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Joseph C. Greenley, Director

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EVALUATION OF TRANSPLANTING SNAKE RIVER
STEELHEAD TROUT TO THE PAHSIMEROI RIVER, 1976

Period Covered: 1 July 1975 to 30 June 1976

by

Melvin Reingold
Principal Fisheries Research Biologist

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EVALUATION OF TRANSPLANTING SNAKE RIVER STEELHEAD TROUT TO THE PAHSIMEROI RIVER, 1976

ABSTRACT

In the spring of 1976, 585 adult steelhead trout were counted into the Pahsimeroi River Steelhead Collection Facility. Most of these (395) were the first returns of 1-ocean Clearwater River stock released as smolts in 1974. There were also 136 adults from a group of smolts pond reared for an additional year, and 54 2-ocean 1973 released Pahsimeroi origin adults. The high loss of 1973 released smolts at Snake River and Columbia River dams resulted in the poorest brood-year return in the history of the station (.022%).

Feed experiments conducted at Niagara Springs Hatchery showed superior growth for steelhead reared on Oregon Moist Pellets. The experiments also showed that starting fry on OMP and then converting to dry feed resulted in reduced early stage mortalities, smaller size variation and a better growth pattern than straight dry feed.

Steelhead smolts on an OMP final diet emigrated from the Pahsimeroi River 2 weeks earlier than smolts on a dry feed final diet. Experiments to further explore this phenomenon were initiated for the 1977 smolt releases.

Author:

Melvin Reingold
Principal Fishery Research Biologist

INTRODUCTION

The Niagara Springs Steelhead Hatchery and Pahsimeroi Steelhead Collection Facility operations are part of Idaho Power Company's obligation to relocate steelhead and salmon stocks from the Snake River to the Salmon River because of inundation and blockage of their ancestral migration routes and spawning beds by Hells Canyon Dam.

This project was initiated in 1966, with the release of the first steelhead smolts from fish trapped at the base of Hells Canyon Dam. Present project plans are to obtain steelhead eggs from adults returning to the Pahsimeroi station from prior smolt releases, incubate the eggs to the advanced eyed stage and ship them to Niagara Springs Hatchery near Wendell, Idaho, for hatching.

The steelhead fry are placed in raceways at Niagara Springs Hatchery and reared until the following spring when they are trucked back to the Pahsimeroi River and released as seaward-bound smolts.

A summary of releases, returns, sport angling harvests, egg takes, etc., is presented in Table 1.

OPERATIONS AND RESEARCH - 1976

Delivery of Fish

Approximately 1,610,000 steelhead juveniles were hauled and released in the Pahsimeroi River from Niagara Springs Hatchery in 49 truckloads between 1 March and 30 April 1976. All fish were released directly into the river near the adult steelhead weir site except for four marked groups of 25,000 fish each released into the river near the upper ponds.

All fish delivered were 1975 brood-year Pahsimeroi River stock from eggs taken from the adult steelhead that returned to the weir in the spring of 1975.

Hatchery Feeding - Smolt Behavior Experiments

Experiments conducted at the Hayden Creek Research Station near Salmon, Idaho has shown Oregon Moist Pellet (OMP) feed to be a superior diet over dry feed for "starting" steelhead fry (Anderson 1975, 1976). After the fish reached approximately 500-550 per pound in size, the growth differential diminished and the lesser cost and increased convenience of dry feed offset the small growth advantage of the moist diet.

We initiated experiments at Niagara Springs Steelhead Hatchery in 1975 to investigate the effects of a similar feeding regime on those stocks, and to follow the experimental groups through their smolt migration behavior and adult returns.

Fry hatched from the same egg take were separated into two groups of approximately 69,000 fish each. These two groups, held under identical

Table 1. Summary of releases, returns, and egg take of the Niagara Springs-Pahsimeroi River steelhead relocation program since its beginning in 1965 through 1976.

