

Fishery Management Report No. 01-6

**Area Management Report for the Recreational
Fisheries of the Southwest Alaska Sport Fish
Management Area, 1999**

by

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and

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March 2001

Alaska Department of Fish and Game

Division of Sport Fish



Symbols and Abbreviations

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Weights and measures (metric)		General		Mathematics, statistics, fisheries
centimeter	cm	All commonly accepted abbreviations.	e.g., Mr., Mrs., a.m., p.m., etc.	alternate hypothesis H_A
deciliter	dL			base of natural logarithm e
gram	g	All commonly accepted professional titles.	e.g., Dr., Ph.D., R.N., etc.	catch per unit effort CPUE
hectare	ha			coefficient of variation CV
kilogram	kg	And	&	common test statistics F, t, χ^2 , etc.
kilometer	km	At	@	confidence interval C.I.
liter	L	Compass directions:		correlation coefficient R (multiple)
meter	m	east	E	correlation coefficient r (simple)
metric ton	mt	north	N	covariance cov
milliliter	ml	south	S	degree (angular or temperature) °
millimeter	mm	west	W	degrees of freedom df
		Copyright	©	divided by \div or / (in equations)
Weights and measures (English)		Corporate suffixes:		equals =
cubic feet per second	ft ³ /s	Company	Co.	expected value E
foot	ft	Corporation	Corp.	fork length FL
gallon	gal	Incorporated	Inc.	greater than >
inch	in	Limited	Ltd.	greater than or equal to \geq
mile	mi	et alii (and other people)	et al.	harvest per unit effort HPUE
ounce	oz	et cetera (and so forth)	etc.	less than <
pound	lb	Exempli gratia (for example)	e.g.,	less than or equal to \leq
quart	qt	id est (that is)	i.e.,	logarithm (natural) ln
yard	yd	Latitude or longitude	lat. or long.	logarithm (base 10) log
Spell out acre and ton.		Monetary symbols (U.S.)	\$, ¢	logarithm (specify base) \log_2 , etc.
		Months (tables and figures): first three letters	Jan, ..., Dec	mid-eye-to-fork MEF
Time and temperature		Number (before a number)	# (e.g., #10)	minute (angular) '
day	d	Pounds (after a number)	# (e.g., 10#)	multiplied by x
degrees Celsius	°C	Registered trademark	®	not significant NS
degrees Fahrenheit	°F	Trademark	™	null hypothesis H_0
hour (spell out for 24-hour clock)	h	United States (adjective)	U.S.	percent %
minute	min	United States of America (noun)	USA	probability P
second	s	U.S. state and District of Columbia abbreviations	use two-letter abbreviations (e.g., AK, DC)	probability of a type I error (rejection of the null hypothesis when true) α
Spell out year, month, and week.				probability of a type II error (acceptance of the null hypothesis when false) β
Physics and chemistry				second (angular) "
all atomic symbols				standard deviation SD
alternating current	AC			standard error SE
ampere	A			standard length SL
calorie	cal			total length TL
direct current	DC			variance Var
hertz	Hz			
horsepower	hp			
hydrogen ion activity	pH			
parts per million	ppm			
parts per thousand	ppt, ‰			
volts	V			
watts	W			

FISHERY MANAGEMENT REPORT NO. 01-6

**AREA MANAGEMENT REPORT FOR THE RECREATIONAL
FISHERIES OF THE SOUTHWEST ALASKA SPORT FISH
MANAGEMENT AREA, 1999**

by

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PREFACE

Data contained in this report represent the Division's most recent efforts to upgrade and update fishery statistics useful in describing Southwestern Alaska's sport fisheries. Data contained in this document were extracted from *Statewide Harvest Summaries, Survey and Inventory Reports*, and the *Fishery Data* and *Fishery Manuscript Series*. The department considers this report to be the most comprehensive information source concerning effort and harvest statistics for the major Southwestern Alaska sport fisheries.

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SECTION I: MANAGEMENT AREA OVERVIEW

MANAGEMENT AREA DESCRIPTION

The Southwest Sport Fish Management Area (SWMA) is composed of the Bristol Bay Sport Fishing Regulatory Area and the southwestern portion of the Arctic-Yukon-Kuskokwim (AYK) Sport Fishing Regulatory Area. Included in the area are all waters and drainages flowing into Bristol Bay north of Cape Menshikof, the eastern shores of Kuskokwim Bay, and the Kuskokwim River from Aniak River downstream to Kuskokwim Bay (Figure 1). This management area contains some of the most productive salmon *Oncorhynchus*, rainbow trout *O. mykiss*, Arctic grayling *Thymallus arcticus*, Arctic char *Salvelinus alpinus*, and Dolly Varden *S. malma* waters in the world.

The sport fisheries of this large region are more easily discussed by dividing the management area into four geographic sections: Eastern, Central, Western, and Northwestern (Figure 1). The four sections are based on general habitat types and are somewhat arbitrary. However, for some species such as rainbow trout, the sections represent distinct differences in the character of the fisheries or biology of local stocks.

The Eastern section includes all drainages from the Kvichak River to the area's southern boundary at Cape Menshikof. Major federal jurisdictions in the Eastern section include the Lake Clark National Park and Preserve, Katmai National Park and Preserve, and the Becharof National Wildlife Refuge.

The Central section is composed of the drainages entering Nushagak Bay, and is dominated by the Nushagak and Wood River systems. The Wood-Tikchik State Park falls within the Central section boundaries.

The Western section reaches from the drainage of the Kanektok River south to Cape Constantine on the Nushagak Peninsula and contains the Togiak National Wildlife Refuge.

The Northwestern section abuts the northern boundary of the management area and includes the drainages flowing into the south side of Kuskokwim River from the Aniak River downstream to Kuskokwim Bay. Portions of the Aniak, Kisaralik, and Kwethluk rivers of the Northwestern section fall within the confines of the Yukon-Delta National Wildlife Refuge.

Major communities located within the region include Naknek, King Salmon, Dillingham, Togiak, Iliamna, Quinhagak, Aniak, and Bethel. The management area is not linked to the state's highway system, although local roads do provide sport fishermen with limited access near the major communities. Float-equipped aircraft are commonly used to access the area's many remote fisheries.

The Southwest Sport Fish Management Area includes portions of four areas for the purposes of recreational effort and harvest reporting in the mail survey of Howe et al. (*In prep* d). These are the Kuskokwim area (Area V), the Nushagak area (Area T), the Kvichak area (Area S), and that portion of the Naknek River Drainage-Alaska Peninsula Area (Area R) excluding the saltwater fisheries and freshwater fisheries of Cold Bay and the Aleutian Islands.

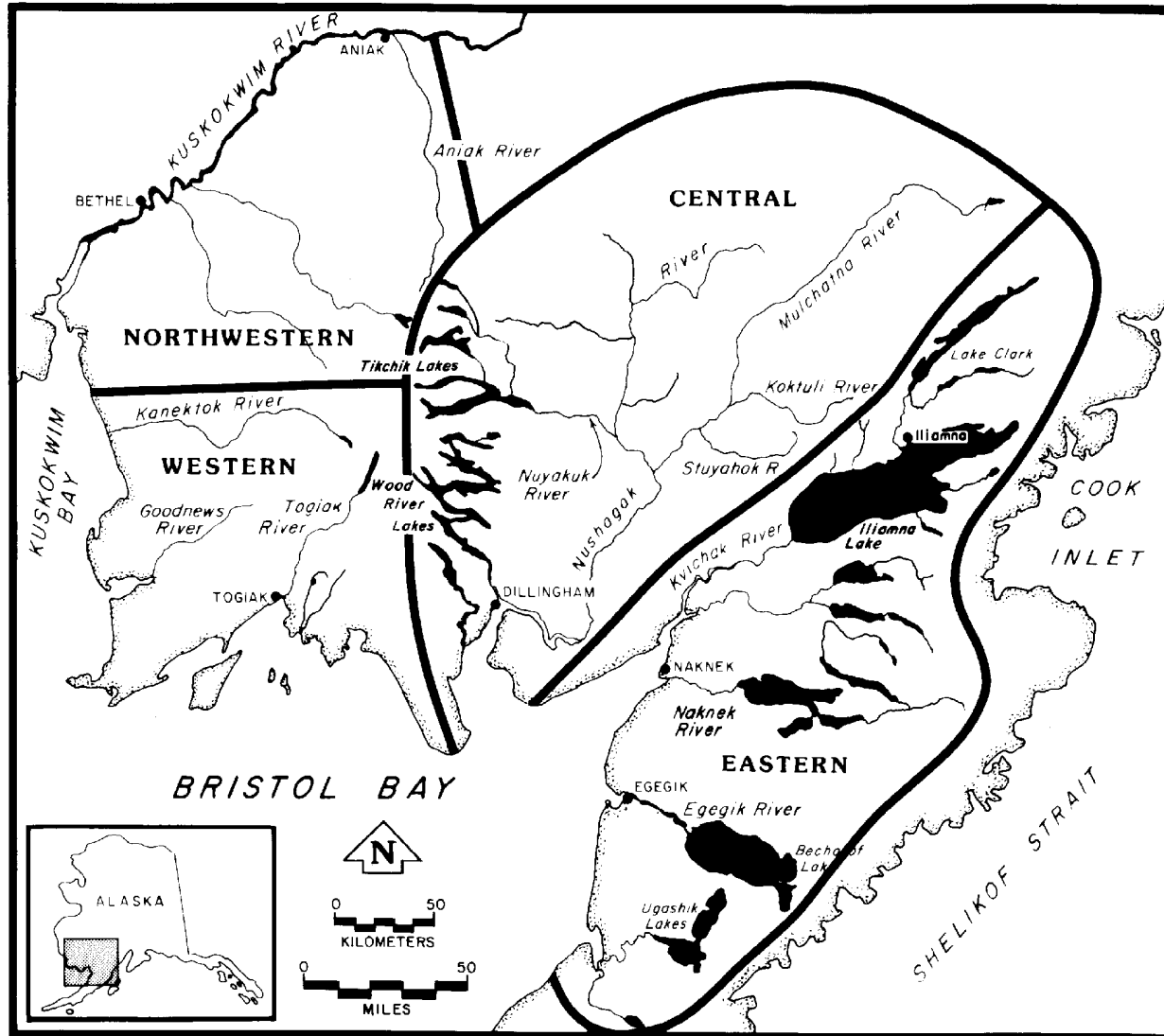


Figure 1.-Southwestern Alaska sport fish management area, showing the Eastern, Central, Western, and Northwestern sections.

REGULATORY PROCESS

The process of developing fishing regulations for fisheries in the SWMA occurs within the established Alaska Board of Fisheries process. Public input concerning regulation changes and allocation issues is provided for in this process through various means including direct testimony to the Board of Fisheries and through participation in fish and game advisory committees. These advisory committees have been established throughout Alaska to assist the Boards of Fisheries and Game in assessing fisheries and wildlife issues and proposed regulation changes in areas that might be affected. Most active committees meet at least once each year, usually in the fall prior to the Board meetings. Staff from the Division of Sport Fish and other divisions often attend the committee meetings. In this way, advisory committee meetings allow for direct public interaction with staff involved with resource issues of local concern. Within the SWMA there are eight Fish and Game Advisory Committees: Lower Bristol Bay, Iliamna, Naknek/Kvichak, Togiak, Nushagak, Lower Kuskokwim, Central Bering Sea, and Central Kuskokwim.

Under the current operating schedule, the Board of Fisheries meets on a 3-year cycle. Proposals regarding the AYK portion of the SWMA were last heard December 2-9, 1997 in Fairbanks. The Alaska Board of Fisheries last met to consider sport fish regulations for the Bristol Bay portion during a meeting held in King Salmon and Naknek during November 4-14, 1997.

The Board of Fisheries is next scheduled to review regulation proposals for Bristol Bay and AYK in January of 2001. The deadline for submitting proposals for these meetings was April 10, 2000.

RECREATIONAL ANGLER EFFORT

Beginning in 1977, recreational angler effort has been estimated statewide using a mail survey (Appendix A) (Mills 1979-1994, Howe et al. 1995 and 1996, *In prep* a, b, c and d). This survey estimates the number of angler-days of sport fishing effort expended by recreational anglers fishing Alaskan waters, as well as the harvest of important sport species. The survey provides estimates of effort and harvest on a site-by-site basis but is not designed to provide estimates of effort directed toward a single species. Beginning in 1990, the survey was modified to include estimates of catch (release plus harvest) on a site-by-site basis (Appendix B). Creel surveys have been selectively used to ground-truth the mail survey for fisheries of interest or for fisheries that require more detailed information or inseason management. The following summary of recreational angler effort in the SWMA is based on the mail survey data.

Recreational angler effort in the SWMA has increased from about 25,000 angler days in 1977 to 112,000 in 1998 (Table 1, Figure 2). In 1998, SWMA effort was 7.9% of the Southcentral region effort and 5.4% of the total angling effort in Alaska (Howe et al. *In prep* c). Recreational angler effort is expected to continue to increase at a modest rate for the foreseeable future.

Historically, most of the effort has occurred in the waters of the Eastern section of the SWMA (Figure 3). This area accounted for 56% of the total effort from 1990-1997. The Central section has accounted for the second largest proportion of effort, followed by the Western and Northwestern sections. Distribution of effort among sections during 1998 showed an increase in the Western section and a lower proportion in the Eastern section (Figure 3).

Table 1.-Sport fishing effort for the Southwest Alaska Management Area by section, 1977-1998.

Year	SWMA Total	Eastern		Central		Western		Northwestern	
	Days ^a	Days	Percent	Days	Percent	Days	Percent	Days	Percent
1977	25,512	17,653	69	7,184	28	675	3		
1978	26,451	18,912	71	7,000	26	539	2		
1979	27,022	19,177	71	6,179	23	1,666	6		
1980	35,358	24,948	71	8,897	25	1,513	4		
1981	33,715	24,964	74	7,819	23	932	3		
1982	41,318	30,385	74	9,773	24	1,160	3		
1983	66,492	43,364	65	16,942	25	3,251	5	2,935	4
1984	63,818	39,394	62	11,160	17	11,732	18	1,532	2
1985	70,108	47,138	67	11,812	17	10,377	15	781	1
1986	74,892	50,724	68	12,026	16	10,323	14	1,819	2
1987	72,730	43,262	59	14,132	19	12,909	18	2,427	3
1988	82,408	40,987	50	19,840	24	18,767	23	2,814	3
1989	73,041	38,460	53	19,677	27	7,638	10	7,266	10
1990	104,699	60,371	58	28,714	27	10,807	10	4,807	5
1991	107,584	56,695	53	38,690	36	6,155	6	6,044	6
1992	110,517	69,310	63	26,621	24	7,842	7	6,744	6
1993	114,300	69,799	61	30,497	27	7,774	7	6,230	5
1994	125,603	67,836	54	40,769	32	10,904	9	6,094	5
1995	128,466	73,779	57	37,531	29	9,926	8	7,230	6
1996 ^b	100,731	49,807	49	32,672	32	11,346	11	6,906	7
1997 ^b	114,104	60,111	53	26,527	23	18,872	17	8,594	8
1998 ^b	111,972	51,989	46	30,493	27	18,048	16	11,442	10
Avg(77-82)	31,563	22,673	72	7,809	25	1,081	3	0	0
Avg(83-89)	71,927	43,333	60	15,084	21	10,714	15	2,796	4
Avg(90-97)	113,251	63,464	56	32,753	29	10,453	9	6,581	6
Avg(94-98)	116,175	60,704	52	33,598	29	13,819	12	8,053	7

^a Days = Angler-day; any portion of a day in which one angler fished.

^b 1996, 1997 and 1998 estimates were revised in 2000, so differ from previously published numbers.

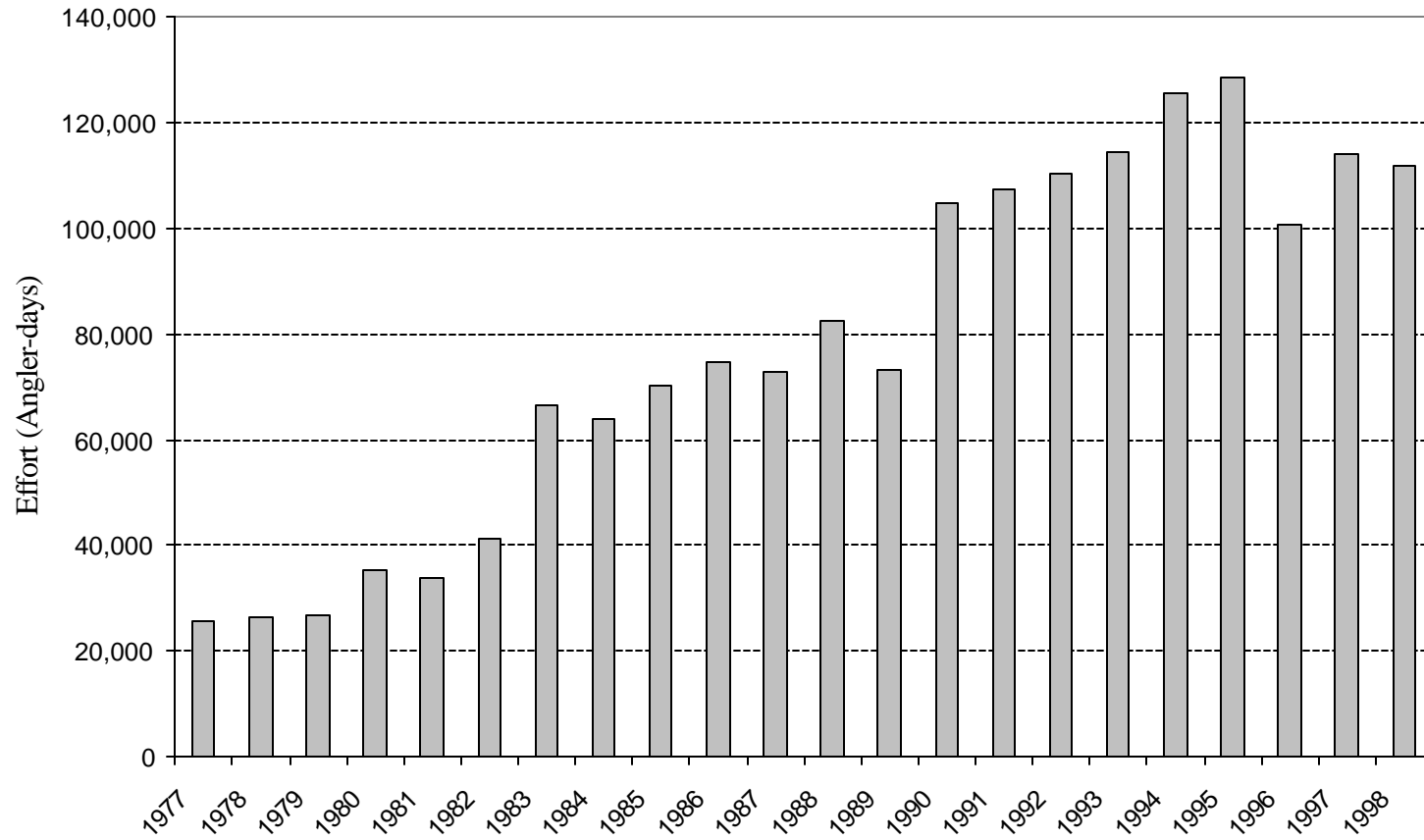


Figure 2.-Sport fishing effort in angler-days for the Southwest Alaska sport fish management area, 1977 to 1998.

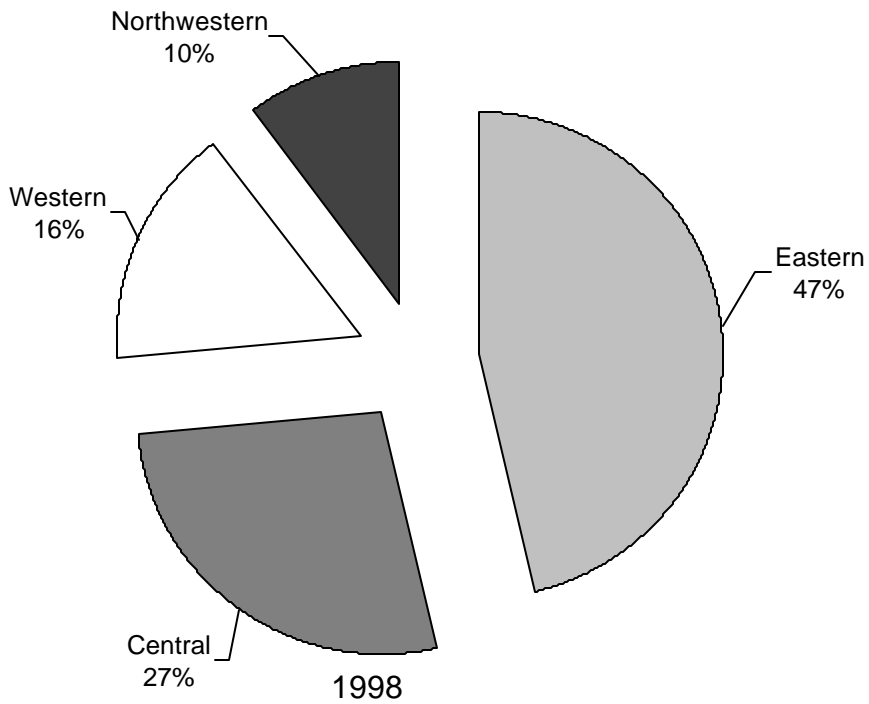
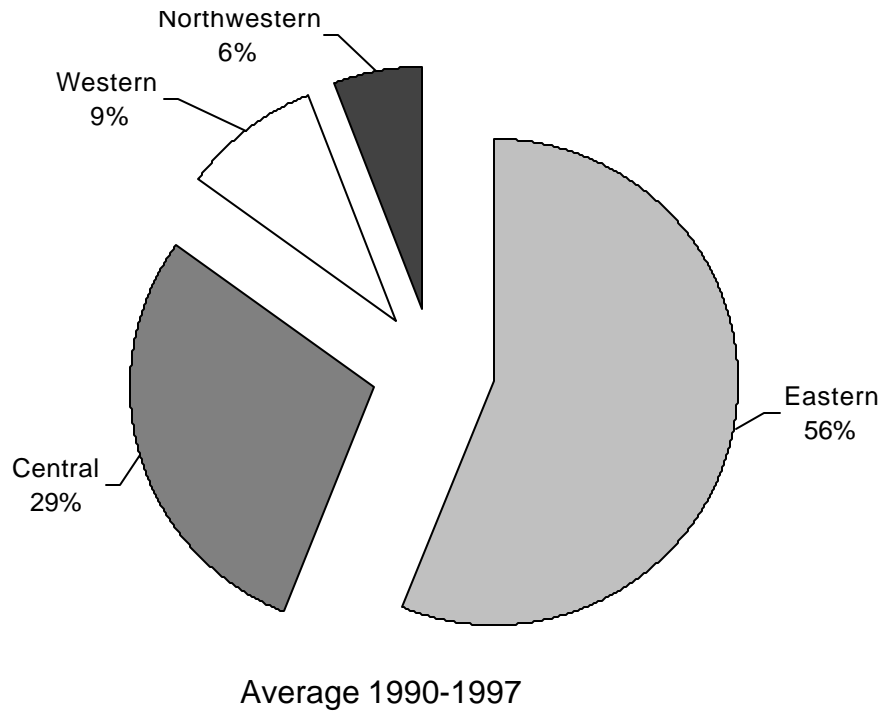


Figure 3.-Percentage of sport fishing effort expended in the Eastern, Central, Western, and Northwestern sections, 1990-1997 average, and 1998.

SPORT HARVEST

Sockeye *O. nerka*, chinook *O. tshawytscha* and coho *O. kisutch* salmon are the most frequently harvested species in the SWMA, with lesser numbers of Dolly Varden/Arctic char, Arctic grayling, and rainbow trout being taken annually (Table 2, Figure 4). In terms of numbers of fish harvested, smelt Osmeridae, which are not highly sought after in Southwest Alaska, were the fourth most frequently harvested species (Table 2). This is more likely a reflection of their abundance and a liberal bag limit than their desirability as a sport species.

Harvests for 1998 were on par with the recent 5-year averages. Two exceptions were the sockeye salmon and chinook salmon harvests which were higher than recent years (Figure 4).

ECONOMIC VALUE OF THE SPORT FISHERY

Recreational fisheries in Southwest Alaska provide the angler with a unique combination of high quality salmon and rainbow trout fishing in a pristine wilderness setting. Although this area accounts for a relatively minor portion of the total statewide sport fishing effort, and even less of the statewide harvest, it is the combination of scenery and diverse fishing opportunities that allows this region of Alaska to compete with other world-class sport fisheries. Studies by the University of Alaska placed the 1988 value of the area's recreational fishery at \$50 million (Ackley 1988).

The annual Sport Fish Division budget to manage the \$50 million fishery in the SWMA in fiscal year 1999 was \$478,000. Sport fishing effort within the area for calendar year 1998 was 109,800 angler-days, which translates to a cost of \$4.35 per angler-day. Put another way, for every dollar the division spends on research and management of sport fisheries in Southwest Alaska, about \$100 are potentially added to the economy of the state.

MANAGEMENT PLANS AFFECTING FISHERIES

Nushagak Chinook Salmon Management Plan

Management of the Nushagak chinook salmon fisheries is governed by the Nushagak-Mulchatna Chinook Salmon Management Plan (5 AAC 06.361), which was adopted by the Alaska Board of Fisheries in January of 1992. The plan was amended in January of 1995 and again during the Board of Fisheries meeting in November of 1997. The purpose of this management plan is to ensure an adequate spawning escapement of chinook salmon into the Nushagak-Mulchatna River system. The plan directs the department to manage for an inriver return goal of 75,000 chinook salmon past the sonar site at Portage Creek. The inriver goal provides for: (1) 65,000 spawning fish; (2) a reasonable opportunity for subsistence harvest; and (3) a sport guideline harvest of 5,000 fish. If the inriver chinook salmon return is greater than 75,000, the sport guideline harvest does not apply.

The plan also addresses poor return scenarios by specifying management actions to be taken in subsistence, commercial, and sport fisheries depending on the severity of the conservation concern. If the inriver return of chinook salmon is projected to be less than 55,000 fish, restrictions in the sport fishery are mandated. If the spawning escapement is projected to be less than 40,000 fish, the sport fishery is to be closed. In 1997, the 55,000 fish "trigger" was adopted after analysis showed this escapement level was not likely to show a difference in the expected productivity versus that expected at the previous trigger of 65,000 fish. In addition, the old 65,000 fish "trigger" had become quite disruptive to the sport fishery.

Table 2.-Numbers of fish harvested, by species, by recreational anglers fishing within the Southwest Alaska Management Area waters, 1977-1998.

Species	1977-1988						1993-1997					
	Average	1989	1990	1991	1992	1993	1994	1995	1996	1997	Average	1998
Smelt	16,004	57,611	5,640	21,165	22,078	7,458	23,815	8,145	15,195	8,053	12,533	12,179
Sockeye Salmon	6,030	32,962	15,996	17,613	15,912	24,889	20,413	20,250	12,752	16,690	18,999	24,477
Chinook Salmon	8,056	13,216	8,875	11,300	10,428	12,651	19,333	12,687	13,043	14,196	14,382	16,029
Coho Salmon	5,517	18,535	8,284	9,382	6,676	5,461	10,608	8,229	19,797	14,151	11,649	10,606
Dolly Varden / Arctic Char	5,835	7,482	5,964	7,635	5,717	5,934	5,970	5,065	7,966	10,069	7,001	5,075
Rainbow Trout	5,533	4,500	3,779	5,233	3,421	3,161	3,122	2,702	3,760	4,385	3,426	2,484
Arctic Grayling	4,862	4,225	3,905	6,750	4,042	4,858	5,971	3,775	4,508	6,879	5,198	4,686
Pink Salmon	1,537	827	1,351	625	1,198	251	669	310	1,887	351	694	1,367
Lake Trout	1,273	3,094	1,617	952	1,355	1,380	2,075	936	1,314	1,709	1,483	662
Chum Salmon	1,000	4,452	1,734	1,999	2,175	1,802	2,934	1,917	2,844	1,973	2,294	3,039
Northern Pike	1,066	2,133	904	2,500	1,960	1,639	2,427	1,803	2,733	1,136	1,948	1,815
Whitefish	318	231	1,538	734	635	557	506	385	524	1,260	646	1,921
Burbot	161	0	1,242	93	169	214	20	0	151	1,675	412	272
Total	57,190	149,268	60,829	85,981	75,766	70,255	97,863	66,204	86,474	82,527	80,665	84,612

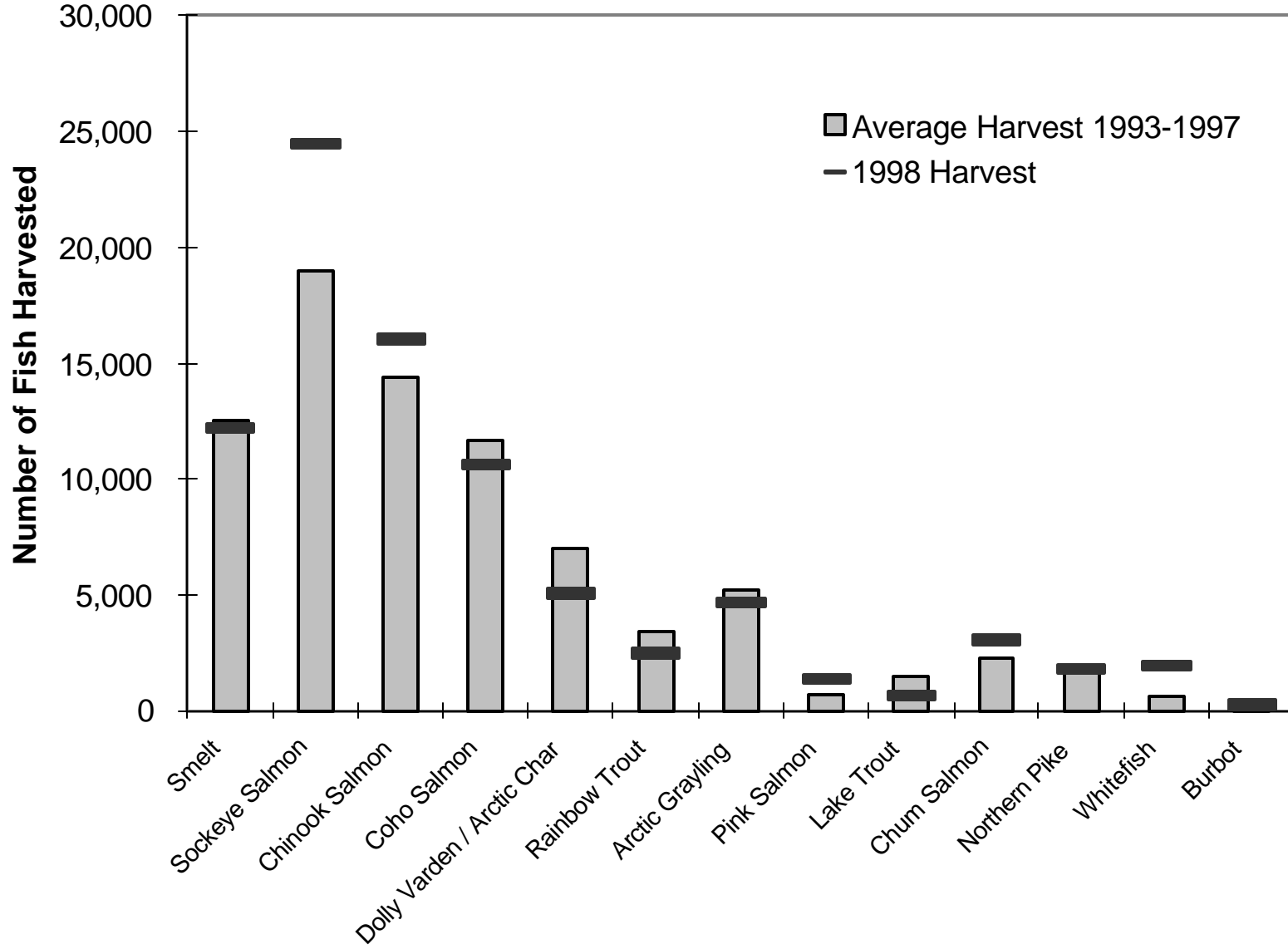


Figure 4.-Sport harvest in Southwest Alaska, by species, 1993-1998.

The 1999 season was the sixth year the department has managed the fishery under some form of this plan. Management is heavily dependent upon the daily estimates of escapement generated from the Commercial Fisheries Division's Portage Creek sonar site on the Nushagak River.

Southwest Alaska Rainbow Trout Management Plan

In February of 1990, the Alaska Board of Fisheries adopted regulations implementing a comprehensive management plan for rainbow trout in Southwest Alaska. The plan itself was not adopted into regulation, but has been recognized as a guiding policy by the Board of Fisheries. The overriding philosophy of the Southwest Alaska Rainbow Trout Management Plan is one of conservative wild stock management (ADF&G 1990). Conservative wild stock management does not necessarily preclude limited harvest of rainbow trout for food or trophies. However, maximum yield principles, which emphasize harvest, are ruled out. Additionally, under a philosophy that emphasizes wild trout management, mitigating losses of wild stocks through enhancement or stocking is not considered a desirable management alternative.

The plan established three policies for rainbow trout stock management, and provides guidance for the Board in developing future regulations.

Policy I states that native rainbow trout populations will be managed to maintain historic size and age compositions and at stock levels sufficient such that stocking is not needed to enhance or supplement the wild population.

Policy II states that a diversity of sport fishing opportunities for wild rainbow trout should be provided through establishment of special management areas by regulation. Selection of areas for special management will be based on 11 criteria adopted by the Board of Fisheries. The 11 criteria include: stock status, abundance and size of rainbow trout, history of special management, proximity to local community, legal public access, overlap with freshwater net fisheries, water characteristics, clear geographic boundaries, importance to the sport fishing industry, geographical distribution of special management areas, and unique considerations such as education or research.

Policy III states that management strategies should be consistent with the prudent economic development of the state's recreational sport fishing industry, while at the same time acknowledging the intrinsic value of this fishery resource to the people of Alaska.

Nushagak River Coho Salmon Management Plan

Management of Nushagak coho salmon stocks is guided by the Nushagak River Coho Salmon Management Plan (5 AAC 06.368), adopted by the Alaska Board of Fisheries in 1996. No changes were made during the 1997 Board meeting. Under this plan the Nushagak coho salmon commercial fishery is to be managed for an inriver goal of 100,000 coho salmon, which provides for a spawning escapement of 90,000; a guideline harvest level of 2,000 in the sport fishery; and a reasonable opportunity in the inriver subsistence fishery. When the projected inriver return falls between 100,000 and 60,000 coho salmon, the sport harvest is not to exceed 2,000 fish. If the inriver return falls below 60,000 fish, the sport fishery is to be closed, and the subsistence fishery restricted. When the spawning escapement is projected to be less than 50,000 fish, all coho salmon fisheries close. The department has managed coho returns to the Nushagak under this plan for four seasons. While the direction is clear, the erratic returns of recent years and problems of accurately assessing run size and timing have

made it difficult for the staff to implement the plan. As with the chinook salmon plan, inseason management is heavily dependent upon the daily estimates of escapement generated from the Commercial Fisheries Division's Portage Creek sonar site on the Nushagak River.

U.S. Fish and Wildlife Service Fisheries Management Plans

There is a Fisheries Management Plan (FMP) for each of the four National Wildlife refuges (Togiak, Becharof, Alaska Peninsula, and Yukon Delta) that are within the SWMA. These plans generally acknowledge the state's authority for management of the sport fisheries and have little direct effect on the day-to-day management of the area's fisheries. Department staff have worked with U.S. Fish and Wildlife Service (USF&WS) personnel to develop these plans, which are essentially a list of fishery-related issues and concerns and a list of projects to address those concerns. Each plan covers a 5-year period, after which the plan is to be reviewed. The individual plans are listed below:

Refuge	Status	Review Scheduled	Plan Type
Togiak	Adopted	1999	Comprehensive Conservation Plan
Yukon Delta	Adopted		
Alaska Peninsula/Becharof	Begun	1999	Comprehensive Conservation Plan/Public Use Management Plan

Department and Service staff have discussed potential changes to the Togiak National Wildlife Refuge FMP but an actual review has not been scheduled.

The Yukon Delta Refuge FMP was adopted in 1992 and implemented gradually over subsequent years. The plan has been adequate and there are currently no plans for revision (John Morgart, USF&WS, Bethel, personal communication).

U.S. Fish and Wildlife Service Public Use Management Plans

The U.S. Fish and Wildlife Service has adopted or drafted Public Use Management Plans (PUMPs) for the refuges which address allowable activities. Of significance are the portions of these plans that address commercial sport fishing services. Since most of the sport fishing effort that occurs within refuge boundaries is guided, plans that affect guided access and activities directly affect opportunity to participate in recreational fishing. Generally, these plans establish levels of allowable commercial use on a river-by-river basis. Unguided use levels are not presently limited. The Togiak PUMP is the most complex of the group, requiring operators to submit prospectus applications and essentially bid for the privilege to provide services on these waters (USF&WS 1991).

The Togiak Refuge PUMP was adopted in 1991. Since adoption, four minor amendments have been made. In 1995 review and revision of the plan commenced according to the plan schedule and consistent with the directive to review the plan when unguided visitor use equaled guided visitor use. Department staff have participated extensively with Refuge staff throughout the PUMP revision process. A Draft Public Use Management Plan Revision was expected to be available for public review in 1998. However, the public review was postponed anticipating a 1999 review of the Refuge Comprehensive Conservation Plan (CCP). Further work on the PUMP will be included in the CCP review process. Currently, occasional differences remain between the state and USF&WS regarding management authority as well as the format and wording of some proposed alternatives.

Separate from the Togiak Refuge CCP, but likely to eventually affect it, the refuge initiated a Land Protection Plan (LPP) in 1999. At year's end the draft plan was nearly ready for submission to the public and other agencies for review in the year 2000. The plan is to help the refuge assess priorities for acquiring private lands within refuge boundaries, should the owners choose to sell to the USF&WS, and should funds become available.

The Alaska Peninsula/Becharof Refuge began a review and revision of its CCP in 1999. The process will include some review and changes to the fisheries and PUMP plans for this refuge as well. As the process advances, draft alternatives will be provided to ADF&G for review and comment.

Plan	Status
Togiak PUMP	Adopted 2/91; 1998 postponed for CCP
Alaska Peninsula/Becharof PUMP	Adopted 2/94; 1999 CCP review commences

National Park Service, Alagnak Wild River Plan

In late fall of 1998, the Park Service expressed its intent to commence a planning effort for the upper 55 miles of the Alagnak River that is designated as a Wild River (Rick Clark, National Park Service, personal communication). The goals of the effort are expected to address human use levels and associated impacts to the resources along the river corridor. The department has been invited to participate when the planning work begins. In late 1999, NPS hired staff for the planning work, gathering data, and developing projects to address planning issues.

Nushagak & Mulchatna Rivers Recreation Management Plan

The Nushagak & Mulchatna Recreation Management Plan (ADNR et al. 1990) was adopted in August of 1990. The plan is the result of a joint effort between Alaska Department of Natural Resources (ADNR), Bristol Bay Coastal Resource Service Area staff, and the Department of Fish and Game. The plan identifies goals and management intent and public use sites for 25 management units in the planning area. Additionally, management policies for long-term uses are identified, as are guidelines for specific management direction for the 25 management units, which constitute the planning area.

Limits on use levels and number of camps were not addressed in the plan. However, much of the policy contained in the plan directly affects commercial operators who provide sport fishing services within the area. Therefore, this plan affects sport fishing opportunity in an indirect but measurable way.

This plan is not scheduled for review or revision at this time. Implementation continues through the ADNR process. Compliance with the permit stipulations required by the plan is considered good to excellent for the sport fishing industry.

Wood-Tikchik State Park Management Plan

The Wood-Tikchik State Park Management Plan (ADNR 1987) was adopted by the ADNR in 1986, approximately 8 years after the largest state park in the nation was created. ADNR's Division of Parks and Outdoor Recreation manages the park. The legislation forming the park also created a park management council made up of seven representatives from the village councils of Koliganek, New Stuyahok, Aleknagik, the Dillingham City Council, Bristol Bay Native Association, ADNR, and ADF&G. The two state agency representatives are expected to provide a broad statewide perspective to the council and its recommendations. A major responsibility of the management council was to develop and review the park management plan and thereby establish policy for the park.

In brief, the goals of the 1986 plan were to: (1) protect the fish, wildlife and habitat resources; (2) protect and manage park resources to ensure continued traditional subsistence activities and Native allotment rights; (3) provide for the outdoor recreation needs of visitors appropriate to the park values and setting; (4) protect and manage areas of significant scientific, educational, visual quality, cultural, or historic value; and (5) establish management practices which respond to regional and statewide recreational and tourism demands.

By 1998, many of the issues initially addressed by the plan had changed, and growth in use of the park has been apparent. In particular, many of the Native allotments within the park had been conveyed to private ownership or were scheduled to be resolved very soon. The privatization of approximately 8,000 acres within the park, growth of nearby communities, and increased public use of the park lead ADNR and the park council to embark upon a review and revision of the plan in the fall of 1998. Work on the plan revision has been limited to organization of a subcommittee, including some members of the general public, and identifying issues. Some issues identified include use levels and boating safety and congestion on the popular angling waters of the Agulowak and Agulukpak rivers. There was no progress on this plan in 1999 due to funding shortages for ADNR. Work is expected to occur in 2000.

Nushagak Mulchatna Watershed Council

In 1998, the Bristol Bay Native Association (BBNA) obtained a federal Environmental Protection Agency (EPA) wetlands grant. During May, BBNA invited local governments, Alaska Native Claims Settlement Act (ANCSA) Corporations, Bristol Bay Coastal Service Area, related state (ADF&G, ADNR, Alaska Department of Environmental Conservation [ADEC]) and federal agencies to participate in a discussion regarding water, environmental issues, and human impacts in the Nushagak Mulchatna drainage. BBNA has enlisted The Nature Conservancy (TNC) to provide technical assistance with the project. A steering committee was formed and met in August 1998 to develop an organizational structure and provide an initial focus to the watershed project. From the August meeting the Nushagak Mulchatna Watershed Council (NMWC) was formed and the following mission statement was written: To serve as a forum for the implementation of solutions to common natural

resource and environmental problems and opportunities in the Nushagak Mulchatna Watershed. In addition to gathering and exchanging natural resource and environmental information and promoting cooperation among landowners, regulatory agencies and resources users, an important function of the Council will be to develop a watershed agreement(s) once the planning process progresses further.

To date, the Division of Sport Fish has participated minimally in the fall meetings. A time may come when more participation will be needed from several department divisions to explain policies and regulations or to contribute data and analysis. Participation in this forum may be a good opportunity for department outreach and coordination with a wide variety of local agencies and the public.

MAJOR ISSUES

Both biological and social issues affect management of the sport fisheries in Southwest Alaska. With the growth of any resource-based activity comes concern for resource conservation and problems related to the competition for those resources between user groups. Significant conservation concerns exist for the following fisheries:

Alagnak River Rainbow Trout

The Alagnak River is located in the eastern portion of the management area and flows into the Kvichak River approximately 20 miles north of King Salmon. Effort on the Alagnak River increased substantially in 1992 (Table 3, Figure 5). From 1994 through 1998, sport effort averaged 10,216 angler-days per year, accounting for 10% of the total effort within the SWMA. The Alagnak River is the third most popular fishing destination in southwest Alaska, after the Naknek River and Nushagak River.

In the lower portion of the drainage anglers pursue chinook, coho, and sockeye salmon. In the middle and upper reaches, rainbow trout are a very popular species. From 1994 to 1998 the average catch (includes fish released and kept) averaged nearly 20,000 rainbow trout per year (Figure 5). At this level, the Alagnak River is the most popular rainbow trout fishery in Southwest Alaska. The average estimated annual harvest from 1994 through 1998 was 99 fish per year, and was likely selective for large fish.

About 1993, coincident with increased fishing effort, department staff began receiving complaints that the rainbow trout stocks in the Alagnak were declining. Data for the Alagnak River rainbow trout fishery prior to 1996 are sparse; however, results from a sampling trip in 1989 suggested that the size composition and age structure were depressed. In 1996 a joint ADF&G and National Park Service (NPS) creel survey was conducted at the outlet of Nonvianuk Lake in the upper Alagnak River drainage (Jaenicke 1998a). Thirty-four returning anglers were asked to compare their experience in 1996 to experiences in the past with regard to catch rate and average size of the catchable population (Table 4). Many anglers felt size composition had diminished (Jaenicke *Unpublished*). In addition to the survey, NPS staff also collected size and age samples from the catchable population. Results showed the size distribution to be skewed to small fish, and age composition to be primarily age-4 and -5 fish (Jaenicke 1998a).

Table 3.-Alagnak River sport fishing effort and rainbow trout harvest and catch, 1981-1999.

Year	Total Effort (Angler-days)	Rainbow Trout Harvest	Rainbow Trout Catch
1981	1,947	76	
1982	2,252	157	
1983	2,348	178	
1984	5,119	187	
1985	2,473	518	
1986	7,628	340	
1987	4,786	824	
1988	1,182	18	
1989	2,717	343	
1990	6,571	423	
1991	6,079	243	23,244
1992	12,323	111	18,452
1993	12,440	312	30,665
1994	10,949	74	11,062
1995	13,232	107	19,499
1996	8,121	26	29,696
1997	11,062	254	29,881
1998	7,715	35	9,711
1999	6,411	57	10,781
1994-98 Average	10,216	99	19,970

Source: Mills 1982-1994; Howe et al. 1995 and 1996, *In prep* a, b, c, and d; 1996-1998 estimates revised in 2000.

As a result of the 1996 work, an emergency order closing the Alagnak and Nonvianuk rivers to the sport harvest of rainbow trout was issued effective July 1, 1996, and was reissued prior to the June 8 opening in 1997.

Additional sampling was conducted in 1997 (Jaenicke 1998b, and *Unpublished*). The size composition information collected throughout the drainage did not suggest the depressed condition indicated in 1996. The study found the following points:

1. Harvests of rainbow trout are estimated to be small, but are likely selective for large fish.
2. Many returning anglers feel the size composition has diminished over time.

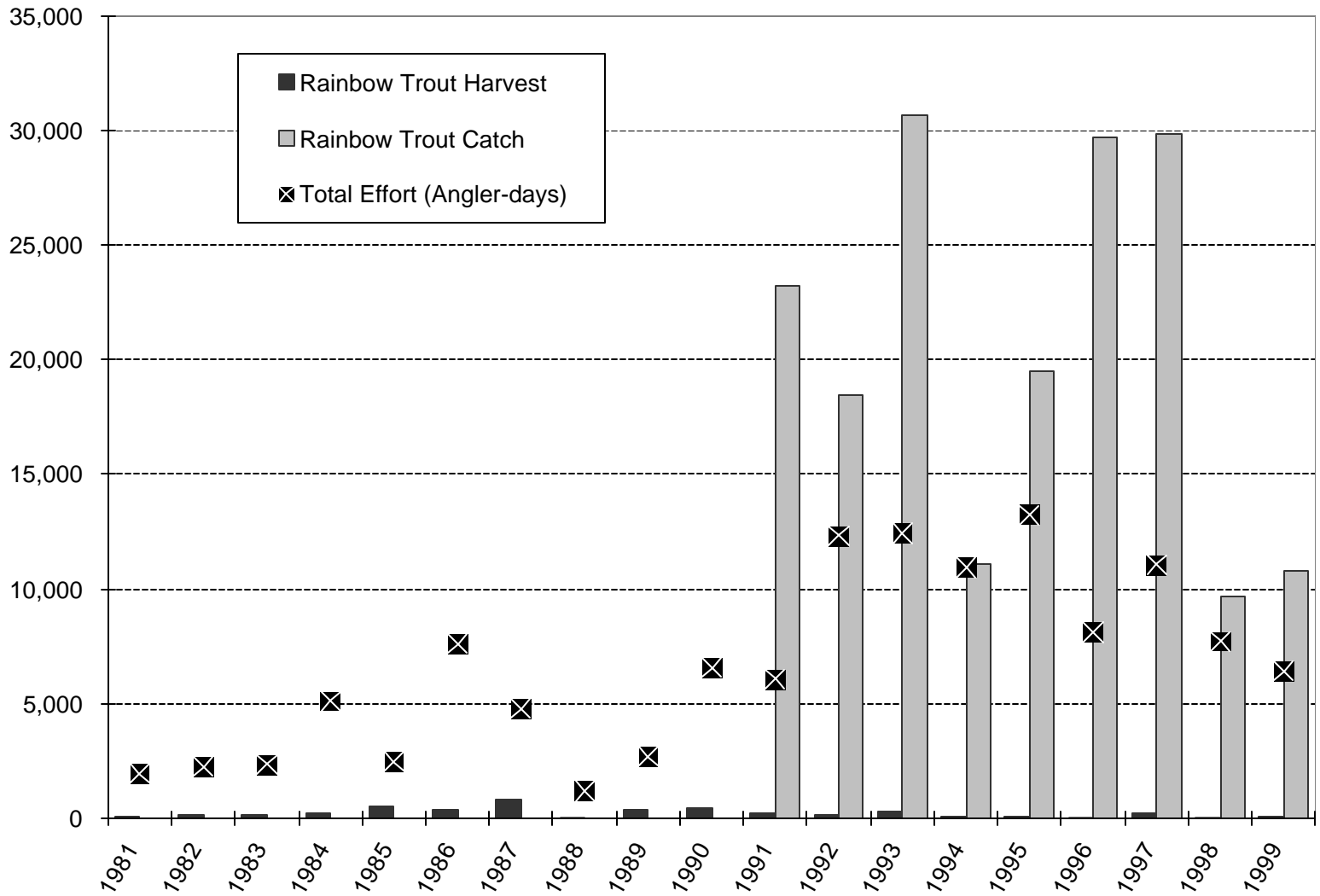


Figure 5.-Alagnak River sport fishing effort and rainbow trout catch and harvest, 1981-1999.

Table 4.-Results from an angler opinion survey concerning the current status of rainbow trout fisheries in the Alagnak River drainage, 1996 and 1997.

Question 1: Have you ever fished here before?

Response	1996 Nonvianuk R. headwaters		1997 Alagnak R. headwaters	
	Number	Percent	Number	Percent
Yes	34	21.9	17	11.9
No	120	77.4	126	88.1
Response not recorded	1	0.6	0	0.0
Total	155	100.0	143	100.0

Question 2: If you have fished here before, how does the current abundance of rainbow trout compare with your previous trip (less abundant than previous trip, same, or more abundant than previous trip).

Response	1996 Nonvianuk R. headwaters		1997 Alagnak R. headwaters	
	Number	Percent	Number	Percent
Less abundant	6	17.6	4	23.5
Same	28	82.4	8	47.1
More abundant	0	0.0	5	29.4
Total	34	100.0	17	100.0

Question 3: If you have fished here before, how does the current average size of rainbow trout compare with your previous trip (smaller average size than previous trip, same, or larger average size than previous trip)?

Response	1996 Nonvianuk R. headwaters		1997 Alagnak R. headwaters	
	Number	Percent	Number	Percent
Smaller average size	12	35.3	5	29.4
Same	22	64.7	9	52.9
Larger average size	0	0.0	3	17.6
Total	34	100.0	17	100.0

A number of proposals were brought to the 1997 Board of Fisheries meeting to restrict harvest opportunity in the Alagnak River. The department favored more conservative regulations for resident species and recommended two options for addressing the potentially depressed stock condition for Alagnak rainbow trout: (1) restrict sport harvest by establishing a maximum size limit, or (2) establish a catch-and-release fishery during the open water season. Either action was expected to accomplish the goal of improving the size and age compositions of this fishery.

During its November 1997 meeting the Board of Fisheries adopted regulations restricting the sport fishery to catch-and-release during the open water season in an effort to avoid potential damage to this population (ADF&G 1998b). Angler effort on the Alagnak River and catch of rainbow trout dropped in 1998 to less than 8,000 angler-days and less than 10,000 rainbow trout caught.

Heavy float trip and guided motor boat use of the river has become a concern of the NPS, nearby communities, and anglers. NPS plans to begin a planning effort for the 55-mile portion of the river that is designated a Wild River. Human impacts and boat wake erosion are two concerns to be addressed.

Naknek River Rainbow Trout

Since the early 1970s rainbow trout in the Naknek River have undergone a decline and subsequent recovery in the abundance of larger, older fish in the catchable population. Research in the late 1980s confirmed comments from the angling public that the average size of the catchable population and the number of spawning-sized fish had declined (Minard 1990). Regulation changes intended to protect larger, older fish through bag and size limit manipulations were recommended by the department and adopted by the Board of Fisheries in 1990. Studies conducted in 1993 and 1995 indicate the rainbow trout population has responded favorably to those actions.

Currently the angling public expresses mixed opinions on how to transition from a period of recovery to a management strategy that would maintain an apparently recovered rainbow trout stock. A variety of regulation proposals addressing the future of this fishery were submitted for the November 1997 Board of Fisheries meeting. The Board deferred any immediate action and formed a subcommittee to develop a rainbow trout management plan for the river.

During April of 1998, Board members Larry Engel and Ed Dersham visited the river to observe this most controversial segment of the fishery, and to hear local public testimony. The Division of Sport Fish committed to review all available data from the Naknek River rainbow trout fishery, and to collect additional information from the early spring fishery. In addition, the division prepared a framework for the Naknek/Kvichak Advisory Committee as a starting point to build a management plan. There has been no activity by the Board subcommittee since spring of 1998. By December 1998, a number of Advisory Committee members had departed, and no progress had been made on the plan. The Naknek Advisory Council submitted no proposals on this issue for the January 2001 Board meeting, and concern appears to be dormant.

To obtain data for the proposed management plan, Sport Fish Division conducted spring and fall angler surveys and biological sampling of the upper Naknek River during 1999.

Nushagak Coho Salmon

The 1998 return of coho salmon to the Nushagak River was projected to be poor, based on parent-year escapement, but the 1998 return turned out to be good and escapement goals were met. The 1999 parent-year escapement was also very poor, and this time the run did not materialize. The commercial fishery was closed on July 26, the sport fishery on August 12, and the subsistence fishery on August 13. The inriver return goal for this river is 100,000 coho salmon. The 1999 sonar inriver estimate of 34,853 was the lowest inriver return since 1987.

In seven of the 10 seasons beginning with 1990, Nushagak River coho salmon inriver returns have been less than the return goal. Although sport harvests are considered negligible in most years, the Nushagak

River drainage was closed for much of the normal sport season in 1997 and 1999 to protect a very weak return. Management of Nushagak coho salmon is guided by the Nushagak River Coho Salmon Management Plan, in which recommended actions are linked to sonar estimates of inriver abundance (5 AAC 06.368). While the direction is clear, the erratic returns of recent years and problems of accurately assessing run size and timing have made it difficult for staff to implement the plan. During the last 10 years, run sizes have been so erratic that sport fishing opportunities have been very unpredictable.

Iliamna River Dolly Varden

Dolly Varden stocks in the Iliamna River appear to have suffered a significant decline in abundance and a loss of the larger, older age classes. Records from area lodges that have a history fishing the Iliamna River show a significant decline in both the number of Dolly Varden landed and the size of those fish. Visual counts of Dolly Varden in the lower Iliamna River in 1996 and 1997 indicated a population in the low thousands to mid hundreds (Jaenicke 1999). Emergency order restrictions were issued in 1996 and 1997, dropping bag and possession limits from 10 per day to catch-and-release. Compliance appeared excellent. The Alaska Board of Fisheries adopted a more permanent catch-and-release restriction for this fishery during their November 1997 meeting. Local concerns about guide use and jet boat traffic in this river are ongoing.

Nushagak Chinook Salmon

Four issues have been a concern to management of the Nushagak chinook salmon fisheries:

1. The accuracy and precision of sonar-estimated inriver abundance. In 1997 sonar-estimated inriver abundance was significantly lower than escapement estimated by aerial survey. Management actions tied to the sonar counts resulted in significant restrictions in the sport fishery (catch-and-release on June 30, 1997) that, in the end, were unnecessary. To address this issue in 1997 and 1998, the Commercial Fisheries Division conducted an extensive test-netting program across the full width of the river at the sonar site. Results of the test net project showed clearly that the sonar counter does not count a significant number of chinook salmon (Miller 1999). Test netting in 1999, when water levels were lower than the test period in 1998, produced the same results (Miller 2000). Based on only 3 years of data, it appears that the sonar counts of chinook salmon are significant underestimates of the number of chinook salmon returning to the Nushagak. However, if data from these 3 years are representative, the counts may be a consistent index of the escapement (Miller 2000).

In 1999 the sonar-estimated inriver abundance was 62,331 chinook salmon. Aerial surveys estimated 59,000 with only one section not surveyed.

2. The ability to keep the sport fishery within the 5,000 fish allocation. Sport harvest exceeded 5,000 fish during several years in the early 1990s (Figure 6). During the 1997 fall meeting, the Board of Fisheries adopted a set of regulations designed to keep the sport harvest within the 5,000 fish allocation. Beginning in the 1998 season, all anglers were restricted to a daily harvest of two chinook salmon, only one could exceed 28 inches. In addition, all anglers were limited to a total annual harvest of four chinook salmon from the drainage. Guides were further restricted from

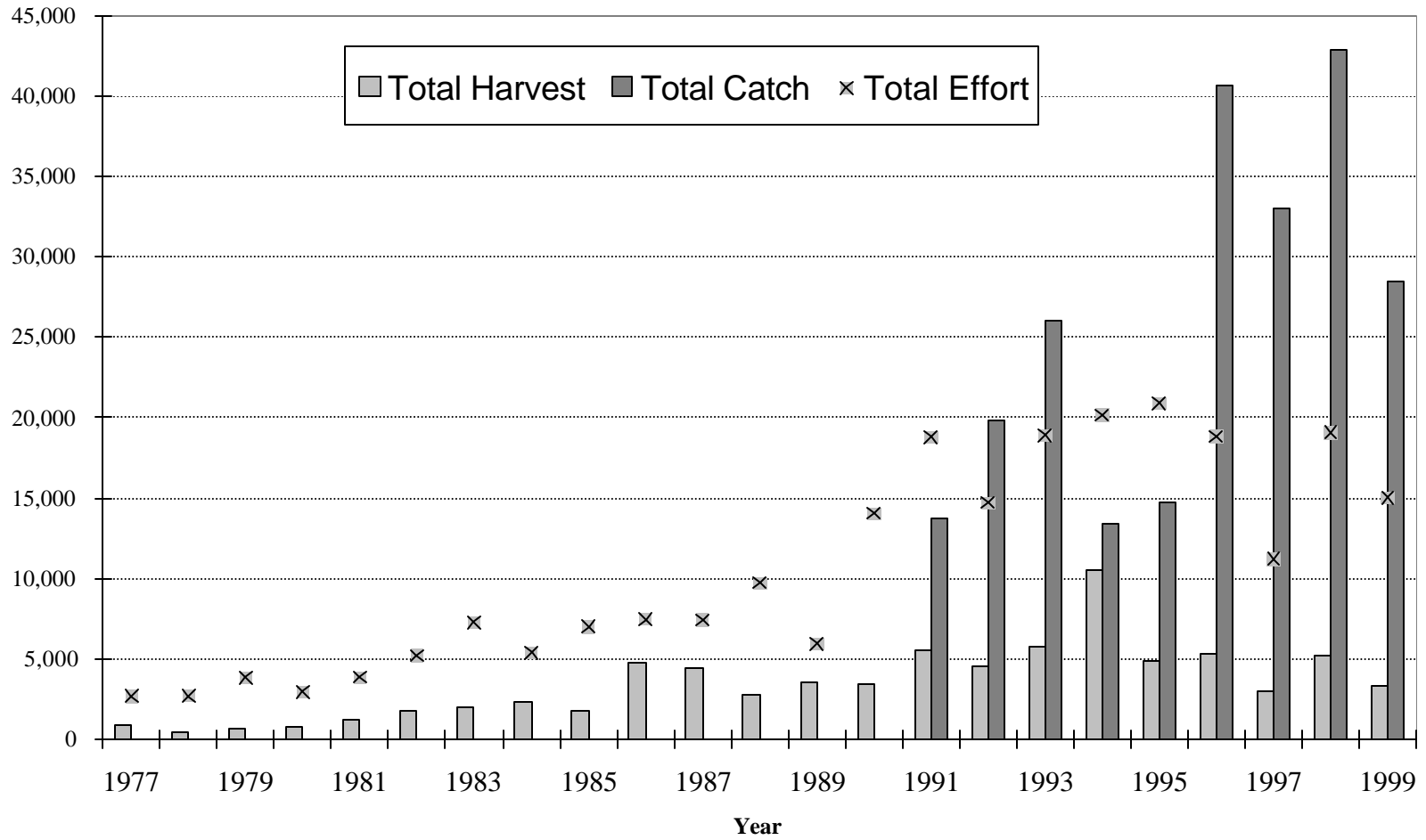


Figure 6.-Sport harvest and catch of chinook salmon and total angler effort from the Nushagak River, 1977-1999.

retaining any chinook salmon while guiding. The Nushagak River upstream from the confluence of Harris Creek, and the Kokwok River drainage (a tributary of the Nushagak River) were closed to chinook salmon fishing year-round. The Nushagak River downstream from the outlet of the Iowithla River closes to chinook salmon fishing after July 31. This combination of regulations was expected to reduce the harvest potential of the sport fishery by about 50% and keep the harvest within the current allocation. The catch (which includes released fish) of chinook salmon in 1998 soared to over 40,000, but harvest was just slightly over 5,000 fish (Figure 6).

In 1999, poor escapements resulted in three emergency orders. The first, on June 30, reduced the seasonal Nushagak chinook bag limit to two. The second, on July 2, closed the chinook salmon sport fishery. The third, on July 6, reopened the sport fishery with a seasonal limit of two. The final sonar inriver return estimate was 62,331 (Miller 2000). Aerial surveys in early August estimated spawning escapement at between 58,000-68,000 fish (ADF&G 2000).

3. The precision of commercial fish management and the effect on sport fishing opportunity. Under the 1996 management plan the commercial fishery was to be managed for an inriver return of 75,000 chinook salmon. Fish surplus to the 75,000 were to be taken in the commercial fishery. Decisions to open and close the commercial fishery in an effort to harvest chinook salmon surplus to the 75,000 were based on the preseason forecast, commercial fishery performance, subsistence catch levels, and sonar-estimated inriver abundance. As with all management tools, a level of error is associated with each of the indicators of run strength. In addition, there is no precise formula for determining the length and frequency of commercial periods.

From 1990 through 1994, management of the commercial fishery was conservative in an effort to rebuild the stock. The sonar estimate of chinook salmon passage ranged from 39% over the inriver goal to 15% under the goal. During the most recent years, management of the commercial fishery has been more aggressive in an effort to comply with the plan by harvesting all fish surplus to the 75,000 inriver goal. Since 1995 the inriver return ranged from 57% above the goal to 46% below. Management precision within the commercial fishery (measured by the difference between the inriver goal and the actual return) has been roughly plus or minus 30% or about 22,500 fish. In some cases this equated to one commercial fishing period.

A comparison of recent escapement levels to resulting returns found that the 30% annual variation has little biological consequence to future production. However, the consequence of this wide variation has been highly significant to the user groups. Where the inriver goal may have been undershot by as little as 13%, the management plan required that the sport fishery be restricted inseason (as in 1996 and 1997). Such restrictions were highly disruptive to anglers and the supporting industry.

From the analysis above, and public testimony, in 1997 the Board of Fisheries addressed the problems by “desensitizing” the management plan, reducing the 65,000 fish action trigger in the plan to 55,000 fish. If the inriver return of chinook salmon is projected to be less than 55,000, restrictions in the sport fishery are mandated; and if the projected spawning escapement is less than 40,000 fish, the sport fishery is to be closed.

