MEMORANDUM

TO: Council, SSC, and AP Members

FROM: Clarence G. Pautzke
Executive Director

DATE: September 16, 1992

SUBJECT: Gulf of Alaska Groundfish Specification for 1993

ACTION REQUIRED

(a) Approve initial Stock Assessment and Fishery Evaluation (SAFE) report for Gulf of Alaska groundfish fisheries for public review.

(b) Approve initial Gulf of Alaska groundfish and bycatch specifications for 1993 for public review.

BACKGROUND

A. SAFE Document

The Plan Team met September 1-4, 1992 to prepare the preliminary SAFE document sent to you on September 10. The document contains the team's estimates of biomass and ABC levels for 1993 for all groundfish species covered under the Gulf of Alaska FMP. Tables 1 and 2 from the SAFE are under D-3(a)(1) for quick comparison to 1992. Note that none of the Plan Team recommended ABCs exceeds or is equal to the overfishing level. Also in that item are summaries of current marine mammal considerations, halibut PSC considerations, and an economic overview of the fisheries. Appendix I of the SAFE contains more detailed information on halibut PSC in the groundfish fisheries of the Gulf.

The SAFE also contains in Appendix III, a preliminary analysis of discard condition of halibut by gear type and specific fishery based on the 1990 and 1991 fisheries. The analysis is preliminary, but recommendations for mortality rates for 1992 will be added in the November SAFE for final decision in December. We need to release the SAFE for public review. A final SAFE will be compiled by the Plan Team in November. It will incorporate additional stock assessment information and discuss how to incorporate ecosystem issues.

B. Set Initial ABCs, TACs, and PSCs for the 1993 Fisheries

Item D-3(b)(1) shows the 1992 ABCs, TACs, and catch statistics (through August 23), and Team's recommended 1993 ABCs, and has space for the SSC and AP recommendations. In 1992, all TACs were apportioned to Domestic Annual Processing (DAP). The preliminary specifications for 1993 will be published for public review after the September meeting. Final specifications will be set in December. Twenty-five percent of these initial specifications will serve as interim specifications to kick off the 1993 fisheries until the final specifications are published in the FEDERAL REGISTER sometime in early 1993. Item D-3(b)(2) is a blank worksheet for Council recommended ABCs and TACs.

NMFS will be presenting additional pollock assessment information at this meeting which incorporates hydroacoustic survey data not now included in the Plan Team's biomass and ABC estimates. This additional information likely will result in a higher biomass estimate than that contained in the SAFE document.

Item D-3(b)(3) is an industry proposal to designate Pacific ocean perch (POP) and shortraker/rougheye as bycatch only species in the Central Gulf for 1993. This proposal contains a provision for releasing unused amounts in the fourth quarter to a directed fishery, if there is adequate quota remaining. The Council may wish to request that the NMFS Regional Office manage this species as bycatch only in 1993.

Major changes from last year's SAFE document include a decrease in the ABC estimates for Pacific cod and for Pacific ocean perch. The ABC estimate for demersal shelf rockfish (DSR) is considerably higher than last year (800 mt vs. 550 mt). It is important to note however, that an estimate is now available of unreported DSR bycatch in the halibut longline fisheries. This estimate of around 200 mt would be taken into account by ADF&G during in-season management of the DSR fisheries (as has been done in the past), such that the effective amount available for a directed fishery would be closer to 600 mt, or about the same as last year.

C. Set Initial PSC Limits for Halibut

Amendment 21 clarifies the halibut PSC framework to permit the Council to specify PSC limits by season and by gear type. For the 1992 fishing year the PSC limits were apportioned as follows:

Trawl Gear		Hook and Line Gear	
1st quarter	600 mt (30%)	1st trimester	150 mt (20%)
2nd quarter	600 mt (30%)	2nd trimester	550 mt (73.3%)
3rd quarter	400 mt (20%)	3rd trimester	50 mt (6.7%)
4th quarter	400 mt (20%)		
TOTALS	2000 mt		750 mt

Of the 750 mt PSC limit for fixed gear, 10 mt was apportioned specifically to the DSR fisheries in Southeast Alaska while pot gear was exempted from PSC closures. The fixed gear PSC cap has not constrained the Gulf longline fisheries in 1992.

Appendix I of the SAFE report contains information on halibut bycatch in the 1992 groundfish fisheries in the Gulf of Alaska. The information in this section details the occurrence of halibut bycatch by time, area, and fishery.

Factors to be considered in apportioning the 1993 PSC limits include postponement of the trawl rockfish fisheries until July 1. Other trawl fisheries will begin on January 20, as they did in 1992.

Table 1. Groundfish maximum sustainable yields (MSYs), 1992 and 1993 ABCs, 1992 TACs, and 1992 catches through August 23, 1992.

Species	MSY		ABC (mt) 1992	ABC (mt) 1993	1992 TAC	1992 Catch
Pollock		W(61) }		13,890	19,320	17,482
		C(62) }	96,000	14,980	18,480	12,426
		C(63) }		35,130	46,200	35,620
		E	3,400	3,400	3,400	62
		Total	99,400	67,400	87,400	65,590
Pacific cod	Unknown	W	23,500	18,700	23,500	34,007
		C	39,000	35,200	39,000	34,753
		E	1,000	2,800	1,000	418
		Total	63,500	56,700	63,500	69,178
Flatfish** (deep water)	13,692	W	1,740	2,020	1,740	120
		C	33,550	35,580	15,000	7,022
		E	3,990	7,930	3,000	66
		Total	39,280	45,530	19,740	7,208
Flatfish*** (shallow water)	28,254	W	27,480	27,480	3,000	1,630
		C	21,260	21,260	7,000	3,068
		E	1,740	1,740	1,740	1
		Total	50,480	50,480	11,740	4,699
Flathead sole	16,589	W	12,580	12,580	2,000	295
		C	31,990	31,830	5,000	1,308
		E	3,710	5,040	3,000	0
		Total	48,280	49,450	10,000	1,603
Arrowtooth flounder	110,042	W	38,880	38,880	5,000	940
		C	253,320	253,330	15,000	10,429
		E	11,680	29,080	5,000	911
		Total	303,880	321,290	25,000	12,280

(continued on next page)

Table 1 (cont.) Groundfish maximum sustainable yields (MSYs), 1992 and 199 ABCs, 1992 TACs, and 1992 catches through August 23, 1992.

Species	MSY (mt)		ABC (mt) 1992	ABC (mt) 1993	1992 TAC	1992 Catch
Sablefish	23,500	W	2,500	2,500	2,500	1,884
		C	9,570	9,570	9,570	8,674
		WYK	3,740	3,740	3,740	4,072
		SEO	4,990	4,990	4,990	4,578
		Total	20,800	20,800	20,800	19,208
Slope rockfish (other)	Unknown	W	1,390	1,390	1,390	1,166
		C	6,510	6,510	6,510	3,539
		E	6,160	6,160	6,160	487
		Total	14,060	14,060	14,060	5,192
Pacific Ocean Perch	Unknown	W	1,620	800	1,470	1,248
		C	1,720	1,230	1,561	2,325
		E	2,390	2,690	2,169	2,255
		Total	5,730	4,720	5,200	5,828
Shortraker/Rougheye	unknown	W	100	100	100	88
		C	1,290	1,290	1,290	1,260
		E	570	570	570	640
		Total	1,960	1,960	1,960	1,988
Pelagic shelf rockfish	Unknown	W	1,212	1,210	1,212	73
		C	4,393	4,400	4,393	1,604
		E	1,281	1,280	1,281	617
		Total	6,886	6,890	6,886	2,294
Demersal shelf rockfish	Unknown	SEO	550	800	550	459

(continued on next page)

Table 1 (cont.) Groundfish maximum sustainable yields (MSYs), 1992 and 1993 ABCs, 1992 TACs, and 1992 catches through August 23, 1992

Species	MSY (mt)		ABC (mt) 1992	ABC (mt) 1993	1992 TAC	1992 Catch
Thornyhead rockfish	Unknown	GW	1,798	1,500	1,798	1,527
Other species	NA	GW	NA	NA	20,432	15,742
Totals			656,604	641,580	289,066	212,795

* Shelikof Strait pollock is included within the W/C ABC range.
** "Deep water flatfish" means rex sole, Dover sole, and Greenland turbot.
*** "Shallow water flatfish" means rock sole, yellowfin sole, butter sole, starry flounder, and other flatfish not specifically defined.
GW means Gulfwide

NOTE: 1993 ABCs are rounded to nearest 10.
Catch data source: NMFS Weekly Processor Reports.
DSR catch applies to the expanded SEO District for 1992.

Table 2. Exploitable biomasses, 1993 ABCs, and estimated trends and abundances of groundfish.

Species	Exploitable Biomass (mt)		1993 ABC	Overfishing level	Abundance, trend
Pollock (W,C)	633,000	W(61)	13,890	32,330	Medium, stable
		C(62)	14,980	34,870	
		C(63)	35,130	81,800	
		E	3,400	7,880	
		Total	67,400	156,880	
Pacific cod	324,000	W	18,700	25,800	Moderately high, decreasing
		C	35,200	48,400	
		E	2,800	3,900	
		Total	56,700	78,100	
Flatfish (deep water)	227,656	W	2,020	2,650	High, stable
		C	35,580	46,610	
		E	7,930	10,390	
		Total	45,530	59,650	
Flatfish (shallow water)	261,724	W	27,480	38,600	High, stable
		C	21,260	28,750	
		E	1,740	3,510	
		Total	50,480	70,860	
Flathead sole	247,247	W	12,580	16,490	High, stable
		C	31,830	41,690	
		E	5,040	6,600	
		Total	49,450	64,780	
Arrowtooth flounder	1,889,922	W	38,880	54,660	High, stable
		C	253,330	356,150	
		E	29,080	40,880	
		Total	321,290	451,690	
Sablefish	179,000	W	2,500	3,380	High, decreasing
		C	9,570	12,970	
		WYK	3,740	5,080	
		SEO	4,990	6,770	
		Total	20,800	28,200	

(Continued on next page)

Table 2. (cont.) Exploitable biomasses, 1992 ABCs, overfishing levels, and estimated abundances and trends of groundfish.

Species	Exploitable Biomass (mt)		1993 ABC level	Overfishing level	Abundance, trend
Slope rockfish (Other)	230,480	W	1,390	2,050	Low, unknown
		C	6,510	9,590	
		E	6,160	9,070	
		Total	14,060	20,710	
Pacific Ocean Perch	94,308	W	800	1,550	Low, increasing slightly
		C	1,230	2,420	
		E	2,690	5,180	
		Total	4,720	9,150	
Shortraker/ Rougheye	72,960	W	100	150	Low, unknown
		C	1,290	1,910	
		E	570	840	
		Total	1,960	2,900	
Pelagic shelf rockfish	76,501	W	1,210	2,030	Relative abundance unknown
		C	4,400	7,380	
		E	1,280	2,140	
		Total	6,890	11,550	
Demersal shelf rockfish (SE Outside district)	48,366	SEO	800	970	Depressed, stable
Thornyhead rockfish	21,411	Gulfwide	1,500	2,034	Depressed, decreasing
Other species	NA	Gulfwide	NA		TAC = 5% of the sum of TACs

Note: DSR catch applies to the expanded SEO District for 1992. 1993 ABCs, and Overfishing are rounded to nearest 10.

