KITOI BAY HATCHERY ANNUAL MANAGEMENT PLAN, 1998

By

Andy Hall
Steven G. Honnold
and
James N. McCullough

Regional Information Report[1] No. 4K98-20

Alaska Department of Fish and Game
Commercial Fisheries Management and Development Division
211 Mission Road
Kodiak, AK 99615

May 1998

[1]The Regional Information Report Series was established in 1987 to provide an information access system for all unpublished division reports. These reports frequently serve diverse ad hoc informational purposes or archive basic uninterpreted data. To accommodate timely reporting of recently collected information, reports in this series undergo only limited internal review and may contain preliminary data; this information may be subsequently finalized and published in the formal literature. Consequently, these reports should not be cited without prior approval of the author or the Commercial Fisheries Management and Development Division.

AUTHORS

Andy Hall is the Kitoi Bay Hatchery Manager, an employee of the Kodiak Region Aquaculture Association, Kitoi Bay Hatchery, PO Box KKB, Kodiak, Alaska 99697

Steven G. Honnold is the Kodiak Area Resource Development Biologist, Alaska Department of Fish and Game, Commercial Fisheries Management and Development Division, 211 Mission Road, Kodiak, Alaska, 99615

James N. McCullough is the Region IV Resource and Development Biologist, Alaska Department of Fish and Game, Commercial Fisheries Management and Development Division, 211 Mission Road, Kodiak, Alaska, 99615

PROJECT SPONSORSHIP

Kitoi Bay Hatchery operations are funded by Kodiak Region Aquaculture Association (KRAA). In addition, all evaluation of hatchery salmon stocking programs are funded by KRAA.

ACKNOWLEDGMENTS

The authors would like to thank Steve Schrof and Rob Markle who provided several of the figures used in this report and to Rob for writing Appendix F and for reviewing a draft of the report. Thanks to Lucinda Neel for her mapping and publication expertise. Also, thanks to Dave Prokopowich, Wayne Donaldson, Larry Malloy, and Len Schwarz who provided editorial comments.

TABLE OF CONTENTS

TABLE OF CONTENTS (Cont.)

LIST OF TABLES

LIST OF FIGURES

LIST OF APPENDICES

KITOI BAY HATCHERY ANNUAL MANAGEMENT PLAN
EXECUTIVE SUMMARY, 1998.

New Project for 1998: **Stocking Location - Little Kitoi Lake (LKL)**
Life Stage - presmolt (PS)
Brood stock - Saltery Lake late run Sockeye Salmon
Egg Take Date - September 1997
Stocking Date - April 1999
Egg Take Date - September 1998
Stocking Date - April 2000

Purpose - to develop a return to LKL for brood stock collection
FTP's - 97A0068 (egg take); 97A0069 (stocking max. 300,000 PS)

Cost Recovery Harvests for 1998: NONE

Salmon Adult Returns, Stocking, and Egg-Take Goals (1999 Stocking Goals), 1998:

Stocking Location (Brood stock)	1998 Projected Enhanced Return	1998 Stocking Plan	Goals 1998 Eggs	Goals 1999 Stocking
Kitoi Bay pinks (BKC)	1,100,000	152,000,000 [a]	215,000,000	165,000,000
Kitoi Bay chums (BKC)	44,000	15,000,000 [a]	25,000,000	22,000,000
Kitoi Bay coho (BKC)	123,000	700,000 [b]	1,000,000	700,000
Little Kitoi Lake coho (BKC)	1,500	0	0	0
Jennifer Lake coho (BKC)	3,000	163,000 [a]	232,000	163,000
Ruth Lake coho (BKC)	1,000	35,000 [a]	69,000	35,000
Crescent Lake coho (BKC)	7,000	165,000 [a]	236,000	165,000
Katmai Lake coho (BKC)	1,500	15,000 [a]	21,000	15,000
Little Kitoi Lake sockeye (LKL)	48,000	497,000 [b]	0	0
Little Kitoi Lake sockeye (SL)	0	0	300,000	250,000[a,c]

Brood stocks: BKC - Big Kitoi Creek (Kitoi Bay Hatchery); LKL - Little Kitoi Lake; SL - Saltery Lake.

[a] Brood Year 1997
[b] Brood Year 1996; LKL presmolt (97,000) will be stocked into LKL; LKL smolt will be stocked into Little Kitoi Bay.
[c] 250,000 presmolt will be stocked in the year 2000 from the 1998 egg take.

Summary of active FTP's (for 1997 egg takes) issued to KRAA for Kitoi Bay Hatchery 1998 stocking:

Project Name FTP Number	Issue Date	Expiration Date	Purpose
Kitoi Bay Pinks 96A-0062	9/1/96	8/30/01	Allows Big Kitoi Creek (BKC) pink salmon egg take of 215,000,000 green eggs and release of up to 165,000,000 0.2-0.5 g fry into Big Kitoi Bay.
Kitoi Bay Chums 96A-0063	9/1/96	8/30/01	Allows BKC chum salmon egg take of 25,000,000 green eggs and release of up to 22,000,000 1.5 g fry into Big Kitoi Bay.
Kitoi Bay Coho 94A-0036	10/1/94	6/30/00	Allows BKC coho salmon egg take of 1,000,000 green eggs and release of up to 750,000 20 g smolt into Big Kitoi Bay.
Kitoi Bay Coho 94A-0036	10/1/94	6/30/00	Allows BKC egg take of 650,000 green eggs and release of various numbers of 1.5-5.0 fingerlings to lakes listed below.
Jennifer Lake Coho 92A-0080	6/1/92	6/30/02	Allows release of up to 163,000 BKC 5.0 g fingerlings into Jennifer Lake.
Ruth Lake Coho 92A-0083	6/1/92	12/31/02	Allows release of up to 60,000 BKC 5.0 g fingerlings into Ruth Lake.
Crescent Lake Coho 92A-0079	6/1/92	12/31/02	Allows release of up to 500,000 BKC 1.5 g fingerlings into Crescent Lake.
Katmai Lake Coho 92A-0081	6/1/92	12/31/02	Allows release of up to 30,000 BKC 5.0 g fingerlings into Katmai Lake.
Little Kitoi Sockeye 97A-0068	8/31/97	**8/31/98**	**Allows Saltery Lake (SL) egg take of 1,200,000 green eggs and release of 300,000 presmolt into Little Kitoi Lake and 600,000 smolt into Little Kitoi estuary.**
Little Kitoi Sockeye 97A-0069	8/31/97	**8/31/98**	**Allows release of 300,000 SL presmolt into Little Kitoi Lake.**
Little Kitoi Sockeye 97A-0070	8/31/97	**8/31/98**	**Allows release of 600,000 SL smolt into Little Kitoi Bay.**
Little Kitoi Sockeye 96A-0064	9/1/96	6/30/01	Allows release of up to 750,000 Little Kitoi Lake stock smolt into Little Kitoi Estuary.
Little Kitoi Sockeye 96A-0065	9/1/96	6/30/01	Allows release of up to 150,000 Little Kitoi Lake presmolt into Little Kitoi Lake.

Bold denotes FTP's that will expire or will need changes prior to 1998 stocking and 1998 egg takes.

Kitoi Bay Hatchery Annual Management Plan calendar of events for stocking and egg takes, 1998.

Species	1996 Sep	Oct	Nov	Dec	1997 Jul	Aug	Sep	Oct	Nov	Dec	1998 Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	1999 Jan	Feb	Mar	Apr	May	Jun	Jul	October
Pink Salmon: Big Kitoi Creek Brood Stock																														
Releases: Big Kitoi Bay							208 M Eggs									152 M Fry			215 M Eggs									165 M Fry		
Chum Salmon: Big Kitoi Creek Brood Stock																														
Releases: Big Kitoi Bay					16.2 M Eggs											15 M Fry		25 M Egg									22 M Fry		
Coho Salmon: Big Kitoi Creek Brood Stock																														
Releases: Big Kitoi Bay	1 M Eggs															0.7 M Smolt														
Releases: Big Kitoi Bay							1 M Eggs																					0.7 M Smolt		
Releases: Big Kitoi Bay																				1 M Eggs										0.7 M Smolt -6/00
Releases: Jennifer Lake							0.232 M Eggs									0.163 M Fingerling				0.232 M Eggs								0.163 M Fingerling		
Releases: Ruth Lake							0.069 M Eggs									0.035 M Fingerlings				0.069 M Eggs								0.035 M Fingerlings		
Releases: Crescent Lake							0.236 M Eggs									0.165 M Fed Fry				0.236 M Eggs								0.165 M Fed Fry		
Releases: Katmai Lake							0.021 M Eggs													0.015 M Fingerling										
																				0.021 M Eggs										0.015 M Fingerlings
Sockeye Salmon: Saltery Lake Brood Stock																														
Releases: Little Kitoi Lake							0.3 M Eggs																					0.25 M Presmolt		
																			0.3 M Eggs											0.250 M Presmolt -4/00
Sockeye Salmon: Little Kitoi Lake Stock																														
Releases: Little Kitoi Estuary	0.550 M Eggs															0.4 M Smolt														
Releases: Little Kitoi Lake	0.135 M Eggs															0.097 M Presmolt														

INTRODUCTION

Kitoi Bay Hatchery (KBH) is located on Afognak Island (58°11'04" N. latitude, 152°21'04" W. longitude) on the west side of Izhut Bay approximately 30 air miles North of the city of Kodiak (Figure 1). The facility was constructed in 1954 by the United States Department of the Interior, Fish and Wildlife Service, but was destroyed in the 1964 earthquake and then rebuilt by the Alaska Department of Fish and Game (ADF&G) in 1965. The hatchery was initially designed as a sockeye salmon research facility; in 1976 the emphasis switched to pink salmon production. The present goal of the facility is to provide enhanced salmon fishing opportunities for the Kodiak common property fisheries by increasing the returns of sockeye, coho, pink, and chum salmon primarily to the Kitoi Bay area (Figures 2 and 3). KBH was designed to increase salmon production for Kodiak Island commercial seiners and set gillnet fishery. Secondary user groups (in terms of the number of salmon harvested) to benefit from the hatchery production include subsistence and recreational fishers. KBH has the capacity to incubate 243.5 million salmon eggs and rear up to 180 million juveniles of all life stages (fry, fingerling, presmolt and smolt). Funding for the hatchery was exclusively by ADF&G prior to FY87, and was jointly funded by ADF&G and Kodiak Regional Aquaculture Association (KRAA) from FY87-FY91. The hatchery has been fully funded by KRAA since FY92.

KBH is primarily a site-specific production facility raising four species of juvenile salmon (sockeye, coho, pink and chum salmon). The majority of eggs are collected and incubated on-site, and resultant juveniles of all lifestages are reared and released at the hatchery. The majority of the returning adults are caught in the Duck, Izhut, and Kitoi Bay Sections of the Afognak District by Kodiak's commercial salmon net fishers (Figures 2 and 3).

Big Kitoi Lake (BKL) supplies KBH with water through two 14 inch pipelines (Figure 4). The deep pipeline extends into BKL approximately 400 yards and draws water from a depth of 70 feet, supplying the hatchery with constant 4.0°C water. The shallow pipeline draws water from a depth of 15 feet, supplying water with temperatures ranging from 0.5 ° to 14.0°C. These pipelines connect to a manifold allowing the hatchery to control water temperatures in any part of the hatchery.

Excess lake water drains from BKL through Big Kitoi Creek (BKC; Figure 4). BKC contains a barrier falls approximately 600 yards upstream from salt water and 200 yards down stream from BKL. The falls prevent adult salmon escapement into BKL. The mouth of BKC is adjacent to KBH. A weir is located at the mouth of the creek. Coho, pink and chum salmon adult egg takes occur at the weir.

Little Kitoi Lake (LKL) is located approximately 0.5 miles north of KBH (Figure 4). LKL drains through a weir and fish pass (Alaskan Steeppass type) system located at the effluent of the LKL. All returning adults and outmigrating smolt must pass through this system before entering or exiting the lake. The weir is designed to control movement of both adult and smolt salmon, enabling the single system to monitor escapement and outmigration simultaneously. Smolt outmigration occurs through a pipeline bypass adjacent to the adult fish pass. The fish pass and

outmigration pipeline drain directly into Little Kitoi Estuary. Late run sockeye egg takes (brood source Upper Station and Little Kitoi Lake) previously occurred in LKL (Appendix E).

The development of a pink salmon brood source began at the hatchery in 1976 using donor stock from a small run to Big Kitoi Creek. Pink salmon are the only salmon species indigenous to Big Kitoi Creek. The program expanded from approximately five million eggs in 1976 to 215 million eggs in 1989, and currently remains at this level. All pink salmon eggs are collected from Big Kitoi Creek and incubated at KBH. The resultant pink fry are reared in saltwater net pens adjacent to the hatchery for an eight week period prior to release into Kitoi Bay. In 1998, we propose continuing the KBH pink salmon program at full production (~182 million fry release in 1999).

In 1980, a chum salmon brood stock program began using Sturgeon River stock. Since 1986, runs to the hatchery have been adequate to collect brood stock on site from Big Kitoi Creek. The lack of sufficient brood stock, however, prevented the production goal of 25 million eggs (a 22 million fry release) from being achieved from 1986-1994. In 1995 and 1996, full production was achieved. The chum salmon program at KBH has been impacted by a number of disease problems which decreased production during some years. In 1991 (brood year 1990), an IHNV outbreak resulted in a complete brood year failure. In 1991, ultraviolet light water disinfecting units were installed in the hatchery to sterilize all incubation water in an effort to prevent further disease outbreaks. The ultraviolet water treatment has been successful; no outbreaks of IHNV have occurred in chum salmon since the water has been treated. Chum salmon fry produced at the hatchery are reared in saltwater net pens adjacent to the hatchery for a ten week period before release into Kitoi Bay. In 1998, we propose continuing the KBH chum salmon program at full production (a release of ~22 million fry in 1999).

A coho salmon fry remote release program was started at KBH in 1982 using Buskin and Little Kitoi Lake (LKL) wild stocks. The fry were released into a number Kodiak road system lakes and a portion were back stocked into Buskin and Little Kitoi Lakes. In 1990, coho salmon were released into Kitoi Bay (wild LKL stock) to develop a hatchery brood stock returning to Big Kitoi Creek and to increase the commercial harvest in the Kitoi Bay area. Since 1993, coho salmon runs have been adequate for hatchery egg takes and provided enough eggs to reach production goals (~2 million). The majority of resulting fry are reared to smolt at the hatchery; however, each spring some of the juveniles are released into local lakes in the Kitoi Bay area (Jennifer, Ruth; Figure 1 and 4). In the spring, coho fingerlings are also stocked into Crescent Lake (adjacent to Port Lions; Figure 5) and in the fall fingerlings are stocked into Katmai Lake (adjacent to Ouzinkie village; Figure 1). These projects have created a substantial coho subsistence fishery for the villages of Port Lions and Ouzinkie. We propose continuing the coho fingerling and smolt release program in 1999 at similar release levels as projected for 1998.

A pilot project was initiated in 1989 and continued through 1994 to develop a late run sockeye salmon brood stock that would return to LKL. This program was designed to utilize an age-0 component of the late run Upper Station Lake sockeye salmon stock. These fish were thought to require only a few weeks of freshwater rearing time at the hatchery; thus, returns could be expected sooner than if reared for the normal 1-2 year time period. This project was intended to

develop a brood source at LKL to provide sockeye eggs for incubation and short-term fry rearing at Pillar Creek Hatchery (PCH; Clevenger et al. 1997) with resultant fry stocked into Spiridon Lake. The project was modified in 1993 to produce 4-5 g presmolt and 10 g yearling smolt due to unsatisfactory survival from the age-0 releases. Adult returns to LKL have not been adequate to supply PCH with eggs or to increase releases at KBH for brood stock development. Research by ADF&G in cooperation with the U.S. Fish and Wildlife Service (FWS) concluded that Saltery Lake sockeye salmon is preferred for Spiridon Lake and LKL stocking (Clevenger et al. 1997; Honnold 1997). The run timing of Saltery Lake sockeye salmon is slightly earlier than late run Upper Station/LKL stock (Figure 6). The use of Saltery Lake stock is expected to increase brood stock available at LKL because the Saltery stock should return after the peak of the chum salmon run and before the pink salmon run. This return timing is expected to decrease harvest pressure on sockeye runs and result in improved escapement to LKL (Figures 7-9). We identify production requirements in this plan using Saltery Lake sockeye salmon as the primary stock for brood stock development.

The egg take season at KBH occurs from early July through late October (Figure 7). The first is a chum egg take with a current goal of 25 million eggs. It starts in early July and runs through early August. The next is a pink egg take with a goal of 215 million eggs. It starts in late August and runs through mid September. The season ends with coho egg takes occurring from late September through late October. The coho egg take goal is 2 million eggs. Sockeye salmon egg takes have occurred at LKL during the same period as the coho salmon egg takes. Sockeye brood stock will not be collected until 2001 or 2002 when the first Saltery Lake stock are expected to return to LKL. This eggtake should occur from mid-to-late September.

This management plan will continue to evolve until all programs objectives are reached. Inseason assessments and project approvals by KRAA, ADF&G, or FWS may result in changes to this document in order to reach or maintain program objectives.

1997 BROOD YEAR: RELEASES IN 1998 AND 1999

Table 1 describes 1997 egg takes, planned releases in 1998 and 1999, projected returns in 1999-2002, and the status of Fish Transport Permits (FTP). Appendix A describes juvenile-to-adult survival estimates used to project adult production. Appendices B - E list KBH historical releases for pink, chum, coho, and sockeye salmon, respectively.

Pink Salmon: Kitoi Bay Hatchery (Big Kitoi Creek) Stock

In 1998, we plan to rear and release 152 million 0.5 g pink salmon fry directly into Big Kitoi Bay (Figure 4). The original brood source for the KBH pink salmon project was Big Kitoi Creek. The fry are volitionally released from the hatchery via PVC pipelines into saltwater net pens and reared in salt water for up to eight weeks and then released into Big Kitoi Bay. The actual stocking levels are estimated by the egg to fry survival.