4. The quality of escapement. Chinook salmon vary significantly in both age and size, much more so than other salmon species. The spawning potential for a chinook salmon run depends to a large extent on the sex, age, and size structure of the fish on the spawning grounds (i.e., the spawning escapement). While it is not specifically stated, the 65,000 fish biological escapement goal (BEG) for Nushagak chinook salmon carries with it the assumption of adequate levels of egg-bearing females in the escapement to maintain productivity.

Inriver users expressed significant concern regarding the unusually high proportion of jacks (small males) and a scarcity of females they observed in the 1995 and 1996 returns. The department examined size and age composition of chinook salmon captured at the sonar site and in the subsistence fishery below the sonar site. Two areas of concern were found with respect to escapement quality: (1) The proportion of female spawners was less than desired for adequate egg deposition, and (2) a pattern has developed where age composition of early season escapement differs substantially from age composition later in the run. These problems appear linked to department management of the commercial fishery, and if they were left unresolved, could have resulted in decreased future yields of Nushagak River chinook salmon.

To avoid low proportions of females in the 1997 escapement, the department only allowed commercial fishing after a pulse of chinook salmon had entered the river. The intent was to allow untouched portions of the run with “natural” size and age compositions to pass through the commercial district and, ultimately, onto the spawning grounds. This strategy appears to have worked in that a greater number of productive females appear to have escaped in 1997 than in the previous 2 years.

The Board of Fisheries in November of 1997 amended the plan so the commercial fishery will be managed much as it was during the 1997 season. New amendments to the plan directed the department to “...maintain a natural representation of age classes in the [inriver] escapement...”. There was no amendment to address the mid-season shift of age and size composition in the escapement.

OTHER ISSUES

Significant social issues concerning sport fisheries in the SWMA include:

1. Preservation of quality sport fishing opportunities in the face of greater competition between user groups for limited resources. Sport fishing effort throughout the SWMA in the 1990s was much higher than the previous decade (Figure 2). Maintenance of high quality sport fishing opportunity within the area is becoming an increasing challenge that is generally being addressed through management plans and coordination with federal and other state agencies. Management objectives that stipulate desired catch rates, population attributes, and address diversity of opportunities are being continually developed and presented in the public process. During the upcoming fiscal year, for example, management objectives for selected rainbow trout fisheries will be reviewed and published. Additionally, an areawide management plan for Arctic grayling is to be drafted. There remains the issue of limiting access to fisheries to preserve quality. As of yet, there are no such fisheries within the area, but demand for such fisheries is growing. The Board of Fisheries initiated the first tentative steps to address this topic for the Naknek River spring rainbow trout fishery during the November 1997 meeting.

2. Increasingly complex land ownership patterns. Of particular concern has been securing access to public lands and waters through negotiated easements across private lands. Limited Department of Natural Resources staff time available for working on these issues necessitates Sport Fish staff remain deeply involved if a desirable outcome is to be achieved. Approximately 20% of the area management biologist's time is spent on land and access issues.
3. Coordination with federal, other state agencies. Ever-increasing staff time is devoted to coordination with other agencies with a management interest in the area fisheries. Efforts have been made to improve communication between agencies and to work cooperatively on projects. To facilitate communication, annual Southwest Interagency Meetings (SWIM) have been conducted in King Salmon or Dillingham each February and hosted by various agencies on a rotating basis since 1994. Usually an informal 2-day event, SWIM has resulted in improved data exchanges, coordination of some small field projects, some informal agreements on research approaches, and appears likely to lead to more and larger jointly funded and staffed programs in the future. Still, the vast area, diverse fisheries, and divergent missions can make ongoing close communication difficult. In the future, local governments and tribal organizations may become involved in these SWIM conferences.
4. Potential effects of federal management of subsistence fisheries on sport fishing opportunity. The federal government has taken over management of all subsistence fisheries within the state. Under federal management, priority is given to rural subsistence uses. Uses, such as sport fisheries, that compete for resources and space may be restricted in times of shortage. There is a very real possibility that sport fishing opportunity in a number of popular waters may be restricted under such management. Department staff are working to closely follow the developments; however, there is little area-level staff can do to affect this issue.

ONGOING RESEARCH AND MANAGEMENT ACTIVITIES

There were four main programs conducted in 1999; three major research projects and the routine management activities.

1. Bristol Bay Rainbow Trout Studies.

This project provided funding for the following three projects:

- a. Volunteer creel survey program at Lower Talarik Creek. Objectives included the census of sport fishing effort and catch, estimation of size and age compositions of catchable trout, and angler demographics. Results show a generally stable level of effort as well as desirable catch rates and size compositions. Results of the Lower Talarik Creek surveys are reported in the Fishery Management Report series. Work at this site is conducted in part to meet the obligations of a cooperative agreement between ADF&G, ADNR, and the Nature Conservancy.
- b. Survey of the spring sport fishery for rainbow trout on the Naknek River. There is a growing rainbow trout fishery on the Naknek River during a few weeks immediately prior to the closure of the fishery on April 10. The closure is to protect spawning fish. Growth of this early spring fishery and the provision of guide services have sparked controversy and demands for more regulations. The objective of the 1999 study was to estimate angler

effort in the early spring fishery. Additional tasks were to estimate the proportion of rainbow trout in the river that appear sexually mature, by length class, and to identify spawning areas in the upper Naknek River.

- c. Survey of the fall sport fishery for rainbow trout on the Naknek River. The last study of the fall rainbow trout fishery in the upper Naknek River was conducted in 1993. Since then, four new lodges have started operations on the river. The objectives of the 1999 study were to estimate angler effort and to estimate the length composition of rainbow trout in the river.

2. Southwest Alaska Salmon Studies.

Onsite creel surveys in the SWMA are scheduled to rotate among the area's main salmon fisheries every 3 to 5 years. In 1999 this project provided funding for monitoring the chinook salmon sport fisheries on the lower Kanektok and lower Naknek rivers, and the coho salmon fisheries on the lower Togiak River and lower Naknek River. Objectives of these surveys include estimating fishery effort, timing and location, angler demographics, and effectiveness of current management strategies.

3. Resident Species Studies.

This project provided funding for the second year of the Lake Aleknagik northern pike project. This is a department-funded graduate student project designed to provide basic information about this important sport and subsistence species. Project objectives include assessing whether the lake population is a single stock; identifying important spawning, feeding and overwintering locations; estimating size and age composition of pike ≥ 300 mm; and assessing the abundance and survival of northern pike in Lake Aleknagik. These data may be used to develop management, population monitoring, and regulatory recommendations for this stock. After a second year of data collection in 1999, project results will be presented in the graduate student's master's thesis to be completed by May of 2000. In addition, this project employed one local Bristol Bay Economic Development Corporation intern through the whole summer of 1999. He assisted with capturing, sampling, and tracking fish.

4. Management Activities.

Management activities in 1998 included participating with local advisory committees in the Board of Fisheries process, public contacts, disseminating information, fisheries monitoring, coordinating with staff from other divisions and resource management agencies, and habitat monitoring and permit review. Coordinating with ADNR, The Nature Conservancy, and local governments to establish a Special Use Area at Lower Talarik Creek required several days of staff time from January through June, at which time an agreement was reached. In addition to the Special Use Area, ADF&G worked with ADNR to secure an Interagency Land Management Agreement for the Lower Talarik Creek cabin site.

ACCESS PROGRAM

Management of the sport fisheries in Southwest Alaska includes the development of projects that promote access for the angling public to common property resources. About 15% of the annual

Sport Fish Division budget is dedicated to the acquisition, development and maintenance of public boating facilities and additional nonboating projects are funded at the discretion of the division. Access projects that benefit sport fishermen may be as simple as a Dumpster for collection of refuse or as complex as the development of a boat launch with parking and picnic facilities.

The Division has a fairly well defined process for the selection and prioritization of projects that are being considered for funding (ADF&G *Unpublished*). There are essentially seven steps in the process: (1) proposed by Area Management Biologist, (2) Regional Access Coordinator Review, (3) Statewide Access Coordinator Review, (4) Acquisition, (5) Development, (6) Maintenance, and (7) Management. All proposed projects must go through the same review process and be assigned a priority based on their individual merit. The following is a list of projects presently being considered in Southwest Alaska.

Aleknagik Lake

This project is located in the central portion of the management area on the south shore of Lake Aleknagik. This site is the most common launching point for traffic heading into or returning from the Wood/Tikchik State Park. Popular sport fishing waters accessed from this point include the Wood, Agulowak and Agulukpak rivers, and the many bays and tributary streams to the Wood River lake system. The project entails the acquisition of property sufficient for the construction of a boat launch, parking for up to 60 vehicles with trailers, an outhouse facility, and day-use picnic site. Total project cost is estimated to be \$1.3-\$1.7 million of which about \$400,000 will come from ADF&G's access program budget.

Construction began in the summer of 1999 and is scheduled to be completed in 2000.

Lake Camp

The outlet of Naknek Lake, commonly referred to as Lake Camp, is frequently used by sport fishermen as an access point for the upper Naknek River and Naknek Lake. The upper reach of the Naknek River supports the second largest rainbow trout fishery in Bristol Bay. Over 20,000 angler-days are expended by recreational fishermen on the Naknek River each year. Presently, access to the upper river is limited to two nearby, undeveloped launch sites on private land and on National Park Service lands. Technically, any use of the private site constitutes trespass. With development of the Lake Aleknagik site assured, an upper Naknek public boating and access site is the highest large-project priority for the access program in the SWMA. This project will entail the acquisition and development of a site for a public launch. Facilities will include a launch ramp, outhouse, picnic area and refuse containers.

Complicated land ownership and unwilling sellers confounded development of the project. In 1999, National Park Service lands were chosen. Initial concerns about possible pollution of the property, which had once belonged to the U.S. Airforce, were resolved. The NPS got federal highway money through State of Alaska Department of Transportation for development of the site. The ADF&G access coordinator, Tom Rutz, serves as a technical advisor for the project; however, no ADF&G money will be used to develop the site. The project is expected to be completed by spring of 2001.

Newhalen River

This project is located at a trailhead near the transient parking ramp at the Iliamna airport, which leads to the Newhalen River falls. Sport fishermen use this location heavily in late June and July while fishing sockeye salmon, and to a lesser extent during the months of August and September while fishing rainbow trout. The installation of an outhouse and refuse containers, as well as a garbage collection and maintenance contract, were completed in the spring of 1993. Additional outhouses were installed at the trail terminus in the spring of 1995. Overall reaction on the part of local residents and the angling public has been highly favorable. The next phase includes the development of a boardwalk (hardened trail) across sensitive habitat to avoid additional erosion and improve the ease of access. No progress has been made on this phase of the project due to right-of-way concerns.

Kvichak River at Igiugig

This project will develop a walkway from the community road system along the banks of the Kvichak River, directing foot traffic away from the village itself. While anglers visit the Kvichak River throughout the open water season, this project has been conceived to accommodate the numerous shorebased anglers during the late June to mid July sockeye salmon fishery. The project has strong support of the local community. It is expected to address trespass issues, enhance angling opportunities, encourage orderly conduct and development of the fishery, and to minimize stream-bank damage from foot traffic. Money was given by ADF&G to the village of Igiugig to put in the walkway; however, progress was delayed due to problems with accessing a gravel source. Work is expected to begin in 2000.

OUTREACH PROGRAM

An important aspect of successful resource management includes public outreach. Over the years a number of methods including presentations, special publications, and signs have been used to inform the public about Southwest Alaska fishery resources and management activities.

Presentations

The Southwest Alaska staff have conducted various presentations, including fishing and fly tying seminars, classroom and school visits, guide information meetings, and talks and slide shows to assorted groups (Table 5). With a full staff in 1999, the Bristol Bay program was more active than in 1998. Presentations included five spring guide meetings conducted in Igiugig, Iliamna, Portage Creek, Ekwok, and King Salmon during the month of June.

Bristol Bay area schools were visited during 1999, including two staff participating as science fair judges. The visits were well-received. In addition, the area office provided support to the Iliamna school for two projects: a pike mark-recapture study of a small lake in the spring, and a lake mapping and stock identification project in the fall. Assistance included help with fisheries permits, sampling equipment and methods, and information sources. In May the area biologist accompanied a group of five Naknek High School students on a day-long fly fishing trip on the Naknek River. Fly fishing techniques were demonstrated and the few fish caught were used to demonstrate biological sampling techniques.

Publications

Written materials have been, and continue to be, developed for the public. In addition to the occasional magazine article and routine news releases announcing special regulations or management actions, the

following brochures are available: commercial services list, float trip guide, Southwest Alaska angling guide, Dillingham day trip guide, Naknek River regulation brochure, Newhalen River access and regulation brochure, Togiak Refuge Waters fishing regulation brochure, Southwest Alaska Rainbow Trout Plan, and an airport tear sheet jointly produced with ADNR, USF&WS, and Bristol Bay Coastal Resource Service Area, on department activities in Southwest Alaska. The Dillingham office also distributes department-produced brochures on catch-and-release fishing, fish handling, fish life histories, and bear safety as well as brochures from other agencies such as the Togiak National Wildlife Refuge and Forest Service. Each spring a Southwest Alaska sport fisheries outlook is written to address many of the most popular fisheries for the coming season.

This written material is mailed out to anyone requesting it. Through December 1999, the Dillingham office mailed 215 information packets to people around the world. Since we began keeping records in 1993, annual Dillingham mailings have ranged from 136 to 233, and average about 180 per year.

Table 5.-Summary of outreach activities in 1999.

Presentations	Fishing classes/ seminars	0
	School visits	2
	Guide meetings	5
	Talks and slide shows	0
Publications	Magazine articles	
	News releases	8
	Current brochures available	9
	Information packet mailings	215
Signs	New in 1999	0
	Updated in 1999	2
Other	Science fair judges	2
	Assistance with school projects	2
	Invitations for media participation	0

From late May through early September, a weekly fishing forecast is written and released to news media outlets and recorded on the department's recorded information system in Anchorage. Regularly updating the forecast and making it available on the department web site helped to keep individual phone calls to a manageable level during the entire fishing season. Anglers who do call are frequently more informed and often mention that they have already checked the web site.

Other Information Outlets

Signs

The Southwest Area office continues to explore and develop additional means to get information to the angling public. Over the last several years, signs have been installed in strategic locations such as airport terminals, boat launches, and trailheads. Topics of the signs may include fishing regulations, easement and directions, angling techniques, and bear safety. Signs are currently installed in Iliamna, Igiugig, King Salmon, Aleknagik, the Naknek River area, and Quinhagak.

Regulation Hotline

It is difficult to inform the public about inseason regulation changes (emergency orders) for Southwest Alaska fisheries, but these changes are becoming increasingly common. In early 1997 the department installed a Southwest Alaska sport fishing regulation "Hot Line" recording at 907-842-REGS (907-842-7347). The recording is updated whenever emergency orders are issued for Southwest Alaska sport fisheries and is available to callers 24 hours a day.

King Salmon Hotline

The community of King Salmon, Alaska is a major transportation hub for Southwest Alaska. Many of the anglers passing through the town visit the local department office. However, much of the year, no Sport Fish Division personnel are available to staff this office. A free telephone connected directly to the Dillingham Sport Fish office available since May 1997 improves service for anglers and relieves public demands on staff from other divisions.

Local Hire and Workforce Development

The Dillingham office has a long history of seeking out and hiring qualified local residents for seasonal work. Area schools have allowed high school students to assist with field projects as a means of providing exposure to the department's work. For several years, students from Dillingham, Iliamna, Naknek/King Salmon, or Igiugig participated in the spring rainbow trout project at Igiugig. Students have also participated in char studies at Lake Aleknagik, and as volunteers on Nushagak River creel surveys for a 1 or 2 week stint. Those students who showed special interest or aptitude were frequently hired for summer work with the department.

The 1998 area outreach program continued during 1999. The Bristol Bay Economic Development Corporation (BBEDC) was formed to coordinate the area's Community Development Quotas allocated from the Bering Sea groundfish harvests. An aspect of BBEDC's program is to train local residents to enhance employment opportunities. For the same reasons, BBEDC has developed student internships with local governments, particularly resource management agencies.

In 1998, BBEDC approached the area sport fish biologist about placing student interns in sport fish projects. In 1999, ADF&G agreed to provide work for one intern in the Aleknagik pike project from June through August. The intern worked as a volunteer for ADF&G. The Dillingham office is eager to continue this arrangement with BBEDC for future field seasons.

AREA STAFF

The following is a list of the staff and project volunteers who conducted sport fishery work in the Southwest Alaska Management Area during 1999. In some case these positions were funded by other regional projects or other agencies, but conducted work in the area.

Paid Staff		
Dan Dunaway	Area Biologist (Fishery Biologist III)	January 1 to December 31
George Naughton	Asst. Area Biologist (Fishery Biologist II)	January 27 to December 31
Andrew Gryska	Fishery Biologist I	May 24 to December 31
Michael Jaenicke	Fishery Biologist I	January 19 to March 22
Helen Jones	Administrative Clerk III	January 1 to December 31
Jason Dye	Fish & Wildlife Technician II	May 17 to October 8
Wesley Jones	Fish & Wildlife Technician II	May 17 to September 1
Craig Schwanke	Fish & Wildlife Technician II	March 16 to June 15
	Fish & Wildlife Technician III	June 16 to October 8
Corey Schwanke	Fish & Wildlife Technician II	April 11 to May 3
Paul E. Lester	Fish & Wildlife Technician I	July 2 to August 6

Volunteers		
Cody Aloysius	Volunteer/BBEDC Intern, Pike	May 26 to July 21
Mathew Mills	Volunteer/Lower Talarik Creek	August 29 to September 4
William Mills	Volunteer/Lower Talarik Creek	August 29 to September 4
Raymond Rotge	Volunteer/Lower Talarik Creek	September 4 to 25
Stephen Johnson	Volunteer/Lower Talarik Creek	September 4 to 25

SECTION II: SPORT FISHING EFFORT

Comprehensive estimates of sport fishing effort for the SWMA were first made in 1977 and published in the Statewide Harvest Survey (Mills 1979). Note that estimates of effort and harvest from 1996-1998 presented in this report were revised in 2000, so are different than previously published estimates.

Total effort in 1977 was just 25,500 angler days. Since that time, effort has increased at an average of about 8% per year, peaking in 1995 at 128,500 angler days (Table 6). During the period 1993-1997, the SWMA contributed an average of 5% of the total effort statewide.

Some of the growth may be a response to the increased publicity associated with the creation of several National Wildlife refuges in the early 1980s. Increased effort may also be the result of improving local facilities and infrastructure such as roads, stores, airports, and air transportation. It is apparent that interest in sport fishing in Southwest Alaska has grown considerably, and the area is accounting for an increasing portion of the total sport fishing effort statewide. Sport fishing effort in the SWMA is expected to continue to increase during the next few years.

Sport fishing effort for some of the more popular locations (Figure 7) is summarized in the following section of this report.

ALAGNAK RIVER

The Alagnak River, known locally as the Branch River, is located approximately 40 miles north of King Salmon in the Kvichak River drainage (Figure 1). The Alagnak River is the third most popular fishing destination in Southwest Alaska, after the Nushagak/Mulchatna and Naknek rivers (Figure 7). In 1998, effort totaled 7,715 angler days (Figure 5). Guided anglers using several river-based lodges or daily fly-in services account for over three-quarters of the sport effort on the Alagnak River (Dunaway 1994). The Alagnak River enjoys Wild and Scenic River status over the upper 55 miles of its length and hosts significant recreational fisheries for chinook, chum, and coho salmon as well as for rainbow trout, Dolly Varden/Arctic char, Arctic grayling, and northern pike. For the near term, sport fishing effort on the Alagnak River is likely to remain around 10,000 angler-days per year.

BROOKS RIVER

The Brooks River, located in the heart of Katmai National Park and Preserve, has been a popular destination for sport fishermen since long before estimates of sport fishing effort were first made in 1977. The Brooks River has shallow, clear water with a moderate current, and flows northeast from Lake Brooks down to Naknek Lake. The Brooks River has long been recognized for its rainbow trout, sockeye and coho salmon, and Arctic grayling fisheries. During the recent 5-year period (1993-1997), Brooks River has supported an average of 4,400 angler-days of effort (Figure 7). At only 1.25 miles in length, the Brooks River supports more fishing pressure per mile than any other water in Southwest Alaska. Effort in 1998 was estimated to be 2,916 angler-days (Table 6).

Although effort remains high on the Brooks River, recent management actions on the part of the National Park Service have likely reduced growth in the fishery from what would have occurred if left unchecked. Several bear-angler incidents in recent years, where bears obtained fish from careless anglers, have resulted in restrictions on fishing area and bags limits, and led to the rule that anglers must

Table 6.-Sport fishing effort in angler-days in the waters of Southwest Alaska by fishery, 1977-1998.

Drainage	1977-1988										1993-1997	
	Average	1989	1990	1991	1992	1993	1994	1995	1996	1997	Average	1998
Eastern												
Naknek R.	12,232	14,120	12,572	15,918	14,436	13,674	12,005	16,738	11,971	13,673	13,612	13,988
Brooks R.	2,168	1,839	8,162	3,305	6,605	5,565	4,566	4,047	3,784	3,971	4,387	2,916
Kvichak R.	1,990	2,616	6,107	3,047	4,716	5,475	5,796	5,411	4,484	3,947	5,023	3,339
Copper R.	1,158	384	1,036	1,791	2,518	4,088	4,324	2,820	1,558	2,782	3,114	2,191
Alagnak R.	3,467	2,717	6,571	6,079	12,323	12,440	10,949	13,232	8,121	11,062	11,161	7,715
Newhalen R.	3,594	5,646	4,370	7,567	4,225	6,428	5,790	6,392	3,037	3,773	5,084	3,506
Lake Clark	2,489	2,697	3,377	3,292	1,803	2,596	3,084	4,148	1,003	3,132	2,793	1,462
Other	7,467	8,441	18,176	15,696	22,684	19,533	21,322	20,991	15,849	17,771	19,093	16,872
Subtotal	^a 33,409	38,460	60,371	56,695	69,310	69,799	67,836	73,779	49,807	60,111	64,266	51,989
Central												
Nushagak	3,289	3,980	7,978	11,351	10,031	14,168	15,460	16,410	15,034	8,866	13,988	15,933
Mulchatna	2,177	1,974	6,070	7,449	4,705	4,729	4,708	4,484	3,806	2,356	4,017	3,145
Agulowak										1,389		1,434
Agulukpak										1,384		923
Wood River L.	^b 3,138	10,272	7,618	10,853	6,647	6,482	12,144	9,022	7,366	4,918	7,986	3,653
Tikchik/Nuyakuk	1,495	1,569	2,424	4,996	3,051	3,678	3,306	2,804	2,341	2,380	2,902	1,722
Other	1,655	1,882	4,624	4,041	2,187	1,440	5,151	4,811	4,125	5,234	4,152	3,683
Subtotal	^a 11,064	19,677	28,714	38,690	26,621	30,497	40,769	37,531	32,672	26,527	33,599	30,493
Western												
Togiak	1,280	1,174	1,638	1,729	1,419	1,647	2,361	3,384	3,535	2,943	2,774	5,206
Goodnews	1,631	1,315	4,578	1,328	1,387	2,276	2,038	1,030	1,694	5,011	2,410	4,007
Kanektok	7,373	4,382	4,525	3,078	4,972	3,791	6,505	5,512	4,812	9,706	6,065	8,114
Other	893	767	66	20	64	60	0	0	1,305	1,212	515	721
Subtotal	^a 6,154	7,638	10,807	6,155	7,842	7,774	10,904	9,926	11,346	18,872	11,764	18,048
Northwestern												
Aniak	797	4,035	1,964	3,078	2,604	2,056	1,815	3,569	3,050	4,778	3,054	5,548
Other	1,254	3,231	2,843	2,966	4,140	4,174	4,279	3,661	3,856	3,816	3,957	5,894
Subtotal	^a 2,051	7,266	4,807	6,044	6,744	6,230	6,094	7,230	6,906	8,594	7,011	11,442
Total	52,678	73,041	104,699	107,584	110,517	114,300	125,603	128,466	100,731	114,104	116,641	111,972

Source: Statewide Harvest Survey databases (Mills 1977-1994, Howe et al. 1995 and 1996, and *In prep* a, b, and c).

^a Subtotals of averages may not be the sum of the drainages because information for some drainages is not available for some years.

^b Wood River Lakes includes Lake Nunavaugluk. Until 1997 Agulowak and Agulukpak rivers were included in Wood River Lakes.

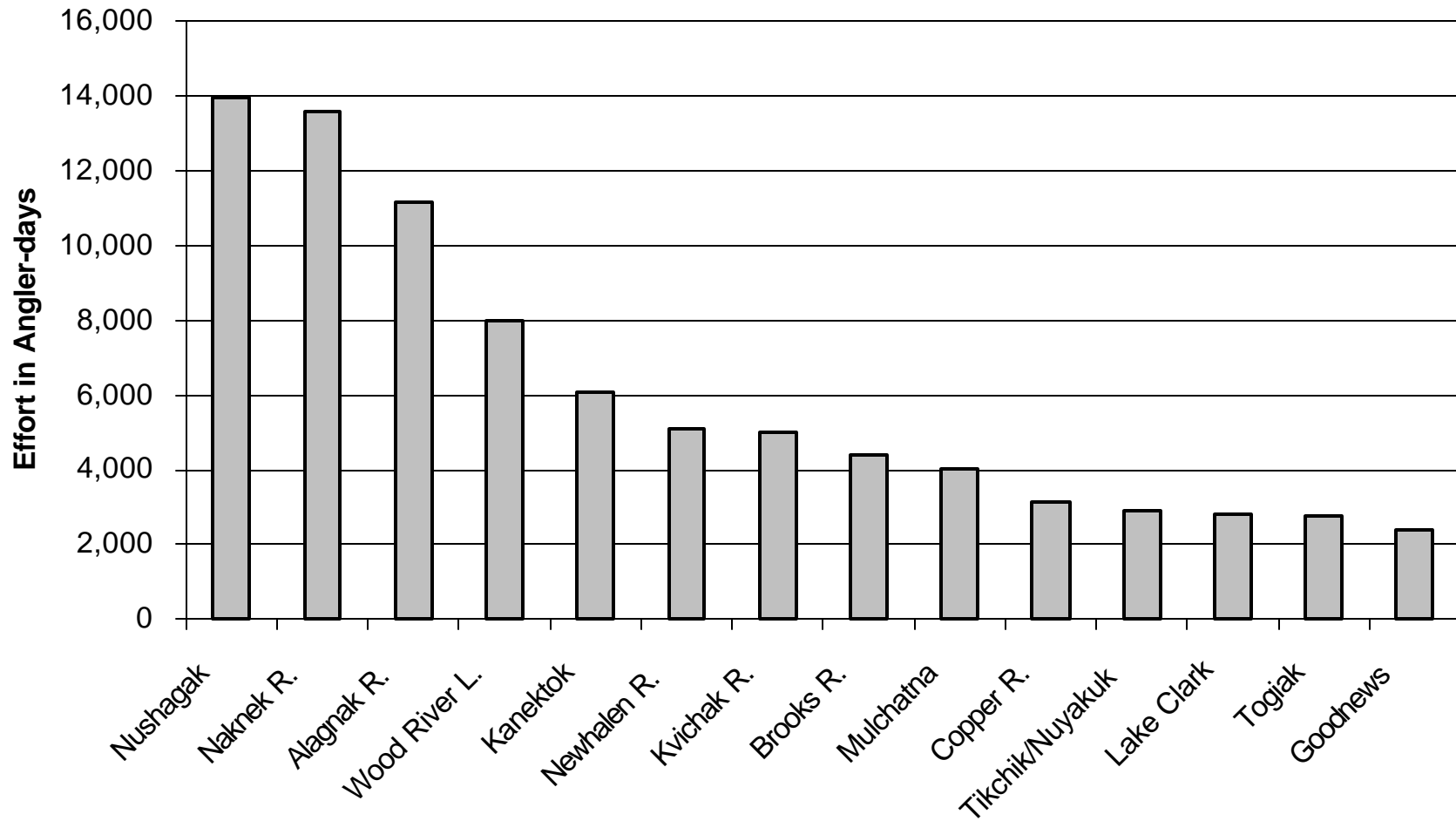


Figure 7.-Five-year average (1993-1997) of the sport fishing effort (angler-days) at the major sport fisheries in Southwest Alaska.

leave fishing areas or at least stop fishing activity when bears are present. The bear problems, the park's difficulty with handling fish cleaning wastes, and the growing emphasis on bear viewing at Brooks River have lead to additional restrictions that have a negative effect on the angling effort.

KVICHAK RIVER

The Kvichak River drains an extensive portion of the Bristol Bay watershed, most notably Lake Iliamna (Figure 1). Known primarily as the world's largest producer of sockeye salmon, the Kvichak drainage also supports significant recreational fisheries for rainbow trout, Dolly Varden/Arctic char, and Arctic grayling. Minor fisheries for coho salmon and lake trout also occur.

Effort during 1993 to 1996 remained stable at between 4,484 and 5,796 angler-days (Table 6). The effort during 1997 dropped slightly, most likely due to the wide publicity of a diminished sockeye salmon run that year. In 1998, the sockeye salmon run was strong, but effort remained low; estimated to be 3,340 angler days.

Expansion of the village airfield at Igiugig was completed in 1994. Improved aircraft access and parking will likely result in increased demand for fishing opportunity. Sport fishing effort is expected to remain stable or to slowly increase in the near future. Some recent evidence indicates that the rainbow trout fishery in August and September is increasing in popularity. An additional sport fishing lodge was built near Igiugig in 1997 and a large air terminal was built during 1998. Both developments may support additional growth in the nearby fisheries. Staff are working with village leaders and access program personnel to find ways to accommodate expected growth in a planned manner, which includes building walkways and boat launching areas.

LAKE CLARK

Lake Clark is located in the eastern section of the management area and forms a major watershed in the Kvichak River drainage (Figure 1). Waters from Lake Clark flow into Sixmile Lake, which drains into the Newhalen River. Lake Clark is within the confines of Lake Clark National Park and Preserve. Fjord-like bays and glacial-colored waters are the signatures of this lake.

Most anglers target northern pike, grayling, lake trout and sockeye salmon. Rainbow trout are found very infrequently, if at all, in the glacial waters of Lake Clark. Because of its proximity to Anchorage, Lake Clark is likely to continue to grow as a fishing destination. The average effort during 1993 to 1997 was 2,790 angler-days (Table 6).

COPPER RIVER

Located in the Eastern section of the management area, the 32-mile Copper River flows west from a series of small lakes into Intricate Bay on the southeastern shore of Iliamna Lake. The high quality rainbow trout fishery in this river was included in the Bristol Bay Trophy Fish area beginning in 1971, and in 1991 was designated a fly fishing only, catch-and-release special management area. The Copper River has a relatively abundant population of large, brightly-colored resident rainbow trout, as well as the more transient lake population of rainbow trout, which enter the river in late August and September. Additional sport fish species present at least part of the year in Copper River include Dolly Varden,

northern pike, and sockeye salmon. The scenic beauty of the area provides anglers either on float-trips or fishing from shore with a quality fly fishing experience.

The angling effort during 1993 to 1997 averaged 3,110 angler-days (Table 6). The level of sport fishing effort is expected to remain steady or slightly increase over the next several years.

NAKNEK RIVER

The Naknek River, located on the east side of Bristol Bay (Figure 1), supports the second most popular sport fishery within the SWMA, and accounts for about one-tenth of the total recreational angler effort expended in the SWMA each year. Effort is split between the upper river, where anglers target rainbow trout, Arctic grayling, Arctic char/Dolly Varden, and sockeye salmon, and the lower river, where they fish primarily for chinook and coho salmon.

A record 18,372 angler-days of effort was estimated for the Naknek River in 1988. From 1989 to 1994, effort ranged from approximately 12,000 to 16,000 angler-days. The reduction after 1988 was most likely due to angler response to more conservative regulations, the issuance of emergency order restrictions inseason, and a growing desire on the part of some fishermen to fish less crowded waters. During 1993 to 1997, the average angling effort was 13,610 angler-days per year (Table 6). Sport fishing effort is expected to increase slowly over the next several years as new lodges and other services become available in the community of King Salmon.

NEWHALEN RIVER

The Newhalen River connects Six-Mile Lake to Lake Iliamna. During the period 1993 to 1997, sport fishing effort averaged 5,084 angler-days per year (Table 6). Record effort was estimated in 1985 at 8,871 angler-days.

The attraction for most anglers is the opportunity to fish for abundant sockeye salmon, which ascend the Newhalen River each summer. The bulk of the fishery occurs during a 4-week period starting in late June and continuing until late July. The sockeye returns to the Kvichak River drainage in 1996 through 1998 were extremely poor, resulting in reduced opportunity and success in harvesting fish. Extensive publicity of the poor runs further depressed angling effort. In addition to sockeye salmon, there is excellent rainbow trout and Dolly Varden fishing opportunity available in the upper reach of the Newhalen River as well as the tail water below the area known as the falls.

Sport fishing opportunity can be significantly enhanced through development of improved camping areas and public trail access from the Iliamna airport to the river. For several years staff have been working with local community leaders and land owners to improve access to the Newhalen River through the division's access program. Most recently, leaders in the community of Newhalen have expressed interest in developing additional public access trails along the river near their community to attract anglers and bolster their economy. No progress has been made on new trail development due to right-of-way concerns, but if that project is completed, participation in the recreational fishery on the Newhalen may increase significantly.

NUSHAGAK AND MULCHATNA RIVERS

The Nushagak and Mulchatna rivers are located in the central section of the SWMA (Figure 1) and together are the greatest producers of chinook, chum, coho, and pink salmon in Bristol Bay. Primary

species of interest to sport fisherman include chinook, chum, and coho salmon as well as rainbow trout, Dolly Varden/Arctic char and Arctic grayling. Sport fishing effort has increased steadily since 1977 to reach a peak of 20,894 angler-days in 1995 (Table 6). Most (75%) of the effort occurs in the Nushagak River, and together the two rivers account for about 14% of the total sport fishing effort in the SWMA (Figure 7).

Recreational fishing effort in the Nushagak River averaged 13,990 angler-days per year during 1993 to 1997, making it the most popular fishery in the SWMA. The 1997 estimate of 8,870 angler-days was about half the 1996 effort for this fishery and likely the result of inseason closures and the unpredictable chinook salmon fishery during 1996 and 1997. The Mulchatna River has averaged approximately 4,000 angler-days per year and, since 1990, has remained relatively stable (Table 6).

Up to 35 commercial guiding services use the Nushagak/Mulchatna drainage and operate spike camps or store boats within the area. Recreational activity within the drainage was the focus of a major planning effort completed in July 1990, which resulted in the Nushagak and Mulchatna Rivers Recreation Management Plan (ADNR et al. 1990). Additionally, local village corporations now maintain a vigorous, and profitable, recreational land management program on their lands. Recent conveyances of Native lands, subsequent subdivision and sale of some Native lands, discoveries of mineral deposits, and prospects of accelerated development along these rivers has precipitated efforts to begin a watershed planning effort initiated by the Bristol Bay Native Association and local communities. These new developments may lead some large landholders to cap the number of trespass permits they sell, particularly to guides or other commercial operations.

WOOD RIVER LAKES, AGULOWAK AND AGULUKPAK RIVERS

The Wood River Lakes system (Figure 1), a series of six large lakes connected by relatively swift short rivers, is located within the confines of the Wood-Tikchik State Park. Sport fishing opportunities have attracted anglers in ever-increasing numbers. Anglers target rainbow trout, Arctic char, Arctic grayling, northern pike and a variety of salmon species. Because of the diverse fishery resources, sport fishing continues throughout most of the open water season. During the 5-year period from 1993 to 1997, effort averaged 7,990 angler-days per year (Table 6).

As the nation's largest state park, the area receives a great deal of publicity, and unguided use of the fishery resources is on the rise. The area is also the base for several major fishing lodges, which offer fly-out fishing trips, often to remote reaches of the Wood River Lakes system. A number of new lodges are being constructed just outside the boundaries of the park. Taken together, the guided and unguided components are significant in these waters and effort is expected to increase substantially in the future.

Once included in the Wood River Lakes, estimates of effort on the two most popular rivers in the system, the Agulukpak and Agulowak, have been assessed separately beginning in 1997 (Table 6). Note the estimates for 1997 are based on less than 12 responses to the Statewide Harvest Surveys, making these estimates extremely imprecise. Still these rivers are very popular with local as well as visiting anglers. Use levels, crowding and quality of experience, boating safety, and potential impacts on the fishery populations are becoming issues for these waters. As the Wood Tikchik Park plan review progresses (See Management Plans section), these two rivers are likely to be focal points of discussions.

TIKCHIK LAKES/NUYAKUK RIVER SYSTEM

The Tikchik Lakes/Nuyakuk River system includes six lakes and connecting river in the northern part of the Wood/Tikchik State Park (Figure 1). The Nuyakuk River starts at the outlet of Tikchik Lake, and flows east 43 miles to join the Nushagak River. The Nuyakuk River has a moderate current, and clear and deep water, making it a popular destination for anglers seeking a quality float-trip experience. Sport fishing opportunities have been increasing in this area, just as they have in the nearby Wood River Lakes. Anglers target rainbow trout, lake trout, Arctic char, Arctic grayling, and a variety of salmon species.

During 1993 to 1997, angling effort remained relatively steady with an average annual effort of 2,900 angler-days (Table 6).

GOODNEWS RIVER

The Goodnews River (Figure 1) is located in the Western section of the management area and is within the Togiak National Wildlife Refuge. The Goodnews River consists of three river forks, which drain approximately 1,000 square miles. The Goodnews River (North Fork) issues from Goodnews Lake and flows approximately 25 miles before leaving the refuge, and continues another 22 miles to Goodnews Bay. The Middle Fork is a 42-mile-long tributary that parallels the North Fork, joining near the outlet. The upper 27 miles of the Middle Fork are located on the refuge. The South Fork is the smallest of the three tributaries and is approximately 25 miles in length, 10 miles of which are within the refuge. The waters of the Goodnews drainage support abundant Dolly Varden/Arctic char, rainbow trout, Arctic grayling, and all five species of Pacific salmon. Of the salmon species, coho salmon are the most popular with recreational anglers fishing these waters.

For the period 1993 to 1997, sport fishing effort on the Goodnews River averaged 2,410 angler-days, accounting for about 2% of the total effort in Southwest Alaska. Until 1997, USF&WS staff estimated about 66% of the effort occurred in the lower portion of the Goodnews River, below the wilderness boundary and outside the refuge. This river system has become very popular for float trips. It is likely a larger proportion of the 1997 effort occurred within the refuge boundaries by unguided anglers.

In May of 1991, the U.S. Fish and Wildlife Service adopted the Togiak Refuge Public Use Management Plan (USF&WS 1991). The plan addressed guided and unguided use of the uplands along the Goodnews River, and allowed 10 sport fishing operators to provide commercial services within the wilderness portion of the drainage. The Service does not control commercial activities below the wilderness area under this plan. The intent of this plan was to maintain the 1990 level of guided sport fishing effort through the 1995 season. Private recreational effort throughout the system and professional guided effort below the refuge boundary is currently unlimited.

KANEKTOK RIVER

The Kanektok River (Figure 1), located south of Bethel and within the Togiak National Wildlife Refuge, is a 93-mile clearwater river that became popular with sport fishermen starting about 1983. After 1983, sport fishing effort increased rapidly to a peak of 12,697 angler-days in 1988. Fishing effort declined, then increased again to 9,710 angler-days in 1997. Approximately 60% of the total effort occurs on the lower 20 miles of the river, where fishermen target chinook, chum, and coho salmon. The upper 73 miles support primarily rainbow trout, Arctic grayling, and Dolly Varden fisheries.

The Togiak Refuge Public Use Management Plan adopted in 1991 by the USF&WS addressed guided and unguided use of the uplands along the Kanektok River (USF&WS 1991). That plan established maximum daily use levels for commercially guided visitors within the wilderness section of the Refuge. This plan is not likely to result in significant changes in sport fishing effort on the Kanektok River. Under this plan, private recreational effort throughout the system and professional guided effort in the lower 20 miles of the river are currently unlimited.

TOGIAK RIVER

The Togiak River, within the confines of the Togiak National Wildlife Refuge on the western side of Bristol Bay (Figure 1), supports significant runs of chinook and coho salmon as well as abundant Dolly Varden/Arctic char and rainbow trout stocks. The river is fished primarily by fly-in and float-trip anglers, as well as clients from two river-based lodges. Increasing numbers of anglers are using the smaller tributaries of the Togiak River to fish grayling and rainbow trout. The average effort during 1993-1997 was 2,770 angler-days (Table 6). Under the Public Use Management Plan adopted in 1991 by the U.S. Fish and Wildlife Service (USF&WS 1991), use of refuge uplands by guided sport fishing services was limited to moderate growth during the next several years by increasing the number of client-days allocated to each guide.

NORTHWESTERN FISHERIES

The least developed fisheries in the SWMA are found in the Northwestern section. The waters in this section are extremely remote with few but growing numbers of facilities catering to sport fishermen. Chinook and coho salmon, rainbow trout, Dolly Varden/Arctic char and Arctic grayling are the most commonly harvested species in the Northwestern section sport fisheries. During 1993 to 1997, effort averaged 7,010 angler-days per year or 6% of the effort for the whole management area (Table 6). The most popular river in this section is the Aniak River where the 1998 estimated effort was 5,550 angler-days, 60% of the Northwestern section total effort.

SECTION III: CHINOOK SALMON FISHERIES

Chinook salmon stocks throughout the management area significantly increased in abundance from the late 1970s through the early 1980s. Then, from about 1984 to 1990, chinook salmon abundance in western Alaska returned to more normal levels. Harvests of chinook salmon have loosely followed the trends in abundance, reaching a peak in 1987 at 17,404 fish, with another peak of 19,333 fish in 1994 (Figure 8). Chinook salmon typically account for about 30% of the recreational salmon harvest in Southwest Alaska. The 1998 sport harvest for the area was 15,970 fish, within the range of harvests common since 1991 (Table 7). Approximately 7% to 8% of all the chinook salmon harvested in the SWMA are taken by sport fishermen.

The peak of the recreational chinook salmon fishery occurs from mid-June to mid-July in the lower reaches of the Alagnak, Nushagak, Naknek, Togiak, and Kanektok rivers, as well as several smaller waters (Figure 9). The chinook salmon sport fisheries of the area, like the sport fisheries for most species, are fished primarily by guided fishermen. With few exceptions, the guided to unguided ratio is about 3 to 1, and the retention rates (the number of fish kept in relation to the total caught) are usually 50% or less.

Since 1960, bag limits for chinook salmon have become increasingly conservative and complex. The most conservative and sweeping regulatory changes to the area chinook salmon fisheries were adopted during the November and December 1997 Board of Fisheries meetings. A Bristol Bay-wide annual limit of 5 chinook salmon was adopted. In the Nushagak River drainage anglers were further restricted to an annual limit of 4 chinook salmon and the daily bag limits in several major fisheries were reduced slightly. Season closures of varying dates were adopted for all Bristol Bay, Kuskokwim Bay and lower Kuskokwim River waters to protect spawning chinook salmon. The following is a chronology of the bag limit regulatory changes affecting chinook salmon sport fisheries in Southwest Alaska. Additional drainage-specific regulations have been adopted and will be described later in this section.

Effective Year	Bristol Bay drainages	Kuskokwim Bay area and Kuskokwim River drainage
1965	10 salmon (all species combined) per day, no size limit	15 salmon per day, no size limit
1972	5 chinook per day, only 2 may be over 26 inches	no change
1976	5 chinook per day, only 2 may be over 28 inches	no change
1985	no change	5 chinook per day, no size limit
1988	3 chinook per day, only 2 may be over 28 inches	<u>Kuskokwim Bay area (excluding Kuskokwim River):</u> 3 chinook per day, only 2 may be over 28 inches <u>Kuskokwim River drainage:</u> 1 chinook per day, no size limit

-continued-

Effective Year	Bristol Bay drainages	Kuskokwim Bay area and Kuskokwim River drainage
1995	no change	<u>Kuskokwim Bay area and Kuskokwim River drainage</u> : 3 chinook per day, only 2 may be over 28 inches
1998	Daily bag and possession limits on several waters reduced to less than 3 per day, only 2 over 28 inches. Annual limit of 5 chinook salmon. Spawning closures for all waters.	Bag limits no change July 25 spawning season closures for all waters.

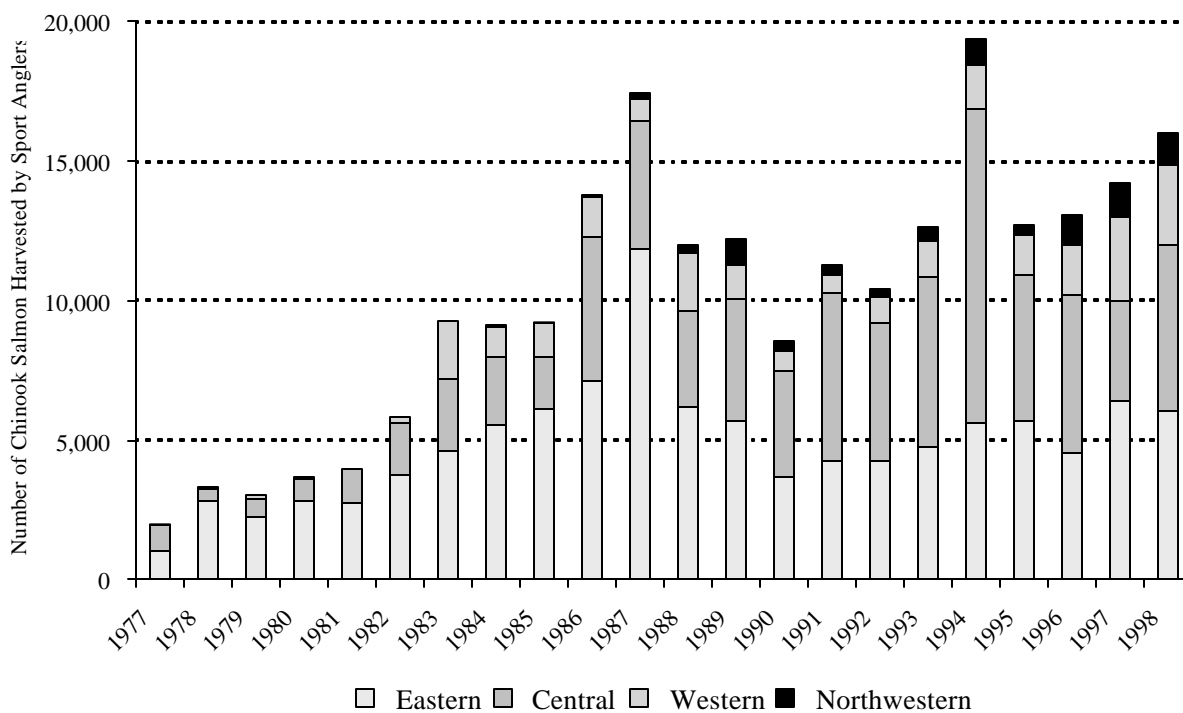


Figure 8.-Sport harvest of chinook salmon from the Eastern, Central, Western, and Northwestern sections of the Southwest Alaska sport fish management area, 1977 to 1998.

Table 7.-Sport harvest of chinook salmon from the waters of Southwest Alaska by fishery, 1977-1998.

Drainage	1977-88										1993-97	
	Average	1989	1990	1991	1992	1993	1994	1995	1996	1997	Average	1998
Eastern												
Naknek R.	4,008	3,224	2,796	3,115	2,633	2,603	3,692	4,153	2,984	4,231	3,533	3,443
Brooks R.	11	0	0	0	44	0	0	19	0	12	6	0
Kvichak R.	126	681	143	44	16	250	90	175	107	47	134	239
Copper R.	3	277	0	22	0	0	0	9	43	0	10	17
Alagnak R.	591	959	474	790	1,160	1,515	1,048	891	931	982	1,073	1,531
Newhalen R.	0	25	0	22	0	0	30	9	0	0	8	0
Lake Clark	0	0	0	0	0	0	0	0	0	0	0	0
Other	199	544	286	293	438	369	739	461	459	1,110	628	813
Subtotal	^a 4,741	5,710	3,699	4,286	4,291	4,737	5,599	5,717	4,524	6,382	5,392	6,043
Central												
Nushagak	1,226	2,807	1,594	3,586	3,688	4,815	8,871	4,476	4,691	3,343	5,239	5,350
Mulchatna	768	754	1,812	1,894	813	965	1,675	402	644	154	768	265
Agulowak										0	0	0
Agulukpak	^b									0	0	30
Wood River L.	53	104	160	173	80	97	435	93	85	23	147	57
Tikchik/Nuyakuk	7	52	80	71	178	101	60	73	11	0	49	170
Other	150	598	137	263	115	124	201	193	236	58	162	90
Subtotal	^a 2,155	4,315	3,783	5,987	4,874	6,102	11,242	5,237	5,667	3,578	6,365	5,962
Western												
Togiak	162	234	172	284	271	225	663	581	790	1,165	685	763
Goodnews	104	68	27	26	23	81	163	41	171	86	108	431
Kanektok	1,077	884	503	316	656	1,006	751	739	728	1,632	971	1,475
Other	21	37	0	0	0	0	0	0	96	128	45	160
Subtotal	^a 761	1,223	702	626	950	1,312	1,577	1,361	1,785	3,011	1,809	2,829
Northwestern												
Aniak	52	738	285	214	172	300	437	279	641	801	492	1,058
Other	59	201	82	187	141	200	478	93	426	424	324	137
Subtotal	^a 111	939	367	401	313	500	915	372	1,067	1,225	816	1,195
Total	7,712	12,187	8,551	11,300	10,428	12,651	19,333	12,687	13,043	14,196	14,382	16,029

Source: Statewide Harvest Survey databases (Mills 1977-1994, Howe et al. 1995 and 1996, *In prep* a, b, and c).

^a Subtotals of averages may not be the sum of the drainages because information for some drainages is not available for some years.

^b Wood River Lakes includes Lake Nunavaugaluk. Until 1997 Agulowak and Agulukpak rivers were included in Wood River Lakes.

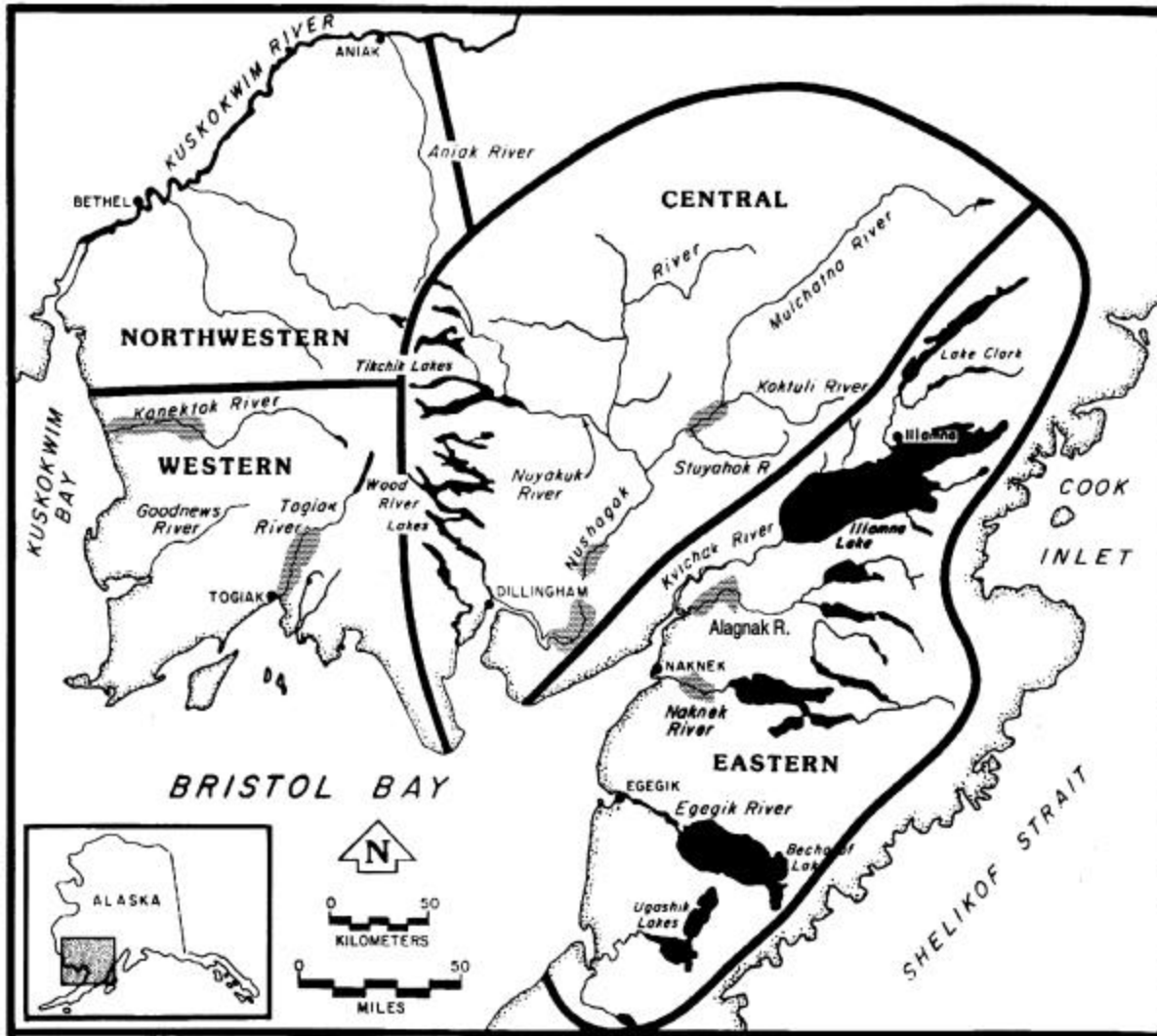


Figure 9.-Popular chinook salmon sport fisheries in Southwest Alaska.

ALAGNAK RIVER

Fishery Description

The Alagnak River, known locally as the Branch River, is located in the Kvichak River drainage, approximately 40 miles north of the community of King Salmon. The Alagnak's proximity to the community of King Salmon makes it an attractive alternative to fishing the more crowded Naknek River. The chinook salmon fishery in the Alagnak River occurs in the lower 12 miles of the river and peaks in mid to late July, which is roughly 2 weeks later than other chinook salmon fisheries in the area (Dunaway 1994). Chinook salmon returning to the Alagnak are typically larger than those found in other systems. Effort is primarily a guided (80%), nonresident (more than 90%) venture (Dunaway 1990a, 1994, Naughton and Gryska 2000.). Most anglers either fly in with float-equipped aircraft for 1-day trips, or base out of one of the several lodges located along the river. Retention rates average approximately 20%, typical of most of the area's chinook fisheries.

Historical Performance

The largest estimated annual harvest of chinook salmon from the Alagnak River was 1,969 fish in 1987 (Mills 1988). The recent 5-year average (1993-1997) harvest of chinook in the Alagnak River was 1,020 fish. In 1997, the year of a peak index count of more than 15,000 chinook salmon, sport harvest was average at about 1,000 fish. In 1998, sport harvest rose higher to about 1,500 fish (Table 8), despite a low index count of 4,000 fish that year.

Table 8.-Unexpanded escapement counts and total sport effort and sport harvest of chinook salmon in the Alagnak River, 1970 to 1999.

Year	Index Count ^a	Total Effort	Harvest
1970	5,250		
1971	1,475		
1972	2,256		
1973	824		
1974	1,596		
1975	6,620		
1976	7,593		
1977	9,425		
1978	11,650		
1979			
1980	2,930		
1981	2,430	1,947	97
1982	3,400	2,252	220
1983	2,980	2,348	252
1984	6,090	5,119	661
1985	3,920	2,473	757
1986	3,090	7,628	680
1987	2,420	4,786	1,969
1988	4,600	1,182	93
1989	3,650	2,717	959
1990	1,720	6,571	474
1991	2,531	6,079	790
1992	3,042	12,323	1,160
1993	10,170	12,440	1,515
1994	8,480	10,949	1,048
1995	6,860	13,232	891
1996	9,885	8,121	931
1997	15,210	11,062	982
1998	4,148	7,715	1,531
1999 ^b	2,178	5,975	639
1970-98 Average	5,049	6,575	824

^a Maximum index count from Glick et al. 2000, Appendix Table 7.

^b Preliminary data.

Through 1988, the daily bag and possession limits for chinook salmon in the Alagnak River were 5 fish, 2 over 28 inches in length. From 1989 through 1997, the limits were 3 per day and in possession, 2 over 28 inches in length. During the November 1997 Board of Fisheries meeting, users of the Alagnak expressed their concern for the high levels of effort on chinook salmon. In response, and in addition to the 5 fish annual limit and July 31 season closure, the Board established a daily bag and possession limit of 3 fish, only 1 of which could exceed 28 inches in length (ADF&G 1998b). Terminal tackle was restricted to single-hook artificial lures only.

Management

Sport harvests and effort are estimated through the Statewide Harvest Survey and reported by Mills (1979-1994) and Howe et al. (1995 and 1996, *In prep* a, b, and c). Commercial and subsistence harvests are monitored by the Commercial Fisheries Division and are reported in their Annual Management Report series (ADF&G 2000). Commercial harvests are reported for the Naknek/Kvichak district, which is a mixed-stock fishery composed of Kvichak, Naknek, and Alagnak River stocks. It is not possible to separate the commercial harvests by river of origin. Sport Fish Division has conducted significant monitoring and stock assessment projects on the Alagnak River in the recent past (Brookover 1989a, Dunaway 1990a and 1994, Naughton and Gryska 2000).

A chinook salmon escapement goal has not been established for Alagnak River stocks. Escapement of chinook salmon in the Alagnak drainage has been indexed by the use of fixed-wing aerial surveys each year since 1970, with the exception of 1979 (Table 8). Unexpanded counts of chinook salmon, called index counts, average 5,049 fish (1970 to 1998). Escapement index counts for 1993 through 1997 were well above the 1970-1990 average of about 4,000 fish (Table 8).

Management concerns for chinook stocks of the Alagnak River drainage center on our inability to estimate total exploitation rates. Allocation of commercial catches from the Naknek/Kvichak district to the river of origin is not possible, and the lack of inseason assessment of escapement makes it impossible to effectively manage this stock. Run timing of chinook stocks to the Alagnak coincides with peak periods of commercial sockeye salmon fishing in the Naknek/Kvichak district. When sockeye returns are sufficient to allow for liberal fishing schedules, the potential for substantial incidental harvest of the Alagnak chinook stocks exists. The 1996 and 1997 chinook salmon runs may have benefited from very low sockeye salmon returns.

Management Objectives

Explicit management objectives have not yet been developed for this fishery. Aerial survey data exist to develop a goal and it is likely that a biological escapement goal (BEG) will be developed for this fishery within the next several years.

1999 Season

The 1999 chinook salmon return was the product of escapements observed in 1992 through 1995. One of the parent year escapements (1992) was below average, and 1993, 1994 and 1995 were well above average (Table 8).

Since parental escapements were generally good, we anticipated a good return in 1999. However, both escapement and fishing success were well below average. Aerial index counts in August found a total of 2,178 chinook salmon, about half the 1970-1998 average escapement (Table 8).

2000 Outlook

The majority of the 2000 return will be the product of escapements observed in 1993-1996. All these years were well above the 1970-1990 average escapement of about 4,000 fish. While strong parental escapements should mean good future returns, that is not always the result. The meager 1999 returns of all Bristol Bay chinook salmon stocks resulted from low production in three of the four parent years for the 2000 return. This poor production is expected to produce a small return again in the 2000 season. In addition, the Naknek-Kvichak district commercial sockeye salmon fishery is expected to be at its peak in 2000. The extensive commercial fishing time necessary to harvest the surplus sockeye may harvest a few more Alagnak River chinook salmon (although typically the interception is quite low). Therefore, we project the 2000 return to be average or lower, and anglers should expect a moderate fishery. This projection is very tentative. If run strength is judged to be poor, there may be inseason sport fishing restrictions, but we will try to preserve some sport fishing opportunity throughout the season. Angling effort on this river can be expected to remain at the high levels of recent seasons.

NAKNEK RIVER

Fishery Description

The Naknek River is located on the Alaska Peninsula and near the communities of King Salmon, Naknek and South Naknek. The Naknek River (Figure 9) chinook salmon sport fishery commences May 1 and continues through July 31, when it closes by regulation to protect spawning fish. The 3 peak weeks are from June 22 to July 14. Effort is concentrated in a 12-mile stretch of the Naknek River adjacent to the community of King Salmon. This fishery is one of the most popular sport fisheries in the area, and accounts for roughly 25% of all the chinook salmon harvested by sport fishermen in the SWMA. Several factors contribute to the popularity of the Naknek River, including ease of access and regularly scheduled airline service into King Salmon. This fishery has a significant amount of unguided effort, reasonably good catch rates, and a high retention rate. The results of a 1999 creel survey showed that 63% of the anglers interviewed at high-use exit areas were unguided (Gryska and Naughton *In prep b*). Of the estimated 1998 catch of 4,494 chinook salmon, 3,443 or 77% were kept (Howe et al. *In prep c*).

Historical Performance

Distribution of the harvest between user groups has remained relatively stable over the last 22 years. During 1994-1998, sport anglers took 38% of the harvest and the remainder of the harvest was split between commercial (42%) and subsistence (20%) users (Table 9).

Effort in the Naknek River has been approaching the record levels last observed in 1986-88. The 1997 estimated effort of 13,670 angler-days (Table 6) represents effort for all species, although much of that effort is directed toward chinook salmon. Since the late 1980s increasingly restrictive regulations on the sport fishery have been effective in balancing escapement with sport harvest. From 1994 through 1998, sport harvests averaged 3,701 fish per year. The escapement index for the same period averaged 7,121 (Table 9), in excess of the goal of 5,000 chinook salmon. The increasing participation may require additional regulations to maintain the balance of sport harvest and spawning escapement. Adjustments to the commercial fishery may be worth consideration as well.

Table 9.-Chinook salmon commercial, subsistence, and sport harvest plus escapement for the Naknek River fishery, 1970-1999.

Year	Harvest			Total	Escapement Index ^d
	Commercial ^a	Subsistence ^b	Sport ^c		
1970	18,481	300			4,145
1971	10,254	200			2,885
1972	2,262	400			2,791
1973	951	600			2,536
1974	480	1,000			
1975	964	700			3,452
1976	4,064	900			7,131
1977	4,373	1,300	1,005	6,678	
1978	6,930	1,200	2,628	10,758	
1979	10,415	1,200	2,264	13,879	
1980	7,517	1,500	2,729	11,746	
1981	11,048	1,000	2,581	14,629	4,271
1982	12,425	1,100	3,264	16,789	8,610
1983	8,955	1,000	3,545	13,500	7,830
1984	8,972	900	4,524	14,396	4,995
1985	5,697	1,179	5,038	11,914	
1986	3,188	1,295	6,160	10,643	3,917
1987	5,175	1,289	9,069	15,533	4,450
1988	6,538	1,057	5,291	12,886	11,730
1989	6,611	970	3,224	10,805	2,710
1990	5,068	985	2,796	8,849	7,000
1991	3,584	1,152	3,115	7,851	4,391
1992	5,724	1,444	2,633	9,801	2,691
1993	7,477	2,080	2,603	12,160	8,016
1994	6,016	1,843	3,692	11,551	9,678
1995	5,084	1,431	4,153	10,668	4,960
1996	4,195	1,574	2,984	8,753	5,010
1997	2,839	2,764	4,231	9,834	10,453
1998	2,444	2,433	3,443	8,320	5,505
1970-98 Average	6,129	1,200	3,681	11,452	5,616
Percent	54%	10%	32%		
1994-98 Average	4,116	2,009	3,701	9,825	7,121
Percent	42%	20%	38%		
1999	1,355	1,567	2,856 ^e	5,778	4,520 ^f
Percent	23%	27%			

^a Naknek Kvichak District commercial harvests likely include Naknek, Alagnak, and Kvichak stocks. The harvests reported above for Naknek River stocks are therefore considered maximums. Sources: 1970 ADF&G Fish Ticket Database; 1971-1998 ADF&G 1991, Appendix Table 6; 1979-1999 ADF&G 2000, Appendix Table 6.