PROHIBITED SPECIES CATCH SUMMARY FOR HALIBUT

[Detailed information on halibut PSC considerations is contained in Appendix I of this SAFE document]

The GOA Plan Team recommends continued evaluation of both bycatch rates and mortality estimates for incidentally caught and released halibut from all Gulf of Alaska groundfish fisheries. The Team has reviewed bycatch rates and mortality estimates gathered from the 1991 and 1992 Domestic Observer Program. Actual bycatch rates from the Domestic Observer Program should be used by the Council and NMFS to monitor cumulative halibut mortality during 1993. The Team notes further that the bycatch information in this SAFE report may be helpful to the Council in examining possible halibut mortality implications when setting final groundfish TAC's for 1993.

The team recommends that halibut bycatch in 1993 should be managed using actual observed bycatch rates. In addition, the team recommends that observers in the 1993 Domestic Observer Program collect information concurrently on the condition factors and size of halibut caught as bycatch in all fisheries. The timing of observations relative to the return of fish to the ocean should also be recorded.

In 1992, Gulf of Alaska fisheries were managed with the following discard mortality rates by gear group: Trawl - 65%; Longline - 16%; Pot - 10%. The Plan Team recommends adoption of these mortality rates for managing the 1993 fisheries, noting, however, that more information may be available from the IPHC in November. Such information will be reviewed by the Plan Team and may result in new recommendations for discard mortality rates in 1993.

For purposes of evaluating existing PSC cap levels, estimates of the halibut mortality associated with anticipated groundfish TACs were made for longline and trawl gear (pot gear was exempted from PSC cap closures in 1991 and 1992 and was not included in this analysis). Results are detailed in the halibut PSC chapter (Part B) of this SAFE document. Part B also contains additional information to assist the Council in its framework process for establishing PSC limits for the coming year. This includes bycatch rates by fishery (species), gear type, management zone, week, and processing mode which have occurred through August 23, 1992. A review of the 1992 fishery is included with a description of bycatch related closures and effects on other directed groundfish fisheries. Seasonal distributions of both halibut and target groundfish species are discussed with guidelines for seasonal distribution of the halibut PSC caps.

ECONOMIC OVERVIEW

Economic developments in the Gulf of Alaska (GOA) groundfish fishery

Landings data presented in the economic section are based on PacFIN data, extracted on August 17, 1992 and on fishticket data from the Alaska Department of Fish and Wildlife, which were last updated on August 26, 1991. This data may differ from catch data presented elsewhere in the SAFE, due to lags in processing fishtickets and the presence of discards. Caution should be used in judging reductions in harvest during 1992 because of the incomplete data. No joint-venture or foreign harvest has occurred in the GOA since 1988. Domestic landings of all groundfish increased from 167,400 mt in 1989 to 228,200 mt in 1991. Year-to-date GOA landings for 1992 are 176,500 mt. Longline landings have held relatively stable since 1987, in the 32-33,000 mt range. Longline sablefish landings fell by about 2,000 mt each year for 1990 and 1991. Pacific cod landings rose by about 4,000 mt over the same period. Although the 7,900 mt of longline-caught Pacific cod was near the 1987 high, the 1992 year-to-date harvest has already exceeded this amount by more than 50%. After increasing from 135,000 mt in 1998 to 180,000 mt in 1990, trawl landings during 1991 increased only slightly, to 183,000 mt. Trawl landings of pollock and flatfish increased by 4-6,000 mt, while rockfish landings fell by a similar amount. It is also noteworthy that the year-to-date 1992 trawl landings of Atka mackeral, 14,100 mt, represent a four-fold increase over the 1991 total.

After two years in which the ex-vessel value of domestic landings (excluding the value added by at-sea processing) declined slightly, primarily because of lower sablefish revenue, ex-vessel revenue in GOA fisheries increased by 41% during 1991. Increases of more than $10 million in the value of both sablefish and Pacific cod landings were the major contributors to this improvement. Pollock revenue was also up by more than $8 million during 1991, representing a nearly 70% increase. Increases in the value of pollock and Pacific cod landings were realized primarily by trawl vessels, while the increase in sablefish revenue accrued primarily to longliners.

The price of trawl-caught pollock rose by 75% in 1991, to $0.12/lb, with the current 1992 price some 50% higher than this. Trawl prices for Pacific cod and flatfish were also up more than 40% in 1991, although the 1992 price for flatfish has returned to the 1989-90 level. After slumping for 2 years, sablefish prices for both gears returned to their 1988 high values. Longline Pacific cod price rose by 33% in 1991, to $0.28/lb, but has fallen somewhat during 1992.

MARINE MAMMAL CONSIDERATIONS

STELLER SEA LIONS

Administrative Actions

Closure of the Bogoslof District during the BSAI "A" Season for walleye pollock produced concern that fishing pressure would increase near Aleutian Island rookeries. Consequently, a 20 nm radius no-trawl zone was put in place during the "A" season around five rookeries--Akutan, Akun, Agligadak, Seguam, and Sea Lion Rock/Amak Islands.

The Steller sea lion recovery team submitted a final draft of the recovery plan to NMFS in August 1991. This plan, criteria for listing or delisting the species under the Endangered Species Act, and areas proposed for designation as critical habitat all remain under review.

1992 Surveys

Aerial surveys of adult and juvenile Steller sea lions were conducted during June 1992 at all rookeries and most haul-outs in Southeast Alaska, Gulf of Alaska, and Aleutian Islands. A minimum of two surveys were made at all trend sites in the area, and at least one survey of all other sites.

Counts of pups were made at five rookeries in the Gulf of Alaska and the eastern Aleutian Islands during July 1992. Pup numbers have increased at three sites (Akutan, Chernabura, and Chowiet Islands) and decreased at one (Sugarloaf Island) since 1989-90.

Juvenile Survival at Marmot Island

During 1987-88 a total of 800 Steller sea lion pups were marked at Marmot Island in a long term study of Steller sea lion dispersal, survival, and reproduction. Based on the results of Calkins and Pitcher (1982), at least 50-100 survivors of the 800 pups tagged in 1987-88 were expected to return to Marmot Island in the summer of 1992. A field team was placed on the island during June-July 1992 to count these returnees. A maximum of eleven tagged animals (of 800) were resighted during June-July 1992 at the island. These and the similar results from 1991 support the hypothesis that increases in juvenile mortality during the 1980's may be a major cause of the declines observed at Marmot Island in the past decade.

1992-93 Foraging Studies

Ten Steller sea lions (6 adult females, and four pups) were tracked during the past year. In summer, adult females (n=2) continued to forage relatively close to the rookery, usually within 20 nm. In winter, adult females (n=4) were wide ranging, and continued to show preferences for different foraging areas. Both female and male pups moved long distances (60 to >250 nm) as early as their fifth month. They appeared to forage over a similar range as adult females. Pups through their 11 month (May) appear to be shallow divers (<20 m). Consequently, even though they may range widely, they can exploit prey in a very limited portion of the water column.

All of the eastern Aleutian Islands animals (with the exception of one pup who went to the Pribilof Islands) generally foraged on the shelf area (z < 200 m) within the Krenitzen Islands and to the east on the north and south sides of Unimak Island.

Genetic Studies

Stock differentiation studies using mitochondrial and nuclear DNA analysis continued during summer 1992. Tissue samples were collected from flippers of adults (5) and pups (39) at sites in the Gulf of Alaska, and the Aleutian Islands. Analysis of these samples and those collected in 1991 is presently underway.

Prey Surveys

NMFS conducted echo integration-midwater trawl surveys to assess Steller sea lion prey availability within 10 nm of rookeries and haul-outs during winter and summer. Four rookeries sites (Forrester, Marmot, Atkins, and Akun Islands) and one haul-out (Cape Serichef as a control site) were surveyed during 1992. Analysis of these data is underway.

Incidental Take

Steller sea lions continue to be taken, albeit at low levels, in the groundfish fishery. Seven Steller sea lions were observed taken through August 1992. This compares with 10 observed to be taken dead during 1991 (extrapolated to 16 total for unobserved tows). An additional two animals were observed taken alive in 1991 (or three additional for extrapolated totals).

NORTHERN FUR SEALS

A new population estimate of northern fur seals will be available later in fall 1992. In 1990 fur seal numbers on St. Paul Island

were stable while those on St. George Island were declining (York 1990, Kajimura and Sinclair 1992). The overall Bering Sea population is considered to be depleted but stable.

Three fur seals were observed taken dead through August 1992. This compares with three observed to be taken dead in 1991 (extrapolated to five dead for unobserved tows).

PACIFIC HARBOR SEALS

NMFS and ADF&G continued the comprehensive population assessment of harbor seals in Alaska begun during 1991. Surveys during 1992 were performed on the south side of the Alaska Peninsula, in the Kodiak Archipelago, along the Kenai Peninsula and in Prince William Sound. Results will be available winter 1992-93.

KILLER WHALE

NMFS began surveys during summer 1992 to assess the abundance of killer whales in Southeast Alaska, the Gulf of Alaska, eastern Bering Sea, and Aleutian Islands to Atka Island.

HARBOR PORPOISE

NMFS continued a three year assessment of the Alaskan harbor porpoise population begun during 1991. During 1992, vessel surveys were conducted in Southeast Alaska in spring, summer, and fall, while aerial surveys were conducted in the central and western Gulf of Alaska during summer.

REFERENCES

Calkins, D. G. and K. W. Pitcher. 1982. Population assessment, ecology, and trophic relationships of Steller sea lions in the Gulf of Alaska, p. 447-546. In Environmental assessment of the Alaskan continental shelf, Final Reps. Principal Investigators, Vol. 19. U.S. Dep. Commer., NOAA, National Ocean Service, Office of Oceanography and Marine Services, Ocean Assessments Division, Juneau, AK.

Kajimura, H. and E. Sinclair. 1992 Fur seal investigation, 1990. U.S. Dep. Commer., NOAA Tech. Memo. NMFS-AFSC-2, 192 p.

York, A. E. 1990. Trends in numbers of pups born on St. Paul and St. George Islands 1973-88. In H. Kajimura (editor), Fur seal investigations, 1987 and 1988, p. 31-37. U.S. Dep. Commer., NOAA Tech. Memo. NMFS F/NWC-180.

