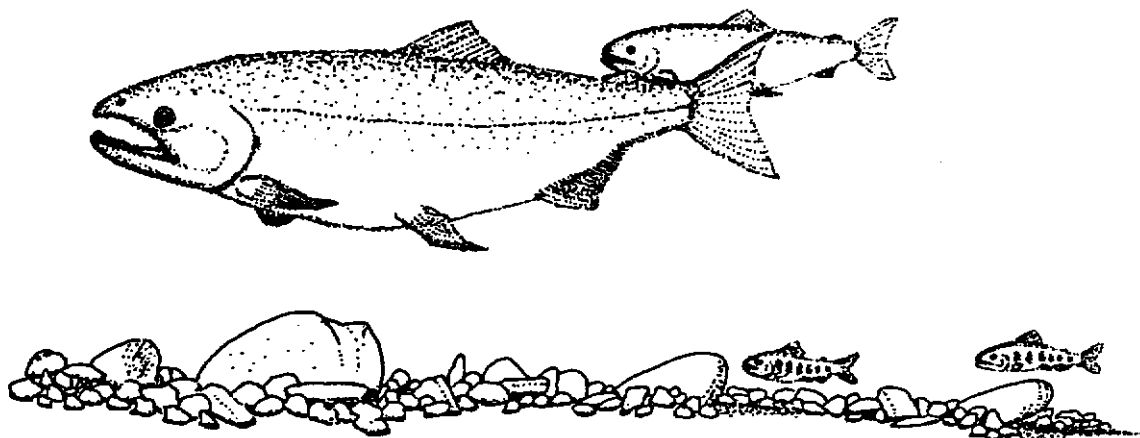


U.S. FISH AND WILDLIFE SERVICE



**EFFECTS OF FREEZE BRANDING ON GROWTH AND SURVIVAL
OF COHO SALMON FRY**



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**Effects of Freeze Branding on Growth and Survival
of Coho Salmon Fry**

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Abstract

We examined the effect of freeze branding on the survival and growth of coho salmon fry. At the time of marking, fry averaged 42.9 mm in length and weighed 0.87 g. Although initial handling mortalities were relatively high (8.3%), branding did not significantly affect subsequent survival or growth of coho salmon fry. However, the brands became indistinguishable after six weeks (mean fork length of 59.7 mm, mean weight 2.99 g). Thus, freeze branding apparently can be used to track coho salmon fry for a limited time without causing significant mortalities.

Introduction

Carbon dioxide freeze branding is an effective marking tool for juvenile salmonids (Bryant and Walkotten 1980). The effects and longevity of these marks has been examined (Mighell 1969, Smith 1973). Freeze branding yearling coho salmon (*Oncorhynchus kisutch*) with liquid nitrogen did not result in increased mortality after two months, at which time the brands were still legible (Mighell 1969). Branding chinook (*O. tshawytscha*), coho, and sockeye (*O. nerka*) fry with both hot and cold metal branding tools did not result in increased mortality of fry (Smith 1973). However, the brand had limited use of 4 months for skilled observers and 1 to 2 months for inexperienced observers (Smith 1973). Freeze branding has been used as a marking tool to monitor juvenile salmonid migration (Cederholm and Scarlett 1982, Peters et al. 1992). However, few studies have examined the impacts of freeze branding on survival of salmon fry, while branding impacts on growth have not been assessed. We examined the effects of branding on growth and survival, and the longevity of carbon dioxide freeze brands on coho salmon.

Materials and Methods

Growth, survival and mark longevity were examined using five replicate net pens each containing 20 branded coho salmon and 20 unmarked control fish. Net pens were located in a rearing pond at the Quinault Indian Nations Salmon River rearing facility located on the Washington Coast. Each net pen was approximately 0.7 meters wide by 1.4 meters long by 0.7 meters deep.

Coho salmon fry from the Clearwater River wild broodstock program (Quinault Fisheries Division 1992) were used for this experiment. Groups of twenty randomly selected individuals were anesthetized using tricaine methanesulfonate (MS-222), measured for fork length (+/- 1.0 mm), weighed (+/- 0.1 g), branded using carbon dioxide freeze branding techniques (Bryant and Walkotten 1980) and placed into each of five net pens. Twenty additional coho salmon fry were weighed, measured and placed into the net pens as controls with the marked coho. Branded and control fish also were marked by clipping a portion of the caudal fin to ensure branded groups could be distinguished from controls if the brands faded.

