

FRED Reports

PINK AND CHUM SALMON ADULT RETURNS
FROM RELEASES AT CANNERY CREEK AND
MAIN BAY HATCHERIES:
1983 FIELD SEASON

by
Tom Kohler
Number 34



Alaska Department of Fish & Game
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ABSTRACT

Returns of hatchery-produced pink (Oncorhynchus gorbuscha) and chum (Oncorhynchus keta) salmon were evaluated in the vicinity of Cannery Creek Hatchery by means of a mark recovery program.

Based on marked recovery data, an estimated 469,000 pink and 20,900 chum salmon returned in 1983 as the result of fry releases at Cannery Creek Hatchery. Fry to adult survival rates were estimated as 3.37% for pink salmon and 4.46% for chum salmon.

The proportion of marked fish found in escapement samples at Cannery Creek was compared with the proportion of marked fish release to determine if differential mortality of marked fish or fin regeneration had occurred. Although there was a smaller proportion of marked fish in the escapement samples than in the releases for both pinks and chums, it was not possible to definitely conclude that mark loss had occurred for either species.

Transplants of pink salmon fry to Main Bay resulted in the creation of a new set gill net and drift gill net fishery.

An estimated 497,000 adult pink salmon returned to Main Bay as the result of fry transplants to the newly-constructed hatchery in 1982. This return to the transplant site constitutes 1.7% of the fry released.

INTRODUCTION

The Alaska Department of Fish and Game (ADF&G), Fisheries Rehabilitation, Enhancement, and Development Division (FRED) operates two salmon hatcheries in Prince William Sound that

are located at Cannery Creek and Main Bay (Figure 1). At full capacity the two facilities will produce up to 200 million pink (Oncorhynchus gorbuscha) and chum (Oncorhynchus keta) salmon fry annually.

The Cannery Creek Hatchery was constructed during 1978 and 1979 with funds provided from a 1976 state bond issue. The hatchery is located at the outlet of Cannery Lake in Unakwik Inlet, approximately 64 kilometers west of Valdez (Figure 1). A complete site description is available in the Cannery Creek Environmental Impact Statement (Dudiak 1978).

Brood-stock development began in 1978 with pink salmon eggs taken from an indigenous stock and chum salmon eggs from donor stocks in the vicinity of Cannery Creek.

Main Bay Hatchery was completed in October 1982 with funding from a 1978 state bond issue. The hatchery is located at the head of Main Bay, approximately 48 kilometers southeast of Whittier (Figure 1).

The brood-stock development program for Main Bay Hatchery began in 1981 with the transplant of pink salmon fry from Cannery Creek Hatchery. In 1982, chum salmon eggs were taken from Wells River.

This report summarizes the evaluation of pink salmon returns from the 1981 brood-year release and chum salmon returns from the 1979 brood year.

