North Pacific Fishery Management Council

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MINUTES
Scientific Statistical Committee
December 7-9, 1992
Anchorage, Alaska

The Scientific and Statistical Committee of the North Pacific Fishery Management Council met December 7-9, 1992 at the Hilton Hotel. All members were present, namely:

Bill Clark, Chair	Larry Hreha
Phil Rigby (alternate-Kruse)	Richard Marasco
Al Tyler (alternate-Quinn)	Jack Tagart
Doug Eggers	Don Rosenberg
Marc Miller	Bill Aron
Dan Huppert	John Burns

B-5 HARBOR SEALS AND KILLER WHALES

The SSC received a report from Rich Ferrero, AFSC, NMML regarding recent surveys of harbor seals and killer whales. Mr. Ferrero reported that harbor seal surveys were conducted in the northern portion of the Gulf of Alaska, including Cook Inlet, the Kodiak archipelago, the south side of the Alaska Peninsula and islands to the south (e.g., Shumagins, Sandman Reef). The counts indicated that a decline in harbor seal abundance is continuing in the western and central GOA. At over 50 sites surveyed by ADF&G in 1978 and by NMFS in 1992, 90% fewer animals were counted in 1992; a total of 2,899 were counted in 1992, compared to 22,808 in 1978. On Tugidak Island in the Kodiak archipelago the 1992 count was 571 which was 40% fewer then in 1990 and 92% fewer than in 1976.

Killer whale abundance surveys were initiated in 1992 in the central and western Gulf of Alaska, westward along the Aleutians to Atka and in the Bering Sea. Vessel coverage totaled over 5,200 nautical miles; air coverage totaled 3,800 nautical miles. A total of 12 pods (184 animals) were encountered on the vessel survey. Air counts were limited due to problems associated with estimating pod size. As a by-product of the photo-identification effort, researchers noted that several killer whales showed evidence of gunshot wounds. A review of photos at NMML later confirmed that animals from 7 of the 12 pods (total 9 animals) showed the wounds. The highest frequency of scarring was noted north of Dutch Harbor where 4 pods (36 animals) contained 6 animals with the marks. NMFS is concerned about possible impacts of shooting as an additional source of mortality on what appear to be a small population of killer whales in this area.

D-1(a) HALIBUT DISCARD MORTALITY RATES

The SSC reviewed the document, "Halibut discard mortality rates in the 1991 groundfish fishery off Alaska," by Williams and Wilderbuer and received an oral report by Bob Trumble (IPHC) explaining the methodology and results. Observers categorize halibut as one of three categories -- excellent, fair, and dead. Mortality estimates for the trawl fishery are based on 1975 study by IPHC which was revised in 1992. Survival rates have been estimated to be 80% for fish in excellent/good condition, 45% for fish in fair condition, and 10% for fish that appear dead.

The longline rates were based on an earlier tagging study and a holding experiment. A specific hook and line mortality study has not been conducted, although the IPHC is planning such a study in 1993. Fish within the excellent category were estimated to have a 98% to 95% survival, the poor ("fair") group to have half the survival of the excellent group, and the "dead" group to have 100% mortality.

Public testimony questioned the hook and line halibut mortality estimates which increased substantially from 1990 to 1991. This increase was particularly noticeable in the GOA sablefish fishery for which mortality estimates increased more than two and one half times.

The very large increases for hook and line fisheries led to a discussion of possible causes, including sampling bias. For the trawl fishery, where halibut are brought on board, the process of categorizing halibut by observers appeared to be accurate and repeatable. However, in the longline fishery, many operators do not bring halibut on board. Since accurate categorization requires direct examination, only halibut brought on board the vessel are sampled. Because only vessels that consistently bring halibut on board are sampled, there is some potential for estimates of discard mortality for the longline fishery to be biased. If these vessels have higher discard mortality rates the estimate of halibut discard mortality rate will not be representative of the fleet. There is potential for both years' estimates to be biased, but the degree of bias may not be consistent between years.

The SSC was not able to identify a specific cause for the increased discard mortality rate observed in the longline fishery. The SSC suggested that NMFS and IPHC review the observer database and methods to determine if sampling problems explain the changes between 1990 and 1991 estimates. NMFS staff testified that the use of the new rates for management of the 1993 hook and line fishery could prevent approximately one third of the GOA sablefish from being harvested.

The SSC discussed variability of the longline data and approaches to handle the inter-annual variations within fisheries. If a trend is evident the best approach is to use the most recent information. If data are variable and no trend is evident, an appropriate approach is to pool information to make the best projection. Such an approach moderates fluctuations in the estimates but de-emphasizes the most recent information and may fail to fully reward fishermen that have taken steps to improve performance.

The SSC strongly supports the IPHC longline discard study proposed for 1993 as a high research priority.

D-1(b) ROCKFISH MANAGEMENT PLAN

The SSC reviewed the documents available, particularly on the determination of rockfish ABCs. These documents included the plan team report, status of stock documents, agency reports, the minutes of the council's rockfish working group, and a report by Steve Davis on the accuracy of trawl survey estimates of rockfish stock size. The SSC agreed, in general, with the plan team recommended

ABCs as did the working group, and the SSC reaffirmed its previous statement that ABCs should take into account all fishing mortality, including undocumented bycatch. Given the large number of rockfish species groups and the number of fisheries which take rockfish as bycatch, the determination of rockfish specifications is a complex problem. The need for reduced rockfish TACs was discussed by the SSC. The issue of rebuilding schedule was not specifically addressed, although the $F_{35\%}$ exploitation rate used for ABC determination does provide for some stock growth. Further analyses on the issue of rebuilding will be required in order to determine appropriate objectives and benefits and costs of various options.

D-1(d) GULF OF ALASKA - SPECIFICATIONS

Central/Western Area - Walleye Pollock

The SSC reviewed the updated Stock Assessment and Fishery Evaluation Report for the 1993 Gulf of Alaska Groundfish Fishery, and received a report from the Team, and testimony from the Aquatic Resources Conservation Group. The SSC in presenting its deliberation to the Council will divide our reports into two parts. The first part of our report deals strictly with a stock specific ABC and the second will deal with our concern for the ecosystem in recommending a final ABC.

