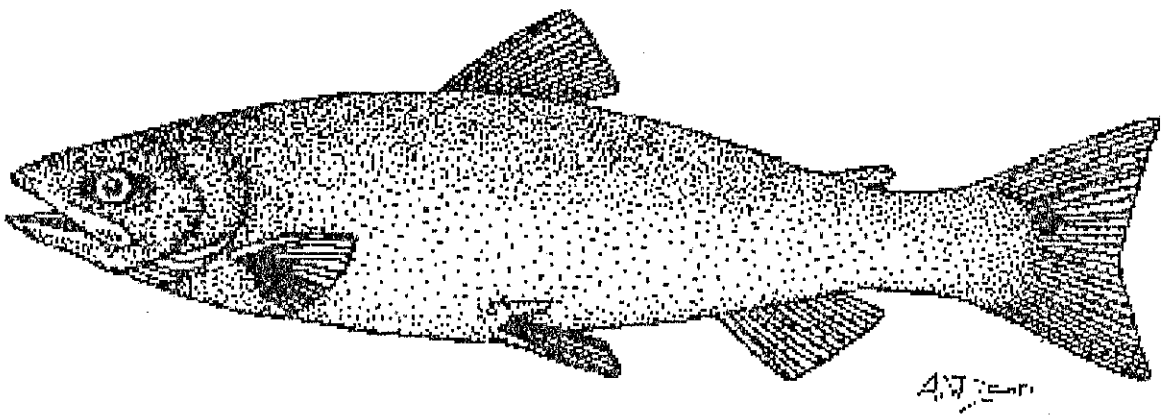
Prince of Wales

HATCHERY

FISH FOREVER FISH

1999 Sockeye Conference

February 26, 1999
New Hope Baptist Church
Bell Tower Square, Klawock Alaska
9:00am to 4:00pm



This conference was funded by Prince of Wales Hatchery Association Inc. and by the USDA Forest Service through a Cooperative Stewardship Grant.

Prince of Wales Hatchery Association Inc. PO Box 554, Craig Alaska. 907-755-2231

1999 Klawock Sockeye Conference
Information Packet
February 26, 1999
New Hope Baptist Church, Bell Tower Square, Klawock

Table of Contents

Issues and Actions

Prince of Wales Hatchery Association provided participants with a questionnaire to identify issues affecting the Klawock Sockeye. Twenty four questionnaires were mailed and 10 returned. Responses were grouped into three categories; Management, Harvest, and Habitat. Participants also listed positive actions that could improve the Sockeye returns in the future.

Management Issues

Lack of accurate information concerning sockeye runs to the public.
Constant changes in Hatchery operations and procedures due to changing administration.
Broodstock problems.
Coho and Steelhead being raised at the Hatchery.
Lack of commitment on past Hatchery Staff.
Competition with hatchery stocks.

Proposed Actions

Cities pass resolution in support of rebuilding Sockeye runs.
Work with KCA for funds to assist in helping Sockeye.
FS assist with personnel and technical assistance.
Monitor run numbers more closely.
Keep politics out of fish biology.
Support Hatchery.
Stop raising Coho and Steelhead.

Habitat Issues

Logging around Klawock.
Loss of Habitat from logging.
Loss of spawning Habitat.
Changing water temperature.
Habitat changes.
Habitat degradation.

Proposed Actions

Watershed analysis.
Stream restoration.
Clean streams in Klawock Lake.
Klawock River Watershed Wetland Assessment and Watershed Council.
Nominate Klawock Watershed as imparted under the Unified Watershed.
Assessment.

Harvest Issues

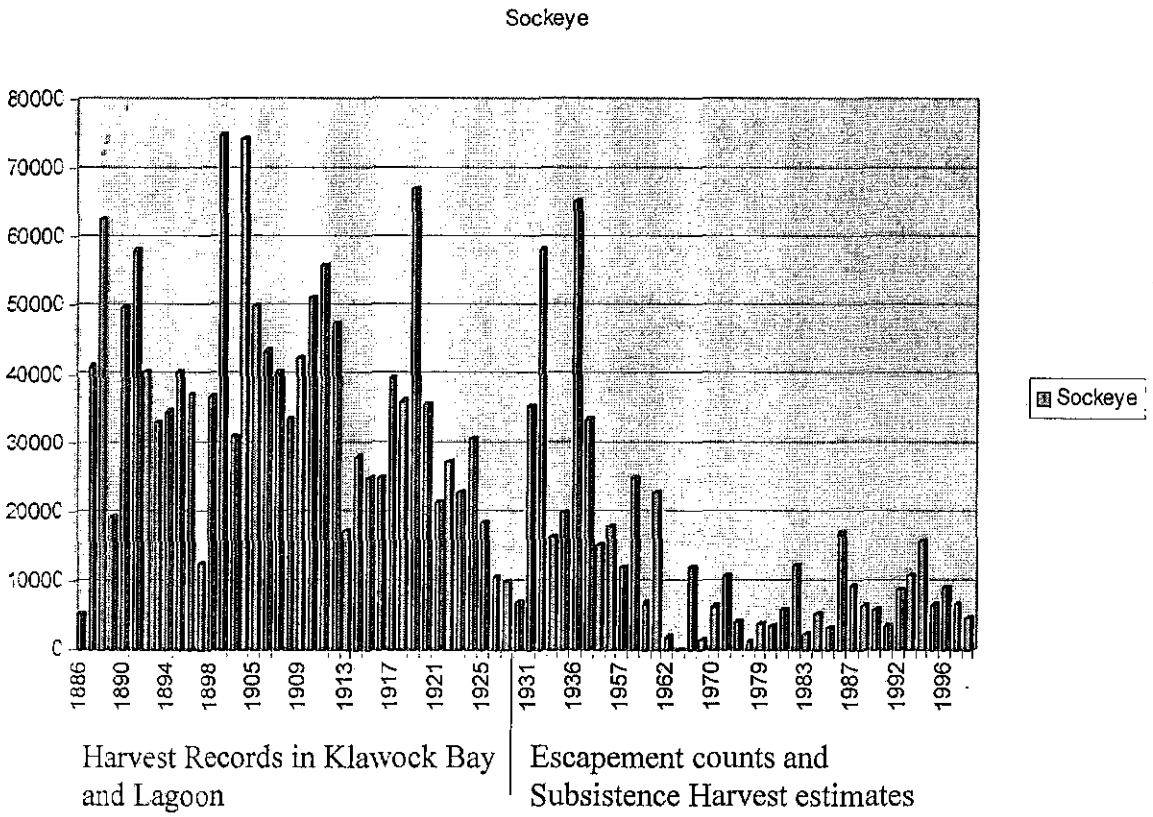
Increase in subsistence harvesting.
Over harvest in ocean fisheries and high seas interception.
excessive terminal fisheries.
Subsistence and Commercial Harvest.
Outside water commercial seining.
High seas and subsistence interception.

Proposed Actions

Restrictions on all user groups.
Do not extend interception at low run cycles.
Fish cop for one month especially for Klawock.
Open seining season later.

History of the Klawock Sockeye Run

Klawock Sockeye have been an important food and commercial resource for perhaps thousands of years. Commercial harvest records begin in 1886 when they were taken within Klawock Bay. Klawock is the site of the first salmon cannery in Alaska that was built to take advantage of the abundant Sockeye harvest.

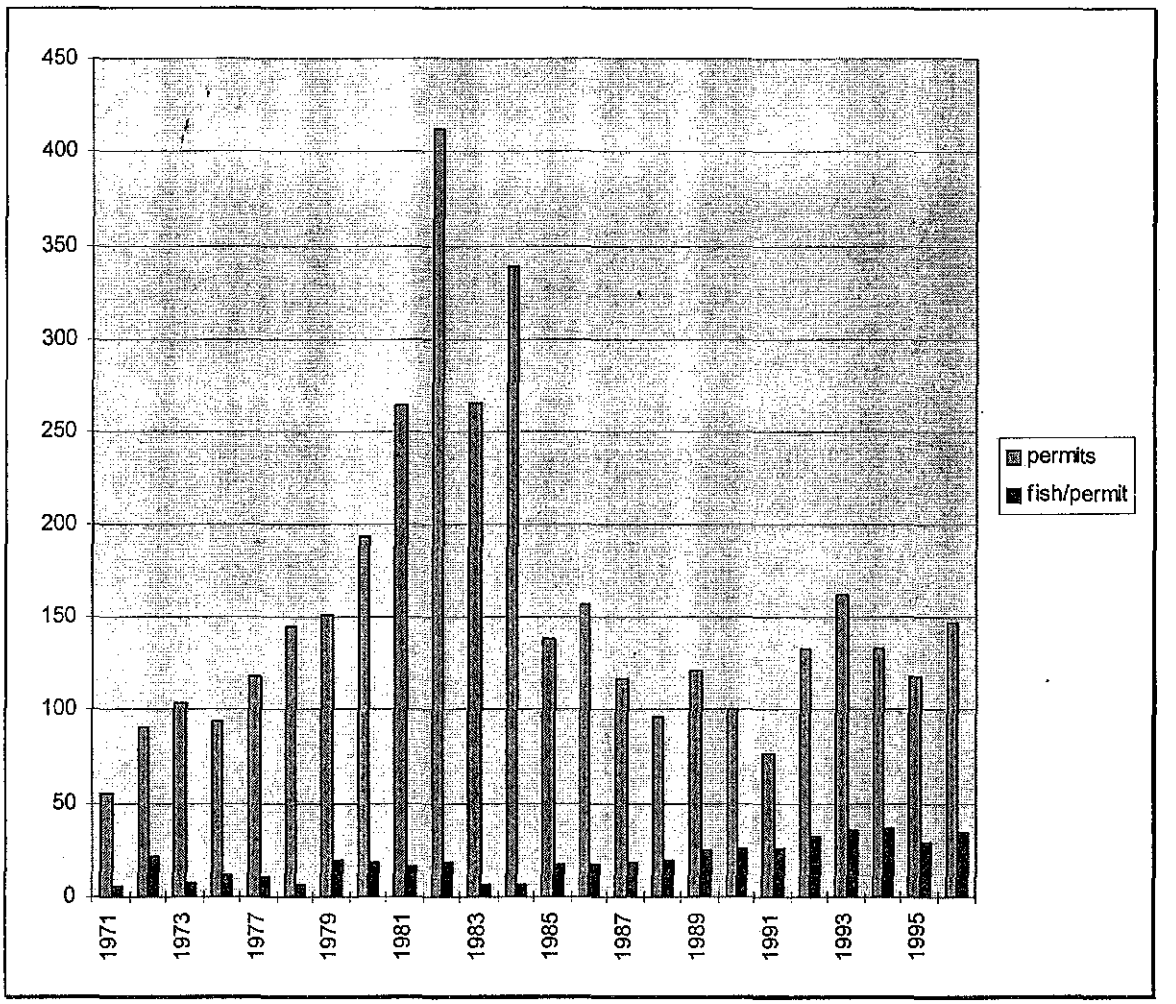


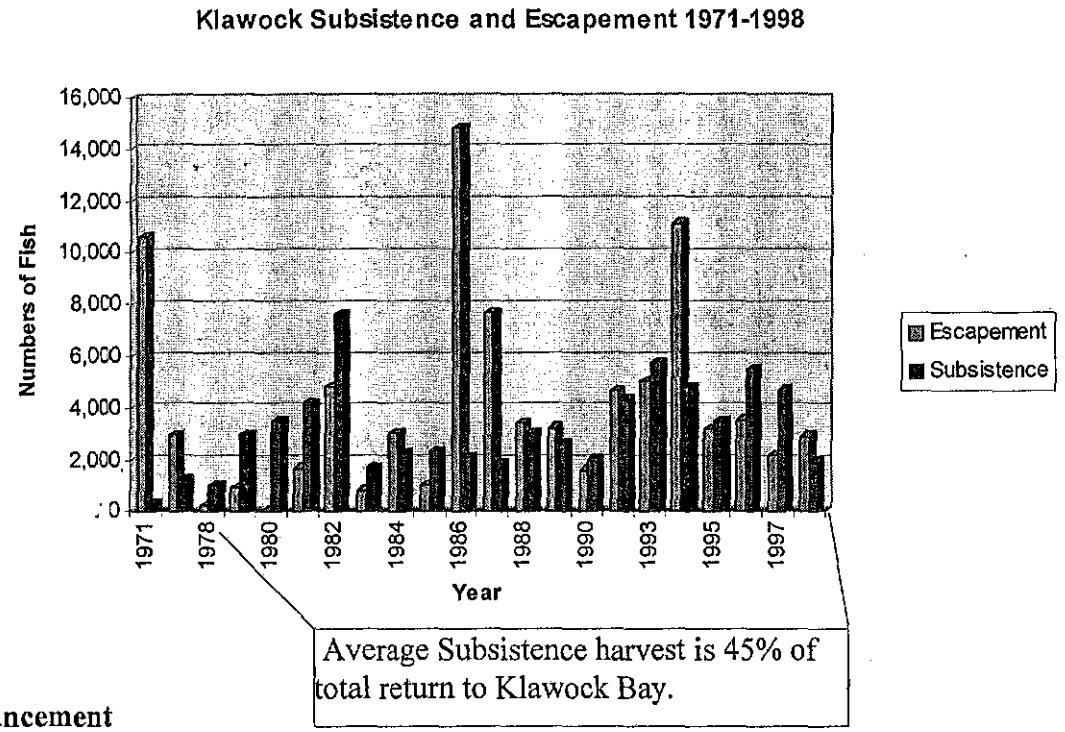
Harvest Records in Klawock Bay and Lagoon

Escapement counts and Subsistence Harvest estimates

Harvest

There is little accurate information on the contribution of Klawock Sockeye to commercial fishing catches. Tagging programs from Klawock origin Sockeye have not been sufficient to determine the number caught in Area 103 and 104 fisheries. Tags have been recovered in Area 104-40 Seine harvests. The majority of recovered tagged hatchery fish were recovered in the subsistence fishery in Klawock Bay and Lagoon. Subsistence permits and harvest information have been collected since 1971. Average subsistence harvest since 1974 was 45% of the total return to Klawock Bay. Although the number of permits has declined since 1984, the harvest has increased.





