39				0	*Theragra chalcogramma*	Hunt et al. 1981
Thick-billed Murre (3/), (4/), (5/), (6/), (7/), (8/)	0.001	+	0.176	0.053		0.396	0.36	0.004			0.01	*Theragra chalcogramma*	Hunt et al. 1981
Parakeet Auklet (9/), (10/)	0.235	+	0.485	0.004		0.045	0.221				0.01	*Euphausiidae*	Hunt et al. 1981
Crested Auklet (9/), (10/), (11)	+	+	0.983				0.008				0.009	*Euphausiidae*	Hunt et al. 1981
Least Auklet (10/), (11/), (12/), (13/), (14/), (15/)	+	+	0.927			0.003	0.004				0.066	*Calanus marshallae-glacialis*	Hunt et al. 1981
Horned Puffin	0.039		0.111	0.007		0.407	0.39				0.046	*Hexagrammos stelleri*	Hunt et al. 1981
Tufted Puffin	0.119		0.034	0.017		0.17	0.644				0.016	*Theragra chalcogramma*	Hunt et al. 1981

* FISH: Low density (~3kj/g) = Cod, Rockfish, Pollock, etc.; Medium density (~5kj/g) = Capelin, Sandlance, etc.; High density (~7kj/g) = Lanternfish, Herring, Saury, Sardine, etc.
1/ Harrison (1984) found high frequencies of occurrence of scyphomedusae in the diets of these species.
2/ Hunt et al. (1996a) found that *Thysanoessa rashii* was the almost exclusive prey of short-tailed shearwaters around the Pribilof Islands.
3/ Springer et al. (1987) found *Eleginus gracilis* and *Ammodytes hexapterus* overall to be the most important prey of Common Murres and Black-legged Kittiwakes at Bluff. They found that *Boreogadus saida* were the most important diet component of Common and Thick-billed murres at St. Lawrence Island, and that *Ammodytes hexapterus* dominated the diets of Black-legged Kittiwakes at St. Lawrence Island.

Factors affecting the distribution of pollock in the Aleutian Basin

Presented by Seok-Gwan Choi, Republic of Korea

Introduction

Mid-water temperature, zooplankton densities, and distribution of adult walleye pollock were compared based on the hydroacoustic survey data conducted in the Aleutian Basin in spring 1997 and 1999. An additional transect line for this analysis was established from the CBS to the Bogoslof Island.

The purpose of this analysis aimed to identify the relationship between water temperature and pollock distribution in order to identify the potential environmental factors that affect the distribution of walleye pollock in the Aleutial Basin ecosystem.

Materials

Busan851 and Tamgu1, research vessels of the National Fisheries Research and Development Institute (NFRDI), conducted conventional hydroacoustic surveys in the Central Bering Sea and Bogoslof Area during May and June in 1997 and 1999 (Fig. 1).

On the top of the regular acoustic transect line surveys, NFRDI had designed one extra transect line that went straight from the Bogoslof Island to the CBS in order to obtain *vertical water temperature* and compare that with *zooplankton densities* from the regular transect lines.

Sampling area of the zooplankton survey covered the whole Aleutian Basin and forty Bongo net samplings were towed obliquely from the depth of 100m to the surface.

These environmental data were compared with the density of the adult pollock obtained by echo-integration. Currently, descriptive analysis will be addressed in this session.

Results

Water temperature:

Vertical distributions of the water temperature show two distinctive phenomena between the surveys in 1997 and 1999. Cool pool of 3.0 °C spread out up to the Bogoslof area in 1999, whereas the same temperature water contour in 1997 reached less and confined to the middle area, that is, between the Bogoslof and CBS, only. Depth range of the cool pool in 1999 also showed wider and shallower than that in 1997 (Fig. 2).

Zooplankton:

Over 90% of the detected zooplankton were Euphausiid and Copepod, known as major prey species of young and adult pollock. Figure 3. shows high density of zooplankton in the image of 1997, which is almost triple the density in 1999. In 1999, density contours ranged from 400 to 1,000 mg/m^3, whereas in 1997, they were 300-2,800mg/m^3.

Distribution of pollock density by echo-integration

Figure 4. shows the results of the hydroacoustic echo-integration, where magnitude of the continental slope region was cut off in order to clarify the distribution of pollock in the middle area. Relatively high densities of the adult pollock were clearly detected in 1997 image, compared with that in 1999, where no pollock was detected.

Discussion

Water temperature is well known as a direct limiting factor to the dynamics of zooplankton. The comparison of water temperature and density of zooplankton in 1997 and 1999 is manifest to support this idea. Density of zooplankton in 1997 seemed almost triple compared with that in 1999, as mentioned before. This also is well matched with the distribution of adult pollock in the middle area as shown in the hydroacoustic image. That is, high temperature, high productivity of zooplankton and aggregation of adult pollock in the middle area in 1997 seemed coincident. As a consequence, I might conclude that water temperature had affected the bloom of zooplankton and also led to the dispersion of pollock to the middle area. Question that still remained to me here was about the origin of the pollock school in the middle area.