Stock Specific ABC

The SSC reviewed the Team's approach and evaluation of the various models to project the status of the pollock biomass. The Team noted that Model E provides the best overall fit to the hydroacoustic and trawl survey data. The SSC noted that Model E did not use the 1984 bottom trawl survey. Model E does provide the best overall fit to the hydroacoustic data, a better fit for bottom trawl data from recent years, and better reflects the 1988 year class strength. The SSC concurs that Model E provides the best estimate of the exploitable biomass.

In the past the Gulf pollock resources have been exploited using an exploitation rate of 10%. At the request of the SSC, the Team has evaluated preferred fishing mortality levels. Based upon this analysis the Team recommends a fishing strategy using an annual exploitation rate of 20%. Using the exploitable biomass provided by Model E and the 20% fishing strategy, the Team recommends an ABC of 203,000 mt for the Western/Central area. The Team evaluated the "risk" of falling below 20% of pristine biomass.

The Team in making this recommendation of an ABC of 203,000 mt noted that although the ABC is biologically defensible, their recommendation may not be adequately conservative relative to a series of concerns. The Team felt that these concerns should be addressed by the Council when setting TAC. The SSC believes that these concerns, (low probability of recruitment of a strong year class, continued declines in spawning biomass, disproportionate targeting on older fish, suspected large scale ecosystem changes that might affect the carrying capacity, and the change in the age at maturity of pollock) must be addressed in recommending ABC. There was discussion within the SSC regarding whether the above concerns were addressed at least in part by the Team in their recommended ABC. The SSC notes that these concerns are unquantifiable and therefore we had a difficult time in making an adjustment to the stocks specific ABC. After long deliberation we agreed a reduction could be calculated by averaging the Team's ABC (203,000 mt) with the ABC determined using the new biomass and the current 10% fishing strategy (111,000). This stock specific ABC would be 157,000 mt.

Ecosystem ABC

The Team and the analysts notes that their recommendation may not be adequately conservative from an ecosystem perspective.

The SSC notes that there are concerns regarding the status of marine mammals and sea birds that prey on pollock and uncertainty about the causes of their recent decline. The SSC further notes that the Council has taken steps that address these concerns through protective measures to prevent local pollock depletions by spreading the fishing effort over larger areas and throughout the year and by closing the areas around rookeries. As noted in the past, it is unclear whether current fishing practices contribute to marine mammal and seabird declines.

Table 21 in the SAFE report provides information on potential yield and the resulting spawning biomass for two recruitment scenarios fishing at an exploitation rate of 20% during 1993. This would drive the spawning biomass to 502,000 mt in 1995. This spawning biomass is less than 20% of the pristine spawner biomass under recruitment scenario 1. This level of spawning biomass would be below the lowest spawning biomass observed.

In light of the concerns and uncertainties regarding the ecosystems, a majority of the SSC could not support an increase in the exploitation rate above the present 10% at this time. The SSC notes that the model projects that fishing at the present rate (10%) will cause the spawning biomass to continue to decline but is not projected to decline in the next 3 years below the 20% level or below the lowest spawning biomass observed.

Therefore the SSC recommends, taking into account ecosystem considerations, that the ABC for pollock in the central and western area be set at 111,200 mt (1,112,000 mid year biomass * 10%).

Eastern Area - Walleye Pollock

The SSC concurs with the Team's recommendation that the ABC for the Eastern area remain at the current level 3,400 mt. No new information is available at this time.

Overfishing

The overfishing level is based on the $F_{30\%}$ fishing mortality rate (0.297) and is calculated to be 286,000 mt for the Western/Central GOA and 9,020 mt for the Eastern Gulf.

Gulf of Alaska - Pacific Cod

The SSC agrees with the Teams' specification of ABC and overfishing limit for Pacific cod. ABC (56,700 mt) was calculated by applying the $F_{0.1}$ rate (0.177) to the projected 1993 exploitable biomass (324,000 mt) estimate by SRA fitted to the 1984, 1987 and 1990 bottom trawl survey results. The overfishing limit (78,100 mt) was calculated by applying the $F_{30\%}$ rate (0.245) to the 1993 exploitable biomass.

Gulf of Alaska - Flatfish

The Plan Team recommendations for ABC are unchanged from September.

Flatfish stocks in the Gulf of Alaska are at high levels and generally stable, excepting arrowtooth flounder which is increasing. The SSC concurs with the Plan Teams' determinations of ABC which

used methods consistent with last year's determinations. Some biomass estimates have been updated for this year after the 1990 trawl survey results were re-edited. Biomass is estimated directly from the 1990 trawl survey, except for the deeper dwelling Dover sole for which 1987 survey estimates were used for depths between 500m and 1000m. The $F_{0.1}$ exploitation rate was used to calculate the 1993 ABC, and the overfishing level was set at $F_{30\%}$.

The 1993 ABCs are :	deepwater flatfish	- 45,530 mt;
	shallow water flatfish	- 50,480 mt;
	flathead sole	- 49,450 mt;
	arrowtooth flounder	- 321,290 mt.

These ABCs represent increases from 1992 for deepwater flatfish, flathead sole, and arrowtooth flounder.

Gulf of Alaska - Sablefish

The SSC concurs with the Plan Teams' recommended ABC of 20,900 mt. Sablefish biomass was estimated using an SRA model adjusted by relative population weights from longline surveys scaled to trawl survey biomass. The method used is identical to that used in 1991 with one notable exception. The 1993 biomass was estimated after assuming recruitment of 22,680 mt rather than zero recruitment as in past years. The assumed recruitment is the mean of 11 years data and excludes recruitment estimates of the 1977 and 1980 year class which the Plan Team noted were unusually high. Gulf of Alaska estimated 1993 sablefish biomass is 190,400 mt.

The Plan Team recommended and the SSC accepted a new approach to estimating sablefish ABC. The Plan Team now promotes $F_{35\%}$ (0.137) as the preferred fishing mortality rate as opposed to $F_{0.1}$ (0.133) used in past analyses. Furthermore $F_{35\%}$ is scaled by the ratio of 1993 exploitable biomass for the GOA/BS/AI (227,000 mt) and $B(F_{35\%})$ of 253,560 ($B_{93}/B(F_{35\%})=0.9$). [At M=0.11, $F_{35\%}$ = 0.137 the preferred exploitation rate is 0.122, therefore ABC = 0.122 (190,400)(0.9)] The Plan Team recommends an overfishing level based on $F_{30\%}$ scale to the ratio of B_{93} and $B(F_{35\%})$. The SSC notes that this recommended level is not allowed by the Council's overfishing definition, and consequently, recommends defaulting to a level derived from the product of the $F_{30\%}$ exploitation rate (0.146) and current biomass. The overfishing level is therefore 27,800 mt.