^b Naknek Kvichak District harvests. Harvests are extrapolated for all permits issued, based on returns. Permit and harvest estimates prior to 1989 based on the community where the permit was issued. Estimates from 1989 to the present are based on the area fished. Sources: 1971-1978 ADF&G 1991, Appendix Table 46; 1979-1999 ADF&G 2000, Appendix Table 31.

^c Previous reports showed sport harvest estimates from 1970-1976. These estimates were based either on voluntary angler reporting forms given to military anglers or onsite creel surveys (1971 and 1975). They are not directly comparable to the Statewide Harvest Survey estimates for 1977-2000, so are not reported here. The 1970-1976 estimates can be found in Gwartney and Russell 1977.

^d Actual raw counts made from fixed wing aerial surveys. Source: Glick et al. 2000, Appendix Tables 3-5.

^e 1999 sport harvest preliminary.

^f Includes 1,200 fish counted during September 9, 1999 aerial survey of mainstem (S. Morstad, ADF&G Commercial Fisheries Division, Dillingham, personal communication).

Management

Sport harvests and effort are estimated through the Statewide Harvest Survey and reported by Mills (1979-1994) and Howe et al. (1995 and 1996, *In prep* a, b, and c). Commercial and subsistence harvests are monitored by the Commercial Fisheries Division and are reported in their Annual Management Report series (ADF&G 2000). The Sport Fish Division has conducted significant monitoring and stock assessment projects on a routine schedule (Dunaway and Fleischman 1996a, Coggins 1992, Coggins and Bingham 1993, Dunaway and Bingham 1991, Minard 1987a and 1989a, Minard and Brookover 1988a).

Since 1986 the sport fishery has been managed to achieve a 5,000 chinook salmon index on the spawning grounds (Table 10). Escapement of chinook salmon is estimated by fixed-wing aerial surveys of the four primary spawning areas of Paul's Creek, King Salmon Creek, Big Creek, and the mainstem of the Naknek River during the presumed peak of spawning. Aerial counts are left unexpanded and are considered minimum estimates of escapement. Results of the escapement surveys indicate the mainstem of the Naknek River, along with Big Creek, comprises approximately 87% of the observed escapement (Table 10). Recent escapements have generally met or exceeded the escapement goal, but those in the smaller tributaries remain a source of concern.

Concern over low escapements and increasing sport harvest prompted the Alaska Board of Fisheries in 1987 to adopt a regulation package addressing Naknek River chinook salmon. The key elements of that package included:

1. Establishing a season for chinook salmon (May 1 to July 31),
2. Artificial-lure-only designation, and
3. Reduction in bag and possession limits to 3 per day, 1 of which may be over 28 inches.

Beginning in the early 1990s, increasing portions of Paul's and King Salmon creeks were closed to chinook salmon fishing to protect spawning stocks in these waters. In 1995, the confluence of King Salmon Creek and the Naknek River were closed to angling to protect an important holding area for chinook salmon.

In 1997, closures to chinook salmon angling in Paul's and King Salmon Creek were clarified, and an annual limit of 5 chinook salmon per angler was adopted for this fishery. The annual harvest limit was Bristol Bay-wide and required anglers to record the date and location of each chinook salmon taken.

Management Objectives

The Naknek River chinook salmon sport fishery is managed for a biological escapement goal (BEG) of 5,000 spawners, indexed by aerial survey. While managing for the BEG, consideration is also given to maintaining the historical distribution of spawners within the four major spawning areas of Pauls, King Salmon and Big creeks, and the mainstem of the Naknek River near Rapids Camp.

Table 10.-Escapement aerial index counts for chinook salmon in the Naknek River and drainage, 1970-1999.

Year	Mainstream		King Salmon		Total
	Naknek	Paul's Creek	Creek	Big Creek	
1970	3,060		260	825	4,145
1971	1,639	52	704	490	2,885
1972	351	156	1,224	1,060	2,791
1973	1,315		115	1,106	2,536
1974		91	495	860	
1975	2,250	144	279	779	3,452
1976	5,950	31	180	970	7,131
1977	4,830		1,860		
1978					
1979					
1980	300	17		30	
1981	2,890		591	790	4,271
1982	5,360	340	980	1,930	8,610
1983	2,860	290	460	4,220	7,830
1984	790	400	385	3,420	4,995
1985	590				
1986	2,200	73	102	1,542	3,917
1987	2,800	7	290	1,353	4,450
1988	7,380	150	600	3,600	11,730
1989	1,700	50	100	860	2,710
1990	4,500	150	350	2,000	7,000
1991	1,655	121	275	2,340	4,391
1992	1,550	88	158	895	2,691
1993	5,520	86	700	1,710	8,016
1994	5,970	203	974	2,531	9,678
1995	2,790	26	239	1,905	4,960
1996	2,965	157	312	1,576	5,010
1997	7,520	248	902	1,783	10,453
1998	2,150	210	1,060	2,085	5,505
1970-98					
Average	3,111	140	544	1,626	5,422 ^a
Percent	57%	3%	10%	30%	
1999	1,200	221	847	2,250	4,518
Percent	27%	5%	6%	31%	

Sources: Glick et al. 2000, Appendix Tables 3-5.

^a Calculated as the sum of the averages.

1999 Season

The 1999 chinook salmon return was the product of escapements observed in 1992 through 1995 (Table 10). The escapements of 1993 and 1994 were well above the 5,000 fish goal and were expected to produce strong returns of 5- and 6-year old fish.

In 1999 Sport Fish Division conducted a creel survey on the Naknek River from June 5 through July 31. The chinook salmon run timing was apparently 7 to 10 days later than usual, with the first chinook salmon encountered in the survey on June 20. Many interviewed anglers expressed concern that the run was depressed, but this concern was not supported by catch rate data. The average weight and length of chinook salmon sampled from anglers' harvests was greater in 1999 than in 1991 or 1995 (Gryska and Naughton *In prep b*). This may indicate that with the 5 fish annual bag limit anglers are releasing more small fish and selecting large fish to keep.

The total escapement index count was about 1,000 fish less than the 1970-1998 average (Table 9). However, a conclusion of a shortfall in chinook salmon spawner numbers is not supported because of a very late survey on the main stem and visual vagaries of these surveys.

2000 Outlook

Much of the 2000 Naknek River chinook salmon return will be the product of the 1993-1996 escapements. 1993 and 1994 escapements were well above the goal; and in 1995 and 1996 the 5,000 fish escapement goal was achieved. Based on the parent year escapements and assuming normal survival, we anticipate an average return in 2000. However, the 1999 chinook salmon return was below average, in spite of several good parent year escapements. Therefore, ADF&G cautiously projects an average return for 2000; again, if returns appear to be poor, inseason restrictions may be adopted.

NUSHAGAK AND MULCHATNA RIVERS

Fishery Description

The Nushagak and Mulchatna rivers support significant recreational, commercial, and subsistence chinook salmon fisheries. Within the drainage, there are three areas of concentrated sport effort (Figure 9): the lower Nushagak River near the village of Portage Creek, the middle section of the Nushagak River in the vicinity of the village of Ekwok, and the mid-section of the Mulchatna River between the Stuyahok and Koktuli rivers. In the last couple years, the lower river fishery has begun to expand upriver towards Ekwok and the two areas are beginning to merge into a single, extended fishery. In addition, there has been increasing angling activity in the vicinity of the outlet of the Mulchatna River and the village of Koliganek. Although sport fishing for chinook salmon does occur in some of the tributaries of the drainage, the overall impact of that activity in terms of harvest is considered slight.

Historical Performance

Nushagak/Mulchatna chinook salmon total runs (Table 11) averaged 152,500 fish during the period 1986 to 1998. Total harvest by commercial, subsistence, and sport fisheries averaged 107,357 chinook salmon from 1994 to 1998 (Table 12). Chinook salmon stocks in the Nushagak/Mulchatna drainage are considered to be stable at average, or slightly above average, levels.

Harvest of chinook salmon by the recreational fishery from 1994 through 1998 averaged 6,058 fish (Table 11). Distribution of the harvest between user groups, as shown in Table 12, shows the majority (83%) of the harvest has historically been taken by commercial fishermen, with an additional 11% taken by the subsistence fishery, and 6% by sport anglers.

Table 11.-Chinook salmon commercial, subsistence, and sport harvest plus escapement for the Nushagak drainage, 1986-1999.

Year	Total Run	Harvests Below Sonar				Inriver Sonar estimate	Harvests Above Sonar		Spawning Escapement	
		Commercial Harvest ^a	Commercial Subsistence Removals ^b	Subsistence Harvest ^c	Sport Harvest ^d		Subsistence Harvest ^e	Sport Harvest ^f	Sonar Estimate ^g	Aerial Survey Estimate ^h
1986	122,226	65,783	798	6,834	628	43,434	4,725	4,162	34,547	
1987	144,258	45,983	318	7,919	1,286	84,309	3,139	3,173	77,997	
1988	82,946	16,648	528	4,911	1,192	56,905	4,037	1,626	51,242	
1989	106,438	17,637	632	4,898	1,404	78,302	2,217	2,210	73,875	
1990	90,381	14,812	1,197	6,228	797	63,955	3,325	2,689	57,941	
1991	140,259	19,718	1,971	6,907	1,793	104,351	3,127	3,758	97,466	
1992	145,362	47,563	907	7,688	1,844	82,848	2,499	2,911	77,438	
1993	181,425	62,976	1,867	10,552	2,408	97,812	2,919	3,492	91,401	
1994	240,157	119,480	1,126	8,587	4,436	95,954	3,775	6,191	85,989	
1995	182,695	79,943	1,327	8,672	2,238	85,622	2,420	2,713	80,489	
1996	142,116	72,011	730	9,598	2,346	52,127	3,055	3,045	46,027	
1997	164,863	64,294	544	8,328	931	40,705	3,192	2,567		82,000
1998	239,376	108,486	805	5,682	1,640	117,495	4,440	4,188	108,868	
1986-1998 Average	152,500	56,564	981	7,447	1,765	77,217	3,298	3,286	73,607	
1994-1998 Average	193,841	88,843	906	8,174	2,318	78,381	3,376	3,740	80,343	
1999	83,560	11,008	863	4,918	934	62,331	2,477	3,304	56,551	

^a Total Nushagak District commercial harvest. Sources: 1967-1970 ADF&G 1987, Appendix Table 39; 1971-1998 ADF&G 1991, Appendix Table 6; 1979-1999 ADF&G 2000, Appendix Table 6.

^b Nushagak Bay Commercial Harvest from Subsistence Division Subsistence Database. Source: ADF&G Subsistence Division, Subsistence Database from Charles Utermohle, Program Coordinator, Subsistence Division, Region II, Anchorage, November 20, 2000.

^c Includes Nushagak Bay and Igushik. Source: ADF&G Subsistence Division, Subsistence Database from Charles Utermohle, Program Coordinator, Subsistence Division, Region II, Anchorage, November 20, 2000.

^d 1977-1996 is 50% of Nushagak River System sport harvest. 1997-1999 is 50% of Nushagak River Black Point to Iowithla. Source: Mills 1978-1994, Howe et al. 1995 and 1996, and *In prep* a, b, c, and d.

^e Includes Ekwoq area, Iowithla River, Klutuk River, Koliganek area, New Stuyahok area, Portage Creek area, Kokwok area, Mulchatna River, and Nushagak watershed site unknown. Source: ADF&G Subsistence Division, Subsistence Database from Charles Utermohle, Program Coordinator, Subsistence Division, Region II, Anchorage, November 20, 2000.

^f 1977-1996 is 50% of Nushagak River System Sport Harvest, plus Mulchatna River System, Tikchik/Nuyakuk, and Kuktuli River harvest reported in Mills 1979-1994 and Howe et al. 1995 and 1996. 1997-1999 is 50% of Nushagak River Black Point to Iowithla, Nushagak upstream of Iowithla, Mulchatna River System, Tikchik/Nuyakuk and Kuktuli River from Howe et al. *In prep* a, b, c, and d

^g 1986-1996, and 1998-1999 estimates are sonar estimates minus subsistence and sport harvest above sonar.

^h Source: ADF&G 2000.

Table 12.-Commercial, subsistence, and sport harvest of Nushagak River chinook salmon, 1966-1999.

Year	Commercial Harvest ^a	Commercial		Subsistence Harvest ^c	Sport Harvest ^d	Total Harvest
		Subsistence Removals ^b				
1966	58,184			3,700		61,884
1967	96,240			3,700		99,940
1968	78,201			6,600		84,801
1969	80,803			7,100		87,903
1970	87,547			6,300		93,847
1971	82,769			4,400		87,169
1972	46,045			4,000		50,045
1973	30,470			6,600		37,070
1974	32,053			7,900		39,953
1975	21,454			7,100		28,554
1976	60,684			6,900		67,584
1977	85,074			5,000	923	90,997
1978	118,548			6,500	442	125,490
1979	157,321			8,700	654	166,675
1980	64,958			11,500	757	77,215
1981	193,461			11,100	1,220	205,781
1982	195,287			12,000	1,803	209,090
1983	137,123	372		10,244	2,003	149,742
1984	61,378	650		8,335	2,320	72,683
1985	67,783	174		7,274	1,838	77,069
1986	65,783	798		11,559	4,790	82,930
1987	45,983	318		11,058	4,458	61,817
1988	16,648	528		8,948	2,817	28,942
1989	17,637	632		7,116	3,613	28,997
1990	14,812	1,197		9,554	3,486	29,049
1991	19,718	1,971		10,034	5,551	37,274
1992	47,563	907		10,187	4,755	63,412
1993	62,976	1,867		13,471	5,899	84,213
1994	119,480	1,126		12,362	10,626	143,594
1995	79,943	1,327		11,092	4,951	97,313
1996	72,011	730		12,654	5,390	90,784
1997	64,294	544		11,520	3,497	79,855
1998	108,486	805		10,121	5,827	125,239
1966-98 Average	75,476	981		8,625	3,528	86,876
1994-98 Average	88,843	906		11,550	6,058	107,357
Percent	83%	1%		11%	6%	
1999	11,008	863		7,395	4,237	23,503

^a Total Nushagak District commercial harvest. Sources: 1967-1970 ADF&G 1987, Appendix Table 39; 1971-1998 ADF&G 1991, Appendix Table 6; 1979-1999 ADF&G 2000, Appendix Table 6.

^b Nushagak Bay Commercial Harvest from Subsistence Division Subsistence Database. Source: ADF&G Subsistence Division, Subsistence Database from Charles Utermohle, Program Coordinator, Subsistence Division, Region II, Anchorage, November 20, 2000.

^c 1966-1976 total Nushagak District harvest. Source: ADF&G 1991, Appendix Table 46. 1977-1982 includes Nushagak Bay and Nushagak System. Sources: ADF&G 1981 a, b, c, and d, ADF&G 1982 and 1983. 1983-1999 includes Igushik, Nushagak Bay, Nushagak River, and Nushagak watershed site unknown. Source: ADF&G Subsistence Division, Subsistence Database from Charles Utermohle, Program Coordinator, Subsistence Division, Region II, Anchorage, November 20, 2000.

^d Nushagak River system, Mulchatna River system, Tikchik/Nuyakuk system, and Kuktuli River harvest reported in Mills 1979-1994, Howe et al. 1995 and 1996, and *In prep* a, b, c, and d.

In 1998, all users of this resource were quite happy and well supplied with chinook salmon. By July 6 the inriver goal had been met, the sport fishery remained very good, and it was clear the sport fishery would not be restrained by the 5,000 fish guideline harvest. In addition, it appeared the new regulatory package for the sport fishery was working as anticipated. An estimated total of 5,827 chinook salmon were harvested in the Nushagak and Mulchatna drainage sport fishery (Table 11). Most surprising was the relatively low harvest of only 265 chinook salmon in the Mulchatna drainage (Table 7). This may have been a response to the numerous closures and disruptions to this fishery in the previous few seasons.

Management

Sport harvest and effort are estimated through the Statewide Harvest Survey and reported by Mills (1979-1994) and Howe et al. (1995 and 1996, *In prep* a, b, and c). Commercial and subsistence harvests are monitored by the Commercial Fisheries Division and are reported in their Annual Management Report series (ADF&G 2000). Sport Fish Division has conducted significant monitoring and stock assessment projects in the recent past (Minard 1987b, Minard and Brookover 1988c, Dunaway et al. 1991, Dunaway and Bingham 1992a, Dunaway and Fleischman 1995b, and Minard et al. 1998).

Under the Nushagak and Mulchatna Chinook Salmon Management Plan (5 AAC 06.361, adopted 1/92; amended 12/94 and 11/97) chinook salmon are managed to attain an inriver return of 75,000 fish which provides 65,000 spawning fish, a reasonable opportunity to harvest chinook salmon in the inriver subsistence fishery, and a guideline harvest in the sport fishery of 5,000. If the inriver return exceeds 75,000, then the guideline sport harvest does not apply. If the inriver return falls below 55,000, then restrictive actions are called for in the sport fishery. If the inriver return falls below 40,000, the sport fishery is to be closed.

Chinook salmon escapement into the Nushagak and Mulchatna rivers was first estimated by aerial survey from 1966 through 1986. Starting in 1987, side scan sonar was used to estimate the chinook salmon inriver return to the Nushagak drainage. The sonar is considered a marked improvement over the aerial survey program since it gives real-time estimates of escapement on which management decisions can be based. In 1997, the sonar apparently underestimated the chinook salmon escapement by half. This was evidenced by escapement estimates based on aerial surveys of between 80,000 and 85,000, compared to the sonar estimate of only 26,000 chinook salmon. To address this issue in 1997 and 1998, the Commercial Fisheries Division conducted an extensive test-netting program across the full width of the river at the sonar site. Results of the test net project showed clearly that the sonar counter does not count a significant number of chinook salmon (Miller 1999). Test netting in 1999, when water levels were lower than the test period in 1998, produced the same results (Miller 2000). Based on only 3 years of data, it appears that the sonar counts of chinook salmon are significant underestimates of the number of chinook salmon returning to the Nushagak. However, if data from these 3 years are representative, the counts may be a consistent index of the escapement (Miller 2000). In 1994-1996 and 1998, spawning escapements estimated by sonar averaged 80,343 chinook salmon (Table 11), very close to the desired 75,000 inriver run goal.

Since 1972, declining stock abundance and increasing sport effort have prompted restrictive actions on the inshore commercial and sport fisheries. A chronology of significant regulation changes follows:

- 1965. Bristol Bay bag and possession limits were 10 salmon (all species combined) daily.
- 1972. Bag limits for the Bristol Bay area were dropped to 5 chinook salmon per day and in possession, of which only 2 could be over 26 inches in length.
- 1987. Bag and possession limits dropped to 3 per day, only 2 over 28 inches in length.
- 1990. Sport season established from January 1 to July 25 upstream of and including the Iowithla River. Spawning season closure adopted to afford drainage-wide protection to spawning chinook salmon stocks.
- 1992. Gear restricted to single-hook artificial lures for the portion of the Mulchatna River between the Kuktuli and Stuyahok rivers.
- 1992. Nushagak and Mulchatna Chinook Salmon Management Plan (5 AAC 06.361) is adopted, capping the sport harvest at 5,000 fish and establishing an escapement projection of 65,000 as the trigger for inseason restrictions in the sport fishery.
- 1994. Nushagak and Mulchatna Chinook Salmon Management Plan (5 AAC 06.361) is amended, setting the sport allocation as a guideline harvest rather than a cap.
- 1997. Nushagak and Mulchatna Chinook Salmon Management Plan (5 AAC 06.361) was amended, by establishing an escapement projection of 55,000 chinook salmon below which inseason restrictions in the sport fishery must be imposed. Daily bag and possession limit is reduced to 2 chinook per day, only 1 over 28 inches. Guides were prohibited from retaining any species of fish while guiding (bay-wide). An annual harvest limit of 4 chinook salmon was adopted for Nushagak/Mulchatna drainage. The Kokwok River and the Nushagak River upstream from its confluence with Harris Creek were closed to angling for chinook salmon. A July 31 spawning season closure was adopted for the Nushagak River downstream from the Iowithla River outlet. The commercial fishery was to be managed to allow pulses of the run to enter the Nushagak River untouched.

Bag and possession limits for Nushagak chinook salmon are currently 2 per day, 1 of which may be over 28 inches (ADF&G 1998b).

Uplands along much of the Nushagak River are privately owned. A recreational land management program is administered by the Land Department of Choggiung Limited, an Alaska Native-owned corporation. Since its inception in the mid-1980s, this program has grown to include the lands of the adjoining villages of Ekwok, New Stuyahok and, in some years, Koliganek. This system has matured into a sound and profitable venture for the corporations. Private and commercial land-use permits sold by the program allow anglers access to desirable campsites while engaged in recreational fishing and hunting. Sales and estimates of camper nights are useful indicators of sport effort. Overnight use rose from 1,365 camper nights in 1989 to 4,939 camper nights from June 15 to July 15, 1998. Thirty-four commercial camps were permitted in 1999.

Management Objectives

The Nushagak/Mulchatna chinook salmon fishery is managed in accordance with the Nushagak and Mulchatna Chinook Salmon Management Plan. Specific objectives are to: (1) manage the commercial

fishery to ensure an inriver return of 75,000 fish; (2) manage the inriver fisheries for a biological escapement goal of 65,000 spawners; and (3) manage the sport harvest for a guideline harvest of 5,000 fish.

1999 Season

The 1999 Nushagak district chinook salmon total return forecast was 214,000 fish, which was 11% greater than the recent 10-year average. Harvest potential in the sport fishery, given an inriver abundance of 75,000 fish and the new regulation package, was expected to stay within the 5,000 chinook salmon guideline harvest level.

In contrast to 1998, the 1999 chinook salmon return was very poor. Poor escapements resulted in three emergency orders. The first, on June 30, reduced the seasonal Nushagak chinook bag limit to two. The second, on July 2, closed the chinook salmon sport fishery. The third, on July 6, reopened the sport fishery, with a seasonal limit of two. The final sonar inriver return estimate was 62,331 (Miller 2000). Aerial surveys in early August counted 18,152 chinook salmon in the Nushagak/Mulchatna drainage (Table 13), resulting in an escapement estimate between 58,000-68,000 fish (ADF&G 2000). The total run estimate was only 83,560, the lowest estimate since 1988 (Table 11). The preliminary estimate of 1999 sport harvest from the Nushagak/Mulchatna drainage is below the 1994-1998 average, at 4,240 fish (Table 12).

2000 Outlook

The 2000 chinook salmon Commercial Fisheries forecast for the Nushagak and Mulchatna drainage calls for a total return of 101,000 fish, with a range from 31,000 to 171,000 fish. If the 2000 run develops as forecast it will be the fourth smallest run and harvest in the last 20 years, and third smallest run and harvest in the last 10 years. Age class 4 and 5 fish are expected to dominate the return (44% and 43%, respectively).

Management of the 2000 fisheries (sport, commercial, and subsistence) will be according to the "Nushagak/Mulchatna Chinook Salmon Management Plan" which calls for managing the commercial fishery to allow 75,000 chinook salmon into the river. If the run develops as forecast, we don't expect to have any directed commercial openings. The Nushagak Bay subsistence harvest and chinook harvest incidental to the commercial sockeye fishery is likely to account for most or all of the 26,000 fish surplus to the 75,000 inriver goal.

The sport fishery will be managed to provide for a spawning escapement of 65,000 chinook salmon and a guideline harvest of 5,000 fish. To remain within the 5,000 fish guideline, the daily bag and possession limit is two (2) chinook salmon per day, of which only one (1) may be longer than 28 inches in length. Additionally there is a seasonal limit of 4 chinook salmon taken from the Nushagak River watershed, including all tributaries, and harvests must be recorded immediately. Guides may not retain fish while guiding.

Given the total run forecast of 101,000 chinook salmon and the very poor showing of the 1999 run, ADF&G will be taking a very cautious management approach in the 2000 season. No preseason emergency restrictions are anticipated, but chinook salmon anglers are warned that inseason restrictions will be announced if the inriver return does not achieve the goals established in the management plan.

Table 13.-Historic aerial escapement index counts of chinook salmon in selected streams in the Wood, Nushagak and Mulchatna drainages, 1967 to 1999.

Year	Wood R.		Nushagak and Mulchatna drainages							Total
	Muklung River	Iowithla River	Kokwok River	Klutuspak River	King Salmon River	Stuyahok River	Koktuli River	Nushagak River ^a	Mulchatna River ^b	
1967	350	200				2,500	3,300			6,000
1968 ^c	750	850		310	1,000	2,470	4,220	970	510	10,330
1969	520	580	90 ^c	90	670	1,220	1,600	910 ^c	680 ^d	5,840
1970	590	700	110 ^c	320	1,060	1,900	1,500	1,180 ^c	880 ^d	7,650
1971	280	390	80 ^c							470
1972	150	170		280	900	610	1,450	690 ^c	510 ^d	4,610
1973				380	1,470	1,220	950			4,020
1974 ^c	1,010	860	60 ^c	440	2,000	2,300	3,920	2,340	2,160	14,080
1975	660	1,040	270	670	2,900	2,530	4,080	2,320 ^c	1,710 ^d	15,520
1976 ^c	840	1,110	560	1,180	3,510	3,750	6,710	1,760	2,580	21,160
1977 ^c	940	840	310	650	1,420	2,700	4,630	820	1,980	13,350
1978 ^c	1,170	1,700	520	1,940	4,450	4,400	6,730	5,850	2,280	27,870
1979 ^c	950	1,350	170	1,040	2,150	3,570	6,260	2,880	1,730	19,150
1980	1,600	2,310 ^d	70	970	4,500	7,200	10,620	5,300 ^c	3,920 ^d	34,890
1981	2,260	2,630	70	1,650	2,950	5,980	9,960	4,960 ^c	3,670 ^d	31,870
1982	790	2,520	90	350	8,390	3,640	6,780	4,380 ^c	3,240 ^d	29,390
1983 ^c	1,830	2,430	350	2,090	5,990	2,910	8,060	6,330	4,260	32,420
1984 ^c	1,300	1,080	110	770	1,780	2,010	2,860	2,800	1,060	12,470
1985	1,250	1,610	60	1,950	4,460	2,690	4,940	3,420 ^c	2,390 ^d	21,520
1986	230	270		170	380	520	290	380 ^c	260 ^d	2,270
1987	160	140		340	570	280	440	390 ^c	270 ^d	2,430
1988	430	550		780	1,380	2,040	2,580	1,800	710	9,840
1989						190 ^c	240 ^c			430
1990 ^e	60	120		340	900	830	3,390	630	800	7,010
1995 ^e	210	170	75	630	3,150	660	2,230			6,915
1997 ^f	1,240	640		1,190	8,900	1,460	6,220	21,818	1,496	41,724
1998	150 ^g		150 ^g	2,620	5,510	550 ^g	720	8,390	180 ^g	18,120
1999	95	450	145	1,545	6,825	645	2,075	6,467		18,152
Mean	762	988	183	908	3,089	2,251	3,954	3,773	1,694	16,840

^a Nushagak River from the outlet of the Nuyakuk River to outlet of King Salmon River (to Big Bend in 1997).

^b Mulchatna River from the outlet of Mosquito Creek to the outlet of the Koktuli River (to outlet of Stuyahok River in 1997).

^c Minimal estimate - very poor survey conditions.

^d These numbers are proportional estimates rather than aerial counts; estimates are based on the mean proportion of fish counted in these areas during year in which aerial coverage was complete.

^e No surveys conducted from 1991 through 1994, or in 1996.

^f Survey conditions in 1997 excellent, water very clear and very low.

^g Surveys conducted 8/11/98, well past peak of spawning. Remaining surveys conducted 7/29/98, before peak of spawning.

KANEKTOK RIVER

Fishery Description

The majority of the chinook salmon fishery occurs in the lower 12 miles of the Kanektok River (Figure 9) in the vicinity of the village of Quinhagak. The fishery peaks in late June and early July, slightly earlier than the fisheries further to the east. Because of its relatively small size, clear water, and consistent returns of chinook salmon, the Kanektok River is considered one of the finest chinook salmon sport fisheries in western Alaska.

Historical Performance

Harvest estimates for the Kanektok River sport fishery date back to 1983 and range from a high of 1,910 fish in 1988 to a low of 316 fish in 1991 (Table 14). The average sport harvest for the recent 5 years (1994 to 1998) was 1,065 fish (Table 14). Distribution of the harvest between user groups has been relatively unchanged over the past 30 years. The commercial fishery accounts for about 80% of the harvest, with the subsistence fishery taking an additional 15%, and the sport fishery harvesting about 5% (Table 14). The sport fishery is characterized by a relatively low retention rate (43% in 1986, 20% in 1987, 25% in 1991), and a high proportion of guided anglers (62% in 1991, 32% in 1994, 48% in 1999). The use of bait has been prohibited since 1997, but even prior to that, bait was not commonly used in this fishery (Minard 1987c, Minard and Brookover 1988b, Dunaway and Bingham 1992b, Dunaway and Fleischman 1995a, Naughton and Gryska *In prep*).

Management

Sport harvest and effort are estimated through the Statewide Harvest Survey and reported by Mills (1979-1994) and Howe et al. (1995 and 1996, *In prep* a, b, and c). Commercial and subsistence harvests are managed by the Commercial Fisheries Division in Bethel and are reported in their Annual Management Report series (Burkey et al. 1997, 1998, 1999a, 1999b, and 2000). The Sport Fish Division has conducted significant monitoring and stock assessment projects in the recent past (Minard 1987c, Minard and Brookover 1988b, Dunaway and Bingham 1992b, Dunaway and Fleischman 1995a, Naughton and Gryska *In prep*). The U.S. Fish and Wildlife Service has collected age and size data from chinook salmon spawning in the Kanektok River since 1994 (Lisac and MacDonald 1995, MacDonald 1996).

Escapement of chinook salmon into the Kanektok River is estimated by aerial survey from fixed-wing aircraft. Counts are left unexpanded and represent minimum escapement estimates. Since 1960, the escapement goal of 5,800 chinook salmon has been reached 50% of the time.

A chronology of significant regulation changes follows:

1965. Kuskokwim drainage chinook salmon limit was set at 15 per day, 30 in possession.
1985. Bag and possession limits for chinook salmon were dropped to 5 chinook salmon with no size limit.
1988. Bag and possession limits were again dropped to the current limit of 3 chinook per day, of which only 2 can be 28 inches or larger.
1997. May 1 to July 25 season established to protect spawning fish. Gear restricted to single-hook artificial lures only year-round.

Table 14.-Chinook salmon commercial, subsistence, and sport harvest plus escapement for the Kanektok River, 1960 to 1999.

Year	Harvest				Escapement	
	Commercial ^a	Subsistence ^b	Sport	Total	Index ^c	Total Run
1960	0			0	6,047	6,047
1961	4,328			4,328		
1962	5,526			5,526	935	6,461
1963	6,555			6,555		
1964	4,081			4,081		
1965	2,976			2,976		
1966	278			278	3,718	3,996
1967	0	1,349		1,349		
1968	8,879	2,756		11,635	4,170	15,805
1969	16,802			16,802		
1970	18,269			18,269	3,112	21,381
1971	4,185			4,185		
1972	15,880			15,880		
1973	14,993			14,993	814	15,807
1974	8,704			8,704		
1975	3,928			3,928		
1976	14,110			14,110		
1977	19,090	2,012		21,102	5,787	26,889
1978	12,335	2,328		14,663	19,180	33,843
1979	11,144	1,420		12,564		
1980	10,387	1,940		12,327	6,172	18,499
1981	24,524	2,562		27,086	15,900	42,986
1982	22,106	2,402		24,508	8,142	32,650
1983	46,385	2,542	1,511	50,438	8,890	59,328
1984	33,633	3,109	922	37,664	12,182	49,846
1985	30,401	2,341	672	33,414	13,465	46,879
1986	22,835	2,682	938	26,455	3,643	30,098
1987	26,022	3,663	508	30,193	4,223	34,416
1988	13,883	3,690	1,910	19,483	11,140	30,623
1989	20,820	3,542	884	25,246	7,914	33,160
1990	27,644	6,013	503	34,160	2,563	36,723
1991	9,480	3,693	316	13,489	2,100	15,589
1992	17,197	3,447	656	21,300	3,856	25,156
1993	15,784	3,368	1,006	20,158	4,670	24,828
1994	8,564	3,995	751	13,310	7,386	20,696
1995	38,584	2,746	739	42,069		
1996	14,165	3,075	728	17,968	6,107	24,075
1997	35,510	3,433	1,632	40,575	8,080	48,655
1998	23,158	4,041	1,475	28,674		
1960-1998 Average	15,722	3,006	947	19,675	6,808	28,177
Percent	80%	15%	5%			
1994-1998 Average	23,996	3,458	1,065	28,519	7,191	31,142
Percent	84%	12%	4%			
1999 ^e	18,426	3,167	917	22,510	1,118	23,628
Percent	82%	14%	4%			

Sources: Escapement and commercial harvest information from Burkey et al. 2000.

^a Quinhagak District commercial harvest.

^b Unexpanded observed count made from fixed-wing aircraft between July 20 and August 5.

^c 1999 sport harvest preliminary. Escapement survey occurred before peak.

^d 1982 escapement survey after August 5, late for chinook salmon.

^e 1999 sport harvest preliminary. Escapement survey on July 14, before peak.

Management Objectives

The Kanektok River chinook salmon fishery is managed to achieve escapement of 5,800 chinook salmon, indexed by aerial survey. The department, USF&WS, and Coastal Villages Corporation (formed to receive federal community development quotas from the Bering Sea trawl fisheries) are working with the local community of Kwinhagak to develop a weir to allow better assessment of salmon escapement into the drainage. Construction was due to start in 1999, but was delayed until late in the season.

1999 Season

The total 1999 return of chinook salmon to the Kanektok was approximately 23,630 fish (Table 14). Commercial and subsistence harvests were about average, at 18,426 and 3,167, respectively. Sport harvest was 917, also similar to the recent 5-year average (Table 14). The escapement index count was only about 1,000 fish, but this count was conducted before the peak of the chinook salmon run, so probably is not an accurate index.

2000 Outlook

We project an average to below average run for the 2000 season. Most of the 2000 return will be the product of escapements observed in 1993-1996. Of the four parent years contributing to the 2000 return, the 1993 escapement was below desired levels and 1994-1996 measured escapements were at or slightly above desired levels. Based on parental escapements, average or slightly below average returns are expected for age-7 fish. Even though returns of age-3 through age-5 fish should be average in 2000, their parent years did not produce well in 1999 and the trend may continue in 2000. Performance of the subsistence and commercial fisheries (and possibly weir counts) will be used as indicators of run strength. We will attempt to implement any adjustments early enough in the season so that sport fishing opportunity will be preserved throughout the season.

The USF&WS, ADF&G and Coastal Villages Corporation are hoping to install a weir in the lower river during the 2000 season. The weir is expected to provide good estimates of salmon escapement and enhance the management of the fisheries of this fine river.

TOGIAK RIVER

Fishery Description

The Togiak River (Figure 9) is one of three major river systems within the Togiak National Wildlife Refuge. The relatively small chinook salmon sport fishery on the Togiak River is concentrated along the lower 15 miles of the river and runs from mid-June through the month of July. The Togiak River supports the second largest chinook salmon run in Bristol Bay, but its remote location, refuge regulations on guides, and ongoing friction between user groups have limited development of the fishery.

Historical Performance

Commercial harvests of Togiak River chinook salmon averaged 18,504 fish from 1969 to 1998, but in the recent 5 years have averaged only 9,291 (Table 15). Subsistence harvests have remained relatively stable, averaging 630 fish since 1974, and 655 fish from 1994 through 1998 (Table 15). From 1994 through 1998, sport harvests averaged 685 fish (Table 15), 6% of the total harvest by all fisheries. Commercial harvest accounted for an average of 87% of the total harvest, and subsistence 6%. Total run estimates were first made in 1980, coincident with high abundance of western Alaska

chinook salmon stocks. Total run declined from the mid-1980s, dropping to almost half that previously observed. Given the performance of other chinook salmon fisheries in the area, this was likely a shift to more normal levels of production. From 1994 through 1998, total runs averaged 21,936 fish (Table 15).

Management

Sport harvest and effort are estimated through the Statewide Harvest Survey and reported by Mills (1979-1994) and Howe et al. (1995 and 1996, *In prep* a, b, and c). Commercial and subsistence harvests are monitored by the Commercial Fisheries Division and are reported in their Annual Management Report series (ADF&G 2000). Sport Fish Division has conducted significant monitoring and stock assessment projects in the recent past (Minard and Lisac 1984, Dunaway 1990b).

Escapement of chinook salmon into the Togiak River has been estimated by aerial survey from fixed-wing aircraft since 1980. Aerial counts are expanded to account for missed fish and therefore represent total escapement estimates. The escapement goal for Togiak chinook salmon, established in 1984, is 10,000. From 1987 to 1992 estimated escapement was less than the escapement goal (Table 15). The goal has been achieved 6 of the 8 years since 1992. Escapements from 1994 through 1998 averaged 11,305 fish. Reduced commercial fishing time during the last half of June is primarily responsible for the improved escapement levels. Since 1992, commercial fishing time has been reduced from 5 days per week to 1 or 2 days per week. Based upon the balance between commercial harvest and escapement, it appears this new schedule is sustainable, while the previous one was not.

The Alaska Board of Fisheries adopted several regulation changes that affected the Togiak chinook salmon sport fishery in 1998. The May 1 through July 31 chinook salmon sport fishery season was established by the Board of Fisheries during the winter of 1997/1998. The season is closed the remainder of the year to protect spawning fish. The same Board meeting resulted in an annual limit of 5 chinook salmon for sport anglers throughout Bristol Bay waters. Anglers are now required to immediately record location and date of each chinook salmon harvested. In addition, guides are no longer allowed to harvest fish while guiding. These measures were designed to moderate the short harvest throughout the Bristol Bay drainage and to spread the harvest among more anglers.

Management Objectives

The Togiak River chinook salmon sport fishery is managed to achieve a biological escapement goal (BEG) of 10,000 chinook salmon. The annual escapement is estimated by expanded aerial survey counts.

1999 Season

From 1994 through 1998, the total return of chinook salmon averaged 21,936 fish, and the 1999 return was expected to be similar or a little better.

The commercial fishery was managed similarly to recent years, with reductions from the “normal” weekly schedule of 96 hours. Only 48 hours per week were allowed in each of the last 2 weeks of June. The total commercial harvest in the Togiak Section of the Togiak District was 10,817 chinook salmon, close to the previous 5-year average (Table 15).

Table 15.-Escapement and commercial, subsistence, and sport harvests of chinook salmon from the Togiak River, 1969-1999.

Year	Harvest			Total	Escapement ^d	Total Run
	Commercial ^a	Subsistence ^b	Sport ^c			
1969	20,092					
1970	28,618					
1971	26,105					
1972	17,099					
1973	9,225					
1974	9,284	1,200				
1975	7,206	800				
1976	28,513	500				
1977	33,827	400	62	34,289		
1978	53,460	300	35	53,795		
1979	28,677	200	78	28,955		
1980	10,858	900	34	11,792	8,045	19,837
1981	22,744	400	0	23,144	12,435	35,579
1982	33,607	400	231	34,238	6,800	41,038
1983	35,669	700	535	36,904	10,975	47,879
1984	19,958	600	87	20,645	19,085	39,730
1985	33,110	600	224	33,934	12,010	45,944
1986	16,267	700	525	17,492		
1987	14,555	700	137	15,392	7,170	22,562
1988	13,212	429	0	13,641	6,390	20,031
1989	9,049	551	234	9,834	6,640	16,474
1990	9,651	480	172	10,303	6,473	16,776
1991	6,019	470	284	6,773	8,380	15,153
1992	11,806	1,361	271	13,438	7,410	20,848
1993	10,054	784	225	11,063	10,210	21,273
1994	9,350	904	663	10,917	15,117	26,034
1995	10,768	448	581	11,797	12,600	24,397
1996	8,113	471	790	9,374	8,299	17,673
1997	5,357	667	1,165	7,189	10,300	17,489
1998	12,867	782	763	14,412	9,856	24,268
1960-1998 Average	18,504	630	323	19,456	9,900	26,277
Percent	95%	3%	2%			
1994-1998 Average	9,291	655	685	10,631	11,305	21,936
Percent	87%	6%	6%			
1999 ^e	10,817	1,244	700	12,761	9,520	22,281
Percent	85%	10%	5%			

^a Togiak Section commercial harvest. Source: ADF&G, CFD Fish Ticket Database, Jobs 23080 and 23078 requested by Saree Timmons, October 19, 2000. Does not include salmon kept for personal use.

^b Togiak District subsistence harvest. Sources: 1974-78 ADF&G 1991, Appendix Table 46; 1979-1999 ADF&G 2000, Appendix Table 31.

^c Sport harvest from Togiak River System.

^d Togiak River Drainage total, estimated by aerial survey and expanded for missed fish. Biological escapement goal is 10,000 fish.

^e 1999 sport harvest data are preliminary.

The subsistence harvest was 1,244 chinook salmon, well above the previous 5-year average of 655. The preliminary estimate of 1999 sport harvest from the Togiak River System is 700 chinook salmon (Table 15).

Aerial surveys estimated 9,520 chinook salmon escaped to spawn (Table 15), essentially achieving the 10,000 fish biological escapement goal.

2000 Outlook

From 1994-1998, the total return of chinook salmon averaged 21,936 fish; the 2000 return is expected to be similar or a little smaller. Escapements for three of the major parent years met or exceeded the 10,000-fish biological escapement goal while the 1996 escapement was 1,700 fish below the goal. However, the relatively poor returns of kings throughout Bristol Bay in 1999 mean the parent year escapements did not reproduce well and suggest the 2000 return could be below average as well, which makes for an about average sport fishery.

Based strictly on the parental escapements of 1993-1996, the 7- and 5-year-old return should be average, 6-year-old fish could be above average, and the 4-year-old component should be below average. The bulk of the catch will consist of modest-sized chinook salmon with a chance of a few larger fish being available.

Management of the commercial fishery is expected to include a restricted fishing schedule during the last half of June, which should provide a balance between commercial harvest opportunity and escapement. The sport fishery will commence under the published regulations, and, as in the past, performance in the commercial, subsistence, and sport fisheries as well as aerial surveys will be used to gauge run strength inseason. Inseason restrictions to the sport fishery may be necessary if run strength appears insufficient to achieve the escapement goal, but we will attempt to implement them early enough to preserve some sport fishing opportunity throughout the season.

NORTHWESTERN CHINOOK SALMON FISHERIES

The Kuskokwim River and its tributaries host large runs of chinook salmon, but the broad muddy waters of the main river and limited access to the tributaries within the management area attract a very small number of sport anglers. No estimates of sport harvest are available before 1983, and since 1984 most of the chinook salmon harvest has come from the Aniak River. In recent years, roughly 2% to 5% of the SWMA chinook salmon harvest has come from the Northwestern section.

The total run size for Kuskokwim drainage chinook salmon is not known. Escapements into some of the major tributaries are estimated by aerial surveys. A small number of weirs are being operated throughout the drainage to assess salmon escapement. For now, total harvests are one of the few statistics available for this drainage. From 1989 through 1998, the Kuskokwim River (Districts W1 and W2) commercial harvest (an incidental fishery since 1987) averaged 27,238 chinook salmon per year, and subsistence harvests averaged 84,137 fish per year (Burkey et al. 2000). In those 10 years commercial harvests were quite variable, ranging from about 7,000 to as high as 54,000 chinook salmon in a season. By comparison, sport harvests in the Northwestern Area for 1993 through 1997 averaged 816 chinook salmon annually, and exceeded 1,000 fish in 1996 through 1998 (Table 7).

In response to conservation concerns, bag limits for Kuskokwim River chinook salmon were reduced from 5 per day and in possession, no size limit to 1 per day and in possession, no size limit in 1988. By

1994 it was apparent that chinook stocks had recovered sufficiently to allow normal subsistence and above average commercial fisheries to occur; therefore, staff recommended to the Board of Fisheries that the bag and possession limits for these waters be returned to 3 per day and in possession of which only 2 may be greater than 28 inches in length. In November of 1994, the Board adopted those recommended changes to the sport fishery, which became effective in 1995.

Since 1995, sport fishing activity in this section has grown, particularly in the vicinity of Aniak. Growth is also apparent on the Kwethluk, Kisaralik, and Kasigluk rivers. The increased pressure has resulted in calls for more restrictions in the sport fishery to avoid conflicts with the commercial and subsistence fisheries.

During the winter of 1997, the Board of Fisheries established a May 1 through July 25 open season for the recreational chinook salmon fishery in this section. The intent was to protect spawning salmon in the fall. Some gear restrictions were adopted for some Kuskokwim tributaries, and though largely addressing resident species issues, chinook salmon anglers were also affected.

The 1999 return of Kuskokwim River chinook salmon was well below the recent 10-year average. The commercial take was 4,705 chinook salmon (Burkey et al. 2000), the lowest harvest since 1960, due largely to restrictions designed to protect chum salmon. Even with a record late start of the commercial fishery and only one opening during the chinook salmon season, the total Kuskokwim River drainage escapement index goal for chinook salmon was not achieved in 1999. Chinook salmon escapement goals were achieved in only one of three aerial survey index streams (Burkey et al. 2000). The 1999 subsistence take was 77,695 chinook salmon, slightly below the previous 10-year average (Burkey et al. 2000). The preliminary estimate of sport harvest in Kuskokwim River drainages below Aniak in 1999 is 1,411 (Howe et al. *In prep d*).

2000 Outlook

Based upon parent year escapement estimates, the chinook salmon run is expected to be about average or below in 2000. Increasing escapements in 1993-1995 could result in good returns of age-4 to age-6 fish, but the 1999 returns from these parent years were average or below. The modest returns observed in 1999 will have managers watching run strength indicators carefully and proceeding cautiously in 2000.

SECTION IV: COHO SALMON FISHERIES

Coho salmon is a very popular species in Southwest Alaska's recreational fishing industry. Coho salmon fisheries occur from August through September with some isolated pockets of fish available into October. Significant fisheries occur in the Naknek, Alagnak, Nushagak, Mulchatna, Togiak, and Kanektok rivers, as well as a host of smaller, less known waters (Figure 10). Commercial fisherman take the greatest share of the southwest Alaska coho harvest. The Kuskokwim commercial fishery dominates the harvest.

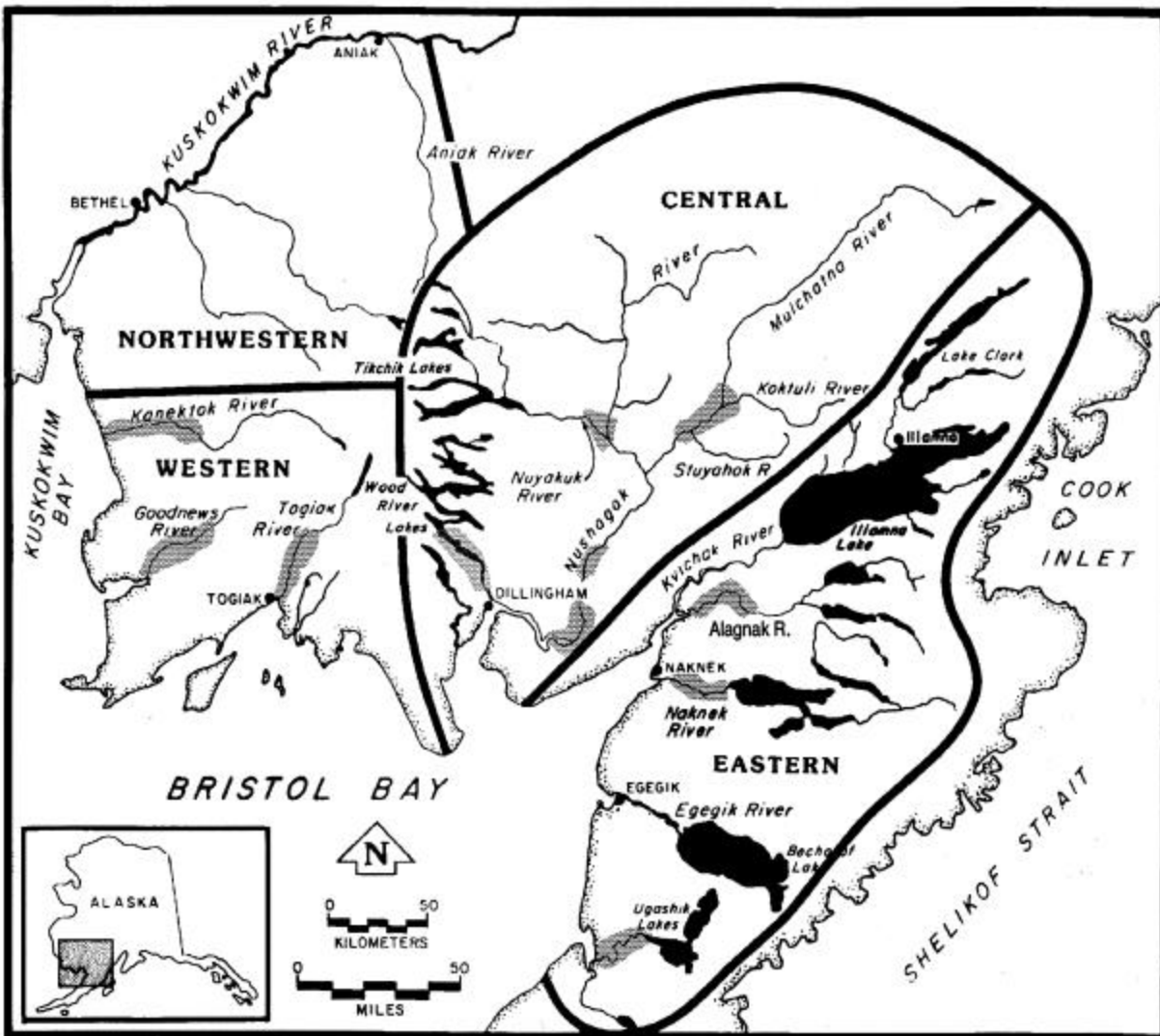


Figure 10.-Popular coho salmon sport fisheries in Southwest Alaska.

During the last 5 years, coho salmon have accounted for approximately 25% of all the salmon harvested by sport fishermen in the SWMA (Table 2). Harvest increased along with sport fishing effort from 1977 to 1996, from fewer than 1,000 fish to almost 19,000 fish (Figure 11). From 1993 through 1997, the average harvest was 11,650 fish areawide (Table 16). In 1998, anglers harvested 10,524 coho salmon.

Many SWMA anglers pursue coho salmon with the assistance of a guide. Annual estimates of harvest (Howe et al. *In prep b*) indicate that despite the 5 fish daily bag limit, coho salmon are harvested in approximately the same total numbers as chinook salmon which have more restrictive bag limits. The mail survey (Howe et al. *In prep b*) also indicates that considerable numbers of coho salmon are caught and released.

Except for the Kvichak River drainage where the daily limit is 2 coho per day and the Alagnak River drainage where the limit is 3 per day, the daily limits for coho salmon are 5 salmon per day, no size limit. The 5 per day limit has been in effect since 1972. The lower limits for the Kvichak and Alagnak drainages were adopted during the 1997 Board of Fisheries meetings (first effective in the 1998 season) to protect the small runs in the Kvichak system and to address modest runs and the large angling effort on the Alagnak River. Some coho salmon returns, particularly in the Central and Western sections, have become very erratic in recent years, precipitating occasional closures or reductions in bag limits for the sport anglers. Except for rare instances, however, limitations on sportsmen have been of little consequence to the strength of the runs that are more heavily impacted by commercial harvests. The lack of escapement data on which to judge the health of the stocks, or base reasonable escapement and harvest goals for all segments of the coho salmon fishery, has become a major concern. The declines observed in some of the area's runs may be the result of excessive harvests in previous years.

NAKNEK RIVER

Fishery Description

In the Naknek River, the coho salmon sport fishery develops in late July and continues well into September. The peak period is normally from August 7 to August 21. Effort is concentrated along a 12-mile stretch of the Naknek River adjacent to the community of King Salmon; but significant and possibly increasing effort occurs upstream from Rapids Camp to Lake Camp. This fishery is the most popular coho salmon fishery in the area and provides significant recreational opportunity and economic benefit for the community of King Salmon. Most anglers in the coho salmon fishery are unguided and are not Alaskan residents (Gryska and Naughton *In prep b*).

Historical Performance

Harvests of coho salmon by the recreational fishery averaged 2,982 fish during 1994-1998, and accounted for 20% to 64% of the total harvest of Naknek River coho salmon (Table 17). Total annual harvest of coho from the Naknek River rose throughout the 1980s (Figure 12). Since 1992, annual harvests have ranged widely from barely 1,000 coho salmon in 1993 to nearly 5,000 in the unusually good season of 1996 (Table 17, Figure 12). The sport fishery has the potential to grow as a result of the construction of several new lodges in the King Salmon area.

In the past, a local commercial fishing venture, the Fall Fishing Cooperative, arranged to provide markets for salmon after the normal sockeye season, resulting in substantial increases in commercial

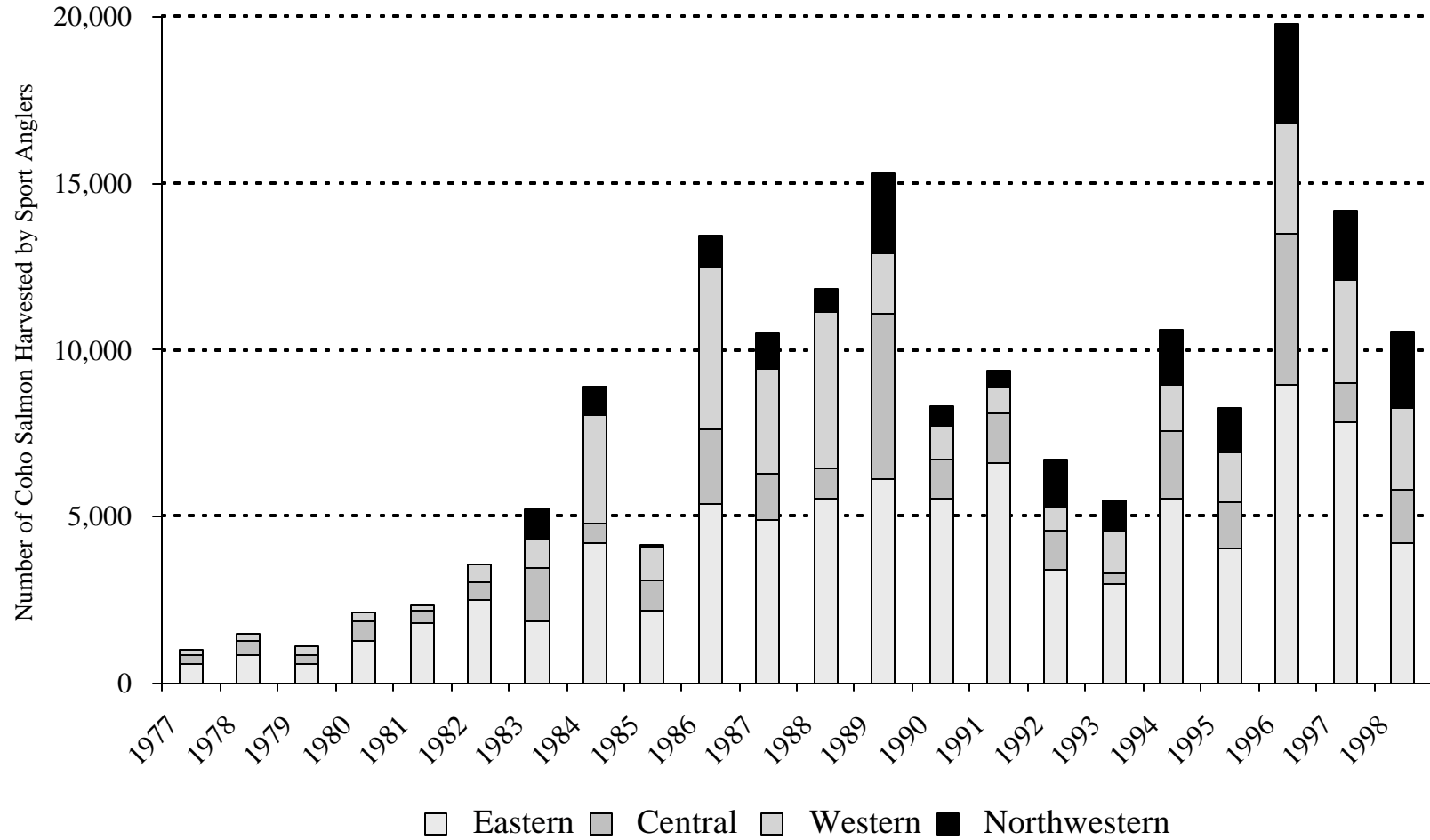


Figure 11.-Sport harvest of coho salmon by section from the Southwest Alaska Management area, 1977 to 1998.

Table 16.-Sport harvest of coho salmon from the waters of Southwest Alaska by fishery, 1977-1998.

Drainage	1977-88										1993-97	
	Average	1989	1990	1991	1992	1993	1994	1995	1996	1997	Average	1998
Eastern												
Naknek R.	1,479	3,092	2,179	4,475	1,579	1,034	1,940	1,788	4,754	3,879	2,679	2,547
Brooks R.	30	52	200	65	24	36	10	141	0	156	69	305
Kvichak R.	139	227	444	329	162	370	553	213	346	535	403	97
Copper R.	0	0	0	0	0	0	0	0	0	22	4	61
Alagnak R.	489	403	194	602	324	246	763	331	1,834	763	787	100
Newhalen R.	136	1,160	467	261	81	444	484	394	20	406	350	77
Lake Clark	1	0	0	102	32	120	0	76	0	110	61	17
Other	509	1,160	2,017	775	1,165	682	1,763	1,105	1,979	1,973	1,500	977
Subtotal	^a 2,619	6,094	5,501	6,609	3,367	2,932	5,513	4,048	8,933	7,844	5,854	4,181
Central												
Nushagak	363	1,586	331	415	445	124	845	521	2,153	237	776	1,033
Mulchatna	176	364	95	437	275	53	230	204	458	111	211	67
Agulowak										89	89	0
Agulukpak										11	11	0
Wood River L.	^b 220	2,417	131	394	275	100	820	450	302	476	430	242
Tikchik/Nuyakuk	60	442	12	22	32	17	50	0	819	78	193	85
Other	30	156	622	241	185	57	93	196	819	130	259	207
Subtotal	^a 848	4,965	1,191	1,509	1,212	351	2,038	1,371	4,551	1,132	1,889	1,634
Western												
Togiak	604	416	367	87	251	330	531	408	1,382	780	686	1,020
Goodnews	239	224	36	297	138	189	170	114	443	855	354	574
Kanektok	1,505	1,096	644	358	275	734	675	970	875	1,220	895	751
Other	136	112	0	0	16	0	0	0	591	245	167	89
Subtotal	^a 1,613	1,848	1,047	742	680	1,253	1,376	1,492	3,291	3,100	2,102	2,434
Northwestern												
Aniak	366	939	182	327	235	213	507	852	957	978	701	1,128
Other	432	1,420	363	195	1,182	712	1,174	466	2,065	1,097	1,103	1,147
Subtotal	^a 738	2,359	545	522	1,417	925	1,681	1,318	3,022	2,075	1,804	2,275
Total	7,712	15,266	8,284	9,382	6,676	5,461	10,608	8,229	19,797	14,151	11,649	10,524

Source: Statewide Harvest Survey databases (Mills 1977-1994, Howe et al. 1995 and 1996, *In prep* a, b and c).

^a Subtotals of averages may not be the sum of the drainages because information for some drainages is not available for some years.

^b Until 1997 Agulowak and Agulukpak rivers were included in Wood River Lakes.

Table 17.-Coho salmon commercial, subsistence, and sport harvest from the Naknek River, 1971 to 1999.

Year	Harvest			
	Commercial ^f	Subsistence ^b	Sport	Total
1971	89	100		
1972	402	100		
1973	255	500		
1974	916	200		
1975	43	200		
1976	1,195	600		
1977	2,883	300	297	3,480
1978	913	300	646	1,859
1979	12,355	1,200	300	13,855
1980	7,802	800	818	9,420
1981	1,229	1,100	1,156	3,485
1982	10,586	1,000	1,676	13,262
1983	7,282	900	1,385	9,567
1984	3,209	600	2,332	6,141
1985	10,474	1,103	1,281	12,858
1986	5,824	650	1,942	8,416
1987	5,274	1,106	2,579	8,959
1988	29,988	813	3,341	34,142
1989	22,668	1,927	3,092	27,687
1990	16,091	726	2,179	18,996
1991	17,527	1,056	4,475	23,058
1992	18,553	1,152	1,579	21,284
1993	1,779	2,025	1,034	4,838
1994	5,877	1,807	1,940	9,624
1995	981	1,791	1,788	4,560
1996	3,601	1,482	4,754	9,837
1997	718	1,457	3,879	6,054
1998	1,587	1,592	2,547	5,726
1971-1998 Average	6,789	950	2,046	11,687
Percent	58%	8%	18%	
1994 to 1998 Avg.	2,553	1,626	2,982	7,160
Percent	36%	23%	42%	
1999 ^c	298	857	3,588	4,743
Percent	6%	18%	76%	

^a Commercial harvests are for the Naknek Kvichak district and therefore include stocks destined for the Kvichak, Alagnak, and Naknek rivers. Source: 1971-1978 ADF&G 1991, Appendix Table 46; 1979-1999 ADF&G 2000, Appendix Table 9.

^b Naknek/Kvichak District total. Subsistence harvests are extrapolated for all permits issued, based on returns. Estimates prior to 1989 are based on the community where the permit was issued; estimates from 1989 to the present are based on the area fished. Estimates prior to 1985 are rounded to the nearest 100 fish. Source: 1971-1978 ADF&G 1991, Appendix Table 9; 1979-1999 ADF&G 2000, Appendix Table 31.

^c 1999 preliminary estimates.

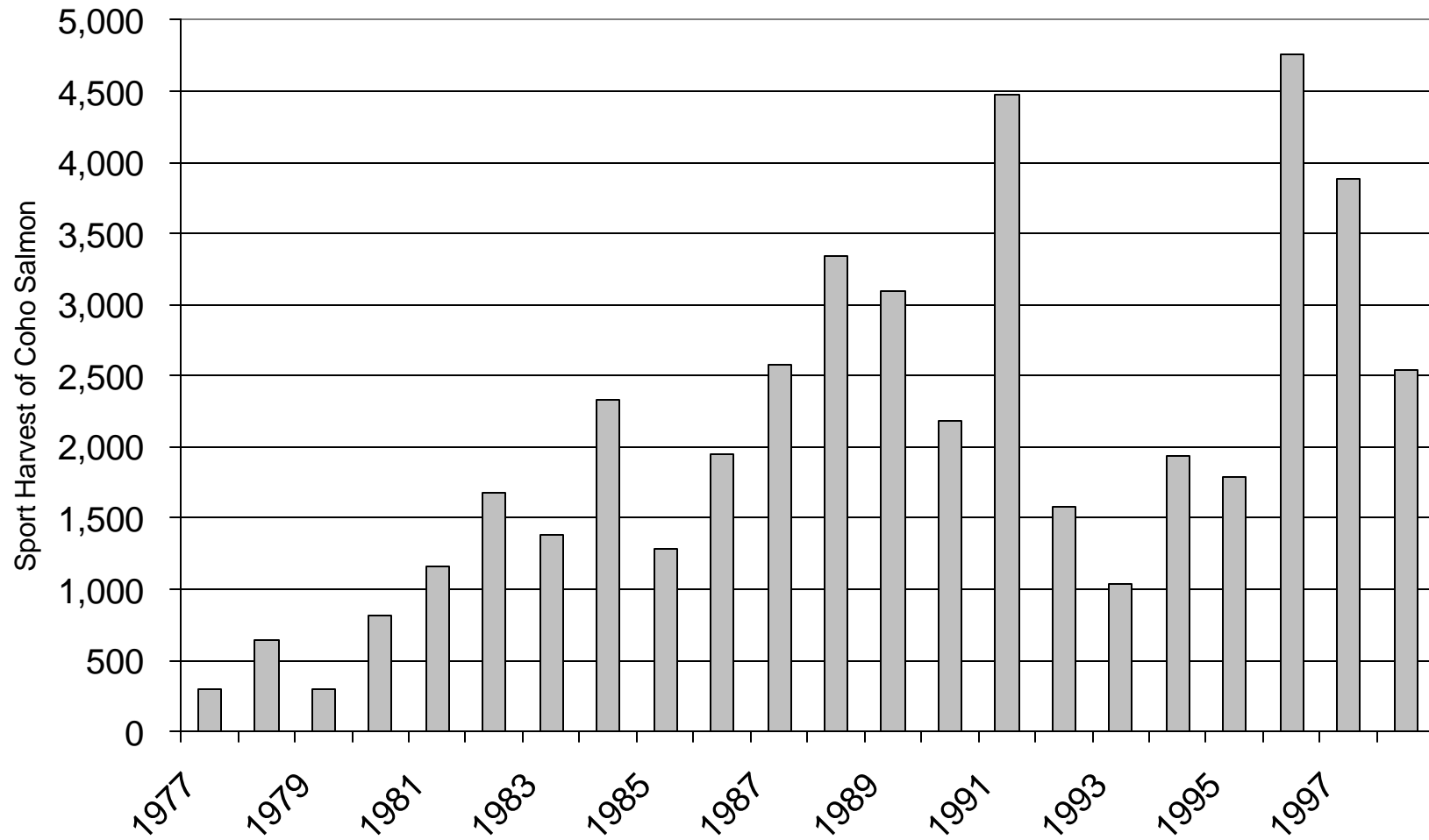


Figure 12.-Sport harvest of coho salmon from the Naknek River, 1977 to 1998.

effort in August and September. Lately, the fall commercial fishery has not been active due to poor markets and its impact on coho salmon has been modest. Most of the 1998 commercial take was incidental to the sockeye salmon fishery. Subsistence harvests of coho salmon were stable in 1994 to 1998, averaging 1,626 fish per year, and accounting for about 23% of the harvest (Table 17).