Enhancement

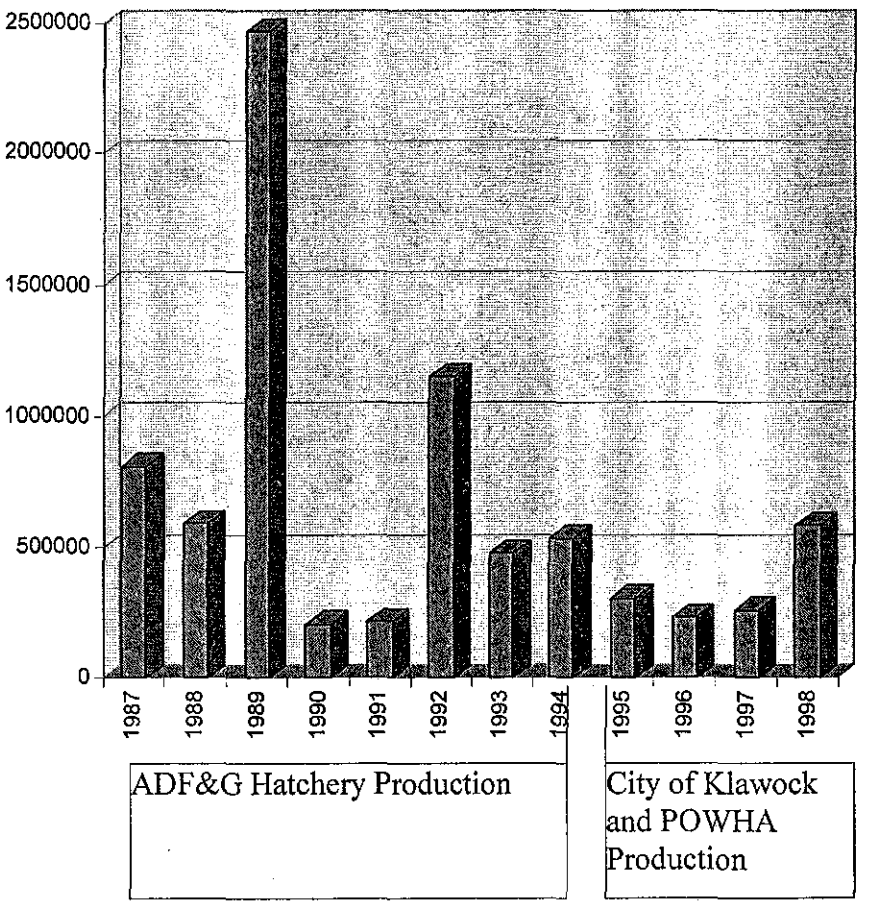
Enhancement of Klawock Sockeye began in 1897 with the construction of a Hatchery facility near the base of Klawock Falls. The Hatchery was constructed and operated by the North Pacific Trading and Packing Company of Klawock to improve the Sockeye catch in Klawock Bay. After one years operation, the facility was moved to the mouth of Three Mile Creek where it operated through 1916. Sockeye eggs were taken from fish entering the mouth of Three Mile and Half Mile Creeks, incubated through the fall and released into the lake as sac fry in December and January. Some eggs were also planted in small tributary stream in October and November. The average release during this period was about 3.2 million sac fry per year. Records show that some releases were doubtful due to storms, icing and floods. The success and contribution of this program is unknown. In 1915 the Canning Company also blasted out a portion of the falls to make sockeye escapement easier for fish returning to the lake.

In 1978 the Alaska Department of Fish and Game constructed a hatchery facility near the base of the Klawock falls primarily to produce Chum and Coho salmon. In 1985 the local Hatchery Advisory Council requested that ADF&G begin a program to enhance Sockeye that would meet increasing subsistence harvest pressure. In 1987 Sockeye were released as both fed and unfed fry into Klawock Lake. Sockeye enhancement continued through 1994 when ADF&G closed Klawock Hatchery. The City of Klawock operated the Hatchery through 1995 and continued Sockeye enhancement. In 1996 Prince of Wales Hatchery Association began operation of the Klawock River facility as a Private Non-Profit Association. POWHA's permitted egg take goal is 10 million eggs annually. ADF&G requires disinfecting Klawock Lake water used for Sockeye culture. As part of POWHA's renovation of the Klawock Hatchery, over $160,000 was spent to install an

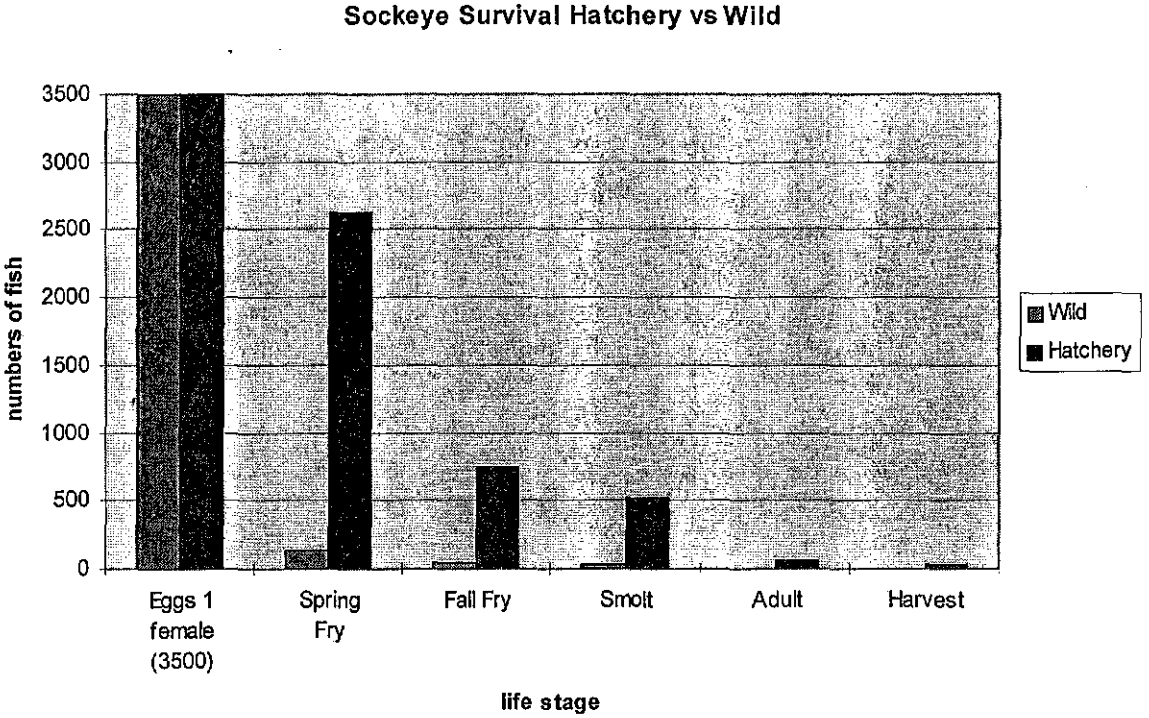
ozone gas disinfection system, primarily for Sockeye culture. Since 1996, Sockeye returns have been below the State's escapement goal of 10,000 adults to Klawock Lake. This has limited the Associations egg take and culture production.

Sockeye culture at Klawock is cost and labor intensive due to the costs of disinfecting Klawock Lake water, brood stock collecting at Three Mile and Half Mile Creeks, incubation and egg handling, and fish feed used for raising fry. The Klawock River facility has limited space to raise fry to a larger size, which would improve their survival in the Lake. The cost of the current Sockeye program has averaged about $42,000 per year. POWHA is funded through donations, memberships and sales of excess hatchery fish returning to Klawock River (Cost Recovery). POWHA does not foresee any cost recovery from the Sockeye enhancement program within the next 15 years. POWHA may not be able to afford to enhance Sockeye and still meet its financial obligations in the future.

Sockeye hatchery release 1987-1998



Sockeye enhancement is beneficial to the overall run in that it increases the survival rate of eggs and sac fry over the "wild" run. Wild fish have an estimated survival of 4% from egg to spring fry, while Hatchery produced eggs have a survival of 70% or more.



Sockeye Survival Rates	Hatchery	Hatchery vs Wild %	Wild	%
Eggs (1 male + 1 female)	3500	70%	3500	4%
Spring Fry	2625	29%	140	29%
Fall Fry	748	70%	40	70%
Smolt	524	12%	28	12%
Adult	63	50%	3	50%
Harvest	31		1.5	
Escapement	31		1.5	

The table and graph show that the by increasing the survival of the egg and sac fry to the spring fry stage provides greater numbers of fish available for harvest and escapement. In the wild populations, a harvest rate of 50% does not provide a sustainable harvest level. Since it takes 2 fish (1 male and 1 female) for successful spawning, a escapement of 1.5 fish is less than sustainable level of 2 adult fish.

Management Issues

Competition of Hatchery Coho and Steelhead with Sockeye

Hatchery produced Coho are reared in net pens within Klawock Lake and released as smolt in after June 1. Coho smolt migrate down the Klawock River to salt water and do not spend significant time in Klawock Lake. Steelhead smolt have not been released into Klawock Lake since 1991. Releases since 1996 have been as smolt into Klawock River. Steelhead can migrate upstream to Klawock Lake and are likely to feed to some extent on Sockeye fry as well as other salmon fry and invertebrates.

Studies conducted by ADF&G and USDA Forest Service in Margaret Lake near Ketchikan indicate that most stocked unfed Sockeye fry are eaten by resident Cutthroat trout. As Sockeye grow, they become successful in avoiding Cutthroat and other fish-eating predators.

POWHA can possible improve Sockeye survival in Klawock Lake by raising Sockeye to a larger size and releasing into Klawock Lake latter in the year.

Broodstock Problems

Broodstock collection and natural spawning in Klawock Lake tributaries is limited by the low numbers of adult fish returning to the system. Sockeye return early in the season beginning in late June and early July and ending by late August. Sockeye tend to move upstream during high water flow periods. Adults then hold in Klawock Lake and school off spawning streams. As water temperatures cool and flows increase, Sockeye begin swim up the creeks to spawn. Low water levels in Klawock River and warm temperatures prohibit sockeye from moving into Klawock Lake. Stress and low dissolved oxygen levels in the stream can contribute to broodstock loss.

Past Hatchery practices included holding broodstock in raceways for ripening. Broodstock were lost due to stress, disease and fungus problems. Since 1995 broodstock have been collected and held in small netpens off Three Mile and Half Mile creeks until ripe. Fish are spawned at the lake and eggs are transported to the Hatchery for incubation.

Changes in hatchery Operations and Procedures

Since 1992, funding cuts have resulted in changes to Hatchery management and operations. Klawock River facility has been managed by ADF&G, the City of Klawock, the City of Craig, and POWHA since 1994. Effective enhancement requires changes to adapt to changing conditions. POWHA is continuing a program that was part of the Klawock River Management Plan. POWHA seeks to find cost effective and beneficial practices that will provide stable Sockeye runs and sustainable harvests. The current Sockeye program receives no outside funding. Since future cost recovery of Sockeye is unlikely, the Sockeye program is operated at a loss by the Association. Adequate and reliable funding sources will help insure the program continues and improves.

Cost Effectiveness of Hatchery Enhancement Programs.

Sockeye are released into Klawock Lake as both unfed and fed fry. Survival of these fish to adult and their contribution to commercial, subsistence and spawning is unknown. ADF&G estimates an overall wild survival from fry to adult as about 2 %. A study of sockeye predation in Margaret Lake near Ketchikan showed that sockeye fry had a predation rate from resident Cutthroat trout that ranged from 30 to 50% of the stocked fry within the first month after stocking. We do not know what the survival rate is for stocked fry in Klawock Lake. Further assessment of enhancement success is needed.

The costs of the Sockeye program at POWHA average between $35,000 and $42,000 per brood year. This is for a nine to ten month program that includes; site preparation, broodstock collection, holding, sorting, spawning, egg management, ponding, feeding, tagging and release, and site cleanup and disinfecting. The major costs are labor and power costs for disinfecting Klawock Lake water. Other costs are fuel, materials, and fish feed. These high costs require that the program be effective in meeting its goal of providing sustainable runs of Sockeye. Adequate assessment of fry stocking in Klawock Lake requires, materials and manpower that are not available at this time. POWHA's limited financial income may not be able to support Sockeye enhancement to the extent that would prevent further stock declines.

Habitat Issues

Klawock Lake has historically supported large numbers of Sockeye. From 1886 thought 1896 annual harvest of over 80,000 fish were reported. It also supports pink, coho and chum salmon. The lake is large, (2,906 acres) and shallow (average depth 18 meters). It is the collecting basin for 26,899 acres of watershed. ADF&G estimated that Klawock Lake could support up to 1.5 million Sockeye smolt annually. A minimum spawning escapement goal of between 7 and 9 thousand adults. Maximum spawning escapement is estimated at 30,000 adults.

Spawning habitat is found in tributary streams to Klawock Lake and to some extent along the shoreline at the mouth of spawning streams. The most important spawning systems are Three Mile and Half Mile Creeks on the North side of the Lake. Stream surveys in 1998 found only a few fish in No Name Creek at the head of the Lake and no Sockeye in other creeks.