The Plan Team recommends that the ABC be apportioned among management areas in proportion to a weighted average of the last 5 years RPWs. While the SSC approves the application of this method in 1993, we want to bring to the Councils' attention, that the apportionment methodology will become increasingly contentious upon implementation of sablefish ITQ. Consequently, this method and various alternatives should be thoroughly evaluated with the goal of developing an objective rationale for the preferred methodology.

Gulf of Alaska - Slope Rockfish - POP

The SSC concurs with the Plan Teams' recommended ABC (5,560 mt) and the proposed regional allocation: western (1,240 mt), centeral (1,360 mt) and eastern (2,760 mt).

The SSC notes that issues identified in September: (1) an analysis to determine if new fishing power correction factors change survey biomass estimates, (2) examination of fishery data to determine if it could be integrated into the analysis, and (3) further examination of inconsistencies in various biomass estimates, were addressed by the assessment scientists. The updated stock synthesis runs produced biomass estimate of 153,600 mt. ABC (5,560 mt) was determined by applying the $F_{35\%}$

(0.114) exploitation rate to exploitable biomass and then scaling down by the ratio of the current female spawning biomass (B_c=68,200 mt) and the spawning biomass corresponding to 35% of the unfished level ($B_{35\%}$=118,200 mt). The Teams' recommended overfishing limit was obtained by applying the $F_{30\%}$ fishing rate and adjusting it downward by the ratio $B_c/B(F_{35\%})$ to maintain the magnitude of OFL relative to the ABC. The SSC does not agree with this approach since it is not consistent with the Council's overfishing definition. The SSC recommends that the unadjusted $F_{30\%}$ be used to define overfishing (12,400 mt).

Gulf of Alaska - Shortraker/Rougheye

The SSC agrees with the Teams' recommended ABC for shortraker/rougheye, 1,960 mt (100 mt - western, 1,290 mt - central and 570 mt - eastern areas). This estimate was obtained by applying an F=M strategy to the average of the 1987 and 1990 trawl survey biomass estimates. The SSC also concurs with the Teams' OFL.

The AFSC is currently undertaking a reexamination of the 1984 and 1987 survey biomass estimates. Any adjustments in these estimates should be taken into account in future assessments.

Gulf of Alaska - Other Slope Rockfish

The SSC concurs with the Teams' recommendation for northern rockfish and other species in this complex. The ABC for northern rockfish is 5,770 mt (1,000 mt, 4,720 mt and 50 mt for the western, central and eastern areas, respectively). The overfishing level is based on $F_{30\%}$ and is equal to 10,360 mt. The ABC for the remaining slope rockfish is obtained by applying F=M fishing rates to the biomass estimates for each species and summing to obtain a value of 8,300 mt (400 mt - western, 1,790 mt - central, and 6,110 - eastern). The overfishing level for these species (9,850 mt) was obtained by applying an $F_{30\%}$=0.080 for sharpchin rockfish and natural mortality rates for the remaining species.

The Team expressed concern over setting quotas for a species complex as the sum of individual ABCs rather than based on the most vulnerable or desirable species in the complex. It is suggested that the Team continue to explore this issue.

Gulf of Alaska - Pelagic Shelf Rockfish

The SSC agrees with the Team's ABC recommendation that ABC for species in this complex excluding black rockfish be set at 6,760 mt. The recommended distribution of this ABC is: 1,010 mt - Western, 4,450 mt - Central, and 1,280 mt in the Eastern area. The trawl survey biomass estimates in 1984, 87 and 90 for dusky rockfish were averaged to represent current exploitable biomass for these species. The ABC was determined by applying F=M=0.09 for dusky rockfish. The overfishing definition for this group of species was based on the fishing rate that would reduce the dusky rockfish exploitable biomass per recruit ratio to 30% of its unexplained value. This is estimated to be 0.151 (11,300 mt).

The SSC shares the Team's concern over the rapidly expanding jig fishery for black rockfish. Because of the lack of an estimate of exploitable biomass, the Team's recommended ABC was obtained from the estimated catch in 1991, 570 mt. The SSC does not support this recommendation because of the limited data it was based on. Until sufficient data become available, it is recommended instead that TAC's be set for black rockfish so as to constrain the catch to 570 mt. The SSC concurs with the Team's overfishing recommendation, 570 mt.

Gulf of Alaska - Demersal Shelf Rockfish

The SSC agrees with the Teams' recommended ABC for this complex, 800 mt. This value was obtained by applying F=M=0.02, the natural mortality for yelloweye rockfish, to the lower 90% confidence limit of the biomass estimate obtained from line transect data. The overfishing level (1,600 mt) for this species was determined by applying $F_{30\%}$=0.04 to the estimate of exploitable biomass (40,050 mt).

Gulf of Alaska - Thornyheads

The SSC concurs with the Team's recommended ABC for Thornyheads, 1,180 mt. Based on results of the 1990 trawl survey the best estimate of current exploitable biomass is 26,207 mt. The exploitation rate was determined by averaging the previously estimated M(0.07) with the value applied to Pacific coast shortspine thornyhead stocks (M=0.03). With an M=0.05 and an $F_{35\%}$=0.045, the ABC is 1,180 mt for 1993. The overfishing level (1,441 mt) was determined by applying $F_{30\%}$ (0.055) to the exploitable biomass.

Gulf of Alaska - Rockfish - Other Considerations

The SSC is concerned about the large undocumented bycatch and discard mortality of rockfish species in the Gulf of Alaska longline and trawl fisheries. ADF&G and NMFS staff presented rough estimates of discard and bycatch mortality for POP and shortraker/rougheye rockfish in the 1992 GOA fisheries. Based on these estimates, total mortality in 1992 (i.e., directed catch, discard and bycatch mortality) was substantially above the ABC for both species and may be above the overfishing limit for shortraker/rougheye rockfish. The SSC reiterates its earlier recommendation that the Council adopt management measures that ensure that total mortality is constrained by the ABC for rockfish species. The SSC endorses NMFS and ADF&G's efforts to document total mortality for Gulf of Alaska rockfish species. The SSC notes that additional observer coverage on small halibut and sablefish longline vessels may be necessary to document bycatch and discard rates for rockfish species.