Brood Year / Year Released	Number Of Steelhead Released	Number Marked	Mark Used	No. of Adults Returned As: 1-Year Ocean	No. of Adults Returned As: 2-Year Ocean	Total Brood Year to Weir	Est. Sport Catch	Est. Total Return to Salmon River	Total Adults to Weir	Marked Adult Returns	No. Eggs Taken at Pahsim. Station
1965 / 1966	65,000	24,000	RVAd	---	0	---	brood year	brood year	fish year	brood year	---
1966 / 1967	1,292,000	97,000	RVAd (pond)	(89%) 798 (1969)	(11%) 107 (1970)	905	590	1,445	798 (1969)	39 RVAd	1,620,000 (1969)
1967 / 1968	1,484000	25,000 25,000	RV (riv.) RVAd (pd.)	(86%) 401 (1970)	(14%) 66 (1971)	467	390 (45%)	857	508 (1970)	15 RV 15 RVAd	1,662,000 (1970)
1968 / 1969	1,645,000	25,000 25,000	RV (river) RVAd (pond)	(80%) 647 (1971)	(20%) 162 (1972)	809	727 (47%)	1,536	713 (1971)	52 RV 24 RVAd	1,758,000 (1971)
1969 / 1970	1,622,000	25,000 25,000	RV (low,riv.) RVAd (up.riv.)	(91%) 4,742 (1972)	(9%) 474 (1973)	5,216	4,373 (46%)	9,589	4,904 (1972)	198 RV 118 RVAd	11,081,000 (1972)
1970 / 1971	1,442,000	50,000 50,000	RV (low.riv.) RVAd (up.riv.)	(79%) 984 (1973)	(21%) 269 (1974)	1,253	1,380 (52%)	2,633	1,158 (1973)	76 RV 90 RVAd	4,528,000
1970 / 1972	175,000	47,500	LVAd (2-year pond rear)	(82%) 36 (1974)	(18%) 8 (1975)	44	30 (40%)	74	---	12 LVAd	---
1971 / 1972	1,555,000	0	---	1,490 (1974)	455 (1975)	1,945	1,253 (39%)	3,198	1,795 (1974)	---	5,128,000

Table 1. Summary of releases, returns, and egg take of the Niagara Springs-Pahsimeroi River steelhead relocation program since its beginning in 1965 through 1976 (Cont'd.).

Brood Year / Year Released	Number of Steelhead Released	Number Marked	Marks Used	No. of Adults Returned As: 1-Year Ocean	2-Year Ocean	Total Brood Year to Weir	Est. Sport Catch	Est. Total Return to Salmon River	Total Adults to Weir	Marked Adult Returns	No. Eggs Taken at Pahsim. Station
1972 / 1973	1,292,000	20,000 20,000 20,000	LVAd(Mar) RVAd(Apr) RV (May)	(81%) 228 (1975)	(19%) 54 (1976)	282	13	295	691 (1975)	2 LVAd 5 RVAd 3 RV	2,235,000
1972 / 1974	242,000	25,000	LV (2 year pond)	136 (1976)	(1977)		season closed		585 (1976)	14 LV	1,786,000 (1976)
1973 / 1974	1,607,000	20,000 20,000 20,000	LVAd(Mar) RVAd(Apr) RV (May)	395 (1976)	(1977) (3-Yr) (1978)					3 LVAd 1 RVAd 7 RV	
1974 / 1975	1,331,000	20,000 20,000 20,000	LVAd(Mar) RVAd(Apr) RV (May)	(1977)	(1978)						
1975 / 1976	1,610,000	25,000 25,000 25,000 25,000	LVAd(OMP) RVAd(dry) RV(OM/dr) LV(large)	(1978)	(1979)						

conditions in outdoor raceways, were started on feed on 19 May 1975. One group was fed a dry diet (Rangen) and the other Oregon Moist Pellets.

The initial mortality from ponding to the end of May was similar for both groups (Table 2). During the months of June and July however, the mortality of the group fed OMP was significantly less than the group on dry feed. After 1 August, mortalities stabilized at a low level for both groups. During May through July, the group fed OMP had approximately 20% fewer mortalities. This period is probably the critical time of life for these juvenile steelhead; when they are buttoning up, learning to feed, and adapting to the hatchery system. During this period a behavioral difference was also noted between the two experimental groups. The steelhead on the OMP diet were normally found in the upper portion or head of the hatchery raceway whereas the fish on the dry diet feed were normally found at the lower end. The OMP fish also showed less size variation and fewer "pinheads" (stunted non-growing fish) than the group on dry feed.

On 18 October, one-half the fish on the OMP diet were moved to another raceway and changed over to the dry diet. Mortality on all three groups remained low through November until an outbreak of Redmouth Disease caused increased losses. Losses from this cause were highest in the switched group and lowest in the dry diet group (Table 2).

The group fed OMP showed an initial increased growth rate and maintained a lead through September (Table 3). After that time, the size and growth rate of the steelhead on dry diet feed converged on the OMP and OMP-dry switched groups. All three groups were approximately the same size when the experiment was terminated and the fish delivered to the Pahsimeroi in March 1976.