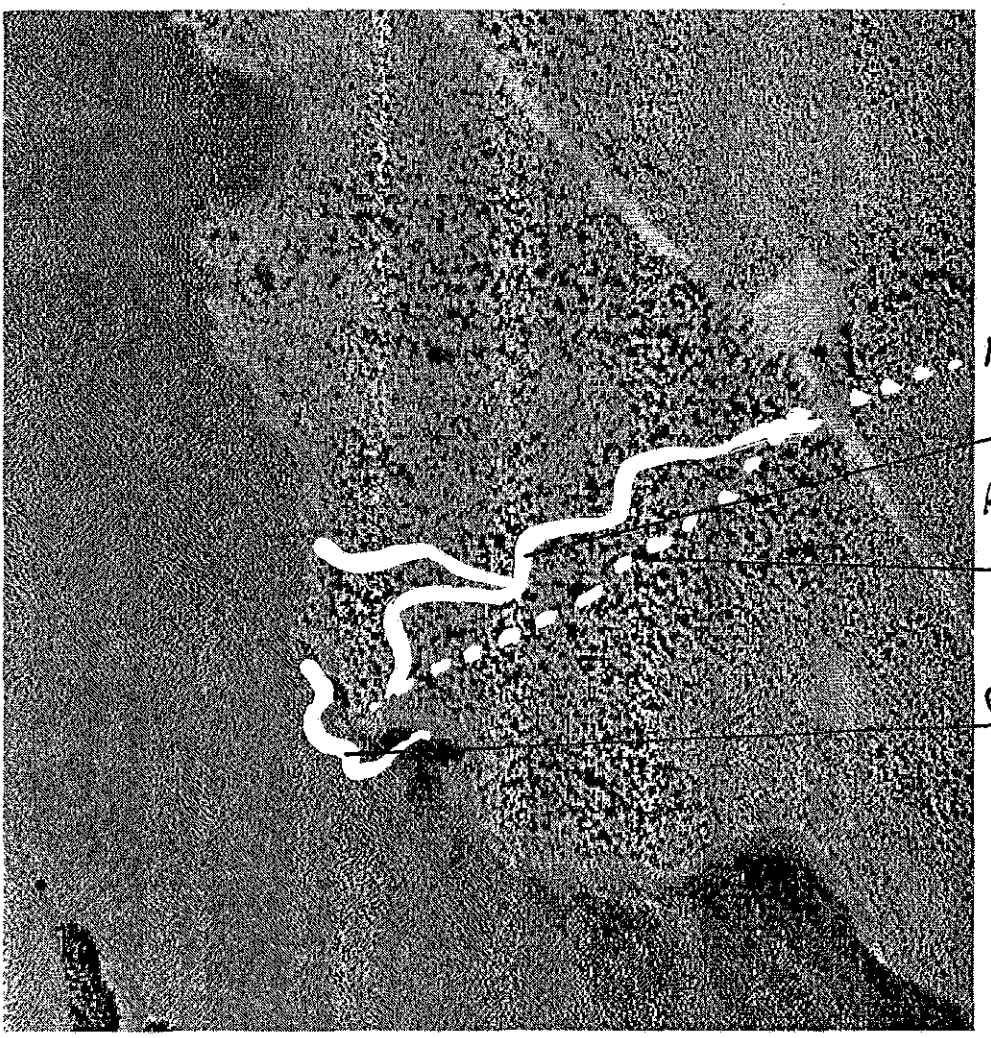
Fry rearing habitat is crucial to fry survival. Sockeye fry feed primarily on plankton populations located in the open waters in the middle of the Lake. Klawock Lake supports a rich plankton population that contributed to high sockeye numbers. Changes in Lake chemistry can reduce or change plankton populations and effect Sockeye productivity.

Effects of Logging on Spawning Habitat

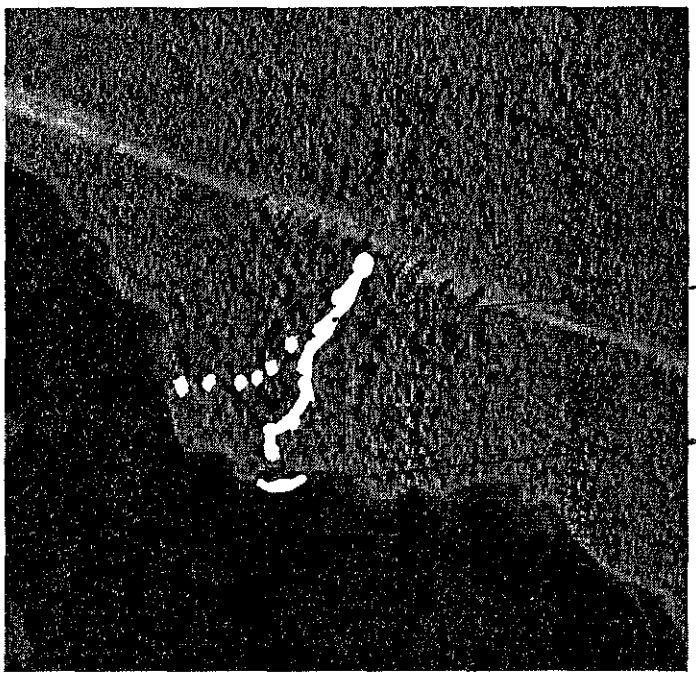
Commercial logging in the Klawock Basin has changed the flow characteristics of tributary streams in Klawock Lake. Tree loss in the basin increases the water runoff into streams. Higher than normal flows destabilize the gravel used by salmon for spawning. Channels begin to fill with gravel and debris causing further erosion. Sockeye spawning in the fall use gravel beds that will be washed downstream, killing eggs or uncovering redds and exposing them to predation. Over time erosion washes out suitable spawning gravel further reducing the amount of intact spawning beds available.

Since 1996, Three Mile and Half Mile Creeks have been building gravel bars in at the mouth of the streams. Half Mile Creek has increased by 80 sq meters in size. Three Mile Creek has created channels as the stream begins to change its course.

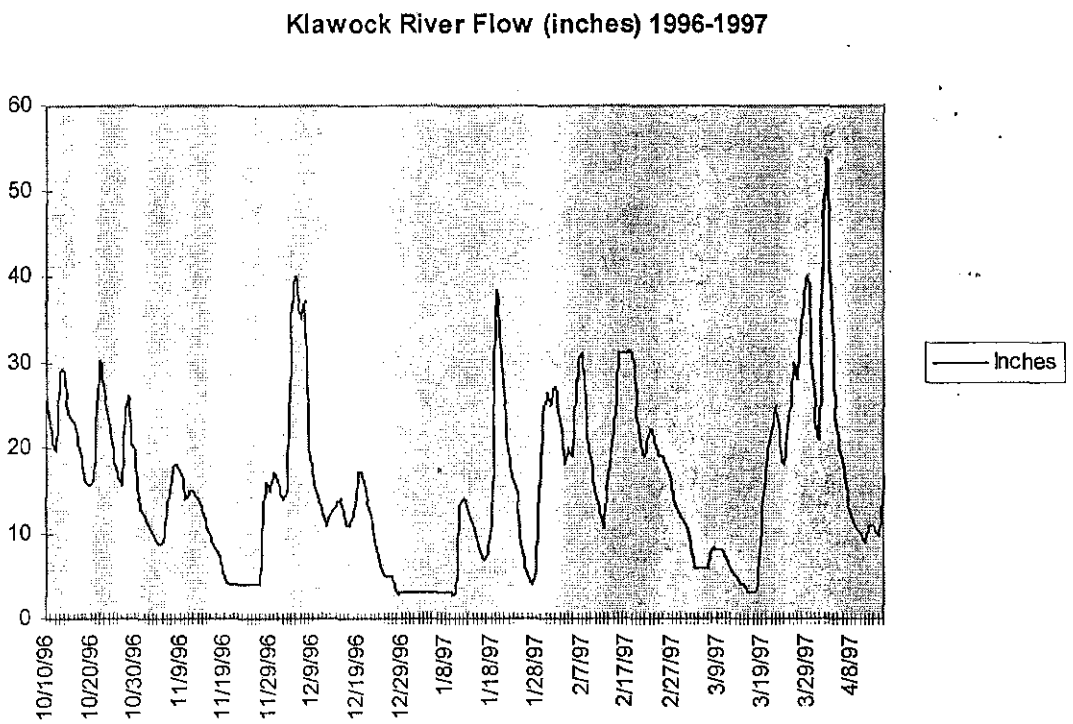
THREE MILE CREEK 1971 Pre Logging



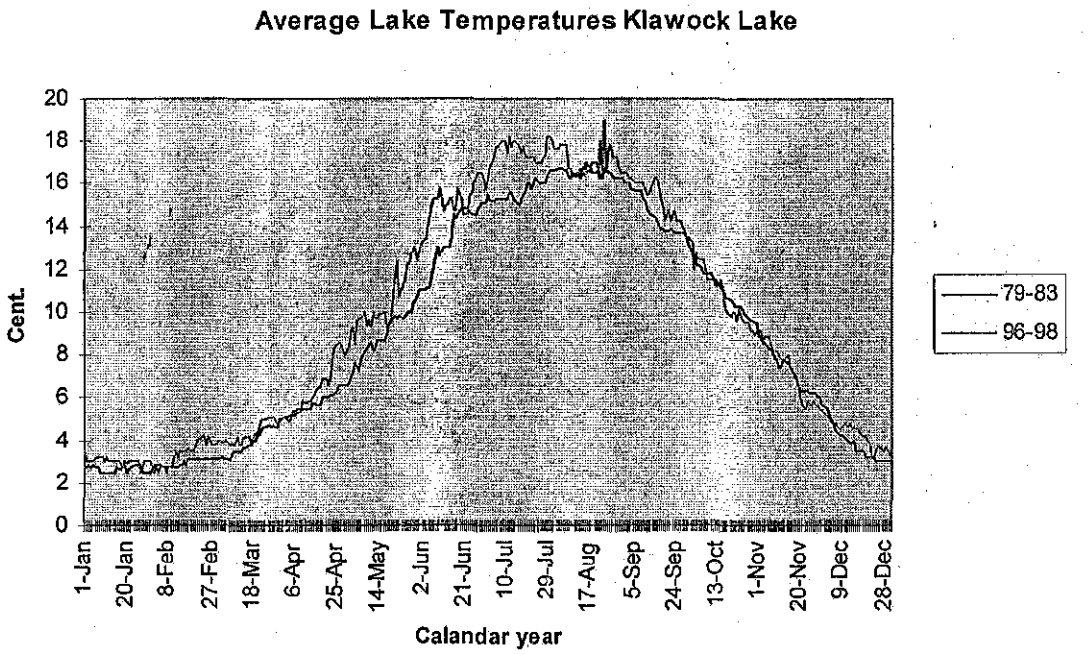
Half Mile Creek 1917 Pre Logging.



In 1986, POWHA began measuring changes water levels in the Klawock River. Water levels rose and fell in response to rain events.



Water temperatures can also be effected by logging programs. ADF&G collected average Lake temperatures from 1979 through 1983 , this is compared with average temperatures in 1996 through 1996. The graph shows an increase in April through September. The effect of this trend on Sockeye is unknown.



Habitat Degradation

Other actions that can change critical Sockeye habitat are road building and maintenance, water diversions, and construction. Road building and maintenance, including paving of the Klawock Hollis Highway can change lake chemistry and runoff. Road salt and oils can leach into the lake and effect both salmon and the plankton population. Half Mile Creek is used as a source for Klawock domestic water, this reduces the flow available for spawning and incubation during periods of low flow. Construction within the watershed can also contribute to changes in the Lake chemistry from septic systems and water use.

