

Fishery Management Report No. 96-5

**Area Management Report for the Recreational
Fisheries of the Upper Copper/Upper Susitna River
Management Area, 1995**

by

Nicole J. Szarzi

November 1996

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

FISHERY MANAGEMENT REPORT NO. 96-5

**AREA MANAGEMENT REPORT FOR THE RECREATIONAL
FISHERIES OF THE UPPER COPPER/UPPER SUSITNA RIVER
MANAGEMENT AREA, 1995**

by
Nicole J. Szarzi
Division of Sport Fish, Glennallen

Alaska Department of Fish and Game
Division of Sport Fish, Research and Technical Services
333 Raspberry Road, Anchorage, Alaska 99518-1599

November 1996

The Fishery Management Reports series was established in 1989 for the publication of an overview of Division of Sport Fish management activities and goals in a specific geographic area. Fishery Management Reports are intended for fishery and other technical professionals, as well as lay persons. Distribution is to state and local publication distribution centers, libraries and individuals and, on request, to other libraries, agencies, and individuals. This publication has undergone regional peer review.

Nicole J. Szarzi
Alaska Department of Fish and Game, Division of Sport Fish,
P.O. Box 47, Glennallen, AK 99588-0047, USA

This document should be cited as:

Szarzi, Nicole J. 1996. Area management report for the recreational fisheries of the Upper Copper/Upper Susitna River management area, 1995. Alaska Department of Fish and Game, Fishery Management Series No. 96-5, Anchorage.

The Alaska Department of Fish and Game administers all programs and activities free from discrimination on the basis of sex, color, race, religion, national origin, age, marital status, pregnancy, parenthood, or disability. For information on alternative formats available for this and other department publications, contact the department ADA Coordinator at (voice) 907-465-4120, or (TDD) 907-465-3646. Any person who believes s/he has been discriminated against should write to: ADF&G, PO Box 25526, Juneau, AK 99802-5526; or O.E.O., U.S. Department of the Interior, Washington, DC 20240.

TABLE OF CONTENTS

| | Page |
|--|------|
| LIST OF TABLES..... | iii |
| LIST OF FIGURES..... | iv |
| SECTION I: MANAGEMENT AREA OVERVIEW | 1 |
| Management Area Description | 1 |
| Fisheries Resources | 1 |
| Alaska Board of Fisheries Activities | 3 |
| Established Management Plans and Policies | 3 |
| Recreational Angler Effort..... | 9 |
| Other User Groups..... | 14 |
| Economic Value of Recreational Fisheries | 14 |
| Major Issues..... | 14 |
| Access Programs..... | 20 |
| SECTION II: FISHERIES | 23 |
| Arctic Grayling Sport Fisheries | 23 |
| Gulkana River Arctic Grayling Sport Fishery..... | 23 |
| Background and Historical Perspective..... | 23 |
| Fishery Objectives..... | 29 |
| Recent Board of Fisheries Actions | 33 |
| Recent Fishery Performance..... | 33 |
| Current Issues..... | 33 |
| Recommended Research and Management | 33 |
| Lake Trout Sport Fisheries | 33 |
| Background and Historical Perspective | 33 |
| Fishery Objectives | 35 |
| Recent Board of Fisheries Action | 35 |
| Recent Fishery Performance | 39 |
| Current Issues..... | 41 |
| Recommended Research and Management | 41 |
| Burbot Sport Fisheries | 41 |
| Background and Historical Perspective | 41 |
| Fishery Objectives | 45 |
| Recent Board of Fisheries Actions..... | 47 |
| Recent Fishery Performance | 47 |
| Current Issues..... | 48 |
| Recommended Research and Management | 48 |
| Chinook Salmon Sport Fisheries..... | 48 |
| Gulkana River Chinook Salmon Sport Fishery | 59 |
| Background and Historic Perspective | 59 |
| Fishery Objectives..... | 64 |
| Recent Board of Fisheries Actions | 64 |
| Recent Fishery Performance..... | 64 |
| Current Issues..... | 65 |
| Proposed Research and Management Activities..... | 66 |
| Klutina River Chinook Salmon Sport Fishery..... | 66 |
| Background and Historical Perspective..... | 66 |
| Fishery Objectives..... | 67 |

TABLE OF CONTENTS (Continued)

| | Page |
|--|-------------|
| Recent Board of Fisheries Actions | 70 |
| Recent Fishery Performance | 70 |
| Current Issues | 70 |
| Proposed Research and Management Activities | 71 |
| Other Copper Basin Chinook Salmon Sport Fisheries | 71 |
| Wild Rainbow and Steelhead Trout Sport Fisheries | 72 |
| Copper River Personal Use and Subsistence Salmon Fisheries | 73 |
| Background and Historical Perspective | 73 |
| Fishery Objectives | 79 |
| Inseason Management Approach | 79 |
| Recent Board of Fisheries Actions | 84 |
| Recent Fishery Performance | 84 |
| Current Issues | 84 |
| Recommended Research and Management | 91 |
| Stocked Fisheries | 91 |
| LITERATURE CITED | 94 |

LIST OF TABLES

| Table | Page |
|--|-------------|
| 1. Emergency orders issued for UCUSMA sport and personal use fisheries during 1987 through 1996. | 4 |
| 2. Number of angler-days of sport fishing effort expended by recreational anglers fishing UCUSMA waters, 1977-1995. | 10 |
| 3. Number of angler-days of sport fishing effort expended by recreational anglers fishing upper Copper River and upper Susitna River drainage waters in the UCUSMA, 1977-1995. | 12 |
| 4. Sport fishing effort (angler-days) in the UCUSMA, averaged for the period from 1977-1986, and annually for the period 1987-1995. | 13 |
| 5. Commercial harvests of chinook and sockeye salmon in the Copper River District, 1977-1996. | 15 |
| 6. Reported subsistence and personal use harvests of chinook, sockeye, and coho salmon in the Copper River, 1977-1996. | 16 |
| 7. Estimated expenditures and net willingness-to-pay (net WTP) in thousands of dollars, for recreational anglers fishing the Gulkana River and Lake Louise complex during 1986. | 17 |
| 8. Estimated economic value of UCUSMA sport fisheries during 1986. | 18 |
| 9. Number of fish harvested, by species, by recreational anglers fishing UCUSMA waters, 1977-1995. | 24 |
| 10. Harvest of Arctic grayling by recreational anglers fishing UCUSMA, averaged for the period from 1977-1986, and annually for the period 1987-1995. | 27 |
| 11. Harvest and catch of Arctic grayling by recreational anglers fishing the Gulkana River drainage, 1977-1995. | 31 |
| 12. Harvest of lake trout by recreational anglers fishing UCUSMA waters averaged for the period from 1977-1986 and annually for the period 1987-1995. | 36 |
| 13. Harvest of burbot by recreational anglers fishing UCUSMA waters, 1977-1995. | 43 |
| 14. Harvest of burbot caught by recreational anglers fishing in the UCUSMA averaged for the period from 1977-1986 and annually for the period 1987-1995. | 44 |
| 15. Upper Copper River chinook salmon aerial escapement index counts, 1966-1996. | 50 |
| 16. Copper River chinook salmon harvest and escapement index estimates, 1966-1995. | 52 |
| 17. Harvest of chinook salmon by recreational anglers fishing in the UCUSMA averaged for the period from 1977-1986 and annually for the period 1987-1995. | 58 |
| 18. Sport harvest and observed spawning escapements of chinook salmon in the Gulkana River drainage from 1977-1995. | 62 |
| 19. Sport harvest and observed spawning escapements of chinook salmon in the Klutina River drainage from 1983-1995. | 68 |
| 20. Harvest of wild rainbow trout by sport anglers fishing UCUSMA waters averaged for the period from 1977-1986 and annually for the period 1987-1995. | 74 |
| 21. Harvest of steelhead trout by sport anglers fishing UCUSMA waters, averaged for the period from 1977-1986, and annually for the period 1987-1995. | 75 |
| 22. Number of permits issued and salmon harvests during the subsistence salmon fishery in the Copper River, 1965-1996. | 80 |
| 23. Number of permits issued and salmon harvested during the personal use salmon fishery in the Copper River, 1984-1996. | 82 |
| 24. Allowable versus observed salmon harvests during the personal use salmon fishery in the Copper River, 1984-1996. | 86 |
| 25. Guideline versus observed salmon harvests during the subsistence salmon fishery in the Copper River, 1984-1996. | 88 |
| 26. Allowable versus observed salmon harvests, by week, during the personal use salmon fishery in the Copper River, 1991-1994. | 90 |
| 27. Number and species of fish stocked (actual and planned) in UCUSMA waters, 1991-1997. | 92 |

LIST OF FIGURES

| Figure | Page |
|---|-------------|
| 1. The Upper Copper-Upper Susitna Management Area (UCUSMA)..... | 2 |
| 2. Number of angler-days expended by recreational anglers fishing UCUSMA waters, 1977-1995..... | 11 |
| 3. Number of fish harvested, by species, by recreational anglers fishing UCUSMA waters, 1977-1995..... | 25 |
| 4. Harvest of Arctic grayling by recreational anglers fishing UCUSMA waters, 1977-1995..... | 26 |
| 5. The Gulkana River drainage..... | 30 |
| 6. Annual harvest of Arctic grayling from the UCUSMA, 1977-1995..... | 32 |
| 7. Lakes supporting major lake trout fisheries in the UCUSMA..... | 34 |
| 8. Annual harvest of lake trout from the UCUSMA, 1977-1995..... | 38 |
| 9. Annual lake trout harvests from the Tyone and Gulkana river drainages, 1984-1995..... | 40 |
| 10. Lakes supporting major burbot fisheries in the UCUSMA..... | 42 |
| 11. Harvest of burbot by recreational anglers fishing UCUSMA waters, 1977-1995..... | 46 |
| 12. Observed spawning escapement index counts for chinook salmon in the Copper River drainage, 1966-1996..... | 51 |
| 13. Harvest of Copper River chinook salmon, by fishery, 1966-1995..... | 53 |
| 14. Commercial harvest of Copper River chinook salmon, 1966-1996..... | 55 |
| 15. Subsistence and personal use harvest of Copper River chinook salmon, 1966-1995..... | 56 |
| 16. Sport harvest of Copper River chinook salmon, 1966-1995..... | 57 |
| 17. Comparison of Copper River chinook salmon harvest and spawning escapement index counts, 1966-1995..... | 60 |
| 18. Comparison of chinook salmon harvest and spawning escapement index counts in the Gulkana River, 1977-1995..... | 63 |
| 19. Comparison of chinook salmon harvest and spawning escapement index counts in the Klutina River, 1983-1995..... | 69 |
| 20. Harvest of wild rainbow/steelhead trout by recreational anglers fishing UCUSMA waters, 1977-1995..... | 76 |
| 21. Annual harvest of salmon, and number of permits issued in the Copper River subsistence fishery, 1965-1995..... | 81 |
| 22. Annual harvest of salmon, and number of permits issued in the Copper River personal use fishery, 1984-1995..... | 83 |
| 23. Difference between estimated and allowable harvests during the Copper River personal use salmon fishery, 1984-1995..... | 85 |
| 24. Difference between estimated and guideline harvests during the Copper River subsistence salmon fishery, 1984-1995..... | 89 |

SECTION I: MANAGEMENT AREA OVERVIEW

MANAGEMENT AREA DESCRIPTION

The Upper Copper River-Upper Susitna River sport fish management area (UCUSMA) consists of all waters and drainages of the Copper River upstream from a line crossing the Copper River between the south bank of the mouth of Haley Creek and the south bank of the mouth of Canyon Creek in Wood Canyon, and all waters and drainages of the Upper Susitna River upstream from the confluence of the Oshetna River (Figure 1). Located within the UCUSMA are the communities of Glennallen, Gulkana, Gakona, Chitina, McCarthy, Kenny Lake, Copper Center, Paxson, Mentasta, Slana and Nabesna. The state's major highways, together with numerous secondary roads and trails, provide relatively good access to most of the area's sport fisheries. Float-equipped aircraft are commonly used during the summer to access the area's many remote lake and stream fisheries not accessible by road. Snowmachines are the popular mode of travel to remote fisheries in the winter. Principal land managers in the UCUSMA are the National Park Service, Bureau of Land Management, Ahtna Incorporated, and the Alaska Department of Natural Resources.

Regulations governing the sport fisheries in the UCUSMA are found in Chapter 52 of Title 5 of the Alaska Administrative Code and regulations regarding the personal use fisheries are found in Chapter 77. Effort and harvest statistics for UCUSMA fisheries are reported in the statewide harvest survey (SWHS) by Mills (1979-1994) and Howe et al. (1995 and 1996), under the heading "Glennallen Area" (Area I).

Management and research of UCUSMA sport and personal use fisheries are directed from the Anchorage and Glennallen area offices of the Alaska Department of Fish and Game. The Area Management Biologist (Andrew Hoffmann) is stationed in Anchorage. The Assistant Area Management Biologist (Nicole Szarzi) is stationed in Glennallen. A permanent full-time field office assistant is also stationed in Glennallen. This assistant is shared with the Division of Wildlife Conservation. The professional staff is assisted by numerous seasonal technicians and biologists whose employment ranges from 2 to 11 months. Expertise on experimental design is provided to the area staff by the Division of Sport Fish, Research and Technical Services staff stationed in Anchorage.

FISHERIES RESOURCES

The UCUSMA offers a unique blend of freshwater fishing opportunities to sport anglers and personal use participants. Three species of North Pacific salmon (chinook *Oncorhynchus tshawytscha*, coho *O. kisutch*, and sockeye *O. nerka*) are available to anglers fishing upper Copper River drainage waters. The upper Susitna River drainage has no anadromous salmon. A velocity barrier in Devil's Canyon prevents upstream migration in the Susitna River. Anglers can also target salmon stocked into various landlocked lakes of the UCUSMA.

Popular fisheries also occur on the area's resident stocks of Arctic grayling *Thymallus arcticus*, burbot *Lota lota*, Dolly Varden *Salvelinus malma*, rainbow and steelhead trout *O. mykiss*, and lake trout *Salvelinus namaycush*. Smaller fisheries occur on the area's resident stocks of whitefish *Coregonus* and *Prosopium*.

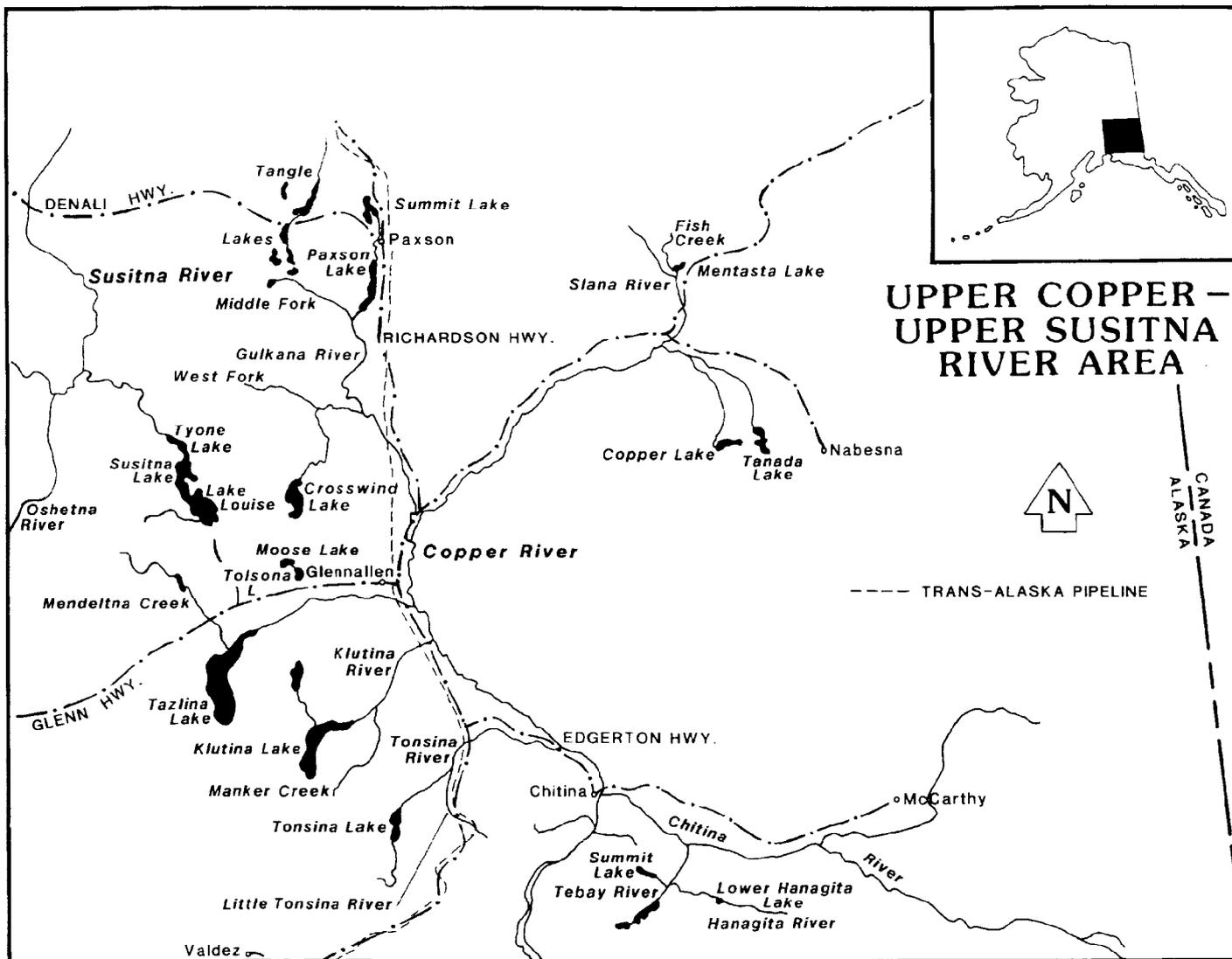


Figure 1.-The Upper Copper-Upper Susitna Management Area (UCUSMA).

ALASKA BOARD OF FISHERIES ACTIVITIES

The development of regulations for fisheries in the UCUSMA occurs within the established Alaska Board of Fisheries (BOF) process. The public provides their input concerning regulation changes and allocation by various means including testifying directly to the BOF, by participating in local fish and game advisory committee meetings, or by becoming members of local fish and game advisory committees. Advisory committees have been established throughout Alaska to assist the BOF in assessing the effects of fisheries issues and proposed regulations on communities local to the resource under consideration. Most active committees meet at least once each year, usually in the fall prior to scheduled BOF meetings. Staff from the Division of Sport Fish and other divisions are often invited to attend the committee meetings. In this way, advisory committee meetings allow the public to interact with the staff involved with resource issues of local concern. Within the UCUSMA there are three advisory committees that serve resource users of the area: the Tok Cutoff/Nabesna Road, Copper Basin, and Paxson advisory committees.

Under the current operating schedule, the BOF meets on a 3-year cycle. Proposals regarding UCUSMA fisheries were last heard during the February 1994 BOF meeting. The next BOF meeting to address proposals regarding UCUSMA sport and personal use fisheries is scheduled for December 1996. The deadline for submission of proposals for the next BOF meeting was April 10, 1996.

To address conservation concerns and to implement BOF adopted management plans, 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 1987 through 1996 are summarized in Table 1.

ESTABLISHED MANAGEMENT PLANS AND POLICIES

Some UCUSMA fisheries have been the focus of allocative conflicts. These conflicts have led the BOF to establish several management plans and policies to guide the area's fisheries. The goal of these plans is to allocate fish resources among users and to provide managers with guidelines to maintain a sustained yield of the area's fish stocks. The following management plans and policies have been adopted by the BOF for UCUSMA fish stocks:

Copper River Personal Use Salmon Fishery Management Plan (5 AAC 77.590). This management plan establishes weekly and seasonal harvest quotas for a personal use fishery in the Copper River. The plan contains spawning escapement goals for sockeye and chinook salmon, harvest guidelines for the subsistence and sport fisheries in the drainage, and hatchery brood stock and hatchery surplus goals. The goals are met through regulation of the commercial fishery at the mouth of the river.

Copper River Subsistence Salmon Fisheries Management Plan (5 AAC 01.647). This management plan establishes a seasonal target count of salmon which must pass the sonar in the lower Copper River. It also establishes the open area, gear, season, bag and possession limits, and permit requirements for a subsistence fishery near the traditional fishing village of Batzulnetas along a portion Tanada Creek and its confluence with the Copper River.

Table 1.-Emergency orders issued for UCUSMA sport and personal use fisheries during 1987 through 1996.

| Year | E. O. Number | Explanation |
|------|--------------|---|
| 1987 | 2-BB-3-xx-87 | Closure of Hudson Lake to burbot fishing. |
| 1988 | 2-BB-3-17-88 | Closure of Hudson Lake to burbot fishing. |
| 1988 | 2-RT-3-18-88 | Closure of Summit Lake and Bridge Creek to all fishing by regulation from April 15 through July 10 to protect spawning rainbow trout. |
| 1988 | 2-RS-3-08-88 | Opening of portions of Paxson and Summit lakes to the taking of sockeye salmon. |
| 1989 | 2-BB-3-19-89 | Closure of Hudson Lake and Lake Louise to burbot fishing and prohibition of set-lines in the Tyone River drainage. |
| 1990 | 2-KS-3-10-90 | Closure of Indian River, Ahtell Creek, and all waters within a one-quarter mile radius of their confluence with the Copper River, and Bernard Creek and all waters within a one-quarter mile radius of its confluence with the Tonsina River to fishing for chinook salmon. |
| 1990 | 2-BB-3-34-90 | Extends the closure of Hudson Lake and Lake Louise to burbot fishing and continues the prohibition of set-lines in the Tyone River drainage and Hudson Lake. |
| 1991 | | No emergency orders issued |
| 1992 | 2-RS-3-09-92 | Opened the personal use salmon fishery in the Chitina Subdistrict of the Upper Copper River Area from 12:00 noon Friday, June 5 through 6:00 p.m. Sunday, June 7 (a total of 54 h). |
| 1992 | 2-RS-3-11-92 | Established the season for the 1992 Copper River personal use salmon fishery. |
| 1992 | 2-RS-3-20-92 | Changed the open periods for the Copper River personal use salmon fishery to 12:00 noon Thursday and continuing through Sunday at midnight effective July 16. Thereafter, the fishery was opened 4 days a week, noon Thursdays until midnight Sundays, through August 6. |
| 1993 | 2-RS-3-06-93 | This emergency order provides for personal use salmon fishing in the Chitina Subdistrict of the Upper Copper River Area from 12:00 noon Friday, June 4 through 6:00 p.m. Sunday June 6, 1993, a total of 54 hours. |
| 1993 | 2-RS-3-12-93 | This emergency order opens the personal use dip net salmon fishery in the Chitina Subdistrict of the Upper Copper River area from 6:00 p.m. Thursday, June 10 through 12:00 p.m. Sunday June 13, 1993 a total of 72 hours. |
| 1993 | 2-RS-3-14-93 | This emergency order opens the personal use dip net salmon fishery in the Chitina Subdistrict of the Upper Copper River area from 12:00 noon Tuesday, June 15 through 12:00 noon Sunday June 20, a total of 144 hours. |
| 1993 | 2-RS-3-15-93 | This emergency order opens the personal use dip net salmon fishery in the Chitina Subdistrict of the Upper Copper River area from 12:01 p.m. Sunday, June 20 through 12:00 p.m. Sunday August 1, 1993. |

-continued-

Table 1.-Page 2 of 5.

| Year | E. O. Number | Explanation |
|------|--------------|---|
| 1993 | 2-RS-3-31-93 | This emergency order opens the personal use dip net salmon fishery in the Chitina Subdistrict of the Upper Copper River area from 12:01 p.m. Monday, August 16 through 12:00 p.m. Thursday September 30, 1993. |
| 1993 | 2-BB-3-38-93 | Opening of Hudson Lake to burbot fishing. |
| 1993 | 2-F-E-52-93 | This emergency order establishes a weekly fishing period for the Batzulnetas area to subsistence salmon fishery. The weekly fishing period will be 84-hours in duration from 12:00 noon Thursday to 12:00 midnight Sunday each week until September 1, or until closed by emergency order. |
| 1994 | 2-RS-3-07-94 | Opens the personal use dip net salmon fishery in the Chitina Subdistrict of the Upper Copper River area from 12:00 noon Thursday June 2, through 8:00 p.m., Sunday June 5, 1994 and 12:00 noon Wednesday June 8 through 6:00 p.m. Monday July 4, 1994. |
| 1994 | 2-F-E-04-94 | Establishes a weekly fishing period for the Batzulnetas area subsistence salmon fishery. The weekly fishing period will be 48-hours in duration from 12:00 noon Friday to 12:00 noon Sunday, beginning Friday, June 3. On July 1, the weekly fishing period will be 84-hours in duration from 12:00 noon Friday to 12:00 midnight Monday each week until September 1, or until closed by emergency order. |
| 1994 | 2-RS-3-20-94 | Opens the personal use dip net salmon fishery in the Chitina Subdistrict of the Upper Copper River area for 48 hours from 12:01 p.m. Friday, July 8, through 11:59 a.m. Sunday, July 10. |
| 1994 | 2-RS-3-22-94 | Opens the personal use dip net salmon fishery in the Chitina Subdistrict of the Upper Copper River area for 72 hours from 12:00 noon Thursday July 14 through 12:00 noon Sunday, July 17, 1994. |
| 1994 | 2-RS-3-24-94 | Opens the personal use dip net salmon fishery in the Chitina Subdistrict of the Upper Copper River area for 120 hours from 12:00 noon Thursday, July 21, through 12:00 noon Tuesday, July 26, 1994. |
| 1994 | 2-RS-3-26-94 | Opens the personal use dip net fishery in the Chitina Subdistrict of the Upper Copper River area at 12:00 noon, Tuesday, July 26, and will remain open until midnight, Sunday, August 14. |
| 1994 | 2-RS-3-36-94 | Opens the personal use dip net salmon fishery in Chitina Subdistrict of the Upper Copper River area at midnight Sunday, August 14, until midnight, Friday, September 30, 1994. |
| 1995 | 2-RS-3-09-95 | Opens the personal use dip net salmon fishery in the Chitina Subdistrict of the Upper Copper River area from 12:00 noon Thursday, June 1, through 8:00 p.m. Sunday June 4, and 12:00 noon Wednesday June 7 through 8:00 p.m. Sunday July 11, 1995. |

-continued-

Table 1.-Page 3 of 5.

| Year | E. O. Number | Explanation |
|------|--------------|--|
| 1995 | 2-F-E-14-95 | Establishes a weekly fishing period for the Batzulnetas area subsistence salmon fishery. The weekly fishing period will be 48-hours in duration from 12:00 noon Friday to 12:00 noon Sunday, beginning Friday, June 16. On July 1, the weekly fishing period will be 84-hours in duration from 12:00 noon Friday to 12:00 midnight Monday each week until September 1, or until closed by emergency order. |
| 1995 | 2-RS-3-12-95 | Opens the personal use dip net salmon fishery in the Chitina Subdistrict of the Upper Copper River area from noon Wednesday, June 7, through 8:00 p.m. Sunday, June 11 1995, and from noon Thursday, June 15, through 8:00 p.m. Sunday, June 18, 1995. |
| 1995 | 2-RS-3-13-95 | Opens the personal use dip net salmon fishery in the Chitina Subdistrict of the Upper Copper River area from noon Thursday, June 22, through 8:00 p.m. Sunday, June 25, 1995. |
| 1995 | 2-RS-3-19-95 | Opens the personal use dip net salmon fishery in the Chitina Subdistrict of the Upper Copper River area from noon Thursday, June 29, through 8:00 p.m. Tuesday, July 4, 1995. |
| 1995 | 2-RS-3-23-95 | Opens the personal use dip net salmon fishery in the Chitina Subdistrict of the Upper Copper River area from 8:01 p.m. Tuesday, July 4, through 8:00 p.m. Sunday, July 9, 1995. |
| 1995 | 2-RS-3-24-95 | Opens the personal use dip net salmon fishery in the Chitina Subdistrict of the Upper Copper River area from 8:01 p.m. Sunday, July 9, through 8:00 p.m. Sunday, July 16, 1995. |
| 1995 | 2-RS-3-27-95 | Opens the personal use dip net salmon fishery in the Chitina Subdistrict of the Upper Copper River area from 8:01 p.m. Sunday, July 16, through 8:00 p.m. Sunday, July 23, 1995. |
| 1995 | 2-RS-3-31-95 | Opens the personal use dip net salmon fishery in the Chitina Subdistrict of the Upper Copper River area from 8:01 p.m. Sunday, July 23, through 8:00 p.m. Sunday, July 30, 1995. |
| 1995 | 2-RS-3-35-95 | Opens the personal use dip net salmon fishery in the Chitina Subdistrict of the Upper Copper River area from 8:01 p.m. Sunday, July 30, through 8:00 p.m. Sunday, August 13, 1995. |
| 1995 | 2-RS-3-13-95 | Closes the personal use dip net salmon fishery in the Chitina Subdistrict of the Upper Copper River area at 8:00 p.m. Sunday, August 6, 1995. The personal use dip net salmon fishery will reopen September 1 and remain open until September 30. |
| 1995 | 2-RS-3-44-95 | Opens the personal use dip net salmon fishery in the Chitina Subdistrict of the Upper Copper River area from 12:01 a.m. Friday, September 1, through midnight Saturday, September 30, 1995. |

-continued-

Table 1.-Page 4 of 5.

| Year | E. O. Number | Explanation |
|------|--------------|---|
| 1996 | 2-BB-3-02-96 | Opens the mainstem of the Copper River to the use of unattended lines for burbot and establishes a bag and possession limit of five burbot per day from 12:01 a.m. Tuesday, January 9, 1996 until further notice. |
| 1996 | 2-BB-3-03-96 | Reopens Hudson Lake to the harvesting of burbot using closely attended lines from 12:01 a.m. Tuesday January 9, 1996 until further notice. The bag and possession limits are two burbot per day. |
| 1996 | 2-BB-3-04-96 | This rescinds Emergency Order 2-BB-3-02-96 which was issued in error. Legalization of unattended lines for burbot and liberalization of the daily burbot bag and possession limits in the Copper River mainstem exceeds the emergency order authority granted to designees of the Commissioner of Fish and Game under 5 AAC 75.003 and 16.05.060. |
| 1996 | 2-RS-3-11-96 | Opens the personal use dip net salmon fishery in the Chitina Subdistrict of the Upper Copper River area from noon on June 1 and will close at noon on June 2. |
| 1996 | 2-RS-3-13-96 | Changes the personal use dip net salmon fishery schedule in the Chitina Subdistrict of the Upper Copper River area for the first opening in June. It will open at 8:00 a.m. on June 1 and will close at 8:00 p.m. on June 1. It will also open at 8:00 a.m. on June 2 and will close at 8:00 p.m. on June 2. |
| 1996 | 2-RS-3-16-96 | Opens the personal use dip net fishery in the Chitina Subdistrict of the Upper Copper River area from noon on June 8 to 8:00 p.m. on June 16. |
| 1996 | 2-RS-3-18-96 | Increases the personal use dip net fishery schedule in the Chitina Subdistrict of the Upper Copper River area for the period from June 16 to June 23. The fishery will remain open through 8:00 p.m. June 23. |
| 1996 | 2-RS-3-22-96 | Increases the personal use dip net fishery schedule in the Chitina Subdistrict of the Upper Copper River area for the period from June 23 to June 30. The fishery will remain open through midnight, June 30. |
| 1996 | 2-RS-3-25-96 | Increases the personal use dip net fishery schedule in the Chitina Subdistrict of the Upper Copper River area for the period from June 30 to July 7. The fishery will remain open through midnight, July 7. |
| 1996 | 2-RS-3-26-96 | Increases the personal use dip net fishery schedule in the Chitina Subdistrict of the Upper Copper River area for the period from July 7 to July 14. The fishery will remain open through 8:00 p.m., Sunday, July 14. |
| 1996 | 2-RS-3-29-96 | Increases the personal use dip net fishery schedule in the Chitina Subdistrict of the Upper Copper River area for the period from July 14 to July 28. The fishery will remain open through 8:00 p.m., Sunday, July 28. |
| 1996 | 2-RS-3-32-96 | Increases the personal use dip net fishery schedule in the Chitina Subdistrict of the Upper Copper River area for the period from July 28 to August 4. The fishery will remain open through 8:00 p.m., Sunday, August 4. |
| 1996 | 2-RS-3-34-96 | Increases the personal use dip net fishery schedule in the Chitina Subdistrict of the Upper Copper River area for the period from August 4 to August 11. The fishery will remain open through 8:00 p.m., Sunday, August 11. |

-continued-

Table 1.-Page 5 of 5.

| Year | E. O. Number | Explanation |
|------|--------------|---|
| 1996 | 2-RS-3-37-96 | Increases the personal use dip net fishery schedule in the Chitina Subdistrict of the Upper Copper River area for the period from August 11 to August 18. The fishery will remain open through 8:00 p.m., Sunday, August 18. |
| 1996 | 2-RS-3-39-96 | This supersedes the news release issued August 14 and increases the personal use dip net salmon fishery opening in the Chitina Subdistrict of the Upper Copper River area from August 18 to August 25. The fishery will remain open through 8:00 p.m., Sunday, August 25. |
| 1996 | 2-RS-3-40-96 | Increases the personal use dip net salmon fishery opening in the Chitina Subdistrict of the Upper Copper River area from August 18 to September 30. The fishery will remain open through 11:59 p.m., Monday, September 30. |

Lake Burbot Management Plan (5 AAC 52.045). This management plan stipulates that the burbot fisheries in lakes of the UCUSMA be managed to ensure maximum sustainable harvests, and provides the department the authority to use emergency orders to reduce the time or areas open to fishing and/or prohibit set lines to accomplish this management objective.

Cook Inlet & Copper River Basin Rainbow/Steelhead Trout Management Policy. This management policy was adopted by the BOF to provide future Boards, fisheries managers, and the sport fishing public with: (1) management policies and implementation directives for area rainbow and steelhead trout fisheries; (2) a systematic approach to developing sport fishing regulations that includes a process for rational selection of waters for special management; and (3) recommended research objectives. This management policy was never adopted as regulation.

Copper River District Salmon Management Plan (5 AAC 24.360). This management plan stipulates that during years when Copper River District sockeye salmon returns are forecast to be weak or are demonstrated to be weak by inseason stock assessment monitoring tools and a *strong* harvestable surplus of chinook salmon can be demonstrated, the department may, by emergency order, authorize the use of large mesh gear in the Copper River District commercial salmon fisheries.

RECREATIONAL ANGLER EFFORT

Recreational angler effort in the UCUSMA has been estimated since 1977 using a mail survey (Mills 1979-1994; Howe et al. 1995 and 1996). The survey results for each year are not available until the following year, hence the results for 1996 will not be available until 1997. This survey estimates the number of angler-days of fishing effort expended by sport anglers fishing Alaskan waters as well as the sport harvest. The survey is designed to provide estimates of effort and harvest on a site-by-site basis and, unfortunately, is not designed to provide estimates of effort directed towards a single species. Beginning in 1990, the survey was modified to include estimation of catch (release plus harvest) on a site-by-site basis. Additionally, creel surveys have been selectively used to ground truth the mail survey for fisheries of interest or for fisheries that require more detailed information or inseason management. The following summary of sport angler effort in the UCUSMA is based on mail survey data.