The most significant size difference between the dry feed and OMP fed groups occurred at the end of June when the dry-feed fed fish were approximately 525 per pound (Table 3). This is similar to the 500-550 per pound break-off point found at Hayden Creek. After that time, the size difference between the groups diminished.

The results of this experiment, coupled with findings at the Hayden Creek Research Station, indicate that better survival and an improved growth pattern can be attained if swim-up steelhead fry are "started" on an Oregon Moist Pellet diet until they are approximately 500-550 per pound before converting to the standard dry feed diet.

Prior to release in March 1976, we sampled each population of experimental smolts to determine final length and size range. Migration studies on the Pahsimeroi River and downstream trapping facilities continue to show that 170 mm (6.7 in) total length appears to be the minimum size smolt necessary to ensure good downstream emigration.

Although average size of the three feed experiment groups were within 17 mm (0.7 in) of each other, the percent of smolts less than 170 mm (6.7 in) was significantly less for the OMP fed group than either the dry feed or OMP-dry switched groups (Fig. 1). Only 8% of the fish fed OMP were less than 170 mm (6.7 in) total length compared to 17% for the switched group and 20% for the dry feed group. In a 1.6 million fish release, (the annual Niagara

Table 2. Mortalities of 1975 brood-year steelhead during feed experiments at Niagara Springs Steelhead Hatchery.

Month	Dry feed (control)	OMP	OMP-dry
May 1975	9,552	9,120	-
June	1,443	389	-
July	1,113	195	-
August	41	30	-
September	64	57	-
Sub-Total	12,213	9,791	
October	10	4	4
November	50	58	52
December	192	153	308
January 1976	69	47	133
February	136	325	765
March	158	444	1,427
Sub-Total	615	1,031	2,689
Total	12,828	10,822	-

Table 3. Size of 1975 brood-year steelhead during feed experiments at Niagara Springs Hatchery, expressed as number of fish per pound.

Month	Dry feed (control)	OMP	OMP-dry
May 1975	2,104	1,944	-
June	525	386	-
July	139	143	-
August	68	57	-
September	41	33	-
October	24	23	23
November	16	13	12
December	12	9	9
January 1976	10	7	7
February	6	5	5
March	5	4	5

