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Comparative Retention of Dart and Jaw Tags on Chinook Salmon and Steelhead Trout During Their Spawning Migration

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ABSTRACT—Adult chinook salmon (Oncorhynchus tshawytscha) *and adult steelhead trout* (Salmo gairdneri) *were tagged alternately with either a dart tag or a jaw tag at Little Goose Dam on the Snake River in Washington State. Tagged fish were recovered from anglers, hatcheries, weirs, and spawning surveys 100-500 kilometers upstream from Little Goose Dam. Among chinook salmon sampled, 10.0 percent of the dart-tagged group and 19.7 percent of the jaw-tagged group were recovered. Recovery rate of steelhead trout tagged with dart tags was 19.6 percent and the recovery rate of the jaw tagged group was 26.4 percent. Chi-square tests supported the conclusion that jaw tags were better retained than dart tags on both chinook salmon and steelhead trout.*

INTRODUCTION

Since 1968, the National Marine Fisheries Service has been conducting transportation experiments (Ebel, Park, and Johnsen, 1973; Slatick, Park, and Ebel, 1975) designed to determine whether collecting juvenile salmon and trout at an upstream dam and transporting them downstream around a series of dams (thus bypassing a number of dams and the associated fish losses) might be a feasible method of increasing their survival during their seaward migration. Evaluation of these tests required returning adult chinook salmon *Oncorhynchus tshawytscha*) and steelhead trout (*Salmo gairdneri*) carrying an internal magnetic coded wire tag (Ebel, 1974) to be separated from other naturally migrating adults at a special detection-separator facility at Little Goose Dam on the Snake River.

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When adult salmon and steelhead trout have ascended the fishway at Little Goose Dam, they have completed approximately half of their spawning migration. They then continue upstream from 100-500 km, depending upon their home stream of origin. To identify our test fish in the sport fishery, at hatcheries, and on the spawning ground, a visible external dart or jaw tag was placed on the adults at the separator facility at Little Goose Dam.

Retention of these external tags on adult salmon and steelhead trout was questionable because of the numerous obstacles these fish faced enroute to the spawning grounds. Adult chinook salmon and steelhead trout often spend up to 8 months in the river above Little Goose Dam before entering a hatchery or spawning stream. The rigors of migrating through turbulent water areas for example, could cause some tag loss. Another cause of tag loss (possibly the major cause) is the general deterioration of tissues as the fish approach maturation, especially among spring and summer chinook salmon.

Differences in retention of jaw and dart tags have been observed. Nelson (1960) indicated that loss of dart tags was greater than that of jaw tags on rainbow trout (*Salmo gairdneri*). Studies by Youngs (1958) indicated that jaw tags remained on rainbow trout for up to 8 months, and Warner (1971) found that jaw tags were retained on Atlantic salmon (*Salmo salar*) for up to 2 years.

A comparison of retention of dart tags and jaw tags placed on chinook salmon and steelhead trout in the Snake River system is covered in this report.

METHODS

Salmon and trout tagged in this study were trapped in the fish ladder (Ebel, 1974) at Little Goose Dam on the Snake River. From April 1973 to May 1974, 290 chinook salmon migrating in

the spring and summer were tagged—199 with dart tags, 91 with jaw tags. During the fall and winter migration, 1,405 steelhead were tagged—849 with dart tags, 556 with jaw tags.

A FT-2 Floy [1] dart tag was used. It consisted of a single nylon barb inserted into a 7.6 cm (3 inch) length of vinyl tubing. The tag was placed in a hollow steel needle, which was inserted below the dorsal fin. As the needle penetrated the interneural bones, it was given a slight turn to hook the barb of the tag under a bone (Fig. 1).

The jaw tags were round monel and/or tempered aluminum bands (National Band Company, sizes 12 through 28). They were clamped around the lower jaw of the fish (Fig. 2).

Fish were intermittently tagged with dart and jaw tags throughout the migratory season so that bias due to size and homing location would be reduced to a minimum. After being tagged at Little Goose Dam, they were released into the fish ladder to continue their upstream migration. Comparative retention of the two types of tags was made when tags were returned from fish taken (1) by anglers, (2) at upstream hatcheries, (3) at state operated traps, or (4) during spawning ground surveys.

