

**Special Publication No. 03-05**

---

---

# **Anchor River Chinook Salmon Stock Status Update, 2002**

by

**Nicole J. Szarzi,**

**Ellen M. Simpson,**

**Steven W. Albert,**

and

**Robert A. Clark**

---

---

September 2003

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.

<b>Weights and measures (metric)</b>		<b>General</b>		<b>Mathematics, statistics, fisheries</b>	
centimeter	cm	All commonly accepted abbreviations.	e.g., Mr., Mrs., a.m., p.m., etc.	alternate hypothesis	H <sub>A</sub>
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, $\chi^2$ , etc.
kilometer	km			confidence interval	C.I.
liter	L			correlation coefficient	R (multiple)
meter	m		east E	correlation coefficient	r (simple)
metric ton	mt		north N	covariance	cov
milliliter	ml		south S	degree (angular or temperature)	°
millimeter	mm		west W	degrees of freedom	df
		Copyright	©	divided by	÷ or / (in equations)
<b>Weights and measures (English)</b>		Corporate suffixes:		equals	=
cubic feet per second	ft <sup>3</sup> /s	Company	Co.	expected value	E
foot	ft	Corporation	Corp.	fork length	FL
gallon	gal	Incorporated	Inc.	greater than	>
inch	in	Limited	Ltd.	greater than or equal to	≥
mile	mi	et alii (and other people)	et al.	harvest per unit effort	HPUE
ounce	oz	et cetera (and so forth)	etc.	less than	<
pound	lb	exempli gratia (for example)	e.g.,	less than or equal to	≤
quart	qt	id est (that is)	i.e.,	logarithm (natural)	ln
yard	yd	latitude or longitude	lat. or long.	logarithm (base 10)	log
Spell out acre and ton.		monetary symbols (U.S.)	\$, ¢	logarithm (specify base)	log <sub>2</sub> , etc.
		months (tables and figures): first three letters	Jan, ..., Dec	mid-eye-to-fork	MEF
<b>Time and temperature</b>		number (before a number)	# (e.g., #10)	minute (angular)	'
day	d	pounds (after a number)	# (e.g., 10#)	multiplied by	x
degrees Celsius	°C	registered trademark	®	not significant	NS
degrees Fahrenheit	°F	trademark	™	null hypothesis	H <sub>0</sub>
hour (spell out for 24-hour clock)	h	United States (adjective)	U.S.	percent	%
minute	min	United States of America (noun)	USA	probability	P
second	s	U.S. state and District of Columbia abbreviations	use two-letter abbreviations (e.g., AK, DC)	probability of a type I error (rejection of the null hypothesis when true)	α
Spell out year, month, and week.				probability of a type II error (acceptance of the null hypothesis when false)	β
<b>Physics and chemistry</b>				second (angular)	"
all atomic symbols				standard deviation	SD
alternating current	AC			standard error	SE
ampere	A			standard length	SL
calorie	cal			total length	TL
direct current	DC			variance	Var
hertz	Hz				
horsepower	hp				
hydrogen ion activity	pH				
parts per million	ppm				
parts per thousand	ppt, ‰				
volts	V				
watts	W				

***SPECIAL PUBLICATION NO. 03-05***

**ANCHOR RIVER CHINOOK SALMON STOCK STATUS UPDATE, 2002**

by

Nicole J. Szarzi,

*Division of Sport Fish, Homer*

Ellen M. Simpson,

Steven W. Albert,

*Division of Sport Fish, Research and Restoration, Anchorage*

and

Robert A. Clark

*Division of Sport Fish, Research and Technical Services, Anchorage*

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

September 2003

The Special Publications series was established in 1991 for the publication of techniques and procedures manuals, informational pamphlets, special subject reports to decision-making bodies, symposia and workshop proceedings, application software documentation, in-house lectures, and other documents that do not fit in another publication series of the Division of Sport Fish. Special Publications are intended for fishery and other technical professionals. Special Publications are available through the Alaska State Library and on the Internet: <http://www.sf.adfg.state.ak.us/statewide/divreports/html/intersearch.cfm> This publication has undergone editorial and peer review.

*Nicole J. Szarzi,  
Alaska Department of Fish and Game, Division of Sport Fish  
3298 Douglas Place, Homer, AK 99827-0330  
Ellen M. Simpson, Steven W. Albert,  
Alaska Department of Fish and Game, Division of Sport Fish, Research and Restoration,  
and Robert A. Clark  
Alaska Department of Fish and Game, Division of Sport Fish, Research and Technical Services  
333 Raspberry Road, Anchorage, Alaska 99518-1599, USA*

*This document should be cited as:*

*Szarzi, N. J., E. M. Simpson, S. W. Albert, and R. A. Clark. 2003. Anchor River chinook salmon stock status update, 2002. Alaska Department of Fish and Game, Special Publication No. 03-05, Anchorage.*

The Alaska Department of Fish and Game administers all programs and activities free from discrimination based on race, color, national origin, age, sex, religion, marital status, pregnancy, parenthood, or disability. The department administers all programs and activities in compliance with Title VI of the Civil Rights Act of 1964, Section 504 of the Rehabilitation Act of 1973, Title II of the Americans with Disabilities Act of 1990, the Age Discrimination Act of 1975, and Title IX of the Education Amendments of 1972.