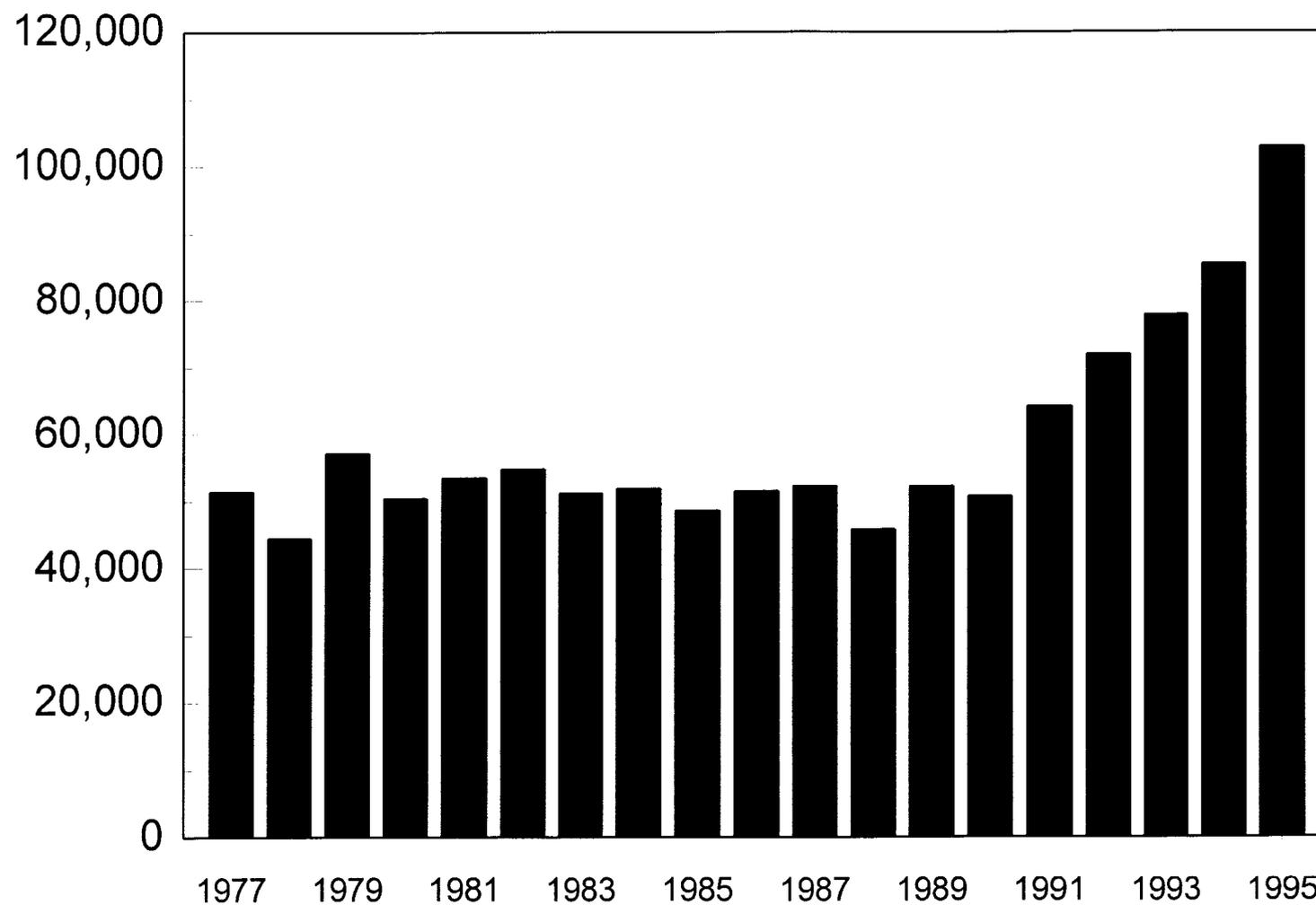
From 1977 through 1995 sport anglers have expended an average of 58,928 angler-days fishing UCUSMA waters, an average of 3.0% of the annual statewide sport angling effort and about 4.2% of the annual Southcentral Alaska (Region II) sport angling effort over this period (Table 2). Recreational angler effort was relatively stable until 1991 when it began to increase (Figure 2).

The upper Copper River drainage has supported an average of 62.7% of the sport effort expended in the UCUSMA from 1977 through 1995 (Table 3). In this drainage, the Gulkana River drainage has supported the vast majority of the sport angling effort (Table 3). The Klutina River is the other upper Copper River drainage which supports a popular sport fishery (Table 4). The major sport fishery in the upper Susitna River drainage is located in the Tyone River drainage and includes Lake Louise and Susitna and Tyone lakes.

Table 2.-Number of angler-days of sport fishing effort expended by recreational anglers fishing UCUSMA waters, 1977-1995.

| Year | UCUSMA Effort | Alaska Effort | % by UCUSMA | Region II Effort | % by UCUSMA |
|---------|------------------|------------------|----------------|---------------------|----------------|
| 1977 | 51,485 | 1,198,486 | 4.3% | 828,351 | 6.2% |
| 1978 | 44,566 | 1,285,063 | 3.5% | 913,417 | 4.9% |
| 1979 | 57,266 | 1,364,739 | 4.2% | 1,014,018 | 5.6% |
| 1980 | 50,518 | 1,488,962 | 3.4% | 1,072,384 | 4.7% |
| 1981 | 53,499 | 1,420,172 | 3.8% | 1,016,731 | 5.3% |
| 1982 | 54,953 | 1,623,090 | 3.4% | 1,131,358 | 4.9% |
| 1983 | 51,276 | 1,732,528 | 3.0% | 1,212,680 | 4.2% |
| 1984 | 51,964 | 1,866,837 | 2.8% | 1,341,658 | 3.9% |
| 1985 | 48,707 | 1,943,069 | 2.5% | 1,406,419 | 3.5% |
| 1986 | 51,563 | 2,071,412 | 2.5% | 1,518,712 | 3.4% |
| 1987 | 52,324 | 2,152,886 | 2.4% | 1,556,050 | 3.4% |
| 1988 | 45,867 | 2,311,291 | 2.0% | 1,679,939 | 2.7% |
| 1989 | 52,262 | 2,264,079 | 2.3% | 1,583,547 | 3.3% |
| 1990 | 50,791 | 2,453,284 | 2.1% | 1,745,110 | 2.9% |
| 1991 | 64,207 | 2,456,328 | 2.6% | 1,782,055 | 3.6% |
| 1992 | 72,052 | 2,540,374 | 2.8% | 1,889,930 | 3.8% |
| 1993 | 77,870 | 2,559,408 | 3.0% | 1,867,233 | 4.2% |
| 1994 | 85,520 | 2,719,911 | 3.1% | 1,966,985 | 4.4% |
| 1995 | 102,951 | 2,787,669 | 3.7% | 1,985,539 | 5.2% |
| Average | 58,928 | 2,012,610 | 3.0% | 1,448,006 | 4.2% |

Number of Angler-Days



Source: Mills 1979-1994; Howe et al. 1995 and 1996.

Figure 2.-Number of angler-days expended by recreational anglers fishing UCUSMA waters, 1977-1995.

Table 3.-Number of angler-days of sport fishing effort expended by recreational anglers fishing upper Copper River and upper Susitna River drainage waters in the UCUSMA, 1977-1995.

| Year | Upper Susitna River | | Upper Copper River | | | | Total | |
|----------------|---------------------|----------------------|--------------------|--------------|---------------------------|--------------------------|---------------|--------------|
| | Number | Percent ^a | Gulkana River | | Other | | Number | Percent |
| | | | Number | Percent | Number | Percent | | |
| 1977 | 14,899 | 28.9% | 12,446 | 24.2% | 2,010 ^b | 3.9% | 14,456 | 28.1% |
| 1978 | 13,161 | 29.5% | 15,487 | 34.8% | 2,584 ^b | 5.8% | 18,071 | 40.5% |
| 1979 | 12,199 | 21.3% | 25,073 | 43.8% | 1,099 ^b | 1.9% | 26,172 | 45.7% |
| 1980 | 10,539 | 20.9% | 21,477 | 42.5% | 1,866 ^b | 3.7% | 23,343 | 46.2% |
| 1981 | 14,397 | 26.9% | 22,332 | 41.7% | 1,473 ^b | 2.8% | 23,805 | 44.5% |
| 1982 | 14,024 | 25.5% | 23,834 | 43.4% | 1,844 ^b | 3.4% | 25,678 | 46.7% |
| 1983 | 13,622 | 26.4% | 25,342 | 49.2% | 9,936 | 19.3% | 35,278 | 68.5% |
| 1984 | 15,875 | 30.5% | 19,937 | 38.4% | 12,872 | 24.8% | 32,809 | 63.1% |
| 1985 | 12,103 | 24.8% | 23,115 | 47.5% | 10,732 | 22.0% | 33,847 | 69.5% |
| 1986 | 17,034 | 33.0% | 18,894 | 36.6% | 11,372 | 22.1% | 30,266 | 58.7% |
| 1987 | 9,638 | 18.4% | 25,467 | 48.7% | 15,629 | 29.9% | 41,096 | 78.5% |
| 1988 | 10,222 | 22.3% | 18,923 | 41.3% | 13,825 | 30.1% | 32,748 | 71.4% |
| 1989 | 9,713 | 18.6% | 23,405 | 44.8% | 15,247 | 29.2% | 38,652 | 74.0% |
| 1990 | 9,411 | 18.5% | 26,284 | 51.7% | 12,233 | 24.1% | 38,517 | 75.8% |
| 1991 | 9,752 | 15.2% | 30,366 | 47.3% | 22,422 | 34.9% | 52,788 | 82.2% |
| 1992 | 12,041 | 16.7% | 34,855 | 48.4% | 21,819 | 30.3% | 56,674 | 78.7% |
| 1993 | 16,836 | 21.6% | 35,845 | 46.0% | 21,265 | 27.3% | 57,110 | 73.3% |
| 1994 | 18,607 | 21.8% | 34,742 | 40.6% | 27,120 | 31.7% | 61,862 | 72.3% |
| 1995 | 20,846 | 20.2% | 44,077 | 42.8% | 31,384 | 30.5% | 75,461 | 73.3% |
| Average | 13,417 | 23.2% | 25,363 | 42.8% | 17,374^c | 27.4%^c | 37,823 | 62.7% |

^a Percent of total effort expended in the UCUSMA during each year.

^b Estimates were combined into general categories precluding estimation of harvests from specific drainages.

^c Average during the period 1983 to 1995.

Table 4.-Sport fishing effort (angler-days) in the UCUSMA, averaged for the period from 1977-1986, and annually for the period 1987-1995.

| Areas | 1977-86 | 1987 | 1988 | 1989 | 1990 | 1991 | 1992 | 1993 | 1994 | 1995 |
|---|---------------------|--------|--------|--------|--------|--------|--------|--------|--------|---------|
| Gulkana River Drainage | | | | | | | | | | |
| Lakes | 7,621 | 7,578 | 7,593 | 7,636 | 7,172 | 9,047 | 8,816 | 8,302 | 9,121 | 10,716 |
| Streams | 13,166 ^a | 17,755 | 11,330 | 15,769 | 19,112 | 21,285 | 26,039 | 27,543 | 25,581 | 33,388 |
| Total | 20,787 | 25,333 | 18,923 | 23,405 | 26,284 | 30,332 | 34,855 | 35,845 | 34,702 | 44,005 |
| Upper Susitna Drainage | | | | | | | | | | |
| Lakes | | 9,399 | 9,768 | 9,383 | 8,334 | 8,342 | 10,569 | 14,345 | 16,567 | 17,000 |
| Streams | | 188 | 454 | 330 | 992 | 1,376 | 1,408 | 2,491 | 2,027 | 3,716 |
| Total | 13,785 ^a | 9,587 | 10,222 | 9,713 | 9,326 | 9,718 | 11,977 | 16,836 | 18,594 | 20,716 |
| Klutina River Drainage | 3,306 ^b | 6,394 | 6,130 | 6,053 | 5,556 | 12,145 | 6,398 | 8,177 | 10,624 | 14,496 |
| Tazlina Drainage | 1,634 ^b | 3,041 | 2,526 | 1,594 | 2,060 | 2,356 | 3,773 | 3,230 | 4,315 | 4,687 |
| Tonsina Drainage | 1,185 | 621 | 723 | 980 | 498 | 2,072 | 2,240 | 2,901 | 2,254 | 3,912 |
| Copper River | | | | | | | | | | |
| Upstream of Gulkana | 993 ^b | 772 | 1,258 | 1,728 | 980 | 853 | 476 | 1,271 | 1,419 | 1,682 |
| Copper River | | | | | | | | | | |
| Downstream of Klutina ^c (not including Tonsina) | 467 ^b | 253 | 248 | 1,322 | 648 | 390 | 1,346 | 728 | 1,811 | 1,474 |
| Stocked Lakes/Streams | 3,140 | 4,511 | 2,940 | 3,438 | 2,577 | 4,675 | 7,246 | 4,665 | 5,051 | 4,766 |
| Other Sites | | | | | | | | | | |
| Lakes | 1,754 | 1,021 | 1,796 | 2,515 | 1,755 | 595 | 1,684 | 2,144 | 3,170 | 3,722 |
| Streams | 1,994 | 792 | 1,101 | 1,514 | 1,108 | 1,072 | 2,058 | 2,074 | 3,581 | 3,491 |
| Total | 3,748 | 1,813 | 2,897 | 4,029 | 2,863 | 1,667 | 3,742 | 4,218 | 6,751 | 7,213 |
| Area Total | 51,603 ^d | 52,325 | 45,867 | 52,262 | 50,792 | 64,208 | 72,053 | 77,871 | 85,521 | 102,951 |

^a Includes all flowing waters, data not broken out by specific area prior to 1983.

^b Average for all the years 1983-1986 only because specific areas were not reported with effort for those areas included in "Other sites" listing.

^c Not including the Tonsina drainage.

^d Average of the total annual area harvest for the period from 1977-1986.

During 1995, approximately 102,951 angler-days were expended by sport anglers fishing UCUSMA waters (Table 2). This was 75% above the historic average effort for this management area and was the highest on record for the fifth year in a row. The 1995 effort represented 3.7% of the total statewide angling effort (Table 2).

OTHER USER GROUPS

Returns of salmon to the Copper River support commercial fisheries in the Copper River District. From 1977 through 1996 an average of 888,926 sockeye salmon and 35,787 chinook salmon were commercially harvested in the Copper River District (Steve Morstad, ADF&G, Cordova, personal communication, Table 5).

A personal use and a subsistence salmon fishery have been established by the BOF in the upper Copper River. The Division of Commercial Fisheries has lead management authority for the subsistence fishery while the Division of Sport Fish has the lead management responsibility for the personal use fishery.

From 1977 through 1996, an average of over 87,000 salmon were harvested annually in these fisheries (Table 6). Sockeye salmon have comprised the largest portion of this catch, accounting for about 91% of the total catch. These fisheries are described in detail in a separate chapter of Section II of this report, and thus will not be described further here.

ECONOMIC VALUE OF RECREATIONAL FISHERIES

The Jones and Stokes Associates, Inc. (1987) survey of Southcentral Alaska sport fisheries only estimated the value of the Gulkana River fisheries and the winter fisheries of the Lake Louise complex (Lake Louise and Susitna and Tyone lakes). Based on this survey, anglers expended \$452,000 to fish for grayling in the Gulkana River during 1986 and expressed a net willingness to pay (net WTP) of an additional \$351,000 to assure the continuation of this fishery (Table 7). Most of the expenditures in this fishery were by resident anglers. Anglers participating in the winter fisheries of the Lake Louise complex for lake trout and burbot expended \$66,000 and expressed a net WTP of an additional \$186,000 to assure the continuation of these fisheries (Table 7). The Jones and Stokes survey did not provide an estimate of the overall economic value of UCUSMA sport fisheries. A rough approximation of the total economic value of the sport fisheries of the UCUSMA can be made by applying the direct expenditures per angler-day values estimated for Southcentral Alaska resident and nonresident sport anglers through the Jones and Stokes survey to the estimated sport effort expended in the UCUSMA (Table 8). Based on this approach, the economic value of all UCUSMA sport fisheries during 1986 was approximately 5 million dollars. This compares to an estimated value of 127 million dollars for all Southcentral Alaska sport fisheries during 1986 (Jones and Stokes Associates, Inc. 1987).

MAJOR ISSUES

The major issues associated with UCUSMA sport and personal use fisheries are summarized below:

Burbot: The lakes of the UCUSMA have historically supported some of the largest sport fisheries for burbot in Alaska. Stock assessment work indicated that many of the larger burbot stocks in lakes were depressed due to overfishing in the early 1980s. Based on these findings, the BOF adopted a management plan for burbot stocks in UCUSMA

Table 5.-Commercial harvests of chinook and sockeye salmon in the Copper River District, 1977-1996.

| Year | Chinook Harvest | Sockeye Harvest |
|----------------|------------------------|------------------------|
| 1977 | 21,722 | 602,737 |
| 1978 | 29,062 | 249,872 |
| 1979 | 17,678 | 80,528 |
| 1980 | 8,454 | 18,908 |
| 1981 | 20,178 | 477,662 |
| 1982 | 47,362 | 1,177,632 |
| 1983 | 52,500 | 626,735 |
| 1984 | 38,957 | 900,043 |
| 1985 | 42,214 | 927,553 |
| 1986 | 40,670 | 780,808 |
| 1987 | 41,001 | 1,180,782 |
| 1988 | 30,741 | 576,950 |
| 1989 | 30,863 | 1,025,923 |
| 1990 | 21,702 | 844,778 |
| 1991 | 34,787 | 1,206,811 |
| 1992 | 39,810 | 970,938 |
| 1993 | 29,727 | 1,398,234 |
| 1994 | 47,061 | 1,152,220 |
| 1995 | 65,675 | 1,271,822 |
| 1996 | 55,575 | 2,307,589 |
| Average | 35,787 | 888,926 |

Table 6.-Reported subsistence and personal use harvests of chinook, sockeye, and coho salmon in the Copper River, 1977-1996.

| Year | Chinook | Sockeye | Coho | Total |
|-------------------|--------------|---------------|--------------|----------------|
| 1977 | 2,213 | 36,349 | 454 | 39,016 |
| 1978 | 1,947 | 22,416 | 587 | 24,950 |
| 1979 | 2,515 | 23,599 | 752 | 26,866 |
| 1980 | 2,256 | 21,437 | 639 | 24,332 |
| 1981 | 1,913 | 53,008 | 849 | 55,770 |
| 1982 | 2,532 | 96,799 | 1,246 | 100,577 |
| 1983 | 5,421 | 100,995 | 1,690 | 108,106 |
| 1984 | 2,007 | 65,078 | 789 | 67,874 |
| 1985 | 1,673 | 50,488 | 544 | 52,705 |
| 1986 | 2,916 | 64,684 | 785 | 68,385 |
| 1987 | 3,280 | 61,900 | 498 | 65,678 |
| 1988 | 3,395 | 58,294 | 695 | 62,384 |
| 1989 | 2,904 | 80,221 | 890 | 84,015 |
| 1990 | 3,198 | 93,740 | 1,533 | 98,471 |
| 1991 | 5,164 | 111,788 | 3,477 | 120,429 |
| 1992 | 4,705 | 127,670 | 1,817 | 134,192 |
| 1993 | 4,037 | 138,211 | 1,428 | 143,676 |
| 1994 | 5,423 | 153,049 | 1,958 | 160,430 |
| 1995 | 6,331 | 125,605 | 5,547 | 137,483 |
| 1996 ^a | 4,613 | 126,141 | 3,590 | 134,344 |
| Average | 3,422 | 80,574 | 1,488 | 85,484 |

^a Preliminary estimates.

Table 7.-Estimated expenditures and net willingness-to-pay (net WTP) in thousands of dollars, for recreational anglers fishing the Gulkana River and Lake Louise complex during 1986.

| Fishery | Resident Anglers | | Nonresident Anglers | | All Anglers | |
|-------------------------|------------------|---------|---------------------|---------|--------------|---------|
| | Expenditures | Net WTP | Expenditures | Net WTP | Expenditures | Net WTP |
| Gulkana River fisheries | | | | | | |
| Grayling fishery | \$370 | \$346 | \$81 | \$5 | \$452 | \$351 |
| Other fisheries | \$732 | \$1,488 | \$331 | \$102 | \$1,063 | \$1,590 |
| All fisheries | \$1,102 | \$1,834 | \$412 | \$107 | \$1,514 | \$1,941 |
| Lake Louise | | | | | | |
| Winter fisheries | \$66 | \$186 | N/A | N/A | \$66 | \$186 |

Data from: Jones and Stokes Associates, Inc., 1987

Table 8.-Estimated economic value of UCUSMA sport fisheries during 1986.

| Angler Type | Southcentral Alaska | | | UCUS Management Area | |
|--------------|-------------------------|--------------------------|---------------------------|--------------------------|--------------|
| | \$/Ang-Day ^a | Angler-Days ^b | Expenditures ^c | Angler-Days ^b | Expenditures |
| Resident | 64.29 | 1,153,660 | 74,163,000 | 43,880 | 2,821,045 |
| Non-resident | 262.51 | 201,488 | 52,892,000 | 7,683 | 2,016,864 |
| Both | --- ^d | 1,355,148 | 127,055,000 | 51,563 | 4,837,909 |

Data from: Jones and Stokes Associates, Inc., 1987

^a Computed from Southcentral Alaska sport fisheries

^b Mills 1987

^c Jones and Stokes Associates, Inc. 1987

^d Not computed

lakes. Under this management plan, the Board has adopted a more conservative management regime for UCUSMA burbot fisheries which allows previously overfished stocks to recover enough to permit sustainable fisheries, and which protects healthy stocks from overharvest. Part of the current regulatory regime is the elimination of unattended set lines from the fishery. Many local anglers are not supportive of this action and have submitted proposals to the Board to have unattended set lines reintroduced to the fishery. Staff do not support reintroduction of unattended setline use in lakes. This gear question will likely continue to remain an issue into the future. Lake Louise remains closed to burbot fishing due to depressed burbot stocks. Lake Louise will be reopened to burbot fishing when stock assessment work shows that the burbot stocks have recovered enough to permit a sustainable fishery. Local advisory committees are supportive of this closure. Limited use of unattended lines has been proposed by the department for the mainstem Copper River.

Lake Trout: Lakes in the UCUSMA have historically supported some of the largest sport fisheries for lake trout in Alaska, with lakes of the Tyone River drainage (Lake Louise and Susitna and Tyone lakes) and Gulkana River drainage (Summit and Paxson lakes) having supported the largest fisheries. Concern was raised in the late 1980s that sport harvests in some of these lakes may have been exceeding sustainable levels. As a result, an 18 inch minimum size limit was enacted for the above lakes to assure that fish could spawn at least once prior to being subject to harvest. Subsequent stock assessment work suggested that an 18 inch size limit does not protect first-time spawners from harvest in these lakes. A 24 inch minimum size limit for these lakes was implemented in 1994. The lake trout bag and possession limit was also reduced to one in some lakes. These actions were supported by the local advisory committees.

Copper River Chinook Salmon: Under the *Copper River Personal Use Salmon Fishery Management Plan* (5 AAC 77.590), the department is directed to manage the Copper River District commercial salmon fishery to attain a spawning escapement of 15,000 chinook salmon, 60,000 salmon (species not defined) for the personal use fishery and enough salmon (species not defined) to meet the demand in the subsistence fishery. Unfortunately, there is a lack of spawner-recruit data to assess the long-term productivity of the Copper River chinook salmon return or the validity of the established 15,000 fish spawning escapement goal. Most managers agree that current harvest levels are sustainable; however, concern has been raised that the Copper River chinook salmon return is nearing full utilization and recommend that total harvests on this stock not be expanded in the future. Commercial harvests, the largest component of the annual harvest, are projected to remain relatively stable into the future. However, increased participation in the area's subsistence, personal use, and sport fisheries is likely to result in increased harvests by these users. To assure that harvest of Copper River chinook salmon does not exceed sustainable levels, the department is seeking BOF direction in the allocation of this return.

Copper River Personal Use & Subsistence Salmon Fisheries: Since 1985, harvests in the Copper River subsistence and personal use salmon fisheries have increased, with most of the growth having occurred in the personal use fishery. Both fisheries are managed under BOF adopted management plans. Under these management plans, the subsistence harvest

does not have a ceiling while the personal use fishery is managed to attain a harvest cap which varies depending upon inriver run strength. In recent years, harvests in the personal use fishery have been near or exceeded the harvest cap. Unless Board action is taken to raise the harvest cap, the department will need to reduce the harvest potential of the current fishery to assure that the harvest cap is not exceeded. The department will seek the Board's guidance in this matter during the upcoming meeting on this area in December of 1996.

Crosswind Lake Enhanced Sockeye: Sockeye salmon produced at the Gulkana Hatchery were first introduced to Crosswind Lake in 1985. Since 1988, hatchery releases and subsequent returns have increased to approximately 10 million fry. During the fall of 1995, over 40,000 sockeye returned to Crosswind Lake. Concern of lake residents and others about the effects and waste of these fish caused department and Prince William Sound Aquaculture Corporation (PWSAC) personnel to reevaluate the Crosswind release. PWSAC operations have been moved and modified to address concerns of Crosswind Lake residents. A personal use fishery in the West Fork Gulkana has been proposed and investigated and tag recovery from sockeye harvested in the Copper River personal use fishery has been initiated to estimate the hatchery contribution and timing in that fishery with hopes of targeting hatchery produced sockeye.

ACCESS PROGRAMS

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. A broad range of access facilities can be approved for funding if constructed to achieve a state fishery management objective. These facilities can include boat ramps and lifts, docking and marina facilities, breakwaters, fish cleaning stations, rest rooms and parking areas. There is one completed large scale access project in the UCUSMA, the boat launch along the Gulkana River at the Bureau of Land Management (BLM) campground at Sourdough. The Gulkana River is the most popular sport fishery for chinook salmon in the area and currently supports the largest Arctic grayling fishery in the state. In 1995, 44,077 angler-days of effort were expended on the Gulkana River, almost half of the total sport fishing effort expended in the area. Phase I of the Sourdough Campground upgrade was completed in 1991. Part of that upgrade was the improvement of the boat launch facilities. BLM received a contribution of \$261,000 in Federal Aid monies toward the construction of the new boat launch.

In spite of the large land base in the UCUSMA, access to sport fishing is restricted near most popular fisheries. The causes for limited access are several: much of the land in the area is private, few roads and trails exist, and suitable launches for boats are scarce. Locations where boat launch facilities would be appropriate follow, in order of priority:

The Gulkana River at the Richardson Highway Bridge crossing is privately owned by the Gulkana Village Native Townsite. Although access across native lands for hunting and fishing is expressly prohibited by all local Alaska Native landowners, the public routinely fishes, launches and camps at this site. A preliminary inquiry by Sport Fish staff into the willingness of the landowners to cooperate on development of the land has yielded some interest from the Ahtna Corporation, overseers of the Gulkana Village lands.

There is currently no public access to the Copper River suitable for launching a power boat. Several fisheries along the Copper River in the vicinity of Glennallen could be accessed with a launch on the mainstem of the Copper River near Copperville, 4 miles south of Glennallen. The Klutina River, a popular chinook salmon fishery, and the Gulkana River are within 10 and 15 miles of this location, respectively. The location is convenient for motor powered boats as well as rafts, which float from the Richardson Highway bridge crossing of the Gulkana River. Preliminary research of land status at the site indicates that no public land is available.

Various smaller access projects are underway in the UCUSMA which entail development of parking for several small but popular roadside lakes: Tex Smith, Strelna, Silver/Van, and Sculpin; and signs for local roadside lakes. Many more sites for foot access to local fisheries are needed.

SECTION II: FISHERIES

The following text discusses, by species, the major sport fisheries in the UCUSMA. For each major fishery, a discussion is presented with respect to: (1) a historical perspective of the fishery, (2) fishery objectives, (3) inseason management approaches, (4) actions taken by the BOF during its last meeting dealing with the fishery, (5) the recent performance and status of the fishery, (6) any current biological and social issues related to the management of the fishery, and (7) recommended research and management activities. Discussion of recent performance of the fishery will center around the 1995 season, as the major source of data for most sport fisheries in the area is the Statewide Harvest Survey (SWHS) (Howe et al. 1996) which is not yet available for 1996. However, observations or data regarding the fisheries in 1996 will also be presented when available. A summary of the historical harvest of fish in the UCUSMA by species is presented in Table 9 and Figure 3.

ARCTIC GRAYLING SPORT FISHERIES

More grayling have been harvested by sport anglers fishing UCUSMA waters since 1977 than any other fish (Figure 3). From 1977 through 1995, an average of 22,969 grayling have been harvested annually (Table 9), accounting for about 41% of the fish harvested from these waters. Harvests remained relatively stable from 1977 through 1987 (Figure 4), averaging about 28,982 grayling. Since 1987, however, harvests have been lower (Figure 4), with the 1992 harvest of 11,125 grayling being the lowest on record (Table 10). This has been primarily the result of more restrictive regulations adopted to assure the sustained yield of the area's grayling stocks. The 1995 harvest accounted for about 31% and 62% of the Southcentral and statewide harvest of grayling, respectively.

The largest grayling fishery in the UCUSMA has historically occurred in the Gulkana River drainage (Table 10). From 1987 through 1991, this drainage accounted for about 45% of the grayling harvest from UCUSMA waters. Since 1991, harvests from the drainage have declined; 25% of the grayling harvest came from the drainage in 1995. A discussion of the Arctic grayling fishery in the Gulkana River drainage follows this area-wide summary. Other UCUSMA drainages that have supported significant grayling fisheries include the Klutina and Tazlina drainages and various upper Susitna River drainage lakes and streams. Various lakes stocked with grayling fry and fingerling also provide fishing opportunity for this species.

To assure a sustainable yield of grayling, daily bag and possession limits for grayling in all flowing waters in the UCUSMA were reduced from 15 daily and 30 in possession to 10 fish daily and in possession in 1988. In 1989, the bag and possession limit for grayling in rivers was further reduced to five grayling. For the Gulkana River, anglers were permitted five grayling but only one grayling per day over 14 inches. This action was taken to maintain historic size compositions in this drainage. The bag and possession limits in stocked lakes and those lakes without management concern remained at 10 per day and in possession. Under these regulations, most grayling stocks in the UCUSMA are currently considered healthy.

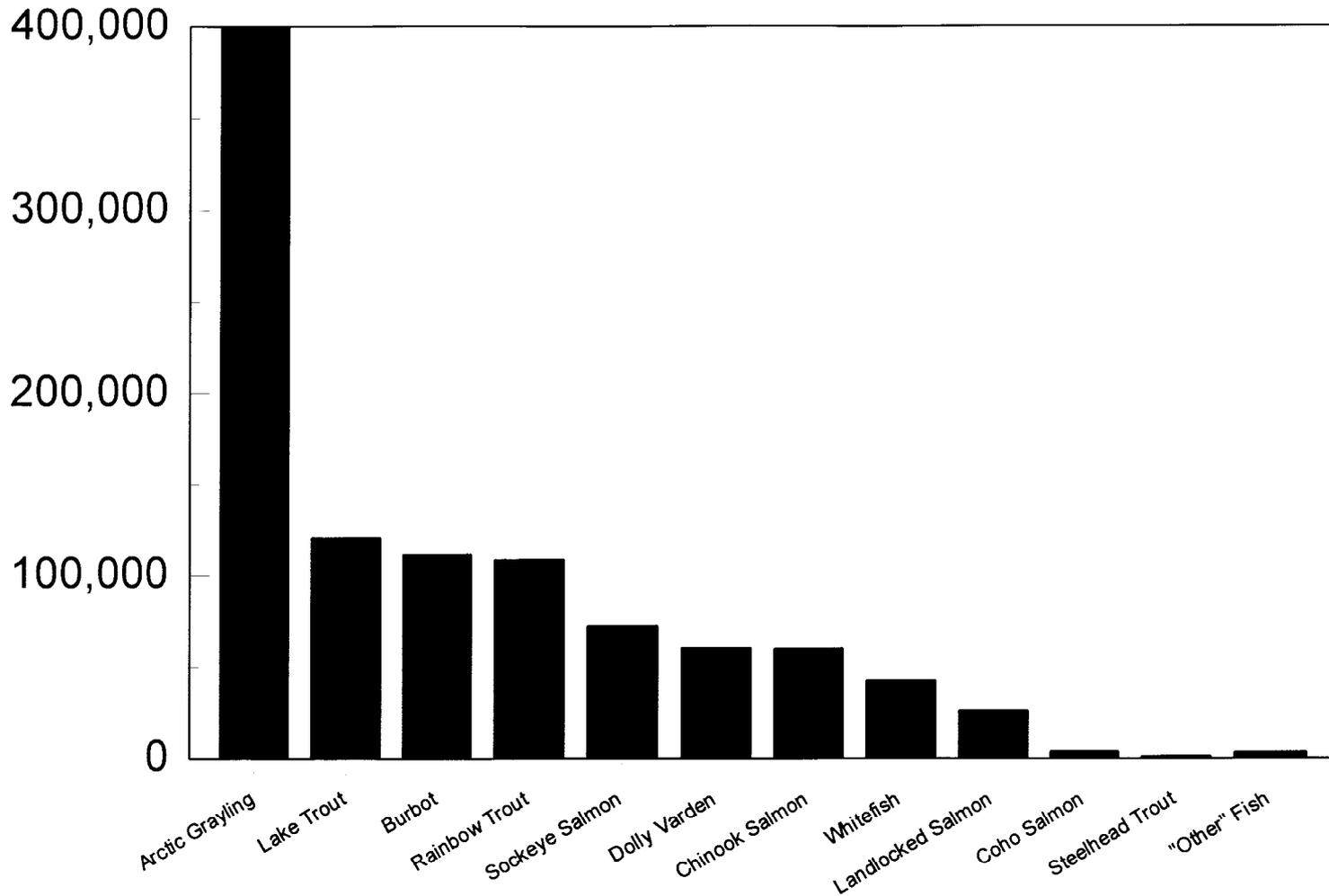
Gulkana River Arctic Grayling Sport Fishery Background and Historical Perspective

The Gulkana River drainage supports the largest grayling population in the UCUSMA. This clearwater drainage originates in the Alaska Range and flows south to join the Copper River near

Table 9.-Number of fish harvested, by species, by recreational anglers fishing UCUSMA waters, 1977-1995.

