Fishery Management Report No. 04-06

Recreational Fisheries in the Lower Cook Inlet Management Area, 1995-2000

by

Nicole J. Szarzi

and

Robert N. Begich

September 2004

Alaska Department of Fish and Game **Divisions of Sport Fish and Commercial Fisheries**

Symbols and Abbreviations

The following symbols and abbreviations, and others approved for the Système International d'Unités (SI), are used without definition in the following reports by the Divisions of Sport Fish and of Commercial Fisheries: Fishery Manuscripts, Fishery Data Series Reports, Fishery Management Reports, and Special Publications. All others, including deviations from definitions listed below, are noted in the text at first mention, as well as in the titles or footnotes of tables, and in figure or figure captions.

Weights and measures (metric)

centimeter	cm
deciliter	dL
gram	g
hectare	ha
kilogram	kg
kilometer	km
liter	L
meter	m
milliliter	mL
millimeter	mm

Weights and measures (English)

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

Time and temperature

day	d
degrees Celsius	°C
degrees Fahrenheit	°F
degrees kelvin	K
hour	h
minute	min
second	s

Physics and chemistry

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

General

Alaska Department of Fish and Game	ADF&G
Alaska Administrative Code	AAC
all commonly accepted abbreviations	e.g., Mr., Mrs., AM, PM, etc.
all commonly accepted professional titles	e.g., Dr., Ph.D., R.N., etc.
at	@
compass directions:	
east	E
north	N
south	S
west	W
copyright	©
corporate suffixes:	
Company	Co.
Corporation	Corp.
Incorporated	Inc.
Limited	Ltd.
District of Columbia	D.C.
et alii (and others)	et al.
et cetera (and so forth)	etc.
exempli gratia (for example)	e.g.
Federal Information Code	FIC
id est (that is)	i.e.
latitude or longitude	lat. or long.
monetary symbols (U.S.)	$, ¢
months (tables and figures): first three letters	Jan,...,Dec
registered trademark	®
trademark	™
United States (adjective)	U.S.
United States of America (noun)	USA
U.S.C.	United States Code
U.S. state	use two-letter abbreviations (e.g., AK, WA)

Measures (fisheries)

fork length	FL
mideye-to-fork	MEF
mideye-to-tail-fork	METF
standard length	SL
total length	TL

Mathematics, statistics

all standard mathematical signs, symbols and abbreviations	
alternate hypothesis	H_A
base of natural logarithm	e
catch per unit effort	CPUE
coefficient of variation	CV
common test statistics	(F, t, χ^2, etc.)
confidence interval	CI
correlation coefficient (multiple)	R
correlation coefficient (simple)	r
covariance	cov
degree (angular)	°
degrees of freedom	df
expected value	E
greater than	>
greater than or equal to	≥
harvest per unit effort	HPUE
less than	<
less than or equal to	≤
logarithm (natural)	ln
logarithm (base 10)	log
logarithm (specify base)	$\log_2$, etc.
minute (angular)	'
not significant	NS
null hypothesis	H_O
percent	%
probability	P
probability of a type I error (rejection of the null hypothesis when true)	α
probability of a type II error (acceptance of the null hypothesis when false)	β
second (angular)	"
standard deviation	SD
standard error	SE
variance	
population	Var
sample	var

FISHERY MANAGEMENT REPORT NO. 04-06

RECREATIONAL FISHERIES IN THE LOWER COOK INLET MANAGEMENT AREA, 1995-2000

by

Nicole J. Szarzi and Robert N. Begich
Division of Sport Fish, Homer

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

September 2004

Development of this manuscript was partially financed by the Federal Aid in Sport Fish Restoration Act (16 U.S.C. 777-777-K) under Project F-10-11, Job No. F-2-6, B-2-1, R-2-5, S-2-6a, b, d, and S-2-15a, b; Project F-10-12, Job No. B-2-1, R-2-5, S-2-6a, b, d, S-2-15 a, b; Project F-10-13, Job No. F-2-6, B-2-1, S-2-6 a, b, S-2-15 a, b; Project F-10-14, F-10-15 and F-10-16, Job No. B-2-1, S-2-6a, b, S-2-15, and S-2-21.

The Division of Sport Fish 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. Since 2004, the Division of Commercial Fisheries has also used the Fishery Management Report series. Fishery Management Reports are intended for fishery and other technical professionals, as well as lay persons. Fishery Management Reports 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 regional peer review.

Nicole J. Szarzi and Robert N. Begich
Alaska Department of Fish and Game, Division of Sport Fish
3298 Douglas Place, Homer, Alaska 99603-8027, USA

This document should be cited as:
Szarzi,N J., and R.N.Begich. 2004. Recreational fisheries in the Lower Cook Inlet Management Area,1995-2000. Alaska Department of Fish and Game, Fishery Management Report No. 04-06, Anchorage.

TABLE OF CONTENTS

Page

TABLE OF CONTENTS (Continued)

TABLE OF CONTENTS (Continued)

TABLE OF CONTENTS (Continued)

LIST OF TABLES

LIST OF TABLES (Continued)

LIST OF FIGURES

Figure **Page**

LIST OF APPENDICES

SECTION I: MANAGEMENT OVERVIEW

MANAGEMENT AREA DESCRIPTION

The Kenai Peninsula Management Area (KPMA) was divided into northern and southern management areas in spring of 1997. The southern portion of the KPMA became what is now the Lower Cook Inlet Management Area (LCIMA) and is composed of all freshwater drainages of the Kenai Peninsula which flow into Cook Inlet south of the Kasilof River to Gore Point (Figure 1). For purposes of this report, Lower Cook Inlet is considered from Bluff Point and south, Central Cook inlet is north of Bluff Point to the Kasilof River, and upper Cook Inlet is north of the Kasilof River. On the west side of Cook Inlet the LCIMA area is composed of freshwater drainages which flow into Cook Inlet south of the latitude of the southern tip of Chisik Island and north of Cape Douglas. The management area includes marine waters in Cook Inlet south of a line from the Kasilof River to the southern tip of Chisik Island and north of the latitude of Cape Douglas and west from the longitude of Gore Point. The LCIMA is administered from the Homer office of the Department of Fish and Game. Nicky Szarzi, the LCI Area Manager for Sport Fish Division, has been stationed in Homer since May 1997.

Public land managers in the LCIMA include the United States Fish and Wildlife Service (Kenai National Wildlife Refuge, Alaska Maritime National Wildlife Refuge), the Alaska Department of Natural Resources and the Kenai Peninsula Borough. The community of Homer also manages lands under its jurisdiction through zoning. The Cook Inlet Regional and Chugach Native corporations manage lands granted them under the Alaska Native Claims Settlement Act. Land is also in private ownership particularly near the major population centers and along major road systems.

Larger communities located within the LCIMA include Homer, Anchor Point, Ninilchik, Seldovia, Nanwalek and Port Graham. The management area is linked to the state's highway system via the Sterling Highway, which provides sport anglers access to many of the area's major fisheries. Remote areas of the LCIMA on the south side of Kachemak Bay and west side of Cook Inlet are accessed via aircraft or boat.

Regulations governing sport fisheries in these areas are found in the following three regulatory summaries: the Kenai Peninsula Area, the Cook Inlet-Resurrection Bay Saltwater Area, and the Susitna-West Cook Inlet Area. The codified regulations for these regulatory areas are found in Chapters 56, 58 and 61, respectively, of the Alaska Administrative Code.

The LCIMA includes portions of two areas for the purposes of participation and harvest reporting in the mail survey of Mills (1979-1994), Howe et al. (1995, 1996, 2001a-d) and Walker et al. (2003). These are: (1) the Kenai Peninsula (Area P) less the marine and freshwater fisheries south of the latitude of Kasilof River and east of the longitude of Gore Point, and (2) that portion of the West Cook Inlet-West Susitna River Drainages Area (Area N) including all freshwater drainages which flow into Cook Inlet between Cape Douglas and the southern tip of Chisik Island.

Management and research functions for the LCIMA recreational and personal use fisheries are the responsibility of the Homer area office of the Alaska Department of Fish and Game (ADF&G), Division of Sport Fish. The Division of Sport Fish staff stationed at Homer is composed of one area biologist (Nicky Szarzi), an assistant area biologist (Robert Begich) and the regional groundfish research

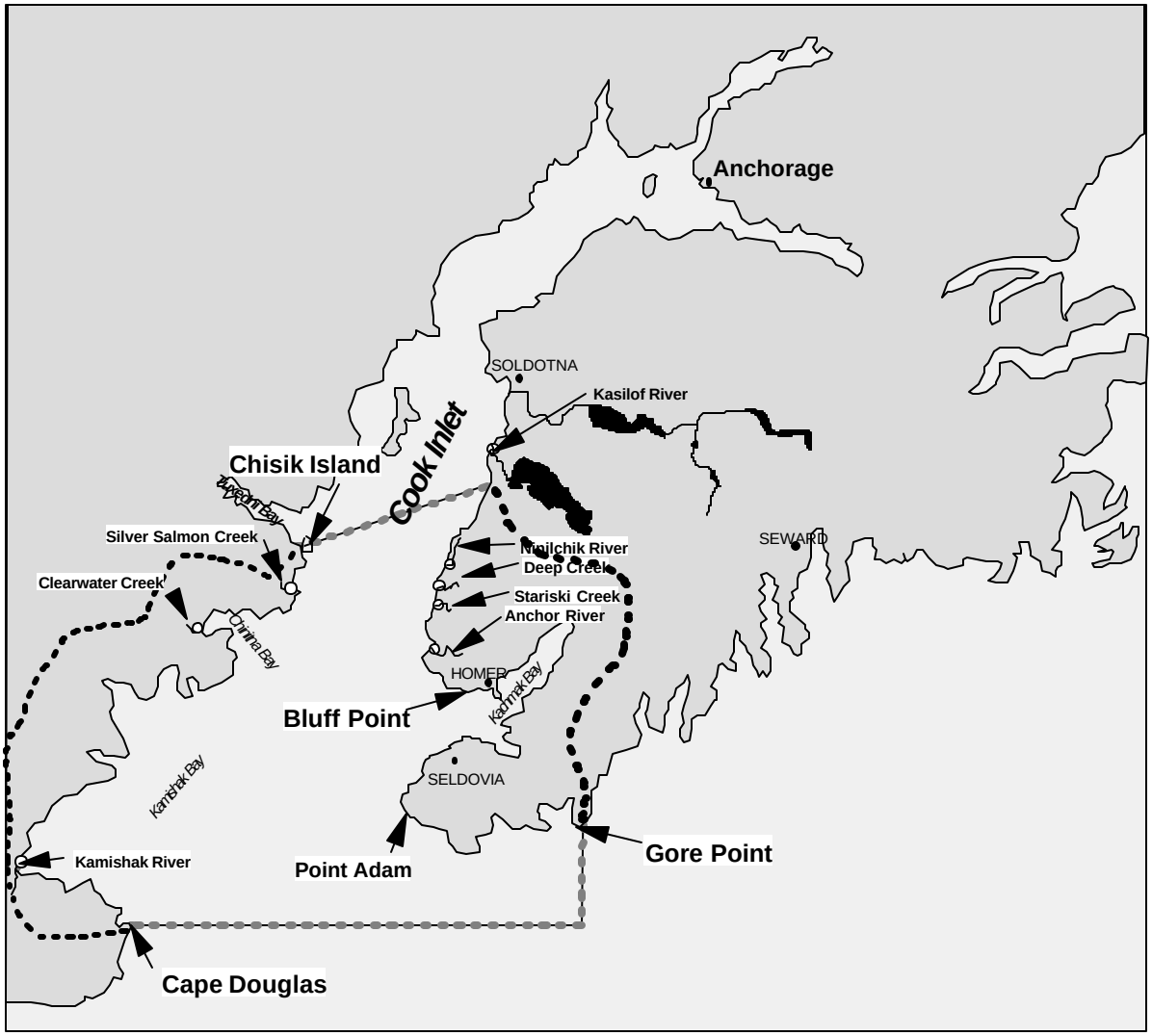


Figure 1.-The Lower Cook Inlet Management Area includes Cook Inlet south of a line from the Kasilof River to the southern tip of Chisik Island, and north of the latitude of Cape Douglas and west of the longitude of Gore Point and all fresh waters flowing into these salt waters, not including the Kasilof River.

and management biologist (Scott Meyer). Two seasonal fisheries biologists and approximately 15 seasonal fishery technicians whose employment ranges from two to 11 months assist these staff. A program technician (Marnee Beverage) and one seasonal clerk (Carolyn Bunker) support the Homer staff.

FISHERIES RESOURCES

The LCIMA offers diverse fishing opportunities for recreational and personal use anglers. Anglers can target five species of North Pacific salmon (pink *Oncorhynchus gorbuscha*, coho *O. kisutch*, sockeye *O. nerka*, chum *O. keta*, and chinook *O. tshawytscha*). Fisheries for these species occur in fresh and salt water. The major salmon fisheries harvest chinook and coho salmon nearshore in Central Cook

Inlet and the adjacent freshwater tributaries. In Kachemak Bay, the Homer Spit Enhancement Lagoon is the focal point of salmon anglers. A popular fishery occurs on the area's anadromous and resident stocks of Dolly Varden *Salvelinus malma*. Steelhead/rainbow trout *O. mykiss* also support popular catch-and-release sport fisheries. Homer has the largest annual landing of sport-caught halibut *Hippoglossus stenolepis* in Alaska.

The state's largest recreational razor clam *Siliqua patula* fisheries occur on the beaches of the central Kenai Peninsula. The fisheries occur along a 50-mile area of beach between the Kasilof and Anchor rivers on the east side of Cook Inlet. The largest hardshell clam fishery (little neck clams *Protothaca staminea* and butter clams *Saxidomus giganteus*) in Southcentral Alaska occurs in Kachemak Bay. A Tanner crab *Chionoecetes bairdi* fishery is also prosecuted in Kachemak Bay.

A small but growing fishery for coho salmon occurs on the west side of Cook Inlet. Western Cook Inlet also hosts small fisheries for chum salmon, halibut, razor clams and several species of hardshell clams. A fishery for Tanner crab occurs in several bays on the west side of Cook Inlet.

Fisheries of lower Cook Inlet provide recreation for local residents, Alaska residents and a growing number of nonresidents. Fishing-directed tourism is a major segment of the economic base of the lower Cook Inlet area. Management of these fisheries has become increasingly complex as additional demands are placed on the resource by a growing population base and tourism industry. Social issues are becoming as prevalent as biological issues.

ALASKA BOARD OF FISHERIES PROCESS

Development of fishing regulations for the LCIMA occurs within the established Alaska Board of Fisheries process. Public input concerning regulation changes and allocation issues is provided through direct testimony to the Board of Fisheries (BOF) and through participation in local Fish and Game advisory committees. Advisory committees have been established throughout Alaska to assist the Boards of Fisheries and Game in evaluating fisheries and wildlife issues and proposed regulatory changes. Most active committees meet at least once each year, usually in the fall prior to the Board meetings. Staffs from the Division of Sport Fish and other divisions often attend committee meetings. This allows for interaction between the public and Departmental staff involved with resource issues of local concern. Within the LCIMA there are three advisory committees: Central Peninsula (meetings occur in Ninilchik), Homer and Seldovia. The area management biologist serves as advisor regarding biological issues to these advisory committees.

The BOF addresses LCIMA fisheries on a 3-year cycle. Finfish proposals regarding fisheries south of Anchor Point were addressed in 1995 and 1998 and again in November 2001. Proposals regarding finfish issues north of Anchor Point and in West Cook Inlet were addressed in 1996 and 1999 and in February 2002. King and Tanner crab proposals were addressed in 1996 and 1999 and March of 2002. Dungeness crab *Cancer magister*, shrimp and miscellaneous shellfish fisheries proposals were addressed in 1997 and 2000 and will be addressed next in 2003.

MANAGEMENT PLANS AFFECTING FISHERIES

The BOF has established management plans and policies to regulate and allocate the area's fisheries resources. These plans ensure the sustained yield of fishery resources and establish allocation, management actions (in specific situations) and guidelines for the department’s fisheries managers.

Management plans germane to LCIMA fisheries are:

1. Kenai River Late-Run King Salmon Management Plan (5 AAC 21.359).

   This plan establishes escapement objectives and management actions for Kenai River late-run chinook salmon and stipulates closure of the Central Cook Inlet marine salmon fishery if late-run Kenai River escapement objectives are not met. The Board adopted the plan in 1989.

2. Upper Cook Inlet Marine Early-Run King Salmon Management Plan (5 AAC 58.055).

   This management plan creates a special harvest area from Bluff Point north to Ninilchik extending 1 mile seaward from the beach. Within this special harvest area guides cannot fish while guiding clients from April 1 through June 30. When an angler removes a chinook salmon from the water within this area between April 1 and June 30, the angler may no longer fish for any species of fish within the special harvest area for the remainder of that day. Conservation zones are located within this special harvest area that are closed to fishing for all species from April 1 through June 30. These zones extend 1 mile seaward and encompass the area from the mouth of the Ninilchik River to 2 miles south of Deep Creek, 1 mile on either side of Stariski Creek and 2 miles on either side of the mouth of the Anchor River. A harvest guideline of 8,000 chinook salmon governs the fishery from April 1 to June 30. If this guideline is exceeded the plan calls for unspecified restrictions of the fishery prior to the following season to ensure compliance with the guideline harvest level. This plan was adopted in 1996.

3. Criteria For Establishing Special Management Areas for Trout (5 AAC 75.013).

   The Cook Inlet and Copper River Basin rainbow/steelhead trout management policy was adopted in 1986 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 codified in 5 AAC 75.013, and (3) recommended research objectives. This Policy was adopted by the BOF in October 1998 and became effective in the spring of 1999. A similar systematic approach for developing sport fishing regulations for Dolly Varden on the Kenai Peninsula is codified in 5 AAC 56.014.

4. Southern District Hardshell Clam Fishery Management Plan (5 AAC 38.318).

   This management plan, adopted in the spring of 1997, establishes harvest guidelines for the noncommercial and commercial fisheries of 160,000 and 40,000 pounds, respectively. The commercial harvest guideline is divided into quarterly allocations. The commercial fishery is prosecuted among five subdistricts on the south side of Kachemak Bay on alternate years. Weekend harvest is closed from May 15 through September 15 to reduce conflict with noncommercial fisheries.

5. Cook Inlet Area Dungeness Crab Fisheries Management Plan (5 AAC 32.146).

   This management plan, adopted in the spring of 1997, closed commercial, sport and personal use fisheries on Dungeness crab in Cook Inlet until stocks recovered and harvest thresholds were established.

6. Cook Inlet Area Shrimp Fisheries Management Plan (5 AAC 31.390).

   This management plan, adopted in spring of 1997, closed commercial, sport and personal use fisheries on shrimp until stocks recovered and harvest thresholds were established.

7. Tanner Crab Harvest Strategy (5 AAC 35.080).

   The "Policy on King and Tanner Crab Resource Management," published in 1990, was adopted as regulation that same year. It directs the department to establish a threshold population level where harvest may occur and a harvest strategy for different levels of abundance above the threshold.

8. Tanner Crab Management Plan for Area H (5 AAC 38.408).

   This management plan was established by the BOF during the March 2002 meeting. It establishes harvest guidelines for the commercial and noncommercial fisheries for Tanner crab at different abundance levels in the Kachemak Bay area.

OTHER USER GROUPS AFFECTING FISHERIES

Fisheries resources of the LCIMA also support commercial, personal use and scientific/educational fisheries. The primary species targeted in the commercial fishery is pink salmon.

In 1992, the BOF designated Cook Inlet as a "nonsubsistence area." An exception was provided for subsistence fisheries to occur in the vicinity of the villages of Port Graham and English Bay in Kachemak Bay. In 1995, the Board also provided for a subsistence fishery for the village of Seldovia in Kachemak Bay. These are relatively small fisheries and resource allocation between subsistence and other resource users is not a major issue except in Seldovia Bay where an enhanced return of chinook salmon is intercepted by the subsistence fishery.

During 2000 and 2001, the entire Kenai Peninsula was designated "rural" by the Federal Subsistence Board. This would have made all Kenai Peninsula residents eligible to participate in federally-designated subsistence fisheries on and adjacent to federal lands. That decision was rescinded in June of 2001.

A scientific/educational permit has been issued to the Ninilchik Traditional Council each year since 1993. The area open is in Cook Inlet from the Ninilchik Boat Harbor north for 1 mile. The harvest quota has been 2,000 total salmon. There have been no allocative issues amongst user groups associated with this fishery. In 1998, a group of Ninilchik residents formerly associated with the Traditional Council applied for a separate educational permit for the area. Due to the overlap in the constituency of the two groups in previous years and the area that each wished to fish, each permitee was given a harvest quota of 1,000 salmon. The fishery was closed for a short period in 1998 during its regularly scheduled period in response to concerns for the late run of chinook salmon to the Kenai River, otherwise it has been prosecuted as permitted.

MAJOR ONGOING RESEARCH ACTIVITIES

Research programs within the LCIMA during the period covered by this report include:

1. An onsite coded wire tag recovery program, designed to estimate the relative contribution of tagged stocks to the marine fishery, occurs at the Homer Harbor, Anchor Point and Deep Creek. The

program is designed to provide information necessary to responsibly manage the mixed stock chinook salmon sport fishery that occurs in Central, and to a lesser extent, Lower Cook Inlet.

2. A weir is located in Deep Creek to enumerate the escapement of coho salmon and will be operated each year through 2003. A graduate student began to study efficiency of traps for capturing coho salmon smolt in spring of 2001; the trap study will continue through 2002. In addition, recovery and enumeration at the weir of returning coho salmon adults that were tagged as smolt augments a marine coded wire tag recovery program for coho and provides estimates of marine survival.

3. A chinook salmon stocking program in the Ninilchik River provides brood stock for area enhancement projects in the Ninilchik River, Homer Spit Fishing Lagoon, Halibut Cove Lagoon and Seldovia Bay. During 1999 through 2001 and possibly in 2002, the Ninilchik River weir will enumerate the entire wild and hatchery chinook salmon escapement to that river as well as provide a mechanism to collect eggs for future stocking projects. The contribution of hatchery-reared chinook salmon to the fishery was estimated in 2000 and 2001.

4. Razor clam population monitoring is being conducted on a limited basis on eastside Cook Inlet beaches south of the Kasilof River. Sampling is rotated among major beaches to assess the abundance of clams with the goal of modeling population parameters by age class. The distribution of diggers and harvest is estimated as well as the age and length composition of the harvest.

5. Area Sport Fish Division (SFD) staff are working with the Division of Commercial Fisheries (CFD) to increase sampling effort of ongoing hardshell clam research in Kachemak Bay. The program expanded to selected sport-harvested beaches in Kachemak Bay in 1999. Experimentation with alternative survey methods to estimate abundance of hardshell clams and other population parameters continues.

6. During 1998, SFD sampled additional deep water sites in Kachemak Bay to compliment the shallow water Dungeness crab monitoring program conducted by CFD, which indexes crab abundance.

7. A program to assess the harvest and escapement of coho salmon in selected west Cook Inlet tributaries was initiated in 1999. This program consists of a combination of aerial and ground escapement surveys and angler contacts.

MAJOR ISSUES

The major biological and social issues associated with LCIMA recreational, commercial and personal use fisheries are summarized below.

1. Lower Kenai Peninsula Freshwater Chinook Fisheries: Aerial escapement indices of early-run chinook salmon stocks in Deep Creek and the Anchor River were below average prior to 1996. Restrictions in both fresh- and saltwater fisheries have restored escapements to within the targeted range in Deep Creek, but escapements to the Anchor River are still below the acceptable range.

   Aerial surveys remain the management tool for the Anchor River and Deep Creek. Aerial counts are not estimates of total escapement but merely inexact indices of relative abundance. The relationship between aerial counts, total escapement and sustainable yield is not understood. Chinook salmon counts through weirs placed in Deep Creek and the Ninilchik River are

considerably higher than aerial index counts. Total enumeration of chinook salmon escapement through the Deep Creek weir hasn't occurred because high water inhibits timely weir installation.

Escapement to the Ninilchik River is difficult to assess because of poor water clarity. Aerial surveys have been variable and mostly below the minimum acceptable level for the Ninilchik River. The presence of hatchery-produced chinook salmon in the Ninilchik River confounds estimation of sustainable wild harvests there. Aerial surveys have been replaced by a weir as an assessment tool in the Ninilchik River. Escapement through the Ninilchik River weir during a limited period in July provides an index of total escapement.

2. Marine Chinook Salmon Fishery: The fishery for chinook salmon in the marine waters of Cook Inlet adjacent to the lower Kenai Peninsula beaches of Deep Creek, Whiskey Gulch and Anchor River was the most rapidly expanding fishery in the LCIMA in the early 1990s, but harvest has since stabilized. Both early- and late-run chinook salmon stocks returning to various Cook Inlet streams, as well as stocks of non-Cook Inlet origin are harvested. Rapid growth of this fishery, coupled with the uncertainty regarding stock-specific harvests on early-run chinook salmon stocks was a primary concern of the department prior to implementation of the Cook Inlet Marine Early Run King Salmon Management Plan in 1996.

   Currently, issues concerning the marine interception of chinook salmon bound for lower Peninsula streams are allocative in nature. Marine users want to share the burden of conservation with inriver users of lower Peninsula stocks. Stock separation studies to identify the stream of origin of chinook salmon harvested in the marine mixed-stock fishery were begun in 1997. Preliminary estimates indicate that 4% to 6% of the chinook salmon harvest from the marine fishery originates from Deep Creek and less than 1% of the harvest originates from the Ninilchik River. The contribution of chinook salmon from the Anchor River is likely to be of a similar small magnitude. These studies indicate that the current magnitude of interception of lower Kenai Peninsula stocks will not negatively impact the reproductive potential of those stocks.

   Allocative issues focus on the early and late Kenai River chinook salmon returns as well. Some sport and commercial fishermen believe that excessive numbers of chinook salmon of Kenai River origin are being harvested in this fishery. Tagging chinook salmon smolt in the Kenai River has not produced enough information to substantiate or dispel this assumption.

   An increasing proportion of harvested chinook salmon originate outside of Cook Inlet. While the total harvest of this component is small relative to other locations, endangered species concerns and international issues are involved. Further expansion of this fishery will increase the probability that restrictions based on established management plans will be placed on commercial and sport fisheries to the north for resource conservation.

3. Kachemak Bay Winter Chinook Salmon Fishery: This fishery began in the 1960s and harvests sexually immature chinook salmon. The fishery occurs in Kachemak Bay and is concentrated in the waters south of Bluff Point. In recent years participation in this fishery has been increasing. Although immature chinook salmon are caught throughout the year, angler participation has increased during the winter months when opportunities to participate in other fisheries are minimal.

Over the years, numerous tagged fish harvested in this fishery have been reported to the department. Of this total, the majority originated in British Columbia hatcheries. Cook Inlet chinook salmon are not thought to be harvested in this fishery because no tagged chinook of Cook Inlet origin have been recovered.

The department has virtually no data regarding this fishery, including harvest and participation estimates. The fishery does not pose a known biological concern. However, expansion of the fishery may have allocative implications in that the harvest (excepting the small proportion of tagged fish recovered from the fishery) can not be apportioned by stream of origin.

4. Shrimp: Shrimp stocks in Lower Cook Inlet are currently at low abundance levels. No sport, commercial or personal use harvest of shrimp is currently permitted. While overfishing likely occurred during earlier years, recent analyses of historical trawl survey data from the northern Gulf of Alaska indicate an ecological regime shift occurred in the early 1980s causing a decline in small forage species, such as shrimp, and an increase in large predator species such as Pacific cod *Gadus macrocephalus* and pollock *Theragra chalcogramma*. A relatively large quantity of shrimp was captured in eight out of 27 survey stations during CF surveys in 2000 raising hopes that recovery of the stock is starting. Stock recovery is projected to take many years; a fishery will not occur in the foreseeable future.

5. King Crab: King crab stocks in lower Cook Inlet are currently at low abundance levels. Overfishing combined with environmental changes and shifts in species composition towards large predator species are the likely cause of low numbers of crab. Juvenile Pacific cod and pollock feed on larval fish and invertebrates. No sport, commercial or personal use harvest of this species is currently permitted. Recovery of this stock is projected to take many years; a fishery will not occur in the foreseeable future.

6. Dungeness Crab: This species is at low levels of abundance in lower Cook Inlet. No sport, commercial or personal use harvest of this species is currently permitted. The commercial fishery was closed in 1991. The recreational fishery was closed during 1998. The outlook for recovery of this population is not good; department indices of Dungeness crab abundance have not increased despite conservation measures.

7. Tanner Crab: Tanner crab are also at low levels of abundance in lower Cook Inlet. A commercial fishery has not been prosecuted since 1994. The recreational Tanner crab fishery remains open but was restricted beginning in 2001 based on recent CFD trawl survey data.

8. Hardshell Clams in Kachemak Bay: Quantitative data regarding this resource are minimal. Some commercial and noncommercial users report depletion of hardshell clams in localized areas. This issue is being addressed through conservative regulation of the commercial fishery and monitoring of resource abundance.

9. Stocking of Anadromous Species in Open Systems: Stocking of anadromous species (primarily salmon) in open systems (in salt water or drainages which ultimately enter salt water) in the LCIMA has occurred for a number of years. Examples of open system stocking in the LCIMA include stocking salmon in the Ninilchik River, the Homer Spit, Halibut Cove Lagoon and Seldovia Harbor. Staff and public are concerned that in some situations there has been an insufficient assessment of

risks associated with stocking in open systems prior to implementing the stocking program. Risks to be assessed include, but are not limited to, the effect on wild anadromous fish (if present) at the origin of the release, and the potential straying and effect of that straying on other wild stocks originating in streams in close proximity to the stocked release site.

10. Anadromous Stocking Evaluation: Post-stocking evaluation of anadromous releases in open systems is inadequate and evaluation programs should be conducted for all stocking programs. These evaluations would address the cost/benefit ratio, the effect of stocking on other species present at the stocking location, the contribution of the stocked fish to intercepting fisheries, the ability of the user groups to use all returning stocked fish and the possibility of excessively harvesting non-targeted wild fish in an effort to maximize benefit (harvest) from the stocking program.

11. Regulatory Complexity: A general concern of the angling public is that sport fishing regulations on the Kenai Peninsula are too complex for the average angler to readily comprehend. The complexity of these regulations is attributed to the efforts of the BOF to provide a regulatory structure for the LCIMA's fisheries to maximize opportunity while addressing the complex resource allocative issues associated with the area's salmon and trout resources.

12. Enforcement of Sport Fishing Regulations: Enforcement of sport fishing regulations is primarily the responsibility of the Fish and Wildlife Protection Division of the Department of Public Safety. The Division of Parks of the Department of Natural Resources and Sport Fish Division staff of the Department of Fish and Game also enforce regulations. Federal agencies may enforce state regulations on federal lands. However, especially during the peak of the fishing season, these enforcement efforts are generally viewed by the agencies involved and the public as being inadequate given the number of violations that are reported to occur. Inadequate enforcement of fishery regulations erodes the public's confidence in the department's ability to adequately manage and protect the fishery resources of the LCIMA.

13. Increasing Guided Angler Harvest and Participation: Guided angler harvest and participation are increasing in LCIMA's sport fisheries. Fisheries affected include the marine chinook salmon fishery and halibut fishery. The guided angler tends is more effective due to the knowledge and equipment of the guide/charter operator, resulting in the guided angler taking an increasingly larger proportion of the harvestable surplus. This allocative issue is of concern to both guided and nonguided anglers in the LCIMA.

14. Allocation of Pacific Halibut Between Chartered Sport Anglers and Commercial Users: Allocation of the halibut resource is a concern to both commercial and noncommercial user groups in the LCIMA. The majority of Pacific halibut in the LCIMA is harvested by commercial users. The harvest by sport charter operators has increased in recent years. The North Pacific Fishery Management Council established an individual fishing quota (IFQ) program for sport charter operators to “cap” the harvest and maintain the present proportionate distribution of the harvest between the commercial industry and sport fishing guide industry. The IFQ program has not yet been implemented.

15. Logging: Extensive logging is occurring in the watersheds of anadromous streams of the LCIMA in conjunction with the spruce bark beetle infestation occurring on the Kenai Peninsula. A University-

level graduate research project conducted in control and pre- and post-logging areas adjacent to Stariski Creek and Deep Creek did not find effects on gravel size or dispersion attributable in these two streams from adjacent logging. Logging road degradation was observed which has threatened stream habitat in non-study areas. Many other riparian zone morphologies exist in the LCIMA where the effects of logging and its associated infrastructure on stream and marine habitats have not been tested. Secondary effects of logging have increased development in areas where logging roads have provided access.

16. Development: Population growth and expansion of developed areas is accelerating in the LCIMA. Of particular concern are impacts to anadromous fish streams. These include destruction of riparian and wetland areas, turbid runoff from developed areas, alteration of groundwater flow and an increase in illegal fishing activities.

RECREATIONAL ANGLER EFFORT

Since 1977, recreational angler effort in the LCIMA has been estimated using the Statewide Harvest Survey (SWHS) (Mills 1979-1994; Howe et al. 1995, 1996, 2001a-d; Walker et al. 2003). The SWHS is a mail survey that estimates participation in sport fishing and the harvest of sport fish species. The survey provides estimates of participation measured in angler-days and the number of fish harvested by location. Unfortunately, it is not designed to provide estimates of participation directed towards a single species.

Beginning in 1990, the survey was modified to include estimations of catch (release plus harvest) by location. Harvest and catch are estimated for individual species. Additionally, creel surveys have been selectively used for fisheries that require more detailed information or inseason management and to validate the mail survey for fisheries of interest. The following summary of recreational angler effort in the LCIMA is based on estimates produced from the mail survey (Mills 1979-1994; Howe et al. 1995, 1996, 2001a-d; Walker et al. 2003).

Access to salt water and popular salmon streams, combined with close proximity to major population centers, attracts large numbers of anglers to the central and lower Kenai Peninsula. As a result, the LCIMA supports the third highest level of angler participation in Alaska. From 1977 through 2000, the LCIMA has accounted for an average of 13% of the total statewide recreational angling participation. During 2000, participation approximated 311,000 angler-days in LCIMA waters (Table 1).

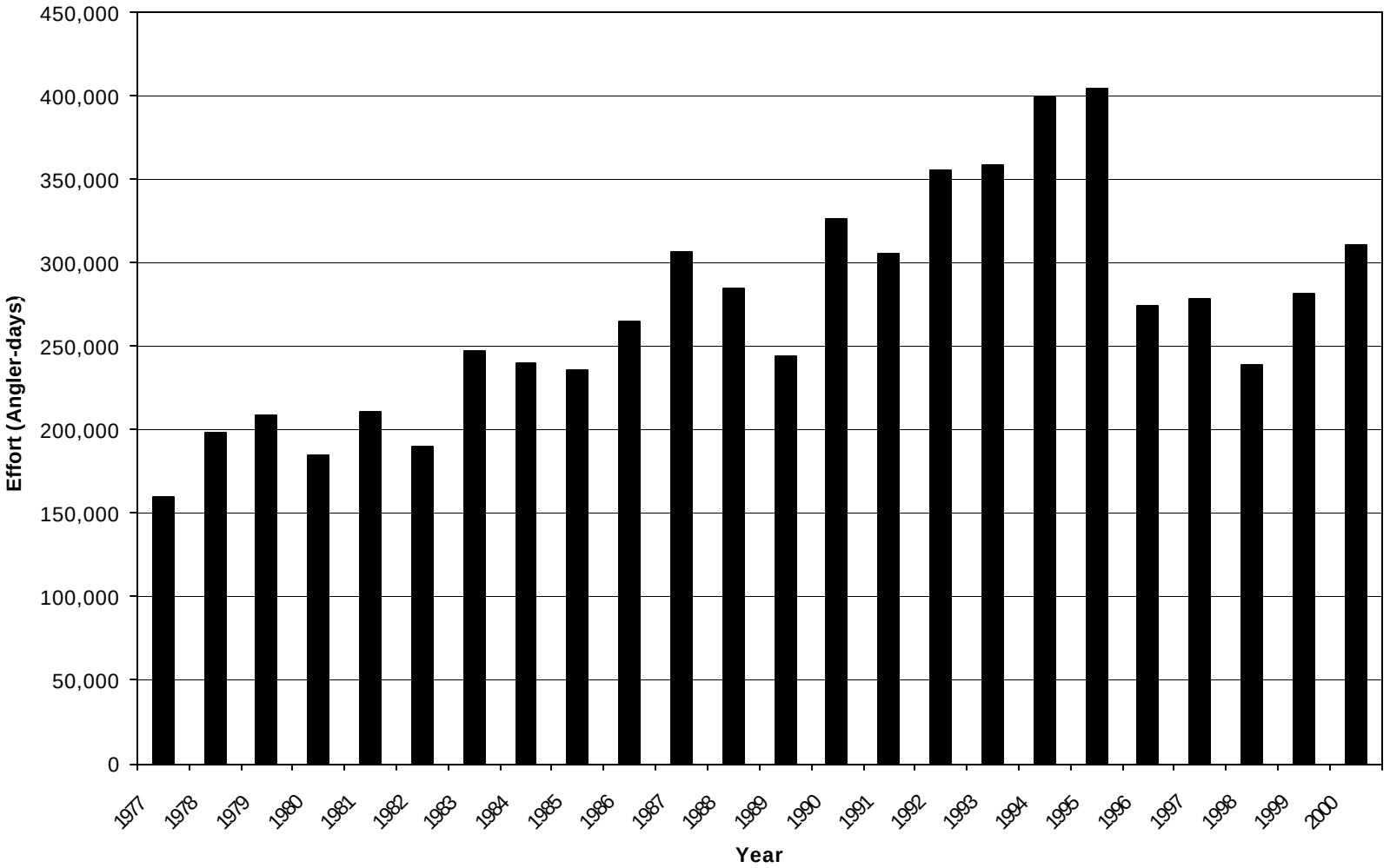
During the 1980s recreational angling effort averaged 255,000 angler-days. Effort increased to an average of about 321,000 angler-days during the 1990s (Figure 2) with a peak of 404,000 angler-days in 1995 (Table 1). Except in 2000, angling effort since 1996 has stabilized closer to the average for the 1980s. This stabilization is attributed to full utilization of the popular freshwater salmon fisheries in the Ninilchik and Anchor rivers and Deep Creek, closure of Dungeness crab and shrimp fisheries, increased opportunities for saltwater fishing in other locations such as Seward and a decline statewide in sport fishing effort. The increase in 2000 may be attributable to the halibut fishery.

The Ninilchik River, Anchor River and Deep Creek support the largest freshwater fisheries in the area. Angling effort here is directed towards salmon, Dolly Varden and steelhead trout. The salt

Table 1.-Angler-days of effort expended by recreational anglers fishing Lower Cook Inlet Management Area waters, 1977-2000.

	West Cook Inlet		Central Cook Inlet (N. of Bluff Point)			Lower Cook Inlet (S. of Bluff Point)			Management	Percent	
Year	Salt Water	Fresh Water	Saltwater Finfish	Saltwater Shellfish	Freshwater Finfish	Saltwater Finfish	Saltwater Shellfish	Freshwater Finfish	Area Total	of State	Alaska Total
1977			57,611		55,706	46,827			160,144	13.4	1,198,486
1978			64,429		74,378	59,128			197,935	15.4	1,286,063
1979	880		65,677		77,027	64,656			208,240	15.3	1,364,739
1980	928		63,481		63,273	57,078			184,760	12.4	1,488,962
1981	972		25,538	31,298	59,648	67,894	25,391		210,741	14.8	1,420,772
1982	1,501		29,718	31,954	49,687	61,315	15,712		189,887	11.7	1,623,090
1983	707	1,739	45,337	31,470	52,721	91,229	20,334	3,844	247,381	14.3	1,732,528
1984	1,673	652	53,955	30,013	53,320	72,441	25,162	2,243	239,459	12.8	1,866,837
1985	1,942	970	55,435	32,652	63,464	63,272	16,732	1,024	235,491	12.1	1,943,069
1986	2,562	399	66,377	33,486	63,132	74,781	21,755	2,231	264,723	12.8	2,071,412
1987	810	903	80,565	25,427	71,191	104,602	20,710	2,569	306,777	14.2	2,152,886
1988	3,989	782	54,799	30,998	50,260	127,748	13,306	2,339	284,221	12.3	2,311,291
1989	2,136	1,474	62,503	22,693	44,583	98,922	9,594	2,180	244,085	10.8	2,264,079
1990	2,406	1,140	82,881	29,427	61,718	133,938	10,342	4,068	325,920	13.3	2,453,284
1991	2,287	1,187	83,988	32,012	60,052	118,015	6,690	1,613	305,844	12.5	2,456,328
1992	2,526	989	93,175	44,537	67,710	127,971	15,727	2,575	355,210	14.0	2,540,374
1993	3,064	2,534	85,460	40,376	70,330	140,302	13,753	2,155	357,974	14.0	2,559,408
1994	4,151	900	111,560	48,546	70,085	143,033	18,187	3,071	399,533	14.7	2,719,911
1995	4,254	2,239	121,936	42,220	55,785	156,222	17,682	3,717	404,055	14.5	2,787,670
1996	2,753	1,865	73,229	29,943	37,797	116,089	11,584	802	274,062	13.7	2,006,528
1997	2,819	1,551	81,602	28,343	38,435	114,998	9,263	1,003	278,014	13.4	2,079,514
1998	2,403	937	68,965	26,636	35,766	99,481	3,926	752	238,866	12.9	1,856,976
1999	2,336	1,887	75,709	36,278	48,263	107,623	9,149	695	281,940	11.3	2,499,152
2000	3,344	1,414	84,602	37,755	48,895	122,613	11,445	1,097	311,165	11.8	2,627,805
Avg. 1977-2000	2,293	1,309	70,356	33,303	57,218	98,757	14,822	2,110	271,101	13.3	2,029,711
Avg. 1981-1990	1,870	1,007	55,711	29,942	56,972	89,614	17,904	2,562	254,869	12.9	1,983,925
Avg. 1991-2000	2,994	1,550	88,023	36,665	53,312	124,635	11,741	1,748	320,666	13.3	2,413,367

Source: Statewide Harvest Survey (Mills 1979-1994; Howe et al. 1995, 1996, 2001a-d; Walker et al. 2003).



Source: SWHS, Mills 1979-1994; Howe et al 1995, 1996, 2001a-d; Walker et al. 2003.

Figure 2.-Angler-days of sport fishing effort expended by recreational anglers fishing Lower Cook Inlet Management Area waters, 1977-2000.

waters of the central and southern Kenai Peninsula account for about 83% of the total recreational effort expended in the LCIMA during the past 5 years or about 223,000 angler-days annually. A large percentage of this effort is directed towards halibut and chinook salmon. The halibut fishery occurs from Deep Creek south to the outer Gulf coast. The chinook salmon fishery occurs from Deep Creek south to Bluff Point and to a lesser degree in Kachemak Bay and the outer Gulf Coast.

Shellfish, notably razor clams, are harvested along the eastern beaches of the Kenai Peninsula. Since 1981, saltwater fisheries for shellfish have accounted for an average of about 48,000 angler-days (Table 1). During the 1980s, shellfish harvesters accounted for about 19% of the total recreational effort expended in the area. During the 1990s, 15% of the effort was by shellfish harvesters.

RECREATIONAL HARVEST

More halibut are harvested than any other fish species in the LCIMA. An average of 171,000 halibut have been caught in the area per year since 1991 (Table 2). Chinook salmon predominate in the harvest of Pacific salmon species. The yearly average chinook salmon harvest was 21,800 during the 1990s (Table 3). Nearly 75% were harvested in marine waters of which 25% were taken at locations where chinook salmon are stocked. Approximately 28% were harvested in the Anchor River, Deep Creek and the Ninilchik River.

Coho salmon are commonly taken in LCIMA waters; the average annual harvest during the last decade was nearly 19,500 (Table 4). Thirty-six percent of the harvest in the past decade came from salt waters not including the shoreline of the Homer Spit; 30% from the Anchor and Ninilchik rivers and Deep and Stariski creeks; and 28% of the harvest was taken by shore anglers fishing along the Homer Spit.

Dolly Varden are common throughout the area. Approximately 4,000 were taken each year throughout the last decade (Table 5). More than half were taken in the streams along the highway system; 33% were taken in the salt waters in Kachemak Bay. Other finfish species harvested in smaller numbers in the LCIMA include rockfish Sebastes sp., lingcod *Ophiodon elongates*, smelt Osmeridae, pink and chum salmon, rainbow/steelhead trout, lake trout *Salvelinus namaycush* and kokanee *0. nerka.*

Nearly a million razor clams were taken annually during the 1990s from the beaches between Anchor Point and the Kasilof River (Table 6). A variety of shellfish species has been harvested south of Bluff Point. Currently, the harvest is dominated by hardshell clams and Tanner crab (Table 7). An average of approximately 13,000 gallons of hardshell clams were harvested along the shoreline south of Bluff Point during the 1990s. An average of 10,200 Tanner crab has been taken annually during the past decade. Previously popular fisheries for king and Dungeness crab as well as shrimp are now closed because abundance of these species is too low to support harvests.

Table 2.-Historical recreational harvest of Pacific halibut in Cook Inlet waters, 1977-2000.

Year	Lower Cook Inlet [a]	Central Cook Inlet [b]	West Cook Inlet[c]	Total Cook Inlet	Southcentral Total	Statewide Total
1977	9,416	4,050		13,466	17,412	23,244
1978	20,756	4,821		25,577	30,954	37,085
1979	20,479	6,518		26,997	34,603	47,705
1980	21,808	8,177		29,985	39,796	64,658
1981	29,294	9,427		38,721	52,370	74,212
1982	28,851	10,681		39,532	55,198	92,358
1983	36,623	23,503		60,126	75,047	117,042
1984	37,747	23,455		61,202	78,045	124,950
1985	41,450	21,198	510	63,158	81,458	127,634
1986	44,250	39,831	1,072	85,153	115,857	160,885
1987	45,707	31,855	869	78,431	101,446	145,829
1988	93,878	42,182	1,192	137,252	168,526	225,106
1989	76,606	49,087	1,224	126,917	154,712	229,016
1990	93,941	52,912	1,685	148,538	180,568	247,202
1991	89,998	57,072	1,576	148,646	192,485	266,523
1992	81,451	60,659	984	143,094	193,049	264,943
1993	94,641	65,256	2,507	162,404	225,314	313,147
1994	88,329	79,747	2,725	170,801	236,609	329,046
1995	85,311	79,607	3,236	168,154	233,389	325,188
1996	105,235	80,118	2,422	187,775	251,746	350,220
1997	103,639	87,119	3,158	193,916	270,775	380,256
1998	93,103	83,263	3,003	179,369	247,316	350,464
1999	85,493	67,592	2,422	155,507	231,695	332,657
2000	105,947	92,396	3,384	201,727	286,323	403,280
1977-2000 Average	63,915	45,022	1,998	110,269	148,112	201,277
1991-2000 Average	93,315	75,283	2,542	171,139	236,870	331,572

Source: Statewide Harvest Survey (Mills 1979-1994; Howe et al. 1995, 1996, 2001a-d; Walker et al. 2003).

[a] Cook Inlet salt waters east of the center of Cook Inlet, south of Anchor Point including Kachemak Bay and Gulf Coast waters west of Gore Point.

[b] Cook Inlet salt waters east of the center of Cook Inlet and north of Anchor Point.

[c] Cook Inlet salt waters west of the center of Cook Inlet and from the Susitna River south to Cape Douglas.