Management

Sport harvest and effort are estimated through the Statewide Harvest Survey and reported by Mills (1979-1994) and Howe et al. (1995 and 1996, *In prep* a, b, and c). Commercial and subsistence harvests are monitored by the Commercial Fisheries Division and are reported in their Annual Management Report series (ADF&G 2000). Sport Fish Division has conducted significant monitoring and stock assessment projects in the recent past (Minard and Brookover 1988a, Minard 1989a, Coggins 1992, Dunaway and Fleischman 1996a, Gryska and Naughton *In prep* b).

No biological escapement goal (BEG) has been established for Naknek River coho salmon stocks. Because of the lack of escapement information it is impossible to assess fishery impacts on the total run.

The present bag and possession limits for coho salmon on the Naknek River are 5 fish per day, no size limit; the same limit has been in effect since 1972. Prior to 1999, no adjustments to the Naknek River coho salmon fishery bag and possession limits had ever occurred by inseason emergency order.

Management concerns for this fishery center on the lack of escapement data, the department's inability to assess fishery impacts, and the lack of a management goal or target for this growing fishery. Without a clearer management target, justification for adjusting fishing time in the various fisheries is tenuous.

Management Objectives

No explicit management objectives exist for this fishery.

1999 Season

Without exception, the 1999 coho salmon return to all of Southwest Alaska was very poor. The Bristol Bay coho salmon sport fishery was restricted by emergency order to one coho per day beginning on August 23.

The preliminary estimate of 1999 harvest of 4,743 fish by all user groups (Table 17) is 66% of the 1994 to 1998 average. The sport fishery accounted for 3,588 fish. Harvest in the commercial fishery was only 298 fish and in the subsistence fishery 857 (Table 17).

2000 Outlook

The lack of stock assessment data makes it difficult to generate a forecast for the 2000 coho salmon return to the Naknek River. The parent year for the 2000 return was 1996, when large subsistence and sport harvests and other information indicated these coho runs were well above average. Strong parent year runs could produce a strong return in 2000, but coho runs are highly erratic and very hard to predict. Given the very poor coho runs observed throughout western Alaska in 1999, we will approach the coming season in these two rivers with caution.

NUSHAGAK AND MULCHATNA RIVERS

Fishery Description

The Nushagak and Mulchatna rivers produce the largest return of coho salmon in Bristol Bay. Within the drainage there are four areas of concentrated recreational effort: the lower 12 miles of the

Nushagak River near the village of Portage Creek, the middle section of the Nushagak River in the vicinity of the village of Ekwok, the mid section of the Mulchatna River between the Stuyahok and Koktuli rivers, and the Nuyakuk River at its confluence with the Nushagak River (Figure 10). Although sport fishing for coho salmon occurs in some of the tributaries of the drainage, the overall harvest resulting from that activity is considered slight. Of the areas mentioned above, the lower portion of the Nushagak River and the mouth of the Nuyakuk River are the most significant. The lower Nushagak River provides fishing opportunity for early coho salmon in late July and early August when other fisheries have not yet begun.

Historical Performance

The sport harvest averaged 1,445 fish, or about 10% of the total harvest of Nushagak and Mulchatna coho stocks from 1994 through 1998 (Table 18). Commercial harvest accounted for 65%, and subsistence 21%, of the total harvest for the same period. With the adoption of the Nushagak Coho Management Plan in 1996 and frequent poor runs, the recent commercial harvest has declined. Subsistence harvest has tended to increase since such harvests were first recorded. At these levels, the coho salmon sport fishery is considered to have a minor impact on the overall productivity of Nushagak and Mulchatna drainage coho stocks.

The Nushagak coho salmon stocks are considered to be depressed but in stable condition. A chronic inability to hit escapement targets despite significant management actions in recent years supports this assessment of stock status. Only 3 of the 10 years since 1989 have achieved the 90,000 fish escapement goal (Table 19). Significant restrictions have been placed on all fisheries, including closure of the subsistence fishery, to reduce exploitation on this stock.

Management

Sport harvest and effort is estimated through the Statewide Harvest Survey and reported by Mills (1979-1994) and Howe et al. (1995 and 1996, *In prep a, b, and c*). Commercial and subsistence harvests are monitored by the Commercial Fisheries Division and are reported in their Annual Management Report series (ADF&G 2000). Inriver abundance of coho salmon in the Nushagak is estimated by side scan sonar operated near the village of Portage Creek. Sport and subsistence harvests are assumed to occur above the sonar site; therefore, estimated spawning escapement is equal to the sonar count minus sport and subsistence harvest.

From 1984 to 1992, Nushagak coho salmon stocks were managed to achieve a biological escapement (BEG) of 150,000 fish, estimated by sonar at Portage Creek. However, spawning escapements during that period consistently fell short of the goal, averaging 85,020 fish (Table 19). Subsequent spawner-recruit analysis suggested the 150,000 fish goal was higher than necessary to manage for maximum sustained yield. The department used the new spawner-recruit data to reduce the BEG to 90,000 spawners in 1992 (ADF&G 1992). To achieve 90,000 spawners necessitated managing the commercial fishery to achieve an inriver abundance of 100,000 fish. The additional 10,000 coho salmon provided for subsistence and sport harvests above the sonar site at Portage Creek.

Table 18.-Coho salmon commercial, subsistence, and sport harvest, for the Nushagak drainage, 1972-1999.

Year	Commercial Harvest ^a	Commercial Subsistence Removals ^b	Subsistence Harvest ^c	Sport Harvest ^d	Total Harvest
1972	3,654		1,000		4,654
1973	28,709		2,200		30,909
1974	12,569		4,700		17,269
1975	7,342		4,300		11,642
1976	6,778		1,800		8,578
1977	52,562		3,500	248	56,310
1978	44,740		1,802	390	46,932
1979	129,607		4,676	212	134,495
1980	147,726		4,100	551	152,377
1981	220,290		7,900	389	228,579
1982	349,669		8,100	503	358,272
1983	81,338	409	4,521	1,404	87,672
1984	260,310	603	5,993	436	267,342
1985	20,230	94	5,163	130	25,617
1986	68,568	832	8,301	1,430	79,130
1987	13,263	177	5,218	961	19,619
1988	52,698	146	4,270	526	57,640
1989	77,077	588	7,435	2,392	87,491
1990	7,733	586	4,450	438	13,206
1991	5,574	1,759	8,309	874	16,517
1992	84,077	495	6,037	752	91,361
1993	14,345	1,112	3,117	194	18,768
1994	5,615	870	3,663	1,143	11,291
1995	4,896	563	2,686	725	8,871
1996	11,401	556	3,737	3,488	19,182
1997	4,110	243	2,262	500	7,115
1998	22,703	643	3,342	1,368	28,056
1974-98 Average	68,209	605	4,775	866	74,133
1994-98 Average	9,745	575	3,138	1,445	14,903
Percent	65%	4%	21%	10%	
1999	2,819	935	2,449	618	6,821

^a Total Nushagak District commercial harvest. Source: ADF&G 2000, Appendix Table 25.

^b Nushagak Bay Commercial Harvest from Subsistence Division Subsistence Database. Source: ADF&G Subsistence Division, Subsistence Database from Charles Utermohle, Program Coordinator, Subsistence Division, Region II, Anchorage, November 20, 2000.

^c 1972-1975 source ADF&G 1991, Appendix Table 46. 1976 source ADF&G 1997, Appendix Table 25. 1977-1982 Nushagak Bay harvest and Nushagak System Harvest. Sources: ADF&G 1981, 1982, 1983. 1983-1999 includes Nushagak Bay, Igushik, Ekwook area, Iowithla River, Klutuk River, Koliganek area, New Stuyahok area, Portage Creek area, Kokwook area, Mulchatna River, and Nushagak watershed site unknown. Source: ADF&G Subsistence Division, Subsistence Database from Charles Utermohle, Program Coordinator, Subsistence Division, Region II, Anchorage, November 20, 2000.

^d Nushagak River system, Mulchatna River system, Tikchik/Nuyakuk system, and Koktuli River harvest reported in Mills 1979-1994, Howe et al. 1995 and 1996, and Howe et al. *In prep* a, b, c, and d.

Table 19.-Coho salmon commercial, subsistence, and sport harvest, plus escapement and total run for the Nushagak drainage, 1980-1999.

Year	Total Run	Harvests Below Sonar				Inriver Abundance estimate ^e	Harvests Above Sonar		Spawning Escapement
		Commercial Harvest ^a	Commercial Subsistence Removals ^b	Subsistence Harvest ^c	Sport Harvest ^d		Subsistence Harvest ^f	Sport Harvest ^g	
1980	247,785	147,726		3,300	0	96,759	800	551	95,408
1981	370,082	220,290		4,800	0	144,992	3,100	389	141,503
1982	652,348	349,669		4,900	0	297,779	3,200	503	294,076
1983	114,460	81,338	409	3,452	0	29,261	1,069	1,404	26,788
1984	408,520	260,310	603	4,767	0	142,841	1,226	436	141,179
1985	107,921	20,230	94	3,562	0	84,034	1,601	130	82,304
1986	129,255	68,568	832	5,423	0	49,676	2,877	1,430	45,369
1987	45,255	13,263	177	3,968	0	23,484	1,250	961	21,273
1988	190,810	52,698	146	3,264	0	131,840	1,005	526	130,309
1989	172,288	77,077	588	6,421	0	84,628	1,013	2,392	81,223
1990	157,439	7,733	586	3,921	0	141,704	529	438	140,737
1991	59,704	5,574	1,759	7,205	0	39,733	1,104	874	37,755
1992		84,077	495	4,707	0		1,330	752	
1993	66,984	14,345	1,112	3,048	0	42,742	69	194	42,479
1994	102,539	5,615	870	3,479	0	82,019	184	1,143	80,692
1995	59,103	4,896	563	2,464	0	46,340	222	725	45,393
1996	207,331	11,401	556	2,862	0	187,028	875	3,488	182,665
1997	66,280	4,110	243	1,847	0	57,096	415	500	56,181
1998	136,633	22,703	643	3,087	0	104,948	255	1,368	103,325
1980-1998 Average	183,041	76,401	605	4,025	0	82,603	856	1,138	80,617
1994-1998 Average	114,377	9,745	575	2,748	0	95,486	390	1,445	93,651
1999	44,281	2,819	935	2,205	0	34,853	244	618	33,991

^a Total Nushagak District commercial harvest. Source: ADF&G 2000, Appendix Table 25.

^b Nushagak Bay Commercial Harvest from Subsistence Division Subsistence Database. Source: ADF&G Subsistence Division, Subsistence Database from Charles Utermohle, Program Coordinator, Subsistence Division, Region II, Anchorage, November 20, 2000.

^c 1977-82 Nushagak Bay harvest. Sources: ADF&G 1981d, 1982, 1983. 1983-1999 includes Nushagak Bay and Igushik. Source: ADF&G Subsistence Division, Subsistence Database from Charles Utermohle, Program Coordinator, Subsistence Division, Region II, Anchorage, November 20, 2000.

^d Sport Harvest is all assumed to take place above the sonar.

^e Inriver abundance estimated by sonar counter at Portage Creek through August 25 for 1982-1996 and 1998-1999. 1980 and 1981 estimated by applying exploitation rates of 0.602 to commercial harvest. Sonar estimates expanded for 1982, 1983, 1985-1988 and 1991, when the project terminated prior to August 25. 1997 used sonar estimate through September 13. Source: ADF&G 2000, Appendix Table 25. Inriver return estimates are found in Miller 2000, Table 16 and ADF&G 2000, Appendix Table 25.

^f 1980-1982 includes Portage Creek, Ekwook, New Stuyahok, and Koliganek. Sources ADF&G 1981, 1982, 1983. 1983-1999 includes Ekwook area, Iowithla River, Klutuk River, Koliganek area, New Stuyahok area, Portage Creek area, Kokwook area, Mulchatna River, and Nushagak watershed site unknown. Source: ADF&G Subsistence Division, Subsistence Database from Charles Utermohle, Program Coordinator, Subsistence Division, Region II, Anchorage, November 20, 2000.

^g Sport harvest is all of Nushagak River system sport harvest, plus Mulchatna River, Tikchik/Nuyakuk, and Koktuli River harvest reported in Mills 1979-1994 and Howe et al. 1995 and 1996, *In prep* a, b, c, and d.

The present bag and possession limits for coho salmon on the Nushagak and Mulchatna drainage are 5 fish per day, no size limit. That is the same background limit for most of the region, and has been in effect since 1972. The first adjustment to that limit occurred in 1991 when the daily bag and possession limits were reduced from 5 to 2 by emergency order. Since then the limits have been adjusted by emergency order several times in response to stock conservation problems. The Nushagak River sport fishery was closed for much of the normal season in 1997 to protect a very weak run. No emergency order restrictions were necessary in the sport fishery in 1998.

Management Objectives

Currently management of Nushagak/Mulchatna River coho salmon is governed by 5 AAC 06.368. Nushagak River Coho Salmon Management Plan, adopted by the Alaska Board of Fisheries in December of 1995. The plan calls for managing the commercial fishery for an inriver return of 100,000 which provides for a spawning escapement of 90,000, a reasonable opportunity in the subsistence fishery, and a 2,000 fish guideline harvest in the sport fishery. The plan goes on to address management actions that should be taken should the inriver return fall short of the goal. In the sport fishery, should the inriver return fall below 60,000, then restrictions to maintain the sport harvest below 2,000 are required. If the inriver return is less than 50,000, then closure of the sport fishery is required. Along with the sport fishery management actions, the plan directs the department when to take actions in the commercial and subsistence fisheries. All fisheries are to close when the inriver return falls below 50,000.

1999 Season

A very poor parent year inriver return, thought to be about 45,000 fish, caused the department to approach the 1999 season very cautiously. Preseason, the angling public was advised that there was a high likelihood the sport fishery would be restricted, depending upon the inseason escapement estimates.

The commercial fishery was closed July 26 when the incidental coho salmon catch was 2,819 fish. Through August 8, the projected estimate of final coho salmon inriver return was between 41,000 and 64,000. At this level, the management plan requires closure of the sport fishery and restrictions to the subsistence fishery. The sport fishery was closed by emergency order on August 12. The subsistence fishery was restricted to 3 days per week on August 12, and closed entirely on August 13. The subsistence fishery reopened on September 10 to allow harvest of spawned-out sockeye salmon and whitefish, but permit holders were requested to release any live coho salmon.

Final inriver return was estimated to be 34,853 (Miller 2000). The final spawning escapement estimate was 33,991 coho salmon (Table 19). The subsistence harvest was 2,449 coho from throughout the drainage, and the preliminary estimate of sport harvest is 618 coho salmon. The total run was estimated to have been approximately 44,281 fish; the worst total run estimate on record (Table 19).

2000 Outlook

The 2000 coho salmon return to the Nushagak drainage will be primarily the product of the 1996 escapement, which was over 187,000 coho salmon—nearly double the inriver goal of 100,000 fish. Despite this fact, there is insufficient data for a formal forecast. Based on parental run strength alone, we would project a good run for 2000, but ADF&G is taking a cautious approach due to the poor returns in 1999. All fisheries and run strength indicators will be carefully watched. If restrictions

become necessary, we will attempt to preserve some angling and harvest opportunity by acting as early as possible in the season.

WOOD RIVER LAKES

Fishery Description

The Wood River Lakes system is a series of six, large, deepwater lakes connected by short swift rivers within the Wood-Tikchik State Park. Known for a variety of fishery resources including Arctic char/Dolly Varden, rainbow trout, and sockeye salmon, the Wood River system also supports significant coho salmon stocks. The majority of the sport fishing effort directed toward Wood River drainage coho salmon occurs at the confluence of Silver Salmon Creek and Wood River, and the outlets of Ice, Youth, and Sunshine creeks on Lake Aleknagik. Sport fishing effort directed toward coho salmon has grown substantially in recent years and has come primarily from greater numbers of local residents pursuing sport fishing as a leisure activity. A few new lodges based on Lake Aleknagik are contributing additional guided effort on these stocks as well.

Historical Performance

Harvest data for coho salmon in the Wood River Lake system (Table 16) dates back to 1977 (Mills 1979-1994 and Howe et al. 1995 and 1996, *In prep* a, b, and c). From 1977 through 1984, sport harvest in the drainage never exceeded 200 fish. Since 1985, however, the harvest levels have increased. In 1989, the estimated harvest reached an isolated peak of 2,417 coho salmon, the only time estimated harvest has exceeded 1,000 fish. The 1993-1997 average harvest of sport-caught coho salmon was 430 fish (Table 16). Estimates of sport harvest noted in the Statewide Harvest Survey are obviously not without error. All things considered, it is safe to say that the coho salmon sport fishery in the Wood River Lake system is growing, probably accounting for about 500 to 1,000 fish annually. It appears that the Nushagak coho management plan and the more conservative commercial fisheries resulting from the plan may be favorably affecting coho salmon abundance in the Wood River drainage, allowing more sport fishing opportunity and possible growth of the run.

Management

No biological escapement goal (BEG) has been established for coho salmon stocks in the Wood River drainage. There is no escapement assessment program in place or planned for these stocks, making it impossible to assess fishery impacts on total run.

Sport harvests are limited to 5 per day and in possession, with no size limit. Terminal tackle is not restricted in any manner beyond the normal methods and means generally allowed in fresh waters.

Management concerns for this stock focus primarily on the effect commercial and subsistence harvests may be having on Wood River stocks. The driving force behind management is the Nushagak coho salmon escapement. Presumably, a fishing schedule in the commercial fishery that allows achievement of the desired escapement in one system will allow sufficient numbers into the other, but there is no way to measure this. A full stock assessment program is needed to better describe the extent to which Wood River drainage coho stocks are impacted by the commercial fishery, what order of magnitude the escapements are, and to what degree the Nushagak and Wood River stocks are mingled in the commercial district.

Management Objectives

No explicit management objectives exist for this fishery.

1999 Season

Wood River Lakes shared the poor coho return that affected all Bristol Bay fisheries in 1999. Sport fisheries throughout Bristol bay were restricted to one coho per day by an emergency order effective on August 23.

2000 Outlook

No data are available to make a projection.

KANEKTOK RIVER

Fishery Description

Coho salmon play a major role in the Kanektok River sport fishery and are caught primarily in the lower 12 miles of the river near the village of Quinhagak (Figure 10). The fishery peaks in mid August. Because of its relatively small size, clear water, and consistent returns of coho salmon, the Kanektok River is one of the finest coho salmon sport fisheries in western Alaska. Approximately 90% of the sport anglers in the Kanektok coho salmon fishery are nonresidents, and more than half of them are guided (Naughton and Gryska *In prep*).

Historical Performance

The total run of coho salmon in the Kanektok River averages about 80,000 to 90,000 fish annually and produces an average total harvest of roughly 70,000 fish (Table 20). More than 90% of the harvest is typically taken by the commercial fishery, which averaged 76,376 coho salmon per year from 1994 through 1998 (Table 20). Recent sport harvests account for 1% to 2% of the total harvest and have not returned to the peak levels observed in 1984 through 1988 (Table 20). After dropping to an all-time low in 1992, the annual sport harvest has generally increased to average 898 coho salmon from 1994 through 1998. The subsistence harvest of coho salmon has been relatively stable, averaging around 2,000 or more fish per year and accounts for 2% to 4% of the total annual harvest.

Management

Sport harvest and effort are estimated through the annual statewide harvest and participation survey and reported by Mills (1979-1994) and Howe et al. (1995 and 1996, *In prep* a, b, and c). Commercial and subsistence harvests are monitored by the Bethel office of the Commercial Fisheries Division and reported in the Annual Management Report series (Burkey et al. 2000). Sport Fish Division has conducted significant monitoring and stock assessment projects in the recent past (Alt 1986, Minard 1987c, Dunaway and Bingham 1992b, Dunaway and Fleischman 1995a, Naughton and Gryska *In prep*).

Escapement of coho salmon into the Kanektok River is estimated by aerial survey when weather and water conditions permit. Counts, made between August 20 and September 5, are left unexpanded and represent only minimum escapement estimates. Since 1984, the observed escapement of coho salmon into the Kanektok River has ranged from 4,330 to 46,830 (Table 20). No formal escapement goal has been established for Kanektok River coho salmon. Poor weather and water clarity, and lack of funding contribute to the erratic aerial escapement estimates.

Table 20.-Coho salmon commercial, subsistence, and sport harvest plus escapement for the Kanektok River, 1983 to 1999.

Year	Harvest			Total	Escapement	Total Run ^d
	Commercial ^a	Subsistence ^b	Sport		Index ^c	
1983	32,442		367	32,809		
1984	132,151		1,895	134,046	46,830	180,876
1985	29,992		622	30,614		
1986	57,544		2,010	59,554		
1987	50,070		2,300	52,370	20,056	72,426
1988	68,605	4,317	1,837	74,759		
1989	44,607	3,787	1,096	49,490	e	
1990	26,926	4,174	644	31,744		
1991	42,571	3,232	358	46,161	4,330	50,491
1992	86,404	2,958	275	89,637		
1993	55,817	2,152	734	58,703		
1994	83,912	2,739	675	87,326		
1995	66,203	2,561	970	69,734	f	
1996	118,718	1,467	875	121,060	23,656 ^g	144,716
1997	32,862	1,264	1,220	35,346	23,166 ^h	58,512
1998	80,183	1,702	751	82,636		
1983-1998 Average	63,063	2,759	1,039	65,999	23,608	101,404
Percent	96%	4%	2%			
1994-1998 Average	76,376	1,947	898	79,220	23,411	101,614
Percent	96%	2%	1%			
1999	6,184	2,021	1,132 ⁱ	9,337	j	
Percent	66%	22%	12%			

^a Quinhagak (District 4) commercial harvest (Burkey et al. 2000, Appendix C3).

^b Subsistence harvests by the community of Quinhagak (Burkey et al. 2000, Appendix A12).

^c Unexpanded observed count made from fixed-wing aircraft between August 20 and September 5. Source Burkey et al. 2000, Appendix C4.

^d Considered a minimum number since escapement estimates are unexpanded.

^e In 1989 a count flown early, on July 25, counted 1,755 coho salmon (Aerial survey notebook, Commercial Fisheries Division, Bethel).

^f In 1995, a count flown early, on August 14, counted 2,900 coho salmon (Aerial survey notebook, Commercial Fisheries Division, Bethel).

^g 1996 escapement survey was partial due to poor conditions.

^h 1997 escapement estimate is based on tower count ending August 21; aerial survey conditions poor. Aerial survey count of coho salmon on October 1, past the peak of the return, was 5,162 (Burkey et al. 2000).

ⁱ 1999 preliminary estimate.

^j In 1999 a count flown early, on July 14, counted 10,120 coho salmon (Burkey et al. 2000).

In 1996, the Quinhagak Indian Reorganization Act (IRA) Council, Togiak National Wildlife Refuge, and the Arctic-Yukon-Kuskokwim region of Commercial Fisheries Division (CFD), initiated a salmon escapement counting tower project in the lower Kanektok River. The 1996 project closed too early in the coho salmon run to provide useful information (Burkey et al. 1998). In 1997 the tower was operated until August 21 and provided the only estimate of coho salmon escapement for the season. The presence of significant numbers of sockeye salmon during the early coho salmon run has confounded staff's ability to make accurate counts. In 1998, muddy water conditions made it impossible to accurately count salmon. A weir is much more likely to provide accurate counts and identification of salmon. The results of the tower have been reported by CFD, Bethel (Burkey et al. 1998).

Bag limits for coho salmon were very liberal, allowing 15 fish per day, 30 in possession until 1986. In 1987, the Board recognized the significance of the harvest potential of this fishery and reduced bag and possession limits to 5 fish daily, the standard limit for the area. Interestingly, sport fishermen on the Kanektok River seldom take the bag limit of 5 fish per day. Fishery surveys conducted in 1991 and 1994 found only 7% to 15% of the anglers interviewed left the river with a full limit of 5 fish (Dunaway and Bingham 1992b, Dunaway and Fleischman 1995a). Most interviewed anglers (61% in 1991 and 66% in 1994) elected to take no fish, even though over 95% of them had caught-and-released at least one fish.

Sport harvests, which appear relatively minor, do not completely reflect the importance of this species to the recreational fishery. In 1986, over 22,500 coho salmon were landed of which only 1,680 (7%) were harvested (Minard 1987c). In 1990, approximately 14% of the coho salmon caught were retained, and since 1992 the retention rate has averaged approximately 20% (Mills 1991-1994, Howe et al. 1995 and 1996 and *In prep* a, b, c, and d). Hook-and-release mortality has been found to be significant for sport-caught coho salmon, particularly those caught in intertidal areas (Vincent-Lang et al. 1993). The Kanektok River coho salmon sport fishery occurs upstream of the intertidal area, therefore mortality due to hook and release is judged to have a minor impact on the overall health of the stocks. Beginning in 1998, fishing in the entire Kanektok drainage was limited to unbaited, single-hook artificial lures.

Management Objectives

No explicit management objectives exist for this fishery.

1999 Season

The 1995 coho salmon return, parent year for the 1999 return, produced average commercial, subsistence, and sport harvests and an average return was expected for the Kanektok River in 1999. However, the Kanektok suffered the same poor coho salmon return that was felt in Bristol Bay and in the Kuskokwim drainage. Commercial fishing was suspended after August 18, the earliest the season has ended in over two decades (Burkey et al. 2000). On August 20 the sport fishery for coho salmon was restricted to 1 coho per day for all waters in the Kuskokwim River and Kuskokwim Bay drainages. The preliminary estimate of 1999 sport harvest is 1,132 coho salmon (Table 20). Poor weather and water conditions prevented aerial escapement index flights during the peak of the coho salmon run, and no total run estimates can be made.

2000 Outlook

The 1996 coho salmon return (parent year for the 2000 return) produced a record commercial harvest and above average harvest in the sport fishery. Record parent year harvests could mean a good run to come, but considering the poor 1999 run and the uncertain parental escapement index, an average coho salmon return is projected for the Kanektok River in 2000. The performance of the commercial, subsistence, and sport fisheries will be closely watched to detect any conservation problems as early as possible.

TOGIAC RIVER

Fishery Description

The bulk of the Togiak River coho salmon fishery occurs in the lower 20 miles of the Togiak River (Figure 10) below the Wilderness boundary of the Togiak National Wildlife Refuge. The sport fishery occurs from early August to the middle of September, usually peaking between August 21 and September 7. Angler effort is largely nonresident guided anglers who access the river by flying out from nearby lodges to fish for the day. In addition, there are a couple of river-based lodges that cater to nonresident anglers, one of which is owned by the local native corporation in Togiak and leased to a concession group.

Historical Performance

Sport harvest of coho salmon from the Togiak River averaged 824 fish annually from 1994 through 1998, or about 2% of the total Togiak River coho salmon harvest (Table 21). Annual sport harvest peaked in 1986 at 2,851. Low run strength and ensuing restrictions in the sport fishery in 1990 and 1991, cancellation of a local salmon derby sponsor, and a general downturn in lodge business about 1992 and 1993 resulted in reduced sport harvests during the early 1990s. The 1996 run was an unexpectedly and unusually abundant return. A high degree of voluntary catch-and-release has been documented for this fishery and ranges from 40% to 60% of the catch. Concern over hook-induced mortality, given previous department studies (Vincent-Lang et al. 1993), prompted staff to evaluate the potential hook-and-release mortality. The department concluded that although the released proportion of the catch was large, the total number of fish caught is small in terms of the total run. Therefore, catch-and-release affects only a small number of fish and is expected to have a minor impact on the overall health of the stocks. In addition, department studies (Vincent-Lang et al. 1993) have demonstrated that the mortality of released coho salmon is low when catches are made above the intertidal area, as in the case of most of the Togiak River fishery.

Commercial catches in the Togiak Section have been erratic, ranging from a high of 111,829 fish in 1980 to a low of 1,284 in 1987. Average commercial harvest from 1994 through 1998 was 42,336; accounting for 97% of the total Togiak coho salmon harvest (Table 21). Over the recent 5 years, the commercial harvests have been quite erratic.

Subsistence harvests are probably stable, and have recently ranged from 200 to 900 fish per year (Table 21). Much of the range in the subsistence harvest is related to variability of reporting rather than actual fluctuations in take.

Management

Sport harvest and effort is estimated through the statewide mail survey and reported by Mills (1979-1994) and Howe et al. (1995 and 1996, and *In prep* a, b, c, and d). Commercial and subsistence

Table 21.-Coho salmon commercial, subsistence, and sport harvest plus escapement for the Togiak River, 1977-1999.

Year	Harvest				Escapement ^c	Total Run
	Commercial ^a	Subsistence ^b	Sport	Total		
1977	33,824	1,100	114	35,038		
1978	36,959	500	214	37,673		
1979	19,201	700	300	20,201		
1980	111,829	1,200	258	113,287	65,130	178,417
1981	19,504	2,200	119	21,823	43,500	65,323
1982	108,000	1,300	524	109,824	69,900	179,724
1983	4,978	800	829	6,607		
1984	111,631	3,800	1,154	116,585	60,840	177,425
1985	35,765	1,500	0	37,265	33,210	70,475
1986	28,030	500	2,851	31,381	21,400	52,781
1987	1,284	1,600	183	3,067	16,000 ^d	19,067
1988	7,974	792	1,238	10,004	25,770 ^d	35,774
1989	35,814	976	416	37,206		
1990	2,672	1,111	367	4,150	21,390 ^d	25,540
1991	4,531	1,238	87	5,856	25,260	31,116
1992	4,396	1,231	251	5,878	80,100	85,978
1993	12,613	743	330	13,686		
1994	88,823	910	531	90,264		
1995	8,864	703	408	9,975		
1996	58,369	199	1,382	59,950	64,980	124,930
1997	2,776	260	780	3,816	20,625	24,441
1998	52,846	310	1,020	54,176	25,335	79,511
1997-1998 Average	35,940	1,076	607	37,623	40,960	82,179
Percent	96%	3%	2%			
1994-1998 Average	42,336	476	824	43,636	36,980	76,294
Percent	97%	1%	2%			
1999 ^e	2,652	217	1,151	4,020	3,855	7,875
Percent	66%	5%	29%			

^a Togiak Section commercial harvest. Source: ADF&G, CFD Fish Ticket Database, Jobs 23080 and 23078 requested by Saree Timmons, October 19, 2000. Does not include salmon kept for personal use.

^b Togiak District subsistence harvest (includes Togiak Village and Togiak River). Sources: 1977-1979 ADF&G 1997, Appendix Table 30; 1980-1999 ADF&G 2000, Appendix Table 26.

^c Escapement estimates are based on fixed-wing aerial surveys. Peak counts are expanded by a factor of 3 to account for missed fish. In 1985-1987 expansion factors were greater due to incomplete surveys or poor survey conditions. Source: ADF&G 2000, Appendix Table 26. Peak aerial counts are in Glick et al. 2000, Appendix Table 31.

^d USF&WS used a sonar located 1 mile upriver from the Pungokepuk River to estimate salmon returns to the Togiak River in 1987, 1988, and 1990. Estimates of coho salmon escapement were 68,428; 78,589; and 28,290 fish for 1987, 1988, and 1990, respectively (Irving et al. 1995, Table 2). Sonar counts for sockeye salmon were higher than corresponding tower counts, so were apparently overestimates. Sonar counts of coho salmon were also likely overestimates.

^e 1999 sport harvest estimate is preliminary.

harvests are monitored by the Commercial Fisheries Division and are reported in their Annual Management Report series (ADF&G 2000). Sport Fish Division conducted significant monitoring and stock assessment projects in 1984 and 1989 (Minard and Lisac 1984, Dunaway 1990b). A creel survey to estimate catch and harvest rates in the sport fishery was conducted in 1999 (Gryska and Naughton *In prep a*). When weather and water conditions permit, the Commercial Fisheries Division estimates annual spawning escapement of Togiak River coho salmon by conducting aerial escapement index counts (Glick et al. 2000).

The bag and possession limit for coho salmon on the Togiak River is 5 per day with no size limit. For years when parental escapements have been adequate, such as 1996, the current bag limit of 5 has been satisfactory, but in poor years the department has responded with emergency order authority to reduce overall harvest. Prior to 1999, the limit was adjusted four times in response to conservation concerns. In 1987, when it appeared the escapement goal for coho salmon would not be achieved, the fishery was restricted to catch-and-release. In 1990 and 1991, the bag limit was dropped to 1 per day and in possession. In 1995 the department again reduced the bag limit to 2 coho salmon per day based on a poor parental year return, very low commercial catches and low aerial survey counts in the river.

The 1998 Togiak coho salmon return was expected to be average or slightly above average based upon parental year (1994) fishery performance. As the season developed, the coho salmon returns appeared to be average or better throughout much of Bristol Bay, and a good return was anticipated in the Togiak River as well. However, aerial surveys of the Togiak River coho salmon escapement, conducted in October by the Division of Commercial Fisheries, indicated the goal of 50,000 was not achieved. The low escapement was a surprise, given that inseason flights indicated good rates of escapement. At one point, an estimated 30,000 coho were holding in the lower reaches of the river. Reported illegal commercial harvests from the lower Togiak River are suspected to have contributed significantly to the low final escapement estimate.

Management Objectives

The escapement goal for the Togiak River drainage is 50,000 coho salmon as estimated by expanding aerial survey counts for missed fish. This fishery has been successfully managed to achieve the escapement goal in only 5 of the 15 years for which estimates are available (Table 21).

1999 Season

The 1999 Togiak coho salmon return was very poor, as were coho salmon returns throughout Bristol Bay. Catch and harvest rates in the sport fishery were correspondingly poor. The sport fishery was restricted by emergency order to 1 salmon per day on August 23. Aerial surveys, flown at or near the peak of coho spawning activity yielded an escapement estimate of only 3,855 coho salmon, 91% below the 1980-1998 average of 40,960 fish (Glick et al. 2000). The preliminary estimate of sport harvest is 1,151 coho salmon.

2000 Outlook

The 1996 Togiak River coho salmon escapement, parent year for the 2000 return, was 65,000; well above the 50,000-fish goal. Based on parent year escapement and fishery performance, it is possible the 2000 return of coho salmon to the Togiak River will be very good. However, because of unknown factors contributing to the poor coho returns in 1999, we are taking a cautious approach in projections and management, and project the 2000 run will be average or slightly above.

NORTHWESTERN COHO SALMON FISHERIES

The Kuskokwim River and its tributaries sustain one of the largest coho salmon returns in Alaska, usually producing a combined commercial and subsistence harvest of 200,000 to over 600,000 fish annually. This run passes through the Northwestern section of the SWMA. Present exploitation by sport anglers is light but increasing. Prior to 1992, annual sport harvests from the Northwestern section contributed 6% to 17% of the SWMA's total sport harvest and since 1992 have ranged from 15% to 22%. From 1987 to 1996, the annual Kuskokwim River coho salmon harvest by all fisheries averaged close to 700,000 fish. The sport harvest represents less than 1% of that harvest. From 1994 through 1998, the sport harvest in this section averaged 1,804 fish annually (Table 16). The few services catering to recreational anglers and the difficulty of access hinders sport fisheries for all species in this section.

The 1998 coho salmon run in the Kuskokwim River was well below average. The commercial fishery was restricted to seven 6-hour openings (1 per week) in the lower river and two openings in the upper, W-2, district. Total commercial harvest was 210,481 coho salmon, less than half of the average of the previous 10 years (545,658) (Burkey et al. 1999b).

1999 Season

Coho returns to the Kuskokwim River were very poor in 1999. The single 6-hour commercial 'test' opening for the Kuskokwim River resulted in the lowest harvest on record. Total 1999 commercial coho salmon harvest in Kuskokwim River districts 1 and 2 was only 23,593; less than 5% of the 1989-1998 average (Burkey et al. 2000). On August 20, the sport fishery for coho salmon was restricted to 1 per day for all waters in the Kuskokwim River drainage.

The Kogrukluuk River weir in the Holitna River drainage operated for most of the coho salmon migration period, and resulted in an estimated escapement of only 12,609 coho salmon; 50% below the minimum escapement goal of 25,000 fish (Burkey et al. 2000).

2000 Outlook

There is no formal forecast for Kuskokwim coho salmon. However, the parent year for the 2000 coho salmon return produced an all-time record commercial harvest of 937,299 fish. All other sources of information indicated the subsistence and sport harvests and spawning escapement of coho salmon in the drainage were good. If the offspring of the 1996 run survived at average or better levels, the 2000 return is likely to be average or very good. However, coho salmon often exhibit very erratic rates of return and the limited data available make forecasting coho salmon returns little more than educated speculation.

SECTION V: SOCKEYE SALMON FISHERIES

Sockeye salmon is the most numerous of the Pacific salmon species to spawn in Bristol Bay, the world's largest producer of sockeye salmon. Their prized eating qualities make sockeye salmon the most popular species of salmon on the commercial market. Traditionally, sockeye salmon have not been popular with anglers due to their indifference to most fishing lures. Since the late 1960s however, anglers have discovered innovative ways to legally catch sockeye salmon with customary sport gear, and the species has gained favor as a hard fighting and delectable game fish. The most popular fisheries exist in the Naknek and Kvichak drainages (Figure 13).

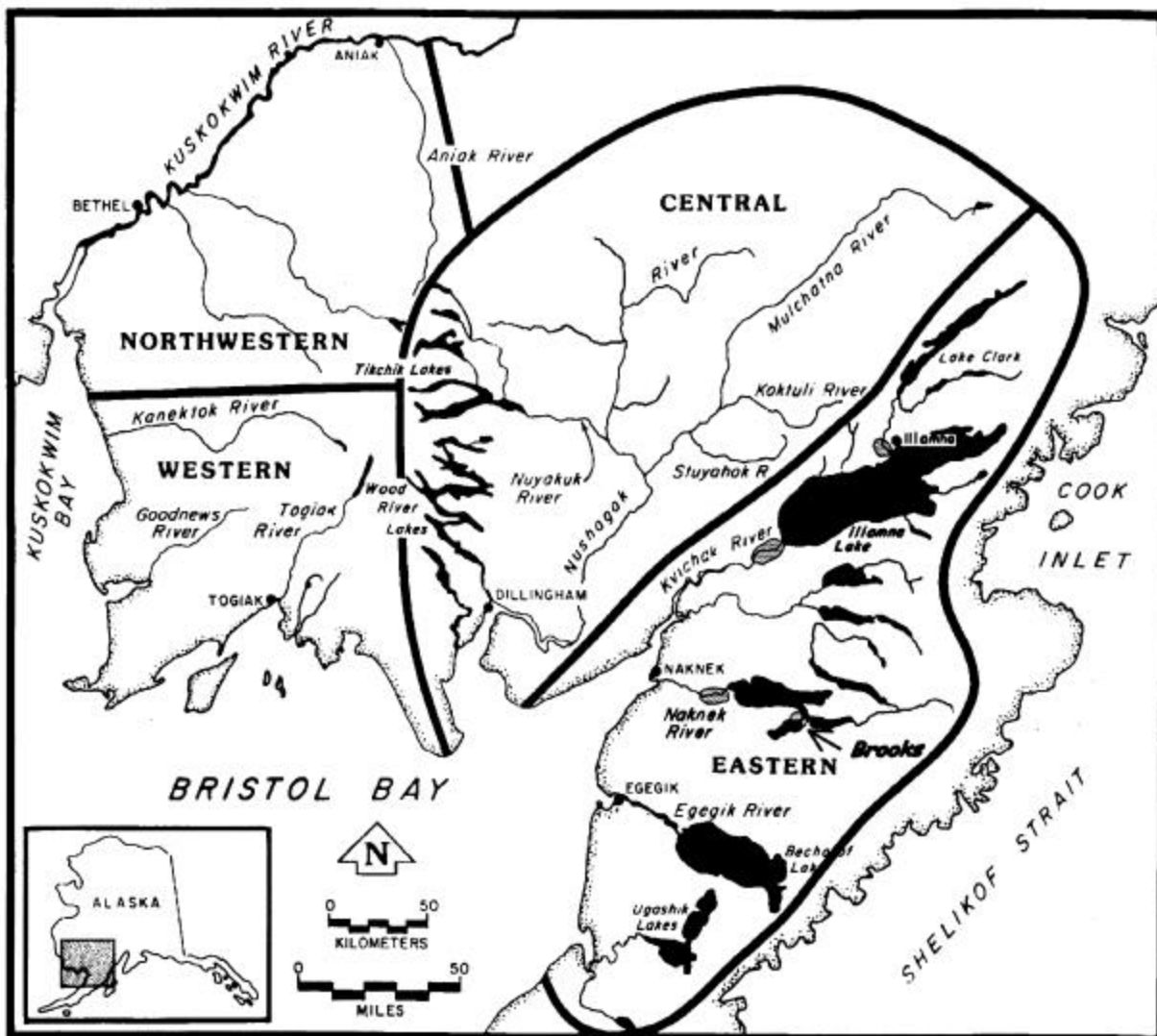


Figure 13.-Popular sockeye salmon sport fisheries in Southwest Alaska.

Harvests of sockeye salmon in the SWMA were at or below 10,000 fish through 1988 (Table 22, Figure 14). After 1988, the sport harvest of sockeye salmon increased substantially in number and variability with a peak estimate of nearly 33,000 fish taken in 1989 and lows of about 16,000 fish in a number of years. From 1993 through 1997 the sport harvest averaged 18,999 sockeye salmon per year (Table 22). The most active sport fisheries occur in the Eastern section of the management area, where an average of more than 16,000 fish or 85% of the annual harvest is taken. The Central section fishery harvests about 2,000 sockeye per year and harvests in the Western and Northwestern sections provide annual harvests of about 600 and 300 fish, respectively (Table 22). Even with the elevated harvests of recent years, the sport harvest is a minute 0.04% of the millions of sockeye salmon returning to spawn in the area. Roughly 60% of the annual Bristol Bay sockeye total return has been taken in the commercial fishery since 1980. Subsistence fishermen have harvested less than 1% of the run.

Sockeye salmon share the same bag and possession limit with all salmon except chinook: 5 salmon per day, no size limit. This regionwide limit has been in effect since 1972. The department's ability to manage for sustained yield is essentially unaffected by the recreational harvest of sockeye salmon. No adjustments have been made to the bag and possession limits in the past and none were made in 1999. Sockeye salmon are expected to play an increasingly important role in the development and expansion of the recreational fishery in Southwest Alaska.

BROOKS RIVER

Fishery Description

Brooks River, which drains Brooks Lake into Naknek Lake, is a 2-mile long stretch of water located within the boundaries of the Katmai National Park and Preserve (Figure 13). Brooks Camp, located on Naknek Lake, was established in 1960 by Northern Consolidated Airlines as primarily a sport fishing facility, but in recent years it has also become popular with tourists for hiking and bear viewing opportunities. Access to Brooks River and Brooks Camp is by float-equipped aircraft or boat. Beside guest cabins, a campground facility is available for overnight visitors. At the lower end of Brooks River is a footbridge which allows visitors to cross between the south and north shores without wading. The sport fishery for sockeye salmon generally takes place below the bridge in the lower quarter mile of the river where it empties into Naknek Lake. The sockeye salmon fishery begins in late June when the first salmon arrive and peaks over the Fourth of July weekend. The recreational fishery occupies waters also used by brown bears fishing for salmon. This overlap has caused management problems and conflicts for the Department of Fish and Game and the National Park Service. At issue is the safety of visitors and the priority that the different groups (bear viewers, sport fishermen, hikers) should have. According to the Final Development Concept Plan Environmental Impact Statement for the Brooks River Area (NPS 1996), the service's preferred action is to significantly curtail or restrict sport fishing opportunity on the Brooks River, particularly the sockeye salmon fishery downstream from the bridge.

Historical Performance

The abundance of sockeye salmon at Brooks River is a function of the escapement into the Naknek River. The Naknek drainage escapement goal is 1.0 million sockeye salmon. The magnitude of the escapement dwarfs the historical sport harvest so that variations in inriver abundance have little effect on fishery performance at Brooks River. Harvests of sport-caught sockeye salmon at Brooks River have

Table 22.-Sport harvest of sockeye salmon from the waters of Southwest Alaska by fishery, 1977-1998.

Drainage	1977-88										1993-97	
	Average	1989	1990	1991	1992	1993	1994	1995	1996	1997	Average	1998
Eastern												
Naknek R.	451	598	835	979	641	946	575	925	562	225	647	787
Brooks R.	323	702	1,181	624	904	586	331	567	433	434	470	490
Kvichak R.	725	4,769	2,988	1,249	1,964	2,923	4,001	3,811	1,604	1,404	2,749	2,910
Copper R.	293	378	246	707	148	818	844	391	325	293	534	850
Alagnak R.	123	479	562	502	608	3,179	725	1,496	1,240	2,182	1,764	2,519
Newhalen R.	1,763	14,508	6,093	9,523	6,509	9,889	7,973	7,859	3,513	4,348	6,716	6,838
Lake Clark	335	252	246	143	510	297	782	800	51	443	475	159
Other	770	5,896	1,658	1,747	2,820	2,933	2,780	3,148	1,605	3,106	2,714	3,843
Subtotal	^a 4,743	27,582	13,809	15,474	14,104	21,571	18,011	18,997	9,333	12,435	16,069	18,396
Central												
Nushagak	322	338	184	480	608	521	432	153	708	509	465	1,282
Mulchatna	322	390	532	280	288	568	219	153	320	697	391	258
Agulowak										253	253	457
Agulukpak										106	106	16
Wood River L.	^b 287	2,105	522	840	526	505	813	539	900	1,065	764	1,420
Tikchik/Nuyakuk	50	598	20	150	58	557	54	32	45	0	138	110
Other	56	1,141	346	120	156	486	159	77	301	232	251	376
Subtotal	^a 1,037	4,572	1,604	1,870	1,636	2,637	1,677	954	2,274	2,862	2,081	3,919
Western												
Togiak	113	416	10	80	16	61	26	22	367	191	133	673
Goodnews	80	146	62	63	8	53	70	34	65	61	57	419
Kanektok	103	101	462	88	66	331	313	148	371	607	354	830
Other	15	112	0	0	0	0	0	0	109	53	32	46
Subtotal	^a 220	775	534	231	90	445	409	204	912	912	576	1,968
Northwestern												
Aniak	32	22	49	38	25	17	17	43	51	391	104	178
Other	25	11	0	0	57	219	299	52	182	90	168	16
Subtotal	^a 57	33	49	38	82	236	316	95	233	481	272	194
Total	6,056	32,962	15,996	17,613	15,912	24,889	20,413	20,250	12,752	16,690	18,999	24,477

Source: Mills 1977-1994, Howe et al. 1995 and 1996 and *In prep* a, b, and c.

^a Subtotals of averages may not be the sum of the drainages because information for some drainages is not available for some years.

^b Until 1997, Agulowak and Agulukpak rivers were included in Wood River Lakes.

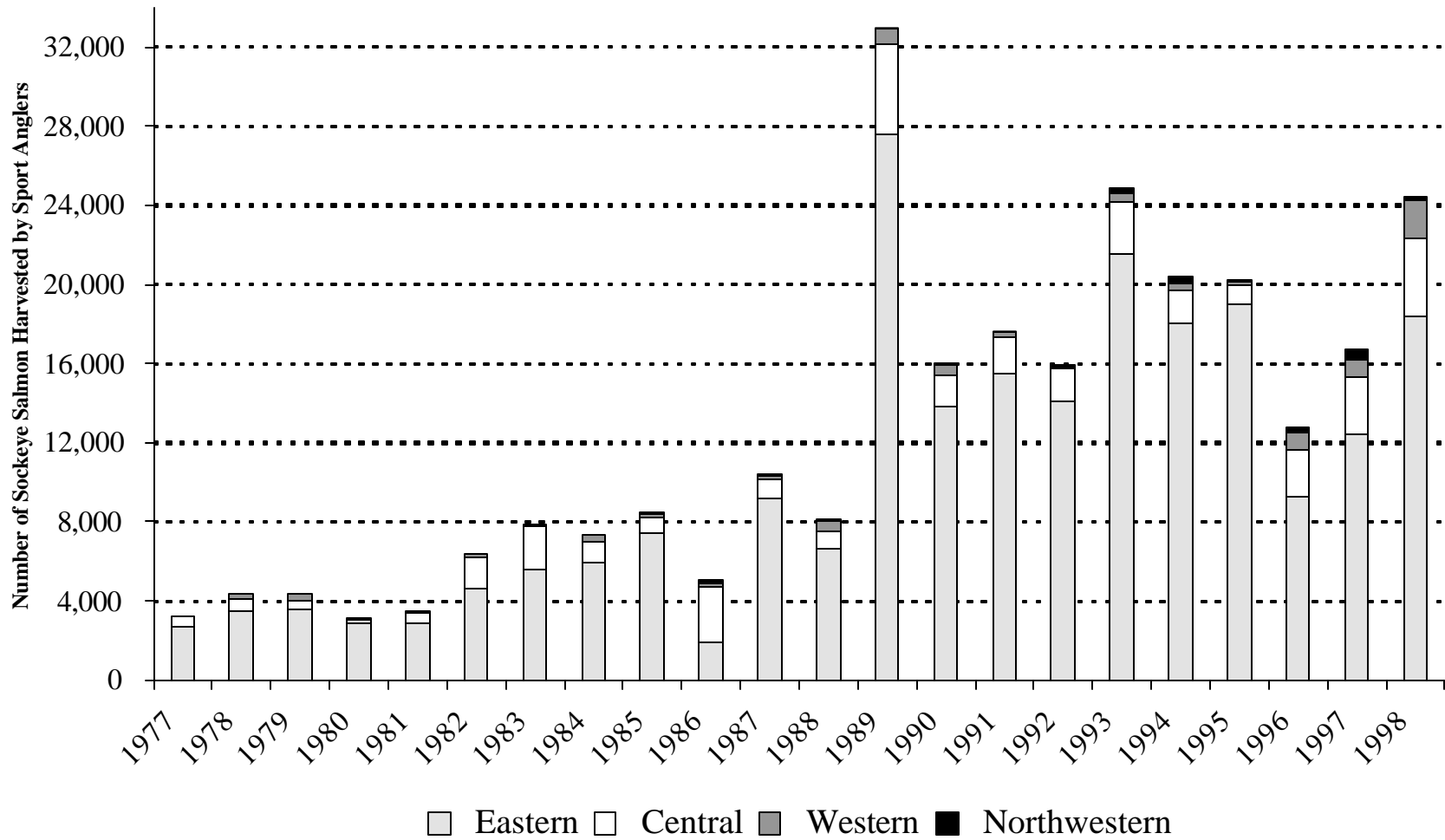


Figure 14.-Sport harvest of sockeye salmon, by section, from the Southwest Alaska Management Area, 1977 to 1998.

ranged from a low of 43 in 1981 to a high of 1,181 in 1990 (Table 22). The recent 5-year (1993-1997) average annual harvest of 470 fish can be easily sustained by this run.

The great publicity given the relatively poor sockeye returns and commercial fishery in Bristol Bay in the late 1990s seems to have depressed sport angling activity as well. A number of the more popular locations received much less effort in 1997 and 1998. In some cases there were still plenty of sockeye salmon available for the recreational fishery but little activity.

Management

Sport harvest and effort are estimated through the Statewide Harvest Survey and reported by Mills (1979-1994) and by Howe et al. (1995 and 1996 and *In prep* a, b, c, and d). Commercial and subsistence harvests are monitored by the Commercial Fisheries Division and are reported in their Annual Management Report series (ADF&G 2000). Sport Fish Division has not conducted any significant monitoring or stock assessment projects for this fishery in recent seasons. Forecasts of next season's return are provided by the Commercial Fisheries Division and are reported in a statewide salmon forecast summary (Geiger and Hart 1999). Escapement of sockeye salmon in the Brooks River is estimated from fixed-wing aerial surveys during the presumed peak of spawning. Survey results were most recently reported in Glick et al. (2000).

The 1982 memorandum of understanding between the Department of Fish and Game and the Department of Interior clearly places management authority for fishery resources of Brooks River with the Department of Fish and Game, and management of use levels and habitat protection with the National Park Service. This management structure has led to a complicated history of regulation regarding the sport fishery. Current regulations for Brooks River allow the keeping of 1 fish per day and in possession except rainbow trout, which are managed for catch-and-release fishing. Anglers are restricted to single-hook artificial lures below the footbridge and unbaited single-hook artificial flies above the bridge. The current regulations are the result of a total revamping of the regulations in 1990 as part of the development of a rainbow trout management plan for the area. Over the years, significant concessions of sport fishing opportunity have been made under the premise of ensuring the safety of sport anglers using the Brooks River. These concessions include reductions in bag limits from 5 sockeye salmon to 1, restrictions in terminal tackle to include single-hook artificial lures below the bridge, and fly-fishing-only above the bridge.

The Park Service has adopted regulations requiring anglers to immediately place a harvested fish in a plastic bag and proceed to the cleaning house with the fish for cleaning and storage. The objective is to avoid conditioning bears to link fish harvested by sport fishermen with an easy meal. Since the early 1990s the NPS has been inconsistent in their enforcement of their fish handling regulations, and bears have occasionally stolen fish that were illegally kept along the river. On occasion, the Service has temporarily restricted public and angling access in the immediate vicinity of Brooks River. Such restrictions have typically occurred in mid July at the peak of the sockeye run, were imposed after some incident, and terminated within a period of 2 to 3 weeks. The degree of coordination concerning these restrictions with the Department of Fish and Game and NPS has been variable, but improved in recent years.

The general erosion of angling opportunities as well as difficulties coordinating emergency management actions emphasize the need for a long-range management plan for the sockeye salmon sport fishery.

Angling opportunity for Brooks River sockeye salmon will continue to be eroded and replaced with other activities unless the National Park Service and the Department of Fish and Game can develop a plan that will be supported by both agencies.

Management Objectives

Naknek River sockeye salmon stocks are managed to achieve a biological escapement of 1.1 million. The Brooks River is managed to provide an average of 5,000 angler-days per year and a diversity of angling opportunity by providing a special management area restricted to unbaited single-hook artificial flies.

1999 Season

Escapement of sockeye salmon into the Naknek drainage totaled 1,625,364; successfully achieving the goal of 1.1 million fish (ADF&G 2000). The large escapement into the Naknek River system provided plenty of sockeye in Brooks River. No restrictions were imposed on the sport fishery for bears or other problems.

2000 Outlook

The inshore run forecast for the 1999 sockeye salmon return to the Naknek River is 5.5 million fish (Table 23). Meeting the 1.1 million escapement goal will leave 4.4 million salmon to be harvested. Given the expected level of escapement into the Naknek drainage, there should be plenty of sockeye salmon at Brooks River in 2000. Good to excellent sport fishing opportunity is expected from late June through July 20.

Park Service and ADF&G staff will continue to monitor human use and will work together should it become necessary to take actions for the safety of visitors and anglers.

KVICHAK RIVER

The Kvichak River drainage (Figure 13) hosts the single largest sockeye salmon run in the world and the river itself is a popular destination for anglers targeting this species. Two locations within the drainage support significant sport fisheries for sockeye salmon. First to occur is the fishery on the Kvichak River at the outlet of Lake Iliamna. The other, often larger fishery, which occurs on the Newhalen River near the community of Iliamna, is discussed further in this report. Other smaller tributaries within the drainage are fished much less intensively and sport harvests are relatively minor.

Fishery Description

Sockeye salmon first appear in the Kvichak River during the last week of June. The run peaks in the first week of July, then declines steadily until late July or early August.

In most years, anglers prefer to fish this medium-sized river's clear waters during the first half of the run when the salmon are more readily taken on sport gear. In peak years, when very large runs are expected, the sport fishery may be active for much of the month of July. A modern airstrip in the village of Igiugig provides easy access to the river where it drains out of Lake Iliamna, and float planes can land on the lake or on the river. Although much of the sport effort is from nonresident guided anglers, a growing component is the resident unguided angler arriving from Anchorage in private, charter, or scheduled aircraft.

Table 23.-2000 Bristol Bay sockeye salmon forecast.

District/ River	Number of Sockeye Salmon		
	Total Return	Spawning Goal	Estimated Harvest
NAKNEK-KVICHAK			
Kvichak	9,767,000	6,000,000	3,767,000
Branch (Alagnak R.)	441,000	215,000	226,000
Naknek	<u>5,525,000</u>	<u>1,100,000</u>	<u>4,425,000</u>
Total	15,733,000	7,315,000	8,418,000
EGEGIK	8,547,000	1,100,000	7,447,000
UGASHIK	4,580,000	850,000	3,730,000
NUSHAGAK ^a			
Wood	3,432,000	1,000,000	2,231,000
Igushik	1,634,000	200,000	1,315,000
Nushagak/ Mulchatna	762,000	550,000	194,000
Total	5,828,000	1,750,000	3,740,000
TOGIAK ^b	741,000	150,000	591,000
TOTAL BRISTOL BAY	35,429,000	11,165,000	23,926,000

From: Scott and Geiger 2000.

^a Forecast for the Snake River system was not included (1971-1991 average escapement was 18,000).

^b Forecasts for Kulukak, Osviak, and Matogak river systems were not included. These systems may contribute an additional 71,000 (1988-1997 mean catch) to the Togiak District harvest.

Since the Igiugig Native Corporation owns most of the uplands along the upper Kvichak River, anglers may expect to pay modest daily fees for access, and commercial operators are expected to pay more substantial fees for annual leases.

Historical Performance

The Kvichak River drainage sockeye salmon run has long been known for its 5-year abundance cycle. Peak returns occur on the fifth and tenth year of each decade: 1975, 1980, 1985, etc. (Table 24). The first and second years following a peak abundance year are the lowest annual returns in the cycle,

Table 24.-Historic sockeye salmon harvests and escapements for the Kvichak River, 1974 to 1999.

Year	Commercial ^a Harvest	Subsistence ^b Harvest	Sport Harvest			Total Harvest	Escapement ^e
			Kvichak River ^c	All Tributaries ^d	Other Total		
1974	148,595	98,100				246,695	4,433,844
1975	1,605,407	115,500				1,720,907	13,140,450
1976	1,458,180	75,900				1,534,080	1,965,282
1977	739,464	72,000	583	1,683	2,266	813,730	1,341,144
1978	3,815,636	83,900	380	2,677	3,057	3,902,593	4,149,288
1979	13,418,829	65,500	283	3,160	3,443	13,487,772	11,218,434
1980	12,743,074	72,600	654	1,052	1,706	12,817,380	22,505,268
1981	5,234,733	75,600	400	2,215	2,615	5,312,948	1,754,358
1982	1,858,475	61,300	639	3,233	3,872	1,923,647	1,134,840
1983	16,534,901	96,500	603	3,768	4,371	16,635,772	3,569,982
1984	12,523,803	100,500	898	3,828	4,726	12,629,029	10,490,670
1985	6,183,103	86,500	1,827	3,620	5,447	6,275,050	7,211,046
1986	787,303	59,900	102	510	612	847,815	1,179,322
1987	3,526,824	72,000	1,805	5,334	7,139	3,605,963	6,065,880
1988	2,654,364	77,100	526	3,622	4,148	2,735,612	4,065,216
1989	11,456,509	71,400	4,769	18,845	23,614	11,551,523	8,317,500
1990	10,468,631	76,600	2,988	7,452	10,440	10,555,671	6,970,020
1991	3,837,923	66,786	1,249	11,467	12,716	3,917,425	4,222,788
1992	5,678,494	72,148	1,964	9,174	11,138	5,761,780	4,725,864
1993	5,239,770	74,123	2,923	13,222	16,145	5,330,038	4,025,166
1994	13,840,448	64,343	4,001	11,453	15,454	13,920,245	8,337,840
1995	17,509,862	54,679	3,811	11,212	15,023	17,579,564	10,038,720
1996	8,187,720	54,872	1,604	4,474	6,078	8,248,670	1,450,578
1997	182,000	59,508	1,404	6,471	7,875	247,965	1,503,732
1998	1,072,760	53,656	2,910	10,209	13,119	1,139,535	2,296,074
1974-1998 Average	6,428,272	74,441	1,651	6,304	7,955	6,509,656	5,992,385
Percent	99%	1%			<1%		
1994-1998 Average	8,158,558	57,412	2,746	8,764	11,510	8,227,196	4,725,389
Percent	99%	1%			<1%		
1999	6,781,260	57,723	3,516	9,244	12,760	6,851,743	6,196,914

^a Estimated Kvichak River fish only - captured in Naknek Kvichak District commercial fishery.

^b Harvests are extrapolated for all permits issued, based on those returned. Harvest estimates prior to 1991 are rounded to the nearest hundred fish. Harvest estimates prior to 1990 are based on the community where the permit was issued; estimates from 1990 to the present are based on community of residence and include fish caught only in the Kvichak District. Sources: 1974-1978 ADF&G 1991, Appendix Table 47; 1979-1999 ADF&G 2000, Appendix Table 32.

^c Kvichak River sport harvest only; estimated by Mills 1977-1994, Howe et al. 1995 and 1996, *In prep* a, b, c, and d.

^d Estimated sport harvest from other tributaries of the Kvichak River, excluding the Alagnak River. This is the SWHS Area S freshwater total, minus the Alagnak River (Mills 1979-1994, Howe et al. 1995 and 1996, *In prep* a, b, c, and d).

^e Tower counts conducted at Igiugig. Sources: 1974-1978 ADF&G 1991, Appendix Table 14; 1979-1999 ADF&G 2000, Appendix Table 13.

such as 1976, 1981, and 1982, and 1996 and 1997 (Table 24). In the intervening seasons, the total abundance of Kvichak drainage sockeye salmon builds to the next peak year. The reason for this cycle is not clear and it has been the source of a number of studies and much speculation (Rogers and Poe 1984, Fried 1984, Eggers and Rogers 1987, Cross 1991, 1994, Cross et al. 1997). Once regarded as a natural phenomenon, there was a period in the 1980s and early 1990s when the cycle was thought to be an artifact of the commercial harvest (Cross et al. 1997). During that period, the Commercial Fisheries Division attempted management strategies designed to reduce or eliminate the cycle. The efforts had minimal success. Cross et al. (1997) conclude: "Available information was inconclusive about the cause of production cycles in Kvichak River, therefore, there is a great uncertainty in what levels of escapement will optimize Kvichak River's production every year." Current management of the commercial fisheries adjusts annual escapement goals over a wide range according to "actual run size and a conservative exploitation rate" (Cross et al. 1997).

