Fishery Management Report No. 00-6

Fishery Management Report for Sport Fisheries in the Tanana River Drainage from 1995 to 1997

by
James Parker
and
Tim Viavant

June 2000

Alaska Department of Fish and Game **Division of Sport Fish**

Symbols and Abbreviations

The following symbols and abbreviations, and others approved for the Système International d'Unités (SI), are used in Division of Sport Fish Fishery Manuscripts, Fishery Data Series Reports, Fishery Management Reports, and Special Publications without definition. All others must be defined in the text at first mention, as well as in the titles or footnotes of tables and in figures or figure captions.

Weights and measures (metric)

centimeter	cm
deciliter	dL
gram	g
hectare	ha
kilogram	kg
kilometer	km
liter	L
meter	m
metric ton	mt
milliliter	ml
millimeter	mm

Weights and measures (English)

cubic feet per second	ft^3/s
foot	ft
gallon	gal
inch	in
mile	mi
ounce	oz
pound	lb
quart	qt
yard	yd

Spell out acre and ton.

Time and temperature

day	d
degrees Celsius	°C
degrees Fahrenheit	°F
hour (spell out for 24-hour clock)	h
minute	min
second	s

Spell out year, month, and week.

Physics and chemistry

all atomic symbols	
alternating current	AC
ampere	A
calorie	cal
direct current	DC
hertz	Hz
horsepower	hp
hydrogen ion activity	pH
parts per million	ppm
parts per thousand	ppt, ‰
volts	V
watts	W

General

All commonly accepted abbreviations.	e.g., Mr., Mrs., a.m., p.m., etc.
All commonly accepted professional titles.	e.g., Dr., Ph.D., R.N., etc.
and	&
at	@
Compass directions:	
east	E
north	N
south	S
west	W
Copyright	©
Corporate suffixes:	
Company	Co.
Corporation	Corp.
Incorporated	Inc.
Limited	Ltd.
et alii (and other people)	et al.
et cetera (and so forth)	etc.
exempli gratia (for example)	e.g.,
id est (that is)	i.e.,
latitude or longitude	lat. or long.
monetary symbols (U.S.)	$, ¢
months (tables and figures): first three letters	Jan,...,Dec
number (before a number)	# (e.g., #10)
pounds (after a number)	# (e.g., 10#)
registered trademark	®
trademark	™
United States (adjective)	U.S.
United States of America (noun)	USA
U.S. state and District of Columbia abbreviations	use two-letter abbreviations (e.g., AK, DC)

Mathematics, statistics, fisheries

alternate hypothesis	H_A
base of natural logarithm	e
catch per unit effort	CPUE
coefficient of variation	CV
common test statistics	F, t, χ^2, etc.
confidence interval	C.I.
correlation coefficient	R (multiple)
correlation coefficient	r (simple)
covariance	cov
degree (angular or temperature)	°
degrees of freedom	df
divided by	÷ or / (in equations)
equals	=
expected value	E
fork length	FL
greater than	>
greater than or equal to	≥
harvest per unit effort	HPUE
less than	<
less than or equal to	≤
logarithm (natural)	ln
logarithm (base 10)	log
logarithm (specify base)	$\log_2$, etc.
mideye-to-fork	MEF
minute (angular)	'
multiplied by	x
not significant	NS
null hypothesis	H_O
percent	%
probability	P
probability of a type I error (rejection of the null hypothesis when true)	α
probability of a type II error (acceptance of the null hypothesis when false)	β
second (angular)	"
standard deviation	SD
standard error	SE
standard length	SL
total length	TL
variance	Var

FISHERY MANAGEMENT REPORT NO. 00-6

FISHERY MANAGEMENT REPORT FOR SPORT FISHERIES IN THE TANANA RIVER DRAINAGE FROM 1995 TO 1997

by
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PREFACE

This report combines fisheries information for 1995 through 1997. This report is organized into two major sections. Section I provides an overview of the two Tanana River Management Areas. Included is a description of the management areas, Board of Fisheries activities, and management information and activities within the areas. Section II provides a more detailed summary of each major fishery, with elaboration on those fisheries most effected by fishing during the reporting period. Included in these summaries are: a fishery description; a description of recent performance of the fishery; a description of recent Board of Fishery actions related to the fishery; a discussion of social or biological issues that may be associated with each fishery; and, a description of ongoing research and management activities related to each fishery.

SECTION I: MANAGEMENT AREA OVERVIEW

MANAGEMENT AREA DESCRIPTION

The State of Alaska sport fishery program divides the Arctic-Yukon-Kuskokwim (AYK) Region into five separate fishery management areas; the Upper Tanana Area, the Lower Tanana Area, the Northwestern Area (Norton Sound and Kotzebue), the Upper Copper/Upper Susitna Area, and the Arctic-Yukon-Kuskokwim (AYK) Area. The Tanana River drainage is divided into two separate management areas because it contains population centers that produce high fishing pressure on fishery resources. Intensive, stock specific studies have been required in the Tanana drainage to provide needed biological information for fishery management because of higher fishery exploitation rates in this area. This report details the management activities in the Tanana River drainage only.

The AYK Region encompasses the majority of the landmass of the state of Alaska (Figure 1). The region contains 1,061,000 km^2 of land, some of the state's largest river systems (Yukon, Kuskokwim, Colville, and Noatak), thousands of lakes, and thousands of miles of coastline and streams. Regional coastline boundaries extend from Cape Newenham in the southwest, around all of western, northwestern and northern Alaska to the Canadian border on the Arctic Ocean (Figure 1). The region as a whole is very sparsely populated, with one densely populated center located in the Tanana River valley. Fairbanks (population about 31,000) is the largest community. In 1997 the Copper River drainage was added to Region III, and the above description of the region will be appropriately revised in subsequent AMRs (Figure 1).

TANANA RIVER AREA DESCRIPTION

The Tanana River is the second largest tributary of the Yukon River. The Tanana River basin (Figure 2) drains an area of approximately 116,500 km^2 (11.7 million ha). The mainstem of the Tanana River is a large glacial stream formed by the confluence of the Chisana and Nebesna rivers near Tok, which then flows in a generally northwest direction for some 917-km. Much of the human population in the AYK region is located along the Alaska, Richardson and Parks Highways, within the Tanana drainage. These highways and secondary roads provide much of the access to sport fisheries. Communities located within the Tanana drainage are Tanana, Nenana, Anderson, Healy, Cantwell, Manley, Livengood, Minto, Fairbanks, North Pole, Eielson AFB, Salcha, Big Delta, Delta Junction, Dot Lake, Tanacross, Tok, Tetlin, Northway, and Nabesna.

Regulations for the Tanana drainage sport fisheries are found in Chapter 70 of Title 5 of the Alaska Administrative Code. Prior to 1990 all southern drainages to the Yukon River were included in the Tanana Area. Harvest reports from these drainages are now included in the AYK area (Burr et al. 1998).

Intensive effort, stock specific studies and high sport fishery exploitation in the Tanana drainage dictate that it be split into the Upper Tanana and Lower Tanana management areas. During this reporting period Jerry Hallberg was the acting Area Management Biologist for the Lower Tanana drainage (Mouth of Tanana River to the eastern boundary of the Fairbanks North Star Borough), and was stationed in Fairbanks. Jerry Hallberg retired from the Department in the fall of 1998 and Tim Viavant has become acting Area Manager since and is co-author of this report.

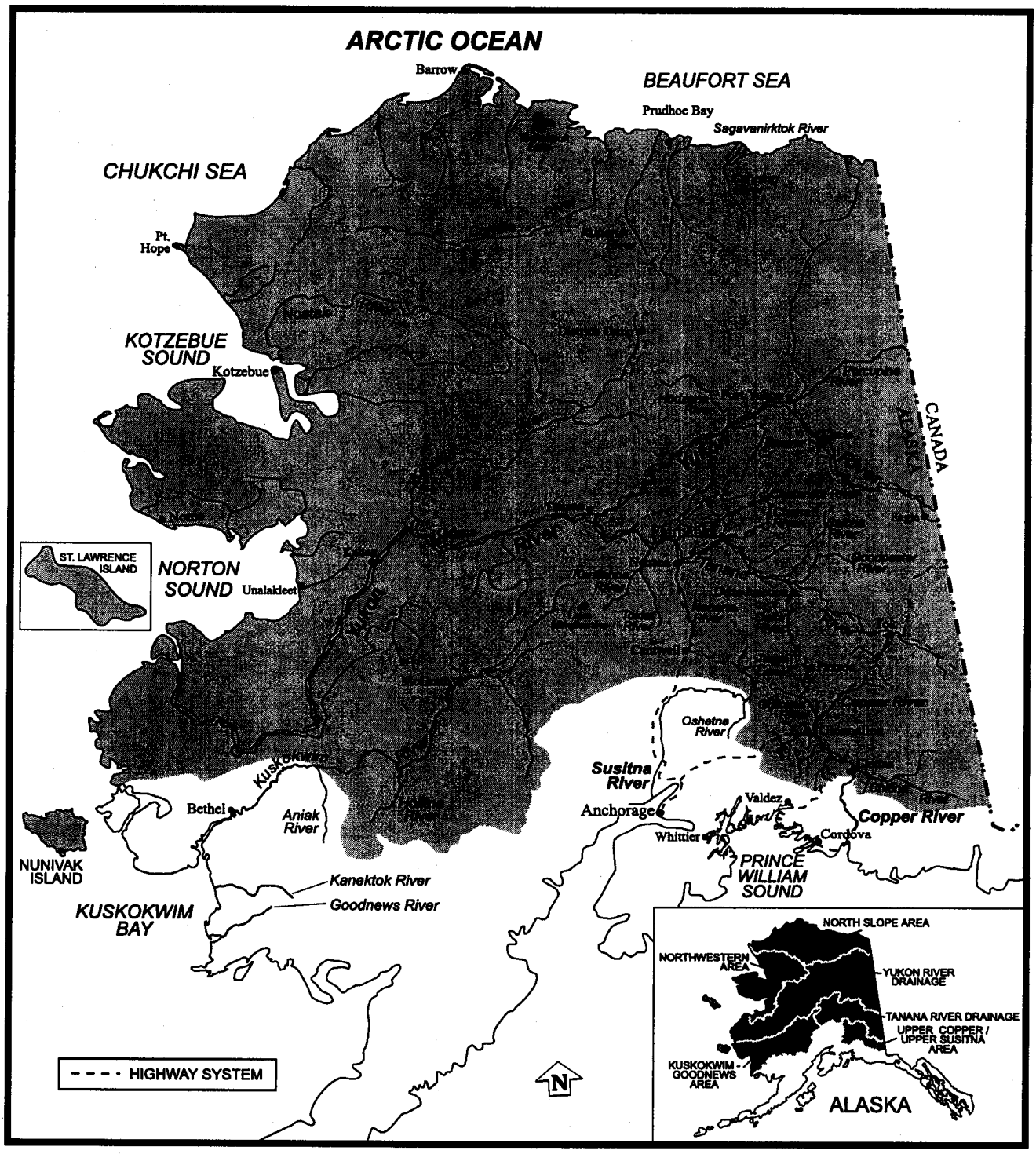

Figure 1.-The Arctic-Yukon-Kuskokwim Region.

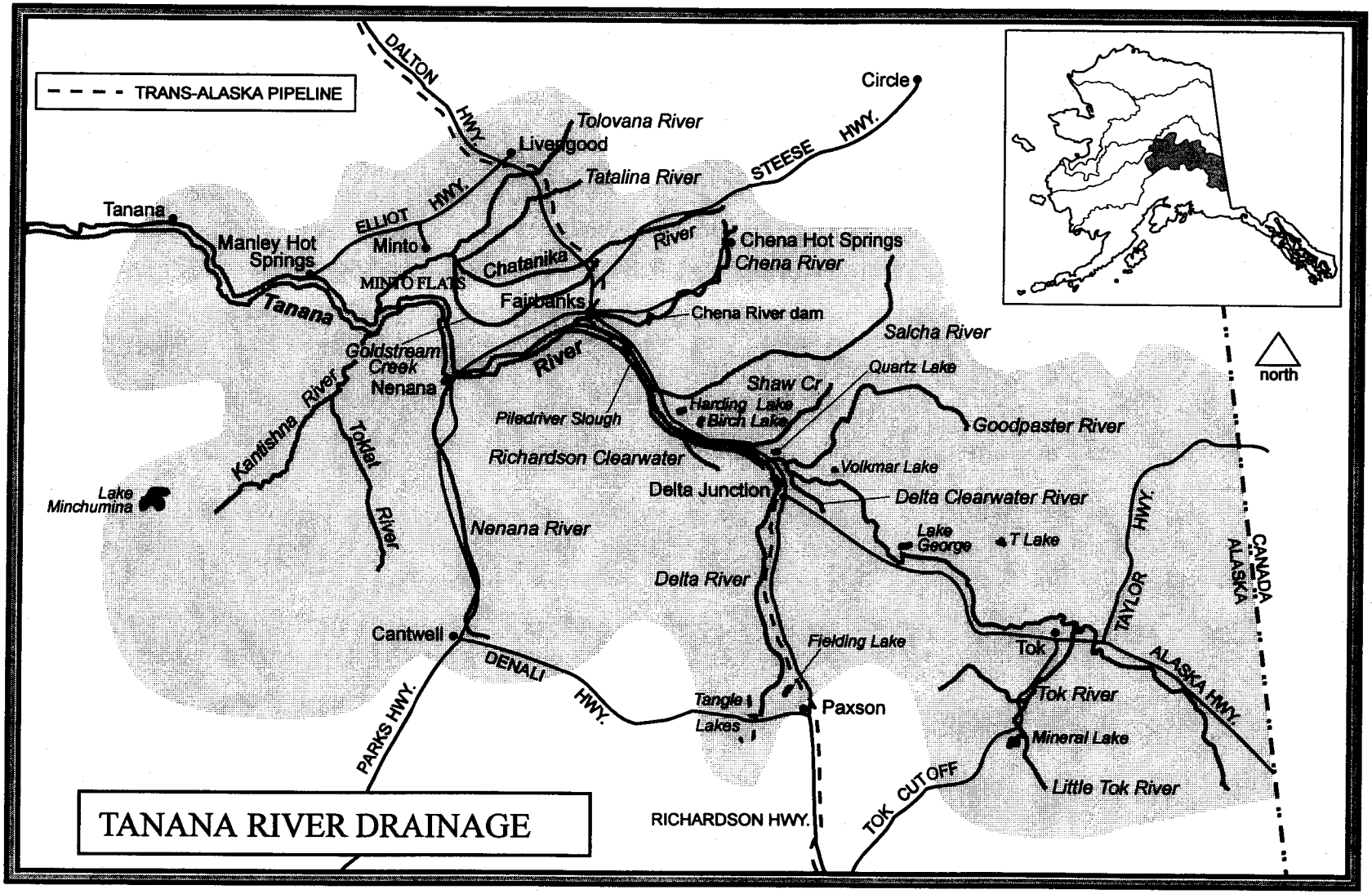

Figure 2.-The Tanana River drainage.

Fronty Parker, Area Management Biologist stationed in Delta Junction, manages the Upper Tanana drainage (remainder of the drainage).

FISHERY RESOURCE INVENTORY

There are 17 fish species known in the Tanana area of which 11 are commonly targeted by sport anglers. They include: chinook salmon *Oncorhynchus tshawytscha*, coho salmon *Oncorhynchus kisutch*, chum salmon *Oncorhynchus keta*, Arctic grayling *Thymallus arcticus*, burbot *Lota lota*, lake trout *Salvelinus namaycush*, inconnu (sheefish) *Stenodus leucichthys*, least cisco *Coregonus sardinella*, humpback whitefish *Coregonus pidschian*, and northern pike *Esox lucius*. Rainbow trout *Oncorhynchus mykiss* are not native to the drainage, but have been stocked in several locations. Arctic char *Salvelinus alpinus*, coho salmon, Arctic grayling and lake trout have also been stocked in selected waters of the Tanana River drainage.

ALASKA BOARD OF FISHERIES

The Alaska Board of Fisheries (BOF) process establishes regulations for fisheries in the Tanana drainage. Under the current operating schedule, the BOF considers regulations for Management Areas such as the AYK Area on a three-year cycle. The meeting generally occurs between October and the end of March. All fisheries are considered when statewide regulations are before the board. Public input concerning regulation changes is provided in this process through various means including direct testimony to the BOF and through participation in local fish and game advisory committees. To address conservation concerns the department has emergency order authority (5 AAC 75.003) to modify time, area, and bag/possession limit regulations. Emergency orders issued under this authority during the reporting period are summarized in Table 1.

During the reporting period (1995-1997) the deadline for submission of proposals for the AYK Finfish BOF meeting was April 10, 1997. The Alaska Board of Fisheries met in Fairbanks December 2-9, 1997. Seven regulation change proposals were submitted to the Alaska BOF for recreational fisheries within the Tanana River drainage. Oral and written reports by staff of the Alaska Department of Fish and Game and written and oral testimony by members of the public and by representatives of Advisory Committees were provided to the Alaska BOF during this meeting. The BOF adopted all seven proposed regulation changes in either original or amended form. Regulation changes are further discussed under the fisheries overview portions of this report, and the regulations approved during the 1997 BOF meeting is reproduced in AYK Sport Fishing Regulations. The next BOF meeting to address proposals regarding Tanana drainage sport fisheries is scheduled for December 2000.

ADVISORY COMMITTEES

Local Fish and Game Advisory committees have been established throughout the state to assist the Boards of Fish and Game in assessing fisheries and wildlife issues and proposed regulation changes in the areas that will be affected. Most active committees meet in the fall and winter on a monthly basis, usually prior to Board meetings. Advisory meetings allow opportunity for direct public interaction with Department staff who answer questions and provide clarification concerning proposed regulatory changes. The Boards Support Section within the Division of Administration provides administrative and logistical support for the BOF and Fish and Game Advisory Committees. During 1995-1997, the Department had direct support responsibilities for

Table 1.-Emergency orders issued for Tanana drainage sport fisheries from 1995 to 1997.