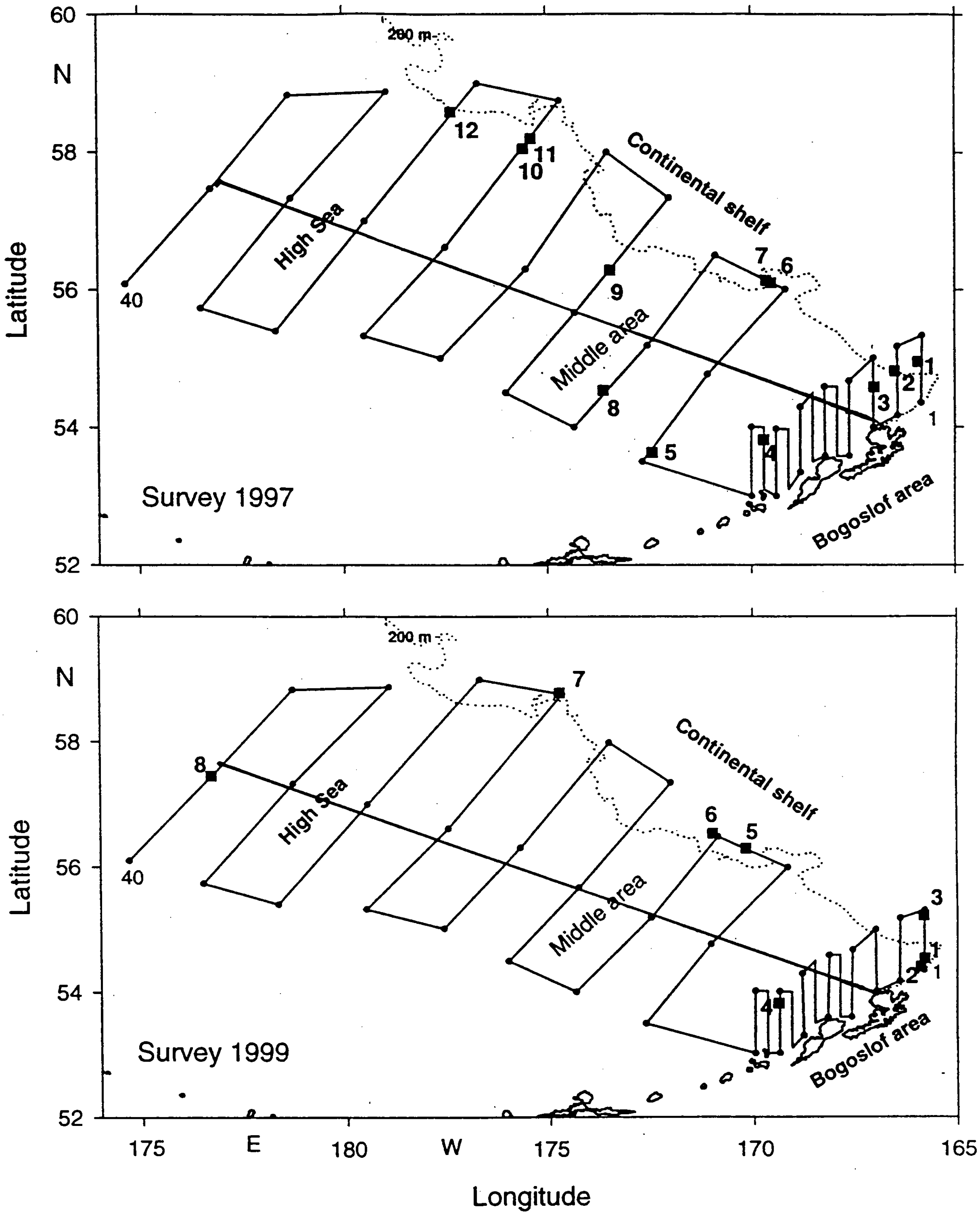


Fig. 1. Survey area with acoustic survey transects, trawl hauls and oceanographic observation locations in the Bering Sea during spring in 1997 and 1999.

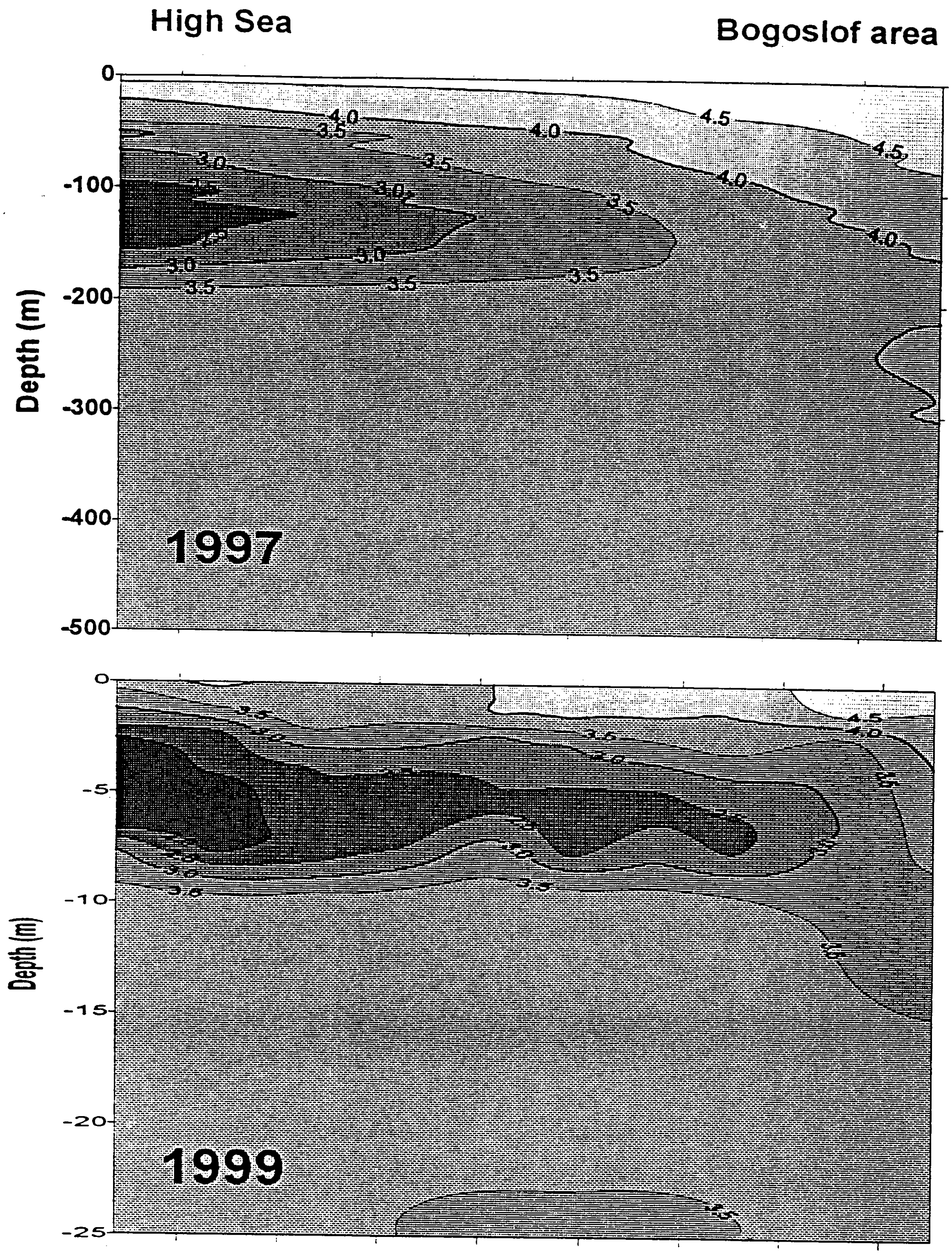


Fig. 2. Vertical water temperature in the Bering Sea during May to June in 1997 and 1999.

