# KITOI BAY HATCHERY ANNUAL MANAGEMENT PLAN, 1997

By

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# 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, was destroyed in the 1964 earthquake and 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, was a joint funding effort by ADF&G and Kodiak Regional Aquaculture Association (KRAA) from FY87-FY91, and 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 20 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 up from saltwater 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) occur in LKL (Appendix B and C).

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 1997, we propose continuing the KBH pink salmon program at full production (~182 million fry release in 1998).

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 1997, we propose continuing the KBH chum salmon program at full production (a release of ~22 million fry in 1998).

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 fry are released into local lakes in the Kitoi Bay area (Little Kitoi, Jennifer, Ruth; Figure 1). In the spring, coho fry are also stocked into Crescent Lake (adjacent to Port Lions; Figure 5) and in the fall presmolt are stocked into Katmai Creek (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 fry, presmolt, and smolt release program in 1998 at similar release levels as projected for 1997.

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 and U.S. Fish and Wildlife Service (FWS) indicate that Saltery Lake sockeye salmon may be preferred for Spiridon Lake and LKL stocking (Clevenger et al. 1997; Honnold *in press*). 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 (Figures 7-9). This plan identifies production requirements using Saltery Lake sockeye salmon as the primary stock for brood stock development; however, is contingent upon ADF&G, FWS, and KRAA approval.

The egg take season at KBH occurs from early July thorough 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 and late run sockeye egg takes occurring simultaneously from late September through late October. The coho egg take goal is 2 million eggs and the late sockeye goal is 1 million eggs.

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.

## 1996 BROOD YEAR: RELEASES IN 1997 AND 1998

Table 1 describes 1996 egg takes, planned releases in 1997 and 1998, projected returns in 1998-2001, and the status of Fish Transport Permits (FTP). Appendix A describes juvenile-to-adult survival estimates used to project adult production.

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

In 1997, we plan to rear and release 110 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 saltwater for up to eight weeks and then released into Big Kitoi Bay. The actual stocking levels are determined by the egg to fry survival.

Approximately 3.3 million adult pink salmon are expected to return to KBH in 1998. The pink salmon run should begin in late July and peak in early August and ending in late August (Figure 8). Most pink salmon returning to KBH should 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 1997, we plan to rear and release 22 million 2.0 g chum salmon fry directly into Kitoi Bay (Figure 1). 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 saltwater for up to 12 weeks. The stocking levels are determined by egg to fry survivals.

Approximately 440,000 adults are expected to return starting in 1999 and continuing through 2001. The majority of the return is expected in 2000 since age 0.3 chum salmon (three years ocean residence) comprise the majority of the run (A. Hall, KRAA, personal communication). 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 should 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 1997, we plan to release 700,000 20.0 g age-1 coho smolt (brood year 1995, 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 freshwater (Hasler and Scholz 1983); as little as four hours exposure to freshwater 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% (A. Hall, KRAA, personal communication). This indicates coho smolt released at Big Kitoi Bay are homing well to the release site. Since the coho smolt are released directly to saltwater, stocking levels are determined by hatchery rearing capacity and egg to smolt survival. We expect ~90,000 adults to return in 1998 as age 1.1 coho salmon (Table 1).

In 1997, we also plan remote releases of 298,000 1.5 g coho fingerlings (brood year 1996 Big Kitoi Creek brood source) into Ruth and Jennifer Lakes and two small lakes that drain into Little Kitoi Lake (35,000, 163,000, 50,000, 50,000 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. These remote releases have occurred only three times in the past six years in order to prevent overgrazing the zooplankton population in each lake. Both Jennifer and Ruth Lakes are barren lakes with barrier falls. Little Kitoi Lake is not stocked directly; the small lakes that drain into Little Kitoi Lake

provide the rearing habitat for the stocked fry (50,000 for each lake). By stocking the barren lakes competition with Little Kitoi wild fry should be prevented. About 18,000 adults are expected to return in 2000 and 2001 from these releases (Table 1).

In 1998, we plan to release 750,000 20.0 g age-1 smolt (brood year 1996, Big Kitoi Creek brood source) directly into Kitoi Bay in a manner similar to the 1997 coho smolt release. From this release, about 90,000 adults are expected to return to the Kitoi Bay area in 1999 (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 1997, we also plan remote releases of 165,000 coho fry into Crescent Lake (Port Lions village) and 15,000 coho presmolt 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 determined by limnological analysis. Katmai Lake stocking levels were determined by modeling the surface area of the lake (limnology samples are not collected); by releasing presmolts we expect to minimize impacts to the lakes forage base. Remote releases into Crescent and Katmai Lakes have occurred annually since 1987.

Adult returns (brood year 1996) are projected to be 10,000 to Crescent Lake and 1,500 to Katmai Lake in 2000 and 2001 combined (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: Upper Station Stock*

In 1997, we plan to release 585,000 10.0 g age-1 late run sockeye salmon smolt (brood year 1995, Upper Station stock) into Little Kitoi Estuary (Figure 4, Table 1. The smolt are 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 freshwater (Shirahata and Tanaka 1969 cited in Hasler and Scholz 1983). The net pens are surrounded by boom material which 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 (Wedemeyer 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 of these releases will be marked by fin clipping (see EVALUATION section). A total of 58,500 adult sockeye are expected to return in 1999 and 2000 from this release (Table 1).

### *Sockeye Salmon: Little Kitoi Lake Stock*

In 1997, we plan to stock 150,000 6.0 g presmolt into LKL in late October-November just before freeze up to minimize the likelihood of plankton cropping. ). The original brood source for the Little Kitoi Lake sockeye salmon project was late run Upper Station. This stocking strategy has been recommended as result of limnological analyses of Kodiak and Alaska Peninsula Lakes (Honnold et al. 1996). The juveniles will be transported to LKL by transfer tank installed on a skiff and then hauled up the LKL fish pass by bucket and released directly into LKL. Presmolt releases in LKL began in 1994; hydroacoustic surveys conducted after the releases in November and in May of 1995, indicated that these juvenile sockeye salmon remained in the lake and did not migrate prematurely in the late fall or winter months (Honnold et al. *in press*). A portion of these releases will be marked by fin clipping (see EVALUATION section). A total of 15,000 adults are expected to return in 2000 and 2001 as result of late run pre-smolt stocking from KBH (Table 1).

In 1998, we plan to release 600,000 10.0 g age-1 late run sockeye smolt (brood year 1996, LKL brood source) into Little Kitoi Estuary which will be reared and released in a manner similar to the 1997 sockeye smolt saltwater pen rearing release. A portion of these releases will be marked by fin clipping (see EVALUATION section). A total of 60,000 adults are expected to return in 2000 and 2001 (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).

In summary, we propose releasing the following juveniles (brood year 1996) in 1997 and 1998: 110 million pink salmon, 22 million chum salmon, 1.23 million coho salmon, and 1.34 million sockeye salmon (Table 1).

## 1997 BROOD YEAR: RELEASES IN 1998 AND 1999

Table 2 describes 1997 egg takes, planned releases in 1998 and 1999, projected returns for 1999-2002, 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 1998, we intend to release up to 182 million 0.5 g pink salmon fry into Kitoi Bay (Table 2). The original brood source for the KBH pink salmon project was late 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 salmon fry are released; the larger the chum salmon egg take (maximum 25 million), the fewer pink salmon eggs that can be incubated. In 1997, 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). If no chum salmon eggs are collected a maximum of 215 million pink salmon eggs will be acquired.

Approximately 5.5 million adults pink salmon are expected to return to KBH in 1999 (Table 2). The pink salmon run should begin in late July and peak in early August and ending in mid to late August (Figures 7 and 8).

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

In 1998, 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 1998 release, about 440,000 chum salmon adults are expected to return in 2000 through 2002. The majority of the return is expected in 2001 since age 0.3 chum salmon (three years ocean residence) comprise the majority of the run (A. Hall, KRAA, personal communication). The run should begin in early June and 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 1998-1999 we intend to release ~1,228,000 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 1998, we plan to release 298,000 1.5 g coho fingerlings (brood year 1997) into Ruth and Jennifer Lakes and two small lakes that drain into Little Kitoi Lake (35,000, 163,000, 50,000, 50,000 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 Jennifer and Ruth Lakes are barren lakes with barrier falls. Little Kitoi Lake is not stocked directly; the small lakes that drain into Little Kitoi Lake provide rearing area for stocked fry (50,000 for each lake) which should prevent competition with Little Kitoi wild fry.

In 1998, we also plan to release coho fry (165,000) and presmolt (15,000) to Crescent (Port Lions village) and Katmai (Ouzinkie village) lakes, respectively in the same manner as described for 1997.

The release in Kitoi Bay in 1999 will consist of 700,000 20.0 g age-1 smolt (brood year 1997). The smolt will be reared and released in a manner similar to the 1998 coho smolt release.

Approximately 29,000 adults are expected from fry stocking in 1998 (brood year 1997) and an additional 90,000 adults from smolt stocking in 1999 (brood year 1997; Table 2). Of these, 18,000 (Jennifer, Ruth, and Little Kitoi returns; Figure 4) will be available for harvest in 2001 and 2002 and 90,000 in the year 2000 in the Kitoi Area (Izhut, Duck, and Kitoi Bays Sections, Figure 3). Adult returns are projected to be 10,000 to Crescent and 1,500 to Katmai in 2001 and 2002 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).

## SPIRIDON LAKE BROOD STOCK CHANGE

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 is 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 *in press*). The transition from Upper Station (Little Kitoi) to Saltery Lake as the primary brood source is scheduled (proposed) to begin with the 1997 egg take (1998 stocking year) if the change is approved by the Commissioner of ADF&G, KRAA and in conjunction with the FWS. In the event that egg takes at Saltery Lake are not approved, LKL would be the secondary egg source and if LKL proved to be insufficient to supply KBH, additional Upper Station eggs will be requested for KBH egg requirements.

The rationale for changing the brood stock from Upper Station Lake to Saltery Lake includes the following:

- The use of Saltery Lake sockeye salmon brood stock is expected to reduce the incidental harvest of Spiridon River sockeye, pink, and chum salmon stocks in Spiridon Bay due to greater separation in the run timing between Saltery Lake and Spiridon River salmon stocks (Clevenger et al. 1997). The sockeye run at Telrod Cove (Spiridon Bay Terminal Harvest Area) as a result of stocking Saltery Lake sockeye into Spiridon Lake is projected to occur from 4 July through 9 August, peaking on 22 July (ADF&G 1994). The run (based on the harvest in statistical area 254-40) using late run Upper Station as brood stock has occurred from ~24 July through 4 September, peaking ~15 August (Honnold *in press*). In the THA, the incidental harvest of chum salmon has been minimal; however, the incidental harvest of pink salmon has been substantially larger; primarily occurring during the peak of the sockeye fishery in mid August. The earlier run timing using Saltery Lake brood stock is expected to reduce the incidental harvest of pink salmon in the THA. Chum salmon harvested in Spiridon Bay (which includes Spiridon Bay and Cape Kuliuk harvest areas) has historically occurred from June through August, peaking in late July. This trend is not expected to change; however, the harvest will be monitored annually to assess any substantial change. Few chum salmon have been observed in the THA and appear to be more direct in their movements into Spiridon River than the pink salmon run. Thus, the incidental harvest of chum salmon in the THA is not expected to increase with the change in sockeye salmon run timing. The small sockeye run (~200-450 escapement) to Spiridon River has been observed inriver from late August into early October (T. Chatto, FWS, personal communication). This would indicate that the earlier Spiridon Lake (Saltery brood stock) sockeye run timing should decrease any incidental harvest of Spiridon River sockeye since indigenous fish are likely in route to the river in early to mid August.