Approximately 4.7 million adult pink salmon are expected to return to KBH in 1999. The pink salmon run should begin in late July, peak in early August and end in late August (Figure 8). Most pink salmon returning to KBH are expected to be harvested in the commercial salmon fishery in Izhut, Duck and Kitoi Bays Sections (Figure 3).

Chum Salmon: Kitoi Bay Hatchery (Big Kitoi Creek) Stock

In 1998, we plan to rear and release 15 million 2.0 g chum salmon fry directly into Kitoi Bay (Figure 4). The original brood source for the KBH chum salmon project was Sturgeon River. The fry are volitionally released from the hatchery via PVC pipelines into saltwater net pens and reared in salt water for up to 12 weeks. The actual stocking levels are estimated by egg to fry survivals.

Approximately 300,000 adults are expected to return starting in 2000 and continuing through 2002. The majority of the return is expected in 2001 since age 0.3 chum salmon (three years ocean residence) historically comprise the majority of the run (Hall et al 1997). Chum salmon runs into Kitoi Bay usually begin in early June, peak in mid-June to early July and end in mid to late July (Figure 8). Most chum salmon returning to KBH are expected to be harvested in the commercial salmon fishery in Duck, Izhut and Kitoi Bay Sections (Figure 3).

Coho Salmon: Kitoi Bay Hatchery (Big Kitoi Creek) Stock

In 1998, we plan to release 700,000 20.0 g age-1 coho smolt (brood year 1996, Big Kitoi Creek brood source) directly into Big Kitoi Bay (Figure 1). The original brood source for the KBH coho salmon project was a mixture of Buskin River and Little Kitoi Lake salmon. The smolt are transferred from the hatchery via PVC pipelines into saltwater net pens and reared for approximately two weeks to provide time for imprinting and osmoregulation. Initial imprinting occurs prior to transfer into salt water while smolt are rearing in freshwater raceways. The smolt are transferred into saltwater net pens located in the vicinity of the Big Kitoi Creek discharge (KBH water source), which is intended to provide further imprinting opportunity. Smolt imprint rapidly once introduced to fresh water (Hasler and Scholz 1983); as little as four hours exposure to fresh water after being transplanted may be sufficient to ensure homing for coho salmon smolt (Mighell 1975 cited in Hasler and Scholz 1983). There is evidence, however, that releasing hatchery-raised fish too early before or too late after smoltification reduces return to the site of release (Reimers 1979 cited in Hasler and Scholz 1983). Several studies indicated that the return rate for transplanted coho smolt may range from 2%-5% with 95% of recovered fish captured in the stream of release which compares favorably to homing in natural populations (Hasler and Scholz 1983). The average survival from smolt released to adult return to Big Kitoi has been ~12%; adults stage in vicinity of BKC (Hall et al 1997). This indicates coho smolt released at Big Kitoi Bay are homing well to the release site. We expect ~84,000 adults to return in 1999 as age 1.1 coho salmon (Table 1).

In 1998, we also plan remote releases of 198,000 1.5 g coho fingerlings (brood year 1997 Big Kitoi Creek brood source) into Ruth and Jennifer Lakes (35,000, 163,000 respectively; Figure 1

and 4). The fingerlings are transported from the hatchery to each lake by transfer tank hauled on logging roads by a 4-wheel ATV. Stocking levels are determined by limnological analysis of each lake. Both Ruth and Jennifer Lakes are barren lakes with barrier falls. About 11,000 adults are expected to return in 2000 and 2001 from these releases (Table 1).

In 1999, we plan to release 700,000 20.0 g age-1 smolt (brood year 1997, Big Kitoi Creek brood source) directly into Kitoi Bay in a manner similar to the 1998 coho smolt release. From this release, about 84,000 adults are expected to return to the Kitoi Bay area in 2000 (Table 1).

Coho salmon runs into Kitoi Bay usually begin in early August, peak in mid to late August and end in early September (Figure 8). Most coho salmon returning to KBH should be harvested in the commercial salmon fishery in Duck, Izhut and Kitoi Bay Sections (Figure 3).

In 1998, we also plan remote releases of 165,000 1.5 g coho fingerlings into Crescent Lake (Port Lions village) and 15,000 7.0g coho fingerlings into Katmai Lake (Ouzinkie village, Figure 1, Table 1). The juveniles are transported to each site by float plane and transfer tank. Crescent Lake stocking levels are estimated by limnological analysis. Katmai Lake stocking levels were estimated by modeling the surface area of the lake (limnology samples are not collected). The release of presmolt in late fall is expected to minimize impacts to the lakes forage base. Remote releases into Crescent and Katmai Lakes have occurred annually since 1987.

Adult returns (brood year 1997) are projected to be 3,500 to Crescent Lake and 1,500 to Katmai Lake in 2000 (Table 1). These salmon are primarily harvested during subsistence fisheries by the residents of each neighboring village. A portion of the Crescent Lake run may be available for a commercial harvest in the Northwest Kodiak District (Figure 1) and the Crescent Lake Terminal Harvest Area (Figure 5) during normal commercial fishery openings.

Sockeye Salmon: Little Kitoi Lake Stock

In 1998, we plan to release 400,000 10.0 g age-1 late run sockeye smolt (brood year 1996, LKL brood source) into Little Kitoi Estuary. These smolt are the last release of this stock (original donor - late run Upper Station sockeye); the brood stock has been changed to Saltery Lake sockeye salmon. The original plan was to release all of the late run sockeye as age-1 smolt as in previous years; however, due to poor survival and low returns, a portion (within the limits of the FTP) will be released as presmolt into LKL to improve survival and imprinting (see below).

The saltwater released smolt will be transferred from the hatchery to Little Kitoi Estuary via transfer tank installed on a skiff. The smolt will be raised in Little Kitoi Estuary at the out fall of LKL in saltwater net pens for a minimum of three days before release. The imprinting process for sockeye salmon smolt is thought to be rapid (Hasler and Scholz 1983) occurring in less than ten days upon introduction to fresh water (Shirahata and Tanaka 1969 cited in Hasler and Scholz 1983). The net pens will be surrounded by boom material to allow a freshwater lens to develop. The freshwater lens is intended to aid in the imprinting process. In addition, freshwater will be siphoned from LKL to the boomed area to provide additional depth to the lens. Three types of

tests are often performed to assess salt-water adaptation in salmonids: salinity tolerance and preference, osmoregulatory capability, and gill Na+/K+ ATPase activity (Hasler and Scholz 1983). Gill Na+/K+ ATPase, plasma thyroxine (T4), or the saltwater challenge-blood sodium test are recommended to track smolt development and monitor effects of hatchery practices and environmental factors (Wedermeyer et al. 1980). Thus, prior to release into net pens, saltwater challenges will be conducted and blood sodium levels assessed. Smolt observed to be osmoregulating properly (150-170 meq/L) will be released into the saltwater pens. Salinity and temperature will also be monitored inside and outside of the boomed area to establish salinity trends during the rearing and release periods. Actual rearing time will be determined as the spring progresses and weather, water temperature and other factors (water quality, sea state, predators, etc.) affecting the smolt are monitored. A portion (45,000) of these releases will be marked by fin clipping (see EVALUATION section and Appendix F). A total of 16,000 adult sockeye are expected to return in 2000 and 2001 from this release (Table 1).

In addition, we plan to release 97,000 9.0 g late run sockeye presmolt (brood year 1996, LKL brood source) into Little Kitoi Lake in April 1998. The presmolt will transferred from the hatchery to Little Kitoi Estuary via transfer tank installed on a skiff and then transported to the base of the fishpass located at the outlet of LKL. There, the presmolt will be transferred to a tank in a skiff in the lake and transported to the release site in the main basin of the lake. A portion (10,000) of these releases will be marked by fin clipping (see EVALUATION section and Appendix F). A total of 9,700 adult sockeye are expected to return in 2000 and 2001 from this release (Table 1).

The late sockeye run (LKL and US brood source) should begin in late July, peak in early to mid August and end in early September (Figure 9). The majority of the fish should be caught by the Kodiak commercial salmon net fishery in Duck, Izhut and Kitoi Bays Sections (Figures 3 and 9).

Sockeye Salmon: Saltery Lake Stock

Since 1994, PCH has annually released about 150,000 early run sockeye salmon presmolt (Afognak Lake brood stock) into LKL (Honnold and Clevenger 1995; Clevenger et al. 1996, Clevenger et al. 1997). Additionally, KBH has annually released up to 150,000 late run presmolt (LKL and Upper Station brood stock) into LKL. Starting in 1998 PCH will no longer release early run presmolt into LKL. We propose that the loss of production due to the elimination of PCH stocking project be compensated for by increasing the number of late-run (Saltery Lake stock) presmolt released from KBH into LKL to 250,000 fish, beginning in 1999. A portion of these releases will be marked by fin clipping (see EVALUATION section and Appendix F). The actual number released will be determined after annual limnological analysis of the lake.

The juveniles will be transported to LKL by transfer tank installed on a skiff and then hauled up the LKL fish pass by bucket, loaded into a skiff, transported across the lake to an influent creek (Elk Creek) and released directly into LKL. The juveniles will be released into LKL in early April 4-6 weeks before the historic LKL outmigration of sockeye smolt.

The juveniles are being released into LKL in an effort to increase juvenile to adult survivals by increasing imprinting time and allowing natural outmigration. If the proposed increase in pre-smolt released into LKL is approved there will not be a saltwater smolt release. In the past the majority of the hatchery reared sockeye were released as smolt directly into Little Kitoi Estuary. If the presmolt release is not approved or limnology data indicates that LKL should not be stocked, the juveniles will be held to smolt at KBH and released directly into Little Kitoi Estuary in a similar manner as in the past. However, the smolt release strategy may be modified to increase freshwater imprinting at LKL; possibly by using the fish pass compound (similar to "typical" cement raceways) at the outlet of the lake to hold the smolt for a longer period prior to release.

Approximately 25,000 adults are expected to return in 2001 and 2002 from these releases. The returning adults are expected to have similar run timing as Saltery Lake sockeye salmon with the initial run beginning in late June, peaking in mid to late July and ending in mid-August (Figures 6, 7, and 9; Honnold 1997). Timing is earlier then Upper Station and Little Kitoi sockeye salmon and should make brood stock collection easier since they should return after most of the chum salmon and before most of the pink salmon to Kitoi Bay. This return timing is expected to reduce their harvest in the common property fishery and increase escapement into LKL.

In summary, we propose releasing the following juveniles (brood year 1996, 1997) in 1998: 152 million pink salmon fed fry, 15 million chum salmon fed fry, 700,000 coho smolt, 378,000 coho fingerlings, 400,000 sockeye salmon smolt (BR 96), and 97,000 sockeye salmon presmolt (BR 96; Table 1). In addition, we propose releasing 700,000 coho smolt and 250,000 sockeye presmolt in 1999 (BR 97).

1998 BROOD YEAR: RELEASES IN 1999 AND 2000

Table 2 describes 1998 egg takes, planned releases in 1999 and 2000, projected returns for 2000-2003, and the status of Fish Transport Permits. Appendix A describes juvenile-to-adult survival estimates used to project adult production.

Pink Salmon: Kitoi Bay Hatchery (Big Kitoi Creek) Stock

In 1999, we intend to release up to 165 million 0.5 g pink salmon fry into Kitoi Bay (Table 2). The original brood source for the KBH pink salmon project was Big Kitoi Creek. At this time, a pink salmon release of this magnitude would be at KBH's maximum capacity. The actual number may be less depending on how many chum salmon eggs are collected and egg to fry survival of both pink and chum salmon. That is, the chum salmon run and associated brood stock collection occurs prior to the pink salmon run and brood stock collection (Figures 7 and 8); thus, the proposed collection of pink salmon eggs may be decreased inseason depending upon incubation space available. Incubation space is the limiting factor on how many pink and chum eggs are collected; the larger the chum salmon egg take (maximum 25 million), the fewer pink salmon

eggs that can be incubated. In 1998, if the chum salmon egg take is less then 25 million eggs, the remaining incubation space will be filled by pink salmon eggs (maximum of 215 million eggs).

Approximately 5.0 million adults pink salmon are expected to return to KBH in 2000 (Table 2). The pink salmon run is expected to begin in late July, peak in early August and end in mid to late August (Figures 7 and 8).

Chum Salmon: Kitoi Bay Hatchery (Big Kitoi Creek) Stock

In 1999, we intend to release up to 22 million 2.0 g chum salmon fry into Kitoi Bay (Table 2). The original brood source for the KBH chum salmon project was Sturgeon River. The actual number released will depend on the number of eggs collected and the egg to fry survival. KBH's maximum capacity is 25 million chum salmon eggs; approximately 22 million fry should result from a maximum egg take.

From the 1999 release, about 440,000 chum salmon adults are expected to return in 2001 through 2003. The majority of the return is expected in 2002 since age 0.3 chum salmon (three years ocean residence) historically comprise the majority of the run (Hall et al 1997). The run is expected to begin in early June, peak in mid-June to early July and end in mid to late July depending on run strength (Figures 7 and 8).

Coho Salmon: Kitoi Bay Hatchery (Big Kitoi Creek) Stock

In 1999-2000, we intend to release ~1,078,000 juvenile coho salmon of Big Kitoi Creek brood stock. The original brood source for the KBH coho salmon project was a mixture of Buskin River and Little Kitoi Lake. The releases will occur in Kitoi Bay and five Kitoi area lakes (Table 2).

In 1999, we plan to release 198,000 1.5 g coho fingerlings (brood year 1998) into Ruth and Jennifer Lakes (35,000, 163,000 respectively; Figure 4). The fingerlings are transported from the hatchery to each lake by transfer tank hauled on logging roads by a 4-wheel ATV. Stocking levels are determined by limnological analysis of each lake. Both Ruth and Jennifer Lakes are barren lakes with barrier falls.

In 1999, we also plan to release 165,000 1.5 coho fingerlings into Crescent Lake (Port Lions village) and 15,000 7.0 g fingerlings into Katmai Lakes (Ouzinkie village), in the same manner as described for 1998.

The release in Kitoi Bay in 2000 will consist of 700,000 20.0 g age-1 smolt (brood year 1998). The smolt will be reared and released in a manner similar to the 1999 coho smolt release.

Approximately 14,000 adults are expected to be produced from fingerling stocking and 1,500 from presmolt stocking in 1999 (brood year 1998) and an additional 84,000 adults from smolt stocking in 2000 (brood year 1998; Table 2). Of these 99,000 returning adults, ~ 90,000 will be

available for harvest in 2001 and in the Kitoi Area (Izhut, Duck, and Kitoi Bays Sections, Figure 3). Adult returns are projected to be 3,500 to Crescent and 1,500 to Katmai Lake in 2001 and are primarily harvested in a subsistence fishery by the residents of each neighboring village. A portion of the Crescent Lake returns may be available for a commercial harvest in the Northwest Kodiak District (Figure 2) and the Crescent Lake Terminal Harvest Area (Figure 5) during normal commercial salmon fishery openings. These coho salmon runs should begin in early August, peak in mid to late August and end in early September (Figures 7 and 8).

Sockeye Salmon: Saltery Lake Stock

Since 1989, ADF&G and KRAA have attempted to develop a late run sockeye salmon brood stock at LKL for use at Spiridon Lake. The project started in 1989 and continued through 1994 using a zero check component of the Upper Station late run. Due to unsatisfactory returns the project was modified in 1993 to produce 3-4 g presmolt and 10 g yearling smolt. The brood source for these juveniles was both LKL and Upper Station. From 1992 through 1996 late run sockeye egg takes have occurred at LKL, these egg takes have not been adequate to supply fry for Spiridon Lake. All the eggs taken at LKL have been reared at KBH. In the event that egg takes at LKL were insufficient to supply KBH, additional Upper Station eggs were supplied to KBH from Pillar Creek Hatchery.

Local ADF&G, FWS, and KRAA staff have determined that Saltery Lake is a preferred brood stock for Spiridon Lake stocking (Clevenger et al. 1997, Honnold 1997). The transition from Upper Station (Little Kitoi) to Saltery Lake as the primary brood source started with the 1997 egg take (1998 stocking year). In the event that future egg takes at Saltery Lake are not approved, LKL would be the secondary egg source.

We propose continuing the present late run sockeye salmon brood stock development program (see preceding sections - 1997 Brood Year Releases in 1998 and 1999) with Saltery Lake sockeye as the primary brood source in 1998. The Saltery Lake brood stock would replace the Little Kitoi/Upper Station stock now returning to LKL. As the brood stock program develops, LKL would eventually become the sockeye salmon egg-take site for the Spiridon lake project (Honnold et al. *in press*).

In 2000, we intend to release 250,000 15 g presmolt directly into LKL in a manner similar to the 1999 sockeye presmolt release. The actual number released will be determined after annual limnological analysis of the lake.

The juveniles will be transported to LKL by transfer tank installed on a skiff and then hauled up the LKL fish pass by bucket, loaded into a skiff, transported across the lake to an influent creek (Elk Creek) and released directly into LKL.

Approximately 25,000 adults are expected to return in 2002, 2003 from these releases. The returning adults are expected to have similar run timing as Saltery Lake sockeye salmon with the initial run beginning in late June, peaking in mid to late July and ending in mid-August (Figures 6, 7, and 9; Honnold 1997). Timing is earlier then Upper Station and Little Kitoi sockeye salmon

and is expected to make brood stock collection easier since they should return after most of the chum salmon and before most of the pink salmon to Kitoi Bay. Harvest of sockeye is expected to be reduced substantially, thus, increasing escapement into LKL for improved brood stock collection.

In summary, we expect the following releases and production from brood year 1998 egg takes: 165 million pink salmon fry producing 4.95 million adults, 22 million chum salmon fry producing 440,000 adults, 700,000 coho smolt producing 84,000 adults, 378,000 coho fingerlings producing 15,500 adults, and 250,000 sockeye presmolt producing 25,000 adults (Table 2). This equates to 189 million juveniles released, producing over 5 million returning adults.

SALMON HARVEST MANAGEMENT

The estimated run, and harvest of salmon returning to systems in 1998 as a result of KBH stocking is projected as follows.