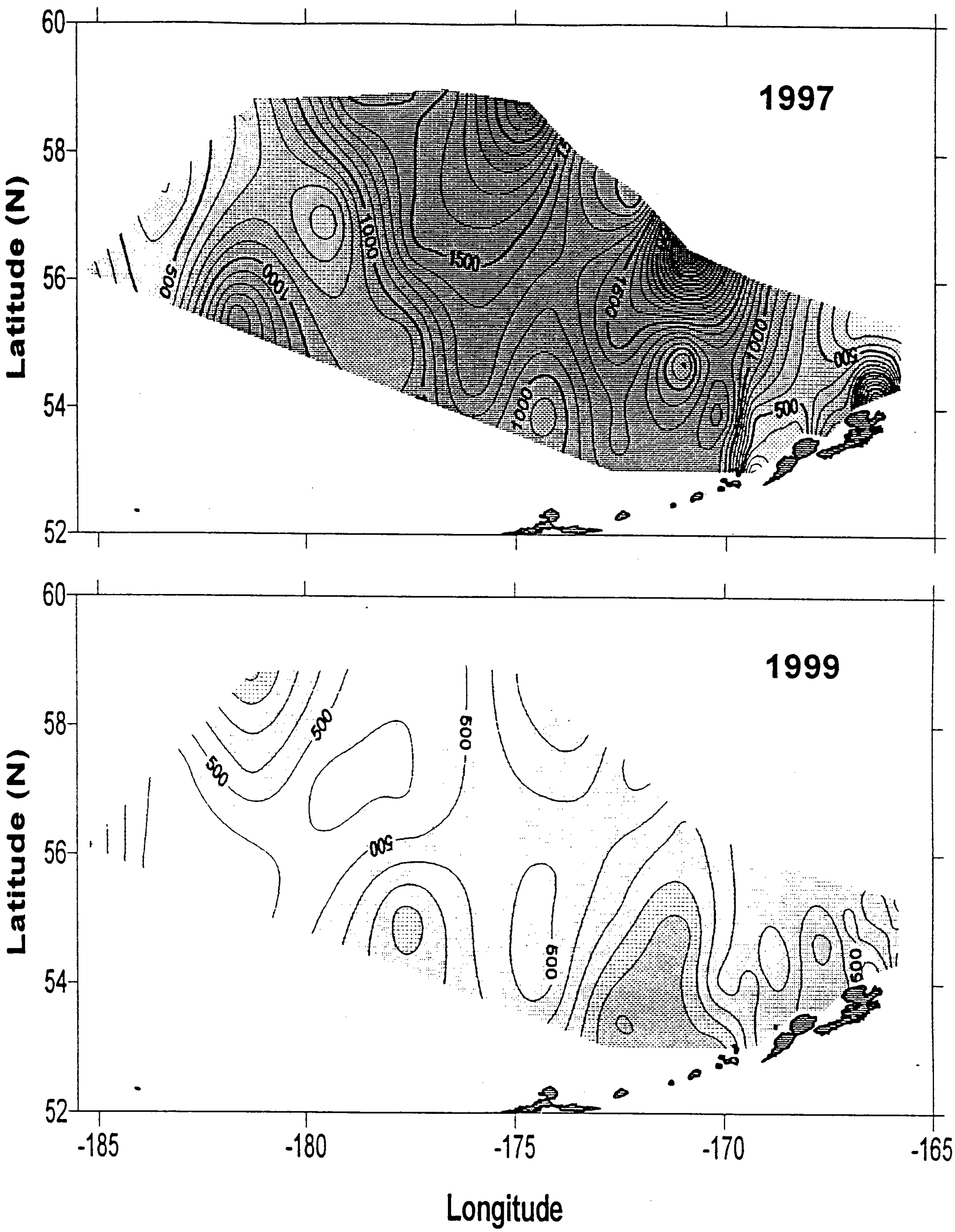
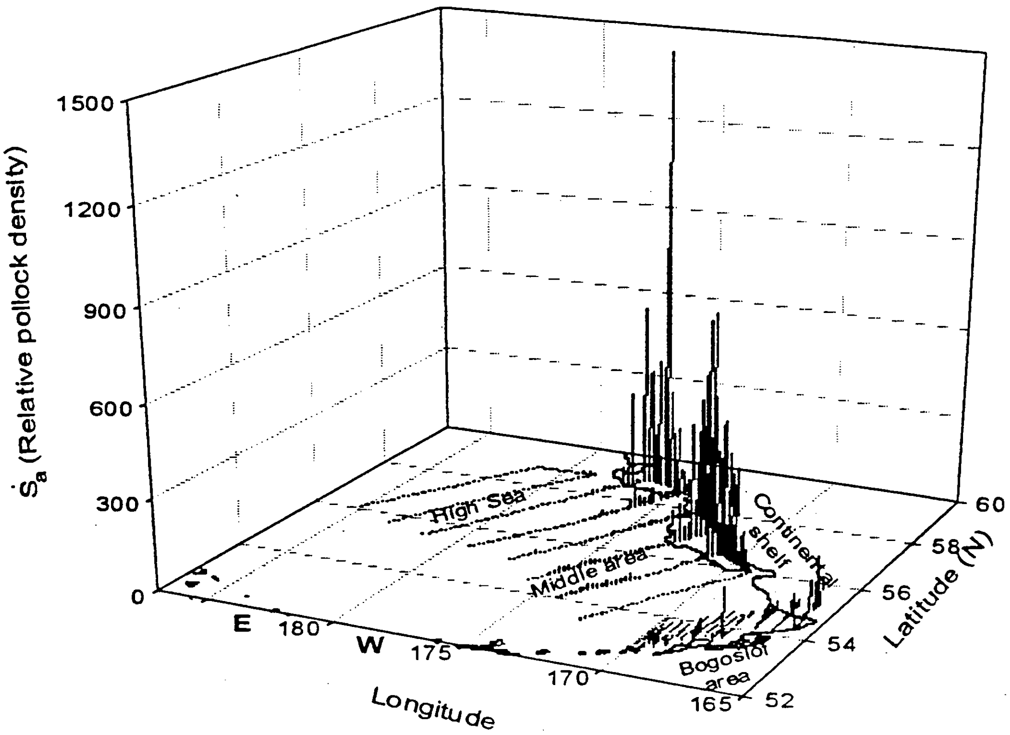


Fig. 3. Distribution of zooplankton (mg/m3) in the Bering Sea during Spring in 1997 and 1999.