Year	E. O. Number	Explanation
1995	3-AG-01-95	Reduces the bag and possession limit of Arctic grayling in the Delta Clearwater River and Clearwater Lake from 5 per day to 2 per day.
1995	3-WF-03-95	Closure of Chatanika River to whitefish sport fishing.
1996	3-AG-01-96	Closes Piledriver Slough and 23-Mile Slough to the retention of Arctic grayling.
1996	3-AG-02-96	Reduces the bag and possession limit of Arctic grayling in the Delta Clearwater River and Clearwater Lake from 5 per day to 2 per day.
1996	3-WF-03-96	Closes the Chatanika River to whitefish sport fishing.
1997	3-AG-01-97	Closes the Delta Clearwater River and Clearwater Lake to the retention of Arctic grayling.
1997	3-NP-04-97	Reduces the bag and possession limit of Northern pike in Volkmar Lake from 5 per day to 1 fish per day.

56 Advisory committees in the state. Jim Marcotte is the Interior Region coordinator, stationed in Fairbanks.

A total of six advisory committees represent resource users in the Tanana drainage: Fairbanks, Delta, Minto/Nenana, Upper Tanana/Forty Mile, Middle Nenana River, and Lake Minchumina. Sport Fisheries Division staff participated in meetings in all these committees with the exception of Lake Minchumina.

SPORT ANGLER EFFORT

Recreational angling effort in the Tanana drainage has been estimated since 1977 using a mail-out survey (Mills 1979-1994, Howe et al. 1995-1997 & 1998 in print). This Statewide Harvest Survey (SWHS) estimates the number of angler-days of sport fishing effort expended by recreational anglers fishing Alaskan waters and as the catch and harvest of important sport species. The survey is designed to provide estimates of effort and harvest on a site-by-site basis but, unfortunately, is not designed to provide estimates of effort directed towards a particular species. From 1977 through 1997, anglers in the Tanana drainage area have expended an annual average of 149,225 angler-days or 7.3% of the total statewide effort (Table 2). The majority (average 73%) of sport effort in the AYK occurs in the Tanana drainage. In 1997, the Tanana drainage portion dropped to 51% (Table 2) of the AYK effort which resulted in the addition to the Glennallen Management Area (Upper Copper and Upper Susitina River drainages) which were added to the Region III area in 1997. The number of angler-day of effort for the Glennallen area for 1997 was 74,410. The predominance of Tanana drainage fisheries within the Region III area reflects the high human population density in the Tanana River valley, rather than higher levels of fish abundance. The largest amount of angler effort in a single fishery in 1997 was directed at the Chena River, in which 13,107 anglers fished 37,638 angler-days, expending nearly 23.8% of the total effort for the Tanana River drainage.

Some of the decline in effort in the Tanana drainage seen in 1992 is probably due to an Emergency order implemented on the Chena River that reduced the bag limit of Arctic grayling to zero. Angling effort for the Chena River decreased by almost 10,000 angler-days between 1991 and 1992, then increased from 1993 through 1996, from 12,654 days in 1992 to 45,942 days in 1996, and 37,638 in 1997, despite the continuation the zero bag limit for Arctic grayling in the Chena River (Table 3). The fraction of statewide effort expended in the Tanana drainage during 1995 - 1997 is near the 20-year average (7.3%). Sport angling effort by locations in AYK Region sub-areas for 1977 to 1997 is reproduced in Appendix A.

SPORT FISH HARVEST

From 1977 through 1997, recreational anglers in the Tanana drainage harvested an estimated 2,878,555 fish, accounting for an average of 4.6% of the annual estimated statewide recreational fish harvest and about 71.2% of the total estimated AYK harvest for the same period (Table 4). Sport harvest of all species since 1977 in the Tanana drainage reached an apparent peak in 1988 when over 198,000 fish were harvested. Harvest has been lower since, and was 63,925 in 1997. Several restrictive regulations to protect fish stocks are partially responsible for the decline in Tanana drainage harvest from 1993 to 1997. For example, in the Chena River, since 1992, harvest has been essentially zero. Restrictive regulations on the Chatanika River have reduced

Table 2.-Number of angler-days of sport fishing effort expended by recreational anglers fishing Tanana drainage waters, 1977-1997.

Year	Tanana Drainage Effort	Statewide Effort	Tanana Percent of Statewide	Region III Effort	Tanana Percent of Region III TRD
Average 1977-1986	128,560	1,599,436	8.0	168,245	76.4
1987	155,346	2,152,866	7.2	217,109	71.6
1988	173,706	2,311,291	7.5	233,559	74.4
1989	185,715	2,264,079	8.2	239,626	77.5
1990	184,887	2,453,284	7.5	245,629	75.3
1991	155,662	2,456,328	6.3	219,922	70.8
1992	120,848	2,540,374	4.8	181,852	66.5
1993	160,117	2,559,408	6.3	220,972	72.5
1994	148,633	2,719,911	5.5	239,626	62.0
1995	201,389	2,787,670	7.2	270,141	74.5
1966	201,389	2,787,670	7.2	270,141	74.5
1997	157,865	2,654,454	5.9	206,517	50.7
Total	3,133,732	40,972,577			
Average	149,225	2,048,629	7.3	206,517	73.3

Table 3.-Estimated effort and Arctic grayling harvest and catch from the Chena River, 1977-1997.

Chena River						
Year	Effort	Effort as % of Total Tanana Effort	Grayling Harvest	Grayling Harvest as % of Tanana Grayling Harvest	Grayling Catch	Grayling Catch as % of Tanana Grayling Catch
1977	30,002	0.41	21,723	0.38	NA	NA
1978	38,341	0.41	33,330	0.40	NA	NA
1979	22,138	0.29	27,977	0.40	NA	NA
1980	30,654	0.34	41,825	0.52	NA	NA
1981	26,753	0.31	27,548	0.37	NA	NA
1982	40,535	0.35	29,318	0.36	NA	NA
1983	40,902	0.36	21,866	0.24	NA	NA
1984	40,223	0.34	30,400	0.36	NA	NA
1985	27,133	0.24	8,038	0.13	NA	NA
1986	35,030	0.28	9,209	0.20	NA	NA
1987[a]	25,065	0.19	3,090	0.08	NA	NA
1988[a, b]	31,851	0.23	5,328	0.10	NA	NA
1989[a, b]	37,562	0.24	13,737	0.25	NA	NA
1990[a, b, c]	29,361	0.20	4,507	0.16	35,869	0.21
1991[a, b, c, d]	21,138	0.17	3,719	0.11	29,548	0.20
1992[d]	12,654	0.14	0	0.00	20,775	0.18
1993[e]	21,649	0.18	0	0.00	44,406	0.23
1994[e]	27,192	0.25	114	0.00	60,604	0.25
1995[e]	35,181	0.17	212	0.01	39,254	0.25
1996[e]	45,942	0.23	0	0.00	50,083	0.30
1997[e]	37,638	0.24	0	0.00	72,377	0.36
Averages						
1977-97	31,283	0.26	-	-	44,115	0.25
1977-86	33,171	0.33	25,123	0.33	NA	NA
1987-97	29,567	0.20	-	-	44,115	0.25

[a] Special regulations were in effect during 1987 through 1991. These regulations were: catch-and-release fishing from 1 April until the first Saturday in June; a 305 mm (12 inch) minimum length limit; and, a restriction of terminal gear to unbaited artificial lures.

[b] In addition to the special regulations, a catch-and-release area was created on the upper Chena River (river km 140.8 to 123.2).

[c] The daily bag and possession limits were reduced from five fish to two fish in 1990.

[d] During 1991, the Chena River and its tributaries were closed to possession of Arctic grayling from 1 July through 31 December.

[e] During 1992 through 1997, the Chena River and its tributaries were closed to possession of Arctic grayling.

Table 4.-Number of fish harvested by recreational anglers fishing Tanana drainage water, 1977-1997.

Year	Tanana Drainage Harvest	Alaska Harvest	Percent by Tanana Drainage Harvest	Region III Harvest	Percent by Tanana Drainage Harvest
Average 1977-1986	154,066	2,758,780	5.6%	214,535	71.8%
1987	139,907	3,207,138	4.4%	201,677	69.4%
1988	198,533	3,483,306	5.7%	264,371	75.1%
1989	188,045	3,213,867	5.9%	253,437	74.2%
1990	128,680	3,033,301	4.2%	174,175	73.9%
1991	152,774	3,311,513	4.6%	221,164	69.1%
1992	84,787	3,234,048	2.6%	131,486	64.5%
1993	105,711	2,989,720	3.5%	151,551	69.8%
1994	97,913	3,350,415	2.9%	152,676	64.0%
1995	84,848	2,909,979	2.9%	118,473	71.6%
1996	92,773	3,336,773	2.8%	137,479	67.6%
1997	63,925	3,294,273	1.9%	140,473	45.5%
1977-1997	2,878,555	62,952,471		4,092,316	
Average	137,074	2,997,737	4.6%	194,872	70.3%

whitefish harvest since 1991 (Table 5). Another likely reason for declines in harvest is the growing angler preference for catch and release fishing.

Arctic grayling was the most harvested species in the Tanana drainage until 1988. Since then stocked rainbow trout have dominated harvests, accounting for 47.2% of the average harvest from 1995-1997. From 1995 to 1997 Arctic grayling accounted for 16.4%, landlocked coho salmon for 11.4%, Northern pike for 9.2%, and Burbot for 4.5%, respectively, of the average harvest (Table 4). Rainbow trout and landlocked salmon, both stocked fish, represented 58.6% of the total harvest in the Tanana drainage (Table 6). The five most harvested sport fish species in the Tanana drainage accounted for approximately 88.8% of the average total harvest from 1995 through 1997. Significant increases in the harvest of chinook salmon in 1995 and 1996 reflect increasing angling effort directed at chinook salmon in the Chena and Salcha rivers. Sheefish is the least harvested species in the Tanana drainage, accounting for only 0.2% of the average total harvest from 1995-1997(Table 4).

CATCH AND RELEASE ANGLING

Estimates of the number of fish caught and released by recreational anglers fishing Tanana drainage waters became available for the first time during 1990. Estimates of catch (which includes harvest) for this reporting period come from the statewide mail survey (Howe et al. 1996, 1997, and 1998). Estimates show that recreational anglers released 78.6% in 1995, 77.2% in 1996 and 83.1% in 1997 of their catch in the Tanana drainage (Tables 6, 7 and 8). The proportions of fish released during this reporting period are substantially higher than the 59% reporting for 1992 (Arvey 1994). Considerable variability exists in the percent of fish released, depending on the species. For example, 71%, 69%, and 70.3% of burbot caught from 1995-1997 were harvested, whereas only 6.6%, 10.3%, and 6.3% of Arctic grayling caught were harvested from 1995-1997 (Tables 6, 7, and 8). Burbot and whitefish, for example, are sought after more for consumption than are Arctic grayling, rainbow trout and chinook salmon. Anglers appear to be engaging in more catch and release practices, perhaps in response to more restrictive regulations in the Tanana drainage.

COMMERCIAL HARVESTS

Tanana River stocks of chum, chinook, and coho salmon provide commercial fisheries in the Tanana River District. Commercial fishing is allowed by emergency order in three statistical areas (6a, b, c), from the mouth of the Tanana River to the mouth of the Chena River. Commercial fishing above the mouth of the Chena River is prohibited. Commercial harvests primarily target summer chum and chinook salmon, while coho salmon are caught incidentally. From 1995 to 1997, 4.6%, 6.9% and 11.1% of the total Yukon River commercial summer chum salmon harvest were caught in Tanana drainage (Table 9). For all salmon species, commercial harvest in the Tanana drainage was 9.5% of the Total Yukon harvest in 1995, 7.7% in 1996, and 6.4% in 1997 (Table 9). The fall chum salmon harvest in the Tanana drainage constitutes a higher proportion of the total Yukon harvest than the summer chum harvest, since lower river fisheries close early enough to allow more escapement (Table 9). In 1997, the Yukon River drainage fall chum salmon Management Plan was implemented directing that commercial fisheries only be allowed when run strengths are projected to be greater than 600,000 fall chum salmon. Based on in-season indicators, the Tanana River component of the fall chum salmon return was weaker than anticipated and closed to commercial fishing in 1997 (Bergstrom 1997).

Table 5.-Number of fish harvested, by species, by recreational anglers fishing Tanana drainage waters, 1977-1997.

	Salmon				Non-salmon								
Year	Chinook	Coho[a]	Coho[b]	Chum	Rainbow Trout	Lake Trout	Char[c]	Grayling	Northern Pike	Whitefish	Burbot	Sheefish	Other Fish
Average 1997-1986	699	357	32,064	564	20,731	1,785	542	73,403	9,823	10,162	3,615	197	124
1987	502	1,231	26,566	620	31,824	652	36	38,480	9,471	26,435	3,855	235	0
1988	853	2,237	32,342	491	78,345	2,221	909	52,569	11,986	11,775	3,733	982	0
1989	963	1,596	18,614	1,134	74,675	1,932	913	54,823	11,330	16,935	4,357	643	130
1990	439	1,719	13,943	55	64,143	896	830	28,414	7,348	6,891	3,799	169	34
1991	630	2,345	22,125	588	72,024	1,978	2,891	33,778	12,476	739	2,739	158	303
1992	118	1,115	14,019	690	37,547	993	2,088	14,983	6,184	3,246	3,620	184	0
1993	1,573	278	15,734	371	49,693	1,939	3,873	17,658	7,712	984	5,717	100	79
1994	1,871	1,165	10,350	260	33,400	1,582	1,799	24,741	16,299	940	5,165	166	175
1995	2,488	1,116	8,198	985	35,625	887	2,736	16,089	10,620	493	4,934	310	367
1996	3,102	1,341	11,818	1,759	50,419	654	2,767	11,334	6,618	195	2,091	40	635
1997	1,878	1,338	7,505	308	27,924	730	1,957	12,257	5,016	967	3,725	46	274
Mean[d]	1,019	907	23,898	614	36,330	1,539	1,248	49,484	9,680	8,153	3,804	238	154
95-97[e]	2,489	1,265	9174	1,017	37,989	757	2,487	13,227	7,418	552	3,583	132	425
Percent[f]	3.1	1.6	11.4	1.3	47.2	0.9	3.1	16.4	9.2	0.7	4.5	0.2	0.5

[a] Anadromous salmon.

[b] Landlocked coho and chinook salmon.

[c] Includes Arctic char and Dolly Varden.

[d] Mean harvest from 1977-1997.

[e] Mean harvest from 1995 to 1997.

[f] Percent of average harvest from 1995 to 1997.

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Table 6.-Number of fish caught and harvested (kept) by recreational anglers fishing Tanana drainage waters during 1995.

Species	Catch	Harvest	Percent Harvested
Salmon:			
Chinook	5,866	2,488	42.4
Coho[a]	7,183	1,116	15.5
Coho[b]	21,281	8,198	38.5
Chum	4,067	985	24.2
Non-Salmon:			
Rainbow trout	102,410	35,625	34.8
Lake Trout	3,314	887	26.8
Char[c]	8,300	2,736	33.0
Arctic grayling	156,611	16,089	10.3
Northern pike	53,963	10,620	19.7
Whitefish	1,766	493	27.9
Burbot	6,966	4,934	70.8
Sheefish	602	310	51.5
Other fish	508	367	72.2
Total	372,837	84,848	22.8

[a] Anadromous salmon.

[b] Landlocked coho and chinook salmon

[c] Includes Arctic char and Dolly Varden.

Table 7.-Number of fish caught and harvested (kept) by recreational anglers fishing Tanana drainage waters during 1996.

Species	Catch	Harvest	Percent Harvested
Salmon:			
Chinook	8,713	3,102	35.6
Coho[a]	4,986	1,341	26.9
Coho[b]	29,279	11,818	40.4
Chum	8,408	1,759	20.9
Non-Salmon:			
Rainbow trout	149,387	50,419	33.8
Lake trout	4,400	654	14.9
Char[c]	8,658	2,767	32.0
Arctic grayling	172,302	11,334	6.6
Northern pike	43,279	6,618	15.3
Whitefish	789	195	24.7
Burbot	3,027	2,091	69.1
Sheefish	226	40	17.7
Other fish	725	635	87.6
Total	475,539	97,913	21.4

[a] Anadromous salmon.

[b] Landlocked coho and chinook salmon

[c] Includes Arctic char and Dolly Varden.

Table 8.-Number of fish caught and harvested (kept) by recreational anglers fishing Tanana drainage waters during 1997.

Species	Catch	Harvest	Percent Harvested
Salmon:			
Chinook	5,888	1,878	31.9
Coho[a]	5,838	1,338	22.9
Coho[b]	26,440	7,505	28.4
Chum	1,656	308	18.6
Non-Salmon:			
Rainbow Trout	85,847	27,924	32.5
Lake Trout	3,317	730	22.0
Char[c]	6,996	1,957	28.0
Arctic Grayling	195,934	12,257	6.3
Northern Pike	36,221	5,016	13.8
Whitefish	2,820	967	34.3
Burbot	5,296	3,725	70.3
Sheefish	647	46	7.1
Other Fish	960	274	28.5
Total	377,860	63,925	16.9

[a] Anadromous salmon.

[b] Landlocked coho and chinook salmon

[c] Includes Arctic char and Dolly Varden.

Table 9.-Commercial salmon harvest in Tanana drainage and percent of Yukon River drainage harvest from 1995 to 1997 (Bergstrom et al. 1997).

	1995			1996			1997		
Species	Tanana Total	Yukon Total	% Tanana	Tanana Total	Yukon Total	% Tanana	Tanana Total	Yukon Total	% Tanana
Chinook	2,747	124,052	2.20	447	90,192	0.50	2,728	113,610	2.4
Summer chum	37,428	818,414	4.60	46,890	682,233	6.90	25,287	228,252	11.1
Fall chum	74,117	283,057	26.20	17,574	105,630	16.60	0	58,187	0.0
Coho	6,900	47,013	9.50	7,142	55,982	12.80	0	35,320	0.0
Total	121,192	1,272,536	9.50	72,053	934,037	7.70	28,015	435,369	6.4

Limited commercial fisheries exist for freshwater species such as sheefish, burbot, northern pike and whitefish however, the majority of the freshwater harvest is from sport and subsistence use.