- The earlier run timing will provide improved opportunity for escapements necessary for the Little Kitoi Bay brood stock development program (Figure 7). Sockeye runs using Saltery Lake brood stock would be expected to return as chum salmon abundance in the Kitoi Bay fishery was declining, and prior to the majority of pink salmon returns. This would provide a window to allow sufficient escapement into Little Kitoi Lake for brood stock requirements.

- The utilization of excess escapement of Saltery Lake sockeye will benefit the Saltery Lake zooplankton community which has experienced a decline in density and biomass in recent years because of excess escapements. Sockeye escapement has averaged 55,412 salmon (average 1991-1995) and has exceeded the upper BEG (40,000) annually since 1991. The 1996 zooplankton density and biomass in Saltery Lake declined four-fold compared to 1995 (Honnold in press).

- The cost benefit ratio of the program will improve as a result of decreased egg take costs at Saltery Lake. Saltery Lake is located much closer to PCH than Upper Station Lakes (Figure 1). Consequently, air charter costs would be reduced for the egg takes. Saltery Lake is also accessible by four-wheeler from the Kodiak road system which would allow egg takes to proceed if weather prevents flying. This would reduce the time required for the egg take and associated remote camp, personnel, transportation, and logistical costs.

### *Sockeye Salmon: Saltery Lake Stock*

We propose modifying the present late run sockeye salmon brood stock development program (see preceding sections - 1996 Brood Year Releases in 1997 and 1998) by switching from Upper Station/Little Kitoi Lake sockeye to Saltery Lake sockeye as the primary brood source in 1997. 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 primary sockeye salmon egg take site for the Spiridon lake project. In the event that egg takes at Saltery Lake are not approved, LKL would be the secondary egg source and if LKL proved to be insufficient to supply KBH, additional Upper Station eggs will be requested for KBH egg requirements.

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). If PCH stocking plans for 1998 are approved, this release project would be eliminated. 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 in 1998 to 300,000 fish. The actual number released will be determined after annual limnology analysis of the lake.

We also propose to release 600,000 10.0 g age 1 smolt into Little Kitoi estuary (1999, Saltery Lake stock). The juveniles will be released in a manner and timing consistent with past years sockeye salmon releases. Approximately 90,000 adults are expected to return in 2001, 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 *in press*). 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.

### *Sockeye Salmon: Little Kitoi Lake Stock*

A late run sockeye salmon egg take will occur at LKL in 1997 if the proposal to use late run Saltery Lake stock sockeye for the Spiridon Lake project or LKL brood stock building programs are denied (Clevenger et al. 1997). The original brood source for the KBH late run sockeye salmon project was Upper Station. Release numbers and adult production will remain as described for the Saltery Lake sockeye stock. The run timing should mimic the current LKL late run timing with the run beginning in late July, peaking in early to mid August and ending in early September (Figures 7 and 9).

### *Sockeye Salmon: Upper Station Stock*

A late run sockeye egg take will occur at Upper Station in 1997 if the proposal to use Saltery Lake late run stock for the Spiridon lake project and LKL brood stock building programs are denied. If the adult escapement into LKL is adequate for an egg take, Upper Station brood stock will not be needed. Release numbers and adult production will remain as described for the

Saltery Lake sockeye stock. The run timing should be similar as described above for Little Kitoi Lake.

In summary, we expect the following releases and production from brood year 1997 egg takes: 182 million pink salmon fry producing 5.5 million adults, 22 million chum salmon fry producing 440,000 adults, 750,000 coho smolt producing 90,000 adults, 478,000 coho fry and presmolt producing 29,000 adults, 600,000 sockeye smolt producing 60,000 adults and 300,000 sockeye presmolt producing 30,000 adults (Table 2). This equates to 206 million juveniles released, producing over 6 million returning adults.

## SALMON HARVEST MANAGEMENT

The estimated run, brood, and harvest of salmon returning to systems in 1997 as a result of KBH stocking is projected as follows.

KBH Returns

| | | |
|---|---|---|
| Pink* | 7,065,000; | range 2,076,000-13,735,000 |
| Chum* | 22,500; | range 15,000-55,000 |
| Coho** | 146,000; | range 95,000-197,000 |

Little Kitoi Lake

| | | |
|---|---|---|
| Late Run Sockeye** | 36,000; | range 15,000-57,000 |

Crescent Lake

| | | |
|---|---|---|
| Coho** | 7,000; | range 3,000-10,000 |

Katmai Creek

| | | |
|---|---|---|
| Coho** | 1,500; | range 1,000-2,000 |

*Hall, unpublished
**Honnold, 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 Bays 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, therefore inseason adjustments in fishing opportunity in any or all management units may be necessary to achieve brood stock goals (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 North of a line from the regulatory markers located at the entrance of Kitoi Bay ("the jaws"; Figure 4). In the event that surplus fish are available, the SHA may be opened by emergency order. In 1987, 1988 and 1989 cost recovery fisheries occurred in the SHA. Since 1989, no cost recovery fisheries have occurred in the Kodiak Management Area.

### *Pink Salmon*

Pink salmon produced at KBH are taken in purse and beach seine fisheries and contribute to the commercial catch in the Kitoi, Izhut and Duck 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 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 (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 assure the maintenance of genetic diversity. In 1997, 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 insure adequate brood stock, the Izhut and Duck Bays 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. The minimum escapement goal

for Big Kitoi Creek is 15,000 pink salmon. 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 Bays Sections (Figure 3). In 1997, chum salmon returns to Kitoi Bay are projected at 22,500 total adults (A. Hall, KRAA, personal communication). Chum salmon brood stock requirements for KBH are 30,000 fish (Table 3); therefore a commercial fishery targeting chum salmon is not expected in the Izhut, Duck or Kitoi Bays Sections in 1997. 1997 is the final season of low chum salmon returns caused by the IHNV epizootic at KBH on brood year 1990 chum salmon.

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).

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 Izhut, Duck and Kitoi Bays Sections (Figure 3). The Hatchery Manager and Kodiak Commercial Fisheries Management Biologist will coordinate openings in the Izhut, Duck and Kitoi Bays 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. The minimum escapement goal for Big Kitoi Creek is 2,000 chum salmon. In 1997, 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 Izhut, Duck and Kitoi Bays Sections (Figures 3 and 4). Coho salmon brood stock requirements are 6,000 (Table 3) while the adult return forecast is 146,000 (Honnold 1997); therefore, a commercial fishery targeting excess coho salmon is expected in the Kitoi Bay area in 1997.

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 insure adequate brood stock. In 1997, the estimated run strength is larger than brood stock requirements, specific commercial fishing closures are not expected to occur. Once all pink salmon brood stock are collected and contained behind the barrier net, additional 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 (A. Hall, KRAA, personal communication). In the event that brood stock collection objectives (6,000 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 1997 coho salmon run. Proposals to address the loss of coho brood stock to sport fishers will be presented by the Sport Fish Division at the next scheduled Kodiak regulatory meeting of the Alaska Board of Fisheries. Sport Fish Division 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 1997, 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 early run sockeye escapement and harvest objectives for salmon stocks of the Duck, Izhut, and Kitoi Bays Sections produced from the Little Kitoi Lake enhancement projects. The harvest strategy also provides for the collection of brood stock to Kitoi Bay Hatchery (Figure 2).

In 1997, early run sockeye salmon (Afognak Lake stock) will be returning to LKL for the first time (Hall et al. 1996; Clevenger et al. 1997). All of the run 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). In addition to providing commercial harvest opportunities, this stock was developed as a back up brood source if escapements were too low at Afognak Lake to provide for early run stocking projects. In 1997, the Afognak Lake sockeye run is expected to be large enough to provide eggs for all early run stocking projects.

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 (A. Hall, KRAA, personal communication). 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 1997, late run sockeye salmon (LKL and Upper Station stock) will be returning to LKL and will all be available for harvest if the proposed brood stock change from Upper Station Lake to Saltery Lake is approved. The fish pass at the mouth of LKL will remain closed throughout the late run (until ~August 20 when coho escapement begins) to allow commercial fishing to occur within the Kitoi Bay Section (Figure 4). The fish pass will be opened after the early sockeye run is complete (early July) to provide for late run escapement and brood stock collection if the Saltery Lake stock is not approved for the Spiridon Lake stocking project. Closed waters adjustments may be necessary to allow sufficient escapement (~14,000; Table 3) for brood stock collection into LKL.

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, Ruth, and Little Kitoi Lakes coho salmon stocking projects is to provide enhanced coho salmon for harvest as they return to the Kitoi area (Figure 1). The Kitoi harvest strategy is also intended to protect Big Kitoi Creek escapement (brood source for the socking of these lakes; Figure 4). Coho salmon returning to Jennifer, Ruth and Little Kitoi Lakes are expected to be harvested during commercial fisheries in Izhut, Duck and Kitoi Bays Sections (Figure 3). 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. Coho will be able to enter LKL after ~August 20 to provide escapement (range of ~500-1000 salmon 1992-1996). 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 any of these lakes since they are the product of a remote release from KBH.

***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 1997 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 1). Special openings are not expected to occur within the THA (Settler Cove; Figure 5; ADF&G 1996). In 1997, 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. A barrier net is not necessary for this project since natural barriers prevent salmon access to the lake and villagers of Port Lions utilizes 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 1). 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 system is barriered which prevents any escapement to the lake. Harvest data will be monitored through subsistence permits and commercial fish ticket data.

### *General Conditions of Harvest Management, 1997*

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 North 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 FY98. 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.

## 1997 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 hatchery water (imprinting source) 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. All returning coho and any sockeye (Appendix D) salmon that are not harvested or used for brood stock are prevented access to the creek by the weir. Pink and chum salmon eggs collected from salmon returning to Big Kitoi Creek/KBH will provide fry for release into Big Kitoi Bay in 1998. Coho eggs collected from KBH will provide fry for release at Big Kitoi Bay, Crescent, Katmai, Ruth, Jennifer, and Little Kitoi Lakes in 1998 and 1999. 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 if the permits for the use of Saltery stock at Spiridon and LKL are approved. Otherwise a large sockeye salmon escapement, well above egg take requirements, is required to overcome the difficulty in collecting adequate numbers of fish in the lake. Sockeye salmon eggs collected from LKL will provide juveniles for backstocking into LKL and for releases into Little Kitoi estuary in 1998 and 1999.

## EVALUATION

### *Sockeye*

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 1997). The sockeye salmon development program in the Kitoi area focuses on rearing and release of presmolt and smolt at Little Kitoi Bay and Lake as well as remote release of fry at other Kitoi area lakes (Tables 1 and 2).

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 (Honnold et al. *in press*; Appendix B). 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 later 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's (Appendix D).

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 found similar straying rates; however, a broader range from 2.0%-6.8% (Hartman and Raleigh 1964). We used a similar straying rate of 2% (threshold) for this study (S. Calson, 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.