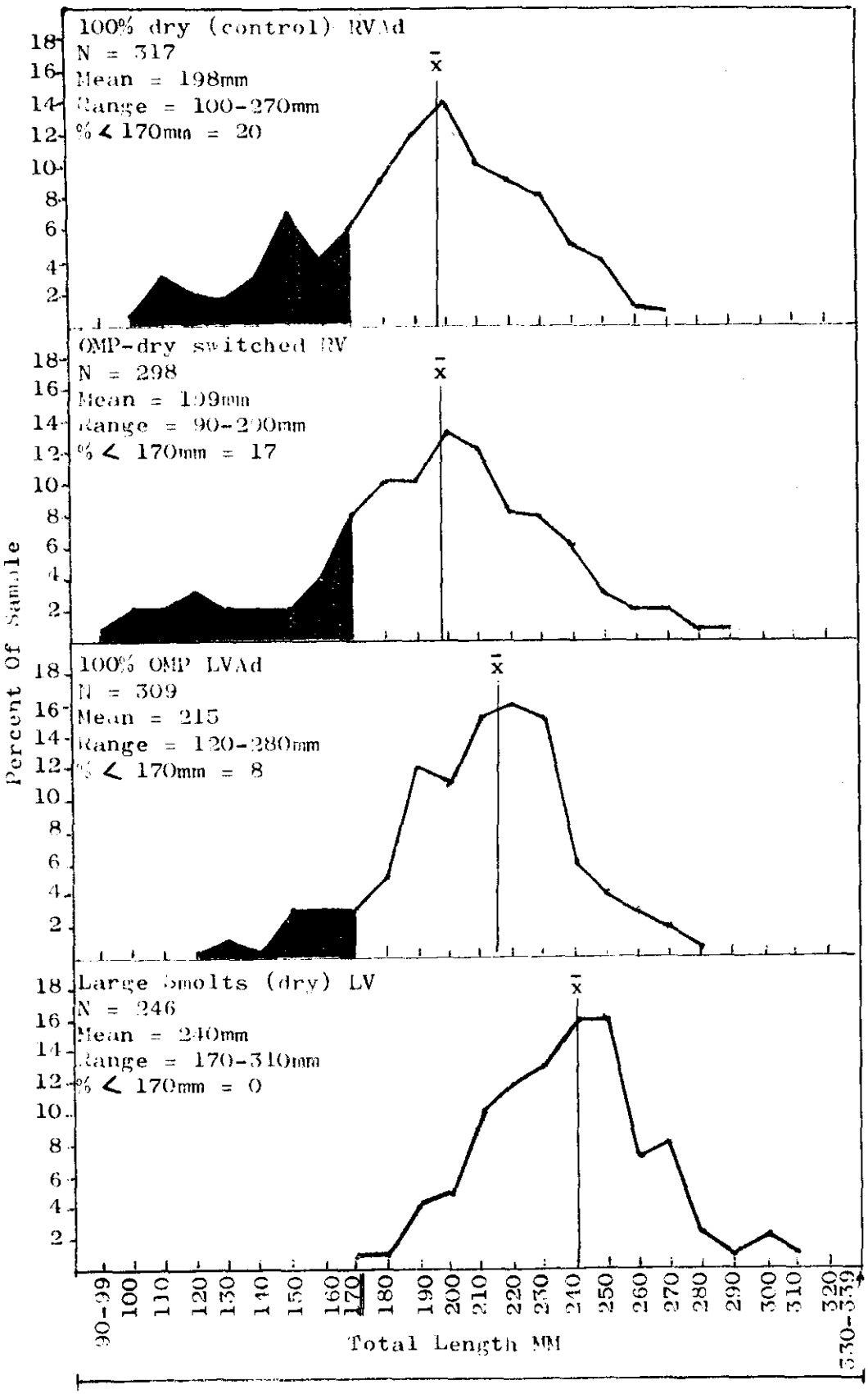

Figure 1. Length frequencies, range and mean lengths of four groups of experimental juvenile steelhead reared at Niagara Springs Steelhead Hatchery in 1975-76. Shaded portion shows percent of population less than 170 mm total length.

Springs quota), this could mean 192,000 more 170 mm (6.7 in) or greater smolts if the entire hatchery product were raised on a 100% OMP diet. There were 3% fewer fish under 170 mm (6.7 in) in the OMP-switched group compared to the dry feed group. This could mean some 48,000 more 170 mm (6.7 in) or greater smolts in the 1.6 million fish delivery. Future adult returns should indicate whether the advantages seen during these rearing experiments result in like returns to the Pahsimeroi station and sport fishery.

Along with the three experimental feed groups released in March 1976, was a group of steelhead selected specifically for their large size. These fish were from the earliest egg takes and intensely graded to produce the largest smolt possible. They were fed the standard dry formula. These fish were reared as part of the research effort to determine if releasing extra large smolts results in downstream migration or survival benefits and increased adult returns. Less than 1% were less than 170 mm (6.7 in) in length and they averaged 240 mm (9.4 in) total length at time of release (Fig. 1).

Twenty-five thousand marked smolts from each experimental group were released in the Pahsimeroi at Dowton Lane the first week in April, 1976. We monitored their downstream emigration at the Burstedt Lane trapping system, 17.6 river km downstream (11 river mi) and personnel from the Idaho Cooperative Fishery Unit and the U.S. National Marine Fisheries Service collected downstream emigrants at Lower Granite Dam on the Snake River near Lewiston, Idaho (Fig. 2).

More large size smolts were collected than any other group (105) and the fewest fish collected were from the group reared on the 100% OMP diet (57) (Fig. 3). Of the three feed experiment groups, the OMP-dry feed switched group showed the greatest emigration (86) compared to the other two.

More significant than the numbers collected was the timing of the emigration of all four groups. The group of steelhead smolts reared on 100% OMP feed reached their peak of emigration 2 weeks earlier than the other three groups. The primary difference between this group and the three other was final diet. The OMP-dry switched group consisted of these same fish taken off of OMP 5 months earlier. Both the control and large-size groups received dry feed throughout the entire rearing phase. Only the 100% OMP fed group was receiving moist feed formula just prior to release. The peak of emigration for the OMP group was 30 April. The peak of emigration for the three other groups was 15 May (Fig. 3). This 2-week earlier migration behavior could have significant survival benefits. One of the detrimental effects of the Snake and Columbia River dams is the emigration delay they cause in downstream migrating salmon and steelhead. The addition of Lower Granite Dam will add to this delay. A 2-week earlier migration behavior could help offset this factor. Other possible benefits such as reduced delay in the Pahsimeroi, migrating in more favorable downriver water temperatures, etc. could also arise from an earlier emigration. Additional experiments to further explore this phenomenon have been initiated for the 1977 releases.