SUBSISTENCE AND PERSONAL-USE HARVESTS

Subsistence and personal-use fisheries are allowed in most of the Tanana drainage. A subsistence permit is not required for non-salmonid species from the mouth of the Tanana River up to and including the Wood River. However, a subsistence permit is needed for northern pike in the waters of the Tolovana River upstream from its confluence with the Tanana River. Subsistence fishing is closed in the Tanana River from the eastern bank of the Salcha River upstream to the mouth of the Volkmar River on the north bank of the Tanana, and the mouth of the Johnson River on the south bank of the Tanana River. In the closed area, however, whitefish and suckers can be taken under the authority of a whitefish and sucker personal-use permit. Deadman, Jan, and Fielding lakes within the Tanana drainage are also closed to subsistence fishing.

Prior to the fall of 1995 a subsistence permit could be obtained to spear chum salmon carcasses in the Delta River after November 21. The Board of Fisheries closed the Delta River in 1994 to all forms of fishing from August 15 through May 15 between the mouth of the Delta River and a department marker placed two miles upstream. The Board concluded that the area is a critical spawning area for chum salmon, and that carcass collection disturbs the spawning area.

Upstream of the Volkmar River (N. side of the Tanana) and the Johnson River (S. bank of the Tanana River), a subsistence permit is required for non-salmonid species in the remainder of the Tanana drainage. Even though a permit is required, subsistence fisheries that target non-salmon species such as pike, sheefish, burbot, and whitefish are inadequately documented (Bergstrom et al 1991). The permit requirement was little known to fishermen in villages along the upper Tanana River and not enforced as of 1988 (Marcotte 1991). In 1987-1988, the harvest of non-salmon fish species accounted for 33.8% of the total edible pounds of fish and wildlife resources in five communities. Household harvests of non-salmon fish ranged from about 100-500 pounds. The majority of the non-salmon subsistence harvest is made up of whitefish and pike (Marcotte 1991).

The Division of Commercial Fisheries Management and Development (CFMD) documents subsistence and personal-use harvest records for salmonid species. In 1995, 1996, and 1997, subsistence and personal-use caught salmon in the Tanana drainage accounted for 25.5%, 18.6% and 13.4% of the total Yukon River subsistence and personal-use harvests (Table 10). Fall chum in the Tanana drainage account for a significant percentage of the Yukon River subsistence salmon harvest, making up nearly 38% in 1995, and 28% in 1996 and 21% in 1997, of the total Yukon River subsistence salmon harvest (Table 10).

MANAGEMENT ACTIVITIES

The management staff began drafting Fishery Management Plans in 1992 for each important fishery. By the end of 1992, plans for sport fisheries at Birch, Chena, and Quartz lakes, Piledriver Slough, the Chatanika River, Chena River Arctic grayling rehabilitation, and Small Stocked Lakes in the Tanana drainage had completed public review and comment and were finalized. Finalized plans are subject to revision. Managers use the plans as planning and evaluation tools. Since 1993, the remaining plans have been finalized on the dates listed:

Table 10.-Subsistence and personal-use salmon harvest in Tanana drainage and percent of Yukon River drainage harvest from 1995 to 1997 (Borba and Hammer 1996, 1997, and 1998).

	1995			1996			1997		
Species	Tanana Total	Yukon Total	% Tanana	Tanana Total	Yukon Total	% Tanana	Tanana Total	Yukon Total	% Tanana
Chinook	2,178	48,934	4.50	1,392	45,886	3.00	3,025	57,430	5.3
Summer chum	12,441	119,503	10.40	8,391	125,843	6.70	4,215	113,211	3.7
Fall chum	50,031	131,369	38.10	36,832	129,614	28.40	19,834	95,425	20.8
Coho	19,219	28,642	67.10	15,091	30,802	49.00	11,945	24,295	49.2
Total	83,869	328,448	25.50	61,697	332,145	18.60	39,019	290,361	13.4%

1. Delta Clearwater River coho salmon fishery, April 1993.
2. East Twin Lake sport fishery, April 1993.
3. George Lake sport fishery, April 1993.
4. Minto Flats sport fishery, April 1993.
5. Volkmar Lake, April 1993.
6. Chena River king salmon sport fishery, May 1993
7. Salcha River king salmon sport fishery, May 1993.
8. Tangle Lake System sport fishery, May 1993.
9. Delta Clearwater River Arctic grayling sport fishery, June 1993.
10. Fielding Lake sport fishery, June 1993.
11. Goodpaster River sport fishery, June 1993.
12. Harding Lake sport fishery, June 1993.
13. Richardson Clearwater River sport fishery, June 1993.
14. Salcha River Arctic grayling sport fishery, June 1993.
15. Shaw Creek sport fishery, June 1993.
16. Tanana River burbot sport fishery, June 1993.
17. Chena River Arctic grayling sport fishery, December 1993.

Management activities during the report period were directed by Fred Andersen who supervised the following Area Management Biologists; Jerry Hallberg, Fronty Parker, Fred DeCicco, John Burr, and Cal Skaugstad. Lake stocking activities were the responsibility of Cal Skaugstad. Tim Viavant directs access coordination. Area management responsibility and emergency order authority was vested with Jerry Hallberg for the Lower Tanana Area and Fronty Parker for the Upper Tanana Area.

ACCESS PROGRAM

The Wallop-Breaux amendment to the Federal Aid in Sport Fish Restoration Act mandates that at least 12.5% of the federal funds collected from taxes on sport fishing equipment be used by the states for the development and maintenance of boating access facilities. This mandate is fulfilled by the ADF&G Sport Fish Access Program, which consists of two parts. The first part, the Boating Access Coordination Program, involves large capital improvement projects, such as boat ramps, parking areas, fishing docks, and land acquisition, which are subjected to public review under the National Environmental Policy Act. The second portion of the program is called the Small Access Site Maintenance Program.

The Small Access program is an ongoing, annually funded program. Activities include placing and maintaining signs at lake and river angling-access sites, constructing and maintaining pedestrian and Off-Road Vehicle (ORV) trails to fishing sites and providing portable toilets, picnic tables, and trash removal at heavily used roadside angling sites. The program also secures permanent rights-of-way on public and private land to ensure continued public access to fishing sites, maintains access roads to boating or angling sites that might not otherwise be maintained, constructs and maintains outhouses and tent platforms at remote angling sites, provides public-

use ice-fishing houses for rental at several large stocked lakes, and produces and prints publications informing anglers about fishing and boat launching opportunities. The history of major and small access projects completed in the Tanana drainage from 1988 to 1994 can be found in Burr et al (1998).

Access program projects completed from 1995 to 1997 are as follows. Six public-use ice-houses were constructed and turned over to both the State of Alaska and Fairbanks North Star Borough Divisions of Parks for rental at three of the areas largest stocked lakes. Handicap access to the boat launch at the Harding Lake State Recreation Area was improved. Four parcels of land totaling over 10 acres were purchased on the shore of George Lake to provide public property for angler-access, eliminating trespass problems. Trails to a number of remote lakes were constructed or maintained, and camping areas at George Lake, Donna Lakes, and Forest Lake were constructed. Applications for rights-of-ways for over 20 trails and angler-access sites were filed with Department of Natural Resources, Division of Lands. Signs marking angler access sites were periodically replaced due to vandalism, and new signs were placed as needed.

FUTURE PROJECTS

Several projects are currently in the planning and environmental phases. These projects include upgrading access and parking at the Dalton Highway Yukon River Bridge boat launch, re-dredging the boat channel and enlarging the launching basin at the Harding Lake State Recreation Area, and major improvements to the boating access infrastructure at the Birch Lake State Recreation Site. The production and printing of several publications are planned, including a brochure on Interior Alaska River boat ramps and river and stream angling sites.

MAJOR BIOLOGICAL AND SOCIAL ISSUES IN THE TANANA DRAINAGE

1. Chena River Grayling Stock Status.

   The estimated abundance of Arctic graying in the Chena River has remained at a level significantly lower than the estimates from the early 1980's. Because of this, the grayling fishery on the Chena remains catch-and-release only. Along with a lack of recovery of the stock to historical levels, effort directed at catch-and-release fishing has increased dramatically in the past few years, prompting some concern over the amount of hooking mortality the stock can sustain.

2. Chinook Salmon Fisheries.

   During the reporting period escapements of chinook salmon increased to Tanana Drainage rivers. Concurrently, there has been an increase in angling effort in the three main chinook salmon fisheries in the Tanana drainage. In prior years the public felt the sport fishery allocations were too small relative to other uses. If and when chinook escapements shift from high escapements to lower ones, the public will have a greater interest in allocation.

3. Interior Logging Practices.

   Public controversy has developed over State Division of Forestry timber harvest plans along the South bank of the Tanana River over an area spanning 30 miles downstream of the Tanana River Bridge at Big Delta. The area contains a large number of spring fed sloughs that provide chum salmon spawning habitat. The Divisions of Sport Fish,

Commercial Fish, and Habitat have been opposed to issuing Title 16 permits to allow road and ice bridge building in the area without guarantees of spawning habitat protections.

4. Major Gold Mining Operations

   Gold exploration has lead to the development of large-scale mining operations in the Tanana drainage. Fort Knox near Fairbanks and the Pogo mine in the Upper Goodpaster River are two examples of large-scale mineral resource development. The Pogo Mine site on the Goodpaster River consists of nearly 200 square miles of claims. The areas surrounding these claims are watersheds that influence important fish streams, and the Division is concerned over water quality issues at both of these large mines.

6. Federal Subsistence Management of Fisheries.

   There are a number of management concerns regarding the Federal takeover of Subsistence management of fisheries in the state. These include enforceability of dual sets of regulations, public confusion over jurisdiction, increases in subsistence harvests related to customary trade, loss of sport fishing opportunity, and the lack of mechanisms for cooperative management of stocks supporting both subsistence and sport harvests.

7. Rainbow Trout Introduction.

   A local angling organization lobbied Sport Fish Division for several years to begin stocking rainbow trout into the Chena or Chatanika rivers. The Division studied the availability of overwintering habitat for rainbow trout in area streams, and found it very limited. Due to concerns over the viability of an introduced stock, and over concerns of interspecific competition with native Arctic grayling and chinook salmon, the Division has decided against attempting to introduce rainbow trout into any interior streams, in accordance with statewide policy.

8. Closure of Native Owned Lands

   As the debate over subsistence use of fish and game resources in the state has become more contentious, much of the land in the state owned by regional and village native corporations has been closed to public access, or open to access by permit only. This has, in some instances, resulted in a loss of angling opportunity. These closures have also raised public access issues related to navigability of waters, and of the delineation of the boundaries between private lands and public lands below the mean high water line of waters.

SECTION II: FISHERIES

Major sport fisheries in the Tanana drainage are discussed by species. Introductory remarks for each species are followed by discussion on major fishery(s) including; 1) background and historical perspective, 2) fishery objectives, 3) recent fishery performance, 4) recent Board of Fisheries actions, 5) current issues and, 6) ongoing research and management activities. A summary of the historical harvest of fish in the Tanana drainage is presented in Table 5.

ARCTIC GRAYLING SPORT FISHERIES

Arctic grayling are popular with recreational anglers, are generally abundant, and occur in most rivers and in many lakes in the region. Sport anglers harvest more Arctic grayling than any other wild species in the Tanana drainage (Table 5). From 1977 through 1997, an average of 49,484 grayling have been harvested annually (Table 5), accounting for 36% of the fish harvested in these waters. Harvests between 1977 and 1990 were high due to the large harvest from the Chena River. However, declines in the Chena River population in the early 1990's caused significant declines in harvest in the region such that during the reporting period only 16.4% of the Tanana drainage harvest were grayling. Reduction in harvests can be attributed to a series of restrictive regulations, including catch-and-release only grayling fishing in the Chena River to insure sustained yield of the fisheries. Other important grayling fisheries in the Tanana drainage include Piledriver slough, the Delta Clearwater, Chatanika, Salcha, Delta, and Goodpaster rivers, Fielding Lake, and the Tangle Lake system.

The background regulation for Arctic grayling in the Tanana River drainage is five fish per day and five in possession with no size limit. In waters with conservation concerns, regulations are more restrictive with lower bag limits, size, season, and gear-type restrictions

Chena River Arctic Grayling Sport Fishery

Background and Historical Perspective

The Chena River is a clear to slightly tannic-stained stream containing resident populations of Arctic grayling and whitefish throughout its length, and of northern pike and burbot in its lower reaches. The river also supports populations of chinook and chum salmon. Some sheefish are present. The river is road-accessible along much of its' upper reaches and lower reaches, with its' lower reaches flowing through Ft. Wainwright and the city of Fairbanks. The Arctic grayling fishery at the Chena occurs primarily in the upper reaches along Chena Hot Springs Road and in the lower reaches in the vicinity of Fairbanks. The grayling fishery at the Chena River is accessed mostly by road, but also by boat. The fishery is almost entirely an open water fishery, occurring from April through October.

The Chena River supports fisheries for Arctic grayling and chinook salmon. The lower river also supports harvests of northern pike, whitefish, sheefish and burbot, but most of the effort at the Chena River is probably directed toward grayling. From 1977 through the mid 1980s, the Arctic grayling fishery on the Chena River was the largest grayling fishery in the state of Alaska. Fishing effort averaged over 33,000 angler-days and harvest averaged over 25,000 fish between 1977 and 1986 (Table 3). Total effort for the Chena River averaged 33 % of all effort in the Tanana drainage between 1977 and 1986, and averaged 20% of all effort in Tanana drainage between 1987 and 1997.

The grayling fishery on the Chena River has probably always included a significant level of catch-and-release fishing. Estimates of catch (vs. harvest) were not available before 1990, and the regulations in place before and after 1990 were markedly different, so inferences about percentages of fish caught that were harvested before 1990 can not be made from data from 1990 forward. Harvests from the fishery during the years that catch estimates are available, and the fishery was still open to harvest, represent only about 12% of total catch (Table 11). After 1991, the fishery was closed to harvest, and catches declined between 1991 and 1992, but then increased by over 100% between 1992 and 1993, and increased by 36% between 1993 and 1994.

The population of Arctic graying in the upper Chena River began to decline in the mid-1980s. Harvest decreased 76% from 1984 to 1985, although effort declined only 39% during that same period. Stock assessment projects during 1986 (Clark and Ridder 1987) and 1987 (Clark and Ridder 1988) reported a decline in population abundance of 49% between these two years (Table B). As the population declined, more restrictive regulations were implemented. The bag limit was reduced (from ten per day to five per day), fishing was closed during the spring spawning period, and the use of bait was eliminated in 1987.

Although harvest decreased for two years after the imposition of these restrictions, and abundance estimates increased, both harvest and effort increased substantially in 1989, prompting the lowering of the bag limit from five per day to two per day. This additional restriction was not sufficient to reduce harvest to sustainable levels, and in 1991 the fishery was further restricted to catch-and-release only. During 1992, effort on the Chena River decreased substantially from the average of the previous ten years, but in the next few years, effort increased rapidly to levels higher than before regulations were first restricted, despite the continuation of catch-and-release only regulations.

Fishery Objectives

There is currently no Management Plan in place for Arctic grayling in the Chena River. There was a Chena River Arctic Grayling Conservation and Rehabilitation Plan adopted in 1992. That Plan is no longer in effect, as the rehabilitation enhancement efforts outlined in the Plan proved to be unsuccessful, and are no longer being undertaken. In the absence of a management plan, the objectives for the Chena River Arctic grayling fishery are to not allow a consumptive fishery until the population of Arctic grayling in the assessed section of the river exceeds 40,000 fish, 230 mm or larger, two years consecutively, while allowing the opportunity for catch-and-release angling.

Recent Fishery Performance

Despite the continuation of catch-and-release only regulations for Arctic grayling in the Chena River, the fishery has remained very popular. Although effort declined substantially during 1992 from the previous ten-year average, effort increased from 1993 through 1997, and total fishing effort for the Chena has remained above 37,000 angler-days for 1995 to 1997 (Table 3). Although separate estimates of angler effort for each fishery (species) are not available, managers believe that some of the increase in angler effort from 1992 for the lower Chena River is due in part to the increase in fishing for chinook salmon. However, the increase in effort observed in the upper Chena River for the same period is almost entirely directed toward Arctic grayling since they are the most common sport fish species found in this portion of river, and since the Chena is closed to salmon fishing in this portion of the river.

The grayling population in the Chena River appeared to be rebuilding during the early 1990s, with abundance estimates increasing to almost 40,000 fish in 1995. Subsequently, population estimates declined, decreasing between 1996 and 1998 by over 30%. Despite the decline in abundance, estimated catches rose 84% during the same period, reaching an all-time high of over

Table 11.-Estimated abundance[a], harvest[b], and catches[b] of Arctic grayling from the Chena River, 1987 to 1997[c].

Year	Estimated Catch	Estimated Harvest	Estimated Abundance
1987	NA	2,681	29,580
1988	NA	4,582	20,268
1989	NA	12,635	16,236
1990	35,869	4,439	29,130
1991	29,548	3,719	24,657
1992	20,775	0	25,211
1993	44,406	0	34,209
1994	60,604	114	39,414
1995	39,254	212	31,016
1996	50,083	0	39,858
1997	72,377	0	35,837
1998	NA	NA	27,565

a. Abundance is for fish age-3 and older, within sections of the river included in mark-recapture experiments.

b. Harvest and catch estimates are for the entire Chena River.

c. Data from Mills (1979-1994), Howe et al (1995-1998), and Ridder and Fleming (1997).

72,000 fish in 1997 (Table 11). It is important to note that catch is estimated for the entire river and its tributaries, while abundance is estimated for only a portion of the river. Abundance estimates are trend indicators.

Recent Board of Fisheries Action

There were no proposals submitted to the Board of Fisheries related to Chena River Arctic grayling during the 1995-97 board cycle, and no board action was taken relating to this fishery.

Current Issues

Despite the continuation of catch-and-release only regulations, the population of Arctic grayling in the Chena River has not recovered to levels of the early 1980s. Effort and catch levels remain high, but there has been little pressure from user groups to re-open the river to consumptive harvest.

The U.S. Army Corps of Engineers is proposing to dredge several sections of the lower Chena River in order to improve navigability. The proposed dredging has raised concerns regarding displacement of overwintering fish and changes to fish habitat.