Species	Run	Range	Harvest
Kitoi Bay Hatchery			
Pink*	1,100,000	714,000-1,960,000	835,000
Chum*	44,000	33,000-60,000	17,000
Coho**	134,000	88,000-180,000	131,000
Note: coho salmon run will include 6,000 from Jennifer Lake stocking, 2,000 from Ruth Lake stocking, 3,000 from Little Kitoi Lake stocking, and 123,000 from Big Kitoi Bay stocking.			
Little Kitoi Lake			
Late Run Sockeye**	48,000	16,000-60,000	48,000
Crescent Lake			
Coho**	7,000;	3,000-10,000	7,000
Katmai Creek			
Coho**	1,500	800-2,200	1,500

*Hall, unpublished
**Honnold 1998, unpublished

Release Site: Kitoi Bay Hatchery

The Kitoi Bay harvest strategy is described in the Eastside Afognak Management Plan (ADF&G 1996). The harvest strategy is designed to increase fishing opportunities for the commercial salmon net fishery in the Duck, Izhut and Kitoi Bay Sections (Figure 3) while providing for adequate brood stock escapement to KBH. Most of the salmon returning to KBH are harvested in these three sections. It is recognized that a joint effort between ADF&G and KRAA is necessary to continue operation of the hatchery at full production levels. Inseason management of KBH salmon runs is complicated because of overlapping run timing between species and the escapement priority given to brood stock requirements (Figures 7 and 8).

Priority will be given to brood stock capture goals; therefore, inseason adjustments in fishing opportunity in any or all management units may be necessary (Table 3). These compromises may occur more frequently in the Kitoi Bay Section and least frequently in the Duck Bay Section. Brood stock collection schedules will maintain the genetic diversity of returning salmon at KBH and allow future harvest in the common property fishery (Figure 3). During the brood stock collection periods, the burden of achieving adequate brood stock escapement while maintaining high quality harvests on hatchery bound returns will be shared by the Kodiak Commercial Fisheries Management Biologist and the Kitoi Bay Hatchery Manager.

Kitoi Bay Special Harvest Area (SHA) is defined as that portion of the Kitoi Bay section Northwest of a line from the regulatory markers located at the entrance of inner Kitoi Bay ("the jaws"; Figure 4). Cost recovery fisheries occurred in the SHA in 1987, 1988 and 1989. Cost recovery fisheries have not occurred in the Kodiak Management Area since 1989 and none are planned in 1998.

Pink Salmon

Pink salmon produced at KBH are taken in purse and beach seine fisheries and contribute to the commercial catch in the Duck, Izhut, and Kitoi Bay Sections (Figure 3). Set gillnet fishers also benefit as a result of the relocation of a segment of the purse seine fleet to target Kitoi salmon. Natural stocks of pink salmon destined for the Westside of Kodiak Island and other Afognak Island systems may also contribute to the harvest.

The Kitoi Bay area will be managed under the guidelines in the Eastside Afognak Management Plan (ADF&G 1996: 5 AAC 18.365). Depending on run strength (forecast for 1998 is 1.1 million pink salmon) there will be an opening, historically in late July, to harvest excess males which usually arrive during the early portion of the run. In order to harvest pink salmon in excess of the hatchery brood stock needs (275,000; Table 3) additional openings in this area may occur. It is an annual objective that the hatchery brood fish sex ratio be at least 60% female to allow for egg take goals, and for salmon to be available to spawn over a four week period, to ensure the maintenance of genetic diversity. In 1998, a pink salmon cost recovery will not occur at Kitoi SHA.

Depending on run strength and timing, the Kitoi Bay Section may close to commercial salmon fishing from August 8 through August 16 to allow for pink salmon brood stock escapement (Figure 7). Most pink salmon brood are expected to be collected by mid-August. If further closures are needed to ensure adequate brood stock, the Izhut and Duck Bay Sections may also close to commercial salmon fishing. Once all pink salmon brood stock are collected and contained behind the barrier net enclosure in Kitoi Bay Estuary (Figure 4), additional commercial fishing time may occur inside Kitoi Bay. Fishing periods are coordinated between the Hatchery Manager and Kodiak Commercial Fisheries Management Biologist to assure adequate brood fish. Big Kitoi Creek pink salmon escapement is monitored at a weir. Escapement goals have not been formally established for Big Kitoi Creek; however, each year, on average, ~ 15,000 pink salmon not necessary for brood stock have been allowed into the creek. Coordinated management of the fisheries and brood stock collection has been effective at Kitoi for the past 15 years.

Chum Salmon

Chum salmon produced at KBH are taken in purse and beach seine fisheries and contribute to the commercial catch in the Izhut, Duck and Kitoi Bay Sections (Figure 3). In 1998, chum salmon returns to Kitoi Bay are projected at 44,000 total adults (Hall et al. 1997). Chum salmon brood stock requirements for KBH are 30,000 fish (Table 3); therefore, a limited commercial fishery targeting chum salmon is expected in the Izhut, Duck or Kitoi Bay Sections in 1998.

The chum salmon return begins in early June, peaks in late June to early July and ends in mid to late July (Figure 8). Most of the chum salmon are expected to be in inner Kitoi Bay (inside "the jaws"; Figure 4) by late July. Chum salmon brood stock collection is expected to occur from mid-June through early July (Figure 7).

Duck, Izhut and Kitoi Bay Sections typically open to commercial salmon fishing in early June, depending on run strength, in order to harvest adults in excess to hatchery brood stock needs. Additional openings in these Sections may occur as run strength is determined.

The Kitoi Bay Section may close to commercial salmon fishing from mid-June through early July to allow for chum salmon brood stock escapement. Most chum brood are expected to be collected by early July. If further closures are required to ensure adequate brood stock, the Izhut and Duck Bay Sections may also close to commercial salmon fishing.

The Kitoi Bay area will be managed under the guidelines in the Eastside Afognak Management Plan (ADF&G 1996: 5 AAC 18.365). The incidental harvest of hatchery bound chum salmon has been estimated to be as high as 50% of the run in some years (Brennan et al. 1996). The major harvest areas are Duck, Izhut and Kitoi Bay Sections (Figure 3). The Hatchery Manager and Kodiak Commercial Fisheries Management Biologist will coordinate openings in the Duck, Izhut, and Kitoi Bay Sections to minimize the harvest of chum salmon during the June sockeye salmon and late July pink salmon fisheries. Brood fish are retained by a barrier net enclosure in the Kitoi Bay Estuary (Figure 4). Once all chum salmon brood stock are collected and contained behind the barrier net additional commercial fishing time may occur inside Kitoi Bay. Big Kitoi Creek chum escapement is monitored at a weir. Escapement goals have not been formally

established for Big Kitoi Creek; however, each year, on average, ~ 2,000 chum salmon in excess of brood stock needs have been allowed into the creek each year. In 1998, a chum salmon cost recovery harvest will not occur at Kitoi SHA.

Coho Salmon

Coho salmon produced at KBH are taken in purse and beach seine fisheries and contribute to the commercial catch in the Duck, Izhut and Kitoi Bays Sections (Figures 3 and 4). Coho salmon brood stock requirements are 6,000 (Big and Little Kitoi) (Table 3) while the adult return forecast is 134,000 fish; therefore, a commercial fishery targeting excess coho salmon is expected in the Kitoi Bay area in 1998.

The coho run is expected to start in late July, peak in late August, and continue through the beginning of September (Figures 7 and 8). The majority of the coho will be harvested incidental to the pink salmon fishery in the Kitoi area as well as in directed coho fisheries in late August and early September.

The Kitoi Bay area will be managed under the guidelines in the Eastside Afognak Management Plan (ADF&G 1996: 5 AAC 18.365). Hatchery brood stock will be collected throughout the coho salmon run. In the past, a specific commercial fishing closure has not been necessary to ensure adequate brood stock. The run strength in 1998 is estimated to be substantially larger than brood stock requirements; therefore, specific commercial fishing closures are not expected to occur. In addition, once all coho salmon brood stock are collected and contained behind the barrier net, an increase in commercial fishing time may occur inside Kitoi Bay.

In addition to commercial salmon fishing, a substantial number of coho salmon brood stock have been lost to marine mammal predation and to sport and subsistence fishing (Hall et al. 1997). In the event that brood stock collection objectives (5,000 salmon) are not being met, a 500 yard closure out from the barrier net may be enacted by emergency order to reduce sport and subsistence fishing pressure during the 1998 coho salmon run. Proposals to address the loss of coho brood stock to sport fishers will be presented by KRAA at the next scheduled Kodiak regulatory meeting of the Alaska Board of Fisheries. KRAA proposals may include regulatory time and area closures which will ensure an orderly egg take and an established sport fishing season in Kitoi Bay.

Brood fish are retained by a barrier net enclosure in the Kitoi Bay Estuary (Figure 4). Big Kitoi Creek escapement is monitored at a weir. In 1998, a coho salmon cost recovery will not occur at Kitoi SHA.

Release Site: Little Kitoi Lake/Estuary

Early Run Sockeye

The June 9 through ~July 20 Kitoi Area Harvest Strategy (Prokopowich et al. 1997) is designed to achieve harvest objectives for salmon stocks of the Duck, Izhut, and Kitoi Bays Sections produced

from the Little Kitoi Lake early run enhancement project (Honnold et al. *in press*). In 1998, all of the run (18,000; Honnold et al. *in press*) will be available for harvest. The fish pass at the mouth of LKL will remain closed to allow for commercial fishing within Little Kitoi Bay (Honnold and Clevenger 1995, Clevenger et al. 1996 and 1997). Fish that are not harvested will be collected at the fish pass compound and donated to charitable organizations in Kodiak. This will prevent fish from straying from the fish pass while it is closed to escapement into LKL. In addition to providing commercial harvest opportunities, this stock was originally developed as a back up brood source if escapements were too low at Afognak Lake to provide for early run stocking projects. This goal will be discontinued in 1998. The Afognak Lake sockeye run is expected to be large enough to provide eggs for all early run stocking projects in the future (Honnold et al. *in press*).

The Kitoi Bay area will be managed under the guidelines in the Eastside Afognak Management Plan (ADF&G 1996: 5 AAC 18.365). The early sockeye run (Afognak Lake stock) should begin in late May and continue through June (Figure 10). Commercial fishing may occur in early June to coincide with the early part of the chum salmon run. The impact on chum salmon brood stock collection should be minimal because the early portion of the chum salmon run is usually composed of a high percentage of males (Hall et al. 1997). Additional short openings may occur in the Kitoi Bay area, depending upon the sockeye and chum salmon run strength. Additional commercial fishing time may also occur inside Kitoi Bay once all chum salmon brood stock are collected and contained behind the barrier net.

Late Run Sockeye

In 1998, late run sockeye salmon (LKL and Upper Station stock) will be returning to LKL and all will be available for harvest. The fish pass at the mouth of LKL will remain closed throughout the late run (until ~August 20 when coho escapement begins) to prevent escapement. This strategy is needed to eliminate LKL stock from the lake which is necessary to simplify development of the Saltery Lake brood stock program. The fish pass closure will allow commercial fishing to occur in Little Kitoi Bay within the Kitoi Bay Section (Figure 4). Fish that are not harvested will be prevented from straying as described above for early run sockeye.

The late sockeye run should begin in late July and continue through August (Figure 9). The majority of the adults will be harvested incidental to the pink and coho salmon commercial harvests. Once all pink salmon brood stock are collected and contained behind the barrier net, additional commercial fishing time may occur in the Kitoi Bay Section.

Release Site: Jennifer, Ruth, Little Kitoi Lake

Coho Salmon

The purpose of the Jennifer and Ruth Lake coho salmon stocking projects are to provide enhanced coho salmon for harvest as they return to the Kitoi area (Figure 1, 2, and 4). The Kitoi harvest strategy is also intended to protect Big Kitoi Creek escapement (brood source for the stocking of

these lakes; Figure 4). Coho salmon returning to Jennifer and Ruth Lakes are expected to be harvested during commercial fisheries in Duck, Izhut and Kitoi Bay Sections (Figure 3). The Jennifer and Ruth Lakes have barrier falls preventing escapement; all coho salmon will be available for harvest.

At LKL the fish pass and weir will be closed until ~August 20 to prevent sockeye salmon from escaping into the lake (see above sections for sockeye salmon). Coho will be able to enter LKL after ~August 20 to provide escapement (range of ~500-1000 salmon 1992-1996) and prevent straying. Peak run timing is slightly later than the pink salmon peak; however the majority of coho salmon are expected to be harvested incidentally during the pink fishery. Brood fish are not required at Jennifer or Ruth Lakes since they are the product of a remote release from KBH. Fish that are not harvested at Jennifer and Ruth Lakes have access to outlet streams so are not expected to stray to other systems.

Release Site: Crescent Lake

Coho Salmon

The purpose of the Crescent Lake coho salmon stocking project is to provide enhanced coho salmon for harvest as they return to Crescent Lake (Figure 5; ADF&G 1996, 5 AAC 18.364). The management plans intent is to provide adequate protection for escapements of wild salmon migrating in the area. Most of the 1998 coho run is expected to be harvested in the local sport and subsistence fishery; however, a portion of the run may be available for commercial harvest after September 10. The commercial harvest of Crescent Lake coho salmon is expected to occur during normal fishing periods targeting coho salmon in the Northwest Kodiak District (Figure 2). Special openings are not expected to occur within the Terminal Harvest Area (THA; Settler Cove; Figure 5; ADF&G 1996). In 1998, the THA will be opened only if large numbers of coho salmon are not harvested during normal fishery openings in the Northwest Kodiak District and large numbers of coho are observed in the Settler's Cove area. Crescent Lake does not require brood fish, escapement or cost recovery, so all returning coho salmon will be available for harvest. Natural barriers prevent salmon access to the lake; however, fish that congregate in the outlet stream are prevented from straying since the villagers of Port Lions utilize all inriver escapement for subsistence purposes. Harvest information will be monitored through subsistence permits issued to each fisher and commercial fish ticket data.

Release Site: Katmai Lake

Coho Salmon

The purpose of the Katmai Lake coho salmon stocking project is to provide adult returns for sport and subsistence harvest by Ouzinkie Village residents (Figure 1). Most coho returning to Katmai Lake are expected to be harvested in the local sport and subsistence fishery. Some may also be harvested in commercial fisheries in the Northwest Kodiak District (Figure 2). All returning coho salmon will be available for harvest. Brood fish are not required since they are a

product of a remote release from an ongoing project at KBH. This is a barriered system which prevents any escapement into the lake; fish do not stray since the residents of the village harvest all inriver escapement. Harvest data will be monitored through subsistence permits and commercial fish ticket data.

General Conditions of Harvest Management, 1998

The primary objective of KBH is to provide salmon for common property fisheries. It is recognized that a joint effort among ADF&G and KRAA is necessary to continue the operation of the hatchery at full production levels. The Kodiak Area Management Biologist will manage fisheries to ensure adequate brood stock and an orderly common property fishery. Operation of the hatchery will maintain the genetic diversity of all brood stocks at KBH and allow future harvest in the common property fishery.

Special Harvest Area Description, Conditions, and Harvest Strategies: KBH

Kitoi SHA is defined as that portion of the Kitoi Bay section Northwest of a line from the regulatory markers located at the entrance of Kitoi Bay ("the jaws", Figure 4). Funds received from the 1989 cost recovery will be used to operate the hatchery in FY99. The common property fishery will harvest all excess salmon over brood stock needs. Harvest information will be monitored through the ADF&G fish ticket information collected from each buyer. Due to the harvest location (Kitoi Bay), incidental catch of non-targeted species should be insignificant.

1998 ESCAPEMENT GOALS AND BROOD STOCK REQUIREMENTS

KBH escapement goals for all species are described in Table 3. Adult pink, chum and coho salmon returning to Big Kitoi Creek are returning to KBH since the imprinting source (hatchery water) is Big Kitoi Creek (Figure 4). Only pink salmon are indigenous to Big Kitoi Creek. All returning salmon are initially prevented access to Big Kitoi Creek by a weir and a barrier falls prevents fish from entering Big Kitoi Lake. Pink and chum salmon are allowed to enter the creek and spawn to propagate the run in the event of the loss of the hatchery reared fish. Coho salmon that are not harvested or used for brood stock are killed and donated to charitable organizations in Kodiak. Pink and chum salmon eggs collected from salmon returning to Big Kitoi Creek/KBH will provide fry for release into Big Kitoi Bay in 1999. Coho eggs collected from KBH will provide fry for release at Big Kitoi Bay, Crescent, Katmai, Jennifer, and Ruth Lakes in 1999 and 2000. Pink and chum salmon escapements include the number of salmon remaining in the creek after KBH has finished its egg takes.

Little Kitoi Lake (LKL) escapement is monitored through a weir at the lake outlet. LKL sockeye salmon escapement will not be required in 1998.

Saltery Lake sockeye replaced Upper Station as the late run brood source in 1997 for enhancement and brood stock development. Approximately 4,600 Saltery Lake sockeye salmon will be necessary in 1998 for brood stock for PCH to continue the Spiridon and Ruth Lake projects (Honnold et al. *in press*). KBH will need an additional 295 adults for brood stock development (presmolt releases) at LKL. The lower range of the BEG for Saltery Lake is 20,000 sockeye salmon (Malloy and Prokopowich 1992; Brennan et al. 1996). Approximately 50% of the escapement in excess of the minimum goal (20,000) will be available for brood stock collection. Eggs will not be collected if escapement is less than 20,000 salmon.

ADDITIONAL MEASURES FOR WILDSTOCK PROTECTION

Genetics Policy

Currently, the ADF&G Genetics policy is being revised (D. Moore, ADF&G, Anchorage, personal communication). The present policy is designed to assure that stocking projects do not negatively impact the genetic integrity of wild stocks (McGee 1995). The policy addresses three primary areas: *1) stock transport; 2) protection of wild stocks; and 3) maintenance of genetic variance.*

Stock transport concerns include interstate, inter-regional, and regional transport. The latter applies to KBH programs and specifies that the donor stocks must be phenotypically matched to the environment at the stocking site and to management goals. Water chemistry, temperature profiles, time of spawning, and fry emergence should be matched with the hatchery environment. Also, the distance of transport should be considered - the longer the distance, the greater risks of straying and the likelihood of poor results.