Table 3.-Chinook salmon harvests in Lower Cook Inlet Management Area waters, 1977-2000.

	South of Bluff Point			North of Bluff Point			
Year	Saltwater Stocked Locations	Saltwater Other Locations	Total	Salt Water	Fresh Water	Total	Area Total
1977		970	970	4,470	2,670	7,140	8,110
1978		816	816	4,800	4,358	9,158	9,974
1979		1,034	1,034	4,070	4,109	8,179	9,213
1980		431	431	1,636	1,510	3,146	3,577
1981		1,145	1,145	2,711	3,196	5,907	7,052
1982		1,963	1,963	3,836	2,749	6,585	8,548
1983		2,664	2,664	2,832	3,294	6,126	8,790
1984	537	1,559	2,096	4,613	2,407	7,020	9,116
1985		883	883	6,256	1,904	8,160	9,043
1986	368	439	807	4,174	2,462	6,636	7,443
1987	1,738	452	2,190	5,125	2,489	7,614	9,804
1988	8,222	1,472	9,694	6,018	2,548	8,566	18,260
1989	3,486	899	4,385	5,487	2,182	7,669	12,054
1990	3,513	1,123	4,636	6,719	3,583	10,302	14,938
1991	2,786	775	3,561	6,883	5,997	12,880	16,441
1992	2,602	2,978	5,580	8,609	8,389	16,998	22,578
1993	7,007	4,400	11,407	11,725	9,543	21,268	32,675
1994	3,985	6,154	10,139	9,272	8,064	17,336	27,475
1995	5,508	3,642	9,150	11,283	5,087	16,370	25,520
1996	3,592	3,509	7,101	7,092	4,770	11,862	18,963
1997	4,000	3,591	7,591	8,926	6,075	15,001	22,592
1998	2,584	3,417	6,001	7,682	2,775	10,457	16,458
1999	3,638	3,605	7,243	6,386	4,095	10,481	17,724
2000	3,028	3,628	6,656	6,074	4,449	10,523	17,179
1977-2000 Average	3,537	2,148	4,506	6,112	4,113	10,224	14,730
1991-2000 Average	3,873	3,570	7,443	8,393	5,924	14,318	21,761

Source: Statewide Harvest Survey (Mills 1979-1994; Howe et al. 1995, 1996, 2001a-d; Walker et al. 2003).

Table 4.-Coho salmon harvests in Lower Cook Inlet Management Area waters, 1977-2000.

	South of Bluff Point			North of Bluff Point)			West Cook Inlet	Area Total
Year	Saltwater Stocked Locations	Saltwater Other Locations	Total	Salt Water	Fresh Water	Total	Fresh Water	
1977		4,749	4,749	557	1,900	2,457		7,206
1978		2,137	2,137	503	3,231	3,734		5,871
1979		2,633	2,633	387	3,707	4,094		6,727
1980		1,748	1,748	405	3,603	4,008		5,756
1981		2,149	2,149	918	4,255	5,173		7,322
1982		2,148	2,148	639	3,105	3,744		5,892
1983		2,408	2,408	860	2,401	3,261	1,872	7,541
1984		1,397	1,397	972	2,881	3,853	773	6,023
1985		1,232	1,232	734	5,262	5,996	747	7,975
1986	245	1,193	1,438	1,467	2,132	3,599	302	5,339
1987	459	994	1,453	1,986	4,111	6,097	706	8,256
1988	200	1,328	1,528	1,109	4,602	5,711	764	8,003
1989	1,439	1,766	3,205	888	5,682	6,570	875	10,650
1990	1,272	2,540	3,812	1,274	4,430	5,704	375	9,891
1991	3,822	3,604	7,426	1,365	5,528	6,893	1,144	15,463
1992	1,109	2,540	3,649	1,270	3,886	5,156	567	9,372
1993	5,823	4,186	10,009	2,190	6,962	9,152	1,579	20,740
1994	5,355	3,866	9,221	3,478	6,971	10,449	443	20,113
1995	5,367	3,418	8,785	2,020	4,786	6,806	1,979	17,570
1996	9,060	6,233	15,293	2,788	5,572	8,360	3,502	27,155
1997	6,091	4,905	10,996	2,793	3,264	6,057	722	17,775
1998	6,672	6,402	13,074	1,795	6,425	8,220	697	21,991
1999	3,890	5,629	9,519	2,425	7,564	9,989	885	20,393
2000	7,067	5,903	12,970	3,136	6,765	9,901	1,264	24,135
1977-2000 Average	3,858	3,130	5,541	1,498	4,543	6,041	1,066	12,382
1991-2000 Average	5,426	4,669	10,094	2,326	5,772	8,098	1,278	19,471

Source: Statewide Harvest Survey (Mills 1979-1994; Howe et al. 1995, 1996, 2001a-d; Walker et al. 2003).

Table 5.-Dolly Varden harvest in Lower Cook Inlet Management Area waters, 1977-2000.

	South of Bluff Point			North of Bluff Point			
Year	Salt Water	Fresh Water	Total	Salt Water	Fresh Water	Total	Area Total
1977	4,137		4,137	603	11,437	12,040	16,177
1978	2,866		2,866	325	22,418	22,743	25,609
1979	3,218		3,218	382	27,808	28,190	31,408
1980	3,917		3,917	164	13,156	13,320	17,237
1981	4,212		4,212	313	18,403	18,716	22,928
1982	3,606		3,606	526	12,484	13,010	16,616
1983	3,997	1,678	5,675	493	18,871	19,364	25,039
1984	1,659	312	1,971	237	7,595	7,832	9,803
1985	2,324		2,324	243	8,826	9,069	11,393
1986	2,172	306	2,478	15	5,367	5,382	7,860
1987	1,358	380	1,738	379	3,911	4,290	6,028
1988	2,819	218	3,037	200	3,802	4,002	7,039
1989	2,083	343	2,426	382	1,848	2,230	4,656
1990	1,522	176	1,698	61	3,811	3,872	5,570
1991	1,393	275	1,668	246	1,983	2,229	3,897
1992	1,804	378	2,182	205	3,097	3,302	5,484
1993	1,720	172	1,892	150	1,506	1,656	3,548
1994	1,516	216	1,732	311	2,034	2,345	4,077
1995	737	154	891	285	2,102	2,387	3,278
1996	1,765	586	2,351	171	2,162	2,333	4,684
1997	1,541	706	2,247	378	2,178	2,556	4,803
1998	1,790	115	1,905	297	3,854	4,151	6,056
1999	774	209	983	288	1,671	1,959	2,942
2000	1,045	695	1,740	491	2,605	3,096	4,836
1977-2000 Average	2,249	407	2,537	298	7,622	7,920	10,457
1991-2000 Average	1,409	351	1,759	282	2,319	2,601	4,361

Source: Statewide Harvest Survey (Mills 1979-1994; Howe et al. 1995, 1996, 2001a-d; and Walker et al. 2003).

Table 6.-Razor clam harvest, participation and success rates on eastside Kenai Peninsula beaches north of Anchor Point, 1969-2000.

Year	Participation (Digger-days)	Harvest	Clams/Digger day
1969	12,200	375,800	31
1970	11,370	314,650	28
1971	6,800	187,760	28
1972	15,400	437,530	28
1973	23,770	682,600	29
1974	27,410	872,450	32
1975	24,260	896,080	37
1976	29,320	939,000	32
1977	25,393	871,247	34
1978	29,750	896,667	30
1979	30,323	966,677	32
1980	31,494	771,603	25
1981	31,298	829,436	27
1982	31,954	963,994	30
1983	31,470	978,720	31
1984	29,963	1,044,307	35
1985	32,652	1,070,265	33
1986	33,486	1,124,728	34
1987	25,427	979,020	39
1988	30,998	1,171,308	38
1989	22,693	832,155	37
1990	29,427	950,974	32
1991	32,012	1,166,787	36
1992	44,537	1,156,034	26
1993	40,364	946,766	23
1994	48,546	1,271,174	26
1995	42,220	1,158,107	27
1996	29,943	814,360	27
1997	28,343	829,841	29
1998	26,636	643,612	24
1999	36,278	750,447	21
2000	37,755	842,270	22
1977-2000 Average	29,172	866,762	30
1991-2000 Average	36,663	957,940	26

Source: Harvest and participation were determined by creel survey through 1976 and by the State wide Harvest Survey (Mills 1979-1994; Howe et al. 1995, 1996, 2001a-d and Walker et al. 2003) since that time.

Table 7.-Kachemak Bay and Lower Cook Inlet shellfish sport and personal use fishery harvest and participation, 1981-2000.

Year	Participation All Species (angler-days)	King Crab (numbers)	Dungeness Crab (numbers)	Tanner Crab (numbers)	Shrimp (gallons)	Hardshell Clams (gallons)	Razor Clams (numbers)	Other Shellfish (numbers)
1981	25,391	6,178	22,928	4,320	7,117	8,132		38,560
1982	15,712	1,981	9,956	4,234	5,009	5,135		1,782
1983	20,334	409	15,083	3,084	3,577	16,110		2,633
1984	25,162	62	15,113	2,332	2,419	8,891	37,476	349
1985	16,732	closed	29,530	3,502	3,260	10,334	16,205	2,982
1986	21,755	closed	34,217	7,926	4,771	20,212	40,937	128
1987	20,710	closed	51,279	8,988	7,788	23,577	25,855	9,080
1988	13,306	closed	32,053	4,669	2,090	26,597	18,374	3,474
1989	9,594	closed	10,075	closed	1,199	18,195	15,954	13,015
1990	10,342	closed	7,034	closed	2,038	11,821	21,701	11,707
1991	6,690	closed	closed	1,142	613	10,476	7,963	1,513
1992	15,727	closed	10,050	4,165	1,547	9,993	11,358	13,327
1993	13,753	closed	15,198	9,206	656	8,350	10,692	7,995
1994	18,187	closed	19,155	9,648	2,087	13,279	13,974	2,384
1995	17,682	closed	8,957	10,936	1,654	20,311	14,669	7,708
1996	11,584	closed	6,428	12,059	301	29,163	6,089	1,327
1997	9,263	closed	5,905	11,376	closed	9,426	1,997	882
1998	3,926	closed	closed	16,763	closed	12,431	4,030	
1999	9,149	closed	closed	17,045	closed	7,971	4,524	216
2000	11,445	closed	closed	19,672	closed	14,697	7,275	992
1981-2000 Average	14,822	2,158	18,310	8,393	2,883	14,255	15,240	6,319
1991-2000 Average	11,741		10,390	10,260	1,271	13,322	9,700	5,229

Source: Harvests were estimated from the Statewide Harvest Survey (Mills 1982-1994, Howe et al. 1995 and 1996, 2001a-d; and Walker et al. 2003), except Tanner crab harvests 1996-2000, which are summaries of reported harvest on returned shellfish permits.

SECTION II: FISHERIES OVERVIEW

MARINE CHINOOK SALMON RECREATIONAL FISHERIES NORTH OF BLUFF POINT

BACKGROUND AND HISTORICAL PERSPECTIVE

The Cook Inlet marine fishery for chinook salmon began in the early 1970s and remained fairly stable through the late 1980s (Nelson 1995). The fishery north of Bluff Point was historically divided into two fisheries: (1) Whiskey Gulch/Anchor River Area Marine Recreational Fishery, and (2) Deep Creek Marine Recreational Chinook Salmon Fishery. The fishery was divided in this manner because during the early years (1970s) of the fishery, anglers concentrated their efforts around the access points of Anchor River/Whiskey Gulch and Deep Creek. Although the respective fisheries targeted the same stocks, there was spatial separation of anglers depending on the access point used.

The Cook Inlet marine chinook salmon recreational fishery has expanded in recent years, with the greatest angler effort occurring in waters adjacent to Deep Creek (Figure 3). Increased marketing by the sport fish guiding and tourism industries, availability of commercial boat launching services that accommodate larger vessels, development of sport fishing lodges along Cook Inlet beaches, and restrictions in the Kenai River fishery following implementation of the Kenai River Chinook Salmon Management Plan, resulted in growth in this fishery, most notably the guided segment. It has become generally known that chinook salmon may be harvested along the entire beach area (approximately 20 miles) between Anchor River and Deep Creek. Because anglers are no longer spatially segregated, it is now appropriate to view this area as supporting a single fishery.

Access to this fishery continues to occur primarily near the mouths of Anchor River and Deep Creek (Figure 3). A commercial operator provides a beach launching and take-out service at Deep Creek making it possible to use larger boats and launch all boats at most tide stages. Deep Creek has a relatively stable beach where launching also occurs. Limited access is available at Whiskey Gulch. Access to Cook Inlet via Whiskey Gulch had previously been through private property. In 1993, the Sport Fish Division of the Alaska Department of Fish and Game purchased 24 acres to provide public access to this popular area at a cost of $281,000. Launching from the Whiskey Gulch beach is limited to small boats because of the steep gradient. Beginning in 1993, the Sport Fish Division provided a garbage collection site and a portable toilet. No further improvements are currently planned; the Sport Fish Division contracts with a private party to maintain the road that connects the recent purchase and beach to the Sterling Highway. Anchor River has two commercial tractor boat launching operations that provide service at any tide stage. Private launching at the river mouth occurs at high tide. The unstable beach precludes most private launching or loading of boats from the beach at most tide levels. Boats also launch in Homer to access the Anchor Point area.

Anglers generally troll near shore within a few hours of the high tide. Many anglers fish for halibut as well as chinook salmon. Historically, angler effort has been dependent on local weather conditions. Limited boat launching facilities have restricted, and for the most part continue to restrict, the size of vessels that are used. As a result, adverse weather has, on occasions, limited fishing to as little as 30% of the available fishing days in which chinook salmon are present.

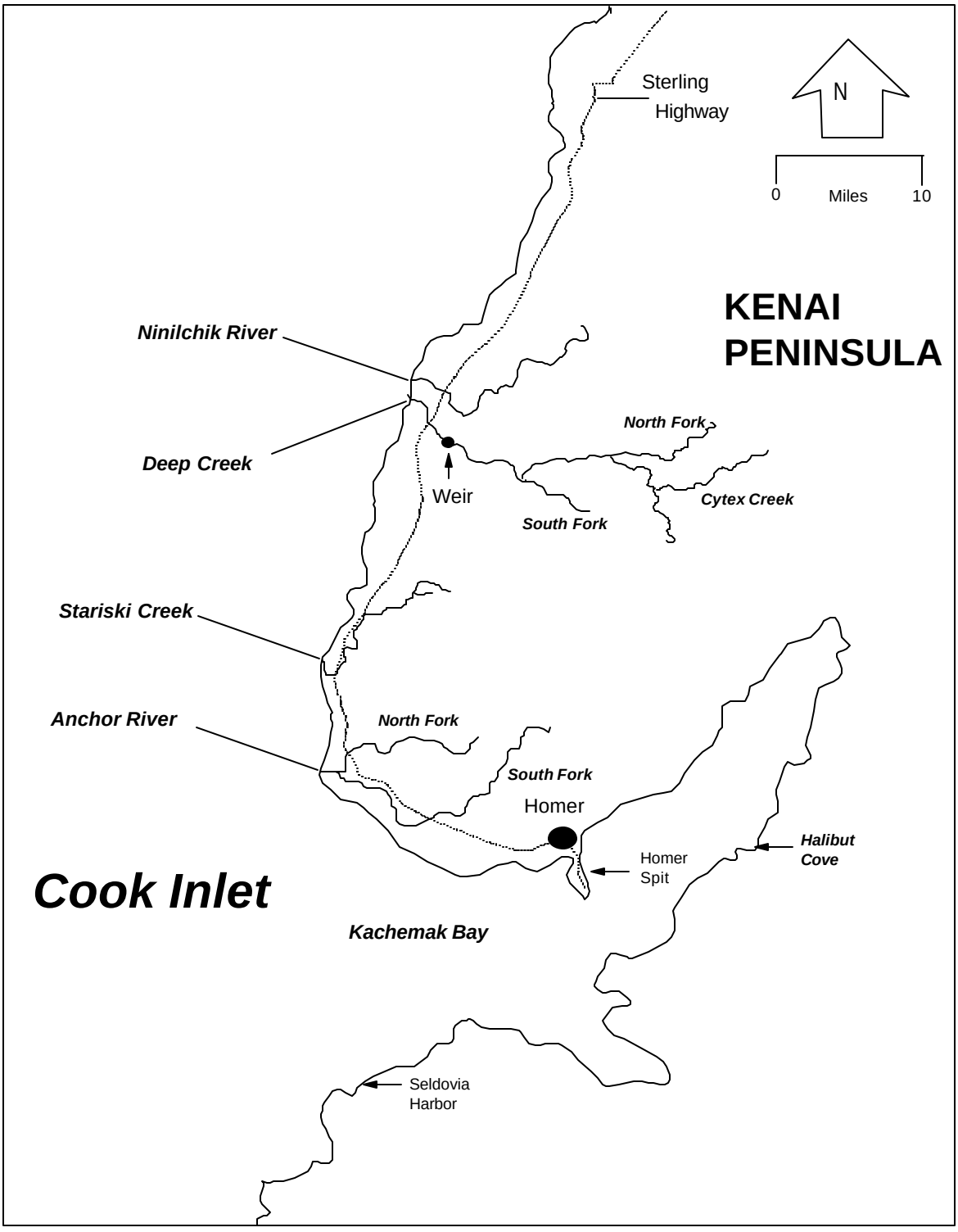


Figure 3.-Map of Lower Kenai Peninsula road system streams.

This recreational fishery is essentially the first harvest of early-and late-run chinook salmon. In the commercial fishery, only drift fishing is allowed south of Ninilchik. The commercial drift fishery does not occur until late June when interception of early-run chinook salmon is minimal.

The department conducted a creel survey at the Deep Creek access from 1972-1986 and at the Anchor River/Whiskey Gulch access in 1986 to estimate harvest and effort. The onsite creel survey was terminated because: (1) the chinook salmon harvest was relatively small in relation to other chinook salmon fisheries; (2) it is a mixed-stock fishery, which virtually precludes any inseason management actions; and (3) harvests here are a poor indicator of the magnitude of the return to upper Cook Inlet drainages and are therefore of limited value in predicting the return and/or success of the major inriver sport fisheries in the Kenai River, Kasilof River, or northern Cook Inlet streams.

The Deep Creek creel survey yielded information on the timing of the chinook salmon marine sport harvest. Approximately 70% of the harvest took place during the early run, and 30% during the late run. This harvest ratio was later applied to annual harvest estimates from the Statewide Harvest Survey (SWHS) to estimate early- and late-run harvests in years after the onsite creel survey was terminated (Tables 8 and 9).

Harvest from 1987-1993 was determined by the SWHS. Participation in the Cook Inlet Marine chinook salmon fishery could not be ascertained because the SWHS determines participation by location, not by species, and a major sport halibut fishery occurs in the same area as the chinook salmon fishery. The steady increase in harvest from 1990 through 1994 (Tables 8 and 9) was due to displacement of anglers from the restricted Kenai River fishery to salt water, increased numbers of guides locating in the Deep Creek/Whiskey Gulch/Ninilchik area (Table 10), and increased use of the fishery by Kenai River guides on days when the Kenai River is closed to fishing from boats. High angler success rates as reported by the news media also attracted additional participants.

Harvest estimates during 1991-1993 from the Statewide Harvest Survey were apportioned 70.5% to the early run and 29.5% to the late run as in prior years, but staff observation suggested that increased early-run participation might have changed this distribution of harvest between the early and late runs.

In 1994 and 1995, a creel survey was again conducted at Deep Creek, Whiskey Gulch, and Anchor River (McKinley 1995, 1996), because of the rapid expansion of the fishery in recent years, and a public perception that harvest in this fishery was negatively impacting other Cook Inlet drainage fisheries. The primary purpose of this onsite survey was to estimate early-and late-run harvest and verify the SWHS data. The creel survey estimated early- and late-run harvest and total participation in the combined chinook salmon and halibut fishery. In 1994, the creel survey estimates of chinook salmon harvest between Deep Creek and the Anchor River were 5,577 during May 1 to June 22 and 1,869 during June 23 to July 31. The creel estimate that 75% of the season's harvest occurred before June 23 compared favorably to estimates of 70.5% from the creel survey during 1972-1986. Seasonal participation in all the area's fisheries (early- and late-run chinook salmon and the halibut fishery) was estimated to be 62,292 days fished.

During 1995, the creel estimate of chinook salmon harvest in this area during May 1 to June 18 was 6,048. After June 18 to July 31, an estimated 2,069 chinook were taken. Effort during this time in the chinook and halibut fisheries combined was 70,384 days fished.

Table 8.-Cook Inlet marine early-run chinook salmon sport fishery harvest and effort, 1972-2000.

	Deep Creek Area		
Year	Harvest	Days Fished	Harvest/ Hour
1972	1,000	2,357	0.119
1973	519	5,245	0.028
1974	500	3,810	0.037
1975	540	3,370	0.061
1976	5,495	12,268	0.101
1977	4,617	18,803	0.069
1978	2,669	14,413	0.059
1979	3,088	13,352	0.053
1980	521	8,065	0.017
1981	2,363	11,601	0.051
1982	2,497	14,514	0.056
1983	1,000	21,707	0.011
1984	2,386	14,694	0.040
1985	5,087	22,118	0.058
1986	3,106	24,393	0.027
1987	3,613		
1988	4,243		
1989	3,863		
1990	4,694		
1991	4,824		
1992	5,996		
1993	8,136		
1994 [a]	6,850		
1995 [a]	8,230		
1996	4,702		
1997	5,646		
1998	5,783		
1999	4,907		
2000	4,773		
Average	3,850	12,714	0.052

Source: 1972-1986 from creel survey (Hammarstrom 1974-1981; Hammarstrom and Larson 1982-1984, 1986; and Hammarstrom et al. 1985). 1987-2000 data from Statewide Harvest Survey (Mills 1988-1994; Howe et al. 1995 and 1996, 2001a-d; Walker et al. 2003). Harvest was apportioned 70.5% to the early run and 29.5% to the late run for 1987-1995, based on estimates from onsite creel surveys from 1972-1986. Beginning in 1996, the Statewide Harvest Survey has generated separate estimates for the early (prior to and including June 24) and late (after June 24) runs.

[a] Early-run percentages of total harvest for 1994 and 1995 were 74.9% and 75.48% respectively, based on creel survey (McKinley 1995, 1996).

Table 9.-Cook Inlet marine late-run chinook salmon sport fishery harvest and effort, 1972-2000.

	Deep Creek Area		
Year	Harvest	Days Fished	Harvest/ Hour
1972	1,250	1,253	0.272
1973	491	2,795	0.050
1974	100	1,280	0.034
1975	345	4,680	0.031
1976	1,382	6,365	0.057
1977	366	6,938	0.017
1978	2,693	9,402	0.081
1979	1,164	8,728	0.034
1980	747	9,104	0.021
1981	170	3,325	0.018
1982	1,173	9,252	0.033
1983	1,707	10,640	0.045
1984	835	11,895	0.019
1985	1,731	13,422	0.027
1986	676	9,421	0.017
1987	1,512		
1988	1,775		
1989	1,616		
1990	1,964		
1991	2,019		
1992	2,509		
1993	3,404		
1994 [a]	2,296		
1995 [a]	2,673		
1996	2,006		
1997	2,850		
1998	1,680		
1999	997		
2000	1,026		
Average	1,488	7,233	0.050

Source: 1972-1986 from creel survey (Hammarstrom 1974-1981; Hammarstrom and Larson 1982-1984, 1986; and Hammarstrom et al. 1985). 1987-2000 data from Statewide Harvest Survey (Mills 1988-1994; Howe et al. 1995 and 1996, 2001a-d; Walker et al. 2003). Harvest was apportioned 70.5% to the early run and 29.5% to the late run for 1987-1995, based on estimates from onsite creel surveys from 1972-1986. Beginning in 1996, the Statewide Harvest Survey has generated separate estimates for the early (prior to and including June 24) and late (after June 24) runs.

[a] Late-run percentages of total harvest for 1994 and 1995 were 25.1% and 24.52% respectively, based on creel survey (McKinley 1995, 1996).

Table 10.-Early- and late-run guided and unguided angler chinook harvests north of Bluff Point, 1986-2000.

Year	Early run Unguided	Guided	Early run Total	Late run Unguided	Guided	Late run Total	Total Unguided	Total Guided	Total Overall
1986	2,719	168	2,888	1,138	71	1,208	3,857	239	4,096
1987	3,268	345	3,613	1,368	144	1,512	4,636	489	5,125
1988	4,026	217	4,243	1,684	91	1,775	5,710	308	6,018
1989	3,611	252	3,863	1,511	105	1,616	5,122	357	5,479
1990	4,186	508	4,694	1,752	212	1,964	5,938	720	6,658
1991	3,031	1,794	4,824	1,268	750	2,019	4,299	2,544	6,843
1992	3,624	2,372	5,996	1,516	993	2,509	5,140	3,365	8,505
1993	4,548	3,588	8,136	1,903	1,501	3,404	6,451	5,089	11,540
1994	3,809	3,042	6,850	1,276	1,019	2,296	5,085	4,061	9,146
1995	4,225	4,004	8,230	1,373	1,301	2,673	5,598	5,305	10,903
1996	2,464	2,238	4,702	1,099	907	2,006	3,563	3,145	6,708
1997	2,989	2,657	5,646	1,656	1,194	2,850	4,645	3,851	8,496
1998	2,600	3,183	5,783	1,164	516	1,680	3,764	3,699	7,463
1999	2,598	2,309	4,907	624	373	997	3,222	2,682	5,904
2000	2,613	2,160	4,773	457	569	1,026	3,070	2,729	5,799

Source: Statewide Harvest Survey (Mills 1987-1994; Howe et al. 1995, 1996, 2001a-d; Walker et al. 2003).

Estimates from the SWHS are thought to be more accurate and complete than the creel estimates because of temporal, area and seasonal limitations to the creel census. Beginning in 1996, the SWHS has requested information from surveyed Central Cook Inlet marine anglers by two time-periods: prior to and including June 24 (early run) and after June 24 (late run). This allows the SWHS to generate separate estimates for the early and late runs.

STOCK COMPOSITION

This fishery targets the mixture of chinook salmon stocks found in Cook Inlet marine waters. Cook Inlet stocks with early run timing (late April through late June) include the small lower Kenai Peninsula drainages (Stariski Creek, Deep Creek, Anchor River, Ninilchik River), and larger drainages in upper and northern Cook Inlet (Kasilof, Kenai, and Susitna rivers). Cook Inlet stocks with late run timing (late June through early August) include the Kenai River and, to a lesser extent, the Kasilof River and late-run hatchery releases into Cook Inlet tributaries.

A coded wire tag (CWT) recovery project was initiated in 1996 to obtain quantitative estimates of stock composition of the Cook Inlet marine chinook salmon harvest (McKinley 1999). This project monitors the Central Cook Inlet marine sport harvest for chinook salmon that were tagged as smolt from Cook Inlet hatchery releases, and for wild chinook salmon that were tagged as fingerlings or smolt in the Kenai River and Deep Creek. Stock composition and age and maturity of early-run chinook harvested in the Cook Inlet marine fishery north of Bluff Point were determined.

From recoveries of coded wire tagged fish we have been able to explain the origin of an average of approximately 16% of the fish taken in this fishery annually since 1996 (Table 11). The first year when tagged chinook stocks from Deep Creek and Cook Inlet hatcheries had all age classes returning so complete contribution estimates for these stocks could be determined was 1998 (Table 11).

Table 11.-Contribution statistics from coded wire tagged chinook salmon recovered in the early-run Central Cook Inlet marine recreational fisheries north of Bluff Point, 1996-2001.

Year	Harvest	Number Examined	Number of Tags Recovered	Origin Determined	Cook Inlet Hatchery		Deep Creek	Other Cook Inlet Wild	Non-Cook Inlet
					Other	Ninilchik			
1996	4,702	1,470	24	543 (11.5%)	13 (0.3%)	[a] 183 (3.9%)		[a]	348 (7.4%)
1997	5,646	2,414	50	695 (12.3%)	139 (2.5%)	[a] 172 (3.0%)	148 (2.6%)	[a]	236 (4.2%)
1998	5,783	2,800	60	1,305 (22.6%)	75 (1.3%)	45 (0.8%)	246 (4.3%)		939 (16.2%)
1999	4,907	2,019	67	712 (14.5%)	136 (2.8%)	73 (1.5%)	139 (2.8%)	123 (2.5%)	241 (4.9%)
2000	4,773	1,839	79	666 (13.9%)	181 (3.8%)	63 (1.3%)	102 (2.1%)		320 (6.7%)
2001	3,671	1,552	93	815 (22.2%)	159 (4.3%)	45 (1.2%)	[a]		621 (16.9%)
Average				789 (16.2%)	117 (2.5%)	97 (2.0%)	159 (3.0%)		451 (9.4%)

[a] Not all age classes represented, so does not represent true contribution of this stock.

The tag-recovery project was also conducted during the late run in 1997 and 1998 (Table 12). None of the tagged Cook Inlet stocks had all major age classes tagged in 1997. Tags were recovered from all three tagged late-run Cook Inlet stocks (Kenai River, Twin Falls and Homer Spit). Due to the small sample size, contribution estimates for the late-run in 1998 are biased. Tagged fish sampled from the harvest originated from the Homer Spit stocking project and non-local hatcheries.

Tagged stocks of non-Cook Inlet origin account for an average of 9.4% of the early run harvest. Tagged Cook Inlet stocks account for 7.5% of the marine harvest (Table 11). Contribution estimates for most Cook Inlet stocks are not possible due to the lack of marking programs for Cook Inlet wild stocks. Therefore, origin is known for an average of only 16.2% and composition of the unexplained harvest, comprising 83.8% of the total, cannot be apportioned exactly. However, composition of the unexplained harvest can be inferred from maturity estimates provided through sampling of the harvest (Table 13).

Maturity sampling of coded wire tagged fish shows that the majority of chinook salmon taken in the entire fishery are mature, spawning fish. This is also true in the nearshore fishery (within ¾ mile of shore). However, the majority of fish taken more than ¾ mile from shore are immature fish (non-spawners) (Table 13).

Table 12.-Contribution statistics from coded wire tagged chinook salmon recovered in the late-run Central Cook Inlet marine recreational fisheries north of Bluff Point, 1997 and 1998.

Year	Harvest	Number Examined	Number of Tags Recovered	Origin Determined	Cook Inlet Hatchery	Cook Inlet Wild	Non-Cook Inlet
1997	2,850	1,045	22	815 (28.6%)	122 (4.3%)	[a] 436 [b] (15.3%)	257 (9.0%)
1998	1,680	453	4	217 (12.9%)	8 (0.5%)		209 (12.4%)

[a] Not all age classes represented.

[b] Preliminary estimate as tagging fraction for the Kenai River wild chinook salmon has not been finalized.

Table 13.-Estimated proportion of non-spawning chinook salmon in the Central Cook Inlet marine recreational fisheries north of Bluff Point, 1996-2001.

	Number Females Examined			Nonspawners			
Year	Nearshore[a]	Offshore[b]	Total	Nearshore[a]	Offshore[b]	Total Number	(Percent of Total)
Early run							
1996 [c]			370			79	(21.4%)
1997	969	55	1,024	200	36	236	(23.0%)
1998	717	131	848	281	99	380	(44.8%)
1999	683	120	803	86	80	166	(20.7%)
2000	556	174	730	150	136	286	(39.2%)
2001	495	89	584	228	58	286	(49.0%)
Late run							
1997	322	54	376	7	34	41	(10.9%)
1998	112	62	174	6	50	56	(32.2%)

[a] Less than ¾ mile from shore.

[b] More than ¾ mile from shore.

[c] Nearshore/Offshore data not available.

Maturity sampling of coded wire tagged fish has also shown that mature (spawning) fish taken in the fishery are mainly of Cook Inlet origin (Table 14). Immature (non-spawning) fish are mainly non-Cook Inlet origin. The fraction of mature fish in the coded wire tag sample has varied between 51% and 79%, averaging about 67%, since 1996 (Table 15). Assuming this same percentage applies to the unexplained harvest results in an estimated average of about 2,800 mature chinook salmon taken in the unexplained portion of the harvest each year since 1996 (Table 15). It is presumed that these fish are destined for Cook Inlet systems.

Table 14.-Origin of mature (spawning) CWT chinook salmon sampled in the Central Cook Inlet marine fishery, 1996-2001.

		Number Mature			Number Immature		
Year	Total CWT Recoveries Sampled for Maturity	Cook Inlet Origin	Non-Cook Inlet	Total	Cook Inlet Origin	Non-Cook Inlet	Total
1996	10	7	0	7	0	3	3
1997	29	19	0	19	0	10	10
1998	28	14	3	17	0	11	11
1999	35	24	1	25	0	10	10
2000	31	19	3	22	0	9	9
2001	45	17	5	22	0	23	23

Although four LCIMA stocks (Anchor River, Deep Creek, Ninilchik River, and Stariski Creek) are in close proximity to the fishery, it is unlikely that a majority of this unexplained harvest of spawners is bound for these systems. All the major age classes of chinook salmon returning to Deep Creek after 1997 contained a fraction of fish with coded wire tags. The estimated marine harvest of Deep Creek-origin chinook salmon in the early run ranged from only 102 to 246 fish between 1998 and 2000 (Table 11). Hatchery-reared chinook stocked in the Ninilchik River are all marked. The estimated marine harvest of Ninilchik hatchery fish was less than 200 fish in all years. The lower contribution of the Ninilchik River in 1998 compared to 1996 or 1997 probably reflects the reduction in the number of fish stocked in the river beginning in 1995 (see the discussion of the Ninilchik River in report section "Lower Kenai Peninsula Early-run Chinook Salmon Freshwater Recreational Fishery"). The contribution of the three other wild LCIMA stocks (Anchor River, Stariski Creek, and Ninilchik River wild) is likely low. This leaves other Cook Inlet stocks to account for most of the marine harvest of mature fish.

Tag recovery and maturity data indicate that the high interception rate on Cook Inlet stocks is not focused on a few selected stocks. Rather, tag recovery data indicate that the origin of the harvest of mature fish is of a broader Cook Inlet distribution composed of numerous individual stocks, none of which make up a large component. By far the most abundant stocks in Cook Inlet are those returning

to the Susitna River drainage, therefore it is reasonable to assume that their contribution to the Central Cook Inlet fishery is proportionate to their abundance in Cook Inlet.

The increasing incidence of a number of Southeast Alaska, British Columbia, and to a lesser extent Washington and Oregon stocks in the harvest indicates the presence and interception of non-Cook Inlet chinook in the early-run marine fishery. We estimate that in 1998, nearly 1,000 chinook from tagged stocks outside of Cook Inlet were harvested in the Central Cook Inlet early-run fishery (Table 11). All of these tagged stocks were from British Columbia. A harvest of similar magnitude of non-Cook Inlet origin fish was taken in 2001.

Table 15.-Estimates of the number of non-spawning (non-local) and spawning chinook salmon harvested in the early-run Central Cook Inlet marine recreational fisheries north of Bluff Point, 1996-2001.

					Stock Origin Unexplained		
Year	Total Harvest[a]	Estimated Fraction Non-spawners[b]	Spawners	Total Number Stock Origin Explained[a]	Total Number	Estimated Number of Non-spawners	Estimated Number of Spawners
1996	4,702	0.21	0.79	543	4,159	873	3,286
1997	5,646	0.23	0.77	695	4,951	1,139	3,812
1998	5,783	0.45	0.55	1,305	4,478	2,015	2,463
1999	4,907	0.21	0.79	712	4,195	881	3,314
2000	4,773	0.39	0.61	666	4,107	1,602	2,505
2001	3,671	0.49	0.51	815	2,856	1,399	1,457
Avg.	4,914	0.33	0.67	789	4,124	1,318	2,806

[a] From Table 10.

[b] From Table 12.

RECENT FISHERY PERFORMANCE

Average early- and late-run harvests since 1996 were approximately 5,100 and 1,700, respectively.

The 1997 early- and late-run harvests were average with many good weather days. Many days of poor weather occurred during both early and late runs in 1998; fishing was reported to be excellent during the early run and dismal during the late run. Fewer fish were caught during the early run in 1999 because frequent bad weather kept boats ashore. Anglers reported that feeder chinook were scarcer in 1999 than in 1998. In 2000, anglers reported fewer mature fish than in previous years and the peak of the return of mature fish appeared to be earlier. Anglers launching at Anchor Point and Homer were able to make up for the lack of mature fish with phenomenal fishing for immature feeders that extended well into the month of June.

ADF&G required sport fishing guide businesses and guides to register before fishing the waters of Alaska beginning in 1995. Guides fishing in salt water were required to enter their catches in a logbook

beginning in 1998. Early-run chinook harvests reported by guides from waters North of Bluff Point compare favorably to estimates of harvest from the SWHS (Howe et al. 2001c and d; Walker et al. 2003) (Table 16). The late run harvest reported in the charter logbooks in 2000 is lower than the SWHS estimate.

Table 16.-Comparison of charter logbook data and Statewide Harvest Survey marine chinook salmon harvest from Central Cook Inlet north of Bluff Point, 1998-2000.

Year		Charter logbook (reported harvest)	Statewide Harvest Survey (estimated harvest)
1998			
	Early	2,833	3,183
	Late	315	516
	Total	3,148	3,699
1999			
	Early	2,322	2,309
	Late	341	373
	Total	2,663	2,682
2000			
	Early	2,077	2,160
	Late	190	569
	Total	2,267	2,729

MANAGEMENT OBJECTIVES

Early-run Marine Chinook Fishery

The Cook Inlet Marine Early-Run King Salmon Management Plan applies to the early-run mixed stock fishery north of Anchor Point. This plan, adopted in 1996, creates a rectangular special harvest area from Bluff Point north to Ninilchik (Figure 4). This area extends 1 mile seaward from the beach. From April 1 through June 30, within this special harvest area, guides cannot fish while guiding clients and an angler can not fish for any species of fish for the remainder of the day after harvesting a chinook salmon, but may fish outside the special harvest area.

Three conservation zones, closed to fishing for all species from April 1 through June 30, are located within this special harvest area. These zones extend 1 mile seaward and encompass the area from the mouth of the Ninilchik River to 2 miles south of Deep Creek, 1 mile on either side of Stariski Creek and 2 miles on either side of the mouth of the Anchor River.

A harvest guideline of 8,000 chinook salmon governs the fishery from April 1 to June 30. If this guideline is exceeded the plan calls for an unspecified restriction of the fishery prior to the following

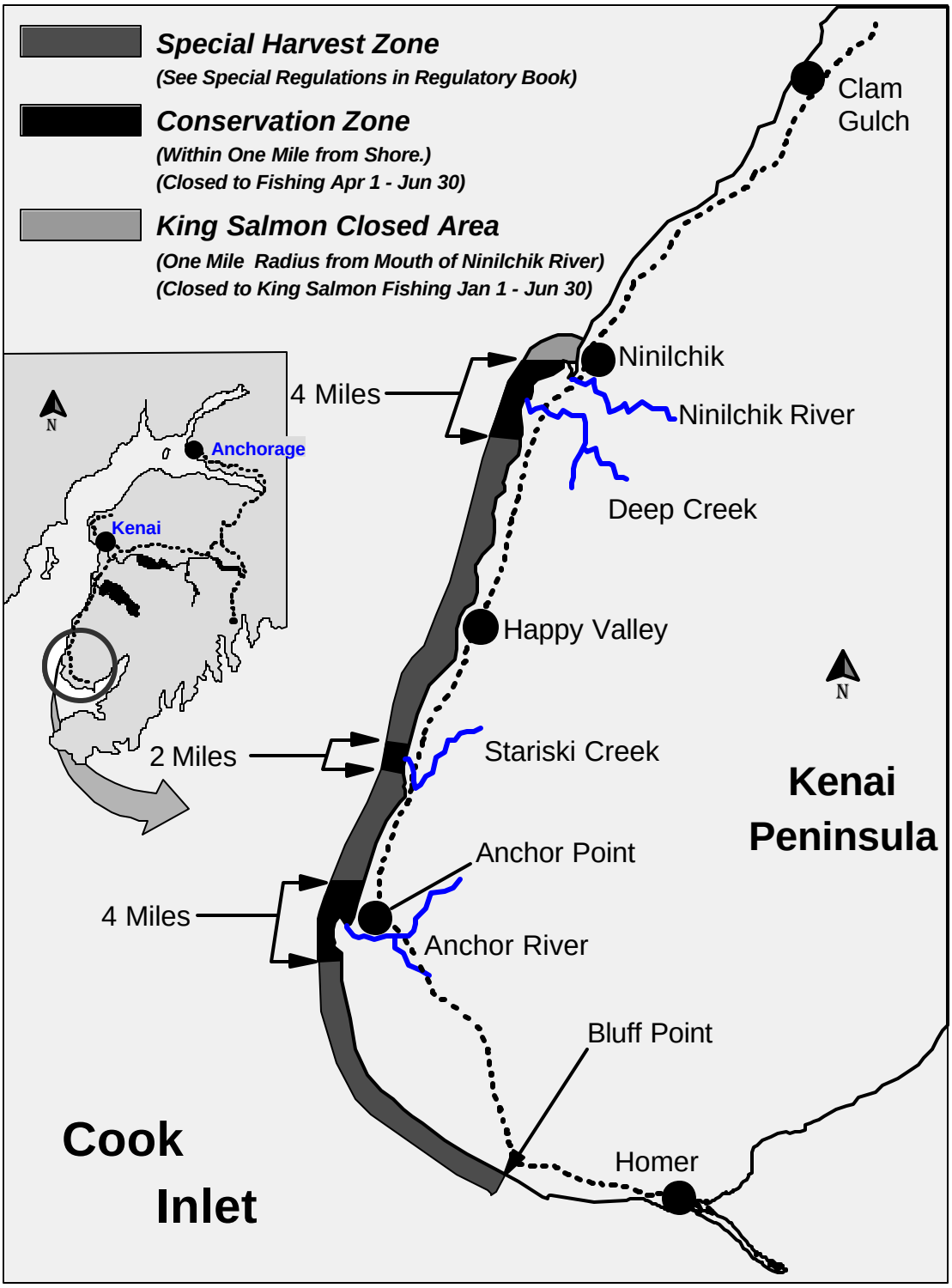


Figure 4.-Central Cook Inlet regulatory zones.

season to ensure compliance with the guideline harvest level. The harvest reported in the SWHS is the fishery performance measure.

Late-run Deep Creek/Anchor Point Marine Chinook Salmon Fishery

Management of the Cook Inlet marine late-run chinook salmon recreational fishery north of Bluff Point is addressed in the Board-adopted Kenai River Late-Run King Salmon Management Plan because it is assumed that a portion of the harvest is late-run chinook salmon of Kenai River origin. This plan was amended in 1990 to address the harvest of late-run Kenai River chinook salmon in the marine fishery. The plan was further amended in 1999.

In referencing the marine fishery, the plan stated that if the spawning escapement in the Kenai River is projected to be less than 15,000 late-run chinook salmon, the department shall close the recreational fisheries in the Kenai River and in the salt waters of Cook Inlet north of the latitude of Bluff Point to the taking of chinook salmon ("north of the latitude of Bluff Point" is specifically referring to the marine late-run chinook salmon fishery which occurs from Bluff Point north to Deep Creek, an area of about 25 linear miles). In 1999, the point was changed to a projected escapement of 17,800 late-run chinook.

To date, the projected escapement to the Kenai River has never been less than 17,800; restrictions to the marine fishery have not been required since the plan was amended by the Board in 1990 and 1999. This notwithstanding, the primary goal of management is to follow the provisions of the Kenai River Late-Run King Salmon Management Plan as they apply to this fishery.

Fishery objectives adopted by the department for the Central Cook Inlet marine chinook fishery are:

Objective 1: Manage for a level of angler participation that results in a harvest in the early run fishery (during April 1 through June 30) that approximates 8,000 chinook salmon.

Objective 2: Ensure, through appropriate management and research programs, that harvest in these fisheries does not reduce the chinook salmon spawning escapement in any drainage or stream below specified levels.

Objective 3: Apportion harvests to streams of origin.

Objective 4: Determine the distance from shore where mature and immature chinook salmon are taken.

There has been no inseason management required in the history of these fisheries. From 1972-1986 an onsite creel survey was used to determine harvest and participation during both the early and late runs; from 1987-1993 relative changes in participation in the fisheries were determined by observation. In 1994-1995 an onsite creel survey was again conducted to estimate harvest and participation to verify estimates in the SWHS in the face of growth in the fisheries. Research since 1995 has consisted of a coded wire tag recovery program to estimate harvest of tagged wild and hatchery stocks to the early- (1996-present) and late- (1997-1998) run harvests. In addition, the sexual maturity of sampled fish and the distribution of the mature and immature chinook salmon relative to shore was determined in 1997 through 2001.

BOARD OF FISHERIES ACTIONS

In 1990, the Board recognized that a public proposal to reduce the saltwater chinook salmon bag limit from its current two fish to one fish was an allocative rather than biological issue. However, since it was

reasonable to assume that this fishery intercepts some early- and late-run Kenai River chinook salmon, and these fully utilized stocks were at relatively low levels of abundance in 1989 and 1990, the Board reduced the bag and possession limits in the saltwater fishery. Beginning in 1991, the bag and possession limits in Cook Inlet north of Bluff Point have been one chinook salmon of any size.

Additional Board action in 1990 rescinded the requirement that Kenai Peninsula chinook salmon caught between April 1 and September 30 in all waters north of a line from Cape Douglas to Point Adam be recorded on a punch card. The punch card was replaced with a harvest record printed on the back of the sport fishing license, identical to the harvest record in use prior to 1990. Unlicensed anglers record their harvest on a separate harvest card.

The Kenai River Late-Run King Salmon Management Plan was amended to close the late-run chinook salmon marine fishery in addition to the recreational fisheries in the Kenai River if numbers of late-run spawning chinook salmon in the Kenai River were projected to be less than the minimum goal for this drainage (15,500). In 1999 the minimum goal was changed to an inriver goal of 17,800.

The Board considered a number of proposals regarding this fishery at its November 1992 meeting. All proposed regulatory changes to this fishery failed to win Board approval. The Board adopted a "housekeeping" proposal that clearly established the chinook salmon daily bag and possession limits south of Bluff Point as two fish, and north of Bluff Point one fish daily or in possession. This corrected an administrative oversight that erroneously limited the bag and possession limits in Resurrection Bay to one fish.

The Board adopted the upper Cook Inlet Marine Early-Run King Salmon Management Plan described earlier in this report, at its 1996 meeting.

Numerous proposals seeking to change portions of the Cook Inlet Marine Early-Run King Salmon Management Plan came before the Board during its meeting in February of 1999. The minimum inriver escapement goal for late-run Kenai River chinook salmon was raised to 17,800. The Board voted to create the North Gulf Coast (NGC) Chinook Salmon Task Force and deferred consideration of the proposals for LCIMA marine chinook fisheries along with other proposals which involved commercial and recreational fisheries in NGC waters on non-local chinook stocks. North Gulf coast waters were defined to be north of Yakutat to and including Kodiak waters. Public proposals regarding LCIMA marine chinook fisheries which were deferred sought to: (1) reduce the current chinook salmon conservation zone (closed area) at the saltwater terminus of the Anchor River from within 2 miles north and south and 1 mile seaward of the river mouth to within 1 1/2 miles north and south and a half mile seaward from the river mouth; (2) decrease the size of the Special Harvest Zone by moving its southern boundary from Bluff Point to 2 miles south of the Anchor River mouth; (3) eliminate the harvest guideline of 8,000 chinook; (4) end the regulations contained in the Upper Cook Inlet Marine Early-Run King Salmon Management Plan on June 26 instead of July 1; (5) limit the conservation zones to the 1 mile radius at the saltwater terminus of each lower Peninsula stream; and (6) amend the Plan to allow unguided anglers who are over 60 years of age to harvest 2 chinook salmon per day and be able to continue to fish for halibut or any other species in the special management zones described in the plan.