Preliminary data indicate straying is less than 1% to Afognak Lake including analysis scenarios that include differential survival at 50%-60% less for marked fish (N. Sagalkin, ADF&G, personal communication). Straying rate to Paul's Lake, however, exceeds the 2% threshold for all scenarios, possibly as a result of the small mark recovery sample sizes. The evaluation of straying to Big Kitoi Creek was not part of the original evaluation program; however, initial observations indicate a portion of the LKL (bay) released sockeye returned to the hatchery in 1996. The proportion may have exceeded 2% of the Little Kitoi late run escapement (R. Markle, ADF&G, personal communication). Sockeye salmon smolt released in Little Kitio Bay are incubated and reared for over a year at KBH. A small portion of these fish have been observed to possess characteristics typical of smolt that are osmocompetent and ready to migrate (i.e. slower feeding, silvery coloration, increased activity) well in advance of the net pen imprinting (in Little Kitio Bay) period (Andy Hall, KRAA, personal communication). Perhaps, these smolt imprint on the hatchery water source instead of LKL outflow. This may explain a portion of the adults that returned to Big Kitoi Creek in 1996.

Preliminary results indicate that the number of adults examined for marks to date has not been adequate to provide statistically valid results (I. Vining, ADF&G, personal communication; Honnold et al. *in press;* Appendix D). Initial examination numbers (7,000 at Paul's Lake; 13,000 at Afognak Lake) were increased in 1996 as result of larger escapements at Pauls and Afognak Lakes to levels unattainable with resources (manpower and funding) available.

It may be prudent to further assess the sockeye return rate to Big Kitoi Creek in lieu of the examination constraints for the other systems. This system does not have a natural run of sockeye and barriers limit migration so if true straying occurs, no negative impact would be expected; however, return rate trend data may be useful. For example, if returns continue to increase, then we could adjust the rearing and release strategies (at the hatchery and/or at Little Kitoi estuary). Such adjustments may include: extending rearing time in net pens; providing more freshwater imprinting time (lake releases of smolt); discontinuing smolt releases in lieu of presmolt releases only, etc.

Consequently, we propose discontinuing the straying evaluation at Afognak and Paul's Lakes in 1997 and initiating 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 will be evaluated for homing success. All sockeye salmon observed in Big Kitoi Creek (hatchery raceways) will be examined for marks. If marked fish are found, two scales and lengths will be taken. Adults with out marks will be aged and scale patterns compared to LKL sockeye scale patterns. These data will also be assigned to early and late run components (based on escapement timing) to enable comparison to LKL early and late run escapements.

The assessment of sockeye salmon stocking strategy (age-0 salt water 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 D). 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 D.

The evaluation of straying as well as adult survival for individual releases is substantially effected by differential mortality. Differential mortality between marked and unmarked sockeye released at KBH appears to be as high as 40% (R. Markle, ADF&G, personal communication). Substantial marked fish mortality has not been observed prior to release (A. Hall, KRAA, personal communication). Marked fish are held separate from other rearing juvenile sockeye for 24-48 hours immediately after marking and mortality is noted. Marked sockeye are then mixed with other juveniles for the remainder of the rearing period; any mortality differences between marked and unmarked fish after mixing are also recorded.

In 1997, a portion of the sockeye salmon will again be marked prior to release by fin clipping to assist with determining the success of a given rearing strategy. In 1997, we propose to expand the post-marking holding period for the different lots marked. We will hold samples of marked and unmarked fish for approximately two months to assess differential mortality (assume that the effects of clipping will occur during a fairly short period of time). Marking may be discontinued for releases in 1998 depending upon the results of data collected from the run in 1997. Returning adult sockeye salmon will be examined for fin clips at LKL fish ladder and biological data will be collected (if sockeye salmon escapement into LKL is required). If operated, the weir/fish ladder may be used to pass and count sockeye into the LKL from May 15 to August 25. Approximately 30% of the escapement into LKL (~4,000) may be inspected for marks. A total of 600 - 800 additional sockeye salmon will be sampled from fisheries in Izhut, Duck and Kitoi Bays Sections for biological data as well as checked for marks. If the fish pass at LKL is closed to prevent escapement, (due to changing the brood stock to Saltery Lake), then the sample from the commercial harvest will be increased to ~1,500 - 2,000 sockeye salmon. The number of adults inspected for marks may be adjusted depending on recommendations from the ADF&G biometrics staff.

In addition, sockeye salmon smolt will be sampled for age and size and marks, at LKL outlet throughout the emigration period (May-June). Weekly smolt samples will also be collected at Jennifer, Ruth, and Sorg Lakes for age, and growth information (May-June). An electronic counter will be used to estimate the smolt outmigration from LKL (Markle and Honnold 1997).

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

Lake limnological surveys will continue at Sorg, Little Kitoi, Jennifer, and Ruth Lakes; salinity, temperature and plankton surveys in Big and Little Kitoi Bays will also occur.

### *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 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 (A. Hall, KRAA, personal communication). 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 release, coho smolt will be 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 adult returns.

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Table 1. Salmon egg takes (1996), planned releases (1997,1998), projected returns (1998-2001), and fish transport permits (FTP), Kodiak Management Area.

| Release Site | Eggtake | | Releases | | | Adult Returns/1 | | | | | FTP | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | eggs | adults | Number | Size | Date | 1998 | 1999 | 2000 | 2001 | Total | Number | Expires |
| **Pink Salmon: Kitoi Bay Hatchery Stock** | | | | | | | | | | | | |
| Kitoi Bay | 132,000,000 | 278,000 | 110,000,000 | 0.50 | May-97 | 3,300,000 | 0 | 0 | 0 | 3,300,000 | 96A-0062 | 8/30/01 |
| **Chum Salmon: Kitoi Bay Hatchery Stock** | | | | | | | | | | | | |
| Kitoi Bay | 30,000,000 | 27,200 | 22,000,000 | 2.00 | May-97 | 0 | 4,400 | 264,000 | 171,600 | 440,000 | 96A-0063 | 8/30/01 |
| **Coho Salmon: Kitoi Bay Hatchery Stock** | | | | | | | | | | | | |
| Kitoi Bay/2 | 1,000,000 | 665 | 700,000 | 20.00 | Jun-97 | 90,000 | 0 | 0 | 0 | 90,000 | 94A-0036 | 6/30/00 |
| Jennifer Lake | 358,000 | 232 | 163,000 | 1.50 | Jun-97 | 0 | 0 | 8,802 | 978 | 9,780 | 94A-0080 | 6/30/02 |
| Ruth Lake | 69,000 | 50 | 35,000 | 1.50 | Jun-97 | 0 | 0 | 1,890 | 210 | 2,100 | 92A-0083 | 12/31/02 |
| Little Kitoi Lake | 185,000 | 74 | 100,000 | 1.50 | Jun-97 | 0 | 0 | 5,400 | 600 | 6,000 | 92A-0089 | 12/31/02 |
| Crescent Lake | 360,000 | 231 | 165,000 | 1.50 | Jun-97 | 0 | 0 | 8,910 | 990 | 9,900 | 92A-0079 | 12/31/02 |
| Katmai Lake | 28,000 | 13 | 15,000 | 10.00 | Oct-97 | 0 | 0 | 1,350 | 150 | 1,500 | 92A-0081 | 12/31/02 |
| Kitoi Bay/3 | 1,000,000 | 760 | 750,000 | 20.00 | Jun-98 | 0 | 90,000 | 0 | 0 | 90,000 | 94A-0036 | 6/30/00 |
| Total: | 2,000,000 | 1,265 | 1,178,000 | | | 90,000 | 90,000 | 0 | 0 | 209,280 | | |
| **Sockeye Salmon: Upper Station Stock** | | | | | | | | | | | | |
| Little Kitoi Estuary/2 | 631,000 | 457 | 585,000 | 10.00 | May-97 | 0 | 40,950 | 17,550 | 0 | 58,500 | 96A-0067 | 6/30/01 |
| **Sockeye Salmon: Little Kitoi Lake Stock** | | | | | | | | | | | | |
| Little Kitoi Lake/4 | 200,000 | 263 | 150,000 | 6.00 | Nov-97 | 0 | 0 | 10,500 | 4500 | 15,000 | 96A-0065 | 6/30/01 |
| Little Kitoi Estuary/3 | 800,000 | 401 | 600,000 | 10.00 | May-98 | 0 | 0 | 42,000 | 18000 | 60,000 | 96A-0064 | 6/30/01 |
| Total: | 1,000,000 | 664 | 750,000 | | | 0 | 0 | 52,500 | 22,500 | 75,000 | | |
| **Grand Total:** | 164,831,000 | 307,185 | 133,913,000 | | | 3,390,000 | 135,350 | 292,050 | 176,100 | 4,022,780 | | |

/1 assuming 1% for 0.2, 60% for 0.3, and 39% for 0.4 chum salmon; 70% age 1.2 and 30% age 1.3 adults for sockeye salmon; 90% 2.1 and 10% 2.2 age adults for coho releases.
/2 Brood Year 1995 age 1 sockeye smolt released in 1997; assume 100% 1.1 adult age of return for coho.
/3 Brood Year 1996 age 1 sockeye smolt released in 1998; assume 100% 1.1 adult age of return for coho.
/4 Pending cancellation of Pillar Creek early run sockeye release into Little Kitoi Lake, amend FTP to 300,000 release.

Table 2. Proposed salmon egg takes (1997), planned releases (1998, 1999), projected returns (1999-2002), and fish transport permits (FTP), Kodiak Management Area.