Ongoing Research and Management Activities

Division of Sport Fish has conducted research on the stock status of Arctic grayling in the Chena River every year since 1971. Early research estimated population abundance in index sections of the river, but research since the late 1980s has involved estimating the abundance for the entire lower 140 km of river. In addition to conducting ongoing stock assessment of Arctic grayling in the Chena River, a radio-telemetry project was initiated to investigate the contribution of fish upstream of the assessment area to the spawning stock in the main river.

In 1996 a study was conducted to determine the abundance of Arctic grayling in the lower 8.8 km of Badger Slough, tributary of the lower Chena that supports a spawning subpopulation of the Chena River, and to determine the relative proportion of Arctic grayling tagged in Badger Slough that were recovered in the mainstem lower Chena River. The Department will continue some form of stock assessment of Arctic grayling in the Chena River for at least the next few years.

Management activities related to this fishery in the last several years have involved pubic education regarding the stock status and the current regulations. Regulatory signs have been posted at angler-access sites along the river, and information on catch-and-release techniques has been provided at campgrounds in the Chena River State Recreation Area.

In an attempt to increase grayling abundance the Department initiated a program of stock enhancement, stocking hatchery and pond-reared Arctic grayling. The Chena River grayling were the brood source for this experiment. Approximately 61,000 fish (each year) were stocked in the lower 160 km of the Chena River during 1993 and 1994. Survival of these fish was estimated as part of ongoing stock assessment efforts during 1993, 1994, and 1995. Survival of introduced fish was determined to be too low to justify the cost of the enhancement effort and stocking was not continued after 1994 (Clark 1994, 1995 and 1996).

Other Stream and Lake Arctic Grayling

Significant sport fisheries for Arctic grayling exist in Piledriver Slough; the Chatanika, Salcha, Richardson Clearwater, and Goodpaster rivers; and Tangle and Fielding lakes.

Fishery Descriptions and Historical Perspective

The Chatanika, Salcha, Richardson Clearwater and Goodpaster rivers are all clearwater rivers. All but the Chatanika are mostly or only accessible by riverboat or floatplane. The Chatanika River is road accessible along a large portion of its upper reaches. Both Tangle and Fielding lakes are road accessible, and both are the sites of either state or federally managed recreation areas. Piledriver Slough is a clearwater stream that flows for some 35 km parallel to the Richardson Highway just across from Eielson Air Force Base. The slough is road accessible at several points, is stocked annually with rainbow trout, and supports a very popular fishery, accounting for around 15,000 angler-days per year between 1990 and 1993.

Besides the grayling fishery on the Chena River, the Chatanika and Salcha rivers supported the largest annual grayling harvests in the Tanana drainage throughout the 1980s (Table 12). Harvests have fallen in these two fisheries since the late 1980s, and the grayling fishery at Tangle Lakes now supports the largest grayling harvest in the Tanana drainage. Grayling harvests for all of these fisheries combined have fallen substantially over the past five years. This decline is at least partially due to the stock decline and subsequent imposition of catch-and-release only regulations at Piledriver Slough in 1993, but harvests at almost all of these fisheries have fallen from the levels of the mid to late 1980s.

A relatively large Arctic grayling fishery developed at Piledriver Slough since the late 1970s, when the diking of the upstream portion from the Tanana River created clear water conditions. Anglers have been attracted to the fishery by the stocking of rainbow trout by ADF&G since 1987. Grayling spawning and rearing habitat has been reduced by beaver dams. The grayling population at Piledriver Slough fell dramatically between 1992 and 1997, with estimated abundance reduced almost by 50% (Fleming 1997, 1998).

As is typical of grayling fisheries these fisheries take place during the open-water season. Much of the reported catch from most of these fisheries is released rather than harvested. Catches from the entire drainage (excluding the Chena River) have generally been between five and ten times harvests (Table 13). Estimated catches for the entire Tanana drainage (excluding the Chena River) peaked in 1994 at over 180,000 fish, then dropped by over 30% between 1994 and 1995, and increased somewhat between 1996 and 1997.

Regulations for Arctic grayling in many of these fisheries were made more restrictive between the early 1970s and the mid-1990s. The drainage wide bag and possession limit was reduced from 10 per day to 5 per day in 1975. A 12 inch minimum size limit was implemented and the use of bait on small hooks was eliminated at the Chena, Salcha, and Richardson Clearwater rivers, and at Piledriver Slough in 1987, and a spring spawning closure was imposed at all of these locations except Piledriver Slough. A spring spawning closure and a 12 inch minimum length limit was implemented on the Chatanika River above the Elliot Highway Bridge in 1992. Piledriver Slough was restricted to catch-and-release only in 1993.

Stock assessments of Arctic grayling have been done at each of these locations since the mid-1980s. Abundance estimates or stock composition estimates were done during one or more years at the Salcha, Chatanika, and Goodpaster rivers, and at Fielding and Tangle lakes between 1987 and 1990. More recently, stock assessment has been done at Piledriver Slough each year except 1995 between 1990 and 1996, and at the Chatanika, Salcha, and Goodpaster rivers during 1994.

Table 12.-Estimated sport harvest of Arctic grayling in selected fisheries in the Tanana River drainage (1977-1997).

Year	Piledriver Slough[a]	Chatanika River	Salcha River	Richardson Clearwater River	Goodpaster River	Fielding Lake	Tangle Lake	[b]Tanana Drainage
1977	NR	6,737	6,387	NR	NR	NR	NR	36,070
1978	NR	9,284	9,067	NR	NR	NR	5,786	49,945
1979	NR	6,121	5,980	NR	NR	NR	3,466	42,266
1980	NR	5,143	5,351	NR	NR	NR	5,522	38,325
1981	NR	3,808	3,983	1,562	NR	1,913	6,858	47,740
1982	NR	6,445	6,843	1,729	NR	3,044	9,590	52,435
1983	5,822	9,766	9,640	2,822	3,021	2,035	7,794	70,497
1984	3,751	4,180	13,305	NR	1,194	935	4,829	53,226
1985	NR	7,404	5,826	NR	2,757	1,023	5,029	55,522
1986	NR	2,692	7,540	NR	1,508	1,329	4,781	36,772
1987	4,907	5,619	4,762	NR	1,702	910	2,467	35,390
1988	8,095	8,640	2,383	NR	1,273	1,492	3,711	47,331
1989	4,459	6,934	5,721	972	1,964	1,283	3,136	41,086
1990	2,380	4,237	1,992	523	760	1,097	2,853	23,907
1991	3,987	2,642	1,688	1,419	636	1,284	4,917	30,059
1992	1,030	1,751	1,592	436	766	548	2,608	14,983
1993	759	2,001	1,768	405	588	1,055	3,741	17,658
1994	57	2,659	2,308	591	700	1,244	5,668	24,627
1995	0	2,108	2,685	244	325	944	2,449	15,877
1996	0	383	1,747	47	596	634	2,564	11,333
1997	0	1,306	2,300	69	532	808	2,992	12,258
Averages								
1977-97	4,304	4,755	4,898	903	1,221	1,263	4,538	36,062
1977-86	-	6,158	7,392	2,038	2,120	1,713	5,962	48,280
1987-97	-	3,480	2,631	524	895	1,018	3,374	24,955

[a] Closed to retention of Arctic grayling in 1993.
[b] Excluding Chena River.
[c] Averages for estimated harvests when fishery was open for the entire year.
NR = Harvest estimate not available.

Table 13.-Estimated sport catches of Arctic grayling from selected fisheries in the Tanana drainage, 1990-1997.

Year	Piledriver Slough[a]	Chatanika River	Salcha River	Richardson Clearwater River	Goodpaster River	Fielding Lake	Tangle Lake	[a]Tanana Drainage
1990	34,840	17,960	8,609	996	3,342	2,802	12,322	135,189
1991	30,012	12,830	9,600	2,984	905	3,815	16,021	117,344
1992	15,252	11,570	8,265	2,104	3,599	2,585	14,953	94,858
1993	32,036	14,283	11,254	1,792	1,923	7,670	23,327	148,682
1994	31,324	24,750	9,994	5,832	1,809	7,657	26,475	183,302
1995	17,431	15,646	12,173	1,771	3,177	3,811	14,001	115,606
1996	16,667	11,217	10,327	3,326	2,921	3,114	17,383	114,595
1997	19,092	17,798	19,798	3,987	4,448	1,651	21,035	130,093
Average	24,582	15,757	11,253	2,849	2,766	4,138	18,190	129,959

[a] Excluding the Chena River.

Fishery Objectives

Each of these fisheries is managed under a Management Plan written and adopted between 1992 and 1993. The objectives in these Management Plans are all similar, and include the objective to ensure that harvests and incidental mortality from the recreational fishery of all sport-harvested species present are sustainable, and to ensure that benefits to the public derived from the recreational fisheries outweigh the costs of managing the fishery. Most of these plans also contain an objective relating to the level of participation in the fisheries. The Piledriver Slough Fisheries Management Plan also includes objectives relating to the costs of stocking.

Recent Fishery Performance

Because of low abundance and over-harvest, grayling fishing in Piledriver Slough was restricted (by Emergency Order) to catch-and-release only on June 26, 1993. Except for Piledriver Slough, harvest estimates in all these fisheries in 1993 and 1994 increased from an all time low observed in 1992. Although the harvests from these fisheries increased during 1993 and 1994, harvests in all these fisheries except the Salcha River fell between 1994 and 1997. Angler effort estimates by fishery (species) are not available, and changes in effort at these fisheries could be related to fisheries for other species at these locations.

Effort at the Chatanika and Salcha have increased substantially between 1995 and 1997 from the levels of 1992 to 1994. Much of this increase is probably due to increased effort directed at chinook salmon. Effort at Piledriver Slough has not decreased substantially since 1994, having already decreased substantially between 1991 and 1994 (Table 14). Catch estimates for Arctic grayling at these fisheries between 1995 and 1997 have fallen in some locations and risen in others, generally staying within the range of levels seen between 1990 and 1994 (Table 14).

Recent Board of Fisheries Action

The Board of Fisheries adopted a Department proposal to change the current codified regulation for Arctic grayling at Piledriver Slough to catch-and-release only during the 1997 AYK meeting. This change did not result in an actual change in regulations, since the regulation proposed by the Department and adopted by the Board had already been in effect by Emergency Order since 1993. There were no other proposals related to Arctic grayling for any of these fisheries before the Board during the 1995-1997 cycle, and no Board action was taken relating to any of these fisheries. The Board did amend and adopt a public proposal (supported by the Department) to change the grayling bag limit in Five Mile Clearwater Creek from five fish per day, no size limit, to two fish per day, only one over 12 inches.

Current Issues

Between 1991 and 1996, the amount of habitat available to Arctic grayling spawning and rearing at Piledriver Slough has fallen by a little over half, due to several large beaver dams that were not present prior to 1991. Because this habitat loss has been accompanied by a corresponding reduction in the estimated grayling population, the department has initiated a study investigate the effect on Arctic grayling abundance of increasing the amount of habitat available to Arctic grayling in Piledriver Slough. The study will allow fish passage to areas of the slough not currently available by removing several of the lower beaver dams, and determine if grayling in Piledriver Slough begin to utilize the habitat that is no longer blocked to fish passage. In September and October of 1998 trappers were permitted to initiate a pre-season harvest of the

Table 14.-Total effort (angler-days) from selected locations in the Tanana drainage, 1977-1997.

Year	Piledriver Slough	Chatanika River	Salcha River	Richardson Clearwater River	Goodpaster River	Fielding Lake	Tangle Lake
1977		9,925	8,167				
1978		10,835	9,715				7,711
1979		4,853	14,788				5,864
1980		5,576	8,858				8,168
1981		4,691	8,090	916		1,369	5,530
1982		9,417	14,126	1,365		2,764	9,502
1983	4,148	10,757	11,802	1,349	1,989	1,737	5,513
1984	4,651	8,605	8,449		766	871	3,954
1985		10,231	13,109		2,844	1,023	5,601
1986		7,783	13,792		933	1,682	5,122
1987	13,257	11,065	10,576		3,061	1,032	2,530
1988	24,375	11,642	7,494		1,037	1,728	2,656
1989	22,746	12,210	9,704	1,364	1,930	1,664	3,991
1990	27,705	11,801	9,783	518	2,083	1,255	5,228
1991	17,703	8,085	11,242	1,199	786	1,572	6,407
1992	13,607	6,775	4,833	1,355	1,430	1,803	4,791
1993	17,253	7,671	7,313	514	1,152	1,827	8,937
1994	11,369	7,272	7,653	566	825	2,129	7,525
1995	12,613	12,697	14,516	1,168	2,028	3,575	7,678
1996	11,736	11,124	13,046	2,148	1,737	1,264	5,817
1997	9,878	9,192	11,276	0	2,996	1,664	7,305
Averages[a]							
1977-97	14,695	9,153	10,397	1,039	1,706	1,703	5,992
1977-86	4,400	8,267	11,090	1,210	1,633	1,574	6,329
1987-97	16,567	9,958	9,767	981	1,733	1,774	5,715

[a] Averages are for those years only that data is available.

beavers in the ponds below the two lower most dams blocking fish passage. Just after freeze-up, in 1998, the dams were breached and the ponds drained.

Ongoing Research and Management Activities

Stock assessment studies of Arctic grayling were conducted at Piledriver Slough in 1996 and 1997, at the Chatanika River in 1997, and on the Goodpaster River in 1995 and 1996.

Delta Clearwater River Arctic Grayling Sport Fishery

Background and Historical Perspective

The Delta Clearwater River (DCR) is the largest of several spring-fed tributaries to the Tanana River in the vicinity of Delta Junction (Figure 3). These clear systems sustain a cool, steady flow throughout the summer and provide ideal adult Arctic grayling habitat.

Near Delta Junction, grayling spawn during the early spring in rapid-runoff systems such as the Goodpaster River (GPR) and Shaw Creek. Grayling are not known to spawn in the DCR.

After spawning, a component of the adult populations move to summer feeding areas in the spring-fed systems. The abundance of the donor populations determines the abundance of the grayling migrating to the summer feeding areas. The dynamics of grayling recruitment to the spring-fed systems are not clear, but fidelity to the spring systems occurs during about the fifth year. The DCR Arctic grayling population thus consists predominantly of fish age 5 and older.

Estimates of abundance based on catch-at-age analysis indicate that the grayling population in the DCR declined during the last 10 years (Figure 4 graph of harvest and abundance). Abundance averaged 8,600 during the period 1977-1989. Abundance declined from about 13,000 fish in 1987 to about 4,000 in 1997.

Despite the decline in abundance, the DCR grayling fishery remains popular with anglers because the fish are large. Average size is the largest ever documented. Recent regulatory actions have changed the fishery from a consumptive fishery to a primarily catch-and-release fishery. In 1995 and 1996, 6,000 and 9,500 fish were caught of which 926 and 957 fish respectively were harvested. In 1997, 4,700 fish were caught and harvest essentially ended with the implementation of a catch and release regulation.

Sustained-yield management scenarios in a fishery such as this are unclear. There is uncertainty about the identity and contributions of parent stocks. A sustainable level of harvest is about 20% for any single contributing population. Average exploitation of the DCR grayling population in 1994 was 37.8% (Clark, 1994). As nearby donor stocks have fluctuated in abundance during the last 20 years, the harvest rate in the DCR has likely exceeded sustainability even though the population consists of adults from up to eight nearby rivers. In 1995 and 1996, the bag and possession limit was reduced to two fish by emergency order, reducing harvest rates to 25%. The population continued to decline, precipitating the 1997 emergency order to restrict grayling fishing to catch and release only.

Fishery Objectives

Because the DCR grayling population is an aggregate of several stocks the fishery will be managed conservatively. Under the management plan implemented in 1993, the biological objectives are to maintain historical stock levels and historical size and age composition while providing 3,000 angler-days of effort and a harvest of 3,000 fish.

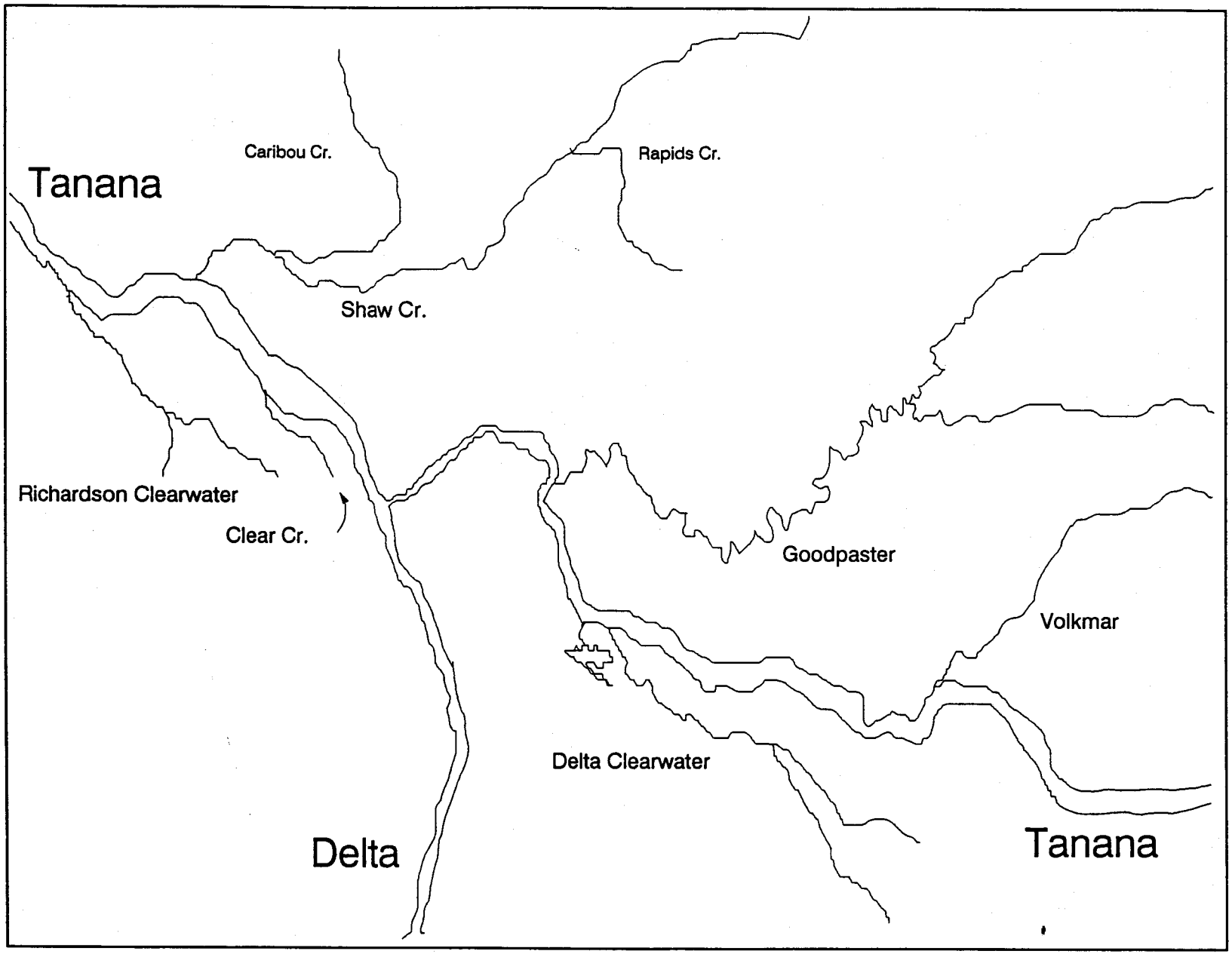

Figure 3.- Map of DCR Area.