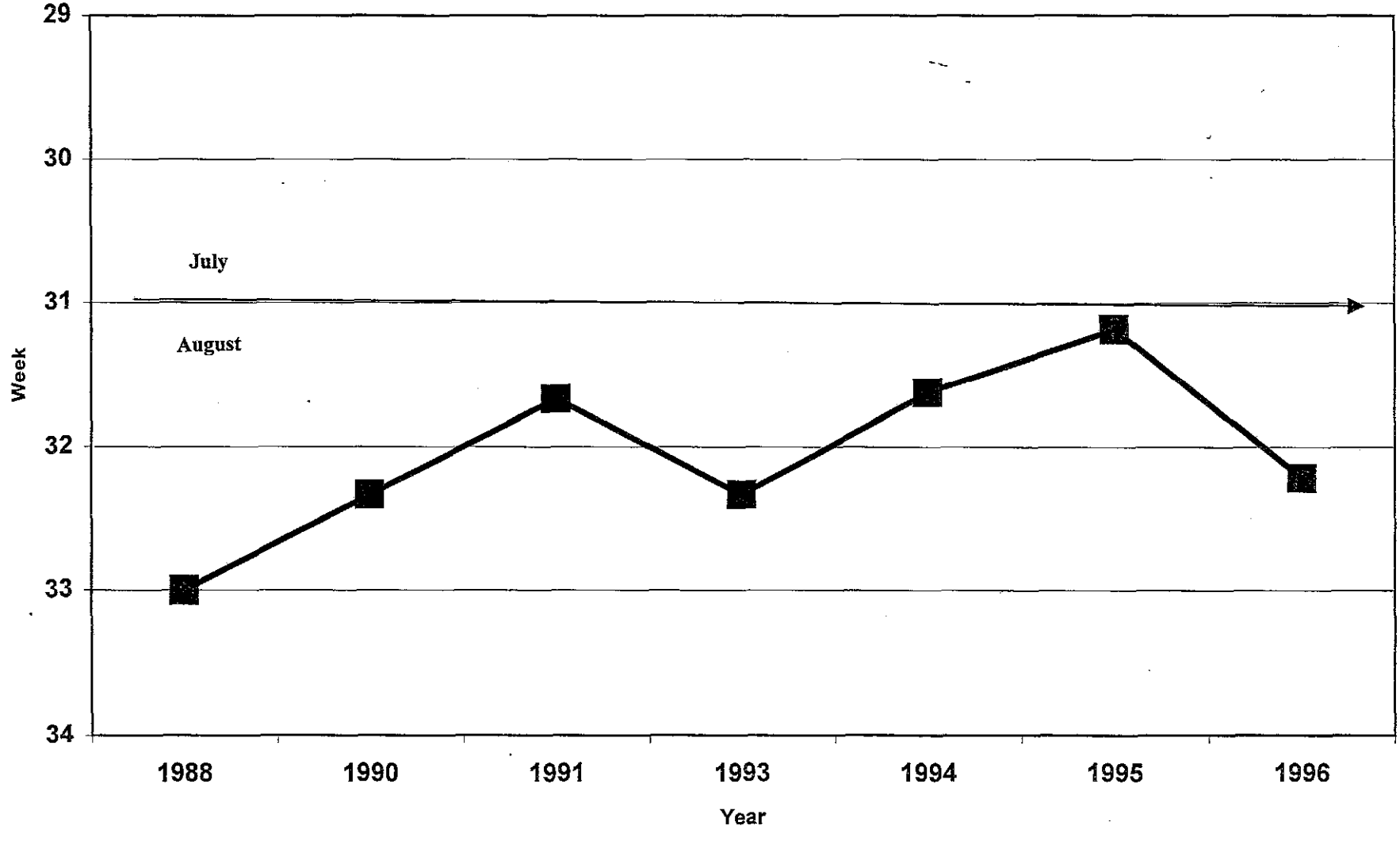
The cumulative effects of logging, road and construction development, and water use are difficult to assess and identify.

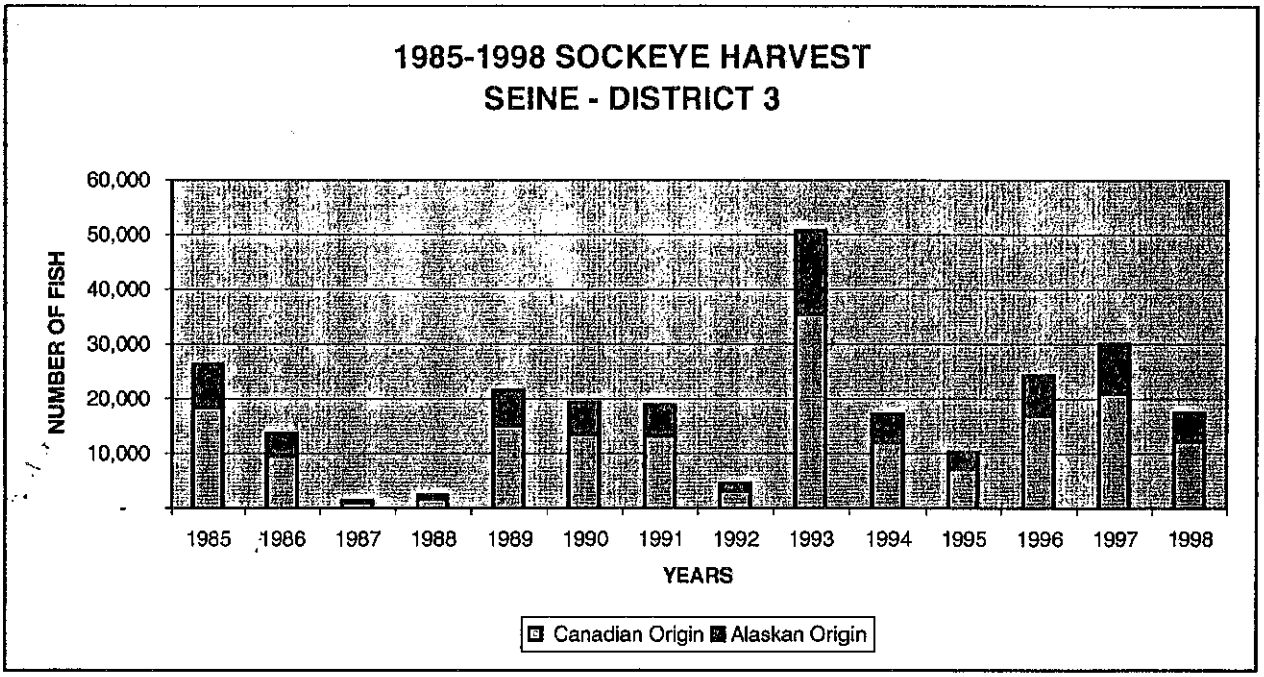
Harvest

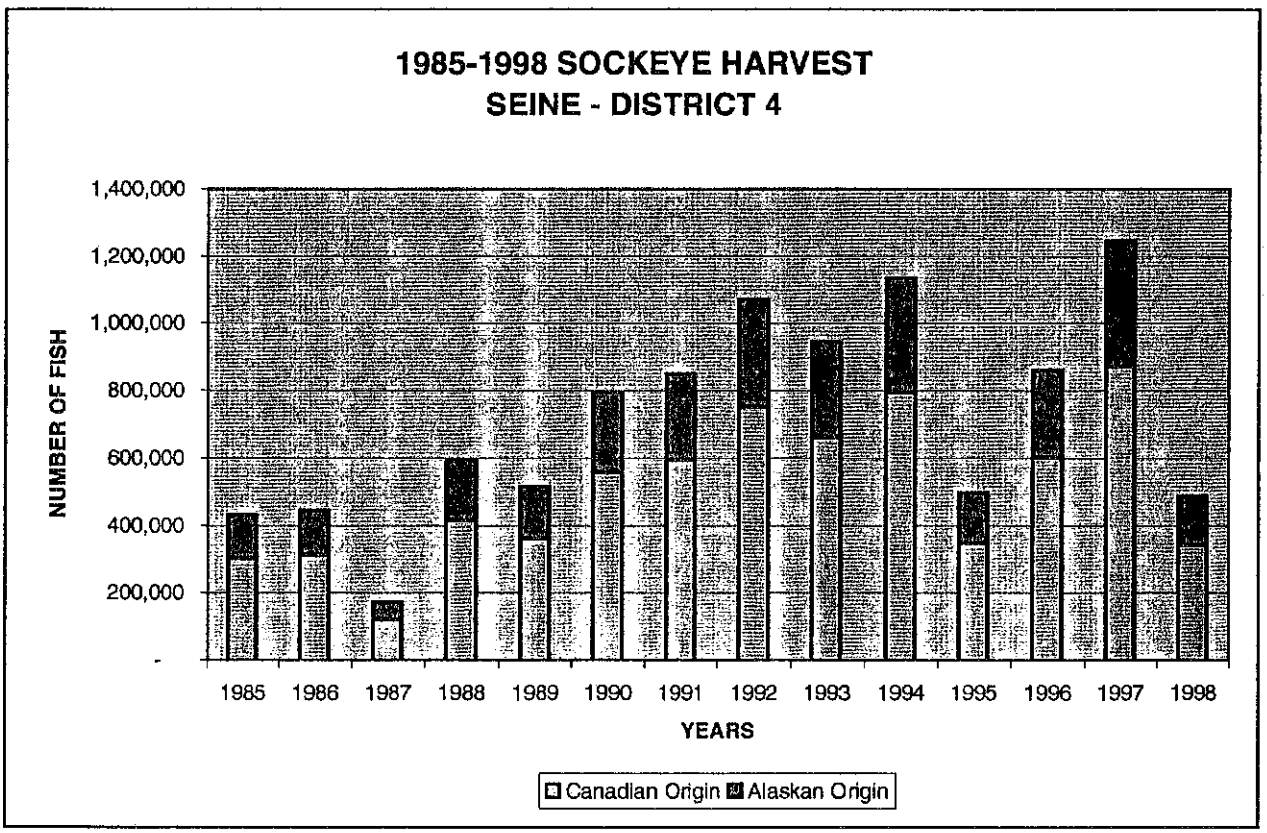
Commercial Seining

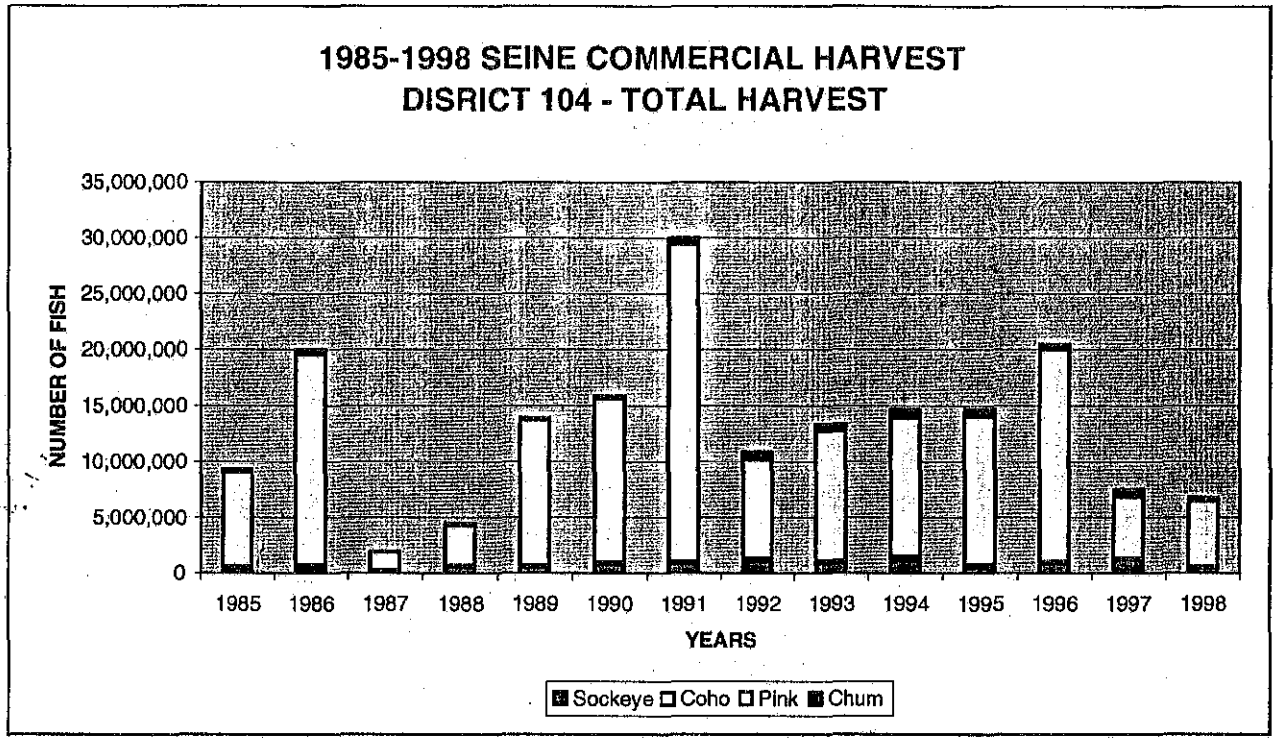
Commercial seine fishing is managed for pink salmon. Sockeye compose a small portion of the commercial catch. State trends are shown in the following graphs.

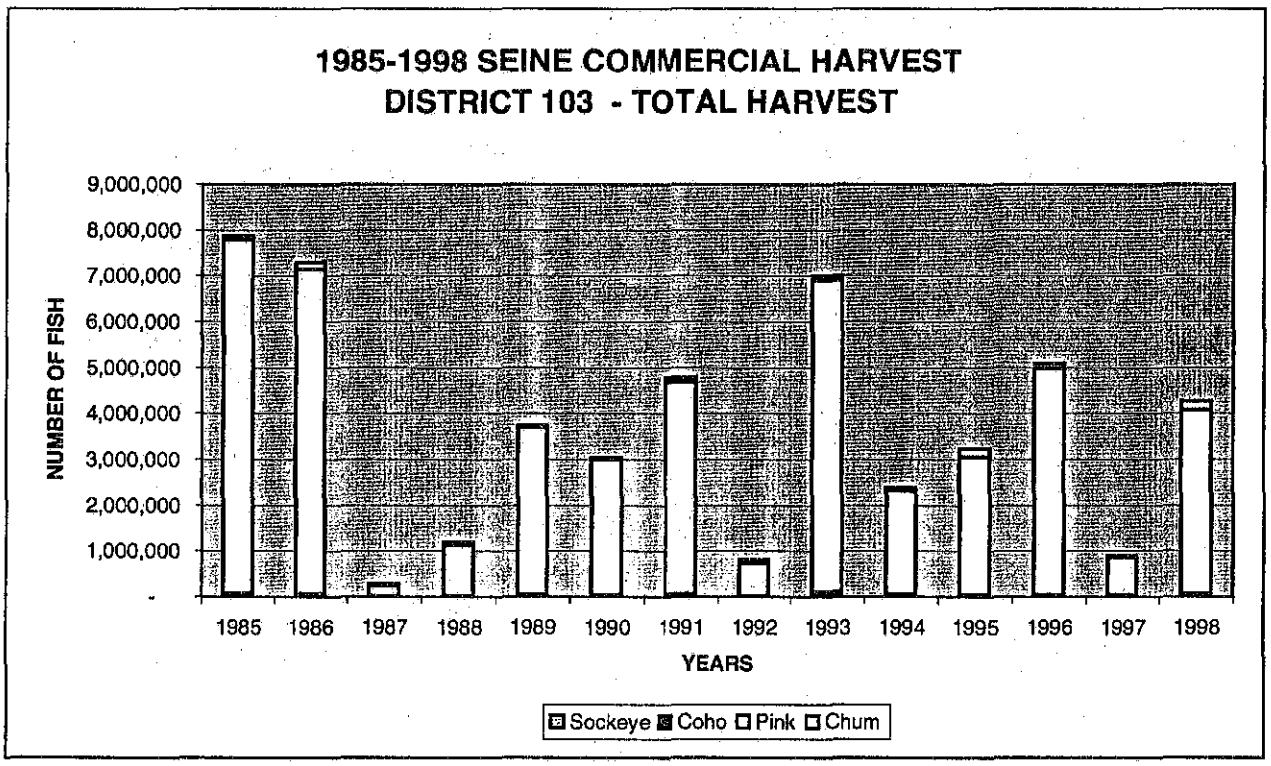
Average Week of Interception in Dist. 104 Seine Fishery, Klawock Lake Sockeye