| Release Site | Eggtake eggs | Eggtake adults | Releases Number | Releases Size | Releases Date | Adult Returns/1 1999 | 2000 | 2001 | 2002 | Total | FTP Number | FTP Expires |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Pink Salmon: Kitoi Bay Hatchery Stock** | | | | | | | | | | | | |
| Kitoi Bay | 215,000,000 | 250,000 | 182,000,000 | 0.50 | May-98 | 5,500,000 | 0 | 0 | 0 | 5,500,000 | 96A-0062 | 8/30/01 |
| **Chum Salmon: Kitoi Bay Hatchery Stock** | | | | | | | | | | | | |
| Kitoi Bay | 25,000,000 | 30,000 | 22,000,000 | 2.00 | May-98 | 0 | 4,400 | 264,000 | 171,600 | 440,000 | 96A-0063 | 8/30/01 |
| **Coho Salmon: Kitoi Bay Hatchery Stock** | | | | | | | | | | | | |
| Kitoi Bay/2 | 1,000,000 | 665 | 750,000 | 20.00 | Jun-98 | 0 | 90,000 | 0 | 0 | 90,000 | 94A-0036 | 6/30/00 |
| Jennifer Lake | 358,000 | 322 | 163,000 | 1.50 | Jun-98 | 0 | 0 | 8,802 | 978 | 9,780 | 94A-0080 | 6/30/02 |
| Ruth Lake | 69,000 | 50 | 35,000 | 1.50 | Jun-98 | 0 | 0 | 1,890 | 210 | 2,100 | 92A-0083 | 6/30/02 |
| Little Kitoi Lake | 185,000 | 74 | 100,000 | 1.50 | Jun-98 | 0 | 0 | 5,400 | 600 | 6,000 | 92A-0089 | 12/31/02 |
| Crescent Lake | 360,000 | 141 | 165,000 | 1.50 | Jun-98 | 0 | 0 | 8,910 | 990 | 9,900 | 92A-0079 | 12/31/02 |
| Katmai Lake | 28,000 | 13 | 15,000 | 10.00 | Oct-98 | 0 | 0 | 1,350 | 150 | 1,500 | 92A-0081 | 12/31/02 |
| Total: | 2,000,000 | 1,265 | 1,228,000 | | | 0 | 90,000 | 26,352 | 2,928 | 119,280 | | |
| **Sockeye Salmon: Saltery Lake Stock/3** | | | | | | | | | | | | |
| Little Kitoi Lake/4 | 400,000 | 263 | 300,000 | 6.00 | Nov-98 | 0 | 0 | 21,000 | 9000 | 30,000 | /7 | |
| Little Kitoi Estuary/2 | 800,000 | 401 | 600,000 | 10.00 | May-99 | 0 | 0 | 42,000 | 18000 | 60,000 | /7 | |
| Total: | 1,200,000 | 664 | 900,000 | | | 0 | 0 | 63,000 | 27,000 | 90,000 | | |
| **Sockeye Salmon: Little Kitoi Lake Stock/5** | | | | | | | | | | | | |
| Little Kitoi Lake/4 | 400,000 | 263 | 300,000 | 6.00 | Nov-98 | 0 | 0 | 21,000 | 9000 | 30,000 | 96A-0065 | 6/30/01 |
| Little Kitoi Estuary/2 | 800,000 | 401 | 600,000 | 10.00 | May-99 | 0 | 0 | 42,000 | 18000 | 60,000 | 96A-0064 | 6/30/01 |
| Total: | 1,200,000 | 664 | 900,000 | | | 0 | 0 | 63,000 | 27,000 | 90,000 | | |
| **Sockeye Salmon: Upper Station Stock/6** | | | | | | | | | | | | |
| Little Kitoi Lake/4 | 400,000 | 263 | 300,000 | 6.00 | Nov-98 | 0 | 0 | 21,000 | 9,000 | 30,000 | 96A-0066 | 6/30/01 |
| Little Kitoi Estuary/2 | 800,000 | 401 | 600,000 | 10.00 | May-99 | 0 | 0 | 42,000 | 18000 | 60,000 | 96A-0067 | 6/30/01 |
| Total. | 1,200,000 | 664 | 900,000 | | | 0 | 0 | 63,000 | 27,000 | 90,000 | | |
| **Grand Total:** | 243,200,000 | 281,929 | 206,128,000 | | | 5,500,000 | 94,400 | 353,352 | 201,528 | 6,149,280 | | |

/1 assuming 1% for 0.2, 60% for 0.3, and 39% for 0.4 chum salmon; 70% age 1.2 and 30% age 1.3 adults for sockeye salmon; 90% 2.1 and 10% 2.2 age adults for coho releases.

/2 Brood Year 1995 age 1 sockeye smolt released in 1997; assume 100% 1.1 adult age of return for coho.

/3 Pending approval of the change to Saltery lake late run sockeye for the Spiridon lake project and LKL broodstock building program.

/4 Pending cancellation of Pillar Creek early run sockeye release into Little Kitoi Lake, amend FTP to 300,000 release.

/5 If the Saltery late run sockeye stock to Spiridon lake project is approved and adequate escapement at Saltery lake for both PCH and KBH eggs the LKL sockeye eggtake will not occur.

/6 This eggtake will take place if the Saltery late run sockeye stock to Spiridon lake project is not approved and there is inadequate escapement at LKL for the KBH eggtake.

/7 FTP needed for this egg take and release.

Tabel 3. Kitoi Bay Hatchery salmon minimum (desired) escapement goals and projected brood numbers required, 1997.

| Big Kitoi Creek/1 | Minimum Escapement/2 | Brood Stock Required |
|---|---|---|
| Pink | 15,000 | 250,000 |
| Chum | 2,000 | 30,000 |
| Coho | 0 | 6,000 |

| Late Run Sockeye/3 | Minimum Escapement/4 | Brood Stock Required/5 |
|---|---|---|
| Little Kitoi Lake | 14,000 | 7,000 |
| Saltery Lake | 20,000 | 5,900 |
| U. Station Lake | 150,000 | 5,900 |

/1 Big Kitoi Creek is where adults returning to KBH imprint and enter the hatchery eggtake systems.

/2 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.
A barrier falls prevents the fish from entering Big Kitoi lake therefore coho and sockeye escapement is not required.

/3 Saltery Lake is the brood source for the enhancement project at Spiridon and the Little Kitoi lake brood stock building program.
In 1994, Saltery Lake brood stock was used for Spiridon Lake stocking on a one year experimental basis;
Beginning in 1997, Saltery Lake will be the primary brood source for the Spiridon Lake and LKL brood stock building projects.
Rose Tead Lake sockeye will be used as a back up brood source if poor escapements prevent the use of Saltery Lake stocks.
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 1997, unless permits are not approved for the use of Saltery Lake stock.

/4 includes number of brood stock needed for Pillar Creek Hatchery.

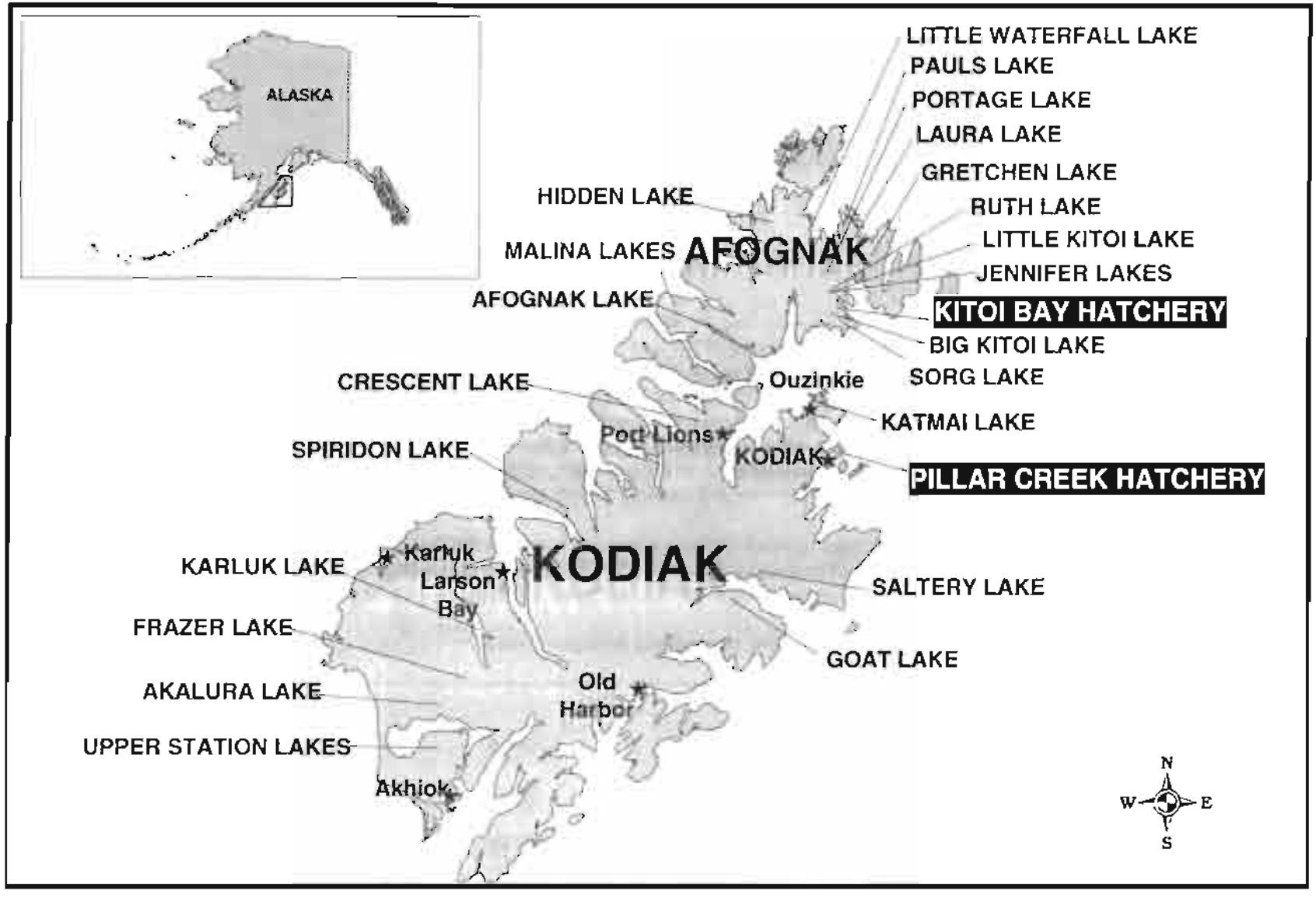


Figure 1. Locations of sockeye salmon enhancement and rehabilitation projects on Kodiak and Afognak Islands, 1951-1997.

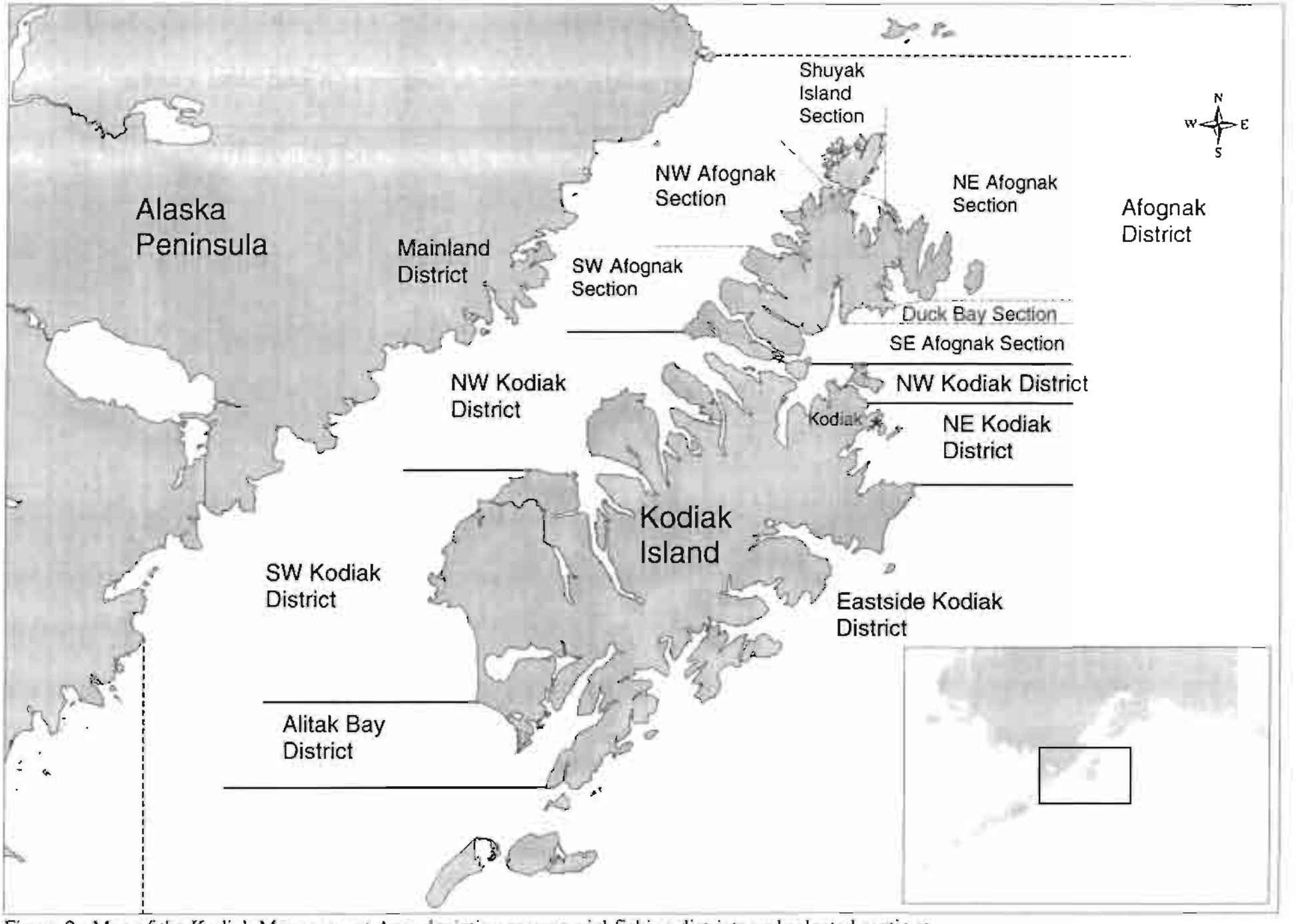


Figure 2. Map of the Kodiak Management Area depicting commercial fishing districts and selected sections.