All pink (BKC), chum (Sturgeon River), and coho (Buskin and Little Kitoi Lakes) salmon stocks transported to KBH for brood stock development and enhancement projects, which are now developed and returning to the facility each year, were local Kodiak Island stocks (Figure 1 and 4). Saltery Lake sockeye salmon stock is now used for the brood stock development program at KBH and is permitted under the current FTP process (Figure 1).

Protection of wild stocks emphasizes that the hatchery fish straying and intermingling with wild stocks should be minimized. Unique or significant wild stocks should be identified to determine sensitive areas of movement. Rehabilitation and enhancement of significant stocks can only be conducted by stocking of indigenous progeny; gametes can only be removed, raised at a hatchery, and returned to the donor system with one generation of separation. Also, some drainages should be considered gene reservoirs and only stocked with indigenous progeny and a conservative sliding egg-take removal schedule applied. Lastly, fish releases where no interaction with, or impact on significant stocks and are not for the purpose of development, enhancement or rehabilitation of a stock will not be restricted by genetic concerns (release for terminal harvest or in landlocked lakes).

The KBH stocking programs have addressed straying of hatchery fish and intermingling with wild fish by proper imprinting of juveniles to lake and river systems. This includes sockeye and coho

salmon smolt releases into LKB and BKB, respectively. These fish are reared for up to two weeks in net pens in the estuaries, then released to correspond with wild stock smolt emigrations. When concerns that imprinting may have not been sufficient (age-0. sockeye releases at Little Kitoi Bay), marking programs have been conducted to identify potential straying to wild stock systems (Honnold et al *in press*; Markle and Honnold *in press*; Hall et al. 1997). Returning adults from barriered lake stocking projects (Crescent, Jennifer, Katmai, Ruth Lakes) are harvested in Duck, Izhut, and Kitoi Bays where aggressive fishing periods occur once brood stock requirements are met. Each of these systems have outlet streams that allow entry of the small number of fish that may not be harvested during commercial fishing periods and should reduce straying risks. The nearest significant wild sockeye and coho stocks to the Kitoi Bay area stocking locations (Kitoi Bay, Little Kitoi, Jennifer and Ruth Lakes) are: Paul's/Laura (stream 251-831), Portage (stream 251-825), and Afognak (stream 252-342) Lakes (Figure 1). Barabara Lake (stream 259-363) is the nearest significant wild sockeye and coho system to Crescent Lake, and Afognak Lake is nearest to Katmai Lake.

Maintenance of genetic variation and diversity among and within hatcheries and from donor stocks states that a single donor stock cannot be used to establish or contribute to more than three hatchery stocks. Also, off-site release for terminal harvest rather than development or enhancement of a stock do not apply if such releases are selected so that they do not impact significant wild stocks, wild stock sanctuaries or other hatchery stocks. Lastly, a minimum effective population (N_e) of 400 should be used for brood stock development; and to ensure that all segments of the run have the opportunity to spawn, sliding egg take scales for donor stock transplants will not allocate more than 90% of any segment of the run for brood stock. Note: currently, the Principal Geneticist recommends that the number of spawning pairs used for an egg take should be > or = to 60 fish (J. Seeb, ADF&G, Anchorage, personal communication).

The KBH program will abide by this policy when stocking juveniles in 1998 and 1999. Saltery Lake sockeye salmon late run stock will be used to stock Little Kitoi and Ruth Lakes. Big Kitoi coho salmon will be used to stock Jennifer, Ruth, Crescent, and Katmai Lakes. The lakes in the Kitoi area are considered one stocking location (J. Seeb, ADF&G, Anchorage, personal communication). Limnological studies will also determine stocking levels at each lake. The adults used for brood stock from Saltery Lake sockeye will be selected from all segments of the run. Lastly, genetic baseline data have been collected from all prior and ongoing sockeye salmon donor stocks to enable future identification of adults if concerns arise that have not been adequately addressed (Appendix G).

Policies and Guidelines for Health and Disease Control

The State of Alaska Pathology Review Committee has developed a long range goal to prevent dissemination of infectious finfish (and shellfish) disease with in or outside the borders of Alaska (McGee 1995). This goal is intended to protect stocks without constraining aquaculture or stock renewal programs. The policy and guidelines advocate no transplanting of wild finfish stocks between geographic zones to minimize the risk of transporting disease from one zone to another. In addition, this policy includes hatchery stocks in order to be consistent with the Genetics policy. Some exceptions may be made on a case by case basis.

The specific criteria to control disease transmission for hatchery operations apply to: *A) Wild fish transplants - transplant of adult fish to a watershed barren of a salmonids, transplant of juvenile fish to a watershed barren of salmonids, transplant of adults, juveniles or eggs to a watershed containing other significant stocks of salmonids, transplants to a hatchery; B) Brood stock screening for egg takes - egg takes at a hatchery, egg takes at a site remote from a hatchery; C) Disease history of juvenile fish prior to release at the hatchery sites, returns to system of origin, to barren systems, to systems with other significant stocks of salmonids, and remote saltwater releases for terminal fisheries; D) Transfer between hatcheries of eggs and fish.* The specific disease considerations for the above (A-D) include sampling recommendations and disease criteria are listed in ***Section C (pages 16-31) of the Hatchery Program and Protection of Wild Salmon in Alaska: Policies and Regulations*** (compiled by McGee 1995).

The ADF&G also has a policy for sockeye salmon culture for hatchery operations to limit the hatchery mortality caused by Infectious Hematopoeitic Necrosis Virus (IHNV; McGee 1995). *This policy addresses hatchery water supplies, species mix within a hatchery, equipment, supplies, and personnel movement, egg take procedures, isolation of stocks, incubation and rearing, and transplanting of sockeye salmon.*

The above policies and guidelines have been followed by KBH and will continue to be applied in 1998 and 1999. Appendix H describes the historical sockeye salmon disease screening sampling efforts and results for KMA donor stocks.

EVALUATION

Sockeye Salmon

The evaluation program will focus on the assessment of salmon production from releases at KBH and at remote sites stocked by both KBH and PCH (Markle and Honnold *in press*). The sockeye salmon development program in the Kitoi area focuses on rearing and release of presmolt and smolt at LKB and LKL as well as remote release of fry at other Kitoi area lakes (Tables 1 and 2). The releases of smolt in LKB will be phased out after 1998 at which time presmolt releases of Saltery Lake origin in LKL will be the focus of brood stock development.

An assessment of straying rate was undertaken from 1992-1996 as part of the evaluation of the Little Kitoi estuary smolt releases including the zero-age program; and secondarily the age-1 smolt program. The zero-age smolt program has been discontinued due to unsatisfactory returns (Appendix F). The straying assessment was intended to determine if adult returns produced from the Little Kitoi net pen releases strayed to nearby systems (Afognak and Paul's Lakes; Figure 1). Age-0 (early and late run) and age-1 sockeye smolt (late run) were marked by fin clipping at KBH prior to release and returning adults were examined for marks from the escapements at Afognak, Paul's and LKL (Appendix F).

Previous research of sockeye salmon have indicated that straying is rare compared to other salmon species (Quinn 1985); sockeye populations tend to be isolated and quite specialized to a particular

freshwater environment. Varnavskiy and Varnavskaya (1985) found that the straying rate between river systems ranged from 1.7%-2.6% for sockeye salmon. In Alaska, studies at Karluk and Brooks Lakes reported straying rates ranging from 2.0%-6.8% (Hartman and Raleigh 1964). We used a similar straying rate of 2% (threshold) for this study (S. Carlson, ADF&G, personal communication); that is, straying to Paul's and Afognak at or below this level would be considered acceptable and due to natural biological dynamics. Substantial straying above this threshold would then, perhaps, indicate that sockeye salmon smolt rearing and release strategies at KBH decrease the likelihood of successful imprinting and homing to LKL and estuary.

No confirmed strays were observed at either Afognak or Paul's Lakes; however, several adults (3) with missing fins were noted. Age analysis did not indicate that these fish were strays from LKB releases. Several statistical analyses were conducted on the available data (releases, marked fraction, number examined, observed marks) to estimate straying rates for the two lakes. Differential survival (5% smolt to adult for unmarked; 2-2.5 % smolt to adult for marked) was incorporated into analyses scenarios. Results indicate that the number of adults examined for marks was not adequate to provide statistically valid results (I. Vining, ADF&G, Kodiak, personal communication; Appendix F). Initial examination numbers (7,000 at Paul's Lake; 13,000 at Afognak Lake) were increased in 1996 as result of larger escapements at Paul's and Afognak Lakes to levels unattainable with resources (manpower and funding) available. The straying evaluation was also complicated by changes in stocking strategies, difficulty in accurately determining marked fish (compared to natural injuries), and unknown differential mortality of the marked groups (N.Sagalkin, ADF&G, Kodiak, personal communication). The basic assumptions necessary for this type of mark-recapture experiment are incompatible with all of these complications.

Consequently, we discontinued the straying evaluation at Afognak and Paul's Lakes in 1997 and initiated a more thorough examination of return rate (degree of imprinting) at Big Kitoi Creek (hatchery raceways). As previously mentioned the 0-age smolt releases have been discontinued, so only age-1 sockeye smolt releases were evaluated for homing success. All sockeye salmon observed in Big Kitoi Creek (hatchery raceways) were examined for marks. Scales and lengths were taken from only two marked fish of 14 observed (due to man power constraints). Scales taken from adults without marks were aged and scale patterns compared to LKL sockeye scale patterns. These data were assigned to early and late run components (based on escapement timing) to enable comparison to LKL early and late run escapements. This evaluation will be repeated in 1998. The sockeye salmon found in hatchery raceways are killed to prevent straying to other systems and donated to charities in the City of Kodiak.

The assessment of sockeye salmon stocking strategy (age-0 saltwater releases; age-0 freshwater releases-presmolt; age-1 saltwater releases) success or differential survival by age and or size at release was also part of the original evaluation program at KBH in conjunction with the straying assessment (Appendix F). Presmolt releases into LKL were also marked in addition to zero checks and age-1 smolt. The intent of the project was to determine if one of the three different stocking strategies was more successful in terms of survival and subsequent adult returns. Preliminary results to date are described in Appendix F.

The evaluation of straying, as well as adult survival, for individual releases is substantially affected by differential mortality. The preliminary results of stock composition estimates based solely on marks for the 1997 adult sockeye run were substantially less (21.4%) than estimates using scale pattern analysis (R. Markle, ADF&G, personal communication). This suggests that fin clipped fish experienced 21.4% greater mortality then un-clipped fish. Juvenile sockeye marked in 1997 (10,005 of 77,039 intended for presmolt stocking) were held separate from other rearing juvenile sockeye for 24-48 hours immediately after marking and any mortality was noted. Marked sockeye were then mixed with other juveniles for the remainder of the rearing period (21 August-14 October); any mortality differences between marked and unmarked fish after mixing were recorded daily and tallied to determine total pre-release mortality. The preliminary results of this study indicated that the marked fish had a mortality rate 11-fold greater than the unmarked fish for the entire eight week rearing period. However, if the intial week after marking is omitted from the calculation, the mortality rate was three-fold more for marked than for unmarked fish. This suggests that greatest mortality of marked fish occurs within the first week after fin-clipping but mortality will continue at a higher rate for marked fish than for unmarked fish throughout the rearing period.

In 1998, a portion of the sockeye salmon released (~10% of the presmolt into LKL and ~11% of the smolt into LKB) will again be marked prior to release by fin clipping to assist with determining the success of a given rearing strategy. Scale pattern analysis will be the primary focus of stock composition assessment; marked fish will help verify age compositions. Returning adult sockeye salmon will be examined for fin clips and sampled (scales collected) at LKL fish ladder and during Kitoi Bay Section commercial salmon openings. In 1997, approximately 12% (3,545 fish) of the sockeye salmon run to the Kitoi Bay Section (~ 30,000) were examined for marks and 8% sampled for age (R. Markle, ADF&G, personal communication). The goal for 1998 will be to examine and sample 10% (~6,500) of the run to the Kitoi Bay, Izhut Bay, and Duck Bay sections combined. Available resources have not permitted such an effort in recent years. While the fish pass at LKL will be opened to allow adult sampling and examination for marks, no escapement into the lake will be allowed. Sampled fish will be marked and returned to salt water to prevent re-examination or sampling. This examination and sampling scenario was utilized in 1997. The avoidance of any escapement into LKL is due to changing the brood stock to Saltery Lake stock. The number of adults inspected for marks may be adjusted depending on recommendations from the ADF&G biometrics staff. In 1999, approximately 25,000 (10%) of the 250,000 presmolt released into LKL will be marked.

In addition, sockeye salmon smolt will be sampled for age, size, and marks, at LKL outlet throughout the emigration period (May-June). Approximately 200 smolt samples will also be collected at Jennifer and Ruth Lakes, each, for age and growth information (May-June). An electronic counter will be used to estimate the smolt emigration from LKL (Markle and Honnold *in press*).

Hatchery reared sockeye smolt will be sampled for biological data and tested for osmocompetence prior to release.

Lake limnological surveys will continue at Little Kitoi, Jennifer, and Ruth Lakes and salinity, temperature, and plankton monitoring will also be conducted in Big and Little Kitoi Bays.

Chum, Coho, and Pink Salmon

Short-term net pen rearing as opposed to direct release of emergent chum salmon fry increases survival and adult returns (Kron 1985; Linley 1994). In 1997, a total of 600 chum salmon brood from Big Kitoi Creek will be sampled for age and length data to ascertain year-class survival, as more extensive rearing appears to be increasing survival (Hall et al. 1997). These data will be used to assign ages to the adult chum salmon run and estimate overall survival by release year. Plankton tows will be conducted in Kitoi Bay to ascertain the timing of plankton blooms to assist with release timing of pink and chum salmon fry. Prior to saltwater rearing, coho smolt will also be sampled for length data to track length frequency trends at release to compare with the magnitude of returning adults. The intent of this comparison is to determine if there is an release size which optimizes survival and subsequent adult returns. Also, coho smolt will be saltwater challenged and blood sodium analyzed to determine osmocompetence.

LITERATURE CITED

ADF&G (Alaska Department of Fish and Game). 1996. Cook Inlet, Kodiak, and Chignik Areas Commercial Fishing Regulations, 1996-1998. Alaska Department of Fish and Game, Commercial Fisheries Management and Development Division, Juneau.

Brennan, K., D. L. Prokopowich, and D. R. Gretsch. 1996. Kodiak Management Area commercial salmon annual management report, 1994. Alaska Department of Fish and Game, Division of Commercial Fisheries, Regional Information Report 4K96-38, Kodiak.

Clevenger C., S. G. Honnold, and J. N. McCullough. 1996. Pillar Creek Hatchery annual management plan, 1996. Alaska Department of Fish and Game, Commercial Fisheries Management and Development Division, Regional Information Report 4K96-15, Kodiak.

Clevenger C., S. G. Honnold, and J. N. McCullough. 1997. Pillar Creek Hatchery annual management plan, 1997. Alaska Department of Fish and Game, Commercial Fisheries Management and Development Division, Regional Information Report 4K97-31, Kodiak.

Hall A., S. G. Honnold, and J. N. McCullough. 1997. Kitoi Bay Hatchery Annual Management Plan, 1996. Alaska Department of Fish and Game, Division of Commercial Fisheries, Regional Information Report 4K97-36, Kodiak.

Hartman, W. L. and R. F. Raleigh. 1964. Tributary homing of sockeye salmon at Brooks and Karluk lakes, Alaska. J. Fish. Res. Board. Can., 21, No. 3, 485-504.

Hasler, A. D. and A. T. Scholz, editors. 1983. Olfactory imprinting and homing in salmon: investigations into the mechanism of the imprinting process. In collaboration with R.W. Goy. Springer-Verlag Press, Berlin Hiedelberg.

Honnold, S. G. 1997. The results of sockeye salmon (*Oncorynchus nerka*) stocking into Spiridon Lake in the Kodiak National Wildlife Refuge: juvenile and adult production, commercial harvest, and ecosystem effects, 1987-1996. Alaska Department of Fish and Game, Commercial Fisheries Management and Development Division, Regional Information Report 4K97-47, Kodiak.

Honnold, S. G. 1998. Run forecasts for enhanced and rehabilitated sockeye salmon systems, 1998. Alaska Department of Fish and Game, Commercial Fisheries Management and Development Division, unpublished report, Kodiak.

LITERATURE CITED (Cont.)

Honnold S. G., and C. Clevenger. 1995. Pillar Creek Hatchery Annual Management Plan, 1995. Alaska Department of Fish and Game, Division of Commercial Fisheries, Regional Information Report 4K95-27, Kodiak.

Honnold S. G., C. Clevenger and J. N. McCullough. *In press*. Pillar Creek Hatchery annual management plan, 1998. Alaska Department of Fish and Game, Commercial Fisheries Management and Development Division, Regional Information Report 4K98-xx, Kodiak.

Kron, T. M. 1985. Japan's salmon culture program and coastal salmon fisheries. Alaska Department of Fish and Game, Fisheries Rehabilitation, Enhancement, and Development Division, FRED Division Report Series No. 50, Juneau.

Linley, T. 1994. Forecasting adult returns of hatchery reared chum salmon. Northern Southeastern Regional Aquaculture Association., Project Report, Sitka.

Malloy, L.R., and D.L. Prokopowich. 1992. Kodiak Management Area commercial salmon annual management report, 1988. Alaska Department of Fish and Game, Division of Commercial Fisheries, Regional Information Report 4K88-32, Kodiak.

Markle, R. A. and S. G. Honnold. *in press*. Little Kitoi evaluation operational plan, 1998. Alaska Department of Fish and Game, Commercial Fisheries Management and Development Division, Regional Information Report 4K98-xx, Kodiak.

McGee, S.G. 1995. The hatchery program and protection of wild salmon in Alaska: policies and regulations. Alaska Department of Fish and Game, Division of Commercial Fisheries, Draft Report (compilation), Juneau.

Prokopowich, D. L., K. Brennan, and D. R. Gretsch. 1997. Kodiak area commercial salmon fishery harvest strategy, 1997. Alaska Department of Fish and Game, Commercial Fisheries Management and Development Division, Regional Information Report 4K97-34, Kodiak.