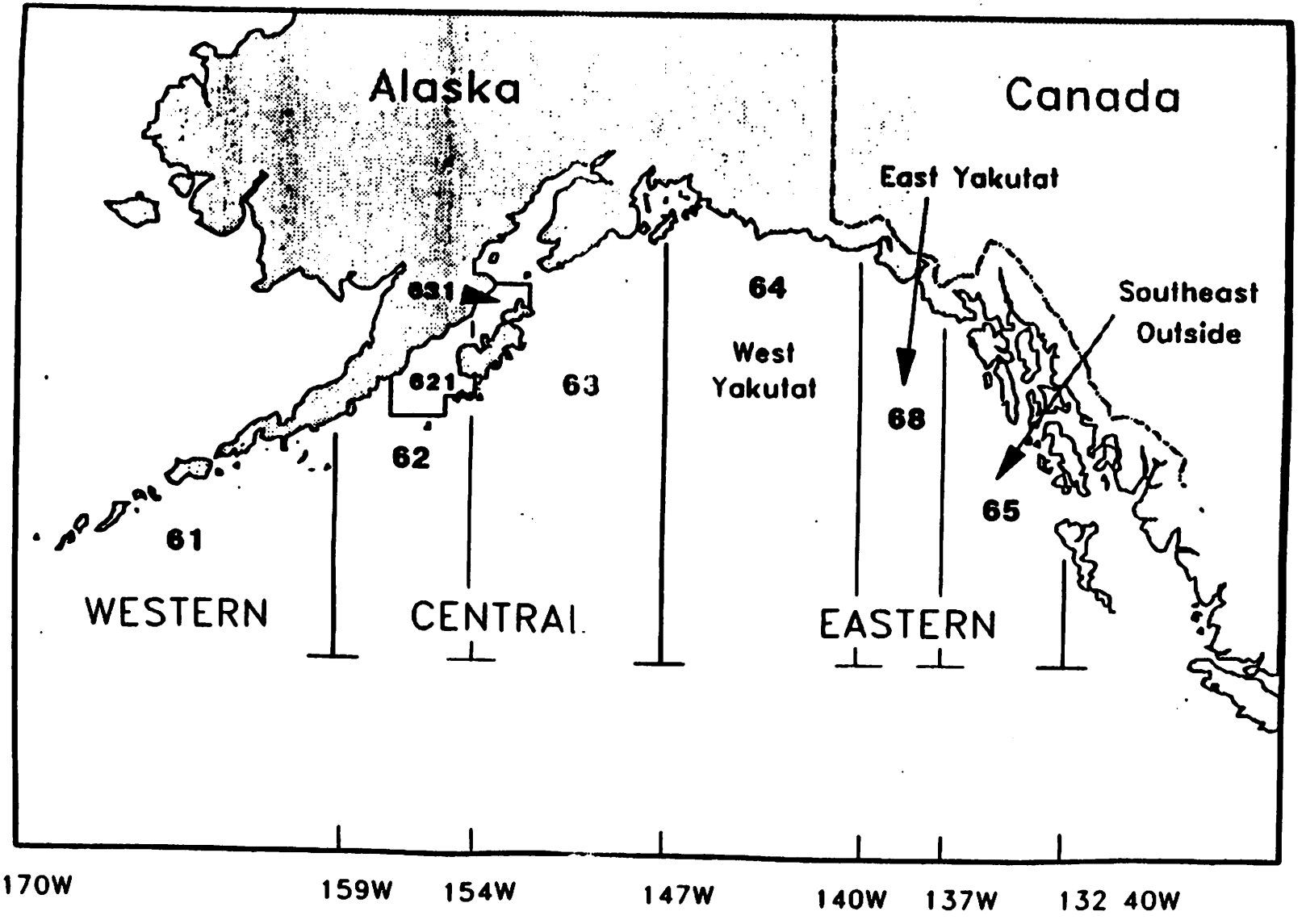
Table 1.--Counts of live Steller sea lion live pups at five index rookeries during 1989-90 and 1992.

Rookery	1989-90 ($\bar{x}$)	1992	Percent change
Sugarloaf	1,874	1,001	- 47
Chowiet	582	635	+ 9
Chernabura	193	210	+ 9
Clubbing Rocks	nd	433	nc
Akutan	442	556	+ 26
Total[1]	3,091	2,402	- 22

[1]Excludes Clubbing Rocks

Figure 1

Regulatory and reporting areas of the Gulf of Alaska



GULF OF ALASKA GROUNDFISH

1993 Plan Team, SSC, and AP recommendations and apportionments (metric tons)

20-Sep-92

		1992			Plan Team	SSC	Advisory Panel	
Species	Area	ABC	TAC	Catch**	ABC - 1993	ABC - 1993	TAC	DAP
Pollock	W/C	96,000	84,000	65,528	64,000			
	Shelikof *	0	0	n/a	0			
	E	3,400	3,400	62	3,400			
	Total	99,400	87,400	65,590	67,400			
Pacific Cod	W	23,500	23,500	34,007	18,700			
	C	39,000	39,000	34,753	35,200			
	E	1,000	1,000	418	2,800			
	Total	63,500	63,500	69,178	56,700			
Flatfish, Deep	W	1,740	1,740	120	2,020			
	C	33,550	15,000	7,022	35,580			
	E	3,990	3,000	66	7,930			
	Total	39,280	19,740	7,208	45,530			
Flathead sole	W	12580	2000	295	12,580			
	C	31,990	5,000	1,308	31,830			
	E	3,710	3,000	0	5,040			
	Total	48,280	10,000	1,603	49,450			
Flatfish, Shallow	W	27,480	3,000	1,630	27,480			
	C	21,260	7,000	3,068	21,260			
	E	1,740	1,740	1	1,740			
	Total	50,480	11,740	4,699	50,480			
Arrowtooth	W	38,880	5,000	940	38,880			
	C	253,320	15,000	10,429	253,330			
	E	11,680	5,000	911	29,080			
	Total	303,880	25,000	12,280	321,290			
Sablefish	W	2,500	2,500	1,884	2,500			
	C	9,570	9,570	8,674	9,570			
	W. Yakutat	3,740	3,740	4,072	3,740			
	E. Yak./S.E. Out.	4,990	4,990	4,578	4,990			
	Total	20,800	20,800	19,208	20,800			
Pacific Ocean Perch	W	1,620	1,470	1,248	800			
	C	1,720	1,561	2,325	1,230			
	E	2,390	2,169	2,255	2,690			
	Total	5,730	5,200	5,828	4,720			
Shortraker/Rougheye	W	100	100	88	100			
	C	1,290	1,290	1,260	1,290			
	E	570	570	640	570			
	Total	1,960	1,960	1,988	1,960			
Other Slope	W	1,390	1,390	1,166	1,390			
	C	6,510	6,510	3,539	6,510			
	E	6,160	6,160	487	6,160			
	Total	14,060	14,060	5,192	14,060			
Rockfish (Pelagic Shelf)	W	1,212	1,212	73	1,210			
	C	4,393	4,393	1,604	4,400			
	E	1,281	1,281	617	1,280			
	Total	6,886	6,886	2,294	6,890			
Rockfish (Demersal Shelf)	S.E. Out.	550	550	459	800			
Thornyhead	G W	1,798	1,798	1,527	1,500			
Other Species	G W	0	20,432	15,742	0			
GULF OF ALASKA TOTAL		656,604	289,066	212,796	641,580			

* Eliminated beginning in 1992

** Catch through August 23, 1992

TABLE 1. GULF OF ALASKA
1993 Council Recommendations for ABC, TAC, and Apportionments

20-Sep-92 — All Values in Metric Tons

Species	Area	Council ABC	Council TAC	Council DAP	Council JVP
Pollock	W/C				
	Shelikof				
	E				
	Total				
Pacific Cod	W				
	C				
	E				
	Total				
Flatfish, Deep	W				
	C				
	E				
	Total				
Flathead sole	W				
	C				
	E				
	Total				
Flatfish, Shallow	W				
	C				
	E				
	Total				
Arrowtooth	W				
	C				
	E				
	Total				
Sablefish	W				
	C				
	W. Yakutat				
	E. Yak./S.E. Out.				
	Total				
Pacific Ocean Perch	W				
	C				
	E				
	Total				
Shortraker/Rougheye	W				
	C				
	E				
	Total				
Other Slope	W				
	C				
	E				
	Total				
Rockfish (Pelagic Shelf)	W				
	C				
	E				
	Total				
Rockfish (Demersal Shelf)	S.E. Out.				
Thornyhead	G W				
Other Species	G W				
GULF OF ALASKA TOTAL					

Alaska Groundfish Data Bank

AGENDA D-3(b)(3)
SEPTEMBER 1992

SUBMITTED SEPTEMBER 10, 1992

PROPOSAL TO DESIGNATE CENTRAL GULF OF ALASKA SHORTRAKER/ROUGHEYE AND PACIFIC OCEAN PERCH BYCATCH ONLY

PROPOSAL

In the Gulf of Alaska Shortraker/Rougheye and Pacific Ocean Perch can be taken only as bycatch: 15% against deep water flatfish and other rockfish, 5% against all other species. In the fourth quarter, if the regional director feels there is adequate quota remaining for a directed fishery, shortraker/rougheye and Pacific Ocean perch may be released for a directed fishery.

JUSTIFICATION

The quotas for shortraker/rougheye and Pacific Ocean perch in the Central Gulf of Alaska are quite small. These species are taken as bycatch in the deep flatfish fisheries and in the Other rockfish fisheries. In 1991 there was concern that shortraker/rougheye would reach its overfishing definition and in 1992 Pacific Ocean Perch did reach its overfishing definition and the flatfish fisheries may remain closed fourth quarter.

This year the target fishery for Pacific Ocean perch was closed early enough to leave what was felt to be adequate amounts for bycatch; however, the bycatch of Pacific Ocean perch in other fisheries proved higher than anticipated and the overfishing definition was reached.

Rather than risk closing the whole Central Gulf to fishing because either shortraker/rougheye or Pacific Ocean perch has reached its overfishing definition, it makes sense to designate both these species as bycatch only at the beginning of the year and allow target fishing in the fourth quarter if adequate quota is available.

Chris Blackburn • Director • P.O. Box 2298 • Kodiak, Alaska 99615 • (907) 486-3033 • FAX (907) 486-3461

Supplemental Report on the Status of Gulf of Alaska Walleye Pollock

By

Anne Hollowed, Bernard Megrey, and William A. Karp
National Marine Fisheries Service
Alaska Fisheries Science Center
7600 Sand Point Way NE
Seattle, WA 98115

1.0 INTRODUCTION

This document contains a description of the 1992 hydroacoustic survey of Shelikof Strait, the biomass estimates and length frequency data collected from that survey, and revised estimates of ABC for 1993 based on the stock synthesis model.

2.0 1992 HYDROACOUSTIC SURVEY

2.1 General Description of 1992 Spring Hydroacoustic Survey

Scientists from the Alaska Fisheries Science Center (AFSC) conducted an echo integration-midwater trawl (EIMWT) survey of walleye pollock (*Theragra chalcogramma*) in the Gulf of Alaska during the second half of March, 1992. This was the latest in a series of annual assessments of spawning pollock biomass that have been conducted since 1981 (with the exception of 1982).

The principal objective of this study was to collect echo integration and trawl data necessary in order to determine the distribution, biomass, and biological composition of walleye pollock in Shelikof Strait. Additional objectives included acoustic system calibration, collection of oceanographic observations, and collection of biological material for several research studies.

2.2 Survey Methodology

The survey was conducted on board the NOAA research vessel Miller Freeman, a 66 m (216-foot) stern trawler equipped for fisheries and oceanographic research. Acoustic data were collected with a

quantitative echo sounding system (Simrad EK500[1]). A Simrad 38 kHz split beam transducer was mounted on the distal end of the vessel's centerboard. The transducer operates at a depth of 10 m below the surface of the water when the centerboard is fully extended. System electronics were contained in a portable laboratory mounted on the weather deck of the vessel. Data from the Simrad EK500 echo sounder/receiver were processed using Simrad BI500 echo integration and target strength data analysis software on a SUN workstation computer.

Midwater echo sign was sampled using a modified Northern Gold 1200 midwater rope trawl (NET Systems, Inc.). The trawl was constructed with ropes in the forward section and stretch mesh sizes ranging from 163 cm (64 inches) immediately behind the rope section to 8.9 cm (3.5 inches) in the cod end. It was fished in a bridleless configuration and was fitted with a 3.2 cm (1.25 inch) mesh cod end liner. Headrope and footrope lengths were 94.5 m (310 ft.) and 50 m (164 ft.), respectively, and the breastlines measured 79.4 m (260.5 ft.). The headrope length was measured between the points of attachment to the breastline. The footrope length was measured between the points where the tom weights are attached. The net was fished with 1.8 m X 2.7 m (6 ft. X 9 ft.) steel V-doors (1000 kg [2200 lb.]), and 340 kg (750 lb.) tom weights on each side. Trawl mouth opening and depth were monitored with a Furuno wireless netsounder system attached to the headrope of the trawl.