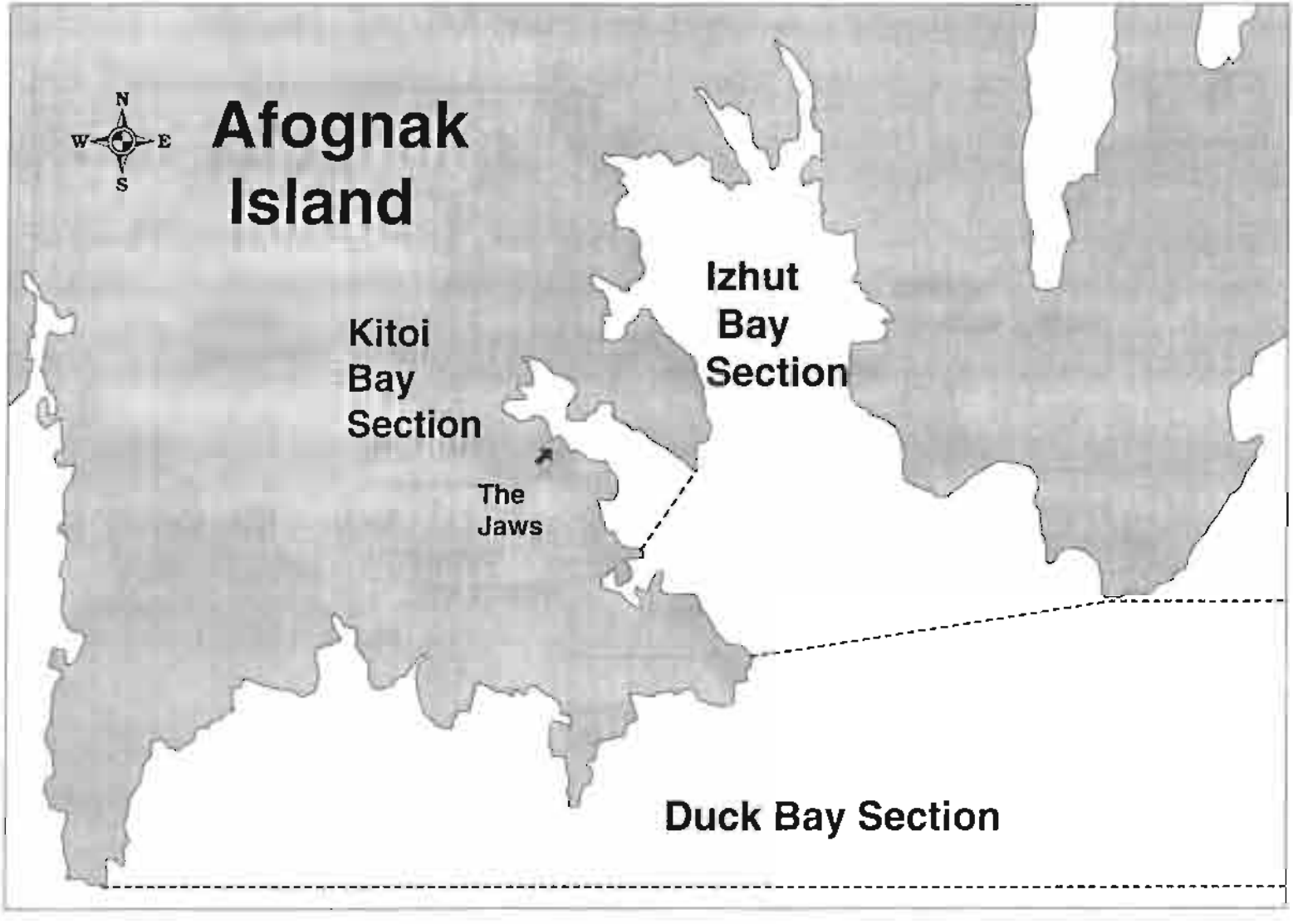


Figure 3. Izhut, Duck and Kitoi Bays Sections of the Afognak District.

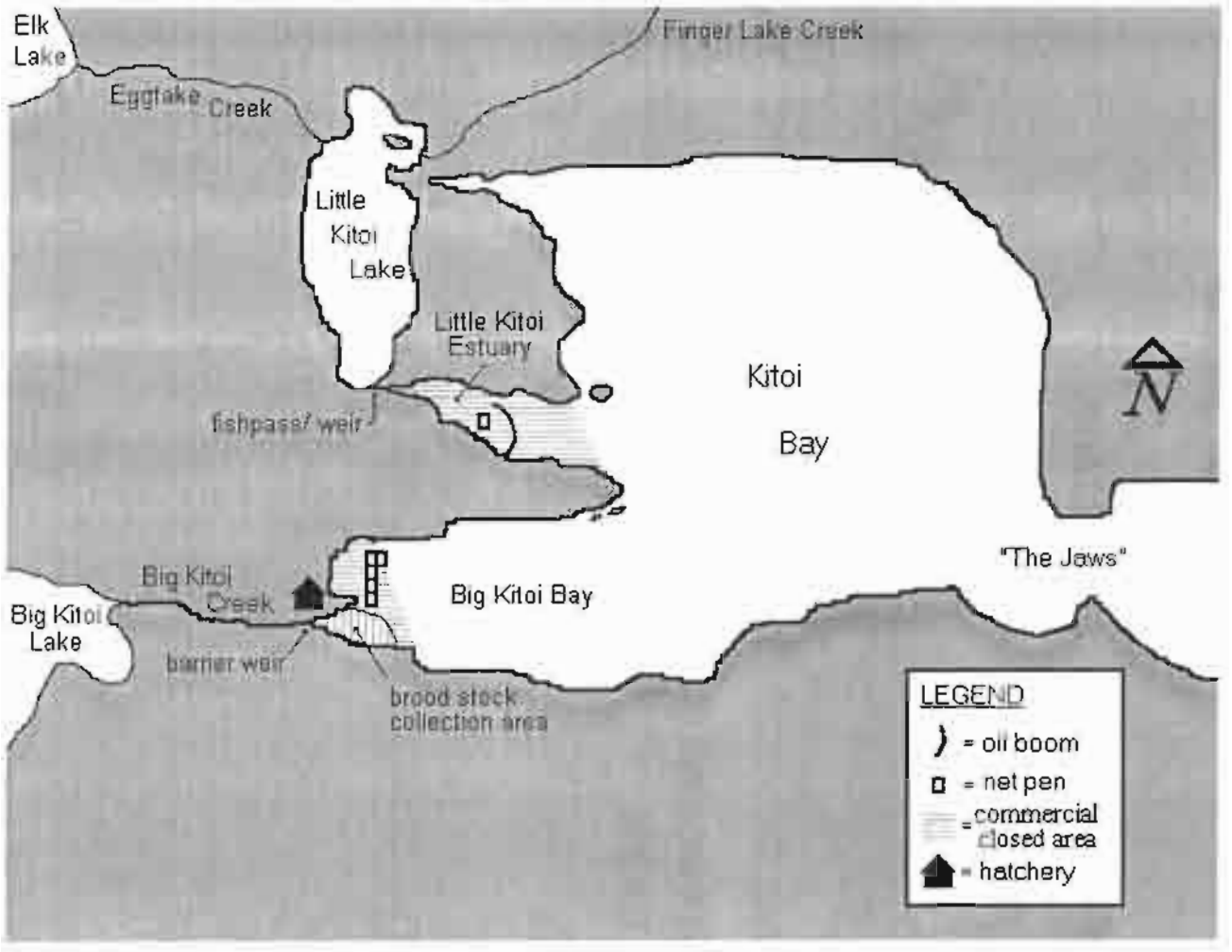


Figure 9. Map of inner Kitoi Bay.

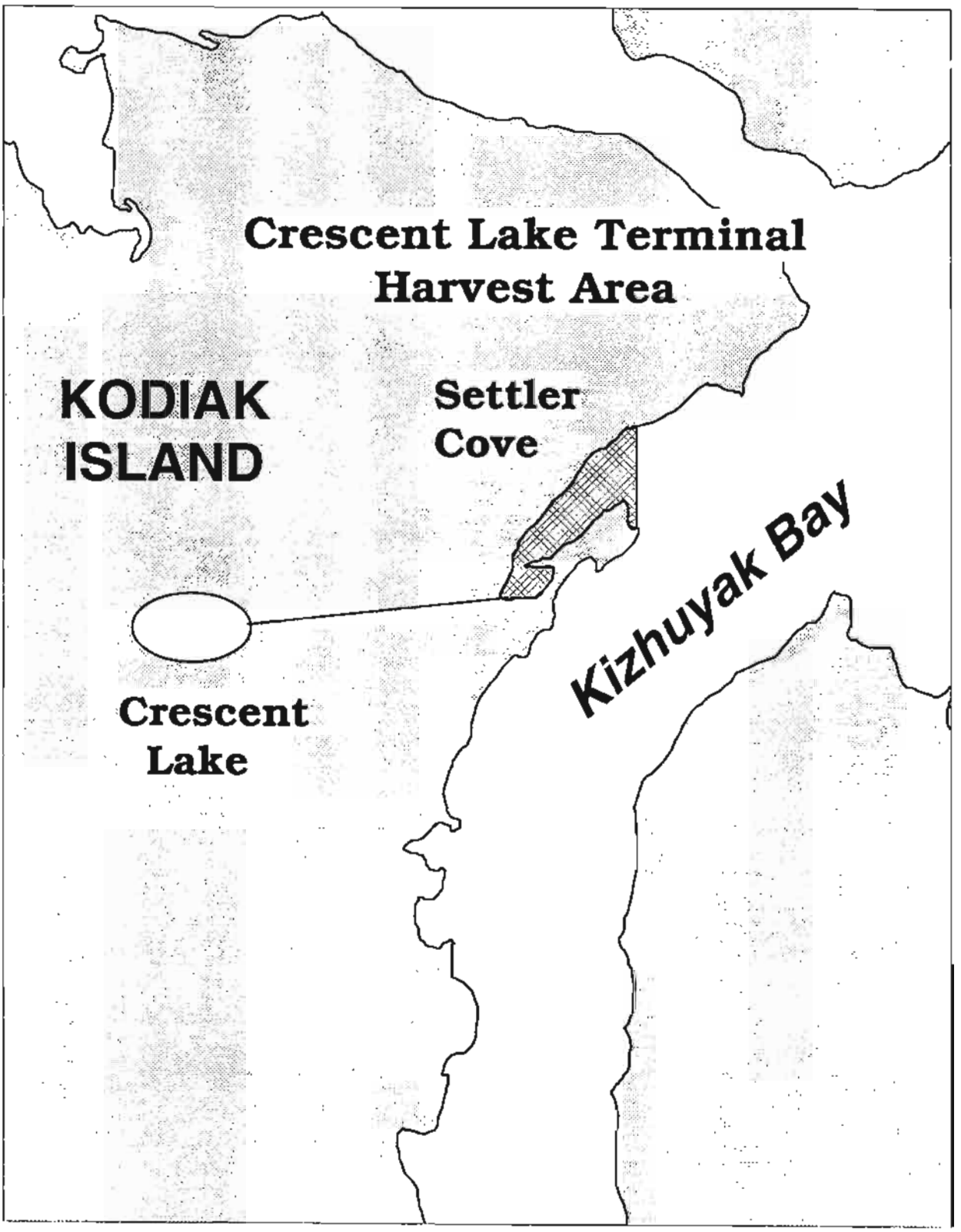


Figure 5. Crescent Lake Terminal Harvest Area.