Length frequencies were taken on the four groups of steelhead at Niagara Springs Hatchery just prior to release in the Pahsimeroi. Length frequencies were also recorded on the marked smolts collected in the Burstedt Lane trap and at the collection facilities at Lower Granite Dam. In the three feed experiment groups, the percent of smolts less than 170 mm (6.7 in) total

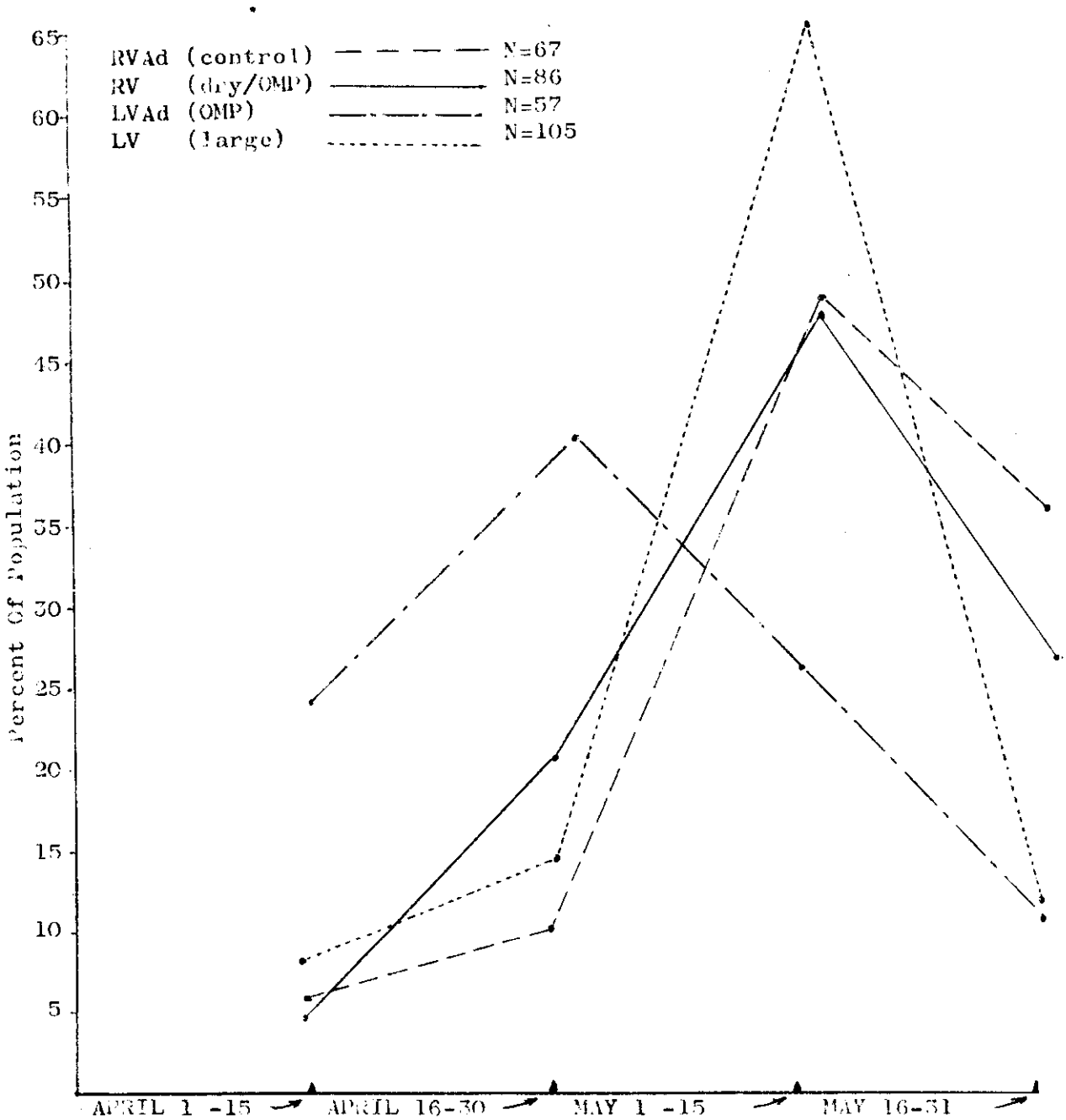

Figure 3. Numbers and migration timing of four groups of steelhead smolts through the Burstedt Lane trap on the Pahsimeroi River in the spring of 1976. Smolts fed Oregon Moist Pellets as a final diet reached the peak of their emigration two weeks earlier than the other three groups fed dry feed as a final diet.