If you believe you have been discriminated against in any program, activity, or facility, or if you desire further information please write to ADF&G, P.O. Box 25526, Juneau, AK 99802-5526; U.S. Fish and Wildlife Service, 4040 N. Fairfax Drive, Suite 300 Webb, Arlington, VA 22203 or O.E.O., U.S. Department of the Interior, Washington DC 20240.

For information on alternative formats for this and other department publications, please contact the department ADA Coordinator at (voice) 907-465-4120, (TDD) 907-465-3646, or (FAX) 907-465-2440.

# TABLE OF CONTENTS

	<b>Page</b>
LIST OF TABLES .....	ii
LIST OF FIGURES .....	ii
ABSTRACT .....	1
INTRODUCTION .....	1
RESEARCH UPDATE.....	6
Sport Fish Division.....	6
Obtain Escapement and Age Composition Information .....	6
Monitoring of Smolt Abundance.....	7
Habitat and Restoration Division.....	7
Maintain Existing Levels of Public Lands with Fish Habitat .....	7
Title 16 Monitoring and Enforcement .....	7
Large Timber Sale Opposition.....	7
Fish Passage Restoration.....	7
ORV Trail Planning .....	8
Land Purchases .....	8
Community-based Watershed Education .....	8
Additional Activities .....	9
LITERATURE CITED .....	9

## LIST OF TABLES

<b>Table</b>	<b>Page</b>
1. Total effort, chinook salmon sport harvest, and chinook salmon escapement in the Anchor River. ....	3

## LIST OF FIGURES

<b>Figure</b>	<b>Page</b>
1. Location of the Anchor River and other Lower Cook Inlet roadside tributaries. ....	2
2. Freshwater harvest of chinook salmon in the Anchor River, 1976-2001. ....	4
3. Escapement index of chinook salmon in the Anchor River (bars) relative to the current SEG range of 750-1,500 fish (dotted lines), 1976-2002. ....	4

## ABSTRACT

In response to guidelines established in the Sustainable Salmon Fisheries Policy (5 AAC 39.222), the Alaska Board of Fisheries classified Anchor River chinook salmon *Oncorhynchus tshawytscha* as a stock of management concern in November 2001. This report provides an update of Anchor River chinook salmon stock status, research, and salmon habitat assessment projects the Board of Fisheries directed the department to undertake to document fish population characteristics, assess watershed attributes, and mitigate development impacts for the Anchor River.

Sport Fish Division conducted an aerial survey of the Anchor River on July 30, 2002, counting 748 chinook salmon. Plans for 2003 and subsequent years include a weir to enumerate chinook salmon during normal flows, and sonar and a partial weir to enumerate chinook during high flows in the spring. Habitat Division seeks to modify current land use patterns that may adversely affect fish habitat resource values in the Anchor River watershed. Projects include off-road vehicle trail planning, land purchases, fish habitat restoration, Title 16 monitoring and enforcement, opposition to large timber sales in the Anchor River drainage, and fish passage restoration.

Key words: Anchor River, chinook salmon, *Oncorhynchus tshawytscha*, weir, sonar, habitat, off-road vehicle, Title 16, timber sales.