The NGC Chinook Salmon Task Force members were to be appointed by the BOF in the spring of 2001 from among stakeholders in marine chinook fisheries. This did not occur due to budgetary

constraints and the deferred proposals were considered at the BOF meetings during the fall of 2001 along with recent proposals for changing the Cook Inlet marine salmon fisheries.

The BOF supported the Department position to preserve the Cook Inlet Marine Early-Run King Salmon Management Plan in its current form because it stabilized marine harvests and protects local stocks from greater exploitation.

OUTLOOK

Infrastructure supporting the Central Cook Inlet marine chinook salmon fishery continues to develop. More guide businesses are evident along the road system adjacent to the fishery, the use of larger-sized (26 to 28 ft) boats is increasing, additional private fishing lodges and recreational cabins are being built, and private access roads to the beach are also on the increase. Improvements to the Whiskey Gulch Road have augmented its use. Homer is a potential source for increased use of the area. A fleet of approximately 50 boats currently accesses the fishery north of Bluff Point from Homer; many are charter operators who primarily target halibut but offer chinook salmon fishing as an alternative.

Early-run harvests have stabilized well below the harvest guideline of 8,000 chinook salmon. Increased participation and harvest are likely to occur as more facilities are developed adjacent to the fishery. Restriction of the halibut fishery could shift more angler effort towards chinook salmon in marine waters. Achievement of the harvest guideline is possible under these scenarios.

CURRENT ISSUES

Tagging studies have shown that interception of early-run chinook salmon from central Kenai streams (Deep Creek, Ninilchik River and Crooked Creek), upper Kenai Peninsula streams (Kenai River) and northern Cook Inlet drainages occurs in the marine fishery. Chinook salmon destined for streams of upper Kenai Peninsula and northern Cook Inlet use the marine waters adjacent to these eastside beaches as a migratory corridor but probably remain subject to capture in this fishery for only a brief period of time. Lower Kenai Peninsula stocks are believed to stage or hold in these waters prior to entering their natal streams and are available to anglers for a greater period of time than upper Peninsula or northern Cook Inlet fish. Conservation zones around the mouths of local streams protect local stocks which otherwise would likely contribute a greater percentage to the harvest than is indicated by their relative abundance.

Early-run Kasilof River chinook salmon are stocked and return at relatively consistent levels. Early-run Kenai River chinook salmon support an intense and conservatively regulated fishery in the Kenai River. As early-run Kenai River chinook salmon are fully utilized in the inriver fishery, there is concern by some members of the public that the marine early-run chinook salmon fishery may impact the early-run Kenai River fishery. Due to poor success recovering tagged chinook of Kenai River origin while sampling harvests, the interception rates of Kenai River stocks cannot be estimated but probably do not dominate the harvest.

Restrictions in both fresh and saltwater fisheries in 1996 along with poor instream fishing conditions in 1998 and 2000 coincided with average or above average chinook escapements to Deep Creek (Table 17). Aerial escapement indices of early-run stocks in the Anchor River continue to be below average (Table 17).

Table 17.-Sport harvest (1976-2000) and unexpanded escapement index counts (1976-2001) of chinook salmon in Anchor River, Deep Creek, and Ninilchik River.

	Anchor River		Deep Creek		Ninilchik River	
Year	Harvest	Aerial Escapement	Harvest	Aerial Escapement	Harvest	Aerial Escapement
1976	830	2,125	220	1,075	630	956
1977	1,077	3,585	425	848	1,168	1,169
1978	2,109	2,209	804	582	1,445	724
1979	1,913	1,335	703	726	1,493	854
1980 [a]	605		182		723	
1981 [a]	1,069	1,066	604	427	1,523	552
1982	718	1,493	791	977	1,240	947
1983	1,269	1,033	1,154	550	871	445
1984	998	1,087	761	380	648	346
1985	672	1,328	249	644	983	582
1986	1,098	2,287	944	976	420	307
1987	761	2,524	604	968	1,112	523
1988	976	1,458	777	409	795	569
1989	578	940	843	561	744	280
1990	1,479	967	1,411	347	693	288
1991	1,047	589	1,776	294	3,123 [c]	594
1992	1,685	99	1,379	63	5,316 [c]	[b]
1993	2,787	1,110	2,503	486	4,235 [c]	688
1994	2,478	837	2,379	364	3,108 [c]	252
1995	1,475	[b]	1,161	229	2,451 [c]	[b]
1996	1,483	277	886	193	2,401 [c]	158
1997	1,563	477	1,249	136	3,263 [c]	393
1998	783	789	539	676	1,453 [c]	316
1999	1,409	685	741	1,190	1,945 [c]	357
2000	1,727	752	913	556	1,738 [c]	578
2001		414		551		258
Mean	1,281	1,228	960	570	1,636	528

Source: Harvest estimates for all three streams in 1976 are from punch card returns (Hammarstrom 1977), all other harvest estimates are from Statewide Harvest Survey (Mills 1979-1994, Howe et al. 1995, 1996, 2001a-d, Walker et al. 2003). Escapement estimates are aerial counts.

[a] Escapement counts not conducted or considered minimal due to high turbid water during aerial escapement surveys.

[b] Aerial escapement counts not obtained due to high water.

[c] Enhanced run.

Aerial counts are not estimates of total escapement but merely inexact indices of relative abundance. The proportion of the total escapement seen in aerial counts is unknown. Comparison of aerial counts to the true escapement is not possible. High water precluded timely installation of the weir and therefore full census of the escapement in Deep Creek in 1998 through 2000. Poor water clarity in the Ninilchik has muddied the relationship between the aerial count and the escapement censused at that weir during 1999 through 2000.

More information is needed to ascertain escapement levels that optimize yield before current fishery restrictions are eased at Deep Creek. Ninilchik River is stocked but the hatchery releases into this tributary were reduced by 75% in 1995. The harvest of stocked Ninilchik fish in the marine sport fishery is less as a result of fewer fish being stocked, but the reduction likely won't result in significant displacement of effort to other stocks because the contribution of Ninilchik fish to the marine harvest is relatively small.

RECOMMENDED RESEARCH AND MANAGEMENT

There are allocative and potential biological issues associated with this fishery. One allocative issue is the perception that this fishery intercepts significant numbers of Kenai River chinook salmon resulting in restrictions or decreased harvest rates in the Kenai River fishery. A potential conservation issue would be the excessive harvest of LCIMA wild stocks. This fishery, coupled with the inriver harvest in these streams, could negatively impact these wild stocks. A permanent weir is slated for operation on the Anchor River to monitor long-term trends in smolt out-migration and escapement and to be used as an indicator of population trends in other Lower Kenai Peninsula streams. If the weir is successful, more accurate spawning escapement goals for wild-stock chinook salmon in these streams can be established, along with appropriate management strategies to achieve these goals.

COOK INLET MARINE CHINOOK SALMON RECREATIONAL FISHERY SOUTH OF BLUFF POINT

HISTORICAL PERSPECTIVE AND RECENT FISHERY PERFORMANCE

A fishery for chinook salmon has occurred for many years south of Bluff Point. The chinook salmon fishery is difficult to characterize because anglers reporting their harvest in the SWHS often generalize their fishing location, and because the survey does not estimate effort by species. Participation and harvests in the area have generally increased. Coded wire tags recovered from the sport harvest indicate a mixture of stocks are present in the fishery including hatchery stocks returning to Seldovia Bay, Halibut Cove Lagoon, and the Homer Spit Enhancement Lagoon, wild and hatchery stocks returning to Cook Inlet tributaries further north, and a mixture of stocks of non-Cook Inlet origin. Effort is concentrated during the summer months, but a fishery occurs outside the summer months on immature non-spawning (feeder) chinook salmon.

Anglers are known to have harvested feeder chinook salmon in the off-season during the 1960s or earlier. Growing interest in harvesting these fish during the fall and winter, when mature salmon are not present, led the BOF to adopt a proposal in 1988 to allow the harvest of chinook salmon unrestricted by a yearly limit or harvest recording requirement during October 1 to March 31.

Effort and harvest directly attributable to fishing for chinook during this time of year are unknown but are thought to be relatively small. Harvests by guides and guided anglers reported in charter logbooks for

all Cook Inlet marine waters during September through March range from 40 in 1998 to 189 in 2000 (Table 18). Most of this harvest takes place near or south of Bluff Point. Participation in the winter chinook salmon fishery has increased slightly in recent years and that increase is also reflected in harvests reported in charter logbooks. An annual increase has occurred in the number of contestants in a March derby targeting chinook salmon since inception of the derby in 1995. A second derby was inaugurated during fall 1997 and occurred again during 1998, 2000, and 2001.

Limited formal sampling of the chinook salmon harvest for coded wire tags, age, length, sex and sexual maturity occurred prior to May or after July from 1994 through 1996. Department personnel also sampled chinook salmon harvested during the salmon derbies each year and on a limited basis at other times during the winter of 1996. Numerous voluntary returns of chinook heads, thought to contain coded wire tags by virtue of the missing adipose fin of the fish, have been returned by anglers independent of department surveys. Only one tagged chinook of Cook Inlet origin has been recovered from any source during August through March. However, relatively few chinook stocks of Cook Inlet origin are tagged and relatively few individual Cook Inlet fish receive tags compared to the diversity of stocks outside of Cook Inlet that are the focus of extensive tagging programs. The relatively small number of tagged Cook Inlet stocks may account for the lack of immature Cook Inlet recoveries in the winter fishery - it is likely that the winter stocks are largely composed of nonlocal stocks because of the lack of coded wire tagged Cook Inlet fish recovered from the fishery.

A formal tag recovery program was initiated in 1997 when early (May through June 23) and late (June 24 through mid July) Cook Inlet chinook salmon are thought to be present in LCIMA marine waters. Both runs were sampled in 1997 and 1998. Late run sampling was discontinued after 1998 but early run sampling is ongoing (Table 19). Tagged fish of non-Cook Inlet origin are all from hatcheries in British Columbia, Washington, and Oregon.

Sexually immature chinook salmon are more predominant in the harvest south of Bluff Point than to the north (Table 20).

MANAGEMENT OBJECTIVES

No regulatory management plan specifically addresses the mixed stock fishery south of Bluff Point and there is no inseason management of this fishery. Staff have been assigned to Homer to recover coded wire tags from May through July in 1997 and 1998 and from May through June since 1998. Sampling of fishing derby catches for CWTs and biological information occurs as staff time permits.

BOARD OF FISHERIES ACTIONS

The BOF rescinded the seasonal bag limit and reporting requirement during October 1 to March 31 in 1988. No further Board action was focused on this fishery until the meeting of 1998, when consideration of a public proposal to reinstate a seasonal limit and reporting requirement during November to April was postponed to the 2001 meeting pending consideration by the North Gulf Coast Chinook Salmon Task Force. This task force was not convened, therefore this proposal was taken up at the BOF meeting in fall 2001. The Board of Fisheries established an annual limit of five chinook salmon based on their concerns that, while small, the harvest was focused on mixed stocks, many of unknown origin, and there was no regulation in place to cap the harvest. Public outrage at the

Table 18.-Cook Inlet marine chinook salmon harvest by month and year reported in charter logbooks, 1998-2000.

	1998			1999			2000			Average		
Month	Number Vessels	Chinook Harvest	Proportion Chinook of Total	Number Vessels	Chinook Harvest	Proportion Chinook of Total	Number Vessels	Chinook Harvest	Proportion Chinook of Total	Number Vessels	Chinook Harvest	Proportion Chinook of Total
Jan	0	0	0.000	0	0	0.000	1	1	0.000	0	0	0.000
Feb	0	0	0.000	0	0	0.000	7	23	0.005	2	8	0.002
Mar	0	0	0.000	8	13	0.003	16	38	0.009	8	17	0.004
Apr	28	35	0.008	23	34	0.008	67	84	0.020	39	51	0.012
May	1,350	2,466	0.581	1,325	2,001	0.471	1,577	2,001	0.477	1,417	2,156	0.510
Jun	918	1,078	0.254	1,001	1,317	0.310	904	1,082	0.258	941	1,159	0.274
Jul	866	500	0.118	833	416	0.098	723	610	0.146	807	509	0.120
Aug	230	127	0.030	454	375	0.088	401	371	0.089	362	291	0.069
Sep	37	33	0.008	53	69	0.016	39	89	0.021	43	64	0.015
Oct	2	7	0.002	13	24	0.006	9	17	0.004	8	16	0.004
Nov	0	0	0.000	9	30	0.007	2	9	0.002	4	13	0.003
Dec	0	0	0.000	5	18	0.004	7	12	0.003	4	10	0.002
Total	3,431	4,246		3,724	4,297		3,753	4,337		3,636	4,293	

Table 19.-Number of chinook salmon examined for tags and number of tags recovered from the summer season marine chinook salmon sport fishery south of Bluff Point, 1997-2001.

Year	Number Examined	Number of Tags Recovered			
		Total	Cook Inlet Hatchery	Cook Inlet Wild	Non-Cook Inlet
Early Run					
1997	92	4	2	0	2
1998	142	6	0	0	6
1999	136	9	5	0	4
2000	73	2	0	0	2
2001	256	12	5	0	7
Late Run					
1997	22	0	0	0	0
1998	72	3	0	1	2

Table 20.-Estimated proportion of non-spawning chinook in the Cook Inlet marine recreational fisheries south of Bluff Point, 1997-2001.

Year	Number Females Examined	Non-spawners	
		Number	Percent of Total
Early run			
1997	26	25	(96.2%)
1998	53	43	(81.1%)
1999	62	28	(45.2%)
2000	38	17	(44.7%)
2001	86	68	(79.1%)
Late run			
1997	8	1	(12.5%)
1998	27	19	(70.4%)

Board's decision prompted them to establish a Local Area Management Plan (LAMP) task force of interested members of the public to propose an alternate regulation that will slow growth in the fishery. The task force proposal will be considered by the Board during their October work session in 2002.

OUTLOOK

Boat anglers fishing the marine waters south of Bluff Point catch primarily immature chinook salmon. Immature fish offer opportunity throughout the year both as a primary target and as an alternative when other fisheries are poor. While regulated by a yearly limit of five during April through September, no seasonal bag limit is in place during the rest of the year. Additional opportunity is afforded throughout the year by the daily bag and possession limits south of Bluff Point, which are two chinook salmon. While inclement weather during the non-summer months may affect fishing opportunity, it has not stemmed a gradual increase in participation observed in the non-summer months. Participation and harvests are expected to continue to increase throughout the year in the fishery south of Bluff Point.

CURRENT ISSUES

Relatively few chinook salmon stocks in the Pacific Northwest are tagged, particularly in Cook Inlet. The growing harvest of immature chinook salmon from many stocks, most of unknown origin, and potential harvest of some stocks falling under the strictures of the Endangered Species Act, is of concern to managers. Small numbers of chinook salmon sampled south of Bluff Point in tag recovery programs, and the uncertainty in reporting the location fished in the SWHS, have made trends in harvest and effort in this fishery difficult to track. Charter logbooks are providing new and helpful information in quantifying part of the harvest, particularly in the winter months. Winter harvests reported in charter logbooks are relatively small, indicating that this fishery doesn't threaten stock viability at present. Significant growth of the fishery in both the summer and winter months may have a detrimental effect on some stocks in the future. Charter logbooks present a valuable tool for monitoring the size, although not the origin, of harvests in the future.

RECOMMENDED RESEARCH AND MANAGEMENT

Sport harvest and participation of anglers south of Bluff Point are difficult to characterize. Angler harvest and participation in the area are estimated from the SWHS. Anglers who respond to the survey often generalize about the location where they fished, making precise estimation of harvest and effort by location difficult. The survey does not estimate effort by species and Alaska's largest halibut fishery is also prosecuted in this area. Nor does the survey provide detail about the time of year when harvest and participation occur, other than before and after July 23. Survey questions have become more specific about fishing location in recent years, but uncertainty in the location of fishing activity still remains. Continued refinement of the SWHS questionnaire is recommended to better represent the marine harvest by location.

Charter operators have been required to report the location and amount of chinook salmon caught and released by date in logbooks since 1998. This provides managers with new information about the timing and location of guided harvest. Effort, harvest and catch statistics from logbooks compare favorably to SWHS estimates. Requiring charter operators to log chinook salmon catch statistics should be continued.

LOWER KENAI PENINSULA EARLY-RUN CHINOOK SALMON FRESHWATER RECREATIONAL FISHERY

BACKGROUND AND HISTORICAL PERSPECTIVE

In the early 1970s, the Anchor River, Deep Creek, and Ninilchik River were the major chinook salmon fisheries in Southcentral Alaska. The only other major chinook salmon fishery of consequence occurred in the marine waters adjacent to Deep Creek. In the late 1970s and early 1980s other chinook salmon fisheries developed on the Peninsula and in northern Cook Inlet. The lower Peninsula chinook salmon fisheries are still major fisheries; but more recently developed fisheries in the Kenai and Kasilof rivers, the Homer Spit, and Susitna River drainage streams now have more participation and harvest. The average participation declined slightly while the harvest increased in Anchor River and Deep Creek during the 1990s. Participation and harvest increased in the Ninilchik River, with return of the first major year class of stocked fish in 1991 (Tables 21-23).

Harvest from the Anchor River, Deep Creek, and Ninilchik River (Figure 3) was controlled by allowable fishing time and area open to fishing. From 1978 through 1988, Anchor River and Deep Creek, from salt water upstream approximately 2 miles, were open to fishing during Memorial Day weekend and the next consecutive three weekends (weekends include Monday). Ninilchik River supported a smaller chinook salmon population than the other two streams and the fishery there was open for only three consecutive 3-day weekends in the lower 2 miles.

Anchor River and Deep Creek

Annual aerial index counts of chinook salmon returns to Anchor River and Deep Creek from 1976 through 1989 averaged 1,700 and 700, respectively (Table 17). In the late 1980s, angler effort appeared to be declining (Tables 21 and 22). The Board therefore extended the fishery on these streams, adding a fifth consecutive 3-day weekend beginning in 1989.

The chinook salmon sport harvest from the Anchor River and Deep Creek increased substantially after 1991 following the extension of the fishing season in these streams (Tables 17, 21, and 22). A general increase in the harvest from these tributaries continued through 1993. Harvests declined in 1994 and again in 1995 but remained well above pre-1990 levels.

A wild salmon tagging project was started in Deep Creek in 1994 because of its proximity to the marine fishery, and concern about overharvest of this relatively small stock in the marine fishery. Juvenile chinook salmon were marked through 1997 and coho salmon were marked during 1995 through 1997 (Table 24). A weir was operated in Deep Creek starting in 1997 with the goal of estimating total smolt outmigration and marine survival.

Ninilchik River

Water conditions on the Ninilchik River are generally less turbid than on the other two streams. The clear water increases angler efficiency and has resulted in a relatively high exploitation rate on the Ninilchik. The BOF has not liberalized the fisheries on Ninilchik River because the number of chinook salmon returning here had not significantly increased (Table 17).

An average of approximately 180,000 hatchery-reared smolt of Ninilchik River origin were stocked annually in the Ninilchik River from 1988-1994 (Appendix A1). Stocking levels were reduced in 1995. Augmentation of the return with hatchery-reared fish provided the opportunity to increase recreational

Table 21.-Angler participation and harvest of chinook, coho, pink, and sockeye salmon; Dolly Varden; rainbow trout and steelhead trout, Anchor River, 1977-2000.

	Harvest							
						Rainbow/Steelhead		
Year	Chinook Salmon	Coho Salmon	Pink Salmon	Sockeye Salmon	Dolly Varden	Harvest	Catch	Days Fished
1977	1,077	1,339	27		9,222	2,099		31,515
1978	2,109	1,559	139		17,357	2,305		42,671
1979	1,913	4,006	18		21,364	1,782		44,220
1980	605	2,649	339		10,948	1,186		33,272
1981	1,069	2,949	11		15,271	928		34,257
1982	718	2,379	161		10,375	698		24,709
1983	1,269	1,395	252		17,277	1,605		28,881
1984	998	1,135	249	167	5,599	985		26,919
1985	672	2,239	124	224	7,716	475		31,715
1986	1,098	1,021	136	39	3,914	520		34,938
1987	761	2,010	54	1,263	2,735	643		39,045
1988	976	2,219	109	109	2,746	200		24,356
1989	578	2,635	115	136	1,476		2,066 [a]	19,145
1990	1,479	2,782	163	136	2,821		1,978 [a]	28,829
1991	1,047	3,169	125	152	1,409		2,349 [a]	22,187
1992	1,685	2,267	92	66	2,532		2,720 [a]	24,028
1993	2,787	4,003	98	45	1,031		4,156 [a]	29,338
1994	2,478	3,360	79	82	1,574		4,035 [a]	27,856
1995	1,475	3,080	47	94	1,537		2,232 [a]	25,888
1996	1,483	1,762	78	218	963		7,570 [a]	16,016
1997	1,563	1,636	321	165	1,575		3,103 [a]	17,020
1998	783	2,386	7	174	2,105		3,878 [a]	14,310
1999	1,409	1,780	54	174	1,061		3,920 [a]	21,184
2000	1,730	2,604	123	127	1,903		8,693 [a]	22,971
1977-2000 Average	1,323	2,349	122	198	6,021			27,720
1977-1996 Average	1,314	2,398	121	210	6,893	1,119	3,388	29,489

Source: Statewide Harvest Survey (Mills 1979-1994; Howe et al. 1995, 1996, 2001a-d; Walker et al. 2003).

[a] Rainbow/steelhead trout caught and released. Retention of this species is prohibited. 1989 catch estimates from unpublished Statewide Harvest Survey data.

Table 22.-Angler participation and harvest of chinook, coho, pink, and sockeye salmon; Dolly Varden; rainbow trout and steelhead trout, Deep Creek, 1977-2000.

	Harvest							
	Chinook	Coho	Pink	Sockeye	Dolly	Rainbow/ Steelhead		Days
Year	Salmon	Salmon	Salmon	Salmon	Varden	Harvest	Catch	Fished
1977	425	306	109		1,330	569		11,399
1978	804	1,383	294		3,046	498		13,872
1979	703	362	9		2,027	263		12,560
1980	182	478	321		1,028	236		8,796
1981	604	464	11		1,382	248		10,127
1982	791	366	293		1,247	239		12,149
1983	1,154	545	42		1,112	315		13,505
1984	761	1,197	112	318	973	311		15,760
1985	249	2,301	37	187	850	179		19,802
1986	944	588	52	52	306	688		17,354
1987	604	1,050	18	191	72	85		16,734
1988	777	1,528	72	182	219	291		12,115
1989	843	2,254	28	117	333		409 [a]	13,414
1990	1,411	1,111	35	165	708		1,291 [a]	23,567
1991	1,776	1,290	50	876	287		425 [a]	17,048
1992	1,379	737	46	378	401		740 [a]	15,226
1993	2,503	1,722	81	145	145		1,448 [a]	19,535
1994	2,379	1,895	25	141	377		1,156 [a]	18,357
1995	1,161	1,014	180	87	301		520 [a]	12,727
1996	886	2,313	21	55	615		1,079 [a]	9,629
1997	1,249	1,115	106	252	276		384 [a]	9,712
1998	539	2,035	47	185	1,061		1,350 [a]	9,206
1999	741	2,651	165	214	496		689 [a]	11,367
2000	913	2,045	62	72	355		1,805 [a]	12,174
1977-2000 Average	991	1,281	92	213	789			14,006
1977-1996 Average	1,017	1,145	92	223	838		884	14,684

Source: Statewide Harvest Survey (Mills 1979-1994; Howe et al. 1995, 1996, 2001a-d; Walker et al. 2003).

[a] Rainbow/steelhead trout caught and released. Retention of this species is prohibited. 1989 catch estimates from unpublished Statewide Harvest Survey data.

Table 23.-Angler participation and harvest of chinook, coho, pink, and sockeye salmon; Dolly Varden; rainbow trout and steelhead trout, Ninilchik River, 1977-2000.

	Harvest							
						Rainbow/ Steelhead		
Year	Chinook Salmon	Coho Salmon	Pink Salmon	Sockeye Salmon	Dolly Varden	Harvest	Catch	Days Fished
1977	1,168	122	0		424	230		11,350
1978	1,445	88	46		1,003	307		14,173
1979	1,493	200	0		2,390	509		18,282
1980	723	321	260		853	381		19,706
1981	1,523	432	0		875	464		14,184
1982	1,240	241	10		514	179		11,806
1983	871	210	42		199	157		9,458
1984	648	549	150	1,405	524	137		10,122
1985	983	697	0	373	87	501		10,213
1986	420	336	13	465	505	275		9,250
1987	1,112	924	108	2,488	507	291		13,329
1988	795	709	36	1,073	655	272		12,533
1989	744	379	216	526	39		505 [a]	9,997
1990	693	368	12	58	116		177 [a]	8,323
1991	3,123 [b]	789	116	203	222		512 [a]	19,640
1992	5,316 [b]	785	37	1,101	131		1,008 [a]	27,816
1993	4,235 [b]	845	0	406	29		442 [a]	20,466
1994	3,108 [b]	1,089	17	943	65		804 [a]	21,827
1995	2,451 [b]	620	38	161	133		178 [a]	16,160
1996	2,401 [b]	1,071	0	284	560		522 [a]	11,445
1997	3,263 [b]	402	32	236	141		380 [a]	11,064
1998	1,453 [b]	836	13	101	272		576 [a]	10,994
1999	1,945 [b]	2,980	107	964	114		694 [a]	15,344
2000	1,782 [b]	1,724	20	255	228		760 [a]	12,405
1977-2000 Average	1,789	697	53	650	441			14,162
1977-1996 Average	1,725	539	55	730	492		519	14,504

Source: Statewide Harvest Survey (Mills 1979-1994, Howe et al. 1995 and 1996, 2001a-d, Walker et al. 2003).

[a] Rainbow/steelhead trout caught and released. Retention of this species is prohibited. 1989 catch estimates from unpublished Statewide Harvest Survey data.

[b] Enhanced run.

Table 24.-Estimated number of chinook salmon and coho salmon fingerling and smolt tagged with coded wire tags in Deep Creek, 1994-1997.

Year	Number of Chinook Tagged	Number of Coho Tagged
1994	13,255	
1995	13,568	9,671
1996	8,966	4,868
1997	7,419	6,948

Source: Bendock 1995 and 1996, King and Breakfield 1998 and 1999.

harvest and participation. From the time of the first adult return (age class 1.3) from stocking in 1991 until the effect of reduced stocking levels was first realized in 1997, harvest in the inriver sport fishery increased from the 1977-1990 average of 1,000 fish to 3,000 fish, while escapement index counts averaged approximately 490 fish (Table 17). Increased fishing opportunity was provided by increasing the length of the season by emergency order. The fishery is open by regulation for three, 3-day weekends beginning with Memorial Day weekend at the end of May. From 1991 through 1995 the season was extended by emergency orders, which generally opened the fishery beginning on Saturday of the fourth weekend and extended the open fishing period through the following Monday. A more conservative approach was applied if stream conditions did not permit visual escapement enumeration or if visual enumeration indicated less than 500 fish upstream from the fishery at the conclusion of the third weekend.

Creel surveys were conducted during the 1991 through 1993 seasons to monitor the fishery and to estimate the contribution of hatchery fish to the harvest (Table 25) (Boyle and Alexandersdottir 1992, Boyle et al. 1993, Balland et al. 1994). Approximately 20% of released hatchery fish were tagged with coded wire tags. Recovery of those tags in the fishery provided the estimate of hatchery contribution. No creel survey was conducted in 1994, but hatchery contribution to the fishery was monitored by examining the harvest for fish missing the adipose fin (Marsh 1995).

Concern about unsustainable harvests of wild chinook salmon in the Ninilchik River, negative hatchery-wild smolt interactions, straying of hatchery fish and "recycling" of hatchery-produced fish during chinook salmon egg takes resulted in a reduction in stocking levels from approximately 180,000 chinook salmon smolt to 50,000 in 1995. The percentage of tagged hatchery smolt was increased from approximately 20% to 100% (Appendix A1).

The Ninilchik River was opened for an additional 14 days in 1995. The opening was based on counts made by foot upstream of the fishery following the third weekend opening. Water conditions precluded

aerial and ground counts in 1995 but escapement to the system was judged to be adequate based on the number of chinook that were allowed upstream of the egg-take weir in place in July.

RECENT FISHERY PERFORMANCE

Anchor River and Deep Creek

Substantial changes of the regulations governing Deep Creek and the Anchor River and the adjacent marine fishery occurred in 1996, partially as a result of recent below average escapement counts to these two streams. The marine fishery from Bluff Point north to Ninilchik was restricted. The chinook salmon fishery in Deep Creek was reduced from five weekends to three, and the combined seasonal bag limit in Deep Creek and the Anchor River was reduced from five to two chinook salmon 16 inches or larger. In both the Anchor River and Deep Creek, an angler could no longer fish for the remainder of the day after harvesting a chinook salmon. The spawning areas of Anchor River, Deep Creek, Stariski Creek and the Ninilchik River were closed to all fishing until August 1 to protect spawning chinook salmon from catch-and-release mortality.

Table 25.-Ninilchik River chinook salmon sport fishery statistics and aerial survey escapement index counts, 1991-2001.

		Creel Survey			Statewide Harvest Survey			
Year	Fishery Days	Effort (Angler Hours)	Harvest	Catch	Effort (Total Days Fished[a])	Harvest	Catch	Aerial Escapement Count
1991	19	51,318	5,053	9,718	19,640	3,123	19,640	594
1992	19	60,246	4,896	12,606	27,816	5,316	27,816	[b]
1993	23	51,203	5,610	15,054	20,466	4,235	20,466	688
1994	23				21,827	3,108	21,827	252
1995	23				16,160	2,451	16,160	[b]
1996	19				11,445	2,401	11,445	158
1997	9				11,064	3,263	11,064	393
1998	9				10,994	1,453	10,994	316
1999	9				15,344	1,945	15,344	357
2000	9				12,405	1,738	12,405	578
2001	9							258
Mean					16,716	2,903	16,716	399

Source: Creel data from Boyle and Alexandersdottir 1992, Boyle et al. 1993, Balland et al. 1994; Statewide Harvest Survey data from Mills 1979-1994; Howe et al. 1995, 1996, 2001a-d; and Walker et al. 2003.

[a] Days fished at the Ninilchik River targeting all species.

[b] Aerial escapement counts not obtained due to high water.

Estimates of sport harvests of chinook salmon from the Anchor River in 1996 were similar to the 1995 harvest estimate; Deep Creek harvests declined by over 20% in 1996 from 1995 estimates (Tables 17, 21, and 22).

In 1996, 360 returning adult chinook salmon were captured using nets in Deep Creek. Those missing their adipose fin (12) were sacrificed to determine their stream of origin and to estimate the total number of their cohort that had outmigrated with them as smolt. Chinook salmon of Ninilchik River hatchery release origin comprised an estimated 14.1% of the 360 fish sampled from Deep Creek.

Sport harvests from the Anchor River remained fairly stable while Deep Creek harvests rebounded above 1995 levels in 1997 (Tables 17, 21, and 22). Fishing success was enhanced because water levels were unusually low and water clarity was unusually high during much of the fishery that year. A weir was operated for the first time in Deep Creek in 1997 to count returning chinook and coho salmon with and without coded wire tags (Table 26). A total of 1,732 chinook passed through the weir during operation (King and Breakfield 1999). Netting upstream of the weir resulted in the capture of 96 chinook salmon that had not been counted at the weir. Of the total salmon counted at the weir and during netting, 136 with coded wire tags (identified by a missing adipose fin) were sacrificed to determine their stream of origin and verify their age. Approximately 3% of the chinook salmon counted at the weir were of Ninilchik River hatchery release origin.

Water levels were high and water clarity was extremely low during much of May and June of 1998. Angler success rates were low in the Anchor River and few anglers attempted to fish in Deep Creek at all during the fishery openings. High water prevented installation of the weir in Deep Creek until June 20, after much of the run was past the weir location. Subsequent mark-recapture experiments upstream were unsuccessful at capturing adequate numbers of chinook to estimate escapements.

The Anchor River suffered from high muddy water throughout most of the five weekends the fishery was open in 1999. Anglers reported good fishing despite the poor water conditions. Deep Creek was not fishable for the first two weekends of the fishery. Anglers reported excellent fishing during the final weekend of the fishery. The fishing season was not extended despite numerous requests because of concerns about stock status and lack of information about run timing, inseason escapement and the efficiency of the fishery. Deep Creek weir installation was delayed from May 9 until June 16 due to high water. An estimated 400 chinook salmon were counted from a fixed-wing aircraft in Deep Creek upstream of the weir and an additional 100 were counted in Clam Creek, June 23. Few fish had been counted through the weir at that time. Approximately 900 chinook salmon were counted in Deep Creek upstream of the weir from a fixed wing aircraft July 1 compared to 406 chinook salmon that had been counted through the weir. The total weir count for 1999 was 2,055 chinook salmon (Table 26). Fewer fish are thought to have traveled upstream prior to weir installation in 1999 than in 1998, although the weir was fish tight on approximately the same date in both years. Coded wire tagged fish that had strayed from other origins in Cook Inlet accounted for 47 chinook salmon counted at the weir or captured with nets upstream of the weir.

In 2000, fishing on the Anchor River was good despite high and muddy water the first two weekends the fishery was open, and fishing was excellent on subsequent weekends as water clarity improved.

Table 26.-Summary of chinook salmon captures during weir operation and upstream netting, Deep Creek, 1997-2000.

	Weir Installation[a]	Weir Count[b]	Upstream Netting	Inriver Harvest	Total Return[c]	Aerial Count	CWT Recovery[d]
1997	24-May	1,732	96	1,249	3,077	136	136
1998	20-Jun	367	118	539	1,024	676	47
1999	17-Jun	2,055	231	741	3,027	1,190	183
2000	15-Jun	1,148	92	937	2,177	556	137

[a] Date weir was fish-tight, installation was postponed due to high water in 1998 through 2000.

[b] Weir counts are minimums, immigration in progress prior to weir installation.

[c] Sum of weir count, upstream netting and harvest; minimum count.

[d] Number of chinook salmon sacrificed for coded wire tag recovery information.

Deep Creek was high and muddy the first weekend, but anglers reported fair fishing at the mouth. During the second and third weekends of the fishery, anglers reported excellent fishing throughout the open area at Deep Creek. Installation of the Deep Creek weir was delayed from May 9 until June 15 due to high water. No aerial survey was possible during this time period because of poor water conditions, so no estimate of the number of fish that may have escaped prior to installation is available. The total chinook count at the weir for 2000 was 1,148 (Table 26). In 2000 the mid-point of the return through the weir was reached on July 13 as compared to July 18 in 1999. During the upstream netting, 92 chinook were captured of which only five had marks identifying them as having passed through the weir. This may be partly the result of the difficulty the weir crew had marking fish in an identifiable manner early in the weir operation. Coded wire tagged chinook salmon accounted for 54 strays from other stocks in Cook Inlet.

The Anchor River and Deep Creek were high and muddy throughout most of the first three open weekends in 2001. Anglers reported fair fishing in the muddy waters of the Anchor River but fish were difficult to bring to shore in the strong currents. Once the water cleared fishing improved and was reported as fair. Virtually no one fished in Deep Creek until June 10, the last day of the regulatory openings. Deep Creek was opened by emergency order (Appendix B1) for an additional 3-day weekend June 16 through June 18. Participation was light and fishing was reported as fair.

Ninilchik River

The Ninilchik River was opened an additional 10 days after the regularly-scheduled openings in 1996 (Appendix B1), based on foot survey counts upstream from the fishery following the regular fishery openings. The season was not extended during 1997-2000 because fewer than 100 chinook salmon

were counted upstream of the fishery after the regulatory openings in 1997 through 1999 and 225 were counted in 2000. The decline in the number of chinook salmon seen upstream of the fishery after 1996 is probably a result of the reduction in the number of stocked chinook salmon after 1995. Counts of chinook salmon that were passed upstream of the Ninilchik River weir operated during July egg collection operations (after some unknown proportion of the chinook escapement had passed upstream of the weir site) have numbered between 500 and 1,000 since 1994. The proportion of hatchery-produced chinook salmon handled at the weir has varied between 19% and 47% of the total handled (unpublished data, located at Homer office of ADF&G, Sport Fish).

The weir was operated throughout the chinook salmon escapement beginning in 1999 to estimate the magnitude and run timing of wild and hatchery stocks returning to the river (Table 27). Only 7% of the total number of fished that passed the weir had done so by the end of June (Appendix C1). The midpoint escapement through the weir occurred on July 13 for the wild stock compared to July 24 for the hatchery fish. A total of 1,644 wild and 641 hatchery fish were counted at the weir. Of those, 42 missing their adipose fins were sacrificed to determine their stream of origin, and 94 were killed to provide progeny for stocking. The total escapement to the spawning grounds of both hatchery and wild chinook was 2,149.

During 2000, run timing of wild and hatchery fish through the weir was nearly identical to 1999. Chinook salmon of hatchery origin were 34% of the weir count compared to 28% in 1999. Chinook salmon sacrificed to determine stock origins and provide for future stocking totaled 249. The total spawning escapement was 2,238.

The overall proportion of hatchery fish in the sport harvest in 2000, estimated from sampling the fishery downstream of the Sterling Highway Bridge, was 49%. The proportions varied from 45% to 53% but were not significantly different. The average hatchery contribution to the fishery in 2000 was similar to the average percent of hatchery-reared chinook salmon sampled in the fishery during the creel survey in 1993 (Balland et al. 1994). Hatchery contribution estimates from creel surveys in 1991 and 1992 were 77% and 57%, respectively (Boyle and Alexandersdottir 1992, Boyle et al. 1993). The duration of the fishery was longer in 1991 through 1993 than during 2000 or 2001.

A total of 2,086 chinook salmon were counted at the weir during 2001. The return was comprised of 32% hatchery-reared fish. Accounting for removal for stocking and sampling for strays, the spawning escapement totaled 1,746 fish of which 1,204 were wild fish. The midpoint of immigration of wild fish was July 13 as compared to July 21 for hatchery-produced fish (Appendix C1).

The overall proportion of hatchery fish observed in the 2001 sport harvest during the three weekend-only fishing periods was 48% and varied from 42% to 58%. These proportions were not significantly different among weekends. High incidence of hatchery fish in the harvest and ample numbers of fish in the lower river between the weir and the area open to fishing justified an extension of the sport fishery. Consequently, an emergency order opened the Ninilchik to include a fourth weekend, June 16 through June 18 (Appendix B1). The estimated hatchery-stock contribution to the fourth weekend's harvest increased to 62%, and was significantly different from weekends one through three.

Table 27.-Summary of chinook salmon return and escapement counts, Ninilchik River weir, 1999-2001.

		Weir Count	Inriver Harvest[a]	Total Return	Inriver Exploitation	CWT Recovery	Egg Take Kill	Spawning Escapement	Aerial Survey Count
1999	Wild	1,644	973	2,617			68	1,576	
	Hatchery	641	972	1,613		42	26	573	
	Total	2,285 [b]	1,945	4,230	0.46	42	94	2,149	357
2000	Wild	1,634	869	2,503	0.35		81	1,553	
	Hatchery	853	869	1,722	0.5	108	60	685	
	Total	2,487	1,738	4,225	0.41	108	141	2,238	578
2001	Wild	1,414					210	1,204	
	Hatchery	672				130		542	
	Total	2,086				130	210	1,746	258
Avg.	Wild	1,564					120	1,444	
	Hatchery	722				93	29	600	
	Total	2,286				93	148	2,044	398

[a] Hatchery harvest estimate average of 50% is based on creel survey data in 2000.

[b] Weir count includes 31 wild chinook salmon and 38 hatchery chinook salmon netted downstream of the weir.

Escapements

Chinook salmon escapement to the Lower Peninsula streams has been assessed since 1962. Prior to 1974, fixed-wing aircraft were used in tandem with foot surveys. After 1973, helicopters were used in concert with foot surveys. The escapement to these streams was indexed by counting salmon from the air along a standard section of each river where the majority of spawning was thought to occur and counting a standard subsection by foot. If the ground count was higher than the aerial count for that subsection, the aerial count for the whole stream was expanded by the difference between the aerial and ground counts in the subsection. If the aerial count was higher for the subsection, the aerial count of the entire stream was used as the escapement index. Ground surveys were discontinued after 1995 as a cost savings because trends in ground counts mirrored trends in aerial counts and because ground counts added an additional source of variability in estimating the true escapement to the Lower Peninsula streams. Since the ground surveys were discontinued, only aerial counts have been used to index escapement.

Chinook salmon biological escapement goals (BEGs) of 950 for Deep Creek, 1,790 for the Anchor River and 830 for the Ninilchik River were adopted in 1993. These goals were an average of the annual expanded estimates from aerial and foot survey index counts conducted from 1966 to 1969 and

1972 to 1991. The expanded escapement index count of the Anchor River of 1,051 chinook salmon was below the goal in 1994. Poor water conditions prevented making either ground or aerial counts for the Anchor River in 1995. The expanded index counts of escapement to Deep Creek were 891 in 1994 and 374 in 1995, both below the BEG.

Since the ground counts of chinook salmon were discontinued in 1996, aerial counts alone have been used to index spawning escapement. In 1998, the BEGs for the Anchor River, Deep Creek and the Ninilchik River were rescaled based on historical aerial survey counts alone and the relationship of the aerial survey counts to sport fishing harvests. The escapement levels that achieve sustainable harvests could not be estimated precisely so they were approximated. For each stream, the median value of counts taken within a 2-week period at the end of July and first week in August in all years since helicopters were used exclusively to conduct surveys was determined. Use of the median value as a BEG implies that escapements are less than that value half the time, so a range of values around the median was chosen as the BEG. The upper end of the range was the value that 20% of the historical aerial counts were above. The lower end of the range was chosen by examining the relationship between aerial escapement counts and harvest, and determining what aerial escapement level was sustained during years of large harvests prior to the 1990s. This lower end of the range was the escapement value that 40% of the historical aerial counts were below. The median aerial count in the Anchor River was 1,211 and the BEG was set within the range of 1,050 to 2,200 chinook salmon. For Deep Creek the median aerial count was 550 and the BEG was set between 400 and 950 chinook. The median aerial count was 550 in the Ninilchik River and the BEG was set within the range of 500 to 900 chinook salmon.

Escapement goals for salmon stocks in Cook Inlet were reevaluated in 2001 after adoption of the Sustainable Fisheries and Escapement Goal policies into regulation by the BOF in 2000. A set of standard criteria was developed to set escapement goal ranges for stocks where total returns cannot be enumerated, based on the performance of salmon stock dynamics where total returns are known. The 25^{th} to 75^{th} percentiles of annual 1976-2000 helicopter aerial escapement counts at Deep Creek and Anchor River were established as the new sustainable escapement goal (SEG) ranges for those streams. The actual escapement goal range values for the Anchor River or Deep Creek are now set at 750-1,500 and 350-800, respectively.

Aerial escapement counts to the Ninilchik are generally considered too poor to base management decisions upon. The correlation between total weir counts and aerial counts is uncertain. The trend in weir counts is similar to the trend in aerial counts but the relative magnitude of the two sources is variable (Table 27). Aerial survey counts of the Ninilchik River in 1999 and 2000 and 2001 were 17%, 26%, and 13%, respectively, of the number of fish counted at the weir by the dates the aerial surveys were flown. The escapement was enumerated at the weir only for the limited period required to collect chinook salmon eggs prior to 1999, but included the period July 8 through July 24 each year. In 1999 through 2001 the weir was in place for the entire run. Approximately 50% of the total wild run was counted during July 8-24 in 1999 through 2001.

The SEG for the Ninilchik River is based on the return of wild fish, indexed by the passage of wild fish through the weir during July 8-24. All hatchery-produced fish are now coded wire tagged. Recovery of these tags at the weir allows separate enumeration of wild and hatchery-produced fish. In 2001, the

lower end of the Ninilchik River chinook salmon SEG range was established as the 15th percentile of the 1994 through 2000 estimates of wild chinook salmon passage through the weir during July 8-24. The upper end of the range was set at the maximum observed wild chinook salmon escapement through the weir during July 8-24 from 1994 through 2000 (Table 28). This approach established an SEG range of 400 to 850 wild chinook salmon.

Table 28.-Number of wild and hatchery-reared chinook salmon counted at the Ninilchik River weir, July 8 through July 24, 1994 through 2001.

Year	Wild chinook	Hatchery chinook
1994	423	40
1995	503	342
1996	591	264
1997	235	358
1998	422	268
1999	799	277
2000	834	426
2001	710	367
Average 1994-2001	565	293
SEG [a]	400-850	

[a] SEG = Sustainable Escapement Goal established in 2001. Goal for Ninilchik is based on return of wild fish.

Anchor River aerial escapement index counts since 1994 have been at the low end of or below the SEG range (Table 17), while harvests have generally been above average levels. In 1998 through 2000, aerial counts improved but were still at the low end of the SEG. The index count in 2001 was the third lowest on record. Aerial spawning escapement index surveys in the Anchor River indicate that the current regulations may not be sufficiently restrictive to manage this fishery for sustained yield.

Aerial index counts of chinook salmon escapement to Deep Creek have been within or above the SEG range since 1998 (Table 17). This increase coincides with the influence of fishing restrictions and with years of high turbid water during some or all of the fishery openings. We are currently unable to determine the actual escapement to Deep Creek or the maximum harvest level that will maintain escapement levels. Weir counts in 1997 and 1999 are likely the closest to the actual escapement. Instream exploitation rates estimated from those counts were 41% and 24%, respectively, and are likely maximum estimates because escapement is underestimated. The number of spawners in 1997 and

1999 was at or above the level thought to achieve stable long-term production in chinook salmon populations (McBride et al. 1989). Our inability to fully enumerate the chinook salmon return to Deep Creek with the weir has precluded evaluation of aerial index counts. The current level of exploitation is likely to be sustainable, assuming weir counts represent minimum escapement levels.

The counts of chinook salmon through the Ninilchik River weir during July 8 through July 24 have exceeded the lower end of the SEG range in all years from 1994-2001, except 1997. Wild and hatchery chinook salmon escapement to the Ninilchik River was successfully censused at the weir in 1999 through 2001. The wild stock exploitation instream was 37% in 1999 and 34% in 2000. The number of wild chinook salmon that spawned is above the level thought to produce long-term sustainable production in chinook populations (McBride et al. 1989). With only 3 years of weir counts available for comparison (Table 27), their correlation to aerial counts is uncertain. Due to variability in the aerial counts caused by years of poor water clarity, counts may never be precisely related to actual escapement. Therefore future escapement will continue to be indexed by weir counts from July 8 through July 24. A harvestable surplus of hatchery-reared chinook is available in the Ninilchik River.

MANAGEMENT OBJECTIVES

Separate department objectives have been established for Anchor River and Deep Creek wild stocks, and Ninilchik River naturally-produced fish.

Objectives for Anchor River and Deep Creek are:

Objective 1: Ensure, through appropriate management and research programs, that the spawning escapement index does not decline below levels necessary to ensure sustained yield. This number is the Sustainable Escapement Goal or SEG, which is 750-1,500 for the Anchor River and 350-800 for Deep Creek.