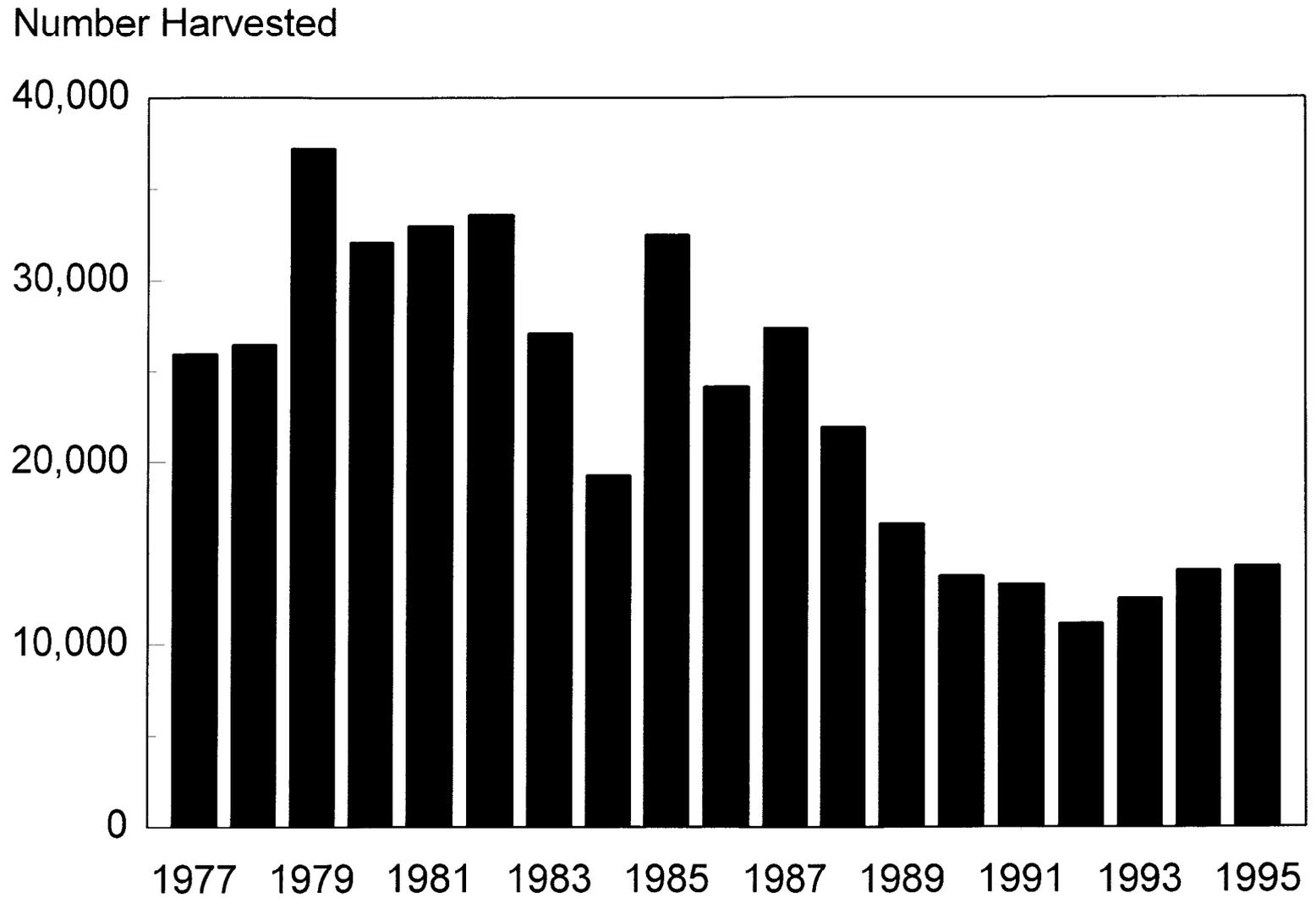
| Year | Arctic | Lake | Rainbow | Sockeye | Dolly | Chinook | White | Landlocked | Coho | Steelhead | Other | |
|-------------|----------|---------|---------|---------|--------|---------|--------|------------|--------|-----------|-------|-------|
| | Grayling | Trout | Burbot | Trout | Salmon | Varden | Salmon | fish | Salmon | Salmon | Trout | Fish |
| 1977 | 25,991 | 7,699 | 5,628 | 2,808 | 3,662 | 2,251 | 532 | 2,445 | 1,750 | 269 | 187 | 236 |
| 1978 | 26,488 | 5,433 | 7,223 | 4,366 | 1,606 | 904 | 641 | 3,634 | 2,819 | 126 | 45 | 27 |
| 1979 | 37,232 | 7,271 | 3,808 | 3,372 | 1,599 | 5,890 | 2,948 | 2,408 | 1,918 | 412 | 55 | 645 |
| 1980 | 32,106 | 8,067 | 10,159 | 3,255 | 2,109 | 835 | 2,101 | 2,507 | 1,919 | 164 | 34 | 973 |
| 1981 | 32,982 | 8,337 | 9,007 | 5,358 | 1,523 | 2,452 | 1,717 | 2,420 | 3,251 | 0 | 76 | 292 |
| 1982 | 33,586 | 8,699 | 8,006 | 3,060 | 3,343 | 2,148 | 1,802 | 1,824 | 4,726 | 398 | 73 | 126 |
| 1983 | 27,094 | 7,246 | 6,555 | 2,460 | 2,619 | 4,509 | 2,579 | 2,810 | 4,175 | 84 | 21 | 63 |
| 1984 | 19,272 | 6,311 | 10,329 | 8,926 | 3,267 | 5,200 | 2,787 | 3,010 | 992 | 496 | 137 | 256 |
| 1985 | 32,511 | 8,686 | 19,355 | 8,149 | 4,752 | 6,001 | 1,939 | 3,745 | 2,342 | 410 | 162 | 417 |
| 1986 | 24,185 | 6,779 | 10,030 | 8,510 | 4,137 | 5,205 | 3,663 | 3,915 | 89 | 202 | 58 | 178 |
| 1987 | 27,359 | 6,721 | 4,386 | 7,838 | 4,876 | 2,023 | 2,301 | 2,096 | 75 | 330 | 134 | 76 |
| 1988 | 21,937 | 6,277 | 3,747 | 6,695 | 3,038 | 5,185 | 1,562 | 2,474 | 746 | 291 | 91 | 0 |
| 1989 | 16,629 | 7,147 | 3,396 | 5,835 | 4,509 | 3,979 | 2,219 | 2,991 | 450 | 18 | 84 | 0 |
| 1990 | 13,775 | 5,503 | 1,836 | 3,924 | 3,569 | 3,159 | 2,232 | 1,784 | 170 | 0 | 34 | 0 |
| 1991 | 13,278 | 4,864 | 793 | 6,868 | 5,511 | 2,140 | 4,427 | 717 | 111 | 69 | 114 | 47 |
| 1992 | 11,125 | 4,251 | 1,495 | 9,373 | 4,560 | 1,997 | 3,997 | 1,150 | 433 | 113 | 8 | 11 |
| 1993 | 12,504 | 4,569 | 1,694 | 7,245 | 5,288 | 3,173 | 7,620 | 815 | 154 | 249 | 0 | 9 |
| 1994 | 14,066 | 4,058 | 2,869 | 5,808 | 6,533 | 1,598 | 6,431 | 1,149 | 188 | 209 | 7 | 128 |
| 1995 | 14,289 | 2,934 | 995 | 4,671 | 6,068 | 1,695 | 6,709 | 898 | 59 | 160 | 10 | 30 |
| Ave. | 22,969 | 6,361 | 5,858 | 5,712 | 3,819 | 3,176 | 3,152 | 2,252 | 1,388 | 211 | 70 | 185 |
| Sum | 436,409 | 120,852 | 111,311 | 108,521 | 72,569 | 60,344 | 59,883 | 42,792 | 26,367 | 4,000 | 1,330 | 3,514 |

Number Harvested, 1977-1994



Source: Mills 1979-1994; Howe et al. 1995 and 1996.

Figure 3.-Number of fish harvested, by species, by recreational anglers fishing UCUSMA waters, 1977-1995.



Source: Mills 1979-1994; Howe et al. 1995 and 1996.

Figure 4.-Harvest of Arctic grayling by recreational anglers fishing UCUSMA waters, 1977-1995.

Table 10.-Harvest of Arctic grayling by recreational anglers fishing UCUSMA, averaged for the period from 1977-1986, and annually for the period 1987-1995.

| Areas | 1977-1986 | 1987 | 1988 | 1989 | 1990 | 1991 | 1992 | 1993 | 1994 | 1995 |
|-------------------------------|--------------------------|---------------|--------------|--------------|--------------|--------------|--------------|--------------|--------------|--------------|
| Gulkana R. Drainage | | | | | | | | | | |
| Lakes | 3,439 | 3,479 | 2,382 | 1,520 | 1,461 | 1,932 | 902 | 1,483 | 1,488 | 1,241 |
| Upper River | 8,849 ^a | 8,921 | 5,748 | 4,746 | 1,850 | 2,888 | 1,691 | 1,409 | 2,076 | 1,793 |
| Lower River | | 1,621 | 455 | 394 | 2,072 | 1,638 | 1,398 | 936 | 665 | 501 |
| Total | 12,288 | 14,021 | 8,585 | 6,660 | 5,383 | 6,458 | 3,991 | 3,828 | 4,229 | 3,535 |
| Upper Susitna Drainage | | | | | | | | | | |
| Lake Louise | | 1086 | 1,855 | 1,576 | 1,613 | 875 | 481 | 994 | 1239 | 1,040 |
| Susitna/Tyone Lk | | 1190 | 455 | 300 | 119 | 330 | 639 | 661 | 949 | 1,273 |
| Other Lakes | | 208 | 0 | 683 | 646 | 125 | 218 | 93 | 301 | 254 |
| Streams | | 580 | 473 | 497 | 866 | 693 | 706 | 1,082 | 1,157 | 1,458 |
| Total | 3,916^b | 3,064 | 2,783 | 3,056 | 3,244 | 2,023 | 2,044 | 2,830 | 3,646 | 4,052 |
| Klutina R. Drainage | 1,026 ^c | 729 | 1,673 | 1,041 | 544 | 1,092 | 346 | 681 | 363 | 285 |
| Tazlina R. Drainage | 1363 ^c | 2,640 | 2,411 | 1,234 | 697 | 1,104 | 869 | 1,555 | 2,075 | 2,619 |
| Tonsina Drainage | 586 ^c | 1,056 | 345 | 629 | 289 | 296 | 811 | 814 | 363 | 261 |

-continued-

Table 10.-Page 2 of 2.

| Areas | 1977-1986 | 1987 | 1988 | 1989 | 1990 | 1991 | 1992 | 1993 | 1994 | 1995 |
|---|--------------------------|---------------|---------------|---------------|---------------|---------------|---------------|---------------|---------------|---------------|
| Copper R Upstream of Gulkana | | | | | | | | | | |
| Lakes | 367 ^c | 1,843 | 909 | 413 | 883 | 216 | 113 | 378 | 234 | 321 |
| Streams | 523 ^c | 967 | 674 | 375 | 119 | 466 | 30 | 356 | 125 | 210 |
| Total | 890^c | 2,810 | 1,583 | 788 | 1,002 | 682 | 143 | 734 | 359 | 531 |
| Copper R Downstream of Klutina^d | | | | | | | | | | |
| Lakes | 205 ^c | 446 | 327 | 600 | 187 | 187 | 128 | 317 | 82 | 166 |
| Streams | 32 ^c | 0 | 146 | 0 | 0 | 34 | 0 | 19 | 41 | 0 |
| Total | 237^c | 446 | 473 | 600 | 187 | 221 | 128 | 336 | 123 | 166 |
| Other Sites | | | | | | | | | | |
| Stocked Lakes | 339 ^c | 394 | 937 | 868 | 935 | 744 | 1,372 | 888 | 1,007 | 485 |
| Other Lakes | 1,251 ^c | 400 | 1,346 | 1,209 | 1,052 | 136 | 767 | 342 | 1,304 | 788 |
| Other Stream | 1,519 ^c | 1,725 | 1,801 | 545 | 442 | 523 | 655 | 496 | 598 | 1,031 |
| Total | 3,109^c | 2,519 | 4,084 | 2,622 | 2,429 | 1,403 | 2,794 | 1,726 | 2,909 | 2,304 |
| Area Total | 26,835 | 27,359 | 21,937 | 16,629 | 13,775 | 13,278 | 11,125 | 12,504 | 14,066 | 14,289 |

^a Includes lower river estimated harvest.

^b Includes all upper Susitna lakes and streams.

^c Includes 1983-1986 average only.

^d Does not include the Tonsina River drainage.

the community of Gulkana (Figure 5). Access to the river is available from various secondary roads and trails off the Richardson Highway, which parallels much of the river. Anglers use rafts, canoes, and power boats to gain access to the more remote sections of the river. Raft and canoe anglers frequent the various sections of the river from Paxson Lake downstream to the Richardson Highway bridge. Power boat operators generally launch at Sourdough and use the river from approximately 2 miles below Sourdough upstream to the confluence of the West Fork. More recently, power boat operators have begun launching from the Richardson Highway bridge and fishing the 5-mile reach of the river above the bridge. Power boat operators also access the confluence of the Gulkana River with the Copper River, using boats launched from Gakona. The section of the Gulkana River upstream from Sourdough has been designated by the U.S. Congress as “wild” as part of the Wild and Scenic Rivers Act of 1968. The Gulkana River from the Richardson Highway bridge downstream to a department marker 500 yards downstream of its confluence with the Copper River is an area in which only single hook, artificial flies may be used. This area has low use, except near the Richardson Highway, and is used primarily by walk-in anglers from the Richardson Highway; however, power boat operators occasionally access the confluence of the Gulkana River with the Copper River after launching from Gakona or from the Richardson Highway Bridge.

The Gulkana River drainage has historically supported the largest sport fishery for grayling in the UCUSMA (Table 10). From 1977 through 1985, harvests of grayling from the Gulkana River drainage generally increased (Table 11, Figure 6). A peak harvest of 20,165 fish occurred in 1985 and accounted for 62% and 35% of the total harvest in the UCUSMA and Southcentral region, respectively (Mills 1986).

The peak harvest experienced in 1985 raised concern that the grayling stocks in the drainage were in danger of overharvest, given that grayling stocks in several interior Alaska streams near Fairbanks became severely depressed when subjected to similar harvest rates. Regulations were therefore adopted in 1988 that reduced the bag and possession limit to five fish per day. Also, past research data indicated that the maximum size of grayling observed in the Gulkana River drainage was decreasing as the result of anglers targeting larger fish (Williams and Potterville 1983). In an attempt to maintain historic size compositions, regulations were also adopted in 1988 that restricted anglers to only one grayling over 14 inches.

A research program was also initiated to assess the status of the various grayling stocks of the Gulkana River drainage. This research program was initiated by the Division of Sport Fish in 1986. Beginning in 1988, the study has been conducted in conjunction with the University of Alaska and formed the basis of an M.S. thesis for a graduate student (Dan Bosch). Objectives of the research program were to determine stock structure; growth; annual abundance, survival, and recruitment; sustainable yields under a variety of management scenarios; and future monitoring strategies. This project was completed in June 1993 and the final report/thesis was completed in May of 1995 (Bosch 1995).

Fishery Objectives

Grayling fisheries in the Gulkana River drainage are managed to assure maintenance of historic age and size composition and stock abundance.

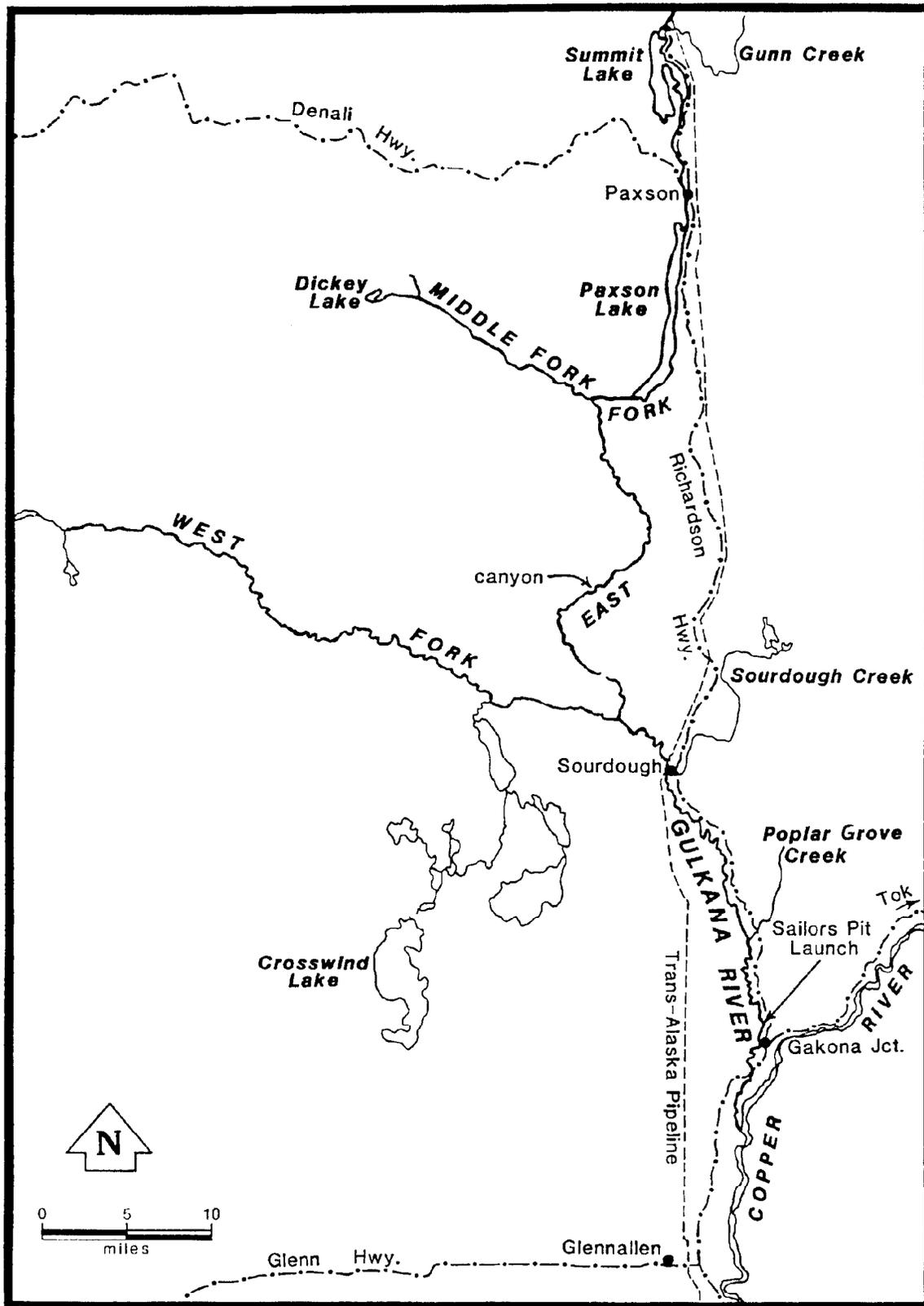
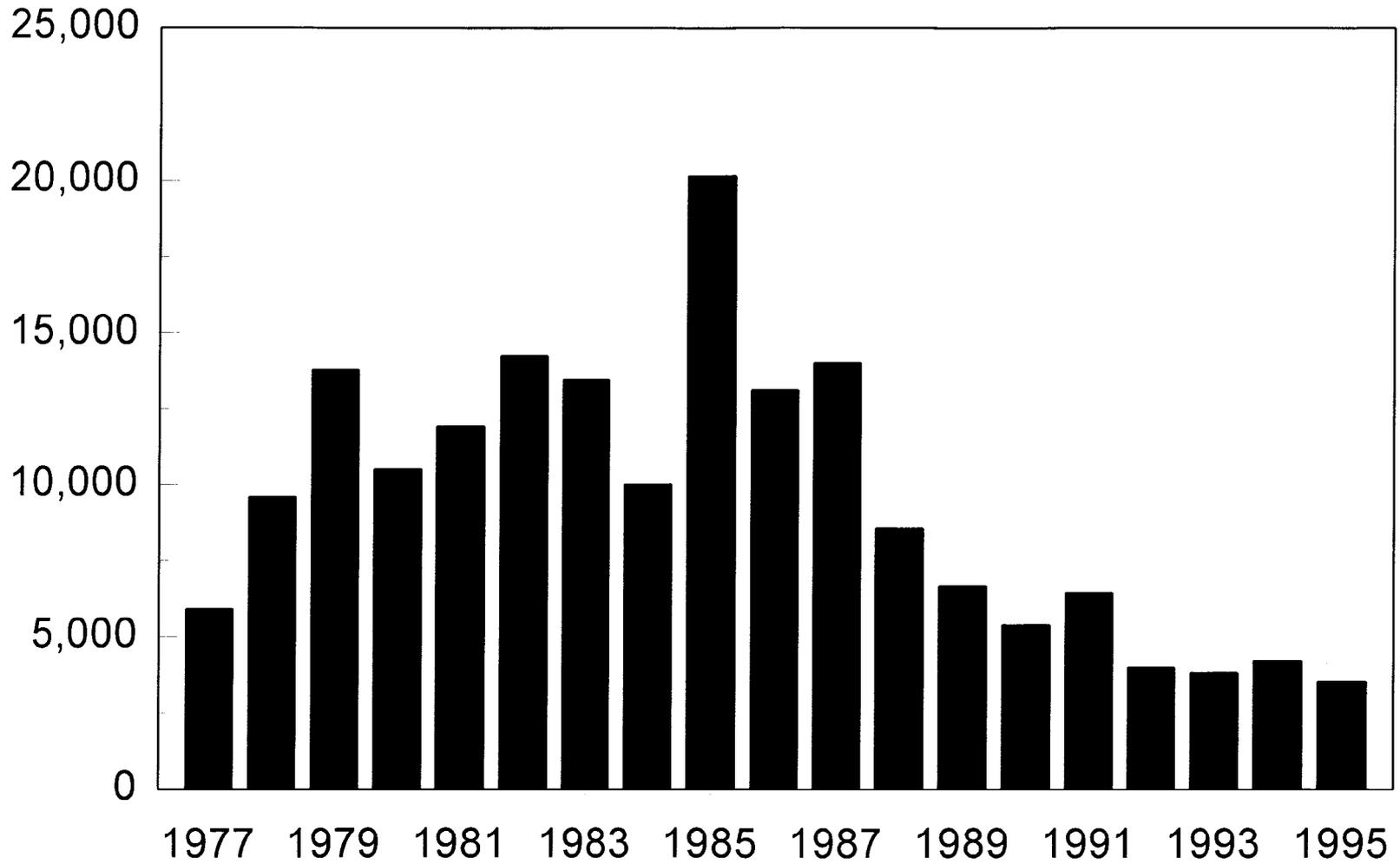


Figure 5.-The Gulkana River drainage.

Table 11.-Harvest and catch of Arctic grayling by recreational anglers fishing the Gulkana River drainage, 1977-1995.

| Year | Gulkana River Drainage Harvest | | | Percent total UCUS harvest | Number Caught | Percent Released |
|-------------|--------------------------------|--------------|--------------|----------------------------|---------------|------------------|
| | Rivers & Streams | Lakes | Total | | | |
| 1977 | 3,355 | 2,574 | 5,929 | 23% | | |
| 1978 | 7,494 | 2,125 | 9,619 | 36% | | |
| 1979 | 8,726 | 5,063 | 13,789 | 37% | | |
| 1980 | 6,776 | 3,754 | 10,530 | 33% | | |
| 1981 | 9,158 | 2,775 | 11,933 | 36% | | |
| 1982 | 9,149 | 5,124 | 14,273 | 42% | | |
| 1983 | 10,417 | 3,063 | 13,480 | 50% | | |
| 1984 | 6,362 | 3,659 | 10,021 | 52% | | |
| 1985 | 16,403 | 3,762 | 20,165 | 62% | | |
| 1986 | 10,645 | 2,493 | 13,138 | 54% | | |
| 1987 | 10,542 | 3,479 | 14,021 | 51% | | |
| 1988 | 6,203 | 2,382 | 8,585 | 39% | | |
| 1989 | 5,140 | 1,520 | 6,660 | 40% | | |
| 1990 | 3,922 | 1,461 | 5,383 | 40% | 40,768 | 87% |
| 1991 | 4,526 | 1,932 | 6,458 | 49% | 34,827 | 81% |
| 1992 | 3,089 | 902 | 3,991 | 32% | 32,316 | 88% |
| 1993 | 2,345 | 1,483 | 3,828 | 31% | 45,865 | 92% |
| 1994 | 2,741 | 1,488 | 4,229 | 30% | 37,999 | 89% |
| 1995 | 2,830 | 1,241 | 4,072 | 28% | 29,102 | 86% |
| Mean | 6,833 | 2,646 | 9,479 | 40% | 36,813 | 87% |

Number Harvested



Source: Mills 1979-1994; Howe et al. 1995 and 1996.

Figure 6.-Annual harvest of Arctic grayling from the UCUSMA, 1977-1995.

Recent Board of Fisheries Actions

The BOF took no action regarding this fishery at its 1994 meeting. Issues regarding this fishery will be considered at the meeting in December 1996.

Recent Fishery Performance

The restrictions placed on the fishery during 1988 have significantly reduced the total harvest of grayling in the Gulkana River drainage (Figure 6). Estimates of abundance indicate that current exploitation rates on the major stock units of grayling in the Gulkana River drainage appear sustainable given current harvest levels. Data from the research program also indicate that the restriction limiting anglers to only one grayling over 14 inches is allowing the population to reach and maintain historic levels.

Current Issues

Overall, Gulkana River drainage grayling stocks appear healthy. ADF&G is developing a management plan for grayling in the Gulkana River drainage. The plan will strive to provide a diversity of fishing opportunities for grayling in the Gulkana River drainage under sustained yield management. This plan will be distributed for public comment and after completion will be forwarded to the BOF at a future scheduled meeting dealing with UCUSMA issues, likely the fall of 2000. Until completion of this management plan, we recommend continuation of the current management strategy and regulatory regime.

Data collected through the statewide mail survey suggest that many anglers fishing grayling in the Gulkana River drainage are practicing catch and release. Anglers have released over 80% of their catch annually since 1990 (Table 11). Assuming a 5% release mortality rate, this appears acceptable given current harvest and abundance levels.

The upper reaches of the Gulkana River drainage above Paxson Lake, notably the Gunn Creek and Fish Creek drainages, contain small populations of large-sized grayling. Currently, these populations are not targeted by a large number of anglers and present exploitation rates appear sustainable given current harvest and abundance levels. However, if exploitation rates increase it may be necessary to reduce harvest to assure sustained yield and maintenance of historic size compositions. The department has submitted a proposal for the upcoming BOF meeting to create a catch and release fishery for grayling in the Gulkana River drainage, upstream of Paxson Lake, in order to preserve the current size composition of the population.

Recommended Research and Management

An objective of the research program was to develop a plan for monitoring the status of grayling stocks in the Gulkana River drainage. We urge that the recommended monitoring program be conducted to assure the sustained yield of this fishery.

LAKE TROUT SPORT FISHERIES

Background and Historical Perspective

Lake trout stocks of the UCUSMA provide significant fishing opportunities and economic benefit to the people of Alaska. Nowhere else in Alaska can lake trout be taken in such quantities and range of sizes along the road system. From 1977 through 1995, an average of 6,361 lake trout have been harvested from UCUSMA lakes and streams annually (Table 9, Figure 7), accounting for about 12% of the total fish harvest from UCUSMA waters over this

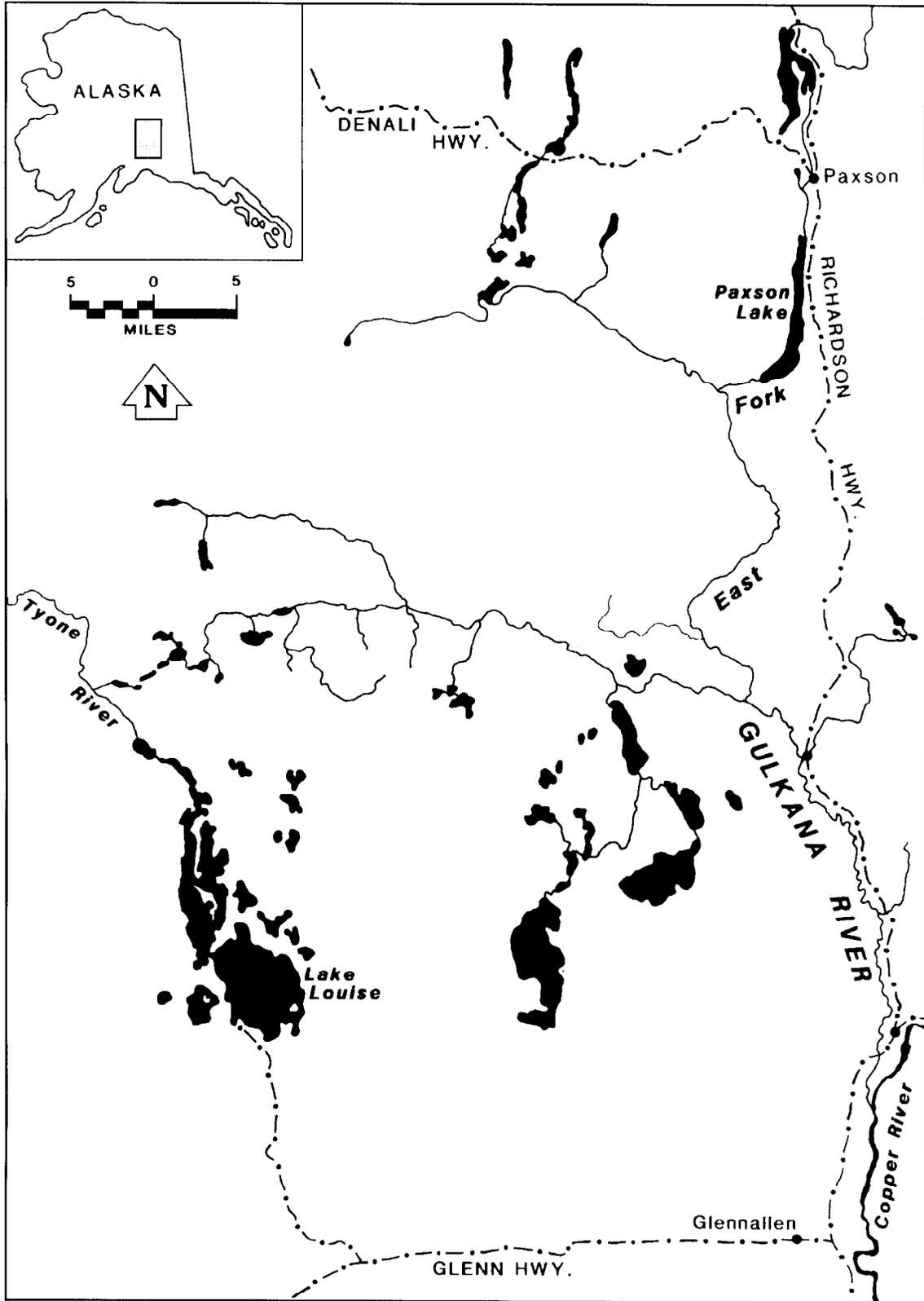


Figure 7.-Lakes supporting major lake trout fisheries in the UCUSMA.

period (Figure 3). Since 1977, lakes and streams of the UCUSMA have accounted for over 40% of the annual statewide harvest of lake trout.

Most of the lake trout harvest in the UCUSMA has come from lakes of the Tyone River (Lake Louise and Susitna and Tyone lakes) and Gulkana River (Paxson, Susitna, and Crosswind lakes) drainages (Table 12). Since 1977, these two drainages have accounted for just over 80% of the UCUSMA lake trout harvest and an average of 33% of the statewide lake trout harvest. Paxson Lake and Lake Louise have supported the largest fisheries for lake trout in the UCUSMA and Alaska. Together, these two lakes have accounted for about half of the UCUSMA lake trout harvest and an average of 20% of the annual statewide harvest of lake trout since 1984. Other major sport fisheries for lake trout in the UCUSMA occur in Summit and Crosswind lakes (in the Gulkana River drainage) and in Susitna Lake (in the Tyone River drainage). These lakes contribute between 3% and 5% of the statewide harvest of lake trout.

Prior to 1987, anglers fishing UCUSMA waters were allowed a daily take of two lake trout over 20 inches and 10 lake trout under 20 inches. Under these regulations, lake trout harvests from UCUSMA waters were relatively stable, averaging about 7,500 (Table 12, Figure 8). A study conducted in 1986, however, suggested that eight of nine study lake populations in the upper Copper and Delta river drainages were being harvested well over the annual harvest estimated to be sustainable based on lake trout populations in Canada and the Great Lakes (Burr 1987). As a result of these research findings, the daily bag limit for UCUSMA waters was reduced to two fish and a minimum size limit of 18 inches was adopted for Summit and Paxson lakes, Lake Louise, and the remainder of the Tyone River drainage in 1987. The minimum size limit was imposed to allow female lake trout to spawn once before reaching harvestable size.

A research program was initiated in 1990 to evaluate the status of lake trout fisheries in the UCUSMA. The goal of the research program was to determine appropriate management strategies that assure the sustained yield of lake trout in UCUSMA lakes. The study was conducted primarily in Paxson Lake and Lake Louise.

Fishery Objectives

Fishery objectives have yet to be defined for specific UCUSMA lake trout fisheries. To date, regulations have been written to assure that maximum sustained yield of the UCUSMA lake trout resource is not exceeded. It is likely that as fishery objectives are defined for specific lake trout fisheries, they will center around assuring for optimal, rather than maximal, sustained yield. For some lakes, optimal sustained yield will equal maximum sustained yield; for other lakes, however, optimal sustained yield will be lower than maximum sustained yield to accommodate angler's wishes for trophy or other type of special fisheries.

Recent Board of Fisheries Action

During the Board of Fisheries meeting in 1994, the minimum size limit for lake trout was increased from 18 to 24 inches in the Tyone drainage, Crosswind, Paxson and Summit lakes; the bag limit was reduced from two to one lake trout in the Tyone drainage and Crosswind Lake. The minimum size limit was increased to better protect female lake trout spawning for the first time in the Tyone drainage and Crosswind Lake and to reduce the harvest to a sustainable level in Paxson and Summit lakes. The bag limit reduction was imposed on lakes with lake trout of greater than average length to prevent effort from being concentrated on these size classes. No

Table 12.-Harvest of lake trout by recreational anglers fishing UCUSMA waters averaged for the period from 1977-1986 and annually for the period 1987-1995.

| Areas | 1977-1986 | 1987 | 1988 | 1989 | 1990 | 1991 | 1992 | 1993 | 1994 | 1995 |
|-------------------------------|--------------------|--------------|--------------|--------------|--------------|--------------|--------------|--------------|--------------|--------------|
| Gulkana Drainage | | | | | | | | | | |
| Paxson Lake | 1,934 ^a | 1,457 | 1,310 | 1,557 | 2,139 | 1,248 | 1,118 | 778 | 262 | 507 |
| Summit Lake | | 1,368 | 528 | 863 | 968 | 981 | 524 | 344 | 353 | 224 |
| Crosswind Lake | 529 | 401 | 382 | 272 | 306 | 463 | 378 | 311 | 429 | 94 |
| Other Lakes | 98 ^b | 119 | 365 | 9 | 68 | 28 | 93 | 256 | 66 | 0 |
| Upper River | 115 ^c | 402 | 782 | 159 | 17 | 28 | 39 | 0 | 29 | 90 |
| Lower River | | 0 | 0 | 19 | 85 | 42 | 108 | 20 | 15 | 0 |
| Total | 2,618 | 3,747 | 3,367 | 2,879 | 3,583 | 2,790 | 2,260 | 1,709 | 1,154 | 915 |
| Upper Susitna Drainage | | | | | | | | | | |
| Lake Louise | 2,631 ^d | 1,636 | 1,801 | 1,979 | 1,036 | 1,332 | 1,033 | 1,316 | 1,463 | 946 |
| Susitna Lake | | 401 | 418 | 441 | 187 | 308 | 324 | 669 | 426 | 200 |
| Other Lakes | 392 | 75 | 55 | 761 | 119 | 182 | 348 | 295 | 308 | 173 |
| Streams | 0 | 0 | 0 | 0 | 0 | 14 | 0 | 19 | 140 | 199 |
| Total | 3,282 | 2,112 | 2,274 | 3,181 | 1,342 | 1,836 | 1,705 | 2,299 | 2,337 | 1,518 |
| Klutina Drainage | 239 ^b | 134 | 163 | 150 | 68 | 84 | 39 | 28 | 74 | 71 |

-continued-

Table 12.-Page 2 of 2.

| Areas | 1977-1986 | 1987 | 1988 | 1989 | 1990 | 1991 | 1992 | 1993 | 1994 | 1995 |
|------------------------------|--------------------------|--------------|--------------|--------------|--------------|--------------|--------------|--------------|--------------|--------------|
| Tazlina Drainage | 65 ^b | 149 | 55 | 0 | 51 | 42 | 62 | 0 | 15 | 0 |
| Copper River Drainage | | | | | | | | | | |
| Upstream of Gulkana | 96 ^b | 104 | 400 | 506 | 102 | 42 | 23 | 145 | 309 | 164 |
| Downstream of Klutina | 77 ^b | 0 | 0 | 103 | 238 | 14 | 0 | 133 | 22 | 20 |
| Other Sites | 590 ^b | 475 | 18 | 328 | 119 | 56 | 162 | 255 | 147 | 246 |
| AREA TOTAL | 7,453^e | 6,721 | 6,277 | 7,147 | 5,503 | 4,864 | 4,251 | 4,569 | 4,058 | 2,934 |

^a Includes Paxson and Summit lake harvests during 1977-1983.