D-1(e) BERING SEA/ALEUTIAN ISLANDS - SPECIFICATIONS

Bering Sea/Aleutian Islands - Pollock

Eastern Bering Sea

Four different age-structured methods are used to estimate exploitable biomass and all methods showed the same trends in biomass over time. The SSC agrees with the Team that the status quo method, cohort analysis tuned to survey biomass and age composition estimates, should be used to determine exploitable biomass. Exploitable biomass in 1993 from this method was estimated to be 5.9 million tons and represents a small decline from last year's assessment. The SSC recommends that the Plan Team add an additional stochastic recruitment approach similar to the approach used for the GOA pollock. This can be substituted for the stock-recruitment function presently used for the Walters and also the delay - difference Models. A comparison of the stochastic and deterministic methods could be developed. The SSC accepts the Teams' recommendations for ABC and overfishing limit, which are based on F_{MSY}=.38.

Aleutian Islands

The 1993 pollock biomass was based on the 1991 bottom trawl survey estimates expanded for the off-bottom component and projected to 1993 based on the relative population change observed in the EBS stock. The SSC accepts the Team's recommendation for ABC and overfishing limit, which are based on $F_{35\%}$ and $F_{30\%}$ estimates of growth and natural mortality which use data collected from the Aleutian Islands population.

Bogoslof Area

The SSC believes the Aleutian Basin pollock population should be managed separately from the EBS and AI populations. The Basin population has a different age structure, a different size at age, a different area and time of spawning, a different migration pattern, and has experienced a different level of exploitation. Available evidence indicates that the fishery that occurs in the international zone of the Bering Sea (i.e., the Donut Hole) exploits the Basin stock. A portion of the stock spawns in the vicinity of the Commander Islands and another portion spawns in the vicinity of Bogoslof Island. It is generally believed that a majority of the Basin pollock originate from the Bogoslof component.

The SSC strongly supports the international effort (P.R.C., Japan, R.O.K, Poland, U.S.S.R., and U.S. scientists) to develop a comprehensive assessment and management of Aleutian Basin pollock. A second workshop was held in late February 1992 in Seattle to assemble available data and to refine and expand population models. A major development was an agreement in August, 1992 by these nations to cease fishing in international waters for two years and to cooperate in further research.

A precipitous decline in the biomass of the Bogoslof pollock has occurred since the 1989 survey. Available evidence strongly suggests that the Bogoslof stock has been overexploited. Recent hydroacoustic surveys provide estimates of biomass of 600,000 tons in 1991 and 800,000 tons in 1992. Assuming that little or no recruitment has occurred recently, the best estimate of 1993 biomass is obtained from the 1992 survey decayed by natural mortality, which is 650,000 mt.

The SAFE indicates that the current Basin biomass as predicted by the preliminary Aleutian Basin stock cohort analysis is only about 10% of the largest observed biomass and well below B_{MSY}. A precise estimate of the ratio B/B_{MSY} is impossible, but it is probably on the order of 1/4. Given the low level of abundance, the SSC believes that under the Council's overfishing definition an exploitation rate of 1/4 of $F_{35\%}$ is appropriate. The SSC recommends using the Plan Teams' estimates of $F_{35\%}$ computed from growth parameters as F=0.33 which equates to an exploitation rate of 26%. The SSC then uses this F to calculate an ABC, applying the rate (0.26 x 0.25) (=25% of the exploitation rate) to the 1993 biomass estimate to obtain an ABC of 42,000 (650,000 x 0.26 x 0.25). The ABC is also the overfishing limit.

Because of the current status of the Bogoslof population, the importance of supporting international efforts to curtail fishing on the Basin population, and the potential impacts on marine mammals and seabirds, the SSC strongly recommends that the TAC be set at a level to provide for bycatch only.

Bering Sea and Aleutian Islands - Pacific Cod

The AFSC presented new information on biomass and exploitation rates that was not available at the November Team meeting. There is a new estimate of 1993 exploitable biomass (624,000 mt) based on an updated stock synthesis model. The new work confirms the lower biomass reported in November. In addition, there is a new data set on size at maturity that differs from that used by the

Team to calculate the $F_{35\%}$ and $F_{30\%}$ exploitation rates. The SSC notes that the two data sets were collected in the 1970's and early 1980's and may not reflect the current size at maturity for the BS/AI Pacific cod stock. There is no information available to select a preferred data set to estimate the $F_{35\%}$ exploitation rate, but the range probably brackets the true value.

In absence of additional data that reflects the current size at maturity for Pacific cod, the AFSC recommended that ABC's and overfishing limits be maintained at the 1992 level. The SSC disagrees with this recommendation, because the new information suggests that Pacific cod biomass is less abundant than estimated in 1992 and this decrease should be considered in setting ABC and overfishing limit.

The SSC agrees with the Team's strategy for calculating ABC and overfishing limit, and recommends that ABC and overfishing limit be calculated by applying $F_{35\%}$ and $F_{30\%}$ exploitation rates to the new estimate of 1993 exploitable biomass, respectively. In lieu of new data on size at maturity for Pacific cod, the SSC recommends that the alternative exploitation rates based on the alternative size at maturity data sets be averaged in calculating ABC and overfishing limit. The ABC and overfishing limit based on the averaged exploitation rates and new estimate of exploitable biomass is 164.5 thousand mt and 192 thousand mt, respectively.

The SSC supports the collecting of additional size at maturity information for BS/AI Pacific cod in 1993, and recommends that these data be used to develop a preferred estimate of $F_{35\%}$ and $F_{30\%}$ in developing future ABC's and overfishing limits for Pacific cod.

Bering Sea/Aleutian Islands - Flatfish Summary

The methods used to calculate ABC for this complex have been changed from prior years for several groups. The SSC commends the Plan Team for its use of the stock synthesis model where necessary data is available and the encourages the analysts to continue their efforts to use new methods which can make use of additional sources of information.

Bering Sea/Aleutian Islands - Yellowfin Sole

The SSC concurs with the Plan Team approach. Yellowfin sole abundance is high and stable. Survey results have been somewhat variable and three methods were used to estimate exploitable biomass; (1) trawl survey, (2) virtual population analysis, and, (3) stock synthesis. Applying $F_{35\%}$ to a projected exploitable biomass (2.50 million mt) estimated by the stock synthesis model yields an 1993 ABC of 238,000 mt, which is 134,000 mt less than 1992. Overfishing level (275,000 mt) is calculated by applying $F_{30\%}$. The large decrease in ABC this year resulted from applying the annualized exploitation rate rather than the instantaneous fishing mortality rate to the estimate of exploitation biomass.