Fish on and near bottom were sampled with a nylon Noreastern demersal trawl equipped with 31.1 m (102 ft.) long roller gear and 54.8 m (30 fm) triple dandylines. Net mesh sizes ranged from 12.7 cm (5 inches) in the body and 8.9 cm (3.5 inches) in the intermediate and codend to 3.2 cm (1.25 inch) in the codend liner. Headrope and footrope lengths were 27.4 and 32.0 m (90 ft. and 105 ft.), respectively.

Water temperature/salinity profile data were collected at trawl and calibration sites using a Seabird CTD (conductivity/ temperature/depth) system. Expendable bathythermographs (XBT) were launched routinely during the survey period to provide additional temperature profile data.

2.3 Survey Transect

Data presented here were collected during the period March 19-31, 1992. Initially, the Strait was surveyed between March 19 and 25

---

[1] Reference to trade names or commercial firms does not constitute U.S. government endorsement.

by means of a series of parallel transect that traversed the Strait at intervals of approximately 7.5 nm (Figure 1). Subsequently, we collected additional data through a series of closely-spaced parallel transect in the area were substantial aggregations of fish had been observed earlier.

Survey operations were conducted during daylight and darkness. Acoustic data were collected while cruising at a speeds of between 5 and 12 knots, depending upon weather conditions. The average trawling speed was about 3 knots. The acoustic system collected echo integration data and split beam target strength data.

Midwater and demersal trawl hauls were made at selected locations to identify echo sign and provide biological samples (Figure 2). The vertical net opening for the midwater rope trawl averaged about 20 m and ranged between 17 and 25 m. The mouth opening was 8-10 m for the nylon Noreastern demersal trawl (generally closed to 7m). Standard catch sorting and biological sampling procedures were used to provide weight and number by species for each haul. Pollock were further sampled to determine sex, length, body weight, age, maturity, gonad weight, stomach contents, and incidence of lamprey scars. In certain areas, whole pollock samples were frozen for sea lion energetic studies and tissue samples were collected and frozen for stock structure studies.

2.4 Survey Results

2.4.1 Calibration

Standard sphere calibrations were conducted in Port Susan, Washington, on February 9 in Ugak Bay, Kodiak Island on February 21 prior to the start of the survey, and in Malina Bay, Kodiak Island on March 25 near the end of the survey. In Ugak Bay, the vessel was anchored fore and aft to keep the ship from moving during the data collection. In Malina Bay, conditions were such that the vessel needed only to be anchored at the bow. Acoustic measurements were made of a copper sphere suspended below the transducer. The standard sphere (38.6 mm diameter) had a known target strength of -33.6 dB. Split beam target strength and echo integration data were collected with the Simrad EK500 system. Data were collected to describe transducer beam pattern characteristics and any changes in system performance. No significant differences in the acoustic system parameters were observed among the three calibrations.

2.4.2 Biological and Oceanographic Data Collections

Trawl station and catch data are summarized in Tables 1 and 2. Pollock was the dominant fish species captured in midwater and demersal trawl hauls. Eulachon (*Thaleichthys pacificus*) was frequently present in the catches, particularly in those obtained with the bottom trawl or near the bottom with the midwater trawl; in some catches eulachon occurred in relatively high quantities. Because it was apparent that acoustic returns from eulachon contaminated those from pollock in some areas, the acoustic sign was partitioned on the basis of trawl catch composition. This improved analytical procedure was possible because of improvements in our instrumentation and analytical procedures (see below). It is likely that acoustic returns from eulachon contaminated those from pollock in previous years and this may have resulted in overestimation of pollock abundance.

2.4.3 Distribution of Biomass

The survey of the pre-spawning pollock in the Shelikof Strait area indicated a distribution similar to that observed in recent years, with the highest densities occurring in the northern part of the Strait, on the northwest side, near Kuliak Point. Bottom trawl hauls in the lower strait revealed the presence of one-year-old fish (10-15 cm) throughout this region and relatively low densities of adult pollock. Older pollock of 30-45 cm dominated the midwater aggregations in the lower strait; most of these fish were immature. In the higher density area midwater and bottom trawl catches generally contained older fish that were mature. However, even in this area, most fish smaller than about 42 cm were immature (Figure 3).

The survey of the dense spawning concentration near Kuliak point appeared to occur during the peak of spawning. Of the females captured during March 25-26 (trawl stations 52, 53, and 54), 27% were categorized as spawning and only 5% were spent (already having spawned). In contrast, 65% were spawning and 29% were spent by March 31 (trawl station 60).

2.4.4 Biomass Estimates

Because the pollock otoliths collected during this cruise have not yet been processed, estimates of age composition are not available. However, it has been possible to compute preliminary estimates of biomass and population size, and to partition these estimates by length.

2.4.4.1 Comparison of Acoustic Systems

In previous years EIMWT biomass estimates were based on data collected with an analog echo sounder that had limited

sensitivity. New digital equipment with improved performance characteristics was first tested in 1990. Both systems were used during parts of the 1991 survey in Shelikof Strait in order to provide data for comparing performance. Analysis of this comparative data indicated that estimates made with the new system would generally be higher than those made with the old system. Most of the discrepancy is attributed to two factors: a) increased sensitivity of the new system results in improved detectibility of pollock in low density situations; and b) improved analytical techniques facilitate the analysis of acoustic measurements in the near-bottom region. With the new system, estimates can be made down to 0.5 m off the bottom; with the old system, the cut off was at 3.0 m off the bottom. Thus, it is apparent that the extent of agreement among estimates made with both systems will be influenced by the density of fish aggregations encountered and the vertical distribution of the target species. Because these patterns vary from year to year, the ability to adjust new system estimates to be consistent with old system estimates is limited.

One improvement available in the new software is the ability to analyze data under different thresholds. This is analogous to adjusting the detection sensitivity of the system. Data collected with the new system in 1991 was analyzed using three threshold systems and the results were compared with density estimates obtained with the old system (Figure 4). The low threshold estimate from the new system is considered to be the best estimate of density that can be obtained. It can be seen that the old system estimate falls somewhere between the medium and high threshold estimates of the new system.

The preliminary biomass estimates for the 1992 Shelikof Strait pollock assessment are 680,000 t and 580,000 t. The higher estimate is our most accurate preliminary estimate; the lower estimate is considered to be similar to an estimate that would have been obtained with the old acoustic system. The lower estimate of 580,000 t compares with estimates of 290,000 t, 380,000 t and 380,000 t in 1989, 1990 and 1991 (Table 3). The equivalent population estimates for 1992 are 1,197 and 941 million fish.

Even though it is not yet possible to partition the estimates by age, some information regarding age composition can be inferred from the biomass and abundance at length results (Figure 5). The numeric size composition indicates a relatively high abundance of age 1 fish. Almost all of these fish were observed near the bottom in the lower part of the strait. Because the 1992 survey was the first to utilize the improved near bottom assessment capabilities of the new acoustic system, and also because more bottom trawling than usual was conducted so that we could make better use of this acoustic information, it is not possible to compare this estimate of the abundance of one year olds with

those obtained in previous years.

The numeric and biomass size composition estimates reveal relatively low abundance of two and three year old fish (20-30 cm) and very high abundance of four year old fish (30-40 cm). These patterns are consistent with trends observed in recent years which indicate that the 1988 year class was comparatively strong and the two subsequent year classes were relatively weak. Further evidence of the importance of the 1988 year class is indicated in the historic biomass estimates and size composition trends (Figure 5).

3.0 REVISED STOCK ASSESSMENT

3.1 Model Description

The stock synthesis model described in Methot (1986, 1989, 1990) was used to assess the status of the Gulf of Alaska pollock stock in 1992. Several model configurations were examined in the preliminary 1992 SAFE document (Hollowed and Megrey 1992). These models differed in the assumptions made regarding fishery partitions. Based on recommendations from the North Pacific Fishery Management Groundfish Management Plan Team three configurations were explored using the additional 1992 hydroacoustic data.

A complete description of the rationale underlying the selection of the three models is provided in Hollowed and Megrey (1992). Briefly, a selectivity trend was fit to the age data using a functional relationship by estimating the inflection point of the ascending limb of a double logistic function. Estimation of annual values for the inflection point of the ascending limb of the double logistic selectivity curve revealed that the partitions used in the 1991 stock assessment may not have been optimal. Two characteristic patterns of selectivity were identified: years with low selectivity at age 2 and 3, and years with high selectivity at young ages.

3.2 Description of Stock Assessment Runs

In the 1991 assessment, the preferred model had a high emphasis (20) placed on the bottom trawl biomass estimate, the selectivity curves for the hydroacoustic and bottom trawl survey were estimated independently and fixed in the final model, and the 1984 and 1987 bottom trawl survey biomass estimates were not included. This model updated with the 1991 age composition, run through 1993, and labeled Model A in Table 4, provides a comparison to last years results.

Models E, F, and G were included to explore the impact of imposing the separability assumption. Model E provided a selectivity trend estimate for each year of age composition data in the model. Model F was based on a slightly different combination of years in the fishery definition. In Model F, the years 1972-1976 and 1985-1991 defined the first fishery type, and the years 1977-1984 defined the second fishery type. Years combined in the second type had somewhat similar selectivity patterns. In Model F, the inflection point for 1972- 1976, 1977-1979, 1980, 1981-1984, 1985, 1986, 1987, 1988, 1989, 1990 and 1991 were all estimated. In Model G, the fisheries were defined as in Model F, however the inflection points were only estimated for 1972-1976, 1977-1979, 1980, 1981-1984, and 1985-1993. Hollowed and Megrey (1992) demonstrated that Models E, F, and G all provided significantly better fits to the fishery and hydroacoustic age composition (Table 4).

3.3 Comparison of Models A, E, F and G

Models E and F allow for the model to estimate selectivity in the terminal years. Models E, F and G all produce mid-year 1992 biomass estimates that are higher than Model A (Figure 6). The years 1964-1968 were truncated from the biomass time series because these biomass estimates were influenced by the assumption that the unfished stock was at equilibrium in 1962. In recent years, Models E and F produce higher biomass estimates than Models A and G (Figure 6). The higher biomass estimates in recent years for Models E and F result from the recruitment estimate for the 1988 year class (Figure 7).

All of the models produced similar estimates of recruitment from 1980 to 1987 (Figure 7). Model E and F produced similar recruitment estimates for the 1988 year class. Likewise, Models A and G produced similar and more conservative recruitment estimates for the 1988 year class (Figure 7). Models E and G were chosen for further analysis. Model E was chosen because it provides the best overall fit to the data (Table 4). Model G was included because it provides a better fit to the data than Model A and a conservative alternative to Model E (Table 4).

Both Models E and G show a peak biomass at between 3.5 and 4.5 million tons in 1982. This observation is consistent with the 1981 hydroacoustic biomass estimate of 3.7 million t in Shelikof Strait.