The Bristol Bay commercial salmon fleet harvests roughly 50% of the annual Kvichak River sockeye salmon run, and the subsistence fishery takes an average of nearly 75,000 fish annually, or about 1% of the total run. Since 1995, the annual subsistence harvest has declined to less than 60,000. This decline is not thought to be related to run strength. Kvichak River sockeye salmon sport harvests ranged between 300 and 600 fish per year until 1984 when nearly 900 fish were taken (Table 24).

After 1984, estimates of the sport harvest ranged from 102 sockeye salmon in 1986 to nearly 4,800 in 1989. From 1994 through 1998, the annual sport harvest averaged 2,750 sockeye salmon (Table 24). Even the highest estimates of sport harvest amounted to about 2% (1989) of the total Kvichak River sockeye salmon harvest, even less of the total return, and did not jeopardize the department's ability to manage for sustained yield.

In 1995 the department conducted a benchmark survey of the sockeye salmon sport fishery near Igiugig (Dunaway and Fleischman 1996b). Harvest was found to be an important aspect of this fishery with nearly 60% of the angler trips harvesting the daily limit of 5 sockeye salmon. Virtually all anglers fished from the shore, fly tackle was used in 97% of the trips, 66% of the anglers were guided, and 81% were nonresidents (Dunaway and Fleischman 1996b). The onsite effort estimate was very similar to effort levels estimated by the annual Statewide Harvest Survey.

Management

Sport harvest and effort are estimated through the Statewide Harvest Survey and reported by Mills (1979-1994) and by Howe et al. (1995 and 1996, *In prep* a, b, and c). Commercial and subsistence harvests are monitored by the Commercial Fisheries Division and are reported in their Annual Management Report series (ADF&G 1998a, 1999a). Sport Fish Division conducted a survey on this fishery in 1995 (Dunaway and Fleischman 1996b). Escapement is estimated by counts made from towers as the salmon migrate up the Kvichak River. Forecasts of each season's return are provided by the Commercial Fisheries Division and are reported in a statewide salmon forecast summary (Geiger and Hart 1999).

Kvichak River sockeye salmon stocks are managed to achieve a biological escapement goal (BEG) between 4 and 10 million fish, depending on the cycle year. For high-cycle years the point goal is set between 6 and 10 million. During off-cycle years the point goal is set between 4 and 6 million, but may

be reduced inseason to 2 million plus 50% of the number projected over 2 million. The specific point goal is established pre-season and published (Geiger and Hart 1999).

The large number of available salmon, angler crowding in the nearby Newhalen River fishery, and improved facilities in Igiugig are all contributing to the growth of this fishery. Increased effort in recent years has raised the potential for conflicts between the traditional subsistence net fishery at the village of Igiugig and sport anglers. A challenge to management of this fishery will be to provide for increased opportunity while ensuring that gear and user conflicts are addressed.

The sport fishery is actively managed to provide increased participation and opportunity. Anglers seeking rainbow trout and sockeye salmon presently expend an average of more than 5,000 angler-days per year at the Kvichak River (Table 6). The level of participation could double in 4 years by improving access to desirable fishing sites, promoting the fishery as a destination, and working to assure necessary facilities are provided to accommodate the growth in a responsible manner. To this end the department has worked closely with the Igiugig City Council on a project to build trails to desirable fishing locations close to the village airfield. Initiated in 1994 with expectations to be complete by 1995, the project has been slowed by problems with easements and access to gravel supplies. Work is expected to begin in 2000.

Management Objectives

The Kvichak River sockeye salmon stocks are managed to achieve a biological escapement goal (BEG) of 2 to 10 million, depending on the cycle year. In 1999, the pre-season BEG was 6 million fish and the total run was expected to be 9.7 million sockeye (Geiger and Hart 1999).

1999 Season

The 1999 inshore return of sockeye salmon to all of Bristol Bay was 40.0 million fish, about 38% more than the pre-season forecast. The Kvichak River run experienced a brief but anxiety raising hiatus in early July, but all other inseason run strength indicators supported the pre-season spawning escapement goal of 6.0 million.

This strong run provided plenty of fish for the sport anglers on the Kvichak River. By July 3 nearly 750,000 sockeye had passed the department counting tower at Igiugig and the word began to spread that fishing was very good. By July 5, over 1.5 million fish had been counted, large numbers of anglers began crowding into the Igiugig area, and trespass complaints from local residents were heard. The complaints quickly faded, however, as the fish began appearing at the Newhalen River and much of the angling effort began concentrating at that more easily accessed fishing site.

No restrictions were issued for the sport fishery and angling success was likely quite good. By the end of the season, the escapement was 6.2 million sockeye salmon and a nearly equal number of fish had been harvested by the commercial fishery. The total run for the Kvichak River was nearly 13 million fish. In the Kvichak River proper, sport anglers harvested an estimated 3,516 sockeye salmon and caught (harvested plus released) 17,967 sockeye salmon during the 1999 sport fishery (Table 24) (Howe et al. *In prep* a, b, c, and d). For the rest of the Kvichak River drainage, including Lake Iliamna and tributaries, the sport fishery harvested an estimated 9,244. The subsistence fishery harvested another 3,965 sockeye salmon from the Kvichak River and a total of 57,723 from the whole drainage during 1999 (ADF&G 2000).

2000 Outlook

The 2000 Kvichak drainage forecast calls for a total return of nearly 9.5 million sockeye salmon, of which 6.0 million are to be allowed into the river for spawning and inriver use (Scott and Geiger 2000). If the inshore run projection and escapement goal are achieved, we expect a strong run this year, and plenty of sockeye salmon should be available to anglers. Year 2000 is expected to be a peak year for this drainage, where annual run strength normally swings high and low on a 5-year cycle. Best fishing will probably occur from late June through July 16; spotty fishing success can be expected before and after these dates.

Exceptional fishing may be accessed from the village of Igiugig, where the Igiugig Native Corporation and the Alaska Department of Fish and Game are in partnership on a sport fishing access project. The project, to begin this year, is intended to provide anglers safe and efficient access to sockeye salmon fishing waters downstream of the village. The village of Igiugig has graciously provided an easement across uplands for anglers to reach the fishing hot spots. The intention is to minimize the intermingling of sport fishermen with ongoing subsistence fishing activities immediately adjacent to the village.

NEWHALEN RIVER

Fishery Description

The Newhalen River is the major tributary in the Kvichak River drainage. It flows from Lake Clark into the north side of Lake Iliamna near the communities of Iliamna and Newhalen (Figure 13). Since it is further inland, sockeye salmon reach the Newhalen River a few days later than the Kvichak River and the best angling usually occurs during the middle 2 weeks of July.

The Newhalen River is more easily accessed than the Kvichak River and supports a large run of sockeye salmon. Several businesses and lodges in the town of Iliamna cater to anglers' needs and a large runway serviced by regularly scheduled commercial airlines provides economical access from Anchorage. From the runway, a mile-long trail leads to the river. The trail ends near a series of cascades where large numbers of sockeye salmon congregate on their way to spawning grounds in the Lake Clark drainage.

Historical Performance

The sockeye salmon entering the Newhalen River are one segment of the normally huge Kvichak River run. Hence, comments on the character of the commercial and subsistence harvests for the Kvichak River apply equally for the Newhalen River stocks. The sport fishery on the Newhalen River is unique for its large component of unguided anglers and for its history of regularly producing 25% to over 40% of the entire area's annual sport harvest of sockeye salmon (Table 22). For the period 1993 to 1997, the annual sport harvest averaged 6,716 sockeye salmon. The department has not conducted any onsite studies of this fishery.

Management

Sport harvest and effort are estimated through the Statewide Harvest Survey and reported by Mills (1979-1994) and by Howe et al. (1995 and 1996, *In prep* a, b, c, and d). Commercial and subsistence harvests are monitored by the Commercial Fisheries Division and are reported in their Annual Management Report series (ADF&G 2000). Sport Fish Division has not conducted any significant monitoring or stock assessment projects for this fishery. Escapement is estimated by counts made from towers at the village of Igiugig as the salmon migrate up the Kvichak River. Escapement

distribution is assessed by aerial index surveys of drainage tributaries by Commercial Fisheries Division. Forecasts of next season's return to the Kvichak drainage are provided by the Commercial Fisheries Division and are reported in a statewide salmon forecast summary (Scott and Geiger 2000).

In response to the growth of the Newhalen River sport fishery, the Sport Fish Division provided funds through its Small Projects Access program to install regulatory signs, several portable toilets and bear-proof garbage facilities along the trail. These modest improvements have been received very well by the angling public and the adjacent landowners. If ADF&G can get permission, we would like to make additional trail improvements to reduce erosion of the trail.

Management Objectives

The Newhalen River sockeye salmon sport fishery is managed to provide an average of 5,000 angler-days of effort and an average harvest of 8,000 sockeye salmon per year. Escapement is addressed by achieving the biological escapement goal (BEG) for the Kvichak River.

1999 Season

See the preceding section, 1999 Season for the Kvichak River sockeye salmon. No monitoring program was in place and the 1999 harvest estimate from the SWHS was 6,356 sockeye salmon (Howe et al. *In prep d*).

Access along the trail to the Newhalen River occurred without interruption this season. Facilities provided by the department access program continued to be used heavily by the visiting public. However, the department is finding it increasingly difficult to locate affordable servicing of the facilities. If servicing becomes too expensive, the department may have to cease providing the toilet and garbage facilities at this site.

2000 Outlook

As in 1999, the Newhalen River component of the Kvichak return is expected to be considerably stronger in 2000 than in 1997 and 1998. The trail from the Iliamna airport to the river remains open to public access and camping opportunities may be available on adjacent private lands. Peak fishing time will occur from about July 4 until July 15. Sockeye numbers typically decline after this period, but some good angling opportunities may still persist. A federally-funded sockeye salmon counting tower is scheduled to operate on the Newhalen River upstream of the falls to assess the number of fish entering the Lake Clark drainage.

CENTRAL SECTION SOCKEYE SALMON FISHERIES

About 15% of Bristol Bay sockeye salmon return to the Central section. Anglers do not fish this section heavily for sockeye salmon, and sport harvests average 2,000 fish, or 11% of the area's total annual sport harvest (Table 22). Harvest of sockeye from the Central Section in 1998 totaled 3,919, and was the second highest reported (after 1989) for the section (Howe et al. *In prep c*). It appears that interest in harvesting sockeye is growing. The stocks are generally healthy and virtually unaffected by the recreational harvest. Commercial fishermen take as much as 58% of the sockeye salmon run while subsistence and sport harvests are each less than 1% of the run. The waters most commonly used by sport anglers are the Nushagak River, Mulchatna River, and the Wood River Lakes system.

2000 Outlook

The Division of Commercial Fisheries expects sockeye salmon returns to the Nushagak Bay drainages to total almost 5.8 million fish in 2000 (Table 23). Approximately 1.7 million sockeye are expected to enter these river systems this season. The best sockeye sport fishing opportunities will be in the Wood River and the Wood River Lakes systems. The best time to fish sockeye will be from late June until about July 15.

SECTION VI: RAINBOW TROUT FISHERIES

Wild rainbow trout stocks of the SWMA are cornerstone to a multimillion dollar recreational fishing industry. Sport fishing opportunity for both guided and unguided anglers is primarily during the ice-free season, generally from June through October. Popular waters include tributaries of the Kvichak River drainage, the Naknek River drainage, portions of the Nushagak/Mulchatna River drainages, streams of the Wood River Lakes system, the Kanektok, Goodnews, and Aniak rivers (Figure 15).

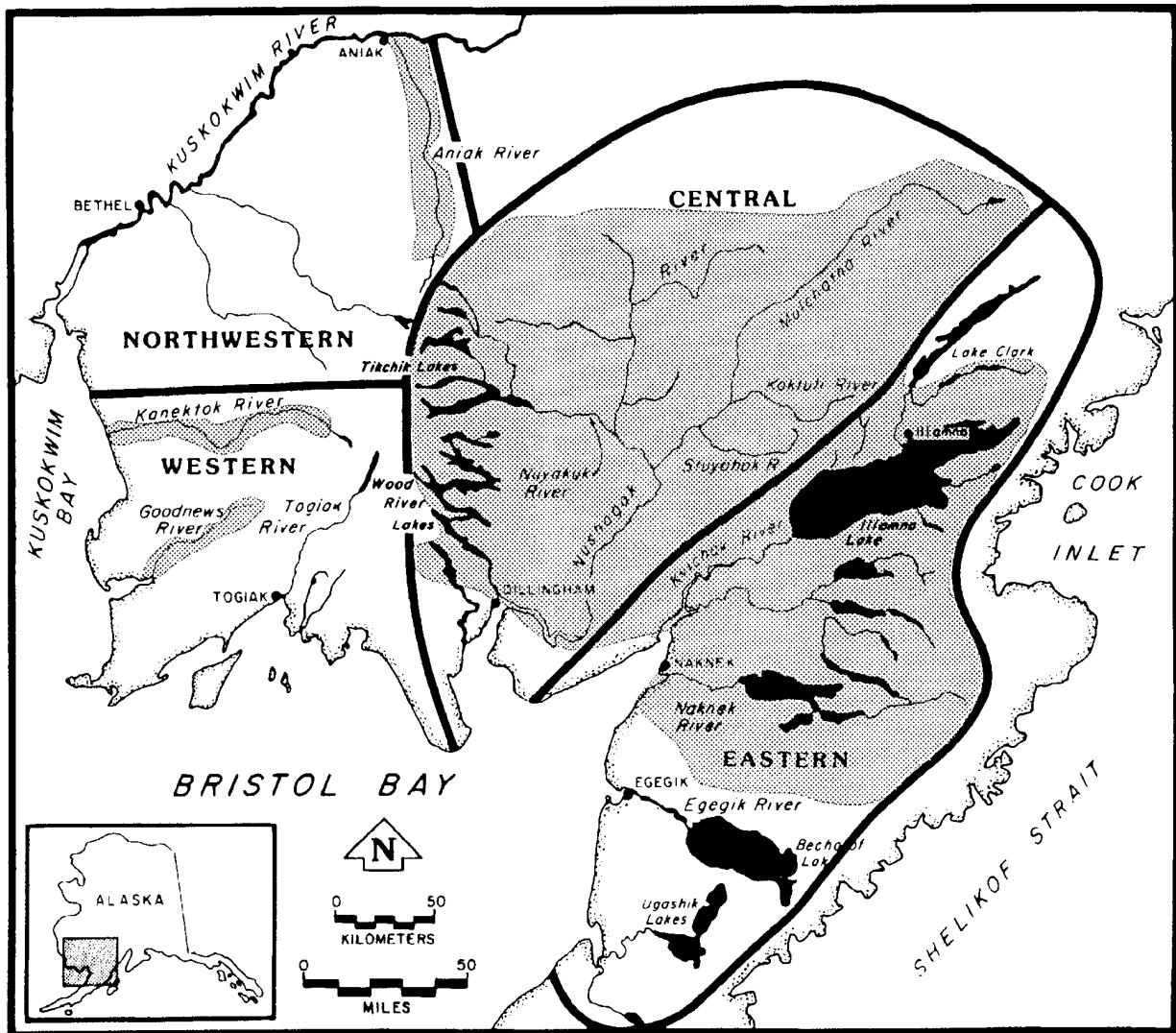


Figure 15.-Popular rainbow trout sport fisheries in Southwest Alaska.

The rainbow trout fisheries within the SWMA underwent rapid growth from the late 1970s to mid 1980s, peaking in 1983 (Figure 16). From 1993 through 1997 annual harvests averaged 3,426 fish (Table 25). The species' importance to the recreational fisheries is not adequately described by estimates of harvest. Studies indicate that during the last 10 years, the retention rate, or the number of fish kept from the total catch, has declined steadily while the total effort and catch remained stable or increased (Minard 1989b and 1990, Brookover 1989b, Dunaway 1993). Estimates of catch (number of fish kept plus fish released) were first available from the Statewide Harvest Survey in 1991, and have ranged from about 122,000 fish to 279,000 fish annually (Table 26). From 1993 through 1997 the annual catch averaged 185,706 rainbow trout. It is evident the angling public has embraced the concept of catch-and-release for rainbow trout, and has voluntarily reduced their harvests throughout the area.

The status of rainbow trout as a subsistence species is changing under the direction of the Alaska Board of Fisheries. In 1993, the Board ruled that rainbow trout, caught incidentally to other species, may be retained by subsistence users. In 1994 the Alaska Board of Fisheries recognized subsistence use of rainbow trout among all other finfish in Bristol Bay (5 AAC 01.336). These are changes from previous years where rainbow trout were explicitly excluded from harvest under the subsistence priority.

The subsistence taking of rainbow trout from nonnavigable waters located within federal land holdings (Refuges and National Parks) has been allowed since December of 1991. Since there were few, if any, significant subsistence fisheries for rainbow trout occurring on nonnavigable waters, the federal regulations had little effect on legal fishing opportunity.

Note that the Board of Fisheries has provided seasonal opportunities for harvesting rainbow trout under sport regulations by liberalizing bag limits during the off-season months (typically fall to late spring), when most local residents pursue rainbow trout for food. For example, in most waters of the SWMA, the summer bag limit is 2 rainbow trout per day, but in the winter months the limit increases to 5 rainbow trout per day. Seasonal changes in the bag limits accommodate the winter harvest needs of the few local residents but do little to jeopardize the health of local rainbow trout stocks.

SOUTHWEST ALASKA RAINBOW TROUT MANAGEMENT PLAN

In February of 1990, the Alaska Board of Fisheries adopted regulations implementing a comprehensive management plan for rainbow trout in Southwest Alaska (ADF&G 1990). The plan provides guidance in the form of policy that gives the Board and the public a clear understanding of the underlying principles by which rainbow trout stocks are to be managed and provide guidance for the Board in developing future regulations.

Philosophy of the Plan

The overriding philosophy of the Southwest Alaska Rainbow Trout Management Plan is one of conservative wild stock management. Conservative wild stock management does not necessarily preclude limited harvest of rainbow trout for food or trophies. However, maximum yield principles which emphasize harvest are ruled out. Additionally, under a philosophy that emphasizes wild trout management, mitigating losses of wild stocks through enhancement or stocking is not considered a desirable management alternative.

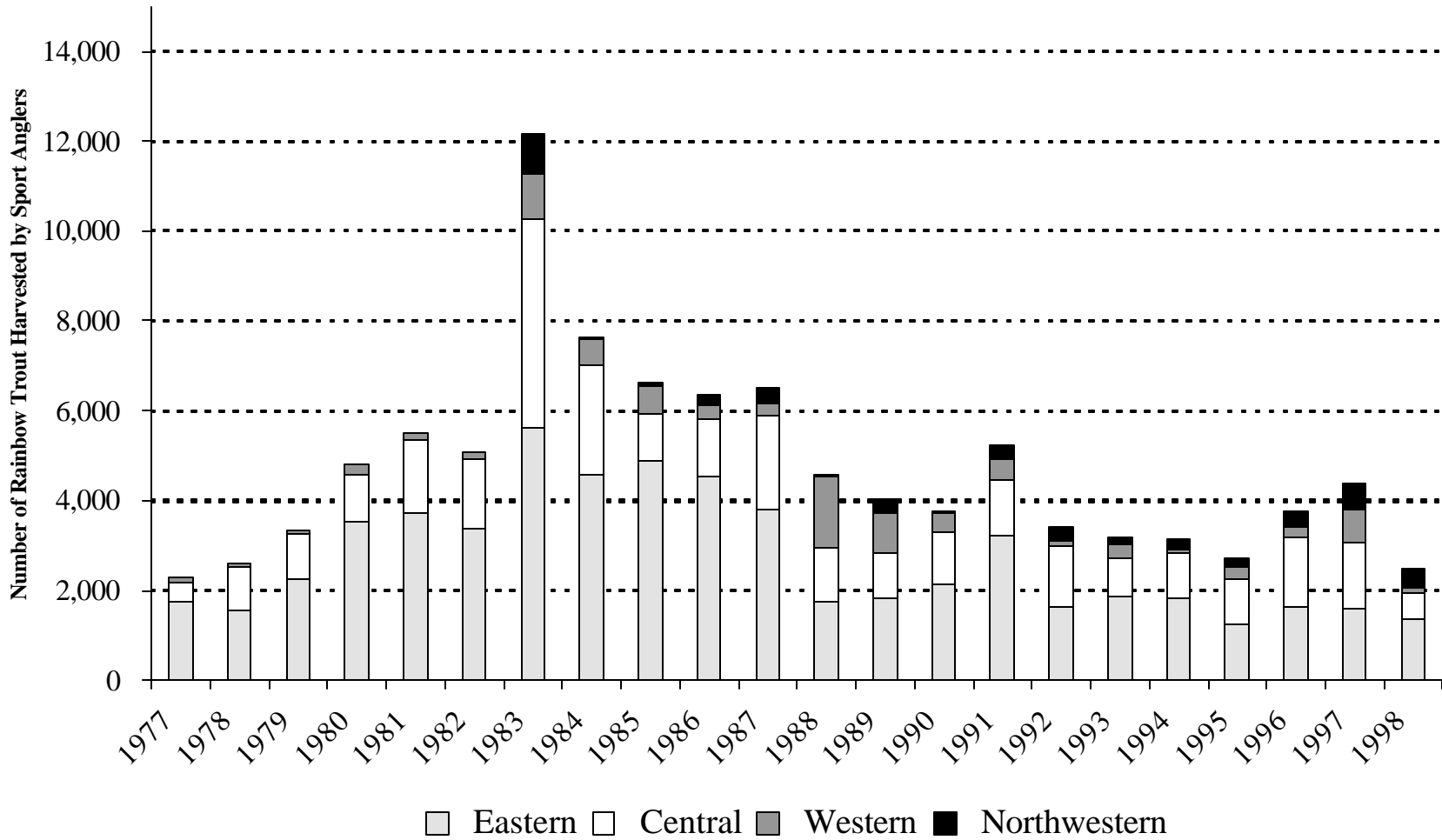


Figure 16.-Sport harvest of rainbow trout from the Eastern, Central, Western, and Northwestern sections of the Southwest Alaska sport fish management area, 1977-1998.

Table 25.-Sport harvest of rainbow trout from waters of Southwest Alaska by fishery, 1977-1998.

Drainage	1977-88										1993-97	
	Average	1989	1990	1991	1992	1993	1994	1995	1996	1997	Average	1998
Eastern												
Naknek R.	1,590	520	491	720	705	842	366	457	603	246	503	388
Brooks R.	141	31	33	112	0	0	19	9	0	0	6	0
Kvichak R.	354	50	254	37	356	269	191	12	58	27	111	25
Copper R.	131	30	42	56	0	0	0	0	0	0	0	0
Alagnak R.	287	343	423	243	111	312	74	107	26	254	155	35
Newhalen R.	256	81	53	693	55	89	175	208	82	254	162	377
Lake Clark	15	10	32	37	0	20	40	0	0	119	36	0
Other	768	736	802	1,321	405	325	935	450	861	705	655	514
Subtotal	^a 3,445	1,801	2,130	3,219	1,632	1,857	1,800	1,243	1,630	1,605	1,627	1,339
Central												
Nushagak	275	135	55	200	190	122	230	172	334	84	188	257
Mulchatna	418	229	273	444	515	375	253	197	879	684	478	163
Agulowak										15	15	43
Agulukpak										0	0	0
Wood River L.	^b 487	478	593	215	547	306	383	209	166	329	279	71
Tikchik/Nuyakuk	131	20	11	43	0	10	19	9	101	44	37	0
Other	359	182	220	339	110	64	138	424	63	302	198	80
Subtotal	^a 1,610	1,044	1,152	1,241	1,362	877	1,023	1,011	1,543	1,458	1,182	614
Western												
Togiak	113	437	22	14	0	0	8	19	58	15	20	8
Goodnews	141	316	141	258	0	145	19	43	24	433	133	97
Kanektok	317	126	281	182	55	130	59	198	133	231	150	0
Other	90	0	0	0	47	0	0	0	24	44	14	0
Subtotal	^a 432	879	444	454	102	275	86	260	239	723	317	105
Northwestern												
Aniak	114	101	35	76	32	10	8	0	21	53	18	349
Other	0	214	18	243	293	142	205	188	327	546	282	77
Subtotal	^a 268	315	53	319	325	152	213	188	348	599	300	426
Total	7,712	4,039	3,779	5,233	3,421	3,161	3,122	2,702	3,760	4,385	3,426	2,484

Source: Mills 1992-1994, Howe et al. 1995 and 1996, and *In prep* a, b, and c.

^a Subtotals of averages may not be the sum of the drainages because information for some drainages is not available for some years.

^b Until 1997, Agulowak and Agulukpak rivers were included in Wood River Lakes.

Table 26.-Sport catch of rainbow trout from the waters of Southwest Alaska by fishery, 1991-1998.

Drainage	1991	1992	1993	1994	1995	1996	1997	1993-97 Average	1998
Eastern									
Naknek R.	13,863	14,850	16,393	10,113	14,501	16,888	13,737	14,326	12,795
Brooks R.	4,573	9,634	13,575	12,301	6,091	14,474	16,166	12,521	6,157
Kvichak R.	15,115	10,161	11,465	7,187	4,741	11,396	15,705	10,099	5,584
Copper R.	11,706	13,916	15,951	12,732	12,683	12,154	29,158	16,536	15,164
Alagnak R.	23,244	18,452	30,665	11,062	19,499	29,696	29,881	24,161	9,711
Newhalen R.	4,795	2,422	2,975	3,949	2,874	1,848	1,403	2,610	3,803
Lake Clark	862	760	173	309	642	119	1,104	469	432
Other	40,504	27,570	42,433	37,774	31,018	65,897	56,114	46,647	33,980
Subtotal ^a	114,662	97,765	133,630	95,427	92,049	152,472	163,268	127,369	87,626
Central									
Nushagak	8,750	5,407	8,966	6,530	5,808	19,540	12,304	10,630	10,649
Mulchatna	3,251	4,433	4,416	3,740	5,962	6,491	4,866	5,095	3,576
Agulowak							8,140	8,140	6,906
Agulukpak							11,382	11,382	3,413
Wood River L ^b	8,879	5,897	8,283	8,677	7,260	12,939	5,366	8,505	3,856
Tikchik/Nuyaku	1,647	1,599	2,574	1,350	1,315	2,537	3,531	2,261	1,708
Other	1,934	1,322	2,167	4,525	4,392	4,096	7,347	4,505	3,663
Subtotal ^a	24,461	18,658	26,406	24,822	24,737	45,603	52,936	34,901	33,771
Western									
Togiak	616	538	1,298	1,206	1,873	2,872	1,810	1,812	1,773
Goodnews	2,776	1,282	3,994	945	1,263	1,450	9,703	3,471	5,738
Kanektok	5,856	1,496	4,106	4,779	3,046	6,704	27,518	9,231	13,567
Other	0	8	267	0	0	923	1,813	601	662
Subtotal ^a	9,248	3,324	9,665	6,930	6,182	11,949	40,844	15,114	21,740
Northwestern									
Aniak	1,881	934	1,144	656	1,581	3,457	12,383	3,844	5,004
Other	790	1,369	2,612	1,625	4,642	3,815	9,693	4,477	5,472
Subtotal ^a	2,671	2,303	3,756	2,281	6,223	7,272	22,076	8,322	10,476
Total	151,042	122,050	173,457	129,460	129,191	217,296	279,124	185,706	153,613

Source: Mills 1992-1994, Howe et al. 1995 and 1996, and *In prep* a, b, and c.

^a Subtotals of averages may not be the sum of the drainages because information for some drainages is not available for some years.

^b Until 1997, Agulowak and Agulukpak rivers were included in Wood River Lakes.

Conservative wild stock management is predicated on both biological considerations and social concerns. Growth in the region's rainbow trout sport fisheries is inevitable, but by managing the area's wild rainbow trout stocks conservatively, the potential for serious long-term resource problems is minimized. From a social perspective, conservative wild stock management is consistent with the wishes and desires of most of the angling public presently using the resource.

The Southwest Alaska Rainbow Trout Management Plan contains policies which are intended to protect the biological integrity of the region's wild trout stocks and maximize their recreational benefit and economic potential. The policies provide management biologists within the Department of Fish and Game, Board of Fisheries members, and the public with clear policies to govern management of rainbow trout fisheries in the SWMA and guide the development of sport fishing regulations designed to implement these policies.

Policy I

Native rainbow trout populations will be managed to maintain historic size and age compositions and at stock levels sufficient such that stocking is not needed to enhance or supplement the wild population.

This policy addresses the department's primary responsibility to ensure that resources are being managed on a sustained yield basis. Adherence to this policy ensures that management practices do not alter the historic size and age compositions of rainbow trout stocks within the management area. Additionally, this policy addresses the desire to maintain wild rainbow trout throughout the area and states that mitigating loss of wild stocks through enhancement or stocking is not a desirable management alternative.

Policy I is realized by managing rainbow trout stocks in a biologically sound manner under a conservative yield philosophy. Consistent with this philosophy, the general bag and possession limits for rainbow trout within the area do not exceed 2 per day of which only 1 may be greater than 20 inches. More restrictive limits may be applied to satisfy the goals associated with waters designated for special management or to address a biological problem.

Policy II

A diversity of sport fishing opportunities for wild rainbow trout should be provided through establishment of special management areas by regulation. Selection of areas for special management will be based on criteria to be adopted by the Board of Fisheries.

Under this policy, special management areas are established to provide the sport fishing public with a variety of angling opportunities. Selection of waters for special management is based on criteria established by the Board of Fisheries, designed to ensure the most suitable waters are selected.

Policy II has been implemented by establishing special management areas that provide the sport fishing public with a range of desirable angling opportunities. In Southwest Alaska, special management may be designated as either Catch-and-Release or Trophy. In waters designated as Catch-and-Release or Trophy areas only unbaited, single-hook artificial lures may be used. Catch-and-Release or Trophy

areas may further be designated as fly-fishing-only. In waters not designated for special trout management, but during times when directed wild trout fisheries occur, the use of artificial lures (no single-hook restriction) can be considered depending on current harvest and effort levels.

Waters designated by regulation for special management are to be selected according to a process that addresses stock status, location, historical use patterns, accessibility, aesthetics, geographical distribution of angling opportunities, and the economic return in terms of commerce generated and jobs created. From 1990 through 1997 under the original plan, each candidate water was ranked according to 11 criteria to determine its suitability for special management. Implementation of the plan became more formalized in the spring of 1998 with regulation 5 AAC 75.013. In this regulation, the Board of Fisheries adopted 10 of the original 11 criteria shown below. The Board chose to exclude criteria number 5 regarding overlap with freshwater net fisheries. The original 11 criteria were:

1. **STOCK STATUS.** To be considered for Catch-and-Release or Trophy designation, a candidate water must meet the biological objectives of conservative yield, which call for the maintenance of the historical size and age composition and stock levels of the rainbow trout population(s). Historical fisheries statistics are used to make this determination. Any candidate water that meets the conservative yield objectives is considered by the Board against criteria 11.
2. **HISTORY OF SPECIAL MANAGEMENT.** This is a subjective category that considers the public's perception of the history of rainbow trout fishing in the candidate water. It is assumed that a water which people associate with having provided "quality" trout fishing can more easily be managed for that purpose than a water with no history of fine trout fishing.
3. **PROXIMITY TO LOCAL COMMUNITY.** A water is preferred if it is not located near enough to a permanent community to be commonly used and/or visited by local residents. The intent of this criteria is to avoid conflict with traditional consumptive use patterns of local residents.
4. **LEGAL ACCESS.** This refers to public ownership of the adjacent lands or the water being classified as navigable. A water with over 50% of its banks publicly owned, or a navigable designation, would be preferred.
5. **OVERLAP WITH FRESHWATER NET FISHERIES.** Special management areas should be seasonally and/or spatially segregated from subsistence and freshwater commercial net fisheries.
6. **ABUNDANCE AND SIZE OF RAINBOW TROUT.** This refers to the number and average size of the catchable rainbow trout seasonally present in a candidate water. Waters with relatively high numbers of rainbow trout and waters with uniquely large rainbow trout would be favored for special management.
7. **WATER CHARACTERISTICS.** This refers to the habitat characteristics and appearances of a water. A stream with clear water and riffle-pool configuration with a gravel bottom would be preferred.
8. **CLEAR GEOGRAPHICAL BOUNDARIES.** This refers to the angling public's ability to clearly distinguish the legal regulatory boundary of a candidate special management area.

9. **RELATIVE IMPORTANCE OF RAINBOW FISHERY TO SPORT FISHING INDUSTRY.** A candidate water of high economic value to the sport fishing industry would be favored as an area for special management.
10. **GEOGRAPHICAL DISTRIBUTION OF SPECIAL MANAGEMENT WATERS.** The designation of a candidate water for special trout management should take into consideration its proximity to other special management waters and the availability of alternative locations not designated for special management.
11. **RESEARCH, EDUCATIONAL, OR UNIQUE CONSIDERATIONS.** Where necessary, waters may be designated for special management for research or educational reasons. This category recognizes unusual situations which would further diversify angling opportunity, such as the potential for a catch-and-release water near a rural community if local support is expressed.

Policy III

Management strategies should be consistent with the prudent economic development of the state's recreational sport fishing industry while at the same time acknowledging the intrinsic value of this fishery resource to the people of Alaska.

This policy acknowledges that Southwest Alaska's wild rainbow trout are of vital importance to the state's recreational industry and that wise development of commercial recreation is to the economic benefit of the region and the state. Management practices that maintain or enhance the marketability of high quality recreation are favored under this policy.

Consideration of the economic impact to the recreational industry, of both the local area and the state in general, should be given in all regulatory actions regarding rainbow trout within the management area. Whenever possible, emergency orders and regulations should be structured to foster the prudent economic development of the industry.

To implement Policy III, department managers are asked to recognize that due to the remoteness and logistical difficulty of travel in southwestern Alaska, fishery closures may severely impact angling opportunity and the related recreational industry.

To assist the department with implementing Policy III, the Board of Fisheries has expanded the department's emergency order authority to include not only the ability to effect time and area closures, but to also adjust bag limits and methods and means that if employed inseason could avoid disruptive closures.

Plan Implementation

Regulations based on the Southwest Alaska Rainbow Trout Management Plan were adopted by the Alaska Board of Fisheries in February of 1990. These regulations were designed to implement the three management policies contained in the rainbow trout management plan. Specifically, the Board:

- Expanded the Wild Trout Zone from the Iliamna drainage to include the drainages of Bristol Bay and Kuskokwim Bay and the Kuskokwim River from Aniak River downstream.
- Established eight catch-and-release areas (Figure 17).

- Established six fly-fishing/catch-and-release-only areas (Figure 18).
- Established 11 unbaited single-hook artificial lure only areas to protect rainbow trout stocks (Figure 19).

Adoption of regulations implementing the management policies contained in this plan was not expected to be a one-time effort. Rather, the implementation of these policies is a long-term process, using the policies contained in this plan as the framework for development of a very important and unique resource.

LOWER TALARIK CREEK

Fishery Description

Lower Talarik Creek, located at the northwest corner of Lake Iliamna, is renowned for its high quality rainbow trout sport fishery. The creek is relatively small and most anglers only fish along the first 2 miles above its entrance into Lake Iliamna. The large fish, for which Lower Talarik Creek is so famous, enter the creek from Iliamna Lake to feed on salmon spawn and salmon carcasses in the fall. The sport fishery takes advantage of this migration and is most active from mid-August until freeze-up in late September or October. Most anglers fishing Lower Talarik Creek are guided, nonresidents who make daily fly-in trips from the many lodges operating in the Lake Iliamna area. From 10 to 20 anglers can be accommodated at any given time in the lower portion of the creek that is commonly fished.

Historical Performance

Fisheries managers first estimated angler effort and harvest on Lower Talarik Creek rainbow trout with onsite creel surveys from 1970 through 1976 (Table 27). Annual harvest ranged from a high of 433 fish in 1971 to 73 fish in 1974. Since 1977, effort has been estimated from the Statewide Harvest Survey and has been measured in angler-days (Mills 1979-1994, Howe et al. 1995 and 1996, *In prep* a, b, and c). Effort on Lower Talarik Creek appears to be relatively constant at 600 to 900 angler-days per year with a few excursions outside this range (Mills 1979-1994, Howe et al. 1995 and 1996, *In prep* a, b, and c). Onsite creel surveys conducted during the fall fisheries of 1989, 1990, 1991, and 1993 through 1997 found effort has been at the upper range of, but not significantly different from, the levels observed in the 1970s (Table 27). Note the small estimates of catch and effort in 1997 are due to the short duration of the survey. In 1998, the size composition of the catchable population appeared to shift to fish larger than those sampled in the mid 1980s.

Harvests of Lower Talarik creek rainbow trout were less than 100 fish annually since 1977 and were virtually nonexistent after 1985 (Mills 1979-1986). Lower Talarik Creek became a catch-and-release only fishery by regulation in 1990.

Management

Lower Talarik Creek is managed as a special management area, restricted to unbaited artificial fly tackle and catch-and-release of rainbow trout. A spawning season closure provides protection during this critical season. Sport effort, catch, and harvest are estimated via the Statewide Harvest Survey. Subsistence harvests are not well monitored and are the responsibility of the Commercial Fisheries Division. Onsite surveys yield detailed estimates of angler use and success. Biological information and demographic information are also collected. Significant stock assessment and creel survey results are

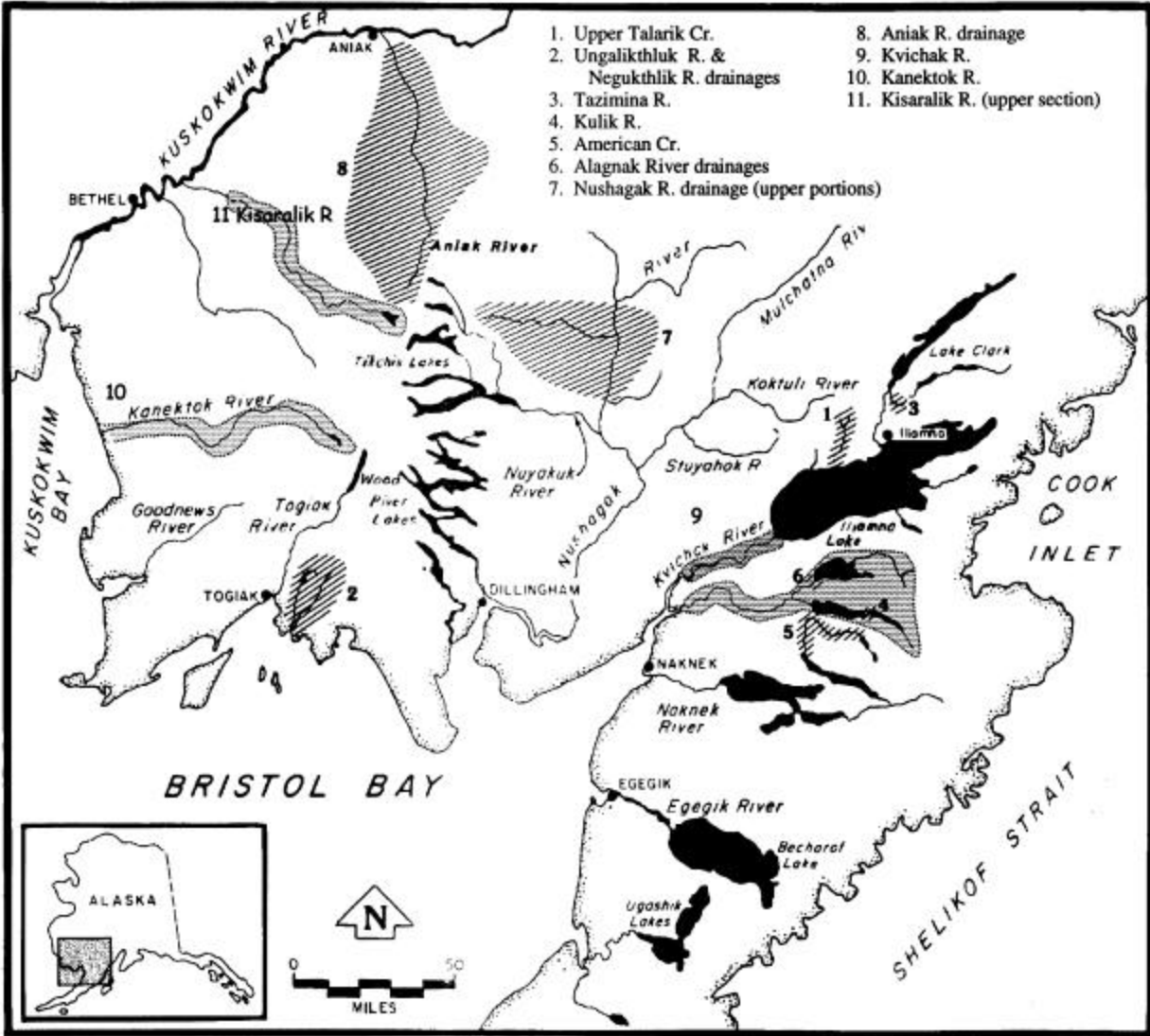


Figure 17.-Catch-and-release special management areas.

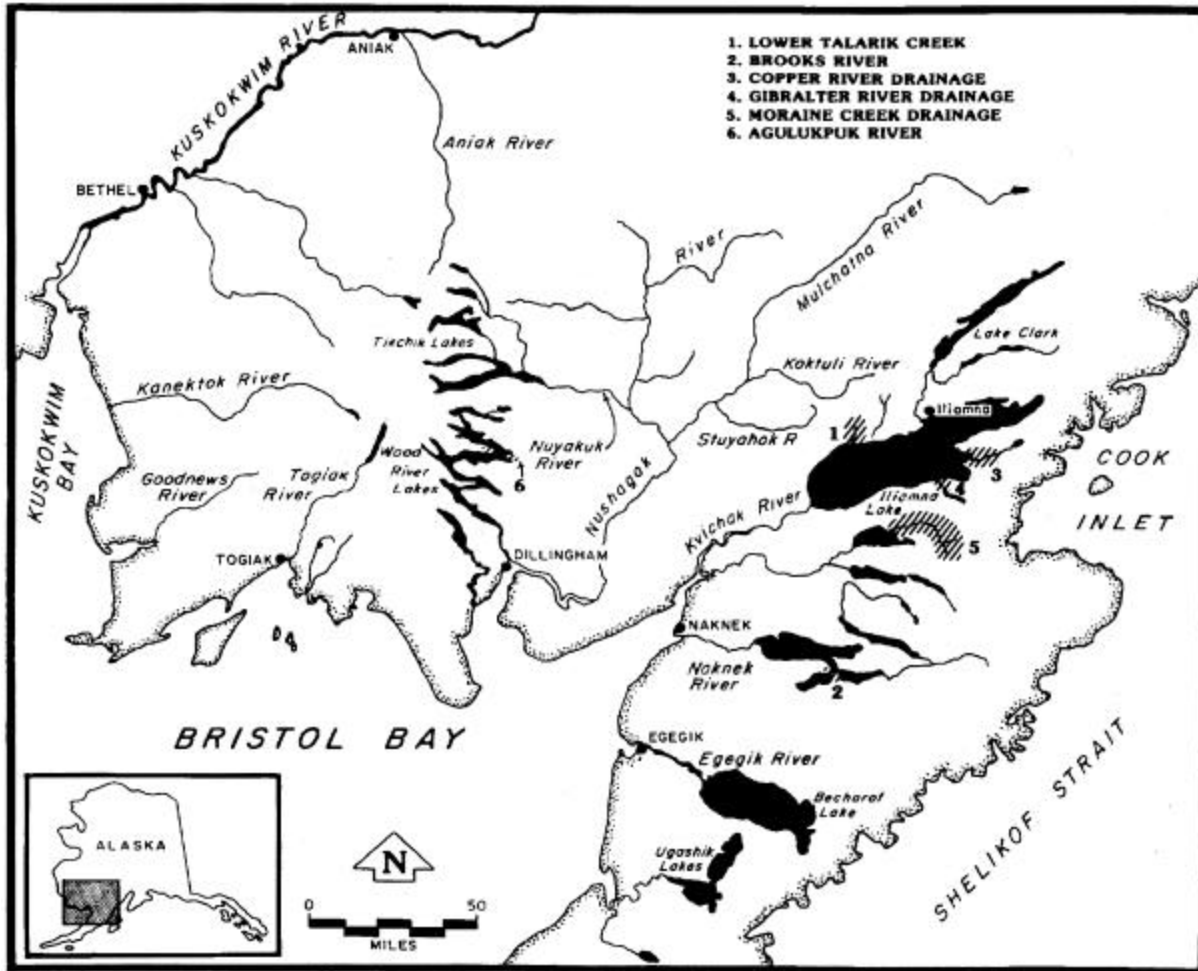


Figure 18.-Fly fishing catch-and-release special management areas.

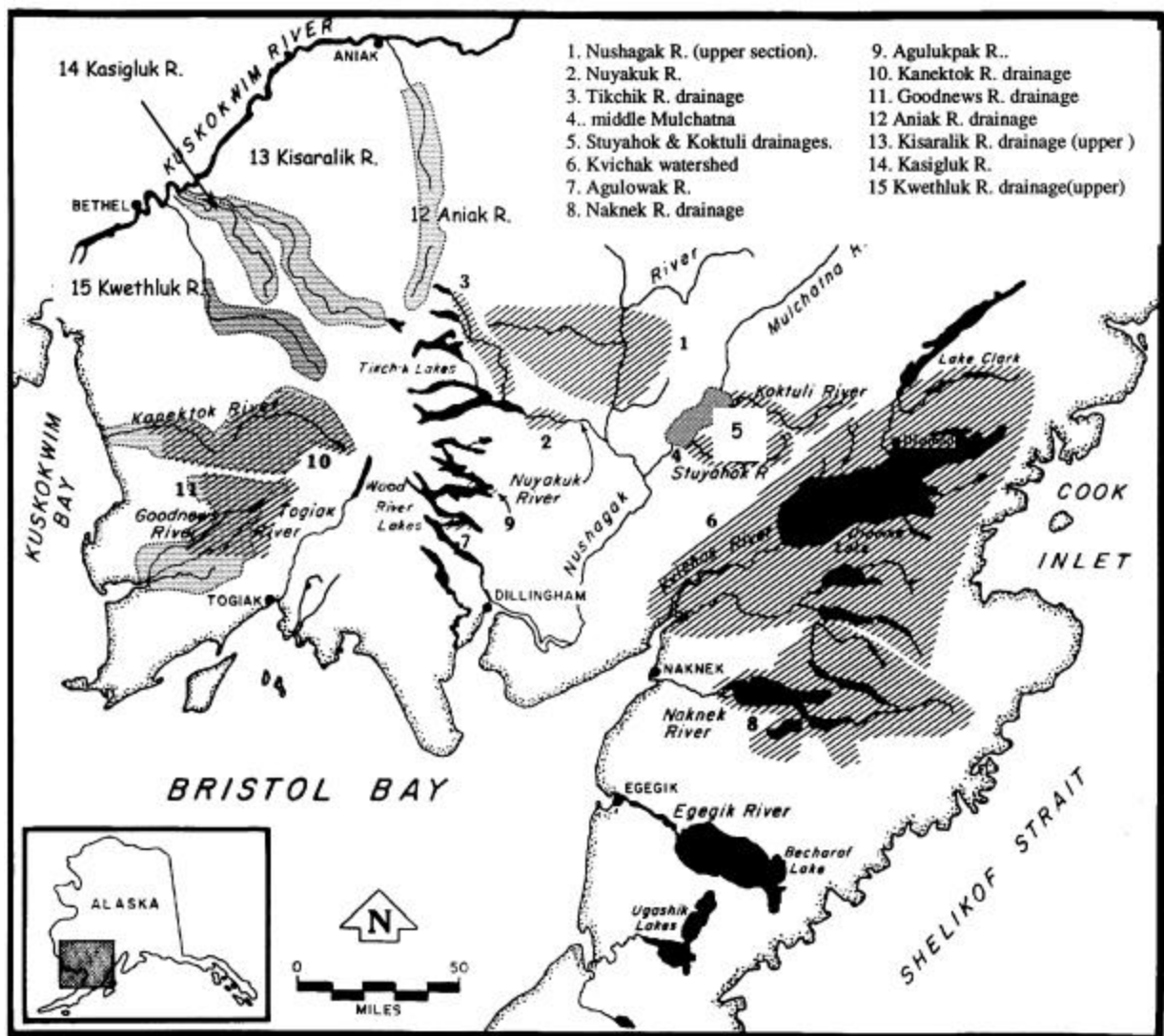


Figure 19.-Unbaited single-hook artificial lure special management areas.

Table 27.-Angler effort, catch, harvest, retention rate, and catch per angler-hour for rainbow trout, Lower Talarik Creek, estimated from onsite creel surveys, 1970-1976, 1986, 1989-1991, 1993-1999.

Year	Angler-Hours	Catch	Harvest ^a	Percent Retained ^a	Survey Dates
1970	1,315	600	119	20%	8/26-10/11
1971	2,604	2,300	433	19%	6/8-9/30
1972	1,718	834	141	17%	6/8-9/30
1973	1,376	780	113	14%	6/8-9/30
1974	1,037	498	73	15%	6/8-9/30
1975	1,048	1,648	127	8%	6/8-9/30
1976	438	843	92	11%	6/8-6/15; 9/12-9/23
1986	2,063	2,389	16	1%	6/8-6/15; 8/15-10/9
1989	1,893	2,844	4	1%	8/22-9/22
1990	2,086	2,910	0		9/1-9/27
1991	1,729	2,363	0		8/30-9/25
1993	1,080	699	0		9/10-9/20
1994	2,462	3,273	0		9/2-9/29
1995	2,496	3,200	0		9/1-9/29
1996	1,930	1,655	0		9/3-9/30
1997 ^b	1,210	1,794	0		9/1-9/15
1998	2,596	1,698	0		8/31-9/21
1999	2,128	1,196	0		8/29-9/23

Source: Russell 1977, Minard 1990, Minard et al. 1992, Dye *Unpublished* a and b, Schwanke *Unpublished* a.

^a Lower Talarik Creek became a catch-and-release fishery in 1990.

^b Small estimates of catch and effort are due to the short duration of the survey.

reported by Russell 1977, Minard 1990, Minard et al. 1992, Dye *Unpublished* a and b, Schwanke *Unpublished* a.

Lower Talarik Creek's small size, accessibility, and abundant large rainbow trout garnered early regulatory attention. A synopsis of significant regulation changes follows:

- 1965. Spawning season closure imposed on Lower Talarik Creek. Lower Talarik Creek closed to all fishing from April 10 to June 8.
- 1968. Lower Talarik Creek was included in the "Bristol Bay Trophy Fish Area."
- 1969. Bag and possession limits reduced to 5 trout, only 1 over 20 inches in length. Helicopter access was forbidden, single hooks were required on tackle.
- 1974. The use of bait was prohibited during the summer months.
- 1977. Trophy Fish Area renamed the Bristol Bay Wild Trout Area, retaining the regulations accumulated since 1965.
- 1981. Gear was limited to single-hook artificial flies from June through October.
- 1984. Reduced the bag and possession limit to 2 rainbow trout, 1 over 20 inches.
- 1985. Reduced the bag limit to 1 rainbow trout during the summer.
- 1990. Adopted the Southwest Alaska Rainbow Trout Management Plan. Lower Talarik Creek was designated as a special management area, to be managed under fly-fishing-only, catch-and-release restrictions.

A Native Allotment claim that could have jeopardized public access to the Lower Talarik Creek fishery has recently been resolved. The Nature Conservancy of Alaska acquired title to the claim, which included the land adjacent to the most popular fishing sites along Lower Talarik Creek, through a special agreement with the claimant. In December 1995, The Nature Conservancy coordinated a three-way land management agreement with ADF&G and the Alaska Department of Natural Resources. One stipulation of the agreement was to establish a Special Use Area (SUA) for the lower reaches of Lower Talarik Creek and nearby uplands. This was completed in August 1999 with some controversy, and after extensive discussions with local municipalities and leaders. Finalizing the SUA allowed the Alaska Department of Natural Resources to enter into an Interagency Land Management Agreement (ILMA) with ADF&G for the land area on which the department-owned cabin sits. The ILMA was completed at about the same time as the SUA. The next steps in the agreement are to obtain Critical Habitat status for the drainage and the eventual conveyance of the Nature Conservancy holdings to the State of Alaska for long-term management.

Management Objectives

The Lower Talarik Creek rainbow trout fishery is managed to maintain historical age and size composition and a diversity of angling opportunity by maintaining the special management designation with fly-fishing-only, catch-and-release.

1999 Season

A direct expansion creel census was conducted at Lower Talarik Creek from August 29 through September 23, 1999 (Table 27). The objectives were to collect angler success and demographics, use

data and biological samples from the fishery. Data from the census was used to calculate effort, catch, distribution of catch success, and angler demographics of this fishery.

Two volunteer survey technicians interviewed all anglers fishing at Lower Talarik Creek at the completion of the angling day, 7 days per week. The technicians also collected biological data from rainbow trout caught by recreational anglers.

During the survey 334 anglers were interviewed and another 17 anglers participated in the fishery but were not interviewed for a total effort of 351 angler-days during the survey period (Dye *Unpublished b*). Over 75% of the anglers were guided, and 91.6% were not Alaskan residents. Of the 22 individuals interviewed who were Alaskan residents, none were “local” residents of nearby communities. A total of 40 camper nights (one person camping overnight in the immediate area) was observed and no campers used the lands owned by The Nature Conservancy. As several campers spent more than one night, the number of individuals camping in the area was less than 40. No count of individual campers was made (Dye *Unpublished b*).

Angler effort totaled 2,121 angler-hours and the total catch was 1,192 rainbow trout. Overall CPUE was an estimated 0.56. Effort, catch, and CPUE were highest during the week of 9/4 through 9/10. There were 209 rainbow trout sampled during the 1999 project. The cumulative length frequency distributions observed in 1990-1991 and 1994-1999 have shifted towards larger fish than those sampled during 1986 and 1987 (Dye *Unpublished b*). Catch-and-release regulations in effect since 1990 may have created a higher percentage of “trophy” rainbow trout (greater than 550 mm FL) for anglers. In addition, refined fishing techniques at Lower Talarik Creek target large fish (Dye *Unpublished b*).

2000 Outlook

From late August through freeze-up in early October fishing should be good to excellent. The number of large fish (in excess of 8 pounds) caught each season appears to be stable. While overall catch rates were good for experienced anglers, the 1999 fall fishery was unexpectedly slow until very late in the season. Most likely, the cold winter of 1998 and very late spring of 1999 affected the fish populations or behavior. The Division of Sport Fish will continue its fishery monitoring program using volunteer staff in the fall of 2000. The crew will be alert for any indications of population changes during the coming season.

NAKNEK RIVER

Fishery Description

The Naknek River supports the largest sport harvest of rainbow trout in the SWMA. The first significant recreational use of Naknek River stocks occurred in the mid-1950s when two recreational camps were constructed by the military for use by military personnel. The camps, one located at the outlet of Naknek Lake (Lake Camp) and one at the lower reach of the rapids (Rapids Camp) provided a base for significant sport fishing opportunity until 1974. Within that time period, civilians discovered the bountiful resources and effort continued to grow. By the mid 1980s there were approximately 12 guiding services working the river regularly, with others less frequently. Boat rental and lodging services, available in King Salmon, provided the necessary support needed by the unguided angler.

The rainbow trout sport fishery takes place in the upper reach of the river upstream from Rapids Camp to the outlet of Naknek Lake and has three periods of activity: March to April 10, June 8 to June 30, and August 15 to freeze-up in October.

Historical Performance

Estimates of harvest for rainbow trout from the Naknek River were first available in 1977 from the statewide harvest and participation survey (Mills 1979-1994, Howe et al. 1995 and 1996 and *In prep* a, b, c, and d). Annual harvest increased from about 600 rainbow trout in 1977 to a peak of 3,700 fish in 1984. Since 1984, harvest of Naknek River rainbow trout has declined to levels first observed in 1977 (Figure 20). Harvest alone, however, is not a reliable indicator of fishery performance for rainbow trout fisheries in Southwest Alaska. The combination of effort, catch, harvest, and fish size information derived from onsite surveys provides a much more comprehensive evaluation of fishery performance. From 1978 through 1989, the Division of Sport Fish conducted fall fishery surveys in the upper reach of the Naknek River (Table 28). These data demonstrated a clear and significant increase in effort and catch occurring over the 10-year study period, along with a significant drop in the proportion of retained fish (Minard 1989a). Somewhat alarming was a declining trend in average size of the spawning stock and catchable population. It was apparent from the combination of creel survey and biological data available that the sport fishery was overharvesting the larger, older segment of the population. Comments received from the angling public were consistent with the department's findings.

Corrective actions in the form of reduced limits as well as size limits and method restrictions were proposed to the Board and adopted in 1990 (Minard 1990). Follow-up assessment work in the spring of 1993 suggested the declining size composition had been arrested, and fall work found early indications of improved recruitment (Dunaway *Unpublished* b). In 1995, sampling of the fall population discovered the size composition of the catchable population has been restored to the proportions observed in the early 1980s (Fair *Unpublished*). Recent comments from the public and anglers familiar with the fishery support these conclusions and generally indicate the population is in very good condition.

Management

Sport effort, catch, and harvest are estimated via the statewide harvest, catch, and participation surveys (Mills 1979-1994, Howe et al. 1995 and 1996, *In prep* a, b, and c). Subsistence harvests, considered slight but not well monitored, are the responsibility of the Commercial Fisheries Division. Onsite surveys yield detailed estimates of angler use and success as well as data on angler demographics and biological samples from the catch. Significant stock assessment and creel survey results have been reported by Berger and Gwartney (1986), Minard 1989a, Minard 1990, in 1993 by Dunaway (*Unpublished* b), and in 1995 by Fair (*Unpublished*).

There is a long history of special regulations for Naknek River rainbow trout stocks dating back to statehood. Seasons, limits, and gear restrictions were initially liberal. However, as effort increased, reports of declining catch rates and smaller size of the catchable population increased. Department studies conducted in the late 1980s verified the suspected decline. Available data supported by public opinion indicate the stocks have recovered. Current regulations (ADF&G 1999b) still reflect the remedial actions adopted in 1990 and allow for an open water harvest of 1 rainbow trout per day less than 18 inches in length and a winter season harvest of 5 per day less than 18 inches in length. The

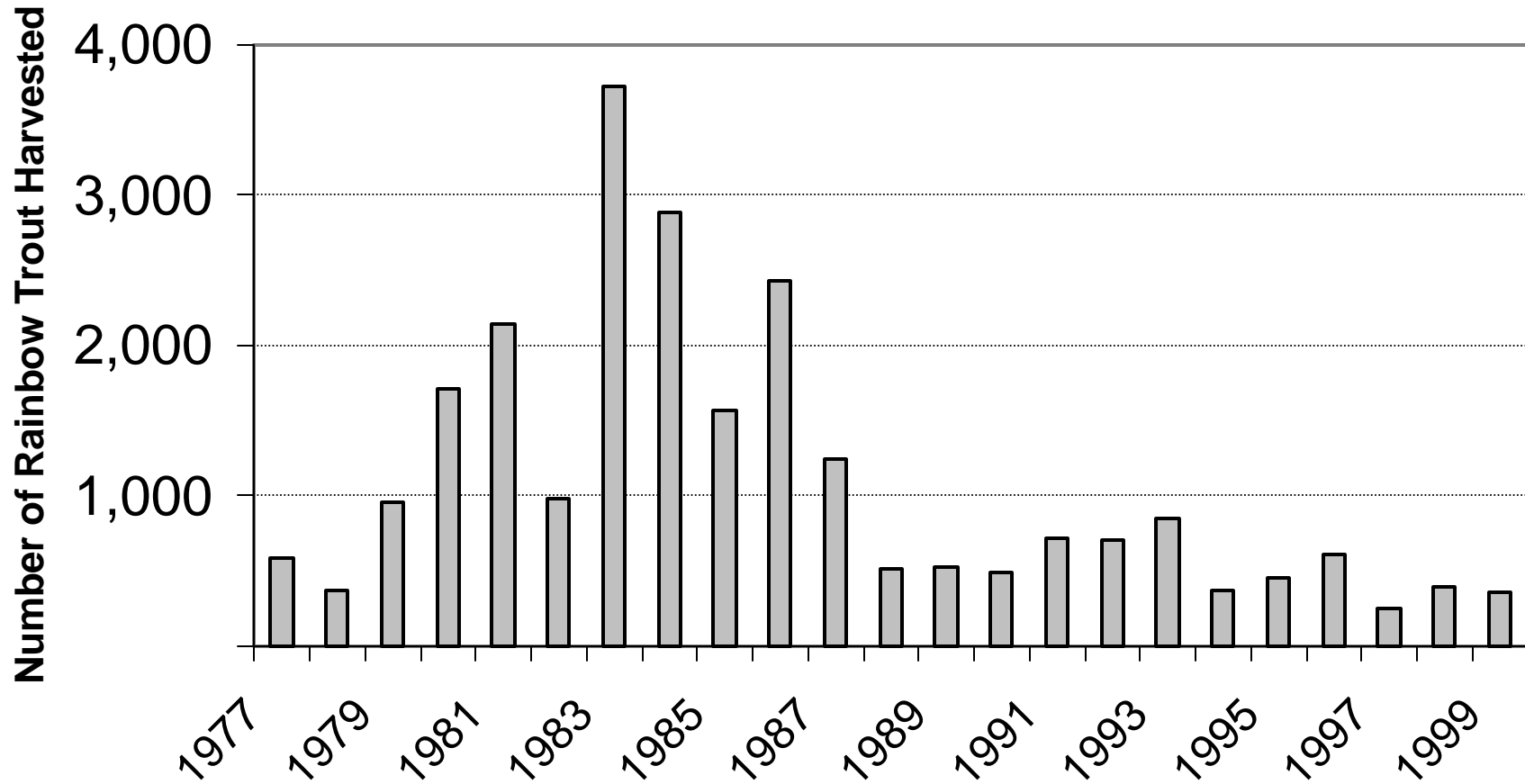


Figure 20.-Sport harvest of rainbow trout from the Naknek River, 1977-1999.

Table 28.-Effort, harvest, and catch for anglers fishing the upper Naknek River during the period August 15 through October 15, 1978, 1981, 1983, 1984, 1987, 1988, and 1989. Length statistics of harvested rainbow trout during these years are also presented.

Year	Effort		Harvest	Proportion Retained	Length (mm)		
	Angler-Hours	Catch			Mean	SE	SS ^a
1978	1,896	847	248	0.29	484	20.2	55
1981	3,025	4,322	860	0.20	444	6.2	218
1983	6,755	4,182	1,452	0.35	430	5.7	135
1984	4,611	3,092	570	0.18	466	9.02	192
1987	4,450	4,779	434	0.09	423	9.3	81
1988	6,246	3,147	566	0.18	377	10.6	99
1989	7,249	7,120	407	0.06	430	15.1	72

Source: Dunaway 1990c, Minard 1987a, 1989a.

^a Sample Size

spawning season closure is still in effect from April 10 to June 7, and only single-hook artificial lures may be used in the area above Rapids Camp.

Growing interest in the spring fishery that occurs prior to April 9 has resulted in public requests for more intensive management during this time period. Some anglers support managing portions of the river for quality of experience by advocating restrictions to angler access. Other management suggestions include managing for a particular size composition in the sport catch with emphasis on providing very large fish. Yet other anglers remain convinced that growth of the rainbow trout fishery on the Naknek River requires vigilance and possibly additional restrictions just to maintain the biological integrity of the population. Regardless of the perspective, it appears clear that the angling public is extremely interested in maintaining and enhancing this fishery. The department is likely to see a growing demand for more intensive management strategies of this and other rainbow trout fisheries.

During the fall 1997 Board of Fisheries meeting in Naknek, the Board formed a committee to develop a rainbow trout management plan for the Naknek River. A community meeting was held in April 1998 and two Board members attended. In addition, the Board members spent a day observing the spring fishery and getting comments from the participants. The department has summarized all relevant data available for Naknek rainbow trout and provided this material to the local advisory committee. The department also provided some examples of management plans as well as suggested some points to include in the eventual plan. Angling has been quite good since then, and the issue seems to have lost most of its momentum.