Objectives for Ninilchik River are:

Objective 1: Ensure that 400-850 chinook salmon spawn naturally in the Ninilchik River annually.

Objective 2: Stock 50,000 chinook salmon smolt into the Ninilchik River, which yield a 3% survival or 1,500 returning adults.

Objective 3: Ensure that the historical age and sex composition are not significantly altered by supplemental production.

Objective 4: Provide approximately 2,500 additional angler-days of participation for chinook salmon at the Ninilchik River during June.

Anchor River and Deep Creek are managed by regulation because the fishery occurs in late May and June when water conditions are often too high and turbid to visually count fish in these streams. The Ninilchik River fishery may be extended by emergency order based on counts made by foot upstream.

BOARD OF FISHERIES ACTIONS

There were no regulatory changes adopted by the Board in 1990 or 1992 that affected these fisheries.

Substantial changes to the regulations governing Deep Creek and the Anchor River occurred in 1996. The chinook fishery in Deep Creek itself was reduced from five weekends to three and the combined seasonal bag limit in Deep Creek and the Anchor River was reduced from five to two chinook salmon

16 inches or larger. In both the Anchor River and Deep Creek, an angler could no longer fish for the remainder of the day after harvesting a chinook salmon. The spawning areas of Anchor River, Deep Creek, Stariski Creek and the Ninilchik River were closed to all fishing until August 1 to protect spawning chinook salmon from catch-and-release mortality.

During the BOF meeting in February of 1999, in response to the guidelines established in the Sustainable Salmon Fisheries Policy (5 AAC 39.222), the BOF designated Anchor River chinook salmon as a stock of "management concern" defined in the policy as "a concern arising from a chronic inability, despite use of specific management measures, to maintain escapements for a salmon stock within the bounds of the SEG, BEG, OEG, or other specified management objectives for the fishery" (5 AAC 39.222 (f) (21)). The decision was based on a general observed decline in escapement index with six of 12 escapement indices measured since 1989 (1989-2001) below the current SEG range of 750 to 1,500 fish and escapements in 4 of the last 6 consecutive years (1996-2001) below the current SEG range. The regulatory fishery openings were reduced from five to four 3-day weekends.

Members of the public proposed to the BOF in 2001 to increase the number of weekends Deep Creek and the Ninilchik River are open to fishing. The Department did not support these proposals and the Board of Fisheries agreed.

CURRENT ISSUES

Prior to 1990, instream harvest from the Anchor River was proportionate to run strength. Average to above average returns resulted in average to above average harvest and aerial spawning escapement index counts. Below average returns result in below average harvests and less than average escapements. Harvests since 1990 average almost twice to more than three times the average harvest from 1976 through 1989 while aerial escapement indices have declined by nearly half to three times from the 1980s to the 1990s. It is hoped that the recent BOF action to reduce the fishery in the Anchor River to four 3-day weekends will result in increased escapement and index counts within the SEG range of 750 to 1,500. The relationship between aerial indices and actual escapements to lower Peninsula streams has yet to be resolved but some inferences can be made where there is weir data. Although complete enumeration of chinook salmon escapement at the Deep Creek weir was not possible, counts in 1999 and 2000 indicate that the lower boundary of the SEG may approximate escapements that provide sustainable yields in years of average water conditions. The aerial survey counts in the Anchor River probably represent a similar proportion of the actual escapement as aerial counts in Deep Creek because the Anchor River experiences water conditions and fluctuations similar to Deep Creek. Successful operation of a weir in the Ninilchik River during 1999 and 2001 indicated that aerial surveys there are poor indices and that the weir counts during a limited period in July are better indicators of run strength.

Regulation of the Deep Creek fishery appears more successful. Deep Creek escapements have rebounded to within the SEG range and, while weir counts don't completely enumerate escapement, return rates compare favorably to levels thought to be sustainable in other chinook salmon populations. The count of wild chinook salmon through Ninilchik weir during July 8-24 is above the level that should sustain future production. Harvest sampling to estimate hatchery contribution to the salt- and freshwater harvests and the results of weir operations should allow managers to manage for sustainable harvests and allow better utilization of hatchery stocks.

The department has concerns about the long-term impact of the hatchery stocking program on wild stocks in the Ninilchik River. Wild chinook salmon escapement peaks nearly 10 days prior to the peak of the hatchery return, indicating that enhancement has influenced run-timing characteristics of the overall population. The proportion of hatchery-reared chinook salmon handled at the weir in the Ninilchik is variable but has been in excess of 30% in 5 of the past 6 years. The effect of hatchery-reared chinook salmon spawning naturally in the Ninilchik River on the long term viability of wild chinook is unknown.

The harvest at Deep Creek has stabilized at a level that coincides with escapement indices in the range that is thought to be sustainable. Since 1997, escapement indices within the goal range have coincided with water conditions that allowed one to two weekends of "good" fishing. When water conditions are so poor that virtually no fishing can occur, the fishery can be extended by emergency order as in 2001. The department plans to investigate options for liberalizing the fishery in the Ninilchik to harvest more hatchery fish without jeopardizing the escapement of wild fish.

RECOMMENDED RESEARCH AND MANAGEMENT

Estimating the actual escapement to the lower Peninsula streams, and relating that to an index of escapement remains difficult. The impacts of harvest levels and human development cannot be measured accurately. Immediate concerns are potential overharvest of Anchor River wild stocks and the effects of hatchery-reared chinook salmon on Ninilchik River wild stocks. Recommendations for future and continued research are:

1. By 2004, install a weir that withstands high water in the Anchor River if feasible, or Deep Creek if not, to accurately assess the spawning escapement of chinook salmon.
2. The Ninilchik River weir may be operated during 2002 throughout the chinook salmon return to census wild and hatchery-reared chinook salmon escapement incidentally to a cooperative project with USFWS focused on steelhead. Otherwise the weir will be operated to enumerate chinook escapement in conjunction with its function as a collection device for chinook salmon eggs.
3. Given that (1) and (2) are achieved, spawning escapement goals for wild stock chinook salmon in these streams should be established and/or refined with appropriate management strategies to achieve these goals.
4. The stock separation program will continue in the adjacent marine fishery through June of 2002 to further define the proportionate contribution of each stock identified to the total harvest.

LOWER PENINSULA EARLY-RUN FRESHWATER COHO SALMON RECREATIONAL FISHERY

HISTORICAL PERSPECTIVE

The lower Peninsula early-run coho salmon fishery occurs on the Anchor River, Deep Creek, Ninilchik River and Stariski Creek (Figure 3). The area open to coho salmon fishing on Deep Creek and Ninilchik River is the lower 2 miles as posted; on Anchor River fishing is permitted upstream to the junction of the north and south forks (about 2 miles); on Stariski Creek, coho salmon may be taken from salt water upstream to the Sterling Highway Bridge (approximately 1 mile). These streams do not contain late-run coho salmon.

Spawning occurs in the upstream areas of these streams. Spawning escapement counts were conducted at the weir in the Anchor River from 1987-1989 and 1992, and at the Deep Creek weir from 1997 to the present (Table 29). Weir counts at Anchor River during the years of operation were 2,409 in 1987; 2,766 in 1988; 20,168 in 1989; and 4,596 in 1992.

Harvests in these streams have been determined by the SWHS since 1977, although in some years a creel survey was also conducted on Anchor River. For comparative purposes, SWHS estimates are used for all species in Tables 21-23 and Table 30.

Anchor River supports the largest harvest of coho salmon in the lower Peninsula, averaging 2,349 fish annually. Average harvests in Deep Creek, Ninilchik River and Stariski Creek are 1,281, 697, and 261, respectively. Predicated on harvest data, most of the populations in these lower streams are maintaining themselves at a relatively high level and support a relatively stable recreational fishery.

Prior to 1989, there was no inseason management of the lower Peninsula coho salmon fishery. In 1989 an exceptionally large return to Anchor River resulted in an emergency order opening of an additional 5 miles of stream in the south fork to coho salmon fishing. This additional area was open from September 2-10. Opening this additional area did not significantly increase harvest.

RECENT FISHERY PERFORMANCE

From 1995 through 1997, coho salmon smolt in Deep Creek were coded wire tagged (Table 29). Adult coho salmon returning to Deep Creek were captured with nets in 1996 and at the weir in 1997 and 1998 to estimate the proportion tagged in 1996 (Table 29) (King and Breakfield 1998, 1999). From that proportion, the smolt abundance in the year of tagging was estimated. Given that estimate of smolt abundance and an estimate of the adult return, marine survival rates were also estimated.

During 1996, 205 adult coho salmon were captured with nets, examined for a missing adipose fin (denoting they were implanted with a coded wire tag), and released. In 1997 and 1998, all adult coho salmon passing through the weir were examined for missing adipose fins. In 1997 and 1998, 2,017 and 1,537 coho salmon were examined and passed through the Deep Creek weir, respectively. The total number of coho salmon smolt emigrating from Deep Creek in 1995 through 1997 was estimated to be 34,351, 38,909 and 19,410, respectively, from the proportion of tagged adults sampled. The marine survival estimated from the adult return for 1997 was estimated to be 8.4%. An estimated 57% of the inriver return of 3,572 (weir count + sport harvest) coho salmon was harvested in 1997 (Table 29).

The Cook Inlet commercial fishery for coho salmon was closed in 1997 and the sport fishery for coho salmon drastically restricted because coho returns were perceived to be poor in much of the Inlet. On August 9, the bag and possession limit for coho salmon was reduced from three to one and tackle was limited to unbaited artificial lures throughout Cook Inlet. Coho salmon returns to most tributaries, including the lower Kenai Peninsula streams, improved later in the season. The regular bag and possession limits in the LCIMA streams were reinstated on August 29. Peak passage rates of coho salmon through the Deep Creek weir were later in 1997 than 1998 (Appendix C2), with 76% of the run having passed the weir by September 1 in 1997. In comparison, 97% of the total coho salmon counted were upstream of the weir by September 1 in 1998.

Table 29.-Parameter estimates for coho salmon in Deep Creek from coded wire tag and weir projects, 1996-2001.

Tagging Year	Number Smolt Tagged	Recovery Year	Gear Type	Weir Count	Number Examined for CWT	Tagged Proportion	Estimated Smolt Abundance	Inriver Harvest	Inriver Return	Exploited Proportion	Marine Survival Fraction
1995	9,671	1996	Gillnet		205	0.278	34,351	2,313			
1996	4,868	1997	Weir	2,017	2,017	0.125	38,909	1,115	3,132	0.36	0.084
1997	6,948	1998	Weir	1,537	1,537	0.356	19,410	2,035	3,572	0.57	0.203
		1999	Weir	2,267				2,651	4,918	0.54	
		2000	Weir	3,425				2,018	5,443	0.37	
2001	2,536	2001	Weir	3,747							

Source: Tagging data from King and Breakfield 1998, 1999.

Table 30.-Angler participation and harvest of chinook, coho, pink, and sockeye salmon; Dolly Varden; rainbow trout and steelhead trout, Stariski Creek, 1977-2000.

	Harvest							
	Chinook [a]	Coho	Pink	Sockeye	Dolly	Rainbow/ Steelhead		Days
Year	Salmon	Salmon	Salmon	Salmon	Varden	Harvest	Catch	Fished
1977		133	26		461	294		1,442
1978		201	15		1,012	352		3,662
1979		275			2,027	236		1,965
1980		155			327	105		1,499
1981		410			875	118		1,080
1982		119			348	59		1,023
1983		251			283	42		877
1984		0			499	137		519
1985		25				50		1,422
1986		187			183	31		1,162
1987		127		153	199	62		1,612
1988		146		36	182	18		804
1989		396					10 [b]	1,533
1990		169		29	167		104 [b]	935
1991		280		13	65		12 [b]	1,143
1992		97		33	8		70 [b]	523
1993		392			67		31 [b]	813
1994		446			9		75 [b]	1,160
1995		72		105	55		[b]	896
1996		426			24		47 [b]	694
1997		111			64		[b]	489
1998		1,168			25		71 [b]	922
1999		153					305 [b]	327
2000		419			24		329 [b]	1,217
1977-2000 Average		257			329	125	105	1,155
1977-1996 Average		215			377	125	50	1,238

Source: Statewide Harvest Survey (Mills 1979-1994, Howe et al. 1995 and 1996, 2001a-d, Walker et al. 2003).

[a] Stariski Creek is closed to fishing for chinook salmon.

[b] Rainbow/steelhead trout caught and released. Retention of this species is prohibited. 1989 catch estimates from unpublished Statewide Harvest Survey data.

During 1998, the fishery was prosecuted in a typical manner, with the majority of angler participation occurring the latter half of August and in early September. Observation suggests that harvests in all streams were average. Coho salmon were difficult to catch during much of the fishery due to low, clear water. Successful anglers fished the relatively brief period immediately after sunrise and just prior to darkness.

Since 1998, the number of coho salmon counted at the Deep Creek weir has increased annually (Table 29). The exploitation of coho salmon in Deep Creek during 1999 was relatively high and comparable to the proportion of the run harvested in 1998. The 1999 return was initially later than in 1998, but surpassed the 1998 daily and cumulative count in late August. Anglers reported poor success in mid August, when the normal peak of the fishery occurs, but excellent fishing in late August and early September. No inseason management actions were taken on these coho salmon stocks in 1999.

The count of coho salmon through the weir in 2000 was higher than previous years (Table 29). Run timing was similar to 1998, with the first coho salmon passing the weir on July 26 as opposed to July 23 in 1998. Timing of coho salmon was reported as average by anglers and fishing as excellent beginning around August 15.

In 2001, a graduate student with the University of Alaska, Fairbanks began a 2-year trap efficiency study on coho salmon smolt emigrating from Deep Creek. During June and July, coho smolt were captured, marked, accumulated and released periodically at two distances upstream from the rotary screw trap where the smolt were initially captured. The number of outmigrating smolt was estimated from the number of smolt initially captured and the marked smolt recaptured at the trap. The weir was operated in Deep Creek between August 2 and September 10, 2001 to enumerate adult coho escapement; 3,747 coho salmon were counted, the highest season count since the weir first operated in 1997. Run timing was similar to 2000 (Appendix C2).

BOARD OF FISHERIES ACTIONS

In 1990 the Board adopted a proposal submitted by the Steelhead Planning Team to permit bait through August 31 in the four lower Peninsula streams. The Board considered and rejected a proposal to restrict hook size and require barbless hooks in lower Kenai Peninsula streams during their meeting concerning resident species issues in the fall of 1998.

During the winter of 1999, the Board of Fisheries held a special meeting to address persistent low coho returns to some Cook Inlet tributaries including the Kenai River and Northern Cook Inlet tributaries. The freshwater daily bag and possession limit for coho on the east side of Cook Inlet was reduced from three to two and the saltwater limits were reduced from six to three except near the Enhancement Lagoon on the Homer Spit.

CURRENT ISSUES

Trends in annual harvests among the four streams are dissimilar. Harvests are fairly stable in the Anchor River (Table 21). Harvests from Deep Creek in 1998 through 2000 were well above the 1977-1996 average (Table 22). Exploitation rates of coho salmon in Deep Creek during 1998 and 1999 were relatively high (Table 29). Recent above average harvests from Deep Creek coupled with estimates of exploitation rates above 50% have managers on the alert for indications of overharvest of this stock. Reported harvests from the Ninilchik River in 1999 and 2000 are five and three times the 1977-1996

average harvest, respectively (Table 23). Continuation of this trend is disturbing, as no coho salmon escapement data are available for the Ninilchik. Estimated coho salmon harvests in Stariski Creek have been variable because of the small number of anglers that respond to the mail harvest survey. Coho stock assessment in the LCIMA is in its infancy. The sustainable harvests are not known for any tributary. The Deep Creek smolt tagging and weir projects have provided a valuable snapshot of marine survival estimates and exploitation rates. A longer-term database is needed to determine the impact of varying harvest levels on long-term stock viability.

RECOMMENDED RESEARCH AND MANAGEMENT

The lower Peninsula coho salmon fisheries appear to be somewhat stable, subject to annual variability in stock abundance characteristic of all coho salmon populations although recent trends of increasing harvests are troubling. The exploitation rate of coho salmon returning to Deep Creek is also of concern. The Deep Creek weir will be operated through 2003 to enumerate coho salmon escapement and estimate ocean survival of coho salmon tagged as smolt in 2001 and 2002. A site is being sought in the Anchor River, Deep Creek, or the Ninilchik River for permanently locating a weir/trap to enumerate outmigrating and returning salmon, including coho, for monitoring long-term salmon population dynamics. Meanwhile, the harvest reported in the SWHS will be used to monitor trends that might signify a decline in the return.

NORTH SIDE KACHEMAK BAY COHO SALMON FISHERY

HISTORICAL PERSPECTIVE AND RECENT FISHERY PERFORMANCE

Coho salmon returning to streams that drain into the upper end of Kachemak Bay migrate close to shore adjacent to the Homer Spit and up the north side of the bay. Recreational shore and boat anglers have historically targeted these fish in the area of Mud Bay, which is located inside and at the north end of the spit.

Caribou Lake, located approximately 20 miles northeast of Homer, is tributary to Kachemak Bay via Fox Creek. Fox Creek did not have a natural coho salmon run; however, fingerling coho salmon were stocked in Caribou Lake from 1984 through 1994. Caribou Lake stocks mixed with wild stocks bound for systems (primarily Fox River) at the head of Kachemak Bay. These mixed stocks were targeted by both personal use and sport fishers. It is believed that stocking stimulated increased participation in the personal use set gillnet fishery in Kachemak Bay, with an unknown effect on the wild stocks. The increased harvest and effort in this personal use fishery is generally felt to have reduced sport angler success rates in the historic coho salmon sport fishery in Mud Bay, following the annual August 15 opening of the personal use fishery. Stocking of Caribou Lake was discontinued in 1995.

A personal use dip net fishery first occurred in Fox Creek in 1991. Coho harvests in the dip net fishery from 1991 through 1997 were small, with a low level of participation. Caribou Lake has not been stocked since 1994 and no stocked coho salmon returned to Fox Creek after 1997. The dip net fishery was closed by emergency order during the season in 1997 and in 1998 to prevent the harvest of wild coho salmon present in Fox Creek, and the handling of non-target species. The BOF closed the fishery by regulation during their meeting in November 1998.

BOARD OF FISHERIES ACTIONS

In 1990 the Board established a fall subsistence coho salmon fishery in Kachemak Bay. This fishery was projected to harvest both wild and stocked fish. The subsistence fishery had a quota of 2,500 to 3,500 coho salmon. It was the determination of the Board that this was the maximum harvest that the wild Fox River stocks could sustain. As the harvestable wild stock surplus was projected to be taken in the subsistence fishery, the Board closed the Fox River drainage to coho salmon sport fishing. When the subsistence fishery achieved its quota, coho salmon sport fishing and all commercial salmon fishing was to close north of a line from a department marker at Fritz Creek east to a department marker at the west entrance to Aurora Lagoon. This closure was designed to provide total protection to the remaining Fox River coho salmon.

The Board further established a personal use dip net fishery in Fox Creek. This location provides a terminal harvest area for stocked coho salmon originating as fingerlings in Caribou Lake. Access to the lake is precluded by a barrier falls; Fox Creek has virtually no spawning or rearing area. The Board established the season as August 16 through December 31.

At its November 1992 meeting, the Board repealed regulations providing for a fall gillnet subsistence fishery targeting Kachemak Bay coho salmon. This fishery was replaced by a personal use fishery, the regulation of which was virtually identical to the repealed subsistence fishery except that personal use does not have priority over other resource users. The Board then adopted a public proposal with staff support which reopened the Fox River sport coho salmon fishery.

Following the achievement of the quota and the resulting closure of the 1993 personal use fishery, the Alaska Superior Court ruled that the Board's division of areas into "subsistence" and "nonsubsistence" was unconstitutional. The Alaska Supreme Court subsequently issued a stay of this ruling, but in April of 1994 the Alaska Supreme Court ended its stay of the Superior Court ruling. This rendered all nonsubsistence areas previously established by the Board unconstitutional and voided the lower Cook Inlet personal use fishery adopted by the Board in 1992.

The Board responded to this court action by directing the department's Commissioner to adopt emergency regulations establishing subsistence fisheries in both upper and bwer Cook Inlet in 1994. The 1994 lower Cook Inlet fishery was prosecuted as a subsistence fishery. Regulation of the fishery was identical to the 1992 season.

Court action after the 1994 fishery reestablished the "subsistence" and "non-subsistence" areas originally created by the Board in 1992, and because most of Kachemak Bay was included in "non-subsistence" area, the Board re-adopted the personal use regulations governing the fishery for the 1995 season and rescinded the subsistence regulations formerly governing the fishery.

In November 1998, the BOF closed the Fox River personal use dip net fishery. The Department proposed to shorten the season of the personal use gillnet fishery by closing it on August 27 rather than September 15, to protect wild stocks while maintaining the duration of the personal use gillnet fishing season at its historic length. Instead, the BOF voted to lower the harvest guideline of the gillnet fishery from 2,500-3,000 to 1,000-2,000, a range around the average pre-stocking harvest to protect wild stocks.

The reduction of the freshwater and saltwater daily bag and possession limits for coho approved by the BOF for Cook Inlet in 1999 included all streams and salt waters in Kachemak Bay except at the Enhancement Lagoon on the Homer Spit.

No proposals regarding coho salmon in Kachemak Bay were before the BOF during the winter of 2001 and 2002.

OUTLOOK AND CURRENT ISSUES

The Kachemak Bay personal use gillnet fishery harvests wild and stocked Homer Spit coho salmon. Until 1997, the guideline harvest range in this fishery was achieved in 3 to 4 days and the fishery closed. When the fishery occurs, success rates in the Enhancement Lagoon sport fishery dramatically decrease. Since the Caribou Lake stocking program was discontinued the personal use gillnet fishery has occurred over a longer time period in order to harvest the guideline. Success rates in the Enhancement Lagoon could be reduced for a greater length of time as could total harvest if the length of the personal use fishery is protracted. Sport anglers would fail to reap maximum benefit from the Homer Spit stocking program.

Fox River at the head of Kachemak Bay is the major producer of wild coho salmon. The river is remote and access is difficult. Wild stock production from Fox River appears relatively stable judging from escapement indices in Clearwater Slough, a tributary to Fox River. A personal use fishery of longer duration may negatively impact the escapement to this tributary that has later run timing than the enhanced stock returning to the Homer Spit.

Sport Fish Division stocked early returning Ship Creek coho salmon at the Homer Spit Enhancement Lagoon beginning in 2001. The Bear Lake coho stocked there will be discontinued after 2002. Bear Lake brood stock have a run timing slightly earlier but closer to the timing of Kachemak Bay wild stocks including Fox River wild stocks. Members of the public are working to acquire funding to continue stocking coho of Bear Lake origin in addition to Ship Creek brood stock. If the public is unsuccessful, the personal use gillnet fishery will be comprised of Kachemak Bay wild coho salmon stocks.

RECOMMENDED RESEARCH AND MANAGEMENT

Coho stocked in the Homer Spit Enhancement Lagoon were coded wire tagged in 1998 and 1999. Coho harvested in the personal use fishery were examined for a missing adipose fin in 1999 and 2000 to estimate the hatchery contribution to the personal use fishery. The results of that sampling effort are reported in the section of this report entitled "Homer Spit Stocked Early-Run Coho Salmon Recreational Fishery."

Estimation of Fox River coho salmon abundance and harvest is recommended. Adult coho salmon escapement could be estimated with a mark and recovery program. Coded wire tagging Fox River coho salmon smolt in conjunction with sampling the coho salmon harvest in Kachemak Bay would provide estimates of the contribution of Fox River stocks to the harvest and the exploitation rate of Fox River stocks.

WEST COOK INLET FRESHWATER COHO SALMON RECREATIONAL FISHERIES

BACKGROUND AND RECENT FISHERY PERFORMANCE

The LCIMA encompasses the western Cook Inlet watershed from the southern tip of Chisik Island south to Cape Douglas (Figure 1). Coho salmon are widely distributed in this area and spawn in a variety of freshwater habitats. Coho salmon begin to enter the streams in late July and continue through mid-September. The exact location and duration of spawning for each stock is unknown. There is no research directed on coho salmon on the Westside because the lack of a significant sport or commercial fishery and stream location, in conjunction with difficulty of assessment, precludes the development of meaningful research objectives. These fisheries are remote, low yield and have a high-cost associated with participation. Access is by plane, helicopter or boat, and anglers are typically guided. Facilities to house anglers overnight are few, currently only four encampments are active in Chinitna Bay. In the fisheries south of Chinitna Bay, participants are composed mostly of guided anglers flown in from the Lake Iliamna area. Information concerning west side Cook Inlet coho salmon sport fisheries comes from the SWHS, anecdotal reports from anglers, inseason observation of selected fisheries by the department staff, and stream surveys of selected tributaries to index coho salmon spawning escapement.

The annual SWHS has been used to estimate sport fishing effort, catch and harvest of coho salmon in many Westside tributaries. However, because of the relatively small number of anglers participating and corresponding low number of surveys returned by anglers who fish these tributaries, many coho salmon fisheries do not appear annually in the survey and others appear even more sporadically. The largest coho salmon sport fisheries occur in Silver Salmon Creek and the Kamishak River (Table 31).

Silver Salmon Creek is located mid-way between Tuxedni and Chinitna bays (Figure 1). Aside from the private lodge properties, the drainage is contained within the borders of Lake Clark National Park. Access is by airplane or boat. Most anglers are housed in one of three sport fishing lodges that are located in the immediate vicinity of the mouth of Silver Salmon Creek. Additional day-use access to the fishery occurs via airplane from the communities of Soldotna and Homer as the adjacent beach along Cook Inlet is favorable in providing easy wheel plane access to the fishery. The catch and harvest reported in the SWHS since 1997 are trending upwards.

During 2000 and 2001, the department conducted foot survey counts of coho salmon on an index area of the creek, as well as interviews of anglers and lodge operators. Although counts of coho salmon decreased from 873 in 2000 to 355 during 2001, the 2001 count did not accurately portray the magnitude of the run as coho were very numerous in the lower intertidal portions of the creek and could not be counted. In addition, lodge operators indicated that coho were late in returning to the creek and anglers were having good fishing success.

Several sport fishing operations from the Lake Iliamna area moor boats in the Kamishak River and fly clients in and out daily. The estimated sport fishing effort and harvest of coho salmon reported in the SWHS has been relatively small and stable while catch has varied presumably with abundance of coho salmon in the return. Departmental observation of the Kamishak River coho salmon fishery during 1999 and 2000 identified that anglers practice catch-and-release, but also attempt to take a three-fish daily

Table 31.-Coho salmon harvest, catch and angler effort (angler days) estimates for Silver Salmon Creek and Kamishak River, 1983-2000.

	Silver Salmon Creek			Kamishak River		
Year	Harvest	Catch	Effort	Harvest	Catch	Effort
1983	1,872		1,585			
1984	661		552	112		100
1985	647		555	100		381
1986	302		292			
1987	706		831			
1988	709		673			
1989	735		1,285			
1990	320	1,212	915		220	44
1991	1,120	1,207	1,112			
1992	494	842	597	57	202	117
1993	1,080	1,280	853	76	535	704
1994	329	689	270	54	134	272
1995	1,715	2,831	1,851	216	1,040	204
1996	2,094	3,440	1,850	109	308	85
1997	453	1,036	1,179	197	1,093	206
1998	422	1,104	440	201	413	305
1999	590	2,157	1,408	229	597	183
2000	1,013	2,293	904	220	1,323	220
Avg.83-00	848	1,645	953	131	587	235

Source: Statewide Harvest Survey (Mills 1979-1994; Howe et al. 1995, 1996, 2001a-d; Walker et al. 2003).

Note: No reports were received in years where harvest, catch and effort are blank.

bag limit before the end of the fishing day. Thus, as documented by SWHS, release is prevalent in this fishery and catch is likely proportionate to instream abundance.

Other fisheries in the tributaries to Kamishak Bay are accessed most commonly by plane or helicopter. Two tributaries, Amakdedori and Douglas River, have appeared occasionally in the SWHS since 1983. Coho salmon returns here are thought to be relatively minor as compared to the return to Kamishak River. Consequently, small numbers of anglers report fishing these streams and the values reported by the SWHS are inexact. However, the annual participation, catch and harvest on these small stocks has remained low with no increasing trend. Similar to the Kamishak River the majority of coho salmon caught are released.

Clearwater and Shelter creeks are small tributaries to Chinitna Bay where the harvest and effort is also reported sporadically in the postal questionnaire, and estimates are inaccurate due to the small number of respondents. However, the low number of respondents indicate a minimal level of angler effort and harvest estimates suggest that the magnitude of harvest is low at both locations. For instance, estimated harvests reported for Shelter Creek average 15 coho between 1998 and 2000, while harvest reported at Clearwater intermittently since 1989 averaged 66 coho.

Commercial Fisheries Division conducts aerial counts of chum salmon in these systems annually during late July through mid-August. Surveys attempt to coincide with peak instream abundance of chum and not coho salmon. Furthermore, it is difficult to differentiate between chum and coho salmon during aerial surveys when both species are present. Therefore, Sport Fish Division conducted foot survey counts of coho salmon at Clearwater Creek and the Chinitna River during 2000 and 2001 to determine spawning distribution and escapement in these interconnected tributaries. Additionally, department personnel observed angling activity at these systems. The majority of coho salmon spawned in Clearwater Creek where the number counted during the ground survey was 3,061 and 938 during 2000 and 2001, respectively. In 2000 and 2001, three and 169 coho salmon were counted during ground surveys of the Chinitna River. Nearly all sport anglers originate from one of three encampments within Chinitna Bay. Periodic observations by the department and anecdotal information from guides indicate that angling activity is low. At present harvest trends for these systems are not discernable by the SWHS.

Hook-and-release mortality of coho salmon caught with bait during their migration through an estuary to reach their spawning areas was studied in the Little Susitna River and found to be considerably higher (69%) than hooking mortality upstream of the estuary (12%) (Vincent-Lang et al. 1993). The hooking mortality of coho salmon caught with lures and caught in short coastal streams such as those that predominate south of Chisik Island is unknown.

The commercial harvest of coho salmon in western Cook Inlet is currently well below the historic average due to low prices and the closure of commercial drift gillnetting after August 9 since 1996.

MANAGEMENT OBJECTIVES

No regulatory management plan specifically addresses the coho salmon fishery on the west side of Cook Inlet; they are managed by regulation. The daily limits for salmon, except chinook salmon, 16 inches or more in length, are three per day and six in possession. The bag and possession limits for chinook salmon less than 20 inches and other salmon less than 16 inches in length are 10 per day and 10 in possession. Only unbaited artificial lures may be used from August 15 through May 15. The McNeil River is closed to fishing.

BOARD OF FISHERIES ACTIONS

The BOF began changing the regulations of these fisheries in the late 1980s. Prior to this time, all flowing waters (except portions of McNeil River) from the southern tip of Chisik Island to Cape Douglas were open to fishing the entire year. Bait was prohibited from September 1 through December 31. The bag limit for coho salmon was three daily and in possession.

During 1988 the Board adopted regulations that closed the portion of Silver Salmon Creek from its outlet at Silver Salmon Lake to a Department marker placed about ½ mile downstream of Silver

Salmon Lake. Silver Salmon Lake was also closed to fishing. The possession limit was increased to six coho salmon. In 1994 the bait prohibition was extended from September 1 through May 15.

At the 1999 BOF meeting several proposals focused on West Cook Inlet coho salmon fisheries. Regulatory changes addressed time and area restrictions in all flowing waters from the southern tip of Chisik Island to Cape Douglas. A January 1 through September 30 season was established for coho salmon and bait restrictions were increased to July 15 through May 15 to encompass the July arrival of coho salmon to west side tributaries. Area restrictions included limiting the fisheries at Clearwater and Shelter creeks within Chinitna Bay to the lower 1-mile section of each creek.

CURRENT ISSUES

Lack of escapement data and uncertainty about the extent of coho salmon mortality from the sport fisheries in the tributaries on the west side of Cook Inlet make it unclear if a problem currently exists or is likely to occur. Information about harvest and participation is only adequate to gauge trends and relative magnitude on a broad scale and not actual amounts, but harvests are relatively small and appear to be stable. The available data do not diminish the concerns of fisheries managers that the fishing mortality in all west side coho fisheries may not be sustainable, particularly from the smaller tributaries such as Douglas River, Shelter Creek, Amakdedori Creek and Clearwater Creek, where stock abundance is small and susceptible to overfishing.

During August of 2001, a court decision rejected Alaska Native land claims to approximately 50 miles of the West Cook Inlet coastline. The disputed land claims were concentrated mostly in the area from Tuxedni Bay to Kamishak Bay. Jurisdiction of these lands now pending appeal will be under the National Park Service. Prior to the decision, land status, access restrictions as well as boundaries of Park Service, private and native claim properties were uncertain. The recent court ruling will likely provide clear land access definitions and easier public access to these sport fisheries. Therefore, it is expected that effort in these remote fisheries will grow.

RECOMMENDED RESEARCH AND MANAGEMENT

Inventory of coho salmon spawning locations, spawning abundance, migration patterns and migration timing in tributaries to west Cook Inlet is needed. Fishery assessment work also needed includes: location of fishing areas, fishing practices, magnitude of fishing effort, fishery timing, and harvests. Investigation of hooking mortality on representative stream types is also needed.

LOWER PENINSULA DOLLY VARDEN RECREATIONAL FISHERY WITH EMPHASIS ON ROADSIDE TRIBUTARIES

HISTORICAL PERSPECTIVE

Dolly Varden are the most common, widely distributed, and complex sport fish of the LCIMA. They spawn during autumn and overwinter in numerous drainages. Adults that survive spawning return to Cook Inlet during spring and forage before returning to fresh water during mid-summer. Adults exhibit intertributary spawning as well as overwintering behavior, i.e. a fish may spawn and overwinter in Anchor River one year and spawn and overwinter in another freshwater system the next year. Juveniles become smolt and migrate to Cook Inlet to forage and often return to a different drainage during mid-summer, where they remain to overwinter. This prolonged freshwater residence makes them available

to sport anglers throughout much of the year. Historically, Dolly Varden contributed the most fish to LCIMA sport fish harvests. Daily bag limits were 20 fish from 1960-1968, 10 fish from 1969–1983 and five fish between 1984 and 1990. Peak harvest typically occurs during July to mid-August. This period coincides with the return of Dolly Varden to fresh water and is between returns of chinook salmon and coho salmon. Incidental harvest of Dolly Varden occurs in the Cook Inlet marine recreational chinook salmon fishery during June through early July and in nearly all freshwater salmon sport fisheries of the LCIMA. Hence, Dolly Varden are important to the LCIMA because they add diversity to the fishing experience by being available concurrent to fisheries for other species and provide directed sport fishing opportunity when little opportunity is available.

Historically the Anchor River supported the largest fishery with other roadside systems including Deep Creek, Ninilchik River and Stariski Creek also supporting fisheries. Declines in harvest at Anchor River from 21,364 fish in 1979 to just 2,735 in 1987 were mirrored by declines in harvest at the other streams (Table 32). Declines in harvest were assumed to reflect stock abundance declines. In 1987, a study was initiated in the Anchor River to: (1) assess abundance by counting fish at a weir, (2) identify overwintering areas through tagging and recapture, and (3) determine the age structure of the population. Weir counts of Dolly Varden at the Anchor River declined from 19,062 in 1987 to 10,427 by 1990 (Table 33). Other major findings of the study indicated that immediate stock concerns were best served by controlling harvests targeting individual spawning stocks, and by protecting overwintering populations. Furthermore, due to the multifaceted life history behavior of the species, it was thought that low inriver abundance could result from numerous out-of-system factors. Management goals therefore focused on stopping and reversing the population decline of the numbers of returning Dolly Varden at Anchor River, maintaining fishing opportunities for Dolly Varden, and meshing regulations for Dolly Varden with concurrent fisheries of other species. Consequently, the Board adopted a department proposal during the 1990 Board cycle reducing the Dolly Varden bag and possession limit from five to two fish. In 1994, 17,259 Dolly Varden were counted through the weir, the highest adult return since the study began in 1987 (Table 33). In 1995, the last year of the Dolly Varden assessment a total of 10,994 Dolly Varden were counted at the weir (Table 33).

RECENT FISHERY PERFORMANCE

The total sport catch of Dolly Varden from LCIMA roadside streams during 2000 was 24,354, the largest total catch ever reported by the SWHS (Table 32). Anchor River accounted for 84% (20,469 fish) of the harvest followed by Deep Creek 9% (2,209 fish), Ninilchik River 6% (1,444 fish) and Stariski Creek 1% (232 fish). Dolly Varden harvest in these fisheries has stabilized since 1990 as compared to harvest prior to 1990. For instance, harvest at Anchor River has averaged 1,683 fish and ranged from 2,821 to 963 fish, while harvests from 1977 through 1989 averaged 9,689 and ranged from 21,364 to 1,476 fish. Trends in catch have been more variable and are assumed to be proportionate to run strength.

MANAGEMENT OBJECTIVE

This fishery is not specifically addressed in a regulatory management plan but is managed by regulations governing methods, means, time and area. Criteria for establishing special management areas for Dolly Varden on the Kenai Peninsula (5 AAC 56.014) were adopted in 1999. Thus far, these criteria have not been invoked to create special Dolly Varden fisheries in the LCIMA.

Table 32.-Harvest and catch of Dolly Varden in Lower Kenai Peninsula roadside streams, 1977 through 2000.

	Anchor River		Stariski Creek		Deep Creek		Ninilchik River		All	
Year	Harvest	Catch[a]	Harvest	Catch[a]	Harvest	Catch[a]	Harvest	Catch[a]	Harvest	Catch[a]
1977	9,222		461		1,330		424		11,437	
1978	17,357		1,012		3,046		1,003		22,418	
1979	21,364		2,027		2,027		2,390		27,808	
1980	10,948		327		1,028		853		13,156	
1981	15,271		875		1,382		875		18,403	
1982	10,375		348		1,247		514		12,484	
1983	17,277		283		1,112		199		18,871	
1984	5,559		499		973		524		7,555	
1985	7,716				850		87		8,653	
1986	3,914		183		306		505		4,908	
1987	2,735		199		72		507		3,513	
1988	2,746		182		219		655		3,802	
1989	1,476				333		39		1,848	
1990	2,821	11,441	167	375	708	3,862	115	1,614	3,811	17,292
1991	1,409	14,433	65	91	287	2,480	222	887	1,983	17,891
1992	2,532	18,303	8	8	401	2,941	131	1,573	3,072	22,825
1993	1,031	9,719	67	184	145	1,423	29	410	1,272	11,736
1994	1,574	13,305	9	36	377	3,437	65	167	2,025	16,945
1995	1,537	10,957	55	119	301	1,325	133	332	2,026	12,733
1996	963	17,189	24	269	615	4,346	560	2,297	2,162	24,101
1997	1,575	17,467	64	213	276	2,409	140	995	2,055	21,084
1998	2,105	16,195	25	261	1,061	4,477	272	1,016	3,463	21,949
1999	1,061	17,076		22	496	2,458	114	818	1,671	20,374
2000	1,903	20,469	24	232	355	2,209	228	1,444	2,510	24,354
Avg. 1977-1989	9,689		581		1,071		660		11,912	
Avg. 1990-2000	1,683	15,141	51	165	457	2,852	183	1,050	2,368	19,208

Source: Statewide Harvest Survey (Mills 1979-1994; Howe et al. 1995, 1996, 2001a-d; Walker et al. 2003).

[a] Catch first reported in SWHS during 1990.

Table 33.-Fish counted at the Anchor River weir, 1987-1995.

Year	Dates of operation	Dolly Varden	Silver Salmon	Pink Salmon	King Salmon	Red Salmon	Chum Salmon	Steelhead/ rainbow
1987	July 4 - Sept. 10	19,062	2,409	2,084	204	33	19	136
1988	July 3 - Oct. 5	14,935	2,805	777	245	30	24	878
1989	July 6 - Nov. 5	11,384	20,187	4,729	95	212	165	769
1990	July 4 - Aug. 15	10,427	190	355	144	39	17	3
1991	July 4 - Aug. 15	18,002	13	1,757	39	46	9	5
1992	July 4 - Oct. 1	10,051	4,596	992	129	174	39	1,261
1993	July 3 - Aug. 16	8,262	290	998	90	71	12	1
1994	July 3 - Aug. 16	17,259	420	723	111	61	2	1
1995	July 4 - Aug. 12	10,994	725	1,094	112	73	4	10

Source: Larson et al. 1988 , Larson and Balland 1989, Larson 1990-1995, 1997.

BOARD OF FISHERIES ACTIONS

In 1990, the Board adopted the staff proposal to reduce the bag and possession limit from five to two fish on LCI roadside tributaries. This proposal was adopted in interest of stock conservation and for regulatory consistency for concurrent seasons for other species. At the 1999 meeting the Board adopted criteria for establishing special management areas for Dolly Varden. The criteria provide guidance for evaluating proposals directed at diversifying Dolly Varden sport fishing opportunities on the Kenai Peninsula. Similar criteria were adopted for West Cook Inlet. No proposals specifically addressed this fishery in 2001.

CURRENT ISSUES

Recent catch and harvest information indicates the LCIMA roadside Dolly Varden fishery has become less harvest oriented since the current regulations were enacted. Assuming catch is proportionate to inriver abundance, it is important to focus on catch rather than harvest as an indicator of run strength. Recent catch estimates at Anchor River indicate that the portion of the run handled by anglers is likely high, as the 2000 catch estimate of over 20,000 fish approximates the highest weir count at Anchor River for this species. Catch-and-release mortality of Dolly Varden in LCIMA tributaries is not known. Catch estimates indicate broad fluctuations in annual run size with no declining trend. Staff opinion is that roadside stocks are experiencing production levels commensurate with the capability of the existing habitat. Furthermore, overexploitation of these stocks is not likely under the current regulatory measures governing these fisheries. Dolly Varden in Southeast and Kodiak, Alaska show an affinity to overwinter in freshwater systems containing lakes. Tributaries of the LCIMA with headwater lakes that are in relatively close proximity to roadside Dolly Varden populations are few and include Packers Lake, English Bay Lakes and Tustumena Lake. It is not known to what extent local roadside stocks use these systems for spawning and overwintering. The extent of the coastal distribution of Dolly Varden originating in local roadside tributaries remains undefined.

RECOMMENDED RESEARCH AND MANAGEMENT

There are currently no ongoing research projects associated with LCI Dolly Varden. It is recommended that future research identify Dolly Varden distribution and overwintering areas to ensure

that the areawide management framework affords the protection necessary to maintain a sustainable Dolly Varden roadside fishery.

LOWER PENINSULA STEELHEAD TROUT RECREATIONAL FISHERY

HISTORICAL PERSPECTIVE

Four roadside tributaries of the LCIMA support steelhead trout fisheries. These are the Anchor River, Deep Creek, Stariski Creek and Ninilchik River, of which the Anchor River supports the largest fishery. Directed steelhead studies in LCIMA have been limited to the Anchor River. Thus, information on life history characteristics of Anchor River steelhead serve as an example of life history behavior typical of all LCIMA stocks. Steelhead stocks are exclusively defined as fall-run fish that enter fresh water from August to November, spawn from April to May and emigrate after spawning during May and June (Larson and Balland 1989, Van Hulle 1985, ADF&G 1990). The Anchor River stock is composed annually of about 19% repeat spawners, supports runs of approximately 1,500 adults, and is known as the largest single run in the LCIMA (Larson and Balland 1989, ADFG 1990, Larson 1993). The numbers of steelhead returning to Stariski Creek, Deep Creek, or Ninilchik River are not known.

These fisheries are currently managed as catch-and-release fisheries, where retention of steelhead trout is prohibited and fish may not be removed from the water prior to release. Additionally, only unbaited, single hook, artificial lures are allowed September 1 through December 31. Other restrictions control allowable fishing time and area open to fishing. During the chinook salmon season, Deep Creek, Anchor and Ninilchik rivers are open to fishing from salt water to approximately 2 miles upstream only on weekends only beginning Saturday of Memorial Day weekend (weekends include Monday). The Anchor River is open for five consecutive weekends while Deep Creek and Ninilchik River are open for three consecutive weekends. Fishing the lower sections of each stream resumes July 1. Stariski Creek has no chinook salmon fishery and the lower section does not open to fishing until July 1. Lastly, the entire drainage of each stream opens to fishing beginning August 1 and continues through December 31.

The conservative regulatory framework for LCIMA steelhead systems evolved over a period of nearly two decades during which angler participation and harvest in the steelhead fishery were generally increasing and numbers of returning steelhead enumerated each fall at a weir in place at the Anchor River were declining. Specifically, in 1977 the bag and possession limit was two steelhead trout daily. The season was closed from May 1 to June 30. By 1984 the bag and possession limit had been reduced to one fish daily, a seasonal limit of two fish was imposed and a harvest record required. The season was gradually reduced, and beginning in 1984 fishing was permitted only from July 1 through December 31. From 1984 through 1988, bait was prohibited after September 15. On October 7, 1988 the Anchor River steelhead trout fishery was closed by emergency order for resource conservation as the number of steelhead counted through the weir was judged to be insufficient to support an inriver fishery. The current regulatory scheme became effective beginning in the 1989 season.

RECENT FISHERY PERFORMANCE

According to the most recent catch data, implementation of the catch-and-release regulation has served to maintain and possibly increase steelhead stock levels in LCIMA roadside tributaries. According to

the SWHS, the annual catch of steelhead on LCIMA streams has increased under current regulations (Table 34). Beginning in 1989 the annual estimated steelhead catch in the Anchor River has exceeded the average annual stock size, thought to approximate 1,500 fish. Furthermore, the estimated annual catch of steelhead at the Anchor River has been more than twice the approximate stock size since 1996 with the 2000 catch estimate of 8,722 fish nearly six times the approximate stock size. These estimates indicate that the number of steelhead in the run has likely increased and that anglers handle a large portion of the run. Furthermore, estimates may also indicate that a large fraction of the population is being exposed to multiple hooking. Catches in the other systems have also increased. At Deep Creek and Ninilchik River, where stock size is believed to be smaller than the Anchor River, the estimated catch also indicates a large portion of the runs is caught and released by anglers. In general, hooking induced mortality can occur directly from a hook wound or indirectly through a hook injury, stress and induced diseases. Delayed hooking mortality estimates for steelhead provided in Reingold (1975), Caverhill (1977), Pettit (1977), and Hooten (1988) were estimated in the range of 0 to 6%. However, these studies were not based on multiple hooking. Taking into account the current regulations that complement mandatory catch-and-release, particularly the unbaited single hook and prohibition of removal from the water prior to release, there is little reason to suspect that mortality is considerably higher for LCIMA steelhead.

MANAGEMENT OBJECTIVE

This fishery is not specifically addressed in a regulatory management plan. The criteria for establishing special management areas for trout (5 AAC 75.013) were adopted in 1998.

Department objectives for this fishery are:

Objective 1: With allowance for natural variation to manage the resource so annual stock size remains at levels of abundance that provides a catch-and-release steelhead trout fishery.

Objective 2: Considering that steelhead trout stocks in lower Kenai Peninsula streams were at low levels of abundance due to harvest permitted under a conservative yield management philosophy, management will continue to regulate these streams as catch-and-release only fisheries.