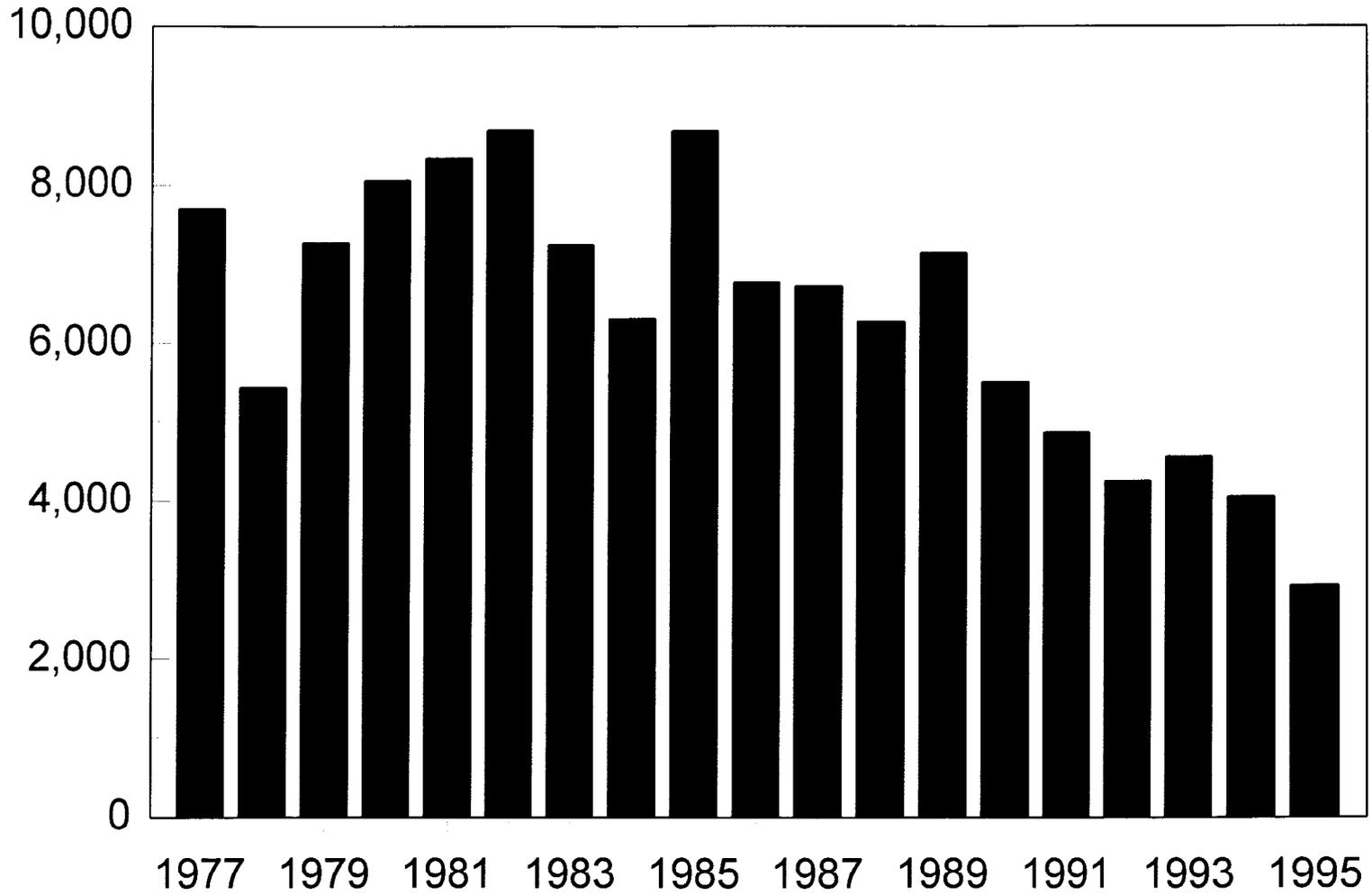
^b Average 1983-1986.

^c Includes lower river harvest.

^d Includes Susitna and Tyone lake harvest estimates.

^e Includes harvest for entire area 1977-1986.

Number Harvested



Source: Mills 1979-1994; Howe et al. 1995 and 1996.

Figure 8.-Annual harvest of lake trout from the UCUSMA, 1977-1995.

proposals regarding lake trout will be considered by the Board of Fisheries during its upcoming meeting.

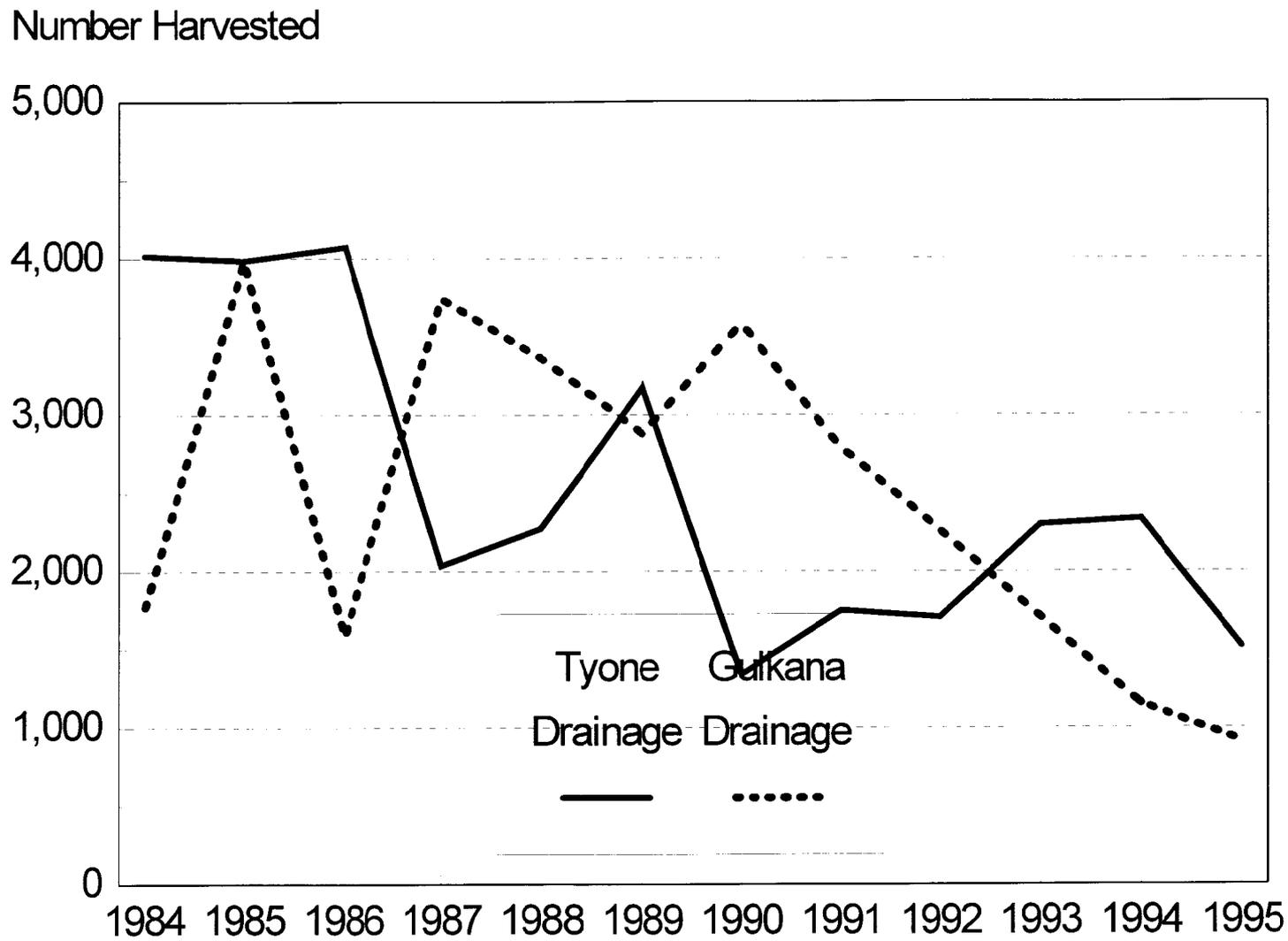
Recent Fishery Performance

Since adoption of the new regulations in 1987 and further restrictions in 1994, lake trout harvests from UCUSMA lakes and streams have fallen (Figure 8). The 1995 harvest of 2,934 lake trout was the lowest on record since 1977 (Table 12). In general, harvests from the Gulkana River drainage have fallen while harvests in the Tyone River drainage have increased (Figure 9)

Two methods are available to assess the current status of lake trout fisheries in the UCUSMA. The first involves estimating the level of sustainable harvests for lakes based on an observed lake trout production-lake surface area relationship for northern latitude lakes (Healy 1970). Healy found that northern latitude lakes could sustain harvests at a rate of approximately $0.5 \text{ kg ha}^{-1} \text{ y}^{-1}$. Because estimates of the average weight of lake trout from most lakes in the UCUSMA are unavailable, the sustainable harvest of lake trout has been estimated based on the probable range of lake trout weights: 1.0 to 3.5 kg. Based on Healy's approach and these weights, lakes in the UCUSMA which are less than 500 ha appear capable of sustaining harvests of 70 to 250 lake trout annually depending, in part, upon their elevation, depth, acreage, and available spawning habitat. Based on these estimates, the harvest of lake trout from lakes smaller than 500 ha appears to be slightly below estimates of sustainable yield. For lakes larger than 500 ha which are not road accessible (e.g., Crosswind, Tanada, and Copper lakes), harvests also appear below estimates of sustainable yield. These larger lakes appear capable of sustaining annual harvests from about 250 to 700 lake trout.

For lakes larger than 500 ha which are road accessible (e.g., Paxson, Summit, Susitna lakes and Lake Louise), Healy's methods plus an alternate approach based on the volume of water in the preferred temperature range for lake trout (8° to 12°C), termed the thermal habitat volume (THV), are used to estimate the current status of lake trout stocks in these lakes. Based on the THV approach, the sustainable yield for Paxson Lake is $0.92 \text{ kg ha}^{-1} \text{ y}^{-1}$, for Lake Louise $0.89 \text{ kg ha}^{-1} \text{ y}^{-1}$, and for Susitna Lake $0.90 \text{ kg ha}^{-1} \text{ y}^{-1}$. Thermal habitat volume information is not available for Summit Lake. Using the average weight of lake trout harvested in each lake to convert yields to numbers of fish, the sustainable harvest from Paxson Lake is approximately 800 trout, Lake Louise 2,123 trout, and Susitna Lake 1,191 trout. These yields compare to yields based on Healy's approach of 430 trout from Paxson Lake, 1,740 trout from Lake Louise, 660 trout from Susitna Lake, and 440 trout from Summit Lake. Based on these estimates, harvests of lake trout appear to be below sustainable levels.

Research indicates that strong and weak year classes are present in Paxson Lake while the population in Lake Louise exhibits a more uniform distribution. Exploitation may be the cause of variable recruitment in Paxson Lake; the age distributions of unexploited populations have been found to be more stable (Martin and Olver 1980). Reduction of the harvest from the recent regulation changes should produce a stable lake trout population in Paxson Lake which will support sustainable harvests into the future.



Source: Mills 1985-1994; Howe et al. 1995 and 1996.

Figure 9.-Annual lake trout harvests from the Tyone and Gulkana river drainages, 1984-1995.

Current Issues

The present regulatory regime should protect all UCUSMA lake trout stocks from overharvest and allow the abundance to increase. Angler preferences for small lake trout to eat and trophies to admire are not being met, however. A protected slot limit would achieve such an end.

Protected slot limits increase abundance by protecting the most productive fish while allowing a harvest of abundant small fish and less abundant but larger trophy-sized fish. Protected slot limits are in use on lake trout fisheries in Ontario but, to date, their effect has not been determined (Hicks and Quinn 1990). Inappropriate application of slot limits was found to crop off larger fish and create a stockpile of small fish in a brown trout population studied by Barnhart and Engstrom-Heg (1984).

Slot limits are supported by anglers at Lake Louise and Susitna lakes; but managers feel that a slot limit is not appropriate for Paxson Lake at this time as the abundance of immature lake trout has not been estimated. Increasing effort on this element of the population might reduce abundance by removing too much of the potential spawning stock needed to rebuild or sustain the population.

Recommended Research and Management

Research on lake trout has been discontinued. The applicability of thermal habitat models to Alaskan lake trout populations has not been verified. It is recommended that a final recapture event be staged during the spring in Paxson Lake with the goal of determining an unbiased lake-specific estimate of sustainable yield for comparison to estimates derived from Canadian models. More information is needed regarding the characteristics of the life history and harvest of other lake trout stocks which have the potential to be overexploited including: size and age structure, maturity schedules, abundance and yield, and the contribution of the winter fishery to the lake trout harvests. Of particular interest are Copper and Tanada lakes, accessed from the Nabesna Road via a 12-mile trail and Kimball Pass Lake, accessed on a 16-mile trail from the Richardson Highway.

BURBOT SPORT FISHERIES

Background and Historical Perspective

The many lakes and rivers of the UCUSMA (Figure 10) support some of the largest populations of burbot in Alaska and have supported up to 70% of the statewide sport harvest of this species (Table 13). The largest fishery has historically occurred in the Lake Louise complex (consisting of Lake Louise, Susitna and Tyone lakes (Table 14). Other significant fisheries occur in the various lakes of the Gulkana River drainage (e.g., Paxson, Summit, and Crosswind lakes), Tolsona and Moose lakes, and various smaller remote lakes scattered throughout the UCUSMA. The fishery occurs primarily during the winter months from November to April using closely attended set or hand jig lines.

Prior to 1979, there were no daily bag or possession limits or gear restrictions governing the harvest of burbot in the UCUSMA. In recognition of burbot as an important sport species to be managed for sustained yield, a daily bag and possession limit of 15 burbot was enacted prior to the 1979 winter fishery. Anglers were allowed to harvest burbot by fishing multiple hand lines and unattended set lines with no more than a total of 15 hooks plus two hand-held jig hooks. Under these regulations, the sport harvest of burbot from UCUSMA waters increased

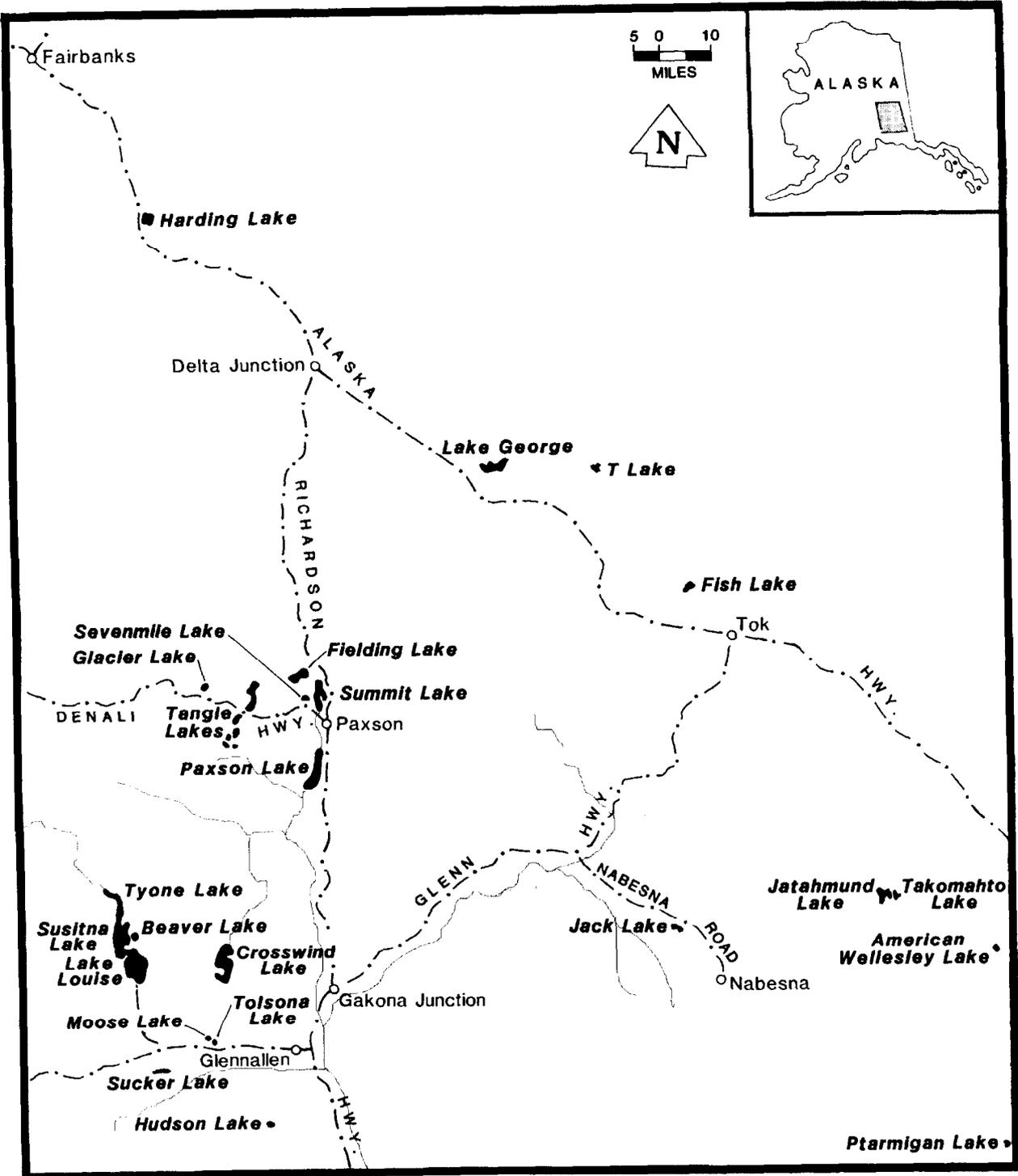


Figure 10.-Lakes supporting major burbot fisheries in the UCUSMA.

Table 13. Harvest of burbot by recreational anglers fishing UCUSMA waters, 1977-1995.

| Year | UCUSMA | Alaska | Percent | Southcentral | Percent |
|-------------|--------------|---------------|-------------|----------------|-------------|
| | Harvest | Harvest | | Alaska Harvest | |
| 1977 | 5,628 | 8,425 | 66.8 | 6,652 | 84.6 |
| 1978 | 7,223 | 9,988 | 72.3 | 8,099 | 89.2 |
| 1979 | 3,808 | 7,304 | 52.1 | 5,207 | 73.1 |
| 1980 | 10,159 | 14,948 | 68.0 | 11,585 | 87.7 |
| 1981 | 9,007 | 14,342 | 62.8 | 9,536 | 94.5 |
| 1982 | 8,006 | 15,445 | 51.8 | 9,662 | 82.9 |
| 1983 | 6,556 | 14,465 | 45.3 | 8,870 | 73.9 |
| 1984 | 10,329 | 19,164 | 53.9 | 13,231 | 78.1 |
| 1985 | 19,355 | 27,230 | 71.1 | 22,015 | 87.9 |
| 1986 | 10,030 | 18,849 | 53.2 | 13,238 | 75.8 |
| 1987 | 4,386 | 13,543 | 32.4 | 9,526 | 46.0 |
| 1988 | 3,747 | 9,478 | 39.5 | 5,600 | 74.8 |
| 1989 | 3,396 | 9,268 | 36.6 | 4,374 | 77.6 |
| 1990 | 1,836 | 10,577 | 17.4 | 5,094 | 36.0 |
| 1991 | 793 | 4,882 | 16.2 | 1,827 | 43.4 |
| 1992 | 1,495 | 7,245 | 20.6 | 2,992 | 50.0 |
| 1993 | 1,694 | 9,858 | 17.2 | 3,392 | 49.9 |
| 1994 | 2,869 | 10,868 | 26.4 | 5,165 | 55.5 |
| 1995 | 995 | 7,128 | 14.0 | 1,853 | 53.7 |
| Mean | 5,859 | 12,264 | 43.0 | 7,785 | 69.2 |

Table 14.-Harvest of burbot caught by recreational anglers fishing in the UCUSMA averaged for the period from 1977-1986 and annually for the period 1987-1995.

| Areas | 1977-86 | 1987 | 1988 | 1989 | 1990 | 1991 | 1992 | 1993 | 1994 | 1995 |
|-------------------------------|--------------------------|--------------|--------------|--------------|--------------|------------|--------------|--------------|--------------|------------|
| Gulkana River Drainage | | | | | | | | | | |
| Lakes | 860 | 550 | 637 | 413 | 561 | 343 | 329 | 257 | 629 | 340 |
| Streams | 82 | 45 | 18 | 19 | 17 | 27 | 127 | 0 | 0 | 7 |
| Total | 939 | 595 | 655 | 432 | 578 | 370 | 456 | 257 | 629 | 347 |
| Upper Susitna Drainage | | | | | | | | | | |
| Lake Louise | 5,040 ^a | 506 | 655 | 976 | 255 | 0 | 0 | 0 | 0 | 0 |
| Susitna/Tyone Lakes | | 684 | 273 | 656 | 323 | 45 | 533 | 172 | 766 | 137 |
| Other Waters | 105 ^b | 30 | 200 | 66 | 0 | 54 | 8 | 0 | 145 | 46 |
| Total | 5,050^c | 1,220 | 1,128 | 1,698 | 578 | 99 | 541 | 172 | 911 | 183 |
| Klutina River Drainage | 13 ^c | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Tazlina Drainage | | | | | | | | | | |
| Moose/Tazlina | 2,223 ^c | 684 | 73 | 94 | 408 | 108 | 127 | 21 | 93 | 23 |
| Hudson | 401 | 446 | 327 | 0 | 0 | 0 | 0 | 0 | 31 | 103 |
| Other | 211 ^c | 862 | 582 | 403 | 0 | 81 | 220 | 86 | 114 | 0 |
| Total | 3,180^c | 1,992 | 982 | 497 | 408 | 189 | 347 | 107 | 238 | 126 |
| Copper River | | | | | | | | | | |
| Upstream of Gulkana | 92 ^c | 0 | 746 | 459 | 238 | 0 | 8 | 611 | 799 | 122 |
| Downstream of Tonsina | 12 ^b | 0 | 0 | 113 | 0 | 0 | 8 | 54 | 42 | 34 |
| Other Sites | 1,144 ^c | 579 | 236 | 197 | 34 | 135 | 135 | 493 | 250 | 183 |
| Area Total | 9,010^d | 4,386 | 3,747 | 3,396 | 1,836 | 793 | 1,495 | 1,694 | 2,869 | 995 |

^a Includes Susitna and Tyone lake harvest estimates.

^b Harvest from 1986 only.

^c Includes 1983-1986 average harvest estimate only. Prior to 1983, harvest included in "Other sites."

^d Average of the total annual area harvest for the period from 1977-1986.

dramatically, peaking in 1985 when a record harvest of 19,355 burbot was taken (Table 13, Figure 11).

The rapid growth in the fishery raised concern that several UCUSMA burbot stocks were either being, or in imminent danger of becoming, overexploited. In response, in 1987 daily bag limits and the number of hooks an angler could fish in area lakes were reduced to five, whether fished on unattended set-lines or hand held jig-lines. In several road accessible lakes (Lake Louise, Tyone, Susitna, Tolsona, Moose, and Summit lakes), the daily bag and possession limits were further reduced to two fish and anglers were restricted to using only two hooks. Also, the sport fishery for burbot in Hudson Lake was closed by emergency order based on findings that this burbot stock had been severely overexploited and was depressed.

During its 1988 meeting, the Board of Fisheries adopted a management plan for the burbot fisheries in lakes of the UCUSMA. The plan was adopted as regulation (5 AAC 52.045) to insure that the department had the necessary tools through which to manage the area's lake burbot fishery for *maximum sustained yield and opportunity to participate*. In order to achieve this management objective, the plan gave the department the authority to use time and area closures *and* method and means restrictions to manage the area's lake burbot sport fisheries. In adopting the plan, the BOF stated its desire to not have the bag limits for burbot reduced to less than two for road accessible lakes and five for remote lakes, as it was considered unreasonable by Board members to participate in these fisheries at lower bag limits.

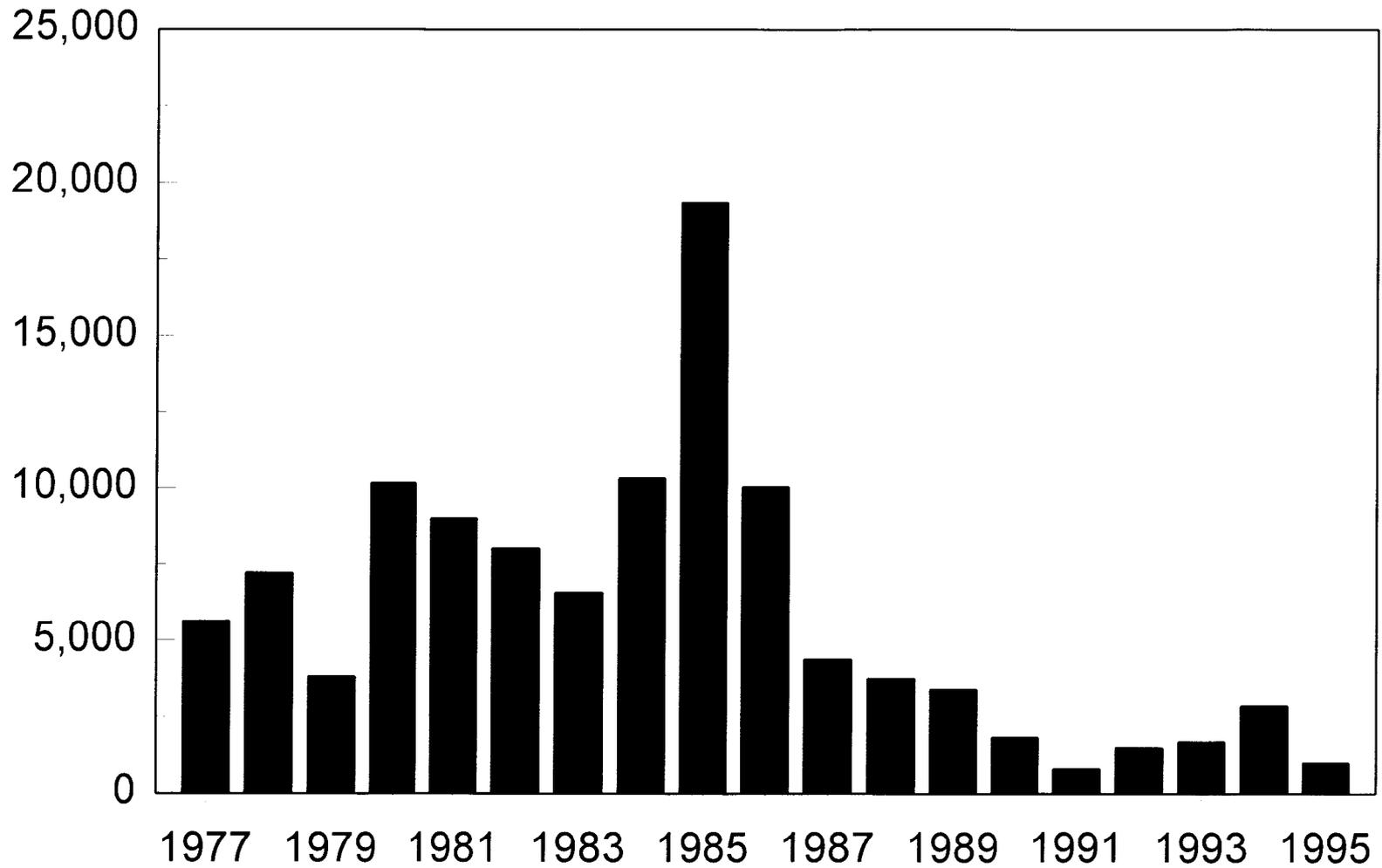
Further actions were implemented during 1989 under the newly adopted management plan. An emergency order was issued that closed the burbot fishery in Lake Louise based on research findings that showed the lake's burbot stocks had become severely depressed due to overfishing. In addition, an emergency order was issued to keep the burbot fishery in Hudson Lake closed, as research showed that burbot in this lake remained depleted. Emergency regulations were also enacted that eliminated set-lines from the sport fishery in all remaining lakes of the Tyone River drainage, given that anglers had begun to seek out previously unexploited lakes in the Tyone River drainage in response to restrictions and closures placed on other area lakes.

A research program was initiated in 1986 to evaluate the life history of interior Alaska burbot and to determine stock status and sustained yields of burbot fisheries in the UCUSMA. The goal of the research program has been to determine appropriate management strategies that assure the maximum sustained yield of burbot from UCUSMA lakes. The study has been conducted in a variety of lakes. Results to date have provided managers with the tools to determine stock status using a variety of assessment methods and an estimate of the productivity of the area's burbot fisheries. Annual results of the research project are summarized in Lafferty et al. (1990-1992), Lafferty and Bernard (1993), Taube et al. (1993), Taube and Bernard (1994), and Szarzi and Bernard (*In prep*).

Fishery Objectives

Based on the lake burbot management plan (5 AAC 52.045), the lake burbot fisheries of the UCUSMA are to be managed for *maximum sustained yield and opportunity to participate*. In order to achieve this fishery objective, the plan gives the department the authority to use time and area closures *and* method and means restrictions to manage the area's burbot sport fisheries. Healthy stocks are managed to permit maximum sustained yield while depressed stocks are

Number Harvested



Source: Mills 1979-1994; Howe et al. 1995 and 1996.

Figure 11.-Harvest of burbot by recreational anglers fishing UCUSMA waters, 1977-1995.

managed to allow the stocks to rebuild. Fishing is permitted on some depressed stocks, however exploitation levels allow the stocks to rebuild to permit a fishery capable of maximum sustained yield.

The management goal is to develop an orderly fishery. As these fisheries rebuild, it is hoped to provide between 10,000 to 15,000 angler days of ice fishing opportunity with a harvest of about 5,000 burbot on an annual basis in the UCUSMA.

Recent Board of Fisheries Actions

Although the more restrictive regulations greatly reduced harvest in the burbot fisheries of the UCUSMA, managers remained faced with a number of biological and social concerns regarding the management of the area's burbot fisheries. For example, in response to closures and restrictions placed on many popular fisheries (e.g., those in the Tyone River drainage), anglers began to target unexploited burbot populations in many of the smaller lakes of the UCUSMA. Many of these smaller burbot populations are capable of providing only limited sustainable yields. There was concern that some of these lakes could become overfished, requiring the department to take, on a lake-by-lake basis, emergency action to protect the stocks. This would be costly and result in a multitude of regulations throughout the management area.

For this reason, managers supported a new approach to the administration of the UCUSMA lake burbot fisheries. Various options were considered; however, managers submitted a proposal to the Board at its 1991 meeting calling for the elimination of *unattended* set lines from all burbot fisheries in the UCUSMA. This proposal was intended to reduce angler efficiency, thereby providing protection from overexploitation to small burbot stocks in the area. After lengthy discussion and consideration, the Board adopted this proposal. Other management options, such as spawning season closures, were considered, but due to insufficient data, were not selected as viable options to protect against overharvest. Managers believe this action should assure the long-term opportunity to fish for and harvest burbot in the UCUSMA.

Lake Louise and Hudson Lake were also closed to burbot fishing at the 1991 Board meeting. Both lakes had been closed through emergency orders for the past several years and were expected to be closed through additional emergency orders into the future. A decision was therefore made to close these fisheries through regulation.

A proposal to reopen Hudson Lake to burbot was submitted to the Board of Fisheries in 1994 following stock assessment which indicated that the population had recovered to a level that would support a fishery. A bag limit of two burbot was suggested to protect the stocks of this popular local fishery from overharvest. To accommodate local anglers, a proposal to allow limited use of unattended setlines in the Copper River was submitted jointly by ADF&G and the Glennallen Advisory Committee. The Board of Fisheries approved both recommendations but they could not be implemented due to improper notification of the regulation proposal. The proposals will be resubmitted at the upcoming BOF meeting in December 1996.

Recent Fishery Performance

With the adoption of the more conservative regulations, harvests of burbot from UCUSMA waters decreased (Table 13, Figure 11). The harvest of 793 burbot during 1991 was the lowest on record (Table 13). The reduction in harvest has allowed some of the previously overexploited burbot stocks in smaller lakes (e.g., Tolsona, Moose and Hudson lakes) and moderately sized lakes (e.g., Susitna and Paxson lakes) to recover to permit sustainable fisheries. For some lakes,

however, these sustainable yields are substantially lower than maximum sustained yields the fisheries are capable of supporting. Larger lakes which were severely overexploited (e.g., Lake Louise) in the early to mid 1980s remain depressed. Stocks in larger lakes take longer to recover from overexploitation than do smaller and moderately-sized lakes. In Lake Louise, historically the largest burbot fishery in Alaska, the burbot stock remains low. The number of mature burbot in this lake, however, has leveled off at 4,000 in recent years. The current level of burbot abundance in this lake, although stable, remains less than the minimal abundance level of 7,000 established by managers to open the fishery. Once opened, only limited fishing will be allowed so that the stock can rebuild to permit a fishery capable of maximum sustained yield. Unfortunately, a lack of recruitment into the Lake Louise burbot population continues to slow the recovery process.

Current Issues

Many anglers have been averse to what they perceive as rapid and drastic changes made to the burbot fisheries of the UCUSMA, and some remain convinced that the actions were unduly restrictive and unfair. This is particularly true with the action taken to eliminate *unattended* set lines from the burbot fisheries of the UCUSMA. Many anglers do not support this action and are choosing to not participate in this fishery because they cannot use this gear type. This reduces participation in fisheries capable of supporting effort and harvest. To promote participation, staff have encouraged anglers to shift to alternative gear types that are legal (attended set lines or tip ups); however, anglers continue to be reluctant. The use of unattended set lines in the mainstem of the Copper River was legalized during 1994 but use of this resource is low. Staff remain opposed to the reintroduction of unattended set lines to lakes. Historically, a few anglers using unattended set lines overharvested several UCUSMA burbot populations within a short period of time. Once overexploited, these fisheries needed to be restricted or closed. Given life history characteristics of burbot, recovery of a depressed stock is slow, often taking many years to rebuild to a condition capable of sustaining a fishery. Creation of the lake burbot management plan gave managers the necessary tools to arrest a fishery that had overexploited a burbot stock. However, actions taken under this management plan promote reactive management where the department bears the burden of detecting overexploited stocks with costly assessment programs. This fragments the burbot fisheries of the UCUSMA and leads to regulations which can be confusing due to superseding emergency orders.

Recommended Research and Management

The stock assessment program was discontinued following sampling of Lake Louise and Tolsona Lake in the spring of 1995. A monitoring program is proposed that will alternate between Lake Louise, Hudson and Tolsona lakes on a 3-year schedule. Catch-per unit-effort will be estimated with baited hoop traps to monitor population trends. Staff will continue to try to educate the angling public and seek their input to managing these important ice fisheries.

CHINOOK SALMON SPORT FISHERIES

In the UCUSMA, only the Copper River drainage supports anadromous runs of chinook salmon. No anadromous runs of chinook salmon return to the upper Susitna River drainage. Devil's Canyon is a hydraulic barrier which prevents upstream salmon migration in this drainage.

Chinook salmon returning to the Copper River drainage begin passing through the Copper River delta and entering the Copper River during early May. Inriver returns are estimated by the sonar

unit located at Miles Lake. The peak migration into the river is generally from mid-May to mid-June, with the return essentially complete by July 1. However, small numbers of chinook salmon continue to enter the Copper River through August. Chinook salmon make their way to spawning areas in Copper River tributaries primarily through June and July with spawning beginning in mid-July and continuing through August.

Chinook salmon are broadly distributed throughout the Copper River basin, having been observed in approximately 40 tributaries. Aerial escapement surveys have been conducted in 35 of these systems; however, only nine of these systems have been surveyed consistently since 1966 (Roberson and Whitmore 1991). In general, chinook salmon returns to these nine Copper River tributaries have been above historical averages since 1982 (Table 15, Figure 12). In 1992 and 1995 escapement to these nine streams was the lowest observed since 1969 (Table 15). The reasons for the low escapement counts in 1992 are unknown. During 1995, heavy rains throughout the summer caused high siltation which obscured visibility in the lower Gulkana River. Flights to the index streams east of the Gulkana were later than normal and may have missed the bulk of the chinook return. Many of the nine streams were not surveyed in 1993, so comparison to historical means for the Copper River is not possible. However, the 1993 escapement count of 1,156 chinook salmon in the Gulkana River is above the historical mean for that system and nearly twice the 1992 and 1995 counts. During 1996, chinook counts of many index streams were records or near records. Unfortunately, assessment of chinook salmon spawning escapements through aerial survey evaluation of key index areas does *not* provide an estimate of the total spawning return. This is because not all spawning areas are surveyed and not all spawners are counted in surveyed areas.