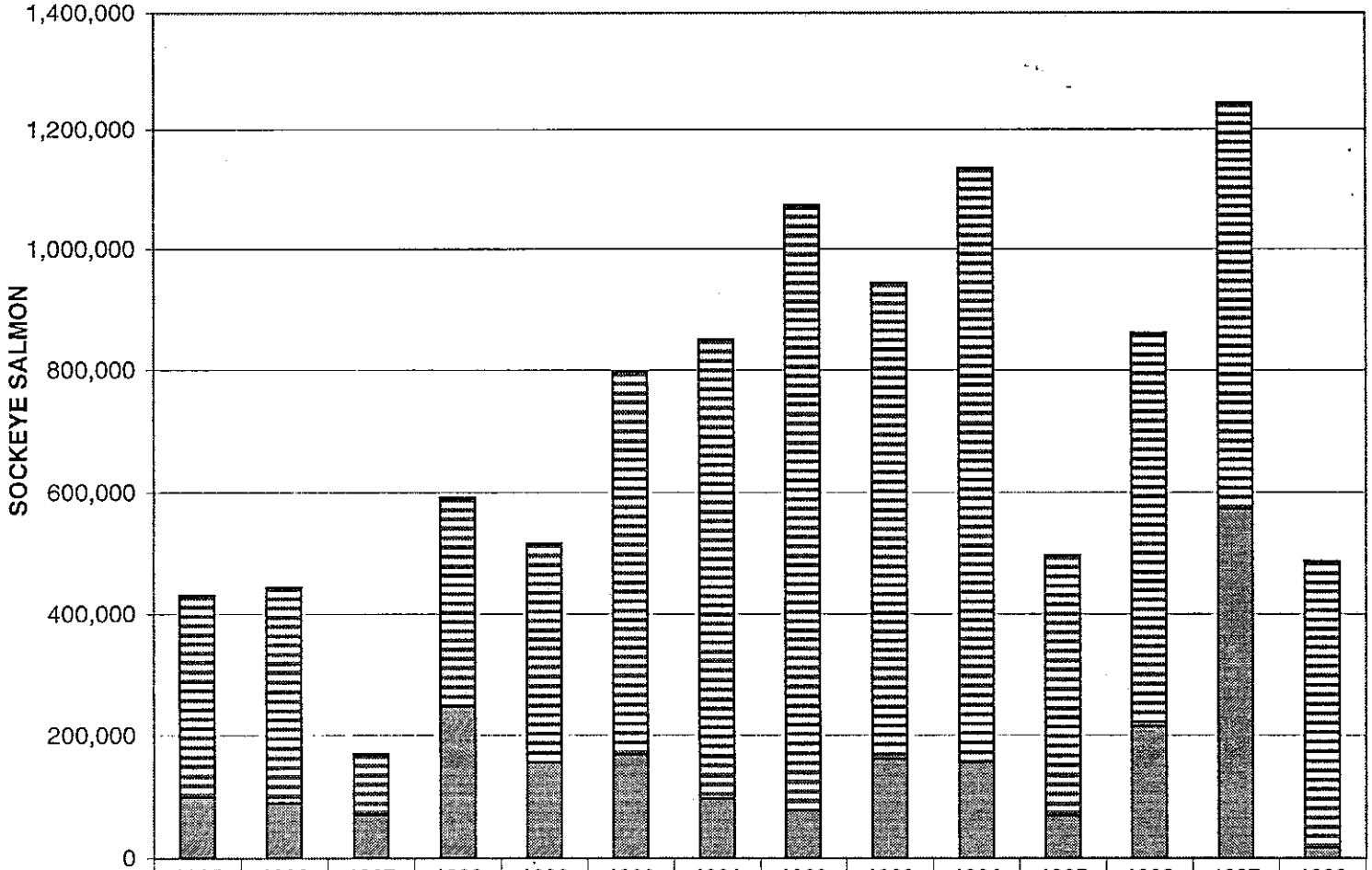

1985-1998 SOCKEYE HARVEST
SEINE - DISTRICT 3
NUMBER OF FISH
60,000
50,000
40,000
30,000
20,000
10,000
-
1985 1986 1987 1988 1989 1990 1991 1992 1993 1994 1995 1996 1997 1998
YEARS
Canadian Origin
Alaskan Origin


1985-1998 SOCKEYE HARVEST
SEINE - DISTRICT 4
NUMBER OF FISH
1,400,000
1,200,000
1,000,000
800,000
600,000
400,000
200,000
-
1985 1986 1987 1988 1989 1990 1991 1992 1993 1994 1995 1996 1997 1998
YEARS
Canadian Origin
Alaskan Origin


1985-1998 SEINE COMMERCIAL HARVEST
DISRICT 104 - TOTAL HARVEST
NUMBER OF FISH
35,000,000
30,000,000
25,000,000
20,000,000
15,000,000
10,000,000
5,000,000
0
1985 1986 1987 1988 1989 1990 1991 1992 1993 1994 1995 1996 1997 1998
YEARS
Sockeye Coho Pink Chum


1985-1998 SEINE COMMERCIAL HARVEST
DISTRICT 103 - TOTAL HARVEST
NUMBER OF FISH
9,000,000
8,000,000
7,000,000
6,000,000
5,000,000
4,000,000
3,000,000
2,000,000
1,000,000
-
1985 1986 1987 1988 1989 1990 1991 1992 1993 1994 1995 1996 1997 1998
YEARS
Sockeye Coho Pink Chum

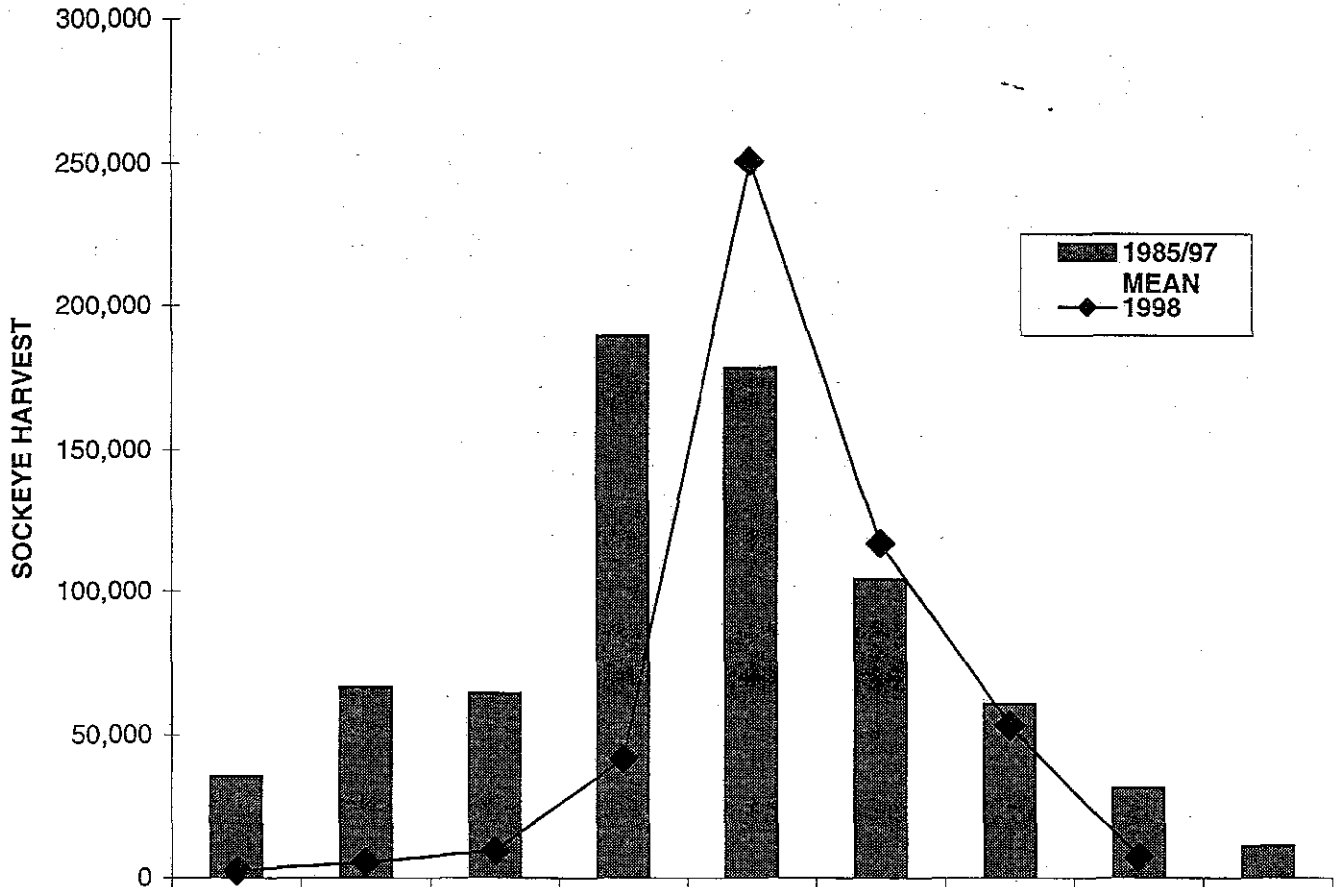
DISTRICT 104 PURSE SEINE SOCKEYE HARVEST



	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998
POST WK 30	330,740	353,351	98,573	342,496	359,035	626,855	751,248	992,396	782,096	975,771	425,769	645,295	671,738	469,836
PRE WK 31	100,590	91,320	72,385	248,789	157,566	169,943	98,583	79,643	163,189	158,524	71,376	215,144	572,942	17,394

2/18/998:25 AM

DISTRICT 104 PURSE SEINE WEEKLY SOCKEYE HARVEST 1985/97 MEAN vs 1998

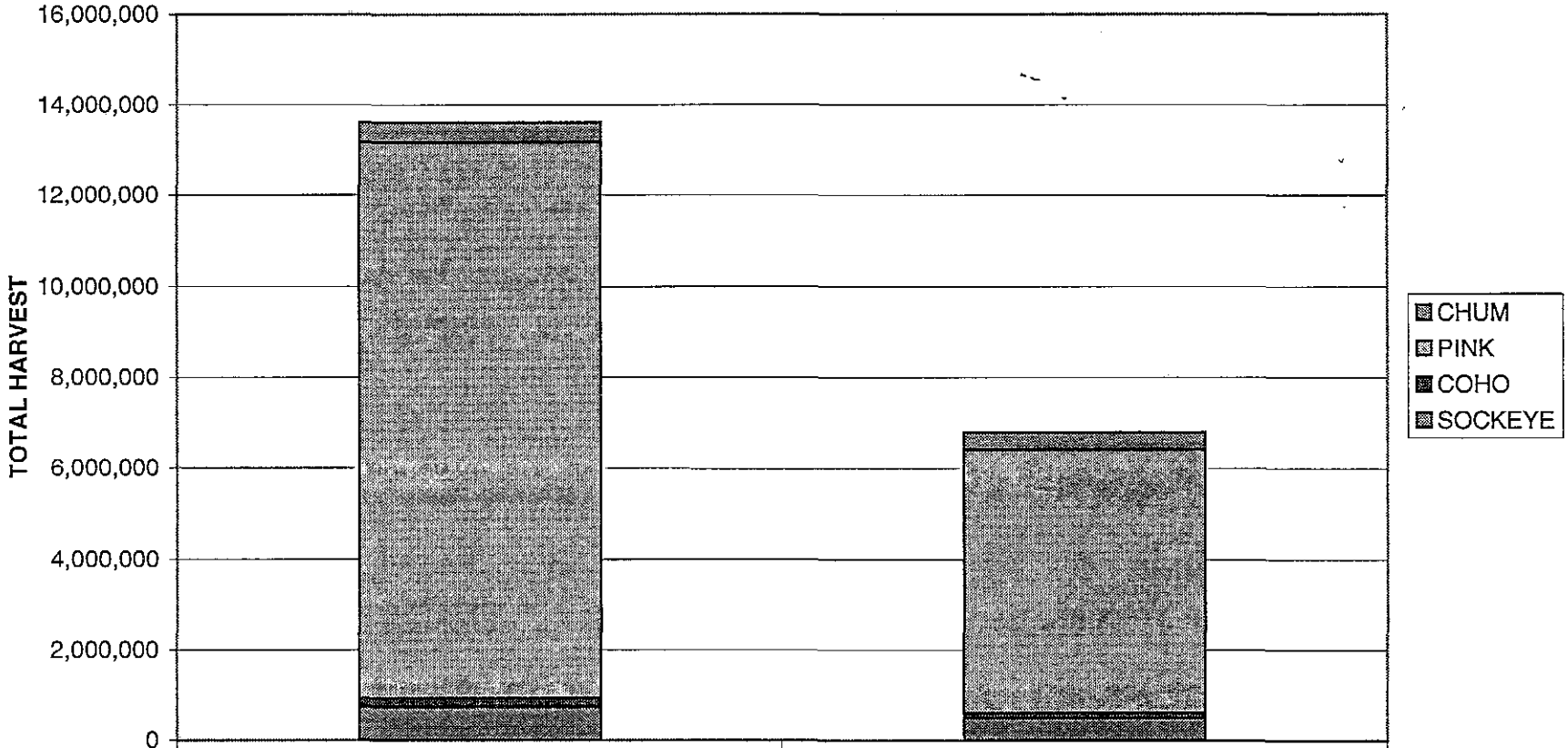


	28	29	30	31	32	33	34	35	36
1985/97 MEAN	35,447	66,615	64,426	189,640	178,560	104,297	60,738	31,432	11,079
1998	2,574	5,333	9,487	41,641	250,889	116,966	53,150	7,190	