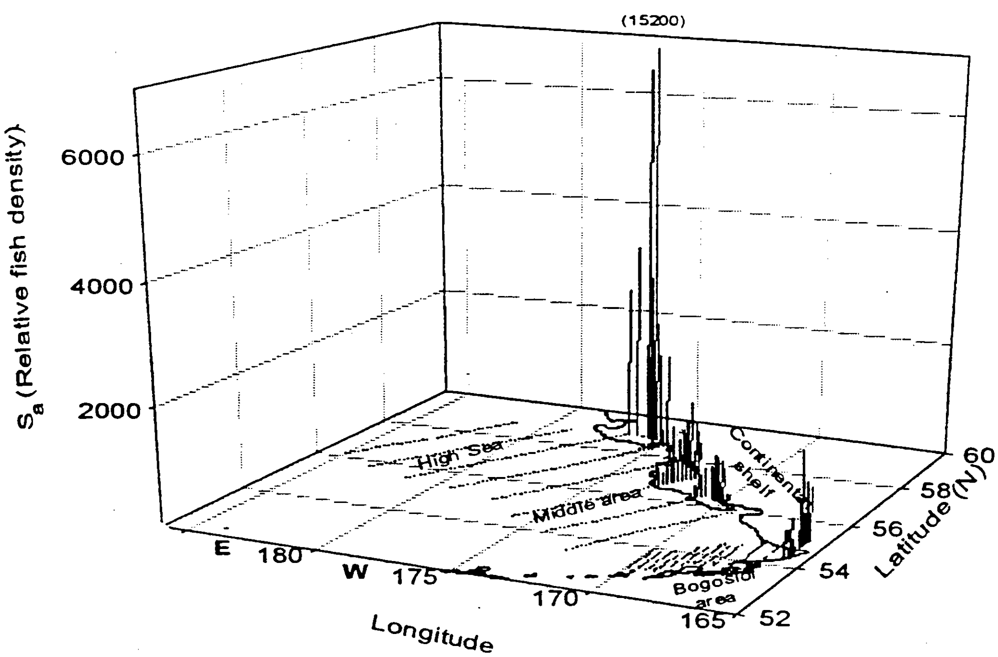
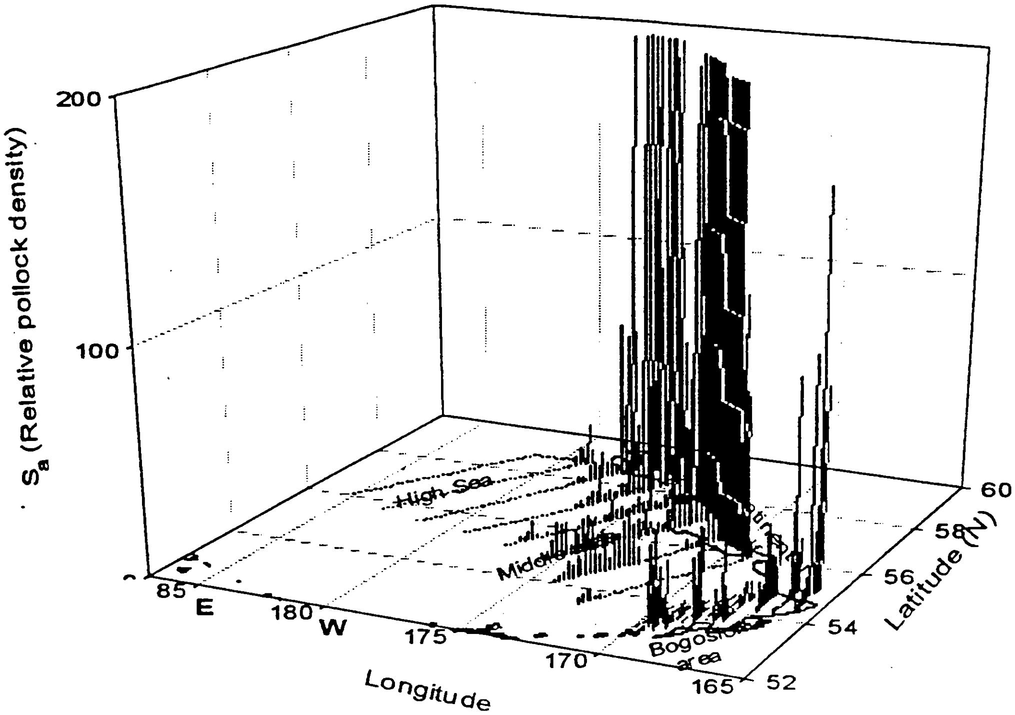


Fig.4. Relative density of walleye pollock along trackline in the Bering Sea during May to June in 1997 and 1999.



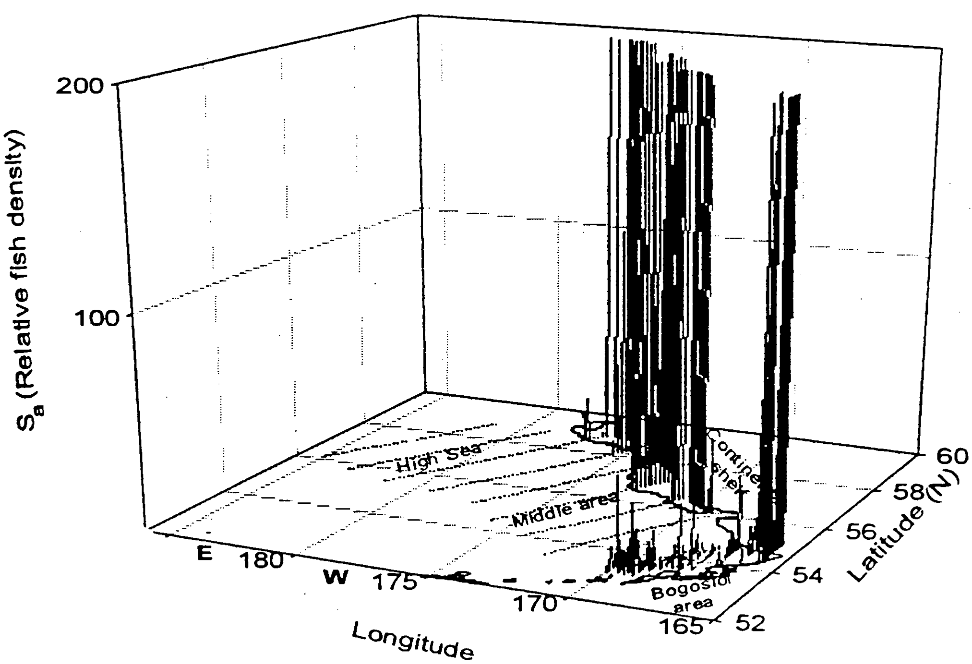


Fig. 4. Continued (Size changed).

JAPANESE VIEW ON THE AGENDA ITEM OF "THE EFFECTS OF THE MORATORIUM AND ITS CONTINUATION"

1. General remarks

Japanese fishermen have complied with the moratorium on fishing in CBS since the beginning of 1993, prior to the time the convention entered into force.

The moratorium has brought about various effects not only to the persons & industries concerned but to the ecosystem in CBS & its adjacent waters.

Below we classified those effects into three categories, such as biological, economical, and social ones, and analyze them respectively, as follows.

2. (1) Biological effects

The moratorium in CBS has excluded virtually all impacts leading to the removal of the pollock stocks in this area.

We recognize that US and Russia have terminated or reduced directed fishing within their adjacent EEZs in order to cooperate with the moratorium in CBS.

Such management of fishing within the adjacent EEZs is expected to have brought about the same effects on the stocks.

Generally speaking, we can expect to improve the stock situation by taking most harsh fishing control measures, such as moratorium, however, we could not have found any positive signs yet.

Of course, the stock situation is affected not only by fishing but also by other various factors, such as changes in ocean environment, the situation of food competitors, and predatory.

However, we could not find an improvement in the current stock situation in any sense in spite of having taken the moratorium measure, which is the most severe measure in terms of human activities to be carried out, for more than 7 years.

2. (2) Economical effects

For the period before and after moratorium commenced, the historical record of Japan's fishing in CBS, changed as follows:

Year	Pollock Catch in CBS (1000 MT)
1985	164
1986	706
1987	804
1988	750
1989	655
1990	417
1991	140
1992	3
1993	0
1994	0
1995	0
1996	0
1997	0
1998	0
1999	0

Above figures show that its relevant Japanese fishing industry has been seriously damaged by the moratorium in CBS.