Copper River chinook salmon stocks are harvested in a variety of fisheries including: (1) a commercial gillnet fishery on the Copper River delta, (2) a personal use dip net fishery in the Copper River near Chitina, (3) a subsistence dip net and fishwheel fishery in the Copper River between Chitina and the Slana River confluence, and (4) a sport fishery that occurs in various spawning tributaries. The total harvest of chinook salmon in these fisheries has been estimated since 1966 (Donaldson et al. 1995, Roberson and Whitmore 1991). Since 1982, the total harvest of chinook salmon in these fisheries has ranged from 27,000 to almost 79,000 (Table 16, Figure 13). Unfortunately, the contribution to the catch by each spawning stock for these mixed stock fisheries cannot be quantified at present (Brady et al. 1991, Roberson and Whitmore 1991). Thus, it is not currently possible to assess the productivity of each stock using spawner-recruit databases.

The Copper River Delta District commercial fishery management strategy provides for two, 24-hour periods per week commencing during the second or third week of May, with adjustments in the fishing schedule being made through emergency order. Early season management, when chinook salmon are of consequence in the fishery, is based on actual catches compared to anticipated catches. Under the *Copper River District Salmon Management Plan*, the department may, through emergency order, authorize the use of large mesh gear in the Copper River Delta District if Copper River District sockeye salmon returns are forecasted or observed to be weak *and* a strong harvestable surplus of chinook salmon is demonstrated. By the

Table 15.-Upper Copper River chinook salmon aerial escapement index counts, 1966-1996.

| Year | Copper R. Upstream of Gulkana ^a | | | Tazlina Drainage ^a | | Klutina Drainages | | Tonsina Drainage ^a | | Total |
|-------------------|--|------------------------|-----------------|-------------------------------|------------------|-------------------|-----------------|-------------------------------|-----------------|--------------------|
| | Gulkana R. | E. Fork Chistochina R. | Indian R. | Mendeltna Ck. | Kiana Ck. | St. Anne Ck. | Manker Ck. | Little Tonsina R. | Grayling Ck. | |
| 1966 | 250 | 152 | 20 ^b | 12 | 272 | 48 | 64 | 42 | 22 | 982 |
| 1967 | 757 ^b | 291 ^b | 20 ^b | 6 | 123 ^b | 53 | 2 | 129 ^b | 48 ^b | 1,429 |
| 1968 | 757 ^b | 150 | 20 ^b | 100 | 100 | 26 ^b | 9 | 19 | 4 | 1,185 |
| 1969 | 147 | 200 | 20 ^b | 38 ^b | 34 | 26 ^b | 19 ^b | 129 ^b | 7 | 620 |
| 1970 | 364 | 368 | 20 ^b | 38 ^b | 162 | 35 | 17 | 129 ^b | 48 ^b | 1,181 |
| 1971 | 269 | 512 | 20 ^b | 56 | 81 | 4 | 30 | 200 | 45 | 1,217 |
| 1972 | 200 | 348 | 13 | 49 | 89 | 25 | 4 | 129 ^b | 47 | 1,904 |
| 1973 | 623 | 476 | 20 ^b | 15 | 172 | 26 ^b | 17 | 100 | 47 | 1,496 |
| 1974 | 317 | 137 | 4 | 15 | 55 | 32 | 29 | 65 | 49 | 1,654 |
| 1975 | 741 | 71 | 6 | 38 ^b | 123 ^b | 26 ^b | 19 ^b | 161 | 48 ^b | 1,233 |
| 1976 | 777 | 289 | 61 | 35 | 37 | 15 | 6 | 98 | 17 | 1,335 |
| 1977 | 1,090 | 132 | 20 | 73 | 91 | 10 | 15 | 35 | 48 ^b | 1,514 |
| 1978 | 921 | 137 | 9 | 52 | 125 | 24 | 20 | 285 | 92 | 1,665 |
| 1979 | 1,380 | 810 | 29 | 5 | 279 | 16 | 16 | 285 | 153 | 2,973 |
| 1980 | 718 | 575 | 24 | 3 | 247 | 8 | 35 | 70 | 66 | 1,746 |
| 1981 | 754 ^b | 120 | 20 ^b | 51 | 191 | 19 | 23 | 191 | 107 | 1,486 |
| 1982 | 1,656 | 1,260 | 179 | 70 | 200 | 35 | 49 | 440 | 127 | 4,016 |
| 1983 | 931 | 575 | 41 | 12 | 166 | 87 | 141 | 330 | 287 | 2,570 |
| 1984 | 2,189 | 577 | 17 | 26 | 382 | 89 | 264 | 568 | 279 | 4,391 |
| 1985 | 321 | 360 | 14 | 26 | 91 | 15 | 22 | 203 | 58 | 1,110 |
| 1986 | 3,182 | 618 | 29 ^b | 76 | 328 | 182 | 251 | 424 | 224 | 5,314 |
| 1987 | 1,228 | 764 | 33 | 10 | 80 | 192 | 141 | 247 | 112 | 2,807 |
| 1988 | 967 | 684 | 0 | 17 | 249 | 62 | 115 | 75 | 161 | 2,330 |
| 1989 | 1,993 | 740 | 3 | 185 | 344 | 90 | 165 | 65 | 72 | 3,657 |
| 1990 | 1,356 | 615 | 15 | 320 | 411 | 42 | 41 | 57 | 49 | 2,906 |
| 1991 | 1,303 | 865 | 18 | 305 | 520 | 115 | 101 | 54 | 151 | 3,432 |
| 1992 | 656 | 88 | 1 | 83 | 79 | 12 | 14 | 107 | 17 | 1,057 |
| 1993 | 1,156 | -- ^c | -- ^c | 126 | 65 | -- ^c | -- ^c | -- ^c | -- ^c | -- ^c |
| 1994 | 1,682 | 508 | 47 | 121 | 430 | 250 | 75 | 4 ^d | 2 ^d | 3,119 |
| 1995 | 720 ^e | 37 ^f | 2 ^f | 41 ^g | 110 ^g | 26 ^g | 8 ^g | 25 ^g | 26 ^g | 995 |
| 1996 ^h | 4,542 | 2,071 | 207 | 370 | 709 | 117 | 194 | 30 ⁱ | 163 | 8,097 |
| Mean | 1,095 | 484 ^j | 31 ^j | 77 | 198 | 53 ^j | 64 ^j | 157 ^j | 86 ^j | 2,314 ^j |

^a Some data published in Brady et al. 1991, remainder is unpublished.

^b Estimated.

^c No aerial surveys conducted in 1993.

^d Surveys flown August 11.

^e Visibility poor, carcass count only downstream of West Fork.

^f Surveys flown August 1.

^g Surveys flown August 8.

^h Counts determined by two surveyors.

ⁱ More chinook were seen entering the system at later survey, but not counted.

^j Average of surveys conducted 1966-1992, 1994-1996.

Number Observed

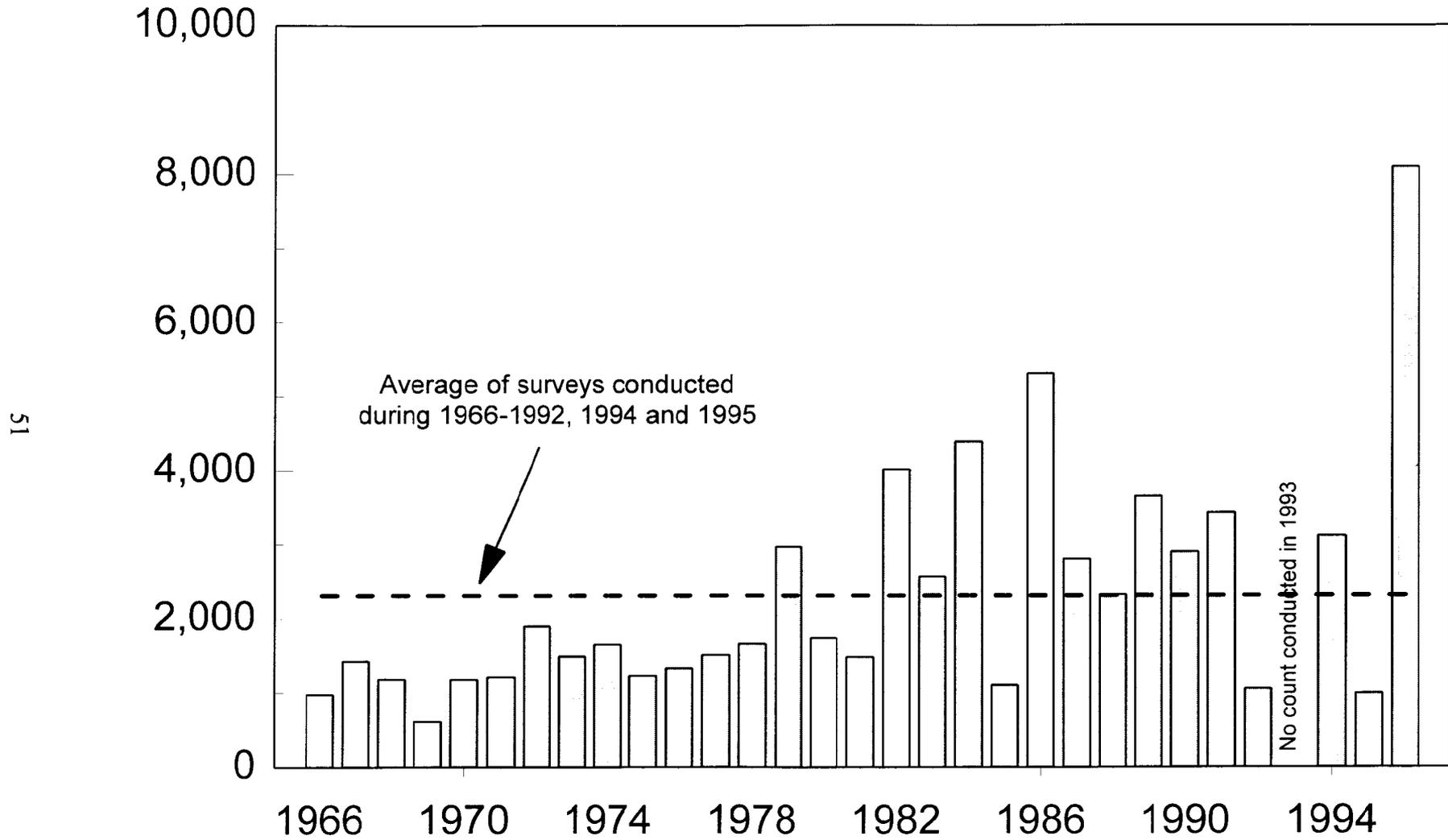


Figure 12.-Observed spawning escapement index counts for chinook salmon in the Copper River drainage, 1966-1996.

Table 16.-Copper River chinook salmon harvest and escapement index estimates, 1966-1995.

| Year | Commercial Harvest ^a | Sport Harvest ^b | Subsistence/ Personal Use Harvest ^c | Total Harvest | Aerial Escapement Index |
|-------------------------------------|---------------------------------|----------------------------|--|---------------|-------------------------|
| 1966 | 11,422 | 500 | 727 | 12,649 | 882 |
| 1967 | 9,853 | 500 | 568 | 10,921 | 1,429 |
| 1968 | 9,743 | 500 | 923 | 11,166 | 1,185 |
| 1969 | 14,050 | 500 | 869 | 15,419 | 620 |
| 1970 | 19,375 | 600 | 551 | 20,526 | 1,181 |
| 1971 | 16,486 | 600 | 1,750 | 18,836 | 1,217 |
| 1972 | 22,349 | 750 | 1,797 | 24,896 | 1,904 |
| 1973 | 19,948 | 850 | 2,015 | 22,813 | 1,496 |
| 1974 | 18,980 | 900 | 1,297 | 21,177 | 1,654 |
| 1975 | 19,644 | 750 | 1,978 | 22,372 | 1,233 |
| 1976 | 31,483 | 400 | 2,335 | 34,218 | 1,335 |
| 1977 | 22,089 | 532 | 2,555 | 25,176 | 1,514 |
| 1978 | 29,062 | 641 | 2,239 | 31,942 | 1,665 |
| 1979 | 17,308 | 2,948 | 3,416 | 23,672 | 2,973 |
| 1980 | 8,449 | 2,101 | 3,035 | 13,585 | 1,746 |
| 1981 | 20,178 | 1,717 | 2,410 | 24,305 | 1,486 |
| 1982 | 47,362 | 1,802 | 2,764 | 51,928 | 4,016 |
| 1983 | 50,022 | 2,579 | 5,950 | 58,551 | 2,570 |
| 1984 | 38,955 | 2,787 | 2,269 | 44,011 | 4,391 |
| 1985 | 42,333 | 1,939 | 1,958 | 46,230 | 1,110 |
| 1986 | 40,670 | 3,663 | 3,052 | 47,385 | 5,314 |
| 1987 | 41,001 | 2,301 | 3,781 | 47,083 | 2,807 |
| 1988 | 31,741 | 1,562 | 3,982 | 37,285 | 2,330 |
| 1989 | 30,873 | 2,356 | 3,040 | 36,269 | 3,657 |
| 1990 | 21,702 | 2,302 | 3,325 | 27,329 | 2,906 |
| 1991 | 34,787 | 4,884 | 5,331 | 45,002 | 3,432 |
| 1992 | 39,819 | 4,412 | 4,826 | 49,057 | 1,057 |
| 1993 | 29,716 | 8,217 | 4,263 | 42,196 | NA |
| 1994 | 47,061 | 6,431 | 5,699 | 57,760 | 3,119 |
| 1995 | 65,675 | 6,709 | 6,596 | 78,980 | 2,113 |
| 1996 | 55,575 | 7,000 ^d | 5,274 ^e | 67,849 | 8,097 |
| Average (since 1984) | 39,993 | 4,197 | 4,107 | 48,187 | 3,328 |

^a Some data published in Donaldson et al. 1993, the rest is unpublished.

^b 1966-1976 sport harvests are subjective approximations from the area biologist.

^c These figures are expanded to reflect unreported permits. See Table 6 for reported harvests.

^d Estimated.

^e Preliminary.

Number Harvested

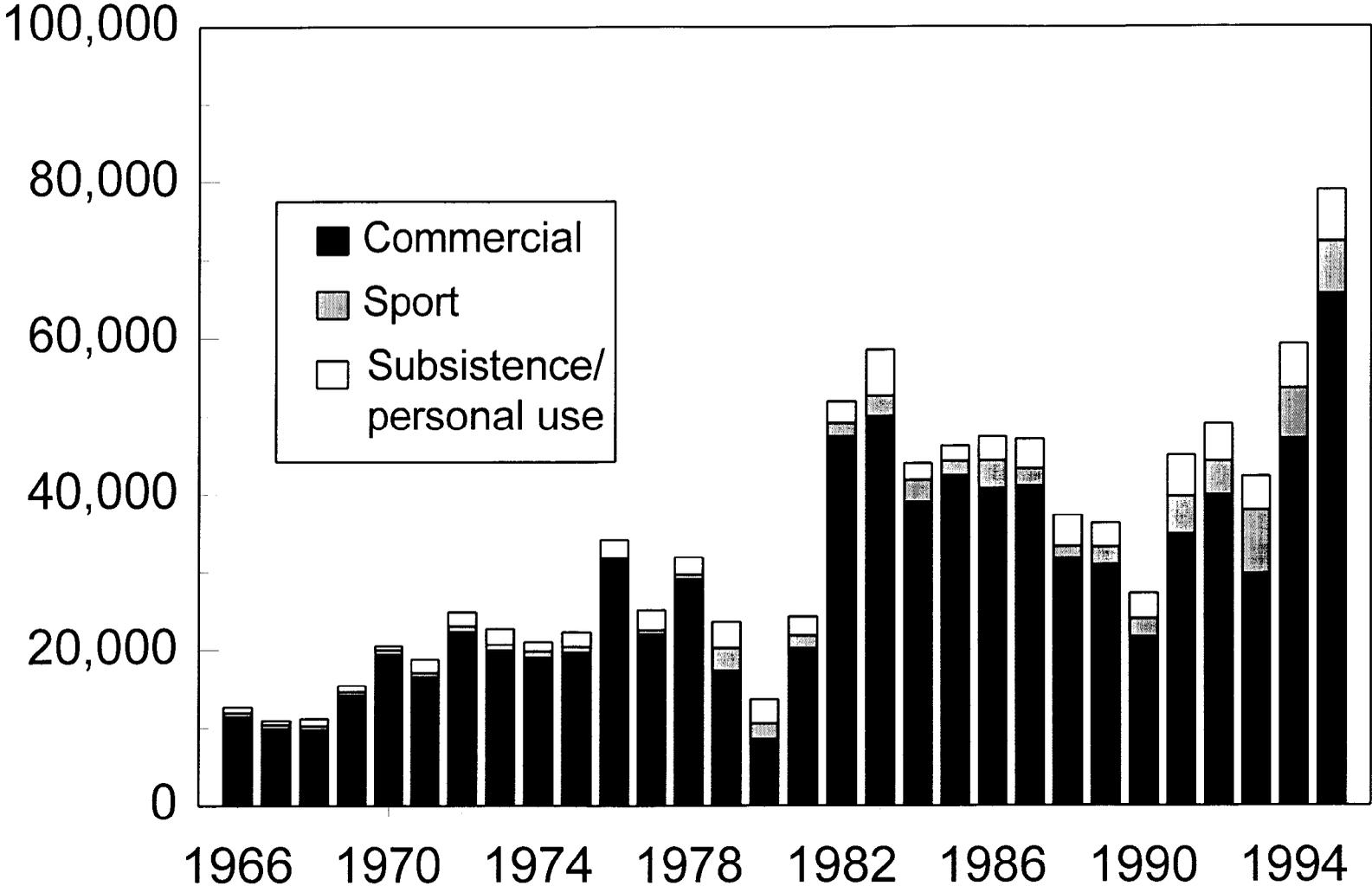


Figure 13.-Harvest of Copper River chinook salmon, by fishery, 1966-1995.

third fishing period, with sockeye salmon harvests near 100,000 fish per period, fisheries management becomes directed toward sockeye salmon. Since 1984, chinook salmon harvest in the Copper River District Delta commercial fishery has averaged approximately 40,000 fish (Table 16), with harvests remaining relatively stable through 1993. Since then record or near record harvests have occurred each year (Figure 14).

Subsistence and personal use harvests of Copper River chinook salmon have averaged approximately 4,000 fish since 1984 (Table 16), with harvests having generally increased in recent years (Figure 15). The subsistence fishery occurs from June 1 through September 30 in the mainstem Copper River from the upstream edge of the Chitina-McCarthy Highway bridge upstream to Slana. Fishwheels and dip nets are legal gear. Permits are a requirement of this fishery. The maximum harvest limit for a household of one person is 200 fish and for a household of two or more is 500 fish. There is no limit as to the number of chinook salmon within the annual permit limit for people using fishwheels, while a five chinook salmon limit is imposed on subsistence fishermen using dip nets. Chinook salmon are present in the fishery when the fishery is opened and, on average, 80% of the chinook salmon harvest is achieved by July 12 (Roberson and Whitmore 1991).

The personal use fishery is restricted to mainstem waters of the Copper River from the downstream edge of the Chitina-McCarthy Highway bridge downstream to a Department marker located approximately 200 yards upstream of Haley Creek. The season is from June 1 through September 30. Fishing periods are established by emergency order. A schedule of fishery openings is published prior to the season. The schedule is designed to allow a total harvest of 60,000 sockeye salmon based on the weekly forecasted return. Inseason adjustments are made to the schedule to allow harvest of 25% of the Miles Lake sonar count that exceeds the weekly forecasted return, or curtail harvests if the return is less than the forecast. If the harvest of salmon is less than 45,000 salmon by the end of the fifth week of the fishery, the possession limit may increase for sockeye salmon, but not for chinook salmon. Participants in this fishery must be residents of Alaska and have a current sport fishing license. Permits are a requirement of this fishery. Permits limit households of one individual to 15 salmon of which no more than five can be chinook salmon and households of more than one person to 30 salmon of which no more than five can be chinook salmon. Chinook salmon are present in the catch when the fishery is opened. On average, 80% of the chinook salmon harvest is completed by July 1 and 95% by July 17 (Roberson and Whitmore 1991).

The sport harvest of chinook salmon from Copper River tributaries has increased substantially since 1982 (Figure 16), with the 1993 harvest of 8,217 being the highest on record (Table 16). Since 1984, the average harvest of chinook salmon by sport anglers fishing UCUSMA waters has been about 4,000 fish. The fishery primarily occurs in various tributaries to the Copper River with the largest fisheries occurring in the Gulkana and Klutina rivers (Table 17). Approximately 94% of the estimated sport harvest of chinook salmon taken from the Copper River drainage since 1983 has been taken from these two drainages. Since 1970, the sport harvest of chinook salmon over 20 inches in length in the sport fishery of the Copper River Basin has been limited by a bag and possession limit of one per day and one in possession. Further protection was afforded area chinook salmon stocks through spawning season closures beginning in 1989. Beginning in 1989, to reduce catch-and-release mortality, any chinook salmon removed from

Number Harvested

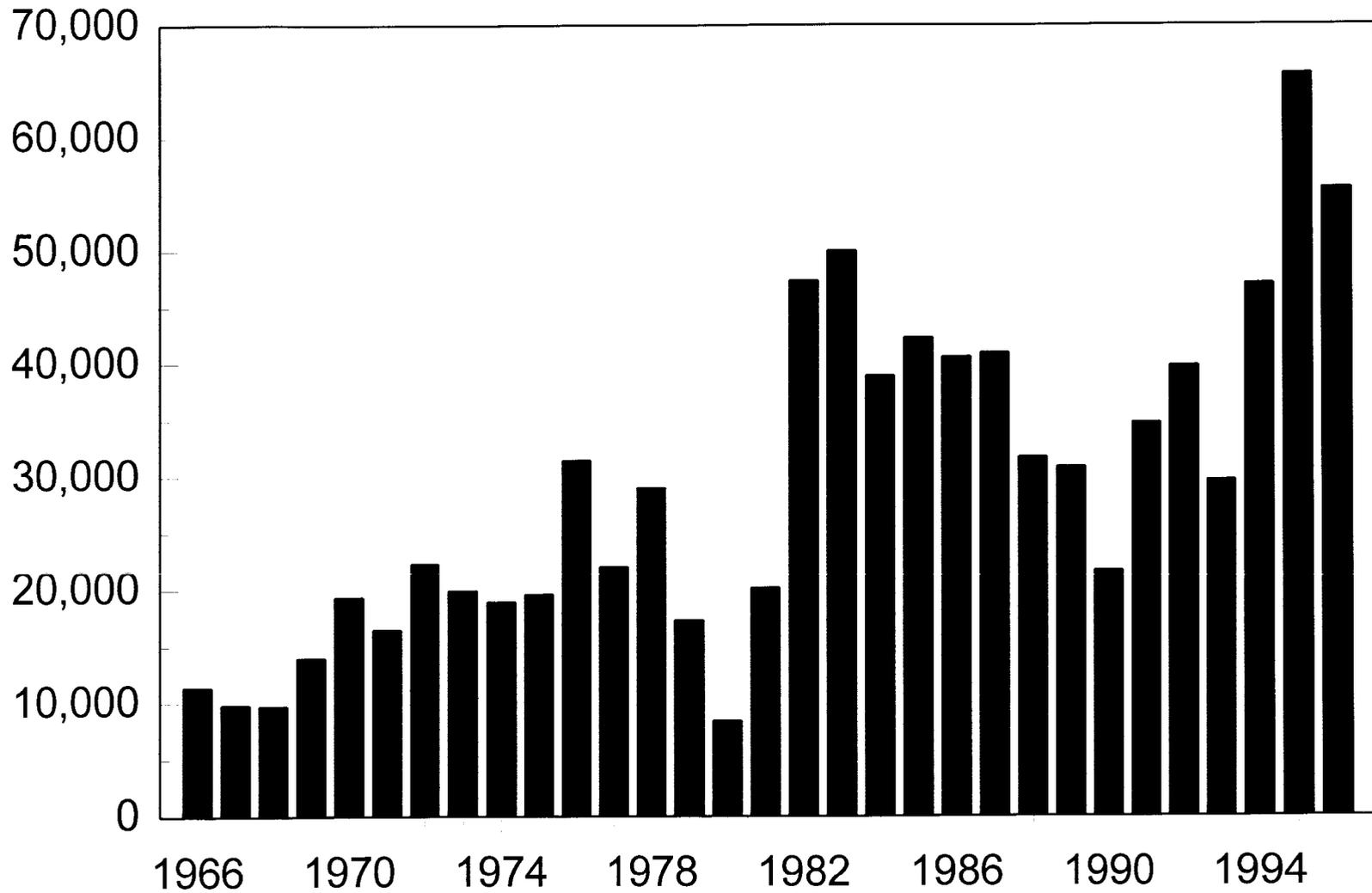


Figure 14.-Commercial harvest of Copper River chinook salmon, 1966-1996.

Number Harvested

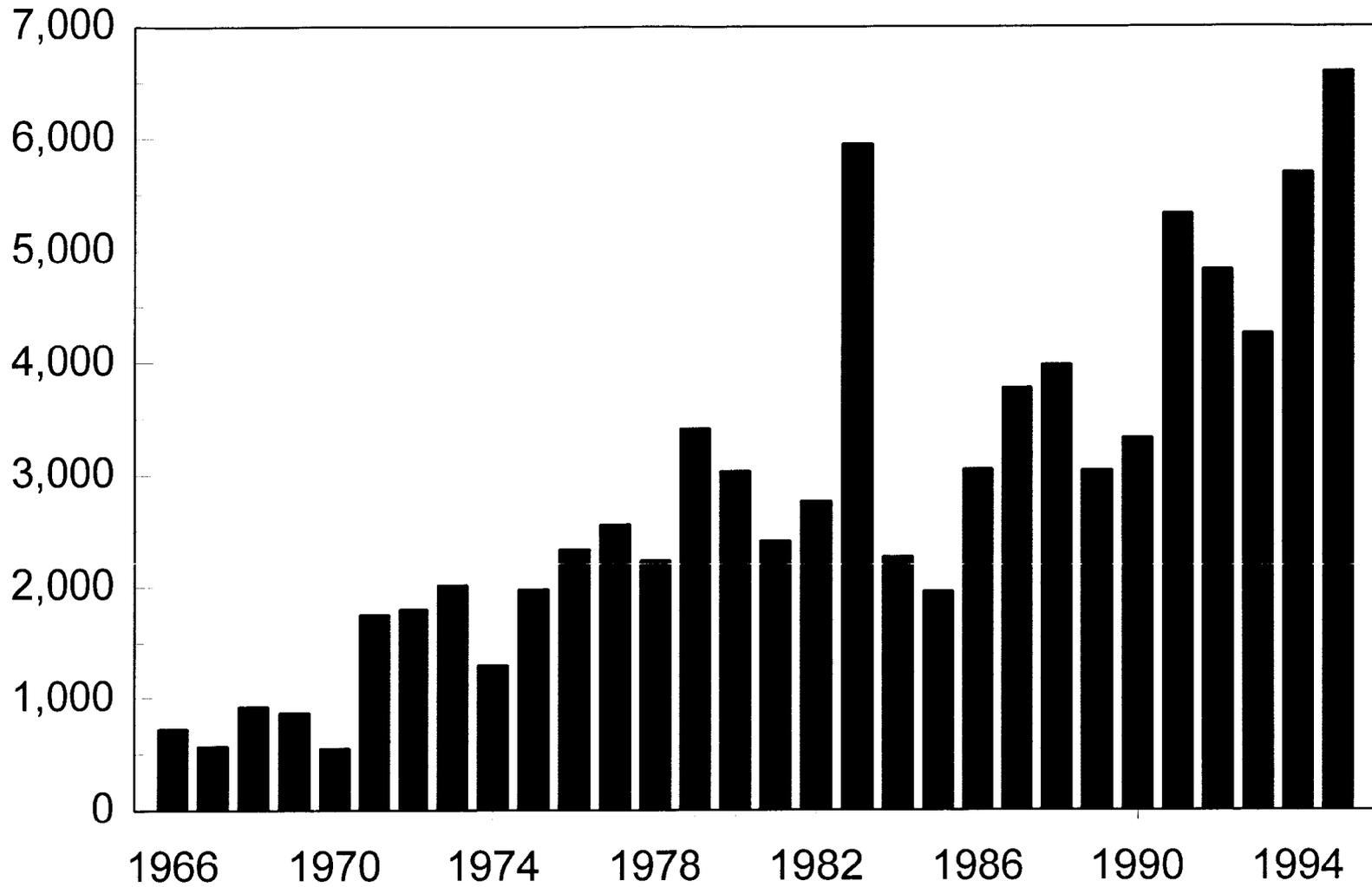
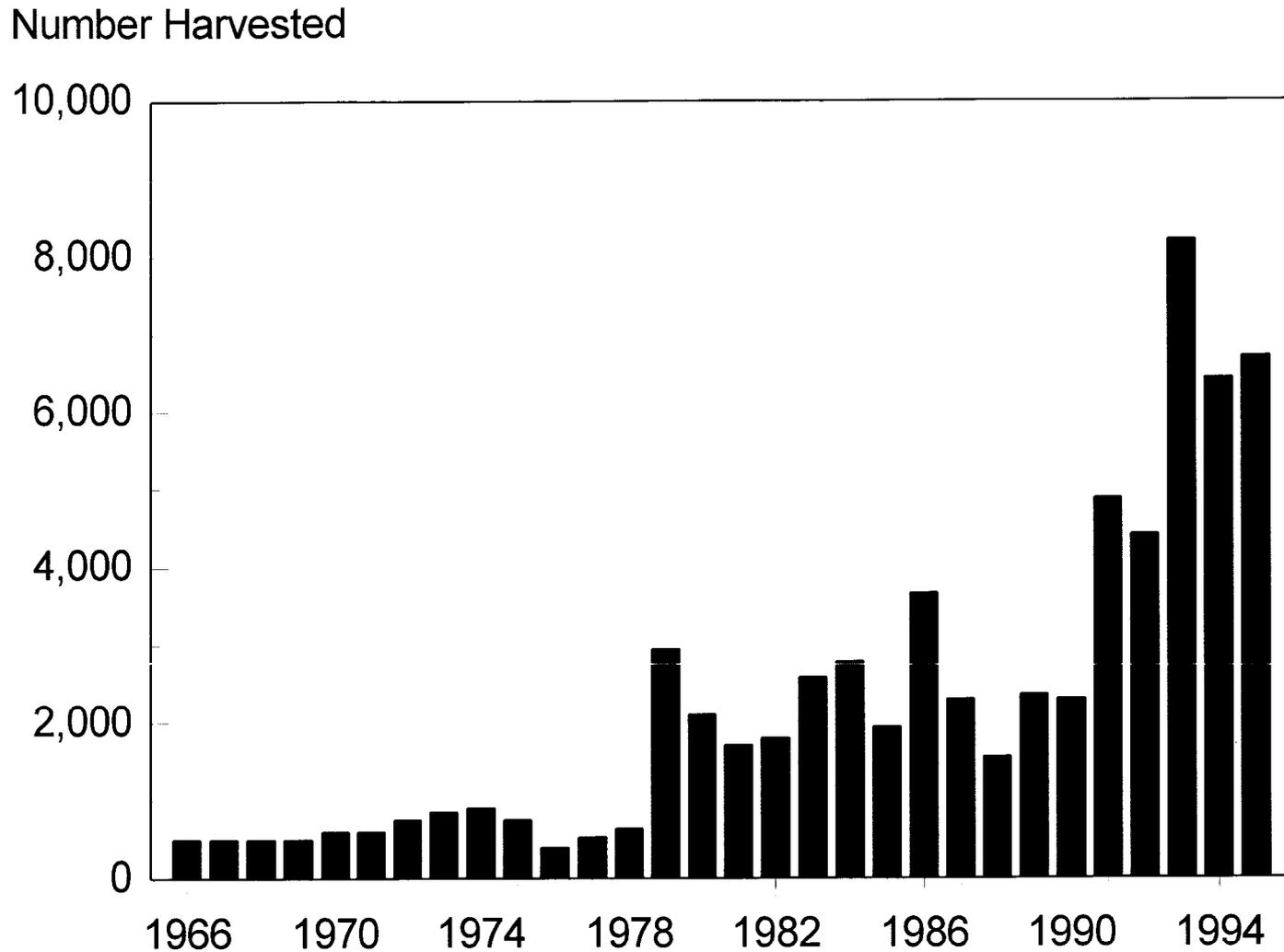


Figure 15.-Subsistence and personal use harvest of Copper River chinook salmon, 1966-1995.



Source: Mills 1979-1994; Howe et al. 1995 and 1996.

1966-1976 sport harvests are subjective approximations from the area biologist.

Figure 16.-Sport harvest of Copper River chinook salmon, 1966-1995.

Table 17.-Harvest of chinook salmon by recreational anglers fishing in the UCUSMA averaged for the period from 1977-1986 and annually for the period 1987-1995.

| Areas | 1977-86 | 1987 | 1988 | 1989 | 1990 | 1991 | 1992 | 1993 | 1994 | 1995 |
|------------------------------------|--------------------------|--------------|--------------|--------------|--------------|--------------|--------------|--------------|--------------|--------------|
| Gulkana River Drainage | | | | | | | | | | |
| Upper River | 1,644 ^a | 1,301 | 881 | 1,211 | 239 | 483 | 416 | 694 | 1,352 | 984 |
| Lower River | | 330 | 152 | 419 | 1,388 | 2,508 | 2,655 | 5,198 | 2,350 | 2,572 |
| Total | 2,071 | 1,631 | 1,033 | 1,630 | 1,627 | 2,991 | 3,071 | 5,892 | 3,702 | 3,556 |
| Klutina River Drainage | 454 ^b | 495 | 483 | 652 | 583 | 1,709 | 1,075 | 1,989 | 2,189 | 2,485 |
| Tonsina River Drainage | 26 | 19 | 0 | 11 | 23 | 89 | 152 | 172 | 349 | 539 |
| Tazlina Drainage | 31 ^b | 49 | 9 | 40 | 17 | 32 | 8 | 0 | 105 | 0 |
| Copper River | | | | | | | | | | |
| Upstream of Gulkana | 15 ^b | 0 | 9 | 0 | 17 | 0 | 18 | 47 | 16 | 0 |
| Downstream of Klutina ^c | 49 ^b | 0 | 28 | 11 | 0 | 25 | 55 | 64 | 20 | 0 |
| Other Waters | 115 | 107 | 0 | 6 | 35 | 38 | 24 | 43 | 50 | 129 |
| AREA TOTAL | 2,071^d | 2,301 | 1,562 | 2,356 | 2,302 | 4,884 | 4,412 | 8,217 | 6,431 | 6,709 |

^a Includes upper and lower river harvests.

^b Includes 1983-1986 average only. Prior to 1983, harvest included in other waters.

^c Does not include Tonsina drainage.

^d Average of total annual harvest 1977-1986.

UCUSMA waters becomes part of the daily bag and possession limit of the person who hooked the fish. During 1991, sport chinook salmon fishing was closed in Fish, Indian, Bernard, Ahtel and Natat creeks and the Little Tonsina River. This action was taken in an effort to bolster escapements to these small clearwater tributaries which have showed decline in chinook salmon returns in recent years. Also during 1991, the portion of the Gulkana River 7.5 miles upstream of the confluence of the West Fork was designated as an area where only unbaited, single-hook artificial lures may be used. This action was taken as a conservation measure for rainbow trout and has had little or no effect on the chinook salmon fishery.

Under the *Copper River Personal Use Salmon Management Plan* (5 AAC 77.590), the Board established a harvest guideline of 2,500 chinook salmon, annually, to the sport fishery in the Copper River tributaries. This allocation has been exceeded six times during the last 10 years (Table 16). Given the increase in the popularity of the sport chinook salmon fishery in the Copper River basin, it is likely that the 2,500 fish quota will continue to be exceeded into the future unless actions are taken to reduce harvest or the quota is raised to accommodate the growth in the fishery.