length ranged from 8 to 20% upon delivery (Table 4). However, only six fish less than that length were collected at the Burstedt Lane trap and only one fish less than 170 mm (6.7 in) was collected at Lower Granite Dam. This further substantiates earlier findings which indicate that fish delivered to the Pahsimeroi less than 170 mm (6.7 in) in length do not migrate well and 170 mm (6.7 in) should be considered the minimum size to be delivered to that stream from Niagara Springs Hatchery.

There were no fish exceeding 270-279 mm (10.6-11.0 in) measured at either Niagara Springs or the Pahsimeroi River for the group fed dry feed, there were several exceeding that size measured at Lower Granite Dam (Table 4). In all groups the average size shows an increase at the Lower Granite sampling point over the Pahsimeroi sampling point and the Pahsimeroi trap samples average larger than the Niagara Springs samples. I believe the difference in the average size between the Niagara Springs samples and the Pahsimeroi samples reflects the loss of the smaller non-migrating fish. I believe the difference in size between the Pahsimeroi and Lower Granite samples reflects additional growth of the migrating smolts.

Intertributary Straying

Past work on the Pahsimeroi River has shown that a portion of the steelhead smolts delivered to that stream do not migrate. Observations have also indicated that while some smolts may move downstream out of the Pahsimeroi River this movement may not reflect an emigration, but rather a drift of non-migrating or weakly migrating fish. These fish may be undersized, precocial, or do not fully develop the migratory urge for reasons not understood. Some leave the Pahsimeroi and enter other Salmon River tributaries.

During July-August 1976, I sampled several streams between the Pahsimeroi and Lemhi Rivers, approximately 80 river km (50 mi), and several tributaries of the main Salmon River between Horse Creek and Crooked Creek, from 177 to 282 km (110-175 mi) below the Pahsimeroi, for the presence of these juvenile steelhead (Table 5). I was particularly interested to see if wilderness streams were being penetrated by hatchery-reared steelhead. Time limitations prevented sampling between the Lemhi River and Horse Creek. I will complete this section in 1977.

Between the Pahsimeroi River and the Lemhi River I found recognizable hatchery origin steelhead in every tributary stream they could readily enter. The Hayden Creek Research Station on the Lemhi River released pond-reared steelhead annually and residual steelhead from these releases are present in the Lemhi.

We found no recognizable hatchery-origin steelhead juveniles in the streams entering the Salmon River from Horse Creek downstream. These wilderness area streams all contain strong populations of wild cutthroat, rainbow and Dolly Varden trout. Chinook salmon and whitefish were also present.

The juvenile hatchery-origin steelhead I observed in the upper tributary streams all showed relatively poor body condition. Past work on the Pahsimeroi has shown that most residualized steelhead in that stream do not survive the winter and perish prior to the following spring.

Table 4. Length frequency of four groups of experimental steelhead smolts measured at Niagara Springs Hatchery, the Burstedt Lane trap on the Pahsimeroi River, and at downstream migrant collection facilities at Lower Granite Dam on the Snake River, spring 1976.

Length group (mm)	100% dry			OMP-dry switched			100% OMP			Large size		
	N.S.	Pah.	L.G.	N.S.	Pah.	L.G.	N.S.	Pah.	L.G.	N.S.	Pah.	L.G.
90-99				1								
100	2			5								
110	8			6								
120	6			10			1					
130	5			6			4					
140	9			6			1					
150	21	1		7			8			1		
160	13	3		11	1	1	10	1		1		
170	19	2		24	1	1	9	2		3		4
180	30	12	4	30	5	1	15	5	3	3	1	6
190	38	7	6	30	7	9	36	3	3	11		1
200	45	9	23	39	9	13	35	1	2	13	3	4
210	33	11	32	38	16	21	45	12	24	25	14	7
220	28	10	40	23	11	27	50	7	42	29	8	10
230	25	7	40	23	11	12	46	8	27	32	14	19
240	17	2	41	18	14	25	20	11	36	39	10	20
250	14	3	17	11	6	18	12	4	32	39	14	20
260	3		13	4	3	14	10	2	22	17	21	25
270	1		8	4	1	7	5		7	20	10	17
280			4	1	1	3	2		6	4	5	12
290			3	1		1				3	3	12
300			1			1				4	2	2
310-319										2		
Avg. t.l.	198	208	234	199	224	235	215	222	241	240	249	251

Table 5. Salmon River tributary streams sampled during 1976 for the presence of hatchery-origin steelhead juveniles.