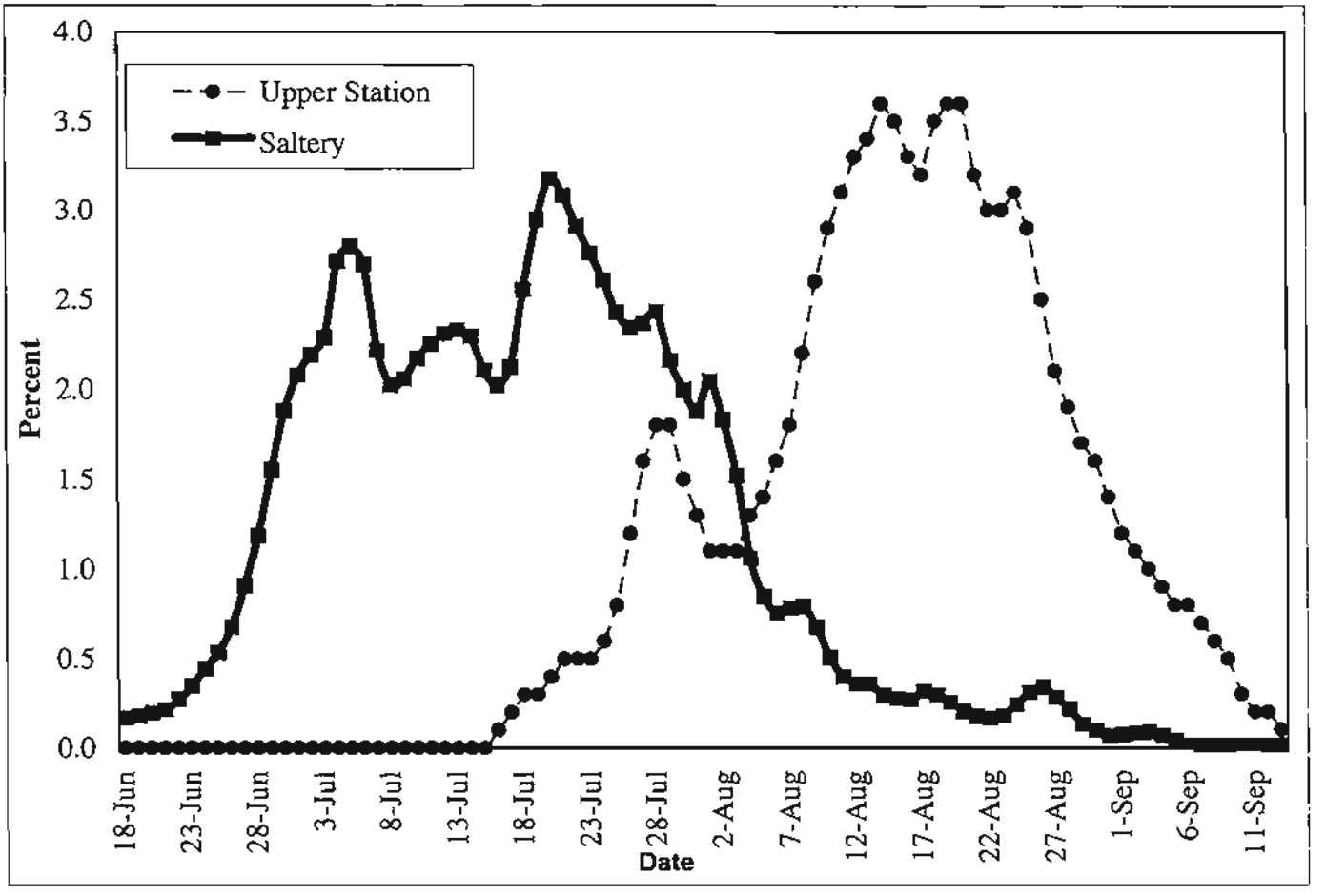


Figure 6. Sockeye salmon escapement timing into Upper Station and Saltery Lakes.

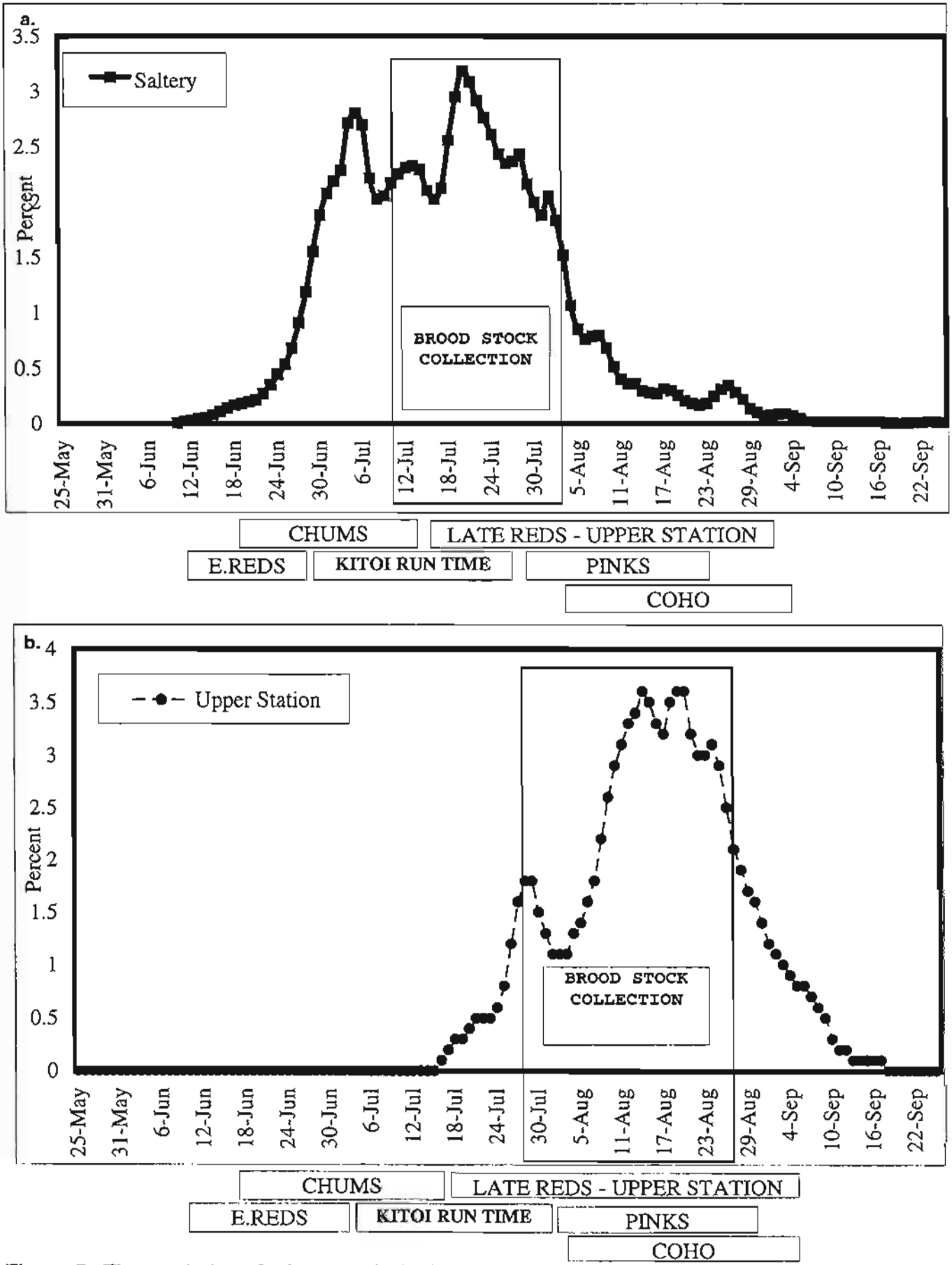


Figure 7. The run timing of salmon stocks in the Kitoi Bay Terminal Harvest Area compared to the late run Saltery sockeye salmon broodstock collection (a) and late run Upper Station sockeye salmon broodstock collection (b).

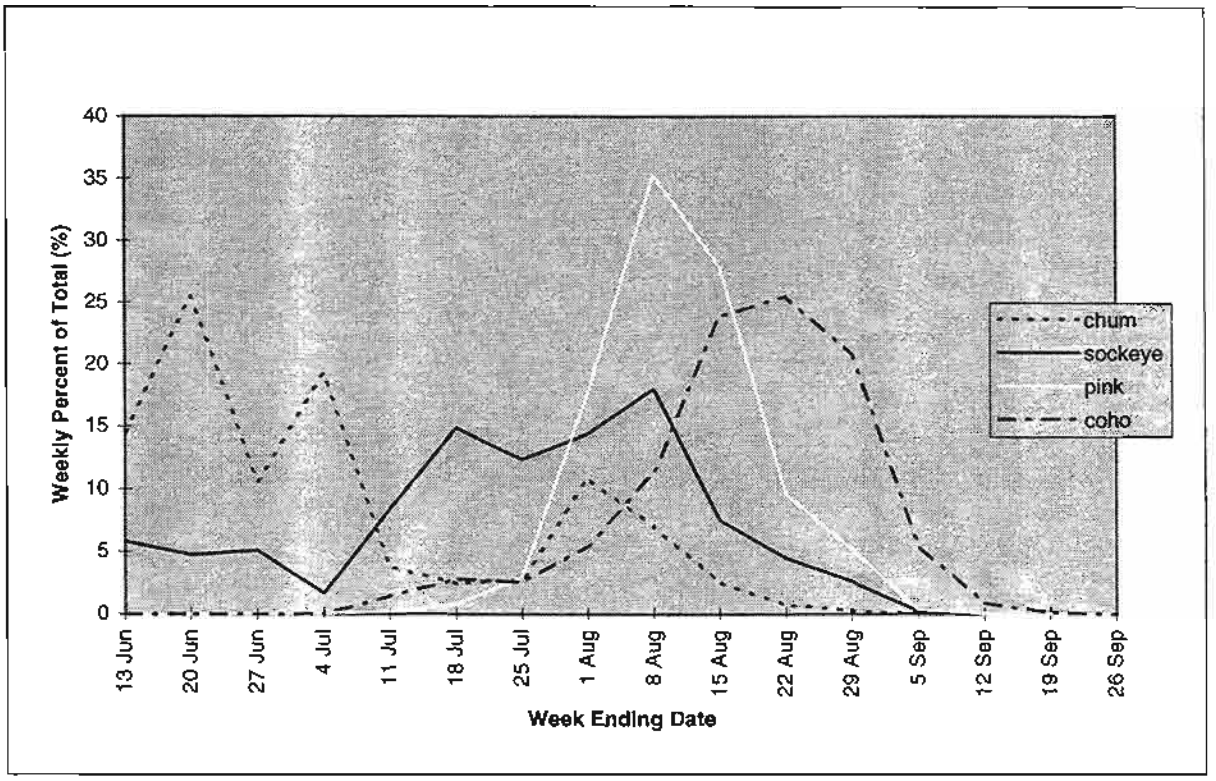


Figure 8. Izhut, Duck, and Kitoi Bays Sections chum, sockeye, pink, and coho salmon average harvest timing, 1987-1996.