Every two weeks fish were removed from the net pens, weighed and measured and checked for brands. Fins were also re-clipped if needed. This process continued until brands began to fade, at which time brands were checked weekly. Fish were fed to satiation twice daily and net pens were cleaned as needed throughout the experiment.

A paired t-test ($\alpha = 0.05$) was used to determine whether branding affected coho salmon survival. We used ANOVA to detect whether there were differences within the control or branding groups and then to determine if growth was affected by branding.

Results

Direct mortalities during branding were relatively high (8.3% compared to 4.8% for controls). These mortalities resulted from fry sticking to the brand, probably due to handling difficulties attributed to the small size of the fish. However, survival following branding was not significantly affected during any sampling period ($0.5 < p < 0.2$ for all sampling periods) (Table 1).

Table 1. Mean (SD) survival of control and branded groups during each sampling period.

<u>Date</u>	<u>Branded</u>	<u>Control</u>
3 June 1992	18.2 (1.095)	17.6 (2.073)
24 June 1992	18.0 (1.414)	16.8 (1.789)
29 June 1992	18.0 (1.414)	16.8 (1.789)

Analysis of variance showed no significant difference in coho salmon length or weight between net pens during each sampling period. Thus, observations from the five net pens were combined and analyzed using t-test for each sampling period. No significant differences in lengths and weights were observed between branded and control groups during any of the sampling dates (Table 2). No weight data was recorded during the 24 June survey because the scale malfunctioned.

Table 2. Mean (SD) lengths and weights of coho salmon in branded and control groups during each sampling period.

Date	Length (mm)		Weight (g)	
	Brand	Control	Brand	Control
5/15/92	42.9(4.38)	42.4(4.81)	0.87(0.33)	0.93(0.41)
6/3/92	48.3(5.79)	47.25(5.87)	1.42(0.57)	1.31(0.55)
6/24/93	57.0(6.45)	55.21(6.45)
6/29/93	59.7(6.41)	58.3(7.16)	2.99(1.03)	2.84(1.07)

Brand retention was good for the first six weeks of the study. By comparing brand recoveries to fin clips it was determined that only one brand was misidentified during the 3 June sampling (1.1% error). No errors were made during the 24 June survey, with two brands missed during the 29 June survey (2.2% error). During the 8 July survey, 7 of 90 brands were missed (7.7% error). However, it would have been difficult to distinguish one brand from another. The brands were of little practical use after the 29 June survey (six weeks from marking).

Discussion

Freeze branding coho salmon fry did not result in increased post-marking mortality. These results support those of other authors (Smith 1973; Everett and Edmudson 1967). We therefore believe freeze branding can be used to monitor migration of salmon fry without causing increased mortalities.

Branded coho salmon fry did not experience reduced growth when compared to control groups. Murray and Beacham (1990) found that pink (*O. gorbuscha*) and chum

salmon (*O. keta*) branded with hot brands experienced growth rates similar to those reported in the literature. The authors concluded that branding did not affect growth if the fish weighed more than 2.0 g at the time of branding. Our data suggest that freeze branding coho salmon did not affect their growth if the average weight was less than 1.0 g when marked.

The usefulness of freeze brands on coho salmon fry apparently lasts for approximately 6 weeks. This is a much shorter time than was suggested by Smith (1973), who stated that skilled observers could distinguish brands for up to 4 months, while unskilled observers could distinguish brands for only 1 to 2 months. Our brand (the letter "u") was still visible at the end of the six weeks. However, it was our conclusion that it would not be distinguishable from similar letter brands (for example, "o", "v" etc.) if they were also present in the population. Brand distortion has also been observed in other studies (Groves and Novotny 1965; Fujihara and Nakatani 1967; Myers and Iwamoto 1986).

Our data indicates that freeze brand marking can be a useful short term tool for monitoring coho salmon fry migration. Branding of fry can be carried out with relatively few mortalities. This marking technique does not appear to impact the growth or survival of the fry and is identifiable for approximately 6 weeks. Binary codes such as those used by Murray and Beacham (1990) may extend the useful period of freeze brands.

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