Comparison of observed and estimated biomass for the bottom trawl and hydroacoustic surveys from Model E and G revealed both models provide reasonable fits to the data from 1983 - 1992 (Figures 8 and 9). Model E provided a slightly better fit to the most recent hydroacoustic and bottom trawl data points. As in

previous years fits to the 1981 hydroacoustic biomass and the 1984 bottom trawl biomass estimates were poor (Figures 8 and 9).

4.0 STOCK PROJECTIONS

4.1 Overfishing Definition

In previous years fishing mortality estimates were derived from models that imposed a spawner recruit relationship. These fishing scenarios were not accepted by the NPFMC due to the uncertainty in the spawner recruit relationship. Therefore, overfishing for pollock was defined as the fishing mortality rate that results in the biomass-per-recruit ratio falling below 30% of the pristine level. This fishing mortality rate was 0.283.

4.2 Recruitment Scenarios

Above average, average and below average year classes were defined by dividing the observed recruitment points into quartiles. Above average or below average year classes were defined as the mean of the upper or lower quartile of recruitment estimates respectively.

Two different scenarios were explored regarding the magnitude of the 1990, 1991, and 1992 year classes at age 2. In the first scenario all three year classes were below average. In the second scenario, the 1990 year class was below average and the 1991 and 1992 year classes were above average.

In support of this the first recruitment scenario, length frequency data from the 1991 and 1992 hydroacoustic surveys shows no indication of an above average or average 1990 year class. FOCI researchers also conducted an analysis of the probability of strong or weak year classes based on time series of spawner recruit data and the recruitment time series itself. Based on this data FOCI projected that the 1990 year class would be weak. Scott Hatch noted that the consumption of juvenile pollock by marine birds in 1991 was low indicating the 1991 year class would be below average. The FOCI researchers also found environmental conditions and larval abundances that indicated the 1991 year class would be poor.

The second recruitment scenario was included because the 1992 hydroacoustic length frequency data indicated the 1991 year class might be average. FOCI researchers conducted an analysis of the probability of recruitment based on the distribution of spawner recruit data points. Based on this analysis, the FOCI group estimated that the 1992 year class would be average or strong.

The recruitment options are outlined below:

	MODEL	RECRUITMENT Age 3 1990YC (billion)	Age 2 1991YC (billion)	Age 2 1992YC (billion)
Option 1	E	0.191(W)	0.259(W)	0.259(W)
Option 2	E	0.191(W)	1.052(A)	1.052(A)
Option 1	G	0.135(W)	0.183(W)	0.183(W)
Option 2	G	0.135(W)	0.667(A)	0.667(A)

4.3 Stock Projections and Estimation of ABC

All yield projections were made by estimating the number of fish at the beginning of 1993 using stock synthesis Models E and G. Estimation of the ABC for pollock based on Models E and G was made by projecting the stock forward and calculating the fishing mortality associated with a 10% harvest rate (Yield / mid-year biomass). The projection model was run assuming the catch was allocated on a quarterly basis.

Choosing a selectivity vector for Model E for the projections presented proved somewhat difficult. Model E provided annual estimates of selectivity rather than a composite. The selectivity vectors estimated in 1990 and 1991 indicated low selectivity at young ages (see Hollowed and Megrey 1992 Preliminary SAFE). This selectivity pattern would be unreasonable for 1993 because it is likely that the fleet will begin to target on the incoming 1988 year class at age 5. To avoid this conflict, we used the selectivity vector estimated for the combined years 1985-1991 from Model G for all projections.

The results show a range in yield for 1993 from 70,000 t to 111,000 t (Table 5). Under the first recruitment scenario, the stock is projected to decline between 1993 and 1995. Under the second recruitment scenario, stock biomass should remain stable.

We recommend that the 1993 ABC should be set at 111,000 t based on the results of projections made using Model E. All indications suggest that the 1988 year class will be larger than the 1984 and 1985 year classes. The population estimates derived from Model E are consistent with an above average 1988 year class. Furthermore, the exploitation rate used here is conservative which further supports the 111,000 t ABC. The fishing mortality rate (0.105) associated with a 111,000 t harvest in 1993 is well below the overfishing level of 0.283.

Table 1. Summary of trawl stations and catch data from the winter 1992 pollock survey in Shelikof Strait.

HAUL NO.	AREA	DATE (1992)	TIME (AST)	START POSITION LAT. (N)	START POSITION LONG. (W)	TEMP (C) GEAR	TEMP (C) SURF	DEPTH (FM) GEAR	DEPTH (FM) BOTM	CATCH (LBS/NOS.) WALLEYE POLLOCK	CATCH (LBS/NOS.) EULACHON	CATCH (LBS/NOS.) OTHER
*33	SH	20 MAR	0152-0217	56 11.7	156 5.1	5.3	3.7	133	133	64/271	2/21	285/133
34	SH	20 MAR	0827-0912	56 19.6	156 13.4	5.2	3.4	137	153	1610/2018	79/1117	92/246
*35	SH	20 MAR	1108-1125	56 19.5	156 12.3	5.2	3.4	153	153	50/153	37/261	1201/865
36	SH	21 MAR	0046-0059	56 37.3	155 27.6	3.5	3.4	39	80	2046/2445	0	18/6
37	SH	21 MAR	0449-0459	56 41.4	155 55.7	5.4	3.7	135	163	1669/2030	115/1246	64/83
*38	SH	21 MAR	0646-0701	56 41.7	155 57.3	5.3	3.7	163	163	606/1157	136/756	628/241
*39	SH	21 MAR	1819-1830	56 48.9	155 48.5	5.2	3.4	161	161	484/971	30/178	4706/2335
40	SH	22 MAR	1536-1552	57 15.8	155 30.9	5.2	3.6	142	148	1586/1427	57/622	20/49
*41	SH	22 MAR	1755-1812	57 15.8	155 31.0	5.2	3.6	149	149	136/285	451/4956	494/450
42	SH	22 MAR	2322-2327	57 11.2	155 6.4	4.5	4.1	97	122	409/584	42/445	137/27
43	SH	23 MAR	0830-0844	57 27.1	155 4.3	5.1	3.7	117	130	400/555	365/4634	9/19
44	SH	23 MAR	1005-1015	57 27.3	155 4.1	5.2	3.7	127	128	3188/4130	911/7469	1/21
45	SH	23 MAR	1348-1349	57 27.6	154 46.0	3.4	3.8	37	71	2999/3599	0	1/2
46	SH	23 MAR	1814-1841	57 36.8	155 20.4	3.0	2.5	141	174	3535/3726	44/361	12/28
*47	SH	23 MAR	2101-2111	57 38.8	155 19.3	5.2	2.5	174	174	145/529	198/941	851/319
48	SH	24 MAR	0810-0824	57 45.0	154 10.2	4.5	4.0	43	90	8588/8663	T/1	2/2
49	SH	24 MAR	1254-1306	57 56.3	154 33.9	5.2	2.5	122	144	565/459	6/65	2/19
*50	SH	24 MAR	1500-1505	57 55.9	154 33.4	4.9	2.5	146	146	2262/928	22/233	287/107
51	SH	24 MAR	2209-2213	58 4.2	154 10.5	5.1	1.8	133	153	9600/5246	0	0
52	SH	25 MAR	2016-2018	58 6.8	154 9.1	5.2	3.2	116	164	7309/2913	T/3	11/2
*53	SH	25 MAR	2320-2322	58 6.5	154 7.5	5.2	3.2	154	154	2890/1085	T/2	320/69
54	SH	26 MAR	0449-0451	58 2.2	154 17.7	5.1	3.7	137	147	2511/1312	2/4	143/6
55	SH	26 MAR	1321-1326	57 52.2	154 55.1	4.8	3.0	130	134	3707/2281	69/807	23/33
59	SH	30 MAR	0746-0747	56 20.6	155 41.1	4.0	3.6	27	41	10585/13102	0	16/2
60	SH	31 MAR	0828-0829	58 4.9	154 11.6	4.9	4.1	109	153	4577/1668	0	3/5

SH=Shelikof
* Bottom trawl; all others midwater trawl
T=trace (i.e., <0.5 lb)

Table 2. Summary of pollock biological samples and measurements from the winter 1992 pelagic pollock survey in Shelikof Strait.

HAUL NO.	LENGTH	MATURITY	OTOLITH	FISH WGT	OVARY WGT	STOMACH SCAN	LAMPREY SCAN	GENETIC	FECUNDITY
33	217	54	54	54	4	32	54	0	0
34	393	111	111	111	0	0	111	0	0
35	153	0	0	0	0	15	0	0	0
36	282	92	92	92	17	0	92	0	0
37	327	98	98	98	2	0	98	0	0
38	343	111	0	0	0	28	111	0	0
39	387	137	0	0	0	16	0	0	0
40	294	49	49	49	10	0	49	0	0
41	285	99	0	0	0	21	0	0	0
42	261	56	56	56	0	12	56	0	0
43	104	104	0	0	0	8	0	0	0
44	259	72	72	72	2	0	72	0	0
45	273	87	87	87	2	0	87	0	0
46	384	112	112	112	11	0	112	0	0
47	529	88	0	0	0	17	0	0	0
48	333	127	127	127	0	20	127	0	0
49	396	91	91	91	0	0	91	0	0
50	197	55	55	55	26	0	55	15	21
51	174	85	85	85	6	0	85	15	0
52	176	110	110	110	23	0	110	0	0
53	266	97	0	0	0	0	0	0	0
54	215	130	130	0	0	0	130	0	0
55	317	95	95	95	37	0	95	20	11
59	268	88	0	0	0	2	0	0	0
60	132	93	93	0	0	0	93	0	0
TOTAL	6965	2241	1517	1294	140	171	1628	50	32

Table 3. Summary of annual estimates of midwater pollock biomass obtained during winter surveys of Shelikof Strait

Year	Biomass Million t	Lower 95% C.I.	Upper 95% C.I.
1981	3.77	2.86	4.67
1982			
1983	2.43	1.69	3.13
1984	1.84	1.21	2.47
1985	0.70	0.50	0.91
1986	0.62	0.37	0.87
1987			
1988	0.33	0.23	0.42
1989	0.29	0.23	0.35
1990	0.38	0.26	0.51
1991	0.38	0.17	0.63
1992	0.58		

Table 4. Summary of stock synthesis model runs for 1992 Gulf of Alaska walleye pollock stock assessment.

Model	BTAC df	HYAC df	FAC df	Emph. BTB	No. BT Surveys	POP Len.	Fishery AC	Hydro AC	BT AC	Hydro R.M.S.E	BT R.M.S.E	1991 MY Biomass
A	0	0	8	20	2	-297	-980	-393	-189	.499	.082	793
E	4	4	26	1	3	-252	-486	-275	-222	.326	.436	1,131
F	4	4	16	1	3	-274	-663	-291	-207	.354	.136	1,122
G	4	4	11	1	3	-266	-788	-317	-215	.395	.116	925

BTAC = Bottom trawl age composition; HYAC = hydroacoustic age composition; FAC = Fishery age composition; BTB = bottom trawl biomass; R.M.S.E. = root mean square error; MY = mid-year.

Table 5. Summary of the 1993-95 potential yields from short term projections for Gulf of Alaska pollock ages 3+ using parameters from Models E and G.

MODEL E.