Bering Sea/Aleutian Islands - Greenland Turbot

Continuous poor recruitment has been observed since the early 1980s and biomass of the adult population is expected to decline throughout the 1990s. Given continued recruitment failure, the Plan Team rejected a preliminary ABC of 14,100 mt based on $F_{0.1}$ and recommended a continuation of the 1992 ABC of 7,000 mt. Given the poor stock conditions, the SSC agreed with this approach. An OFL of 10,500 mt was calculated using the ratio of exploitable biomass to $B_{MSY} \times F_{MSY}$ (0.06). The SSC recommends that the Team calculate $F_{30\%}$ for the determination of OFL.

Bering Sea/Aleutian Islands - Arrowtooth Flounder

Recruitment from the 1986 and 1987 year classes was good. Biomass is high. In the absence of a stock recruitment relationship, $F_{35\%}$ was applied to a projected biomass from the 1991 survey to calculate a 1993 ABC of 72,000 mt, a reduction of 10,000 mt from the 1992 calculation. Overfishing, calculated at $F_{30\%}$ is 96,000 mt for 1993. The methodology used remains similar to the prior year. Exploitation rates have been annualized, as in the case of yellowfin sole.

Bering Sea/Aleutian Islands - Rock Sole

In a change from preliminary estimates, stock synthesis was used by the Plan Team to calculate a 1993 exploitable biomass of 1,550,000. This procedure uses catch-at-age data on this stock for the first time.

An exploitation rate of $F_{35\%}$ provided an estimated ABC for 1993 of 185,000 mt, which is 75,800 mt below 1992. ABC is below the 1993 level of overfishing (270,000) based on $F_{30\%}$. As done above, exploitation rates have been annualized.

Bering Sea/Aleutian Islands - Other Flatfish Complex

Reliable estimates of B_{MSY} and F_{MSY} are not available for this group of species. $F_{35\%}$ was applied to an increased biomass estimate which is a sum of estimates for three species groups and is based on the 1992 survey to calculate an ABC of 191,000 mt, 9,000 mt below 1992. A reduced ABC from preliminary estimates results from the application of $F_{35\%}$ rather than $F_{0.1}$. Exploitation rates were annualized. Overfishing was calculated using $F_{30\%}$ at 228,00 mt.

Bering Sea/Aleutian Islands - Sablefish

The SSC agrees with the Plan Team's recommended ABCs. Sablefish is assessed jointly in the Gulf of Alaska, Bering Sea and Aleutian Islands. Consequently, the methods are identical to those discussed in the Gulf of Alaska section above.

Estimated biomass is 23,600 mt for the Aleutians and 13,400 mt for the EBS. ABCs are estimated to be 2,600 mt and 1,500 mt, respectively, with companion overfishing levels of 3,500 mt and 2,000 mt.

Bering Sea/Aleutian Islands - POP Complex

True POP

The SSC accepts the Team's ABC for species in this complex. For the eastern Bering Sea the ABCs for 1993 are 3,300 mt for True POP and 1,400 mt for other red rockfish. Aleutian Island ABCs are 13,900 mt, 5,670 mt and 1,220 mt for True POP, Northern/Sharpchin and Rougheye/Shortraker, respectively.

The recommended 1993 ABC for True POP is based on a harvest strategy that reduces the equilibrium level of spawning biomass per recruit to 35% of the pristine level ($F_{35\%}$=0.059 for the EBS and 0.056 for the AI). These fishing mortalities are applied to the projected 1993 biomass levels of 59,700 mt in the EBS and 260,000 mt in the AI region.

The overfishing limit for True POP is based on the harvest strategy that reduces the equilibrium level of spawning biomass per recruit to 30% of the pristine level. The $F_{30\%}$ for EBS and AI are 0.067 and 0.069, respectively. The corresponding catch limits are 3,750 mt and 16,800 mt.

Bering Sea/Aleutian Islands - Other Red Rockfish

The SSC accepts the Team's ABC recommendations for species in this group. ABCs were calculated by using F=M for exploitation rates and average biomass estimates from bottom trawl surveys to obtain an estimate of current biomass. Natural mortalities used were 0.06 for northern and sharpchin, 0.025 for rougheye, and 0.03 for shortraker. Biomass estimates were as follows: northern/sharpchin (EBS) 17,500 mt; (AI) 94,500 mt; rougheye (EBS) 3,000 mt; (AI) 25,300 mt; and shortraker (EBS) 9,200 mt; (AI) 19,700 mt.

The other red rockfish ABC for the eastern Bering Sea is 1,400 mt. The SSC does not recommend splitting this complex up. It still believes that the added protection afforded rougheye and shortraker by separating them into their own group is insignificant. The SSC recommend that this complex be divided into two groups for the Aleutian Islands: rougheye and shortraker, and all remaining species. The ABC for rougheye/shortraker is 1,220 mt and 5,670 mt for northern/sharpchin.

Lacking a value of $F_{30\%}$, the F=M criterion is used to define overfishing (ABC=OFL).

Bering Sea/Aleutian Islands - Other Rockfish

The SSC accepts the Team's ABC recommendation for this complex. ABCs were calculated by applying an exploitation rate equal to natural mortality for POP (0.05) to the estimate of current exploitable biomass, 8,000 mt for the eastern Bering Sea and 18,500 mt for the Aleutian Islands. Current biomass estimates were obtained by averaging recent trawl survey results. The F=M criterion was used to define overfishing (lacking $F_{30\%}$), which is therefore equal to ABC.

Bering Sea/Aleutian Islands - Atka Mackerel

The SSC accepts the Team's determination that the best estimate of ABC, given information now available, is 351,000 mt. The ABC was derived by applying the estimated rate of natural mortality (0.30) to the 1993 exploitable biomass (1,121,000 mt) based on the stock synthesis model fitted to catch at age data (age 3+) and bottom trawl survey results. The SSC notes the biomass projections are higher than the 1992 projection due to updated 1991 survey data and inclusion of fish older than age 7 that appear in the fishery catches. This biomass estimate is conservative because some fraction of Atka mackerel biomass is distributed in mid-water and nearshore, and therefore is not included in the standard bottom trawl survey estimate.