Overall, Copper River chinook salmon stocks are considered healthy (Roberson and Whitmore 1991). Increasing harvests over the past decade have been compensated by above average returns (Figure 17). Strong returns of chinook salmon are unlikely to continue indefinitely, while participation in upriver fisheries is likely to increase. To more accurately assess chinook abundance, research was initiated during 1995 to estimate the timing and contribution of chinook stocks from major tributaries to the Copper River. During 1995 and 1996, capture and coded wire tagging of juvenile chinook salmon was investigated in various tributaries and determined to be feasible. A weir was operated successfully in the Gulkana River from June 11 to July 31 in 1996, and will be used in the future to count returning adults and determine the fraction of the return with coded wire tags.

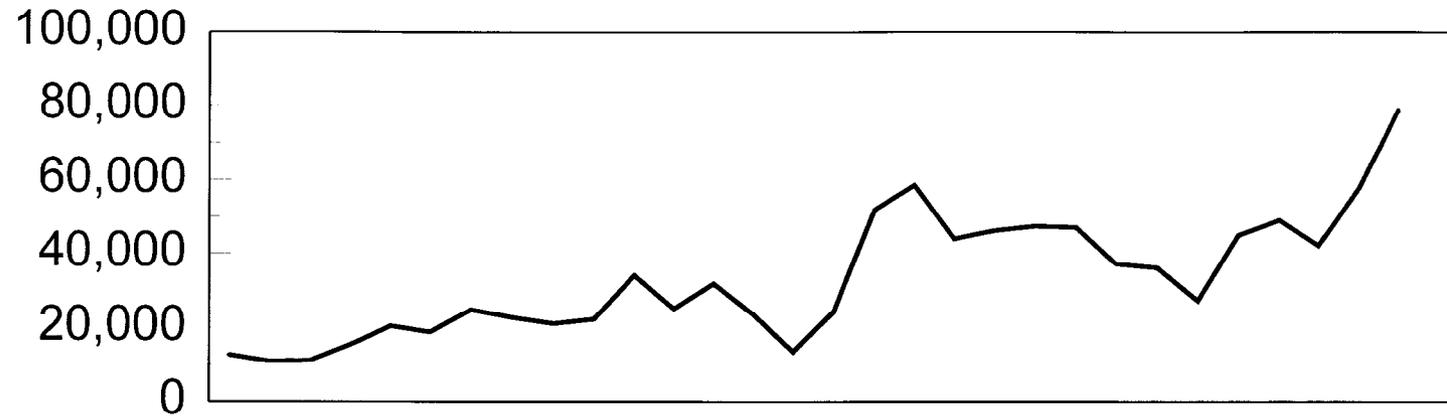
Conflicts among users and concerns over chinook salmon resources have resulted in the submission of more than 26 proposals to the Board of Fisheries at its upcoming meeting. The department is proposing to protect chinook salmon spawning areas drainage-wide with the closure of fishing for chinook salmon in most large lakes and their tributaries. Proposals from the public address catch-and-release fishing mortality. Other proposals will be discussed in detail in the subsequent sections of this report that address specific fisheries.

Gulkana River Chinook Salmon Sport Fishery

Background and Historic Perspective

The Gulkana River drainage has historically supported the largest sport fishery for chinook salmon in the UCUSMA. This drainage originates in the Alaska Range and flows south to join the Copper River near the community of Gulkana (Figure 5). The section of the Gulkana River upstream from Sourdough has been designated by the U.S. Congress as “wild” under the Wild and Scenic Rivers Act of 1968. Access to the river is available from various secondary roads and trails off the Richardson Highway, which parallels much of the river. Anglers use rafts, canoes, and power boats to gain access to the more remote sections of the river. Raft and canoe anglers frequent the various sections of the river from Paxson Lake downstream to the Richardson Highway bridge. Power boat operators generally launch at Sourdough and use the river from approximately 2 miles below Sourdough upstream to the confluence of the West Fork. More

Total Harvest



Escapement Index

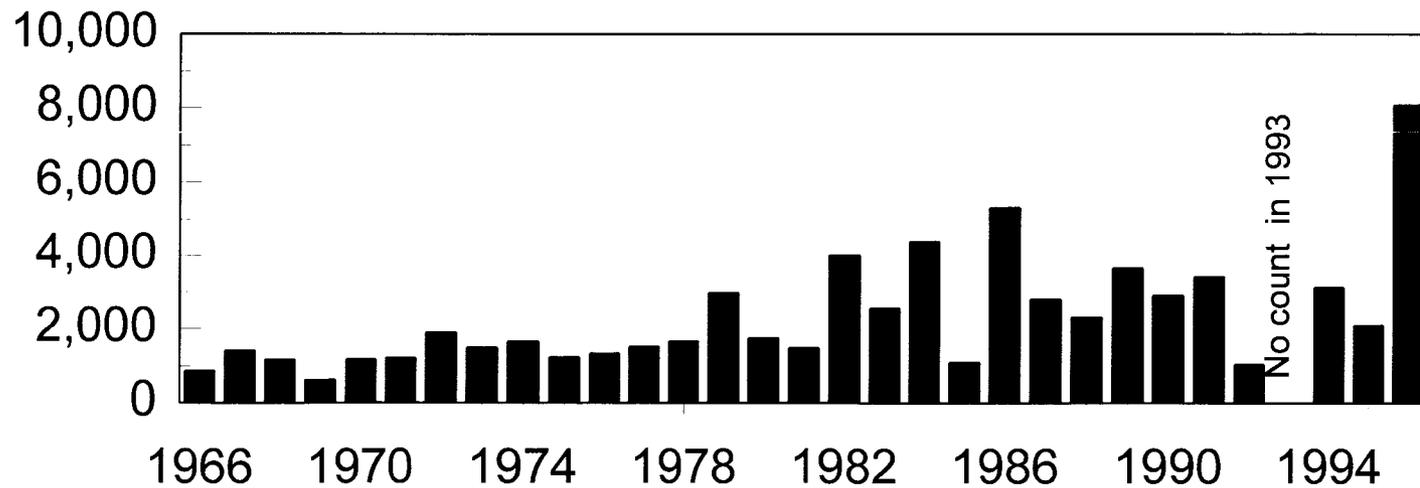


Figure 17.-Comparison of Copper River chinook salmon harvest and spawning escapement index counts, 1966-1995.

recently power boat operators have begun launching from the Richardson Highway bridge and fishing the 5-mile reach of the river above the bridge. Power boat operators occasionally access the confluence of the Gulkana River with the Copper River using power boats launched from Gakona.

Chinook salmon typically begin entering the Gulkana River in early to mid-June. The sport fishery typically peaks during late June; however, limited fishing for chinook salmon continues until the season closes in mid July. Spawning begins in mid-July and continues through late August. Most spawning occurs upstream of the confluence of the West Fork.

Under current regulations, anglers fishing the Gulkana River are allowed one chinook salmon over 20 inches daily and in possession and a total of five per year. All waters above the Middle Fork confluence with the mainstem Gulkana River are closed to fishing for chinook salmon year-round to protect spawning fish. The rest of the river is open to chinook salmon fishing from January 1 through July 19. The closure date is intended to offer protection to spawning fish. The Gulkana River from the Richardson Highway bridge downstream to a department marker 500 yards downstream of its confluence with the Copper River is an area where only single-hook, artificial flies may be used from June 1 through July 31. In all waters of the Gulkana River drainage upstream of a marker 7.5 miles upstream of the West Fork confluence with the mainstem only unbaited, artificial lures may be used. This regulation is intended to protect rainbow trout stocks that inhabit this area.

The primary source of information regarding the sport fishery is the statewide mail survey (Mills 1979-1994, Howe et al. 1995 and 1996). Based on this survey, the sport harvest of chinook salmon in the Gulkana River has averaged about 2,188 fish annually since 1977 (Table 18, Figure 18). The 1993 harvest of 5,892 chinook salmon was the largest on record and accounted for nearly 72% of the sport harvest of chinook salmon in the UCUSMA. Sport fishing effort on the Gulkana River has averaged 27,789 angler-days annually since 1983 (Table 3). Due to the nature of the mail survey, we do not know how much of this effort was directed towards chinook salmon but observations suggest that chinook salmon are a focus of a majority of the effort.

A creel survey was conducted in 1989 to estimate the catch and harvest of and effort directed toward chinook salmon. Results of this survey (Potterville and Webster 1990) indicated that sport anglers expended 29,103 angler-hours to catch 2,398 chinook salmon. Sixty-one percent (1,461 fish) of the catch was estimated to be harvested. This estimate of harvest is close to that estimated from the mail survey (1,630 fish), indicating that the mail survey appears to accurately estimate the harvest of chinook salmon in this fishery. Approximately 50% of the harvest was estimated to have occurred on weekends. The majority of the sport harvest occurred in the 5-mile reach directly upstream of the Richardson Highway bridge and the 10-mile reach near the Bureau of Land Management campground and boat launch at Sourdough. Few anglers fished the single-hook, artificial fly-fishing-only area and, although many anglers floated the upper river, the harvest of chinook salmon was minimal in this reach due to the July 20 spawning season closure.

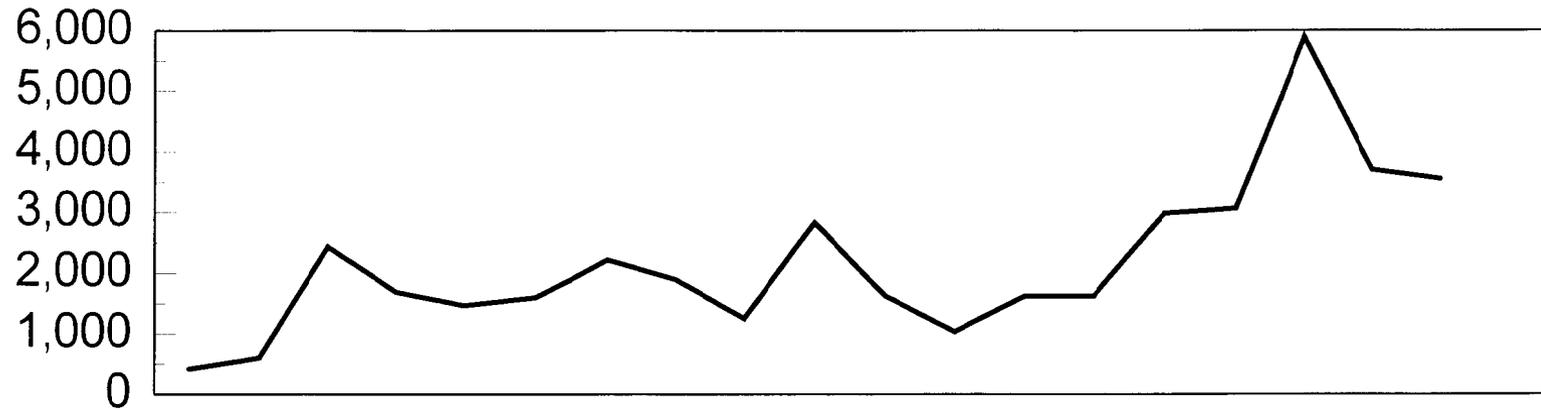
The spawning escapement of chinook salmon in the Gulkana River upstream of the West Fork has been documented since 1966 by aerial surveys of index sites in the drainage (Brady et al. 1991, Roberson and Whitmore 1991). Through 1996, escapement indices averaged 1,095,

Table 18.-Sport harvest and observed spawning escapements of chinook salmon in the Gulkana River drainage from 1977-1995.

| Year | Sport Harvest | Observed Spawning Escapement |
|-------------|---------------|------------------------------|
| 1977 | 421 | 1,090 |
| 1978 | 606 | 921 |
| 1979 | 2,440 | 1,380 |
| 1980 | 1,688 | 718 |
| 1981 | 1,469 | 754 |
| 1982 | 1,603 | 1,656 |
| 1983 | 2,224 | 931 |
| 1984 | 1,898 | 2,189 |
| 1985 | 1,256 | 321 |
| 1986 | 2,833 | 3,182 |
| 1987 | 1,631 | 1,228 |
| 1988 | 1,033 | 967 |
| 1989 | 1,630 | 1,993 |
| 1990 | 1,627 | 1,356 |
| 1991 | 2,991 | 1,303 |
| 1992 | 3,071 | 656 |
| 1993 | 5,892 | 1,156 |
| 1994 | 3,702 | 1,682 |
| 1995 | 3,556 | 720 ^a |
| Mean | 2,188 | 1,274 |

^a Visibility poor, carcass count only downstream of West Fork.

Sport Harvest



Escapement Index

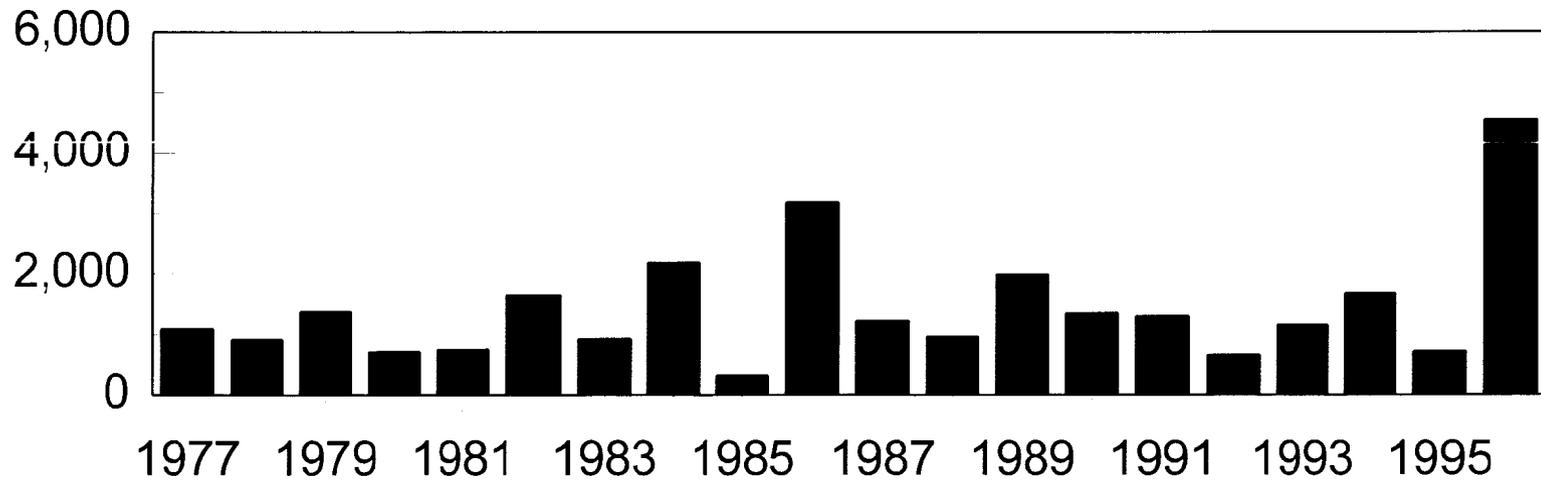


Figure 18.-Comparison of chinook salmon harvest and spawning escapement index counts in the Gulkana River, 1977-1995.

ranging from a high of 4,542 fish in 1996 to a low of 147 fish in 1969 (Table 15). With the exceptions of a low escapement during 1985 and 1992 and high escapement during 1996, escapements have remained relatively stable since 1977 (Figure 18).

As part of a drainage-wide chinook salmon research project, a weir was operated on the Gulkana River in 1996 to provide a count of chinook escapement. A creel survey was conducted concurrently to estimate the harvest of chinook. A total of 11,684 chinook salmon were counted passing through the weir during its operation from June 11 to July 31. An estimated 4,920 chinook were caught of which 2,441 chinook were harvested during June 1 to July 19, when the season closes for chinook salmon.

Fishery Objectives

The underlying goal of past and current management has been to assure sustained yield. An annual escapement objective of 1,000 fish has been established, based on enumeration of spawning fish by aerial surveys. During years in which water clarity has been good enough to conduct area surveys, no action has been taken to restrict the fishery if spawning escapements of 1,000 fish are achieved in the area between the mouth of the Gulkana River and the confluence with the West Fork during the week following the Fourth of July weekend. Unfortunately, water clarity often prohibits conducting aerial surveys during this period.

Recent Board of Fisheries Actions

During 1994, a seasonal bag limit of five chinook was imposed on the UCUSMA fisheries and guides were restricted from fishing while accompanying paid clients. Both restrictions were implemented to reduce the harvest potential on chinook salmon stocks in the area that are considered fully utilized.

Recreational harvests are documented through the mail survey, the personal use and subsistence harvests are recorded through permits, and the commercial harvest is enumerated through fish tickets. Beginning in 1994, commercial fishermen were required to record their take of chinook salmon for personal use on ADF&G fish tickets to allow managers to estimate the total harvest of Copper River-bound chinook.

Several proposals concerning the Gulkana River have been submitted by the public for consideration at the upcoming Board of Fisheries meeting in December 1996.

Recent Fishery Performance

During 1995, 3,556 chinook salmon were harvested by sport anglers fishing the Gulkana River drainage (Table 17). Observed chinook salmon spawning escapement during 1995 (720) was lower than average (1,274) but should be considered a minimum count because of poor visibility due to above average rainfall that occurred during the summer of 1995 (Table 18). The harvest estimate of 2,441 from the creel survey is less than the average from the mail survey (Mills 1992-1994; Howe et al. 1995 and 1996) of the past 5 years (3,842) but should be considered a minimum estimate due to some anglers being missed at access points. Low water conditions also made angling more difficult upstream of Sourdough. Aerial counts in 1996 were the highest on record and likely reflect an exceptionally large return to the Copper River.

Unusually heavy rainfall occurred during 1995 and may have resulted in fewer chinook being taken. During 1996, there was a significant increase in the number of shore anglers by the Richardson Highway bridge. Extremely low water resulting from almost no precipitation during

much of June and July and large numbers of sockeye and chinook salmon holding in the area may have created better than average fishing opportunity at this location.

Since 1991 there has been a significant increase in the use of power boats from the Richardson Highway bridge upstream for about 5 miles. Also, a notable increase in the number of guides specializing in guiding anglers targeting chinook salmon has occurred on the lower river (below the West Fork confluence) over the past several years. Prior to the 1986 season, only one individual specialized in guiding anglers targeting chinook salmon on this section of the river. During the 1987 and 1988 seasons, a minimum of eight guides operated on the lower portions of the river, while the number increased to at least ten guides during 1989 and 1990. Available data indicate that the guided anglers are more successful than unguided anglers. During 1990, back-trolling techniques similar to those used in the Kenai River were introduced on the Gulkana River. It is generally believed this technique has further increased catch rates for chinook salmon.

Current Issues

Increased use by float and power boat operators on the Gulkana River is intensifying conflicts between users. Float-boat operators fish primarily from the bank casting and drifting lures through the holes while power boats hover in the holes and back troll. Additionally, reports have been made by float-boat operators that power boats have bumped into them. Several proposals before the Board of Fisheries in December address the use of power boats. They range from restricting horsepower throughout the drainage to curtailing their use on certain portions of the river downstream of Sourdough.

The majority of the land adjacent to the Gulkana River downstream of Sourdough is owned by the Ahtna Native Corporation. Beginning during the 1991 season, this corporation prohibited trespass across its lands for the purpose of hunting or fishing because it felt its customary and traditional lifestyle has been jeopardized by elimination of the rural preference in the subsistence law. It may, if requested, allow access for camping, hiking, or other nonconsumptive resource uses. During the fall of 1996, Ahtna Corporation is considering the development of a public use area on its lands near the Richardson Highway Bridge, a popular fishing and camping site where land ownership is in dispute.

The allocation of Copper River drainage chinook salmon between personal use, sport, and commercial uses remains a controversial issue. A significant portion of the total chinook salmon commercial harvest is taken during the first week of the commercial fishery when only a small portion of the sockeye salmon harvest is taken. Many sport anglers think this fishery should begin at least a week later than historically conducted. Since stock status is considered healthy, this is an allocative rather than biological issue. Numerous public proposals before the Board of Fisheries at its upcoming meeting call for restriction of the commercial harvest to allow more chinook for upriver users.

Other proposals from the public regarding the Gulkana River for consideration at the upcoming Board meeting deal with limiting the number of sport fishing guides, limiting the number of days per week sport fishing guides may operate, liberalizing the fly-only area downstream of the Richardson Highway Bridge and expanding the bait restriction on the river.

Proposed Research and Management Activities

The department has determined that the mail survey accurately estimates the harvest of chinook salmon in this drainage; therefore, we do not recommend that creel surveys be conducted on an annual basis. Managers depend on aerial surveys to estimate the escapement of chinook. These are, at best, indicators of relative spawning abundance rather than absolute abundance due to their dependence on survey conditions, surveyor, and the residence of fish in the survey area. In 1996, a weir as operated in the Gulkana to count returning adult chinook and verify aerial counts. Coded wire tagging of chinook smolts was determined to be feasible in 1995 and 1996 and will occur beginning in 1997 with the purpose of determining the contribution of various stocks to the total chinook run in the Copper River. Coded wire tag returns in the commercial fishery will also indicate the run timing of different Copper River chinook stocks and whether one stock (the Gulkana River stock) can serve as a gauge of the abundance of other chinook stocks. A weir will be reinstalled in the Gulkana River during 2000, when chinook carrying coded wire tags from 1997 will first return, to estimate the abundance of chinook in that drainage. Aerial surveys will be continued to index numbers of spawning salmon, and the results compared to future weir counts.

Klutina River Chinook Salmon Sport Fishery

Background and Historical Perspective

The Klutina River supports the second largest sport fishery for chinook salmon in the UCUSMA. This semi-glacial river drops rapidly out of Klutina Lake to enter the Copper River at the community of Copper Center. Access to the river is available along the Richardson Highway and from the Klutina Lake Road (also called the Brenwick-Craig Road) which parallels the river. Shore anglers participate in the fishery adjacent to the Richardson Highway and the Klutina River Road. The distance between the Klutina River Road and the river varies along the course of the road, with the road running along the ridge above the river. Much of the land between the road and the river belongs to the Ahtna Native Corporation and permission to cross its land is required. Jet river boats are used by experienced operators to access the upstream portions of the river. Jet boats are launched from private land adjacent to the highway or from a site along the Copper River. The river has considerable stretches of whitewater and is considered to be very challenging to jet river boat operators. The fast water of the Klutina River limits the number of resting pools for chinook salmon; therefore, there are less than two dozen good fishing sites in the lower portion of the river accessible to most anglers.

Chinook salmon typically begin entering the Klutina River in late June, with the run continuing well into August. The sport fishery typically peaks during the second week of July, but fishing for chinook salmon continues until the season closes on August 10. Peak spawning occurs from late July through August. Most spawning occurs upstream of a point adjacent to mile 19.2 on the Klutina Lake Road.

Chinook salmon spawning season closures were established in the UCUSMA during the 1989 Board meeting to allow chinook salmon to spawn unmolested. On the Klutina River upstream of a Department marker located adjacent to Mile 19.2 of the Klutina Lake Road, chinook salmon may be taken only from January 1 through July 19. Downstream of this marker, the chinook salmon season is from January 1 through August 10. Current bag and possession limits governing the sport fishery for chinook salmon over 20 inches are one and one, respectively. The area-wide bag limit of five chinook per year includes the Klutina River.

Sport harvest of chinook salmon from the Klutina River drainage has been estimated using the mail survey Mills (1979-1994) and Howe et al. (1995, 1996) since 1983. Based on this survey, the sport harvest of chinook salmon from the Klutina River drainage averaged 1,037 fish from 1983 through 1995, ranging from a low of 189 fish in 1983 to a high of 2,485 fish in 1995 (Table 19). Harvests remained relatively stable from 1983 to 1990 (Figure 19). Over this same period, sport effort on the Klutina River averaged approximately 4,600 angler-days, ranging from 1,568 in 1983 to 6,394 in 1987. Due to the nature of the mail survey, we do not know how much of this effort was directed towards chinook salmon versus other species. Observations in recent years, however, suggest that a majority of the recent effort is directed towards chinook salmon.

During 1988 and 1989, creel surveys of the sport fishery targeting chinook salmon in the Klutina River drainage were conducted. High water reduced effort and catch during a significant portion of the 1988 season, whereas river conditions remained favorable throughout the 1989 season. Results of the 1988 survey (Roth and Delaney 1989) indicated that sport anglers caught a total of 1,048 chinook salmon of which 43% were retained. The estimated harvest (450) was close to that reported in the mail survey for 1988 (483), indicating that the mail survey fairly accurately estimates sport harvest in this fishery. In 1989 the creel survey estimate was 1,587 chinook salmon caught of which 65% were retained (Potterville and Webster 1990). The estimated harvest (1,031 fish) was again reasonably close to that reported in the mail survey for 1989 (652 fish). The 1988 creel survey showed that guided boat anglers accounted for nearly 90% of the catch and 80% of the harvest of chinook salmon. During the 1989 survey, boat anglers accounted for 88% of the estimated total catch and exhibited significantly higher catch (3.3 fish per hour) and harvest (2.1 fish per hour) rates than did shore anglers (0.5 and 0.4 fish per hour, respectively). The vast majority of boat anglers that participated in the fishery were guided and therefore insufficient data were available to determine if guided boat anglers had different catch or harvest rates than unguided boat anglers. Daily estimates of CPUE from the 1988 survey were used to estimate the timing of chinook salmon into the fishery. These data indicate that CPUE peaks during mid-July, with 50% of the run having entered the river by late July. Approximately 12 guides operated on the Klutina River during 1989 and 1990, all of which conducted boat trips. The vast majority of shore anglers fished that portion of the river downstream from the Richardson Highway bridge.

The spawning escapement of chinook salmon to the Klutina River has been documented by aerial surveys of St. Anne and Manker Creeks since 1966 (Table 15). Spawning escapement has averaged 117 fish during 1966-1996, ranging from a high of 433 in 1986 to a low of 21 in 1976. Since 1986, observed escapements to this drainage have declined (Table 19, Figure 19). No escapements surveys were flown on the Klutina River index areas in 1993. The 2-mile stretch of the river just below the lake is known to support chinook salmon spawning; however, due to the turbid water conditions in this area, it is not possible to assess abundance of spawning fish.

Fishery Objectives

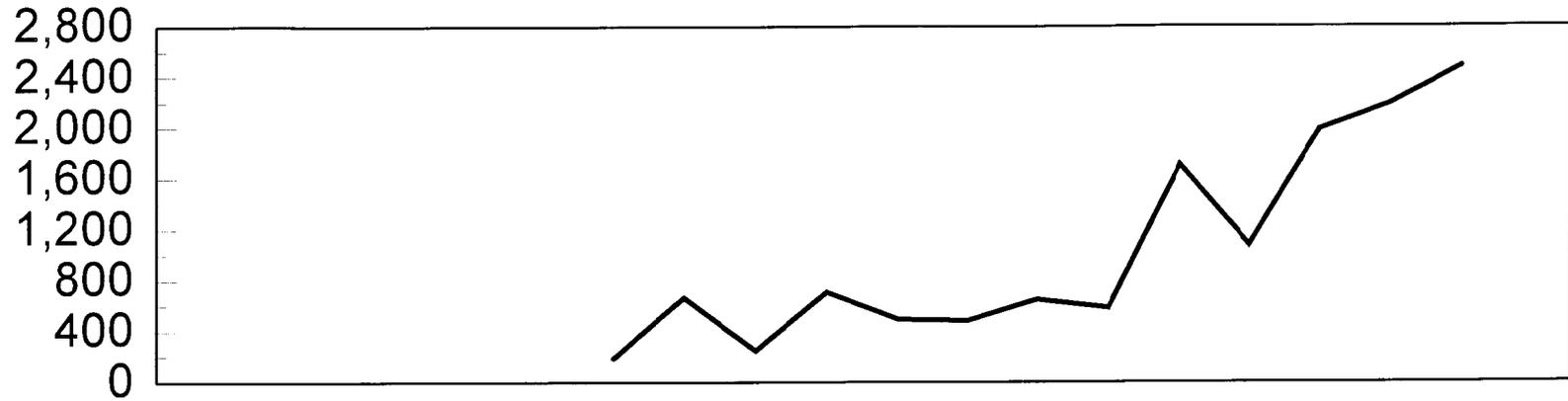
No specific fishery objectives have been established for this stock. An underlying goal of past and current management, however, has been to assure sustained yield. Aerial survey index

Table 19.-Sport harvest and observed spawning escapements of chinook salmon in the Klutina River drainage from 1983-1995.

| Year | Sport Harvest | Observed Spawning Escapement |
|------|---------------|------------------------------|
| 1983 | 189 | 228 |
| 1984 | 667 | 353 |
| 1985 | 249 | 37 |
| 1986 | 710 | 433 |
| 1987 | 495 | 333 |
| 1988 | 483 | 177 |
| 1989 | 652 | 255 |
| 1990 | 583 | 83 |
| 1991 | 1,709 | 216 |
| 1992 | 1,075 | 26 |
| 1993 | 1,989 | ^a |
| 1994 | 2,189 | 325 |
| 1995 | 2,485 | 34 |
| Mean | 1,037 | 208 |

^a No aerial survey conducted in 1993.

Sport Harvest



Escapement Index

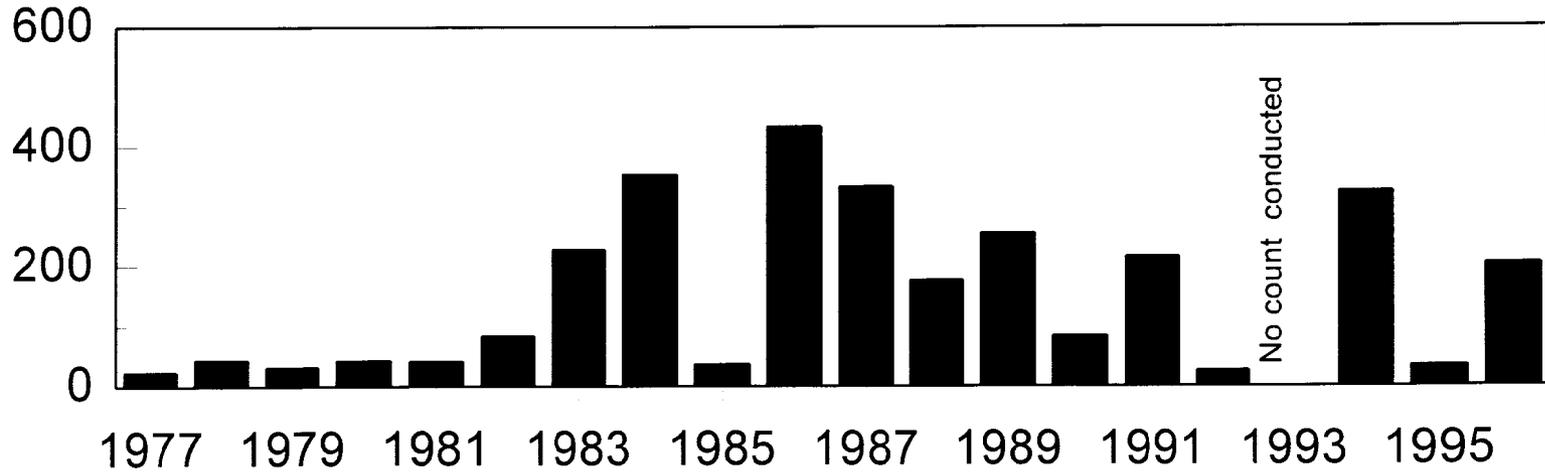


Figure 19.-Comparison of chinook salmon harvest and spawning escapement index counts in the Klutina River, 1983-1995.

evaluation does not appear to evaluate the majority of spawning fish in this system and has not been used to manage this fishery.

Recent Board of Fisheries Actions

Refer to the section on Board actions for the Gulkana River chinook salmon fishery for recent Board actions. The department has submitted two proposals which specifically address the Klutina River drainage for consideration at the upcoming Board meeting in December 1996.

Recent Fishery Performance

The 1995 sport harvest of 2,485 chinook salmon was the largest on record and accounted for about 37% of the estimated total sport harvest of chinook salmon in the UCUSMA, an increase in the proportion of the area harvest. The aerial escapement count for index streams in the Klutina River drainage in 1995 was 34, well below the average. This count may have missed the peak of chinook spawning although it was made at a similar time to previous peak counts. Escapement of chinook salmon to index sites in the Klutina River drainage, as documented by aerial surveys during 1996 was 311 fish (Table 15) supporting evidence of a large return to the Copper River.

Current Issues

The sport fishery for chinook salmon in the Klutina River has, in recent years, taken a higher proportion of returning fish (Figure 19). This has resulted from an increase in the number of guides operating in the fishery, increased angler access to salmon holding areas, and a general increase in angler proficiency. Greater exploitation rates increase the risk of overharvest during years of low production and high angler effort. Further harvest increases may make further restrictions to the fishery necessary.

The chinook salmon sport fishery in the lower Klutina River extends to August 10, later than the closure of most other chinook fisheries in Alaska. To protect spawning salmon, the department has proposed an earlier closure for the Klutina River sport fishery. Observations of the fishery during 1996 indicate that salmon in near spawning condition are being caught but that anglers are, for the most part, not fishing on spawning beds.

The majority of the land adjacent to the Klutina River upstream of the Richardson Highway is owned by Ahtna Native Corporation. Beginning during the 1991 season, this corporation prohibited trespass across its lands for the purpose of hunting or fishing. The corporation is not allowing access for hunting or fishing purposes because it feels its customary and traditional lifestyle has been jeopardized by elimination of the rural preference in the state subsistence law. It may, if asked, allow access for camping, hiking, or other nonconsumptive resource uses.

The allocation of Copper River drainage chinook salmon between sport, commercial, personal use and subsistence fisheries remains a controversial issue. A significant portion of the total chinook salmon commercial harvest is taken during the first week of the commercial fishery while only a small portion of the sockeye salmon harvest is taken during this time period. Many sport anglers think this fishery should begin at least a week later than historically conducted. Numerous proposals to the Board of Fisheries address the reallocation of chinook salmon in favor of upriver users.

Increasing use of the swift Klutina River by power boats and limited use by rafts creates a greater hazard to users. Many sections of the river are not wide enough to allow boats to pass.

Proposed Research and Management Activities

Aerial survey index counts do not appear to evaluate the majority of spawning fish in this system. Coded wire tagging of chinook smolts was determined to be feasible in 1996 and will occur beginning in 1998 with the purpose of determining the contribution of various stocks to the total chinook run in the Copper River. Coded wire tag returns in the commercial fishery will also indicate the run timing of different Copper River chinook stocks and whether one stock (the Gulkana River stock) can serve as a gauge of the abundance of other chinook stocks.

A portion of the chinook salmon hooked in the Klutina River are lost in the fast water before they can be landed. We suspect that many of these fish may not survive to spawn. The hooking mortality of these fish needs to be evaluated.

Other Copper Basin Chinook Salmon Sport Fisheries

Less than 10% of the harvest of chinook salmon in the UCUSMA occurs in systems other than the Gulkana and Klutina rivers. The majority of this harvest occurs in the Tonsina River. The glacial Tonsina River flows from Tonsina Lake into the Copper River downstream of the Klutina River confluence. The Tonsina River crosses under the Richardson Highway at mile 79 and the Edgerton Highway at mile 19. Shore anglers participate in the fishery adjacent to the Edgerton Highway; some angling is conducted by raft between the Richardson and Edgerton highways; and some angling is conducted by fly-in anglers fishing the outlet of the Tonsina River at Tonsina Lake and Grayling Creek, a tributary which flows into Tonsina Lake. Chinook salmon run timing to the Tonsina River drainage is thought to be similar to that of the Klutina River; late June through August.

The Tonsina River chinook salmon sport fishery harvest has increased annually since 1988 (Table 17). Creel surveys or fishery monitoring of catch or catch rates have not been conducted on the Tonsina River due to low fishing effort and low chinook salmon catches within this drainage. Fish and Wildlife Protection and Department of Fish and Game personnel do, however, conduct enforcement monitoring of this fishery on a sporadic basis.