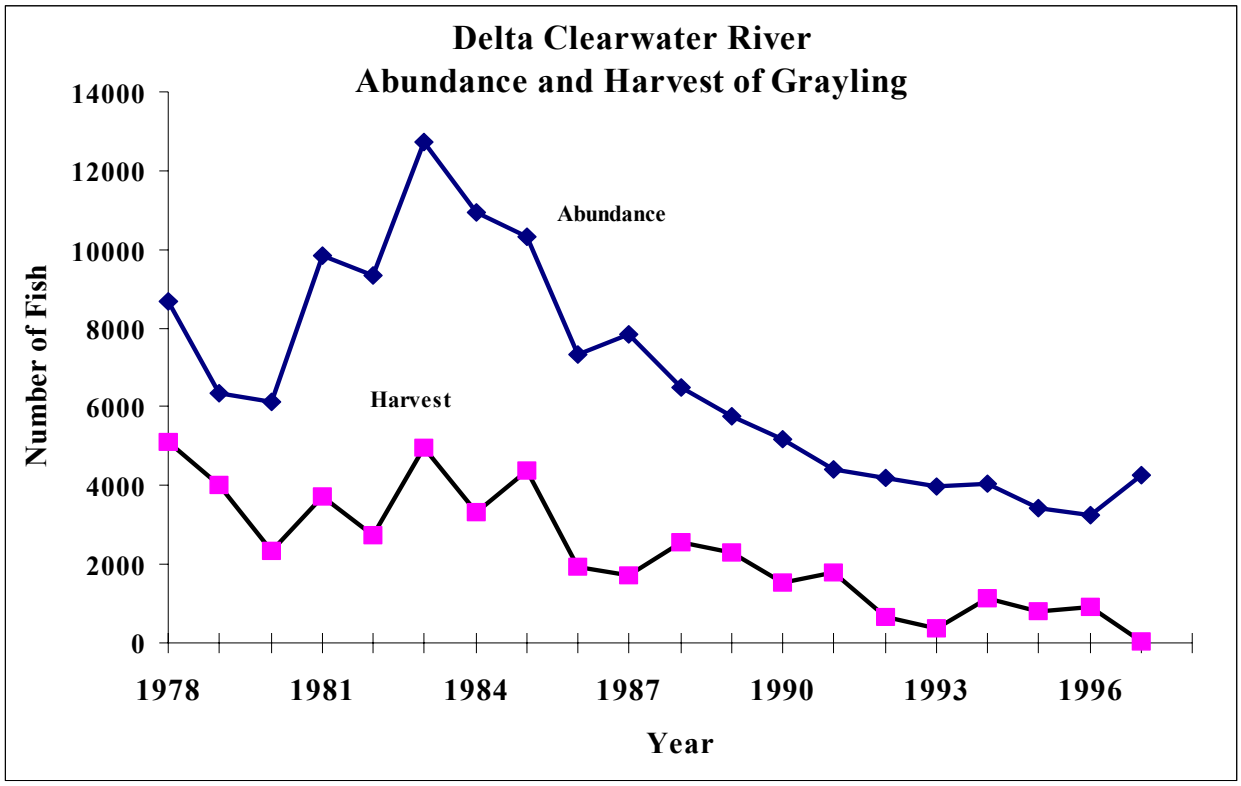

Figure 4.-DCR abundance and harvest of grayling.

Recent Board of Fisheries Actions

The BOF took action regarding this fishery at its 1997 meeting in Fairbanks, passing amended proposal 195. The proposal restricted Arctic grayling fishing in the DCR to catch and release only, and was amended to add single-hook to the unbaited and artificial lure gear restrictions from January 1 to September 1. The multiple hook is allowed for the remainder of the year when the fishery targets coho salmon. Additional substitute language included the Clearwater Lake drainage into the regulation change to avoid enforcement issues.

Recent Fishery Performance

Angler effort declined in the DCR as the grayling population declined. Angler effort during 1977-1986 averaged 6,500 days annually, and the majority of that effort targeted grayling. During the period 1987-1997 angler effort averaged 4,800 days per year (Table 15), but nearly half of that effort was directed to a developing coho salmon fishery. Average annual effort directed toward grayling during the period 1992-1997 at 2,100 angler days. For the reporting period 1995-1997 average annual effort was slightly higher at nearly 2,200 angler days.

Anglers harvested an average of 3,500 grayling annually from 1977 through 1997, and recently, an annual average of 700 grayling during the period 1992-1997. The catch of grayling in the DCR averaged 7,400 fish during the period 1990-1997 (Table 15).

Table 15.-Delta Clearwater River Arctic grayling and coho salmon effort, harvest and catches from Statewide Harvest Survey (Mills 1979-1994; Howe et al. 1995-1997, 1998 (*In press*) and abundance.

Year	Grayling Abundance[a]	Both	Angler-days		Grayling Harvest	Grayling Catch
			Grayling	Coho		
Average 1997-1986	6,550	6,550	5,394	1,156	5,698	N/A
1987	7,823	5,397	3,123	2,274	2,005	N/A
1988	6,503	5,184	3,092	2,092	2,910	N/A
1989	5,770	5,368	2,500	2,868	3,016	N/A
1990	5,175	4,853	2,263	2,590	1,772	12,424
1991	4,420	5,594	2,605	2,989	2,165	9,600
1992	4,210	3,756	1,765	1,991	797	6,086
1993	3,972	4,909	2,307	2,602	437	5,712
1994	4,059	3,984	1,872	2,112	1,411	5,037
1995	3,260	6,261	2,943	3,318	926	5,974
1996	3,342	4,622	2,172	2,450	957	9,448
1997	5,270	2,925	1,375	1,550	30	4,665
Average 1977-1997	6,871	5,636	3,807	1,828	3,495	7,368
Average 1987-1997	4,807	4,805	2,365	2,440	1,493	7,368
Average 1995-1997	3,642	4,603	2,163	2,439	638	6,696

[a] Estimates of abundance generated from the Catch-at-Age Analysis model, CAGEAN, for years 1997-1994, and regular mark-recapture estimates for 1995-1997.

Current Issues

The catch and release fishery that has been established by the Board of Fisheries for Arctic grayling in the DCR might restore historical levels of abundance quickly, and has some public support. However, this action may also reduce effort with a resulting reduction of public interest and concern for the resource. Permitting harvest when the grayling population has recovered will likely result in increased effort, rising toward the objective of 3,000 angler days/year listed in the current management plan for the DCR.

The methodology used to generate abundance estimates has changed over the years. Clark (1994) published catch-at-age abundance estimates for the DCR for the period 1977-1990. During a creel census program conducted at the DCR, age structures (scales) were collected from grayling. From 1991 through 1993 no creel surveys took place on the DCR and no age structures were collected from DCR grayling. During that period, age composition models were developed using data collected from grayling sampled during fall studies on the Goodpaster River. Harvest composition for DCR grayling was inferred from a regression analysis of age 3 grayling collected during those years (B. Ridder, Alaska Dept. of Fish and Game, Delta, personal communication). In 1994 a creel survey was again conducted on the DCR and age structures were collected. The inferred harvest compositions for the years 1991 - 1993 provide continuity in the CAGEN estimate, but the estimates for those years change as time passes and more data accumulates. However, the data seems to support the observation that the population appears to be declining. This decline is further verified by abundance estimates completed in 1995, 1996, and 1997. Recent data analysis has refined the estimates for the years when no data was collected, and this will likely continue as data is collected and analyzed in future years. In retrospect, continuing the creel census program and producing catch at age estimates of abundance would have met the management needs as well as the more costly mark-recapture program.

Ongoing Research and Management Activities

The objective of providing a 3,000 fish harvest from the DCR is out of the question because of stock decline. In 1995 and 1996, an emergency regulation reducing the bag limit to two fish successfully in reduced exploitation to 25%, but did not stop the population decline. The fishery was closed to harvest in 1997.

A tagging study showed that the largest contributor of grayling (60%) to the DCR was the Goodpaster River (B. Ridder, Alaska Department of Fish and Game, Delta Junction, personal comm.). In 1995 and 1996 the Goodpaster River (GPR) contributed 10% and 7% of its pre-migration population respectively to the DCR. In 1995 and 1996, the stock exploitation of GPR fish in the DCR was 5.2% and 2.8% respectively. In addition, GPR stocks contribute fish to other fisheries and sustain a grayling fishery within the GPR for a total exploitation in 1995 of 10.1% and 1996 of 6.4%. This is within sustainable levels (B. Ridder, Alaska Department of Fish and Game, Delta Junction, personal comm.). In 1995 and 1996, harvest was low (about 500) in the DCR because of the decline and bag limit reduction. In previous years when harvests were much higher, averaging over 3,000 fish, the potential for a much higher, perhaps unsustainable, exploitation may have existed.

The process of adult recruitment from the Goodpaster River to the DCR is unclear. Adults may be recruited to the DCR from a discrete portion of the GPR population or the recruitment may be dependant on the strength of the entire population. If the process depends on a subpopulation

within the adult population of the GPR, the exploitation of GPR fish in the DCR would result in a greater impact upon the recruitment process.

ADF&G has only estimated abundance of grayling present in the GPR in the spring during the years 1995 - 1997. There is, however, a long-term series of late summer abundance estimates of the GPR grayling. This summer-resident population consists primarily of younger grayling (<age 5), which misled managers to believe that the recruitment process was not in jeopardy. It is reasonable to believe that the spring (pre-migration to DCR) population abundance was historically greater that it is now. During periods of high levels of harvest in the DCR, there was potentially a high exploitation rate of the component of the GPR stock present in the DCR. This may have contributed to a long-term decline in the contribution of the GPR fish to the DCR. This may have resulted in a disproportionately high harvest of other contributing stocks before the fishery was closed by the emergency order. While little exploitation of stocks such as those from the Volkmar River and Shaw Creek occurs within their natal streams, higher exploitation of those stocks within the DCR may cause harmful population effects.

Arctic grayling studies within spring-fed (clearwater) systems in the Delta Area had a planned duration of three years. In general these studies are:

1. a. Floy tagging and abundance estimation in the lower 96 km of the Goodpaster River during spring of 1995, 1996, and 1997, in conjunction with sampling of the immigration of Arctic grayling to the DCR during late May through early June. This will allow estimation of contributions of Goodpaster River adults to the DCR.

   b. Testing of the assumption that stock assessments done in the Goodpaster River during August provide an accurate assessment of future productivity in the DCR. Sampling in August will determine if non-emigrating fish tagged during May reside in the area that has been assessed since 1988.

2. Estimate grayling abundance in the DCR, using Mark/Recapture and CAGEAN estimates.

3. Catch sampling of the fishery in the DCR to provide data in order to estimate abundance via age structured analysis (CAGEAN).

4. Radio telemetry studies will determine relative contribution from other contributing rivers.

5. Expansion of studies to other spring-fed systems such as the Richardson Clearwater River.

Management activities will continue to ensure protection of aquatic habitat for healthy fish production. Mapping of habitat area and determining a means to monitor changes to habitat are types of studies that should be implemented in the near future.

Summary of the 1998 Season

Arctic grayling catch and release regulations remained in place in the DCR. A mark-recapture experiment was completed along with a companion survey of the river by divers using snorkels. Division of Parks and Recreation indicated that campground use declined in 1997 and in 1998. Catch and release regulations were cited as probable cause. Increasing recruitment of young fish to the population was observed for the first time in 4 years in 1997, this trend continued in 1998.

SALMON SPORT FISHERIES

Important salmon sport fisheries occur in the Tanana River drainage where fishing for chinook salmon in the Salcha, Chena and Chatanika rivers is growing in popularity. Other recreational salmon fisheries include Clear Creek, a tributary of the Nenana River (chinook and coho) and the Delta Clearwater River near Delta Junction where coho salmon are harvested.

Chinook Salmon Sport Fishery

Background and Historical Perspective

There have been chinook salmon sport fisheries at the Chena, Salcha, and Chatanika rivers since before statehood. These fisheries were relatively small throughout the 1980s. Estimated harvests between 1977 and 1992 ranged from single digits to several hundreds, but were generally less than 300 for the Chena and Chatanika rivers, and under 1,000 for the Salcha River (Table 16). The fishery on the Salcha supported the largest harvests up until 1993, and the Chatanika (which has a much smaller run) has supported the smallest harvests. Very small harvests of chinook salmon have been reported sporadically from several other locations, but there are no other chinook salmon fisheries in the Tanana drainage where significant harvests or catches occur.

The chinook fisheries occur almost entirely during the month of July. The fisheries on all three rivers are closed above points that below the majority of the spawning areas. The fishery on the Chena River is concentrated at a number of road and boat accessible places, along the lower reaches of the river. The fishery on the Salcha River takes place in the lower three miles of the river, and is accessible by boat and by road. The fishery on the Chatanika River takes place primarily in the area just below the Elliot Highway Bridge. Much of the catch in these fisheries is released rather than harvested, possibly due to the relatively poor quality of the fish. In general, catches have been two to three times harvests (Table 16).

The spawning stocks of chinook salmon in the Chena, Salcha, and Chatanika rivers are extremely important to the commercial and subsistence fisheries in the middle Yukon and Tanana rivers because these are the largest spawning stocks between the Anvik River and the Canadian border. Escapements to the Chena and Salcha rivers were estimated by aerial survey by Commercial Fisheries Division biologists from 1974 through 1997, and have been estimated by either mark-recapture experiments or counting tower operations, or both, by Sport Fish Division since 1993. Escapement goals (BEGs) based on aerial surveys were set for aerial surveys by Commercial Fisheries Division in 1992 at 2,500 fish for the Salcha River and 1,700 fish for the Chena River. These aerial survey escapement goals were expanded into actual escapement abundance goals by Sport Fish Division in 1993. These expanded escapement goals are 7,100 fish for the Salcha River and 6,300 fish for the Chena River. There are no BEGs (aerial or abundance) set for the Chatanika River chinook run.

Regulations for chinook salmon in the Tanana drainage have remained unchanged since the early 1960s, at one daily and in possession. Fisheries in the Chena and Salcha were closed by emergency order in 1987 and 1992, and in all three rivers in 1998 in response to weak runs. Because of large returns, the bag limit was increased in the Salcha and Chena rivers to two fish by emergency order in 1993 and 1994.

Table 16.-Harvest and catch[a] of chinook salmon from the Chena, Chatanika, and Salcha, rivers, 1977 to 1997.

	Chena River		Chatanika River		Salcha River	
Year	Catch	Harvest	Catch	Harvest	Catch	Harvest
1977	NA	29	NA	9	NA	62
1978	NA	23	NA	35	NA	105
1979	NA	10	NA	29	NA	476
1980	NA	0	NA	37	NA	904
1981	NA	39	NA	5	NA	719
1982	NA	31	NA	136	NA	817
1983	NA	31	NA	147	NA	808
1984	NA	0	NA	78	NA	260
1985	NA	37	NA	373	NA	871
1986	NA	212	NA	0	NA	525
1987	NA	195	NA	21	NA	244
1988	NA	73	NA	345	NA	236
1989	NA	375	NA	231	NA	231
1990	406	64	164	37	680	291
1991	258	110	181	82	515	373
1992	71	39	31	16	86	47
1993	2,545	733	625	192	1,788	601
1994	1,308	993	278	105	971	714
1995	1,095	662	134	58	4,091	1,448
1996	3,692	1,280	1,164	499	3,298	1,136
1997	2,680	936	425	225	2,238	695
Averages[b]						
1977-97	NA	280	NA	127	NA	551
1977-86	NA	41	NA	85	NA	555
1987=97	1,507	496	375	165	1,708	547

[a] NA = not available.

[b] Averages are only of those years for which data is available.

Estimated escapement abundance (as opposed to aerial survey counts) between 1987 and 1997 for the Salcha ranged from just over 3,000 to over 18,000, and from less than 2,700 to over 13,000 for the Chena. Abundance estimates for the Chatanika chinook run were not done until 1997, but aerial and boat counts of escapement were conducted each year from 1989 to 1996. Escapements from these counts ranged from under 100 to 444 fish.

Fishery Objectives

Chinook salmon sport fisheries in the Salcha and Chena rivers are managed under management plans with prescribed BEGs and guideline harvest allocations for the sport fisheries. Salmon fisheries in the Chatanika River are managed under the Chatanika River Sport Fishery Management Plan, but this plan does not include a BEG or guideline harvest allocation. Escapement goals for the Salcha and Chena rivers have been met or exceeded in 1995, 1996, and 1997. Estimated sport harvests have exceeded the guideline sport harvest ranges in the Chena River for 1995-1997, and in the Salcha River for 1995 and 1996. Since escapement goals were met or exceeded for those years, restrictions to the sport fisheries were not implemented.