We understand that those suffered damages are not limited to fishermen but are extended to other related industries concerned, such as processors and transpotators.

2. (3) Social effects

Japanese fishing industry and related industries have gradually changed their mind with respect to the moratorium in CBS.

When the moratorium started, they strongly believed and expected of resuming fishing in near future, as they were sure that the stock should be improved by the moratorium measure that imposes the vessel operation to stop for a certain period of time. However, their expectation was gradually disappeared and turned into disappointment, as there has not appeared any positive signs of improvement of the stock in CBS in spite of having kept the moratorium for a long time. They came to appeal complaint on the continuation of moratorium and doubts on its scientific rationality.

Certainly, the moratorium contributes to eliminate removal of stocks by fishing and may be one of the effective and realistic measures in order to improve the condition of low biomass level.

However, it is natural for Japanese fishermen to express their doubt and complaint about continuation without any adequate review and adjustment, because they have been forced to accept it without alternative for a long period, while they have not been informed of any scientific rationality or have not realized any positive effects in the stock situation.

We are afraid to lose their trust in the existing framework of the convention, as we could not improve the stock biomass significantly in spite of having taken the most severe control measure.

3. Summary

We recognize that the past moratorium in CBS has certainly contributed to avoid removal of fish stock by fishing in CBS and its adjacent areas, however, unfortunately, it could not result in the significant improvement of the stock biomass.

We understand that the major reason why the stock situation could not have improved in spite of having taken the long-term moratorium, is that the scientific understandings on the pollock stock characteristics in the Bering Sea and the stock management measure have been taken to the present are inadequate.

As the evidence of this, it is pointed out that the '78 year class, which was estimated as the strong year class, was succeeded to recruit the fishery in the Aleutian Basin and contributed to the significant catch in mid '80s, however, following '82, '84 &'89 year classes, which appeared strong year classes at their young stage failed to recruit to the Aleutian Basin stock.

Accordingly, all parties should address the stock management measures for the whole migrating areas of the pollock stocks distributed in Aleutian Basin.

3. Potential Loss by Moratorium

3.1. On fishing companies

Bering Sea fishing industries in Korea have their own processing factories, as well as fishing vessels. With the contraction of the pollock fishery in the Bering Sea, tremendous economic losses of the relevant companies were inevitable since 1992. As a result, the numbers of fishing companies and fishing vessels have reduced to 15 and 32 from a total of 20 companies and 46 vessels prior to moratorium.

Table 3. Number of dishonored and/or bankrupted fishing companies during the moratorium

Year	1993	1994	1995	1996	1997	1998
No. companies	2	1		2	2	2

3.2 . Decrease of pollock price

Table 4 compares pollock prices between pre- and post-moratorium. After moratorium, imported pollock price was almost a half of the domestically produced pollock price, whereas they were relatively similar before the moratorium. Low priced imported pollock induces price drop of the domestically produced one, which worsens the management of fishing industries in Korea.

Table 4. Pollock prices between pre- and post-moratorium (annual foreign exchange rate was adjusted)

Year	Pre-moratorium (average price of 5 years, 1988-1992)	Post-moratorium (average price of 5 years, 1993, 95, 97-1999)
Imported pollock price	$0.54	$0.52
Domestically produced price	$0.69	$1.01

4. Conclusion

- Pollock is an important fish as a source of protein in Korea.
- Increased price of pollock threatens the stability of fisheries economic sector.
- Pollock is a straddling fish stock and coastal states have the responsibility to cooperate for the conservation and management of the stock both within and beyond exclusive economic zone.
- Factors to be considered for fisheries management include social, economic, and political, as well as the results from stock assessment. Stability in post-harvesting sector including the sustainability of fishing industries and fish price is as important as other relevant factors required in harvesting sector.

The Effects of the Moratorium and Its Continuation

Presented by Dae-Won Kim, Republic of Korea

1. Introduction

Members of this Conference can have two intentions regarding the purpose of conducting pollock fishery on the Bering Sea: fishing for the subsistence of its nationals and fishing for making money by selling the catches and/or their products.

2. Background Information

- Members voluntarily started moratorium in 1993, based on the spirit of international cooperation for the conservative management and subsequent sustainable exploitation of the natural resources, and expected the resumption of this fishery in a couple of years.
- Even after eight years of moratorium, however, unsatisfactory level of pollock stock size still remains in the Bogoslof area.
- During the past eight years, many fishing industries in Korea have been dishonored and/or bankrupted.
- Pollock is one of the major sources of animal protein consumed by Koreans.

Table 1. Consumption of marine products (including algae) by nation

State	Japan	Korea	Canada	U.S.	England
Year	1995-97	1998	1995-97	1995-97	1995-97
Per capita (kg)	70.3	48.8	22.5	21.0	20.0

(Source: Korea Rural Economy Institute)

Figure 1 Proportion of animal protein consumption (gram/day/person)

- Recent data show the decline of fish protein uptake compared with the increase of meat uptake

Figure 2. Proportion of Pollock in Korean major fish consumption (gram/day/person)

- Pollock comprises around 15% of the total fish comsumption

Figure 3. Pollock supplies and demands between pre- and post-moratorium

- Almost 40% of the total pollock consumption need to be imported.

Table 2. Imports of Pollock after moratorium

(unit : million dollars)

	1996	1997	1998	1999
Russia	141.6	119.2	70.6	156.4
U.S.A.	51.0	42.1	29.1	46.8
Total	192.6	161.3	99.7	203.2

Figure 1. Proportion of animal protein consumption(g/person/day)

Year	Meat	Fish & shellfish	Prop
1973	4.58	9.93	0.7
1976	5.85	11.29	0.7
1980	9.49	10.66	0.5
1985	12.08	16.44	0.6
1988	15.89	13.27	0.5
1989	15.86	14.81	0.5
1990	17.25	15.88	0.5
1991	17.19	15.19	0.5
1992	18.46	15.1	0.4
1993	19.45	16.04	0.5
1994	19.73	16.66	0.5
1995	22.87	16.41	0.4
1996	24.1	17.03	0.4
1997	24.58	15.66	0.4
1998	23.85	12.51	0.3