Quinn, T. P. 1985. Homing and the evolution of sockeye salmon, (*Oncorhynchus nerka*). Contributions in Marine Science 27 (Suppl.): 353-366. Department of Fisheries and Oceans, Fisheries Research Branch, Pacific Biological Station, Nanaimo, BC.

Varnavskiy, V. S. and N. V. Varnavakaya. 1985. originally published in: Voprosy Ikhtioilogii, No. 1, 1985, pp. 157-159, Kamchatka Section, TINRO, Petropavlovsk.

Wedemeyer, G. A., R. L. Saunders, and W. C. Clarke. 1980. Environmental factors affecting smoltification and early marine survival of anadromous salmonids. Marine Fisheries Review, June 1980.

Table 1. Salmon egg takes (1997), planned releases (1998,1999), projected returns (1999-2002), and fish transport permits (FTP), Kodiak Management Area.

Release Site	Eggtake		Releases			Adult Returns [a]					FTP			
	eggs	adults	Number	Size	Date	1999	2000	2001	2002	Total	Number	Expires	Maximum No.	Life Stage
Pink Salmon: Kitoi Bay Hatchery Stock											*96A-0062*	*8/30/01*	*215,000,000*	*G.Eggs*
Kitoi Bay	208,000,000	259,000	152,000,000	0.5/FF	May	4,700,000	0	0	0	4,700,000	96A-0062	8/31/01	182,000,000	Fry
Chum Salmon: Kitoi Bay Hatchery Stock											*96A-0063*	*8/30/01*	*25,000,000*	*G.Eggs*
Kitoi Bay	16,200,000	18,000	15,000,000	2.0/FF	May	0	3,000	180,000	117,000	300,000	96A-0063	8/30/01	22,000,000	Fry
Coho Salmon: Kitoi Bay Hatchery Stock											*94A-0036*	*6/30/00*	*1,650,000*	*G. Eggs*
Kitoi Bay [b]	1,000,000	760	700,000	20.0/S	Jun-98	84,000	0	0	0	84,000	94A-0036	6/30/00	700,000	Smolt
Jennifer Lake	232,000	266	163,000	1.5/FG	June	0	9,780	0	0	9,780	92A-0080	6/30/02	163,000	Fingerlings
Ruth Lake	69,000	68	35,000	1.5/FG	June	0	700	0	0	700	92A-0083	12/31/02	60,000	Fingerlings
Crescent Lake	236,000	254	165,000	1.5/FF	June	0	3,500	0	0	3,500	92A-0079	12/31/02	500,000	Fry
Katmai Lake [c]	21,000	32	15,000	7.0/FG	October	0	1,500	0	0	1,500	92A-0081 (new FTP for presmolt)	12/31/02	30,000	Fingerlings
Kitoi Bay	1,000,000	880	700,000	20.0/S	Jun-99	0	84,000	0	0	84,000	94A-0036	6/30/00	700,000	Smolt
Total:	1,558,000	1,500	1,778,000			84,000	99,480	0	0	183,480				
Sockeye Salmon: Saltery Lake Stock											*97A-0068*	*8/31/98*	*1,200,000*	*G.Eggs*
Little Kitoi Lake	300,000	250	250,000	15.0/PS	Apr-99	0	0	7,500	17500	25,000	97A-0069	8/31/98	300,000	Presmolt
Sockeye Salmon: Little Kitoi Lake Stock [b]											*No listing for an FTP for the egg take*			
Little Kitoi Estuary	550,000	276	400,000	10.0/S	May-98	0	11,200	4,800	0	16,000	96A-0064	6/30/01	750,000	Smolt
Little Kitoi Lake	135,000	125	97,000	9.0/PS	Apr-98		6,800	2,900		9,700	96A-0065	6/30/01	150,000	Presmolt
Grand Total:	229,301,000	281,411	171,303,000			4,868,000	219,960	195,200	134,500	5,417,660				

FF-Fed fry, FG-Fingerling, PS-Pre-smolt, S-Smolt

[a] assuming 1% for 0.2, 60% for 0.3, and 39% for 0.4 chum salmon. Assuming 70% age 1.2 and 30% age 1.3 adults for LKL stock sockeye salmon. Assuming 30% 1.2 and 70% 1.3 adults for Saltery sockeye stock.

[b] Brood Year 1996.

[c] FTP states fingerling release - may need to be amended to presmolt release.

Table 2. Proposed salmon egg takes (1998), planned releases (1999, 2000), projected returns (2000-2003), and fish transport permits (FTP), Kodiak Management Area.

Release Site	Eggtake eggs	Eggtake adults	Releases Number	Releases Size	Releases Date	Adult Returns [a] 2000	2001	2002	2003	Total	FTP Number	FTP Expires	FTP Maximum No.	FTP Life Stage
Pink Salmon: Kitoi Bay Hatchery Stock											*96A-0062*	*8/30/01*	*215,000,000*	*G.Eggs*
Kitoi Bay	215,000,000	275,000	165,000,000	0.5/FF	May	4,950,000	0	0	0	4,950,000	96A-0062	8/31/01	182,000,000	Fry
Chum Salmon: Kitoi Bay Hatchery Stock											*96A-0063*	*8/30/01*	*25,000,000*	*G.Eggs*
Kitoi Bay	25,000,000	30,000	22,000,000	2.0/FF	May	0	4,400	264,000	171,600	440,000	96A-0063	8/30/01	22,000,000	Fry
Coho Salmon: Kitoi Bay Hatchery Stock											*94A-0036*	*6/30/00*	*1,650,000*	*G. Eggs*
Kitoi Bay	1,000,000	665	700,000	20.0/S	Jun-00	0	84,000	0	0	84,000	94A-0036	6/30/00	700,000	Smolt
Jennifer Lake	232,000	266	163,000	1.5/FG	June	0	9,780	0	0	9,780	92A-0080	6/30/02	163,000	Fingerlings
Ruth Lake	69,000	68	35,000	1.5/FG	June	0	700	0	0	700	92A-0083	12/31/02	60,000	Fingerlings
Crescent Lake	236,000	254	165,000	1.5/FF	June	0	3,500	0	0	3,500	92A-0079	12/31/02	500,000	Fry
Katmai Lake	21,000	32	15,000	7.0/FG	October	0	1,500	0	0	1,500	92A-0081 (new FTP for presmolt)	12/31/02	30,000	Fingerlings
Total:	1,558,000	1,285	1,078,000			0	99,480	0	0	99,480				
Sockeye Salmon: Saltery Lake Stock											*97A-0068*	8/31/98	1,200,000	G.Eggs
Little Kitoi Lake	300,000	295	250,000	15.0/PS	Apr-00	0	0	7500	17,500	25,000	97A-0069	8/31/98	300,000	Presmolt
Grand Total:	243,416,000	307,865	189,406,000			4,950,000	203,360	271,500	189,100	5,613,960				

FF-Fed fry, FG-Fingerling, PS-Pre-smolt, S-Smolt

[a] assuming 1% for 0.2, 60% for 0.3, and 39% for 0.4 chum salmon; 30% age 1.2 and 70% age 1.3 for Saltery lake stock sockeye salmon.

Table 3. Kitoi Bay Hatchery salmon minimum (desired) escapement goals and projected brood numbers required, 1998.

Big Kitoi Creek [a]	Minimum Escapement [b]	Brood Stock Required
Pink	15,000	275,000
Chum	2,000	30,000
Coho	0	5,000
Little Kitoi Lake Coho	1,000	

Late Run Sockeye [c]	Minimum Escapement [d]	Brood Stock Required [e]
Saltery Lake	20,000	295

[a] Big Kitoi Creek is where adults returning to KBH imprint and enter the hatchery eggtake systems.

[b] Minimum escapement refers to the number of adults remaining in the creek after KBH has completed its eggtakes. These fish are allowed up the creek to spawn to continue the run in the event of the loss of the hatchery reared fish.

[c] Saltery Lake is the brood source for the enhancement project at Spiridon and the Little Kitoi lake brood stock building program.
Upper Station Lake was the primary brood source for Spiridon Lake for all years, except 1994;
Upper Station Lake stock was used to develop brood at Kitoi Bay - returning to Little Kitoi Lake;
Upper Station and Little Kitoi Lake runs will not be used for brood in 1998.

[d] Lower Biological Escapement Goal - egg take can proceed if this goal is reached; the allowable proportion of the escapement available for brood stock is 50% of the sockeye above this goal .

[e] Approximately 4,600 brood stock are needed for Pillar Creek Hatchery (Honnold et al. *in press*)

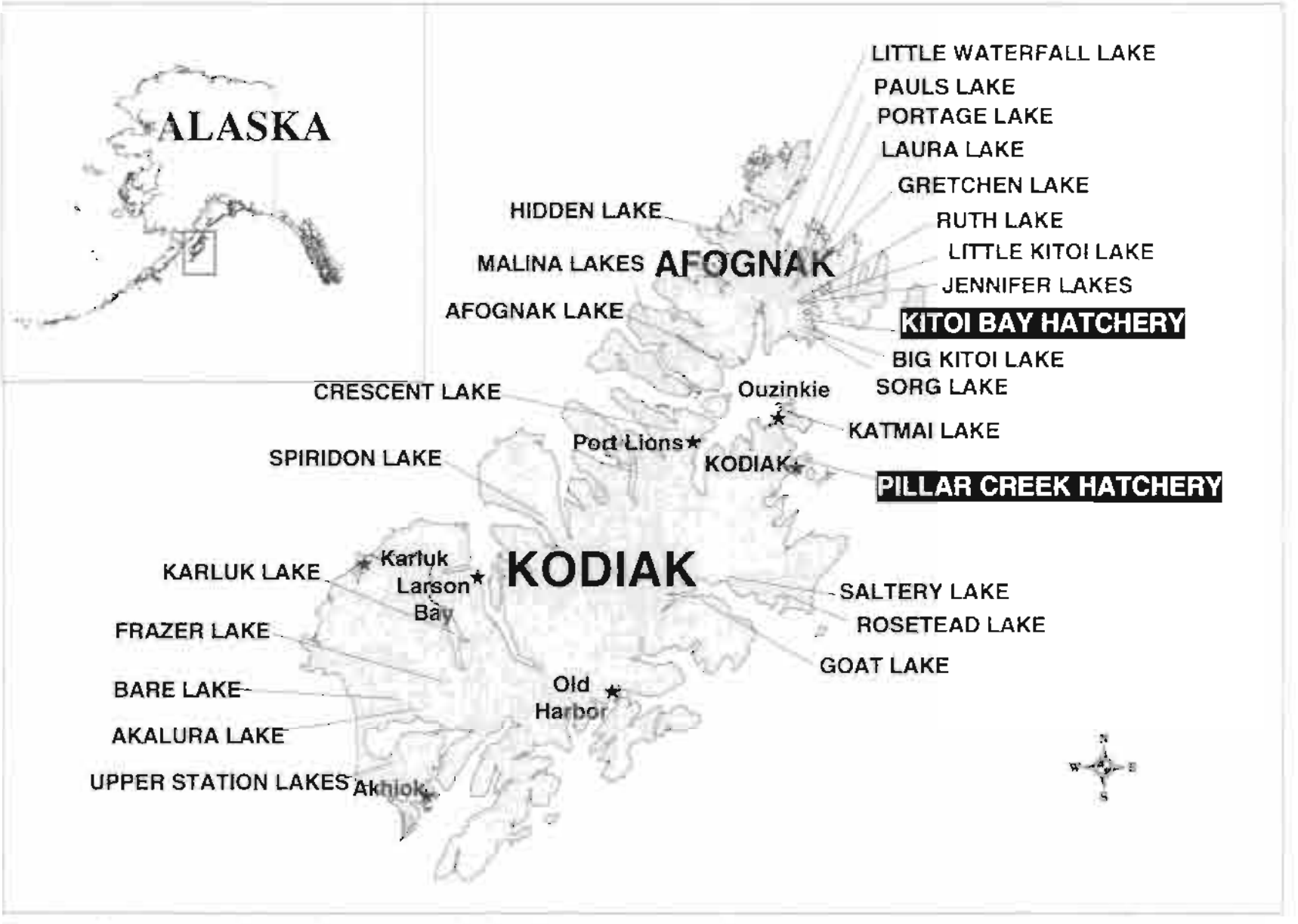

Figure 1. Locations of salmon enhancement and rehabilitation projects on Kodiak and Afognak Islands, 1951-1998.

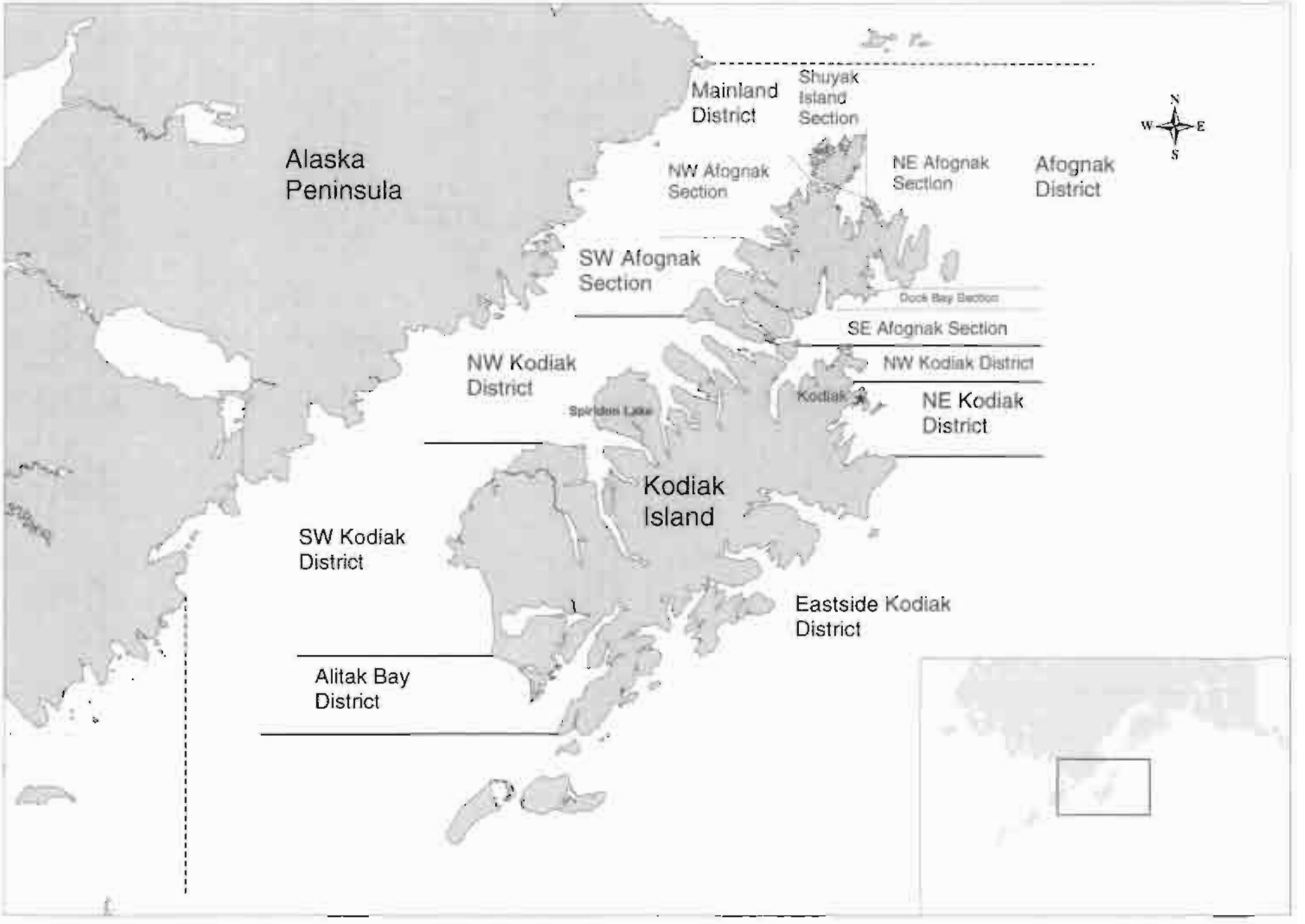

Figure 2. Map of the Kodiak Management Area depicting commercial fishing districts and selected sections.