While accepting the Teams' ABC determination, the SSC is concerned that the series of trawl surveys is short and inconsistent in their extent of coverage. We are also apprehensive about the possible environmental problems that may result from an increased catch of the magnitude implied by the 1992 and 1993 ABC estimate. Atka mackerel is a prey species of northern fur seals and northern sea lions. During their migrations, northern fur seals (a depleted species) feed heavily on Atka mackerel as they move through the Aleutian passes.

In these circumstances, the SSC prefers to phase in the new higher ABC over a six-year period, adopting the current biomass estimate and raising the exploitation rate in steps from M/6 in 1992, M/3 in 1993, to M in 1997. According to the this schedule, the recommended ABC for 1993 is (0.30/3)* 1,171,000 = 117,100 mt. While this approach provides a 6 year schedule for increasing

ABC, it should be clear that the estimate and procedures will be reviewed annually. The main purpose of the gradual approach is to postpone a large ABC increase until its correctness has been confirmed by additional data and analysis.

The SSC accepts the Teams' overfishing limit calculated by applying the $F_{30\%}$ rate (F=0.506) to the 1993 exploitable biomass.

The SSC is particularly concerned about the need to distribute a greatly increased harvest over the range of the stock in proportion to the distribution of biomass. This would require 70% of the catch to be taken west of 180° W. The SSC recommends that ABC for the eastern Aleutians be 32,100 mt and for the Western Aleutians be 85,000 mt.

The SSC notes that almost all of the 1992 catch of Atka mackerel was taken in the eastern Aleutian Islands area. Because of the possibility of localized depletion of Atka mackerel and the resulting impact on predator populations, the 1993 ABC is at a level that cannot be safely taken entirely from eastern Aleutians area. It is critical that the Council develop a plan amendment that will allow TAC's to be allocated geographically. In the absence of means to apportion ABC's, the SSC recommends the ABC for BS/AI Atka mackerel should be constrained to 32,100 mt, which can be safely taken in the eastern Aleutians area.

The SSC recommends that the Team consider the use of an annualized exploitation rate to calculate ABC for future years.

D-3(a) PRIBILOF ISLAND TRAWL CLOSURE

The SSC reviewed the final EA/RIR and public comment for Amendment 21a to the Bering Sea/Aleutian Island FMP. This proposed amendment is to close the area around the Pribilof Islands to trawling to protect important habitat for blue king crab, Korean hair crab, marine mammals and seabirds.

At our September meeting the SSC provided the Council staff with comments on the draft document and a reference to a scientific paper on the habitat requirements of blue king crab around the Pribilof Islands (Armstrong, D.A., et al. 1985. Early life history of juvenile blue king crab, Paralithodes platypus, around the Pribilof Islands. Proc. Int. King Crab-Symp.). It was the expectations of the SSC that this information would be included in the document prior to public review. This information was not included due to time limitations on the staff.

The SSC received public testimony from Dave Fraser noting the distribution of blue king crab sampled in NMFS bottom trawl surveys contrasted with pollock distribution. Mr. Fraser noted that the blue king crab were distributed in the vicinity of St. Paul and St. George Island and northeast of the islands; whereas, pollock, while found in the vicinity of the islands, are also found in greater abundance northwest of the islands. Mr. Fraser using his own joint venture catch data, demonstrated that bottom trawl caught pollock are taken around the southern and western edge of St. George Island, in a "horseshoe" following the 50 fm contour.

Furthermore, the mean size of pollock decreases as one moves northwest of the islands. Mr. Fraser's joint venture catch data also indicated that trawling for yellowfin sole occurs northeast of St. Paul Islands in shallow waters (33-36 fm).

Habitat Considerations

The scientific paper provides the following regarding an early life history of the blue king crab in the area of the Pribilof Islands:

(1) Juvenile blue king crab were located in the area around St. Paul Island and east of St. George.

(2) Juveniles were exclusively located in a particular substrate composed of cobble and shell.

(3) Juveniles were primarily located between the 40 and 60 meter isobaths.

(4) Crab density was exceedingly high in that substrate and virtually absent in other substrates.

(5) The importance of this cobble/shell habitat is comparable to that of the rocky niche habitat for red king crab around Kodiak Island.

(6) The unique cobble/shell habitat provides a refuge for the juvenile crab.

(7) The ocean current patterns in the area and the apparent dependence of the early life stages of the blue king crab on the particular benthic material make it likely that the species may experience year class failures.

(8) During the study mature adult female blue king crab area were most abundant to the southwest of St. Paul Island and were generally within 14 nautical miles of St. Paul Island.

Status of Blue King Crab Resource

The SSC reviewed the status of the blue king crab resource in this area. As noted in this document there has been no commercial fishery since 1987. The 1990 and 1991 surveys indicated a potentially fishable population, but the fishery has not been opened. The SSC requested and received from the staff data on the annual abundance estimates for blue king crab in the Pribilof District. This data indicates that the total number of individual decreased significantly after 1981 reaching a low in 1985. 1989, 1990 and 1991 data indicates an increase in the total number of individuals, but that the resource remains low. The annual abundance estimate for the latest year is a grand total of 6.7 million crabs. The population is classified as low and stable.

The causes of the decline in the early 1980's are unknown.

Korean Hair Crab

No information has been presented on the habitat requirements, bycatch, or status of this resource in the area.

Marine Mammal and Sea Bird Considerations

As noted in the final draft document the impact of closing the area to trawling on the population of bird and marine mammal is not clear. Limitation on the physical presents of fishing vessels will most likely be beneficial by reducing physical contact.

Bycatch

The SSC was unable to determine the magnitude of the blue king crab bycatch as data were not available.

Impact Assessment

Given the information contained in the document it is not possible to forecast the benefits to the blue king crab resource from the various closure alternatives.

The impact of the closures on fishermen were assessed with the crab bycatch model. The results obtained indicated little change in the catch and value of directed groundfish and bycatch species for the alternatives. Public testimony received by the SSC indicates that management measures proposed may be unnecessarily restrictive to groundfish fisherman without commensurate protection to blue king crab particularly along the southern and western area of St. George Island.

Recommendations

Although we have limited data on which to formulate a recommendation, the SSC believes that protection of the blue king crab could be accomplished by the use of smaller areas than those examined. These smaller areas should be structured to encompass the important habitat of the blue king crab and marine mammals.