RESULTS AND DISCUSSION

Chinook salmon tag returns are listed in Table 1. These data show that the return proportions of dart and jaw tags were the same ($X^2 = 0.055$: df = 1) between Rapid River Hatchery and other sources (sport fishery and spawning ground surveys). The return data were combined and a chi-square test showed that jaw tags had a significantly greater ($X^2 = 4.373$: df = 1) expected recovery than dart tags. The combined returns (38 fish—10.0 percent from the dart tagged group and 19.7 percent from the jaw tagged group) indicated that the jaw tag was twice as effective as the dart tag in producing the desired long-term mark.

There was little difference between retention of dart and jaw tags of chinook salmon recovered in the sport fishery, but substantial differences were noted from tag data obtained on spawning grounds and at hatcheries. Although data are limited, they suggest that the extensive physical deterioration of the fish in combination with the vigorous spawning activity caused the loss of the dart tags.

Most steelhead tag returns (198) came from anglers. There were, however, 115 tag returns from the Pahsimeroi and Dworshak Hatcheries in Idaho. Steelhead returning to the Pahsimeroi Hatchery retained a significantly greater proportion of jaw tags ($X^2 = 18.82$: df = 1) than dart tags. Comparison of the proportions of tags recovered in the sport fishery and at Dworshak Hatchery indicated little difference in the retention of dart and jaw tags, although the recovery rate of jaw tags was higher than dart tags in

Table 1.—Comparative retention of dart and jaw tags on adult migrating chinook salmon recovered above Little Goose Dam, 1973.

Tag type	Total fish tagged	No. and percentage of tagged fish recovered by area: Rapid River Hatchery No.	%	Other No.	% [1]	Total recovered No.	%
Dart	199	13	6.5	7	3.5	20	10.0
Jaw	91	12	13.1	6	6.5	18	19.7
Total	290	25		13		38	

[1] Includes returns from the sport fishery and spawning ground surveys.

Figure 1.—Position of a dart tag inserted in a steelhead trout.

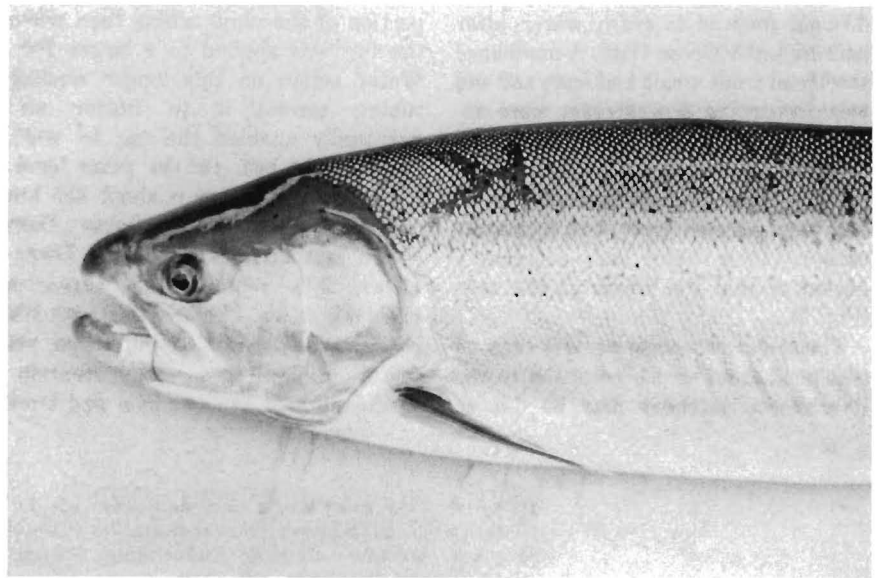

Figure 2.—Position of a jaw tag placed on a steelhead trout.

[1] Reference to trade names does not imply endorsement by the National Marine Fisheries Service, NOAA.

Table 2.—Comparative retention of dart and jaw tags on adult migrating steelhead trout recovered by the sport fishery and at two hatcheries, 1973.