BOARD OF FISHERIES ACTIONS

In 1990, the Board adopted a proposal submitted by the Steelhead Planning Team to permit bait use in the four southern Peninsula streams through August 31. The proposal was implemented in 1991. The Board also adopted a proposal prohibiting the retention of rainbow/steelhead trout in Cook Inlet north of a line from Cape Douglas to Point Adam in 1990. This proposal was adopted for regulatory consistency and for resource conservation in that rainbow/steelhead trout may not be retained in the fresh waters of the southern Peninsula. No proposals had been submitted pertaining to this fishery until 2001 when the BOF adopted a department proposal clarifying that steelhead/rainbow trout could not be removed from the water at any time.

Table 34.-Harvest and catch of steelhead trout in Lower Kenai Peninsula roadside streams, 1977 through 2000.

	Anchor River[a]		Stariski Creek[a]		Deep Creek[a]		Ninilchik River[a]		All	
Year	Harvest[b]	Catch[c]	Harvest[b]	Catch[c]	Harvest[b]	Catch[c]	Harvest[b]	Catch[c]	Harvest	Catch
1977	2,099		294		569		230		3,192	
1978	2,305		352		498		307		3,462	
1979	1,782		236		263		509		2,790	
1980	1,186		105		236		381		1,908	
1981	928		118		248		464		1,758	
1982	698		59		239		179		1,175	
1983	1,605		42		315		157		2,119	
1984	985		137		311		137		1,570	
1985	475		50		179		501		1,205	
1986	520		31		688		275		1,514	
1987	643		62		85		291		1,081	
1988	200		18		291		272		781	
1989		2,066		10		409		505		2,990
1990		1,978		104		1,291		177		3,550
1991		2,349		12		425		512		3,298
1992		2,720		70		740		1,008		4,538
1993		4,156		31		1,448		442		6,077
1994		4,035		75		1,156		804		6,070
1995		2,232				520		178		2,930
1996		7,570		47		1,079		522		9,218
1997		3,103				384		380		3,867
1998		3,878		71		1,350		576		5,875
1999		3,920		305		689		694		5,608
2000		8,693		329		1,805		760		11,587
Average	1,119	3,892	125	105	327	941	309	547	1,880	5,467

[a] Source: Statewide Harvest Survey (Mills 1979-1994, Howe et al. 1995 and 1996, 2001a-d, Walker et al. 2003).

[b] Retention of this species is prohibited beginning in 1989.

[c] Catch first estimated by SWHS during 1989. 1989 catch estimates from unpublished Statewide Harvest Survey data.

CURRENT ISSUES

Available data indicating declining steelhead trout populations in LCIMA streams during the 1980s and early 1990s created an interest in steelhead stock conservation and generated interest in steelhead sport fishing. A conservative, no harvest approach continues to receive broad public support. Consequently, the autumn steelhead sport fishery has grown into an extremely popular fishery on the Lower Kenai Peninsula. Members of the public have voiced concerns about this fishery. Biological concerns include the impact catch-and-release fishing has upon the steelhead resource and riparian habitat. Social concerns include growth in both the guided and unguided segment of this fishery. Social issues resulting from conflicts between users with differing values are unclear.

RECOMMENDED RESEARCH AND MANAGEMENT

There are currently no ongoing research projects associated with lower Peninsula steelhead trout. Popularity of this fishery favors catch-and-release management. Assessment to determine abundance and impact of catch-and-release hooking mortality upon spawning stock size is recommended.

KACHEMAK BAY MARINE STOCKED SALMON FISHERIES

HOMER SPIT RECREATIONAL FISHERY

Historical Perspective and Recent Fishery Performance

The Homer Spit, located in Kachemak Bay (Figure 5), is the site of an ongoing stocking program of early-run chinook and coho salmon smolt. Fish are stocked at a small inlet on the Spit, formally called the Enhancement Lagoon but commonly known as the "Fishing Hole," and most of the sport fishing effort on these stocked fish is directed here. The major goal of the program is to meet the summer demand for more sport fishing opportunities along the Kenai Peninsula road system. The majority of the return is harvested by recreational anglers. This is a terminal harvest fishery; salmon returning here will not naturally reproduce because there is no spawning area available. Regulations prohibit snagging while salmon are susceptible to being caught using conventional angling methods, but allow a snag fishery when salmon become sexually mature and can no longer be caught by non-snagging methods. Snagging is permitted for an abbreviated period of time, permitting the harvest of surplus fish. After this harvest is achieved, snagging is again prohibited.

The success of this fishery resulted from the combined efforts of the department, the City of Homer, and the South Peninsula Sportsmen's Association to promote the idea, improve the Lagoon itself, implement the fishery and promote the fishery. These three entities were co-recipients of the American League of Anglers and Boaters Sport Fish Management Award for best project in the nation for 1990.

Early-run chinook salmon have been stocked in the Lagoon since 1983 (Table 35). Coho salmon with Lower Cook Inlet run timing were stocked from 1988 through 2001. An earlier-returning stock of coho salmon of northern Cook Inlet origin was first stocked in 2001. Pink salmon fry releases began in 1987 and ended in 1992. Late-run chinook salmon smolt were stocked from 1992 through 1999.

Early-run Chinook Salmon

Anglers usually report harvesting the first early-run chinook salmon about May 9. The peak of the return occurs in mid-June and the snag opening near the end of June signals the end of the fishery.

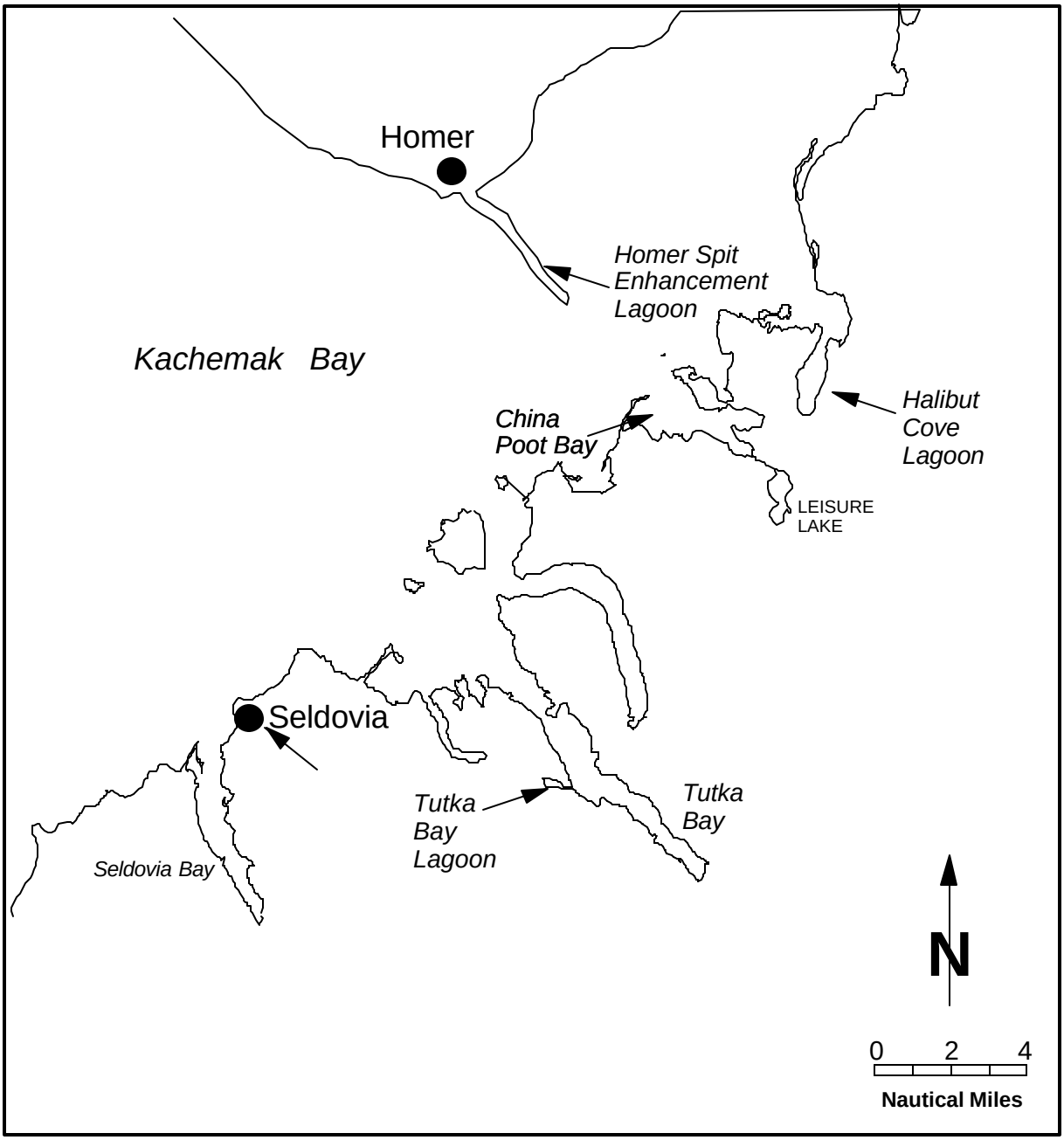


Figure 5.-Kachemak Bay enhanced fishery sites.

Table 35.-Salmon smolt releases to terminal fisheries in Kachemak Bay, 1974-2001.

Release Year	Homer Spit				Halibut Cove Lagoon	Seldovia
	Early-Run Chinook	Late-Run Chinook	Early-Run Coho	Late-Run Coho	Early-Run Chinook	Early-Run Chinook
1974					3,872	
1975					3,463	
1976					16,183	
1977					48,907	
1978					126,306	
1979					305,145	
1980					260,295	
1981					76,472	
1982						
1983					200,900	
1984	88,753				84,000	
1985	152,226				98,000	
1986	103,946				101,331	
1987	103,860				94,100	80,420
1988	219,572			62,550	93,874	111,435
1989	212,737			153,844	115,682	108,300
1990	210,087			122,945	112,458	98,525
1991	190,915			100,029	92,363	91,592
1992	227,125	126,130		100,570	117,850	112,935
1993	212,292	100,000		116,129	100,228	106,497
1994	163,963	156,873		156,213	98,872	107,246
1995	216,026	123,048		110,701	37,577	116,165
1996	204,085	108,204		149,685	97,729	118,274
1997	217,733	100,933		232,146	78,133	103,757
1998	177,730	112,100		130,219	65,893	69,461
1999	163,170	59,611		129,602	79,221	74,057
2000	219,984			122,338	83,277	68,114
2001	208,062		100,280	124,762	106,719	102,793

From 1984 until 1993, the brood stock for the early-run came from Crooked Creek, a tributary to the Kasilof River. Between 1993 and 1999, adults were collected from the Enhancement Lagoon and spawned in the hatchery to produce the smolt stocked in the Homer Spit. Since 2000, chinook salmon from the Ninilchik River have been artificially spawned and reared to produce the early run to the Homer Spit.

Anglers first reported benefit from the early-run chinook salmon stocking program in 1986 when approximately 300 2-ocean chinook salmon were harvested from the return of 88,000 smolt released in

1984. The first significant harvest of stocked fish occurred in 1987 when 833 chinook salmon were taken from shore (Table 36). Annual shore harvests from 1988 through 2000 have ranged from 1,406 to 5,275. The contribution to the harvest of anglers fishing from boats near the Spit shoreline is difficult to assess because anglers are imprecise about reporting their harvest location, but it may approach 1,000 fish in some years. An unusual number of 1-ocean or "jack" chinook salmon were sighted in the fishery in 2001 by anglers and confirmed by department staff although there was no sampling program to confirm this.

When this program was first initiated, chinook salmon smolt were artificially imprinted to a chemical at the Elmendorf Hatchery. This same chemical was dispensed from several drip stations anchored along the Spit to attract imprinted adult chinook salmon returning from previous years' releases. The majority of the returning chinook salmon, however, imprinted to the Enhancement Lagoon where they were held in pens prior to release. As no fresh water is present, the fish apparently imprint to some unique characteristic of the inlet salt water therefore the use of drip stations was discontinued.

Through 1994, snagging was permitted beginning on June 24. Dates when the regulatory area near the Homer Spit was opened to snagging have been more variable since 1994. Snagging dates are determined by staff observations that surplus fish are available and that these fish are no longer "on the bite." Snagging ends in early July when most surplus early-run chinook salmon have been harvested and brood stock collection needs are met. The fishery reverts to non-snagging techniques as the next stocked run of salmon (late-run chinook salmon after 1992) begin to enter the Enhancement Lagoon.

The yearly harvest of chinook salmon taken prior to June 25 (early run) and the number taken after June 24 (late run) was estimated separately with the SWHS starting in 1996 (Table 36). The separate estimates are misleading, however, because the snag opening for early-run chinook salmon has usually fallen on June 24 and the fishery continued for several days after June 24; therefore many early-run fish are harvested during this opening after the demarcation between the two runs.

Late-run Chinook Salmon

The original brood stock for the late run was Kasilof River chinook salmon; brood stock was collected from adults returning to the Homer Spit from 1994 through 1998. The program was discontinued in 1999 when insufficient numbers of sexually mature adults were available to take eggs from. Anglers first benefited from the late-run chinook salmon stocking program in 1993 when chinook salmon "jacks" (1-ocean fish) were harvested. As expected, not more than several hundred of these fish returned for the first 2 years. The full complement of age classes has returned since 1995. Run timing is the month of July and early August. The harvest of late-run chinook was first estimated separately from the early-run harvest in 1996 (Table 36). The estimates have ranged from 1,423 to 688. The stocking program may have contributed as many as 450 chinook to the harvest from boats fishing near shore during these years. Recreational anglers harvest the majority of the return.

Anglers reported excellent fishing for chinook salmon in the Enhancement Lagoon through 1998. During 1999, the return was weak and anglers reported poor fishing. Fishing for late-run chinook salmon in 2000 was also poor. The majority of late-run chinook salmon were harvested by non-snagging techniques. Snagging has not been permitted since the inception of the stocking project because the harvestable surplus of chinook salmon has been small and the beginning of the stocked coho salmon run overlaps with the end of the chinook salmon run.

Table 36.-Shorebased harvest and angler participation directed toward enhanced chinook, pink, and coho salmon stocks in the Homer Spit fishery, 1987-2000.

	Chinook Salmon Harvest[a]					Total	
Year	Early run	Late run[b]	Total	Pink Salmon Harvest[c]	Coho Salmon Harvest	Days Fished	Harvest
1987			833				833
1988			5,275	1,819		20,282	7,094
1989			1,956	3,856	1,439	16,758	7,251
1990			2,027	697	1,272	22,751	3,996
1991			1,634	647	3,822	11,495	6,103
1992			1,406	485	1,109	8,440	3,000
1993			4,997	1,836	5,823	28,290	12,656
1994			2,607		5,355	30,221	7,962
1995			4,266		5,367	36,451	9,633
1996	933	1,423	2,356		9,060	24,315	11,416
1997	1,512	1,450	2,962		6,091	23,197	9,053
1998	1,051	805	1,856		6,672	15,093	8,528
1999	1,753	688	2,441		3,890	19,448	6,331
2000	1,223	789	2,012		7,125	23,227	9,137
Mean	1,294	1,031	2,616	1,557	4,752	21,536	7,357

Source: Statewide Harvest Survey (Mills 1979-1994; Howe et al. 1995, 1996, 2001a-d; Walker et al. 2003).

[a] Early-run fish only prior to 1993 when 1-ocean late-run fish were first available. Early- and late-run harvests estimated separately beginning in 1996.

[b] Stocking program discontinued in 2000; last return will be in 2004.

[c] Stocking program discontinued; last return was in 1993.

Between 104 and 384 chinook salmon have been taken annually in the Kachemak Bay personal use gillnet fishery since 1995 (Table 37). Gillnet harvests of chinook salmon increased until 1998. These were predominantly enhanced late-run chinook salmon, as no known wild late-run chinook stocks return to Kachemak Bay.

Although angling was reported to be excellent in 1998, insufficient brood stock was available to meet the goals of the stocking program. In 1999, almost no sexually mature chinook salmon were found when the Enhancement Lagoon was seined to collect brood stock and none were transferred to the hatchery for spawning. As a result, the program was discontinued after 1999. The reason for the decline in the number of returning late-run chinook salmon is unknown.

Coho Salmon

Coho salmon were first stocked in the Enhancement Lagoon in 1988 (Table 35) producing the first adult return in 1989. The source of the brood stock was Bear Lake, in the Salmon Creek drainage about 10 miles north of Seward. Coho salmon from this stock begin to arrive at the Enhancement Lagoon around the first of August and the run peaks during the third or fourth week in August. The fish begin to sexually mature in mid-September and will no longer accept lures or bait. Coho salmon are generally available at the site until mid-October. The stock is thought to have a slightly earlier run timing than wild coho salmon returning to lower Cook Inlet tributaries.

The annual harvest by shore anglers ranged from 1,109 to 9,060 during 1989 through 2000 (Table 36). An unknown portion of the 500 to 1,500 coho taken annually from boats fishing near the Homer Spit during this period was likely of hatchery origin from the Enhancement Lagoon or the Caribou Lake stocking project which supplemented fisheries through 1996.

Anglers have reported extended periods of excellent fishing in all years from 1995 through 2001, except in 1999. In 1999, the run appeared to be about 2 weeks late and below average in magnitude.

The year 2001 was the last stocking of coho salmon of Bear Lake origin and the first time coho salmon of an earlier run timing stock from Ship Creek in Anchorage were released in the Enhancement Lagoon. The Ship Creek coho stock will return closer to the peak tourist season and therefore provide more angler opportunity. During 2002 and 2003, both early and late coho salmon runs will return to the Enhancement Lagoon. Beginning in 2004, only the early-run stock will return. During 2001, angler counts were conducted at regular intervals in the vicinity of the Enhancement Lagoon from August 15 through September 15 to monitor the response of the sport fishery to the different coho salmon stocks. The counts took place during the peak hour of fishing effort when the water is first pouring over the sill into the Enhancement Lagoon during the daylight hours. Angler counts will be conducted similarly during 2002 through 2004.

Approximately 32% and 34% of the stocked coho salmon returning to the Enhancement Lagoon during 1999 and 2000 were coded wire tagged and adipose finclipped as smolt. The contribution of hatchery-produced coho to the personal use set gillnet fishery only on the east side of the Homer Spit was estimated; the number sampled without adipose fins from the personal use harvest was expanded by the fraction tagged at the hatchery as smolt. Of the 499 coho salmon examined during the four 48-hour personal use fishing periods in 1999, 402 or 81% were estimated to be of hatchery origin (Table 38). The proportion of hatchery fish was significantly different during all the openings and higher during the

Table 37.-Personal use/subsistence fishery catches for the Southern District of Cook Inlet, 1969-2000.

	Harvest						
Year	Chinook	Sockeye	Coho	Pink	Chum	Other	Total
1969	0	9	752	38	0	17	816
1970	0	12	1,179	143	13	39	1,386
1971	2	16	1,549	44	7	20	1,638
1972	1	11	975	48	69	19	1,123
1973	0	18	1,304	84	40	9	1,455
1974	0	16	376	43	77	27	539
1975	4	47	1,960	632	61	95	2,799
1976	16	46	1,962	1,513	56	75	3,668
1977	12	46	2,216	639	119	84	3,116
1978	4	35	2,482	595	34	89	3,239
1979	6	37	2,118	2,251	41	130	4,583
1980	43	32	3,491	1,021	25	153	4,765
1981	15	73	4,370	718	68	0	5,244
1982	41	49	7,398	956	154	0	8,598
1983	5	17	2,701	305	44	2	3,074
1984	3	25	3,639	804	105	27	4,603
1985	5	49	3,317	138	34	3	3,546
1986	7	68	3,831	3,132	56	0	7,094
1987	5	50	3,979	279	61	0	4,374
1988	14	73	5,007	1,445	75	0	6,614
1989	41	156	7,219	883	53	49	8,401
1990	12	200	8,323	1,846	69	0	10,450
1991	8	47	4,931	366	23	0	5,375
1992	5	63	2,292	643	21	0	3,024
1993	6	44	1,992	463	18	0	2,523
1994	66	80	4,097	1,178	18	0	5,439
1995	118	108	2,916	343	7	0	3,492
1996	302	102	3,347	1,022	24	0	4,797
1997	384	191	1,817	257	12	0	2,661
1998	135	20	1,461	167	5	0	1,788
1999	276	119	1,803	168	3	0	2,369
2000	104	28	2,064	304	4	0	2,504
Average	51	59	3,027	702	44	26	3,909

Note: 1992-2000 reported harvests are based on both returned permits and oral reports.

Table 38.-Hatchery contribution to the personal use gillnet harvest from the east side of the Homer Spit during open fishing periods in 1999 and 2000.

	1999			2000		
Date	Total Examined	Number Hatchery Origin	Percent Hatchery	Total Examined	Number Hatchery Origin	Percent Hatchery
Period 1	147	102	70	385	318	83
Period 2	43	15	36	290	290	100
Period 3	139	136	98			
Period 4	170	149	87			
Total	499	402	81	675	608	90

last two openings than the first two. In 2000, 685 coho salmon were examined during the two fishing periods the fishery was open and 608 or 90% were estimated to be fish stocked in the Enhancement Lagoon. The number of hatchery fish in the harvest was higher during the second opening than the first. It was previously thought that the wild return to the Fox River occurs later than the enhanced return.

Management Objectives

The Homer Spit stocked salmon sport fishery is not specifically addressed in a regulatory management plan. Department objectives for this fishery are:

Objective 1: Annually stock 210,000 early-run chinook salmon smolt in the Homer Spit Enhancement Lagoon to produce 6,500 returning adults all of which are available for harvest in the recreational fishery.

Objective 2: Annually stock 120,000 coho smolt in the Homer Spit Enhancement Lagoon, which will return approximately 6,000 adult fish, all of which are available for harvest in the recreational fishery.

Objective 3: Provide for 25,000 angler-days of annual sport fishing opportunity directed at early-run chinook salmon on the Homer Spit and in Seldovia Bay and Halibut Cove Lagoon.

Objective 4: Generate 10,000 angler-days of sport fishing opportunity directed at stocked coho salmon in Kachemak Bay.

Objective 5: Manage the stocked fisheries to achieve, insofar as possible, a 100% harvest of stocked salmon.

Because this is a stocked terminal harvest fishery, resource conservation of the returns is not a concern. At issue is the harvest technique of snagging versus non-snagging and the management objective to obtain as close to a 100% harvest of these stocked fish as is reasonably possible. The Board addressed these issues in 1988 and regulations became effective in 1989.

The Board determined that non-snagging techniques would be employed to harvest stocked early-run chinook salmon as long as these fish could reasonably be expected to accept bait and lures. The Board further determined that the fishery would be prosecuted with non-snagging techniques prior to June 23. After June 23, if fish remained in the fishery and if it was the department's determination that they could no longer be harvested with non-snagging techniques and the department had met any brood-stock requirements, then the department could permit snagging by emergency order for the length of time necessary to harvest the fish remaining in the Homer Spit Enhancement Lagoon. This management scheme has been applied to the other salmon species stocked in the Lagoon except for the late-run of chinook salmon which overlaps with the onset of the coho fishery.

Board of Fisheries Actions

There were no sport fishing regulatory changes proposed for this fishery for the 1990, 1992 1995, 1996 or 1998 Board meetings and none were adopted. However, the Board considered a proposal to limit the duration of the personal use gillnet fishery at the 1998 meeting and chose to reduce the harvest guideline (see the section on Kachemak Bay coho salmon fisheries). A housekeeping proposal to clarify the regulatory language regarding snag openings in Kachemak Bay and at the Homer Spit was passed by the BOF in fall 2001.

Outlook

This is an extremely popular stocked terminal harvest area fishery. No change is anticipated in the number of early-run chinook salmon smolt stocked or in the numbers of adult fish returning. Management of the early-run fishery has not changed since 1989. Restriction of weighted hooks and weights following hooks by regulation is under consideration.

No late-run chinook salmon will return to the Enhancement Lagoon after 2004. Over the course of 2001 through 2004, the current coho salmon stock is being replaced with a stock that returns earlier and that has similar timing to the late-run chinook salmon stock. It is anticipated that the new coho salmon stock will return closer to the peak of the tourist season and provide more opportunity for less cost. The timing of the new stock is such that interception of stocked fish by the personal use gillnet fishery will be reduced. While the change will provide more fishing opportunity where opportunity is currently dwindling, the change may increase fishing pressure on wild stocks, both those migrating to the Fox River and elsewhere in the management area. The personal use gillnet fishery harvest guideline of 1,000-2,000 coho salmon is based on pre-stocking levels and is thought to be sustainable. Impacts from human development of the Fox River area are unknown and may have reduced the harvestable surplus of wild fish. Changes to the personal use set gillnet fishery may be required to mitigate the loss of stocked coho salmon to the fishery.

Current Issues

The conflict between fishers who wish to harvest salmon by non-snagging methods in the Enhancement Lagoon and those who wish to snag was largely solved by the snagging regulation enacted by the Board in 1989. While some anglers continue to object to the legalization of snagging, they are fewer than

before the snagging closures were implemented. The public has generally been supportive of the Board's harvest strategy employed on the Homer Spit. Public compliance with emergency orders has been good although reports of snagging during periods closed to this activity are frequent.

Anglers have developed a technique using a weight following a single hook, referred to as "tight lining," that is technically legal, but results in fish being snagged in the mouth and also in other body parts. The technique has increased the incidence of snagging-related complaints by the public and snagging citations by enforcement personnel. During 2001, the use of weighted hooks and weights following hooks was restricted by emergency order during snagging closures to lessen the incentive for anglers to snag and keep fish during the period when the fish are still biting (Appendix B1). The department may submit a proposal to the BOF in the future to adopt the gear restriction as regulation, depending upon the success of the action during 2001.

The demise of the late-run chinook salmon caused a flurry of concern among anglers and prompted the department to seek alternative fishing opportunity during the time between the early-run chinook and the coho return. Loss of opportunity in late July and early August combined with complaints about the interception of stocked fish in the personal use set gillnet fishery led to the replacement of the historic stock of coho salmon with an earlier returning coho stock. Changes in the demographics and effort in the fishery will be monitored as well as potential impacts to wild stocks. There is the potential to stock both early and late returning coho salmon to the Enhancement Lagoon but doing so will require funding to rear the later returning Bear Lake stock at the Trail Lakes Hatchery. Interested citizens and department personnel are cooperating to investigate this option.

Recommended Research and Management

Changes in fishing effort from the discontinuation of late-run chinook and late-run coho salmon stocking and the advent of stocking earlier returning coho salmon will be monitored starting in 2001 through 2004.

A portion of the Ship Creek coho stock that was released in the Enhancement Lagoon beginning in 2001 has been coded wire tagged and finclipped. A weir will be operated in Deep Creek from July into September 2002 to enumerate coho salmon escapement and look for strays from the Homer Spit enhancement project. A central Kenai Peninsula stream is targeted for weiring to monitor long-term trends in salmon abundance; sampling for strays should be part of that operation. Additionally, Silver and Stonehocker creeks, 4 miles across Kachemak Bay from the Homer Spit, are seined periodically during July to mid September to look for stray coho salmon from the Homer Spit enhancement project. These monitoring projects to detect straying should be continued.

The hatcheries began releasing chinook salmon smolt at a smaller size in 2001 to reduce the incidence of jack salmon in the return. Previous chinook size at stocking averaged 17 grams, now the target size is 13 grams. The target size is determined from studies of outmigrating smolt from the parent streams. This information is not available for the Ninilchik River, the parent stock of chinook planted in Kachemak Bay locations.

Many questions about the effects of rearing and stocking practices are unanswered. The effect on age composition in the return of smolt size at stocking is unknown. Smolt are held for up to 5 days after they are stocked and volunteers feed the smolt every 2 hours of daylight during this period. The benefits

of this practice to survival and fidelity to release location have not been tested. The marine survival of the stocked salmon has not been estimated nor has size of the return. The impact on survival and fidelity to release location of varying levels of fresh water in the vicinity of the release location has not been investigated. Research focused on these questions could do much toward reducing the cost and improving the benefits of stocking anadromous fish in marine waters.

The impacts of stocked fisheries on wild stocks have not been investigated. It is not known if the stocking program in Kachemak Bay truly displaces fishing pressure from local wild stocks or if it actually attracts additional anglers to the area than would otherwise have fished elsewhere. The stray rate to other Kachemak Bay systems of stocked fish is not known.

HALIBUT COVE LAGOON STOCKED EARLY-RUN CHINOOK SALMON FISHERY

Historical Perspective

Halibut Cove Lagoon is located approximately 10 miles across Kachemak Bay from the Homer Spit (Figure 5). This is formerly the site of the Halibut Cove Lagoon Saltwater Rearing Facility, established in 1973 by the former Fisheries Rehabilitation, Enhancement and Development Division (FRED) of the Alaska Department of Fish and Game, where all five species of Pacific salmon were reared experimentally for varying periods of time. Since 1979, the Lagoon has served only as a chinook salmon smolt imprinting and rearing site.

Access to the fishery is via boat. Chinook salmon begin to return here in late May, with the run ending by mid July. Snagging is permitted by regulation after June 23. After this date the fish are maturing and angler efficiency using non-snagging techniques is reduced. Halibut Cove is a terminal harvest area; there is no natural production due to the absence of spawning area. The fishery is relatively small; the peak harvest was 2,911 chinook in 1988 (Table 39). It provides fishing opportunity in a beautiful and remote setting.

This stocked return is subject to a commercial set gillnet interception fishery adjacent to the lagoon from the first Monday in June until September 30. The use of purse seines has been prohibited inside the lagoon since 1992 and outside the lagoon since 1996. The commercial set gillnet fishery harvest of chinook salmon in the Halibut Cove Subdistrict has ranged from 280 to 1,400, averaging 650 fish annually from 1991 through 2000. The number of chinook salmon harvested in the commercial fishery is estimated from fish tickets.

Recent Fishery Performance

Fishing success has been rated by anglers as good during the peak of the run in most years since 1996. However, anglers reported only fair fishing in 1997 and 1998. Poor success during those years may have related to the low number of chinook salmon that were stocked in the Lagoon in 1995. Catch rates in 2000 were reportedly poor to fair until late in the run. No onsite survey to estimate the size of the harvest has been conducted since 1984.

Management Objectives

This fishery is not specifically addressed in a regulatory management plan. Department objectives for this fishery are:

Table 39.-Summary of chinook salmon sport harvest and effort and commercial harvest, Halibut Cove, 1984-2000.

Year	Sport Angler Effort (days fished)	Sport Harvest	Commercial Harvest	Total Return
1984		537	200	737
1985		[a]	300	300
1986		368	350	718
1987		905	500	1,405
1988		2,911	1,350	4,261
1989		1,380	1,420	2,800
1990		1,302	810	2,112
1991	5,889	1,064	420	1,484
1992	3,418	1,040	1,034	2,074
1993	4,728	1,727	1,200	2,927
1994	5,875	1,094	500	1,594
1995	2,798	794	785	1,579
1996	6,682	917	420	1,337
1997	6,018	632	392	1,024
1998	4,642	625	426	1,051
1999	4,325	990	825	1,815
2000	2,032	408	584	992
1984-2000 Average	3,666	1,043	677	1,659
1991-2000 Average	4,641	929	659	1,588

Source: Sport effort and harvest data from the Statewide Harvest Survey (Mills 1979-1994; Howe et al. 1995, 1996, 2001a-d; Walker et al. 2003).

[a] No data.

Objective 1: Annually stock 105,000 early-run chinook salmon smolt in Halibut Cove Lagoon, which will return approximately 3,000 adult fish available for harvest in the Halibut Cove recreational fishery.

Objective 2: Manage the fishery to achieve insofar as is practical a 100% harvest of early-run stocked chinook salmon.

Objective 3: In concert with the stocking projects on the Homer Spit and the early-run chinook stocking project in Seldovia Bay, generate 25,000 angler-days of annual sport fishing opportunity directed at chinook salmon in Kachemak Bay.

This is a stocked terminal harvest fishery; resource conservation is not a concern of management. Inseason management is conducted by regulations adopted by the Board in 1988 and first implemented in 1989. Snagging is prohibited in this fishery prior to June 24. On this date this practice becomes a legal harvest method for the remainder of the calendar year. This management strategy provides for a percentage of the harvest to be taken with non-snagging techniques. It also provides the opportunity for virtually all fish returning to Halibut Cove Lagoon to be harvested (Objective 2).

Board of Fisheries Actions

The Board reviewed two public proposals at its November 1992 meeting that would have reduced the interception of Halibut Cove chinook salmon in the commercial set and seine fisheries. After lengthy deliberation, the Board rejected these proposals. The rationale was that all user groups should have the opportunity to harvest these stocked fish even though the project was designed to primarily provide early-run chinook salmon for the recreational fishery.

At its November 1998 meeting, the Board again considered public proposals regarding interception of Halibut Cove chinook salmon in the commercial setnet fishery. A proposal to delay the opening of the commercial season from the first Monday in June until June 10 to reduce the commercial catch of stocked chinook salmon was not adopted by the Board. A proposal to limit the mesh size of commercial gillnets on or after the first Monday in June to 5 1/4 inches from 6 inches to reduce the commercial interception of chinook was amended to establish a 6-inch maximum mesh size year around.

Outlook

Chinook salmon smolt size at stocking was reduced in 2001 to reduce the number of 1-ocean “jacks” in the return. No change in stocking level is anticipated at this time. However, hatchery space is fully allocated, and increases in one stocking program necessitate the reduction or elimination of others. If the department seeks to maximize fishing opportunity in the region, stocking locations and small fisheries such as Halibut Cove Lagoon may be discontinued to provide for new fisheries where more anglers can be served.

Current Issues

This is a stocked terminal harvest fishery. There are no biological concerns associated with its management, although the incidental commercial chinook salmon harvest is of concern to some recreational anglers. Current regulations compromise the department's ability to achieve the objective in that all chinook salmon produced are not available to the recreational angler.

Recommended Research and Management

Sport angler participation, harvest and catch are estimated with the SWHS.

Questions about the effects of rearing and stocking practices referred to in the section of this report on the Homer Spit stocked fisheries apply to the fishery at Halibut Cove Lagoon as well.

SELDOVIA BAY STOCKED EARLY-RUN CHINOOK SALMON FISHERY

Historical Perspective and Fishery Performance

Seldovia is located approximately 15 miles southwest of the Homer Spit across Kachemak Bay (Figure 5). Chinook salmon smolt were released beginning in 1987 to create a new sport fishery. The release site was in the Seldovia Harbor until 2000 when fish were released upstream of a dam in Fish Creek, a small tributary to Seldovia Slough. This is a terminal harvest fishery where all fish are intended for harvest and none spawn at the stocking location.

Local anglers and tourists first benefited from this program with the return of chinook salmon jacks in 1988 and both jacks and 2-ocean fish which had attained 8 to 17 pounds in 1989. The full complement of ocean age classes has returned since 1991. The sport harvest reported in the SWHS ranges from 100 to 600 chinook salmon (Table 40). These harvest estimates are believed to be conservative because fewer than 30 respondents to the mail survey reported fishing in Seldovia in 1988-1990, 1992, 1995 and 1999, rendering the estimates inaccurate. The reported sport catch and harvest of chinook salmon from Seldovia Bay is variable but stable.

In 1998, angler counts were conducted to estimate fishing effort in the sport fishery in the Seldovia Slough and Seldovia Harbor to evaluate the benefit of the stocking program. Sport anglers expended a total of 3,986 angler hours: 931 by anglers under the age of 16 and 3,055 angler hours by anglers 16 and over.

A subsistence set gillnet fishery for salmon was created in Seldovia Bay by the BOF during its 1995 meeting. The harvest of chinook salmon was limited to 200 fish to protect the enhanced chinook fishery in Seldovia Bay. The annual possession limit is 20 chinook per household. The fishery is opened for two 48-hour periods per week from April 1 to May 30 and one 36-hour period each of the first 2 weekends in August. Annual harvest of chinook and sockeye salmon taken in the spring fishery are reported in Table 41.

A commercial set gillnet fishery also occurs in Seldovia Bay. Much of this harvest is likely composed of enhanced chinook returning to Seldovia. Commercial harvests averaged 40 prior to stocking from 1984 through 1988 (Table 40). From 1991 to 2000, the average commercial harvest has been 390 chinook salmon. The highest harvest since 1991 was 770 chinook salmon in 1995 and the lowest was 161 in 2001.

Management Objectives

The Seldovia Bay stocked chinook salmon fishery on the north side of Kachemak Bay is not specifically addressed in any regulatory management plans. Department objectives for this fishery are:

Objective 1: Annually stock 105,000 early-run chinook salmon in Seldovia Harbor to produce approximately 3,000 adult fish which are available for harvest in the recreational fishery.

Objective 2: In concert with the early-run stock projects on the Homer Spit and the early-run chinook salmon stocking project in Halibut Cove, to generate 25,000 angler-days of annual sport fishing opportunity directed at chinook salmon in Kachemak Bay.

Table 40.-Summary of chinook salmon sport harvest and effort, 1984-2000, and commercial and subsistence harvests, 1984-2001, in Seldovia Bay.

Year	Sport Angler Effort (days fished)	Sport Harvest	Commercial Harvest	Subsistence Harvest	Total Harvest
1984	100	[a]	52		52
1985	1,179	[a]	70		70
1986	1,804	[a]	27		27
1987	454	[a]	7		7
1988	1,292	36	40		76
1989	1,408	150	182		332
1990	2,011	184	370		554
1991	2,509	88	350		438
1992	1,665	156	301		457
1993	1,445	283	419		702
1994	2,530	284	407		691
1995	1,504	448	770		1,218
1996	2,677	319	322	51	692
1997	3,061	406	476	44	926
1998	1,959	103	325	132	560
1999	1,981	207	287	150	644
2000	4,516	608	241	189	1,038
2001			161	134	
1984-2000 Average	1,888	252	267	113	499
1991-2000 Average	2,385	290	390	113	737

Source: Statewide Harvest Survey (Mills 1979-1994; Howe et al. 1995, 1996, 2001a-d; Walker et al. 2003).

[a] No data.

Table 41.-Summary of participation and chinook and sockeye salmon harvests in the spring subsistence fishery, Seldovia Bay, 1996-2001.

Year	Permits Issued	Permits Fished	Chinook Harvest (numbers)	Sockeye Harvest (numbers)
1996	41	13	51	7
1997	19	12	44	19
1998	20	9	132	61
1999	16	12	150	130
2000	28	21	186	236
2001	19	14	134	124

Board of Fisheries Actions

A subsistence set gillnet fishery for salmon was created in Seldovia Bay by the BOF during its 1995 meeting. The Board established a customary and traditional use finding for this area and subsequently crafted regulations to control this fishery. The harvest of chinook salmon was limited to 200 to protect the enhanced chinook salmon fishery in Seldovia Bay. The Seldovia subsistence fishery was opened for two 48-hour periods per week from April 1 to May 20 and one 36-hour period each of the first 2 weekends in August. The Board adopted a proposal extending the April/May period by 10 days to May 30 at their February 1998 meeting. During that meeting they rejected a companion proposal to expand the area open to this fishery. Instead, the Board modified the customary and traditional use determination to close additional waters near the Seldovia Harbor to reduce harvest of enhanced chinook salmon in the subsistence fishery. Subsistence fishers were required to be present when their nets were fishing. A proposal to limit the mesh size of commercial gillnets on or after the first Monday in June to 5 1/4 inches from 6 inches to reduce the commercial interception of chinook was modified to establish a 6-inch mesh size requirement year round in the commercial fishery.

Outlook

Beginning in 2000, smolt were no longer stocked and held in net pens in the Seldovia Harbor prior to release but were placed in fresh water upstream of the Fish Creek Dam. This action was taken to increase the number of chinook salmon returning by improving fidelity and survival. Smolt size at stocking was reduced in 2001 to reduce the number of 1-ocean "jacks" in the return. No change in stocking level is anticipated in the near future.

The fishery is small relative to most other stocked saltwater terminal fisheries in Southcentral Alaska. As with the stocked early-run fishery in Halibut Cove Lagoon, if new salmon stocking projects are

identified, their costs and benefits will be weighed against those of existing projects. Smaller fisheries provide diversity but provide less angler opportunity, and may lose out in the competition for hatchery space.

Current Issues

Support for this fishery from the local community is strong although numerous complaints have been lodged about snagging violations prior to the June 24 regulatory opening for this harvest method. Complaints have also arisen over the practice of snagging and wasting chum salmon that return to the Seldovia Slough after the chinook salmon run is over. Snagging is legal because the slough is salt water but the waste of fish is not. It may be necessary to close the slough to snagging at the conclusion of the chinook salmon return to prevent snagging of other fish species. Although not a consideration in managing this fishery, the incidental commercial and subsistence chinook salmon harvest is of concern to some recreational anglers. Current regulations compromise the department's ability to achieve the objective that all chinook salmon produced be available to the recreational angler.

Recommended Research and Management

Sport angler participation, harvest and catch are estimated with the SWHS, a mail survey to a random selection of sport fishing license holders. The accuracy of mail survey estimates improves as the number of respondents increases. Estimates become increasing inaccurate with a decreasing number of respondents until there are fewer than 30 respondents; at which point the estimates become only indicators of magnitude. Because fewer than 30 mail survey respondents reported fishing in the Seldovia Bay during some years, estimates of participation, harvest and catch are only precise enough to indicate that the fishery is small. The public claimed that the effort and harvest in the fishery was much higher than reported in the SWHS. It was thought that the SWHS might be missing a large component of the anglers because youths under 16 do not have to purchase a sport fishing license and are therefore not sampled by the mail survey unless another household member has a license. A survey of angler participation occurred on a limited basis during 1998 to provide an independent estimate of angler participation to more accurately assess the benefits of this stocking project. A volunteer was dedicated by the City of Seldovia to estimate angler participation by age of angler in the Seldovia sport fishery. The angler participation survey estimated that only a small proportion of participants in the fishery were under 16. Therefore the discrepancy between the high participation and harvest claimed by the public and low estimates from the SWHS couldn't be explained by high numbers of youths participating in the fishery. A more rigorous approach creel survey is needed to quantify participation and harvest in order to accurately assess the benefits of the stocking program.

CHINA POOT BAY FISHERY

Historical Perspective

Leisure Lake, also known as China Poot Lake, is located across Kachemak Bay in a southeasterly direction from the Homer Spit (Figure 5). The lake is stocked with sockeye salmon fry to supplement the commercial catches in Kachemak Bay. The project was initiated by ADF&G but was transferred to Cook Inlet Aquaculture Association (CIAA). Due to the presence of barrier falls upstream from the intertidal area of China Poot Creek, adult sockeye salmon returning to Leisure Lake are harvested in a terminal fishery. The terminal harvest area has provided excellent opportunities for anglers and dipnetters.

Until the early 1990s Leisure Lake was used experimentally as a rearing system for hatchery-produced sockeye salmon fry. The major goal of the Leisure Lake project was to determine fry stocking densities that produce optimum adult returns. Lake fertilization was initiated in 1984 to increase salmon production. Stocking and fertilization levels have been fairly constant since then. An average of 1.7 million juvenile sockeye salmon have been released annually into Leisure Lake since 1984. High mortality due to an IHN outbreak at Trail Lakes hatchery reduced the stocking level to less than 300,000 fry in 1999 and 2001. Adults returning to Leisure Lake have represented as much as 49% of the lower Cook Inlet commercial sockeye salmon harvest and are subject to sport and personal use harvest as well.

A personal use fishery occurs along 200 yards of China Poot Creek between the intertidal area and the barrier falls, and the sport fishery occurs along an expanse of intertidal mud flats in China Poot Bay. Until 1995, the personal use season was July 1 through July 31. In some years, sockeye salmon continued to enter China Poot Creek after the close of the season. Harvest of these fish was accomplished by extending the fishery by emergency order through early August. The decision to extend the season was determined by index counts of sockeye salmon present in the stream in late July. Extended openings for personal use dipnetting were held by department emergency order in August of 1983, 1984, 1985, 1989, and 1994 to completely harvest fish that had entered China Poot Creek. The BOF extended the season through August 7 in 1995 and no inseason extensions have been required since.

The average personal use harvest prior to 1996 was 3,680 (Mills 1984-1994, Howe et al. 1995, 1996). The largest harvest of 8,605 was taken in 1995 and the lowest, 796, was taken in 1985. The personal use harvest is no longer estimated. Sport harvests are small, likely less than 500 fish in most years. The average commercial harvest in China Poot Bay from 1983 to 1990 averaged 65,000 sockeye. Commercial harvests for China Poot Bay were not estimated separately from other harvests in the China Poot subdistrict after 1990.

Virtually all of the sport and personal use fishing originally took place on property owned by the Seldovia Native Association. This land was included in a parcel which was being offered for sale to the State of Alaska for inclusion in Kachemak Bay State Park. When this purchase was not approved by the Legislature, the Association initially planned to prohibit trespass. An agreement for the 1990 season was reached between the department, Seldovia Native Association, and the Kachemak Bay Heritage Land Trust. The Land Trust is a nonprofit group interested in preserving natural areas and easements in Kachemak Bay. Land Trust members sold voluntary seasonal use permits for a $5 fee with proceeds being earmarked for access purchase. In 1991 and 1992 it was reported that anglers fished from private property even though the property was "posted." In 1993 the lands adjacent to the creek were purchased by the state; access to the fishery is no longer an issue.

Board of Fisheries Actions

There were no regulatory changes to this fishery during the 1990 and 1992 BOF meetings. In 1995, the Board extended the personal use fishery until August 7 to maximize the opportunity to harvest stocked sockeye salmon while minimally impacting wild pink salmon which spawn in China Poot Creek.

When changes were made to the Cook Inlet personal use regulations the prohibition on the harvest of other salmon species in the China Poot personal use dip net fishery was deleted erroneously. At the

November 2001 meeting the Board of Fisheries reinstated the regulation that all salmon species besides sockeye salmon may not be possessed or retained.

Outlook

Annual production from the stocking of Leisure Lake is expected to remain relatively constant, provided that CIAA remains viable. No change in the prosecution of the fisheries harvesting this stock is anticipated.

Current Issues

The China Poot Bay sport and personal use sockeye salmon fishery is a stocked terminal harvest fishery. There are no biological concerns associated with its management. Conflicts between snaggers and commercial boats conducting cost recovery in China Poot Bay have intensified recently. No regulation changes have been proposed to date.

Recommended Research and Management

No Sport Fish Division research specific to this fishery is recommended.

TUTKA BAY FISHERY

Historical Perspective

Tutka Bay Lagoon is located across Kachemak Bay approximately 9 miles south of Homer Spit (Figure 5). A pink salmon hatchery located at this site is currently operated by CIAA. The lagoon is only accessible through a narrow intertidal channel during the high tide period. Pink salmon enter Tutka Lagoon and stage for several weeks prior to moving into a small stream to spawn. This staging period in the small, 35 acre lake-like lagoon offers an excellent opportunity to effectively sport fish for these 3- to 5-pound salmon. As many as 40 boats and 150 anglers have been observed fishing in the small lagoon during a single high tide period. The recreational fishery occurs in July. The preferred terminal tackle is small artificial lures on medium to ultra light gear.

Pink salmon returns peak during odd numbered years in Cook Inlet. Commercial harvests from 1978 to 1989 averaged over 400,000 fish. In 1987, due to low stock levels, both the commercial and sport fisheries were closed by emergency order. The 1990 return was also below projections; commercial harvest was 37,426 fish. The corresponding sport saltwater harvest was 1,074 pink salmon. Since 1991 the odd year commercial harvest has averaged 1.3 million pink salmon. The commercial harvest has exceeded 1 million annually since 1995 when the Tutka Hatchery increased production substantially. Since 1991 the sport harvest in salt water has been relatively stable with an average of approximately 1,500 pinks taken annually. In 1997, the sport bag and possession limits for pink salmon were doubled by emergency order to 12 in Tutka Bay Lagoon and in Tutka Bay, near the Lagoon, because of an available harvestable surplus of 80,000 pink salmon.