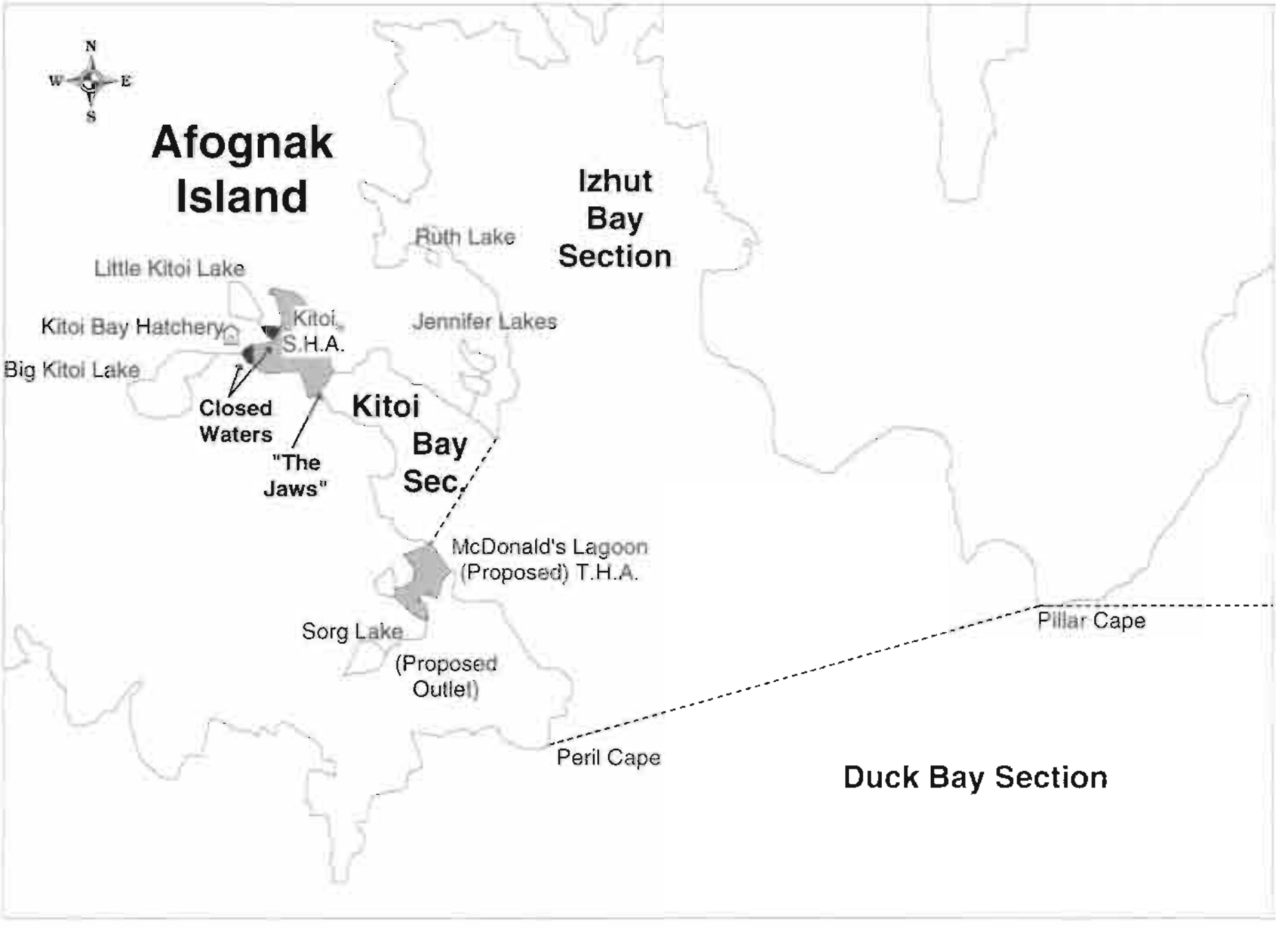

Figure 3. Izhut (252-30), Duck (252-31) and Kitoi (252-32) Bay Sections of the Afognak District.

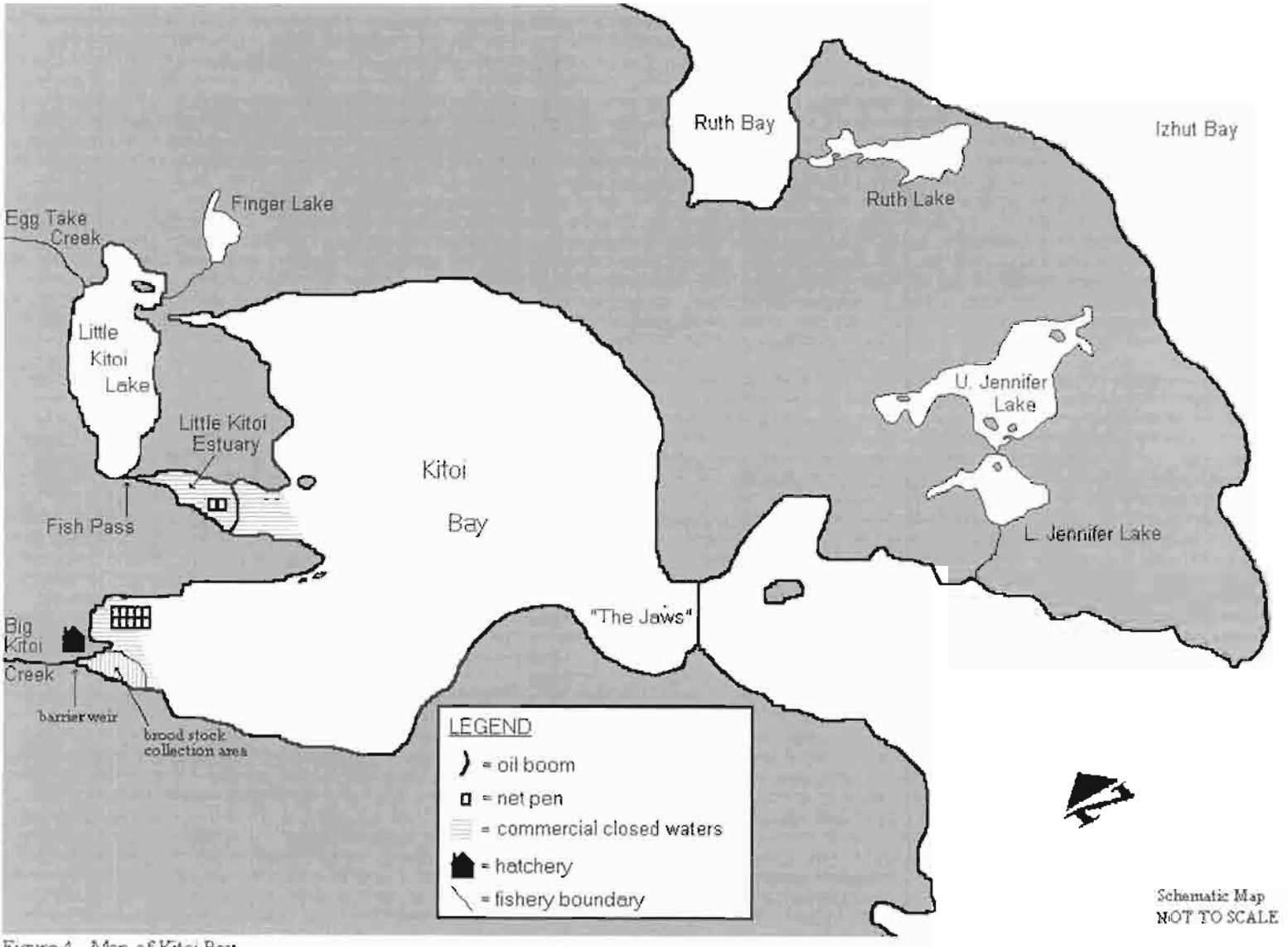

Figure 4. Map of Kitoi Bay

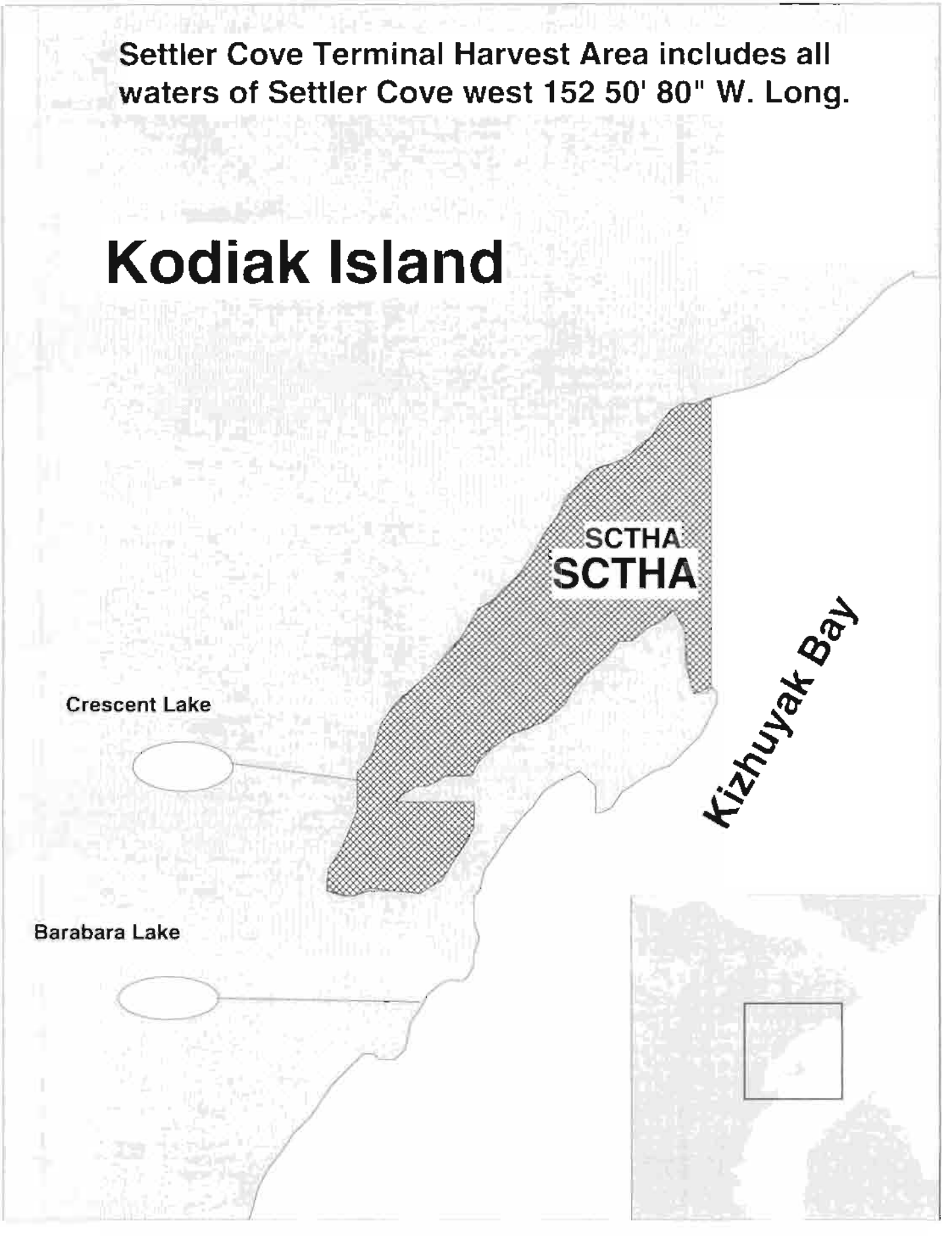

Figure 5. Settler Cove (Crescent Lake) Terminal Harvest Area (SCTHA) boundaries in Kizhuyak Bay, 1997.

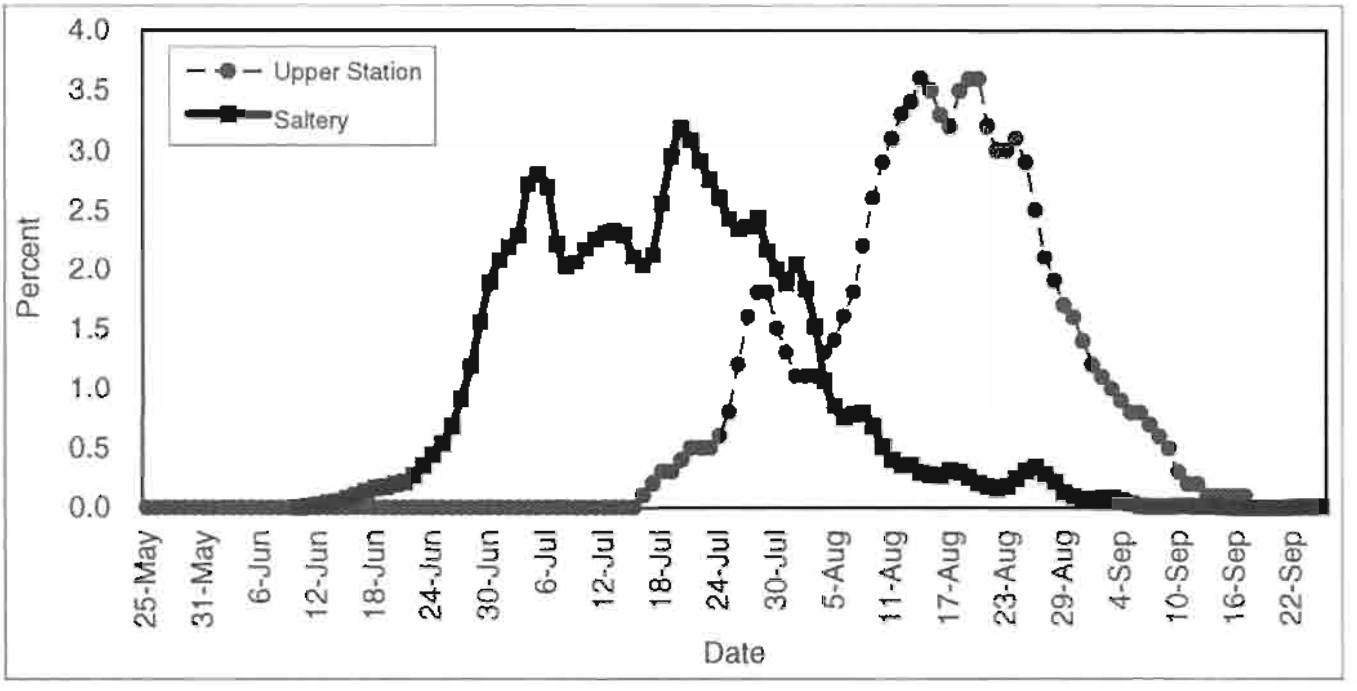

Figure 6. Sockeye salmon escapement timing into Upper Station and Saltery Lakes.

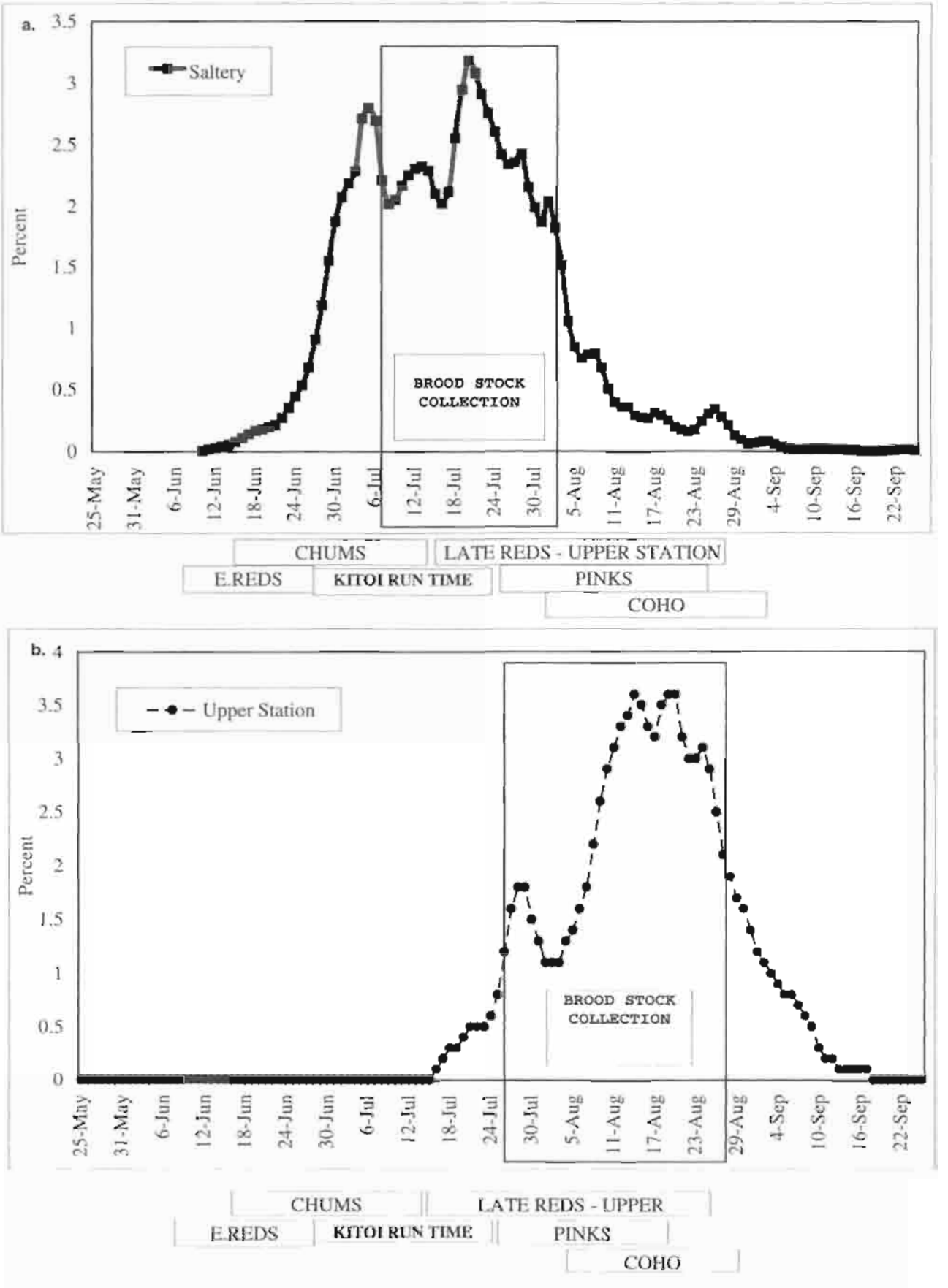

Figure 7. The run timing of salmon stocks in the Kitoi Bay Terminal Harvest Area compared to the late run Saltery sockeye salmon broodstock collection (a) and late run Upper Station sockeye salmon broodstock collection (b).