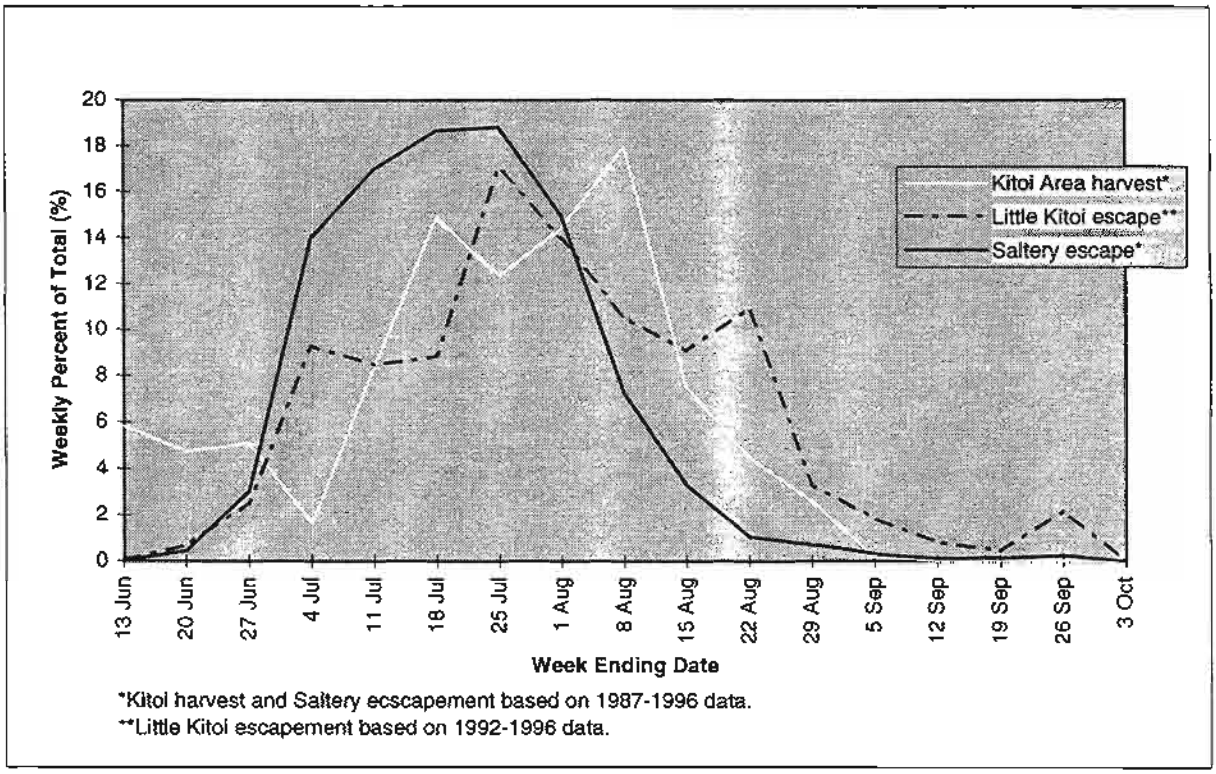


Figure 9. Izhut, Duck, and Kitoi Bays Sections sockeye salmon harvest timing (1987-1996), Little Kitoi Lake (1992-1996) and Saltery Lake (1987-1996) sockeye salmon escapement timing.

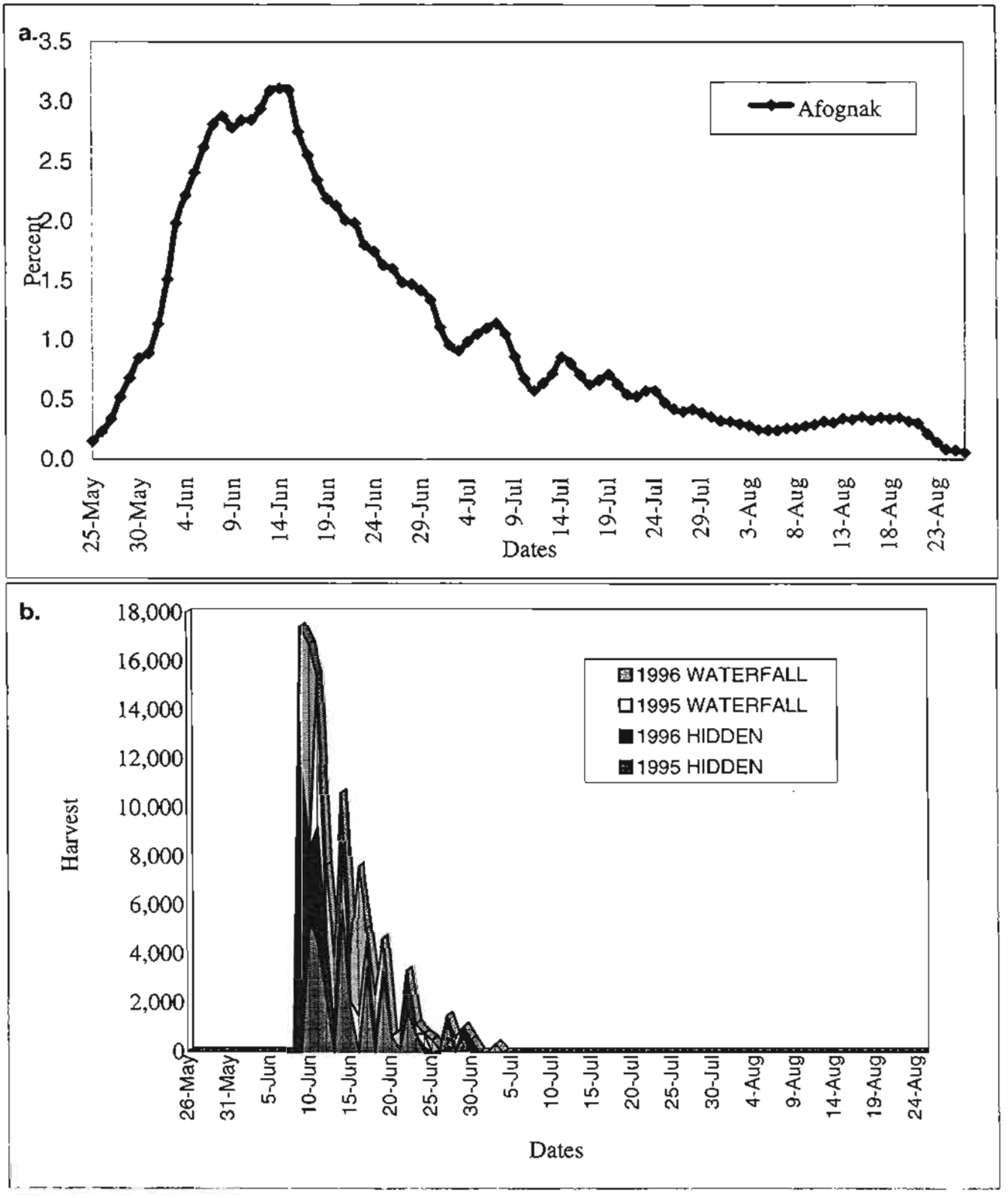


Figure 10. The post June Afognak Lake (AL) escapement has a large component of sockeye age 1.1, 1.2 and 2.1 that is not used for broodstock (Nelson and Swanton 1996). The compressed harvest (b) as compared to the broodstock run timing (a) can be attributed to the broodstock selection and the timing of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

# APPENDIX

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

Survival Estimate in percent

| Species | Life Stage | Freshwater Release | Marine Release |
|---|---|---|---|
| Pink | Fry (0.5g) | | 1.5% |
| Coho | Fingerling (1.5g) | 6.0% | |
| Coho | Pre-Smolt (5.0g) | 10.0% | 5.0% |
| Coho | Smolt (20.0g) | | 12.0% |
| Chum | Fingerling (2g) | | 2.0% |
| Sockeye | Pre-Smolt (5.0g) | 10.0% | |
| Sockeye | Smolt age 1. (10.0g) | | 10.0% |

Appendix B. Upper Station sockeye salmon egg takes, past, present, and proposed.

| Brood Year | Adults | Eggs (millions) | Facility | No. Stocked and Year (millions) | Stocking Location |
|---|---|---|---|---|---|
| 1988 | 120 | 0.2 | KBH | 0.15 - 1989 | Kitoi Bay |
| 1989 | 3,000 | 5.0 | PCH/KBH | 0.26 - 1990<br>0.8 - 1990<br>0.3 - 1990 | Spiridon Lake<br>L. Kitoi Bay<br>L. Kitoi Lake |
| 1990 | 3,700 | 4.5 | PCH | 3.5 - 1991 | Spiridon Lake |
| | | 1.5 | KBH | 1.25 - 1991 | L. Kitoi Bay |
| 1991 | 3,800 | 4.0 | PCH | 2.2 - 1992 | Spiridon Lake |
| | | 2.3 | KBH | 1.8 - 1992 | L. Kitoi Bay |
| 1992 | 6,816 | 9.8 | PCH | 4.2 - 1993 | Spiridon Lake |
| | | 1.9 | KBH | 0.05 - 1993<br>0.3 - 1994 | L. Kitoi Lake<br>L. Kitoi Bay |
| 1993 | 5,551 | 7.8 | PCH | 5.0 - 1994<br>0.3 - 1994 | Spiridon Lake<br>Jennifer Lake |
| | | 2.0 | KBH | 1.6 - 1994 | L. Kitoi Bay |
| 1994 | 120 | 0.3 | PCH | 0.0 - 1995<br>0.2 - 1995 | Spiridon Lake<br>Jennifer Lake |
| | 120 | 0.3 | KBH | 0.0 - 1995<br>0.2 - 1995<br>0.0 - 1996 | L. Kitoi Bay<br>Jennifer Lake<br>L. Kitoi Bay |
| 1995 | 3,668 | 7.3 | PCH | 4.5[a] - 1996<br>0.0 - 1996 | Spiridon Lake<br>Jennifer Lake |
| | 0 | 0.5 | KBH | 0.0 - 1995<br>0.0 - 1996<br>0.5 - 1997 | L. Kitoi Bay<br>Jennifer Lake<br>L. Kitoi Bay |
| 1996 | 4,810 | 9.8 | PCH | 6.0[a] - 1997<br>0.5 - 1997 | Spiridon Lake<br>Jennifer Lake |
| | 0 | 0.0 | KBH | 0.0 - 1996<br>0.0 - 1997 | L. Kitoi Bay<br>Jennifer Lake |
| 1997[b] | 5,200 | 9.4 | PCH | 7.0[a] - 1998<br>0.0 - 1998 | Spiridon Lake<br>Jennifer Lake |
| | 0 | 0 | KBH | 0.0 - 1998<br>0.0 - 1998 | L. Kitoi Bay<br>Jennifer Lake |

[a] Actual egg take to be determined no later than August 15, 1997 pending limnology results.