Management Objectives

Naknek River rainbow trout stocks are being managed to restore and maintain the historical age and size composition reported in the early 1980s. Research projects on rainbow trout populations throughout the SWMA are beginning to provide the department with new understanding and may soon allow more precise and quantitative definitions of management objectives for this species.

1999 Season

To obtain data for the proposed Naknek River rainbow trout management plan, the department conducted spring and fall angler surveys and biological sampling in the upper river during 1999 (Dye and Schwanke *Unpublished*, Dye *Unpublished* c). Severe cold weather delayed the start of the spring fishery and likely reduced angling effort. Of the 223 anglers counted in the spring, 30% were guided. Five hundred and fifty-four rainbow trout were sampled and tagged. In the fall, 406 anglers were counted and 31 rainbow trout were sampled (Dye and Schwanke *Unpublished*, Dye *Unpublished* c).

2000 Outlook

Sport fishing for rainbow trout is expected to be good to excellent all season. The best fishing can be expected in mid June at the outlet of the lake and in the Rapids area. During this period, trout are drawn to these areas to feed on salmon smolt as they migrate to sea. Fishing in early July with dry flies will be good, and then after a lull in late July, fishing will improve in early August as the trout move into salmon spawning areas to feed on eggs and carcasses. The best fishing for large trout will occur from late September until freeze-up in October. No inseason adjustments to the fishery are anticipated in 2000.

ALAGNAK (BRANCH) RIVER

Fishery Description

The Alagnak River, frequently referred to locally as the Branch River, is located in the eastern portion of the management area and flows into the Kvichak River approximately 40 miles north of King Salmon. The Alagnak River arises in Katmai National Park and Preserve and has been designated a Wild and Scenic River.

Two large lakes, Kukaklek and Nonvianuk, feed this drainage. Kukaklek Lake is drained by the Alagnak River while the Nonvianuk River flows 11 miles from Nonvianuk Lake to join the Alagnak River from the south. The Nonvianuk River is a wide, relatively gently flowing river (class 2 or less) that provides the most convenient float trip access to the upper drainage. The upper Alagnak River is characterized by a narrow canyon and class 2+ rapids that provide a more rigorous boating experience. Below its confluence with the Nonvianuk River, the Alagnak is slower and easily navigated. At the proper water levels both rivers can be navigated their entire lengths with power boats. The water is clear throughout its length, though the lower 20 miles are colored lightly from silt and bog-stained runoff.

In the lower portion of the drainage anglers pursue chinook, coho and sockeye salmon. In the upper reaches, rainbow trout are the big attraction, with some lake trout at headwater lakes and char and grayling in the river adding diversity to the angling experience. The fisheries are accessed with power boats, particularly the lower 1/2 to 2/3 of the river, while float trips are the most common access in the upper reaches. Seven lodges are based along the river, 4 in the lower 20 miles, 1 lodge near the outlet

of each of the headwater lakes and 1 more is located along the midpoint of the river. Many other lodges from the surrounding area fly clients to the river for day-trip fishing.

The easy access and abundant fish populations of the Alagnak River are major reasons the popularity of this river has grown so quickly. Rainbow trout from the Alagnak River drainage are similar to fish of the nearby Kvichak and Naknek drainages and are known for their abundance and large size.

Historical Performance

In terms of angler effort, the Alagnak River is the second most popular fishing destination in Southwest Alaska after the Naknek River. Estimates of effort and harvest for rainbow trout from the Alagnak River were first available in 1981 from the statewide harvest and participation survey (Table 3, Figure 5). Average annual effort increased suddenly to 12,323 angler-days in 1992 and remained above 10,000 angler days through 1995. Effort averaged 10,216 angler-days for the 1994-1998 seasons (Table 3). From 1994 to 1998 the annual harvest averaged approximately 100 fish, and catch (fish released plus fish kept) averaged approximately 20,000 rainbow trout per year (Table 3). At this level of catch, the Alagnak River has become the most popular rainbow trout fishery in southwest Alaska.

Harvest alone is not a reliable indicator of fishery performance for rainbow trout fisheries in Southwest Alaska. During the period 1978 through 1989, the Division of Sport Fish conducted fall fishery surveys for seven seasons in the nearby Naknek River. Over the study, data demonstrated a clear and significant increase in effort and catch, yet a significant drop in the proportion of fish kept or harvested (Dunaway 1990c). Similar observations have been made in other fisheries throughout the SWMA. The department has interpreted the phenomenon as an acceptance of catch-and-release as an ethic among anglers, particularly for rainbow trout, and we assume the declining harvest on the Alagnak River can be explained in part by this shift in attitude.

Management

Sport effort, catch, and harvest are estimated via the statewide harvest, catch, and participation surveys (Mills 1979-1994, Howe et al. 1995 and 1996 and *In prep* a, b, c, and d). Subsistence harvests, considered slight but not well monitored, are the responsibility of the Commercial Fisheries Division. Onsite surveys yield detailed estimates of angler use and success as well as data on angler demographics and biological samples from the catch. Significant stock assessment and creel survey results, focused on the lower river salmon fisheries but containing some rainbow trout data, have been collected and reported by Brookover (1989a) and by Dunaway (1990a and 1994). Surveys of the spring sport fisheries were conducted jointly with the NPS and department in 1996 at the outlet of Nonvianuk Lake and at the outlet of Kukaklek Lake in 1997 (Jaenicke 1998a and 1998b).

Located between the Kvichak and Naknek drainages, management of the Alagnak and Nonvianuk rainbow trout fisheries has been much the same as outlined for those adjacent fisheries. For quite some time the sport fishing season has featured a spring spawning closure from April 10 through June 7, and single-hook artificial lure only restrictions. During the open water season, regulations have allowed the retention of 1 rainbow trout per day, no size limit.

Because it is comparatively difficult to access, the Alagnak fishery only lately received angling effort in levels capable of affecting the fish populations. Starting about 1993, coincident with increased fishing effort, department staff began receiving complaints that the rainbow trout stocks in the Alagnak were

declining. Data for the Alagnak River rainbow trout fishery prior to 1996 were sparse. Results from a sampling trip in 1995 suggested that the size composition and age structure may be depressed. In 1996 a joint ADF&G and National Park Service creel survey was conducted at the outlet of Nonvianuk Lake, in the upper Alagnak River drainage (Jaenicke 1998a). Thirty-four anglers were asked to compare their experience in 1996 to experiences in the past with regard to catch rate and average size of the catchable population (Table 4). Many anglers felt both catch rate and size composition had diminished (Jaenicke *Unpublished*). In addition to the survey, NPS staff also collected size and age samples from the catchable population. Results showed the size distribution to be skewed toward small fish, and age composition to be primarily age-4 and -5 fish.

As a result of the 1996 work, an emergency order closing the Alagnak and Nonvianuk rivers to the sport harvest of rainbow trout was issued effective July 1, 1996, and was reissued prior to the June 8 opening in 1997.

In the spring of 1997 another creel survey was conducted at the outlet of Kukaklek Lake (Jaenicke 1998b and *Unpublished*). The size composition information collected throughout the drainage does not suggest as depressed a condition as shown in 1996. These studies show the following points:

1. Harvests of rainbow trout are estimated to be small, but are likely selective for large fish.
2. Many anglers felt the catch rate and size composition have diminished over time.

In addition to the lake outlet creel surveys on the upper Nonvianuk and Alagnak rivers, a population assessment study was initiated in 1997 by the Biological Research Division (BRD) of the U.S. Geological Survey, in cooperation with the NPS. The study was designed to include the entire length of the two rivers (Eric Knudsen, USGS-BRD, Anchorage, personal communication). The study continued through 1998 but was plagued by failures of the batteries in some radio tags (Troy Hamon, Fisheries Biologist, Katmai National Park, personal communication). Results of this study are not likely to be available until the spring of 2000, but are expected to provide insights on the populations (Jennifer Nielsen, USGS-BRD, Anchorage, personal communication). Due to design problems, a valid estimate of population abundance may not be possible; however, comments from Eric Knudsen (USGS-BRD, Anchorage) indicate that the USGS project was not expected to show a population in imminent danger or decline. From their data it appears that there is a relatively abundant rainbow trout population in the Alagnak River, but the size composition may be different than in the past.

During its 1997 fall meeting, the Alaska Board of Fisheries created a catch-and-release special management area for Alagnak River rainbow trout. From June 8 through October 31 rainbow trout in the Alagnak and Nonvianuk rivers may not be possessed or retained. From November 1 through April 9 fishermen may retain 5 rainbow trout less than 18 inches in length. The new regulations were generally well received by anglers and are expected to provide a measure of protection to this population until better information becomes available.

The large rainbow trout fishery, coupled with heavy float trip and motor boat use, has become a concern of the NPS, nearby communities, and anglers. NPS plans to begin a planning effort for the 55-mile portion of the river that is designated a wild river. Human impacts and boat wake erosion are issues.

Management Objectives

The Alagnak River rainbow trout fishery is managed to maintain historical age and size composition.

1999 Season

Anecdotal reports on the 1999 fishery were mixed from mediocre to very good. The very strong outcry for restrictions heard during 1995-1997 seems to have died down. The new catch-and-release regulations, and frequent poor reviews seems to be discouraging angling effort on this fishery. The restricted coho season may have reduced angling pressure on this fishery as well.

2000 Outlook

Spring angling at the outlets of Kukaklek and Nonvianuk lakes should be average in 2000. Fall fishing in the braids and along salmon spawning areas is likely to be average as well. With a stronger sockeye salmon run expected, the rainbow trout's food supply should be better than in the previous two seasons. The National Park Service and USGS-BRD will be conducting a hooking stress graduate study on Alagnak River rainbow trout during the 2000 fishing season. The study seeks to assess the degree of injury and the physiological effects of catch-and-release fishing on individual rainbow trout.

AGULOWAK RIVER

Fishery Description

The Agulowak River is located north of Dillingham and just inside the southern boundary of the Wood-Tikchik State Park. Though known primarily for its abundant Arctic char stocks, it is also one of the two most popular rainbow trout fisheries in the Central section. As with other fisheries in the SWMA, development of the recreational fishery grew gradually from the 1950s, saw its first commercial lodge facility by the early 1960s, then grew significantly beginning in the early 1970s as more lodges were built and Alaskan fly-out fishing became popular. A unique characteristic of the Agulowak River is the relative ease of access from Bristol Bay's most populous city, Dillingham, and the village of Aleknagik. As a consequence, the Agulowak River supports a much greater rate of local use than more remote waters within the section.

The rainbow trout sport fishery takes place throughout the open water period along the entire 3-mile length of the river. Favored periods for catching rainbow trout are early summer before the sockeye and pink salmon runs begin, and after mid-August when the trout feed on salmon eggs and carcasses. There may be limited fishing through the ice at the head of the river in winter.

Historical Performance

The Agulowak River has not received the level of regulatory attention given to fisheries in the Eastern section, and little historical information is available. Informal investigations of the sport fishery in 1975, 1976, and 1977 suggested increasing sport fishing effort resulting in increased catches and harvests of rainbow trout. A formal creel survey program conducted on the Agulowak River in 1986, 1987, and 1988 (Minard 1989b) estimated angler effort to range from 3,582 to 6,397 angler-hours per year; estimated annual catches of 1,784 to 2,666 rainbow trout; and estimated harvests to range from 72 to 328 rainbow trout per year (Table 29). Analysis of the size and age data collected during the surveys suggested that the size composition of rainbow trout in the Agulowak River was shifting to smaller fish, indicating the sport fishery may have been harvesting too many older aged fish (Minard 1990). These results prompted more restrictive harvest regulations and the fishery is presently in a state of recovery.

Table 29.-Estimates of effort, catch, and harvest of rainbow trout from the sport fisheries in the Agulowak and Agulukpak rivers, 1986-1989, 1992 and 1996.

Year	Location	Survey Dates	Effort		Catch		Harvest	
			Angler-hours	SE	Fish	SE	Fish	SE
1986	Agulowak	6/19-8/23	3,732	533.5	1,784	266	84	15
1987	Agulowak	6/6-9/7	6,397	501.1	2,584	611	328	113
1988	Agulowak	6/6-9/6	3,582	360.9	2,666	618	72	31
1989	Agulowak	6/11-9/1	4,009	303.6	1,488	1,193	40	102
1986	Agulukpak	6/29-8/23	1,826	208.8	1,322	151	0	0
1987	Agulukpak	6/17-9/16	4,265	57.5	3,692	25	2	0
1988	Agulukpak	6/14-9/16	3,684	45.9	2,884	48	0	0
1989	Agulukpak	6/25-9/24	4,010	29.9	2,115	187	0	0
1992	Agulukpak	8/1-9/22	2,759	53.6	1,862	72	0	0
1996	Agulukpak	6/23-9/22	6,301	103.0	5,320	113	5	0

Source: Minard 1989b, Dunaway *Unpublished a*, Rogan and Jaenicke 1997.

Management

Sport effort, catch, and harvest are estimated via the statewide harvest, catch, and participation survey (Mills 1979-1994, Howe et al. 1995 and 1996, *In prep a, b, and c*). Subsistence harvests, considered slight but not well monitored, are the responsibility of the Commercial Fisheries Division. Onsite surveys yield detailed estimates of angler use and success.

Biological information and demographic information were also collected. Significant stock assessment and creel survey results have been reported by Minard (1989b and 1990), and Dunaway (1993).

The following is a regulatory chronology for the Agulowak River:

- 1959. Year-round season and a bag limit of 15 fish per day, only 3 over 20 inches.
- 1962. Ten trout per day, only 2 over 20 inches.
- 1972. Five rainbow trout, 1 over 20 inches.

- 1984. Season was split with a June 8 to October 31 bag limit of 2 rainbow trout, 1 over 20 inches per day, and a November 1 through June 7 limit of 5 fish per day, 1 over 20 inches long.
- 1990. Implementation of the Southwest Alaska Rainbow Trout Management Plan. Created the first special regulations for the Agulowak River. In response to conservation concerns raised by the department, summer bag limits were reduced to 1 rainbow trout daily and terminal tackle was limited to single-hook artificial lures.
- 1996. Entire river and Lake Aleknagik within ½mile of the outlet of Agulowak River restricted to single-hook artificial lures. While designed to protect char, this also added protection to rainbow trout in the lower section of the river.

A stock assessment survey on the Agulowak River in 1992 indicated that restrictive regulations adopted in 1990 were having the desired effect (Dunaway 1993). The project estimated 9,000 to 18,000 rainbow trout over 250 mm (10 inches) in the river and found the population to contain a significantly greater proportion of older fish than was observed in 1988. Size distributions approached those first recorded in the mid 1970s.

Management Objectives

Agulowak River rainbow trout stocks are being managed to restore and maintain the historical age and size composition reported in the 1980s.

1999 Season

No surveys were conducted on the Agulowak River rainbow trout fishery in 1999. Incidental contacts with anglers suggested that fishing was excellent. Guided use of the river continues to grow with relatively heavy use throughout the months of June through September. August and September are probably the highest use months of the season. A dozen or more guide boats, carrying two to four anglers each, use the river daily in August and September.

Local unguided use appears to have grown as well. However, crowding is an increasing complaint and many local, unguided anglers report avoiding the Agulowak.

The Agulowak is also an important thoroughfare to the upper lakes and streams of the Wood River Lakes system. The river is seeing greatly increased boat traffic as more land allotments are conveyed and developed and as more local boaters obtain jet boats. The congestion from increased angler use and general boat traffic is creating a safety hazard and is becoming an issue locally.

2000 Outlook

Sport fishing for Agulowak River rainbow trout is expected to be good to excellent all season. The best fishing opportunity will likely occur when the spring runoff has passed and water levels begin to drop. Reduction in water levels and the presence of spawning salmon in August make for a very good fishing opportunity.

AGULUKPAK RIVER

Fishery Description

The Agulukpak River is one of the best known rainbow trout fisheries west of the Kvichak River. The river is 2.4 km (1.5 miles) long and drains from Lake Beverly into Lake Nerka in the Wood-Tikchik

State Park north of Dillingham. The river's remote location and hazardous rocks in its lower section discourage boat access and most anglers come to the river via float-equipped aircraft. Development of the Agulukpak River fishery is virtually identical to the development of the Agulowak River, but other than one small cabin, no lodges were ever built close to the river. The river is clear, shallow, about 100 yards wide, and easily waded in its upper section. Its remote location, and abundant rainbow trout, Arctic grayling, and Arctic char populations make the Agulukpak River a premier location for fly fishermen. The sport fishery occurs from spring until freeze-up, mainly in the upper mile of the river.

Historical Performance

The Agulukpak River has received slightly more attention than the Agulowak River fishery but historical quantitative information remains somewhat scarce. The remote location of the fishery and a tradition of conservative use by many of the visiting anglers served to protect the Agulukpak River rainbow trout population. Informal investigations of the sport fishery during 1976 and 1977 suggested that sport fishing effort, catch, and harvest were increasing. The first definitive work conducted on the Agulukpak River was a creel survey program during the seasons of 1986, 1987, and 1988 (Minard 1989b). Angler effort was estimated to range from 1,826 to 4,265 angler-hours per year. Sport catch of rainbow trout ranged from 1,322 to 3,692 fish and virtually no rainbow trout were harvested during the three seasons sampled (Table 29). The normal distributions of age and length of the fish sampled during the 3-year survey indicated the rainbow trout population was reasonably stable in the Agulukpak River.

Management

Sport effort, catch, and harvest are estimated via the statewide harvest, catch, and participation survey (Mills 1979-1994, Howe et al. 1995 and 1996, *In prep* a, b, and c). Once buried as part of the estimate for the Wood River Lakes System, the statewide survey began making separate annual estimates of effort, catch and harvest for the Agulukpak River in 1997 (Tables 6, 25, and 26). Future estimates will provide a convenient basis for comparisons. Subsistence harvests, considered slight but not well monitored, are the responsibility of the Commercial Fisheries Division. Onsite surveys yield detailed estimates of angler use and success. Biological information and demographic information were also collected during onsite surveys. Significant stock assessment and creel survey results have been reported by Minard (1989b and 1990), Dunaway (1993), and from 1996 by Rogan and Jaenicke (1997).

The following is a regulatory chronology for the Agulukpak River:

- 1959. Year-round season and a bag limit of 15 fish per day, only 3 over 20 inches.
- 1962. Ten trout per day, only 2 over 20 inches.
- 1972. Five rainbow trout, 1 over 20 inches.
- 1984. Managed as a catch-and-release fishery with year-round open season. Catch-and-release restriction limited to the upper half of the Agulukpak River.
- 1990. Implementation of the Southwest Alaska Rainbow Trout Management Plan in 1990 resulted in designation of the Agulukpak River as a special management area with regulations for the upper half of the river permitting only fly fishing gear from June 8 until August 31, and permitting the use of single-hook artificial lures from September 1 until October 31. In addition, the harvest of rainbow trout was not permitted in the special

management area from June 8 until October 31, while the daily bag limit from November 1 until June 7 became 5 rainbow trout, 1 over 20 inches.

The designation as a special management area in 1990 served to preserve the traditional character of the sport fishery as well as to protect the stocks of rainbow trout in the face of the increasing effort observed during the surveys of 1986 through 1988.

During the fall of 1992, a rainbow trout stock assessment survey and a limited, 53-day creel survey were conducted on the Agulupak River to gauge whether significant changes in the stock status or the fishery had occurred since 1988. The 1992 study estimated the population of rainbow trout in the upper half of the Agulupak River to range between 1,764 and 3,128 fish greater than 340 mm (13 in) in length (Dunaway 1993). A statistical comparison of the age and length data collected during 1987 and 1992 failed to detect any change in the rainbow trout size composition. Results from the 1992 creel survey showed 2,759 angler-hours of effort were spent to catch 1,862 rainbow trout (Table 29). A creel survey conducted in 1996 recorded the highest estimates of effort and catch observed in this fishery since surveys were initiated (Table 29, Rogan and Jaenicke 1997).

Management Objectives

The Agulupak River rainbow trout fishery is managed to maintain historical age and size composition and a diversity of angling opportunity by maintaining the special management designation of fly-fishing-only catch-and-release.

1999 Season

No surveys were conducted on the Agulupak River rainbow trout fishery in 1999. Incidental contacts with anglers suggested that fishing was considered excellent, but dependent on water level and temperature. Increasingly, concerns about crowding and diminished angling experience are heard regarding this fishery, particularly during the prime fall fishery.

2000 Outlook

In recent seasons, the recreational fishery for rainbow trout on the Agulupak River has been excellent. Angler success is often moderate from early spring until mid autumn after the salmon begin to spawn. Fall fishing is typically best after the peak of the salmon spawning until freeze-up. Recent survey data (Rogan and Jaenicke 1997) suggest the present system of regulations adequately balances opportunity with stock conservation. No inseason changes are anticipated in 2000.

UPPER NUSHAGAK RIVER

Fishery Description

A less well known but increasingly popular rainbow trout fishery occurs in the upper reaches of the Nushagak River and tributaries north of the village of Koliganek. Particularly popular is the section known as the “braids” north of the confluence of the Nushagak River and Harris Creek. Rainbow trout can be found in this water in the spring after ice-out and again in the fall when large numbers of chum and chinook salmon spawn in the braids.

This is a remote, mainly guided fishery with anglers flown in for day trips from a number of the lodges based in the Wood/Tikchik lakes systems. One or two smaller lodges have been based in the area since at least the late 1980s. As other, more easily accessed waters have become popular with floaters, the number of guided and unguided float trips to this area has grown. Growth of the Mulchatna caribou

herd in the area has brought hunters and anglers into this area as well. A few local anglers make the long trip to the area via jet boat from Dillingham, as well.

Historical Performance

Little is known of this fishery. The annual mail survey does not identify this fishery separately from other fisheries on the Nushagak River. No onsite creel survey or other studies have been conducted in this area by the department. Largely through the voluntary work of a few guides, a small amount of biological data has been collected from rainbow trout in this area and nearby tributaries since the late 1970s.

This fishery began to grow in popularity in the late 1980s as the Rainbow Trout Management Plan was being developed. The upper Nushagak River was not part of the department's original proposal for special management waters under implementation of the plan. However, during the February 1990 meeting, concerned guides and anglers convinced the Board of Fisheries to establish catch-and-release regulations for rainbow trout in the Nushagak River drainage from its confluence with Harris Creek, upstream to its confluence with the Chichitnok River. In addition, single-hook artificial lure restrictions were adopted for this section of the river. The catch-and-release restrictions were originally in effect from June 8 until July 31, but were later changed to June to October 31 in accordance with similar waters in the SWMA.

For the first time, department staff visited the area in 1998 to collect data from rainbow trout and to assess the area's potential for a creel survey or fishery study (Schwanke *Unpublished b*). From August 7 to August 19, 1998, a total of 241 rainbow trout were sampled between Harris Creek and the Chichitnok River (Schwanke *Unpublished b*). The mean length and weight of rainbow trout were 369 (SE = 3.34) mm and 644 (SE = 16.7) grams, respectively. On August 11 and 12, 1998, a total of 57 rainbow trout were sampled for a USF&WS pathology study on Southwest Alaska's rainbow trout populations. The results are to be published by the United States Fish and Wildlife Service.

From this brief study, the total number of fish sampled during the 12-day survey period may indicate healthy populations of rainbow trout (Schwanke *Unpublished b*). Schwanke further concluded: "The upper Nushagak River currently provides recreational anglers with a multi-species fishery. The mean size of rainbow trout, Arctic grayling and Dolly Varden may not be as large as other fisheries in the region, but their abundance is encouraging. The commercial guiding outfits on the upper Nushagak River are currently spread out over the drainage. Surveys of this fishery by the Alaska Department of Fish and Game should occur periodically in future years to monitor the growth of the fishery."

Management

The Upper Nushagak River rainbow trout fishery is managed to maintain historical age and size composition and a diversity of angling opportunity by maintaining the special management designation of catch-and-release and single-hook artificial lure regulations.

As with many of the area rainbow trout fisheries, the peak season restrictions from June 8 through October 31 give way to a daily bag limit of 5 rainbow trout per day, 1 over 20 inches during the remaining months of the year (ADF&G 1998b).

1999 Season

No field studies were conducted on this rainbow trout fishery in 1999. Incidental contacts with anglers suggested that fishing was considered fair to excellent. Like other fisheries in the area there are increasing concerns about crowding and diminished angling experience in this fishery.

2000 Outlook

This area should provide good rainbow trout angling opportunities for the 2000 season.

KANEKTOK RIVER

Fishery Description

One of the most popular rainbow trout fisheries in the SWMA occurs on the Kanektok River, where abundant and brilliantly colored rainbow trout offer excellent angling opportunities. This river is located in the Western section of the management area and drains west into the Kuskokwim Bay near the mouth of the Kuskokwim River (Figure 15). Mainly targeting salmon, the sport fishery has grown quickly since 1980, and subsequent conflicts between commercial and sport anglers drew statewide attention by the late 1980s. Changes in the management of the commercial fishery, and a drop in the level of sport fishing effort on the river, seem to have reduced the friction between the two groups. The river has become popular for float trips as air service from Dillingham has improved and as the river gained a reputation for excellent angling opportunities for abundant resident species as well as salmon. Angling effort appears to be growing again in recent years.

Historical Performance

Estimates of effort and harvest have been generated from the Statewide Harvest Survey since 1983. Sport fishing effort peaked at 12,697 angler days in 1988, and then dropped markedly. Since 1994 effort has again grown, and in 1996 exceeded 8,000 angler-days and approached the levels observed in 1987 and 1988 (Figure 21). Most effort is directed toward chinook and coho salmon but rainbow trout are an important attraction. The estimates of rainbow trout harvest averaged 150 rainbow trout per year from 1993 through 1997 (Table 25). The seven onsite creel surveys conducted on the Kanektok River by the department and the U.S. Fish and Wildlife Service targeted the salmon fisheries and did not encompass enough of the season to produce a useful estimate of the harvest of rainbow trout (Snellgrove *Unpublished*, Alt 1986, Minard 1987c, Minard 1990, Minard and Brookover 1988b, Wagner 1991, Dunaway and Bingham 1992b, Dunaway and Fleischman 1995a). The U.S. Fish and Wildlife Service studies of Kanektok River rainbow trout in 1993 and 1994 (Adams 1996) provide some information on size composition and distribution of the populations in the river.

Management

Sport effort, catch, and harvest are estimated via the statewide harvest, catch, and participation survey (Mills 1979-1994, Howe et al. 1995 and 1996, *In prep* a, b, and c). Subsistence harvests are not well monitored and are managed by the Commercial Fisheries Division.

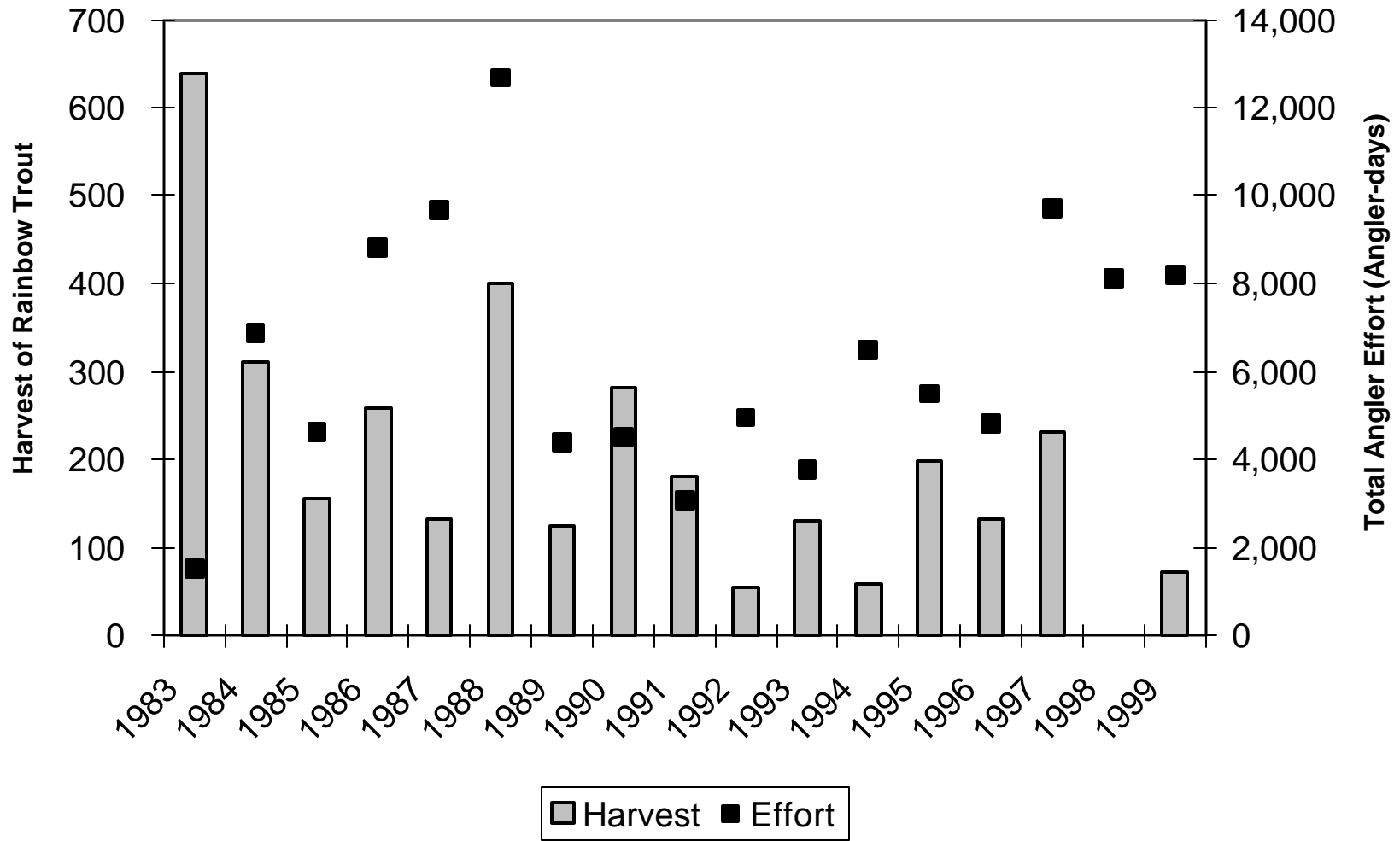


Figure 21.-Kanektok River harvest of rainbow trout and total angler effort, 1983-1999.

Because of the low effort and harvest, little regulatory or management attention has been devoted to the Kanektok River rainbow trout stocks. The following is a regulatory chronology for the Kanektok rainbow trout fishery:

- 1969. Year-round open season and daily bag limit of 15 fish (including rainbow trout) of which no more than 3 could exceed 20 inches in length.
 - 1985. Bag limit reduced to 2 rainbow trout per day of any size.
 - 1990. Single-hook artificial lures required for the Kanektok River upstream of the wilderness boundary in the Togiak National Wildlife Refuge. Sport fishing prohibited within 300 feet of a legally set subsistence gill net.
1998. Entire Kanektok River drainage restricted to unbaited single-hook artificial lures the entire year. June 8 through October 31, catch-and-release only for rainbow trout. November 1-June 7 daily bag and possession limit is 2 rainbow, only 1 over 20 inches.

There have been no indications that further management actions are necessary; however, occasional monitoring of this popular fishery would be prudent. Estimates of stock abundance would be useful in assessing stock status. Unfortunately the cost and difficulties associated with designing a statistically valid project on such a long river have so far confounded biologist's attempts to obtain sound assessments of this population or to measure the likely effects of the sport fishery (Adams 1996). The variety of salmon species which spawn in the river should impart a measure of stability to the population of Kanektok River rainbow trout by allowing it to be less dependent upon the success or failure of a single run of salmon.

Management Objectives

The Kanektok River rainbow trout fishery is managed to maintain historical age and size composition, and abundance levels such that stocking is not needed to enhance or supplement the wild population.

1999 Season

No surveys were conducted on the Kanektok River rainbow trout fishery in 1999. Incidental contacts with anglers provided a large range of opinion on the status of the fishery, but most anglers seem to have had good fishing. Sport fishing effort during the last few seasons has grown steadily from past years according to the U.S. Fish and Wildlife Service staff of the Togiak Refuge. Residents of the community of Quinhagak at the outlet of the Kanektok River, at least two commercial operators who use the river, and a number of private individuals continue to express concern for the use levels and angling pressure on the Kanektok River.

There seems to be good support for the new gear and bag limit restrictions adopted during the winter of 1997. It is notable that the latest restrictions were adopted with support from the local residents of Quinhagak.

2000 Outlook

The Kanektok River rainbow trout fishery has been good to excellent in recent years and 2000 should be the same. Angling success on the Kanektok River in 2000 may depend on weather and water conditions. No inseason management actions are anticipated for the 2000 season.

NORTHWESTERN RAINBOW TROUT FISHERIES

Northwestern section rainbow trout are found in the Aniak, Kisaralik, Kasigluk, and Kwethluk rivers, and probably other smaller adjacent tributaries which flow northwesterly into the Kuskokwim River from the Kilbuck Mountains. Until recently, most of the sport effort in this section was limited to the residents of communities along the lower Kuskokwim River. Since 1983, the sport fishery has grown as guides and outfitters from Bristol Bay and within the Kuskokwim drainage offer more services on these and other nearby rivers. From 1993-1997 harvest estimates averaged 300 fish per year (Table 25).

Rainbow trout in the Northwestern section are at the far extreme of their range in North America and can be characterized as slow growing, with small size at age, and not particularly abundant. The Northwestern section's severe environment is assumed to make its rainbow trout populations very sensitive to changes in climate and food availability. Sustaining a population which demonstrates such slow growth, low productivity, and environmental sensitivity typically requires conservative management strategies.

There are four special management areas in the Northwestern section. The oldest, established in 1990, is the Aniak River drainage. Above its confluence with the Doestock River the Aniak River is restricted to unbaited single-hook artificial lures for all species, and catch-and-release for rainbow trout.

During the December 1997 meeting, the Alaska Board of Fisheries established special management areas on the Kisaralik, Kasigluk, and Kwethluk rivers (Figures 17 and 19). The restrictions were proposed by the Kwethluk Joint Group and had strong local support. Much of the Kisaralik River was designated as a special management area, restricted to unbaited single-hook artificial lures for all species and catch-and-release only for rainbow trout (ADF&G 1998b).

The Kwethluk River above Three Step Mountain and the whole Kasigluk River (Figure 19) were restricted to unbaited single-hook artificial lures for all species. Daily bag and possession limits for rainbow trout are 1 fish 14 inches or less in length. The length limit was based on the size rainbow trout are believed to reach sexual maturity in these rivers. The analysis was based on data collected from the Kwethluk and Kisaralik rivers by Ken Harper, USF&WS, Kenai Fisheries Research Office.

General growth of sport fishing in the Northwestern section and poor runs of chum salmon in 1993 and 1994 prompted concern from many local residents more accustomed to subsistence fisheries and few outside visitors. These concerns as well as the department's interest in monitoring unstudied "edge" rainbow trout populations resulted in two exploratory sport fishery projects on the Aniak River, the most popular water in the section. In 1993 Sport Fish Division staff spent 10 days in late July and August observing the sport fishery and collecting biological data from rainbow trout, char and grayling in the middle portion of the Aniak River. These data were a quick snapshot of the resident fish and fisheries and provided little quantitative information.

A more extensive project was conducted for 6 weeks in 1996 (Dunaway 1997). The anticipated poor chum salmon run was the major impetus behind the project but the department used the opportunity to become familiar with aspects of the area's fisheries and to assess the need and feasibility for quantitative fisheries studies. The sport fishery on the Aniak River did not appear to be a threat to resident species

populations; there was general local support for additional restrictions on the sport harvest of resident species. The sport fishery did not appear to conflict with the subsistence fisheries.

Recent years show sport effort is growing on the Kisaralik, Kwethluk, and Kasigluk rivers. These rivers are within the huge Yukon-Kuskokwim Delta (YKD) Wildlife Refuge. The lower reaches of these rivers support important subsistence fisheries for nearby villages as well as popular recreational fisheries for Bethel-based anglers. Nonlocal anglers are increasingly aware and interested in these rivers as well. A lake at the head of the Kisaralik River makes it attractive to rafting enthusiasts. Several falls or cascades in its upper reaches make it most suited to individuals with considerable wilderness experience. The accessibility, complex land ownership patterns and subsistence concerns spurred the refuge to complete a management plan for the uplands along this river in March of 1997 (USF&WS 1997). In 1997 the USF&WS began a study of the Kisaralik River rainbow trout population but reports are not yet available.

A similar study was begun by the USF&WS on the Kwethluk River in 1998 but work could not be completed and the project was extended into 1999 (Ken Harper, USF&WS, Fisheries Research office, Kenai, personal communication). Relatively difficult access appears to make the Kwethluk less appealing to float trip anglers. Most effort occurs in the lower river accessible by motorboat. In 1996 the USF&WS conducted some preliminary work and tagged many rainbow trout. The tagging had not been planned and was not conducted according to a rigorous study design (Ken Harper, USF&WS, Fisheries Research office, Kenai, personal communication). However the work succeeded in collecting the most extensive and only recent data on this fish population.

The department expects interest in the Northwestern section rainbow trout fisheries to grow and these stocks will eventually need additional monitoring and management strategies.

SECTION VII: OTHER SPECIES FISHERIES

Southwest Alaska offers diverse sport fishing opportunity for a large variety of species that often go unnoticed because of the publicity given the more popular species. Arctic char/Dolly Varden, Arctic grayling, lake trout, and chum salmon, to name four, are species that contribute to the sport fishing pleasures of many anglers who fish the area (Tables 30-33). Harvest estimates are made annually for these "other species" and trends are followed for the more popular sport species.

In the winter of 1997, the Board of Fisheries reduced the bag and possession for Dolly Varden/char and grayling throughout the Bristol Bay and Kuskokwim areas. In addition, the daily bag and possession limits for pike and sheefish were reduced in the Kuskokwim. In most cases, the older liberal bag limits were not causing biological problems, but growth of the sport fishery was a concern to many local residents. At the same time, the current ethic among many anglers tends to advocate very limited or no harvest. Therefore, the winter 1997 bag limit reductions enjoyed widespread support from most user groups. Undoubtedly the fish populations gained a greater measure of protection as well. The new regulations were first effective during the 1998 season (ADF&G 1998b). The new bag limits generated no complaints during the 1998 or 1999 season.

WOOD RIVER LAKES ARCTIC CHAR

Fishery Description

The recreational fishery for Arctic char in the Wood River Lakes is the largest fishery for this species in the SWMA. Before 1989, sport fishing effort in the Wood River Lakes averaged about 3,000 angler-days per year, but from 1993-1997 has averaged about 8,000 angler-days. Much of the effort is aimed at char and Dolly Varden, and the bulk of the sport harvest for these two species occurs at the mouths of the Agulowak and Agulukpak rivers.

Historical Performance

Abundance of Arctic char at the Agulowak River was first estimated in 1954. Since that time, abundance has been estimated for 1971 and 1972, and 1975 through 1980. With the exception of 1980, abundance estimates indicated that a very stable population of 8,000 to 12,000 Arctic char was present at the mouth of the Agulowak.

Similar, but less extensive, data are available for the Agulukpak population. Abundance there was also stable, between 4,300 to 7,800 fish.

Agulowak River/Lake Aleknagik Arctic Char

A stock assessment project conducted in 1993 found the abundance of Arctic char at the mouth of the Agulowak River had declined from 12,000 to 5,000 fish over a 10-year period (Minard and Hasbrouck 1994). Sport harvests during the period of decline are thought to have been excessive. This prompted emergency order reduction in bag limits for the 1994 season. Restrictive regulations addressing this fishery were adopted by the Alaska Board of Fisheries in January of 1995. The new regulations reduced the daily bag limit from 10 to 2 fish per day and in possession, and required the use of single-hook artificial lures. Additionally, a single-hook artificial lure restriction was adopted for the portion of Lake Aleknagik within a half-mile radius of the outlet of the Agulowak River. These

Table 30.-Sport harvest of Dolly Varden/Arctic char from waters of Southwest Alaska, 1977-1998.

Drainage	1977-88										1993-97	
	Average	1989	1990	1991	1992	1993	1994	1995	1996	1997	Average	1998
Eastern												
Naknek R.	919	479	939	580	721	568	401	356	876	261	492	276
Brooks R.	19	20	0	0	0	0	0	0	0	0	0	0
Kvichak R.	67	71	63	84	180	89	187	19	389	46	146	8
Copper R.	14	20	0	118	16	9	57	0	0	0	13	0
Alagnak R.	100	30	21	84	139	54	18	192	270	376	182	14
Newhalen R.	250	91	106	355	131	190	145	198	170	491	239	107
Lake Clark	127	202	42	51	82	86	203	43	49	675	211	67
Other	^a 1,157	652	661	2,060	902	1,219	1,533	826	1,071	1,744	1,279	599
Subtotal	^a 2,618	1,565	1,832	3,332	2,171	2,215	2,544	1,634	2,825	3,593	2,562	1,071
Central												
Nushagak	148	31	77	144	254	270	272	273	695	372	376	151
Mulchatna	136	41	165	131	172	200	121	232	296	663	302	59
Agulowak										89	89	261
Agulukpak										68	68	59
Wood River L.	^b 1,019	2,348	1,362	1,724	1,818	1,288	1,373	1,289	1,476	1,262	1,338	358
Tikchik/Nuyakuk	230	218	77	170	344	376	122	70	134	276	196	163
Other	386	145	638	39	98	56	102	296	270	405	226	17
Subtotal	^a 1,757	2,783	2,319	2,208	2,686	2,190	1,990	2,160	2,871	3,135	2,469	1,068
Western												
Togiak	443	218	88	78	66	117	137	99	391	85	166	1,472
Goodnews	287	530	18	605	82	343	132	158	284	1,071	398	460
Kanektok	1,241	1,073	1,020	389	66	378	233	212	451	789	413	368
Other	77	288	0	0	41	0	0	0	121	129	50	0
Subtotal	^a 1,245	2,109	1,126	1,072	255	838	502	469	1,247	2,074	1,026	2,300
Northwestern												
Aniak	222	808	598	547	115	260	496	481	195	316	350	394
Other	288	655	89	476	490	431	438	321	828	951	594	242
Subtotal	^a 510	1,463	687	1,023	605	691	934	802	1,023	1,267	943	636
Total	7,712	7,920	5,964	7,635	5,717	5,934	5,970	5,065	7,966	10,069	7,001	5,075

Source: Mills 1979-1994, Howe et al. 1995 and 1996, and *In prep* a, b, and c.

^a Subtotals of averages may not be the sum of the drainages because information for some drainages is not available for some years.

^b Until 1997, Agulowak and Agulukpak rivers were included in Wood River Lakes.

Table 31.-Sport harvest of Arctic grayling from waters of Southwest Alaska, 1977-1998.

Drainage	1977-88										1993-97	
	Average	1989	1990	1991	1992	1993	1994	1995	1996	1997	Average	1998
Eastern												
Naknek R.	635	280	197	337	316	501	240	185	170	362	292	38
Brooks R.	35	42	11	52	0	0	0	0	0	0	0	10
Kvichak R.	221	141	127	122	180	139	225	148	98	222	166	71
Copper R.	19	20	0	15	0	50	10	0	0	0	12	0
Alagnak R.	251	222	106	184	180	171	113	104	192	186	153	228
Newhalen R.	308	171	85	291	263	185	224	399	328	874	402	506
Lake Clark	599	313	402	168	548	568	568	270	289	1,273	594	296
Other	468	431	596	643	514	484	1,390	217	768	530	678	810
Subtotal	^a 2,452	1,620	1,524	1,812	2,001	2,098	2,770	1,323	1,845	3,447	2,297	1,959
Central												
Nushagak	245	72	307	170	624	316	941	579	698	612	629	407
Mulchatna	512	260	285	425	210	762	314	604	614	285	516	158
Agulowak										20	20	8
Agulukpak										10	10	0
Wood River L.	^b 308	104	220	524	143	212	345	218	12	176	193	51
Tikchik/Nuyakuk	303	93	296	1,473	218	650	112	266	287	333	330	27
Other	548	287	604	312	181	170	1,008	271	366	966	556	475
Subtotal	^a 1,825	816	1,712	2,904	1,376	2,110	2,720	1,938	1,977	2,402	2,229	1,126
Western												
Togiak	98	62	0	0	23	65	20	26	25	20	31	0
Goodnews	152	198	53	122	0	17	0	14	41	74	29	28
Kanektok	185	58	123	54	23	25	0	0	0	99	25	33
Other	43	0	0	0	128	0	0	0	46	0	9	0
Subtotal	^a 288	318	176	176	174	107	20	40	112	193	94	61
Northwestern												
Aniak	172	909	422	1,085	121	288	116	53	398	162	203	715
Other	461	734	71	773	370	255	345	421	176	675	374	835
Subtotal	^a 634	1,643	493	1,858	491	543	461	474	574	837	578	1,550
Total	7,712	4,397	3,905	6,750	4,042	4,858	5,971	3,775	4,508	6,879	5,198	4,696

Source: Mills 1979-1994, Howe et al. 1995 and 1996, and *In prep* a, b, and c.

^a Subtotals of averages may not be the sum of the drainages because information for some drainages is not available for some years.

^b Until 1997, Agulowak and Agulukpak rivers were included in Wood River Lakes.

Table 32.-Sport harvest of lake trout from waters of Southwest Alaska, 1977-1998.

Drainage	1977-88										1993-97	
	Average	1989	1990	1991	1992	1993	1994	1995	1996	1997	Average	1998
Eastern												
Naknek R.	78	10	33	17	8	28	44	0	127	30	46	12
Brooks R.	13	10	11	0	0	9	0	0	0	0	2	0
Kvichak R.	8	30	0	14	0	0	69	0	53	0	24	0
Copper R.	0	10	0	0	0	0	0	0	0	0	0	0
Alagnak R.	166	20	74	14	8	83	15	0	9	10	23	0
Newhalen R.	1	20	21	127	39	20	143	29	0	114	61	41
Lake Clark	313	485	402	113	247	219	437	219	134	101	222	81
Other	318	444	736	297	581	541	756	275	525	527	525	250
Subtotal	^a 843	1,029	1,277	582	883	900	1,464	523	848	782	903	384
Central												
Nushagak	6	42	0	0	8	31	107	7	47	315	101	9
Mulchatna	56	0	11	0	0	0	156	9	0	0	33	0
Agulowak										100	100	12
Agulukpak										0	0	0
Wood River L.	^b 4	0	0	0	0	51	22	0	0	0	15	12
Tikchik/Nuyakuk	97	437	176	86	31	192	55	76	215	45	117	129
Other	231	133	99	69	23	37	0	131	75	106	70	0
Subtotal	^a 316	612	286	155	62	311	340	223	337	566	355	162
Western												
Togiak	1	10	0	0	39	0	0	0	19	0	4	0
Goodnews	5	38	0	0	0	9	22	20	9	23	17	40
Kanektok	23	959	0	0	0	0	18	80	28	113	48	0
Other	10	328	18	0	15	0	0	0	0	11	2	0
Subtotal	^a 20	1,335	18	0	54	9	40	100	56	147	70	40
Northwestern												
Aniak	6	63	18	0	47	0	231	61	9	56	71	9
Other	184	55	18	215	309	160	0	29	64	158	82	82
Subtotal	^a 190	118	36	215	356	160	231	90	73	214	154	91
Total	7,712	3,094	1,617	952	1,355	1,380	2,075	936	1,314	1,709	1,483	677

Source: Mills 1979-1994, Howe et al. 1995 and 1996, and *In prep* a, b, and c.

^a Subtotals of averages may not be the sum of the drainages because information for some drainages is not available for some years.

^b Until 1997, Agulowak and Agulukpak rivers were included in Wood River Lakes.

Table 33.-Sport harvest of chum salmon from waters of Southwest Alaska, 1977-1998.

Drainage	1977-88						1993-97					
	Average	1989	1990	1991	1992	1993	1994	1995	1996	1997	Average	1998
Eastern												
Naknek R.	161	260	239	398	175	34	36	173	55	118	83	195
Brooks R.	0	0	0	0	0	0	0	0	0	0	0	0
Kvichak R.	9	278	81	306	0	17	48	0	44	0	22	42
Copper R.	0	0	0	0	0	0	0	0	0	0	0	58
Alagnak R.	96	50	219	227	448	545	282	477	274	305	377	1,104
Newhalen R.	0	0	0	0	0	0	0	0	0	0	0	0
Lake Clark	11	0	0	0	0	0	0	0	0	0	0	0
Other	53	388	0	93	54	0	63	160	276	29	106	0
Subtotal	^a 298	976	539	1,024	677	596	429	810	649	452	587	1,399
Central												
Nushagak	177	884	192	219	501	540	887	441	1,002	710	716	928
Mulchatna	124	156	203	55	175	133	64	83	256	272	162	87
Agulowak										0	0	0
Agulupak										29	29	0
Wood River L.	^b 16	26	24	119	8	33	7	0	33	0	15	15
Tikchik/Nuyakuk	10	26	60	27	23	0	29	11	0	0	8	0
Other	21	26	0	0	15	26	87	28	77	29	49	176
Subtotal	^a 340	1,118	479	420	722	732	1,074	563	1,368	1,040	955	1,206
Western												
Togiak	61	130	24	37	8	17	153	105	77	82	87	34
Goodnews	61	0	72	189	0	156	15	0	0	24	39	50
Kanektok	391	537	202	80	251	183	156	213	221	212	197	213
Other	15	26	0	0	0	0	0	0	154	15	34	13
Subtotal	^a 293	693	298	306	259	356	324	318	452	333	357	310
Northwestern												
Aniak	79	1,140	159	169	304	101	231	127	298	86	169	101
Other	106	525	259	80	213	17	876	99	77	62	226	23
Subtotal	^a 185	1,665	418	249	517	118	1,107	226	375	148	395	124
Total	7,712	4,452	1,734	1,999	2,175	1,802	2,934	1,917	2,844	1,973	2,294	3,039

Source: Mills 1979-1994, Howe et al. 1995 and 1996, and *In prep* a, b, and c.

^a Subtotals of averages may not be the sum of the drainages because information for some drainages is not available for some years.

^b Until 1997, Agulowak and Agulupak rivers were included in Wood River Lakes.

restrictions have been in place since 1994 season (by emergency order in 1994, and by regulation since 1995). Public acceptance appears good, as does compliance. There are anecdotal indications that the char stocks at the Agulowak are recovering, suggesting that the regulatory changes have been sufficient to allow recovery to previous levels.

Since the Board action, harvests for the Wood River Lake system have remained fairly stable, around 1,200 fish per year. The vast majority of the harvest comes from the Agulowak River stock; the fishery at the Agulukpak is primarily catch-and-release.

The Aleknagik Lake char stocks were used intermittently to supply eggs to State hatcheries in the mid 1980s and early 1990s. When the 1993 abundance study (Minard and Hasbrouck 1994) found a significantly reduced char population, there was concern that egg takes may have been a contributing factor. Before any more egg takes were allowed, a population assessment had to be conducted. In the fall of 1997 a preliminary study (Skaugstad *Unpublished*) showed the population was not likely to suffer significant impacts from an egg take scheduled for 1998.

During October and November of 1998, about 450 Arctic char were caught by various means from Aleknagik Lake. About 400 of these fish were held in live pens until they ripened for spawning. Twenty-five fish died while being held, 13 from mink predation and the rest from apparent disease or fungal infections. In late November, the fish were spawned and released back into the lake. Approximately 230,000 eggs were taken during the project (Schwanke & Schwanke *Unpublished*).

Management

Sport effort, catch, and harvest are estimated via the Statewide Harvest Survey. Subsistence harvests are not well monitored and are managed by the Commercial Fisheries Division. Onsite surveys yield detailed estimates of angler use and success. Biological information and demographic information are also collected. Significant stock assessment and creel survey results have been reported by Minard (1989b), and Minard and Hasbrouck (1994).

Management Objectives

The management objectives for this fishery are to:

1. Maintain the Agulukpak River stock at historic levels and sizes previously documented, and
2. Rebuild the Agulowak River stock to previously reported levels observed in the 1980s.

Management objectives for the Agulowak River stock will be addressed by keeping exploitation rates to less than 10% of the available stock size and by minimizing mortality associated with catch-and-release fishing.

1999 Season

Guided anglers continue to fish the Agulowak and Agulukpak rivers, and char are an important component of some lodge activities. Char are also still popular with local and nonlocal private anglers. There has been some call for more enforcement on this fishery. Current limits and gear restrictions seem appropriate given the popularity of these fisheries.

2000 Outlook

Agulowak River: Fishing is expected to be good in the Agulowak River; it may even improve over the next several years. Catch rates are expected to be highest in June and July. Another egg take is scheduled for fall 2000, using fewer fish than in 1998.

Agulukpak River: The Agulukpak River has produced very well over the last several seasons and is expected to do so again in 2000.

KUSKOKWIM RIVER CHUM SALMON

Fishery Description

Kuskokwim River chum salmon stocks are harvested primarily for subsistence and commercial use. Subsistence use of chum salmon has been documented as early as 1922 when sporadic surveys were first conducted (Francisco et al. 1993, Burkey et al. 1997, 1998, 1999a). The subsistence fishery is subject to few restrictions and most subsistence fishing is accomplished by the use of drift and set gill nets. Directed commercial harvests started in 1971. The commercial fishery was allowed to expand with management consisting of catch monitoring. In 1983, escapement-based management was instituted.

The sport fishery for Kuskokwim chum salmon is a very minor component of the overall harvest. Most of the harvest takes place in tributary streams and incidental to small fisheries targeting chinook salmon. The total sport harvest of chum salmon in the lower Kuskokwim River (Northwestern section) has ranged from 118 to 1,107 fish per year, and during 1993 through 1997 averaged 395 fish per year (Table 33). The Aniak River, a major tributary of the Kuskokwim, supports the largest sport fishery for chum salmon with a peak annual harvest of 1,140 fish estimated in 1989 (Table 33). Annual sport harvest of Aniak River chum salmon is usually much lower than the 1989 estimate, and from 1993 through 1997 averaged 169 fish (Table 33). Chum salmon are probably more popular as a catch-and-release fishery, with the catch far exceeding the harvest. The average annual catch estimate for Aniak River from 1993-1997 was 2,718 chum salmon (Table 34), while harvest was only 395.

Management

In 1983, chum salmon escapement goals were established for several Kuskokwim River tributary streams based on the average observed escapement in those waters since 1960. Basic to this management approach was the assumption that achieving these goals should maintain salmon returns at historic levels, and that observing returns from these escapements would allow for adjustment of the goals to achieve maximum sustained yield (Burkey et al. 1997, 1998, 1999a). The primary indicators have long been escapement enumeration by the Aniak River sonar, remote Kogruluk River weir, and aerial spawning ground surveys conducted by CFD. Other state or federal projects designed to assess salmon run strength in the Kuskokwim drainage have been added including test fishing, Bethel sonar, and various weirs on other tributaries. Reduced funding has since terminated some programs, some were abandoned as ineffective, and a couple weir projects were terminated when nearby communities asked for their removal.

The lower portion of the Kuskokwim River is divided into two commercial fishing districts, District 1 near Bethel, and District 2 that includes the river near the community of Aniak. The Kuskokwim River chum salmon subsistence and commercial fisheries continue to be managed for biological escapement goals in several key tributaries. Commercial fishery management actions are usually made after

Table 34.-Sport catch of chum salmon from the waters of Southwest Alaska by fishery, 1991-1998.

Drainage	1991	1992	1993	1994	1995	1996	1997	1993-97 Average	1998
Eastern									
Naknek R.	567	517	249	926	950	745	1,583	891	636
Brooks R.	0	23	0	19	0	0	292	62	0
Kvichak R.	1,180	516	573	759	175	625	907	608	1,229
Copper R.	0	0	0	0	0	0	0	0	146
Alagnak R.	5,811	11,677	10,320	4,636	9,978	14,933	14,667	10,907	18,601
Newhalen R.	0	0	0	0	0	0	0	0	26
Lake Clark	0	0	0	0	0	0	0	0	0
Other	320	1,391	1,107	388	1,739	5,786	4,045	2,613	1,925
Subtotal	^a 7,878	14,124	12,249	6,728	12,842	22,089	21,494	15,080	22,563
Central									
Nushagak	1,662	6,544	3,651	7,005	3,581	9,432	3,900	5,514	6,693
Mulchatna	457	2,050	2,275	2,223	1,251	3,351	1,757	2,171	2,660
Agulowak							116	116	0
Agulukpak							29	29	146
Wood River L.	^b 310	410	297	133	40	784	381	327	37
Tikchik/Nuvakuk	46	850	28	327	120	231	15	144	44
Other	401	341	869	2,174	303	2,179	676	1,240	1,814
Subtotal	^a 2,876	10,195	7,120	11,862	5,295	15,977	6,874	9,426	11,394
Western									
Togiak	493	395	906	1,419	2,064	6,811	1,198	2,480	4,888
Goodnews	527	402	924	381	315	407	1,118	629	2,955
Kanektok	1,382	3,994	4,849	6,386	5,049	10,916	11,124	7,665	11,560
Other	0	0	191	0	0	1,167	59	283	368
Subtotal	^a 2,402	4,791	6,870	8,186	7,428	19,301	13,499	11,057	19,771
Northwestern									
Aniak	656	1,670	2,412	1,342	2,785	4,691	2,358	2,718	2,664
Other	577	851	1,147	2,284	843	5,446	433	2,031	2,332
Subtotal	^a 1,233	2,521	3,559	3,626	3,628	10,137	2,791	4,748	4,996
Total	14,389	31,631	29,798	30,402	29,193	67,504	44,658	40,311	58,724

Source: Mills 1992-1994, Howe et al. 1995 and 1996, and *In prep* a, b, and c.

^a Subtotals of averages may not be the sum of the drainages because information for some drainages is not available for some years.

^b Until 1997, Agulowak and Agulukpak rivers were included in Wood River Lakes.

consultation with the Kuskokwim Working Group. The Working Group includes department representatives, commercial processing representatives, and individuals from communities along the length of the Kuskokwim River representing traditional knowledge, subsistence, commercial, and sport interests. Since 1996, Sport Fish staff from the Dillingham office have increased their participation in the group meetings via teleconferences.

Exceptionally poor runs of Kuskokwim River drainage chum salmon in 1993 and 1994 resulted in extensive restrictions in the sport and commercial fisheries. The sport harvest of chum salmon was prohibited by emergency order in 1993, and in 1994 an emergency order reduced the bag limit to 1 fish per day. On July 10, 1997, Emergency Order No. 2-CS-5-22-97 was issued closing sport fishing, including catch-and-release fishing, for chum salmon in the Kuskokwim River drainage for the 1997 season.

In 1996 and 1997, the Bureau of Indian Affairs provided funding for additional enumeration and research projects to address the potential long-term effects of the 1993 and 1994 returns. Counting towers were installed on the Kwethluk and Takotna rivers and a weir on the George River. Commercial Fisheries Division and local Native organizations operated the projects jointly. In addition, the department used a new sonar site and new sonar equipment on the Aniak River.

The poor chum runs lead the Sport Fish Division to conduct two informal fishery studies on the Aniak River. The first was a short 10-day visit to the middle section of the river in late July and August of 1993. Too late for the chum fishery, this project collected a small amount of biological data from rainbow trout, grayling, and Dolly Varden.

A second project was conducted on the Aniak River from late June through early August of 1996 (Dunaway 1997). This study was an opportunity to get oriented to the fishery and to assess the need and feasibility for more quantitative studies. Anglers and guides were interviewed to learn the timing of the fishery, species targeted, numbers of fish kept and released, and angler demographic information. Biological data were collected from sport-caught salmon and resident species. Over 70% of the anglers were guided, nonresident men. The lower river fishery is characterized by motor-boat-based anglers, both local and nonlocal. The nonlocal anglers are typically lodge-based and guided. The upper river fisheries are largely raft trippers, mainly guided, accessing the Aniak via an airstrip along the Salmon River or other tributaries. Sport harvest appeared to be minimal and the sport fishery on the Aniak River did not appear to be a threat to salmon or resident species populations. The sport fishery did not appear to conflict with the subsistence fisheries. This sport fishery was small and diffuse and expensive to survey with a rigorous sample design.

The 1998 chum salmon return to the Kuskokwim River was expected to be poor based on parent-year escapement estimates of 1993 and 1994. Surprisingly, the 1998 chum salmon return was quite good, and the escapement goal of 250,000 fish was exceeded.

Management Objectives

Kuskokwim River chum salmon stocks are managed to achieve biological escapements of 30,000 fish past the Kogrukuk weir, and 250,000 fish past the Aniak River sonar counter. As additional weirs and counting projects come on line and mature, their data will likely contribute to management.

1999 Season

The 1999 chum salmon return to the Kuskokwim River was expected to be average to below average based on parent-year escapement estimates.

The 1999 return was well below average. The Aniak River sonar count was 177,771; 29% below the 250,000 fish goal (Burkey et al. 2000). The weak return of chum salmon resulted in a very conservative management strategy for the commercial fishery. Only one commercial period was allowed and the commercial chum salmon fishery was closed on July 15. The Kogrukluk River weir passage of 13,644 was 54% below the 30,000 fish goal.

On July 17 an emergency order prohibited sport anglers from retaining chum salmon in the entire Kuskokwim drainage to conserve fish. The 1999 estimate of chum salmon sport harvest from Kuskokwim drainages below Aniak was 520. The catch estimate was 26,724.

2000 Outlook

Chum salmon return to the Kuskokwim primarily at 5 and 4 years of age, so 1995 and 1996 are expected to be the main brood years for the 2000 returns. Parent-year escapements from these years should provide the foundation for producing a good chum salmon return in 2000. However, overall chum salmon returns to the Kuskokwim River have been low in most of the past few years and this trend raises concern for the 2000 season (Burkey et al. 2000). As in previous years, the 2000 season will be approached cautiously and emergency order restrictions are possible for all fisheries.

UGASHIK LAKES GRAYLING

The Ugashik Lakes are located on the Alaska Peninsula, 560 km southwest of Anchorage, and are within the Alaska Peninsula National Wildlife Refuge. Two popular sport fishery areas are the Ugashik Narrows, which connect the Upper and Lower Ugashik lakes, and the Outlet, which includes the upper 2 km of the Ugashik River between Lower Ugashik Lake and a large lagoon. The Ugashik Narrows is approximately 0.5 km long, and consists of two main channels with moderately fast water. The Outlet consists of shallow, braided channels with moderately fast water. The Ugashik Lakes area is accessible only by float plane or by boat from the village of Ugashik and Pilot Point, 40 km downstream from the Outlet.

Fishery Description

Angler effort in the Ugashik Lakes area is concentrated at the Narrows and Outlet, with limited effort expended in other parts of the drainage (Jaenicke and Squibb 2000). Due to the inclement weather of the Alaska Peninsula and the remote nature of the Ugashik Narrows, fishing pressure is moderate. Three active lodges and one inactive sport fishing lodge are located in the Ugashik Lakes area. In addition, a number of lodges in the King Salmon area fly guests to the Ugashik Lakes for day fishing trips.

Species of interest in the sport fishery include Arctic grayling, coho and sockeye salmon, Arctic char/Dolly Varden, and lake trout. Annual sport harvest and catch are estimated for the drainage through the Alaska statewide sport fish harvest and participation survey (Mills 1979-1994, Howe et al. 1995 and 1996 and *In prep* a, b, c, and d). Rainbow trout have never been officially documented in the drainage, but reports of catches and harvests of this species routinely appear in the sport fish harvest and participation survey (Mills 1992-1994, Howe et al. 1995 and 1996 and *In prep* a, b, c, and d).

The primary attraction in the drainage has been the Ugashik Narrows that harbors a population of very large Arctic grayling. Studies indicate that the grayling at this site are an accumulation of old large fish (Meyer 1990 and 1991). The Alaska state record for sport-caught Arctic grayling was caught in the Ugashik Narrows in 1981. From 1967 to 1998, 66 trophy fish certificates or honorary catch-and-release certificates were issued for Arctic grayling in the Ugashik River drainage (Jim Andel, ADF&G, Division of Sport Fish, Juneau, personal communication).