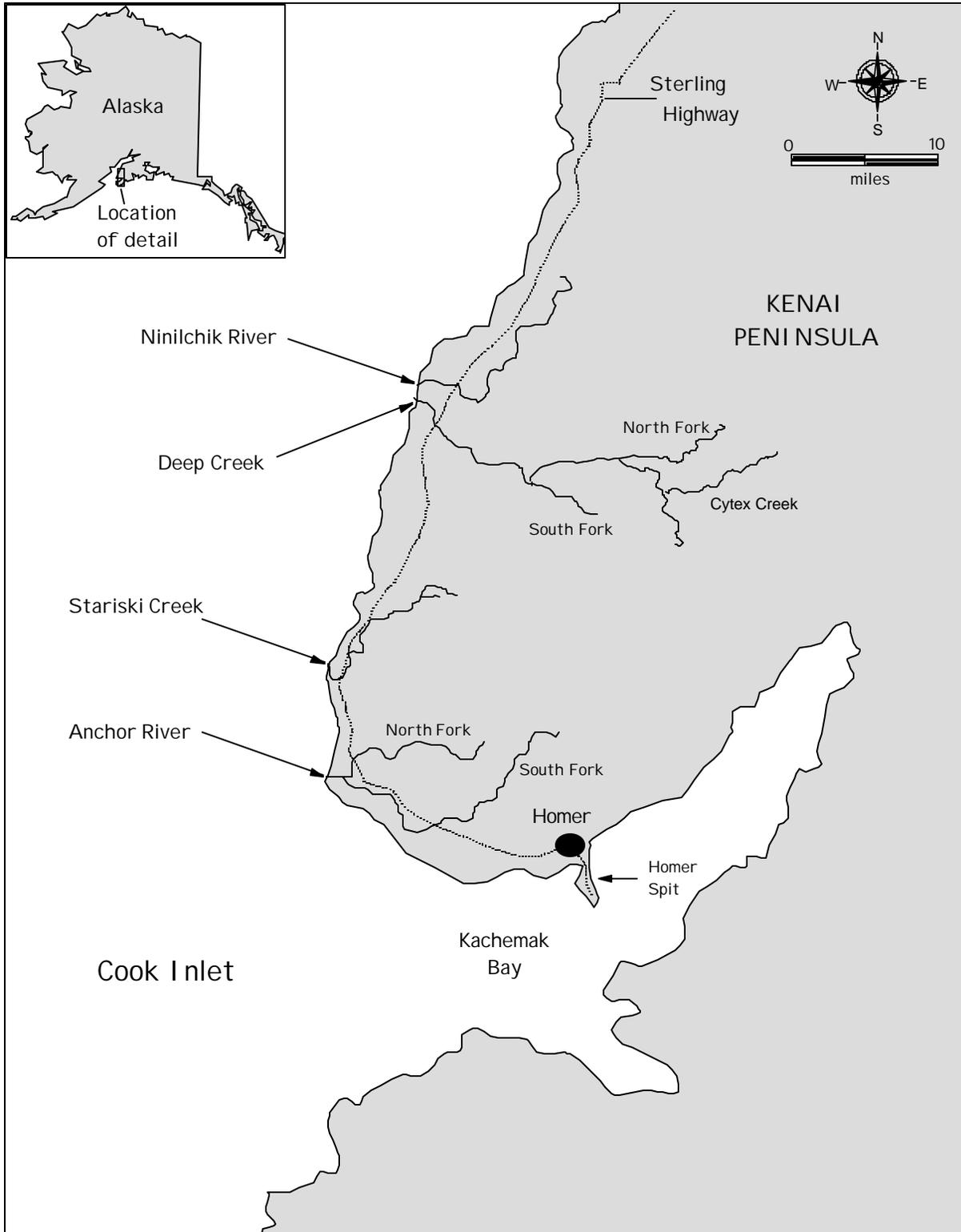
## INTRODUCTION

From 1978-1988, the Anchor River (Figure 1), located on the Kenai Peninsula, was open to chinook salmon *Oncorhynchus tshawytscha* fishing on four or less consecutive weekends starting with the Memorial Day holiday weekend. From 1976-1988, harvests of chinook salmon in the Anchor River averaged 1,084 fish and the escapement index averaged 1,794 fish (Table 1, Figures 2 and 3). The current sustainable escapement goal (SEG) range of 750-1,500 fish, which was set in 2001 (Bue and Hasbrouck 2001), was attained or exceeded in all 12 years surveyed from 1976-1988 (Figure 3). In 1989, regulations were changed to five consecutive weekends open to fishing, and harvests of chinook salmon increased to an average of 1,491 fish and the escapement index decreased to an average of 668 fish. The current SEG range was attained in only 5 of 13 years surveyed from 1989-2001, and in one of these years, 2000, the SEG was barely attained. The escapement index was below the SEG during these years despite actions taken to correct this trend in the 1995-1996 Board of Fisheries meeting cycle. These regulatory changes, which went into effect in 1996, included closures and restrictions to the nearby marine fishery as well as the inriver fishery.

During the same period, habitat alterations in the Anchor River drainage caused by increased use of recreational off-road vehicles (ORV), continued salvage logging, extensive road and trail network, increased oil and gas exploration, development and transportation, gravel mining, and recreational and residential development were also noted. These activities may also contribute to low escapements and production of chinook salmon in the Anchor River.

The Anadromous Fish Act (AS 16.05.870), required prior approval from ADF&G for activities such as construction, road crossings, gravel removal, placer mining, and bank stabilization that could significantly affect waterbodies used by anadromous fishes. AS 16.05.840, the Fishway Act, required that an individual or governmental agency notify and obtain authorization from ADF&G for activities that could impede fish passage such as culvert installation, stream realignment or diversions, dams, low-water crossings, and construction.