Inseason Management

The majority of the pink salmon harvested in this fishery originate in Tutka Hatchery therefore resource conservation has not been an issue in management of the fishery. The sport fishery is not specifically addressed in a regulatory management plan. There has been a closure of all intercepting fisheries during a year of low return to ensure sufficient numbers of fish were present to provide brood stock for the hatchery. The sport fishery was liberalized to take advantage of a surplus of stocked pink salmon in 1997.

Board of Fisheries Actions

There were no regulatory changes adopted for this fishery by the Board at either its 1990, 1992, 1995, 1998 or 2001 meetings.

Outlook

CIAA will continue to operate Tutka Hatchery as long as the organization is financially solvent. Production from the hatchery is not expected to significantly deviate from present levels. With allowances for annual variability, no significant change is anticipated in the sport fishery's pink salmon harvest or level of angler participation.

Current Issues

There are currently no major biological issues associated with the sport fishery. Conflicts between commercial fishers conducting cost recovery and anglers were reported in 2001.

Recommended Research and Management

No Sport Fish Division research activities specific to this fishery are recommended. The department has publicized the necessity for unimpeded cost recovery by commercial fishers for continuation of the stocking program in hopes that anglers won't interfere with commercial fishing in the lagoon.

SHELLFISH FISHERIES

The beaches on the east side of central Cook Inlet support the largest fishery for razor clams in the State of Alaska. Southcentral Alaska's largest hardshell clam fishery (little neck *Protothaca staminea* and butter clam *Saxidomus giganteus*) fishery occurs in Kachemak Bay. Once thriving fisheries for king crab, Dungeness crab and shrimp in Kachemak Bay are now closed because abundance of those species is low. The formerly robust Tanner crab C*hionoecetes bairdi* sport and personal use fishery is restricted because the population is depleted. Other mollusks such as cockles *Clinocardium* sp. and *Serripes* sp., softshell clams Family Myidae, tritons *Fusitriton oregonensis*, sea urchins Class Echinoidea, and sea cucumbers *Parasthichopus californicus* are harvested in small amounts.

RAZOR CLAM

Historical Perspective

The Kenai Peninsula razor clam *Siliqua patula* sport fishery occurs primarily in a 50-mile area on the east side of Cook Inlet between the Kasilof River and the Anchor River (Figure 6).

From 1959 until 1962 the razor clam bag limit was 30. In 1960, a sport fishing license was required and a seasonal closure from July 10 through August 31 was implemented. The bag limit was increased to 60 in 1962. The seasonal closure was repealed in 1968. In 1968, the bag limit was amended to the "first 60 clams dug" (Nelson *Unpublished*). A possession limit was adopted in 1994, the first significant regulatory change in more than 20 years. The daily bag limit was lowered to 45 clams and the possession limit to two daily limits (90 clams) in 2000. There is no closed season but winter weather conditions preclude most from digging during October through February. Razor clams may be dug on any minus tide; however, tides lower than -2.0 feet on the northern beaches and -3.0 on the southern beaches are preferred. On the northern beaches these tides occur about 65 days annually while on the more southern beaches the average number of days this species is available to the sport digger declines to about 35.

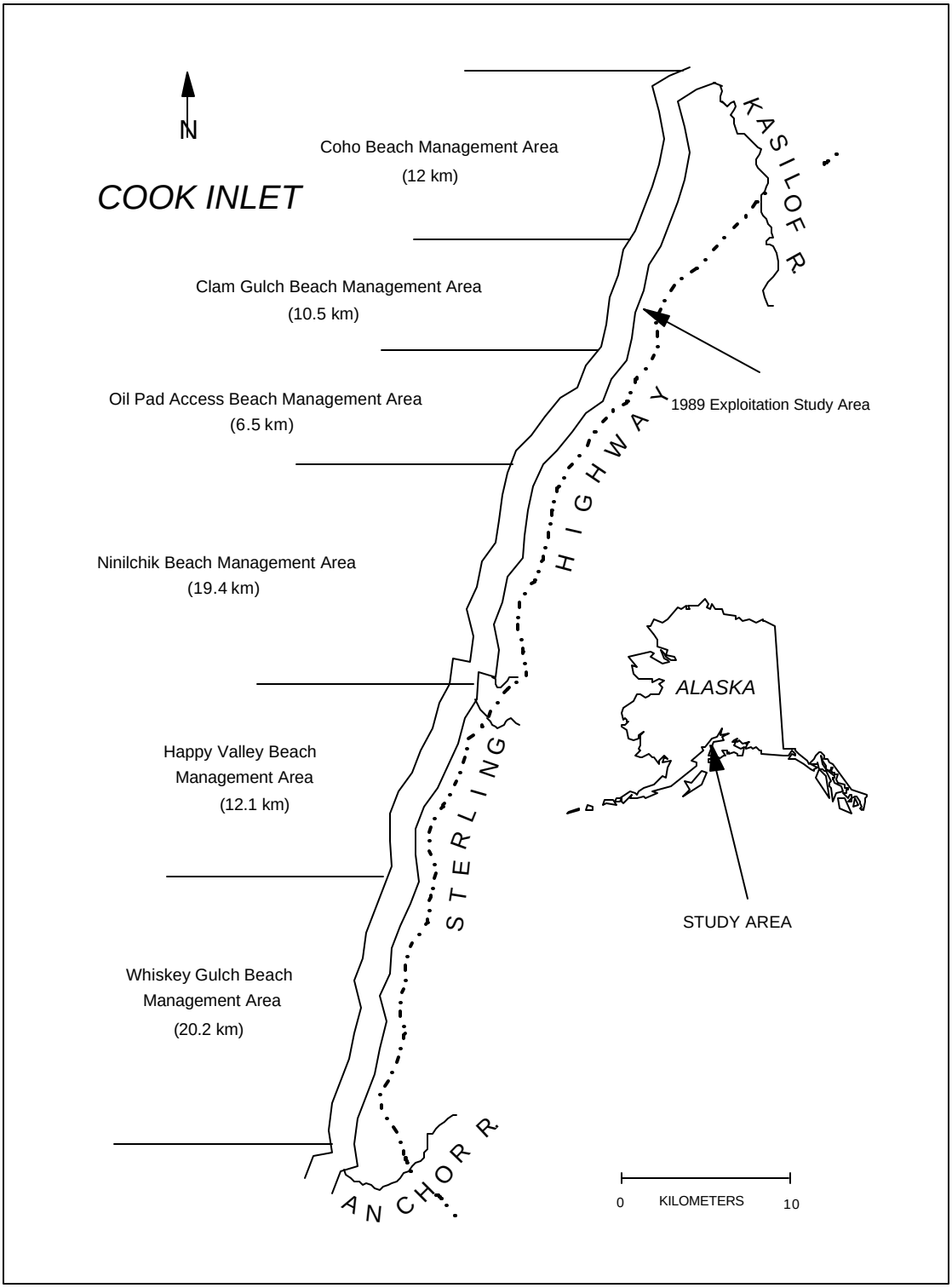


Figure 6.-Eastside Kenai Peninsula razor clam beaches.

It is assumed that razor clams 80 mm (approximately 3 inches) or greater are fully available for harvest by diggers while some proportion of clams smaller than 80 mm will be missed by diggers because of their small size. Fully exploitable size is therefore assumed to be 80 mm. This length is attained after approximately four winters of life.

Research and management programs have been conducted annually since the mid 1960s to estimate age class composition, the mean length of clams available to the sport digger, as well as to determine spawning success and recruitment of younger age classes to the fishery. Abundance and fishing mortality of clams at Clam Gulch and Ninilchik has been estimated periodically since 1988, when a major research project was directed toward this resource (Szarzi 1991). An estimate of total harvest is obtained from the SWHS (Howe et al. 2001d). The distribution of harvest is estimated from periodic aerial counts of diggers conducted throughout each summer.

Inseason management actions have not been required to date; there is minimal fluctuation in annual harvest and participation. Management of the fishery inseason is therefore affected by current regulation.

Fishery Performance

Harvest and participation is determined by SWHS (Howe et al. 2001d). Average annual participation in the last 10 years has been approximately 37,000 days; harvest has averaged about 1.0 million razor clams (Table 6). Participation and harvest peaked in 1994 when 48,500 digger days were spent digging 1.2 million razor clams. Since 1996, participation and harvest have been below average. The proportion of the total harvest taken at Clam Gulch peaked in 1979 (Table 42) and declined as the Ninilchik beach became more popular for clam digging. Ninilchik beach grew in popularity until 1995 when digging effort shifted toward Clam Gulch again. There has been a slight decline in the proportion of the total harvest taken from the Happy Valley and Whiskey Gulch beaches since the 1980s. Anecdotal reports of diggers having greater difficulty finding razor clams at Ninilchik, Happy Valley and Whiskey Gulch may be the reason for the recent shift in effort back to Clam Gulch.

Abundance of exploitable size (Table 43) and abundance of all clams has been estimated for sections of beach at Clam Gulch and Ninilchik. Abundance of exploitable sized clams at the beach section in the Clam Gulch area ranges from 6.8 to 16.0 million during the years that abundance was estimated. The increase in abundance in 1999 is likely the result of a strong year class growing into a harvestable size during that summer.

A strong year class recruited into the population of harvestable sized clams in 1991 and 1992 at Ninilchik Beach. That is verified by the capture of many small-sized clams during department surveys in 1989. This strong year class has mostly died or been harvested by 2001, and the decline in abundance reflects the demise of this year class. The harvest has remained stable resulting in increasing exploitation rates in 1998 and 2001.

The average length of razor clams increases from north to south along the eastside beaches (Table 44).

Table 42.-Percentage of harvest by beach area in the Cook Inlet eastside beach razor clam fishery adjusted for relative success rate, 1977-2000.

Year	No. of Surveys	Percentage of Harvest					
		Cohoe	Clam Gulch	Oil Pad	Ninilchik	Happy Valley	Whiskey Gulch
1977	3	2.2	70.6	11.2	11.4	3.1	1.5
1978	9	1.8	74.7	10.4	6.9	4.3	1.9
1979	8	2.5	77.1	7.3	7.5	4.8	0.8
1980	8	2.0	67.5	8.2	11.7	8.3	2.3
1981	9	1.7	60.9	12.8	11.1	10.2	3.4
1982	6	1.2	49.6	10.9	13.7	18.4	6.2
1983	6	1.7	48.5	12.8	15.7	15.0	6.3
1984	6	0.9	45.7	19.5	20.2	10.0	3.7
1985	5	0.9	35.1	17.5	31.1	12.7	2.7
1986	4	1.0	25.3	21.4	35.5	13.3	3.5
1987	3	0.2	21.6	13.1	51.9	9.5	3.7
1988	3	0.8	26.1	4.9	53.3	11.2	3.7
1989	11	0.2	28.8	12.1	50.4	5.7	2.8
1990 [a]	12	0.3	30.5	14.8	46.4	6.0	2.0
1991 [a]	10	0.6	28.0	13.6	50.2	6.2	1.4
1992 [a]	13	0.3	21.6	10.4	61.9	5.0	0.8
1993 [a]	13	0.3	21.0	11.8	61.9	4.3	0.7
1994 [a]	13		19.7	10.0	65.0	4.0	1.0
1995 [a]	13	0.1	19.9	10.5	65.5	3.2	0.7
1996 [a]	13	0.5	23.3	13.6	57.5	3.9	1.1
1997 [a]	12	0.6	26.5	13.6	56.1	2.2	1.1
1998 [a]	12	1.0	28.3	16.6	50.6	2.4	1.1
1999 [a]	14	1.2	27.1	13.4	53.5	4.0	0.9
2000 [a]	13	2.2	31.3	12.8	47.8	4.9	1.2
Average	9	1.0	37.9	12.6	39.0	7.2	2.3

[a] Harvest percentage weighted by tidal height beginning in 1990.

Table 43.-Estimates of harvest (H), abundance of exploitable individuals (> 80 mm; N), and exploitation rate (Exp) with associated standard errors, of razor clams from Tower to A-frame at Clam Gulch, and from Deep Creek to Lehman's Point (Ninilchik).

Beach	Year	Harvest	SE(H)	N_e	SE(N_e)	Exp	SE(Exp)
Clam Gulch	1988 [a]	286,375	14,646	10,340,788	2,148,524	0.028	0.006
	1989 [a]	224,173	11,465	6,768,427	552,057	0.033	0.003
	1999	185,144	10,286	16,048,936	1,292,348	0.012	0.001
Ninilchik	1989 [a]	334,889	18,139	483,289	108,972	0.692	0.160
	1990	321,354	26,342	719,655	199,174	0.447	0.129
	1991	354,583	20,952	2,048,658	360,725	0.173	0.032
	1992	563,709	24,690	2,938,234	781,655	0.192	0.052
	1998	287,423	15,845	887,858	128,443	0.324	0.050
	2001	219,972	12,371	793,900	113,086	0.277	0.042

[a] Harvest estimated as the product of the proportion of total beach harvest that occurred in smaller beach area and the harvest of the entire beach as reported in Table 3 of Athons and Hasbrouck (1994). Variance estimated as the product of the square of the harvest estimate and the average squared coefficient of variation.

Board of Fisheries Actions

The Board reviewed regulations for this fishery at its March 1994 meeting. At that time the Board adopted as regulation a possession limit of three daily bag limits or 180 razor clams. Purpose of adopting a possession limit was better ability to enforce the bag limit. Without a possession limit, once a digger left the beach he could claim any clams over his daily bag limit (60) were dug on a previous day. A possession limit of 180 razor clams was therefore a tool to complement existing regulations rather than a conservation measure.

During its meeting in the spring of 2000, the Board was prevailed upon by residents of the central and southern Kenai Peninsula to adopt lowering the daily bag limit from 60 to 45 and the possession limit to 90 from 180 despite the healthy stock size. The proponents claimed that 60 clams were more than diggers could process and that quantities of clams were being found in area dumpsters. The wastage was not corroborated by Fish and Wildlife Protection officers or ADF&G biologists.

Table 44.-Average length of razor clams sampled from eastside Cook Inlet beaches, 1969-2000.

Year	Average Length of Sampled Clams (millimeters)					
	Cohoe	Clam Gulch	Oil Pad Access	Set Net Access	Ninilchik	Deep Creek
1969	104.5	121.0	110.8			
1970		118.2	109.6			
1971		113.6	109.9			
1972		113.5	114.5	132.2		136.9
1973		115.5	117.5			
1974		124.3	127.0	126.0	143.1	126.0
1975		126.2	125.8			
1976	107.9	125.3	123.0			124.6
1977		124.5	129.3		151.3	
1978		127.1	124.2		153.7	
1979		127.3	122.6			
1980		122.6	114.3		118.2	
1981	93.3	111.3	113.8	116.3		126.1
1982	101.0	112.3	114.8	115.8	127.3	129.1
1983	99.9	106.9	113.5	102.1	99.7	115.0
1984	98.0	112.4	114.9	114.7	104.4	118.0
1985	98.4	115.5	116.9	107.5	115.1	
1986	88.6	113.0	113.4	115.4	134.1	141.2
1987	92.1	112.4	110.7	119.5	137.2	146.2
1988 [a]						
1989	97.3	116.8	114.2	109.5	138.1	133.5
1990	90.2	108.9	108.4	120.7	118.1	
1991	102.1	116.6	125.8	112.7	128.9	
1992	95.5	115.2	122.8	119.3	131.0	
1993	100.7	111.0	114.6	118.7	134.4	
1994	94.6	100.3	115.1	124.4	133.5	140.8
1995	99.1	110.0	116.0	122.0	135.0	
1996	98.4	107.5	117.8	116.0	120.9	
1997	104.0	102.7	102.1	98.9	115.0	144.2
1998	90.2	105.0	105.4	112.7	121.3	
1999	102.3	100.8	111.4	116.6	117.8	
2000	101.4	112.9	110.4	116.8	118.2	
Average	98.1	114.5	115.8	116.1	127.1	131.8

[a] Samples not obtained in 1988.

Outlook

The razor clam population on the eastside beaches of Cook Inlet is healthy. Harvest and effort are stable. A large harvestable surplus exists at Clam Gulch (Table 43). The exploitation rate of razor clams at Ninilchik Beach has varied; a year class with many clams reached harvestable size in 1991 lowering the exploitation rate. The exploitation rate is currently 28% of the harvestable sized population at Ninilchik. A strong year class recruited into the fishery in 1997 on all beaches but the recruitment at Ninilchik was not of the magnitude of the 1991 recruitment. While periodic high exploitation rates are a concern, diggers are shifting away from Ninilchik to Clam Gulch. This trend may alleviate any ill effects of current harvest rates at Ninilchik. Exploitation rates on most other beaches have not been estimated but the harvest from these beaches is relatively low (Table 42). Large expanses of relatively unexploited dense concentrations of razor clams exist to the north of Ninilchik. Razor clam distribution is more patchy to the south and while effort is relatively low, exploitation rates may be higher there because clams are concentrated in smaller areas.

The effects of the recent reduction in the razor clam bag limit are unknown but may shift digger effort back towards Ninilchik where larger clams are found. So far there is no noticeable shift in effort back to Ninilchik. The lower bag limit may also motivate diggers to illegally discard broken or small clams in favor of larger clams since diggers can keep fewer clams. Wastage of clams by diggers discarding broken clams does occur but the amount is undocumented.

The department will continue to monitor trends in effort, harvest, age and length composition, and abundance. Ninilchik Beach will be a primary focus to estimate abundance because of the high exploitation rate there. Abundance will be estimated on other beaches in rotation. No change in the management of the razor clam fishery is anticipated at this time. Should the population at Ninilchik Beach show evidence of overexploitation, measures to curtail the harvest there may include closure of some beach areas.

Current Issues

The department's sampling program has indicated recruitment on all beaches to be at high levels periodically. Year classes were present in the population during the 1970s, 1980s and 1990s with a large number of individual clams. A particularly large year class grew into harvestable size in 1991. Digger distribution is now more widespread than it was during the 1970s when Clam Gulch was the focal point of the fishery. Digger emphasis now occurs at the more southern beaches of Ninilchik and Deep Creek, but is shifting back to Clam Gulch again. The exploitation rate is low at Clam Gulch and a large harvestable surplus exists there. The high exploitation rate at Ninilchik may have resulted in fewer clams being available for harvest and diggers having more difficulty finding clams. The high exploitation rate is cause for concern there and population trends will be monitored closely. No changes in population structure can be attributed to overexploitation from high rates in 1988 and 1989. Little is known about the role that exploitation plays in the distribution and abundance of clams.

The effect of the recent bag limit reduction is unknown but biologists are concerned that diggers may focus more effort at Ninilchik where they can get bigger clams and that wastage of clams may increase. The decrease in the bag limit has angered many users who feel it is unwarranted and a burden on non-local diggers. Locals feel the bag limit is still excessive and would like to see it further reduced.

Limited public access to the beaches is a concern. In 2001, a private road that many diggers used to the Ninilchik Beach north of the Ninilchik River was closed. Dedicated public access remains at Cohoe, Clam Gulch, Ninilchik, and Deep Creek. Despite the increased use of 4-wheel drive and other all-terrain vehicles, diggers tend to concentrate around access points. Additional access points would help distribute digger effort. This would reduce congestion and provide access to razor clam beaches that presently receive minimal usage. Additional access would therefore benefit both the user group and the resource, as harvest would occur over a larger area, reducing impact to the populations near access points. Closure of the road to the northern Ninilchik beach may benefit this heavily exploited beach but may place more pressure on other parts of the Ninilchik beach which are also heavily harvested.

Recommended Research and Management

A formal sampling program on the aforementioned beaches will continue to include aerial surveys to determine trends in digger distribution and hand collection of razor clams to monitor age and length distribution. The population estimation program will rotate among beaches, including Clam Gulch and Ninilchik, but also less well-known locations. The quest to better age razor clams will continue with the investigation of alternatives to surface reading of shells, capture and marking of clams, and collection of juvenile clams.

Management will continue to focus on informal information and education programs to apprise the public of the fishery's status. Production of a pamphlet addressing both the biological and social issues relevant to this fishery will also continue.

HARDSHELL CLAM

Historical Perspective

The marine waters of lower Cook Inlet support commercial and noncommercial (sport and personal use) clam fisheries. Commercial fishery data are available for clams since 1986 (Table 45). Commercial effort is obtained from permits while estimates of harvest and harvest location come from digger logs and fish tickets. Noncommercial harvest data have been collected by the SWHS since 1981 (Table 7). A permit, required of diggers beginning in 1997, provides reported harvest, effort, and harvest location (Table 46).

Lower Cook Inlet is divided into five commercial fishing regulatory districts: Southern, Kamishak, Barren Island, Outer and Eastern (Figure 7). The Southern District encompasses the waters of the eastern lower Cook Inlet including all of Kachemak Bay and the waters adjacent to the communities of Seldovia, English Bay and Port Graham. The SWHS and the shellfish permits estimate the noncommercial harvest for Kachemak Bay. These data are comparable to the Southern District commercial fishing regulatory area. The noncommercial harvest in the remaining four commercial fishing regulatory areas is negligible. The entire documented commercial harvest comes from Kachemak Bay.

The generic term, hardshell clam, refers to littleneck *Protothaca staminea* and butter clams *Saxidomus giganteus*. The commercial hardshell clam fishery targets primarily Pacific littlenecks, with harvests of butter clams and cockles *Clinocardium nuttallii* in some years. The noncommercial hardshell clam fishery harvests seven clam species; the majority of the harvest is comprised of Pacific littlenecks, butter clams, and cockles. Littleneck clams generally predominate in the noncommercial harvest. Butter clams are also popular and comprised nearly 42% of the harvest recorded on permits in 1997 (Table 46). Harvest in all fisheries is by hand, usually with a rake or shovel.

Table 45.-Commercial harvest (pounds) of hardshell clams, Cook Inlet Management Area, 1986-2000.

Year	Number of Permits	Number of Landings	Pacific Littleneck Clams	Butter Clams	Cockles	Total
1986	5	18	17,303	0	0	17,303
1987	8	69	12,214	206	2,347	14,767
1988	2	32	14,449	0	0	14,449
1989	9	41	2,584	13,675 [a]	3,581 [b]	19,840
1990	19	62	35,744	0	0	35,744
1991	19	78	47,486	85	0	47,571
1992	21	117	54,631	0	0	54,631
1993	33	159	63,676	0	0	63,676
1994	32	104	44,291	0	0	44,291
1995	21	93	66,723	4,267	35	71,025
1996	25	102	53,524	233	0	53,757
1997	15	67	31,525	0	0	31,525
1998	12	40	23,465	0	0	23,465
1999	12	24	18,530	0	0	18,530
2000	11	63	20,798	0	0	20,798

[a] Includes 13,348 pounds sold as otter food as a result of *Exxon Valdez* oil spill.

[b] Includes 1,981 pounds sold as otter food as a result of *Exxon Valdez* oil spill.

The commercial fishery occurs in areas approved for commercial digging by the Department of Environmental Conservation on the south side of Kachemak Bay (Figure 8) between Bradley River and Barabara Point. Half of the certified beaches are open to commercial harvest even-numbered years and the other half on odd-numbered years. Areas of high noncommercial value are closed to commercial fishing and commercial digging in open areas is restricted to weekdays during months of high noncommercial use from May 15 through September 15. The commercial fishery opens in the winter only if the air temperature is above 32ºF and the wind chill is above 20ºF. The annual commercial harvest guideline of 40,000 clams is divided into quarterly allocations. Both commercial and noncommercial users are limited to taking littleneck clams 1.5 inches and greater and butter clams 2.5 inches or more in length.

Table 46.-Sport and personal use hardshell clam harvest and effort reported on shellfish permits, 1997-2000.

	Effort		Harvest		
Location	Trips	Digger Days	Littleneck Clams (gallons)	Butter Clams (gallons)	Other Clams (gallons)
1997					
Chugachik Island Area	15	33	17	14	0
Bear Cove	97	199	237	77	9
Aurora Lagoon to Glacier Spit	11	24	71	18	2
Halibut Cove Area	123	256	208	230	22
Peterson Bay	71	121	106	38	1
China Poot Bay	208	415	431	399	27
Neptune Bay	2	3	2	1	1
Sadie Cove Area	243	458	594	372	14
Tutka Bay	90	139	157	101	4
Little Tutka Bay to Barabara Point	252	429	479	571	18
Barabara Point to Pt. Pogibshi	3	13	2	12	0
Pt. Pogibshi to Pt. Adam	2	3	2	20	0
North side of Kachemak Bay	366	725	599	516	364
Unknown	99	171	122	160	33
Total	1,582	2,989	3,027	2,529	495
1998					
Chugachik Island Area	14	24	26	4	1
Bear Cove	85	112	372	10	0
Aurora Lagoon to Glacier Spit	4	5	9	10	2
Halibut Cove Area	46	91	123	43	21
Peterson Bay	38	49	134	4	4
China Poot Bay	78	120	275	83	4
Neptune Bay	1	1	0	0	0
Sadie Cove Area	167	238	563	85	68
Tutka Bay	40	55	90	16	13
Little Tutka Bay to Barabara Point	115	196	323	18	32
Barabara Point to Pt. Pogibshi	5	10	46	0	0
Pt. Pogibshi to Pt. Adam	1	1	0	1	0
North side of Kachemak Bay	91	150	179	51	25
Unknown	80	141	193	44	26
Total	765	1,193	2,333	369	196

-continued-

Table 46.-Page 2 of 2.

Location	Effort		Harvest		
	Trips	Digger Days	Littleneck Clams (gallons)	Butter Clams (gallons)	Other Clams (gallons)
1999					
Chugachik Island Area	12	14	34	0	0
Bear Cove	100	143	322	77	11
Aurora Lagoon to Glacier Spit	11	26	45	17	0
Halibut Cove Area	109	167	223	117	26
Peterson Bay	27	40	87	5	5
China Poot Bay	186	286	503	265	43
Neptune Bay	2	5	6	2	0
Sadie Cove Area	203	365	530	131	14
Tutka Bay	48	65	97	18	8
Little Tutka Bay to Barabara Point	192	302	387	217	23
Barabara Point to Pt. Pogibshi	2	4	2	0	5
Pt. Pogibshi to Pt. Adam	1	2	0	0	0
North side of Kachemak Bay	147	258	215	201	51
Unknown	172	286	284	183	54
Total	1,212	1,963	2,735	1,233	240
2000					
Chugachik Island Area	8	11	12	3	5
Bear Cove	114	181	324	43	22
Aurora Lagoon to Glacier Spit	14	26	42	25	0
Halibut Cove Area	140	276	435	189	41
Peterson Bay	47	76	92	59	5
China Poot Bay	309	577	942	677	120
Neptune Bay	8	11	12	10	0
Sadie Cove Area	280	497	695	378	48
Tutka Bay	79	144	243	75	6
Little Tutka Bay to Barabara Point	258	468	416	423	44
Barabara Point to Pt. Pogibshi	6	8	7	8	2
Pt. Pogibshi to Pt. Adam	2	2	3	6	0
North side of Kachemak Bay	252	465	685	409	78
Unknown	367	601	712	423	167
Total	1,884	3,343	4,620	2,728	538

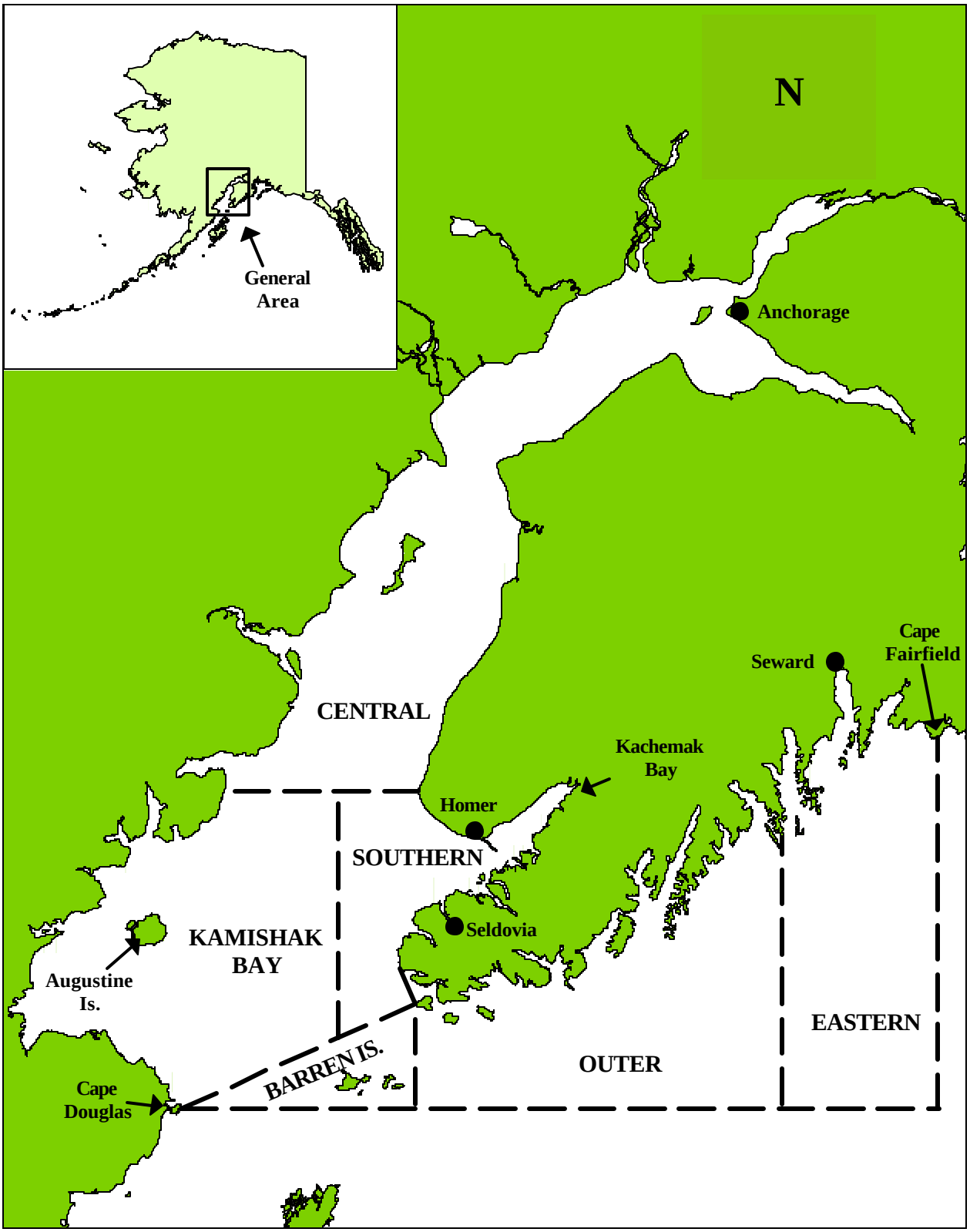


Figure 7.-Commercial fishing districts in the Lower Cook Inlet Management Area.

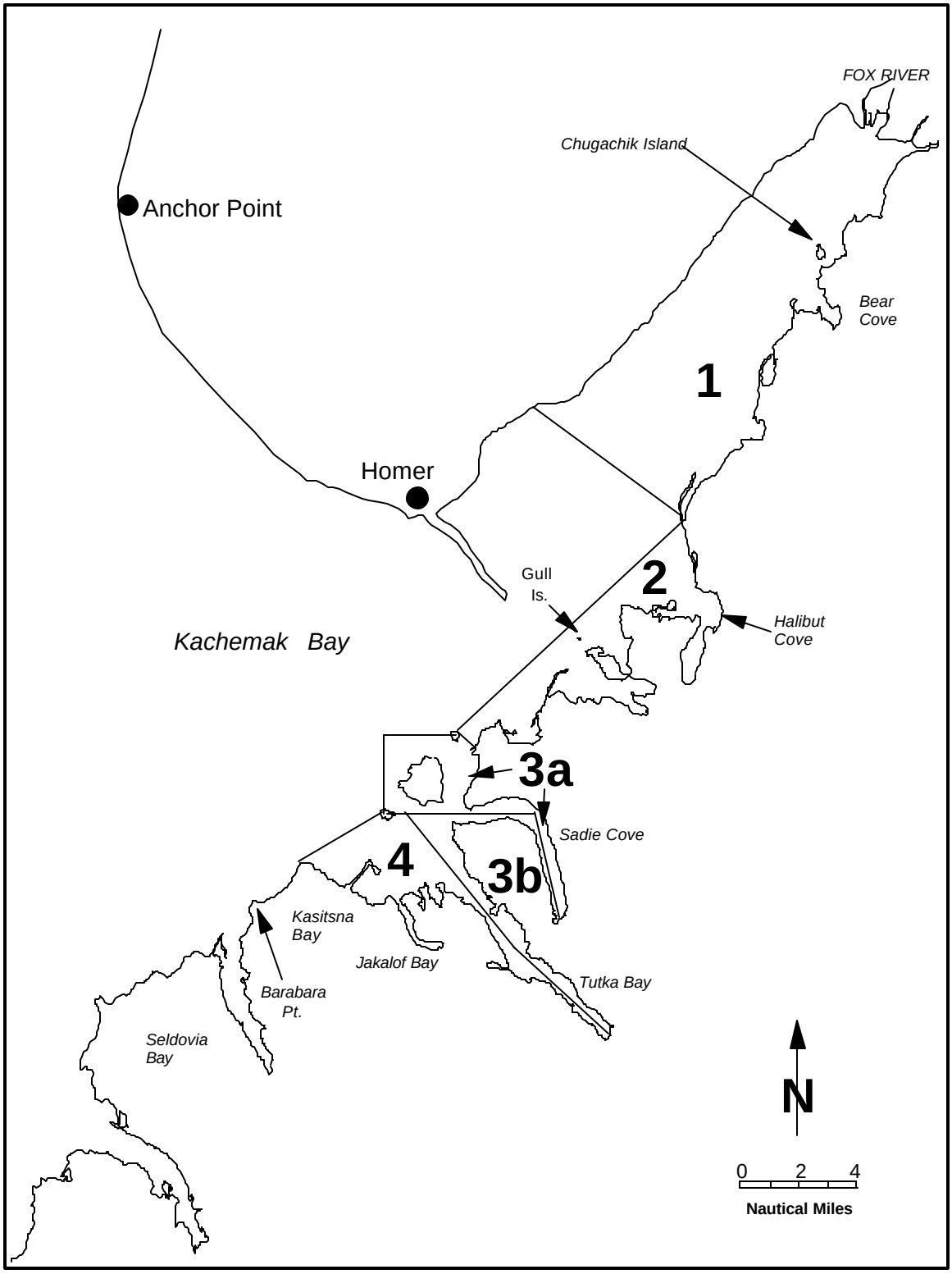


Figure 8.-Commercial hardshell clam fishing districts in the Lower Cook Inlet Management Area.

In 1989, the bulk of the commercial clam harvest went to sea otter food for a rehabilitation project resulting from the *Exxon Valdez* oil spill. However, in most years the majority of the harvest is Pacific littleneck clams that go to Kenai Peninsula and Anchorage markets. Commercial harvest peaked in 1995 when nearly 67,000 pounds of clams were taken. Participation in the commercial fishery was highest in 1993 when 33 permit holders participated (Table 45).

The Guideline Harvest Level (GHL) of 40,000 pounds was established by the BOF in spring of 1997. The department further modifies the GHL downward if necessary to maintain a 5% harvest rate of clam abundance indicated by department assessment surveys. Temperature dependent restrictions and the quarterly harvest requirement were also implemented in 1997. This combination of restrictions has resulted in harvests below the GHL.

All beaches in lower Cook Inlet are open to the taking of clams for sport and personal use. Sport and personal use harvests of hardshell clams are reported in the statewide SWHS and on shellfish permits in "gallons of clams." Approximately 120 Pacific littleneck clams comprise a gallon. The estimated hardshell clam harvest in Kachemak Bay and Lower Cook Inlet has ranged from 5,135 gallons in 1982 to 29,163 gallons in 1996 (43,648 to 247,885 pounds; one gallon is approximately equal to 8.5 pounds) and averaged 14,255 gallons (121,167 pounds) from 1981-2000 (Table 7). The harvest is almost entirely from the Kachemak Bay area.

The reported harvest from permits is considerably less than the harvest estimated from the SWHS (Table 47). This is likely due to diggers who don't obtain permits and consequently don't report their harvests. The distribution of the effort reported on the permits matches the distribution of diggers observed on aerial digger surveys, so the permits probably reflect the true distribution of both diggers and harvest (Table 46). Most of the harvest reported on permits is from Sadie Cove, China Poot, Jackalof and Kasitsna bays and the east side of the Homer Spit (Figure 9).

The SWHS estimates effort expended on all shellfish species harvested at a particular location, rather than estimating the effort directed at individual species. Effort specifically for hardshell clams is reported on permits. While estimates of effort aren't comparable between the two data sources, trends in effort are similar. A dramatic decline in digger effort occurred in 1998. This is probably the result of the closure of the Dungeness crab fishery; many people dug clams in conjunction with fishing for crab.

The department's primary assessment tool for hardshell clams has been fishery-independent surveys of clam abundance in commercial harvest areas. Surveys in Kachemak Bay date to 1990 and have typically been conducted during low tides between approximate elevations of the –4 ft (–1.2 m) tide level and the blue mussel beds at around 5 feet (1.5 meters). Sampling effort focused on areas of commercial digger concentration or locations with suitable clam habitat. Surveys are conducted biennially, the year prior to a commercial opening. Since 1999, the survey focus has broadened to estimate long-term trends in clam abundance and sustainable yield. New areas have been incorporated including locations where noncommercial diggers concentrate. Population estimates are stratified by legal and sublegal size categories. Other estimated statistics from clam surveys include mean annual biomass, size-at-age, and substrate composition. Currently, the harvest of littleneck clams from the south side of Kachemak Bay in all fisheries is likely less than 20% of the biomass of legal sized clams.

Table 47.-Kachemak Bay and Lower Cook Inlet Dungeness, Tanner crab and hardshell clam sport and personal use fishery harvest and participation from Statewide Harvest Survey (SWHS), 1981-2000 and shellfish permits 1996-2000.

	Participation From Permits (Days Fished)		Dungeness Crab Harvest			Tanner Crab Harvest			Hardshell Clam Harvest		
Year	Crab	Clams	Pounds (From SWHS)	Numbers (From SWHS)	Numbers (From Permits)	Pounds (From SWHS)	Numbers (From SWHS)	Numbers (From Permits)	Pounds (From SWHS)	Gallons (From SWHS)	Gallons (From Permits)
1981			48,149	22,928		10,800	4,320		69,122	8,132	
1982			20,908	9,956		10,585	4,234		43,648	5,135	
1983			31,674	15,083		7,710	3,084		136,935	16,110	
1984			31,737	15,113		5,830	2,332		75,574	8,891	
1985			62,013	29,530		8,755	3,502		87,839	10,334	
1986			71,856	34,217		19,815	7,926		171,802	20,212	
1987			107,686	51,279		22,470	8,988		200,405	23,577	
1988			67,311	32,053		11,673	4,669		226,075	26,597	
1989			21,158	10,075		closed	closed		154,658	18,195	
1990			14,771	7,034		closed	closed		100,479	11,821	
1991			closed	closed		2,855	1,142		89,046	10,476	
1992			21,105	10,050		10,413	4,165		84,941	9,993	
1993			31,916	15,198		23,015	9,206		70,975	8,350	
1994			40,226	19,155		24,120	9,648		112,872	13,279	
1995			18,810	8,957		27,340	10,936		172,644	20,311	
1996		[a]	13,499	6,428	7,860	5,443	2,177	12,059	230,886	29,163	[b]
1997	4,250	2,989	12,401	5,905	7,774	8,028	3,211	11,376	80,971	9,426	6,051
1998	1,762	1,193	[c]	[c]	293 [c]	3,190	1,276	16,763	105,664	12,431	2,898
1999	1,782	1,963	closed	closed	closed	21,270	8,508	17,045	67,754	7,971	4,208
2000	2,182	3,343	closed	closed	closed	40,353	16,141	19,672	124,925	14,697	7,886
Average	2,494	2,372	38,451	18,310		14,648	5,859	15,383	120,360	14,255	5,261

[a] Number of trips only reported in 1996.

[b] No clam harvest solicited on permits in 1996.

[c] Dungeness fishery closed by emergency order, May 29.

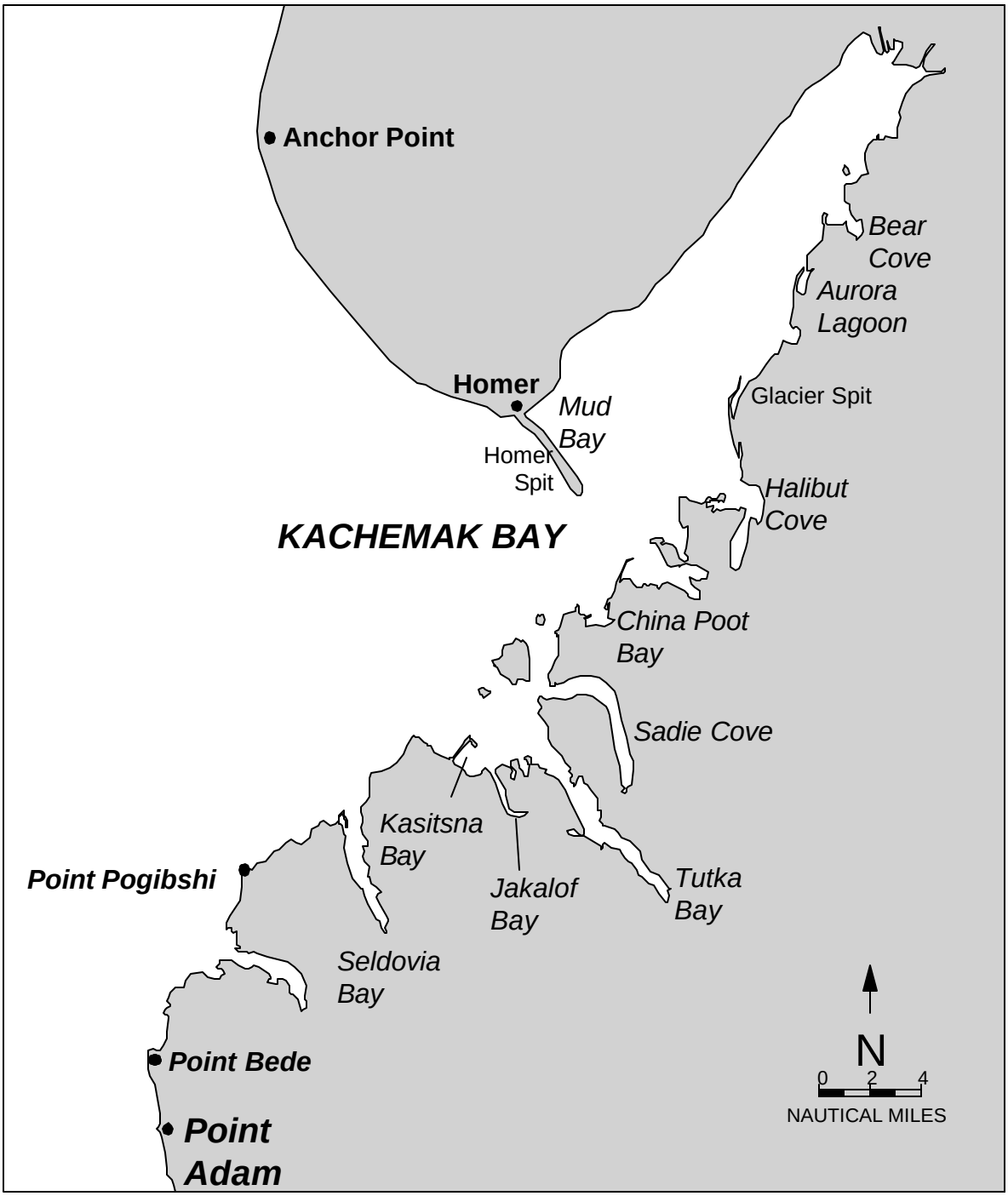


Figure 9.-Sport and personal use clam harvest permit reporting areas in Cook Inlet.

Management Objectives

This fishery is addressed in the Southern District Hardshell Clam and Mussel Fishery Management Plan. The management plan mandates the noncommercial harvest not exceed 160,000 hardshell clams in the southern and eastern portions of Kachemak Bay (Figure 9). To date, emergency orders have not been required to manage the lower Cook Inlet noncommercial hardshell clam fishery inseason.

Board of Fisheries Actions

Personal use regulations previously adopted by the Board required a valid resident Alaska sport fishing license for taking finfish for personal use and a valid Alaska sport fishing license for shellfish. In 1986 the legislature adopted a definition of personal use that is now statute. This statute defined personal use fishing as "the taking, fishing for or possession of finfish, shellfish or other fishery resources, by Alaska residents for personal use..." As Alaska statutes supersede Board regulations, nonresidents could not participate in personal use shellfish fisheries. Since sport fishing regulations were not applicable to the noncommercial harvest of shellfish, nonresidents could not harvest shellfish for their personal use.

It was not the intent of the Board that nonresidents be disqualified from this fishery. In the fall of 1989 the Board adopted sport fishing regulations for Cook Inlet shellfish that were identical to existing personal use regulations. Nonresidents thereafter participated under sport fishing regulations while residents could participate under either sport or personal use regulations. The Board adopted a regulation whereby bag/possession limits under sport regulations could not be added to the bag/possession limits allowed by personal use regulations and vice versa. These regulatory changes were administrative and did not affect the prosecution of the fishery.

The Board adopted the following department proposals governing noncommercial fisheries in Kachemak Bay in 1994:

1. A minimum legal size for littleneck and butter clams of 1.5 and 2.5 in shell length, respectively (both of these are the same as the commercial size limits), and
2. A bag and possession limit of 1,000 littleneck clams and 700 butter clams.

Although these regulations are liberal enough that they have had little or no effect on the daily harvest by noncommercial users, they were restrictions in a previously unregulated fishery. The regulations allow clams to reach reproductive maturity before harvest, and facilitate the enforcement of commercial closures by preventing commercial diggers from claiming they are noncommercial harvesters to avoid commercial regulations.

Previously, enforcement of commercial clam minimum sizes and area closures was difficult since commercial violators could simply claim they were engaging in the noncommercial fishery, thereby eliminating the applicability of commercial regulations. Establishing a liberal bag and possession limit for the noncommercial harvest did not meaningfully reduce the noncommercial harvester's ability to harvest clams. But, the bag and possession limit is not large enough to make it worthwhile for a commercial harvester to take clams from commercially closed beaches under the guise of participating in the noncommercial fishery.

A guideline harvest level of 160,000 lb was established for the noncommercial fishery in 1997 based on the average harvest in the fishery from 1981–1995. A permit was instated in 1997 to obtain estimates

of the noncommercial harvest by location and the fishing effort directed specifically at hardshell clams. No BOF actions have been directed at the hardshell clam fisheries since 1997.