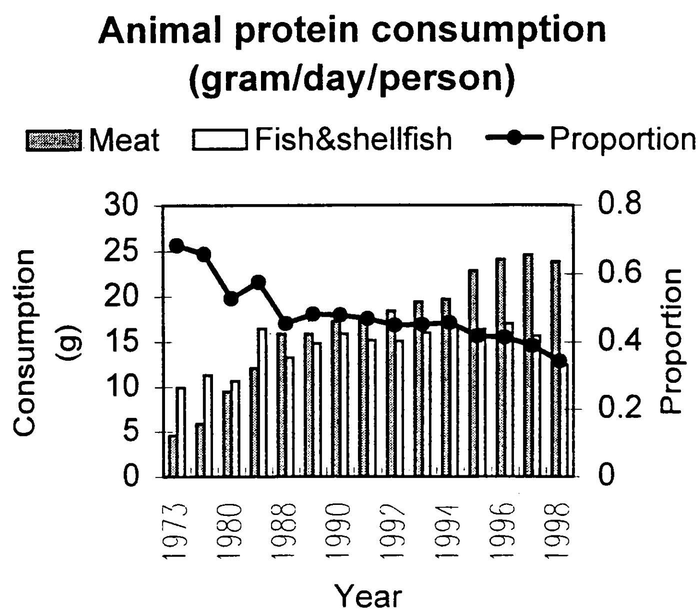


Figure 2. Portion of Pollock in Korean fish consumption (gram/day/person)

Year	Total	Pollock	Cod	Hairtail	Anchovy	Herring	Atka Mac	Others	Proportion
1982	58.3	6.4	0.9	6.4	7.9	0.5	1.2	35	0.1
1985	62	12.8	0.4	2.1	6.3	0.7	1.2	38.5	0.2
1988	51.75	12.68	0.41	3.86	5.51	0.49	0.71	28.09	0.2
1989	56.47	14.33	0.25	3.45	5.37	0.63	0.27	32.17	0.3
1990	57.48	11.1	0.49	3.75	6.68	0.47	0.38	34.61	0.2
1991	55.18	7.84	0.58	4.25	10.41	0.33	0.36	31.41	0.1
1992	50.74	9.34	0.66	3.78	10.08	0.36	0.58	25.94	0.2
1993	53.81	8.03	0.71	2.55	14.71	0.19	0.66	26.96	0.1
1994	62.7	9.74	1.07	4.23	11.2	0.24	0.99	35.23	0.2
1995	59.3	10.23	0.96	4.03	13.34	0.34	0.67	29.73	0.2
1996	62.93	9.12	0.95	3.06	13.48	0.23	0.82	35.27	0.1
1997	58.87	8.52	0.95	3.02	13.19	0.46	0.45	32.28	0.1
1998	46.09	7.06	0.52	3.57	14.22	0.63	0.94	19.15	0.2

Figure 3. Pollock supply (mt) and demand (mt) between pre- and post-moratorium

	Pre-M	Ave 97-99
Demand	311	333
Supply	280	195

Session 4

Proposals of Strategies to rebuild and/or Reassess the Aleutian Basin stock with a shared Goal of Resuming Fishing Operations as soon as possible (SLIDE)

Central Issues

1.Why has the Aleutian Basin stock been depressed since early 1990's?

2.What should be resolved to evaluate the stock condition with high reliability?

3.What are the appropriate methods for fisheries management to recover the stock?

In the session 4 following issues will be discussed (SLIDE)

I to review the stock structure in the Bering Sea

↓

II to clarify the migration routs of the stocks distributed in Bering Sea

↓

III proposal for the appropriate fisheries management system based on the scientific data

I. Review of the population stock structure in the Bering Sea (OHP)

It is essentially important to clear the population structure for fisheries management. Phenotypic and genotypic characteristics have been used to distinguish fish subpopulations. Subpopulation is a unit of reproduction of the resource.

One of the major issues of the subpopulation concept is the fidelity to a home range or natal site. Each subpopulation has inherent spawning grounds, feeding areas; migration routs may be limited by physical impediments and biological factors, and has an inherent growth rate, life span, and other biological characteristics. Fidelity to home range depends on habitat quality, which can depend on density. However, through feeding migration and natal homing, some juveniles and adults fish may stray away from their natal site and mixing of gene may occur within subpopulations.

It is important to carry out the cooperative program agreed at the international workshop on stock identification methods held in Yokohama. Already sampling protocol and sampling program between the contract parties was established. And it is needed to carry out to keep management applications of stock-structure studies.

Ⅱ. Migration rout

Hypothesis

- Subpopulation has own natal site and migration rout.
- They slightly change depending on the situation which subpopulation facing the environmental condition including the stock abundance in the age/a period/a time/an era.
- It is easier to introduce or apply the metapopulation theory to understand the subpopulation structure in the Bering Sea.
- Because the subpopulation vary its migration range in accordance with its stock condition.

When we study the subpopulation structure of pollock distributed in Bering Sea, the view of metapopulations structure and geographical distribution (Balley et al. 1999) should be considered.

According to the data of catch and tagging experiment, a part of fish belonging to Eastern Bering Sea population and Western Bering Sea population migrated to the area of Donut Hole where Aleutian Basin stock widely distributed when the stock size of each subpopulation used be very high level. But in accordance with the depression of the stock size of them migration range had been shrunk and only Aleutian Basin stock has a possibility to expand the migration range to the Donut Hole areas after 1990s. And intermingling has not been observed in these days among Aleutian Basin stock and Western Bering Sea stock but it is not clear the actual intermingling between Aleutian Basin stock and Eastern Bering stock, and Western Bering Sea stock and Eastern Bering Sea stock.

In the case of pollock, broad-scale migrations can result in seasonal mixing of subpopulations.

So it is needed to proceed the program of population structure analysis.

1. Movement of Japanese fishing grounds (OHP)

Seasonal shift of Japanese fishing ground and CPUE distribution may be showing the way of movement of pollock in the Donut Hole area. Some big circles showing high value of CPUE distributed in the edge of eastern part of Donut Hole in January and February 1988 and 1989 and they have gone out in March. Further more in March some large circles were appeared in the edge of southeastern part of Donut Hole and then have also gone out. It is assumed that they probably moved to westward and southward to spawn in the natal site. On the other hand, female pollock of the maturity stage of spent were collected by Japanese research vessel in the southern part of Donut Hole area. It occupied only 0.7% of female.(OHP)

These data are showing that pollock distributed in the Donut Hole area were consisted of three stocks, Aleutian Basin stock, Western Bering Sea stock and Eastern Bering Sea stock in feeding season in late 1980s.

2. Results of tagging experiments (OHP)

Tagging experiments offer an approach to study migration mechanism and linkages between subpopulations. The results should be analyzed carefully because the result may vary depend on the season and developmental stages even though the fish released at the same place.

According to the results of tagging experiment operated in the Bering Sea, Pollock moved from Navarin area to Donut Hole, from Korfo-Karaginsk to northern central area and northern central area to southeastern area.(OHP)

These results are showing the western Bering Sea pollock migrate across or around the basin.

3. Transportation of larvae from hatching area to the shelf area(SLIDE)

Age composition of pollock caught in Aleutian Basin area at the spawning season is usually consisted of ages four and more older fish. Therefore where do younger fish less than age five or four distribute? (OHP)

It is presumed that larvae hatched around Bogoslof area are transported to the shelf area and after that they grow to juvenile and young fish stages accompanied with migration northward. And they spend on the shelf area till they become mature stage and they migrate to Aleutian basin area that is natal site.(OHP)

More information of migration for Aleutian Basin stock is needed.