The Sustainable Salmon Fisheries Policy (5 AAC 39.222) recommends that salmon habitats be maintained to assure sustained yields by avoiding perturbations beyond normal levels of variability. The policy requires completion of detailed science-based assessments prior to



**Figure 1.-Location of the Anchor River and other Lower Cook Inlet roadside tributaries.**

**Table 1.-Total effort, chinook salmon sport harvest, and chinook salmon escapement in the Anchor River.**

Year	Effort <sup>a</sup>	Sport Harvest		Aerial Escapement
		Inriver <sup>b</sup>	Marine <sup>c</sup>	
1976		830	5,495	2,125
1977	31,515	1,077	4,617	3,585
1978	42,671	2,109	2,669	2,209
1979	44,220	1,913	3,088	1,335
1980	33,272	605	521	<sup>d</sup>
1981	34,257	1,069	2,363	1,066 <sup>d</sup>
1982	24,709	718	2,497	1,493
1983	28,881	1,269	1,000	1,033
1984	26,919	998	2,386	1,087
1985	31,715	672	5,087	1,328
1986	34,938	1,098	3,106	2,287
1987	39,045	761	3,613	2,524
1988	24,356	976	4,243	1,458
1989	19,145	578	3,863	940
1990	28,829	1,479	4,694	967
1991	22,187	1,047	4,824	589
1992	24,028	1,685	5,996	99
1993	29,338	2,787	8,136	1,110
1994	27,856	2,478	6,867	837
1995	25,888	1,475	8,230	<sup>d</sup>
1996	16,016	1,483	4,702	277
1997	17,020	1,563	5,646	477
1998	14,310	783	5,783	789
1999	21,184	1,409	4,907	685
2000	23,141	1,730	4,773	752
2001	19,192 <sup>e</sup>	888 <sup>e</sup>	4,680 <sup>e</sup>	414
2002 <sup>f</sup>				748
1976-1988 Avg.	33,042	1,084	3,130	1,794
1989+ Avg.	22,164	1,491	5,623	668

<sup>a</sup> Effort is the number of recreational angler-days expended on the Anchor River for all species, estimated from the Statewide Harvest Survey (Mills 1979-1994; Howe et al. 1995, 1996, 2001a, b, c, d; Walker et al. 2003), available beginning in 1977.

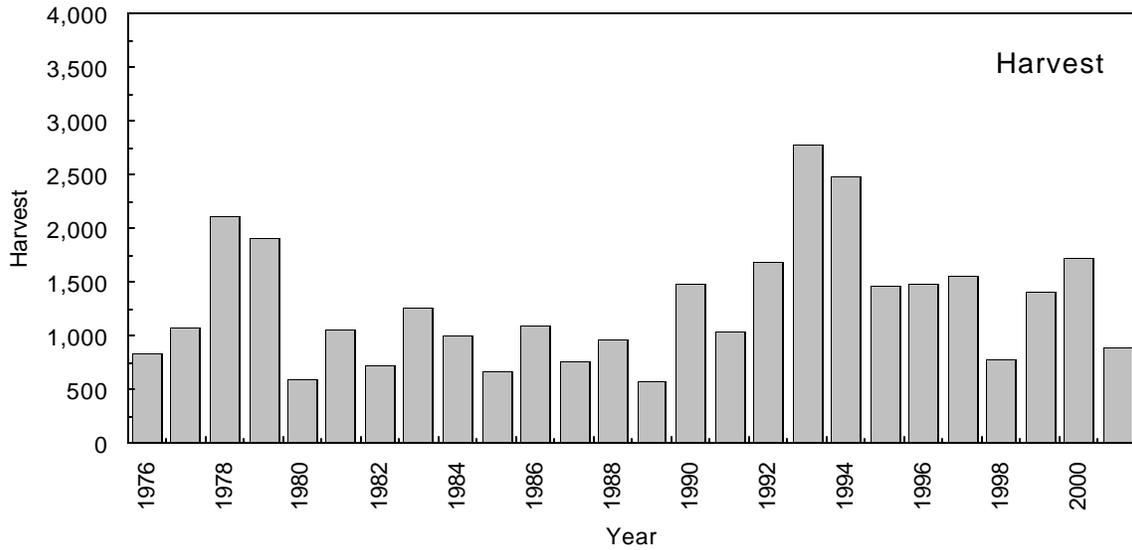
<sup>b</sup> Harvest is the harvest of chinook salmon from the Anchor River, estimated from the Statewide Harvest Survey for 1977-2001 (Mills 1979-1994; Howe et al. 1995, 1996, 2001a, b, c, d; Walker et al. 2003). Harvest estimates for 1976 are from punchcard returns (Hammarstrom 1977).