Year	f	F	Catch (billion)	Yield (MMT)	Begin-Yr Number (billion)	Mid-Yr Biomass (MMT)	Spawning Biomass (MMT)	Age 2 Recruitment (billion)	Y / B
1993	0.155	0.105	0.165	0.111	1.557	1.112	0.977	0.259(W)	0.100
1994	0.165	0.081	0.124	0.088	1.194	0.881	0.848	0.259(W)	0.100
1995	0.256	0.134	0.127	0.068	0.932	0.687	0.684	0.259(W)	0.100
1992	0.155	0.105	0.165	0.111	1.557	1.112	0.977	0.259(W)	0.100
1993	0.178	0.077	0.166	0.107	1.675	1.066	0.868	1.052(A)	0.100
1994	0.253	0.131	0.228	0.104	1.717	1.038	0.759	1.052(A)	0.100

f = Year specific term of fishing mortality; F = Estimated total instantaneous fishing mortality

MODEL G.

Year	f	F	Catch (billion)	Yield (MMT)	Begin-Yr Number (billion)	Mid-Yr Biomass (MMT)	Spawning Biomass (MMT)	Age 2 Recruitment (billion)	Y / B
1993	0.188	0.108	0.104	0.070	0.953	0.701	0.652	0.183(W)	0.100
1994	0.200	0.083	0.080	0.055	0.743	0.553	0.538	0.183(W)	0.100
1995	0.300	0.143	0.083	0.043	0.590	0.434	0.427	0.183(W)	0.100
1992	0.188	0.108	0.104	0.070	0.953	0.701	0.652	0.183(W)	0.100
1993	0.210	0.080	0.106	0.066	1.035	0.666	0.550	0.667(A)	0.100
1994	0.280	0.135	0.146	0.065	1.067	0.647	0.473	0.667(A)	0.100

f = Year specific term of fishing mortality; F = Estimated total instantaneous fishing mortality

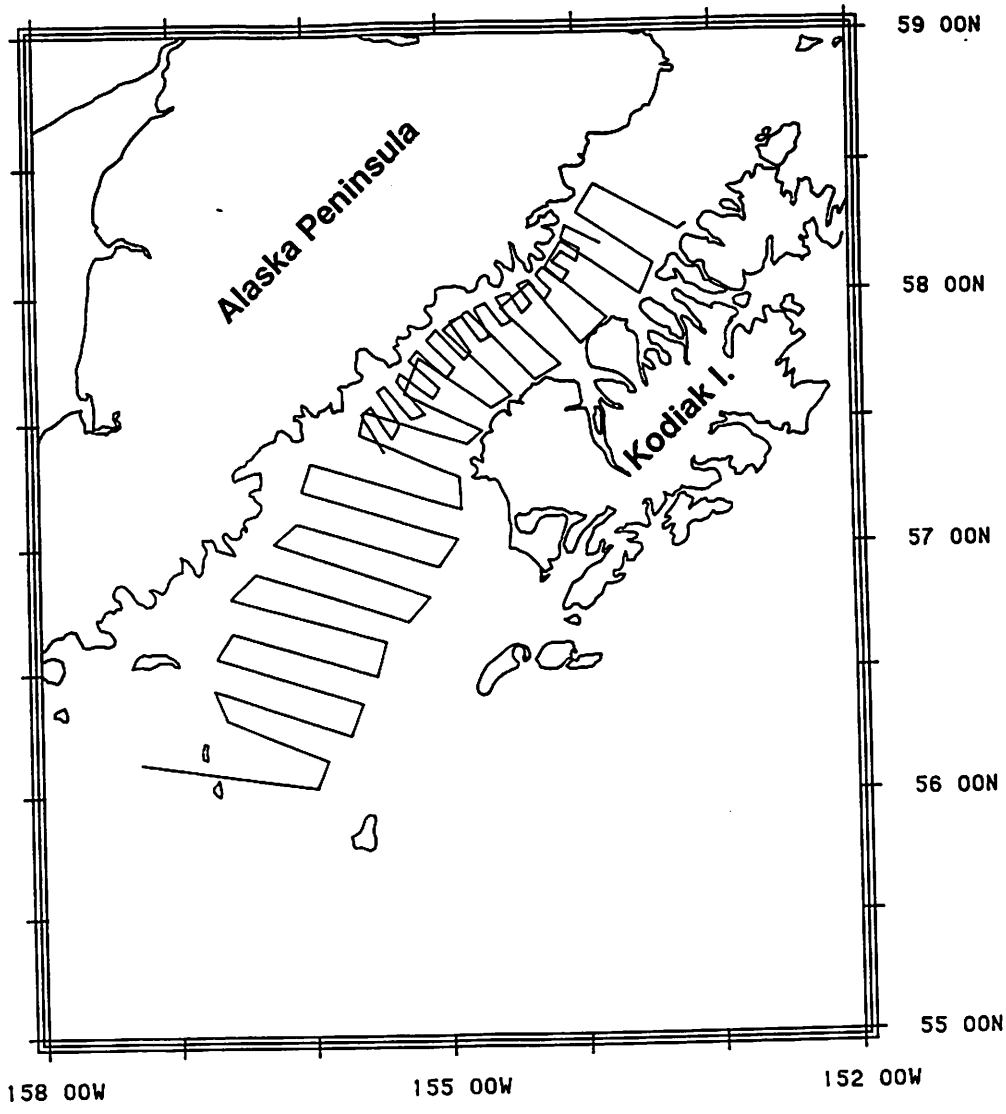


Figure 1. Survey trackline for the winter 1992 survey of Shelikof Strait.

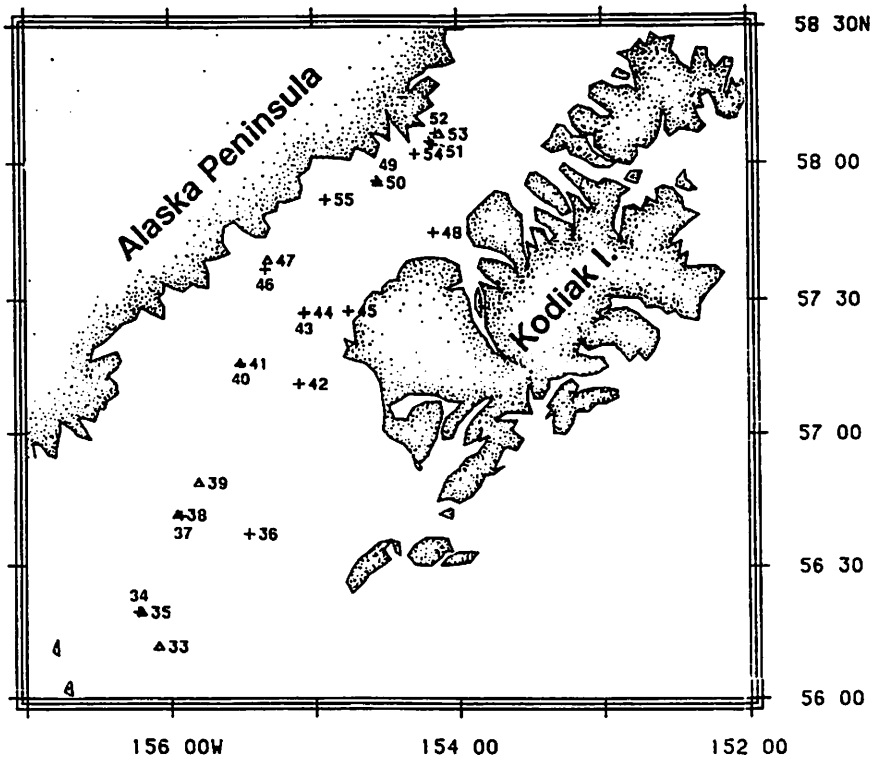


Figure 2. Trawl haul locations for the winter 1992 survey of Shelikof Strait. Rope trawl (x), bottom trawl (△)

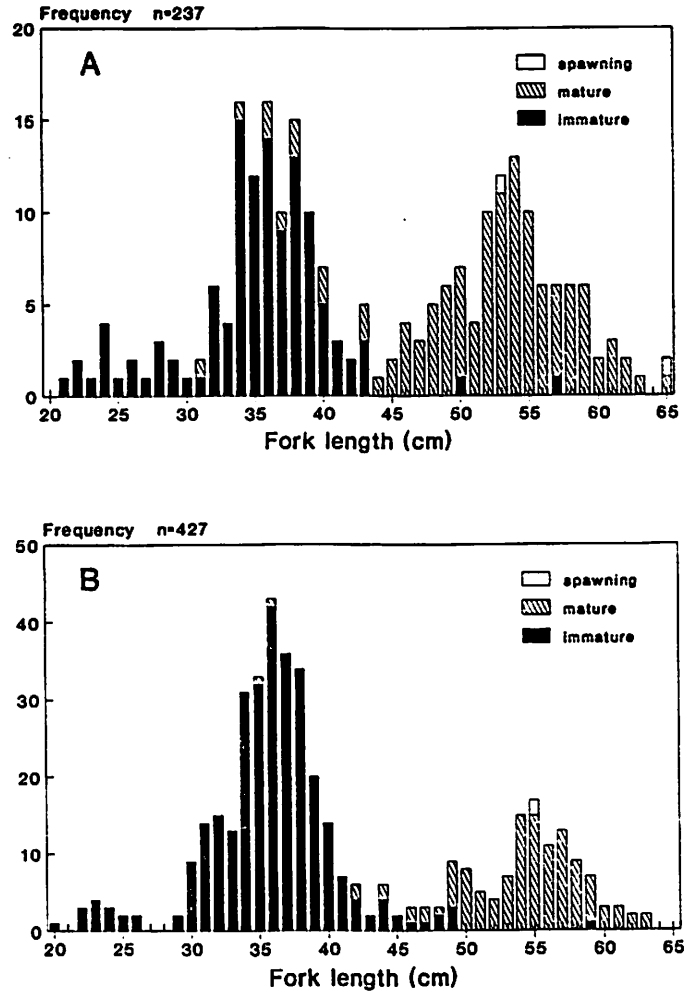


Figure 3. Female pollock maturity-length composition from A) prespawning aggregation in upper strait, B) lower strait. Relative proportion by size reflects the number of maturity samples collected and is not indicative of actual size composition of the population.