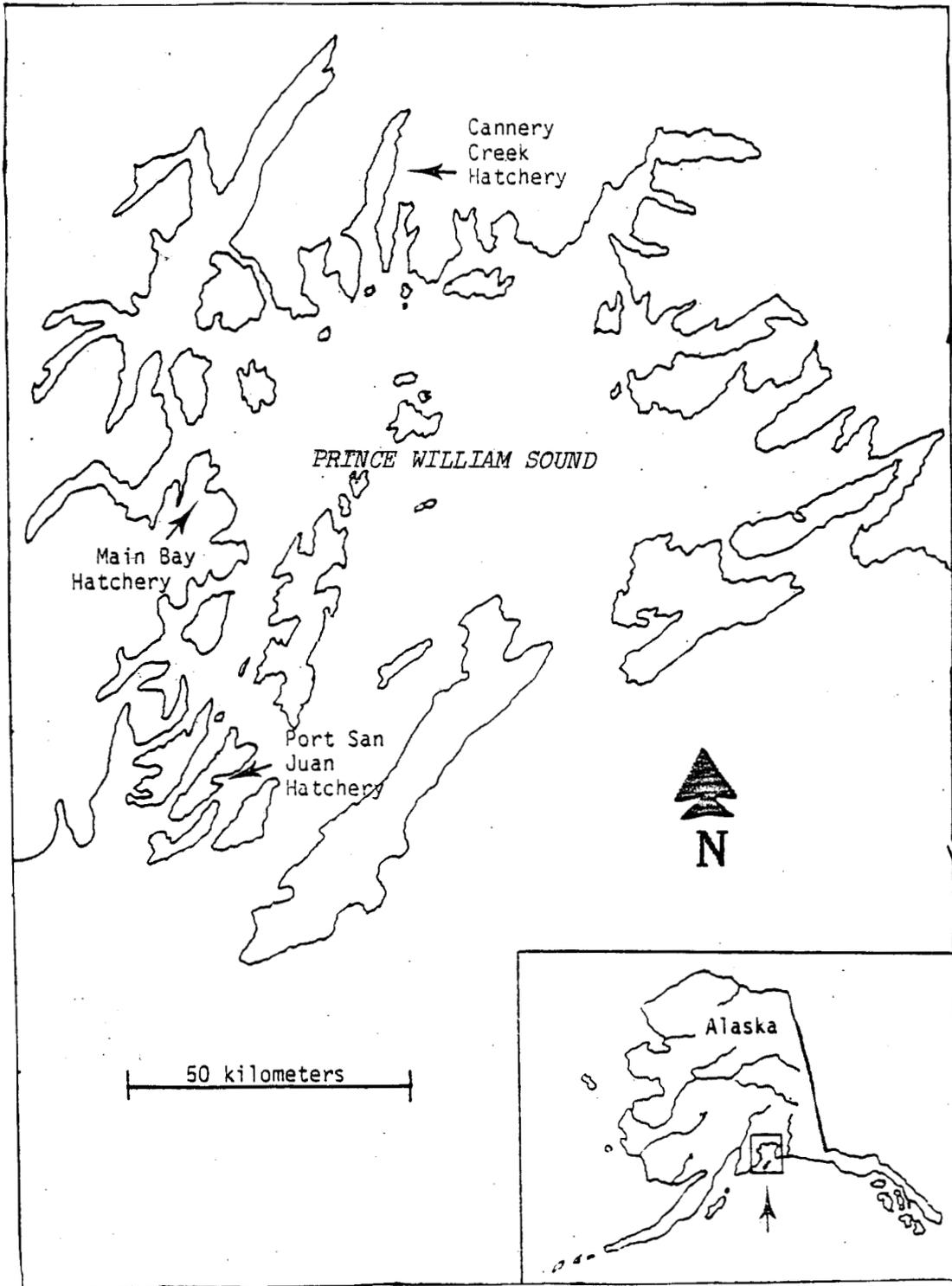


Figure 1. Study area and location of Cannery Creek, Main Bay and Port San Juan Hatcheries, Prince William Sound, Alaska.

MATERIALS AND METHODS

Incubation, Fry Marking, and Fry Release

Cannery Creek egg-take procedures, hatchery incubation techniques, and fry release methods are discussed in detail by Ellison (1981). For the purpose of evaluating adult returns of hatchery-produced salmon, a portion of released fry was marked by excising adipose and left ventral fins. Marking techniques and quality control methods used are described by Moberly et al. (1977). Fry were marked throughout the period of emergence and released in the same manner as unmarked fry. Discount rates that were derived from the quality control analysis were applied to estimate the total number of validly marked fry released.

The pink salmon fry released in 1982 at Main Bay originated at Prince William Sound Aquaculture Corporation's Port San Juan Hatchery. Eyed eggs were transported by float plane to Cannery Creek Hatchery where they were incubated to the fry stage. The fry were then transported by chartered landing craft to Main Bay where they were held in net pens for 1 to 3 days prior to release.