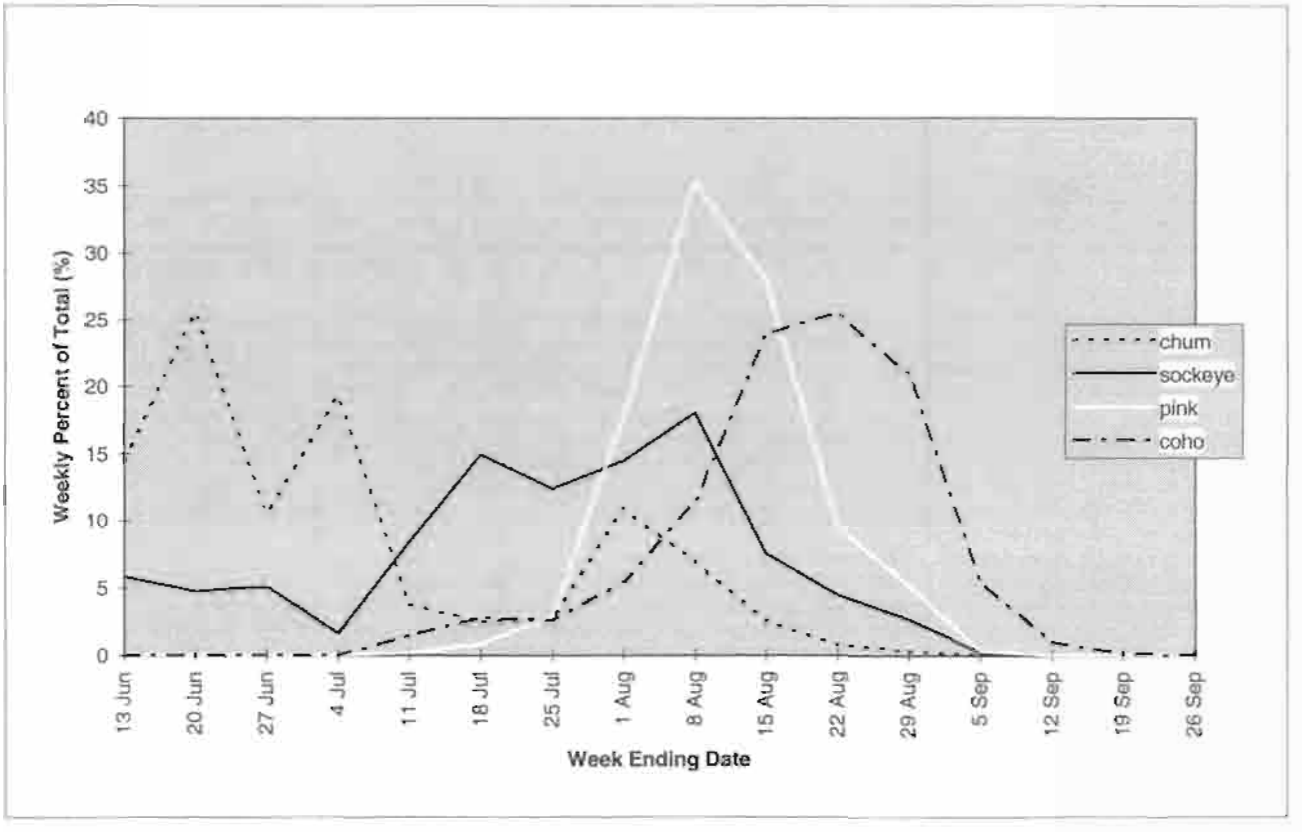

Figure 8. Izhut, Duck, and Kitoi Bay Sections chum, sockeye, pink, and coho salmon average harvest timing, 1987-1996.

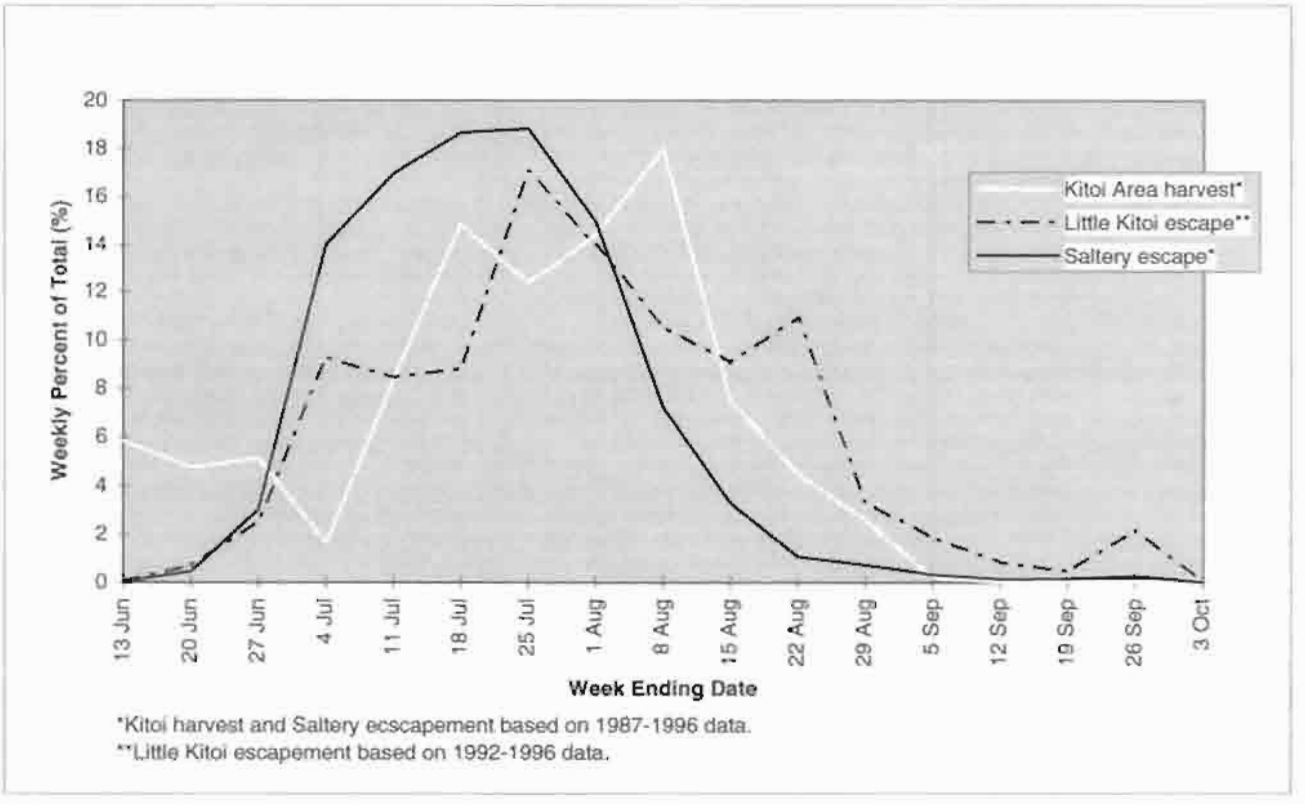

Figure 9. Izhut, Duck, and Kitoi Bay Sections sockeye salmon harvest timing (1987-1996), Little Kitoi Lake (1992-1996) and Saltery Lake (1987-1996) sockeye salmon escapement timing.

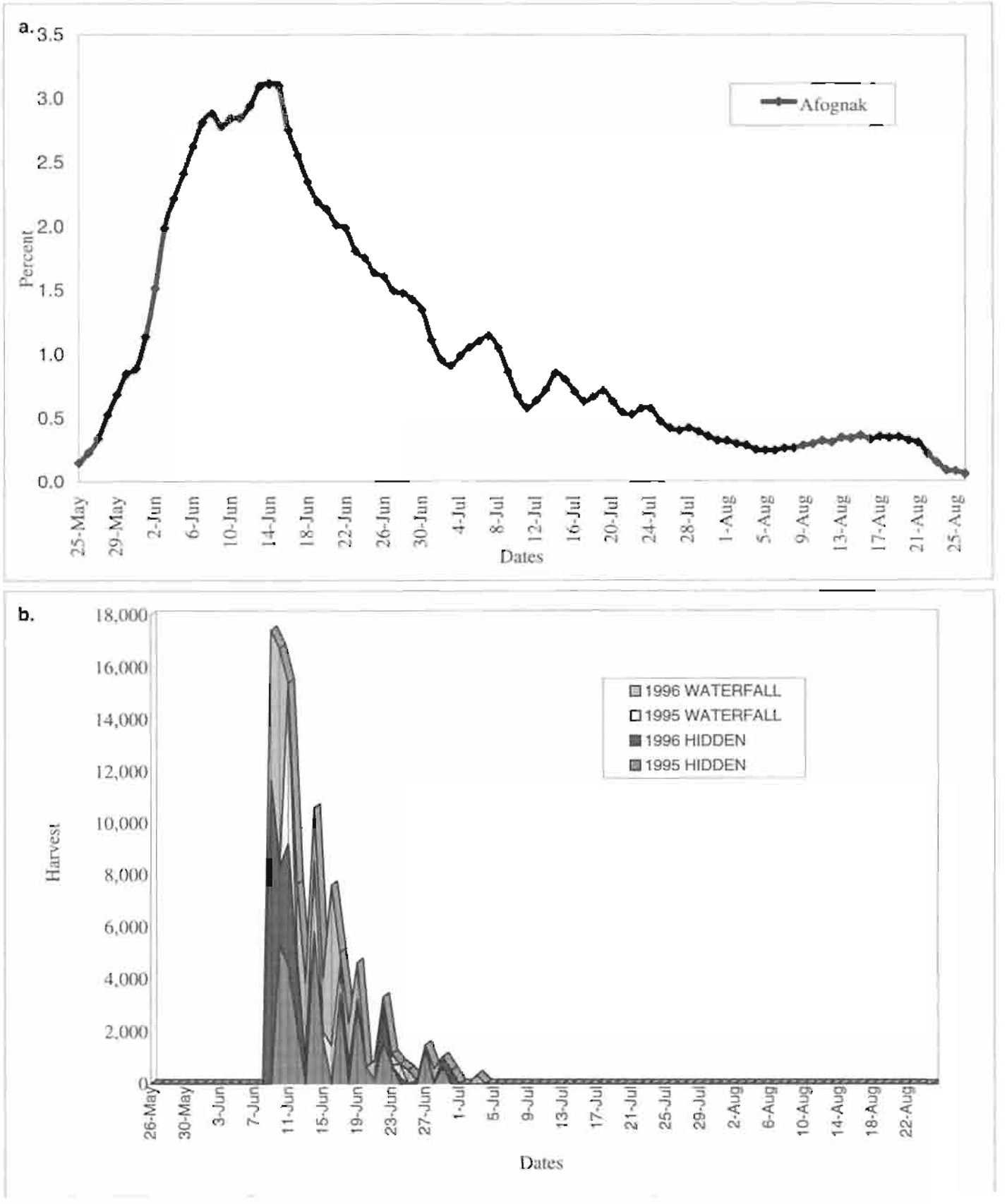

Figure 10. The post June Afognak Lake (AL) escapement has a large component of sockeye age 1.1, 1.2 and 2.1 that is not used for broodstock (Nelson and Swanton 1996). The compressed harvest (b) as compared to the broodstock run timing (a) can be attributed to the broodstock selection and the timing of fishing periods in the terminal harvest areas.

APPENDIX

Appendix A. Salmon survival assumptions used to estimate returns for Kitoi Bay Hatchery.

Species	Life Stage	Size (g)	Survival to Adult [a]	
			FW release	SW Release
Pink	Fed Fry (FF)	0.5		3%
Chum	Fed Fry (FF)	2.0		2%
Coho	Fed Fry (FF) or Fingerling (FG)	1.5		2% - 6%
Coho	Fingerling (FG)	5.0-7.0	10%	
Coho	Age-1. Smolt (S)	20.0		12%
Sockeye	Presmolt (PS)	5.0	10%	
Sockeye	Age-1. Smolt (S)	10.0		3%-5%

FW = Freshwater

SW = Saltwater

[a] based on known survivals from previous years releases and resultant returns.

Appendix B. Kitoi Bay Hatchery pink salmon release history, brood years 1972-1996.

Brood Year	Brood Stock	Number Released	Size (grams)	Life stage	Location
1972	Big Kitoi Creek	493,130		Fry	Big Kitoi Creek
1973	Big Kitoi Creek	447,642		Fry	Big Kitoi Creek
1974	Big Kitoi Creek	1,226,314		Fry	Big Kitoi Creek
1975	Big Kitoi Creek	2,486,410		Fry	Big Kitoi Creek
1976	Big Kitoi Creek	4,722,152	0.50	Fry	Big Kitoi Creek
1977	Big Kitoi Creek	17,255,424	0.44	Fry	Big Kitoi Creek
1978	Big Kitoi Creek	17,319,537		Fry	Big Kitoi Creek
1979	Big Kitoi Creek	22,458,947	0.63	Fry	Big Kitoi Creek
1980	Big Kitoi Creek	26,351,664	0.93	Fry	Big Kitoi Creek
1981	Big Kitoi Creek	47,828,701		Fry	Big Kitoi Creek
1982	Big Kitoi Creek	72,054,096	0.79	Fry	Big Kitoi Creek
1983	Big Kitoi Creek	87,065,569	0.58	Fry	Big Kitoi Creek
1984	Big Kitoi Creek	75,109,442	0.29	Fry	Big Kitoi Creek
1985	Big Kitoi Creek	97,773,052	0.78	Fry	Big Kitoi Creek
1986	Big Kitoi Creek	90,017,823	0.27	Fry	Big Kitoi Creek
1987	Big Kitoi Creek	94,172,516	0.73	Fry	Big Kitoi Creek
1988	Big Kitoi Creek	80,502,220	0.62	Fry	Big Kitoi Creek
1989	Big Kitoi Creek	84,907,550	0.61	Fry	Big Kitoi Creek
1990	Big Kitoi Creek	124,148,019	0.60	Fry	Big Kitoi Creek
1991	Big Kitoi Creek	147,145,130	0.80	Fry	Big Kitoi Creek
1992	Big Kitoi Creek	169,552,112	0.51	Fry	Big Kitoi Creek
1993	Big Kitoi Creek	163,192,575	0.45	Fry	Big Kitoi Creek
1994	Big Kitoi Creek	134,104,406	0.53	Fry	Big Kitoi Creek
1995	Big Kitoi Creek	144,045,245	0.48	Fry	Big Kitoi Creek
1996	Big Kitoi Creek	105,000,000	0.50	Fry	Big Kitoi Creek

Appendix C. Kitoi Bay Hatchery chum salmon release history, brood years 1981-1996.

Brood Year	Brood Stock	Number Released	Size (grams)	Life stage	Location
1981	Sturgeon River	36,846	0.56	Fry	Big Kitoi Creek
1982	Sturgeon River	105,058	1.05	Fry	Big Kitoi Creek
1983	Sturgeon River	630,422	1.16	Fry	Big Kitoi Creek
1984	Sturgeon River	784,078	0.67	Fry	Big Kitoi Creek
1985	Sturgeon River	414,233		Fry	Big Kitoi Creek
1986	Big Kitoi Creek	693,166	2.00	Fry	Big Kitoi Creek
1987	Big Kitoi Creek	4,737,587	2.10	Fry	Big Kitoi Creek
1988	Big Kitoi Creek	3,289,878	1.85	Fry	Big Kitoi Creek
1989	Big Kitoi Creek	1,502,501	2.44	Fry	Big Kitoi Creek
1990	Big Kitoi Creek	[a]		Fry	Big Kitoi Creek
1991	Big Kitoi Creek	22,214,472	1.80	Fry	Big Kitoi Creek
1992	Big Kitoi Creek	10,101,986	2.02	Fry	Big Kitoi Creek
1993	Big Kitoi Creek	6,507,497	1.52	Fry	Big Kitoi Creek
1994	Big Kitoi Creek	9,738,472	1.51	Fry	Big Kitoi Creek
1995	Big Kitoi Creek	20,139,843	1.27	Fry	Big Kitoi Creek
1996	Big Kitoi Creek	23,500,000	1.50	Fry	Big Kitoi Creek

[a] disease outbreak (IHNV); all alevin and fry were destroyed.

Appendix D. Kitoi Bay Hatchery coho salmon release history, brood years 1983-1996.

Brood Year	Brood Stock	Number Released	Size (grams)	Life stage	Location
1982	Buskin	77,348	0.85	Fingerling	Buskin Lake
1983	Buskin	43,288	0.64	Fingerling	Buskin Lake
	Little Kitoi Lake	131,825	0.96	Fingerling	Kodiak Road System
		5,000	2.54	Fingerling	Shemya
		127,700	1.00	Fingerling	Little Kitoi Lake
1984	Buskin	45,645	1.88	Fingerling	Buskin Lake
	Little Kitoi Lake	109,568	0.90	Fingerling	Kodiak Road System
		33,472	1.50	Fingerling	Little Kitoi Lake
		12,731	2.60	Fingerling	Kodiak Road System
1985	Buskin	50,024	0.79	Fingerling	Buskin Lake
	Little Kitoi Lake	141,750	1.08	Fingerling	Kodiak Road System
		53,360	6.10	Presmolt	Little Kitoi Lake
1986	Little Kitoi Lake	103,824	1.03	Fingerling	Kodiak Road System
		171,103	1.79	Fingerling	Little Kitoi Lake
		9,600	5.00	Presmolt	Big Kitoi Creek
		22,349	0.50	Fingerling	Katmai Creek
1987	Little Kitoi Lake	84,600	1.18	Fingerling	Kodiak Road System
		43,807	1.52	Fingerling	Little Kitoi Lake
		241,373	1.13	Fingerling	Crescent Lake
		20,000	0.70	Fingerling	Katmai Creek
		137,585	1.13	Fingerling	Hidden Lake
1988	Little Kitoi Lake	87,585	0.80	Fingerling	Kodiak Road System
		137,493	23.30	Smolt	Big Kitoi Creek
		202,955	0.82	Fingerling	Crescent Lake
		239,817	0.85	Fingerling	Hidden Lake
1989	Little Kitoi Lake	36,040	1.75	Fingerling	Kodiak Road System
1990	Little Kitoi Lake	83,530	1.24	Fingerling	Kodiak Road System
		60,755	32.00	Smolt	Big Kitoi Creek
		191,416	1.10	Fingerling	Crescent Lake
		250,889	1.25	Fingerling	Hidden Lake
1991	Little Kitoi Lake	51,500	1.60	Fingerling	Kodiak Road System
		15,200	8.00	Presmolt	Kodiak Road System
		69,100	7.04	Presmolt	Crescent Lake
		14,973	8.00	Presmolt	Katmai Lake
		162,387	4.50	Fingerling	Jennifer Lakes
		70,605	1.40	Fingerling	Little Kitoi Lake
		613,681	18.90	Smolt	Big Kitoi Creek
1992	Little Kitoi Lake	64,000	1.76	Fingerling	Kodiak Road System
		68,420	14.60	Presmolt	Crescent Lake
		15,052	14.60	Presmolt	Katmai Lake
		135,486	1.94	Fingerling	Jennifer Lakes
		139,147	1.30	Fingerling	Little Kitoi Lake
		5,163	14.60	Presmolt	Big Kitoi Creek
		97,973	28.40	Smolt	Big Kitoi Creek
1993	Big Kitoi Creek	163,680	0.98	Fingerling	Crescent Lake
		13,178	23.28	Presmolt	Katmai Lake
		258,926	25.90	Smolt	Big Kitoi Creek
1994	Big Kitoi Creek	167,776	1.16	Fingerling	Crescent Lake
		165,000	1.46	Fingerling	Jennifer Lakes
		59,500	1.74	Fingerling	Ruth Lake
		28,350	2.41	Fingerling	Finger Lake
		59,030	2.50	Fingerling	Elk Lake
		16,489	5.87	Presmolt	Katmai Lake
		894,486	23.54	Smolt	Big Kitoi Creek
1995	Big Kitoi Creek	163,200	0.40	Fingerling	Crescent Lake
		15,246	5.04	Presmolt	Katmai Lake
		819,046	19.57	Smolt	Big Kitoi Creek
1996	Big Kitoi Creek	35,000	0.35	Fingerling	Ruth Lake
		163,000	0.35	Fingerling	Jennifer Lakes
		165,000	0.35	Fingerling	Crescent Lake
		15,735	7.33	Presmolt	Katmai Lake

Appendix E. Little Kitoi lake sockeye salmon egg takes, past, present, and proposed.