Recent Fishery Performance

Although available estimates of angling effort cannot be segregated by target species, increases in total effort and in harvest and catch of chinook salmon indicate that chinook fisheries in the Tanana drainage have been growing over the past few years. Estimated total harvests for the three major chinook fisheries averaged around 700 fish between 1977 and 1989, rose from 1,526 in 1993 to 2,915 in 1996, and declined to 1,883 in 1997. Because the quality of the fish is considered marginal by the time the fish enter the sport fishery, much of effort directed at the fishery in recent years consists of catch-and-release angling. Catches for 1995 through 1997 have been around 2 ½ times harvests. Because of weak run strength during 1998, the fisheries in all three rivers were closed by emergency order on July 14.

Recent Board of Fisheries Action

During the 1997 AYK Board of Fisheries meeting, the Department proposed closing the Chatanika River to chum salmon fishing above the Elliot Highway. The Board adopted this proposal, and now the Chatanika River is closed to all salmon fishing above the Elliot Highway.

Current Issues

The Department is currently reviewing the policy on salmon escapement goals, and if new policy is adopted it will likely be applied to the salmon fisheries in the Tanana drainage. The review of these escapement goals should include the establishment of a BEG for the Chatanika River chinook run.

Ongoing Research and Management Activities

Chinook salmon escapements (abundance) were estimated using tower counting operations, mark-recapture estimates, or both, during 1995, 1996, and 1997 on the Chena and Salcha rivers. Escapement was estimated in 1997 on the Chatanika River by a mark-recapture experiment. In addition to estimating escapements with tower counts, carcass sampling has been done on all three rivers during each year to provide estimates of size and age distribution and sex ratio.

Coho Salmon Sport Fishery

Background and Historical Perspective

Recreational coho salmon fisheries in the Tanana drainage occur in September and October in the Delta Clearwater River (DCR) near Delta Junction and in Clear and Julius Creeks (tributaries of the Nenana River). There is a minor fishery in the Richardson Clearwater River west of Delta Junction.

The DCR is a road accessible spring-fed tributary to the Tanana River about 20 miles in length, and it has the largest coho stock and provides the major riverine coho salmon sport fishery in the Tanana drainage. Before reaching the DCR, coho salmon travel about 1,700 km from the ocean and pass through six commercial fishing districts in the Yukon and Tanana rivers. Subsistence and personal-use fishing also occurs in each district. The DCR coho run strength and population characteristics are monitored by ADF&G.

Weekly escapement counts of coho salmon in the DCR are done from an elevated platform on a riverboat, and aerial surveys have been used to estimate escapement into non-boatable sections of the river. The portion of the escapement enumerated by the aerial survey comprises an average of about 20% of the total escapement (Stuby et al. 1998). When the weekly counts indicate that the escapement goal (9,000 fish) may not be reached, the bag limit (three daily and in possession) is reduced or the fishery is closed.

Estimated total coho escapements for the DCR for the years 1995, 1996, and 1997 were 26,383, 17,235, and 13,900. Average total escapement since 1977 has been 16,785. Large escapements during the reporting period can be attributed to average or below average harvests in the commercial and personal-use fisheries during these years and strong parent year escapements.

The Department has little information on the other, smaller coho salmon sport fisheries or stocks, except for estimates of harvest and catch from the Statewide Harvest Survey.

Fishery Objectives

ADF&G has established a minimum escapement goal of 9,000 coho salmon for the DCR (ADF&G 1993). Escapement is monitored between mid-September and early October. Previous research has indicated that about 33% of the total escapement is present in the lower 8-miles of the river. When at least 3,000 coho salmon are enumerated in that section, the projected escapement is at least 9,000 fish, the escapement goal has been met, and the sport fishery can proceed without restriction. If the goal is not met, the department will close the fishery to the retention of coho salmon. The objective for the sport fishery is to provide 3,000 angler-days per year in the DCR targeting coho salmon.

Recent Fishery Performance

The DCR coho salmon sport fishery began in the mid-1980s. Most of the fishing occurs within approximately one mile of the State campground, but boats are used to get to other areas of the stream. Because the coho salmon are close to spawning, flesh quality is questionable and many anglers practice catch and release fishing. During the 1995, 1996, and 1997, angler effort targeting coho salmon was 3,318, 2,450, and 1,550 angler days respectively (Table 16). During the period 1987 - 1997, effort averaged about 2,500 angler days annually.

DCR coho harvests (average 908) during the period 1977 - 1997 were about 4% of the escapement estimates. Harvests in 1995, 1996, and 1997 were 463, 983, and 866 respectively

(Table 17). Catches during 1992 - 1997 averaged 3,300. Catches in 1995, 1996, and 1997 were 5,636, 2,543, and 4,174 respectively.

Ongoing Research and Management Activities

Coho carcasses in the DCR are collected in November for length, sex, and age composition. In 1995, 381 carcasses were collected, males comprised 60% of the sample, and returns from the brood year 1992 comprised 71% of the sample (Evenson 1996). In 1996, 400 carcasses were collected, males comprised 51% of the sample, and returns from the brood year 1993 comprised nearly all the sample (Evenson 1997). In 1997, 391 carcasses were collected, males comprised 54% of the sample, and the returns from the brood year 1994 comprised 85% of the sample (Stuby et al. 1998).

Summary of 1998 Season

During 1998, the run was about two weeks late. The peak escapement count including the tributaries was 13,875 fish, of which 20% were in the non-navigable portion of the river.

Lake Trout Sport Fishery

Sport fisheries for lake trout occur in many lakes and some streams of the Delta River and upper Tanana River drainage's (Burr 1987).

Background and Historical Perspective

Since 1986 lake trout populations in the Upper Tanana drainage have declined. Research on road-accessible stocks confirms that populations are low. Currently, restrictive regulations exist on most waters with lake trout.

Lake trout most frequently inhabit deep, oligotrophic mountain lakes and are seldom found at lower elevations of the Tanana River drainage. Lakes of the Delta River drainage including Fielding, Two Bit, Landmark Gap, Glacier, Sevenmile, and the Tangle lakes contain lake trout. Lake trout are stocked in several lakes throughout the Tanana drainage: Summit Lake on the East end of the Denali Highway; Chet, Ghost, Nickel, and North Twin Lakes along the Meadows Road (Fort Greely); Paul's Pond along Coal Mine Road; and, 4-Mile Lake on the Taylor Highway, East of Tok; and Crystal Lake #2 near Fielding Lake.

Tanana River drainage (TRD) lake trout harvest from 1995 to 1997 was 11% of the statewide lake trout harvest. From 1995-1997, an average of 67% of the AYK Region lake trout harvest is from lakes in the TRD. An average of 30% of the lake trout harvested since 1988 in the TRD came from stocked lakes (Table 18).

Specific life history features (slow growth, delayed maturity and non-consecutive spawning) combined with the short growing season at higher altitudes increases the vulnerability of the species to overharvest. The impact of even modest fishing pressure can be significant. Lake trout 25 years of age and older are not uncommon and individuals older than 50 years have been found in Alaskan waters (Burr 1987). Trophy lake trout weighing 9.1 kg (20 lb.) or more are typically 20 or more years old (Burr 1987). Lake trout move into shallow rocky shoals to spawn in late fall. Lake trout spawn for the first time at ages ranging from 5 to 12 years of age,

Table 17.-Sport harvest and catch for Tanana River coho stocks.

Year	Delta Clearwater River	Nenana River Drainage	Other Streams	Total
Average 1977-1986	261	17	79	357
1987	1,068	0	163	1,231
1988	1,291	255	691	2,237
1989	1,049	125	422	1,596
1990	1,375	261	83	1,719
1991	1,721	357	265	2,345
1992	615	89	411	1,115
1993	48	0	134	182
1994	509	440	99	1,048
1995	463	77	134	674
1996	983	149	209	1,341
1997	866	195	128	1,189
Average from 1977-1997	587	96	170	853
Average from 1987-1997	908	177	249	1,334

Table 18.-Sport harvest and catch[a] of lake trout in the Tanana River drainage (1977-1997 SWHS).

Harvests Year	Harding Lake	Fielding Lake	Tangle Lake[b]	Delta River	Stocked lakes/ponds	other	Total
1987	NR	127	NR	54	NR	254	652
1988	55	364	127	NR	1,247	428	2,221
1989	119	195	478	11	283	293	1,932
1990	51	186	236	51	135	153	896
1991	133	295	472	44	443	399	1,978
1992	200	170	208	15	285	54	993
1993	132	276	597	0	564	370	1,939
1994	66	52	416	0	817	165	1,582
1995	177	44	246	0	227	193	887
1996	121	37	219	0	38	239	654
1997	77	51	196	0	127	279	730
1977-86	24	265	1,062	234	24	528	1,785
1987-91	90	233	328	40	527	305	1,536
1992-96	139	116	337	3	386	204	1,211
Catch[a]							
1990	186	321	523	169	NR	1,234	2,433
1991	148	870	988	44	811	1,301	4,162
1992	517	247	1,488	23	547	1,834	4,656
1993	438	939	2,668	9	1,814	1,108	7,414
1994	280	213	1,357	0	1,729	556	4,415
1995	258	486	928	7	508	1127	3,314
1996	556	222	2,229	51	602	740	4,400
1997	245	245	1,466	0	402	959	3,317
Average	329	443	1,456	38	916	1,107	4,264

[a] Information available from 1990-1997 only. Anglers may have harvested or released fish tallied as “catch."

[b] Includes Tangle River.

[c] No reported Harvest.

depending apparently on growth rate. Alternate year spawning may be more normal than spawning in concurrent years in interior and northern Alaska.

Of the 105 trophy (minimum size 9.1 kg-20 lb.) lake trout registered from 1965 through 1997 in Alaska, 19 (18%) were taken in the Tanana Area. The majority of these (17) were taken in Harding Lake. One each was taken from Fielding and Upper Tangle lakes.

Fishery Objectives

Lake trout fisheries in the Tanana River drainage are managed to assure maximum sustained yield. Objectives for the future for lakes such as Fielding Lake will center on assuring for optimal, rather than maximum sustained Yield. Optimal sustained yield will be lower than maximum sustained yield to accommodate recovery of populations or accommodating angler's wishes for special fisheries. The current harvest guideline is to prevent harvest levels from exceeding 0.5 kg per hectare annually.

Recent Fishery Performance

The harvest of lake trout in the Tanana River drainage peaked at approximately 3,100 fish in 1982. Harvest declined to 713 and 652 in 1986 and 1987, after the bag limit was reduced from 12 to two lake trout per day (Table 14). After two years of reduced harvest, the 1988 harvest of lake trout increased to 2,221 fish (Table 14). In 1989, staff discovered that anglers in some lakes reported rainbow trout and Arctic char as lake trout. Adjusting for this reduced the total Tanana drainage estimate from 1,932 fish to 1,498 (Arvey 1995). Since then staff edits on the preliminary SWHS accurately adjust the lake trout harvest taken from the TRD. Harvest for Tanana drainage lake trout in 1995 was 887, 50% lower than the 21-year average (Table 14). Likewise in 1996 and 1997, harvests were 63% and 59% below the 20-year average (Table 14?). Estimated harvest from 1995 to 1997 of lake trout taken in stocked lakes was 26%, 6%, and 17% respectively of the total harvest from the Tanana River drainage. Catch rates averaging 3,700 during the reporting period are below the eight year average (4,300) but have not declined as much as harvest. The Tangle Lake system remains the largest lake trout fishery in the TRD, but its average harvest during the reporting period (220) is only 20% of the 21-year average. The catch rate however is consistent with the eight-year average. Lower harvests are a result of restrictive regulations with length limits or a lower abundance of larger sized fish in these waters.

Recent Board of Fisheries Action

The Board of Fisheries approved reduced bag limits throughout the Tanana River drainage in 1987. The Board restricted the daily bag and possession limit to two fish per day with no size limit. With continued intense fishing pressure in Fielding, Harding, and Tangle Lakes it was necessary to add additional restrictions, requiring lake trout harvested in Fielding and Tangle lakes to equal or exceed 18 inches in total length. Continued high harvest of lake trout in the Tangle Lakes prompted a reduction of the daily bag and possession limit to one fish per day and a minimum length limit of 18 inches. Another change aimed at reducing harvest occurred on Fielding and Harding lakes on July 1, 1993, when the minimum size limit was changed by emergency regulation from 18 to 22 in on Fielding Lake and 18 in length limit was established for Harding Lake. This regulation was effective in reducing the harvest in Fielding Lake from 276 in 1993 to an average of 46 from 1994-1997 (Table 18). No formal Board action has occurred since changes made in 1987.

Current Issues

No brood source for the lake trout stocking program could be accepted from outside the Tanana drainage because of genetics and disease considerations. The lake trout population at Sevenmile Lake was identified as a suitable brood source for the stocking program in 1992. Beginning in 1993 and during every other year since (1995 and 1997), Sport Fish Division has conducted a live-spawning egg-take from lake trout in Sevenmile Lake. The 107,000 eggs taken in 1993 represent a minimum of 20 percent of the annual egg production of the population (Burr 1994). Conducting egg takes every other year will likely lesson the impact of production removal. In 1995, 63,100 eggs were taken (Taube 1996), and about 90,200 eggs in 1997 (C. Skaugstad, Alaska Dept. of Fish and Game, personal communication). It is not clear how egg loss will impact the population. Estimated Abundance of adult lake trout (>375 mm FL) was 1,139 fish in 1993 (Burr 1994) and 1,241 in 1996 (Taube 1997). No detrimental impact upon the population has been documented to date. Future periodic monitoring of the population will help managers to decide if egg-takes should continue.

Ongoing Research and Management Activities

Because of the difficulty in obtaining lake trout biological information, estimation of sustainable yield is difficult. One method to determine sustainable harvest is based on observed lake trout production. Guideline harvest levels of 0.5 Kg/ha/yr. have been successful in regulating harvest to acceptable level (Burr 1993). In Fielding Lake harvests averaged 230 fish per year during the period 1987-1991. Sustainable harvests would have been 130 fish per year. From 1992 to 1996 harvest dropped to a sustainable average harvest of 120 fish annually. While effort in Fielding Lake has been above the long-term average during the reporting period, the decline in harvest and catches may be attributed to a decline of large fish in the population. Reports from fishermen also indicate that the population of lake trout in Fielding Lake contains few mature fish. Female lake trout in Fielding Lake reach sexual maturity at an average age of eight years and an average length of 21 inches. In order to allow more female trout to spawn at least once before recruiting to the harvest, it appears another regulation is needed to protect the larger, mature fish.

Stocking of lake trout into small roadside lakes in the Tanana drainage has been successful in higher elevation lakes and has added diversity to the stocking program. Lakes stocked along Meadows Road and Coal Mine Road, South of Delta Junction, and 4-Mile Lake along the Taylor Highway have healthy populations of lake trout. Estimated average harvest from 1995-1997 of lake trout taken in stocked lakes was 16% the total harvest in the Tanana drainage (Table 18).

Eggs from the 1995 Sevenmile Lake egg-take were put into artificial spawning substrate in Donnelly Lake. The objective was to estimate the proportion of successful incubation from two different depths and different numbers of layers of substrate. The average rate of hatching success from each of the study elements was 43.4% (Viavant 1996). There were no significant differences at depth or from substrates with differing number of layers (Viavant 1996). This hatching proportion is substantially lower than the 73% hatching success in the hatchery. Viavant (1996) points out that the substrate may have been too deep and that there may not have been enough wave action to provide needed circulation prior to freeze-up. Using this methodology over the known spawning substrates on lakes such as Fielding Lake would increase natural production survival of lake trout fry.

An age validation study has been in progress since 1991. In 1991, about 53,000 lake trout released in Tanana drainage lakes were marked with an adipose fin clip. Some of these lake trout of known age have been removed annually and otolith, opercular bones, and scales were collected for aging purposes. Taube (1998) found that ageing fish with otoliths was less accurate than using scales. For younger fish (less than six years old) scales are found to be just as accurate for aging purposes. This concludes this study.

Summary of 1998 Season

A three-year research project started this year in Fielding Lake to estimate the population of lake trout. In June, a total of 25 lake trout was caught using hook and line. Catch rate was one fish per hour. In September, a total of 96 fish was captured with a seine on a spawning bed. Size of fish caught with hook and line was smaller that those caught on the spawning bed and will create a size bias when using these fish as part of the estimate. No other lake trout research occurred in the Tanana drainage in 1998.

Burbot Sport Fishery

The Tanana River supports one of the largest burbot fisheries in the state, rivaled only by burbot fisheries in the Copper River Basin.

Background and Historical Perspective

Local residents using baited setlines or hand-held fishing gear are the primary participants in this year-around fishing. Most fishing in the Tanana River near Fairbanks occurs during the winter months while in the upper Tanana River drainage, a major portion of the annual harvest occurs in spring and summer. Burbot are fished in streams, such as the Tanana, Chena, Lower Chatanika, Salcha, Goodpaster, and Tolovana rivers, and in lakes. The most common gear type in flowing waters of the drainage is set lines, on which up to 15 hooks may be used. In past years, the most heavily fished lakes were Fielding, Harding, and Tangle lakes. Since 1987, bag limits in these lakes were reduced to two fish daily, and use of setlines was eliminated. Burbot stocks in the Tanana River are exploited most heavily near population centers such as Fairbanks, Delta Junction, and near Northway. Burbot movements within the Tanana River tend to minimize effects of concentrated local fishing effort, and stocks in the Tanana River appear to be lightly exploited (Evenson 1997).

Of the 227 trophy burbot registered from 1973 to 1997 in Alaska, (minimum size 3.6 kg-8 lb.) 154 (68%) were taken in the Tanana drainage, and the majority of these (91%) were taken in the Tanana and Chena rivers.

Fishery Objectives

The Management objective for the Tanana River and Tanana drainage lakes is to ensure harvests and incidental mortality of burbot are sustainable. The department has the authority to use time and area closures *and* method and means restrictions to manage burbot sport fisheries. Healthy stocks such as the Tanana River are managed to permit maximum sustained yield while depressed stocks, such as these in road accessible lakes, are managed to allow the stocks to rebuild.

Recent Fishery Performance

The estimated harvest of burbot in the Tanana River drainage by sport anglers was 4,934 (1995) 2,091 (1996), and 3,725 (1997; Table 19). The estimated average harvest of burbot in the Tanana River drainage during these three years is slightly below the 21-year average (Table 13).