Adult Returns

Commercial catches of pink and chum salmon in the vicinity of Cannery Creek Hatchery were sampled to estimate the interception rate and contribution of hatchery-produced salmon to the commercial catch (Figure 2). Sampling for marked fish was conducted in the fishery as individual vessels transferred their daily catches to cannery tenders. Samplers examined individual fish for fin clips during the transfer process. The number of fish sampled for marks, number of marked fish recovered, and the specific location of individual vessel

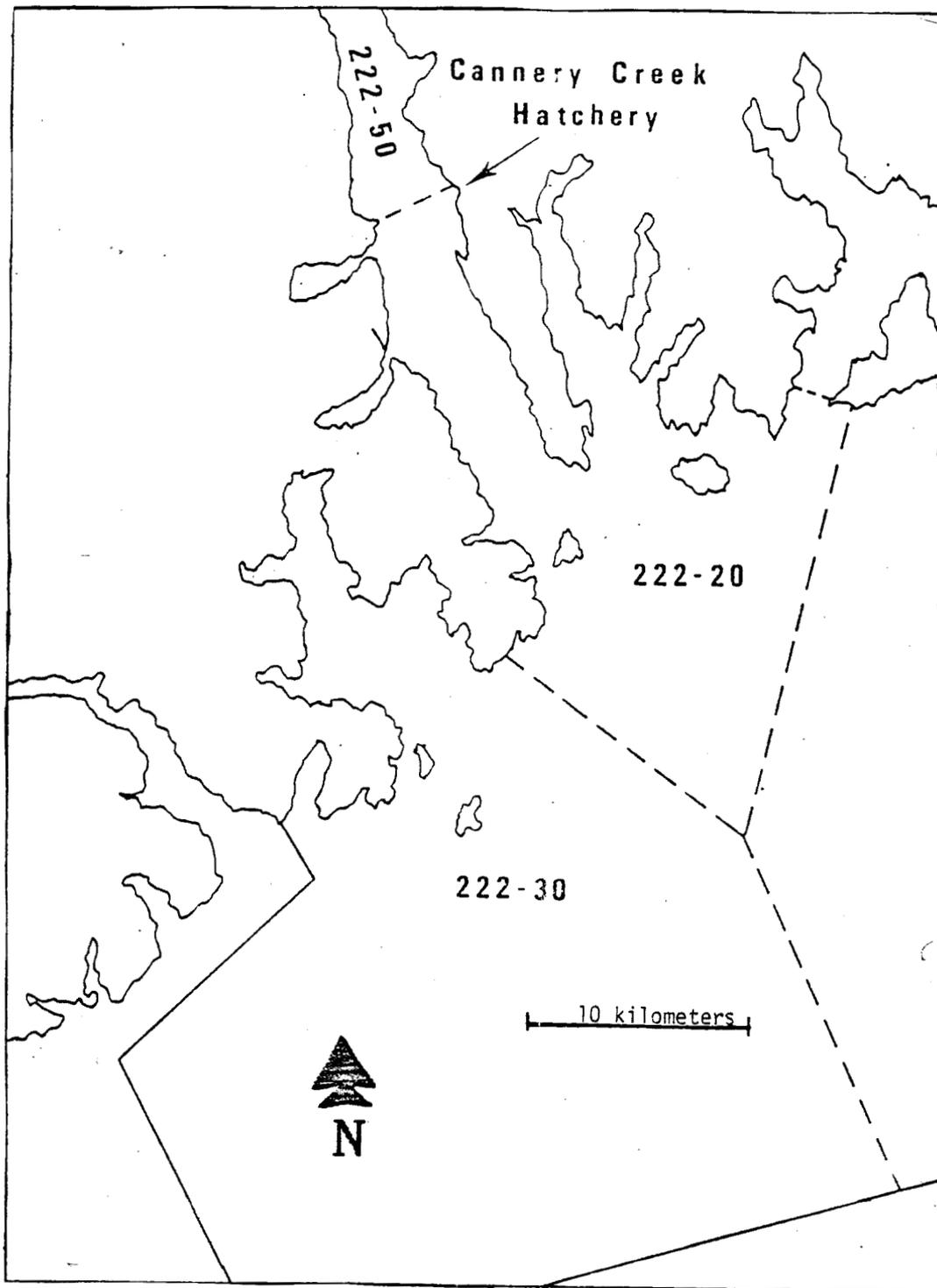


Figure 2. Commercial fishing subdistricts in which commercial catch sampling was conducted in 1983 and the location of Cannery Creek Hatchery.

catches were recorded on a daily basis. Total catch figures in the three commercial fishing subdistricts where catch sampling was conducted were obtained from vessel catch reports (fish tickets).