History

Management of the sport fishery for Arctic grayling in the Ugashik River drainage has been conservative since 1969, when the bag limit was reduced to 2 fish per day. The entire drainage was closed to the taking of Arctic grayling during 1990-1994 after studies found declining and very low grayling populations of old fish and poor recruitment (Meyer 1990 and 1991, Villegas 1993). In 1995 the Board of Fisheries again allowed a sport harvest in portions of the drainage, with a 5 fish per day daily bag limit in the Ugashik River drainage, excluding the Ugashik Narrows and Ugashik River for the period of 1995-1997. The Ugashik Narrows has been designated as a catch-and-release Arctic grayling fishery since 1995. The Ugashik River has been closed to Arctic grayling fishing since 1990. During their 1997 winter meeting, the Board of Fisheries reduced the daily limit where harvest is allowed to 2 fish per day, with no size restrictions (ADF&G 1998b).

Creel censuses were conducted with cooperative effort by Sport Fish Division and the U.S. Fish and Wildlife Service (USF&WS) Alaska Peninsula/Becharof National Wildlife Refuge at the Ugashik Narrows during 1987 and 1988 (Meyer 1991).

A joint USF&WS and ADF&G creel survey was conducted at the Ugashik Narrows from June 20 through September 14, 1998 (Jaenicke and Squibb 2000). This study originated from a need to update public use data for a revision of the comprehensive conservation plan of the Alaska Peninsula/Becharof National Wildlife Refuge Complex (APB NWRC). The Ugashik Narrows were identified by staff of the King Salmon Fishery Resource Office (KSFRO) and the APB NWRC as the top priority among sites within the refuge complex where public use records were not current. In addition, the department wanted to have updated information on this well known fishery. Objectives of the study were to census the recreational fishing effort, catch, and harvest at the Narrows; census the distribution of catch and harvest success of anglers; collect angler demographics; and estimate the length and age composition of the sport catch.

During the survey, the 348 anglers interviewed expended a total of 1,340 hours of angling effort (Jaenicke and Squibb 2000). Jaenicke and Squibb (2000) concluded that effort at the narrows has declined from that observed in 1987. The majority of the catch consisted of Arctic grayling (991 released), and Dolly Varden and Arctic char (855 released, 23 kept). The typical angler was guided (66%), not an Alaskan resident (77%), used air charter to access the area (89%), fished from shore (99%), and used fly fishing gear (70%) (Jaenicke and Squibb 2000). The 1998 demographic data are not significantly different from the data collected in 1987. Review of previous mark-recapture projects at the Ugashik Narrows indicates a need for a large-scale mark-recapture project over at least a 3-year period, in conjunction with a radiotelemetry study, before the current population status of Arctic grayling is properly understood.

During much of early and mid 1990s, the Ugashik Narrows was the site of a controversy regarding public access easements for this popular angling site. The state sought to preserve a site easement on Lower Ugashik Lake and a trail easement running north along the west side of the Narrows to public lands along Upper Ugashik Lake. Fly-in anglers had a tradition of getting dropped off on the shores of one lake, angling along the shores of the Narrows and then getting picked up at the other lake at the end of the day. Frequent and rapid weather changes often made the different drop-off and pick-up sites a necessity for safe air travel. A Native corporation sought to obtain control of the lands along the Narrows and objected to establishment of the easements. From 1992 through 1997 there had been extensive legal discussions. The state accumulated extensive documentation establishing historical use of the site and trail, and showed its determination to secure these easements through litigation or a negotiated agreement. In August 1997 the Native corporation chose to relinquish its selection of these lands thereby allowing the lands to remain as public lands under the management of the Alaska Peninsula/Becharof National Wildlife Refuge. The Narrows and landing sites at both lakes continue to be accessible to the public. Note that a portion of land on the southeast side of the outlet is being conveyed to a private, Native allotment applicant.

Management Objectives

Maintain historical abundance, distribution, and size composition of Arctic grayling.

1999 Season

The 1999 season occurred without incident and with no major comments or complaints. Fishing was fair to good and grayling abundance seemed average.

2000 Outlook

The 2000 grayling fishery in the Ugashik Lakes drainage is expected to be very similar to the last few years.

SECTION VIII: MANAGEMENT ACTIONS

Emergency Order No.: 2-KS-5-09-99

Issued June 28, 1999

Effective Date 12:01 a.m., Wednesday, June 30, 1999

Expiration Date 11:59 p.m., Friday, December 31, 1999

This emergency order reduces the seasonal limit for king salmon in the Nushagak/Mulchatna River drainage from four per season to two per season. The more restrictive seasonal limit provides for retention of a single daily bag limit (two king salmon, one over 28 inches). Only one of the two king salmon taken from the Nushagak/Mulchatna River drainage may exceed 28 inches in length.

Amended Regulation: 5 AAC 67.024 (b)(2) and (3).

Emergency order No.: 2-KS-5-12-99

Issued June 30, 1999

Effective Date 8:00 p.m., Tuesday, July 6, 1999

Expiration Date 11:59 p.m., Friday, December 31, 1999

This emergency order opens sport fishing for king salmon in the Nushagak/Mulchatna River drainage and allows a seasonal harvest limit of two king salmon, only one of which may exceed 28 inches. This emergency order supercedes E.O. 2-KS-5-10-99.

Amended Regulation: 5 AAC 67.022 (a).

Emergency order No.: 2-KS-5-10-99

Issued July 6, 1999

Effective Date 12:01 a.m., Friday July 2, 1999

Expiration Date 11:59 p.m., Friday, December 31, 1999

This emergency order closes all sport fishing for king salmon in the Nushagak/Mulchatna River drainage. This emergency order supercedes E.O. 2-KS-5-09-99.

Amended Regulation: 5 AAC 67.022 (a).

Emergency order No.: 3-CS-07-99

Issued July 15, 1999

Effective Date 12:01 a.m., Saturday, July 17, 1999

Expiration Date 11:59 p.m., Friday, December 31, 1999

This emergency order prohibits sport anglers from retaining chum salmon in the Kuskokwim River drainage, including all tributaries. Chum salmon may not be retained or possessed. All chum salmon must be released immediately.

This restriction is for the Kuskokwim River and its tributaries only and does not include other waters draining into Kuskokwim Bay such as the Kanektok and Goodnews rivers.

Amended Regulation: 5 AAC 70.022.

Emergency order No.: 2-SS-5-18-99

Issued August 10, 1999

Effective Date 12:01 a.m., Thursday, August 12, 1999

Expiration Date 11:59 p.m., Friday, December 31, 1999

This emergency order closes all sport fishing for coho salmon in the Nushagak/Mulchatna River drainage. This closure prohibits targeting coho salmon including catch-and-release fishing. All coho salmon caught incidentally by sport fishing methods must be immediately released. Additionally, this emergency order reduces the daily bag limit for coho salmon from five fish to two fish per day in all waters of the Wood River drainage.

Amended Regulation 5 AAC 67.022 (a)(7) and 5 AAC 67.022(a)(10).

Emergency order No.: 2-SS-5-21-99

Issued August 18, 1999

Effective Date 12:01 a.m., Friday, August 20, 1999

Expiration Date 11:59 p.m., Friday, December 31, 1999

This emergency order reduces the daily bag and possession limit for coho salmon from five to one per day in all waters of the Kuskokwim Bay and Kuskokwim River drainages.

Amended Regulation 5 AAC 70.022 (e)(1 through 14).

Emergency order No.: 2-SS-5-21-99

Issued August 20, 1999

Effective Date 12:01 a.m., Monday, August 23, 1999

Expiration Date 11:59 p.m., Friday, December 31, 1999

This emergency order reduces the daily bag and possession limit for coho salmon from five to one per day in all waters of the Bristol bay drainage from Cape Newenham east to Cape Menshikof, excluding the Nushagak/Mulchatna drainages, and the Kvichak River drainage upstream from the outlet of Yellow Creek.

Amended Regulation 5 AAC 70.022 (e) (1 through 14).

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APPENDIX A

Appendix A1.-Sport fishing effort in angler days in the waters of Southwest Alaska by fishery, 1977-1998.

Drainage	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989
Eastern													
Ugashik	707	2,477	1,399	472	671	870	769	1,609	954 ^a	627 ^a	1,682	528 ^a	998
Egegik/Becharof	403	883	314	386	360	239	405	1,147 ^a	954 ^a	367 ^a	335 ^a	1,037 ^a	779
Naknek R.	4,675	5,600	5,691	9,967	10,863	11,393	14,786	14,914	15,311	18,057	17,152	18,372	14,120
Naknek L.	872	646	770	1,542	1,472	1,777	1,052	574	121 ^a	1,590	762	1,710 ^a	914
Bay of Islands							1,012	1,197	971	1,131 ^a	1,005	564 ^a	1,527
Brooks R.	1,195	1,464	1,163	1,971	1,391	2,423	2,976	1,821	1,474	2,752	2,784	4,602	1,839
Brooks L.													
American Cr.							61 ^a	175 ^a	364 ^a	122 ^a	335 ^a	31 ^a	343
King Salmon R.													
Kvichak R.	1,509	948	2,044	2,056	1,865	1,877	2,206	2,576	2,533	2,379	2,544	1,346	2,616
Copper R.	1,686	1,120	723	1,200	916	2,491	2,429	251 ^a	222 ^a	1,699 ^a	1,012 ^a	146 ^a	384
Alagnak R.					1,947	2,252	2,348	5,119	2,473	7,628	4,786	1,182 ^a	2,717
Newhalen R.	1,686	1,572	2,672	4,013	1,832	3,054	2,834	3,664	8,871	4,475	5,087	3,365	5,646
L Talarik Cr.	749	646	927	585	458	972	688	1,288 ^a	666	623 ^a	137 ^a	1,619 ^a	172 ^a
Lake Clark	3,748	2,910	3,128	2,342	2,519	2,286	4,777	1,322	1,511	4,248	824	255 ^a	2,697
Lake Iliamna							142 ^a	485 ^a	548 ^a	3,700	1,641	891	1,151
Kulik R.													
Tazimina R.													
Moraine Cr.													
Other	423	646	346	414	670	751	6,879	3,252	10,165	1,326	3,176	5,339	2,557
Subtotal	17,653	18,912	19,177	24,948	24,964	30,385	43,364	39,394	47,138	50,724	43,262	40,987	38,460

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Appendix A1.-Page 2 of 4.

Drainage	1990	1991	1992	1993	1994	1995	1996	1997	1998	1994-98 Average
Eastern										
Ugashik	1,383	1,627	2,001	1,918	2,315	905	2,098	2,551	1,534	1,881
Egegik/Becharof	1,193	1,033	1,634	888	1,771	1,083	610	853	1,236	1,111
Naknek R.	12,572	15,918	14,436	13,674	12,005	16,738	11,971	13,673	13,988	13,675
Naknek L.	2,148	981	2,411	844	700	931	829	469	414	669
Bay of Islands	2,620	2,259	2,838	1,160	747	857	518	666	463	650
Brooks R.	8,162	3,305	6,605	5,565	4,566	4,047	3,784	3,971	2,916	3,857
Brooks L.	680	813	2,262	900	642	1,289	235	411 ^a	286	573
American Cr.	1,550	491 ^a	939	1,659	1,833	609	543	1,085	811	976
King Salmon R.			918	190	605	1546 ^a	763 ^a	423 ^a	1,232	914
Kvichak R.	6,107	3,047	4,716	5,475	5,796	5,411	4,484	3,947	3,339	4,595
Copper R.	1,036	1,791	2,518	4,088	4,324	2,820	1,558	2,782	2,191	2,735
Alagnak R.	6,571	6,079	12,323	12,440	10,949	13,232	8,121	11,062	7,715	10,216
Newhalen R.	4,370	7,567	4,225	6,428	5,790	6,392	3,037	3,773	3,506	4,500
L Talarik Cr.	1,975	549	1,184	491	705	955	601	408	544	643
Lake Clark	3,377	3,292	1,803	2,596	3,084	4,148	1,003	3,132	1,462	2,566
Lake Iliamna	1,220	1,097	1,291	2,184	1,625	2,700	1,117	1,017	1,310	1,554
Kulik R.			886	1,555	851	621	1,644	512	1,150	956
Tazimina R.			437	343	627	800 ^a	205 ^a	294 ^a	384	462
Moraine Cr.			405	689	591	739	574	696	869	694
Other	5,407	6,846	5,478	6,712	8,310	7,956	6,112	8,386	6,639	7,481
Subtotal	60,371	56,695	69,310	69,799	67,836	73,779	49,807	60,111	51,989	60,704

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Drainage	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989
Central													
Nushagak	1,380	1,206	2,421	1,885	2,732	3,992	4,615	3,212	3,750	4,557	4,677	5,039	3,980
Mulchatna	1,296	1,486	1,431	1,057	1,145	1,228	2,672	2,175	3,266	2,920	2,735	4,711	1,974
Agulowak													
Agulukpak													
Wood River L.	3,549	2,843	1,745	3,884	1,701	3,139	5,040	3,497	2,460	3,012	2,325	4,457	10,272
Tikhik/Nuyakuk	959	1,465	582	2,071	2,241	1,058	1,579	1,171	1,693	292 ^a	684 ^a	4,147	1,569
Koktuli R.													
Other						356	3,036	1,105	643	1,245	3,711	1,486	1,882
Subtotal	7,184	7,000	6,179	8,897	7,819	9,773	16,942	11,160	11,812	12,026	14,132	19,840	19,677
Western													
Togiak	675	539	1,666	1,513	932	1,160	972	3,497	1,290 ^a	1,208	848 ^a	1,055 ^a	1,174
Goodnews							742	1,010 ^a	4,214	229 ^a	2,372 ^a	1,219 ^a	1,315
Kanektok							1,517	6,881	4,630	8,825	9,689	12,697	4,382
Arolik													
Other						20	344	243	61			3,796	767
Subtotal	675	539	1,666	1,513	932	1,160	3,251	11,732	10,377	10,323	12,909	18,767	7,638
Northwestern													
Aniak							253 ^a	383 ^a	87 ^a	1,116 ^a	507 ^a	2,437 ^a	4,035
Kisaralik													
Kwethluk													
Other							2,682	1,149	694	703	1,920	377	3,231
Subtotal							2,935	1,532	781	1,819	2,427	2,814	7,266
Eastern	17,653	18,912	19,177	24,948	24,964	30,385	43,364	39,394	47,138	50,724	43,262	40,987	38,460
Central	7,184	7,000	6,179	8,897	7,819	9,773	16,942	11,160	11,812	12,026	14,132	19,840	19,677
Western	675	539	1,666	1,513	932	1,160	3,251	11,732	10,377	10,323	12,909	18,767	7,638
Northwestern							2,935	1,532	781	1,819	2,427	2,814	7,266
Total	25,512	26,451	27,022	35,358	33,715	41,318	66,492	63,818	70,108	74,892	72,730	82,408	73,041

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Drainage	1990	1991	1992	1993	1994	1995	1996	1997	1998	1994-98 Average
Central										
Nushagak	7,978	11,351	10,031	14,168	15,460	16,410	15,034	8,866	15,933	14,341
Mulchatna	6,070	7,449	4,705	4,729	4,708	4,484	3,806	2,356	3,145	3,700
Agulowak								1,389 ^a	1,434	1,412
Agulukpak								1,384 ^a	923	1,154
Wood River L.	7,618	10,853	6,647	6,482	12,144	9,022	7,366	4,918	3,653	7,421
Tikchik/Nuyakuk	2,424	4,996	3,051	3,678	3,306	2,804	2,341	2,380	1,722	2,511
Koktuli R.			1,323	342	1,522	576 ^a	1,170	649 ^a	662	916
Other	4,624	4,041	864	1,098	3,629	4,235	2,955	4,585	3,021	3,685
Subtotal	28,714	38,690	26,621	30,497	40,769	37,531	32,672	26,527	30,493	33,598
Western										
Togiak	1,638	1,729	1,419	1,647	2,361	3,384	3,535	2,943	5,206	3,486
Goodnews	4,578	1,328	1,387	2,276	2,038	1,030	1,694	5,011	4,007	2,756
Kanektok	4,525	3,078	4,972	3,791	6,505	5,512	4,812	9,706	8,114	6,930
Arolik								359 ^a	347	353
Other	66	20	64	60			1,305	853	374	844
Subtotal	10,807	6,155	7,842	7,774	10,904	9,926	11,346	18,872	18,048	13,819
Northwestern										
Aniak	1,964	3,078	2,604	2,056	1,815	3,569	3,050	4,778	5,548	3,752
Kisaralik					1,463	369 ^a	1,173 ^a	1,189 ^a	1,021	1,043
Kwethluk			640	554	466 ^a	387 ^a	1,162 ^a	539 ^a	1,498	810
Other	2,843	2,966	3,500	3,620	2,350	2,905	1,521	2,088	3,375	2,448
Subtotal	4,807	6,044	6,744	6,230	6,094	7,230	6,906	8,594	11,442	8,053
Eastern	60,371	56,695	69,310	69,799	67,836	73,779	49,807	60,111	51,989	60,704
Central	28,714	38,690	26,621	30,497	40,769	37,531	32,672	26,527	30,493	33,598
Western	10,807	6,155	7,842	7,774	10,904	9,926	11,346	18,872	18,048	13,819
Northwestern	4,807	6,044	6,744	6,230	6,094	7,230	6,906	8,594	11,442	8,053
Total	104,699	107,584	110,517	114,300	125,603	128,466	100,731	114,104	111,972	116,175

Source: Mills 1979-1994, Howe et al. 1995 and 1996, *In prep* a, b, and c.

^a Unpublished estimates from Statewide Harvest Survey for sites with less than 12 responses.

Appendix A2.-Sport harvest of chinook salmon from the waters of Southwest Alaska by fishery, 1977-1998.

Drainage	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989
Eastern													
Ugashik	0	0	0	0	0	0	0	64	0 ^a	0 ^a	322	0 ^a	52
Egegik/Becharof	4	0	0	0	0	0	0	148 ^a	0 ^a	37 ^a	0 ^a	588 ^a	78
Naknek R.	1,005	2,628	2,264	2,729	2,581	3,264	3,545	4,524	5,038	6,160	9,069	5,291	3,224
Naknek L.	0	0	0	0	0	0	0	0	0 ^a	15	0	62 ^a	26
Bay of Islands							0	0	62	0 ^a	0	0 ^a	0
Brooks R.	0	0	0	0	0	0	0	42	25	0	64	0	0
Brooks L.													
American Cr.							0 ^a	0 ^a	0 ^a	0 ^a	0 ^a	0 ^a	0
King Salmon R.													
Kvichak R.	9	210	10	129	64	252	420	100	57	68	191	0	681
Copper R.	0	0	0	0	0	0	0	37 ^a	0 ^a	0 ^a	0 ^a	0 ^a	277
Alagnak R.					97	220	252	661	757	680	1,969	93 ^a	959
Newhalen R.	0	0	0	0	0	0	0	0	0	0	0	0	25
L Talarik Cr.	0	0	0	0	0	0	0	0 ^a	0	0 ^a	0 ^a	0 ^a	0 ^a
Lake Clark	0	0	0	0	0	0	0	0	0	0	0	0 ^a	0
Lake Iliamna							0 ^a	0 ^a	0 ^a	34	54	0	50
Kulik R.													
Tazimina R.													
Moraine Cr.													
Other							430	0	161	128	149	124	338
Subtotal	1,018	2,838	2,274	2,858	2,742	3,736	4,647	5,576	6,100	7,122	11,818	6,158	5,710

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Drainage	1990	1991	1992	1993	1994	1995	1996	1997	1998	1994-98 Average
Eastern										
Ugashik	120	113	72	150	106	19	21	128	45	64
Egegik/Becharof	80	0	16	9	20	9	86	43	156	63
Naknek R.	2,796	3,115	2,633	2,603	3,692	4,153	2,984	4,231	3,443	3,701
Naknek L.	0	9	69	0	0	9	0	187	0	39
Bay of Islands	0	18	25	18	67	45	32	0	0	29
Brooks R.	0	0	44	0	0	19	0	12	0	6
Brooks L.	0	0	0	0	0	0	0	0 ^a	0 ^a	0
American Cr.	0	0 ^a	0	0	0	0	0	0	0	0
King Salmon R.			182	19	219	124 ^a	171 ^a	373 ^a	194	216
Kvichak R.	143	44	16	250	90	175	107	47	239	132
Copper R.	0	22	0	0	0	9	43	0	17	14
Alagnak R.	474	790	1,160	1,515	1,048	891	931	982	1,531	1,077
Newhalen R.	0	22	0	0	30	9	0	0	0	8
L Talarik Cr.	0	0	0	0	0	0	0	0	0	0
Lake Clark	0	0	0	0	0	0	0	0	0	0
Lake Iliamna	55	11	17	0	60	0	0	0	224	57
Kulik R.			0	0	0	0	0	0	30	6
Tazimina R.			0	0	0	0 ^a	0 ^a	0 ^a	0 ^a	0
Moraine Cr.			0	0	0	0	0	0	0 ^a	0
Other	31	142	57	173	267	255	149	379	164	243
Subtotal	3,699	4,286	4,291	4,737	5,599	5,717	4,524	6,382	6,043	5,653

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Appendix A2.-Page 3 of 4.

Drainage	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989
Central													
Nushagak	402	151	312	611	929	1,436	1,615	1,534	1,517	1,256	2,571	2,383	2,807
Mulchatna	521	291	342	146	291	367	388	786	292	3,534	1,860	403	754
Agulowak													
Agulukpak													
Wood River L.	0	0	0	0	0	0	0	62	14	0	0	557	104
Tikchik/Nuyakuk	0	0	0	0	0	0	0	0	29	0 ^a	27 ^a	31	52
Koktuli R.													
Other					0	42	545	12	0	350	191	62	598
Subtotal	923	442	654	757	1,220	1,845	2,548	2,394	1,852	5,140	4,649	3,436	4,315
Western													
Togiak R. drainage	62	35	78	34	0	231	535	87	224 ^a	525 ^a	137 ^a	0 ^a	234
Goodnews R.							31	52 ^a	323	0 ^a	125 ^a	91 ^a	68
Kanektok R.							1,511	922	672	938	508	1,910	884
Arolik R.													
Other							0	12	0	0		91	37
Subtotal	62	35	78	34	0	231	2,077	1,073	1,219	1,463	770	2,092	1,223
Northwestern													
Aniak							0 ^a	39 ^a	12 ^a	49 ^a	49 ^a	164 ^a	738
Kisaralik													
Kwethluk													
Other							0	78	12	0	118	146	201
Subtotal							0	117	24	49	167	310	939
Eastern	1,018	2,838	2,274	2,858	2,742	3,736	4,647	5,576	6,100	7,122	11,818	6,158	5,710
Central	923	442	654	757	1,220	1,845	2,548	2,394	1,852	5,140	4,649	3,436	4,315
Western	62	35	78	34	0	231	2,077	1,073	1,219	1,463	770	2,092	1,223
Northwestern								117	24	49	167	310	939
Total	2,003	3,315	3,006	3,649	3,962	5,812	9,272	9,160	9,195	13,774	17,404	11,996	12,187

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Drainage	1990	1991	1992	1993	1994	1995	1996	1997	1998	1994-98 Average
Central										
Nushagak	1,594	3,586	3,688	4,815	8,871	4,476	4,691	3,343	5,350	5,346
Mulchatna	1,812	1,894	813	965	1,675	402	644	154	265	628
Agulowak								0	0	0
Agulukpak								0	30	15
Wood River L.	160	173	80	97	435	93	85	23	57	139
Tikchik/Nuyakuk	80	71	178	101	60	73	11	0	170	63
Koktuli R.			76	18	20	0 ^a	44	0 ^a	42 ^a	21
Other	137	263	39	106	181	193	192	58	48	134
Subtotal	3,783	5,987	4,874	6,102	11,242	5,237	5,667	3,578	5,962	6,337
Western										
Togiak R. drainage	172	284	271	225	663	581	790	1,165	763	792
Goodnews R.	27 ^a	26	23	81	163	41	171	86	431	178
Kanektok R.	503	316	656	1,006	751	739	728	1,632	1,475	1,065
Arolik R.								0 ^a	30 ^a	15
Other	0	0	0	0	0	0	96	128	130	71
Subtotal	702	626	950	1,312	1,577	1,361	1,785	3,011	2,829	2,113
Northwestern										
Aniak	285	214	172	300	437	279	641	801	1,058	643
Kisaralik					148	9 ^a	21 ^a	49 ^a	6 ^a	47
Kwethluk			31	0	19 ^a	0 ^a	64 ^a	49 ^a	75 ^a	41
Other	82	187	110	200	311	84	341	326	56	224
Subtotal	367	401	313	500	915	372	1,067	1,225	1,195	955
Eastern	3,699	4,286	4,291	4,737	5,599	5,717	4,524	6,382	6,043	5,653
Central	3,783	5,987	4,874	6,102	11,242	5,237	5,667	3,578	5,962	6,337
Western	702	626	950	1,312	1,577	1,361	1,785	3,011	2,829	2,113
Northwestern	367	401	313	500	915	372	1,067	1,225	1,195	955
Total	8,551	11,300	10,428	12,651	19,333	12,687	13,043	14,196	16,029	15,058

Source: Mills 1979-1994, Howe et al. 1995 and 1996, *In prep* a, b, and c. Unless otherwise noted, these are published estimates for sites that garnered 12 or more responses in the Statewide Harvest Survey.

^a Unpublished estimates from Statewide Harvest Survey for sites with less than 12 responses.

Appendix A3.-Sport harvest of coho salmon from the waters of Southwest Alaska by fishery, 1977-1998.

Drainage	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989
Eastern													
Ugashik	26	163	125	17	87	314	157	611	0 ^a	31 ^a	215	186 ^a	234
Egegik/Becharof	138	0	0	155	65	10	115	312 ^a	0 ^a	0 ^a	0 ^a	217 ^a	104
Naknek R.	297	646	300	818	1,156	1,676	1,385	2,332	1,281	1,942	2,579	3,341	3,092
Naknek L.	0	0	0	0	0	0	0	0	0 ^a	92	0	217 ^a	78
Bay of Islands							0	0	37	153 ^a	0	0 ^a	26
Brooks R.	0	0	0	0	0	0	0	62	37	46	215	0	52
Brooks L.													
American Cr.							0 ^a	0 ^a	0 ^a	0 ^a	107 ^a	0 ^a	26
King Salmon R.													
Kvichak R.	86	38	150	258	65	42	42	100	0	850	0	31	227
Copper R.	0	0	0	0	0	0	0	0 ^a	0 ^a	0 ^a	0 ^a	0 ^a	0
Alagnak R.					400	422	147	599	11	1,699	46	588 ^a	403
Newhalen R.	0	0	0	0	0	0	0	50	404	238	687	248	1,160
L Talarik Cr.	5	0	0	0	0	0	0	75 ^a	0	0 ^a	0 ^a	93 ^a	0 ^a
Lake Clark	0	0	0	0	0	0	0	0	11	0	0	0 ^a	0
Lake Iliamna							0 ^a	0 ^a	212 ^a	204	962	62	302
Kulik R.													
Tazimina R.													
Moraine Cr.													
Other							0	49	181	91	64	558	390
Subtotal	552	847	575	1,248	1,773	2,464	1,846	4,190	2,174	5,346	4,875	5,541	6,094

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Drainage	1990	1991	1992	1993	1994	1995	1996	1997	1998	1994-98 Average
Eastern										
Ugashik	840	97	445	92	739	346	392	631	223	466
Egegik/Becharof	300	97	275	48	426	48	375	370	117	267
Naknek R.	2,179	4,475	1,579	1,034	1,940	1,788	4,754	3,879	2,547	2,982
Naknek L.	0	32	73	0	0	68	0	0	63	26
Bay of Islands	0	11	32	19	0	0	0	10	5	3
Brooks R.	200	65	24	36	10	141	0	156	305	122
Brooks L.	420	0	0	10	0	39	40	21	0	20
American Cr.	0	0 ^a	0	0	0	0	0	0	0	0
King Salmon R.			24	38	0	0 ^a	355 ^a	0 ^a	99	91
Kvichak R.	444	329	162	370	553	213	346	535	97	349
Copper R.	0	0	0	0	0	0	0	22	61	17
Alagnak R.	194	602	324	246	763	331	1,834	763	100	758
Newhalen R.	467	261	81	444	484	394	20	406	77	276
L Talarik Cr.	0	0	0	19	9	19	0	30	0	12
Lake Clark	0	102	32	120	0	76	0	110	17	41
Lake Iliamna	57	114	0	93	54	206	0	100	61	84
Kulik R.			0	0	0	0	0	0	0	0
Tazimina R.			0	0	0	0 ^a	0 ^a	0 ^a	0	0
Moraine Cr.			0	0	0	0	0	0	0	0
Other	400	424	316	363	535	379	817	811	409	590
Subtotal	5,501	6,609	3,367	2,932	5,513	4,048	8,933	7,844	4,181	6,104

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Drainage	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989
Central													
Nushagak Drainage	65	126	212	379	216	451	849	399	0	934	595	124	1,586
Mulchatna	90	113	0	129	173	52	524	37	130	496	0	371	364
Agulowak													
Agulukpak													
Wood River L.	61	25	25	43	22	52	126	100	781	701	366	341	2,417
Tikchik/Nuyakuk	93	151	0	43	0	0	31	0	0	0 ^a	366 ^a	31	442
Koktuli R.													
Other					0	0	94	37	0	146	46	31	156
Subtotal	309	415	237	594	411	555	1,624	573	911	2,277	1,373	898	4,965
Western													
Togiak	114	214	300	258	119	524	294	1,154 ^a	0	2,851	183	1,238 ^a	416
Goodnews							168	195 ^a	386	0 ^a	685 ^a	0 ^a	224
Kanektok							367	1,895	622	2,010	2,300	1,837	1,096
Arolik													
Other							0	0	0	0		1,637	112
Subtotal	114	214	300	258	119	524	829	3,244	1,008	4,861	3,168	4,712	1,848
Northwestern													
Aniak							42 ^a	^a	12 ^a	905 ^a	254 ^a	618 ^a	939
Kisaralik													
Kwethluk													
Other							850	857	12	24	815	36	1,420
Subtotal							892	857	24	929	1,069	654	2,359
Eastern	552	847	575	1,248	1,773	2,464	1,846	4,190	2,174	5,346	4,875	5,541	6,094
Central	309	415	237	594	411	555	1,624	573	911	2,277	1,373	898	4,965
Western	114	214	300	258	119	524	829	3,244	1,008	4,861	3,168	4,712	1,848
Northwestern							892	857	24	929	1,069	654	2,359
Total	975	1,476	1,112	2,100	2,303	3,543	5,191	8,864	4,117	13,413	10,485	11,805	15,266

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Drainage	1990	1991	1992	1993	1994	1995	1996	1997	1998	1994-98 Average
Central										
Nushagak Drainage	331	415	445	124	845	521	2,153	237	1,033	958
Mulchatna	95	437	275	53	230	204	458	111	67	214
Agulowak								89 ^a	0	45
Agulukpak								11 ^a	0	6
Wood River L.	131	394	275	100	820	450	302	476	242	458
Tikchik/Nuyakuk	12	22	32	17	50	0	819	78	85	206
Koktuli R.			0	0	18	0 ^a	58	0 ^a	0	15
Other	622	241	185	57	75	196	761	130	207	274
Subtotal	1,191	1,509	1,212	351	2,038	1,371	4,551	1,132	1,634	2,145
Western										
Togiak	367	87	251	330	531	408	1,382	780	1,020	824
Goodnews	36 ^a	297	138	189	170	114	443	855	574	431
Kanektok	644	358	275	734	675	970	875	1,220	751	898
Arolik								223 ^a	74	149
Other	0	0	16	0	0	0	591	22	15	126
Subtotal	1,047	742	680	1,253	1,376	1,492	3,291	3,100	2,434	2,339
Northwestern										
Aniak	182	327	235	213	507	852	957	978	1,128	884
Kisaralik					72	0 ^a	619 ^a	182 ^a	172	209
Kwethluk			624	313	525 ^a	0 ^a	626 ^a	274 ^a	714	428
Other	363	195	558	399	577	466	820	641	261	553
Subtotal	545	522	1,417	925	1,681	1,318	3,022	2,075	2,275	2,074
Eastern	5,501	6,609	3,367	2,932	5,513	4,048	8,933	7,844	4,181	6,104
Central	1,191	1,509	1,212	351	2,038	1,371	4,551	1,132	1,634	2,145
Western	1,047	742	680	1,253	1,376	1,492	3,291	3,100	2,434	2,339
Northwestern	545	522	1,417	925	1,681	1,318	3,022	2,075	2,275	2,074
Total	8,284	9,382	6,676	5,461	10,608	8,229	19,797	14,151	10,524	12,662

Source: Mills 1979-1994, Howe et al. 1995 and 1996, *In prep* a, b, and c. Unless otherwise noted, these are published estimates for sites that garnered 12 or more responses in the Statewide Harvest Survey.

^a Unpublished estimates from Statewide Harvest Survey for sites with less than 12 responses.

Appendix A4.-Sport harvest of sockeye salmon from the waters of Southwest Alaska by fishery, 1977-1998.

Drainage	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989
Eastern													
Ugashik	213	127	189	379	11	126	55	100	12 ^a	0 ^a	370	340 ^a	884
Egegik/Becharof	144	56	31	34	0	42	137	37 ^a	25 ^a	92 ^a	173 ^a	0 ^a	1,040
Naknek R.	78	345	236	542	184	534	644	436	1,157	107	69	1,082	598
Naknek L.	165	42	299	112	140	73	137	37	50 ^a	0 ^a	173	62 ^a	286
Bay of Islands							0	75	0	15 ^a	23	31 ^a	364
Brooks R.	135	113	79	121	43	157	260	449	299	566	1,097	557	702
Brooks L.													
American Cr.							0 ^a	0 ^a	50 ^a	15 ^a	23 ^a	0 ^a	26
King Salmon R.													
Kvichak R.	583	380	283	654	400	639	603	898	1,827	102	1,805	526	4,769
Copper R.	62	183	252	122	281	1,038	1,206	75 ^a	127 ^a	0 ^a	82 ^a	93 ^a	378
Alagnak R.					11	0	21	100	127	544	54	124 ^a	479
Newhalen R.	805	1,479	1,163	715	1,490	1,786	1,671	2,581	2,623	238	4,185	2,414	14,508
L Talarik Cr.	58	0	47	0	22	0	0	187 ^a	53	0 ^a	0 ^a	186 ^a	151 ^a
Lake Clark	420	648	1,022	155	292	220	603	449	106	0	110	0 ^a	252
Lake Iliamna							41 ^a	474 ^a	382 ^a	272	602	619	1,741
Kulik R.													
Tazimina R.													
Moraine Cr.													
Other	8	113			22		247	74	612	0	421	589	1,404
Subtotal	2,671	3,486	3,601	2,834	2,896	4,615	5,625	5,972	7,450	1,951	9,187	6,623	27,582

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Drainage	1990	1991	1992	1993	1994	1995	1996	1997	1998	1994-98 Average
Eastern										
Ugashik	20	77	8	174	263	96	556	843	1,077	567
Egegik/Becharof	183	96	485	149	90	556	25	273	44	198
Naknek R.	835	979	641	946	575	925	562	225	787	615
Naknek L.	10	163	90	106	142	66	60	78	36	76
Bay of Islands	0	106	41	0	44	89	0	53	228	83
Brooks R.	1,181	624	904	586	331	567	433	434	490	451
Brooks L.	753	134	123	101	19	56	46	21	0	28
American Cr.	51	0 ^a	0	0	0	11	63	0	0	15
King Salmon R.			0	0	9	0 ^a	18 ^a	0 ^a	5	6
Kvichak R.	2,988	1,249	1,964	2,923	4,001	3,811	1,604	1,404	2,910	2,746
Copper R.	246	707	148	818	844	391	325	293	850	541
Alagnak R.	562	502	608	3,179	725	1,496	1,240	2,182	2,519	1,632
Newhalen R.	6,093	9,523	6,509	9,889	7,973	7,859	3,513	4,348	6,838	6,106
L Talarik Cr.	0	82	329	78	38	125	46	0	237	89
Lake Clark	246	143	510	297	782	800	51	443	159	447
Lake Iliamna	474	788	1,011	1,431	849	1,469	319	725	1,059	884
Kulik R.			0	0	0	0	0	0	0	0
Tazimina R.			197	58	275	0 ^a	0 ^a	0 ^a	220	99
Moraine Cr.			0	0	0	0	0	0	0	0
Other	167	301	536	836	1,051	680	472	1,113	937	851
Subtotal	13,809	15,474	14,104	21,571	18,011	18,997	9,333	12,435	18,396	15,434

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Drainage	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989
Central													
Nushagak	94	310	204	60	140	796	1,123	236	260	88	274	279	338
Mulchatna	280	56	79	17	0	199	397	536	14	1,548	301	433	390
Agulowak													
Agulukpak													
Wood River L.	129	211	110	112	270	461	466	100	506	876 ^a	109 ^a	93	2,105
Tikchik/Nuyakuk	16	99	16	34	65	105	123	25	0	58 ^a	27 ^a	31	598
Koktuli													
Other					0	0	68	124	0	204	246	31	1,141
Subtotal	519	676	409	223	475	1,561	2,177	1,021	780	2,774	957	867	4,572
Western													
Togiak	14	183	393	69	108	241	69	75	116 ^a	0	27 ^a	62 ^a	416
Goodnews							14	156 ^a	75	24 ^a	49 ^a	164 ^a	146
Kanektok							0	143	12	200	153	109	101
Arolik													
Other							0	0	0	0		182	112
Subtotal	14	183	393	69	108	241	83	374	203	224	229	517	775
Northwestern													
Aniak							0 ^a	0 ^a	0 ^a	0 ^a	28 ^a	164 ^a	22
Kisaralik													
Kwethluk													
Other							0	0	12	98	42	0	11
Subtotal							0	0	12	98	70	164	33
Eastern	2,671	3,486	3,601	2,834	2,896	4,615	5,625	5,972	7,450	1,951	9,187	6,623	27,582
Central	519	676	409	223	475	1,561	2,177	1,021	780	2,774	957	867	4,572
Western	14	183	393	69	108	241	83	374	203	224	229	517	775
Northwestern							0	0	12	98	70	164	33
Total	3,204	4,345	4,403	3,126	3,479	6,417	7,885	7,367	8,445	5,047	10,443	8,171	32,962

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Drainage	1990	1991	1992	1993	1994	1995	1996	1997	1998	1994-98 Average
Central										
Nushagak	184	480	608	521	432	153	708	509	1,282	617
Mulchatna	532	280	288	568	219	153	320	697	258	329
Agulowak								253 ^a	457	355
Agulukpak								106 ^a	16	61
Wood River L.	522	840	526	505	813	539	900	1,065	1,420	947
Tikchik/Nuyakuk	20	150	58	557	54	32	45	0	110	48
Koktuli			156	95	96	32 ^a	146	0 ^a	212	97
Other	346	120	0	391	63	45	155	232	164	132
Subtotal	1,604	1,870	1,636	2,637	1,677	954	2,274	2,862	3,919	2,337
Western										
Togiak	10	80	16	61	26	22	367	191	673	256
Goodnews	62 ^a	63	8	53	70	34	65	61	419	130
Kanektok	462	88	66	331	313	148	371	607	830	454
Arolik								0 ^a	32	16
Other	0	0	0	0	0	0	109	53	14	35
Subtotal	534	231	90	445	409	204	912	912	1,968	881
Northwestern										
Aniak	49	38	25	17	17	43	51	391	178	136
Kisaralik					0	0 ^a	0 ^a	10 ^a	0	2
Kwethluk			0	19	0 ^a	0 ^a	0 ^a	0 ^a	16	3
Other	0	0	57	200	299	52	182	80	0	123
Subtotal	49	38	82	236	316	95	233	481	194	264
Eastern	13,809	15,474	14,104	21,571	18,011	18,997	9,333	12,435	18,396	15,434
Central	1,604	1,870	1,636	2,637	1,677	954	2,274	2,862	3,919	2,337
Western	534	231	90	445	409	204	912	912	1,968	881
Northwestern	49	38	82	236	316	95	233	481	194	264
Total	15,996	17,613	15,912	24,889	20,413	20,250	12,752	16,690	24,477	18,916

Source: Mills 1979-1994, Howe et al. 1995 and 1996, *In prep* a, b, and c. Unless otherwise noted, these are published estimates for sites that garnered 12 or more responses in the Statewide Harvest Survey.

^a Unpublished estimates from Statewide Harvest Survey for sites with less than 12 responses.

Appendix A5.-Sport harvest of pink salmon from the waters of Southwest Alaska by fishery, 1977-1998.

Drainage	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989
Eastern													
Ugashik	0	356	0	34	0	0	0	0	0 ^a	31 ^a	0	0 ^a	0
Egegik/Becharof	0	77	0	17	0	0	0	249 ^a	0 ^a	0 ^a	0 ^a	0 ^a	26
Naknek R.	0	1,723	0	818	0	859	0	1,584	0	3,089	23	2,939	26
Naknek L.	0	0	0	0	0	0	0	0	12 ^a	0 ^a	0	155 ^a	0
Bay of Islands							0	0	0	0	0	0 ^a	0
Brooks R.	0	0	0	0	0	0	0	50	0	0	0	0	26
Brooks L.													
American Cr.							0 ^a	0 ^a	12 ^a	0 ^a	0 ^a	0 ^a	0
King Salmon R.													
Kvichak R.	0	0	0	0	0	0	0	187	0	204	0	62	101
Copper R.	0	31	0	0	0	0	0	0 ^a	0 ^a	0 ^a	0 ^a	0 ^a	0
Alagnak R.					0	0	0	748	0	0	0	0 ^a	25
Newhalen R.	0	0	0	0	0	0	0	0	0	0	0	0	0
L Talarik Cr.	0	0	0	0	0	0	0	0 ^a	0	0 ^a	0 ^a	0 ^a	0 ^a
Lake Clark	0	0	0	0	0	0	0	0	0	0	0	0 ^a	0
Lake Iliamna							0 ^a	0 ^a	0 ^a	0	0	0	25
Kulik R.													
Tazimina R.													
Moraine Cr.													
Other							0	25	0	0	0	990	51
Subtotal	0	2,187	0	869	0	859	0	2,843	24	3,324	23	4,146	280

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Drainage	1990	1991	1992	1993	1994	1995	1996	1997	1998	1994-98 Average
Eastern										
Ugashik	0	0	0	0	0	0	0	0	0	0
Egegik/Becharof	0	0	0	0	34	0	145	22	0	40
Naknek R.	512	10	119	9	25	35	89	0	244	79
Naknek L.	0	0	0	0	0	0	0	54	0	11
Bay of Islands	12	0	0	0	0	0	0	43	0	9
Brooks R.	97	0	101	0	0	19	0	9	0	6
Brooks L.	0	0	0	0	0	0	0	0	0 ^a	0
American Cr.	0	0 ^a	0	0	0	0	0	0	0	0
King Salmon R.			9	0	0	0 ^a	0 ^a	0 ^a	0	0
Kvichak R.	141	218	119	0	24	0	0	0	0	5
Copper R.	0	0	0	0	0	0	145	0	0	29
Alagnak R.	94	150	192	60	73	19	290	22	227	126
Newhalen R.	0	0	0	0	0	0	0	9	279	58
L Talarik Cr.	0	0	0	0	0	0	0	0	0	0
Lake Clark	0	0	0	0	0	0	21	0	0	4
Lake Iliamna	0	0	0	43	8	0	104	0	0	22
Kulik R.			0	0	0	0	0	0	0	0
Tazimina R.			0	0	0	0 ^a	0 ^a	0 ^a	0 ^a	0
Moraine Cr.			0	0	0	0	0	0	0 ^a	0
Other	12	122	101	112	102	75	181	82	155	119
Subtotal	868	500	641	224	266	148	975	241	905	507

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Drainage	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989
Central													
Nushagak	0	836	0	258	0	73	0	50	0	175	0	31	182
Mulchatna	0	0	0	0	0	0	0	12	0	0	109	62	26
Agulowak													
Agulukpak													
Wood River L.	0	31	0	0	0	0	0	50	43	0	0	31	104
Tikchik/Nuyakuk	0	232	0	60	0	0	0	0	0	0 ^a	0 ^a	31	0
Koktuli R.													
Other					0	0	0	0	0	0	0	0	0
Subtotal	0	1,099	0	318	0	73	0	112	43	175	109	155	312
Western													
Togiak	0	0	0	112	0	210	10	25	0 ^a	58	0 ^a	31 ^a	156
Goodnews							168	78 ^a	0	0 ^a	0 ^a	55 ^a	0
Kanektok							210	195	0	72	18	437	45
Arolik													
Other							0	0	0	0		218	0
Subtotal	0	0	0	112	0	210	388	298	0	130	18	741	201
Northwestern													
Aniak							0 ^a	0 ^a	0 ^a	0 ^a	0 ^a	182 ^a	34
Kisaralik													
Kwethluk													
Other							0	0	0	0	0	0	0
Subtotal							0	0	0	0	0	182	34
Eastern	0	2,187	0	869	0	859	0	2,843	24	3,324	23	4,146	280
Central	0	1,099	0	318	0	73	0	112	43	175	109	155	312
Western	0	0	0	112	0	210	388	298	0	130	18	741	201
Northwestern							0	0	0	0	0	182	34
Total	0	3,286	0	1,299	0	1,142	388	3,253	67	3,629	150	5,224	827

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Drainage	1990	1991	1992	1993	1994	1995	1996	1997	1998	1994-98 Average
Central										
Nushagak	90	11	165	0	38	144	178	20	80	92
Mulchatna	0	0	0	0	43	9	270	0	0	64
Agulowak								0 ^a	0	0
Agulukpak								0 ^a	0	0
Wood River L.	23	79	119	0	107	0	10	37	0	31
Tikchik/Nuyakuk	0	0	27	0	16	0	10	0	0	5
Koktuli R.			0	0	0	0 ^a	10	0 ^a	0 ^a	2
Other	23	0	0	0	0	0	42	0	0	8
Subtotal	136	90	311	0	204	153	520	57	80	203
Western										
Togiak	0	11	27	0	90	0	10	0	260	72
Goodnews	43 ^a	12	0	17	32	0	20	11	22	17
Kanektok	145	0	9	0	26	9	51	31	13	26
Arolik								11 ^a	0 ^a	6
Other	0	0	0	0	0	0	311	0	0	62
Subtotal	188	23	36	17	148	9	392	53	295	179
Northwestern										
Aniak	29	0	156	10	0	0	0	0	40	8
Kisaralik					0	0 ^a	0 ^a	0 ^a	0 ^a	0
Kwethluk			27	0	51 ^a	0 ^a	0 ^a	0 ^a	0 ^a	10
Other	130	12	27	0	0	0	0	0	47	9
Subtotal	159	12	210	10	51	0	0	0	87	28
Eastern	868	500	641	224	266	148	975	241	905	507
Central	136	90	311	0	204	153	520	57	80	203
Western	188	23	36	17	148	9	392	53	295	179
Northwestern	159	12	210	10	51	0	0	0	87	28
Total	1,351	625	1,198	251	669	310	1,887	351	1,367	917

Source: Mills 1979-1994, Howe et al. 1995 and 1996, *In prep* a, b, and c. Unless otherwise noted, these are published estimates for sites that garnered 12 or more responses in the Statewide Harvest Survey.

^a Unpublished estimates from Statewide Harvest Survey for sites with less than 12 responses.

Appendix A6.-Sport harvest of chum salmon from the waters of Southwest Alaska by fishery, 1977-1998.

Drainage	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989
Eastern													
Ugashik	0	20	0	0	0	0	0	0	0 ^a	61 ^a	104	0 ^a	26
Egegik/Becharof	0	78	0	0	0	0	0	37 ^a	0 ^a	0 ^a	0 ^a	93 ^a	26
Naknek R.	78	302	18	86	54	126	31	112	124	387	243	371	260
Naknek L.	0	0	0	0	0	0	0	0	0	0	0	0	0
Bay of Islands							0	0	0	0 ^a	0	0 ^a	26
Brooks R.	0	0	0	0	0	0	0	0	0	0	0	0	0
Brooks L.													
American Cr.							0 ^a	0 ^a	0 ^a	0 ^a	0 ^a	0 ^a	0
King Salmon R.													
Kvichak R.	0	0	9	9	0	0	0	37	0	0	27	31	278
Copper R.	0	0	0	0	0	0	0	0 ^a	0 ^a	0 ^a	0 ^a	0 ^a	0
Alagnak R.					108	0	0	287	53	68	219	31 ^a	50
Newhalen R.	0	0	0	0	0	0	0	0	0	0	0	0	0
L Talarik Cr.	0	0	0	0	0	0	0	0 ^a	0	0 ^a	0 ^a	0 ^a	0 ^a
Lake Clark	0	117	0	9	0	0	0	0	0	0	0	0 ^a	0
Lake Iliamna							0 ^a	0 ^a	0 ^a	0	0	0	50
Kulik R.													
Tazimina R.													
Moraine Cr.													
Other							10	0	12	0	35	186	260
Subtotal	78	517	27	104	162	126	41	473	189	516	628	712	976

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Drainage	1990	1991	1992	1993	1994	1995	1996	1997	1998	1994-98 Average
Eastern										
Ugashik	0	0	8	0	19	0	0	26	0	9
Egegik/Becharof	0	0	8	0	15	0	0	0	0	3
Naknek R.	239	398	175	34	36	173	55	118	195	115
Naknek L.	0	0	0	0	0	0	0	0	0	0
Bay of Islands	0	20	8	0	0	0	0	0	0	0
Brooks R.	0	0	0	0	0	0	0	0	0	0
Brooks L.	0	0	0	0	0	0	0	0	0 ^a	0
American Cr.	0	0 ^a	0	0	0	0	0	0	0	0
King Salmon R.			0	0	19	40 ^a	132 ^a	0 ^a	0	38
Kvichak R.	81	306	0	17	48	0	44	0	42	27
Copper R.	0	0	0	0	0	0	0	0	58	12
Alagnak R.	219	227	448	545	282	477	274	305	1,104	488
Newhalen R.	0	0	0	0	0	0	0	0	0	0
L Talarik Cr.	0	0	0	0	0	0	33	0	0	7
Lake Clark	0	0	0	0	0	0	0	0	0	0
Lake Iliamna	0	0	0	0	10	0	0	0	0	2
Kulik R.			0	0	0	0	0	0	0	0
Tazimina R.			0	0	0	0 ^a	0 ^a	0 ^a	0 ^a	0
Moraine Cr.			0	0	0	0	0	0	0 ^a	0
Other	0	73	30	0	0	120	111	3	0	47
Subtotal	539	1,024	677	596	429	810	649	452	1,399	748

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Drainage	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989
Central													
Nushagak	24	117	64	17	130	293	336	399	72	117	54	495	884
Mulchatna	46	0	55	9	54	178	126	312	202	321	55	124	156
Agulowak													
Agulukpak													
Wood River L.	0	0	0	0	0	0	0	12	58	0	0	124	26
Tikchik/Nuyakuk	0	39	0	0	11	10	0	0	0	0 ^a	0 ^a	62	26
Koktuli R.													
Other					0	0	52	0	0	29	55	31	26
Subtotal	70	156	119	26	195	481	514	723	332	467	164	836	1,118
Western													
Togiak	0	59	36	17	22	168	199	37	14 ^a	0	27 ^a	155 ^a	130
Goodnews							10	130 ^a	124	0 ^a	84 ^a	18 ^a	0
Kanektok							315	376	149	777	111	618	537
Arolik													
Other							0	0	0	0		73	26
Subtotal	0	59	36	17	22	168	524	543	287	777	222	864	693
Northwestern													
Aniak							115 ^a	26 ^a	75 ^a	98 ^a	70 ^a	91 ^a	1,140
Kisaralik													
Kwethluk													
Other							21	286	25	98	167	36	525
Subtotal							136	312	100	196	237	127	1,665
Eastern	78	517	27	104	162	126	41	473	189	516	628	712	976
Central	70	156	119	26	195	481	514	723	332	467	164	836	1,118
Western	0	59	36	17	22	168	524	543	287	777	222	864	693
Northwestern								312	100	196	237	127	1,665
Total	148	732	182	147	379	775	1,079	2,051	908	1,956	1,251	2,539	4,452

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Drainage	1990	1991	1992	1993	1994	1995	1996	1997	1998	1994-98 Average
Central										
Nushagak	192	219	501	540	887	441	1,002	710	928	794
Mulchatna	203	55	175	133	64	83	256	272	87	152
Agulowak								0 ^a	0	0
Agulukpak								29 ^a	0	15
Wood River L.	24	119	8	33	7	0	33	0	15	11
Tikchik/Nuyakuk	60	27	23	0	29	11	0	0 ^a	0 ^a	8
Koktuli R.			15	0	10	18 ^a	31	0 ^a	72 ^a	26
Other	0	0	0	26	77	10	46	29	104	53
Subtotal	479	420	722	732	1,074	563	1,368	1,040	1,206	1,050
Western										
Togiak	24	37	8	17	153	105	77	82	34	90
Goodnews	72 ^a	189	0	156	15	0	0	24	50	18
Kanektok	202	80	251	183	156	213	221	212	213	203
Arolik								0 ^a	0 ^a	0
Other	0	0	0	0	0	0	154	15	13	36
Subtotal	298	306	259	356	324	318	452	333	310	347
Northwestern										
Aniak	159	169	304	101	231	127	298	86	101	169
Kisaralik					58	0 ^a	0 ^a	0 ^a	0 ^a	12
Kwethluk			30	0	15 ^a	90 ^a	55 ^a	0 ^a	8 ^a	34
Other	259	80	183	17	803	9	22	62	15	182
Subtotal	418	249	517	118	1,107	226	375	148	124	396
Eastern	539	1,024	677	596	429	810	649	452	1,399	748
Central	479	420	722	732	1,074	563	1,368	1,040	1,206	1,050
Western	298	306	259	356	324	318	452	333	310	347
Northwestern	418	249	517	118	1,107	226	375	148	124	396
Total	1,734	1,999	2,175	1,802	2,934	1,917	2,844	1,973	3,039	2,541

Source: Mills 1979-1994, Howe et al. 1995 and 1996, *In prep* a, b, and c. Unless otherwise noted, these are published estimates for sites that garnered 12 or more responses in the Statewide Harvest Survey.

^a Unpublished estimates from Statewide Harvest Survey for sites with less than 12 responses.

Appendix A7.-Sport harvest of rainbow trout from the waters of Southwest Alaska by fishery, 1977-1998.

Drainage	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989
Eastern													
Ugashik	0	0	0	0	0	0	0	0	69 ^a	0 ^a	0	0 ^a	52
Egegik/Becharof	0	0	136	0	0	0	0	50 ^a	520 ^a	153 ^a	21 ^a	0 ^a	20
Naknek R.	586	371	954	1,705	2,138	975	3,724	2,881	1,561	2,425	1,246	509	520
Naknek L.	37	63	109	198	216	555	126	150	0 ^a	381	215	418 ^a	62
Bay of Islands							105	237	312	186 ^a	43	237 ^a	177
Brooks R.	173	181	227	224	227	42	207	50	69	79	86	127	31
Brooks L.													
American Cr.							0 ^a	25 ^a	17 ^a	0 ^a	64 ^a	0 ^a	21
King Salmon R.													
Kvichak R.	672	226	355	637	421	398	283	175	578	136	275	91	50
Copper R.	14	325	55	34	119	514	294	12 ^a	89 ^a	0 ^a	92 ^a	18 ^a	30
Alagnak R.					76	157	178	187	518	340	824	18 ^a	343
Newhalen R.	122	190	255	629	250	430	283	187	459	102	92	73	81
L Talarik Cr.	57	81	91	69	97	84	63	0 ^a	74	0 ^a	92 ^a	36 ^a	20 ^a
Lake Clark	0	0	0	0	0	0	0	25	44	0	92	18 ^a	10
Lake Iliamna							0 ^a	312 ^a	0 ^a	578	92	18	91
Kulik R.													
Tazimina R.													
Moraine Cr.													
Other	62	127	82	17	184	210	376	298	553	170	581	163	293
Subtotal	1,723	1,564	2,264	3,513	3,728	3,365	5,639	4,589	4,863	4,550	3,815	1,726	1,801

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Drainage	1990	1991	1992	1993	1994	1995	1996	1997	1998	1994-98 Average
Eastern										
Ugashik	22	0	0	0	19	0	0	0	0	4
Egegik/Becharof	22	32	32	18	95	12	11	63	0	36
Naknek R.	491	720	705	842	366	457	603	246	388	412
Naknek L.	44	160	63	18	43	40	13	82	42	44
Bay of Islands	109	240	222	10	0	0	66	77	52	39
Brooks R.	33	112	0	0	19	9	0	0	0	6
Brooks L.	240	80	40	9	114	90	0	0	0 ^a	41
American Cr.	22	32 ^a	0	0	113	0	119	0	0	46
King Salmon R.			0	0	0	0 ^a	63 ^a	0 ^a	38	20
Kvichak R.	254	37	356	269	191	12	58	27	25	63
Copper R.	42	56	0	0	0	0	0	0	0	0
Alagnak R.	423	243	111	312	74	107	26	254	35	99
Newhalen R.	53	693	55	89	175	208	82	254	377	219
L Talarik Cr.	0	37	16	0	0	0	0	0	0	0
Lake Clark	32	37	0	20	40	0	0	119	0	32
Lake Iliamna	53	75	24	122	103	155	21	48	35	72
Kulik R.			0	0	239	0	0	0	0	48
Tazimina R.			0	0	35	119 ^a	0 ^a	0 ^a	0 ^a	31
Moraine Cr.			0	0	0	0	0	0	0 ^a	0
Other	290	665	8	148	174	34	568	435	347	312
Subtotal	2,130	3,219	1,632	1,857	1,800	1,243	1,630	1,605	1,339	1,523

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Drainage	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989
Central													
Nushagak	31	108	191	387	670	252	346	599	87	263	92	272	135
Mulchatna	116	497	236	189	281	409	1,018	611	607	496	412	145	229
Agulowak Agulukpak													
Wood River L.	252	217	409	258	475	461	944	1,060	304	262	595	601	478
Tikchik L.	62	145	136	232	216	220	178	25	58	0 ^a	137 ^a	164	20
Koktuli R.													
Other					0	210	2,137	124	29	234	824	36	182
Subtotal	461	967	972	1,066	1,642	1,552	4,623	2,419	1,085	1,255	2,060	1,218	1,044
Western													
Togiak	102	54	82	215	130	168	336	75	0 ^a	58	46 ^a	91 ^a	437
Goodnews							52	104 ^a	451 ^a	0 ^a	111 ^a	127 ^a	316
Kanektok							640	312	156	259 ^a	132	400	126
Arolik													
Other							0	100	0	0		982	0
Subtotal	102	54	82	215	130	168	1,028	591	607	317	289	1,600	879
Northwestern													
Aniak							336 ^a	52 ^a	0 ^a	221 ^a	56 ^a	18 ^a	101
Kisaralik													
Kwethluk													
Other							556	0	52	24	293	0	214
Subtotal							892	52	52	245	349	18	315
Eastern	1,723	1,564	2,264	3,513	3,728	3,365	5,639	4,589	4,863	4,550	3,815	1,726	1,801
Central	461	967	972	1,066	1,642	1,552	4,623	2,419	1,085	1,255	2,060	1,218	1,044
Western	102	54	82	215	130	168	1,028	591	607	317	289	1,600	879
Northwestern	0	0	0	0	0	0	892	52	52	245	349	18	315
Total	2,286	2,585	3,318	4,794	5,500	5,085	12,182	7,651	6,607	6,367	6,513	4,562	4,039

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Drainage	1990	1991	1992	1993	1994	1995	1996	1997	1998	1994-98 Average
Central										
Nushagak	55	200	190	122	230	172	334	84	257	215
Mulchatna	273	444	515	375	253	197	879	684	163	435
Agulowak								15 ^a	43	29
Agulukpak								0 ^a	0	0
Wood River L.	593	215	547	306	383	209	166	329	71	232
Tikchik L.	11	43	0	10	19	9	101	44	0	35
Koktuli R.			55	36	40	144 ^a	13	111 ^a	17 ^a	65
Other	220	339	55	28	98	280	50	191	63	136
Subtotal	1,152	1,241	1,362	877	1,023	1,011	1,543	1,458	614	1,130
Western										
Togiak	22	14	0	0	8	19	58	15	8	22
Goodnews	141 ^a	258	0	145	19	43	24	433	97	123
Kanektok	281	182	55	130	59	198	133	231	0	124
Arolik								43 ^a	0 ^a	22
Other	0	0	47	0	0	0	24	1	0	5
Subtotal	444	454	102	275	86	260	239	723	105	283
Northwestern										
Aniak	35	76	32	10	8	0	21	53	349	86
Kisaralik					124	9 ^a	211 ^a	218 ^a	0 ^a	112
Kwethluk			71	58	72	66 ^a	63 ^a	227 ^a	69 ^a	99
Other	18	243	222	84	9	113	53	101	8	57
Subtotal	53	319	325	152	213	188	348	599	426	355
Eastern	2,130	3,219	1,632	1,857	1,800	1,243	1,630	1,605	1,339	1,523
Central	1,152	1,241	1,362	877	1,023	1,011	1,543	1,458	614	1,130
Western	444	454	102	275	86	260	239	723	105	283
Northwestern	53	319	325	152	213	188	348	599	426	355
Total	3,779	5,233	3,421	3,161	3,122	2,702	3,760	4,385	2,484	3,291

Source: Mills 1979-1994, Howe et al. 1995 and 1996, *In prep* a, b, and c. Unless otherwise noted, these are published estimates for sites that garnered 12 or more responses in the Statewide Harvest Survey.

^a Unpublished estimates from Statewide Harvest Survey for sites with less than 12 responses.

Appendix A8.-Sport harvest of Dolly Varden/Arctic char from the waters of Southwest Alaska by fishery, 1977-1998.