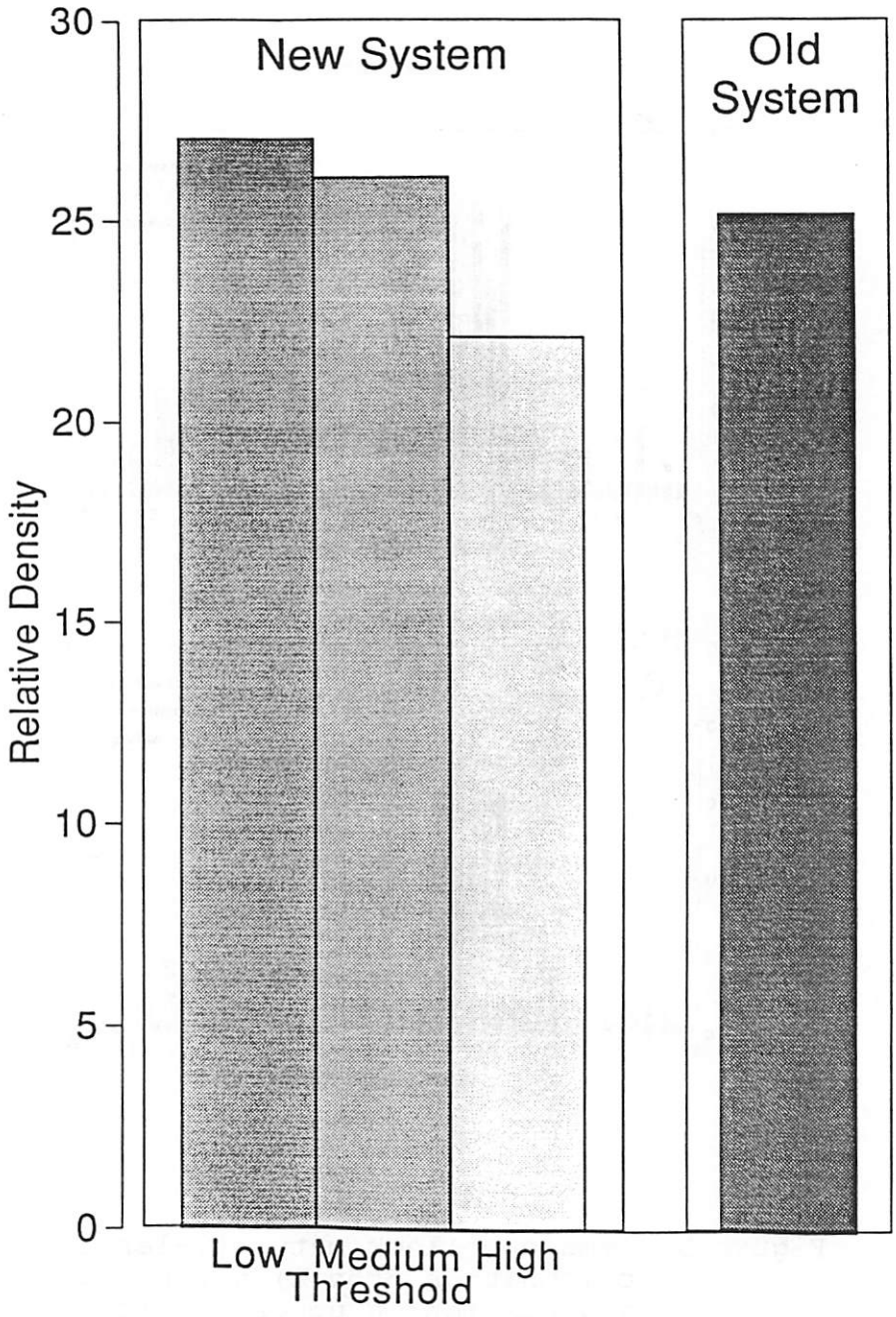


Figure 4. Comparison of performance charateristics of the two acoustic systems.

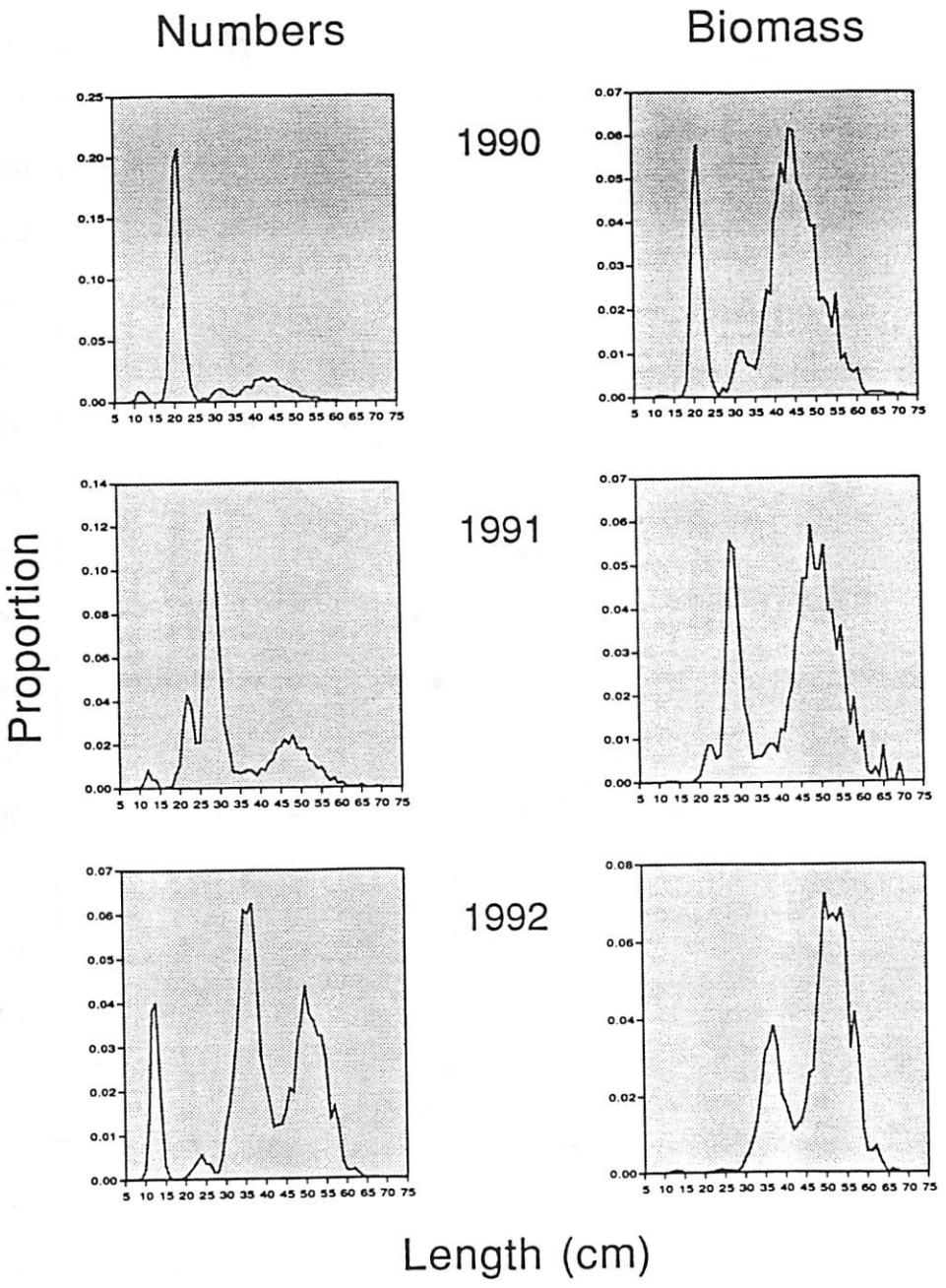


Figure 5. Size composition estimates obtained from winter pelagic pollock surveys conducted in Shelikof Strait in 1990, 1991, and 1992.

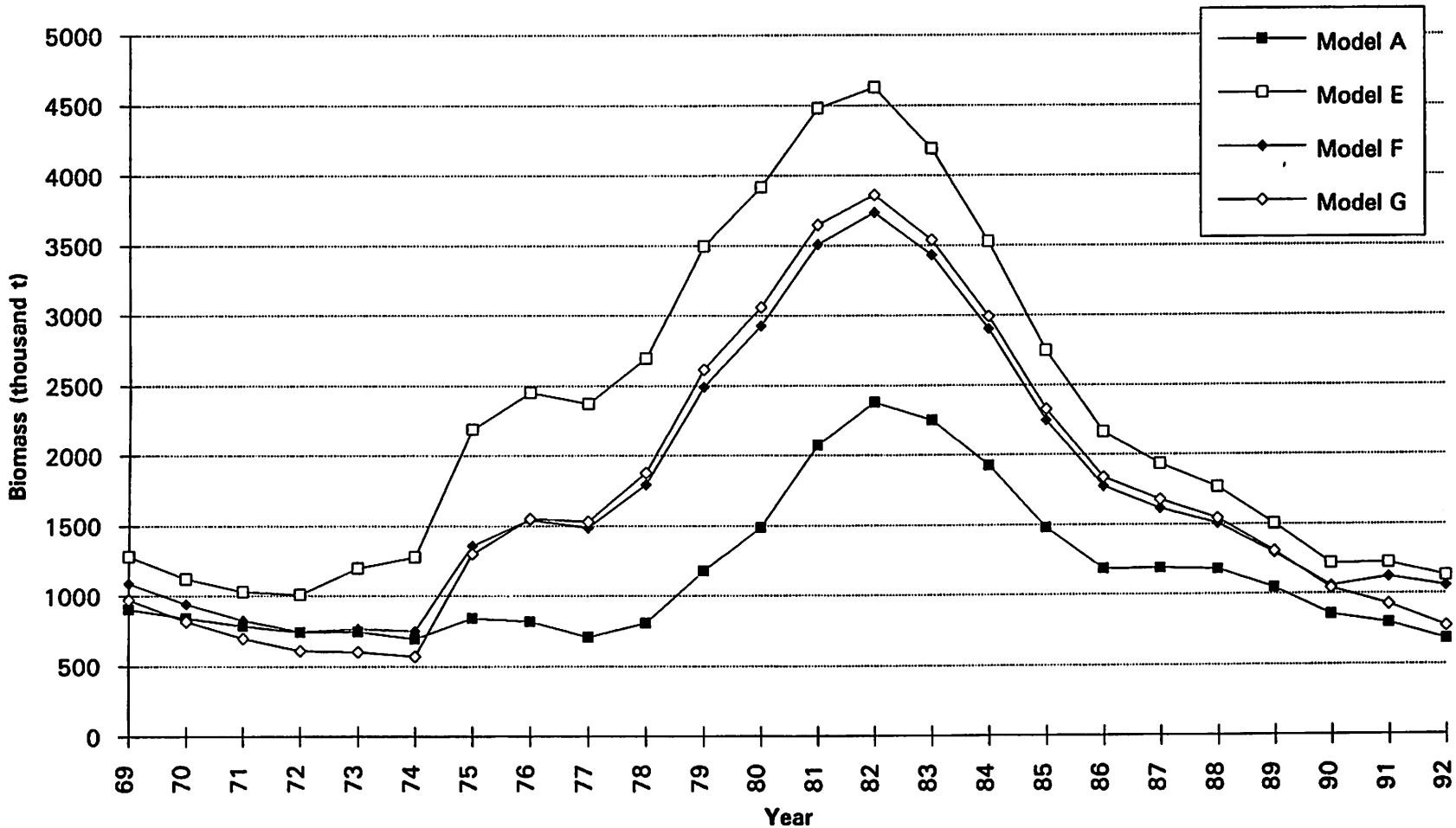


Figure 6 . Estimates of population biomass age 3+ based on stock synthesis Models A, E, F, and G.