Commercial fishery contribution by hatchery-produced fish were calculated using the following formulas:

$$\hat{p} = (H/n_1) (m_2/n_2) \quad \text{Var} (\hat{p}) = [H/(n_1 n_2)]^2 \quad \text{Var} (m_2)$$

$$\hat{r} = (N/n_1) (m_2/n_2) \quad \text{Var} (\hat{r}) = [N/(n_1 n_2)]^2 \quad \text{Var} (m_2)$$

$$\hat{t} = (E/n_1) (m_2/n_2) \quad \text{Var} (\hat{t}) = [E/(n_1 n_3)]^2 \quad \text{Var} (m_3)$$

where:

\hat{p} = Estimated proportion of catch produced by hatchery-released fry.

\hat{r} = Estimated proportion of hatchery fish in catch.

\hat{t} = Estimated proportion of hatchery fish in escapement.

H = Number of hatchery fry released.

N = Number of fish caught in the fishery.

E = Total number of fish in escapement

n₁ = Number of marked fry released.

n₂ = Number of fish examined for marks in the fishery.

n₃ = Number of fish examined for marks in escapement

m2 = Number of marks recovered in the fishery.

m3 = Number of marks recovered in escapement

Var (m2) - [see Howe (1982) for formula].

Var (m3) - [see Howe (1982) for formula].

Adult salmon returns to the Cannery Creek Hatchery were also sampled for marks during the spawning process. The marked-unmarked ratio in the escapement was used to determine if any differential survival and/or fin regeneration had occurred. For this analysis it was assumed that natural production from Cannery Creek was insignificant and all fish returning to Cannery Creek were hatchery fish.

Chum salmon in Prince William Sound normally return as adults at 3, 4, and 5 years of age. Returns at Cannery Creek were estimated only for 4-year-olds as neither 3- nor 5- year marked chums were recovered in sampling.

The total catch of Main Bay pink salmon was determined from fish ticket reports of Prince William Sound Hatchery subdistrict 225-21 (Figure 3). All pink salmon caught in the subdistrict were attributed to hatchery production. Main River escapement was determined by ground surveys.

RESULTS

Fry Marking and Release

A total of 13,933,000 pink salmon fry were released into Cannery Creek in 1982. Of this number 50,000 were marked with