STAT WEEKS

2/18/99 8:28 AM

DISTRICT 104 PURSE SEINE SALMON HARVEST 1985/97 vs 1998



	1985/97 MEAN	1998
CHUM	443,185	369,207
PINK	12,252,596	5,830,663
COHO	177,528	102,671
SOCKEYE	735,027	487,230

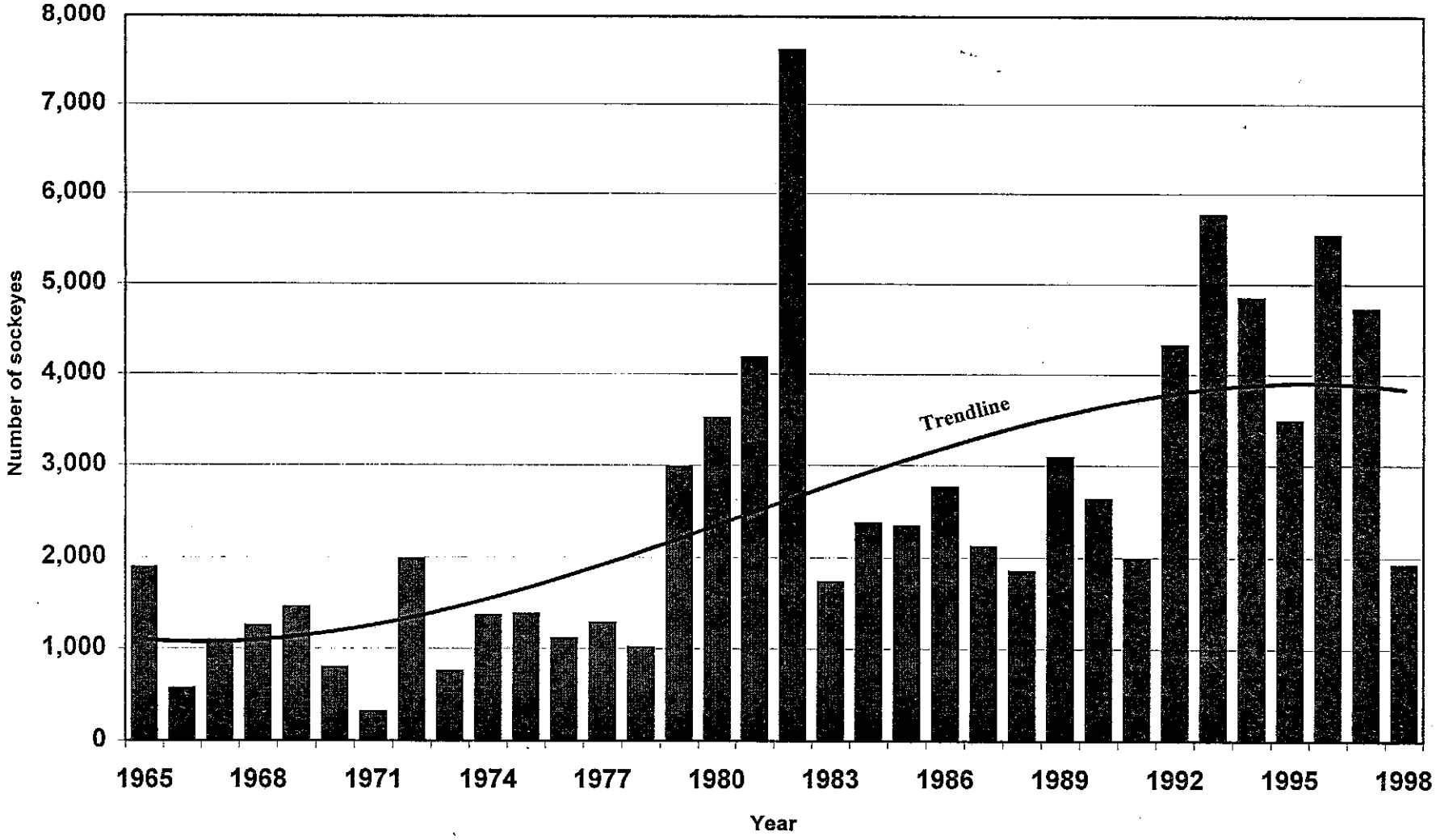
Subsistence Harvest

Subsistence Harvests have the greatest single impact on adult escapement to Klawock Lake. Where Area 103 and 104 commercial and sport fishing targets mixed stocks of salmon, subsistence fishing within Klawock Bay and Lagoon target Klawock River fish. Subsistence trends and harvest levels are shown in the following graphs.

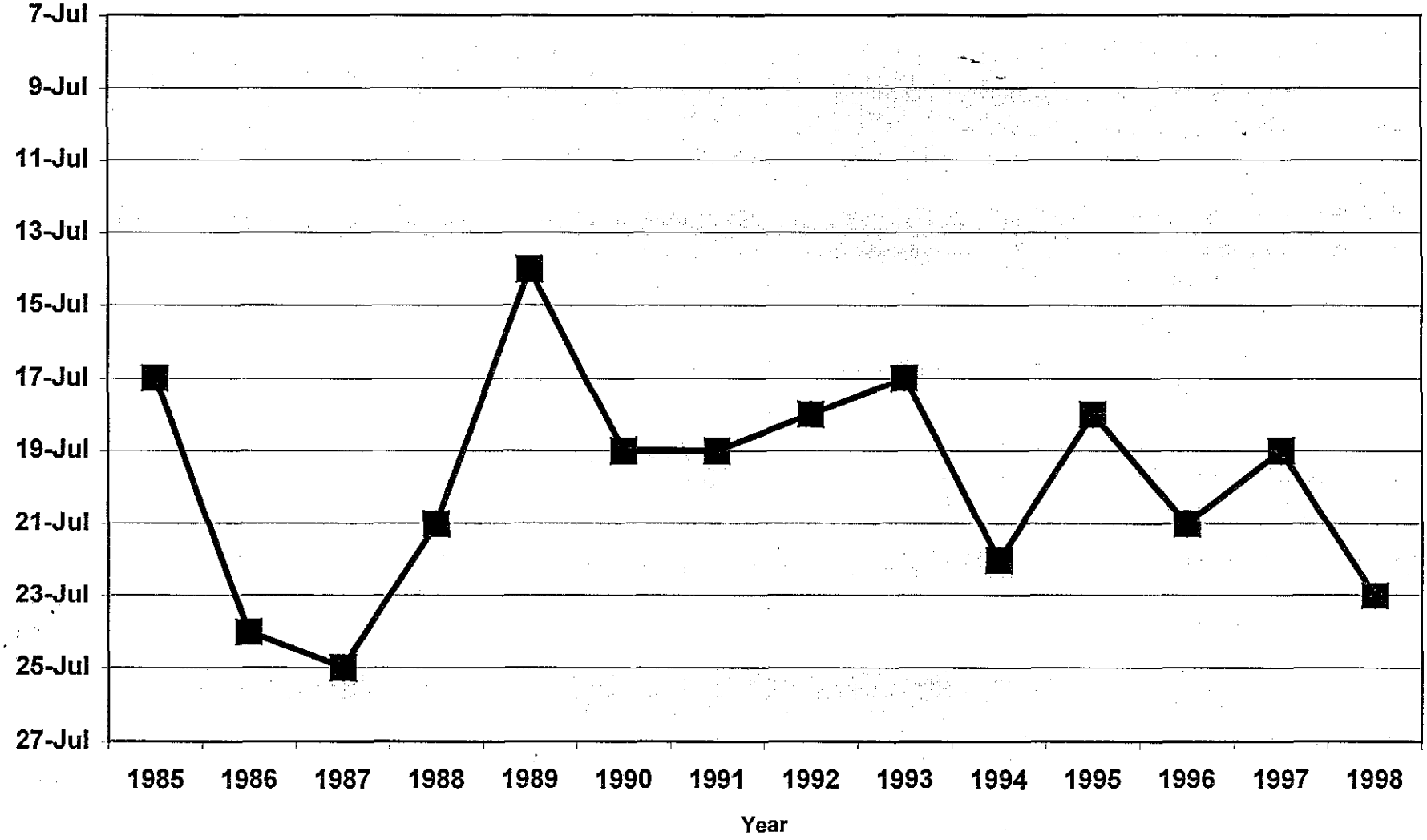
High Seas Interception

High Seas interception from foreign flag drift nets have been shown to intercept Alaska origin salmon. This fisheries has been reduced by international agreement. The impact of this fishery on Klawock River Sockeye is unknown.

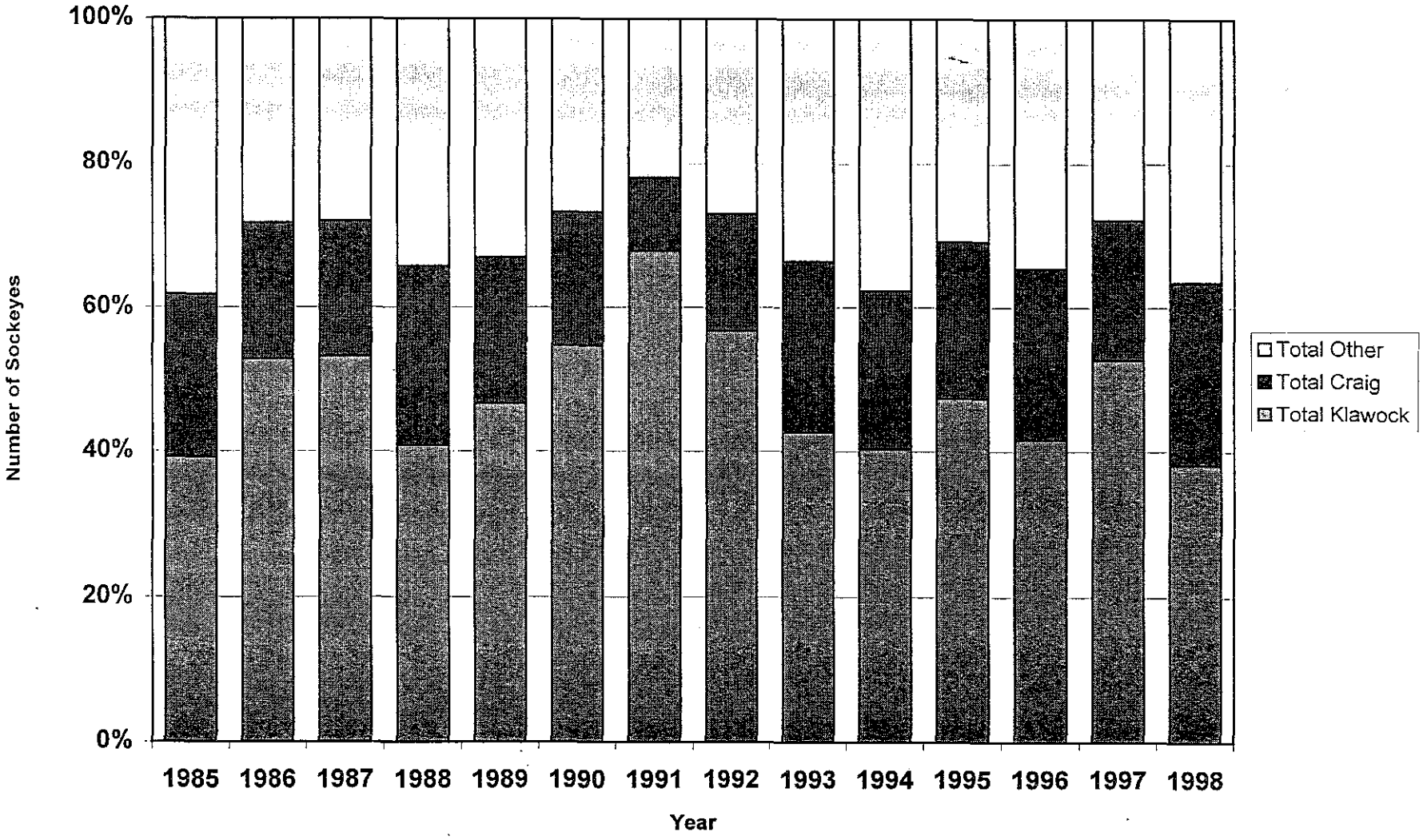
Sockeye Subsistence Harvest, Klawock River