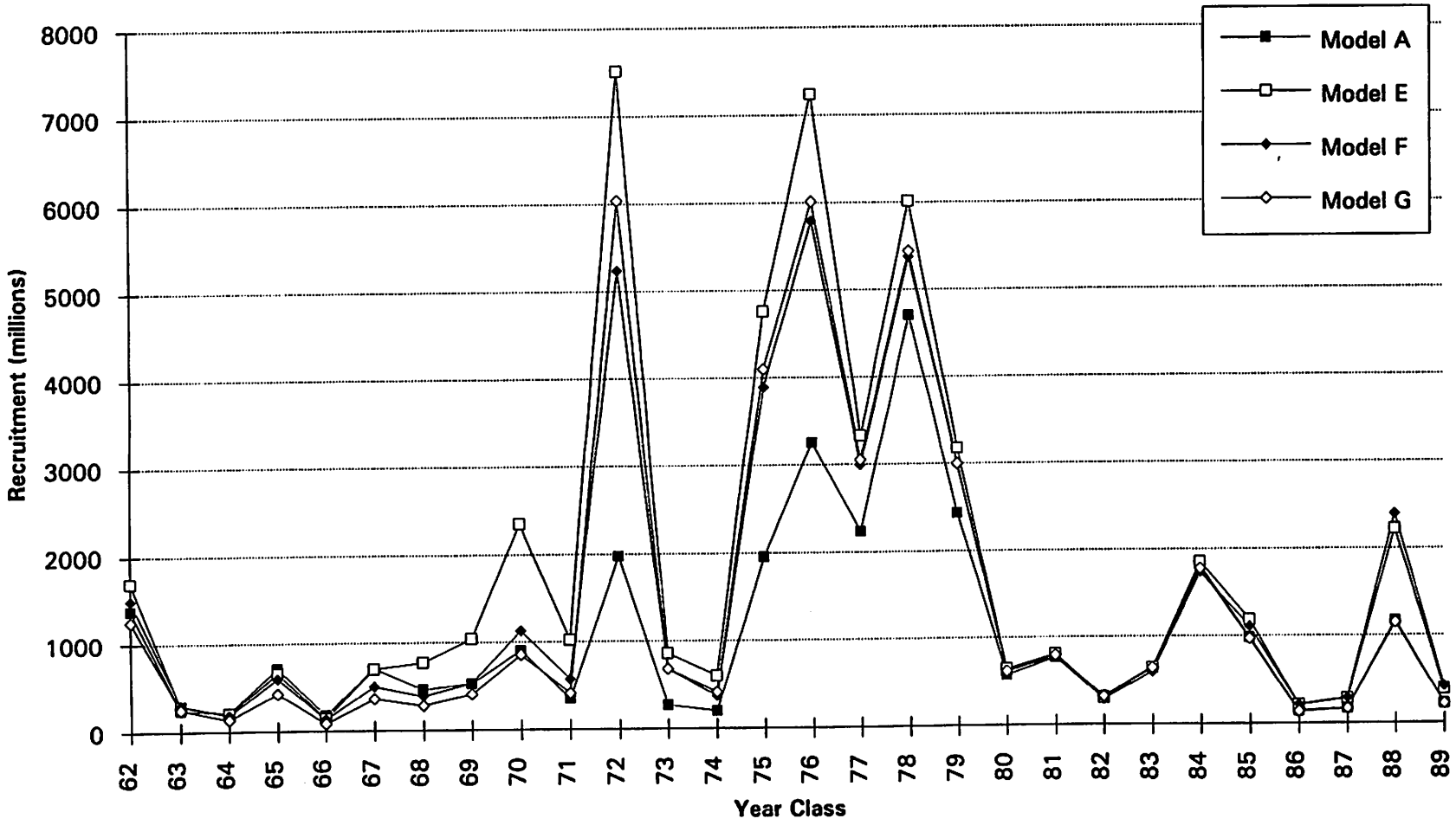


Figure 7. Estimates of age 2 recruits form stock synthesis Models A, E, F, and G.

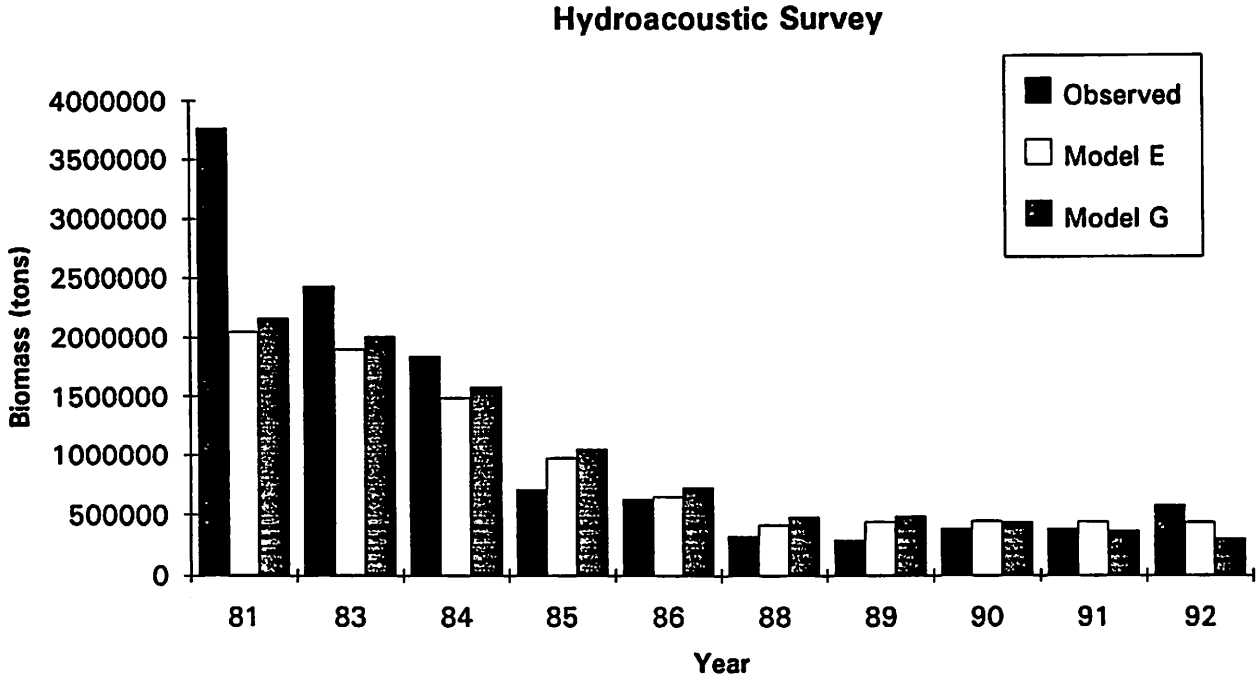


Figure 8 . Comparison between observed and expected biomass estimates for hydroacoustic surveys from Stock Synthesis Models E and G.

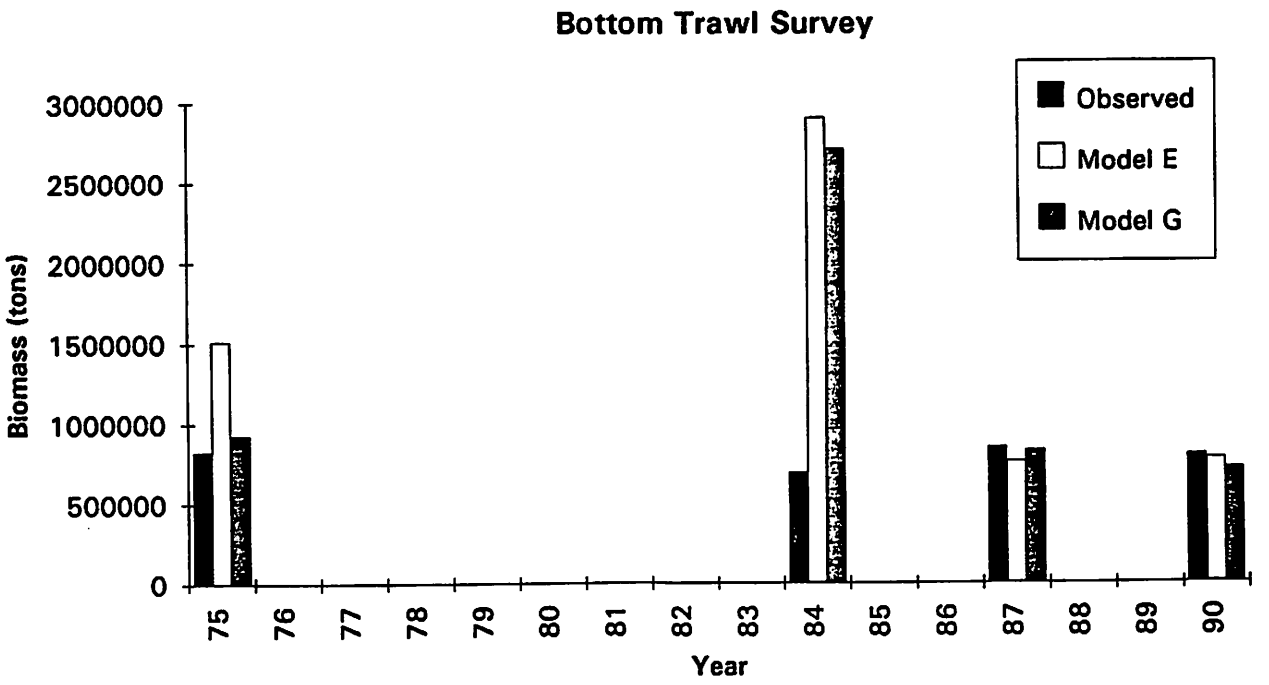


Figure 9. Comparison between observed and expected biomass estimates for bottom trawl from Stock Synthesis Models E and G.

GULF OF ALASKA
1993 Council Recommendations for ABC, TAC, and Apportionments

26-Sep-92 — All Values in Metric Tons

final

Species	Area	Council ABC	Council TAC	Council DAP	JVP
Pollock	W/C	111,000	111,000	111,000	
	Shelikof	0	0	0	
	E	3,400	3,400	3,400	
	Total	114,400	114,400	114,400	
Pacific Cod	W	18,700	18,700	18,700	
	C	35,200	35,200	35,200	
	E	2,800	2,800	2,800	
	Total	56,700	56,700	56,700	
Flatfish, Deep	W	2,020	2,020	2,020	
	C	35,580	35,580	35,580	
	E	7,930	7,930	7,930	
	Total	45,530	45,530	45,530	
Flathead sole	W	12,580	12,580	12,580	
	C	31,830	31,830	31,830	
	E	5,040	5,040	5,040	
	Total	49,450	49,450	49,450	
Flatfish, Shallow	W	27,480	27,480	27,480	
	C	21,260	21,260	21,260	
	E	1,740	1,740	1,740	
	Total	50,480	50,480	50,480	
Arrowtooth	W	38,880	5,000	5,000	
	C	253,330	15,000	15,000	
	E	29,080	5,000	5,000	
	Total	321,290	25,000	25,000	
Sablefish	W	2,500	2,500	2,500	
	C	9,570	9,570	9,570	
	W. Yakutat	3,740	3,740	3,740	
	E. Yak./S.E. Out.	4,990	4,990	4,990	
	Total	20,800	20,800	20,800	
Pacific Ocean Perch	W	800-1620	720	720	
	C	1,230-1,720	1,107	1,107	
	E	2,690-2,390	2,421	2,421	
	Total	4,720-5,730	4,248	4,248	
Shortraker/Rougheye	W	100	90	90	
	C	1,290	1,161	1,161	
	E	570	513	513	
	Total	1,960	1,764	1,764	
Other Slope	W	1,390	1,390	1,390	
	C	6,510	6,510	6,510	
	E	6,160	6,160	6,160	
	Total	14,060	14,060	14,060	
Rockfish (Pelagic Shelf)	W	1,210	1,210	1,210	
	C	4,400	4,400	4,400	
	E	1,280	1,280	1,280	
	Total	6,890	6,890	6,890	
Rockfish (Demersal Shelf)	S.E. Out.	800	720	720	
Thornyhead	G W	1,500-1,834	1,500	1,500	
Other Species	G W	0	19,577	19,577	
GULF OF ALASKA TOTAL		689,924 *	411,119	411,119	