Brood Year	Number Adults	Eggs (millions)	Facility	Stocking Number (millions)	Year	Stocking Location
1992	1,011	0.59	Kitoi Bay	0.00	1993	Little Kitoi Bay
1993	1,050	1.10	Kitoi Bay	0.88	1995	Little Kitoi Bay
1994	600	1.50	Kitoi Bay	0.15	1995	Little Kitoi Lake
				0.88	1996	Little Kitoi Bay
				0.30	1995	Jennifer Lake
1995	155	0.19	Kitoi Bay	0.15	1996	Little Kitoi Lake
1996	1,210	1.20	Kitoi Bay	0.15	1997	Little Kitoi Lake
				0.58	1998	Little Kitoi Bay
1997 [a]	0	0.00	Pillar Creek	0.00	1998	Little Kitoi Lake
				0.00	1999	Little Kitoi Bay
				0.00	1998	Spiridon Lake
				0.00	1998	Jennifer Lake

[a] Little Kitoi lake was a contigency egg take location in 1997; the late run brood source was changed to Saltery Lake stock in 1997. Brood stock are not expected to be collected at Little Kitoi Lake until the first returns from Saltery Lake sockeye stock occur in 2001 or 2002.

Appendix F. Summary of Preliminary Findings of Little Kitoi Lake Sockeye Salmon Marking Study.

by Robert Markle and Steven G. Honnold
Alaska Department of Fish and Game

Introduction

A sockeye salmon (*Oncorhynchus nerka*) brood stock development project began at Little Kitoi Lake (LKL), Afognak Island, in 1989. Originally an underyearling stocking program, the project diversified to include presmolt and age-1 smolt (1994), including early (1992) and late run stocks. In 1992, a marking program commenced in an effort to determine the success of different stocking strategies (FTP 92A0085) and the straying rate of adult returns produced from saltwater juvenile releases. The project proposal was submitted for review in January 1993, and signed off on April 12, 1993 (geneticist signed FTP only). Survivals from stocking to adult return evaluated stocking strategy success. The percentage of Little Kitoi Bay origin adults observed in escapements at Paul's Lake and Afognak Lake assessed the straying rate. Examination for marks at Little Kitoi fish pass commenced in 1994. The first substantial return data were gathered in 1996. Discontinuation of the zero-check stocking program occurred in 1996. Current plans call for the discontinuation of early run LKL stocking in 1998 and no saltwater releases in 1999.

Smolt Emigration

Sockeye salmon presmolt stocking of LKL commenced in October 1994. Mark and age data collected in 1995-1997 indicate 98% of emigrating presmolts stocked in 1994 smolted as age-1 fish (Table F.1).

Emigration data indicate preliminary "presmolt to smolt" survival rates ranging from 34% to 85% (Table F.1). Early run Afognak Lake presmolts stocked in LKL have exhibited a stocking to emigration survival rate of 34% to 85%. Late run presmolts stocked into LKL (Upper Station/ Little Kitoi Lake parent stock) have exhibited a survival rate of 44% to 53% (Table F.1). Some concern exists that the smolt emigration in 1996 began prior to monitoring, leading to an underestimation of 1995 presmolt survival.

Age 2 emigration of stocked presmolts has remained minimal with an additional emigration of only 1%-4% observed following the second winter of lake residency (Table F.1). There has been no verification that age 3 emigration of stocked fish has occurred, and all indications suggest any such hold over is negligible. The majority of presmolts stocked have emigrated at age 1 (1995-1997). As a result, unless mark observations indicate otherwise, unaccounted stocked presmolt were attributed to lake mortality. Considering age at smolt data (1995-1997), there is no expectation of appreciable second or third year emigration of released presmolts in 1998.

-Continued-

A zero-check release at LKL in July 1995 displayed a 48.8% emigration within two weeks of release. An estimated 0.2% (435 fish) emigrated in 1996 as age-1 smolts. In 1997, an additional 1.1% (2,976 fish) emigrated as age-2 smolts (Table F.1). Those zero-checks smolting in 1997 appeared to mirror growth observed in the naturally propagated population with little change in size noted since stocking.

The fact that scales of stocked fish appear to contain a "false check" complicated aging (Dave Kaplan, ADF&G, Kodiak, personal communication). Initially, this false check was attributed to stress during stocking or the change in environment; however, further review has suggested another cause. Scales collected from the hatcheries prior to stocking exhibited a similar characteristic. We now believe this false check may result from environmental changes experienced at the hatcheries. This phenomenon warrants further study. The false check anomaly was first noted during 1996 scale aging and was also evident in adult escapement scale samples. Aging has relied on scale patterns to distinguish the small remnant "wild" sockeye population from stocked populations (Little Kitoi Lake was originally a barren system and had several stocks of sockeye stocked in the late 1950's and early 1960's). Wild propagated smolts are distinguished by tight circuli, while hatchery reared smolts have broad, uniform circuli (Dave Kaplan, ADF&G, Kodiak, personal communication). This false check may have caused assigning age 1. freshwater age to fish that may have been age 0. in adult samples from years prior to 1996.

Adult Escapement

Little Kitoi Lake sockeye salmon escapements in 1992 and 1993 exceeded 4,500 fish, but were considerably less than expected. In 1994, escapement declined substantially to 2,402 sockeye. Escapement declined further in 1995 to 1,180 sockeye. The cause of the 1994 and 1995 decline is unknown. In 1996, escapement reached 5,628 sockeye. Minimal escapement was allowed in 1997.

The low magnitude of adult returns to LKL and the lack of marks observed in escapement samples suggest that saltwater zero-check releases have exhibited extremely poor survival. Escapement age analysis did not reveal any zero-check returns. However, the number of zero-check fish may have been under reported due to the possible false checks described above. Sockeye salmon harvest figures in the Kitoi Area indicate a marked increase beginning in 1992, which correlates well with the zero-check release program. However, the incidence of marked zero-checks observed at the LKL fish pass has remained extremely low. This low incidence, along with the observed behavior of saltwater released age-1 smolts, suggest that saltwater releases may imprint fish to the estuarine release site rather than the freshwater source. If true, the zero-check program was successful in contributing to the commercial fishery, but was unsuccessful in developing an adequate brood stock source.

-Continued-

Fresh water release of zero-checks occurred in 1990, 1993, and 1995; however, adult return survival estimates are only available for the 1995 stocking. No marking of the 1990 and 1993 release populations took place. Mark observation data for the 1995 release population indicate a stocking to adult return survival rate of 1% (to date). The 1993 release was smaller than expected due to a large mortality of unknown origin (possibly IHNV) and may have contributed to the low escapement levels observed in 1995. The last zero-check release occurred in 1995.

The 1996 sockeye salmon escapement success is due largely to presmolt lake stocking. Observations of marked fish indicate early run presmolts released in 1994 dominated the 1996 sockeye run (38%) with an estimated jack return of 10,544 fish (Table F.1). This return represented 9% of the 1995 emigration by this stock.

In 1997, concern over run timing, brood stock collection, and rearing potential led to changes in the LKL stocking strategy. Late run sockeye salmon brood stock development has taken priority, resulting in the phase out of early run sockeye and coho stocking. In addition, the decision to change the LKL brood stock source to Saltery Lake was finalized. In preparation for the 1998 brood stock change, minimal sockeye salmon escapement was allowed in 1997. Mark examination efforts in Kitoi Bay indicate early run presmolts stocked in 1994 (age 1.2) dominated the 1997 sockeye salmon run (age 1.2; 46%), exhibiting a stocking to adult survival rate of 19% (Table F.1). With the return of age 1.3 fish in 1998, the survival rate will increase. The 1995 age 1 release (age 1.2) composed an estimated 36% of the 1997 run; however, stocking to adult survival was only 2%. While late run presmolts stocked in 1994 only contributed 2% to the 1997 run, they exhibited a release to adult survival rate of 9%.

Differential mortality of marked fish was first suggested by 1996 adult return data, and further supported in 1997. Essentially, this means that marked fish experience a greater mortality than unmarked fish. Therefore, each marked fish represents more unmarked fish than the marking fraction indicates. When calculating run composition, differential mortality requires extrapolation of mark incidence data to the total estimated sockeye salmon run. Run composition estimates for 1996 and 1997 used this technique.

Adult return data collected in 1998 will be critical to determining the extent of presmolt release success, as well as differential mortality of marked fish. With LKL sockeye escapements not planned to resume until 2001, there is a need to intensify commercial harvest sampling and mark examination efforts in the interim (1998-2000).

Commercial catches in Duck Bay, Izhut Bay, and Kitoi Bay Sections have mirrored changes in sockeye escapement, except with regard to the 1995 harvest. While the 1995 sockeye salmon harvest approximated the 1993 harvest, the 1995 escapement (1,180 sockeye) was only 24% of

-Continued-

the 1993 escapement. The majority of the 1995 sockeye harvest took place in Duck Bay; this may indicate that the commercial harvest in this section may have a low Kitoi Bay sockeye component. In 1997, the Kitoi Area sockeye salmon harvest reached an all time record with 50,392 fish reported taken in Duck Bay, Izhut Bay, and Kitoi Bay Sections. Within the Kitoi Area, the Kitoi Bay Section had the highest harvest with 29,626 sockeye taken. An increased sampling effort in the Izhut Bay and Duck Bay Sections would assist with stock composition estimates and improve evaluation of the Kitoi Bay Hatchery production.

Straying

An effort to determine if Kitoi Bay released sockeye stray to unintended systems was inconclusive. No definitive data indicated straying to Paul's or Afognak Lake had occurred. Some returns were noted at Kitoi Bay Hatchery in 1996 and 1997, but were <1% of annual runs. The effort was discontinued in 1997. Plans call for no saltwater releases in 1999.

Table F.1. Sockeye salmon marking and stocking numbers, smolt outmigration, adult returns, and survival to date, Kitoi Bay and Lake, 1989-1997.

Brood Year	Broodstock	Clip	# Marked	# Planted	Life Stage	Year Released	Release Location	Outmigrated to Sea[a]										Return[b]				Survival (to date)		
								1989	1990	1991	1992	1993	1994	1995	1996	1997	Total	1995	1996	1997	Total	plant to smolt	smolt to adult	plant to adult
1988	U Station		0	150,000	0	1989	*B.Kitoi Bay*	150,000									150,000					100%		
1989	U Station		0	578,932	0	1990	L.Kitoi Lake										*unknown*							
1989	U Station		0	1,312,728	0	1990	L.Kitoi Bay		1,312,728								1,312,728					100%		
1990	U Station		0	1,250,000	0	1991	L.Kitoi Bay			1,250,000							1,250,000					100%		
1991	U Station		0	1,463,000	0	1992	L.Kitoi Bay				1,463,000						1,463,000					100%		
1991	Afognak	LV	30,000	182,000	0	1992	L.Kitoi Bay				182,000						182,000					100%		
1992	U Station		0	52,418	0	1993	L.Kitoi Lake										*unknown*							
1992	U Station	Ad/LV	19,968	326,500	1	1994	L.Kitoi Bay						326,500				326,500		9,962	394	10,356	100%	3.2%	3.2%
1993	Afognak	LV	20,186	293,000	0	1994	L.Kitoi Bay						293,000				293,000					100%		
1993	U Station	LV	40,950	1,672,710	0	1994	L.Kitoi Bay						1,672,710				1,672,710		3,945		3,945	100%	0.2%	0.2%
1993	Afognak	RV	10,103	183,000	pre	1994	L.Kitoi Lake							122,282	2,065		124,347		10,544	23,766	34,310	67.9%	27.6%	18.7%
1993	L Kitoi	Ad/RV	10,108	10,108	pre	1994	L.Kitoi Lake							4,367	63		4,430		71	862	933	43.8%	21.1%	9.2%
1993	Afognak		0	3,500	1	1995	L.Kitoi Lake							3,025			3,025							
1993	L Kitoi	Ad/LV	59,950	916,677	1	1995	L.Kitoi Bay							916,677			916,677		168	18,770	18,938	100%	2.1%	2.1%
1994	U Station	LV	10,000	266,952	0	1995	L.Kitoi Lake							130,199	435	2,976	133,610			2,761	2,761	50.1%	2.1%	1.0%
1994	Afognak	RV	10,000	112,880	pre	1995	L.Kitoi Lake								34,025	4,691	38,716			847	847	34.3%	2.2%	0.8%
1994	L Kitoi	Ad/RV	10,000	84,861	pre	1995	L.Kitoi Lake								44,697		44,697			497	497	52.7%	1.1%	0.6%
1994	L Kitoi	Ad/LV	45,000	573,242	1	1996	L.Kitoi Bay								573,242		573,242			1,651	1,651	100%	0.3%	0.3%
1995	Afognak	RV	10,000	50,650	pre	1996	L.Kitoi Lake									42,795	42,795				0	84.5%		
1995	L Kitoi	Ad/RV	10,000	155,687	pre	1996	L.Kitoi Lake									77,728	77,728				0	49.9%		
1995	U Station	Ad/LV	45,081	587,435	1	1997	L.Kitoi Bay									587,435	587,435				0	100%		
1996	Afognak	RV	9,980	125,800	pre	1997	L.Kitoi Lake										0				0			
1996	L Kitoi	Ad/RV	9,969	77,039	pre	1997	L.Kitoi Lake										0				0			

a\ Based upon estimates derived from age composition, size at age, and marks observed.
b\ Based on estimates derived from mark incidence.

Appendix G. Genetic samples collected from adult sockeye salmon from Kodiak and Afognak Island lakes.

Area/Lake	Samples Collected Month/Year	Sample Size	Harvest Timing	Samples Analyzed
Afognak Island				
Afognak	August 1993	100	Early	No
Laura	August 1994	100	Early	No
Little Kitoi	September 1993	100	Late	No
Malina	August 1993	100	Early	No
Kodiak				
Frazer	July-August 1996	900	Early	Yes [1]
	July-August 1997	400	Early	Yes [1]
Karluk	1978-1981	560	Early	Yes [2]
		437	Late	Yes [2]
Little River	July 1997	100	Early	No
Saltery	September 1994	100	Late	Yes [3]
Uganik	July 1997	100	Early	No
Upper Station	September 1993	100	Early	Yes [3]
		100	Late	Yes [3]

[1] Forrest R. Bowers, ADF&G, Kodiak, personal communication.

[2] Wilmot, R.L. and C.L. Burger. 1985. Genetic Differences among Populations of Alaskan Sockeye Salmon. Transaction of the American Fisheries Society 114:236-243.

[3] Honnold, S.G. 1997. The Results of Sockeye Salmon *Oncorhynchus nerka* Stocking into Spiridon Lake on the Kodiak National Wildlife Refuge: Juvenile and Adult Production, Commercial Harvest, and Ecosystem Effects, 1987-1996. Alaska Department of Fish and Game, Commercial Fisheries Management and Development Division, Regional Information Report 4K97-47. Kodiak.

Appendix H. Number sampled and incidence of IHNV from Kodiak and Afognak area sockeye salmon adults, 1987-1997.

Year Sampled	Lake Stock	IHNV	
		Number	Percent
1987	Afognak	3/59	5%
1988	Afognak	0/60	0%
1993	Afognak	0/60	0%
1997	Afognak	0/60	0%
1990	Malina	0/62	0%
1993	Malina	0/51	0%
1997	Malina	0/60	0%
1993	Paul's	26/60	43%
1988	Sitkalidak	0/60	0%
1991	Rose Tead	0/53	0%
1991	Frazer	44/60	73%
1992	Little Kitoi	24/62	39%
1993	Little Kitoi	43/64	67%
1992	Karluk	58/60	97%
1987	Upper Station	12/58	21%
1988	Upper Station	28/60	47%
1989	Upper Station	46/63	73%
1993	Upper Station (upper lake)	31/56	55%
1993	Upper Station (lower lake)	24/59	41%
1986	Saltery	20/60	34%
1994	Saltery	55/60	92%
1995	Saltery	13/39	33%
1996	Saltery	47/66	71%
1997	Saltery	60/65	92%

SIGN-OFF

Andy Hall: Kitoi Bay Hatchery Manager, KRAA — 5/5/98 Date

Steve Honnold: Area Development Biologist, CFM&D — 5/4/98 Date

Jim McCullough: Regional Resource Development Biologist, CFM&D — 5/4/98 Date

Dave Prokopowich: Area Management Biologist, CFM&D — 5/6/98 Date

Wayne Donaldson: Regional Management Biologist, CFM&D — 5-6-98 Date

Pete Probasco: Regional Supervisor, CFM&D — 5-6-98 Date

Len Schwarz: Area Biologist, Sport Fish — 5-6-98 Date

Doug McBride: Sport Fish Regional Supervisor — 5/12/98 Date

Larry Malloy: Executive Director, KRAA — 5-7-98 Date

The 1998 Hatchery Management Plan for KBH is hereby approved:

Robert Bosworth: Deputy Commissioner, ADF&G — 5-13-98 Date