Stream name	Distance below Pahsimeroi R. km	(mi)	Hatchery steelhead present	Comments
Cow Creek	8	(5)	Yes	
Iron Creek	31	(19)	Yes	
Warm Springs Creek	34	(21)	Yes	
Twelvemile Creek	55	(34)	No	Mouth blocked
Williams Creek	66	(41)	Yes	At mouth
Lemhi River	80	(50)	Yes	
Horse Creek	177	(110)	No	Wilderness stream
Cottonwood Creek	188	(117)	No	Wilderness stream
Chamberlain Creek	203	(126)	No	Wilderness stream
Sabe Creek	212	(132)	No	Wilderness stream
Bargamin Creek	229	(142)	No	Wilderness stream
Big Mallard Creek	237	(147)	No	Wilderness stream
Trout Creek	245	(152)	No	Wilderness stream
Rhett Creek	253	(157)	No	Wilderness stream
Five-Mile Creek	262	(163)	No	Wilderness stream
Crooked Creek	282	(175)	No	Wilderness stream

Plans for the 1977 field season include springtime observations to determine if residualized smolts have led to adult returns, and further sampling of streams between the Lemhi River and Horse Creek. Tributaries of the Salmon River above the Pahsimeroi will also be sampled to determine if upstream distribution occurs.

A steelhead introduction program such as the Niagara Springs-Pahsimeroi project cannot be implemented without impacting surrounding fish populations physically and probably genetically, and cannot be contained to the receiving stream. I hope to further delineate the range of this impact.

Seawater Survival Experiments

On 12 May 1976, four groups of 100 steelhead each, collected at the Lower Granite Dam downstream migrant trapping facilities, were placed in a tank truck and hauled to Manchester, Washington. Over a period of some 28 hours the salinity of the holding water was gradually increased until the steelhead were tempered to normal seawater salinity levels. They were then placed in pens directly in seawater and held until 27 May.

During this 16 day period, the survival of these four groups was monitored. The groups consisted of 100 fish each identified as wild smolts, Dworshak National Fish Hatchery smolts, Niagara Springs-Pahsimeroi smolts, and unmarked hatchery-origin smolts (source unknown). The 16-day cumulative mortality of smolts from each group held in the seawater pens were as follows:

Group	Percent Mortality
Wild	9%
DNFH	35%
N.S.-Pah.	8%
UnMkd. Hatch.	23%

This experiment was conducted by personnel of the Idaho Cooperative Fisheries Unit, under the supervision of Dr. T. C. Bjornn, University of Idaho. Dr. Bjornn attributes the higher survival of Pahsimeroi smolts, as compared to the other groups, to their large size (personal correspondence).

ADULT RETURNS

1973 Release - 1972 Brood-year

In 1975, I identified 228 Pahsimeroi steelhead returnees as 1-ocean fish. In 1976, I identified 54 of the adults that returned to the Pahsimeroi as 2-ocean fish. Both of these groups of adults were from the 1973 smolt release of 1972 brood-year steelhead reared at Niagara Springs. Of a total 1973 release of 1,292,000 smolts, we obtained an estimated return to the station of 282 adult steelhead. Only a brief 27-day fishing season was allowed on these steelhead in the fall of 1975, and I estimated that anglers caught only 13 fish during that period.

This is the lowest smolt-to-adult return percentage (.022%) experienced at the Pahsimeroi station since the first returns in 1969. This reflects the tremendous loss of downstream migrating smolts at lower dam sites during the spring of 1973 (estimated at 96%).

1974 Release - 1973 Brood-year (Clearwater Race)

In the spring of 1976, I identified 395 adult steelhead that returned to the Pahsimeroi station as 1-ocean adults from the spring 1974 release of Clearwater stock smolts. This is the first return of this stock of steelhead substituted for the Pahsimeroi progeny lost as a result of an IPN eipzootic in 1973. These fish were not separated from the Pahsimeroi origin stock at the station and eggs and sperm from both races of steelhead were mixed during spawn-taking.