D-3(b) EXCLUSIVE AREA REGISTRATION PROPOSAL

The Draft EA/RIR for Exclusive Area Registration contains analyses of both net economic benefits and economic impacts. We address these two analyses in order.

Net Economics Benefits (Benefit/Cost Analysis)

This analysis has been developed to estimate the increase or decrease in net earnings likely to occur throughout various segments of the groundfish fleet due to exclusive area registration proposals. It does this using an innovative empirical approach which uses detailed information on catch and revenue by area/season/vessel characteristics to predict how vessel operators choose fishing areas. The model assumes vessel owners select fishing areas based upon expected net earnings. When an area is closed due to regulation, the vessel operator will seek out another area with next-best earning opportunities. Because each operator will choose the best areas first, any reduction in areas available may cause a reduction in expected profits for that vessel type. Exclusive registration areas essentially cause a restriction in the ability of vessels to make the best adaptations to fishing conditions. Hence, the model will not predict an increase in net economic benefits, and will generally cause a reduction in net benefits. This characteristic of the economic model dictates that increasing restrictions on area of operation will impose costs on the fishing fleet. Gauging the magnitude of the costs and distribution of costs and benefits among segments of the fishery requires quantitative specification of the model.

The analysts estimated a choice model for groundfish fleets in the BS/AI and GOA using individual vessel catch and revenue (weekly reports or fish ticket) data. The resulting cost estimates are specific to circumstances encountered in 1991, as well as numerous assumptions built into the economic model. The SSC finds the model to be a promising extension of existing approaches to economic assessment, and is pleased with its ability to correctly model and measure the impacts of area

restrictions. While the technically complex choice model needs further review and, possibly, more thorough development, the direction of change in economic benefits predicted is correct under the assumptions and the magnitude seems reasonable. If the model were updated to include data of more recent years (years that encompass recently adopted fishery regimes, i.e. onshore-offshore allocation, CVOA, etc) the quantitative estimate of economic loss might be different. But the difference would be of degree, not kind.

Economic Impact Analysis

The EA/RIR contains a brief analysis of potential income impacts of exclusive area registration based upon the Alaska Fisheries Economic Assessment Model. As with all such models, the predicted impacts depend upon a large number of assumptions and estimated parameters(i.e. prices, production yields, distribution of raw fish to product categories, etc.). Unfortunately this particular impact model continues to be poorly documented. The authors of the EA/RIR note that the model is the best information available to the analysts. The SSC finds it to be less than acceptable.

Anomalous results of the analysis detract from our confidence in it. For example, the large economic impact gain associated with shifting "other groundfish" to the onshore sector in GOA (Table 3.26) is not very credible. It is unclear how a net increase of $34 million can be generated from redistribution of fish. It is likely that this large magnitude of income increase is due to a fallacious assumption that low-valued groundfish offshore can be converted to high-valued groundfish onshore.

Given the poor documentation provided, we cannot determine what exactly accounts for the reported impacts; neither can the analysts doing the work. Hence, we conclude that the current model for economic impact assessment in Alaska's fisheries in not an acceptable scientific tool of analysis.

D-2(a) POLLOCK "B" SEASON DELAY

The SSC reviewed the Draft Environmental Assessment/Regulatory Flexibility Analysis For The Proposed Delay of the Pollock "B" Season In The Bering Sea/Aleutian Islands. The document contains analyses of environmental/biological impacts, net benefits, bycatch impacts and regional/community income impacts.

In September, the SSC noted that the discussions in the environmental and biological impacts sections on bycatch were inconsistent with the results presented in the economic analysis section. The description of the impact of season delays on herring bycatch in the two sections differs. These inconsistencies still exist.

Industry participants were contacted to determine: how pollock yield and market prices might change under various "B" season dates, the extent to which pollock harvesters would prosecute other groundfish fisheries during the summer months, and the interest of groundfish processors in processing salmon during the same period. The information on substitute groundfish fisheries generated by the canvass was used to drive the fishery simulation model used for past bycatch analyses.

After reviewing the results of the simulation runs the authors state that, "...delaying the pollock "B" season has little substantive effect on overall groundfish catch and the bycatch of prohibited species with the exception of herring." Further, it is indicated that, "...although total groundfish tonnages, net revenue, bycatch amounts, bycatch impact costs, and net bycatch costs vary among alternatives,

the magnitude of the predicted changes are small relative to overall catch and bycatch levels and are likely within the precision of the data used to estimate the model."

During the canvass of industry, information was elicited about the intent and ability of groundfish processing operations to process salmon during the summer months should the pollock fishery be closed. The canvass of processors provided only limited information about potential salmon processing by pollock processors in the event of a "B" season delay. The results of the canvass were considered insufficient to project how many pollock processors might process salmon in different areas, what products they might produce, or what prices they might pay. Because of data limitation the authors provided only a qualitative assessment of how the salmon industry would be affected by season delays. These effects are summarized on page 3-21 of the document.

The analysis indicates that net benefits associated with alternative season delays could range from about $55 million for the September 1 opening to about $35 million and $15 million for the August 1 and July 1 openings, respectively. Effects quantified included changes in yields and bycatch impacts. Price response effects, product quality changes and changes in storage costs were not capable of being quantified. The impacts on net benefits due to changes in the salmon industry also were not quantified.

Herring bycatch is predicted to nearly triple under a September 1 opening. It was noted by the authors that any new effort in the Atka mackerel, yellowfin sole, other flatfish and cod summer fisheries could further increase herring bycatch.

The Alaska Fisheries Economic Assessment Model was used to assess the potential income impacts of season delays. As previously indicated, this impact model continues to be poorly documented. Therefore, until it is fully evaluated, cautions should be exercised in the use of results obtained from it.

D-5(b) TRAWL MESH PROPOSAL

The SSC reviewed the Highliners Association proposal to initiate trawl mesh regulations in the pollock fishery, and finds that the proposal has merit. Earlier research has shown, however, that some portion of the young fish that pass through enlarged mesh sizes will not survive, yet some increase in survival will be realized. Research is at present being conducted at the Fisheries Industrial Technology Center on rates of escapement of pollock in the Kodiak region. Anticipating that the results will corroborate the Japanese-Russian findings on pollock escapement, the SSC recommends that Council study ways to implement the mesh-size proposal, including the possibility of an industry organized voluntary compliance. Compliance will likely mean less time spent in deck sorting of small pollock as well as economic gain due to the increased survival of young pollock to marketable sizes.