<sup>c</sup> Early-run harvest of all chinook salmon in salt water north of Bluff Point prior to June 25, estimated from the Statewide Harvest Survey for 1977-2001 (Mills 1979-1994; Howe et al. 1995, 1996, 2001a, b, c, d; Walker et al. 2003). Harvest estimates for 1976 are from creel surveys (Hammarstrom 1977).

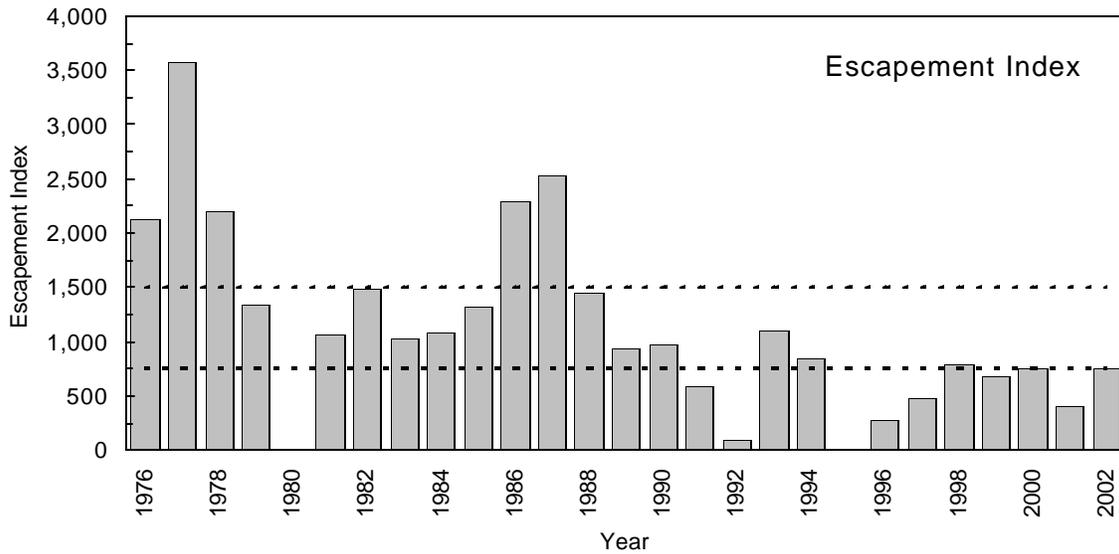
<sup>d</sup> Escapement counts not conducted or considered minimal due to high and/or turbid water during aerial escapement surveys.

<sup>e</sup> Preliminary data.

<sup>f</sup> Sport effort and harvest estimates not yet available from the Statewide Harvest Survey.



**Figure 2.-Freshwater harvest of chinook salmon in the Anchor River, 1976-2001.**



**Figure 3.-Escapement index of chinook salmon in the Anchor River (bars) relative to the current SEG range of 750-1,500 fish (dotted lines), 1976-2002.**

authorization of development projects to assess any possible adverse effects on salmon habitat and populations from habitat alteration. Salmon habitat should be protected on a watershed basis including appropriate levels of protection of riparian habitat, water quality, and sufficient water flows to allow for salmon movements. All degraded salmon habitat resources should be restored to previously known natural productivity levels. Access to all essential habitat features should be protected. Long-term monitoring should be conducted to assess current status of habitat and the effectiveness of restoration efforts.

In response to guidelines established in the Sustainable Salmon Fisheries Policy, the Alaska Department of Fish and Game (ADF&G) identified Anchor River chinook salmon as a candidate for stock of management concern status during their October 11-13, 2001 work session. After reviewing stock status information and public input during the November 2001 regulatory meeting, the Board of Fisheries (BOF) classified Anchor River chinook salmon as a stock of management concern and restricted the fishery from five to four 3-day weekends. The classification and restriction were mandated by the Policy for salmon stocks with escapements below the stock's SEG bounds during 4 of the last 6 years even after specific management measures. The Board hoped that decreasing the number of weekends open to fishing would increase escapement in the Anchor River to within the SEG range.