The majority of the harvest (79% in 1995, 70% in 1996, and 78% in 1997) was taken in the Tanana River and lower Chena rivers. The harvest from area lakes has declined since 1987 when restrictions on number of hooks, use of set lines, and seasons for many lakes were enacted. Most of the lake burbot harvest came from George and Harding lakes during the reporting period. The average 21-year harvest is 73% of the mean catch, indicating the consumptive nature of this fishery, the highest of any fishery in the Tanana drainage.

Recent Board of Fisheries Action

To prevent further declines in burbot populations inhabiting lakes of the Tanana drainage, the ADF&G implemented emergency regulations in 1987 that prohibited the use of set lines from 15 May to 15 October, and reduced the bag and possession limit in all Tanana drainage lakes to five fish. Also, a ban on the use of setlines throughout the entire year was enacted for Harding, Fielding, T, and Tangle lakes. A further reduction in the bag and possession limits to two burbot daily in Fielding, T, Harding and Tangles lakes was enacted at that time as well. In 1994 the burbot fishery at Fielding Lake was closed by emergency order to prevent overfishing on a declining population. No regulatory matters concerning burbot were brought before the Board of Fisheries during the 1997 cycle.

Current Issues

Although exploitation rates of burbot in the Tanana River are not considered excessive, studies suggest low stock population abundance in most of the lakes examined. High river harvests near Fairbanks are sustainable because of extensive movements and exchange of burbot in the drainage (Evenson 1997). Population density of burbot in lakes declined dramatically in the early 1980's due to unsustainable rates of sport fishing exploitation. Stock assessment studies conducted in lakes of the upper Susitna/upper Copper River basin and the Tanana River drainage, in the mid-1980's (Lafferty et al. 1992), confirmed that several lake stocks in the Tanana drainage showed evidence of high exploitation. More recent stock assessment studies conducted in lakes of the Tanana River drainage demonstrate the effects of long term high exploitation rates on stocks (Parker 1998).

Ongoing Research and Management Activities

Several studies of burbot were conducted during the reporting period in the Tanana Area. Stock assessment of burbot in the Tanana River continued in areas of high fishing effort (Evenson 1996, Evenson 1997, and Evenson 1998 in print). Stock assessment of lake-dwelling burbot occurred in Fielding lakes (Parker 1996, 1997, and 1998). Burbot stock assessment work at the Fort Knox project was done during 1995 (Evenson 1996). Catch-age analysis using SWHS harvest estimates and catch sampling appears to be successful in estimating abundance and fishing mortality in the Tanana River drainage (Evenson 1997).

Table 19.-Sport harvest and catch of burbot in the Tanana River drainage (1977-1997).

Harvest Year	Harding Lake	Fielding Lake	Tangle Lake[b]	Chena River	George Lake	Minto Flats[c]	Chatanika River	Piledriver Slough	Shaw Creek	Nenana River	Tanana River	Other	Total
1987	53	13		149		132	13	79	607	53	2,362	394	3,855
1988	73	36		386		0	55	55			2,419	709	3,733
1989	10			1,322	20	20	10	100	170	60	2,305	340	4,357
1990	17		17	304	34	0	17	456	354	68	1,789	743	3,799
1991	45		23	225	11	56	0	203	45	11	1,601	519	2,739
1992	17	51	17	1,032	110	0	8	195	161	76	1,717	236	3,620
1993	0	32	11	1,135	43	0	0	568	161	11	3,156	600	5,717
1994	31	73	31	592	52	208		73	93	0	3,194	818	5,165
1995	46	0	0	597	220	161	91	299	138	0	3,302	80	4,934
1996	80	0	0	441	0	18		80	27	44	1,019	382	2,091
1997	42	0	42	703	52	42	243	126		42	2,193	240	3,725
Averages													
1977-1981	NR	249	146	856	46	39	39	NR	NR	NR	NR	1,234	2,346
1982-1986	428	255	80	1,331	83	49	49	77	237	NR	2,214	1,109	4,884
1977-1986	428	253	109	1,094	69	44	41	77	237	NR	2,214	1,171	3,615
1987-1991	40	25	20	477	22	42	42	179	294	48	2,095	541	3,697
1992-1996	35	31	12	759	85	77	33	243	116	26	2,478	423	4,305
1977-1997	70	102	66	849	64	51	44	184	206	37	2,261	799	3,804
Catch[a]													
1990	17		51	338		0	17	456	726	68	1,975	1,468	5,116

-continued-

Table 19.-Page 2 of 2.

Harvest Year	Harding Lake	Fielding Lake	Tangle Lake[b]	Chena River	George Lake	Minto Flats[c]	Chatanika River	Piledriver Slough	Shaw Creek	Nenana River	Tanana River	Other	Total
1991	45		23	609	11	56	0	237	45	11	1,950	587	3,574
1992	17	51	34	1,235	110	0	17	203	161	102	2,148	295	4,373
1993	0	32	21	1,328	43	0	0	760	161	21	3,627	664	6,657
1994	31	73	31	685	73	218	0	135	114	0	4,048	989	6,397
1995	46	0	70	1045	220	172	206	500	172	0	4,421	114	6,966
1996	133	0	0	540	0	18	18	117	88	44	1,521	548	3,027
1997	42	0	42	735	73	189	274	126		42	3,138	635	5,296
Mean	41	26	34	814	76	82	67	317	210	36	2,854	663	5,176

[a] Information available from 1990-1997 only. Anglers may have harvested or released fish tallied as "catch".

[b] Includes Tangle River.

[c] Includes Tolovana River.

NR = no harvest or catch reported.

Northern Pike Sport Fishery

Background and Historical Perspective

There are sizable sport fisheries for northern pike in the Tanana drainage at Minto Flats; the Chena and Chatanika rivers; and at Harding, George, and Volkmar lakes. Of these fisheries, Minto Flats has supported the largest northern pike sport fishery in the Tanana River area for many years. Pike are common in many smaller lakes and in sloughs and tributaries of the Tanana River, and small harvests are reported annually from many locations throughout the Tanana drainage.

The fisheries on the Chena River and at Harding Lake are accessible mostly by road and by boat, and are mostly open water fisheries. The fisheries at Minto Flats and on the Chatanika River are accessed primarily by boat and float plane, and are also mostly open water fisheries. George Lake is accessed by boat, snowmachine and float and ski equipped airplane, and occurs year round. Volkmar Lake is accessed primarily by snowmachine, but also by float and ski equipped airplane, and the fishery there primarily occurs in the winter. Much of the effort directed towards pike in the Tanana drainage is catch-and-release fishing. Harvests for the entire Tanana drainage between 1990 and 1997 have represented between 14 and 40% of total catch.

Estimated harvests for northern pike fisheries in the Tanana drainage have been highly variable over time at most locations (Table 20). The fishery at Minto Flats has always supported the largest harvests in the Tanana drainage. The Minto pike fishery averaged 26% of the total Tanana drainage harvest between 1977 and 1997, but this contribution to the total drainage harvest was highly variable, ranging from less than 10% to over 50%. George Lake supported harvests consistently in excess of 1,000 fish up until the late 1980s, but since then harvests have ranged from over 1,200 to under 500. Harding Lake supported relatively high harvests in the late 1980s, but those harvests fell dramatically during the early 1990s.

Much of the effort directed at northern pike in the Tanana drainage appears to be toward non-consumptive angling. Estimated catches for most pike fisheries in the Tanana drainage range from over twice to over twenty times the estimated harvest (Table 21). Both estimated total harvests and catches for the Tanana drainage increased substantially during 1993 and 1994. Most of this increase was due an extremely high catch from Minto Flats in 1994, which more than doubled between 1993 and 1994. Catches at Harding Lake fell by about 35% between 1994 and 1995.

Although effort is not estimated by target species (fishery), it is felt that the majority of the effort at Harding, George, and Volkmar lakes, and at Minto Flats is directed toward northern pike. Effort at both the Chena and Chatanika rivers is probably primarily directed toward species other than pike (Arctic grayling and chinook salmon). Estimated effort at Harding increased through the mid-1980s and ranged around 5,000 angler-days from 1990 to 1994 (Table 22). Effort at George and Volkmar lakes has been more variable, particularly at George Lake. Effort at Minto Flats ranged from 3,911 to 699 between 1977 and 1992, but increased to over 6,000 angler-days in 1993 and 1994.

Stock assessment of northern pike populations in the Tanana drainage has been done during various years between 1987 and 1994 at Harding, George, and Volkmar lakes, and at Minto

Table 20.-Sport harvest[a] of northern pike in the Tanana River drainage (1977-1997).

Year	Chena River	Chatanika River	Harding Lake	George Lake	Volkmar Lake	Minto Flats[c]	Tanana Drainage Total
Harvest							
1977	871	121	NA	1,227	NA	3,736	9,345
1978	452	407	NA	1,392	NA	3,707	7,838
1979	437	71	NA	2,018	NA	3,280	7,975
1980	458	458	NA	1,395	NA	4,367	9,452
1981	333	28	NA	2,236	648	2,037	9,941
1982	377	305	NA	1,635	777	2,191	9,822
1983	780	713	178	1,322	430	2,748	10,225
1984	1,064	389	766	1,700	428	2,453	9,490
1985	787	763	503	2,670	503	4,146	12,066
1986	664	1,282	673	3,076	657	4,927	11,854
1987	169	554	1,886	2,229	224	1,781	9,405
1988	453	364	2,092	1,837	255	1,492	11,823
1989	1,303	812	1,764	882	180	1,734	11,170
1990	204	388	591	945	84	1,570	7,348
1991	1,650	401	1,888	1,262	565	2,155	12,476
1992	256	26	341	529	231	1,299	6,148
1993	282	1,344	391	442	322	2,076	7,712
1994	236	1,051	539	948	206	8,438	16,299
1995	500	1,354	502	531	1,084	3,126	10,620
1996	407	629	363	1,069	?	2,078	6,618
1997	206	376	94	462	84	1,702	5,106
Averages[b]							
1977-97	566	564	838	1,419	417	2,907	9,654
1977-86	622	454	530	1,867	574	3,359	9,801
1087-97	515	664	950	1,012	324	2,496	9,520

[a] NA = data not available.

[b] Averages are only from those years with data available.

Table 21.-Sport catch of northern pike in the Tanana River drainage (1990-1997).

Year	Chena River	Chatanika River	Harding Lake	George Lake	Volkmar Lake	Minto Flats[c]	Tanana Drainage Total
1990	1,553	979	3,629	3,950	NA	4,946	37,524
1991	3,019	520	5,071	4,996	1,011	5,427	30,009
1992	1,513	410	3,400	2,861	1,256	6,175	32,250
1993	4,532	4,842	8,471	7,857	432	19,536	51,272
1994	1,092	4,943	5,559	4,377	1,928	47,248	88,702
1995	1,890	6,155	3,852	1,582	1,801	21,823	53,963
1996	1,624	3,338	4,070	3,687	NA	12,495	43,279
1997	1,762	2,594	2,578	2,966	598	14,714	36,221
Average	2,123	2,973	4,579	4,035	1,171	16,546	46,653

NA = no harvest or catch reported.

Table 22.-Estimated angling effort (number of angler-days) at locations of significant northern pike fisheries in the Tanana drainage, 1977-1997.

Year	Chena River	Chatanika River	Harding Lake	George Lake	Volkmar Lake	Minto Flats
1977	30,002	9,925		854		3,886
1978	38,341	10,835		1,271		3,640
1979	22,138	4,853		903		2,709
1980	30,654	5,576		1,057		2,727
1981	26,753	4,691		1,351	458	2,045
1982	40,535	9,417		989	546	1,791
1983	40,902	10,757	708	860	270	1,281
1984	40,223	8,605	1,707	1,254	436	1,829
1985	27,133	10,231	850	1,127	711	2,011
1986	35,030	7,783	2,064	1,957	596	3,318
1987	25,065	11,065	5,125	1,467	472	1,539
1988	31,851	11,642	3,256	964	186	1,564
1989	37,562	12,210	4,935	610	466	699
1990	29,361	11,801	3,895	1,540	129	932
1991	21,138	8,085	5,155	1,931	1,052	1,532
1992	12,654	6,775	5,068	1,067	608	2,401
1993	21,649	7,671	4,885	772	579	3,911
1994	27,192	7,272	4,913	594	722	6,267
1995	35,181	12,697	6,743	708	1,263	6,260
1996	45,942	11,124	6,734	998	191	3,917
1997	37,638	9,192	4,100	783	768	4,372
Averages[b]						
1977-97	31,283	9,153	4,009	1,098	566	2,792
1977-86	33,171	8,267	1,332	1,162	503	2,524
1987-97	29,567	9,958	4,983	1,039	585	3,036

NA= No data available.

Flats. Assessments were done at Minto Flats during 1987, 1988, 1990, and 1991, and a study of movement and distribution was done in 1993. Assessments were done at George Lake from 1987 through 1991, at Volkmar Lake from 1985 through 1994, and at Harding Lake from 1991 through 1993.

Because of indications of stock declines and of unsustainable harvests in some fisheries, more restrictive regulations for pike were enacted during the late 1980s. Fishing was closed at Minto Flats between October 15th and May 31 in 1987, and the bag limit was reduced from ten per day to five per day, with only one allowed over 30 inches. In 1991, pike fishing at Harding Lake was closed between April 1 and May 31, spear fishing was closed, and a 26-inch minimum length limit was imposed. An area-wide, spring spawning closure (April 1 through May 31) was implemented in 1992.

Fishery Objectives

Each of these pike fisheries (except for the Chena River) is managed under a Management Plan written and adopted between 1992 and 1993. The objectives in these management plans include ensuring that northern pike harvests and incidental mortality from the recreational fishery are sustainable, and ensuring that benefits to the public derived from the recreational fisheries outweigh the costs of managing the fishery. These Plans also include objectives regarding the level of participation in each fishery. In addition to the existing Minto Flats Sport Fishery Management Plan, recent Board of Fisheries action placed language into the codified regulations (5 AAC 70.044) relating to Minto Flats pike management (see Recent Board of Fisheries Action).

Until a Management Plan is adopted for northern pike in the Chena River, objectives for that fishery are to manage for sustainable yield, to maintain historic size and age composition, to allow for consumptive harvest when possible, and to allow for catch-and-release fishing when consumptive harvest is not possible.

Recent Fishery Performance

Pike fisheries in the Tanana drainage remain popular, although estimated effort has declined since 1995 at Minto Flats by about 30%. Effort at Harding Lake also declined about 39% between 1996 and 1997. These are the two most popular pike fisheries in the drainage, accounting for about 35% of the harvest and between 38 and 47% of the catch from the Tanana drainage between 1995 and 1997. Harvests of northern pike from all Tanana drainage fisheries have declined substantially since 1994, falling over 50% between 1995 and 1997. Catches of northern pike in the Tanana drainage have also declined, with declines in catches at both Harding Lake and Minto Flats, the two largest pike fisheries in the Tanana drainage, responsible for much of this decline. Catches at Minto Flats fell by 32% between 1995 and 1997, and catches at Harding Lake fell by 37% between 1996 and 1997.

Estimated abundance at Harding Lake increased between 1995 and 1996, from 2,338 to 3,337, but has declined since then, falling to 1,780 in 1997 and to below 1,500 in 1998 (Roach 1998a, D. Roach, ADF&G, Sport Fish, personal communication). Estimated abundance for Minto Flats fell from 23,850 to 16,465 between 1996 and 1997. Abundance estimation was not done at Minto Flats during 1998.

Recent Board of Fisheries Action

Several proposals relating to northern pike in the Tanana drainage were considered by the Board of Fisheries during the 1997 AYK meeting. The Board adopted a Department proposal to remove the area-wide spring spawning closure for flowing waters (except the Tolovana drainage) and extend the winter ice-fishing season by 20 days (moving the spring closure from April 1 to April 21) for most remote lakes in the Tanana drainage. The Board adopted a public proposal (supported by the Department) to reduce the bag and possession limit at Volkmar Lake from five down to one fish per day, but amended the proposal to continue to allow spear fishing (the original proposal was to reduce the bag limit to one fish, and to ban spear fishing). The Board also amended a Department proposal adopting a Minto Flats Northern Pike Management Plan. The amended Management Plan which was adopted sets certain subsistence harvest guidelines for a portion of the Chatanika River, which, if are exceeded, result in a reduction in the sport bag limit from five to two fish per day, and restricts sport angling in this same portion of the Chatanika river to single-hook terminal gear only.

Current Issues

Estimated abundance for Harding Lake has declined in the last two years. Abundance of fish over 300 mm ranged between 3,765 and 2,285 between 1990 and 1996, but fell to 1,780 in 1997. The abundance estimate for 1998 was the smallest since assessment efforts have been done, at under 1,500 fish over 300 mm. Harvest and effort estimates have decreased from 1995 to 1997, but estimated catches remain high. It is likely that the Department will consider some further restrictions to increase the size of the spawning stock, probably an increase in the minimum length limit from 26 inches to 30 inches.

Subsistence users of northern pike from Minto Flats have been concerned for the last several years about the pike population. This concern will probably lead to proposals to Board of Fisheries in upcoming years to further reduce harvest.

Ongoing Research and Management Activities

Abundance estimates for Northern pike were conducted at Harding Lake during 1995-1997 and at Minto Flats in 1996 and 1997. Length and age distributions of pike were estimated for Minto Flats in 1995, and a radio-telemetry project was conducted between 1995 and 1997 at Minto Flats.

Whitefish Sport Fishery

Background and Historical Perspective

The only major sport fishery for whitefish in the Tanana drainage was the spear fishery on the Chatanika River in the vicinity of the Elliot Highway Bridge. This fishery took place in September, while least cisco and humpback whitefish were engaged in spawning and post-spawning migrations. Both of these species were harvested, as well as a small percentage of round whitefish. The spear fishery at the Chatanika typically accounted for over half to over 90 % of the total Tanana drainage whitefish harvest between 1977 and 1990 (Table 22). Harvests during the late 1970s were generally under 5,000 fish, but the fishery became very popular during the 1980s, and harvests had increased to 25,000 by 1987.