The spawning escapement of chinook salmon to the Tonsina River has been documented by aerial surveys of the Little Tonsina River and Grayling Creek since 1966 (Table 15). The spawning escapement to these index sites has averaged 243 fish through 1996, ranging from a high of 847 in 1984 to a low of 23 fish in 1968.

Current regulations allow sport fishing for chinook salmon in the Tonsina River from January 1 through July 19. The July 19 closure date was established in 1989 to allow chinook salmon to spawn unmolested. Current daily bag and possession limits for chinook salmon over 20 inches in this drainage river are one and one, respectively.

The Little Tonsina River and Bernard Creek and all flowing waters within a 1/4 mile radius of their confluence with the Tonsina River are closed to chinook salmon fishing. A staff proposal was submitted during the 1989 Board meeting to open the Little Tonsina River, which had been closed to fishing since 1967, to a 2-day per week fishery. This proposal was for a 3-week long season and required closing all areas to fishing except when open to chinook salmon fishing. This area has a history of illegal fishing activity. The Copper Basin Advisory Committee

recommended that additional emphasis be placed on enforcement of current regulations and, until the illegal harvest could be curtailed, no changes should be made. They were also opposed to the restriction of the sport fishery which targets Dolly Varden. At this time, staff see no need to create a chinook salmon sport fishery given the lack of local support.

The primary biological concern regarding the Tonsina River drainage chinook salmon in recent years is the extremely low chinook salmon escapements. While the return to Grayling Creek in 1996 was more than twice the average, returns to the Little Tonsina River continued to be poor. The yearly trend in harvest does not match the yearly trend in escapement within this drainage. The problem, therefore, is reduced production, overharvest within one of several other mixed-stock fisheries, or the result of illegal fishing activities within the Tonsina River drainage.

The run-timing of chinook salmon returning to the Tonsina drainage is thought to be similar to that of the Klutina drainage. Based on this, a public proposal was submitted to the Board to extend the fishery through August 10 rather than July 20 to give anglers a better opportunity to harvest fish. The proposal was defeated based on the poor returns to the index streams and the lack of information about the size of the run. No proposals specifically addressing chinook fisheries in the Tonsina drainage have been submitted for consideration at the upcoming Board of Fisheries meeting.

A limited fishery for chinook salmon also occurs on Kiana Creek in the Tazlina River drainage. The average escapement since 1966 has been 198 salmon (Table 15). The return to Kiana Creek in 1996 was 510 chinook. This was the second highest count since surveys were initiated.

WILD RAINBOW AND STEELHEAD TROUT SPORT FISHERIES

The UCUSMA is the northernmost extent of the natural range of rainbow and steelhead trout in North America. Given this, the area's widely distributed stocks of wild rainbow and steelhead trout stocks display generally low and variable production. To assure that these stocks are not overexploited, a conservative regulation package has been developed to manage the fisheries targeting these stocks. This package has been guided by the *Upper Cook Inlet and Copper River Basin Rainbow/Steelhead Trout Management Policy*. This policy was adopted by the Board of Fisheries during 1986 and provides the department with:

1. management policies and implementation directives for Copper River basin rainbow and steelhead trout fisheries;
2. a systematic approach to developing sport fishing regulations that includes a process for rational selection of waters for special management such as catch and release, trophy areas, or high yield fisheries; and
3. recommended research activities needed to meet these goals.

Under this policy, the entire Gulkana River drainage has been managed as a catch-and-release fishery for rainbow and steelhead trout since 1990. Managers believe that the abundance of trout in this drainage is low and that the stocks are incapable of supporting any level of long-term sustainable harvest. Additional protection was afforded this drainage's trout stocks through the establishment of an unbaited, artificial lure only area in all flowing waters of the Gulkana River drainage upstream from an unnamed creek flowing into the Gulkana River 7.5 miles upstream from the confluence of the West Fork. This action was taken in 1990.

The policy has also guided the development of regulations for the Tebay River drainage. In Summit Lake and Bridge Creek in the Tebay drainage, rainbow/steelhead trout less than 32 inches in length may not be possessed or retained and the daily bag and possession limit for trout over 32 inches is one. This trophy fishery was established in 1988 to provide anglers the opportunity to harvest a "trophy trout" in the UCUSMA. Research has shown that these waters contain the largest nonanadromous rainbow trout in the Copper River drainage, with individual fish measuring over 32 inches in length and weighing up to 20 pounds. Also, the waters of Lower Hanagita Lake and the Hanagita River from Lower Hanagita Lake to the Tebay River have been managed as a catch-and-release fishery for trout since 1988. In all these waters, only unbaited, artificial lures may be used. This special regulation was adopted in 1988 to afford additional protection to these trout stocks.

All other waters supporting wild rainbow/steelhead trout stocks are managed under a two fish daily and two fish possession limit of which only one trout may be over 20 inches. The season is year-round with the exception of Our Creek (a tributary to Moose Lake) which is closed from May 5 through June 15 to protect spawning grayling.

Under this regulation package, the harvest of wild rainbow and steelhead trout has been lowered (Tables 20 and 21, Figure 20). Several proposals for regulation changes address rainbow/steelhead stocks in the area. To further protect rainbow/steelhead stocks, the department is proposing to close identified rainbow trout/steelhead spawning areas on the Middle Fork of the Gulkana River to fishing during the adult spawning and egg incubation periods. In addition, the department has proposed that the take of rainbow/steelhead trout in the Copper River Personal Use fishery be prohibited in light of department efforts to focus fishing effort on hatchery sockeye salmon returning concurrently with steelhead trout. A public proposal recommends that the use of bait be eliminated from the fishery in the Gulkana to protect rainbow/steelhead trout.

COPPER RIVER PERSONAL USE AND SUBSISTENCE SALMON FISHERIES

Background and Historical Perspective

There is a long history of salmon harvest for consumption as food or use as bait in the Copper River drainage. Prior to white settlement, Ahtna natives took salmon, mostly chinook and sockeye, with funnel traps and spears in clearwater tributaries. Weirs, gillnets, and dip nets were used in the turbid mainstem Copper River and at its delta. Haley Creek was the site of one of the many traditional fishing camps along the Copper River. With white settlement, fishwheels were introduced to the Copper River. By 1920, fishwheels and dip nets took over as the traditional means of capturing salmon for personal needs in this river. Also, the popularity of the fishery increased substantially with the introduction of this gear.

Historically, the taking of salmon for consumption as food or use as bait in the Copper River drainage was governed under subsistence regulations. In 1978, Alaska passed its first subsistence law. This legislation guaranteed the "customary and traditional use" of fish and game harvest in Alaska and gave this harvest a priority in terms of allocation. Under this law, the Board of Fisheries adopted the *Copper River Subsistence Salmon Management Plan* (5 AAC 01.647). This management plan established seasons, open areas, legal gears, permit requirements, and bag limits for a subsistence salmon fishery in the Copper River. The plan also directed the department to manage the Copper River commercial salmon fishery to assure that an adequate escapement reaches the spawning areas and to provide for subsistence harvest.

Table 20.-Harvest of wild rainbow trout by sport anglers fishing UCUSMA waters averaged for the period from 1977-1986 and annually for the period 1987-1995.

| Areas | 1977-86 | 1987 | 1988 | 1989 | 1990 | 1991 | 1992 | 1993 | 1994 | 1995 |
|---|--------------------------|--------------|--------------|--------------|--------------|------------|--------------|------------|--------------|------------|
| Gulkana River Drainage^a | | | | | | | | | | |
| Upper River | 1,379 ^b | 1,309 | 1,127 | 656 | 204 | 14 | 0 | 0 | 0 | 0 |
| Lower River | | 238 | 36 | 0 | 221 | 150 | 8 | 0 | 0 | 0 |
| Total | 1,379^b | 1,547 | 1,163 | 656 | 425 | 164 | 8 | 0 | 0 | 0 |
| Klutina River Drainage | 107 ^c | 208 | 18 | 56 | 17 | 96 | 63 | 108 | 8 | 37 |
| Tazlina Drainage | 45 ^c | 15 | 146 | 0 | 68 | 0 | 24 | 0 | 8 | 84 |
| Tonsina Drainage | 17 ^c | 595 | 18 | 38 | 17 | 14 | 103 | 40 | 87 | 28 |
| Copper River | | | | | | | | | | |
| Downstream of Klutina ^d | 10 ^c | 149 | 0 | 601 | 17 | 177 | 214 | 0 | 515 | 160 |
| Upstream of Gulkana | 4 ^c | 178 | 0 | 0 | 68 | 0 | 0 | 0 | 0 | 0 |
| Other Sites | 1,145 ^e | 506 | 419 | 366 | 662 | 177 | 681 | 730 | 981 | 309 |
| | 2,735^f | 3,198 | 1,764 | 1,717 | 1,274 | 628 | 1,093 | 918 | 1,599 | 618 |

^a In 1991, the river was closed to the harvest of rainbow trout.

^b Includes average of entire drainage.

^c Includes 1983-1986 average harvest only. Prior to 1983, harvest included in the listing for "Other sites."

^d Not including Tonsina drainage.

^e Average harvest for years 1983-1986.

^f Average of total annual harvest.

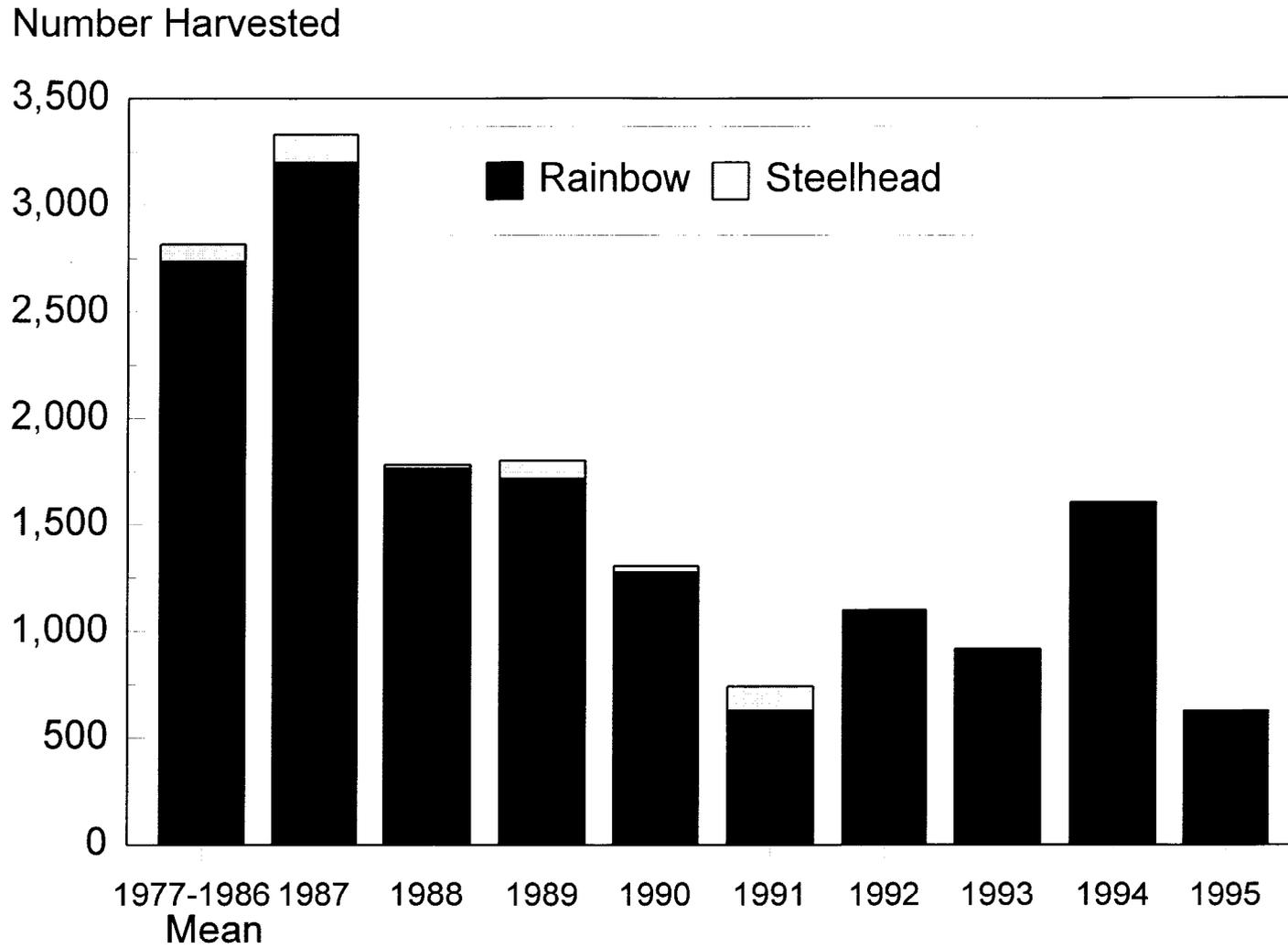
Table 21.-Harvest of steelhead trout by sport anglers fishing UCUSMA waters, averaged for the period from 1977-1986, and annually for the period 1987-1995.

| Areas | 1977-86 | 1987 | 1988 | 1989 | 1990 | 1991 | 1992 | 1993 | 1994 | 1995 |
|---|-----------------------|------------|-----------|-----------|-----------|------------|----------|----------|----------|-----------|
| Gulkana River Drainage^a | 44 | 104 | 18 | 47 | 34 | 0 | 8 | 0 | 0 | 10 |
| Tazlina Drainage | 0 ^b | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Copper River | | | | | | | | | | |
| Upstream of Gulkana | 0 ^b | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Downstream of Tonsina | 0 ^b | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Other Sites | 51 ^b | 0 | 0 | 9 | 0 | 114 | 0 | 0 | 7 | 0 |
| Total | 85^c | 134 | 18 | 84 | 34 | 114 | 8 | 0 | 7 | 10 |

^a In 1991, the river was closed to the harvest of steelhead trout.

^b Includes 1983-1986 average harvest only. Prior to 1983, harvest included in "Other sites."

^c Average of total annual harvest.



Source: Mills 1979-1994; Howe et al. 1995 and 1996.

Figure 20.-Harvest of wild rainbow/steelhead trout by recreational anglers fishing UCUSMA waters, 1977-1995.

In 1980, with the passage of the Alaska National Interest Lands Conservation Act (ANILCA), the federal government mandated a subsistence hunting and fishing preference for "rural" residents on federal lands. Subsequent rulings by the federal government stated that if the state failed to meet this requirement, the federal government would take over management of fish and game on all federal lands. To comply with this requirement and prevent federal takeover, the joint Boards of Fish and Game adopted a regulation in 1982 stating that only "rural" residents had "customary and traditional use" of fish and game and established eight criteria for identifying "customary and traditional uses." Under this plan, subsistence fishers were given one of four classes of permits depending upon their locality to the fishery, income, age, and past use. At times of low escapement, Copper River basin residents received priority over nonbasin residents. Due to growth in the fishery, the Board eliminated nonbasin residents from the Copper River subsistence fishery based on an analyses of the eight-point criteria in 1984.

This decision precluded many individuals from participating in the Copper River subsistence fisheries, thereby efficiently precluding them from harvesting fish for their personal use. This led the Board of Fisheries to establish a new category of fisheries, personal use fisheries (5 AAC 77.001), in 1982. These fisheries were created to provide Alaskans who became ineligible to harvest fish under new subsistence regulations the opportunity to harvest fish for consumption as food or use as bait. Personal use fisheries, like commercial and sport fisheries, were not given a "priority" in terms of allocation as were subsistence fisheries. In 1984 the Board of Fisheries created a personal use salmon fishery in the Copper River drainage under the *Copper River Personal Use Salmon Fishery Management Plan* (5 AAC 77.590).

Personal use fisheries differ from sport fisheries in both their objective and management. Both fisheries provide Alaskans the opportunity to harvest fish for personal consumption (in either fishery, fish cannot be sold or bartered); however, personal use fisheries are managed to maximize harvest potential whereby sport fisheries are managed to provide diversity of opportunity and to maximize economic benefit to Alaska. Also, whereas anyone can participate in Alaska's sport fisheries (provided they have a license), only Alaska *residents* may participate in personal use fisheries. The personal use fishery is managed by the Division of Sport Fish whereby subsistence fishery is managed by the Division of Commercial Fisheries.

Both the subsistence and personal use salmon fisheries in the Copper River drainage have undergone changes since their establishment. Currently, all Alaskans are eligible to participate in the subsistence fishery based on the McDowell decision in 1989. The subsistence fishery occurs upstream of the Chitina-McCarthy bridge to Slana and can be prosecuted with fishwheels and dip nets. The season is from June 1 through September 30, unless closed by emergency order. Only Alaska residents can participate in this subsistence fishery. A special permit, which is free, is required to participate in the fishery. The permit can only be obtained at the Fish and Game office in Glennallen. Anglers must record their harvest on their permit and return the permit upon completing fishing. The limits are 30 salmon for a household of one, 60 salmon for a household of two, and 10 salmon for each additional person in a household of more than two people. Individuals may request additional salmon up to a maximum of 200 salmon and households may request up to 500 salmon. For people using dip nets, only 5 of the salmon may be chinook salmon. There is also a requirement that all anglers, upon landing a salmon while subsistence fishing, must immediately remove its caudal fin. A subsistence fishery is also allowed in a portion of Tanada Creek with spears and dip nets.

As is the case for the subsistence fishery, only Alaska residents can currently participate in the Copper River personal use salmon fishery. This fishery is opened by emergency order. Both a valid Alaska sport fishing license and a special permit are required to participate in the personal use fishery. The permit costs \$10 and can only be obtained at the department trailer at Chitina. Anglers must record their harvest on their permit and return the permit upon completing fishing. The limits are 15 salmon for a single person and 30 salmon for a household of two or more, only five of which may be chinook salmon. Only dip nets may be used to harvest salmon. The entire mainstem Copper River between the downstream edge of the Chitina-McCarthy bridge and a department marker located about 200 yards upstream of Haley Creek (in Wood Canyon) is open to personal use fishing. The Board has mandated that Alaskans can participate in either the subsistence or personal use fishery in the Copper River drainage, but not both.

For a total return of 560,000 salmon past the Miles Lake sonar counter, the Board of Fisheries has authorized the following allocations and guidelines (in 5 AAC 77.590):

| | |
|--|---------|
| spawning escapement (sockeye) | 300,000 |
| spawning escapement (chinook) | 15,000 |
| subsistence harvest guideline | 69,000 |
| personal use harvest quota | 60,000 |
| sport fishery harvest guideline(sockeye) | 3,500 |
| sport fishery harvest guideline(chinook) | 2,500 |
| hatchery brood stock | 20,000 |
| hatchery surplus | 90,000 |

The subsistence guideline is adjusted annually in order to accommodate the anticipated subsistence harvest. The hatchery brood stock and hatchery surplus are also adjusted annually based on the anticipated return of wild and hatchery stocks.

The maximum harvest for the personal use fishery is 60,000 salmon, given a total return of 560,000 salmon, not including any salmon harvested after August 31. When an escapement of more than 560,000 salmon is projected to pass the sonar counter, the Board has mandated that 25% of the excess be allocated to the personal use fishery with the remainder being added to the spawning escapement, other user groups, and hatchery brood stock.

Due to changes in the distribution of fishing effort since the inception of the plan in 1984, the Board in 1994 allowed the department leeway to deviate from the apportionment of the run stipulated in the regulations in order to better spread effort and harvest over the return. The regulations as written state that the department shall manage the personal use fishery so as to apportion the harvest as follows:

| Week | Percent of Total Harvest |
|------|--------------------------|
| 1 | 10 |
| 2 | 20 |
| 3 | 25 |
| 4 | 20 |
| 5 | 15 |

The remaining 10% of the harvest may be taken during the rest of the season. When establishing these harvest quotas, the Board tried to reduce the harvest of wild stocks during the early portion of the run and increase harvest of hatchery-supported returns during the later part of the run.

Harvests by the subsistence fishery have been estimated since 1965 (Table 22). From 1965 through 1979, harvests in the subsistence fisheries remained relatively stable, averaging about 28,000 salmon (Figure 21). The fishery experienced rapid growth from 1980 through 1983, when a peak harvest of about 119,000 salmon were taken (Table 22, Figure 21). Under the subsistence fishery management plan, harvests decreased substantially in 1984 to about 28,000 salmon. Since 1984, subsistence harvests have gradually increased (Figure 21). Concern has been expressed regarding significant under-reporting of salmon harvest in this fishery, especially over the past decade. Trends in the number of permits issued to participate in this fishery closely resemble harvest trends (Table 22, Figure 21).

Harvests in the personal use fisheries have been estimated since their establishment in 1984 (Table 23). From 1984 through 1988, harvests remained relatively stable, averaging about 47,000 salmon annually (Figure 22). Since 1988, harvests in the personal use fishery have increased annually until 1995 (Figure 22). Trends in the number of permits issued to participate in this fishery closely resemble harvest trends (Table 23, Figure 22).

Harvests in both the subsistence and personal use fisheries are dominated by sockeye salmon (Table 6). Chinook salmon comprise the second largest harvest. The remaining harvest is made up of coho salmon.

Fishery Objectives

Both fisheries are managed under Board of Fisheries adopted management plans. The subsistence fishery is managed under the *Copper River Subsistence Salmon Management Plan* (5 AAC 01.647). The personal use fishery is managed under the *Copper River Personal Use Salmon Fishery Management Plan* (5 AAC 77.590). Both management plans stipulate management objectives and guidelines.

Inseason Management Approach

The inseason management of the personal use fishery follows the objectives and guidelines in the *Copper River Personal Use Salmon Management Plan* (5 AAC 77.590). The Board established weekly harvest quotas and also allocated 25% of any escapement in excess of the optimum

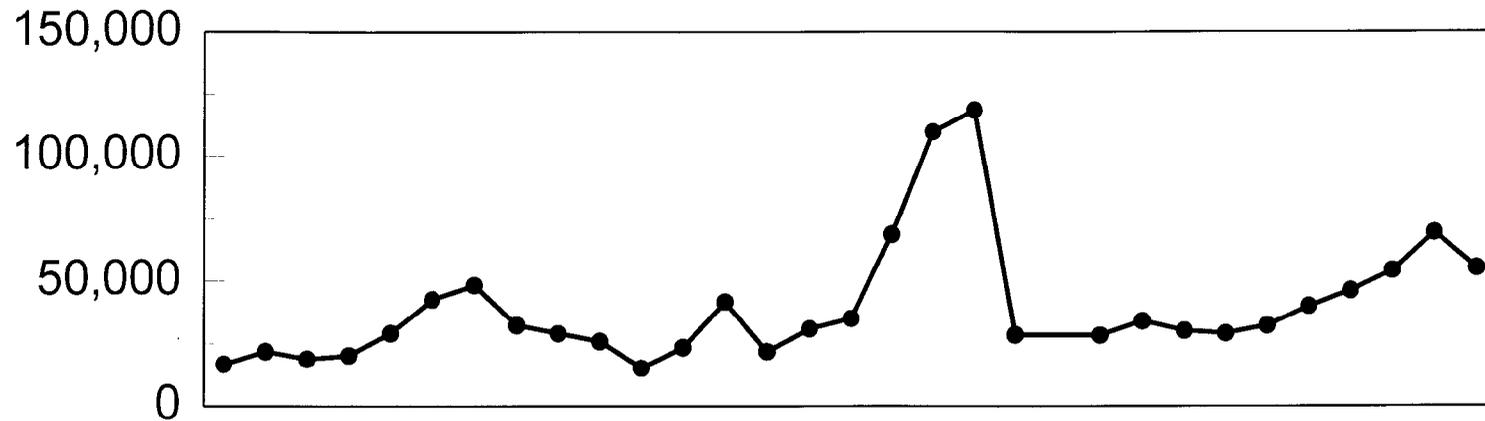
Table 22.-Number of permits issued and salmon harvests during the subsistence salmon fishery in the Copper River, 1965-1996.

| Year | Number Permits Issued | Estimated Salmon Harvest |
|-------------------|-----------------------|--------------------------|
| 1965 | 1,125 | 16,818 |
| 1966 | 1,270 | 21,896 |
| 1967 | 1,320 | 19,007 |
| 1968 | 1,378 | 20,383 |
| 1969 | 1,582 | 29,266 |
| 1970 | 3,487 | 42,757 |
| 1971 | 4,542 | 48,449 |
| 1972 | 3,690 | 32,468 |
| 1973 | 4,145 | 29,248 |
| 1974 | 3,593 | 26,001 |
| 1975 | 2,802 | 15,357 |
| 1976 | 2,963 | 23,623 |
| 1977 | 4,066 | 41,815 |
| 1978 | 3,705 | 22,029 |
| 1979 | 3,200 | 30,963 |
| 1980 | 3,203 | 35,081 |
| 1981 | 4,078 | 68,746 |
| 1982 | 6,090 | 110,006 |
| 1983 | 7,541 | 118,728 |
| 1984 | 562 | 28,617 |
| 1985 | --- ^a | --- ^a |
| 1986 | 405 | 28,417 |
| 1987 | 431 | 34,080 |
| 1988 | 409 | 30,313 |
| 1989 | 386 | 29,225 |
| 1990 | 406 | 32,283 |
| 1991 | 711 | 40,070 |
| 1992 | 655 | 46,395 |
| 1993 | 773 | 54,370 |
| 1994 | 970 | 69,598 |
| 1995 | 858 | 55,290 |
| 1996 ^b | 847 | 51,493 |

^a Data not available.

^b Preliminary estimates.

Estimated Total Harvest



Permits

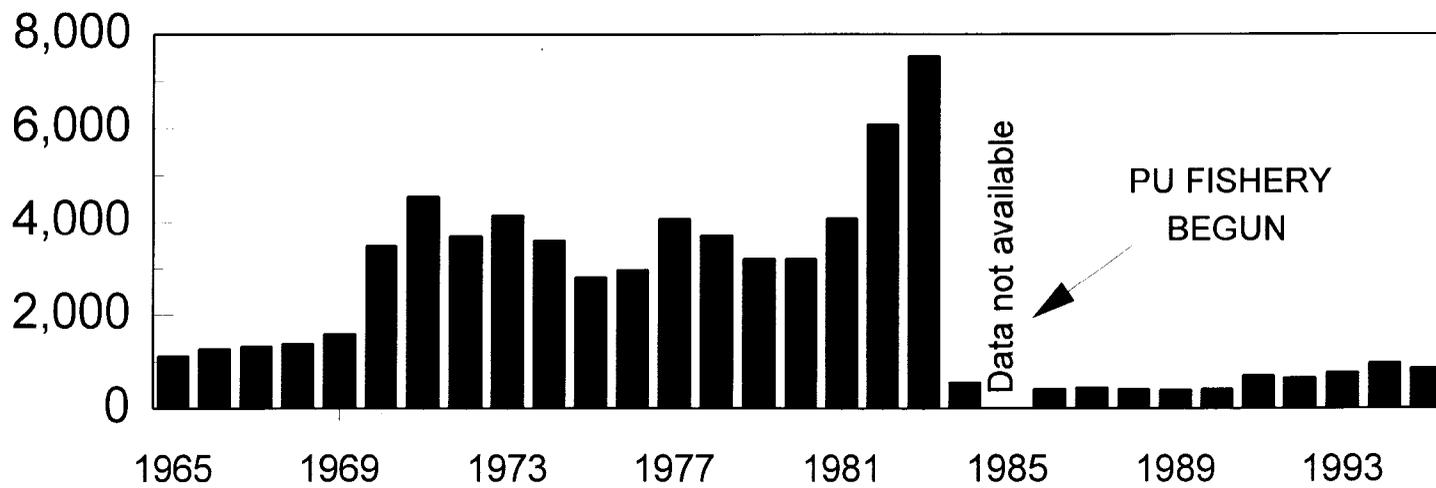


Figure 21.-Annual harvest of salmon, and number of permits issued in the Copper River subsistence fishery, 1965-1995.

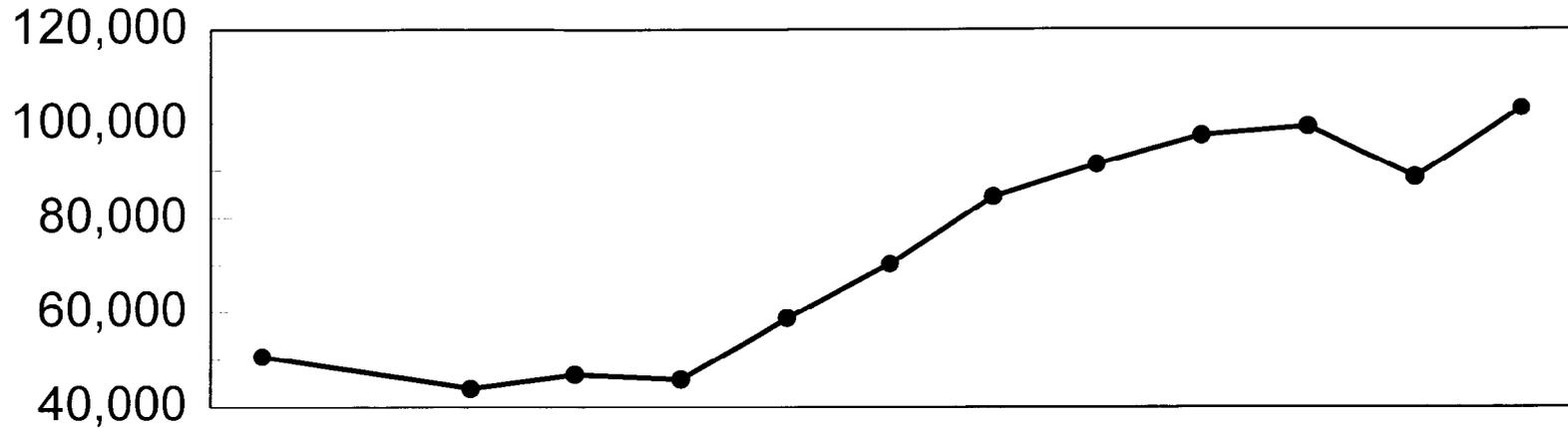
Table 23.-Number of permits issued and salmon harvested during the personal use salmon fishery in the Copper River, 1984-1996.

| Year | Number Permits Issued | Estimated Salmon Harvest |
|-------------------|-----------------------|--------------------------|
| 1984 | 5,311 | 50,714 |
| 1985 | --- ^a | --- ^a |
| 1986 | 3,966 | 43,959 |
| 1987 | 4,186 | 46,884 |
| 1988 | 4,205 | 45,895 |
| 1989 | 4,447 | 58,858 |
| 1990 | 5,631 | 70,317 |
| 1991 | 6,222 | 84,622 |
| 1992 | 6,387 | 91,400 |
| 1993 | 7,914 | 97,500 |
| 1994 | 7,061 | 99,430 |
| 1995 | 6,763 | 88,625 |
| 1996 ^b | 7,199 | 103,343 |

^a Data not available.

^b Preliminary estimates.

Estimated Harvest



Permits

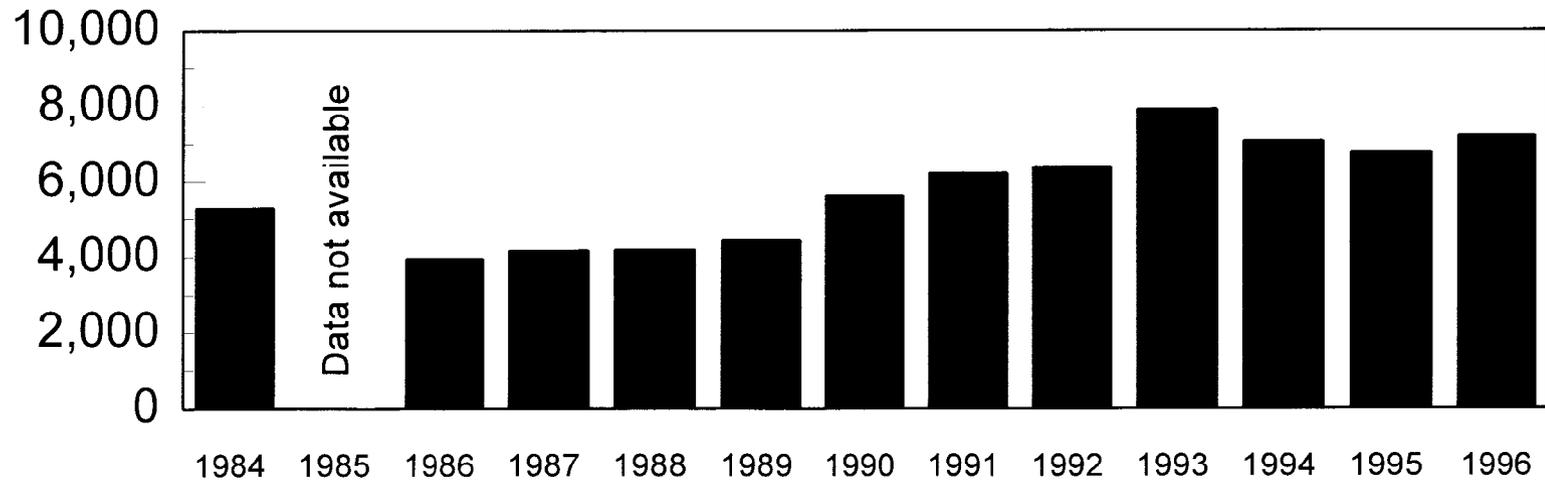


Figure 22.-Annual harvest of salmon, and number of permits issued in the Copper River personal use fishery, 1984-1995.

escapement goal of 560,000 to the personal use fishery. The weekly fishing periods and limits are established by emergency order based on the projected inriver returns. Inriver returns are estimated by the sonar unit located at Miles Lake.

Recent Board of Fisheries Actions

Several proposals were submitted by members of the public regarding the personal use and subsistence fisheries at the 1994 Board of Fisheries meeting. It was proposed that the Board designate a working group to rewrite the personal use and subsistence fishery management plans. The Board followed the department's recommendation that a review of the existing data and management strategies be conducted and presented at local advisory committee meetings to form the basis for Department and public proposals for the 1997 Board meeting. A proposal to increase the personal use allocation from 60,000 to 100,000 was rejected pending the department review. A proposed change in the mark of subsistence harvested salmon from removal of the dorsal fin to the caudal fin passed. It was felt this would ease in recognition of subsistence harvested salmon for enforcement purposes. A recommendation to require the release of chinook salmon taken in the personal use fishery also failed.

Due to changes in the distribution of fishing effort since the inception of the plan in 1984, the Board allowed the department leeway to deviate from the apportionment of the run stipulated in the regulations in order to better spread effort and harvest over the return and suspended the mandated bag limit increase if the harvest was below 45,000 salmon by the end of the fifth week of the fishery.

Over 20 proposals proffering changes to the management plans that govern salmon fisheries in the Copper River have been submitted for consideration by the Board of Fisheries at its upcoming meeting.

Recent Fishery Performance

The number of permits issued to participate in and salmon harvests in both the subsistence and personal use fisheries have increased in recent years. The 1994 harvest of 69,598 salmon in the subsistence fishery was the highest on record since the fishery has been managed under the subsistence fishery management plan (Table 22, Figure 21). Although, the number of personal use and subsistence permits issued has stabilized somewhat (Tables 22 and 23, Figures 21 and 22), this is not necessarily an indication that the popularity of either fishery is on the decline; participation and harvest are expected to increase. Preliminary estimates of the permits issued in the personal use and subsistence fisheries for 1996 are 7,199 and 847, respectively. The preliminary estimated harvest (expanded to account for 9% of the harvest reports which are unreturned) for the personal use fishery in 1996 is 103,343 salmon. The subsistence harvest estimates for 1996 are 51,439 with remaining 32% of the harvest reports yet to be returned.