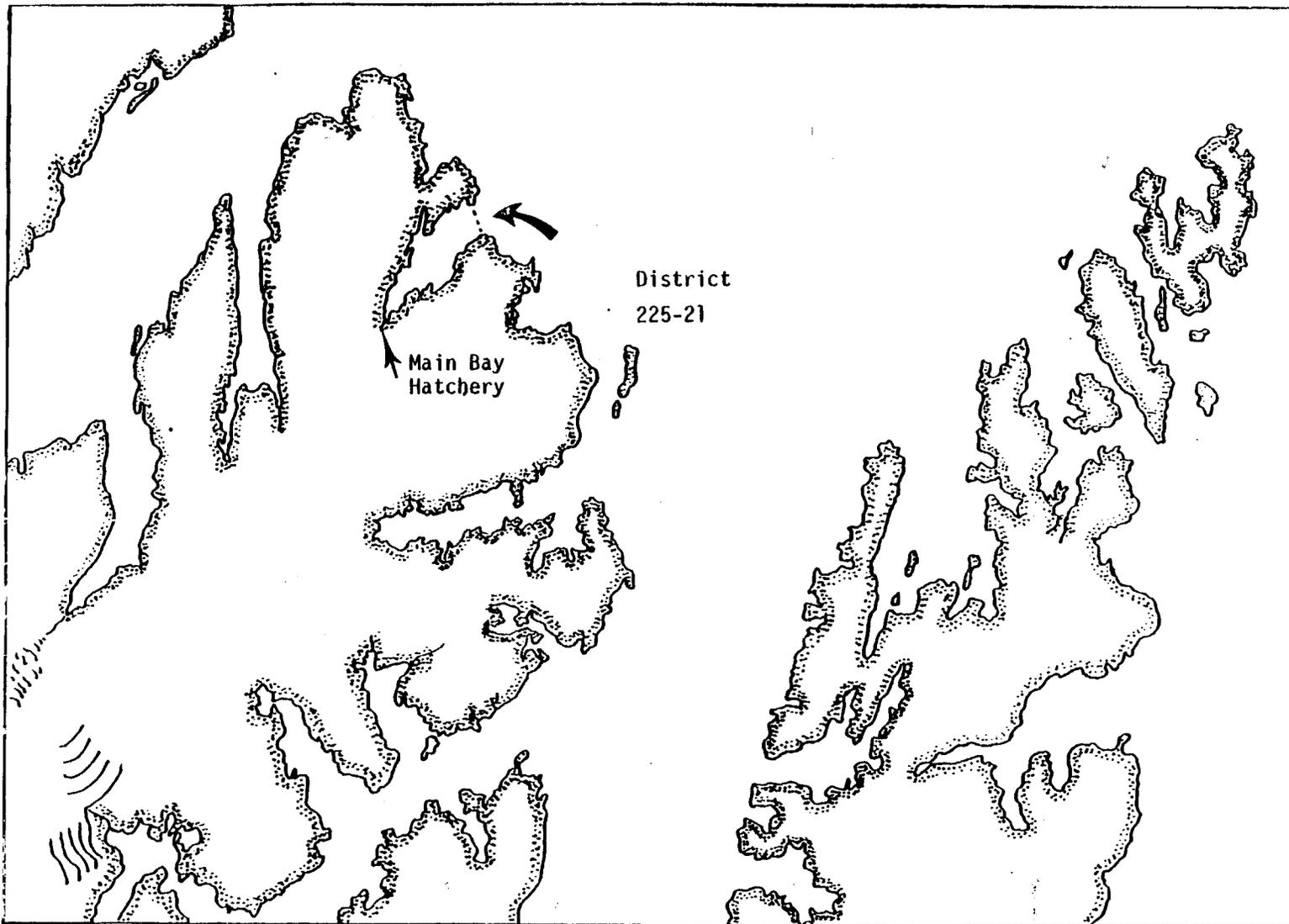


Figure 3. Prince William Sound Hatchery subdistrict 225-21 and location of Main Bay Hatchery.

an adipose left ventral fin clip. In 1979 a total of 469,000 chum salmon were released at Cannery Creek, of which 10,250 were marked with an adipose left ventral clip.

An estimated 30,961,000 pink salmon fry were transported from Cannery Creek Hatchery between 22 April and 20 May 1982. Survival to release was estimated at 29,222,000.

Adult Returns

Sampling of commercial catches for marked adults was conducted from 25 July to 12 August 1983. Sampling for marked fish was restricted to subdistricts 222-20, 30, and 50 of the Northern District (Figure 2). These subdistricts are considered primary interception areas for salmon returning to Cannery Creek.

During the sampling period, 39,658 pink salmon and 5,073 chum salmon were examined for marks. Fifty-four adipose left ventral-marked pink salmon and four adipose left ventral-marked chum salmon were recovered.

The combined catch for subdistricts 222-20, 30, and 50 totaled 586,000 pink salmon and 94,500 chum salmon. The estimated proportion of the catch produced by hatchery fish (\hat{p}) was calculated from mark recoveries to be 0.379 (95% confidence interval: [.273, .480]) for pink salmon and 0.036 [0.00, .071] for chum salmon. Without correcting for any differences in survival between marked and unmarked fish or for mark loss, an estimated 223,300 [163,800; 282,800] pink salmon and 3,400 [100; 6,700] chum salmon of hatchery origin were caught in these subdistricts.

The observed return to Cannery Creek and Cannery Creek Hatchery was estimated at 183,100 pink salmon and 11,900 chum salmon. Approximately 58,400 pinks and 2,200 chums were utilized for hatchery broodstock and stream escapement. An additional 124,800 pink salmon and 9,700 chum salmon were harvested by seiners in the special harvest area.