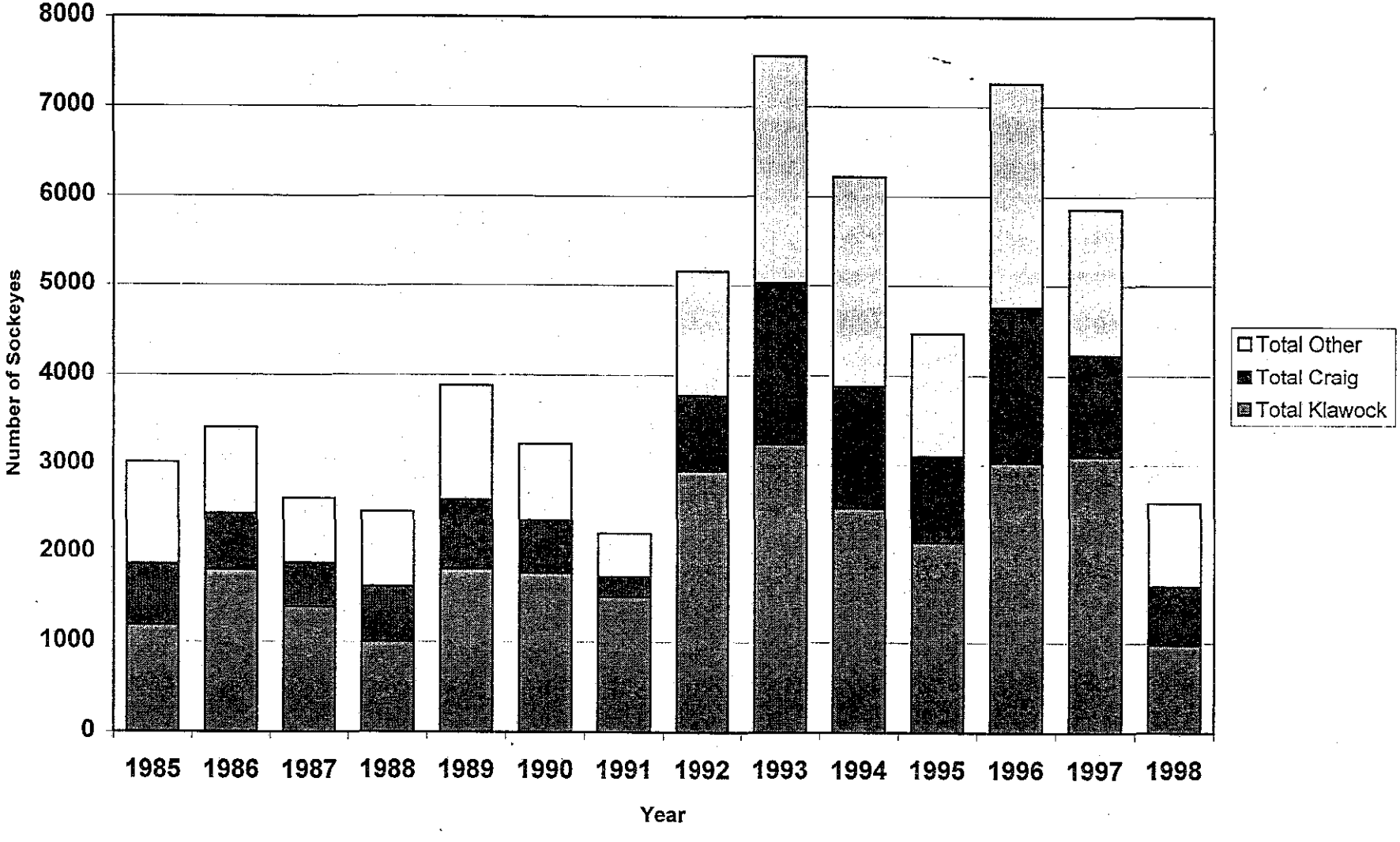
Average Date of Klawock River Subsistence Sockeye Harvest



Percent of Klawock Sockeye Subsistence Harvest by Residence



Klawock Sockeye Subsistence Harvest by Residence



Appendix

1985 Sockeye Production Information (ADF&G)

Sockeye Information (ADF&G)

Quantifying cutthroat trout predation on sockeye salmon fry using bioenergetics approach (Meg Cartwright)

Klawock Local Advisory Board Letter (1985)

ADF&G Memo (1985)

ADF&G Proposed Klawock River Sockeye Rehabilitation Plan (1985)

ALASKA DEPARTMENT OF FISH AND GAME
Division of Commercial Fisheries
P.O. Box 3-2000, Juneau, Ak 99802

October 25, 1985

To: Ken Parker, Director

From: Phil Mundy
Chief Fisheries Scientist 465-4210

Re: Klawock sockeye management information

Attached are the data which you requested in order to formulate a plan for rebuilding the sockeye stocks for the people of Klawock. I have considered the information and I have the following recommendations for your consideration.

1) The minimum escapement goal range for the system should be 5,000 - 7,000 females at 3000 eggs/female, exclusive of subsistence and personal use requirements. At a sex ratio of 1 male for every three females, this translates into a rounded total escapement goal of 7,000 - 9,000 spawners. This was based on an analysis of the historical cacth record using reasonable figures for exploitation and production. Using historical catch records and three levels of possible exploitation, the following estimates of average escapement have been made by Fred Bergander.

Exploitation rate

	60	70	80
mean escape	24491	15744	9180
s.d. esc.	11215	7210	4206
max escape	50000	32143	18750
min escape	36616	2325	1356

2) The optimum escapement goal to maximize the sockeye production potential of the lake is 50,000 females, for a total escapement of 67,000 spawners at 1 male/ 3 females. The level is based on the limnological work of Jeff Koenings (FREDD, Soldotna) which is attached, assuming 3000 eggs/female and 10% survival from egg to spring fry.

No information on tagging is attached because none exists other than four tag recoveries at Klawock from widely separated U.S./Canadian tagging programs on Alaska's Pacific coast. It is probable that Klawock sockeye are intercepted at a wide variety of locations including Southeast Alaska and British Columbia at a very low rate.

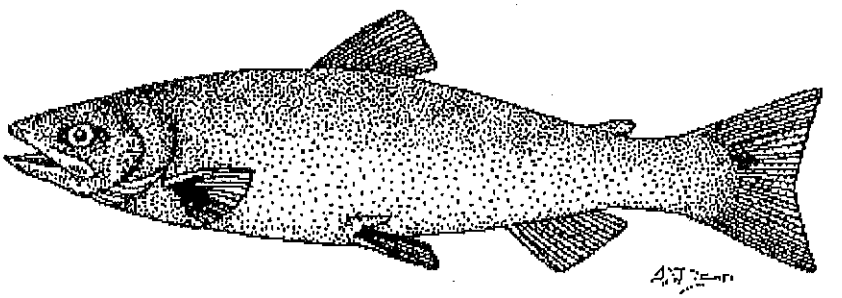
The timing of the escapement at Klawock weir in 1968-1971 and 1982-1983 is highly variable, with dates of median (50%) escapement ranging from July 22 - August 31. The time distribution of abundance at the weir is consistent with that of

a stock which has been badly damaged; it is sporadic, highly variable from year to year, and numerically very weak, ranging from 823 - 12,087 fish during these years.

Please let me know if you need further detail or justification on any of these points.

ADF&G Wildlife Notebook Series

Sockeye Salmon



The **sockeye salmon** (*Oncorhynchus nerka*), often referred to as "red" or "blueback" salmon, occurs in the North Pacific and Arctic oceans and associated freshwater systems. This species ranges south as far as the Klamath River in California and northern Hokkaido in Japan, to as far north as far as Bathurst Inlet in the Canadian Arctic and the Anadyr River in Siberia. Aboriginal people considered sockeye salmon to be an important food source and either ate them fresh or dried them for winter use. Today sockeye salmon support one of the most important commercial fisheries on the Pacific coast of North America, are increasingly sought after in recreational fisheries, and remain an important mainstay of many subsistence users.

General description: Sockeye salmon can be distinguished from chinook, coho, and pink salmon by the lack of large, black spots and from chum salmon by the number and shape of gill rakers on the first gill arch. Sockeye salmon have 28 to 40 long, slender, rough or serrated closely set rakers on the first arch. Chum salmon have 19 to 26 short, stout, smooth rakers.

Immature and prespawning sockeye salmon are elongate, fusiform, and somewhat laterally compressed. They are metallic green blue on the back and top of the head, iridescent silver on the sides, and white or silvery on the belly. Some fine black speckling may occur on the back, but large spots are absent. Juveniles, while in fresh water, have the same general coloration as immature sockeye salmon in the ocean, but are less iridescent. Juveniles also have dark, oval parr marks on their sides. These parr marks are short-less than the diameter of the eye-and rarely extend below the lateral line.

Breeding males develop a humped back and elongated, hooked jaws filled with sharp caniniform teeth. Both sexes turn brilliant to dark red on the back and sides, pale to olive-green on the head and upper jaw, and white on the lower jaw.

Life history: Sockeye salmon are anadromous: they live in the sea and enter freshwater systems to spawn. After hatching, juvenile sockeye salmon may spend up to four years in fresh water before migrating to sea as silvery smolt weighing only a few ounces. They grow quickly in the sea, usually reaching a size of 4 to 8 pounds after one to four years. Mature sockeye salmon travel thousands of miles from ocean feeding areas to spawn in the same freshwater system where they were born. Little is known about the navigation mechanisms or cues they use on the high seas, although some evidence suggests that they may be able to use cues from the earth's magnetic field. Once near their natal freshwater system, sockeye salmon use olfactory cues to guide them home. Like all Pacific salmon, sockeye salmon die within a few weeks after spawning.

Maturing sockeye salmon return to freshwater systems from the ocean during the summer months, and most populations show little variation in their arrival time on the spawning grounds from year to year. Freshwater systems with lakes produce the greatest number of sockeye salmon. Spawning usually occurs

in rivers, streams, and upwelling areas along lake beaches. The female selects the spawning site, digs a nest (redd) with her tail, and deposits eggs in the downstream portion of the redd as one or more males swim beside her and fertilize the eggs as they are extruded. After each spawning act, the female covers the eggs by dislodging gravel at the upstream end of the redd with her tail. A female usually deposits about five batches of eggs in a redd. Depending upon her size, a female produces from 2,000 to 4,500 eggs.

Eggs hatch during the winter, and the young sac-fry, or alevins, remain in the gravel, living off the material stored in their yolk sacs, until early spring. At this time they emerge from the gravel as fry and move into rearing areas. In systems with lakes, juveniles usually spend one to three years in fresh water before migrating to the ocean in the spring as smolts. However, in systems without lakes, many juveniles migrate to the ocean soon after emerging from the gravel.

Sockeye salmon return to their natal stream to spawn after spending one to four years in the ocean. Mature sockeye salmon that have spent only one year in the ocean are called jacks and are, almost without exception, males. Once in the ocean, sockeye salmon grow quickly. While returning adults usually weigh between 4 and 8 pounds, weights in excess of 15 pounds have been reported.

In some areas, populations of sockeye salmon remain in fresh water all their lives. This landlocked form of sockeye salmon, called "kokanee," reaches a much smaller maximum size than the anadromous form and rarely grows to be over 14 inches long.

Food habits: While in fresh water, juvenile sockeye salmon feed mainly upon zooplankton (such as ostracods, cladocerans, and copepods), benthic amphipods, and insects. In the ocean, sockeye salmon continue to feed upon zooplankton (such as copepods, euphausids, ostracods, and crustacean larvae), but also prey upon larval and small adult fishes (such as sand lance), and occasionally squid.

Fisheries: The largest harvest of sockeye salmon in the world occurs in the Bristol Bay area of southwestern Alaska where 10 million to more than 30 million sockeye salmon may be caught each year during a short, intensive fishery lasting only a few weeks. Relatively large harvests of 1 million to 6 million sockeye salmon are also taken in Cook Inlet, Prince William Sound, and Chignik Lagoon. All commercial Pacific salmon fisheries in Alaska are under a limited entry system which restricts the number of vessels allowed to participate. Most sockeye salmon are harvested with gillnets either drifted from a vessel or set with one end on the shore, some are captured with purse seines, and a relatively small number are caught with troll gear in the southeastern portion of the state.

Sockeye salmon are the preferred species for canning due to the rich orange-red color of their flesh. Today, however, more than half of the sockeye salmon catch is sold frozen rather than canned. Canned sockeye salmon is marketed primarily in the United Kingdom and the United States while most frozen sockeye salmon is purchased by Japan. Sockeye salmon roe is also valuable. It is salted and marketed in Japan.

There is also a growing sport fishery for sockeye salmon throughout the state. Probably the best known sport fishery with the greatest participation occurs during the return of sockeye salmon to the Russian River on the Kenai Peninsula. Other popular areas include the Kasilof River on the Kenai Peninsula as well as the various river systems within Bristol Bay.

Subsistence users harvest sockeye salmon in many areas of the state. The greatest subsistence harvest of sockeye salmon probably occurs in the Bristol Bay area where participants use set gillnets. In other areas of the state, sockeye salmon may be taken for subsistence use in fishwheels. Most of the subsistence

harvest consists of prespawning sockeye salmon, but a relatively small number of postspawning sockeye salmon are also taken. Personal use fisheries have also been established to make use of any sockeye salmon surplus to spawning needs, subsistence uses, and commercial and sport harvests. Personal use fisheries have occurred in Bristol Bay, where participants use set gillnets, as well as in Cook Inlet and Prince William Sound, where participants also use dip nets.

While most sockeye salmon production in Alaska results from the spawning of wild populations, some runs have been developed or enhanced through human effort. Although artificial propagation of sockeye salmon has proven difficult, notable success has been achieved at state-maintained hatcheries located on the upper Copper River in Prince William Sound and the Kasilof River on the Kenai Peninsula. A fish ladder installed on the Fraser River on Kodiak Island has also served to enhance sockeye salmon returns.