At the November 2001 regulatory meeting of the Board of Fisheries, staffs of the ADF&G divisions of Sport Fish and Habitat presented ongoing and future research plans and actions to rebuild the chinook salmon stock of the Anchor River to levels within the current SEG range (ADF&G 2001). These actions were aimed at reducing inriver sport harvest, documenting fish population characteristics, assessing watershed attributes, and mitigating development impacts for the Anchor River. Specific actions recommended were to:

1. Reduce the number of weekends open to chinook salmon fishing on the Anchor River. A reduction in exploitation by reducing the number of open weekends from five to four could increase escapement levels in the Anchor River to within the SEG range.
2. Obtain escapement and age composition information for chinook and coho salmon and steelhead.
3. Develop long-term monitoring of smolt abundance relative to changes in habitat due to logging, urbanization, and oil and gas exploration.
4. Maintain existing levels of publicly held (i.e. state, municipal, and federal) lands that support fish habitat.
5. Increase Title 16 bio-monitoring and enforcement in the Anchor River watershed.
6. Oppose any new large-scale commercial timber sales on public lands in the Anchor River drainage.
7. Enhance free and efficient fish passage and improve water quality by removing or repairing any stream crossing structures (primarily culverts) assumed to block fish movements or impair water quality as sources of sediment input.
8. Consult with the Board of Game and user groups to address the growing problem of illegal ORV crossings of fish streams and adverse impacts to riparian habitat.

9. Pending availability of funds, purchase lands that will provide protection for fish habitat and investigate the use of conservation easements to protect riparian habitat and maintain healthy streambank conditions.
10. Foster development of a community-based watershed council for educating the public on proper land use practices that protect fish habitat and for monitoring watershed health and condition.

## **RESEARCH UPDATE**

Following is an update of Anchor River chinook salmon stock status and research by Sport Fish Division and salmon habitat assessment projects by Habitat Division to address the actions listed above.

### **SPORT FISH DIVISION**

#### **Obtain Escapement and Age Composition Information**

In 2002, aerial surveys of chinook salmon were conducted on July 29 and 30 in Deep Creek and the Anchor River. A total of 748 chinook salmon were counted in the Anchor River on July 30 and 696 chinook were counted in Deep Creek on July 29. This is an improvement in the index count over the previous year, is near the lower boundary (750 fish) of the SEG range, and may be the first in a trend of increased escapements to the Anchor River as a result of the restriction implemented in 2001. Periodic foot surveys conducted in 2002 on the Anchor River in a subsection of the aerial index area indicate that timing of the aerial survey occurred within the peak spawning period.

Upcoming research by Sport Fish Division will include enumerating chinook salmon. A location 110 ft downstream of the confluence of the North and South forks of the Anchor River was chosen to place fish counting equipment beginning in 2003. However, we may need to reevaluate location of the equipment because two 100-year floods in October and November 2002 significantly altered the river bottom. New fish-counting sonar technology that produces realistic images of fish as they cross the sonar beam will allow counting of fish. A partial weir, approximately 50 ft in length, will be operated in conjunction with the sonar counter beginning May 15. The partial weir will direct migrating fish into the sonar beam. The remaining weir, including rail, weir panels, fish passage gates and live box, will be installed and completely extend across the river when water levels recede if the bottom substrate shifts to make the river bed accessible. In 2003, chinook salmon will be enumerated into July, through the entirety of the run.

In subsequent years, the partial weir in conjunction with the sonar unit will operate until completion of spring high flows allows a full weir to be installed. The full weir will operate through September to enumerate chinook and coho salmon *O. kisutch* and rainbow/steelhead trout *O. mykiss*. Dolly Varden *Salvelinus malma* will be counted opportunistically.

If the site remains too deep to weir completely, alternate study plans to differentiate and count species besides chinook salmon will be formulated. Preparation for operation of the sonar and weir entailed obtaining permits from various agencies and a public review process. The review process was completed approximately October 25, 2002. After approval of the permits, the weir attachment rail for the partial weir was placed in the bed of the Anchor River at the weir/sonar site during November 2002.

The sport fishery for salmon is open in the Anchor River on four consecutive 3-day weekends, starting Memorial Day, downstream of the confluence of the North and South forks. The entire river opens to fishing July 1 but salmon fishing is closed upstream of the forks. Operation of the partial weir in May and part of June will require closure of 110 ft of the Anchor River upstream of the weir to the upper boundary of the fishery at the confluence of the North and South forks. A smaller area approximately 50 ft in length will be closed downstream of the weir. The total closed area of the fishery during operation of the partial weir will be approximately the upper 160 ft of the fishery. Operation of a full weir will necessitate closure of the sport fishery in the adjacent waters approximately 300 ft upstream and 300 ft downstream of the weir or where posted to protect holding fish (AAC 75.050 (a) and (b)). The total closed area for operation of the full weir will be a distance of approximately 600 ft. Sport Fish will work to mitigate the loss of this fishing area with the help of data gathered with the weir/sonar.

### **Monitoring of Smolt Abundance**

The fish counting equipment and project described above will be used to enumerate and tag chinook and coho salmon smolt starting in 2004, or thereafter as feasible.