Current Issues

Salmon harvests in the personal use fishery exceeded Board-allowed allocations during the 1991, 1992 and 1995 seasons (Figure 23). The 1991 harvest exceeded the allowable harvest by about 4,805 salmon, the 1992 harvest exceeded the allowable harvest by about 8,194 salmon and the 1995 harvest exceeded the allowable harvest by almost 13,000 salmon (Table 24). Given that

Difference between estimated and allowable harvest

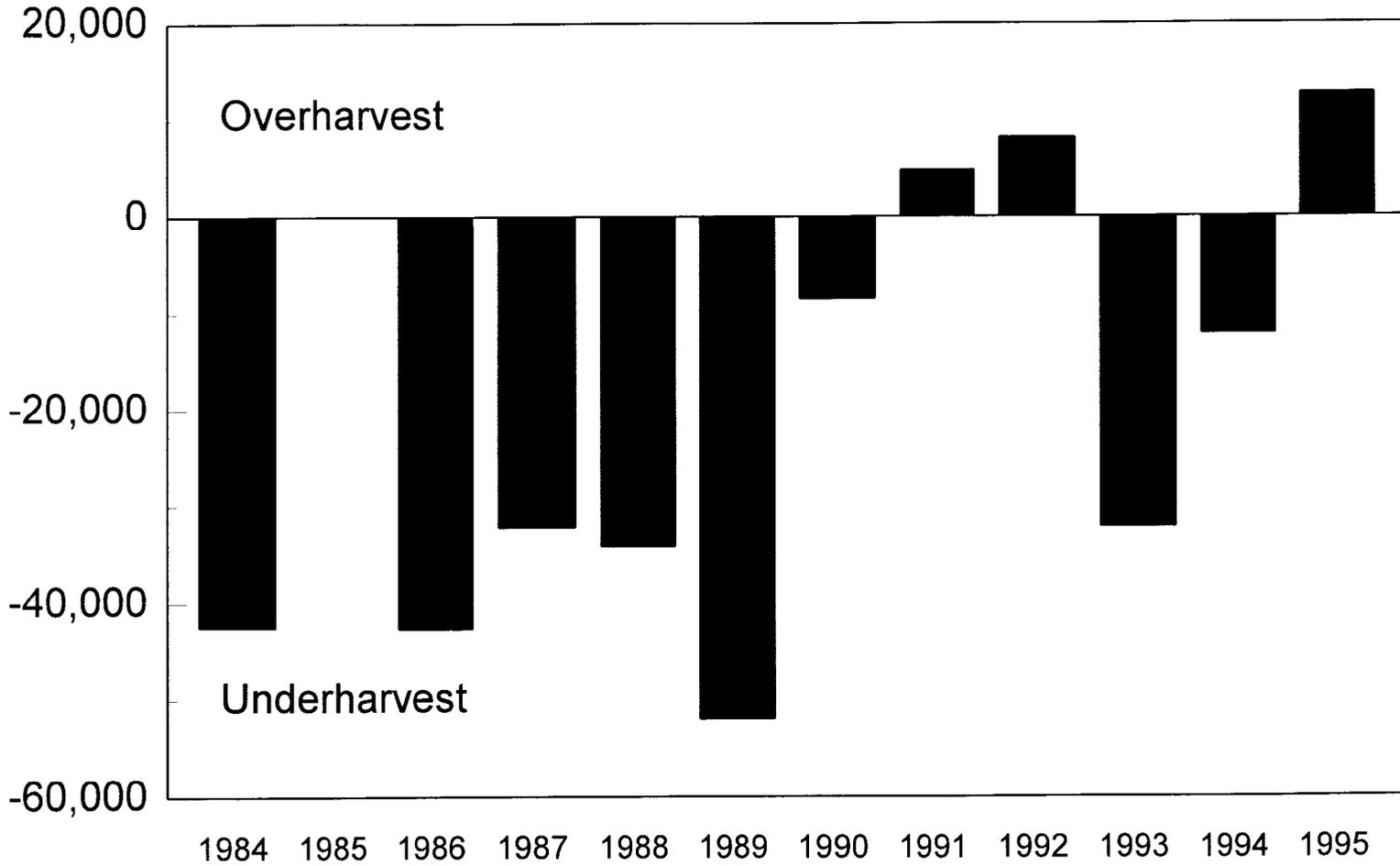


Figure 23.-Difference between estimated and allowable harvests during the Copper River personal use salmon fishery, 1984-1995.

Table 24.-Allowable versus observed salmon harvests during the personal use salmon fishery in the Copper River, 1984-1996.

| Year | Sonar Goal | Estimated Sonar | Difference | Allowable Harvest ^{a,b} | Estimated Total Harvest | Estimated Harvest through August 31 | Difference Between Estimated ^a and Allowable Harvest |
|-------------------|------------|-----------------|------------|----------------------------------|-------------------------|-------------------------------------|---|
| 1984 | 411,000 | 536,806 | 125,806 | 91,452 | 50,714 ^c | 48,956 | -42,496 |
| 1985 | 411,000 | 436,313 | 25,313 | 66,328 | ^d | ^d | ^d |
| 1986 | 411,000 | 509,275 | 98,275 | 84,959 | 43,959 | 42,303 | -42,656 |
| 1987 | 411,000 | 483,478 | 72,478 | 78,120 | 46,884 ^c | 45,926 | -32,194 |
| 1988 | 411,000 | 488,398 | 77,341 | 79,350 | 45,895 ^c | 45,227 | -34,123 |
| 1989 | 411,000 | 607,797 | 196,797 | 109,199 | 58,858 | 57,210 | -51,989 |
| 1990 | 516,000 | 581,859 | 65,859 | 76,465 | 70,317 | 67,958 | -8,507 |
| 1991 | 516,000 | 579,435 | 63,435 | 75,859 | 84,622 | 80,664 | 4,805 |
| 1992 | 516,000 | 601,952 | 85,952 | 81,488 | 91,400 | 89,682 | 8,194 |
| 1993 | 516,000 | 797,902 | 271,902 | 127,976 | 97,500 | 95,824 | -32,152 |
| 1994 | 516,000 | 715,181 | 191,481 | 109,795 | 99,430 | 95,685 | -14,110 |
| 1995 | 560,000 | 599,267 | 39,267 | 69,817 | 88,625 | 82,632 | 12,815 |
| 1996 ^c | 560,000 | 906,867 | 346,867 | 146,717 | 103,343 | 101,577 | -45,140 |

^a If sonar difference greater than 0, then guideline harvest equals $60,000 + (0.25 \times \text{sonar difference})$.

^b If sonar difference less than 0, then guideline harvest equals 60,000.

^c Personal use and subsistence dip net harvest.

^d Data not available.

^e Preliminary estimate of personal use harvest.

there is little indication that the popularity of the personal use fishery will decrease in the near future, it can be expected that harvest will continue to exceed the allocation unless the allocation for this fishery is increased or actions are taken to curtail harvests.

Subsistence salmon harvests exceeded harvest guidelines in 1992 and 1994 (Table 25, Figure 24). The sonar goal was increased to 69,000 salmon in 1995 to accommodate the expected level of future harvests.

The overharvest in the personal use fishery during 1991 and 1992 was apparently caused by overharvest during the later part of the season (Table 26). In both years harvests during the early part of the run were lower than allowed while harvests during the later part of the run exceeded allowable harvests. This was especially evident during the period after the fifth week of the fishery. Under the *Copper River Personal Use Salmon Fishery Management Plan*, 10% of the harvest may be taken during this period. During both years, however, harvests well exceeded this quota; by 500% in 1991 and by 425% in 1992. Managers used cautious incremental openings during the early portion of the run, to protect the wild stocks that comprise the early run of sockeye. Fishing opportunity, given to increase harvest during the later part of the season to replace that lost during the early portion of the run, shifted too much fishing pressure later in the season.

At its 1994 meeting, the Board of Fisheries gave the department leeway in regulating the personal use fishery openings in order to better mimic the run-timing of the wild and hatchery salmon runs while staying within the seasonal harvest quota. During 1994, fishery openings were liberalized early, and restricted during the fifth through the seventh week of the fishery. This resulted in fish being taken in excess of the weekly quota during the fifth week of the fishery (Table 26) but prevented the fishery from exceeding the overall harvest quota for the season (Table 24, Figure 23).

In 1995, weekly personal use fishery openings in June were curtailed due to lower than anticipated salmon passage rate by the sonar counter at Miles Lake. The fishery remained open through most of July and early August. The fishery was closed on August 6, when participation increased above expected levels, to prevent the harvest of fish in excess of the fishery quota. The fishery was reopened in September. The closure in August enraged many participants.

Prior to the fishing season in 1996, a schedule of weekly openings was published that apportioned the harvest quota of 60,000 salmon throughout the season until August 31 based on the weekly projected inriver sonar counts. Weekly openings were to be expanded or decreased depending upon whether the actual weekly sonar count exceeded or fell short of the weekly forecast. Due to an exceptionally large run of sockeye salmon, the fishery remained open after June 8 until the regulated close date of September 30.

The work group appointed by the Board of Fisheries during its 1994 meeting was convened but failed to resolve the allocative conflicts between the user groups. The resulting proposals submitted to the Board of Fisheries for its upcoming meeting address the major areas of conflict: allocation of chinook salmon between sport and commercial users, allocation of the sockeye salmon between commercial and personal use fishers and concern about increasing effort in the upriver fisheries. Several points were agreed upon by the work group and may give the Board guidance in resolving allocative battles.

Table 25.-Guideline versus observed salmon harvests during the subsistence salmon fishery in the Copper River, 1984-1996.

| Year | Sonar Goal | Estimated Sonar | Difference | Guideline Harvest ^a | Estimated Harvest | Difference |
|------|------------|-----------------|------------|--------------------------------|---------------------|------------|
| 1984 | 411,000 | 536,806 | 125,806 | 33,839 | 28,617 | -5,222 |
| 1985 | 411,000 | 436,313 | 25,313 | 22,784 | ^b | 8,804 |
| 1986 | 411,000 | 508,600 | 98,275 | 30,810 | 28,417 | -2,393 |
| 1987 | 411,000 | 475,734 | 72,478 | 27,973 | 34,080 | 6,108 |
| 1988 | 411,000 | 488,398 | 77,341 | 28,508 | 30,313 | 1,800 |
| 1989 | 411,000 | 607,869 | 196,797 | 41,648 | 29,225 | -12,423 |
| 1990 | 516,000 | 581,859 | 65,859 | 27,244 | 32,283 | 5,039 |
| 1991 | 516,000 | 579,435 | 63,435 | 41,978 | 40,070 | -1,908 |
| 1992 | 516,000 | 601,952 | 85,952 | 44,455 | 46,395 | 1,940 |
| 1993 | 516,000 | 797,902 | 271,902 | 64,909 | 54,370 | -10,539 |
| 1994 | 516,000 | 715,181 | 191,481 | 56,910 | 69,598 | 12,688 |
| 1995 | 560,000 | 599,267 | 39,267 | 73,319 | 55,323 | -18,030 |
| 1996 | 560,000 | 906,867 | 346,867 | 107,155 | 51,439 ^c | -55,716 |

^a If sonar difference less than 0, then guideline harvest equals 20,000 (from 1984-1990) or 35,000 (from 1991-present). If sonar difference greater than 0, then guideline harvest equals 20,000 (from 1984-1990) or 35,000 (from 1991-1994) or 69,000 + (0.11 X sonar difference).

^b Data not available.

^c Preliminary estimate of subsistence harvest.

Difference between estimated harvest and harvest guideline

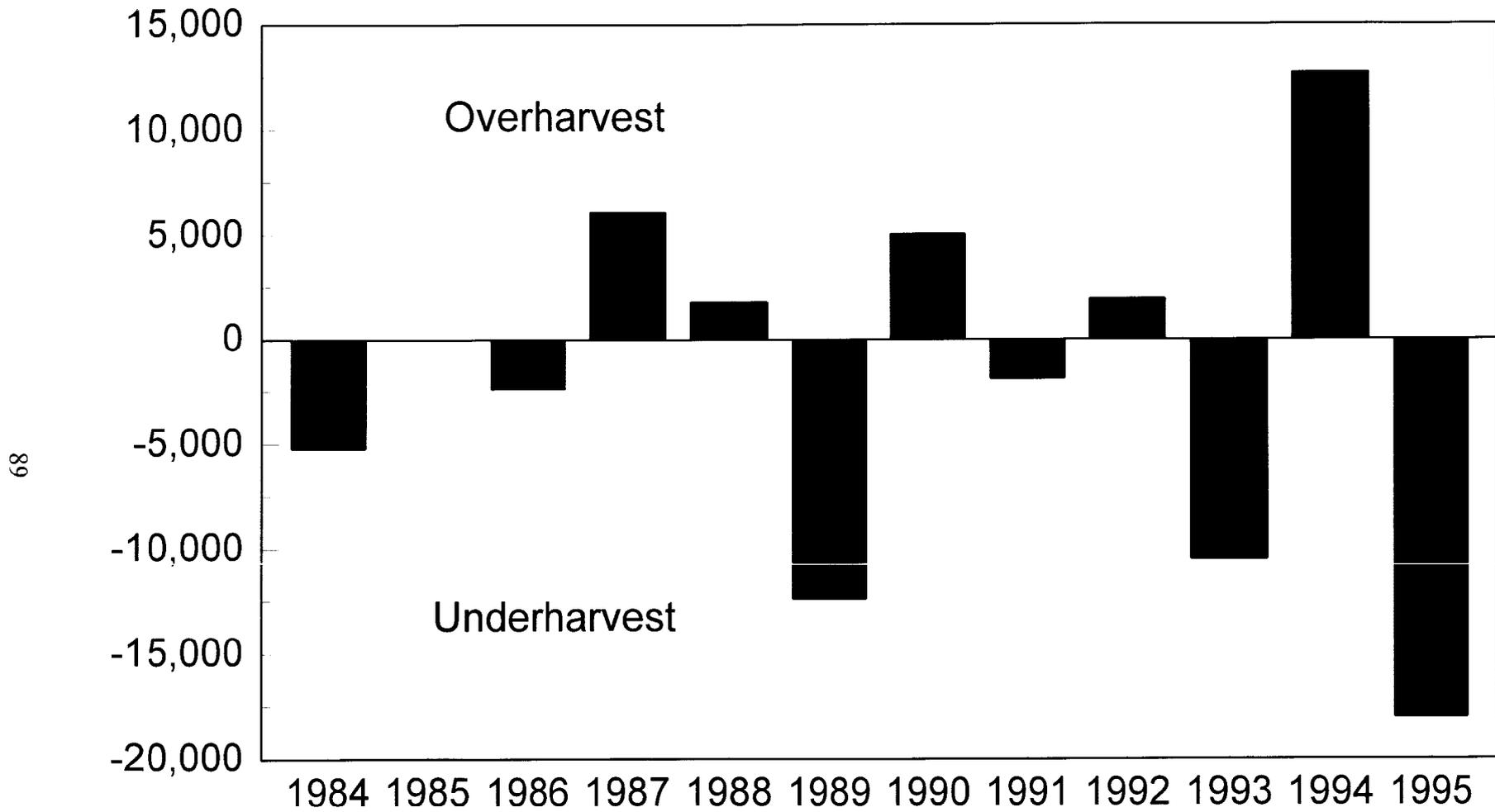


Figure 24.-Difference between estimated and guideline harvests during the Copper River subsistence salmon fishery, 1984-1995.

Table 26.-Allowable versus observed salmon harvests, by week, during the personal use salmon fishery in the Copper River, 1991-1994.

| | Week | Allowed Harvest | Observed Harvest | Difference |
|------|------|---------------------|------------------|------------|
| 1991 | 1 | 6,000 | 1,837 | -4,163 |
| | 2 | 12,000 | 9,476 | -2,524 |
| | 3 | 15,000 | 10,053 | -4,947 |
| | 4 | 12,000 | 5,417 | -6,583 |
| | 5 | 9,000 | 6,487 | -2,513 |
| | Rest | 21,859 ^a | 45,591 | 23,732 |
| 1992 | 1 | 6,000 | 3,169 | -2,831 |
| | 2 | 12,000 | 4,613 | -7,387 |
| | 3 | 15,000 | 10,136 | -4,864 |
| | 4 | 12,000 | 16,960 | 4,960 |
| | 5 | 9,000 | 8,810 | -190 |
| | Rest | 27,488 ^a | 45,396 | 17,908 |
| 1993 | 1 | 6,000 | 6,879 | 879 |
| | 2 | 12,000 | 12,243 | 243 |
| | 3 | 15,000 | 12,913 | -2,087 |
| | 4 | 12,000 | 12,735 | 735 |
| | 5 | 9,000 | 8,089 | -911 |
| | Rest | 73,976 ^a | 39,438 | -34,538 |
| 1994 | 1 | 6,000 | 6,424 | 424 |
| | 2 | 12,000 | 7,947 | -4,053 |
| | 3 | 15,000 | 6,709 | -8,291 |
| | 4 | 12,000 | 14,573 | 2,573 |
| | 5 | 9,000 | 18,979 | 9,979 |
| | Rest | 53,870 ^a | 38,742 | -15,128 |

^a Ten percent of the 60,000 salmon harvest quota, plus 25% of the escapement past the sonar counter that exceeds 516,000 salmon.

The department seeks to clarify harvest allocations and management guidelines in the current plans and receive direction from the Board on the future management of chinook salmon.

Another issue regarding this fishery relates to access. Much of the land in the area open to subsistence and personal use fishing is privately owned. In 1985 and 1986, the Chitina Native Corporation blocked the road to O'Brien Creek and charged a fee for access. In 1987 the State of Alaska negotiated a \$15,000 contract with the Chitina Native Corporation for access and to build and maintain outhouses and collect and remove garbage. The contract was renewed in 1988. The legislature refused to appropriate funds for access in 1989 after road work done on the road in the fall of 1988 eliminated areas where the road passed on private land. In response, the Chitina Native Corporation refused dipnetters access to O'Brien Creek during the 1989 season. The legislature again appropriated funds for access to O'Brien Creek in 1991. Also in 1991, at the urging of the Chitina Dipnetter's Association, the legislature instituted a \$10 fee for the personal use fishery. The fee was to be used to develop a long-term lease. During 1994, a 5-year lease was negotiated with the Chitina Corporation. Trespass on lands not included in the lease agreement remains an issue. During 1995, a 5-year lease was negotiated with Ahtna Corporation for use of lands surrounding Haley Creek. During work group meetings in the fall and winter of 1995-1996, native groups from the Chitina area expressed discontent with the adequacy of the negotiated leases.

Recommended Research and Management

At present, the Division of Sport Fish conducts a program to issue permits, monitor the fishery, and estimate harvests during the Copper River personal use salmon fishery.

Continued refinement of the criteria for opening and closing the fishery is needed. The relationship between the sonar count and fish passage rate through the personal use fishing area is poorly understood. Comparison of sonar counts to harvest rates was attempted with poor success. Time series analysis of the factors affecting fish passage is necessary. During 1995, a program was initiated to estimate the proportion and timing of sockeye salmon produced by the Gulkana Hatchery from coded wire tag (CWT) recoveries in the personal use fishery. In time, this will allow managers to better exploit hatchery stocks while protecting wild fish.

STOCKED FISHERIES

The sport fish stocking program in the UCUSMA dates to 1965. At present 37 lakes in the UCUSMA are stocked (Table 27). Stocked species include rainbow trout, Arctic grayling and coho salmon. Stocked lakes have accounted for between 2,100 and 6,600 angler-days of effort spent in the UCUSMA.

Table 27.-Number and species of fish stocked (actual and planned) in UCUSMA waters, 1991-1997.

| | 1991 Actual | 1992 Actual | 1993 Actual | 1994 Actual | 1995 Actual | 1996 Actual | 1997 Planned |
|------------------------------|----------------|----------------|----------------|----------------|----------------|----------------|-----------------|
| Coho Salmon | | | | | | | |
| Landlocked Fingerling | | | | | | | |
| Strelna Lake | 0 | 59,000 | 0 | 17,812 | 0 | 34,000 | 0 |
| Peanut Lake | 3,861 | 0 | 2,000 | 0 | 0 | Dropped | |
| South Jan Lk | 20,000 | 0 | 20,400 | 13,000 | 15,000 | 15,000 | 20,000 |
| Kettle Lake | 2,970 | 0 | 3,500 | 0 | Dropped | Dropped | |
| Total | 26,831 | 59,000 | 25,900 | 30,812 | 1,500 | 49,000 | 20,000 |
| Chinook Salmon | | | | | | | |
| Catchables | | | | | | | |
| Meiers Lake | 0 | 0 | 0 | 0 | 0 | Dropped | |
| Tolsona Lake | 0 | 24,000 | 25,061 | 0 | 0 | Dropped | |
| Total | 0 | 24,000 | 25,061 | 0 | 0 | 0 | 0 |
| Arctic Char>Fry | | | | | | | |
| Dick Lake | 0 | 0 | 0 | 0 | 0 | 4,000 | 4,000 |
| Total | 0 | 0 | 0 | 0 | 0 | 4,000 | 4,000 |
| Rainbow Trout | | | | | | | |
| Catchables | | | | | | | |
| Squirrel Cr. Pit | 600 | 500 | 486 | 516 | 500 | 1,000 | 1,000 |
| Buffalo Lake | 500 | 500 | 400 | 500 | 500 | 500 | 500 |
| Ryan ^a Lake | 500 | 500 | 0 | 500 | 500 | 500 | 500 |
| Round Lake | 250 | 500 | 400 | 250 | 250 | 250 | 250 |
| Old Road Lake | 250 | 250 | 400 | 250 | 250 | 250 | 250 |
| Tex Smith Lake | 0 | 50 | 388 | 550 | 500 | 500 | 500 |
| Total | 2,100 | 2,319 | 2,101 | 2,404 | 2,500 | 3,000 | 3,000 |
| Landlocked Fingerling | | | | | | | |
| Sculpin Lake | 28,000 | 30,341 | 28,000 | 19,000 | 28,000 | 28,000 | 28,000 |
| Ryan Lake | 9,000 | 0 | 0 | 9,000 | 9,000 | 9,000 | 9,000 |
| Buffalo Lake | 800 | 800 | 800 | 800 | 800 | 800 | 800 |
| Tolsona Lake | 30,000 | 30,067 | Dropped | | | | |
| Tex Smith Lake | 0 | 3,400 | 0 | 1,607 | 0 | 3,400 | 0 |
| Squirrel Cr. Pit | 0 | 1,000 | 0 | 2,000 | 0 | Dropped | |
| Crater Lake | 0 | 3,400 | 0 | 1,600 | 0 | 3,200 | 0 |
| Three Mile Lake | 0 | 4,000 | 0 | 4,000 | 0 | 4,000 | 0 |
| Silver Lake | 0 | 80,000 | 0 | 80,036 | 0 | 80,000 | 0 |
| Two Mile Lake | 3,400 | 0 | 3,400 | 3,400 | 3,400 | 0 | 0 |
| 14 Mile Lk (Den) | 0 | 10,000 | 0 | 7027 | 0 | Dropped | |
| Kettle Lake | 0 | 1,200 | 0 | 0 | 0 | Dropped | |
| D-J Lake | 0 | 0 | 0 | 400 | 0 | 400 | 0 |
| Little Crater Lk | 0 | 450 | 0 | 400 | 0 | 400 | 0 |
| North Jan Lake | 0 | 10,000 | 0 | 11,600 | 0 | 11,600 | 0 |
| Old Road Lake | 0 | 350 | 0 | 300 | 0 | Dropped | |
| Round Lake | 0 | 450 | 0 | 200 | 0 | Dropped | |
| Gergie Lake | 0 | 0 | 0 | 9000 | 0 | 9,000 | 0 |
| Tiny Lake | 500 | 0 | 500 | 0 | 500 | 0 | Dropped |
| Peanut Lake | 2,400 | 0 | 2,400 | 0 | 2,400 | 0 | 2,400 |
| Tolsona Mt. Lake | 15,000 | 0 | 15,000 | 0 | 15,000 | 0 | 15,000 |
| South Jan Lake | 20,000 | 0 | 20,000 | 0 | 20,000 | 0 | 20,000 |
| Meiers Lake | 0 | 0 | 0 | 0 | 20,000 | 0 | 20,000 |
| Total | 117,114 | 115,408 | 87,100 | 158,695 | 103,700 | 150,500 | 98,600 |

-continued-

Table 27.-Page 2 of 2.

| | 1991 Actual | 1992 Actual | 1993 Actual | 1994 Actual | 1995 Actual | 1996 Actual | 1997 Planned |
|------------------------|----------------|----------------|----------------|----------------|----------------|----------------|-----------------|
| Arctic Grayling | | | | | | | |
| Fingerling | | | | | | | |
| Moose Lake | 33,500 | Dropped | | | | | |
| Tolsona Lake | 10,000 | 10,000 | 10,000 | Dropped | | | |
| Caribou Lake | 5,000 | 8,000 | 0 | 8,000 | 0 | 8,000 | 0 |
| Moose Cr.(Taz) | 0 | 5,000 | 0 | 5,000 | Dropped | | |
| Meiers Lake | 0 | 0 | 0 | 0 | 0 | 10,000 | 0 |
| Squirrel Creek Pit | 0 | 0 | 0 | 0 | 0 | 2,000 | 0 |
| Total | 48,500 | 23,000 | 10,000 | 13,000 | 0 | 12,000 | 0 |
| Fry | | | | | | | |
| Tolsona Lake | 80,000 | 80,000 | 80,000 | 80,000 | Dropped | | |
| Moose Cr. (Taz) | 50,000 | 50,000 | 50,000 | 50,000 | Dropped | | |
| Two Mile Lake | 0 | 5,000 | 0 | 5,000 | 0 | 5,000 | 0 |
| Three Mile Lake | 0 | 8,000 | 0 | 8,000 | 0 | 8,000 | 0 |
| Junction Lake | 3,500 | 0 | 3,500 | 0 | 3,000 | 0 | 0 |
| Squirrel Cr. Pit | 5,000 | 0 | 5,000 | 0 | 5,000 | Dropped | |
| Lower Twin Lake | 0 | 90,000 | 0 | Dropped | | | |
| Little Junction Lake | 0 | 5,000 | 0 | 5,000 | 0 | 5,000 | 0 |
| Arizona Lake | 0 | 10,000 | 0 | 10,000 | 0 | 10,000 | 0 |
| Connor Lake | 0 | 15,000 | 0 | 15,000 | 0 | 15,000 | 0 |
| Dick Lake | 0 | 10,000 | 0 | 10,000 | 0 | 10,000 | 0 |
| Elbow Lake | 0 | 5,000 | 0 | 5,000 | 0 | 5,000 | 0 |
| Bearcub Lake | 0 | 10,000 | 0 | 10,000 | 0 | Dropped | |
| Meiers Lake | 0 | 40,000 | 0 | 40,000 | 0 | 40,000 | 0 |
| Forgotten Lake | 0 | 10,000 | 0 | 10,000 | 0 | 10,000 | 0 |
| Caribou Lake | 0 | 8,000 | 0 | 8,000 | 0 | 8,000 | 0 |
| Total | 138,500 | 346,000 | 138,500 | 256,000 | 8,000 | 116,000 | 0 |

^a Previously known as Mirror Lake.

LITERATURE CITED

- Barnhart, G. A. and R. Engstrom-Heg. 1984. A synopsis from New York experiences with catch and release management of wild salmonids. Pages 91-101 in F. Richardson and R. H. Hamre, eds. Wild trout III, Proceedings of the Symposium. Yellowstone National Park, September 1984.
- Bosch, D. E. 1995. Population dynamics and stock assessment of Arctic grayling (*Thymallus arcticus*) in the Gulkana River drainage, Alaska. Master's thesis, University of Alaska Fairbanks.
- Brady, J. A., S. Morstad, and E. Simpson. 1991. Review of Prince William Sound area commercial salmon fisheries, 1990. Alaska Department of Fish and Game, Regional Information Report No. 2C91-02, Anchorage.
- Burr, John M. 1987. Synopsis and bibliography of lake trout (*Salvelinus namaycush*) in Alaska. Alaska Department of Fish and Game, Fishery Manuscript No. 5, Juneau.
- Donaldson, W., S. Morstad, E. Simpson, J. Wilcock, and S. Sharr. 1993. Prince William Sound management area 1992 annual finfish management report. Alaska Department of Fish and Game, Commercial Fisheries Management and Development Division. Regional Information Report No. 2A93-12, Anchorage.
- Donaldson, W., S. Morstad, D. Sharp, J. Wilcock, S. Sharr. 1995. Prince William Sound Management Area 1994 Annual Finfish Management Report. Regional Information Report No. 2A95-47, Anchorage.
- Healy, M. C. 1970. Dynamics of exploited lake trout populations and implications for management. *Journal of Wildlife Management* 42:307-328.
- Hicks, F. and N. Quinn. 1990. Lake trout slot size limit regulations, Algonquin Park. Progress Report, Experimental Management Project. Ontario Ministry Natural Resources, Toronto.
- Howe, Allen L., Gary Fidler, and Michael J. Mills. 1995. Harvest, catch, and participation in Alaska sport fisheries during 1994. Alaska Department of Fish and Game, Fishery Data Series No. 95-24, Anchorage.
- Howe, Allen L., Gary Fidler, Allen E. Bingham, and Michael J. Mills. 1996. Harvest, catch, and participation in Alaska sport fisheries during 1995. Alaska Department of Fish and Game, Fishery Data Series No. 96-32, Anchorage.
- Jones and Stokes Associates, Inc. 1987. Southcentral Alaska sport fishing economic study. Final research report. November 1987. (JSA86-0413). Sacramento, CA. Prepared for Alaska Department of Fish and Game, Division of Sport Fish, Research and Technical Services Section, Anchorage, Alaska.
- Lafferty, R. and D. Bernard. 1993. Stock assessment and biological characteristics of burbot in Lake Louise, Moose, and Tolsona lakes, Alaska, 1992. Alaska Department of Fish and Game, Fishery Data Series No. 93-19, Anchorage.
- Lafferty, R., J. F. Parker, and D. R. Bernard. 1990. Stock assessment and biological characteristics of burbot in lakes of interior Alaska during 1989. Alaska Department of Fish and Game, Fishery Data Series No. 90-48, Anchorage.
- Lafferty, R., J. F. Parker, and D. R. Bernard. 1991. Stock assessment and biological characteristics of burbot in lakes of interior Alaska during 1990. Alaska Department of Fish and Game, Fishery Data Series No. 91-57, Anchorage.
- Lafferty, R., J. F. Parker, and D. R. Bernard. 1992. Stock assessment and biological characteristics of burbot in lakes of interior Alaska during 1991. Alaska Department of Fish and Game, Fishery Data Series No. 92-20, Anchorage.
- Martin, N. V. and C. H. Olver. 1980. The lake charr, *Salvelinus namaycush*. In E. K. Balon, editor. Charrs: Salmonid Fishes of the Genus *Salvelinus*. D. W. Junk, The Hague, Netherlands.
- Mills, M. J. 1979. Alaska statewide sport fish harvest studies. Alaska Department of Fish and Game. Federal Aid in Fish Restoration, Annual Performance Report, 1978-1979, Project F-9-11, 20 (SW-1), Juneau.

LITERATURE CITED (Continued)

- Mills, M. J. 1980. Alaska statewide sport fish harvest studies. Alaska Department of Fish and Game. Federal Aid in Fish Restoration, Annual Performance Report, 1979-1980, Project F-9-12, 21 (SW-1), Juneau.
- Mills, M. J. 1981a. Alaska statewide sport fish harvest studies (1979). Alaska Department of Fish and Game. Federal Aid in Fish Restoration, Annual Performance Report, 1980-1981, Project F-9-13, 22 (SW-I-A), Juneau.
- Mills, M. J. 1981b. Alaska statewide sport fish harvest studies (1980). Alaska Department of Fish and Game. Federal Aid in Fish Restoration, Annual Performance Report, 1980-1981, Project F-9-13, 22 (SW-I-A), Juneau.
- Mills, M. J. 1982. Alaska statewide sport fish harvest studies (1981). Alaska Department of Fish and Game. Federal Aid in Fish Restoration, Annual Performance Report, 1981-1982, Project F-9-14, 23 (SW-I-A), Juneau.
- Mills, M. J. 1983. Alaska statewide sport fish harvest studies (1982). Alaska Department of Fish and Game. Federal Aid in Fish Restoration, Annual Performance Report, 1982-1983, Project F-9-15, 24 (SW-I-A), Juneau.
- Mills, M. J. 1984. Alaska statewide sport fish harvest studies (1983). Alaska Department of Fish and Game. Federal Aid in Fish Restoration, Annual Performance Report, 1983-1984, Project F-9-16, 25 (SW-I-A), Juneau.
- Mills, M. J. 1985. Alaska statewide sport fish harvest studies (1984). Alaska Department of Fish and Game. Federal Aid in Fish Restoration, Annual Performance Report, 1984-1985, Project F-9-17, 26 (SW-I-A), Juneau.
- Mills, M. J. 1986. Alaska statewide sport fish harvest studies (1985). Alaska Department of Fish and Game. Federal Aid in Fish Restoration, Annual Performance Report, 1985-1986, Project F-10-1, 27 (RT-2), Juneau.
- Mills, M. J. 1987. Alaska statewide sport fisheries harvest report. Alaska Department of Fish and Game, Fishery Data Series No. 2, Juneau.
- Mills, M. J. 1988. Alaska statewide sport fisheries harvest report. Alaska Department of Fish and Game, Fishery Data Series No. 52, Juneau.
- Mills, M. J. 1989. Alaska statewide sport fisheries harvest report. Alaska Department of Fish and Game, Fishery Data Series No. 122, Juneau.
- Mills, M. J. 1990. Harvest and participation in Alaska sport fisheries during 1989. Alaska Department of Fish and Game, Fishery Data Series No. 90-44, Anchorage.
- Mills, M. J. 1991. Harvest, catch, and participation in Alaska sport fisheries during 1990. Alaska Department of Fish and Game, Fishery Data Series No. 91-58, Anchorage.
- Mills, M. J. 1992. Harvest, catch, and participation in Alaska sport fisheries during 1991. Alaska Department of Fish and Game, Fishery Data Series No. 92-40, Anchorage.
- Mills, M. J. 1993. Harvest, catch, and participation in Alaska sport fisheries during 1992. Alaska Department of Fish and Game, Fishery Data Series No. 93-42, Anchorage.
- Mills, M. J. 1994. Harvest, catch, and participation in Alaska sport fisheries during 1993. Alaska Department of Fish and Game, Fishery Data Series No. 94-28, Anchorage.
- Potterville, W. D. and K. A. Webster. 1990. Estimates of sport effort and harvest of chinook salmon from the Klutina and Gulkana rivers, 1989. Alaska Department of Fish and Game, Fishery Data Series No. 90-58, Anchorage.
- Roberson, K. and C. Whitmore. 1991. Copper River subsistence and personal use salmon fishery management and research, 1990. Alaska Department of Fish and game, a report to the Alaska Board of Fisheries, Prince William Sound Data Report No. 2C91-01. Anchorage.
- Roth, K. and K. Delaney. 1989. Estimates of sport effort and harvest of chinook salmon in the Klutina River, 1988. Alaska Department of Fish and Game, Fishery Data Series No. 80, Juneau.
- Szarzi, N. J. 1995. Evaluation of lake trout stock status and abundance in selected lakes in the upper Copper and upper Susitna drainages, 1994. Fishery Data Series No. 95-40, Anchorage.

LITERATURE CITED (Continued)

- Szarzi, N. J. and D. R. Bernard. *In prep.* Stock assessment and biological characteristic of burbot in Lake Louise and Tolsona Lake, Alaska, 1995. Fishery Data Series, Anchorage.
- Taube, T. and D. Bernard. 1994. Stock assessment and biological characteristics of burbot in Lake Louise and Tolsona Lake, Alaska, 1994. Fishery Data Series No. 95-14, Anchorage.
- Taube, T., D. R. Bernard and R. Lafferty. 1993. Stock assessment and biological characteristics of burbot in Lake Louise, Hudson and Tolsona Lakes, Alaska, 1993. Fishery Data Series No. 94-4, Anchorage.
- Williams, F. T. and W. D. Potterville. 1983. Inventory and cataloging of sport fish and sport fish waters of the Copper River, Prince William Sound, and the upper Susitna River drainages. Alaska Department of Fish and Game. Federal Aid in Fish Restoration, Annual Report of Progress, 1982-1983, Project F-9-15, 24 (G-I-F).