[b] Upper Station egg take will be a contingent site if Saltery Lake is not approved as the primary egg take location or insufficient brood stock are available at, Little Kitoi Lake.

Appendix C. Little Kitoi Lake sockeye salmon egg takes, past, present, and proposed.

| Brood Year | Adults | Eggs (millions) | Facility | No. Stocked and Year (millions) | Stocking Location |
|---|---|---|---|---|---|
| 1992 | 1,011 | 0.59 | KBH | 0.0 - 1993 | L. Kitoi Bay |
| 1993 | 1,050 | 1.1 | KBH | 0.88 - 1995 | L. Kitoi Bay |
| 1994 | 600 | 1.5 | KBH | 0.0 - 1995 | L. Kitoi Bay |
| | | | | 0.15 - 1995 | L. Kitoi Lake |
| | | | | 0.88 - 1996 | L. Kitoi Bay |
| | | | | 0.3 - 1995 | Jennifer Lake |
| 1995 | 155 | 0.191 | KBH | 0.0 - 1996 | L. Kitoi Bay |
| | | | | 0.15 - 1996 | L. Kitoi Lake |
| 1996 | 1,210 | 1.2 | KBH | 0.15 - 1996 | L. Kitoi Lake |
| | | | | 0.88 - 1997 | L. Kitoi Bay |
| 1997 | 646 | 1.2 | KBH | 0.3 - 1997 | L. Kitoi Lake |
| | | | | 0.6 - 1998 | L. Kitoi Bay |
| | 7,000 | 7.3 | PCH | 5.5 - 1998 | Spiridon Lake |
| | | | | 0.3 - 1998 | Jennifer Lake |

Appendix D. Summary of preliminary findings of Little Kitoi Lake sockeye salmon marking study.

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## INTRODUCTION

A sockeye salmon *Oncorhynchus nerka* brood stock development project began at Little Kitoi Lake, Afognak Island, in 1989. Originally an underyearling stocking program, the project was diversified in to include presmolt and age-1 smolt (1994), as well as early (1992) and late run sockeye salmon releases. In 1992, a marking program was implemented in an effort to determine the success of different stocking strategies (FTP 92A0085) and the straying rate of adult returns produced from 0-check and age-1 smolt releases. The project proposal was submitted for review in January 1993, and signed off on April 12, 1993 (geneticist signed FTP only). Stocking strategies were to be evaluated by the survival from stocking to adult return. Straying rate was to be assessed by the percentage of Little Kitoi Bay origin adults observed in escapements at Paul's and Afognak Lakes. Although examination for marks at Little Kitoi fish pass commenced in 1994, the first substantial return data were gathered in 1996.

### Smolt Outmigration

Sockeye salmon presmolt stocking of Little Kitoi Lake commenced in October 1994 (Markle and Honnold *in press* ). Age data from the 1995 and 1996 indicated the majority of 1994 planted presmolt migrated as age-1 smolt. Outmigration monitoring in 1995 and 1996 has indicated preliminary "presmolt to age-1 smolt" survival rates ranging from 32% to 64% (Markle and Honnold *in press*; Appendix A).

The early run Afognak Lake presmolt stocked in Little Kitoi Lake exhibited a survival rate of 64% for the 1994 release and 32% for the 1995 release. Late run presmolt stocked into Little Kitoi Lake (Upper Station/Little Kitoi Lake parent stock) exhibited a survival rate of 52% for the 1994 release and 50% for the 1995 release. It is believed that the beginning of the outmigration in 1996 began prior to monitoring, therefore leading to an underestimation of 1995 presmolt survival rates.

No appreciable outmigration of 1994 released presmolt was detected following the potential second year (1996) of lake residency (Markle and Honnold *in press*). The majority of presmolt stocked in both 1994 and 1995 emigrated at age-1 in 1995 and 1996, respectively. As a result, the balance of the planted presmolt were attributed to lake mortality. Based on the 1994 age at smolt data, no appreciable second year outmigration of 1995 released presmolt is expected in 1997.

-Continued-

A zero-check release into Little Kitoi Lake in July 1995 displayed a 48.8% outmigration within two weeks of release with an additional 430 (<1%) fish outmigrating in 1996 as age-1 smolt (Markle and Honnold *in press*).

Aging was complicated by the fact that scales of planted fish appeared to contain a "false check" (Dave Kaplan, personal communication). Presumably, this false check was the result of stress during planting, or the related change in environment. This 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" (Little Kitoi Lake was originally a barren system and had several stocks of sockeye planted in the late 1950's and early 1960's) sockeye population from planted populations. Tight circuli distinguishing wild propagated smolt and broad, uniform circuli distinguishing hatchery reared smolt (David Kaplan, personal communication). This false check may have caused assigning 1. freshwater age to fish that may have been 0. age in adult samples from years prior to 1996.

**Adult Escapement**

Salt water zero-check releases are assumed to have exhibited extremely poor survival due to the low magnitude of adult returns following stocking and few observed marks in escapement samples. Escapement age analysis did not reveal any age 0 returns; however, the number of age-0 fish may have been under reported due to the possible false checks as described above. Age 0 smolt releases were discontinued in 1996. Although Little Kitoi sockeye escapements in 1992 and 1993 exceeded 4,500 fish, this was considerably less than expected. In 1994, escapement declined drastically to 2,402 sockeye. Escapement continued to decline in 1995 to 1,180 sockeye. The cause of the 1994 and 1995 decline is unknown.

In 1996, sockeye escapement rebounded to 5,628 fish, and is believed due largely to presmolt lake stocking. The observation of marked fish at Little Kitoi fish pass indicates that the 1996 escapement was dominated by sockeye released in 1994. Lake released presmolt were the dominant year class with a mark-based estimate of 1,559 returning as jacks. This represented 1.3% of the estimated presmolt observed outmigrating in 1995. The mark-based estimate may well be low considering the potential differential mortality of marked fish may be underestimating stock contributions by approximately 40% (ADF&G unpublished data).

Fresh water release of zero-checks occurred in 1990 and 1993; however, survival estimates are not available as neither group was marked. The 1993 release was smaller than expected due to a large mortality of unknown origin (possibly IHNV).

Adult return data collected in 1997 and 1998 will be critical to determining the success of the presmolt release strategy, as well as confirming the existence and extent of differential mortality

-Continued-

of marked fish. Commercial catches in Duck, Izhut, and Kitoi Bays Sections have mirrored changes in sockeye escapement, except with regard to the 1995 harvest. While the 1995 sockeye salmon harvest approximately equaled the 1993 harvest, the 1995 escapement (1,180 sockeye) was only 24% of 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 sockeye component. Further investigation of the stock composition in the Eastside Afognak District is needed.

**Straying**

An effort to determine if Kitoi released sockeye have strayed is inconclusive. Since 1994, a portion of the sockeye escapements at Afognak and Paul's Lakes have been examined for marks. No definitive identification of Kitoi released sockeye salmon has been determined based upon scale or otolith aging. Examination goals set by Department biometricians have proven unrealistic to attain (original goals: 13,000 salmon at Afognak Lake and 7,500 salmon at Paul's Lake). The significance of the examination data has yet to be statistically determined. Definitive identification of "marked" fish has been complicated by the existence of natural fin loss. For this reason, the origin of "simple" finclipped fish (one fin removed) are difficult to attribute.

In 1996, a total of 74 sockeye returned to Kitoi Bay Hatchery via Big Kitoi Creek. The hatchery and Big Kitoi Creek are thought to be the most likely site for straying due to its proximity to Little Kitoi Lake. The fact that planted fish were reared there, however, may induce a small portion of age-1 smolt to imprint on the hatchery water source prior to release into net pens at Little Kitoi estuary. Although no marked fish were found, the majority (>90%) are believed to be late run fish from Little Kitoi Lake, based on return timing. Using the estimated escapement of 2,850 sockeye for the age-1.1 Little Kitoi early run, the nine age-1.1 sockeye found at the hatchery represent a straying rate of 0.3%. Assuming all 62 sockeye attributed to the late run were from the 1994 Upper Station brood stock planting and the Little Kitoi escapement of this stock was 1,312 sockeye, the straying rate was 4.5% (ADF&G, unpublished data). This rate is likely inflated as there is no age data available on the late returning hatchery sockeye confirming that all were of the 1994 Upper Station stock. Furthermore, it does not take into account sockeye which returned to Little Kitoi Bay after the fish pass was unattended. The large number of adults necessary to examine for marks to allow for statistically valid analysis of straying rate is problematic. Current funding and manpower levels assigned to this portion of the evaluation program are not sufficient to continue the examination of adults at Paul's and Afognak Lakes.

Markle, R and S.G. Honnold. *in press*. Summary of Little Kitoi Lake sockeye salmon marking. Alaska Department of Fish and Game, Commercial Fisheries Management and Development Division, Regional Information Report 4K97-xx, Kodiak.

**SIGN-OFF**

Andy Hall 5/23/97

Andy Hall: Kitoi Bay Hatchery Manager — Date

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Jim McCullough: Regional Resource Development Biologist, CFM&D — Date

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Len Schwarz: Area Biologist, Sport Fish — Date

Doug McBride: Sport Fish Regional Supervisor — Date

Larry Malloy 5/27/97

Larry Malloy: Executive Director, KRAA — Date

The 1997 Hatchery Management Plan for Kitoi Bay is hereby approved:

Robert Bosworth: Deputy Commissioner, ADF&G — Date

1997 Kitoi Bay Hatchery - Annual Management Plan

KRAA Comments - 5/29/97

All of the tasks identified in the 1997 Kitoi Bay Hatchery (K.B.H.) A.M.P. conform to enhancement strategies identified in Kodiak's Regional Comprehensive Salmon Plan. They are consistent with the types of projects needed to achieve long term production goals identified in that Plan. This A.M.P. progressively addresses project impact concerns related to wild salmon stocks. Additionally, review of these projects has occurred during R.P.T. discussions and assessments of data summaries provided by ADFG's Salmon Development, Research and Management Staff.

Special mention and emphasis should be made about K.B.H. coho production, from both local and remote juvenile releases, for all of Kodiak's user groups. Directly benefiting from the production identified on pages 4, 5, 7, 8, 13, 14, 15, 16, 17 and 20 are the communities of Ouzinkie, Port Lions, Aleneva, Silver Bay Camp, Ben Thomas Camp and Kodiak. In particular, for Ouzinkie, Port Lions and Kodiak residents, this production represents an important component for their subsistence, recreational, guided-sport and commercial net fisheries. The historical harvest strategies for this production has yielded relatively orderly harvest activities between these various users, and in that context, represents a positive harvest event between users who can easily be in conflict. KRAA appreciates ADFG's input, support and consistency in implementing these harvest strategies.

Full funding for all the tasks identified in this A.M.P. is derived from KRAA's special cost-recovery fund associated with the Kitoi Bay Hatchery.