Tag type	Total fish tagged	No. and percentage of tagged fish recovered by area: Sport fishery No.	%	Dworshak Hatchery No.	%	Pahsimeroi Hatchery No.	%	Total recovered No.	%
Dart	849	113	13.3	50	5.9	3	0.4	166	19.6
Jaw	556	85	15.1	43	7.7	19	3.4	147	26.4
Total	1,405	198		93		22		313	

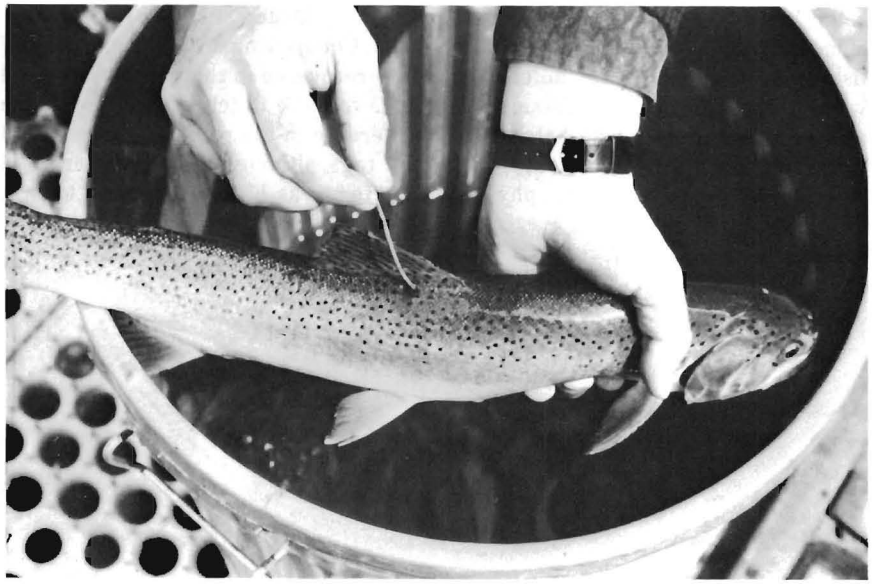

Figure 3.—Completely healed puncture wound on a steelhead trout dart-tagged 8 months previously. Skin has completely grown around the stem of the dart tag.

all areas (Table 2). The difference in overall recovery rate of dart tags (19.6 percent) was significantly ($X^2 = 35.21$: df = 1) less than the rate 26.4 percent observed for jaw tags.

Steelhead trout may spend 8 additional months in fresh water after passing Little Goose Dam. A number of steelhead trout which had spawned and were returning downstream were recaptured in a juvenile salmon-trout collection system at Little Goose Dam. Some of these fish had dart tags which had been applied from 4 to 8 months earlier; their skin had completely healed around the stems of the tags (Fig. 3).

The lower retention of dart tags on steelhead trout which returned to the Pahsimeroi Hatchery may be due to amount of tag exposed on the smaller fish. Steelhead trout returning to Pahsimeroi Hatchery had a mean length of 61 cm compared to 83 cm at Dworshak. A tag applied to small fish had a considerably longer exposed portion of the vinyl tubing than when the tag was applied to a larger fish. Water action on this longer trailing tubing caused it to flutter and eventually enabled the tag to work loose and be lost. On the other hand, Pahsimeroi Hatchery is about 435 km upstream from Little Goose Dam (much farther upstream than Dworshak), thus requiring an extensive river migration. I believe that both size of fish and length of migration are factors influencing dart tag retention.

Mortality of adult salmon and trout due to tagging was not measured during the study. If mortality due to tagging did occur, it is logical to assume that dart tags caused more mortality than jaw tags since dart tagging causes a piercing wound in the dorsal muscle tissue. Jaw tags did not show evidence of wounds and were not a factor in interfering with feeding since feeding by adults on the spawning migration is nil.

Whether the use of jaw tags on adult salmonids causes less mortality or whether they are better "retained" remains speculative. Data herein presented clearly indicate that proportionally more jaw tags than dart tags were recovered on chinook salmon and steelhead trout in the Snake River system.

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