## **HABITAT AND RESTORATION DIVISION**

### **Maintain Existing Levels of Public Lands with Fish Habitat**

Staff continue to review and comment on land use actions initiated by the Alaska State Department of Natural Resources (ADNR) for effects on fish habitat. These include conveyances of state lands to the Kenai Peninsula Borough and land use leases and permits issued to private individuals. Land classifications proposed by the Kenai Peninsula Borough are also reviewed.

### **Title 16 Monitoring and Enforcement**

To fulfill Title 16 responsibilities at the Anchor River in 2002, the department increased staff presence in the field for monitoring projects that could adversely affect fish habitat and to increase enforcement of habitat-related violations within the watershed.

In 2003 implementation of Executive Order 107 repealed the Anadromous Fish Act (AS 16.05.870) and the Fishway Act (AS 16.05.840), and transferred authority to the Department of Natural Resources. To ensure that Anchor River chinook salmon habitat receives appropriate levels of protection, department staff are committed to work cooperatively with ADNR staff. ADF&G biologists will maintain their field presence monitoring projects that could adversely affect fish habitat within the watershed.

### **Large Timber Sale Opposition**

Staff continue to closely review proposed and ongoing timber harvest activities and monitor existing logging operations in the Anchor River drainage. Although no new actions have occurred to implement previously proposed large timber sales on public lands, the Division will continue to oppose such operations in the uppermost portions of the Anchor River drainage.

### **Fish Passage Restoration**

Staff completed a culvert inventory and fish passage assessment project on all state-maintained roads throughout the Kenai Peninsula. Preliminary findings indicate there are five culverts in the Anchor River watershed that are impeding fish movements. Staff is actively seeking funding to restore fish passage and will work closely with the Department of Transportation (DOT) and ADNR staff to improve conditions at these road-stream crossings. ADF&G staff also received

funding to improve fish passage on a private road crossing Two Moose Creek, and important tributary stream that provides several miles of upstream spawning and rearing habitat for Anchor River chinook and coho salmon.

### **ORV Trail Planning**

As the first step of a longer term planning effort, scoping interviews were conducted with a broad spectrum of potential off-road vehicle (ORV) stakeholders. Individuals interviewed in the scoping process included landowners and managers (Alaska Department of Natural Resources [ADNR], Cook Inlet Region Incorporated [CIRI], Ninilchik Native Corporation, Kenai Peninsula Borough, ADNR-Parks, ADF&G), resource specialists, ORV industry representatives, environmental groups, legislators, Board of Fisheries and Game advisory committee members, sportsman's groups, snowmachine clubs and other trail users such as eco-tour operators and bicyclists. Forty-six stakeholders were asked the same eight questions about ORV use. The interviews were a qualitative effort to (1) isolate the issues surrounding ORV use on the lower Kenai Peninsula, (2) identify appropriate stakeholders to participate in a planning process, (3) evaluate the importance of developing an ORV plan, and (4) identify an appropriate planning process and any products which would help implement a plan. The interview responses indicate that an important issue concerning ORV use on the lower Kenai Peninsula is the effect ORVs have on fish and wildlife habitat. Interviewees generally indicated the ADF&G would be an appropriate organization to coordinate an ORV planning effort. The final report for this portion of the project will be completed in November 2003. ADNR Department of Parks and Outdoor Recreation (DPOR), in a cooperative project with ADF&G, will continue the ORV trail planning effort in 2004 in a collaborative partnership with stakeholders.

Respondents also questioned if the ORV impacts observed by ADF&G biologists in the fall, as in the original study in 2000, would be more representative if the observations were in the summer. To address this concern ADF&G surveyed a subsample of the sites located during the original study in July and again in September 2002. These data have not yet been analyzed.

### **Land Purchases**

The department has been actively involved in land protection efforts on the Anchor River. Through the Exxon Valdez Trustee Council, the department has successfully acquired a 20-acre parcel just downstream of the Sterling Highway. The purchase of another 60-acre parcel located upstream is expected to be completed soon. In cooperation with The Nature Conservancy, ADF&G also obtained and is administering a National Coastal Wetland Conservation Grant to purchase approximately 75 acres of estuarine wetlands and barrier beach near the mouth of the Anchor River. These and future purchases are expected to provide lasting benefits for Pacific salmon, steelhead trout and Dolly Varden that migrate, spawn and rear throughout the river. These efforts are also intended to ensure that angler access is maintained on the Anchor River, which is one of the most popular sport fishing streams in Southcentral Alaska.

### **Community-based Watershed Education**

Staff presented information on watershed ecology and restoration to two schools in the Anchor River area. One of these classes was actively involved in "hands-on" revegetation work in the Anchor River State Recreation Area.

The department continues to track the activities of the Anchor River Community Rivers Planning Coalition and provides information to the group when requested. The group is a nonprofit

organization whose purpose is to respond creatively and collaboratively to increasing growth and change in the Anchor River, Stariski Creek, and Happy Valley Creek watersheds.