This fishery had no bag limit until 1988 when a 15 fish per day limit was implemented. Harvest did decrease in 1988 after the bag limit was imposed, but increased again in 1989. Declines in abundance combined with estimated harvest that were considered unsustainable prompted the

Department to close the fishery by emergency order on October 10, 1990, and again on September 9, 1991. In February 1992, the Board of Fisheries adopted a Department proposal to set a season limiting the fishery to the month of September, and to restrict the area where the fishery took place to downstream of a point one mile above the Elliot Highway Bridge.

During 1992 the Department also adopted a management plan that set threshold abundance levels above which harvest could be allowed. Stock assessment done in 1992 indicated abundance levels above the threshold levels in the management plan, and the fishery was open during 1992, but an extremely early winter resulted in low participation in the fishery, and harvest was only just over 2,000. Stock assessment done in 1993 also indicated abundance levels above the threshold levels required to allow harvest, and the fishery remained open. Although the fishery was open, harvest levels were very low. The low harvest in 1993 was attributed to heavy rainfall and flooding that persisted during much of the spear fishery. This created poor visibility due to high turbid water conditions making spearing difficult. Stock assessment during 1994 indicated that the abundance level of least ciscos was below the threshold set by the management plan, and the fishery was closed by emergency order on September 5.

Minor harvests and catches of whitefish from the Tanana drainage occur in the Chena, Salcha, Delta Clearwater, and Tanana rivers. These fisheries may involve spearing of fish migrating to spawning grounds in the fall, and may include some hook-and-line angling. Of these fisheries, the Chena and Tanana rivers have accounted for the largest harvests. Total whitefish harvests for the Tanana drainage excluding the Chatanika River peaked during the late 1980s. Since 1993, total harvests have ranged from 195 (1n 1996) to 2820 (in 1997).

Although it has been surmised in the past that there was very little hook-and-line angling for whitefish in the Tanana drainage, and that most harvests and effort involved spear fisheries, estimated catches in many cases are much higher than estimated harvests (Table 23, 24). The proportion of total catch that was harvested for the entire Tanana drainage has ranged from 87% to 26% between 1990 and 1997, and was below 50% in 1991, and from 1994 through 1997. This clearly indicates that a substantial portion of the catch is caught with hook-and-line, and is subsequently released. These data also indicate that although the fishery for whitefish on the Chatanika was almost entirely a spear fishery, catches at many other locations were probably from hook-and-line fisheries.

Fishery Objectives

The whitefish fishery on the Chatanika River is managed under the Chatanika River Sport Fisheries Management Plan written and adopted in 1992. The objectives of the Plan are to ensure that harvests and incidental mortality of whitefish are sustainable, to increase participation in the recreational fishery (for all species) to 15,000 angler-days by 1995, and to ensure that public benefits derived from the fisheries on the Chatanika River outweigh the costs of fishery management. The plan sets threshold abundance levels for both humpback whitefish and least cisco below which no harvest is allowed, and a range of maximum exploitation rates depending on the threshold abundance for that species. The threshold abundance level for humpback

Table 23.-Estimated whitefish harvests from the Tanana drainage, 1977-1997.

Year	Chena River	Chatanika River	Salcha River	Delta Clearwater River	Tanana River	Other Locations Total	Tanana Drainage Total
1977	538	1,635	45	28	NA	1,132	3,378
1978	187	6,013	137	0	NA	236	6,573
1979	622	3,021	44	53	NA	5,159	5,159
1980	1,032	3,340	17	0	NA	1,569	5,958
1981	683	3,185	56	203	NA	746	4,873
1982	462	6,640	94	94	NA	1,353	8,643
1983	1,064	5,895	94	262	21	996	8,321
1984	883	9,268	117	325	52	1,013	12,177
1985	3,780	14,350	35	1,015	0	1,050	20,405
1986	1,954	22,038	783	208	1,272	555	29,354
1987	56	25,074	277	66	210	752	26,908
1988	790	7,983	0	1,114	1,300	588	14,653
1989	603	15,542	362	34	68	326	17,071
1990	136	5,216	68	0	0	1,471	7,128
1991	34	0	0	91	34	580	898
1992	129	2,033	0	294	239	551	3,724
1993	96	558	9	0	9	312	1,002
1994	0	97	19	10	223	591	1,734
1995	155	9	0	0	18	275	457
1996	18	46	0	46	0	85	195
1997	254	42	85	0	423	163	967
Averages							
1977-1997	651	6,290	134	207	276	1,246	8,640
1977-1986	1,121	7,539	142	274	336	1,532	10,484
1987-1997	224	5,155	127	158	252	1,081	6,963

Table 24.-Estimated catches of whitefish (all species) from the Tanana drainage, 1990-1997.

Year	Chena River	Chatanika River	Salcha River	Delta Clearwater River	Tanana River	Other Locations Total	Tanana Drainage Total
1990	287	5334	68		169	2,805	8,663
1991	137	23	0	410	34	1,115	1,719
1992	212	2033	28	358	258	845	3,734
1993	148	558	17	50	64	526	1,363
1994	249	436	58	38	495	1,517	2,793
1995	436	71	54	9	36	1,051	1,657
1996	150	320	35	85	9	190	789
1997	442	147	532	85	423	1,191	2,820
Average	258	1,115	99	148	186	1,155	1,155

whitefish is 10,000 mature adults, and the maximum exploitation rate is from 10 to 15%. The threshold abundance level for least cisco is 40,000 mature adults, and maximum exploitation rate is from 20 to 25%.

Recent Fishery Performance

The whitefish fishery on the Chatanika River has been closed by emergency order since September 5, 1994. Harvest (illegal) of whitefish from the Chatanika River during 1995 was only 9 fish; in 1996 was only 18 fish, and the estimate for 1997 was 42 fish. These harvests may be from anglers hook-and-line fishing who do not realize that the current closure affects all harvest, not just spear fishing. Abundance estimates for whitefish in the Chatanika were not conducted in 1995 or 1996, but estimates of stock composition were obtained in 1996 (Fleming 1997) and an abundance estimate was done in 1997 (Fleming 1997). Abundance of humpback whitefish increased in 1997 to above the levels of 1993 and 1994, but the estimate for least cisco was below estimates for 1993 and 1994, and was almost 70% lower than the 1992 estimate (Table 24).

Recent Board of Fisheries Action

There were no proposals related to whitefish in the Tanana drainage before the Board of Fisheries in 1997, and no Board action was taken relating to whitefish in the Tanana drainage.

Current Issues

Stock assessment of whitefish on Chatanika River over the past few years has indicated that although the spawning population of humpback whitefish has recovered, and that the stock is showing good recruitment of younger age classes, the same is not true of the spawning population of least cisco (Table 25). Abundance estimates for least cisco have fallen between 1992 and 1997 by almost 70%, and stock composition analysis showed a continuing decline in the number of three-year old least cisco. Whereas stock assessment between 1992 and 1994 showed three-year old least cisco making up over 30% of the total estimate, three-year olds only represented 14% of the 1997 sample, and only 5% of the 1997 abundance estimate. This recruitment failure will result in a weak year class that will slow any stock recovery.

There remains a segment of the angling public who wish to participate in a spear fishery for whitefish in the Tanana drainage. The Department receives inquiries each fall as to whether or not the Chatanika will open to spearing that year. Because of this ongoing interest, it is possible that new spear fisheries may emerge on small stocks of whitefish in some of the clearwater tributaries of the Tanana River, and reported harvest levels should be tracked in future years, especially from those streams that are easily accessible.

The current closure of the whitefish fishery at the Chatanika River closes the fishery to all methods of fishing, including hook-and-line. Differences between reported catches and harvests of whitefish from the Chatanika River since it has been closed in 1994 indicate that some anglers may be unaware of this aspect of the closure, and target whitefish for harvest while hook-and-line fishing. Because the spawning stock of humpback whitefish in the Chatanika is above the harvest threshold level in the Management Plan and because hook-and-line fishing would allow anglers to selectively harvest only humpback whitefish, the department should consider

Table 25.-Humpback whitefish and least cisco abundance estimates from the Chatanika River, 1992-1997[a].

Assessment Year:	Humpback Whitefish	Least Cisco
1992	19,187 fish (SE = 1,617)	75,035 fish (SE = 8,555)
1993	13,112 fish (SE = 1,096)	46,562 fish (SE = 5,971)
1994	12,700 fish (SE = 1,138)	27,639 fish (SE = 3,211)
1995	NA	NA
1996	NA	NA
1997	16,107 (SE = 1,260)	22,811 (SE = 4,496)

[a] Data from Fleming (1977).

amending the current closure to allow to hook-and-line fishing for humpback whitefish in the Chatanika River.

Ongoing Research and Management Activities

No stock assessment of whitefish was undertaken on the Chatanika River during 1995. During 1996, size and age composition was estimated, and during 1997, an abundance estimate was done. A stock composition sample was taken during 1998. Because the current emergency order closing the fishery remains in effect until superceded by a new emergency order, no management action was taken relating to the Chatanika whitefish fishery between 1995 and 1998. The department provides news releases and other public information to ensure that the fishing public is aware that the fishery remains closed.

Because the stock of least cisco in the Chatanika has not been rebuilding, and research indicates that a recruitment failure took place in 1997, it is unlikely that abundance levels of least cisco will reach the threshold level set to allow harvest in 1999. Because of this, research on whitefish stocks in the Chatanika River should be limited to estimating stock composition during 1999, and abundance estimation should not be done until 2000.

SECTION III: 1998 FISHERIES OVERVIEW

CHENA RIVER ARCTIC GRAYLING SPORT FISHERY

Abundance estimation was conducted for Arctic grayling in the lower 150 km of the Chena River during 1998. The estimate for 1998 was 27,565 fish over 150 mm, which represents a 23% decrease from the estimate of 1997, and a 30% decrease from the estimate of 1996. Age and size composition of Arctic grayling sampled during the 1998 population estimation indicated that there was little decrease in the number of fish five years old and older, but that the number of fish younger than five years old had dropped substantially from the 1997 estimate.

Delta Clearwater River Arctic Grayling Sport Fishery

Arctic grayling catch and release regulations continue in effect in the DCR. Mark – recapture abundance estimates are conducted within the 13 miles of river. The estimate for 1998 was 6,723 (SE = 742) fish greater than 240 mm. A mark-recapture experiment was completed along with a companion survey of the river by divers using snorkels. An estimated 1,915 (SE = 99) fish of all sizes were present in 11 miles of river. Division of Parks and Recreation indicated campground use declined in 1998, and catch and release regulations were cited as the probable cause. Increasing recruitment of young fish to the population was observed for the first time in four years in 1997, this trend continued in 1998.

Chinook Salmon Sport Fishery

Estimates of escapement abundance and length, age, and sex composition of chinook salmon were conducted on the Chena, Salcha, and Chatanika rivers during July and August of 1998. Because run strength indicators suggested weak returns for chinook within the entire Yukon drainage, and escapement estimates indicated the same for the Chena and Salcha river chinook runs up to July 14th, fishing for chinook salmon was restricted to catch-and-release only on that date in all three rivers.

Escapement estimates for 1998 for the Salcha and Chena rivers were below the escapement goals set in the current management plans for these fisheries. The estimated escapement for the Chena River was 4,672 (SE = 487), over 25% below the escapement goal of 6,300 fish. The estimated escapement for the Salcha River was 5,055, over 28% below the escapement goal of 7,100 fish. The escapement estimate for the Chatanika River was 861 fish. This estimate is substantially below the estimated abundance of 1997, which was over 3,000, but that estimate had extremely large confidence intervals. There is currently no escapement goal for the Chatanika River chinook run.

Coho Salmon Sport Fishery

During 1998, the coho salmon run in the Delta Clearwater River was about two weeks late, with a peak escapement count of 13,875 fish of which 20% were in the non-navigable portion of the river.

Lake Trout Sport Fishery

A three-year research project began in Fielding Lake to estimate the population of lake trout. No other lake trout research occurred in the Tanana River drainage (TRD) in 1998.

Burbot Sport Fishery

Abundance and an index of abundance were estimated for burbot in Fielding Lake. The Multi-year estimate for single sampling done in 1998 is generated for 1997. Estimates are made for fully (450 millimeters total length and longer) and partially (300 to 449 millimeters total length) recruited burbot. CPUE was 0.84 (SE = 0.11) and 0.42 (SE = 0.07), respectively. In 1997, estimated abundance of fully recruited burbot was 420 (SE = 58). The length composition and CPUE of burbot in a 29 km sections the Tanana River near Fairbanks and in the Chena River was estimated in 1998. Results of this estimate are similar to 1997 but the 1998 data has not been analyzed yet.

Northern Pike Sport Fishery

Northern pike research conducted in the Tanana drainage during 1998 was limited to population estimation at Harding Lake. The abundance estimate for 1998 was about 1,300 fish over 300 mm, which is a decline of about 16% from the estimate of 1997, and a decrease of about 44% from the average of the seven population estimates done between 1990 and 1997.

Whitefish Sport Fishery

No abundance estimate for whitefish in the Chatanika River was conducted during 1998. Age and length composition sampling done in 1998 indicate that recruitment of age-3 least cisco may be improving slightly from 1997, but that recruitment of age three humpback whitefish may have declined from 1997.

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APPENDIX A

Appendix A. –Sport fishing effort by location in the Tanana River drainage, 1983-1997.

	[a]Effort (Angler-Days) by Year														
Fishery	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997
Tanana Area:															
Chena River[b]	40,902	40,223	27,133	35,030	25,065	31,851	37,562	29,361	21,138	12,654	21,649	27,194	37,479	45,942	37,638
Piledriver Slough	4,148	4,651	NR	NR	13,267	24,375	22,746	27,705	17,703	13,607	17,263	11,369	12,613	11736	9,878
Nenana River Drain.	NR	NR	NR	NR	1.575	1,912	1,719	724	1,550	1,863	1,026	1,020	1,370	2,254	1,346
Chatanika River	10,757	8,605	10,231	7,783	11,065	11,642	12,210	11,801	8,085	6,775	7,671	7,272	12,697	11,124	9,192
Salcha River	11,802	8,449	13,109	13,792	10,576	7,494	9,704	9,783	11,242	4,833	7,313	7,653	14,516	13,046	11,276
Delta Clearwater R.	5,867	5,139	8,722	10,137	5,397	5,184	5,368	4,853	5,594	3,862	4,909	3,984	6,261	4,622	2,925
Goodpaster River	1,989	766	2,844	933	3,061	1,037	1,930	2,083	786	1,430	1,162	825	2,028	1,737	2,996
Tanana River	NR	2,195	988	9,449	5,940	4,965	4,850	4,593	5,115	6,102	5840	4,816	8,722	6,724	6,088
Brushkana Creek	NR	NR	NR	550	674	1,114	887	725	666	1,120	1,149	1,277	1,432	1,202	1,776
Shaw Creek	NR	2,195	1,248	2,003	797	NR	488	1,462	773	491	732	541	868	449	NR
Richardson Clear.	1,349	NR	NR	NR	NR	NR	1,364	518	1,199	1,355	514	566	1,168	2,148	NR
Delta R. (below Tangle Lakes)	NR	NR	624	NR	NR	800	388	958	679	790	1,142	1,040	1,186	837	746
Other Stream	19,054	10,904	12,675	7,378	7,556	10,578	6,168	7,653	4,628	4,164	6,360	5,209	8,415	9,022	5,922
Birch Lake	15,882	13,170	14,444	9,969	15,375	15,607	14,284	15,541	13,893	10,072	10,447	9,880	11,702	14,208	7,929
Quartz Lake	14,162	15,922	16,456	18,486	20,410	19,391	18,299	19,746	15,478	13,486	17,613	14,031	17,569	14,163	9,239
Fielding Lake	1,737	871	1,023	1,682	1,032	1,728	1,664	1,255	1,572	1,803	1,827	2,129	3,575	1,264	1,664
Minto Lakes	1,281	1,829	2,011	3,318	1,539	1,564	699	932	1,532	2,401	3,911	6,229	6,260	3,973	4,372
Tangle Lakes	5,513	3,954	5,601	5,122	2,530	2,656	3,991	5,228	6,407	4,791	8,937	7,525	7,678	5,817	7,305
Chena Lakes	NR	11,044	11,288	8,853	9,472	9,404	16,180	12,875	9,444	6,007	6,688	2,828	9,317	11,582	8,534
Harding Lake	NR	1,707	NR	2,064	5,125	3,256	4,935	3,895	5,155	5,068	4,885	4,913	6,743	6,734	4,100
Dune Lake	NR	NR	NR	NR	NR	NR	2,296	815	799	854	587	744	851	912	901
East Twin Lake	NR	NR	NR	NR	NR	NR	765	1,035	679	950	406	NR	458	NR	NR
George Lake	860	1,254	1,127	1,957	1,467	964	610	1,540	1,931	1,067	772	594	708	998	783
Volkmar Lake	270	NR	NR	NR	NR	NR	NR	NR	1,052	608	NR	NR	1,263	NR	NR
Koole Lake	NR	NR	NR	NR	NR	NR	433	686	NR	NR	NR	886	1,060	NR	577
Healy Lake	NR	NR	NR	NR	NR	NR	954	NR	NR	NR	NR	NR	NR	NR	NR
Steese Ponds	NR	NR	NR	NR	NR	NR	NR	NR	1,785	960	2,142	1,302	1,452	2,530	1,822
Chena Hot Springs Road Ponds	NR	NR	NR	NR	NR	NR	NR	NR	2,224	1,206	1,655	2,098	2,386	1,687	2,629
Meadow Road Lakes	NR	NR	NR	NR	NR	NR	NR	NR	2,975	1,751	5,894	5,270	2,038	765	1,905
Coal Mine Road	NR	NR	NR	NR	NR	NR	NR	NR	1,230	565	771	782	1,672	1,327	1,774
Other Lakes	9,813	12,874	6,898	6,431	14,148	19.996	15,924	19,120	10,349	9,669	NR	14,976	16,810	25,036	14,548
Other	NR	NR	NR	NR	NR	NR	NR	NR	NR	533			1,092	NR	NR
Total	145,386	145,752	136,422	144,937	156,061	175,518	186,418	184,887	155,663	120,837	160,117	148,633	201,389	203,962	157,865