

**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 4<sup>th</sup> 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.*

*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.

### Summary

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 4<sup>th</sup> 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.