Text: Commercial Fisheries Management and Development Staff
Illustration: Ashley Dean
Revised and reprinted 1994

ADF&G Home | Wildlife Notebook Series Home | CF Salmon Home | Top of Document |

maintained by: marlat@fishgame.state.ak.us
Last updated: 11/02/98 12:44:31

Quantifying cutthroat trout (*Oncorhynchus clarki*) predation on sockeye salmon (*Oncorhynchus nerka*) fry using a bioenergetics approach

Margaret A. Cartwright, David A. Beauchamp, and Mason D. Bryant

Pages 1285-1295

Abstract: Although some sockeye salmon (*Oncorhynchus nerka*) enhancement programs achieve production goals in Alaskan lakes, others like the Margaret Lake project fall well below expected levels. We used bioenergetics model simulations, coupled with field sampling of predator diet and distribution, to quantify the intensity of cutthroat trout (*Oncorhynchus clarki*) predation on stocked sockeye salmon fry in Margaret Lake during 1993 and 1994. Model results indicated that, by September, cutthroat trout consumed an estimated 34-51 and 32-100% of the 200 000 and 100 000 sockeye salmon fry stocked in May 1993 and 1994, respectively. September hydroacoustic survey results estimated a 82-87% decline of fry in 1993 and 90-93% in 1994. Stomach fullness and evacuation estimates of total consumption were 59% of model estimates after the first fry release in 1994 and 120% of the model estimates after the second release. All approaches to estimating cutthroat trout predation on stocked fry suggested that piscivores played a substantial role in the decline of sockeye salmon fry in Margaret Lake. The ability to estimate consumption is valuable in isolating predator influence on food web dynamics, especially in manipulated systems.

Back to Table of Contents

Résumé : Bien que certains programmes d'amélioration des stocks de saumon rouge (*Oncorhynchus nerka*) atteignent leurs objectifs de production dans les lacs de l'Alaska, d'autres comme le projet du lac Margaret obtiennent une production bien en deçà des niveaux attendus. Grâce à des modélisations bioénergétiques, alliées à un échantillonnage sur le terrain pour déterminer le régime et la distribution des prédateurs, nous avons quantifié l'intensité de la prédation exercée par la truite fardée (*Oncorhynchus clarki*) sur les alevins de saumon rouge ensemencés dans le lac Margaret au cours de 1993 et 1994. Les résultats de la modélisation indiquent que, dès septembre, la truite fardée avait consommé entre 34 et 51 % et entre 32 et 100 % des 200 000 et 100 000 alevins de saumon rouge ensemencés en mai 1993 et en 1994, respectivement. Selon les résultats d'un relevé hydroacoustique effectué en septembre, il y a eu réduction estimative de 82 à 87 % des alevins en 1993 et de 90 à 93 % en 1994. Des estimations de la consommation totale obtenues grâce à une évaluation de la plénitude et de l'évacuation gastriques correspondaient à 59 % des estimations du modèle après le premier lâcher d'alevins en 1994 et à 120 % des estimations du modèle après le deuxième lâcher. Selon toutes les méthodes d'estimation de la prédation exercée par la truite fardée sur les alevins ensemencés, les piscivores jouaient un rôle substantiel dans la réduction du nombre d'alevins du saumon rouge dans le lac Margaret. La capacité d'estimer la consommation est utile pour isoler l'effet des prédateurs sur la dynamique du réseau trophique, en particulier dans les systèmes aménagés. [Traduit par la Rédaction]

Retour à la table des matières

M E M O R A N D U M

TO: Frank Van Hulle
Regional Supervisor
Sport Fish Division
Juneau

October 15, 1985

FROM: Donald Siedelman DCS
Area Management Biologist
Sport Fish Division
Ketchikan

Subj: Klawock Sockeye

With this memo on Klawock River sockeye it is hoped that a better understanding of this situation will be realized. It is also hoped that the task force will see where the problem arises from and will speak to, and solve, the problem rather than use the band-aid.

The answers to your questions are as follows:

Angler harvest from the State-Wide Harvest Questionnaire is as listed below by year. River data was not collected prior to 1982.

Year	Klawock River	Prince of Wales
1977	-	325
1978	-	296
1979	-	308
1980	-	250
1981	-	479
1982	84	1321
1983	38	2040
1984	0	790

In talking with Department staff personnel that are in the area, they feel there are very few sockeye harvested from the river. One lodge owner stated he may catch 1 or 2 sockeye/year in saltwater at the most. His clients do not fish the river for sockeye.

The local effort is primarily at the highway bridge and that is a snag fishery but the sockeye are all utilized for personal use/subsistence and for protein.

As to who is doing the fishing? Local staff states that 70% are recognizable residents and the others are either local loggers on the road system or non-resident tourists. Most of the anglers are adults (80%) and 20% juveniles.

Other fish/fisheries do exist within the river and drainages during the sockeye salmon return dates. Sockeye enter the

river from early July through early September with the peak after mid to late August.

Throughout the year the system has rainbow trout, Dolly Varden, and cutthroat trout.

Weir counts indicate coho enter into the river as early as August. Pink salmon enter into the system in mid to late July. By August 15 in 1984 there were 730 coho up to the hatchery weir and in 1985, 163. By August 30 in 1984 there was 2,900 coho and in 1985, 1,085. These numbers will increase as hatchery production increases.

The river annually has been getting 200,000 - 400,00 pink salmon. All fish enter the estuary at an earlier date than the weir dates since the weir is just below the lake.

We have a Klawock hatchery program that we pay out of our sport monies for at least releasing steelhead in Klawock River and Ward Creek. This is a growing fishery in the river from October through early June.

The sport fishing and angling options are the usual which we normally end up receiving when the cake has been divided.

There is a no major fishery on the river or in the lake for sockeye salmon. I do not see our <u>small</u>, and I repeat <u>small</u>, sockeye harvest as a problem in this river system. Most of our angling takes place at the Klawock Bridge for sockeye, coho, and pink salmon. The remainder of the species are taken throughout the drainage. The coho river fishery has been developing in the river and will increase in importance as hatchery production is maintained on this species.

The bridge area has its problems with want and waste on other species of fish such as pink and chum. Very little waste or no waste on sockeye or coho - all protein fish.

Most of these harvested fish were, or are, shared throughout the community.

If there is want and waste on fish in this area it is an enforcement problem <u>not</u> a sport fishery problem.

One could close the "bridge" to all fishing and minimize the harvest of <u>all</u> fish. This would make fishing only from the banks in the estuary. Some snagging may move to the river, but not too any great extent.

Another option would be limit the gear to single hooks of 1/2" etc., as in Thomas Basin. This would also minimize the <u>total</u> harvest if it was enforced. This would again create an enforcement problem. This has worked at Thomas Basin as

long as it was enforced, mainly by Sport Fish and not Public Safety.

A total closure on red salmon fishing within the entire drainage and saltwater area is another option. This would leave the basin open to angling for all other species of fish. This proposal would be the most palatable to all groups but sport anglers. Enforcement would still be needed and some difficulty on fish identification may be a problem.

A total saltwater closure to angling would not be in our best interest or the multiple use of the areas resource. There are too many anglers in the area to enact a total closure on salmon returns - especially with hatchery coho production, 200 - 400,000 pink, plus chum salmon, trout, and steelhead. The total closure of the system to all angling is not a solution due to needed angler usage and importance of hatchery production of steelhead and coho salmon.

All staffers that are willing to make comments on this situation state, and I agree, that the real problem is enforcement, misuse of subsistence privileges, and over harvest in the Noyes Island commercial seine fishery.

The local residents want to blame all other user groups rather than themselves for the demise of their subsistence fishery. They are their own biggest problem since they abuse the fishery constantly and claim it is their given heritage to barter, sell, trade, etc., their subsistence fish. So the seiner arrives and takes his boat load. Then the other subsistence users arrive, day in and day out, to harvest their permit quota <u>each</u> day. The next user arrives to harvest his quota, runs down to the fish buyer and sells his catch. This all takes place under the guise of subsistence, which no one wants to or can enforce. Everyone just hopes the subsistence system will change or go away.

The so-called barrels and pick-up loads of fish that leave the area by other user groups are stated to be occurring all too frequently but not by subsistence users. A good case of transferring responsibility to keep the subsistence users given rights clean.

It is felt that the Klawock letter stating that the Noyes Island commercial fishery does not affect the areas sockeye fishery is in error.

The truth is that this fishery does have an affect on the Klawock sockeye return. The problem is that it is a "cape fishery" or "mix stock fishery" that is geared to harvest Canadian red slmon at the expense of our west coast sockeye fisheries. Thus no one wants to reduce this fishery's harvest to achieve an adequate escapement for subsistence

and Klawock River needs. It was thought that subsistence had first priority, but when it comes to economics etc., commercial fishery has the number one priority. If this is not a good example, then take Hugh Smith in 1985 as another example of commercial vs. sport vs. subsistence and note who gave up the sockeye to achieve an adequate escapement. I do not agree with the statement that since these fleets do not directly fish on these rivers stocks that subsistence is not a major concern.

Lets face the facts - - with no enforcement at Klawock on subsistence then there will be no increase in sockeye salmon. Also, if there is no reduction in commercial fishing there will be no increase in sockeye for Klawock River.

The way to solve this problem is to require enforcement throughout the permitted subsistence fishery. A full time seasonal for 6-7 weeks. This individual could enforce the rules for subsistence and sport angling. Both groups, subsistence and sport fishing, can co-exist. To insure this potential, the commercial fishery should be curtailed in the Noyes Island area thus allowing greater escapements into the Sarkar and Klawock Rivers. This commercial curtailment could also reduce the king salmon harvest by this user group in these West Coast waters - thus "killing two birds with on stone."

Lets get the Subsistence Section out and evaluate the fishery if they want to solve the problem. A little difficult to solve this problem from Juneau. It would seem that the Subsistence Section would have jumped at this problem when they hired someone to evaluate the areas traditional deer harvest areas. One would think this would have had top priority and could have been included into this deer study since they were aware of the Klawock River's immediate problem.

Having Klawock Hatchery commence a sockeye salmon program will probably not solve the real problem, nor the long term problems. This program would look good on paper and probably would by readily funded but again the results are questionable due to the known returns of this fisheries and their related problems.

This sums up the Klawock, Craig, Hydaburg, Thorne Bay, etc, (total Prince of Wales Island) subsistence problem that occurs on Klawock River. I really do not feel if we change the sport fishery that this will speak to the real problem in a significant manner. It would assist in taking some immediate pressures off of Headquarters. This is probably being pursued by two or three local people and does not represent all the users in Klawock and definately not the other area communities who utilize this system for

subsistence or sport angling. Do we assume that the Klawock community owns this system and not the other users or communities.

Maybe we should use a seiner to harvest a boat load of fish for the community from our Department test fishery program at Noyes Island and give fish to all past subsistence users in the area. This would then be paid for by the test fish program. Then we could keep the river closed to subsistence.

PROPOSED KLAWOCK RIVER SOCKEYE REHABILITATION PLAN

ADF&G 1985

I. GOAL

Within 10 years (2 sockeye cycles)(1996) rebuild the Klawock River sockeye run to 50,000 spawners with an annual targeted subsistence harvest of sockeye comparable to the harvest which occurred in 1985.

II. BASIC ASSUMPTIONS

A. Something must be changed or the sockeye stock will remain at it's present status. The present status is not acceptable because the stock is in grave danger of becoming non-viable.

B. Items which can be controlled fall into three(3) broad categories:

1. Harvest Management
2. Habitat Management
3. Stock Enhancement

III. HARVEST MANAGEMENT OPPORTUNITIES

Purpose is to increase escapement to Klawock River to meet Minimum Escapement Goal (5,000 with hatchery enhancement, 12,000 with natural production)

A. Closure of targeted sport fishery harvest in Klawock River watershed (Proposal to Board of Fisheries).

B. Closure of Klawock River Bridge to all fishing (Proposal to Board of Fisheries).

C. Eliminate snagging (Proposal to Board of Fisheries).

D. Maintain 1986 subsistence harvest at level of no greater than the 1985 harvest.

1. Issue permits at similar level of 1985 (350 permits, 10/person, 20/household.

2. Encourage utilization of other species for subsistence.

3. Enforce permit conditions and monitor catches for fishing period.

4. Time restriction possibilities:
   a) No weekend fishing
   b) confine season to period beginning 7/7/86 - 7/31/86.

5. Issue Subsistence Permits locally.

6. The bay East of the Klawock River Bridge shall be closed to sockeye subsistence fishing.

IV. RESEARCH & EVALUATION

Information gathering activities designed to provide information which will: provide a yearly progress report.

A. Tag sockeye smolt as they leave Klawock to enter the ocean. Recovery of these tags in fisheries and when the fish return to Klawock Lake to spawn will:

   1. Estimate harvest time and location of these sockeye.
   2. Determine what portion of the Klawock sockeye are harvested in traditional commercial fisheries.

B. Develope a local Information & Education Program.

2. cont'd.

be incubated and 2,700,000 fry will be stocked into the lake. Two Hundred Seventy Thousand will exit the lake for the ocean. Anadult return of 27,000 will result due to the incubation/stocking work. These adult sockeye will return 6 years after the eggtake.

3. Hatchery incubation will occur at the 3,000,000 egg level for each of the six years during the period 1986-1991. Of the 27,000 adults produced annually from this technique, it is assumed an additional 16,200 adults will escape to spawn in Klawock beginning in 1992. We assume a 40% harvest rate in the existing commercial fisheries and harvest in the terminal area fisheries (subsistence, sport) will remain at the level of 1985. Therefore, is 1992 we expect to have an escapement of 20,200. (4,000 + 16,200)