Ⅲ. Proposal for strategies to rebuild the Aleutian Basin stock with a shared goal of resuming fishing operations as soon as possible

1. In case of overlapping of migration routs of Aleutian Basin stock with neighboring stocks (SLIDE)

For example, if eastern or western Being Sea fish migrate across or around the basin, they may be harvested on either side of the Bering Sea basin each of which has its own harvest quota. Therefore, a migratory population would experience two independent sources of fishing mortality. And young fish originated from Aleutian Basin stock may be caught in the shelf or basin area in northeastern and northwestern

JAPANESE VIEW ON THE AGENDA ITEM OF "TERMS AND CONDITIONS FOR TRIAL FISHING"

1. General remarks

Japanese fishermen are highly interested in conducting TF, as they have enough experiences of actual fishing in CBS in the past. They wish to get a chance to investigate the possibilities of actual fishing in CBS through conducting TF.

However, Japanese fishermen have never conducted TF in the past and we understand that, in order to promote their TF, a certain improvement on the current procedure of providing information on TF vessels is required.

On the other hand, unfortunately, it is a fact that the scientific and technical information to establish the Aleutian Basin Pollock biomass and to clarify the Aleutian Basin Pollock stock structure are still insufficient, in spite of having made eager research activities by each parties.

Those shortage of information may lead to delay the attainment of the objectives of the convention, and, therefore, it is necessary to discuss the practical measures for making up the shortage of such information.

We, therefore, understand that it is significant to improve the current procedure of providing information on TF vessels, as a certain promotion of TF can contribute to make up the role of scientific researches.

2. The suggestion for improvement of the procedure

All parties authorized at the last annual meeting about the procedure of providing information on TF vessels, namely that "Information on the vessels that will engage in TF will be provided to all Parties at least one month prior to commencement of TF.".

On the other hand, Japanese fishermen claim that It is practically difficult to provide the fixed "Information on the vessels", as their schedule of fishing trips are much influenced by catch conditions at fishing grounds, weather & marine conditions and progress of loading & unloading at the port. The fishermen, therefore, request to improve the current procedure that the schedule of TF and other items of "Information on the vessels", which was once provided one month prior to commencement of TF, are possible to be modified by providing information of such modification at least 2 weeks prior to commencement of TF.

We understand that, as such improvement requested by the fishermen is technical modification on the current procedure and it will not be caused any

Bering Sea.

- Continue of moratorium or reduction of fishing excluding trial fishing in Donut Hole area till the recovery of the Aleutian Basin stock.
- Application of appropriate fisheries management in neighboring areas for preservation of Aleutian Basin stock.

2. In case of no overlapping of migration routs of Aleutian Basin stock with neighboring stocks (SLIDE)
   - Continue the moratorium or reduction of fishing in Donut Hole area till the recovery of Aleutian Basin stock.
   - Appropriate fisheries management in neighboring areas for Aleutian Basin stock

3. Restore essential fish habitat Favorable for pollock (SLIDE)
   - Quantitative estimation of predation for pollock
   - Regime shift toward better environmental condition for pollock
   - Relationship Aleutian low and the distribution area of juveniles and adults

IV. More listing of procedures to assess and monitor strategies to rebuild Aleutian Basin stock (SLIDE)

1. Assessment and monitoring for the recruitment success
   - A. To carry out the study of population structure analysis
   - B. To collect more biological and oceanic environmental data
     - Migration rout, Mortality, Mechanism of recruitment and reproduction
   - C. To continue the survey using EIMT
     - Estimation of spawning stock biomass and age composition
     - Detection of strong year-class
2. Recommendation
   - Joint scientific meeting with other scientific organization (PICES,… ・ ・) to deepen the understanding of relationship between long-term fluctuation of pollock resources and dynamics of marine ecosystem.

hindrance in the actual operation of TF system, it is desirable to improve the current procedure as follows:

"Information on the vessels that will engage in TF will be provided to all Parties at least one month prior to commencement of TF.

If vessels planned to engage in TF and they were still uncertain, whether they actually engage in TF or not, at the time of one month prior to the planned date of commencement of TF, information on such vessels will be provided to all Parties at least one month prior to the planned date of commencement of TF. Those information will be confirmed by providing the latest information to all Parties at least two weeks prior to actual commencement of TF."

Finally, we wish to emphasize that the promotion of TF will enable to obtain the significant scientific and technical information and will contribute to attain the objectives of the convention.

Sample Cruise Plan for Trial Fishing in International Waters of the Central Bering Sea

1. Institution
   Name of Fishing Companies

2. Number and Identification of Vessels
   Number of vessels – to be determined at the Annual Conference
   Name of Vessel – to be determined later
   Type, Length, Tonnage, Radio call sign, Immarsat number – to be provided later

3. Notification
   a. All details on identity of vessels and fishing plans will be provided to the Parties at least one month prior to commencement of trial fishing.
   b. Any change to the plans of the trial fishing vessels will be provided to the Parties at least two weeks prior to commencement of fishing.

4. Trial Fishing Area
   International waters of the central Bering Sea. The detailed trial fishing and research tracklines will depend on availability of vessels and will be determined before the cruise.

5. Time of Trial Fishing
   To be determined later

6. Purpose – The main purposes of trial fishing operations are to:
   a. determine geographic distribution of pollock in the international waters of the central Bering Sea
   b. estimate fish density (collect CPUE data)
   c. determine feasibility of commercial fishing operations
   d. determine species composition of catches
   e. collect biological data on pollock (length, sex, body weight, maturity, etc.)

7. Data Collection
   Data will be collected in the format according to the
   "Observer Manual for Sampling of Central Bering Sea Pollock Fisheries"
   as agreed to by the Parties in March 1997. The forms are:
   – Haul Summary Form
   – Species Composition Form
   – Length Frequency Form
   – Biological Samples Form

8. Scientific Observers
   Observers will be trained and certified in accordance with guideline procedures for training observers as conducted for the Parties in March 1997 in Seattle.
   The training institution for the observers will be (insert name)________________.

9. Report of Results
   The reports and data collected will be made available to the Science and Technical Committee at the annual conference.