## **Additional Activities**

### **Fish Habitat Restoration**

Fish habitat restoration projects have been conducted at several sites within the Anchor River watershed. Two of these projects are located within the Anchor River State Recreation Area. Approximately 200 ft of bank in the Silverking day use area were restored with the installation of coir logs, willow brush-layering, vegetative mats and spruce tree revetments. Farther downstream, 120 ft of bank adjacent to the Steelhead Campground were recently restored with root wads, brush-layering and vegetative mat. Unfortunately, during the record floods of fall 2002, most of the Steelhead Campground restoration project was washed out. At this time, there are no plans to repair the damage. Other restoration projects have been completed along the North Fork of the Anchor River.

## **LITERATURE CITED**

- ADF&G (Alaska Department of Fish and Game). 2001. Anchor River chinook salmon stock status and action plan, 2001. Report to the Alaska Board of Fisheries. Alaska Department of Fish and Game, Division of Sport Fish, Anchorage.
- Bue, B. G., and J. J. Hasbrouck. 2001. Escapement goal review of salmon stocks of Upper Cook Inlet. Report to the Alaska Board of Fisheries, October 2001. Alaska Department of Fish and Game, Division of Sport Fish, Anchorage.
- Hammarstrom, S. L. 1977. Evaluation of chinook salmon fisheries of the Kenai Peninsula. Alaska Department of Fish and Game. Federal Aid in Fish Restoration, Annual Performance Report, 1976-1977, Project F-9-9, 18 (G-II-L), Juneau.
- Howe, A. L., G. Fidler, A. E. Bingham, and M. 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.
- Howe, A. L., G. Fidler, and M. 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, A. L., R. J. Walker, C. Olnes, K. Sundet, and A. E. Bingham. 2001a. Participation, catch, and harvest in Alaska sport fisheries during 1999. Alaska Department of Fish and Game, Fishery Data Series No. 01-8, Anchorage.
- Howe, A. L., R. J. Walker, C. Olnes, K. Sundet, and A. E. Bingham. 2001b. Revised Edition: Harvest, catch, and participation in Alaska sport fisheries during 1996. Alaska Department of Fish and Game, Fishery Data Series No. 97-29 (revised), Anchorage.
- Howe, A. L., R. J. Walker, C. Olnes, K. Sundet, and A. E. Bingham. 2001c. Revised Edition: Harvest, catch, and participation in Alaska sport fisheries during 1997. Alaska Department of Fish and Game, Fishery Data Series No. 98-25 (revised), Anchorage.
- Howe, A. L., R. J. Walker, C. Olnes, K. Sundet, and A. E. Bingham. 2001d. Revised Edition: Participation, catch, and harvest in Alaska sport fisheries during 1998. Alaska Department of Fish and Game, Fishery Data Series No. 99-41 (revised), Anchorage.
- 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-I-A), Juneau.
- 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-I-A), Juneau.

## LITERATURE CITED (Continued)

- Mills, M. J. 1981a. Alaska statewide sport fish harvest studies - 1979 data. Alaska Department of Fish and Game, Federal Aid in Fish Restoration and Anadromous Fish Studies, 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 data. Alaska Department of Fish and Game, Federal Aid in Fish Restoration and Anadromous Fish Studies, 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 data. Alaska Department of Fish and Game, Federal Aid in Fish Restoration and Anadromous Fish Studies, 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 data. Alaska Department of Fish and Game, Federal Aid in Fish Restoration and Anadromous Fish Studies, 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 data. Alaska Department of Fish and Game, Federal Aid in Fish Restoration and Anadromous Fish Studies, 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 data. Alaska Department of Fish and Game, Federal Aid in Fish Restoration and Anadromous Fish Studies, 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 data. Alaska Department of Fish and Game, Federal Aid in Fish Restoration and Anadromous Fish Studies, Annual Performance Report 1985-1986, Project F-10-1, 27 (RT-2), Juneau.
- Mills, M. J. 1987. Alaska statewide sport fisheries harvest report, 1986. Alaska Department of Fish and Game, Fishery Data Series No. 2, Juneau.
- Mills, M. J. 1988. Alaska statewide sport fisheries harvest report, 1987. Alaska Department of Fish and Game, Fishery Data Series No. 52, Juneau.
- Mills, M. J. 1989. Alaska statewide sport fisheries harvest report, 1988. 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.
- Walker, R. J., C. Olnes, K. Sundet, A. L. Howe, and A. E. Bingham. 2003. Participation, catch, and harvest in Alaska sport fisheries during 2000. Alaska Department of Fish and Game, Fishery Data Series No. 03-05, Anchorage.