Drainage	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989
Eastern													
Ugashik	51	389	200	164	270	304	73	486	329 ^a	84 ^a	493	200 ^a	104
Egegik/Becharof	76	289	18	129	162	31	136	324 ^a	121 ^a	260 ^a	43 ^a	346 ^a	52
Naknek R.	195	127	527	1,679	1,609	786	808	2,831	416	1,506	215	327	479
Naknek L.	9	36	18	43	140	94	42	200	17 ^a	459	43	128 ^a	145
Bay of Islands							84	125	1,561	76 ^a	21	54 ^a	42
Brooks R.	71	90	0	9	0	0	0	0	17	0	21	18	20
Brooks L.													
American Cr.							10 ^a	0 ^a	191 ^a	0 ^a	64 ^a	0 ^a	42
King Salmon R.													
Kvichak R.	165	154	55	60	43	42	21	137	59	0	46	18	71
Copper R.	6	9	18	43	22	10	10	0 ^a	0 ^a	0 ^a	46 ^a	0 ^a	20
Alagnak R.					86	0	21	75	0	170	412	36 ^a	30
Newhalen R.	85	163	182	405	54	241	199	262	711	204	366	127	91
L Talarik Cr.	6	9	9	69	65	0	10	0 ^a	0	0 ^a	0 ^a	36 ^a	20 ^a
Lake Clark	25	9	136	77	173	859	126	37	15	0	46	18 ^a	202
Lake Iliamna							31 ^a	623 ^a	341 ^a	204	92	18	30
Kulik R.													
Tazimina R.													
Moraine Cr.													
Other	5						218	710	1,625	197	893	327	217
Subtotal	694	1,275	1,163	2,678	2,624	2,367	1,789	5,810	5,403	3,160	2,801	1,653	1,565

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Drainage	1990	1991	1992	1993	1994	1995	1996	1997	1998	1994-98 Average
Eastern										
Ugashik	164	165	41	248	275	77	122	262	88	165
Egegik/Becharof	207	166	180	171	193	0	219	260	0	134
Naknek R.	939	580	721	568	401	356	876	261	276	434
Naknek L.	0	179	0	19	47	117	0	34	8	41
Bay of Islands	11	41	66	28	9	11	0	27	59	21
Brooks R.	0	0	0	0	0	0	0	0	0	0
Brooks L.	11	0	8	0	0	0	0	0	0 ^a	0
American Cr.	22	442 ^a	8	44	199	96	170	138	76	136
King Salmon R.			33	10	0	10 ^a	121 ^a	0 ^a	44	35
Kvichak R.	63	84	180	89	187	19	389	46	8	130
Copper R.	0	118	16	9	57	0	0	0	0	11
Alagnak R.	21	84	139	54	18	192	270	376	14	174
Newhalen R.	106	355	131	190	145	198	170	491	107	222
L Talarik Cr.	0	84	82	0	0	0	0	0	0	0
Lake Clark	42	51	82	86	203	43	49	675	67	207
Lake Iliamna	63	51	98	106	100	22	24	264	0	82
Kulik R.			0	0	0	0	0	0	0	0
Tazimina R.			0	0	63	115 ^a	0 ^a	54 ^a	0 ^a	46
Moraine Cr.			0	0	18	0	0	0	0 ^a	4
Other	183	932	386	593	629	378	415	705	324	490
Subtotal	1,832	3,332	2,171	2,215	2,544	1,634	2,825	3,593	1,071	2,333

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Drainage	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989
Central													
Nushagak	23	45	136	206	151	231	346	274	159	29	138	36	31
Mulchatna	102	217	100	52	119	52	325	137	72	117	46	291	41
Agulowak Agulukpak													
Wood River L.	435	905	685	646	529	1,048	2,108	1,559	882	526	2,335	564	2,348
Tikchik L.	34	217	145	232	713	272	147	349	130	0 ^a	321 ^a	200	218
Koktuli R.													
Other					0	104	1,675	185	29	29	642	36	145
Subtotal	594	1,384	1,066	1,136	1,512	1,707	4,601	2,504	1,272	701	3,482	1,127	2,783
Western													
Togiak	133	72	236	560	345	671	1,007	848	29 ^a	1,080	183 ^a	146 ^a	218
Goodnews							147	195 ^a	780	0 ^a	306 ^a	291 ^a	530
Kanektok							1,406	1,116	815	1,213	752	2,146	1,073
Arolik													
Other							0	62	70	0		327	288
Subtotal	133	72	236	560	345	671	2,560	2,221	1,694	2,293	1,241	2,910	2,109
Northwestern													
Aniak							105 ^a	91 ^a	69 ^a	245 ^a	56 ^a	764 ^a	808
Kisaralik													
Kwethluk													
Other							1,227	130	35	98	237	0	655
Subtotal							1,332	221	104	343	293	764	1,463
Eastern	694	1,275	1,163	2,678	2,624	2,367	1,789	5,810	5,403	3,160	2,801	1,653	1,565
Central	594	1,384	1,066	1,136	1,512	1,707	4,601	2,504	1,272	701	3,482	1,127	2,783
Western	133	72	236	560	345	671	2,560	2,221	1,694	2,293	1,241	2,910	2,109
Northwestern	0	0	0	0	0	0	1,332	221	104	343	293	764	1,463
Total	1,421	2,731	2,465	4,374	4,481	4,745	10,282	10,756	8,473	6,497	7,817	6,454	7,920

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Drainage	1990	1991	1992	1993	1994	1995	1996	1997	1998	1994-98 Average
Central										
Nushagak	77	144	254	270	272	273	695	372	151	353
Mulchatna	165	131	172	200	121	232	296	663	59	274
Agulowak								89	261	175
Agulukpak								68 ^a	59	64
Wood River L.	1,362	1,724	1,818	1,288	1,373	1,289	1,476	1,262	358	1,152
Tikchik L.	77	170	344	376	122	70	134	276	163	153
Koktuli R.			57	9	9	48 ^a	159	43 ^a	17 ^a	55
Other	638	39	41	47	93	248	111	362	0	163
Subtotal	2,319	2,208	2,686	2,190	1,990	2,160	2,871	3,135	1,068	2,245
Western										
Togiak	88	78	66	117	137	99	391	85	1,472	437
Goodnews	18 ^a	605	82	343	132	158	284	1,071	460	421
Kanektok	1,020	389	66	378	233	212	451	789	368	411
Arolik								21 ^a	0 ^a	11
Other	0 ^a	0	41	0	0	0	121	108	0	46
Subtotal	1,126	1,072	255	838	502	469	1,247	2,074	2,300	1,318
Northwestern										
Aniak	598	547	115	260	496	481	195	316	394	376
Kisaralik					117	22 ^a	293 ^a	414 ^a	92 ^a	188
Kwethluk			57	97	134 ^a	98 ^a	268 ^a	243 ^a	14 ^a	151
Other	89	476	433	334	187	201	267	294	136	217
Subtotal	687	1,023	605	691	934	802	1,023	1,267	636	932
Eastern	1,832	3,332	2,171	2,215	2,544	1,634	2,825	3,593	1,071	2,333
Central	2,319	2,208	2,686	2,190	1,990	2,160	2,871	3,135	1,068	2,245
Western	1,126	1,072	255	838	502	469	1,247	2,074	2,300	1,318
Northwestern	687	1,023	605	691	934	802	1,023	1,267	636	932
Total	5,964	7,635	5,717	5,934	5,970	5,065	7,966	10,069	5,075	6,829

Source: Mills 1979-1994, Howe et al. 1995 and 1996, *In prep* a, b, and c. Unless otherwise noted, these are published estimates for sites that garnered 12 or more responses in the Statewide Harvest Survey.

^a Unpublished estimates from Statewide Harvest Survey for sites with less than 12 responses.

Appendix A9.-Sport harvest of Arctic grayling from the waters of Southwest Alaska by fishery, 1977-1998.

Drainage	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989
Eastern													
Ugashik	141	72	145	215	195	142	168	237	87 ^a	122 ^a	278	18 ^a	41
Egegik/Becharof	59	81	55	43	140	105	94	249 ^a	87 ^a	0 ^a	21 ^a	18 ^a	93
Naknek R.	484	398	300	1,128	799	796	1,007	1,297	347	474	172	418	280
Naknek L.	17	0	18	0	0	105	10	12	0	153	21	73 ^a	10
Bay of Islands							0	0	0	0 ^a	0	0 ^a	0
Brooks R.	50	63	73	26	43	0	21	12	69	0	21	36	42
Brooks L.													
American Cr.							0 ^a	0 ^a	139 ^a	0 ^a	21 ^a	0 ^a	42
King Salmon R.													
Kvichak R.	361	579	136	207	162	136	63	87	311	68	504	36	141
Copper R.	0	0	0	0	0	73	31	0 ^a	15 ^a	0 ^a	92 ^a	18 ^a	20
Alagnak R.					119	52	94	436	518	578	138	73 ^a	222
Newhalen R.	88	172	164	207	54	576	252	536	681	102	641	218	171
L Talarik Cr.	60	36	18	86	65	63	10	0 ^a	0	0 ^a	46 ^a	18 ^a	20 ^a
Lake Clark	275	606	373	301	626	377	713	698	726	1,801	641	54 ^a	313
Lake Iliamna							0 ^a	0 ^a	0 ^a	0	46	0	30
Kulik R.													
Tazimina R.													
Moraine Cr.													
Other			118				115	361	429	0	681	127	195
Subtotal	1,535	2,007	1,400	2,213	2,203	2,425	2,578	3,925	3,409	3,298	3,323	1,107	1,620

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Drainage	1990	1991	1992	1993	1994	1995	1996	1997	1998	1994-98 Average
Eastern										
Ugashik	0	0	0	0	10	0	0	50	0	12
Egegik/Becharof	120	117	143	37	72	26	24	27	0	30
Naknek R.	197	337	316	501	240	185	170	362	38	199
Naknek L.	11	13	0	0	10	0	0	0	17	5
Bay of Islands	0	0	0	17	0	0	0	0	0	0
Brooks R.	11	52	0	0	0	0	0	0	10	2
Brooks L.	11	0	0	0	0	0	0	0	0 ^a	0
American Cr.	11	13 ^a	0	0	0	0	17	0	17	7
King Salmon R.			0	9	0	0 ^a	0 ^a	0 ^a	151	30
Kvichak R.	127	122	180	139	225	148	98	222	71	153
Copper R.	0	15	0	50	10	0	0	0	0	2
Alagnak R.	106	184	180	171	113	104	192	186	228	165
Newhalen R.	85	291	263	185	224	399	328	874	506	466
L Talarik Cr.	0	31	23	0	41	70	25	0	0	27
Lake Clark	402	168	548	568	568	270	289	1,273	296	539
Lake Iliamna	42	0	8	101	609	9	57	0	10	137
Kulik R.			0	0	0	0	0	0	0	0
Tazimina R.			0	76	200	62 ^a	33 ^a	27 ^a	0 ^a	64
Moraine Cr.			0	0	8	0	0	0	0 ^a	2
Other	401	469	340	244	440	50	612	426	615	429
Subtotal	1,524	1,812	2,001	2,098	2,770	1,323	1,845	3,447	1,959	2,269

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Drainage	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989
Central													
Nushagak	34	72	345	95	238	283	273	312	116	409	92	673	72
Mulchatna	59	443	227	103	324	1,373	462	461	347	438	870	1,037	260
Agulowak													
Agulukpak													
Wood River L.	201	199	527	525	259	587	692	237	159	58	92	164	104
Tikchik L.	108	199	318	775	400	84	776	274	347	175 ^a	92 ^a	91	93
Koktuli R.													
Other					0	260	2,097	374	58	380	2,107	200	287
Subtotal	402	913	1,417	1,498	1,221	2,587	4,300	1,658	1,027	1,460	3,253	2,165	816
Western													
Togiak	26	18	200	241	43	31	315	150	0 ^a	0	46 ^a	109 ^a	62
Goodnews							178	104 ^a	416	0 ^a	14 ^a	200 ^a	198
Kanektok							231	169	87	213	244	164	58
Arolik													
Other							0	0	0	0		255	0
Subtotal	26	18	200	241	43	31	724	423	503	213	304	728	318
Northwestern													
Aniak							63 ^a	234 ^a	35 ^a	318 ^a	111 ^a	273 ^a	909
Kisaralik													
Kwethluk													
Other							1,364	26	746	195	237	200	734
Subtotal							1,427	260	781	513	348	473	1,643
Eastern	1,535	2,007	1,400	2,213	2,203	2,425	2,578	3,925	3,409	3,298	3,323	1,107	1,620
Central	402	913	1,417	1,498	1,221	2,587	4,300	1,658	1,027	1,460	3,253	2,165	816
Western	26	18	200	241	43	31	724	423	503	213	304	728	318
Northwestern								260	781	513	348	473	1,643
Total	1,963	2,938	3,017	3,952	3,467	5,043	7,602	6,266	5,720	5,484	7,228	4,473	4,397

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Drainage	1990	1991	1992	1993	1994	1995	1996	1997	1998	1994-98 Average
Central										
Nushagak	307	170	624	316	941	579	698	612	407	647
Mulchatna	285	425	210	762	314	604	614	285	158	395
Agulowak								20 ^a	8	14
Agulukpak								10 ^a	0	5
Wood River L.	220	524	143	212	345	218	12	176	51	160
Tikchik L.	296	1,473	218	650	112	266	287	333	27	205
Koktuli R.			45	101	398	34 ^a	190	0 ^a	344 ^a	193
Other	604	312	136	69	610	237	176	966	131	424
Subtotal	1,712	2,904	1,376	2,110	2,720	1,938	1,977	2,402	1,126	2,033
Western										
Togiak	0	0	23	65	20	26	25	20	0	18
Goodnews	53 ^a	122	0	17	0	14	41	74	28	31
Kanektok	123	54	23	25	0	0	0	99 ^a	33 ^a	26
Arolik								0 ^a	0 ^a	0
Other	0	0	128	0	0	0	46	0	0	9
Subtotal	176	176	174	107	20	40	112	193	61	85
Northwestern										
Aniak	422 ^a	1,085	121	288	116	53	398	162	715	289
Kisaralik					69	0 ^a	123 ^a	304 ^a	58 ^a	111
Kwethluk			75	47	49 ^a	88 ^a	36 ^a	257 ^a	8 ^a	88
Other	71	773	295	208	227	333	17	114	769	292
Subtotal	493	1,858	491	543	461	474	574	837	1,550	779
Eastern	1,524	1,812	2,001	2,098	2,770	1,323	1,845	3,447	1,959	2,269
Central	1,712	2,904	1,376	2,110	2,720	1,938	1,977	2,402	1,126	2,033
Western	176	176	174	107	20	40	112	193	61	85
Northwestern	493	1,858	491	543	461	474	574	837	1,550	779
Total	3,905	6,750	4,042	4,858	5,971	3,775	4,508	6,879	4,696	5,166

Source: Mills 1979-1994, Howe et al. 1995 and 1996, *In prep* a, b, and c. Unless otherwise noted, these are published estimates for sites that garnered 12 or more responses in the Statewide Harvest Survey.

^a Unpublished estimates from Statewide Harvest Survey for sites with less than 12 responses.

Appendix A10.-Sport harvest of lake trout from the waters of Southwest Alaska by fishery, 1977-1998.

Drainage	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989
Eastern													
Ugashik	14	45	9	9	11	10	10	37	52 ^a	3 ^a	172	0 ^a	114
Egegik/Becharof	0	0	0	0	0	0	0	12 ^a	0 ^a	0 ^a	21 ^a	0 ^a	10
Naknek R.	34	27	9	164	65	42	136	187	52	159	21	36	10
Naknek L.	23	0	18	155	130	84	105	25	17 ^a	40	236	109 ^a	0
Bay of Islands							52	312	121	76 ^a	150	73 ^a	42
Brooks R.	11	9	9	17	11	0	31	12	0	0	43	18	10
Brooks L.													
American Cr.							0 ^a	0 ^a	104 ^a	0 ^a	0 ^a	0 ^a	10
King Salmon R.													
Kvichak R.	0	0	0	0	0	0	0	62	0	0	0	36	30
Copper R.	0	0	0	0	0	0	0	0 ^a	0 ^a	0 ^a	0 ^a	0 ^a	10
Alagnak R.					0	0	0	0	0	1,257	0	73 ^a	20
Newhalen R.	0	0	0	0	0	0	0	0	15	0	0	0	20
L Talarik Cr.	0	0	0	0	0	0	0	0 ^a	0	0 ^a	0 ^a	0 ^a	0 ^a
Lake Clark	122	118	518	172	410	430	273	786	59	714	137	18 ^a	485
Lake Iliamna							0 ^a	0 ^a	0 ^a	0	46	18	30
Kulik R.													
Tazimina R.													
Moraine Cr.													
Other							94	112	548	144	422	199	238
Subtotal	204	199	563	517	627	566	701	1,545	968	2,393	1,248	580	1,029

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Drainage	1990	1991	1992	1993	1994	1995	1996	1997	1998	1994-98 Average
Eastern										
Ugashik	33	17	39	72	59	66	214	149	31	104
Egegik/Becharof	0	0	0	9	0	0	0	0	0	0
Naknek R.	33	17	8	28	44	0	127	30	12	43
Naknek L.	11	17	39	29	48	27	0	11	40	25
Bay of Islands	11	68	39	40	15	10	67	148	28	54
Brooks R.	11	0	0	9	0	0	0	0	0	0
Brooks L.	535	85	116	28	169	140	41	106	42 ^a	100
American Cr.	11	0 ^a	8	0	0	0	0	0	12	2
King Salmon R.			0	0	0	0 ^a	0 ^a	0 ^a	0	0
Kvichak R.	0	14	0	0	69	0	53	0	0	24
Copper R.	0	0	0	0	0	0	0	0	0	0
Alagnak R.	74	14	8	83	15	0	9	10	0	7
Newhalen R.	21	127	39	20	143	29	0	114	41	65
L Talarik Cr.	0	0	0	0	0	0	0	0	0	0
Lake Clark	402	113	247	219	437	219	134	101	81	194
Lake Iliamna	42	0	46	156	194	0	19	30	18	52
Kulik R.			0	0	0	0	0	0	0	0
Tazimina R.			0	0	0	0 ^a	0 ^a	0 ^a	0 ^a	0
Moraine Cr.			0	0	0	0	0	0	0 ^a	0
Other	93	110	294	207	271	32	184	83	79	130
Subtotal	1,277	582	883	900	1,464	523	848	782	384	800

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Drainage	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989
Central													
Nushagak	0	0	0	0	0	0	0	25	0	0	46	0	42
Mulchatna	0	0	27	0	0	0	0	0	29	88	92	437	0
Agulowak													
Agulukpak													
Wood River L.	0	0	0	0	0	0	42	0	0	0	0	0	0
Tikchik L.	28	45	45	69	194	10	21	87	58	0 ^a	275 ^a	327	437
Koktuli R.													
Other					0	0	1,259	37	0	58	367	127	133
Subtotal	28	45	72	69	194	10	1,322	149	87	146	780	891	612
Western													
Togiak	0	0	0	17	0	0	0	0	0 ^a	0	0 ^a	0 ^a	10
Goodnews							0	0 ^a	17	0 ^a	14 ^a	0 ^a	38
Kanektok							0	117	0	9	14	0	959
Arolik													
Other							0	52	0	0		0	328
Subtotal	0	0	0	17	0	0	0	169	17	9	28	0	1,335
Northwestern													
Aniak							0 ^a	0 ^a	0 ^a	0 ^a	0 ^a	36 ^a	63
Kisaralik													
Kwethluk													
Other							0	0	0	1,101	0	0	55
Subtotal							0	0	0	1,101	0	36	118
Eastern	204	199	563	517	627	566	701	1,545	968	2,393	1,248	580	1,029
Central	28	45	72	69	194	10	1,322	149	87	146	780	891	612
Western	0	0	0	17	0	0	0	169	17	9	28	0	1,335
Northwestern								0	0	1,101	0	36	118
Total	232	244	635	603	821	576	2,023	1,863	1,072	3,649	2,056	1,507	3,094

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Drainage	1990	1991	1992	1993	1994	1995	1996	1997	1998	1994-98 Average
Central										
Nushagak	0	0	8	31	107	7	47	315	9	97
Mulchatna	11	0	0	0	156	9	0	0	0	33
Agulowak								100 ^a	12	56
Agulukpak								0 ^a	0	0
Wood River L.	0	0	0	51	22	0	0	0	12	7
Tikchik L.	176	86	31	192	55	76	215	45	129	104
Koktuli R.			0	0	0	0 ^a	0	0 ^a	0 ^a	0
Other	99	69	23	37	0	131	75	106	0	62
Subtotal	286	155	62	311	340	223	337	566	162	326
Western										
Togiak	0	0	39	0	0	0	19	0	0	4
Goodnews	0 ^a	0	0	9	22	20	9	23	40	23
Kanektok	0	0	0	0	18	80	28	113	0	48
Arolik								0 ^a	0 ^a	0
Other	18	0	15	0	0	0	0	11	0	2
Subtotal	18	0	54	9	40	100	56	147	40	77
Northwestern										
Aniak	18	0	47	0	231	61	9	56	9	73
Kisaralik					0	0 ^a	33 ^a	50 ^a	8 ^a	18
Kwethluk			0	0	0 ^a	0 ^a	0 ^a	0 ^a	0 ^a	0
Other	18	215	309	160	0	29	31	108	74	48
Subtotal	36	215	356	160	231	90	73	214	91	140
Eastern	1,277	582	883	900	1,464	523	848	782	384	800
Central	286	155	62	311	340	223	337	566	162	326
Western	18	0	54	9	40	100	56	147	40	77
Northwestern	36	215	356	160	231	90	73	214	91	140
Total	1,617	952	1,355	1,380	2,075	936	1,314	1,709	677	1,342

Source: Mills 1979-1994, Howe et al. 1995 and 1996, *In prep* a, b, and c. Unless otherwise noted, these are published estimates for sites that garnered 12 or more responses in the Statewide Harvest Survey.

^a Unpublished estimates from Statewide Harvest Survey for sites with less than 12 responses.

Appendix A11.-Sport harvest of northern pike from the waters of Southwest Alaska by fishery, 1977-1998.

Drainage	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989
Eastern													
Ugashik	0	0	0	0	0	0	0	0	17 ^a	0 ^a	64	0 ^a	31
Egegik/Becharof	0	0	0	0	0	0	0	0 ^a	0 ^a	18 ^a	0 ^a	0 ^a	0
Naknek R.	15	18	36	0	86	21	42	137	225	171	64	18	62
Naknek L.	12	9	9	26	22	63	21	0	17 ^a	0	21	0 ^a	10
Bay of Islands							10	62	35	15 ^a	64	0 ^a	41
Brooks R.	0	0	0	0	0	0	0	0	0	0	0	0	0
Brooks L.													
American Cr.							0 ^a	0 ^a	0 ^a	0 ^a	0 ^a	0 ^a	0
King Salmon R.													
Kvichak R.	0	0	0	0	0	0	0	0	15	68	0	0	50
Copper R.	0	0	18	0	0	0	0	12 ^a	0 ^a	0 ^a	0 ^a	0 ^a	0
Alagnak R.					0	42	21	224	0	34	0	0 ^a	20
Newhalen R.	0	18	45	34	22	115	0	0	0	0	0	0	0
L Talarik Cr.	0	0	0	0	0	0	0	37 ^a	0	0 ^a	0 ^a	0 ^a	0 ^a
Lake Clark	43	54	127	43	162	409	84	87	104	0	46	0 ^a	40
Lake Iliamna							157 ^a	0 ^a	0 ^a	68	229	18	0
Kulik R.													
Tazimina R.													
Moraine Cr.													
Other							0	1,409	0	18	43	18	102
Subtotal	70	99	235	103	292	650	335	1,968	413	392	531	54	356

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Drainage	1990	1991	1992	1993	1994	1995	1996	1997	1998	1994-98 Average
Eastern										
Ugashik	11	0	17	19	278	0	430	103	0	162
Egegik/Becharof	0	0	0	0	0	0	0	31	0	6
Naknek R.	175	0	68	0	350	106	108	0	45	122
Naknek L.	0	62	68	0	27	0	40	15	13	19
Bay of Islands	22	31	60	75	54	59	120	127	177	107
Brooks R.	0	0	0	0	0	0	0	0	0	0
Brooks L.	0	0	0	0	0	0	0	0	0 ^a	0
American Cr.	0	0 ^a	0	8	0	0	0	0	0	0
King Salmon R.			0	0	0	0 ^a	0 ^a	0 ^a	0	0
Kvichak R.	0	65	60	17	118	33	74	21	41	57
Copper R.	0	0	0	0	0	100	0	0	18	24
Alagnak R.	63	98	145	0	9	118	212	15	0	71
Newhalen R.	0	33	0	0	9	0	108	34	25	35
L Talarik Cr.	0	0	0	0	0	0	0	0	0	0
Lake Clark	85	196	162	247	128	19	137	63	189	107
Lake Iliamna	32	0	51	0	0	45	62	0	0	21
Kulik R.			0	0	0	0	0	0	0	0
Tazimina R.			0	0	0	0 ^a	0 ^a	0 ^a	0 ^a	0
Moraine Cr.			0	0	0	0	0	0	0 ^a	0
Other	0	227	274	27	108	19	50	30	38	49
Subtotal	388	712	905	393	1,081	499	1,341	439	546	781

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Drainage	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989
Central													
Nushagak	5	63	9	26	43	42	178	50	202	58	595	127	343
Mulchatna	25	0	18	0	22	31	252	87	43	146	46	91	31
Agulowak													
Agulukpak													
Wood River L.	3	18	100	95	0	0	315	12	14	0	916	36	374
Tikchik L.	8	199	0	52	76	0	73	125	14	0 ^a	0 ^a	18	62
Koktuli R.													
Other					0	0	241	100	0	88	92	36	93
Subtotal	41	280	127	173	141	73	1,059	374	273	292	1,649	308	903
Western													
Togiak	12	0	0	0	0	84	0	25	0 ^a	29	0 ^a	18 ^a	0
Goodnews							0	0 ^a	0	0 ^a	0 ^a	0 ^a	0
Kanektok							0	0	0	0	0	18	23
Arolik													
Other							0	0	0	0		0	0
Subtotal	12	0	0	0	0	84	0	25	0	29	0	36	23
Northwestern													
Aniak							42 ^a	78 ^a	17 ^a	98 ^a	125 ^a	127 ^a	70
Kisaralik													
Kwethluk													
Other							1,322	403	277	24	126	36	781
Subtotal							1,364	481	294	122	251	163	851
Eastern	70	99	235	103	292	650	335	1,968	413	392	531	54	356
Central	41	280	127	173	141	73	1,059	374	273	292	1,649	308	903
Western	12	0	0	0	0	84	0	25	0	29	0	36	23
Northwestern							1,364	481	294	122	251	163	851
Total	123	379	362	276	433	807	2,758	2,848	980	835	2,431	561	2,133

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Drainage	1990	1991	1992	1993	1994	1995	1996	1997	1998	1994-98 Average
Central										
Nushagak	110	604	393	508	591	521	145	248	132	327
Mulchatna	44	14	26	74	9	21	168	14 ^a	52	53
Agulowak								0 ^a	0	0
Agulukpak								0 ^a	0	0
Wood River L.	99	503	333	139	126	373	201	351	54	221
Tikchik L.	0	72	9	9	0	45	40	0	0	17
Koktuli R.			0	0	9	0 ^a	0	0 ^a	0 ^a	2
Other	77	57	0	0	55	70	228	0	138	98
Subtotal	330	1,250	761	730	790	1,030	782	613	376	718
Western										
Togiak	44	0	9	17	0	0	0	0	13	3
Goodnews	0 ^a	0	0	0	54	0	0	0	0	11
Kanektok	0	0	0	0	0	0	0	0	0	0
Arolik								0 ^a	0 ^a	0
Other	0	0	0	0	0	0	0	0	0	0
Subtotal	44	0	9	17	54	0	0	0	13	13
Northwestern										
Aniak	18	244	43	0	54	77	443	42	553	234
Kisaralik					0	29 ^a	108 ^a	21 ^a	67 ^a	45
Kwethluk			60	329	90 ^a	39 ^a	0 ^a	0 ^a	18 ^a	29
Other	124	294	182	170	358	129	59	21	514	216
Subtotal	142	538	285	499	502	274	610	84	1,152	524
Eastern	388	712	905	393	1,081	499	1,341	439	546	781
Central	330	1,250	761	730	790	1,030	782	613	376	718
Western	44	0	9	17	54	0	0	0	13	13
Northwestern	142	538	285	499	502	274	610	84	1,152	524
Total	904	2,500	1,960	1,639	2,427	1,803	2,733	1,136	2,087	2,037

Source: Mills 1979-1994, Howe et al. 1995 and 1996, *In prep* a, b, and c. Unless otherwise noted, these are published estimates for sites that garnered 12 or more responses in the Statewide Harvest Survey.

^a Unpublished estimates from Statewide Harvest Survey for sites with less than 12 responses.

APPENDIX B

Appendix B1.-Sport catch of chinook salmon from the waters of Southwest Alaska by fishery, 1991-1998.

Drainage	1991	1992	1993	1994	1995	1996	1997	1998	1994-98 Average
Eastern									
Ugashik	846	862	1,115	164	170	1,334	1,279	494	688
Egegik/Becharof	0	67	341	130	18	267	1,204	723	468
Naknek R.	4,178	4,499	6,519	5,014	6,211	4,522	10,414	12,119	7,656
Naknek L.	9	87	0	10	9	0	665	0	137
Bay of Islands	18	42	37	76	54	32	0	0	32
Brooks R.	0	391	18	58	119	0	12	45	47
Brooks L.	0	0	20	0	9	0	0	0 ^a	2
American Cr.	0 ^a	0	0	0	0	0	0	0	0
King Salmon R.		430	38	317	327 ^a	683 ^a	1,108 ^a	575	602
Kvichak R.	100	56	1,477	139	677	149	261	563	358
Copper R.	89	0	0	0	9	75	0	17	20
Alagnak R.	3,224	7,636	14,097	1,884	3,916	4,899	5,573	9,087	5,072
Newhalen R.	22	8	0	39	18	32	0	0	18
L Talarik Cr.	0	0	0	0	0	0	0	0	0
Lake Clark	0	0	0	0	0	0	70	0	14
Lake Iliamna	11	17	64	80	0	0	0	972	210
Kulik R.		0	0	76	0	0	0	432	102
Tazimina R.		0	0	30	0 ^a	11 ^a	0 ^a	0 ^a	8
Moraine Cr.		0	0	0	0	0	0	0 ^a	0
Other	1,082	366	983	451	437	490	1,631	1,385	879
Subtotal	9,579	14,461	24,709	8,468	11,974	12,494	22,217	26,412	16,313
Central									
Nushagak	8,762	16,806	21,965	11,476	12,945	35,261	34,279	42,971	27,386
Mulchatna	4,944	3,025	4,035	1,950	1,797	5,442	3,360	2,582	3,026
Agulowak							0 ^a	105	53
Agulukpak							0 ^a	486	243
Wood River L.	253	416	565	475	245	363	1,140	397	524
Tikchik/Nuyakuk	101	469	217	219	263	21	0	843	269
Koktuli R.		518	222	20	179 ^a	599	1,202 ^a	360 ^a	472
Other	527	475	528	521	1,124	887	1,200	198	786
Subtotal	14,587	21,709	27,532	14,661	16,553	42,573	41,181	47,942	32,582
Western									
Togiak	1,044	1,137	2,035	1,368	2,100	5,335	5,809	5,004	3,923
Goodnews	68	47	469	230	279	1,136	1,578	3,171	1,279
Kanektok	1,742	3,153	5,245	1,483	3,226	6,757	13,374	9,528	6,874
Arolik							0 ^a	30 ^a	15
Other	0	0	0	0	0	726	443	806	395
Subtotal	2,854	4,337	7,749	3,081	5,605	13,954	21,204	18,539	12,477
Northwestern									
Aniak	222	827	1,273	573	2,729	4,531	13,069	5,896	5,360
Kisaralik				196	155 ^a	491 ^a	679 ^a	74 ^a	319
Kwethluk		47	47	57 ^a	0 ^a	299 ^a	108 ^a	467 ^a	186
Other	316	428	1,923	340	424	1,516	1,236	328	769
Subtotal	538	1,302	3,243	1,166	3,308	6,837	15,092	6,765	6,634
Total	27,558	41,809	63,233	27,376	37,440	75,858	99,694	99,658	68,005

Source: Mills 1992-1994, Howe et al. 1995 and 1996, and *In prep* a, b, and c.

^a Unpublished estimates from Statewide Harvest Survey for sites with less than 12 responses.

Appendix B2.-Sport catch of coho salmon from the waters of Southwest Alaska by fishery, 1991-1998.

Drainage	1991	1992	1993	1994	1995	1996	1997	1998	1994-98 Average
Eastern									
Ugashik	592	1,166	837	1,586	891	2,975	1,990	540	1,596
Egegik/Becharof	581	842	275	590	546	1,806	1,335	608	977
Naknek R.	2,032	2,745	2,187	3,188	3,692	7,440	6,889	4,494	5,141
Naknek L.	32	283	67	111	418	0	11	178	144
Bay of Islands	11	40	19	0	0	0	10	9	4
Brooks R.	86	429	549	136	1,061	78	574	459	462
Brooks L.	86	40	153	30	212	40	21	0 ^a	61
American Cr.	0 ^a	0	17	0	0	0	56	0	11
King Salmon R.		40	506	0	312 ^a	746 ^a	613 ^a	549	444
Kvichak R.	908	518	863	939	701	604	1,087	827	832
Copper R.	0	0	0	0	0	0	334	244	116
Alagnak R.	1,283	2,964	2,358	2,088	1,578	14,635	4,120	1,149	4,714
Newhalen R.	499	405	1,066	683	890	20	872	209	535
L Talarik Cr.	0	24	210	29	77	59	109	255	106
Lake Clark	102	81	382	0	110	0	289	26	85
Lake Iliamna	114	49	145	72	500	10	446	107	227
Kulik R.		0	0	0	0	0	0	46	9
Tazimina R.		0	0	0	0 ^a	0 ^a	0 ^a	0 ^a	0
Moraine Cr.		0	0	0	0	0	0	0 ^a	0
Other	1,145	1,012	2,018	1,358	969	2,351	2,678	2,683	2,008
Subtotal	7,471	10,638	11,652	10,810	11,957	30,764	21,434	12,383	17,470
Central									
Nushagak	863	1,029	1,154	1,735	2,296	9,767	1,242	2,849	3,578
Mulchatna	579	470	368	458	826	5,503	680	434	1,580
Agulowak							368 ^a	30	199
Agulukpak							256 ^a	82	169
Wood River L.	831	1,036	549	1,036	1,195	1,201	1,883	811	1,225
Tikchik/Nuyakuk L.	22	32	176	180	0	2,435	680	131	685
Koktuli R.		0	0	82	0 ^a	1,283 ^a	0 ^a	0	273
Other	252	678	351	680	423	4,332	1,350	1,109	1,579
Subtotal	2,547	3,245	2,598	4,171	4,740	24,521	6,459	5,446	9,067
Western									
Togiak	547	996	727	1,408	1,268	10,461	4,044	8,093	5,055
Goodnews	1,176	1,571	499	456	761	5,130	2,930	7,852	3,426
Kanektok	2,404	3,174	3,741	1,322	3,602	10,730	14,480	15,017	9,030
Arolik							279 ^a	737 ^a	508
Other	405	0	0	0	0	1,382	120	487	398
Subtotal	4,532	5,741	4,967	3,186	5,631	27,703	21,853	32,186	18,112
Northwestern									
Aniak	1,432	575	753	852	2,246	4,639	4,604	3,639	3,196
Kisaralik				492	274 ^a	3,662 ^a	839 ^a	2,638	1,581
Kwethluk		1,790	566	525 ^a	208 ^a	2,502 ^a	490 ^a	3,204	1,386
Other	307	1,391	2,152	596	1,428	4,674	1,636	1,583	1,983
Subtotal	1,739	3,756	3,471	2,465	4,156	15,477	7,569	11,064	8,146
Total	16,289	23,380	22,688	20,632	26,484	98,465	57,315	61,079	52,795

Source: Mills 1992-1994, Howe et al. 1995 and 1996, and *In prep* a, b, and c.

^a Unpublished estimates from Statewide Harvest Survey for sites with less than 12 responses.

Appendix B3.-Sport catch of sockeye salmon from the waters of Southwest Alaska by fishery, 1991-1998.

Drainage	1991	1992	1993	1994	1995	1996	1997	1998	1994-98 Average
Eastern									
Ugashik	403	625	566	1,020	325	2,734	3,317	4,054	2,290
Egegik/Becharof	336	1,323	695	239	1,134	1,024	1,952	376	945
Naknek R.	2,314	1,471	3,029	1,539	2,949	1,389	715	4,321	2,183
Naknek L.	1,210	764	868	467	408	1,229	743	284	626
Bay of Islands	144	419	0	87	89	109	105	259	130
Brooks R.	3,552	5,515	10,504	1,921	3,699	5,831	5,007	2,925	3,877
Brooks L.	490	304	442	271	720	182	85	280 ^a	308
American Cr.	0 ^a	33	642	577	525	1,212	1,886	138	868
King Salmon R.		0	506	9	67 ^a	124 ^a	0 ^a	697	179
Kvichak R.	3,451	4,685	8,961	7,886	6,906	3,733	3,875	8,594	6,199
Copper R.	1,720	1,512	7,566	3,167	2,004	3,060	1,967	3,912	2,822
Alagnak R.	2,724	6,443	24,650	2,751	7,821	10,376	11,533	24,184	11,333
Newhalen R.	24,842	16,117	21,928	15,283	15,324	7,016	8,798	13,053	11,895
L Talarik Cr.	287	427	746	559	125	529	117	962	458
Lake Clark	829	1,693	820	1,088	1,990	102	1,672	190	1,008
Lake Iliamna	2,171	2,877	7,405	2,272	3,148	1,790	3,100	2,213	2,505
Kulik R.		131	165	357	45	1,393	424	206	485
Tazimina R.		1,151	116	418	31 ^a	9 ^a	0 ^a	542 ^a	200
Moraine Cr.		164	287	218	134	371	232	965 ^a	384
Other	2,044	2,292	5,792	4,794	2,279	3,497	8,407	7,924	5,380
Subtotal	46,517	47,946	95,688	44,923	49,723	45,710	53,935	76,079	54,074
Central									
Nushagak	2,720	1,693	2,122	1,202	865	2,870	2,465	4,001	2,281
Mulchatna	1,350	1,446	1,898	607	1,211	2,022	2,538	1,585	1,593
Agulowak							718 ^a	2,367	1,543
Agulukpak							880 ^a	416	648
Wood River L.	6,080	3,590	6,394	3,000	1,836	6,504	3,347	8,905	4,718
Tikchik L.	1,480	1,537	6,286	475	267	487	392	947	514
Koktuli		781	980	479	385 ^a	1,861	1,060 ^a	1,051 ^a	967
Other	550	148	1,255	550	283	1,537	1,230	1,541	1,028
Subtotal	12,180	9,195	18,935	6,313	4,847	15,281	12,630	20,813	11,977
Western									
Togiak	640	140	429	193	499	1,736	965	2,328	1,144
Goodnews	2,003	90	321	207	380	749	1,705	3,402	1,289
Kanektok	1,147	1,290	1,887	3,622	733	5,247	2,836	3,987	3,285
Arolik							148 ^a	113 ^a	131
Other	0	0	78	0	0	367	601	71	208
Subtotal	3,790	1,520	2,715	4,022	1,612	8,099	6,255	9,901	5,978
Northwestern									
Aniak	151	74	79	87	166	115	567	367	260
Kisaralik				452	0 ^a	335 ^a	10 ^a	0 ^a	159
Kwethluk		58	19	0 ^a	0 ^a	1,021 ^a	0 ^a	35 ^a	211
Other	0	246	377	316	85	328	80	5	163
Subtotal	151	378	475	855	251	1,799	657	407	794
Total	62,638	59,039	117,813	56,113	56,433	70,889	73,477	107,200	72,822

Source: Mills 1992-1994, Howe et al. 1995 and 1996, and *In prep* a, b, and c.

^a Unpublished estimates from Statewide Harvest Survey for sites with less than 12 responses.

Appendix B4.-Sport catch of pink salmon from the waters of Southwest Alaska by fishery, 1991-1998.

Drainage	1991	1992	1993	1994	1995	1996	1997	1998	1994-98 Average
Eastern									
Ugashik	0	183	0	32	0	374	526	13	189
Egegik/Becharof	0	18	0	358	169	1,223	260	105	423
Naknek R.	10	1,814	104	738	214	2,745	121	3,183	1,400
Naknek L.	0	256	0	0	0	0	87	0	17
Bay of Islands	0	0	0	0	0	0	43	0	9
Brooks R.	0	101	0	65	469	52	233	66	177
Brooks L.	0	0	0	16	0	0	0 ^a	0 ^a	3
American Cr.	0 ^a	0	9	0	0	0	152	0	30
King Salmon R.		9	0	43	0 ^a	104 ^a	32 ^a	36	43
Kvichak R.	300	1,081	9	1,708	66	2,076	57	565	894
Copper R.	0	0	0	0	0	311	0	13	65
Alagnak R.	409	13,016	786	975	45	19,200	419	1,763	4,480
Newhalen R.	0	0	0	0	0	115	121	598	167
L Talarik Cr.	0	0	0	0	0	0	0	0	0
Lake Clark	0	0	0	0	0	156	0	0	31
Lake Iliamna	0	0	302	51	0	209	0	0	52
Kulik R.		0	0	0	0	0	0	0	0
Tazimina R.		0	0	0	0 ^a	0 ^a	0 ^a	0 ^a	0
Moraine Cr.		0	0	0	0	0	22	266 ^a	58
Other	2,045	1,145	557	450	1,032	855	1,068	1,429	967
Subtotal	2,764	17,623	1,767	4,436	1,995	27,420	3,141	8,037	9,006
Central									
Nushagak	348	2,629	211	356	341	2,585	94	646	804
Mulchatna	0	46	43	231	26	373	0	13	129
Agulowak							0	0	0
Agulukpak							0	0	0
Wood River L.	202	1,301	29	909	38	252	660	179	408
Tikchik L.	0	348	0	49	66	592	119	0	165
Koktuli R.	0	0	0	32	0 ^a	228	0 ^a	0 ^a	52
Other	90	0	36	220	0	52	28	271	114
Subtotal	640	4,324	319	1,797	471	4,082	901	1,109	1,672
Western									
Togiak	11	568	43	365	333	527	108	5,627	1,392
Goodnews	173	431	269	528	28	1,120	870	2,154	940
Kanektok	544	6,971	482	2,598	150	4,433	1,495	11,051	3,945
Arolik							22 ^a	68 ^a	45
Other	0	0	0	0	0	695	0	0	139
Subtotal	728	7,970	794	3,491	511	6,775	2,495	18,900	6,434
Northwestern									
Aniak	0	998	364	388	116	301	357	168	266
Kisaralik				98	0 ^a	91 ^a	0 ^a	34 ^a	45
Kwethluk		101	0	154 ^a	0 ^a	49 ^a	0 ^a	0 ^a	41
Other	12	761	0	32	9	1,205	0	351	319
Subtotal	12	1,860	364	672	125	1,646	357	553	671
Total	4,144	31,777	3,244	10,396	3,102	39,923	6,894	28,599	17,783

Source: Mills 1992-1994, Howe et al. 1995 and 1996, and *In prep* a, b, and c.

^a Unpublished estimates from Statewide Harvest Survey for sites with less than 12 responses.

Appendix B5.-Sport catch of chum salmon from the waters of Southwest Alaska by fishery, 1991-1998.

Drainage	1991	1992	1993	1994	1995	1996	1997	1998	1994-98 Average
Eastern									
Ugashik	50	395	100	92	22	1,766	808	44	546
Egegik/Becharof	30	84	0	147	197	493	1,045	399	456
Naknek R.	567	517	249	926	950	745	1,583	636	968
Naknek L.	0	0	0	0	0	0	0	0	0
Bay of Islands	20	304	0	0	0	0	0	0	0
Brooks R.	0	23	0	19	0	0	292	0	62
Brooks L.	0	0	8	0	0	0	0 ^a	0 ^a	0
American Cr.	0 ^a	0	0	0	0	0	0	0	0
King Salmon R.		0	0	29	350 ^a	714 ^a	0 ^a	569	332
Kvichak R.	1,180	516	573	759	175	625	907	1,229	739
Copper R.	0	0	0	0	0	0	0	146	29
Alagnak R.	5,811	11,677	10,320	4,636	9,978	14,933	14,667	18,601	12,563
Newhalen R.	0	0	0	0	0	0	0	26	5
L Talarik Cr.	0	0	0	0	0	219	0	0	44
Lake Clark	0	0	0	0	0	0	0	0	0
Lake Iliamna	0	38	83	10	0	110	189	0	62
Kulik R.		0	0	0	0	0	0	88	18
Tazimina R.		0	17	0	0 ^a	0 ^a	0 ^a	0 ^a	0
Moraine Cr.		0	0	0	0	0	145	0 ^a	29
Other	220	570	899	110	1,170	2,484	1,858	825	1,289
Subtotal	7,878	14,124	12,249	6,728	12,842	22,089	21,494	22,563	17,143
Central									
Nushagak	1,662	6,544	3,651	7,005	3,581	9,432	3,900	6,693	6,122
Mulchatna	457	2,050	2,275	2,223	1,251	3,351	1,757	2,660	2,248
Agulowak							116 ^a	0	58
Agulukpak							29 ^a	146	88
Wood River L.	310	410	297	133	40	784	381	37	275
Tikchik L.	46	850	28	327	120	231	15	44	147
Koktuli R.		296	440	538	18 ^a	1,287	0 ^a	920 ^a	553
Other	401	45	429	1,636	285	892	676	894	877
Subtotal	2,876	10,195	7,120	11,862	5,295	15,977	6,874	11,394	10,280
Western									
Togiak	493	395	906	1,419	2,064	6,811	1,198	4,888	3,276
Goodnews	527	402	924	381	315	407	1,118	2,955	1,035
Kanektok	1,382	3,994	4,849	6,386	5,049	10,916	11,124	11,560	9,007
Arolik							44 ^a	17 ^a	31
Other	0	0	191	0	0	1,167	15	351	307
Subtotal	2,402	4,791	6,870	8,186	7,428	19,301	13,499	19,771	13,637
Northwestern									
Aniak	656	1,670	2,412	1,342	2,785	4,691	2,358	2,664	2,768
Kisaralik				1,123	44 ^a	1,849 ^a	9 ^a	163 ^a	638
Kwethluk		91	221	183 ^a	90 ^a	931 ^a	53 ^a	296 ^a	311
Other	577	760	926	978	709	2,666	371	1,873	1,319
Subtotal	1,233	2,521	3,559	3,626	3,628	10,137	2,791	4,996	5,036
Total	14,389	31,631	29,798	30,402	29,193	67,504	44,658	58,724	46,096

Source: Mills 1992-1994, Howe et al. 1995 and 1996, and *In prep* a, b, and c.

^a Unpublished estimates from Statewide Harvest Survey for sites with less than 12 responses.

Appendix B6.-Sport catch of rainbow trout from the waters of Southwest Alaska by fishery, 1991-1998.

Drainage	1991	1992	1993	1994	1995	1996	1997	1998	1994-98 Average
Eastern									
Ugashik	208	467	272	498	297	179	1,184	407	513
Egegik/Becharof	96	1,195	1,404	194	743	111	962	568	516
Naknek R.	13,863	14,850	16,393	10,113	14,501	16,888	13,737	12,795	13,607
Naknek L.	672	1,021	900	620	805	1,371	712	426	787
Bay of Islands	2,526	3,150	2,094	1,028	1,342	967	1,638	431	1,081
Brooks R.	4,573	9,634	13,575	12,301	6,091	14,474	16,166	6,157	11,038
Brooks L.	1,295	1,781	1,306	1,450	1,610	1,003	491	769 ^a	1,065
American Cr.	1,759 ^a	2,889	5,816	3,871	1,767	2,924	6,800	3,204	3,713
King Salmon R.		348	20	17	111 ^a	76 ^a	44 ^a	901	230
Kvichak R.	15,115	10,161	11,465	7,187	4,741	11,396	15,705	5,584	8,923
Copper R.	11,706	13,916	15,951	12,732	12,683	12,154	29,158	15,164	16,378
Alagnak R.	23,244	18,452	30,665	11,062	19,499	29,696	29,881	9,711	19,970
Newhalen R.	4,795	2,422	2,975	3,949	2,874	1,848	1,403	3,803	2,775
L Talarik Cr.	3,165	1,480	1,272	2,183	1,352	2,468	2,858	2,186	2,209
Lake Clark	862	760	173	309	642	119	1,104	432	521
Lake Iliamna	281	2,224	3,413	2,893	1,683	3,194	2,265	576	2,122
Kulik R.		2,201	7,225	5,373	3,717	20,895	12,480	7,242	9,941
Tazimina R.		1,172	1,035	996	2,027 ^a	1,348 ^a	401 ^a	104 ^a	975
Moraine Cr.		989	4,541	3,208	6,082	6,889	6,777	1,715 ^a	4,934
Other	30,502	8,653	13,135	15,443	9,482	24,472	19,502	15,451	16,870
Subtotal	114,662	97,765	133,630	95,427	92,049	152,472	163,268	87,626	118,168
Central									
Nushagak	8,750	5,407	8,966	6,530	5,808	19,540	12,304	10,649	10,966
Mulchatna	3,251	4,433	4,416	3,740	5,962	6,491	4,866	3,576	4,927
Agulowak							8,140 ^a	6,906	7,523
Agulukpak							11,382 ^a	3,413	7,398
Wood River L.	8,879	5,897	8,283	8,677	7,260	12,939	5,366	3,856	7,620
Tikchik L.	1,647	1,599	2,574	1,350	1,315	2,537	3,531	1,708	2,088
Koktuli R.		823	917	832	1,461 ^a	1,404	2,901 ^a	780 ^a	1,476
Other	1,934	499	1,250	3,693	2,931	2,692	4,446	2,883	3,329
Subtotal	24,461	18,658	26,406	24,822	24,737	45,603	52,936	33,771	36,374
Western									
Togiak	616	538	1,298	1,206	1,873	2,872	1,810	1,773	1,907
Goodnews	2,776	1,282	3,994	945	1,263	1,450	9,703	5,738	3,820
Kanektok	5,856	1,496	4,106	4,779	3,046	6,704	27,518	13,567	11,123
Arolik							1,813 ^a	631 ^a	1,222
Other	0	8	267	0	0	923	0	31	191
Subtotal	9,248	3,324	9,665	6,930	6,182	11,949	40,844	21,740	17,529
Northwestern									
Aniak	1,881	934	1,144	656	1,581	3,457	12,383	5,004	4,616
Kisaralik				1,226	1,153 ^a	2,470 ^a	7,067 ^a	1,289 ^a	2,641
Kwethluk		158	333	87 ^a	66 ^a	1,076 ^a	335 ^a	980 ^a	509
Other	790	1,211	2,279	312	3,423	269	2,291	3,203	1,900
Subtotal	2,671	2,303	3,756	2,281	6,223	7,272	22,076	10,476	9,666
Total	151,042	122,050	173,457	129,460	129,191	217,296	279,124	153,613	181,737

Source: Mills 1992-1994, Howe et al. 1995 and 1996, and *In prep* a, b, and c.

^a Unpublished estimates from Statewide Harvest Survey for sites with less than 12 responses.

Appendix B7.-Sport catch of lake trout from the waters of Southwest Alaska by fishery, 1991-1998.

Drainage	1991	1992	1993	1994	1995	1996	1997	1998	1994-98 Average
Eastern									
Ugashik	222	170	131	121	114	821	1,051	125	446
Egegik/Becharof	0	8	9	0	17	0	0	0	3
Naknek R.	154	93	97	396	74	465	173	52	232
Naknek L.	205	116	160	140	168	63	56	156	117
Bay of Islands	358	648	730	392	241	239	276	109	251
Brooks R.	0	23	224	117	112	0	101	0	66
Brooks L.	819	609	654	919	583	559	273 ^a	154 ^a	498
American Cr.	0 ^a	139	230	165	10	218	0	147	108
King Salmon R.		0	0	0	0 ^a	0 ^a	34 ^a	4	8
Kvichak R.	113	108	202	376	38	152	45	0	122
Copper R.	0	0	0	66	0	19	0	17	20
Alagnak R.	495	147	460	119	404	219	159	59	192
Newhalen R.	353	324	699	610	260	74	114	176	247
L Talarik Cr.	0	0	0	0	0	0	60	0	12
Lake Clark	904	1,619	2,121	2,472	721	228	643	382	889
Lake Iliamna	155	409	811	720	88	158	30	60	211
Kulik R.		8	424	132	133	247	0	0	102
Tazimina R.		8	18	550	0 ^a	0 ^a	0 ^a	0 ^a	110
Moraine Cr.		23	19	221	7	37	0	0 ^a	53
Other	1,266	2,475	2,984	3,181	559	1,078	477	1,398	1,339
Subtotal	5,044	6,927	9,973	10,697	3,529	4,577	3,492	2,839	5,027
Central									
Nushagak	34	231	144	184	17	167	696	327	278
Mulchatna	0	23	0	204	9	9	120	59	80
Agulowak							171	12	92
Agulukpak							0	0	0
Wood River L.	0	15	106	44	0	9	0	12	13
Tikchik L.	2,043	1,072	1,764	3,305	1,089	1,217	1,601	1,181	1,679
Koktuli R.		0	0	0	0 ^a	0	0 ^a	0 ^a	0
Other	292	108	37	308	424	132	266	4	227
Subtotal	2,369	1,449	2,051	4,045	1,539	1,534	2,854	1,595	2,313
Western									
Togiak	137	162	0	148	198	93	0	47	97
Goodnews	388	15	294	382	38	293	212	230	231
Kanektok	0	46	18	972	90	191	155	333	348
Arolik							0 ^a	0 ^a	0
Other	0	0	0	0	0	22	260	0	56
Subtotal	525	223	312	1,502	326	599	627	610	733
Northwestern									
Aniak	0	555	10	0	163	56	56	62	67
Kisaralik				59	0 ^a	131 ^a	50 ^a	17 ^a	51
Kwethluk		0	0	0 ^a	0 ^a	0 ^a	0 ^a	0 ^a	0
Other	517	810	340	294	152	102	289	265	220
Subtotal	517	1,365	350	353	315	289	395	344	339
Total	8,455	9,964	12,686	16,597	5,709	6,999	7,368	5,388	8,412

Source: Mills 1992-1994, Howe et al. 1995 and 1996, and *In prep* a, b, and c.

^a Unpublished estimates from Statewide Harvest Survey for sites with less than 12 responses.

Appendix B8.-Sport catch of Dolly Varden/Arctic char from the waters of Southwest Alaska by fishery, 1991-1998.

Drainage	1991	1992	1993	1994	1995	1996	1997	1998	1994-98 Average
Eastern									
Ugashik	1,711	499	3,288	3,951	1,309	6,929	2,937	3,881	3,801
Egegik/Becharof	359	5,260	3,723	1,604	1,339	769	5,426	5,904	3,008
Naknek R.	1,076	3,490	4,727	2,409	2,437	3,454	2,047	3,697	2,809
Naknek L.	469	33	1,238	1,205	616	1,238	299	186	709
Bay of Islands	290	729	232	172	76	342	54	110	151
Brooks R.	14	172	1,166	716	200	1,201	713	498	666
Brooks L.	0	459	78	27	77	24	0 ^a	17 ^a	29
American Cr.	2,305 ^a	4,654	9,855	4,158	5,704	2,526	4,093	3,886	4,073
King Salmon R.		107	19	206	198 ^a	784 ^a	11 ^a	1,765	593
Kvichak R.	676	426	572	810	358	7,276	2,304	418	2,233
Copper R.	1,351	598	1,048	332	471	609	925	1,000	667
Alagnak R.	1,250	1,802	2,527	935	1,855	3,421	3,126	320	1,931
Newhalen R.	1,030	1,147	1,658	1,672	1,607	968	1,963	495	1,341
L Talarik Cr.	220	115	465	0	0	61	0	14	15
Lake Clark	659	533	484	688	385	172	1,779	930	791
Lake Iliamna	321	844	982	1,721	356	982	558	340	791
Kulik R.		860	0	334	0	49	21	0	81
Tazimina R.		238	336	476	426 ^a	221 ^a	554 ^a	0 ^a	335
Moraine Cr.		90	132	318	19	48	27	212 ^a	125
Other	6,264	3,910	11,196	7,872	7,484	6,862	9,991	6,641	7,770
Subtotal	17,995	25,966	43,726	29,606	24,917	37,936	36,828	30,314	31,920
Central									
Nushagak	5,825	4,736	7,632	3,771	3,351	9,423	5,544	8,850	6,188
Mulchatna	940	639	923	717	1,376	1,685	1,109	777	1,133
Agulowak							4,029	6,022	5,026
Agulukpak							4,260	3,022	3,641
Wood River L.	15,764	16,222	13,787	13,960	13,445	14,124	7,726	10,187	11,888
Tikchik L.	2,259	2,384	5,867	3,854	2,013	3,051	3,096	2,882	2,979
Koktuli R.		672	44	404	299 ^a	1,203	1,170 ^a	84 ^a	632
Other	1,019	458	1,091	1,297	965	2,159	1,671	1,937	1,606
Subtotal	25,807	25,111	29,344	24,003	21,449	31,645	28,605	33,761	27,893
Western									
Togiak	823	1,008	1,030	3,368	3,156	3,768	2,127	6,766	3,837
Goodnews	9,936	5,694	8,156	3,156	2,336	5,146	23,583	16,680	10,180
Kanektok	10,757	3,990	10,136	8,270	6,231	15,815	42,049	24,287	19,330
Arolik							691 ^a	643 ^a	667
Other	0	0	395	0	0	1,748	1,246	14	602
Subtotal	21,516	10,692	19,717	14,794	11,723	26,477	69,696	48,390	34,216
Northwestern									
Aniak	3,514	3,736	9,340	3,115	3,454	6,096	12,158	21,053	9,175
Kisaralik				2,283	1,667 ^a	1,655 ^a	4,717 ^a	599 ^a	2,184
Kwethluk		57	349	251 ^a	131 ^a	1,106 ^a	243 ^a	188 ^a	384
Other	1,873	2,179	6,024	908	3,167	1,157	2,826	1,738	1,959
Subtotal	5,387	5,972	15,713	6,557	8,419	10,014	19,944	23,578	13,702
Total	70,705	67,741	108,500	74,960	66,508	106,072	155,073	136,043	107,731

Source: Mills 1992-1994, Howe et al. 1995 and 1996, and *In prep* a, b, and c.

^a Unpublished estimates from Statewide Harvest Survey for sites with less than 12 responses.

Appendix B9.-Sport catch of Arctic grayling from the waters of Southwest Alaska by fishery, 1991-1998.

Drainage	1991	1992	1993	1994	1995	1996	1997	1998	1994-98 Average
Eastern									
Ugashik	337	518	568	889	1,263	3,010	1,708	3,352	2,044
Egegik/Becharof	637	1,082	1,265	740	1,118	360	2,808	2,420	1,489
Naknek R.	2,479	2,630	4,158	3,212	1,974	2,148	1,991	2,822	2,429
Naknek L.	104	113	280	429	0	121	116	65	146
Bay of Islands	143	150	54	57	0	0	0	0	11
Brooks R.	299	977	1,227	2,081	734	1,215	1,550	1,151	1,346
Brooks L.	0	75	9	0	9	0	0	52 ^a	12
American Cr.	39 ^a	286	177	418	0	951	71	98	308
King Salmon R.		30	37	0	122 ^a	24 ^a	201 ^a	1,818	433
Kvichak R.	5,205	4,643	4,729	7,497	2,180	3,674	8,543	4,520	5,283
Copper R.	77	240	420	398	461	317	650	180	401
Alagnak R.	7,563	5,673	11,280	7,608	7,235	4,957	4,387	2,102	5,258
Newhalen R.	3,905	3,020	4,636	4,477	4,554	3,995	7,816	5,912	5,351
L Talarik Cr.	949	301	846	296	395	198	731	182	360
Lake Clark	4,379	3,404	4,435	4,993	2,371	1,714	8,092	7,459	4,926
Lake Iliamna	15	346	594	2,364	497	643	302	651	891
Kulik R.		0	0	0	0	83	50	0	27
Tazimina R.		3,088	2,740	3,180	1,273 ^a	621 ^a	2,911 ^a	460 ^a	1,689
Moraine Cr.		248	897	655	307	499	212	125 ^a	360
Other	10,787	3,871	5,634	4,835	2,159	5,087	6,951	6,351	5,077
Subtotal	36,918	30,695	43,986	44,129	26,652	29,617	49,090	39,720	37,842
Central									
Nushagak	9,147	7,243	12,746	6,988	7,672	21,220	8,483	13,752	11,623
Mulchatna	2,067	2,772	4,325	2,821	5,504	4,781	5,610	3,136	4,370
Agulowak							2,449 ^a	3,288	2,869
Agulukpak							2,939 ^a	1,355	2,147
Wood River L.	9,785	3,818	7,498	5,765	8,017	6,255	4,108	1,699	5,169
Tikhik L.	3,611	5,131	11,013	6,476	3,902	10,058	23,960	5,388	9,957
Koktuli R.		594	2,211	1,685	1,246 ^a	3,115	2,270 ^a	1,391 ^a	1,941
Other	6,712	3,140	2,284	4,087	4,165	4,415	8,557	2,010	4,647
Subtotal	31,322	22,698	40,077	27,822	30,506	49,844	58,376	32,019	39,713
Western									
Togiak	156	579	1,452	1,323	873	1,393	312	5,052	1,791
Goodnews	461	609	851	1,813	544	812	2,717	3,126	1,802
Kanektok	3,092	391	2,727	1,599	1,128	2,143	5,375	5,576	3,164
Arolik							181 ^a	221 ^a	201
Other	0	0	109	0	0	384	0	0	77
Subtotal	3,709	1,579	5,139	4,735	2,545	4,732	8,585	13,975	6,914
Northwestern									
Aniak	4,841	3,855	5,580	2,022	2,266	5,095	15,194	11,930	7,301
Kisaralik				1,920	70 ^a	1,535 ^a	3,753 ^a	984 ^a	1,652
Kwethluk	0	120	165	212 ^a	132 ^a	1,376 ^a	500 ^a	1,408 ^a	726
Other	2,236	3,293	5,948	1,123	4,119	462	1,552	3,231	2,097
Subtotal	7,077	7,268	11,693	5,277	6,587	8,468	20,999	17,553	11,777
Total	79,026	62,240	100,895	81,963	66,290	92,661	137,050	103,267	96,246

Source: Mills 1992-1994, Howe et al. 1995 and 1996, and *In prep* a, b, and c.

^a Unpublished estimates from Statewide Harvest Survey for sites with less than 12 responses.

Appendix B10.-Sport catch of northern pike from the waters of Southwest Alaska by fishery, 1991-1998.

Drainage	1991	1992	1993	1994	1995	1996	1997	1998	1994-98 Average
Eastern									
Ugashik	62	60	880	938	150	1,091	223	269	534
Egegik/Becharof	0	51	0	0	0	53	77	0	26
Naknek R.	31	325	252	2,084	160	483	22	635	677
Naknek L.	289	342	160	134	50	1,040	30	67	264
Bay of Islands	227	1,093	2,663	869	547	1,323	1,435	1,053	1,045
Brooks R.	0	0	0	0	0	0	0	0	0
Brooks L.	0	17	0	0	0	106	0 ^a	8 ^a	23
American Cr.	0 ^a	0	169	0	0	293	0	9	60
King Salmon R.		0	0	0	0 ^a	0 ^a	0 ^a	0	0
Kvichak R.	408	649	366	767	490	466	439	438	520
Copper R.	0	51	228	0	100	0	0	30	26
Alagnak R.	342	846	347	83	241	1,611	381	266	516
Newhalen R.	33	17	0	9	111	108	41	135	81
L Talarik Cr.	228	0	0	0	11	0	0	0	2
Lake Clark	1,516	777	1,116	1,992	502	521	363	1,019	879
Lake Iliamna	33	342	1,134	65	387	152	231	336	234
Kulik R.		0	0	37	0	0	0	0	7
Tazimina R.		0	0	0	0 ^a	0 ^a	0 ^a	0 ^a	0
Moraine Cr.		0	0	0	0	0	0	0 ^a	0
Other	768	1,124	981	812	708	799	691	751	752
Subtotal	3,937	5,694	8,296	7,790	3,457	8,046	3,933	5,016	5,648
Central									
Nushagak	2,071	5,970	3,551	1,831	2,325	2,926	719	1,624	1,885
Mulchatna	216	512	227	453	318	227	112	512	324
Agulowak							0	72	36
Agulukpak							0	351	176
Wood River L.	4,457	5,134	1,447	1,787	3,216	4,006	1,522	1,672	2,441
Tikchik L.	475	461	162	571	965	966	857	658	803
Koktuli R.		154	0	90	0 ^a	238	15 ^a	142 ^a	97
Other	1,553	514	9	551	436	1,135	311	778	642
Subtotal	8,772	12,745	5,396	5,283	7,260	9,498	3,536	5,809	6,277
Western									
Togiak	0	26	193	138	238	51	15	71	103
Goodnews	0	0	0	54	0	0	0	0	11
Kanektok	0	145	56	0	0	0	34	0	7
Arolik							0 ^a	0 ^a	0
Other	0	0	0	0	0	0	0	0	0
Subtotal	0	171	249	192	238	51	49	71	120
Northwestern									
Aniak	1,448	794	45	698	623	959	305	1,883	894
Kisaralik				18	69 ^a	526 ^a	119 ^a	67 ^a	160
Kwethluk		231	526	358 ^a	805 ^a	2,011 ^a	206 ^a	247 ^a	725
Other	976	1,634	1,088	905	853	1,025	278	780	768
Subtotal	2,424	2,659	1,659	1,979	2,350	4,521	908	2,977	2,547
Total	15,133	21,269	15,600	15,244	13,305	22,116	8,426	13,873	14,593

Source: Mills 1992-1994, Howe et al. 1995 and 1996, and *In prep* a, b, and c.

^a Unpublished estimates from Statewide Harvest Survey for sites with less than 12 responses.