CONVENTION ON THE CONSERVATION AND MANAGEMENT OF POLLOCK RESOURCES IN THE CENTRAL BERING SEA

APPROPRIATE GOVERNMENT AUTHORITIES TO RECEIVE ENTRY AND TRANSSHIPMENT NOTIFICATIONS

1. JAPAN

Mr. Ichiro KANTO
Assistant Director
International Affairs Division
Fisheries Agency of Japan
Fax: (+81-3) 3502-0571

2. PEOPLE'S REPUBLIC OF CHINA

Mr. Liu XIAOBING
Assistant Consultant
Division of International Cooperation
Bureau of Fisheries
Ministry of Agriculture
Fax: 8610-64192961, 65002448

3. REPUBLIC OF KOREA

Deep-Sea Fisheries Production Division
Bureau of Fisheries Promotion
National Fisheries Administration
Fax: 82-2-752-5738

4. REPUBLIC OF POLAND

Wojciech Pienkowski
Maritime Office in Szczecin
Fisheries Department
Ministry of Transport and Maritime Economy
Fax: 91-336-283 or 011-48-91-433-6238
Phone: 011-48-91-440-3532

5. RUSSIAN FEDERATION

Kamchatrybovd
Fax: 415-00-72-875

6. UNITED STATES OF AMERICA

Command Center
Seventeenth Coast Guard District
Juneau, Alaska
Fax: 907-463-2023 (Primary means of communication)
Telex: 49615066, Answer Back "USCG JUNEAU"
Use telex if vessel's facsimile is inoperative.

U.S. Department of Transportation
United States Coast Guard

Commander
Seventeenth Coast Guard District

P.O. Box 25517
Juneau, AK 99802-5517
Staff Symbol: p
Phone: (907) 463-2226
FAX: (907) 463-2216

16214
JUL 19 2000

Honorable Delegates,
Convention for the
Central Bering Sea Workshop,
Seattle, Washington

Dear Esteemed Colleagues,

A recent policy change by Inmarsat Company requires government agencies to provide written permission from the vessel owner and Inmarsat equipment owner, if different, at the time such agencies request access to Vessel Monitoring System information (transponder data).

For your convenience I am providing each of you with a sample authorization letter developed in consultation with Inmarsat Company. This letter should be completed by the owner of a trial fishing vessel and provided to their respective government officials. Parties should transmit such letters when they provide notification of intent to conduct trial fishing operations. Parties receiving such notification will then be able to include the authorization letters in their request to an Inmarsat Service Provider for transponder data.

Use of these procedures will ensure Parties meet their obligations under the Convention to provide transponder data from their vessels operating in the Convention Area. I hope this simple change meets with your approval. If your have any questions or comments about this procedure please contact me by phone, fax, or e-mail; all are provided on my attached business card.

In closing I would like to thank you all for your continued spirit of cooperation in working with me to implement the provisions of this important Convention.

With Great Respect,

J.V. O'Shea

J.V. O'Shea
Captain, U.S. Coast Guard
Chief, Planning and Policy Division
Seventeenth Coast Guard District
By direction of the District Commander

Encl: Sample Authorization Letter

Date

Company Name
Address
Contact numbers

To Whom It May Concern,

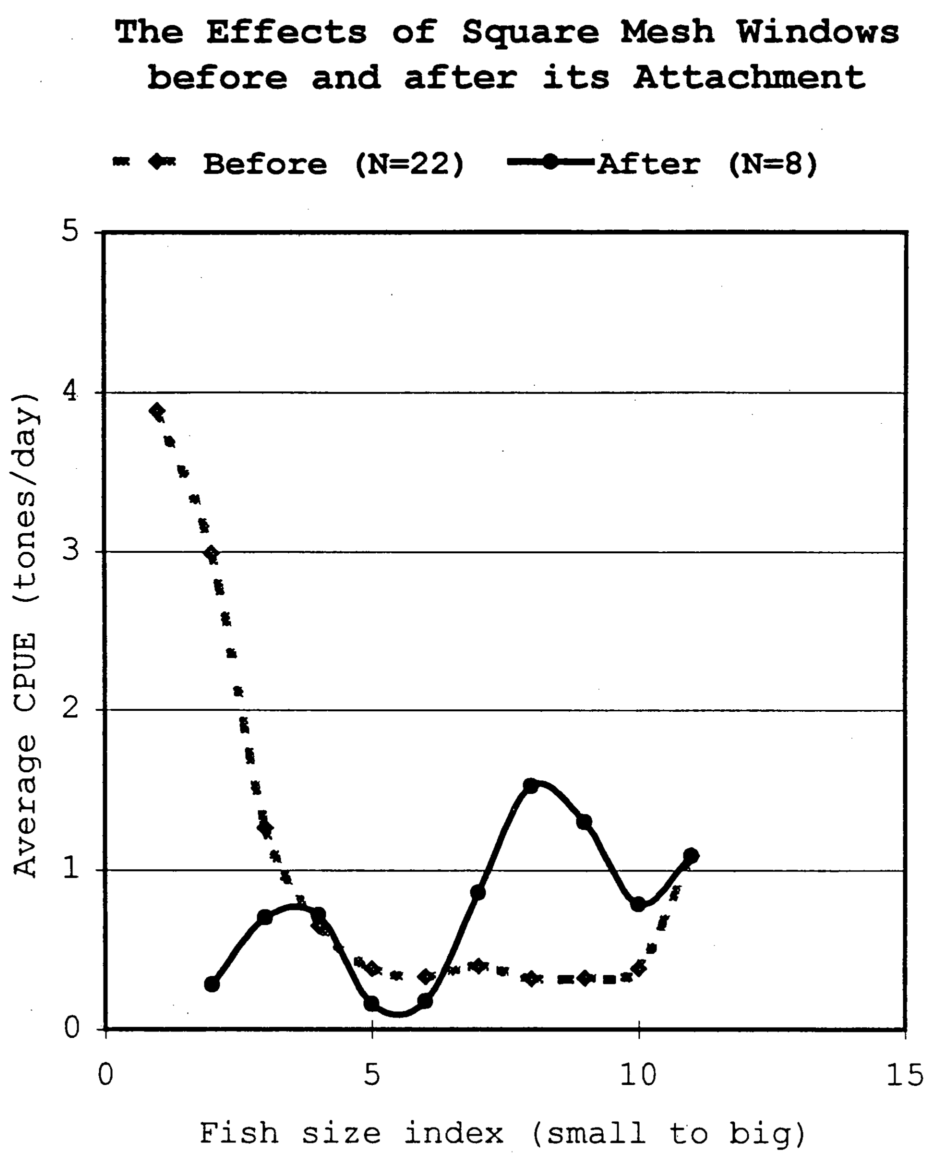
1. This letter hereby authorizes government officials from People's Republic of China, Japan, the Republic of Korea, the Republic of Poland, the Russian Federation, and the United States of America to obtain real time satellite position information by polling the Inmarsat C terminal(s) listed below. This authorization is only for the period of time our vessels are involved in Trial Fishing for Pollock in the Central Bering Sea as designated below or by the government agency responsible for managing fishing in the Central Bering Sea:

Vessel Name	Call Sign/ Official Number	Terminal Number (9 digit IMN)	Terminal Manufacturer	Primary Reporting Ocean Area	Start Date	Stop Date

Terminal Owner ______________________ Date____________________
(signature)

Vessel Owner________________________ Date_____________________
(signature)

Figure 1.



The Effects of Square Mesh Windows before and after its Attachment
Before (N=22)
After (N=8)
5
4
3
2
1
0
Average CPUE (tones/day)
0
5
10
15
Fish size index (small to big)