SSC Recommendations - Bering Sea/Aleutian Islands

Stock	Region	B_{93}	B_{MSY}	F_{msy}	ABC Strategy	ABC	Overfishing Definition	Y_{of}	Notes
Pollock	EBS	5.9M	6.0M	0.37	F_{msy}=.37	1.34M	F_{msy}=.37	1.34M	Cohort Analysis
	AI	196K	?	0.38	F_{35}=.30	68.7K	F_{30}=.45	62.6K	
	Bogoslof	655K	?	?	F_{35}/4=.10	42K	F_{35}/4	42K	B/B_{msy} = 1/4
Cod	BSAI	624K	?	?	F_{35}=average[c]	164.5K	$F_{30\%}$=average	192K	
Yellowfin sole	BSAI	2.5M	?	?	F_{35}=.11	238K	$F_{30\%}$=.12	275K	
Greenland turbot	BSAI	292K	?	?	Bycatch only	7K	F=.04	10.5K	1977-1987
Arrowtooth	BSAI	480K	?	?	F_{35}=.18	96K	$F_{30\%}$=.25	96K	
Rock sole	BSAI	1.55M	?	?	F_{35}=.14	185K	F_{30}=.21	270K	
Other flatfish	BSAI	1.25M	?	?	F_{35}=.18	191K	$F_{30\%}$=.22	228K	
Sablefish	EBS	13.4K	?	?	F^{b}_{35}=.12	1400	$F_{30\%}$=.166	2000	
	AI	23.6K	?	?	F^{b}_{35}=.12	3000	$F_{30\%}$=.166	3500	
POP complex									
True POP	EBS	59.7K	?	?	F_{35}=0.06	3330	$F_{30\%}$=0.07	3750	SRA & trawl survey
	AI	260K	?	?	F_{35}=0.06	13900	$F_{30\%}$=0.07	16800	
NO/SC/RE/SR	EBS	29.7K	?	?	F=M	1400	F=M	1400	
NO/SC	AI	94.5K	?	?	F=M	5670	F=M	5670	
RE/SC	AI	45K	?	?	F=M	1220	F=M	1220	
Other Rockfish	BS	8K	?	?	F=M	400	F=M	400	Surveys
	AI	18.5K	?	?	F=M	925	F=M	925	
Atka Mackerel	BS/AI	1.17M	?	?	F=M/3=.073	32.1K[a]	$F_{30\%}$=.5	771K	Stairstep ABC
Squid	BS/AI	?	?	?	Ave. Catch	3400	Ave. Catch	3400	
Other species	BS/AI	780K	?	?	Ave. Catch	26,600	Ave. Catch	26,600	

a/ If there is a Plan Amendment to separate eastern and western Aleutian Island - ABC =117K
b/ Adjusted by Bc/B35
c/ Values for high and low size of maturity averaged

SSC Recommendations - Gulf of Alaska

Stock	Region	B_{93}	B_{MSY}	F_{msy}	ABC Strategy	ABC	Overfishing Definition	OFL	Notes
Pollock	W/C	1,112,000	?	?	F_{hist}=10%	111,200	$F_{30\%}$=0.297	286,000	SS Model E, G
	E					3,400	$F_{30\%}$=.283	7,880	1990 Trawl survey
Cod	W					18,700			
	C					35,200			
	E					2,800			
	GOA	324,000	?	?	$F_{0.1a}$=.177	56,700	$F_{30\%}$=.245	78,100	Survey B 84, 87, 90 in SRA Model
Deepwater flat	W					2,020			
	C					35,580			
	E					7,930			
	GOA	227,660	?	?	$F_{0.1a}$=.20	45,530	$F_{30\%}$=.26	59,650	Survey B 90
Shallow flat	W					27,480			
	C					21,260			
	E					1,740			
	GOA	261,724	?	?	$F_{0.1a}$=.20	50,480	$F_{30\%}$=.26	70,860	Survey B 90
Flathead	W					12,580			
	C					31,830			
	E					5,040			
	GOA	247,247	?	?	$F_{0.1a}$=.20	49,450	$F_{30\%}$=.26	64,780	Survey B 90
Arrowtooth	W					38,880			
	C					253,330			
	E					29,080			
	GOA	1,889,922	?	?	$F_{0.1a}$=.17	321,290	$F_{30\%}$=.24	451,690	Survey B 90
Sablefish	W					2,030			
	C					9,610			
	WYK					3,830			
	SEO					5,430			
	GOA	190,400	?	?	$F_{35\%}$=0.137	20,900**	$F_{30\%}$=0.166	27,750	Constant R Longline, trawl surveys in SRA model

(GOA - continued)

Stock	Region	B_{93}	B_{MSY}	F_{msy}	Strategy	ABC	Overfishing Definition	OFL	Notes
Slope rockfish:	W					1,240			
POP	C					1,560			
	E					2,760			
	GOA	153,600	?	?	$F_{35\%}$=0.114*	5,560**	$F_{30\%}$=0.148	12,400	
SR/RE	W					100			
	C					1,290			
	E					570			
	GOA	72,960	?	?	F=M (RE=0.025) (SR=0.030)	1,960	$F_{30\%}$(RE)=0.046 F=M(SR)=0.030	2,900	Ave. Survey B 87, 90
Northern Rockfish	W					1,000			
	C					4,720			
	E					40			
	GOA	96,070	?	?	F=M=0.06	5,760	$F_{30\%}$=0.113	10,360	
Other slope	W					330			
	C					1,640	(Sharpchin)=		
	E					6,330	$F_{30\%}$ and F=M		
	GOA	134,400	?	?	F=M	8,300	(other species)	9,850	Ave. Survey B 87, 90
Pelagic shelf rockfish	W					1,010			
	C					4,450			
	E					1,280			
	GOA	74,900	?	?	F=M=0.09	6,740	$F_{30\%}$ = 0.151	11,300	Includes black rockfish. Ave. Survey B 84, 87, 90
Black rockfish		unknown			TAC=570 mt		1991 catch	570	
Demersal shelf rockfish	GOA	40,050	?	?	F=M=0.02	800	$F_{30\%}$ = 0.04	1,600	Lower 90% CI submersible Survey B
Thornyhead	GOA	26,210	?	?	$F_{35\%}$ = 0.045	1,180	$F_{30\%}$=0.055	1,441	Survey B 90

*Fully recruited age groups.
**Adjusted by $Bc/B_{35\%}$.