Outlook

The commercial hardshell clam harvest is limited to 40,000 pounds per year. The noncommercial harvest has remained well below the harvest guideline of 160,000 pounds per year and is expected to remain relatively stable. Population levels of Pacific littleneck clams may fluctuate on a fairly regular cycle as evidenced by changes in abundance observed at Chugachik Island. The role of harvest in population cycles isn't understood but localized depletion of some beaches may occur; users report that some beaches are being overharvested. If overharvested beach areas increase in size and harvest outstrips natural production, harvest in future years may be restricted for resource conservation. This is unlikely to occur because harvested areas in Kachemak Bay that are assessed in department surveys are maintaining stable numbers of clams and the harvest rates for all fisheries combined are likely below 20%.

Current Issues

The impact of harvest on hardshell clam abundance is difficult to assess because the noncommercial harvest is not known with adequate precision. Compliance to reporting requirements by noncommercial users must be improved.

Past abundance estimates of hardshell clams in many bays are variable and imprecise. The Sport and Commercial fisheries divisions are cooperating to increase sampling effort to improve the precision of these estimates and detect low abundance before it threatens the sustainability of the resource.

During 1999 and 2000, the department sought public opinion on allowing the lease of small beach areas within the Kachemak Bay Critical Habitat Area (the waters east of a line from Anchor Point to Point Pogibshi) for commercial cultivation of littleneck clams. The public took issue with the privatization of beaches, the use of netting to prevent predation of cultivated areas, eradication of other species in cultivated areas and genetic impacts. Public opposition outweighed proponents of beach cultivation of clams, and the Critical Habitat area was closed to on-bottom farming using administrative procedures.

Recommended Research and Management

Research relevant to the hardshell clam resource has historically been conducted by Commercial Fisheries Division staff in Homer. However, the noncommercial fishery is the primary user of the resource (Tables 45 and 47). Starting in 1999, Sport Fish Division dedicated staff to assist with stock assessment and study of noncommercial fishery practices and effects. It is recommended that the divisions continue to cooperate to expand knowledge of this resource to improve management precision of the fisheries.

DUNGENESS CRAB

Historical Perspective

The marine waters of lower Cook Inlet supported commercial fisheries for Dungeness crab until 1991 and noncommercial fisheries until spring of 1998. Commercial harvest data for Dungeness crab are available since 1961 (Table 48). Sport and personal use shellfish harvest and effort data have been collected since 1981 via the SWHS (Table 7). Estimates of crab harvest and effort for Kachemak Bay and Cook Inlet are also available from permits, first required in 1996 (Table 49).

Table 48.-Commercial Dungeness crab harvest by year, Cook Inlet Management Area, 1961-2000.

Year	Southern District Catch (lbs)	Other Districts Catch (lbs)	Total Catch (lbs)	No. of Vessels	No. of Landings
1961	193,683	0	193,683		
1962	530,770	0	530,770		
1963	1,665,599	11,605	1,677,204		
1964	417,005	6,036	423,041		
1965	74,211	0	74,211		
1966	12,523	117,037	129,560		
1967	7,168	0	7,168		
1968	484,452	3,407	487,859		
1969	49,894	0	49,894		
1970	209,819	0	209,819		
1971	97,161	0	97,161		
1972	38,930	0	38,930		
1973	308,777	1,271	310,048		
1974	718,729	2,514	721,243	38	619
1975	361,893	922	362,815	34	402
1976	118,903	395	119,298	19	123
1977	74,195	510	74,705	18	94
1978	1,212,571	3,208	1,215,779	49	668
1979	2,130,963	0	2,130,963	72	1,485
1980	1,875,281	0	1,875,281	54	1,183
1981	1,850,977	0	1,850,977	88	2,047
1982	818,380	505	818,885	108	2,310
1983	746,585	834	747,419	71	1,194
1984	799,638	570	800,208	102	1,687
1985	1,389,891	12,511	1,402,402	106	1,768
1986	550,968	12,894	563,862	83	1,069
1987	761,423	21,753	783,176	100	1,377
1988	677,334	41,941	719,275	84	1,305
1989	170,266	7,798	178,064	43	455
1990 [a]	28,938 [b]	564	29,502	23	112
1991	[c]	0 [d]	0	0	0
1992	[c]	[e]	[e]	[e]	[e]
1993	[c]	[e]	[e]	[e]	[e]
1994	[c]	[e]	[e]	[e]	[e]
1995	[c]	[e]	[e]	[e]	[e]
1996	[c]	[e]	[e]	[e]	[e]
1997	[c]	[e]	[e]	[e]	[e]
1998	[c]	[e]	[e]	[e]	[e]
1999	[c]	[e]	[e]	[e]	[e]
2000	[c]	[e]	[e]	[e]	[e]
Average	612,564	8,209	600,748	64	1,053

[a] Southern district season set by regulation: west of Homer Spit opens June 1; east of Spit opens by emergency order on or after June 1 when softshell percentage is 10% or less; entire district closes November 1 by regulation.

[b] East of Spit opened June 29, closed August 8, by emergency order; west of Spit opened June 1 by regulation, closed September 7 by emergency order; closures due to low stock conditions.

[c] Fishery closed by emergency order.

[d] Fishery open: no harvest reported.

[e] Harvest confidential: Alaska statute does not allow publication when catch is from three or fewer vessels.

Table 49.-Sport and personal use effort directed at crab and sport and personal use harvests of crab in Cook Inlet reported on permits 1996 through 2000.

	Effort		Harvest	
			Dungeness	Tanner
Location	Trips	Crabber-days	Numbers	Numbers
1996				
Cook Inlet north of Anchor Point	33		12	300
Cook Inlet remainder	6		0	0
North Gulf Coast	19		15	6
Kachemak Bay east of Homer Spit	2,132		7,337	2,495
Kachemak Bay west of Homer Spit	651		341	9,112
Unknown	55		167	146
Total	2,896		7,872	12,059
1997				
Cook Inlet north of Anchor Point	29	58	146	5
Cook Inlet remainder	30	65	42	791
North Gulf Coast	21	46	6	19
Kachemak Bay east of Homer Spit	1,674	3,057	6,977	2,856
Kachemak Bay west of Homer Spit	560	956	475	7,559
Unknown	34	68	128	146
Total	2,348	4,250	7,774	11,376
1998				
Cook Inlet north of Anchor Point	13	17	40	0
Cook Inlet remainder	10	15	1	46
North Gulf Coast	3	4	0	0
Kachemak Bay east of Homer Spit	232	420	17	2,285
Kachemak Bay west of Homer Spit	850	1,144	58	13,386
Unknown	75	162	0	1,046
Total	1,183	1,762	116	16,763

-continued-

Table 49.-Page 2 of 2.

Location	Effort		Dungeness Number Released[a]	Tanner Number Harvested
	Trips	Crabber-days		
1999				
Cook Inlet north of Anchor Point	5	5	0	0
Cook Inlet remainder	39	64	77	792
North Gulf Coast	10	10	0	0
Kachemak Bay east of Homer Spit	315	575	303	2,562
Kachemak Bay west of Homer Spit	783	1,066	1,176	13,102
Unknown	50	62	33	589
Total	1,202	1,782	1,589	17,045
2000				
Cook Inlet north of Anchor Point	2	3	0	0
Cook Inlet remainder	12	23	50	204
North Gulf Coast	9	27	0	0
Kachemak Bay east of Homer Spit	258	419	453	2,216
Kachemak Bay west of Homer Spit	1,161	1,603	2,150	16,341
Unknown	76	107	149	911
Total	1,518	2,182	2,802	19,672

[a] Dungeness fishery closed beginning in 1999.

This species is presently at low levels of abundance and a commercial fishery has not targeted Dungeness crab since 1990 (Table 48). The commercial Dungeness fishery in the Southern District (Figure 7) was closed by emergency order beginning in 1991, although other districts remained open. Commercial Dungeness fishing was closed in all Cook Inlet areas by Board action in 1997. The sport and personal use fisheries for Dungeness crab in lower Cook Inlet were closed by emergency order in 1991 for resource conservation, but reopened from 1992 to 1998. In May of 1998, the waters of Kachemak Bay were closed by emergency order; the continued poor catches of Dungeness crab in department surveys indicated that sport and personal use harvests of Dungeness crab could be affecting the maintenance and recovery of this stock. The fishery remained closed by emergency order until the BOF closed it by regulation at the spring meeting in 2000. Prior to the closure, Dungeness crab seasons in Kachemak Bay were from July 15 through December 31, and from January 15 or the beginning of the commercial Tanner crab season, whichever was later, through March 15.

The commercial fishery was the primary harvester of Dungeness crab with a historical average harvest in the Southern District of about 612,000 pounds (Table 48), equating to about 290,000 crab annually (the average weight of one crab is estimated to be 2.1 pounds). The noncommercial average annual

harvest was approximately 38,000 pounds (Table 47). The noncommercial Dungeness harvest average was nearly 21,000 crab (44,100 pounds) through 1994. The average harvest dropped by more than half to nearly 9,000 crab (18,900 pounds) from 1995 until the fishery was closed in May of 1998. Dungeness harvest reported on permits is fairly close to harvests obtained by the mail survey (Table 47). Most of the Dungeness crab harvest reported on permits occurred in Kachemak Bay east of the Homer Spit. Fewer were caught west of Homer Spit (Table 49, Figure 9). The remainder was taken in Cook Inlet and from outer Gulf Coast waters.

The SWHS estimates sport and personal use effort for all shellfish species combined. Effort for shellfish in Kachemak Bay and lower Cook Inlet from 1981 through 2000 averaged approximately 14,800 days of fishing (Table 7). Effort was reported on permits as trips in 1996 rather than the number of people who fished. A total of 2,896 trips was made for crab in 1996 (Table 49). Analysis of individual permits reveals that only Dungeness crab were caught on 55% of those trips. Both trips and days fished were recorded on permits in 1997. Approximately 4,250 days of effort reported on permits were spent crabbing in 1997 (Table 49). People who caught only Dungeness crab accounted for approximately 20% of the effort for crab, whether effort was measured in days fished or trips. Approximately 15% of the effort was attributed to persons who caught both Dungeness and Tanner crabs. The remainder was people who caught only Tanner crab or caught nothing. Effort directed at Dungeness crab in areas that remained open to fishing was insignificant after Kachemak Bay was closed to Dungeness fishing in May of 1998.

Through 1998, the department conducted an annual Dungeness crab pot survey in the shallows (4 to 60 feet in depth) on the north side of Kachemak Bay to monitor changes in stock status (Table 50). The stocks were surveyed biennially after 1998. In 1993, a dramatic decline in the department pot survey catch occurred from previous years. The most recent survey in 2000 indicated that Dungeness crab numbers remain low in the Southern District. Survey catches of one legal, eight sublegal, and one female Dungeness crab in 87 pots were the worst catches in the history of the survey. Similarly, department trawl survey catches of all male Dungeness crab declined from 317 in 1990 to fewer than 20 crab from 1997 to 2000 (Table 51). Although department trawl surveys have typically caught more sublegal than legal Dungeness crab, cohort strength has failed to yield sufficient recruitment to support a fishery.

In 1998, the pot survey program was expanded to document Dungeness crab concentrations at greater depth to determine the relationship between pot catches and trawl catches so that abundance of Dungeness crab could be estimated rather than indexed. Additional pots were fished in strings parallel to historic ADF&G pot survey strings but at greater depths. The additional pots were fished within two areas encompassed by the ADF&G trawl survey used to estimate crab abundance. Some of the additional pots were fished directly along two of the trawl survey paths. A portion of the traditional pot survey area was trawled as well. All captured crab were marked with Floy brand modified T-bar numbered tags and released. A total of three female and one male Dungeness crab was caught in 84 pot sets. Two additional Dungeness crab were captured with the trawl in the area where the two gear types overlapped. None of the captured crab had tags. The supplemental survey confirmed that the Dungeness crab populations are at low levels over a broader range than the area traditionally surveyed.

Table 50.-Dungeness crab catch, in numbers, Southern District Dungeness pot surveys, 1990-2000.

Year	Dates	Location	Pots Pulled	Females	Sublegal Males	Legal Males	Total Males	Soft-shell Males (%)
1990	5/15-17	East of Spit	90	53	47	17	64	8 (13)
	6/19-21		90	54	65	23	88	9 (10)
1991	6/04-06	East of Spit	89	6	116	110	226	21 (9)
	7/09-11		90	21	388	263	651	36 (6)
	8/06-08		90	85	625	475	1,100	47 (4)
	9/12-14		90	30	615	492	1,107	5 (<1)
	7/02-06	West of Spit	82	9	6	5	11	2 (18)
	8/14-16		95	9	7	11	18	0 (0)
1992 [a]	5/31-6/04	East of Spit	89	27	276	180	456	2 (1)
	6/30-7/02		89	76	583	578	1,161	31 (3)
	7/27-29		90	65	621	531	1,152	50 (4)
	8/11-13		90	47	849	792	1,641	14 (1)
	8/25-27		88	47	853	737	1,590	24 (2)
	9/10-12		89	47	621	749	1,370	4 (<1)
	10/07-09		90	19	516	349	865	2 (<1)
	7/05-07	West of Spit	96	30	7	14	21	1 (5)
	8/05-07		78	59	49	59	108	0
1993 [a]	5/17-19	East of Spit	90	18	105	120	225	2 (1)
	6/15-17		90	60	226	203	429	5 (1)
	7/20-22		90	95	297	448	745	25 (3)
	8/16-23		90	84	352	555	907	35 (4)
	9/22-24		86	78	148	280	428	5 (1)
	7/13-15	West of Spit	70	11	6	3	9	0
	8/09-11		80	25	9	34	43	0
1994 [a]	5/23-25	East of Spit	90	18	9	7	16	1 (6)
	6/21-23		90	119	28	48	76	0
	7/19-21		90	113	39	93	132	0
	8/22-24		88	37	58	119	177	3 (2)
	7/12-14	West of Spit	70	17	0	3	3	0
	8/16-18		77	13	3	8	11	0

-continued-

Table 50.-Page 2 of 2.

Year	Dates	Location	Pots Pulled	Females	Sublegal Males	Legal Males	Total Males	Soft-shell Males (%)
1995 [a]	5/23-25	East of Spit	90	0	5	3	8	0
	6/27-29		90	14	22	8	30	0
	7/25-27		90	88	20	9	29	0
	8/29-31		90	49	18	13	31	2
	7/18-20	West of Spit	77	31	3	10	13	0
	8/16-18		74	41	8	51	59	0
1996 [a]	6/12-14	East of Spit	89	5	16	6	22	3
	7/13-15		90	20	39	20	59	4
	8/11-13		90	64	55	19	74	0
1997 [a]	6/21-23	East of Spit	90	2	15	8	23	1 (4)
	7/21-23		89	11	19	8	27	1(<1)
	8/20-22		90	21	58	5	63	0
1998 [a]	8/16-18	East of Spit	90	0	11	3	14	0
2000 [a]	8/14-8/16	East of Spit	87	1	8	1	9	1(11)

[a] 33% of escape rings closed 1992-2000.

Management Objectives

The Dungeness crab fishery in lower Cook Inlet is addressed in 5 AAC 32.390 Cook Inlet Area Dungeness Crab Fisheries Management Plan. The management plan closes all Dungeness crab fisheries until stocks recover and a management plan is adopted that considers 14 criteria specified in the regulation. To date, no guidelines for opening the fishery have been developed.

Board of Fisheries Actions

Personal use regulations previously adopted by the Board in 5 AAC 77.010 required a valid resident Alaska sport fishing license for taking finfish for personal use and a valid Alaska sport fishing license for shellfish. In 1986 the legislature adopted a definition of personal use that is now statute. This statute defined personal use fishing as "the taking, fishing for or possession of finfish, shellfish or other fishery resources, by Alaska residents for personal use..." As Alaska statutes supersede Board regulations, nonresidents could not participate in personal use shellfish fisheries. Since sport fishing regulations were not applicable to the noncommercial harvest of shellfish, nonresidents could not harvest shellfish for their personal use.

Table 51.-Dungeness crab catch, in numbers, in Southern District trawl surveys, 1990-2001.

	Pre-recruit-4	Pre-3	Pre-2 115-139 mm		Pre-1 140-164 mm		Recruit 165-189 mm		Post-Recruit > 189		Males	
Year	<90 mm	90-114 mm	New-shell	Old-shell	New-shell	Old-shell	New-shell	Old-shell	New-shell	Old-shell	Legals	Total
1990	1	17	189	5	91	7	6	1	0	0	7	317
1991	0	1	15	2	158	12	45	1	0	0	46	234
1992	0	0	19	2	93	31	54	10	1	1	66	211
1993	0	0	0	3	50	7	67	9	0	0	76	136
1994	0	0	2	0	7	3	13	12	0	0	25	37
1995	0	2	97	1	46	3	5	5	0	0	10	159
1996	0	0	3	16	43	56	1	1	28	28	58	176
1997	0	1	1	1	1	7	3	1	0	0	4	15
1998	0	0	0	0	2	2	0	2	0	1	3	7
1999	0	0	1	0	5	1	6	4	0	0	10	17
2000	0	0	1	0	0	2	1	3	0	1	5	8
2001	0	93	289	45	97	13	5	1	0	0	6	543

It was not the intent of the Board that nonresidents be disqualified from this fishery. Therefore, in the fall of 1989, the Board adopted sport fishing regulations for Cook Inlet shellfish that were identical to existing personal use regulations. Nonresidents thereafter participated under sport fishing regulations while residents could fish under either sport or personal use regulations. The Board adopted a regulation whereby bag/possession limits under sport regulations could not be added to the bag/possession limits allowed by personal use regulations and vice versa. These regulatory changes were administrative and did not affect the prosecution of the fishery.

The Board made the following changes to the noncommercial Dungeness crab regulations at its March 1990 meeting:

1. Established a Dungeness crab season of June 15 through December 31.
2. Reduced the Dungeness crab daily bag and possession limit from 20 to 5.
3. Established a minimum size of 6.5 inches in carapace width for Dungeness crab.
4. Established pots, ring nets, diving gear, hooked or hookless hand lines or by hand as legal harvest methods in the noncommercial crab fishery.

The 1992 and 1993 the noncommercial Dungeness crab fishery was opened concurrently with the Tanner crab noncommercial fishery. Dungeness crab could be harvested in all waters of the Cook Inlet-Resurrection Bay saltwater regulatory area from July 15 through March 15, except in that area east of a line from Anchor Point to Point Pogibshi, i.e. Kachemak Bay. This area closed on January 1 and re-opened January 16 (the beginning of the commercial Tanner crab season) and remained open through March 15. In 1994, the BOF established in regulation the season that had been in place during 1992 and 1993. The season protected Dungeness crab during the molting period and was identical to the season established to protect Tanner crab.

The noncommercial Dungeness crab fishery was closed by emergency order on May 29, 1998 due to low crab numbers estimated from the department pot survey in 1997. The fishery remained closed by emergency order until the spring of 1999 when a department proposal to close the fishery by regulation and place it under the purview of the Southern District Dungeness Fishery Management Plan was passed by the BOF.

Outlook

Due to the low numbers of Dungeness crab, department pot surveys will be conducted every 3 years until significant numbers of crab recruit into larger size classes. The next survey will be conducted in 2003. It appears unlikely that a harvestable surplus that would support a fishery will be available in the near future.

Recommended Research and Management

Crab abundance will continue to be indexed with pot surveys in the nearshore waters and trawl surveys in deeper waters of Kachemak Bay until there is evidence of sustained recruitment to legal size. At that time research will again be aimed at estimating absolute abundance and sustainable yields for noncommercial and commercial harvest. The department plans to conduct the next Dungeness pot survey in August 2003 and the next trawl survey in July 2002. It is unlikely these surveys will indicate a significant recovery of Dungeness crab in lower Cook Inlet.

TANNER CRAB

Historical Perspective

The marine waters of lower Cook Inlet support a noncommercial (sport and personal use) fishery for Tanner crab. The commercial Tanner crab fishery began in the mid-1960s in the Southern District when this species was harvested incidentally to red king crab *Paralithodes camtschaticus* (Davis 1981). Greater fishing effort was directed toward Tanner crab during the 1970s when price and demand increased. Fishing effort quickly expanded to other Cook Inlet districts. The commercial Tanner crab fishery closed after 1994 when department trawl surveys estimated that insufficient numbers of crab were available to support a commercial fishery. Tanner crab harvest data are available since 1968 (Table 52). Noncommercial harvest data are available from the SWHS since 1981 (Table 7) and from shellfish permits since 1996 (Table 49).

The commercial fishery was the primary harvester of Tanner crab until its closure in 1994. Average annual harvest in the Southern District (Kachemak Bay area) approximated 1.2 million pounds or about 480,000 crab (Table 52). SWHS estimates of noncommercial Tanner crab harvest in most years are significantly lower and more variable than estimates obtained from shellfish permits (Table 47). The SWHS estimates may be low due to the small number of respondents to the survey that fished for Tanner crab. There is also uncertainty in the shellfish permit estimates, due to an unrepresentative sample. From 1996 through 2000 the average annual noncommercial harvest was 3,793 crab estimated from the SWHS and about 15,000 crab based on the shellfish permits (Tables 47 and 49).

Prior to 1989, the noncommercial Tanner crab fishery in Cook Inlet was open all year with a daily bag and possession limit of 20 males. The noncommercial fishery was closed in 1989 for resource conservation. In 1990, only the waters east of a line from Anchor Point to Point Bede were open for a month in the fall. The same area was open in 1991 from August 1 through October 31 by emergency order. The 1992 season was established by emergency order to coincide with the commercial Tanner crab season, July 15 through December 31, and from the opening of the commercial season (about January 15) through March 15, 1993. This emergency season was adopted as regulation by the BOF in 1993 for the waters east of a line from Anchor Point to Point Pogibshi. Elsewhere in Cook Inlet the BOF adopted an open season of July 15 through March 15. The noncommercial fishery preceded without inseason regulatory changes until 2001, when the bag limit and possession limits were reduced from 20 to 5, and the pot limit from five to one per person and two per boat by emergency order for resource conservation.

There was no commercial Tanner crab fishery in 1990. The fishery remained closed in the Outer and Eastern Districts after 1990. A commercial fishery was prosecuted in the Southern District from 1991 through 1994 when it closed. The entire Area H fishery was closed in 1995 for resource conservation and remains closed.

From the 1970s to 1990, pot surveys were used to index crab abundance in the Southern, Kamishak, and Barren Island Districts. Trawl surveys have been used annually since 1990 to estimate absolute abundance of Tanner crab (Table 53). Tanner crab stocks in all surveyed districts have been at low abundance levels since the early 1990s. Concurrent trawl and pot surveys were conducted in only one year, 1990. No direct correlation between trawl and pot survey data sets can be determined based solely on the 1990 survey year. Estimates of Tanner crab abundance in the Southern District declined sharply in 1994. Large numbers of juvenile crab captured in 1999 and 2000 surveys have failed to recruit into larger size classes. The largest number of juvenile crabs

Table 52.-Commercial Tanner crab harvest (pounds) and effort by district in the Cook Inlet Management Area (H), 1968-2001.

	Southern		Kamishak/Barren Is.		Outer/Eastern		Central		
Season	Harvest (Pounds)	Vessels (No.)	Harvest (Pounds)	Vessels (No.)	Harvest (Pounds)	Vessels (No.)	Harvest (Pounds)	Vessels (No.)	Total Harvest
1968-69	1,388,282		12,398		816				1,401,496
1969-70	1,147,154		71,196		104,191				1,322,541
1970-71	1,046,803		541,212		3,000				1,591,015
1971-72	2,462,956		974,962		804,765				4,242,683
1972-73	2,935,662		3,361,023		1,266,023				7,562,708
1973-74	1,387,535		4,689,251		1,891,021				7,967,807
1974-75	967,762		2,150,462		656,660				3,774,884
1975-76	1,339,245		3,281,084	17	850,964				5,471,293
1776-77	2,009,633	35	1,765,926	24	824,520				4,600,079
1977-78	2,806,568	55	2,077,092	28	502,049				5,385,709
1978-79	2,323,420	75	2,713,339	27	694,728				5,731,487
1979-80	1,134,940	68	3,338,623	24	595,645				5,069,208
1980-81	1,047,630	46	1,757,331	20	463,201				3,268,162
1981-82	548,529	41	1,286,332	18	524,897	9			2,359,758
1982-83	584,908	48	1693794	20	682,919	20			2,961,621
1983-84	996,763	45	1,373,674	17	443,384	14			2,813,821
1984-85	1,229,298	83	1,535,547	19	259,083	7			3,023,928
1985-86	1,164,261	103	1,288,711	24	177,041	5			2,630,013
1987	1,077,379	87	1,111,339	21	251,174	13	7,771	2	2,447,663
1988	944,763	127	417,182	24	168,969	23	8,396	3	1,539,310
1989	CLOSED		CLOSED		CLOSED		CLOSED		
1990	CLOSED		422,037	7	CLOSED		CLOSED		422,037
1991	271,379	68	266,106	8	CLOSED		CLOSED		537,485
1992	354,868	107	CLOSED		44,400	16	CLOSED		399,268
1993	534,003	136	CLOSED		CLOSED		CLOSED		534,003
1994	284,676	110	CLOSED		CLOSED		CLOSED		284,676
1995	CLOSED		CLOSED		CLOSED		CLOSED		
1996	CLOSED		CLOSED		CLOSED		CLOSED		
1997	CLOSED		CLOSED		CLOSED		CLOSED		
1998	CLOSED		CLOSED		CLOSED		CLOSED		
1999	CLOSED		CLOSED		CLOSED		CLOSED		
2000	CLOSED		CLOSED		CLOSED		CLOSED		
2001	CLOSED		CLOSED		CLOSED		CLOSED		
Average	1,249,517	77	1,642,210	20	533,783	13	8,084	3	3,093,706

Table 53.-Abundance of Tanner crab in Kachemak Bay estimated from trawl surveys, 1990-2001.

				Pre-2		Pre-1		Recruit		Post-recruit	
				91-114 mm		115-139 mm		140-165 mm		>165 mm	
	No. of	Pre-4	Pre-3	New-	Old-	New-	Old-	New-	Old-	New-	Old-
Year	Tows	<70 mm	70-90 mm	shell	shell	shell	shell	shell	shell	shell	shell
1990	19	453,024	682,569	541,891	9,492	403,015	37,055	137,235	163,961	12,081	53,504
1991	20	316,529	295,026	826,589	35,265	790,463	117,838	279,543	187,509	45,587	24,084
1992	18	306,159	134,137	438,453	34,688	683,607	205,970	740,136	138,101	49,547	26,155
1993	19	599,873	89,299	120,343	12,548	215,292	109,962	280,719	185,496	41,158	16,946
1994	20	258,118	169,986	114,102	8,572	95,260	58,967	65,675	94,138	6,726	20,633
1995	20	372,035	356,327	449,225	17,330	386,004	37,399	157,383	62,421	6,049	9,466
1996	19	189,773	42,712	312,708	121,332	368,250	156,423	48,546	45,116	0	0
1997	23	148,607	111,729	267,005	6,655	311,678	36,110	143,170	10,525	468	0
1998	23	267,276	16,323	11,802	11,915	131,082	37,975	154,674	24,420	5,999	0
1999	20	967,083	1,251,769	591,655	81,833	161,674	76,204	66,642	42,056	609	1,899
2000	23	515,098	361,622	282,882	14,222	314,006	10,038	64,935	6,968	0	2,058
2001	22	1,879,906	531,311	243,588	23,149	234,487	96,045	54,960	23,669	0	1,407
Average	20.5	522,790	336,901	350,020	31,417	341,235	81,665	182,801	82,032	14,019	13,013

	Males			
Year	Sublegal	Legal	%Legal	Total
1990	2,127,046	366,781	14.7%	2,493,827
1991	2,381,710	536,723	18.4%	2,918,433
1992	1,803,014	953,939	34.6%	2,756,953
1993	1,147,317	524,319	31.4%	1,671,636
1994	705,005	187,172	21.0%	892,177
1995	1,618,320	235,319	12.7%	1,853,639
1996	1,191,198	93,662	7.3%	1,284,860
1997	881,784	154,163	14.9%	1,035,947
1998	476,374	185,093	28.0%	661,467
1999	3,130,217	111,206	3.4%	3,241,423
2000	1,497,867	73,961	4.7%	1,571,828
2001	3,008,486	80,035	2.6%	3,088,522
Mean	1,664,028	291,864	14.9%	1,955,893

sharply in 1994. Large numbers of juvenile crab captured in 1999 and 2000 surveys have failed to recruit into larger size classes. The largest number of juvenile crabs captured in department trawl surveys occurred in 2001. It is hoped that this strong showing of young crabs signals the beginning of recovery of the Tanner stocks in lower Cook Inlet.

Management Objectives

This fishery was not specifically addressed in a regulatory management plan until 2002. Inseason management of the noncommercial Tanner crab fishery until now has been both by regulation and department emergency order.

Board of Fisheries Actions

Personal use regulations previously adopted by the Board in 5 AAC 77.010 required a valid resident Alaska sport fishing license for taking finfish for personal use and a valid Alaska sport fishing license for shellfish. In 1986 the legislature adopted a definition of personal use that is now statute. This statute defined personal use fishing as "the taking, fishing for or possession of finfish, shellfish or other fishery resources, by Alaska residents for personal use..." As Alaska statutes supersede Board regulations, nonresidents could not participate in personal use shellfish fisheries. Since sport fishing regulations were not applicable to the noncommercial harvest of shellfish, nonresidents could not harvest shellfish for their personal use.

It was not the intent of the Board that nonresidents be disqualified from this fishery. Therefore in the fall of 1989 the Board adopted sport fishing regulations for Cook Inlet shellfish that were identical to existing personal use regulations. Nonresidents thereafter participated under sport fishing regulations while residents could fish under either sport or personal use regulations. The Board adopted a regulation whereby bag/possession limits under sport regulations could not be added to the bag/possession limits allowed by personal use regulations and vice versa. These regulatory changes were administrative and did not affect the prosecution of the fishery.

At its January 1993 meeting, the Board adopted four department proposals addressing the personal use and sport fisheries for Tanner and king crab in lower Cook Inlet. The Board established that male Tanner crab may be taken only from July 15 through March 15, except that in Kachemak Bay east of a line from Anchor Point to Point Pogibshi male Tanner crab may only be taken from July 15 through December 31 and again from January 15 or the beginning of the commercial Tanner crab season (whichever is later) through March 15.

Regulations adopted by the Board at its January 1993 meeting now protect this species during its molting season. The Board of Fisheries Policy on King and Tanner Crab Resource Management was adopted as regulation 5 AAC 35.080 in 1993, requiring that when adequate data exist, a harvest threshold be developed below which no fishing will occur.

The BOF passed the Tanner Crab Management Plan for Area H (5 AAC 38.408) (Cook Inlet and North Gulf Coast waters) in March of 2002. The plan covers sport fisheries in salt waters west of the longitude of Cape Puget and commercial and personal use fisheries in salt waters west of the longitude of Cape Fairfield. The plan includes harvest rates that vary in relation to stock abundance estimates, stock abundance thresholds below which fisheries would remain closed and gear restrictions. The plan stipulates if the estimate of legal males from the department trawl survey in Kachemak Bay equals or

exceeds the maximum sustainable yield (MSY) stock size of 1.0 million crab, the stock may be harvested in aggregate among commercial and recreational users at an annual exploitation rate of 25% of estimated legal male abundance. If the legal male population equals or exceeds the minimum stock threshold of 500,000 crab for a commercial fishery but is less than MSY stock size, the stock may be harvested in aggregate among commercial and recreational users at an annual exploitation rate of 15% of estimated legal male abundance. Implicit in this strategy is that a commercial fishery will not occur if commercial harvests would drive the population below the minimum stock threshold. In addition, it is assumed that as the allowable aggregate harvest rate increases, the commercial proportion of the harvest will increase because of relatively low efficiency of noncommercial users. When estimated legal male Tanner crab abundance, including fishery removals, is less than 500,000 crab, no commercial harvest will occur. The noncommercial exploitation rate will be 10% when the 5-year average stock size is less than 500,000 legal male crab. When the 5-year mean of estimated legal male Tanner crab population abundance is less than 100,000 crabs, or the most recent three estimates are less than 100,000 crab, or the most recent abundance estimate is less than 50,000 crab, the noncommercial fisheries will be closed. The 5-year average is used to provide fishery stability amid high annual crab abundance variability. The daily noncommercial bag and possession limits are five crab. No more than two pots may be fished per vessel. Noncommercial harvest guidelines in the plan are expected to produce a sustainable fishery based upon recent fishery performance and management actions.

Outlook

Tanner crab stocks in the Southern District are at low levels of abundance. The resource will not support a commercial fishery in the near future. The 2002 noncommercial Tanner crab season may be very short because the population abundance estimate from the 2002 Kachemak Bay trawl survey will be available, after the July 15 fishery opening, and is expected to be less than 100,000 legal male crab.

Current Issues

Issues associated with the Dungeness and Tanner crab fisheries are both biological and allocative. Closely related to the biological concern for the resource is a determination of management strategies designed to restore both Dungeness and Tanner crab to higher levels of abundance. The Board addressed these issues in March of 2002.

Recommended Research and Management

Tanner crab research is conducted by the CF Division staff stationed in the Homer office. The harvest of the noncommercial fishery is assessed by the SWHS and the shellfish permit program administered by the Sport Fish Division. The discrepancy of harvest estimates between the SWHS and the shellfish permits should be resolved.

KENAI PENINSULA HALIBUT RECREATIONAL FISHERY

HISTORICAL PERSPECTIVE

Halibut harvests summarized here are estimated from the SWHS. The marine waters of Cook Inlet currently comprise 50% of the recreational halibut harvests in Alaska (Table 2). This fishery occurs in two primary areas: lower Cook Inlet (south of Bluff Point) and central Cook Inlet (north of Bluff Point) (Figure 1). The fishery south of Bluff Point is based primarily in Homer. The central Cook Inlet fishery is primarily accessed from Anchor Point, Whiskey Gulch and Deep Creek. Slightly more than 57% of

the harvest from the two areas comes from south of Bluff Point. Anglers employing charter boats take about 60% of the harvest south of Bluff Point (Table 54). North of Bluff Point, nonchartered anglers predominated until 1994. In 2000, 56% of anglers fishing north of Bluff Point were guided.

Homer has a developed harbor that permits both chartered and nonchartered fishermen to use relatively large vessels. These boats are capable of fishing Kachemak Bay, the outer areas of lower Cook Inlet and the Outer Gulf Coast. The number of charter boats currently based in Homer is not precisely known but the staff estimates that number at approximately 150.

Anchor River and Deep Creek have commercial operations that launch and retrieve boats at all tide levels with tractors. Both have developed campgrounds and boat launches that can be used only at high tide. Whiskey Gulch has no developed launching facilities but small boats may be launched from the beach. Fishing lodges operating along the beach near Whiskey Gulch provide guide services for halibut. Charter boat activity that originates at Deep Creek, Anchor River and Whiskey Gulch increased in the early to mid-1990s but has since stabilized. Part of the increase was operators based in the Soldotna area who began guiding for halibut secondary to chinook salmon in the Kenai River or marine waters.

By regulation, the halibut season occurs from February 1 through December 31. Due to weather constraints, the majority of the halibut caught in Kenai Peninsula waters is taken from late April through early September.

The total halibut harvest from Cook Inlet in 1977 of 13,466 fish increased to 201,727 in 2001 (Table 2). An overall increase in the percentage of the annual harvest taken by anglers employing charter operators has occurred since the inception of the mail survey. The 2000 harvest was weighted slightly (56%) in favor of charter anglers (Table 54). The harvest reallocation from private to chartered anglers is most evident north of Bluff Point and reflects increased use of the Deep Creek area by charter operators. Observation and data indicate that these charter operators are targeting both chinook salmon and halibut.

All sport fishing guides and guide business owners operating in the fresh and salt waters were required to register with the department annually beginning in 1995. Saltwater charter vessel operators were required to have and complete a logbook starting in 1998. In the logbook, vessel operators report the daily sport fishing effort and harvest of halibut and salmon by location. In addition, reporting of some other groundfish and shark species is also required. Currently, department biometric staff is investigating the cause of the large disparity between estimates of halibut harvests from the SWHS and harvest from logbook reports.

MANAGEMENT OBJECTIVES

The State of Alaska does not have direct management authority of this species. Management of the halibut resource is the joint responsibility of the International Pacific Halibut Commission (IPHC) and the North Pacific Fishery Management Council (NPFMC). The BOF may adopt sport fishery regulations established by the IPHC or other regulations that aren't in conflict with IPHC regulations. Inseason management of the sport fishery has not been required to date; management has been by existing regulations.

Table 54.-Recreational harvest of Pacific halibut, by percent, charter vs. noncharter boats in the marine waters of the Kenai Peninsula, 1986-2000.

	Lower Cook Inlet Area [a]			Central Cook Inlet Area [b]			EAST COOK INLET TOTAL			West Cook Inlet Area [c]		
Year	Total Harvest	% Charter	% Non-Charter	Total Harvest	% Charter	% Non-Charter	Total Harvest	% Charter	% Non-Charter	Total Harvest	% Charter	% Non-Charter
1986	44,250	50.4	49.6	39,831	2.7	97.3	84,081	0.28	0.72	1,072		
1987	45,707	50.2	49.8	31,855	3.7	96.3	77,562	0.31	0.69	869		
1988	93,878	51.9	48.1	42,182	5.6	94.4	136,060	0.38	0.62	1,192		
1989	76,606	60.2	39.8	49,087	5.7	94.3	125,693	0.39	0.61	1,224		
1990	93,941	65.0	35.0	52,912	9.3	90.7	146,853	0.45	0.55	1,685		
1991	89,998	67.6	32.4	57,072	17.9	82.1	147,070	0.48	0.52	1,576		
1992	81,451	60.2	39.8	60,659	40.6	59.4	142,110	0.52	0.48	984		
1993	94,641	62.4	37.6	65,256	43.6	56.4	159,897	0.55	0.45	2,507		
1994	88,329	59.2	40.8	79,747	50.3	49.7	168,076	0.55	0.45	2,725		
1995	85,311	64.4	35.6	79,607	54.3	45.7	164,918	0.60	0.40	3,236		
1996	105,235	64.0	36.0	80,118	50.1	49.9	185,353	0.58	0.42	2,422	84.4	15.6
1997	103,639	64.0	36.0	87,119	48.8	51.2	190,758	0.57	0.43	3,158	81.0	19.0
1998	93,103	64.3	35.7	83,263	50.7	49.3	176,366	0.58	0.42	3,003	83.5	16.5
1999	85,493	61.5	38.5	67,592	54.9	45.1	153,085	0.59	0.41	2,422	93.4	6.6
2000	105,947	60.4	39.6	92,396	51.3	48.7	198,343	0.56	0.44	3,384	68.8	31.2

[a] Cook Inlet salt waters east of the center, south of Anchor Point including Kachemak Bay and Gulf Coast waters west of Gore Point.

[b] Cook Inlet salt waters east of the center and north of Anchor Point.

[c] Cook Inlet west of a dividing line down the middle from the Susitna River south to Cape Douglas.

BOARD OF FISHERIES ACTIONS

There has been no recent change in the management of this fishery.

A local area management plan process (LAMP) was developed jointly by the NPFMC and the BOF in 1998 to resolve local social and biological issues related to the halibut fishery. The process begins when representatives of the "publics" involved in a fishery identify a fishing area and issues that need resolution. The representatives propose regulations to resolve those issues. The BOF reviews the proposed regulations to assure the LAMP protocol has been met and the viability of affected state-managed fisheries is maintained in the process of regulating the halibut fishery. Charter industry representatives and other fishing interests in Cook Inlet were working to resolve issues of localized depletion and overcapitalization of the charter industry, but progress is mired by lack of funding to convene representatives.

OUTLOOK

The halibut stock size in IPHC Area 3A (Cape Spencer to the southeast end of Kodiak Island including Cook Inlet) estimated using commercial harvests and IPHC survey data, is thought to be at about average levels but declining due to a natural decline in recruitment that started in the mid 1980s.

A motion to establish a guideline harvest level for the sport charter industry in Alaska passed the NPFMC in February of 2000. The GHL for area 3A was established at 125% of the average 1995-1999 charter halibut harvest. No GHL was established for the nonguided fishery. A motion to incorporate the sport charter fleet into the existing individual fishing quota (IFQ) program was approved by the NPFMC in 2001. The IFQ program would allot charters 14.11% of the total commercial and charter harvest in area 3A. Both programs are in the process of final federal review and approval. If the Secretary of Commerce approves the IFQ program, it will likely not be implemented before 2003.

The future trends in the Cook Inlet halibut fishery are uncertain. It is not anticipated that subsequent harvests will remain at the high level of the 2000 harvest (Table 2). Declines in halibut abundance are expected to decrease catch rates, and under a GHL program, would result in restrictions on allowable charter harvest. Tourism to Alaska is expected to be lower in 2002 than in 2000 and 2001 due to national events affecting tourism nationwide. If the IFQ program is implemented, the charter fleet is likely to shrink in size due to some guides failing to qualify for quota share or due to aggregation of the quota share. It is possible that some spontaneous demand for guided halibut fishing may not be met.

CURRENT ISSUES

Halibut provide a valuable recreational fishery and are economically important to coastal Kenai Peninsula communities. The primary issues surrounding this fishery are:

1. Allocation of the resource between the longline and charter fleets.
2. Overcapitalization within the charter fleet
3. Concern for the status of local stocks. In all major areas fished, boats are traveling greater distances offshore to locate harvestable numbers of halibut of acceptable size to their clients.
4. Loss of harvest opportunity of anglers who employ charter boat services if the charter boat fleet is limited.

RECOMMENDED RESEARCH AND MANAGEMENT

Sport Fish Division conducts a recreational harvest assessment program to estimate average weight, harvest biomass, length and sex composition, and spatial distribution of effort and harvest in the guided and unguided sport halibut and groundfish fishery. The program provides valuable information for management of the stock to the IPHC and NPFMC. Continuation of this program is recommended, including the current objectives. Collection of otoliths should continue so the IPHC can build on the 1991-1998 time series of age composition estimates from the sport fishery in Area 3A. All estimates should be done by user group and by port so data are available to address future allocation issues and local area conflicts.

SPORT FISHING ACCESS PROJECTS

BACKGROUND

The Division of Sport Fish sport fishing access program coordinates and implements projects to improve access to fisheries by boating and non-boating anglers. The funding is derived from a combination of state and federal sources, including sport fishing license sales and a federal excise tax on sport fishing equipment and motorboat fuel. The federal funding source is the result of the Federal Aid in Sport Fish Restoration Act (also known as "Dingell-Johnson") and the Wallop-Breaux amendment made to the Act in 1984.

The primary beneficiary of each access project that involves Federal Aid funding must be the recreational boater or sport fishing public. A minimum of 15% of the Federal Aid funds allocated to the state is mandated to be used for recreational boating access projects. Federal Aid funds cannot be used for projects that support subsistence and personal use fisheries due to Alaska resident status restrictions placed on these fisheries and the type of fishing gear used (subsistence and personal use gear do not fit under the federal definition of sport fishing gear). Federal Aid funds cannot be used to support commercial user groups because commercial fishermen are exempt from the federal taxes that support the program. Federal Aid funds pay for approximately 75% of eligible access projects. The remaining 25%, called the state match, must be made up of non-federal funds or assets.

A variety of sport fishing access projects have been accomplished in the Lower Cook Inlet Management area since 1995. In 1995, a grant proposal was written to research and potentially purchase approximately 84 acres of land at or near the mouth of the Anchor River to provide access to sport anglers and recreational boaters. The purchase was denied because the appraised value of the property was lower than the owner's selling price and the department cannot spend more than the appraised fair market value for any property using Federal funding. Recently, The Nature Conservancy, a non-profit organization dedicated to the protection of land and water, submitted a proposal through ADF&G to the National Coastal Wetlands Conservation Grant Program to purchase the property. Notification of acceptance of the appraisal will occur in October 2001.

In 1996, the department cooperated with the Department of Natural Resources (DNR), Division of Parks and Outdoor Recreation (DPOR) to fund the fabrication and installation of two public mooring buoys in Halibut Cove Lagoon. The buoys became property of DNR in 1999. In 1997 additional funds were added to the original agreement for the construction and installation of two additional

mooring buoys in Tutka Bay. The department is no longer funding mooring buoy related projects due to liability and maintenance concerns.

Handicapped accessible ramps and landings were installed inside Homer Spit Enhancement Lagoon in 1999 to allow full accessibility to the sport fishery. The parking area adjacent to the ramps and a trail to an accessible toilet facility near the lagoon were paved. DNR and Alaska Department of Transportation and Public Facilities (ADOTPF) were cooperators through grants. Also in 1999, the seaward banks of the lagoon were hardened to reduce maintenance costs and to provide winter storm protection for the upgrades inside the lagoon. Hardening of the outer banks of the fishing lagoon and protection of the channel leading into the lagoon were accomplished with funds from the Federal Aid in Sport Fish Restoration Program and ADOTPF.

The department cooperated with the City of Homer to construct an additional fish cleaning table, carcass trailer, an industrial fish waste grinder and building to house the grinder during 2000 and 2001 because the amount of fish waste being dumped by the City was exceeding United States Environmental Protection Agency (EPA) limits. The fish cleaning facility was operational beginning in June 2001 and the City is now in compliance with EPA regulations.

Maintenance projects paid for by the department that relate to sport fishing access include annual upkeep of the road to the beach at Whiskey Gulch. During the summer of 1999, the road was graded and brushed along the edges near the entrance, widened at the top of the bluff, and drainage culverts were installed on both sides. The existing roadbed materials were replaced on the road up the bluff with more stable roadbed materials and a drainage culvert was installed in the streambed at the base of the bluff road.

Annual installation and pumping of portable toilets and refuse service at Whiskey Gulch and Ninilchik River is paid for by access funds. DPOR is given $10,000 annually for operation and maintenance of the Ninilchik wayside.

CURRENT PROJECTS

Removal of the broken wire gabion “mattresses” that were originally installed for slope stabilization adjacent to the Deep Creek boat ramp and their replacement with articulated concrete matting was completed during the spring of 2002. Interpretive display signboards will also be constructed/installed at the boat launch as part of this project.

Funding is being sought to construct stairways to access the Seldovia Slough at the ends of the Seldovia Slough bridge for sport anglers to descend to the water more easily and to eliminate trespassing on property adjacent to the fishery.

The department is seeking additional public easements to the eastside Cook Inlet beaches for public access to clam digging and angling north of the Ninilchik River. Increasing the number of public access routes can occur by development of existing public easements, or lease or purchase and improvement of easements currently in private ownership.

CURRENT ISSUES

Large sections of the watersheds of the road accessible streams and many remote streams on the central and lower Kenai Peninsula are privately owned. Private land owners are becoming less tolerant

of trespass, particularly as subdivision of large tracts of private property occurs, and access for fishing is decreasing. The ADF&G has limited options for protecting public access through land purchase or easement dedication. Several private non-profit organizations are based on the lower Peninsula that purchase land or protect it from development through easements. Public access for sport fishing can be an outcome of agreements between private landowners and these non-profit agencies, but habitat protection is the priority. Access for sport fishing in the central lower Kenai Peninsula will be sharply reduced in the future without further public land acquisition or easements.

FISHERIES HABITAT

The Habitat and Restoration Division of the Department of Fish and Game regulates human activities affecting fish-bearing waters, state game refuges, critical habitat areas and game sanctuaries through the issuance of permits so the activities are compatible with Alaska's fish and wildlife habitat. The division also participates in the permitting and planning of other state and federal agencies to ensure that fish and wildlife habitat needs are adequately addressed. This includes land use plans, oil and gas leasing and development, timber harvesting, mining, community expansion, mariculture, hydroelectric projects, and a variety of other activities. Table 55 lists the permitting and mitigation projects that have been conducted by Habitat Division on the central and southern Kenai Peninsula since 1996. These include projects to restore habitat damage from illegal activities. Forestry projects are not included in the table.