From the Cannery Creek escapement, 18,929 pinks and 726 chums were examined for fin marks. Fifty-three adipose left ventral-clipped pink salmon and six adipose left ventral-clipped chum salmon were recovered. The estimated proportion of hatchery-produced fish in the escapement to Cannery Creek (\hat{t}) was calculated from mark recoveries at 0.780 [.570, .990] for pink salmon and 0.378 [.077, .679] for chum salmon. This represents 45,500 [33,300; 57,700] pink salmon and 820 [170; 1,470] chum salmon.

A total of 363,250 pink salmon were caught in the Main Bay special harvest area. Of this total 168,350 were caught by drift gill net and 194,900 were caught by set gill net.

The estimated pink salmon escapement into Main River was 40,000. Main Bay Hatchery utilized 87,600 for broodstock, and an additional 6,000 were excess to hatchery needs.

The total adult pink salmon return was estimated at 497,000, which translates to a 1.7% marine survival of transplanted fry to returning adults.

DISCUSSION

The returns of both Main Bay and Cannery Creek salmon are underestimated in this report because of the relatively small portion of the Prince William Sound fishery that was sampled.

Salmon tagging studies conducted between 1980 and 1983 showed the presence of hatchery-produced salmon in numerous areas of fishing activity other than those sampled (McCurdy 1983).

The estimated pink salmon adult return to Main Bay of 1.7% was considered excellent for a transplant. The 1982 transplant of pink salmon fry to Main Bay, resulted in an estimated 1.2% return. Pink salmon fry transplanted to Hobo Creek in western Prince William Sound in 1980 and 1981 resulted in estimated adult returns of 0.4% and 0.06%, respectively, to the transplant site (McDaniel 1983). Transplants of pink salmon fry to Seal Bay Creek on Afognak Island in 1976 and 1977 resulted adult returns of 0.84% and 0.06%, respectively, to the transplant site (McDaniel 1981).

If one can assume that all of the fish in the escapement are derived from hatchery releases then it is possible to compare the ratio of marked to unmarked fish in the escapement with the same ratio in the release. A significantly smaller proportion of marked fish in the escapement might be due to a higher mortality rate of marked fish, compared with unmarked fish, as well as to fin regeneration. The assumption that all of the escapement is derived from hatchery fish seems to be valid for Cannery Creek pinks and chums.¹ However, there is no clear evidence of a smaller ratio of marked to unmarked fish in the 1983 escapement than in the releases.

1/ Fry pre-emergent sampling conducted on 7 April 1982 estimated total live pink fry in Cannery Creek at 6,100, and the last chum salmon escapement observed was 210 in 1964 (Pirtle 1977).

For pink salmon, 0.36% of the 1982 release was marked, while a 95% confidence interval for the percent marked in the 1983 escapement sample is [0.21, 0.37] (Table 1), since this interval includes the percent of the release marked, it is not possible to definitely conclude that there was a differential mark mortality or fin regeneration. However, since the percent of marks in the escapement sample was only about 80% of the percent released, it is possible that there was a loss of marked fish, and such a loss would be demonstrated in the same pattern was observed for several years.

For chum salmon, 2.19% of the 1979 release was marked, while a 95% confidence interval for the percent of marked fish in the escapement sample is [0.34, 1.88] (Table 1). Although the confidence interval does not include the percent released, there is no definite indication of differential mortality of marked fish since only 4-year-old fish were evaluated.

Table 1. Summary of possible changes in the proportion of marked fish between the time of release and the time of recovery.

Species	RELEASE			ESCAPEMENT RECOVERY		
	Total	No. Marked	% Marked	Total	No. Marked	% Marked
Chum (1980 Release)	469,000	10,250	2.19	726	6	0.83 [0.34, 1.88] ^{1/}
Pink (1982 Release)	13,933,000	50,000	0.36	18,929	53	0.28 [0.21, 0.37] ^{1/}

^{1/} 95% confidence intervals for proportions computed according to equations (1.26) and (1.27) of Fleiss (1981).

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