Table 55.-Habitat Division projects on the central and southern Kenai Peninsula, 1996-2001.

Activity Type	Number of Projects
Road Construction	7
Bank Restoration	3
Bank Stabilization	9
Culvert/Bridge	24
Debris Removal	4
Stream Diversion/Realignment	2
Dock/Boat Launch	34
Fish and Wildlife Enhancement	10
Land Use (ORV, Grazing, etc.)	37
Material Removal/Dredging	18
Seismic	9
Outfall Structures	3
Utility Lines	2
Vehicle Stream Crossings	12
Waste Water/Water Use	4
Wetland Fills	16

RECOMMENDED RESEARCH AND MANAGEMENT

Development of all types is occurring in the LCIMA. In the past decade, large tracts of public and private land on the central and southern Kenai Peninsula have been deforested as a consequence of the spruce bark beetle infestation. Many deforested lands have been subdivided for sale. Access roads to logged areas and developments have proliferated in formerly remote areas of important anadromous watersheds. House and business construction is also occurring along coastlines and in river flood plains and adjacent uplands as the population grows. A staff of two habitat biologists with responsibilities for the entire Cook Inlet area and the busy LCIMA staff must respond to a plethora of permit requests and habitat violations. Basic questions about the characteristics and extent of existing anadromous fish habitat go unanswered. Current staffing levels are inadequate. The authority of the department is limited to anadromous fish streams. It is recommended that statutory protections of anadromous habitat must be extended to waters containing only resident species. School curricula about harmful and healthful habitat practices are available, but general public education programs are minimal and need to be developed.

EDUCATIONAL FISHERIES

BACKGROUND

The objectives for educational fisheries are specified in 5 AAC 93.235 as "educating persons concerning historic, contemporary, or experimental methods for locating, harvesting, handling, or processing fishery resources." Standards, general conditions, and requirements of the educational fishery program are outlined in 5 AAC 93.200-235. The Federal Court initially ordered educational fisheries while litigation was underway regarding issues surrounding rural preference for subsistence uses in Alaska and in Cook Inlet. Nelson et al. 1999 outlines the legal and political events surrounding conflicts over subsistence rights in Alaska that pertain to the creation of educational fisheries on the Kenai Peninsula.

The first educational fishery permit granted in the LCIMA was issued to the Ninilchik Traditional Council (NTC) in 1993 (Nelson et al. 1999). The goal of the NTC educational fishery was to teach and preserve the cultural and traditional subsistence way of life as well as provide food for the Elders and others in need. They were the lone applicant for a permit from 1993 through 1996. Permit stipulations in 1993 allowed a saltwater harvest of 2,000 salmon; not more than 100 could be chinook and 250 coho salmon. Only 50 chinook salmon could be taken prior to July 21. An additional 50 could be taken beginning July 21 if the chinook salmon spawning escapement to the Kenai River was projected above 22,300. The fishing area extended north 1 mile from near the Ninilchik River and ¼ mile from shore. Gear was limited to a single 10-fathom gillnet. Regular harvest reporting was required along with a season summary 10 days after the completion of the season. Virtually the same permit requirements were in place in 1994 through 1997 with a few alterations. Beginning in 1996, 100 chinook salmon could be taken prior to July 21 and 50 thereafter if the Kenai River escapement goal was met. The duration of the permit expanded each year until 1996; since then fishing has been allowed from May 1 until October 31. A very limited freshwater fishery was permitted on the Ninilchik River downstream of the Sterling Highway Bridge beginning in 1995 using traditional methods. After 1995, the freshwater harvest was limited to no more than 30 chinook and 20 coho salmon. The annual harvest in the educational fishery is reported in Table 56.

Table 56.-Harvest in the Ninilchik-area educational fishery, 1993-2001.

Year	Educational fishery participant		Chinook Salmon	Sockeye Salmon	Coho Salmon	Pink Salmon	Total
1993							215
1994			7	162	119	16	304
1995			77	229	85	23	414
1996			101	910	56	8	1,075
1997			94	474	99	55	722
1998	NND[a]		52	139	110	20	317
	NTC[b]		67	506	95	57	721
		Total	119	645	205	77	1,038
1999	NND		56	302	76	18	452
	NTC		117	434	84	5	640
		Total	173	736	160	23	1,092
2000	NND		51	199	96	15	361
	NTC		50	439	59	57	605
		Total	101	638	155	72	966
2001							
	NND		73	310	123	0	506
	NTC		75	760	125	42	1,002
		Total	148	1,070	248	42	1,508
Grand total			820	2,316	1,127	316	7,334
Average of annual totals			91	540	125	35	733

[a] Ninilchik Native Descendents.

[b] Ninilchik Traditional Council.

In 1998, a group of NTC members formed a new organization, the Ninilchik Native Descendents (NND), and requested a separate permit with similar goals of passing on traditional knowledge and providing food for needy tribal members. Initially, one permit was granted to both organizations jointly with the same stipulations as in the past. This was not acceptable to the NTC. The NND fished upon receiving the joint permit while the NTC members did not fish until they were granted a separate permit. Since the two groups represented the same constituents that had been served in the past by one permit,

two permits were issued and the allocation normally granted to the NTC was divided in half between them. Each permit allowed the taking of 1,000 salmon. No more than 50 chinook salmon could be harvested in total, with 25 taken before July 21, and no more than 125 coho salmon in total. No more than 15 chinook and 10 coho salmon could be taken during the limited freshwater fishery. The remaining terms of the permits were the same as in the past. Each permitee was allowed their own net.

After the permits had been issued, the NTC asked that they be allowed an additional 20 chinook salmon, the number caught by the NND before separate permits were granted, for a total of 70 prior to July 21. The NTC permit was amended to allow the taking of 18 additional chinook salmon because they had taken 52, two more than the amount allotted them at the time of their request for additional fish. The NTC also requested an additional 25 coho salmon but were refused. Their coho salmon allocation was thought to achieve the educational purposes stipulated in the permit; coho salmon harvests in previous years had not exceeded 119 in total. The educational fishery was closed July 28 through August 2 because sockeye returns to the Kenai River were projected to be under the goal (Appendix B1).

The harvest in 1998 totaled 1,038 salmon (Table 56). The NTC took 506 sockeye, 67 chinook, 95 coho and 57 pink salmon; NND 139 sockeye, 52 chinook, 110 coho and 20 pink salmon (Table 56)

Both the NTC and NND applied for and received permits in 1999. The stipulations of the two permits were the same as in 1998. The NTC requested an additional 50 chinook salmon on May 25 after they harvested their initial quota of 50. The additional harvest was approved because they would not meet their educational goals otherwise and the additional allocation was not thought to negatively impact the chinook salmon resource or other fisheries. Both organizations exceeded their allocation of chinook salmon in early July and were requested to cease their harvest of chinook until after July 20. No further chinook salmon were reported harvested. The final harvest reported by the NTC was 434 sockeye salmon, 117 chinook, 84 coho and 5 pink salmon. The NND harvested 302 sockeye, 56 chinook, 76 coho and 18 pink salmon (Table 56).

The educational fishery permits issued in 2000 contained the same stipulations and quotas as initially granted in 1998. The fishery proceeded without inseason changes. The NTC took 439 sockeye, 50 chinook, 59 coho and 57 pink salmon (Table 56). The NND caught 199 sockeye salmon, 51 chinook, 96 coho and 15 pink salmon.

In 2001, the NTC was allowed the use of an additional net, at their request, to better attain their quota of sockeye salmon. The NND requested an additional 25 chinook salmon prior to July 21, for a total of 75 during that period, to provide educational opportunities for an anticipated increase in participants to the program. The chinook salmon quota of both groups was increased prior to July 21 to 75; the increase to the NTC was to allow them to achieve their quota of sockeye salmon and better achieve their educational goals. The largest reported harvest since the inception of the fishery was taken in 2001, primarily by the NTC who harvested 760 sockeye, 75 king, 125 coho and 42 pink salmon (Table 56). The NND harvested 310 sockeye, 73 chinook 123 coho and no pink salmon.

RECOMMENDED RESEARCH AND MANAGEMENT

No research or management activity specific to this fishery is recommended.

LITERATURE CITED

ADF&G (Alaska Department of Fish and Game). 1990. A review of steelhead in Alaska. An interagency report for: International symposium on steelhead management pages 1-25, in International Symposium on Steelhead Trout Management, Pacific State Marine Fisheries Commission and Association of Northwest Steelheaders. Portland.

Athons, D. E., and J. J. Hasbrouck. 1994. Harvest distribution, age composition, and abundance of razor clams along the eastern beaches of Cook Inlet, 1992. Alaska Department of Fish and Game, Fishery Data Series No. 94-3, Anchorage. http://www.sf.adfg.state.ak.us/FedAidPDFs/fds94-03.pdf

Balland, D. T., S. Sonnichsen, and S. L. Timmons. 1994. Contribution of stocked chinook salmon to the Ninilchik River sport fishery, 1993. Alaska Department of Fish and Game, Fishery Data Series No. 94-25, Anchorage. http://www.sf.adfg.state.ak.us/FedAidPDFs/fds94-25.pdf

Bendock, T. N. 1995. Marking juvenile chinook salmon in the Kenai River and Deep Creek, Alaska, 1993-1994. Alaska Department of Fish and Game, Fishery Data Series No. 95-17, Anchorage. http://www.sf.adfg.state.ak.us/FedAidPDFs/fds95-17.pdf

Bendock, T. N. 1996. Marking juvenile chinook salmon in the Kenai River and Deep Creek, Alaska, 1995. Alaska Department of Fish and Game, Fishery Data Series No. 96-33, Anchorage. http://www.sf.adfg.state.ak.us/FedAidPDFs/fds96-33.pdf

Boyle, L., and M. Alexandersdottir. 1992. Contribution of stocked chinook salmon to the Ninilchik River sport fishery, 1991. Alaska Department of Fish and Game, Fishery Data Series No. 92-30, Anchorage. http://www.sf.adfg.state.ak.us/FedAidPDFs/fds92-30.pdf

Boyle, L., S. Sonnichsen, and T. D. Balland. 1993. Contribution of stocked chinook salmon to the Ninilchik River sport fishery, 1992. Alaska Department of Fish and Game, Fishery Data Series No. 93-21, Anchorage. http://www.sf.adfg.state.ak.us/FedAidPDFs/fds93-21.pdf

Caverhill, P. A. 1977. The B.C. experience in catch and release fishing. Pages 151-160, in R. A. Barnhart and T. D. Roelofs, editors. Catch and Release Fishing, Sponsored by California Trout Inc., California Cooperative Fisheries Research Unit, Humboldt State University, Arcata.

Davis, A. S. 1981. King and Tanner crab studies – Cook Inlet. Commercial Fisheries Research and Development Act, Project No. 5-44-R-1, Technical Report for period July 1, 1979 to June 30, 1980. Alaska Department of Fish and Game, Juneau.

Hammarstrom, S. L. 1974. Inventory and cataloging of Kenai Peninsula, Cook Inlet, and fish stocks. Alaska Department of Fish and Game. Federal Aid in Fish Restoration, Annual Performance Report, 1973-1974, Project F-9-6, 15 (G-I-C), Juneau.

Hammarstrom, S. L. 1975. Inventory and cataloging of Kenai Peninsula, Cook Inlet, Prince William Sound, and fish stocks. Alaska Department of Fish and Game. Federal Aid in Fish Restoration, Annual Performance Report, 1974-1975, Project F-9-7, 16 (G-I-C), Juneau.

Hammarstrom, S. L. 1976. Inventory and cataloging of Kenai Peninsula, and Cook Inlet drainages and fish stocks. Alaska Department of Fish and Game. Federal Aid in Fish Restoration, Annual Performance Report, 1975-1976, Project F-9-8, 17 (G-I-C), Juneau.

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.

Hammarstrom, S. L. 1978. Evaluation of chinook salmon fisheries of the Kenai Peninsula. Federal Aid in Fish Restoration, Annual Report of Performance, 1977-1978, Project F-9-10, Volume 19 (G-II-L), Juneau, Alaska, USA, Juneau.

LITERATURE CITED (Continued)

Hammarstrom, S. L. 1979. Evaluation of chinook salmon fisheries of the Kenai Peninsula. Federal Aid in Fish Restoration, Annual Report of Performance, 1978-1979, Project F-9-11, Volume 20 (G-II-L), Juneau, Alaska, USA, Juneau.

Hammarstrom, S. L. 1980. Evaluation of chinook salmon fisheries of the Kenai Peninsula. Federal Aid in Fish Restoration, Annual Report of Performance, 1979-1980, Project F-9-12, Volume 21 (G-II-L), Juneau, Alaska, USA, Juneau.

Hammarstrom, S. L. 1981. Evaluation of chinook salmon fisheries of the Kenai Peninsula. Alaska Department of Fish and Game. Federal Aid in Fish Restoration, Annual Performance Report, 1980-1981, Project F-9-13, 22 (G-II-L), Juneau.

Hammarstrom, S. L., and L. L. Larson. 1982. Evaluation of chinook salmon fisheries of the Kenai Peninsula. Federal Aid in Fish Restoration, Annual Report of Performance, 1981-1982, Project F-9-14, Volume 23 (G-II-L), Juneau, Alaska, USA, Juneau. http://www.sf.adfg.state.ak.us/FedAidPDFs/f-9-14(23)G-II-L.pdf

Hammarstrom, S. L., and L. L. Larson. 1983. Evaluation of chinook salmon fisheries of the Kenai Peninsula. Alaska Department of Fish and Game. Federal Aid in Fish Restoration, Annual Performance Report, 1982-1983, Project F-9-15, 24 (G-II-L), Juneau. http://www.sf.adfg.state.ak.us/FedAidPDFs/f-9-15(24)G-II-L.pdf

Hammarstrom, S. L., and L. L. Larson. 1984. Evaluation of chinook salmon fisheries of the Kenai Peninsula. Alaska Department of Fish and Game. Federal Aid in Fish Restoration, Annual Performance Report, 1983-1984, Project F-9-16, 25 (G-II-L), Juneau. http://www.sf.adfg.state.ak.us/FedAidPDFs/f-9-16(25)G-II-L.pdf

Hammarstrom, S. L. and L. L. Larson. 1986. Cook Inlet chinook and coho salmon studies. Alaska Department of Fish and Game. Federal Aid in Fish Restoration, Annual Performance Report, 1985-1986, Project F-10-1, 27 (S-32-1,2,4,5), Juneau.

Hammarstrom, S. L., L. Larson, M. Wenger, and J. Carlon. 1985. Kenai Peninsula chinook and coho salmon studies. Alaska Department of Fish and Game. Federal Aid in Fish Restoration. Annual Performance Report, 1984-1985, Project F-9-17, 26 (G-II-L), Juneau. http://www.sf.adfg.state.ak.us/FedAidPDFs/f-9-17(26)G-II-L_AFS-50-1.pdf

Hooten, R. S. 1988. Catch and release as a management strategy for steelhead in British Columbia. Pages 143-156, in R. A. Barnhart and T. D. Roelofs, editors. Catch and Release Fishing a Decade of Experience, California Cooperative Fisheries Research Unit, Humboldt State University, Arcata.

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. http://www.sf.adfg.state.ak.us/FedAidPDFs/fds96-32.pdf

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. http://www.sf.adfg.state.ak.us/FedAidPDFs/fds95-24.pdf

Howe, A. L., R. J. Walker, C. Olnes, K. Sundet, and A. E. Bingham. 2001a. 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. http://www.sf.adfg.state.ak.us/FedAidPDFs/fds97-29(revised).pdf

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 1997. Alaska Department of Fish and Game, Fishery Data Series No. 98-25 (revised), Anchorage. http://www.sf.adfg.state.ak.us/FedAidPDFs/fds98-25(revised).pdf

Howe, A. L., R. J. Walker, C. Olnes, K. Sundet, and A. E. Bingham. 2001c. 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. http://www.sf.adfg.state.ak.us/FedAidPDFs/fds99-41(revised).pdf

LITERATURE CITED (Continued)

Howe, A. L., R. J. Walker, C. Olnes, K. Sundet, and A. E. Bingham. 2001d. Participation, catch, and harvest in Alaska sport fisheries during 1999. Alaska Department of Fish and Game, Fishery Data Series No. 01-8, Anchorage. http://www.sf.adfg.state.ak.us/FedAidPDFs/fds01-08.pdf

King, B. E., and J. A. Breakfield. 1998. Coded wire tagging of coho and chinook salmon in the Kenai River and Deep Creek, Alaska, 1996. Alaska Department of Fish and Game, Fishery Data Series No. 98-9, Anchorage. http://www.sf.adfg.state.ak.us/FedAidPDFs/fds98-09.pdf

King, B. E., and J. A. Breakfield. 1999. Chinook and coho salmon coded wire tagging studies in the Kenai River and Deep Creek, Alaska, 1997. Alaska Department of Fish and Game, Fishery Data Series No. 99-11, Anchorage. http://www.sf.adfg.state.ak.us/FedAidPDFs/fds99-11.pdf

Larson, L. L. 1990. Statistics for selected sport fisheries on the Anchor River, Alaska, during 1989 with emphasis on Dolly Varden char. Alaska Department of Fish and Game, Fishery Data Series No. 90-57, Anchorage. http://www.sf.adfg.state.ak.us/FedAidPDFs/fds90-57.pdf

Larson, L. L. 1991. Statistics for Dolly Varden on the Anchor River, Alaska, during 1990. Alaska Department of Fish and Game, Fishery Data Series No. 91-13, Anchorage. http://www.sf.adfg.state.ak.us/FedAidPDFs/fds91-13.pdf

Larson, L. L. 1992. Stock assessment of Dolly Varden on the Anchor River, Alaska during 1991. Alaska Department of Fish and Game, Fishery Data Series No. 92-14, Anchorage. http://www.sf.adfg.state.ak.us/FedAidPDFs/fds92-14.pdf

Larson, L. L. 1993. Lower Kenai Peninsula Dolly Varden and steelhead trout studies during 1992. Alaska Department of Fish and Game, Fishery Data Series No. 93-54, Anchorage. http://www.sf.adfg.state.ak.us/FedAidPDFs/fds93-54.pdf

Larson, L. L. 1994. Lower Kenai Peninsula Dolly Varden studies during 1993. Alaska Department of Fish and Game, Fishery Data Series No. 94-51, Anchorage. http://www.sf.adfg.state.ak.us/FedAidPDFs/fds94-51.pdf

Larson, L. L. 1995. Lower Kenai Peninsula Dolly Varden studies during 1994. Alaska Department of Fish and Game, Fishery Data Series No. 95-44, Anchorage. http://www.sf.adfg.state.ak.us/FedAidPDFs/fds95-44.pdf

Larson, L. L. 1997. Lower Kenai Peninsula Dolly Varden studies during 1995. Alaska Department of Fish and Game. Fishery Data Series No. 97-2, Anchorage. http://www.sf.adfg.state.ak.us/FedAidPDFs/fds97-02.pdf

Larson, L. L., and D. T. Balland. 1989. Statistics for selected sport fisheries on the lower Kenai Peninsula, Alaska, during 1988 with emphasis on Dolly Varden char. Alaska Department of Fish and Game, Fishery Data Series No. 101, Juneau. http://www.sf.adfg.state.ak.us/FedAidPDFs/fds-101.pdf

Larson, L. L., D. T. Balland, and S. Sonnichsen. 1988. Statistics for selected sport fisheries on the lower Kenai Peninsula, Alaska, during 1987 with emphasis on Dolly Varden char. Alaska Department of Fish and Game, Fishery Data Series No. 68, Juneau. http://www.sf.adfg.state.ak.us/FedAidPDFs/fds-068.pdf

Marsh, L. E. 1995. Harvest of Stocked Chinook Salmon in the Ninilchik River Sport Fishery, 1994. Alaska Department of Fish and Game, Fishery Data Series No. 95-33, Anchorage. http://www.sf.adfg.state.ak.us/FedAidPDFs/fds95-33.pdf

McBride, D. N., M. Alexandersdottir, S. Hammarstrom, and D. Vincent-Lang. 1989. Development and implementation of an escapement goal policy for the return of chinook salmon to the Kenai River. Alaska Department of Fish and Game, Fishery Manuscript No. 8, Juneau. http://www.sf.adfg.state.ak.us/FedAidPDFs/fm-008.pdf

McKinley, T. R. 1995. Angler effort and harvest of chinook salmon and Pacific halibut in the marine recreational fishery of Central Cook Inlet, 1994. Alaska Department of Fish and Game, Fishery Data Series No. 95-34, Anchorage. http://www.sf.adfg.state.ak.us/FedAidPDFs/fds95-34.pdf

LITERATURE CITED (Continued)

McKinley, T. R. 1996. Angler effort and harvest of chinook salmon and Pacific halibut in the marine recreational fishery of Central Cook Inlet, 1995. Alaska Department of Fish and Game, Fishery Data Series No. 96-46, Anchorage. http://www.sf.adfg.state.ak.us/FedAidPDFs/fds96-46.pdf

McKinley, T. R. 1999. Contributions of coded wire tagged chinook salmon to the recreational fishery in Central Cook Inlet, Alaska, 1996. Alaska Department of Fish and Game, Fishery Data Series No. 99-2, Anchorage. http://www.sf.adfg.state.ak.us/FedAidPDFs/fds99-02.pdf

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. http://www.sf.adfg.state.ak.us/FedAidPDFs/f-9-11(20)SW-I-A.pdf

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. http://www.sf.adfg.state.ak.us/FedAidPDFs/f-9-12(21)SW-I-A.pdf

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. http://www.sf.adfg.state.ak.us/FedAidPDFs/f-9-13(22a)SW-I-A.pdf

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. http://www.sf.adfg.state.ak.us/FedAidPDFs/f-9-13(22b)SW-I-A.pdf

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. http://www.sf.adfg.state.ak.us/FedAidPDFs/f-9-14(23)SW-I-A.pdf

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. http://www.sf.adfg.state.ak.us/FedAidPDFs/f-9-15(24)SW-I-A.pdf

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. http://www.sf.adfg.state.ak.us/FedAidPDFs/f-9-16(25)SW-I-A.pdf

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. http://www.sf.adfg.state.ak.us/FedAidPDFs/f-9-17(26)SW-I-A.pdf

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. http://www.sf.adfg.state.ak.us/FedAidPDFs/f-10-1(27)RT-2.pdf

Mills, M. J. 1987. Alaska statewide sport fisheries harvest report, 1986. Alaska Department of Fish and Game, Fishery Data Series No. 2, Juneau. http://www.sf.adfg.state.ak.us/FedAidPDFs/fds-002.pdf

Mills, M. J. 1988. Alaska statewide sport fisheries harvest report, 1987. Alaska Department of Fish and Game, Fishery Data Series No. 52, Juneau. http://www.sf.adfg.state.ak.us/FedAidPDFs/fds-052.pdf

Mills, M. J. 1989. Alaska statewide sport fisheries harvest report, 1988. Alaska Department of Fish and Game, Fishery Data Series No. 122, Juneau. http://www.sf.adfg.state.ak.us/FedAidPDFs/fds-122.pdf

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. http://www.sf.adfg.state.ak.us/FedAidPDFs/fds90-44.pdf

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. http://www.sf.adfg.state.ak.us/FedAidPDFs/fds91-58.pdf

LITERATURE CITED (Continued)

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. http://www.sf.adfg.state.ak.us/FedAidPDFs/fds92-40.pdf

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. http://www.sf.adfg.state.ak.us/FedAidPDFs/fds93-42.pdf

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. http://www.sf.adfg.state.ak.us/FedAidPDFs/fds94-28.pdf

Nelson, D. C. 1995. Area management report for the recreational fisheries of the Kenai Peninsula, 1994. Alaska Department of Fish and Game, Fishery Management Report No. 95-4, Anchorage. http://www.sf.adfg.state.ak.us/FedAidPDFs/fmr95-04.pdf

Nelson, D. C. Unpublished. A review of Alaska's Kenai Peninsula eastside beach recreational razor clam fishery, 1965-1980. Alaska Department of Fish and Game, Sport Fish Division, Soldotna.

Nelson, D. C., D. Athons, P. Berkhahn, and S. Sonnichsen. 1999. Area management report for the recreational fisheries of the Kenai Peninsula, 1995-1997. Alaska Department of Fish and Game, Fishery Management Report No. 99-3, Anchorage. http://www.sf.adfg.state.ak.us/FedAidPDFs/fmr99-03.pdf

Pettit, S. W. 1977. Comparative reproductive success of caught-and-released and unplayed hatchery female steelhead trout (Salmo gairdneri) from the Clearwater River, Idaho. Transactions of the American Fisheries Society 5:431-435.

Reingold, M. 1975. Effects of displacing, hooking and releasing migrating adult steelhead trout. Transactions of the American Fisheries Society 3:458-460.

Szarzi, N. J. 1991. Distribution and abundance of the Pacific razor clam, Siliqua patula (Dixon), on the east side Cook Inlet beaches. Master's thesis. University of Alaska, Fairbanks.

Van Hulle, F. D. 1985. Alaska steelhead workshop. Alaska Department of Fish and Game, Division of Sport Fish, Juneau, AK.

Vincent-Lang, D., M. Alexandersdottir, and D. McBride. 1993. Mortality of coho salmon caught and released using sport tackle in the Little Susitna River, Alaska. Fisheries Research 15:339-356

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. http://www.sf.adfg.state.ak.us/FedAidPDFs/fds03-05.pdf

APPENDIX A: NINILCHIK RIVER CHINOOK SALMON STOCKING RECORDS

Appendix A1.-Numbers of chinook salmon smolt stocked in the Ninilchik River, 1988-2001.

Release Year	Brood Source/ Eggtake location	Rearing Facility	Number Released	Percent Marked	Weight (grams)
1988	Ninilchik/Ninilchik	Elmendorf	247,327	12	
1989	Ninilchik/Ninilchik	Elmendorf	199,831	9	
1990	Ninilchik/Ninilchik	Elmendorf	215,804	19	
1991	Ninilchik/Ninilchik	Elmendorf	87,992	24	
1992	Ninilchik/Ninilchik	Elmendorf	132,387	31	
1993	Ninilchik/Ninilchik	Elmendorf	184,585	23	
1994	Ninilchik/Ninilchik	Elmendorf	201,513	23	
1995 [a]	Ninilchik/Ninilchik	Elmendorf	54,662	99	
1996 [a]	Ninilchik/Ninilchik	Elmendorf	51,688	98	
1997 [b]	Ninilchik/Ninilchik	Elmendorf	50,698	99	
1998 [b]	Ninilchik/Ninilchik	Elmendorf	48,798	97	11.4
1999 [b]	Ninilchik/Ninilchik	Elmendorf	49,853	98	13.6
2000 [b]	Ninilchik/Ninilchik	Elmendorf	51,298	98	10.2
2001 [b]	Ninilchik/Ninilchik	Elmendorf	54,770	99	13.6

[a] Smolt held in Ninilchik harbor prior to release there.

[b] Smolt released in fresh water.

APPENDIX B: EMERGENCY ORDERS

Appendix B1.-Emergency orders issued for LCIMA waters during 1996-2001.

Emergency Orders issued in 1996:

1. E.O. No. 2-SHR-1-08-96 closed the recreational shrimp fishery in Kachemak Bay east of a line from Anchor Point to Point Pogibshi. Effective April 15 through December 31, 1996.
2. E.O. No. 2-KS-1-20-96 extended the chinook salmon fishery on the Ninilchik River on a continual basis between Saturday, June 15 through Monday, June 24. Effective June 15, 12:01 a.m. through Monday June 24, 1996.
3. E.O. No. 2-SS-1-41-96 opened the Homer spit lagoon to snagging for chinook salmon and coho salmon. Effective September 8 through December 31, 1996.

Emergency Orders issued in 1997:

1. E.O. No. 2-SHR-7-01-97 closed sport fishing for shrimp in all of Kachemak Bay east of a line from Anchor Point to Point Pogibshi. Effective January 1 through December 31, 1997.
2. E.O. No. 2-PU-H-02-96 closed the personal use fishery for shrimp in waters of Kachemak Bay east of a line from Anchor Point to Point Pogibshi. Effective January 1 through December 31, 1997.
3. E.O. No. 2-KS-7-21-97 opened snagging at the Homer Lagoon. Effective 12:00 p.m. July 2 through July 7, 1997.
4. E.O. No. 2-PS-7-32-97 increased the bag limit for pink salmon to 12 per day in the marine waters of Tutka Bay. Effective August 9 through September 21, 1997.
5. E.O. No. 2-SS-7-35-97 closed the Fox Creek Personal Use dip net fishery.
6. E.O. No. 2-SS-7-36-97 increased the daily bag and possession limit for salmon other than chinook salmon, including silver salmon 16 inches or more in length from one to three in Ninilchik River, Deep Creek, Stariski Creek and the Anchor River. Effective August 29 through October 15, 1997.
7. E.O. No. 2-SS-7-41-97 opened the Homer Lagoon to snagging. Effective August 7 through December 31, 1997.

Emergency Orders issued in 1998:

1. E.O. No. 2-DC-7-05-98 closed the Dungeness crab sport fishery in Lower Cook Inlet east of a line extending from Anchor Point to Point Bede. Effective May 29 until further notice.
2. E.O. No. 2-DC-7-06-98 closed the personal use fishery for Dungeness crab in Lower Cook Inlet east from a line extending from Anchor Point to Point Bede. Effective May 29 until further notice.

3. E.O. No. 2-KS-7-13-98 opened the Homer Spit and enhancement lagoon to snagging. Effective July 1 through July 7, 1998.
4. E.O. No. 2-RS-7-24-98 closed the Ninilchik Traditional Council Educational Fishery. Effective July 28 through August 10, 1998.
5. E.O. No. 2-RS-1-27-98 rescinded E.O. No. 2-RS-7-24-98 and restored the Ninilchik Traditional Council Educational fishery to the regular fishing times. Effective August 3 through October 1, 1998.
6. E.O. No. 2-PU-7-29-98 closed the personal use dip net fishery in Fox Creek. Effective August 22 through December 31, 1998.
7. E.O. No. 2-SS-7-32-98 opened snagging on the Homer Spit. Effective 12:00 p.m. September 18 through December 31, 1998.

Emergency Orders issued in 1999:

1. E.O. No. 2-KS-7-08-99 opened the Homer Spit fishing lagoon to snagging. Effective 12:00 p.m. June 30 through July 4, 1999.
2. E.O. No. 2-RS-7-19-99 opened China Poot Creek to sockeye dipnetting. Effective 12:00 p.m. August 11 through 12:00 p.m. August 20, 1999.
3. E.O. No. 2-SS-7-24-99 opened Homer Spit and enhancement lagoon to snagging. Effective 12:00 p.m. September 24 through December 31, 1999.

Emergency Orders issued in 2000:

1. E.O. No. 2-KS-7-08-00 opened snagging on the Homer Spit and enhancement lagoon. Effective June 24 through July 2, 2000.
2. E.O. No. 2-SS-7-22-00 opened the Homer Spit and lagoon to snagging. Effective 12:00 p.m. September 22 through December 31, 2000.

Emergency Orders issued in 2001:

1. E.O. No. 2-RS-7-02-01 closed all waters of the English Bay River drainage and Port Graham Subdistrict to sockeye salmon sport fishing from June 1, 2001 12:01 a.m. until August 31.
2. E.O. No. 2-KS-7-05-01 opened Deep Creek downstream of the regulatory marker for an additional 3-day weekend, June 16, 2001, 12:01 a.m. to June 18, 2001, 11:59 p.m.
3. E.O. No. 2-KS-7-05-02 opened the Ninilchik River downstream of the regulatory marker for an additional 3-day weekend, June 16, 2001, 12:01 a.m. to June 18, 2001, 11:59 p.m.
4. E.O. No. 2-KS-7-10-01 opened the Homer Spit Enhancement Lagoon area to snagging from noon, Friday, June 29, 2001, until 11:59 p.m., Sunday, July 8, 2001.

5. E.O. No. 2-KS-7-11-01 prohibited the use of weighted hooks or weights following hooks in the Homer Spit Enhancement Lagoon area from Monday, July 9, 2001 until superceded by E.O.
6. E.O. No. 2-TC-7-19-01 reduced the personal use daily bag and possession limit from 20 male crab to five and the pot limit from five to one per person and two per boat.
7. E.O. No. 2-TC-7-18-01 reduced the sport fishery daily bag and possession limit from 20 male crab to five and the pot limit from five to one per person and two per boat.
8. E.O. No. 2-SS-7-22-01 opened the Homer Spit Enhancement Lagoon area to snagging from noon, Sunday September 16, 2001 through 11:59 p.m., Monday, December 31, 2001.

APPENDIX C: WEIR COUNTS

Appendix C1.-Daily and cumulative count of wild and hatchery-reared chinook salmon through the Ninilchik River weir, 1999-2001.

	1999						2000						2001					
	Wild		AFC		Total		Wild		AFC		Total		Wild		AFC		Total	
	Daily	Cum. %	Daily	Cum. %	Daily	Cum. %	Daily	Cum. %	Daily	Cum. %	Daily	Cum. %	Daily	Cum. %	Daily	Cum. %	Daily	Cum. %
17-May	0	0	0	0	0	0	0	0	0	0	0	0						
18-May	0	0	0	0	0	0	0	0	0	0	0	0						
19-May	0	0	0	0	0	0	0	0	0	0	0	0						
20-May	0	0	0	0	0	0	1	0	0	0	1	0						
21-May	0	0	0	0	0	0	0	0	0	0	0	0						
22-May	0	0	0	0	0	0	0	0	0	0	0	0						
23-May	0	0	0	0	0	0	1	0	0	0	1	0						
24-May	0	0	0	0	0	0	1	0	0	0	1	0						
25-May	0	0	0	0	0	0	0	0	0	0	0	0						
26-May	0	0	0	0	0	0	0	0	0	0	0	0						
27-May	0	0	0	0	0	0	0	0	0	0	0	0						
28-May	0	0	0	0	0	0	2	0	0	0	2	0						
29-May	0	0	0	0	0	0	15	1	0	0	15	1						
30-May	0	0	0	0	0	0	2	1	0	0	2	1						
31-May	6	0	0	0	6	0	0	1	1	0	1	1	0	0	0	0	0	0
1-Jun	0	0	0	0	0	0	0	1	0	0	0	1	0	0	0	0	0	0
2-Jun	0	0	0	0	0	0	2	1	0	0	2	1	0	0	0	0	0	0
3-Jun	2	0	0	0	2	0	0	1	0	0	0	1	0	0	0	0	0	0
4-Jun	10	1	0	0	10	1	15	2	1	0	16	2	0	0	0	0	0	0
5-Jun	17	2	0	0	17	2	14	3	0	0	14	2	0	0	0	0	0	0
6-Jun	30	4	0	0	30	3	10	4	0	0	10	3	0	0	0	0	0	0
7-Jun	9	5	0	0	9	3	5	4	0	0	5	3	0	0	0	0	0	0
8-Jun	3	5	0	0	3	3	0	4	0	0	0	3	0	0	0	0	0	0
9-Jun	0	5	0	0	0	3	2	4	0	0	2	3	0	0	0	0	0	0
10-Jun	1	5	0	0	1	4	0	4	0	0	0	3	0	0	0	0	0	0
11-Jun	3	5	0	0	3	4	0	4	0	0	0	3	0	0	0	0	0	0
12-Jun	0	5	0	0	0	4	0	4	0	0	0	3	0	0	0	0	0	0
13-Jun	0	5	0	0	0	4	0	4	0	0	0	3	0	0	0	0	0	0
14-Jun	0	5	0	0	0	4	0	4	0	0	0	3	2	0	0	0	2	0
15-Jun	0	5	0	0	0	4	0	4	0	0	0	3	22	2	4	1	26	1
16-Jun	1	5	0	0	1	4	0	4	0	0	0	3	27	4	3	1	30	3
17-Jun	0	5	0	0	0	4	0	4	0	0	0	3	11	4	3	1	14	3
18-Jun	0	5	0	0	0	4	0	4	0	0	0	3	14	5	1	2	15	4
19-Jun	1	5	0	0	1	4	0	4	0	0	0	3	2	6	1	2	3	4
20-Jun	0	5	0	0	0	4	0	4	0	0	0	3	7	6	2	2	9	5
21-Jun	0	5	0	0	0	4	0	4	0	0	0	3	14	7	1	2	15	5
22-Jun	0	5	0	0	0	4	0	4	1	0	1	3	4	7	0	2	4	6
23-Jun	3	5	0	0	3	4	8	5	0	0	8	3	24	9	1	2	25	7
24-Jun	5	6	0	0	5	4	4	5	0	0	4	3	28	11	1	3	29	8
25-Jun	3	6	0	0	3	4	8	6	0	0	8	4	27	13	2	3	29	10
26-Jun	4	6	0	0	4	4	8	6	0	0	8	4	25	15	1	3	26	11
27-Jun	3	6	0	0	3	5	18	7	2	1	20	5	50	18	4	4	54	13
28-Jun	18	7	0	0	18	5	36	9	2	1	38	6	17	19	3	4	20	14
29-Jun	16	8	1	0	17	6	52	12	2	1	54	9	18	21	1	4	19	15
30-Jun	14	9	0	0	14	7	30	14	3	1	33	10	15	22	3	5	18	16

-continued-

Appendix C1.-Page 2 of 2.

	1999						2000						2001					
	Wild		AFC		Total		Wild		AFC		Total		Wild		AFC		Total	
	Daily	Cum.	Daily	Cum.	Daily	Cum.	Daily	Cum.	Daily	Cum.	Daily	Cum.	Daily	Cum.	Daily	Cum.	Daily	Cum.
Date		%		%		%		%		%		%		%		%		%
1-Jul	51	12	4	1	55	9	6	15	0	1	6	10	9	22	3	5	12	17
2-Jul	15	13	1	1	16	10	9	15	0	1	9	10	6	23	2	5	8	17
3-Jul	14	14	0	1	14	11	20	16	1	2	21	11	1	23	1	6	2	17
4-Jul	122	22	12	3	134	17	19	18	3	2	22	12	5	23	1	6	6	18
5-Jul	136	30	6	4	142	23	95	23	14	4	109	17	45	26	4	6	49	20
6-Jul	52	33	0	4	52	25	111	30	18	6	129	22	73	32	2	7	75	23
7-Jul	45	36	1	4	46	27	13	31	4	6	17	22	83	37	12	8	95	28
8-Jul	19	37	1	4	20	28	2	31	0	6	2	23	23	39	11	10	34	30
9-Jul	40	40	4	5	44	30	0	31	1	6	1	23	24	41	3	10	27	31
10-Jul	37	42	4	6	41	32	14	32	3	7	17	23	4	41	12	12	16	32
11-Jul	30	44	2	6	32	34	60	36	3	7	63	26	49	44	7	13	56	34
12-Jul	38	46	7	7	45	36	234	50	44	12	278	37	70	49	23	17	93	39
13-Jul	59	50	6	8	65	39	126	58	41	17	167	44	112	57	34	22	146	46
14-Jul	20	51	3	9	23	40	2	58	0	17	2	44	33	60	4	22	37	48
15-Jul	117	59	12	11	129	45	0	58	0	17	0	44	80	65	32	27	112	53
16-Jul	49	62	10	12	59	48	1	58	1	17	2	44	72	70	31	32	103	58
17-Jul	25	63	7	13	32	50	67	62	24	20	91	48	67	75	33	37	100	63
18-Jul	16	64	9	15	25	51	66	66	54	26	120	52	40	78	28	41	68	66
19-Jul	102	70	39	21	141	57	76	71	66	34	142	58	25	80	10	42	35	68
20-Jul	85	76	33	27	118	62	6	71	4	34	10	58	62	84	48	49	110	73
21-Jul	45	78	29	32	74	66	28	73	16	36	44	60	24	86	53	57	77	77
22-Jul	25	80	24	36	49	68	54	76	49	42	103	64	9	86	10	59	19	78
23-Jul	22	81	21	39	43	70	33	78	32	46	65	67	0	86	0	59	0	78
24-Jul	70	86	66	50	136	76	65	82	88	56	153	73	22	88	24	62	46	80
25-Jul	66	90	61	60	127	82	72	86	86	66	158	79	93	95	115	79	208	90
26-Jul	40	92	48	68	88	86	72	91	72	75	144	85	28	97	58	88	86	94
27-Jul	18	93	29	73	47	88	36	93	67	82	103	89	13	98	23	92	36	96
28-Jul	16	94	20	76	36	89	28	95	40	87	68	92	5	98	7	93	12	96
29-Jul	12	95	17	79	29	91	34	97	31	91	65	95	6	98	8	94	14	97
30-Jul	22	97	33	85	55	93	4	97	20	93	24	96	1	98	4	94	5	97
31-Jul	9	97	11	86	20	94	8	98	4	94	12	96	3	99	3	95	6	97
1-Aug	3	97	6	87	9	95	10	98	17	96	27	97	3	99	4	95	7	98
2-Aug	12	98	10	89	22	96	5	99	9	97	14	98	5	99	6	96	11	98
3-Aug	7	98	12	91	19	96	17	100	18	99	35	99	5	100	6	97	11	99
4-Aug	10	99	11	93	21	97	5	100	7	100	12	100	1	100	4	98	5	99
5-Aug	1	99	15	95	16	98	1	100	1	100	2	100	6	100	15	100	21	100
6-Aug	10	100	18	98	28	99	1	100	2	100	3	100						
7-Aug	1	100	1	99	2	99	0	100	0	100	0	100						
8-Aug	0	100	0	99	0	99	0	100	1	100	1	100						
9-Aug	0	100	0	99	0	99												
10-Aug	0	100	0	99	0	99												
11-Aug	3	100	9	100	12	100												
12-Aug	0	100	0	100	0	100												
13-Aug	0	100	0	100	0	100												
TOTAL	3,612		603		2,216		3,634		853		2,487		3,415		672		2,086	

Appendix C2.-Daily and cumulative count of coho salmon through the Deep Creek weir, 1997-2001.

	1997		1998		1999		2000		2001	
	Coho Salmon		Coho Salmon		Coho Salmon		Coho Salmon		Coho Salmon	
Date	Daily Count	Cumulative Proportion	Daily Count	Cumulative Proportion	Daily Count	Cumulative Proportion	Daily Count	Cumulative Proportion	Daily Count	Cumulative Proportion
23-Jul	0	0.00	1	0.00	0	0.00	0	0.00		
24-Jul	0	0.00	0	0.00	0	0.00	0	0.00		
25-Jul	0	0.00	0	0.00	0	0.00	0	0.00		
26-Jul	0	0.00	0	0.00	0	0.00	1	0.00		
27-Jul	0	0.00	1	0.00	0	0.00	0	0.00		
28-Jul	0	0.00	2	0.00	0	0.00	10	0.00		
29-Jul	0	0.00	1	0.00	0	0.00	1	0.00		
30-Jul	0	0.00	6	0.01	0	0.00	12	0.01		
31-Jul	0	0.00	38	0.03	0	0.00	5	0.01		
1-Aug	0	0.00	8	0.04	0	0.00	0	0.01		
2-Aug	1	0.00	12	0.04	1	0.00	11	0.01	1	0.00
3-Aug	1	0.00	29	0.06	0	0.00	17	0.02	1	0.00
4-Aug	0	0.00	0	0.06	2	0.00	19	0.02	9	0.00
5-Aug	1	0.00	0	0.06	1	0.00	44	0.04	27	0.01
6-Aug	5	0.00	0	0.06	15	0.01	26	0.04	10	0.01
7-Aug	6	0.01	0	0.06	6	0.01	77	0.07	17	0.02
8-Aug	1	0.01	0	0.06	0	0.01	26	0.07	4	0.02
9-Aug	1	0.01	0	0.06	3	0.01	30	0.08	61	0.03
10-Aug	2	0.01	49	0.10	35	0.03	91	0.11	2	0.04
11-Aug	23	0.02	41	0.12	5	0.03	104	0.14	11	0.04
12-Aug	78	0.06	123	0.20	16	0.04	90	0.16	51	0.05
13-Aug	2	0.06	36	0.23	66	0.07	68	0.18	94	0.08
14-Aug	16	0.07	91	0.28	46	0.09	141	0.23	68	0.10
15-Aug	4	0.07	99	0.35	29	0.10	175	0.28	57	0.11
16-Aug	21	0.08	142	0.44	52	0.12	198	0.33	154	0.15
17-Aug	7	0.08	133	0.53	84	0.16	101	0.36	240	0.22
18-Aug	7	0.09	37	0.55	115	0.21	41	0.38	245	0.28
19-Aug	9	0.09	21	0.57	38	0.23	120	0.41	200	0.33
20-Aug	1	0.09	105	0.63	36	0.24	300	0.50	147	0.37
21-Aug	64	0.12	35	0.66	68	0.27	183	0.55	320	0.46
22-Aug	132	0.19	149	0.75	13	0.28	107	0.58	182	0.51
23-Aug	226	0.30	25	0.77	215	0.37	10	0.59	238	0.57
24-Aug	82	0.34	165	0.88	181	0.45	29	0.59	78	0.59
25-Aug	40	0.36	69	0.92	115	0.50	19	0.60	168	0.64
26-Aug	324	0.52	13	0.93	256	0.62	8	0.60	84	0.66
27-Aug	224	0.63	12	0.94	157	0.69	230	0.67	69	0.68
28-Aug	70	0.67	11	0.95	22	0.70	360	0.77	79	0.70
29-Aug	8	0.67	1	0.95	20	0.70	411	0.89	163	0.74
30-Aug	39	0.69	12	0.95	25	0.72	197	0.95	80	0.76
31-Aug	119	0.75	22	0.97	125	0.77	3	0.95	82	0.79

-continued-

Appendix C2.-Page 2 of 2.

	1997 Coho Salmon		1998 Coho Salmon		1999 Coho Salmon		2000 Coho Salmon		2001 Coho Salmon	
Date	Daily Count	Cumulative Proportion	Daily Count	Cumulative Proportion	Daily Count	Cumulative Proportion	Daily Count	Cumulative Proportion	Daily Count	Cumulative Proportion
1-Sep	14	0.76	0	0.97	144	0.83	51	0.97	56	0.80
2-Sep	13	0.76	13	0.98	119	0.89	14	0.97	162	0.84
3-Sep	8	0.77	2	0.98	0	0.89	44	0.99	146	0.88
4-Sep	1	0.77	3	0.98	25	0.90	7	0.99	101	0.91
5-Sep	6	0.77	3	0.98	88	0.94	4	0.99	275	0.98
6-Sep	11	0.78	3	0.98	23	0.95	23	1.00	17	0.99
7-Sep	72	0.81	9	0.99	28	0.96	17	1.00	32	1.00
8-Sep	152	0.89	3	0.99	44	0.98			12	1.00
9-Sep	135	0.95	2	0.99	34	0.99			4	1.00
10-Sep	53	0.98	0	0.99	1	0.99			0	1.00
11-Sep	4	0.98	4	1.00	9	1.00				
12-Sep	2	0.98	3	1.00	5	1.00				
13-Sep	0	0.98	0	1.00						
14-Sep	0	0.98	1	1.00						
15-Sep	0	0.98	2	1.00						
16-Sep	0	0.98								
17-Sep	0	0.98								
18-Sep	20	0.99								
19-Sep	0	0.99								
20-Sep	12	1.00								
21-Sep	0	1.00								
Total	2,017		1,537		2,267		3,425		3,747	