1974 Release - 1972 Brood-year (2-Year Reared)

In the spring of 1974 we released some 240,000 2-year reared steelhead from the North Pond at the upper station. These fish were judged too small to emigrate when delivered in the spring of 1973, 6.2/kg (13.7/lb), and were reared for an additional year in the pond on an experimental basis. Approximately 25,000 of these fish carried a left-ventral fin clip (LV).

In the spring of 1976, we counted 14 adult steelhead that returned to the weir bearing a LV clip. All 14 were 66 cm (26 in) or less total length. Assuming equal survival for marked and unmarked fish from this group, 122 additional 1-ocean steelhead at the station should have been from this same group of 2-year reared fish for a total 1-ocean return estimate of 136 steelhead. We should see additional 2- ocean returnees in the spring of 1977.

Of the 585 fish total run in 1976, 402 (69%) were females and 183 (31%) were males. These females yielded 1,786,000 eggs for the 1976-77 rearing phase.

DEFINITION OF STOCKS

Clearwater River race steelhead traditionally return as 80-90% 2-ocean fish, almost the exact reverse of the Snake River-Pahsimeroi stock steelhead which return primarily as 1-ocean fish. Because of this trait, most Clearwater race fish return as larger size fish. Length frequencies measured by other fishery workers handling Clearwater stock fish also show that this race of fish average larger for similar age groups than Snake River-Pahsimeroi race steelhead.

With the mix of genetic material from these two stocks commencing in 1976, length-frequency will no longer be usable on their progeny as a dependable parameter for discerning various brood-years of returning adults. The first adults from this brood year will return to the Salmon River in the fall of 1978 and to the Pahsimeroi Weir in the spring of 1979.

Commencing in the spring of 1977, a portion of each years' production at Niagara Springs Hatchery will be implanted with a coded magnetic wire in their snouts. The code will be unique for each brood-year. Experimental groups within the same brood-year will also carry unique codes. Each fish with a coded wire tag will also have the adipose fin removed to allow external recognition in the various downriver fisheries and ocean harvests.

State and federal fisheries agencies have initiated a coastwide and Columbia River recovery effort of coded wire tagged anadromous fish in sport, commercial and Indian fisheries. Idaho's contributions may be accurately assessed in the near future.

To assess short term experiments at Niagara Springs or in the Pahsimeroi River, various externally recognizable marks will also be needed. Next year's research will include exploration of subcutaneously injected dye material.

DOWNRIVER TAGGING DATA

In the spring of 1976, 14 adult steelhead returning to the Pahsimeroi station carried a coded magnetic wire tag implanted in their snouts. We determined this with an electronic detector provided by the National Marine Fisheries Service (Fig. 4). This was part of a cooperative effort to help evaluate the results of the NMFS smolt transport work. All of these fish had been captured as smolts at Little Goose Dam in the spring of 1973 and tagged with coded wire. Thirteen had been transported downstream by tank truck and released below Bonneville Dam. One travelled down through all the dams to reach the ocean. The adjusted transport benefit for 1976 returns of these steelhead to the Pahsimeroi is 10 to 1.

All these adult steelhead were detected while traversing the fish ladder at Little Goose Dam in the fall of 1975. All the recovered wire tags were identified as having been inserted in the fish in the spring of 1973. They all returned to the Pahsimeroi in the spring of 1976. These facts indicate that all 14 of these steelhead spent 2 years in the ocean. However, out of the 14 fish, 4 were 66 cm (26 in), 1 was 63.5 cm (25 in) and 2 were 61 cm (24 in) total length.

The small size of these 2-ocean steelhead is a marked departure from past years' information. Earlier work has shown that most 2-ocean Pahsimeroi returnees exceed 66 cm (26 in) and rarely are 63.5 cm (25 in) or less in length. It seems unusual that these steelhead could spend 2 years at sea and only achieve 61 to 63 cm (24-25 in) length. It raises the question of possible lower Columbia or estuarine rearing. It also raises the question of the effect of the transportation program on these steelhead. The possibility of unusual circumstances in the ocean environment in 1973 and/or 1974 also exists.

DORSAL FIN DEFORMITY RECOGNITION

In the spring of 1976, I inspected 147 adult steelhead spawner carcasses to determine the degree of dorsal fin deformity. I classified the fins into three categories:

Class I - Strongly deformed, easily recognizable
Class II - Moderately deformed, recognizable with education
Class III - Slight deformity or none, not recognizable

Figure 2. Migrating smolts entering the Burstedt Lane trap were checked for fin clips, measured and released.

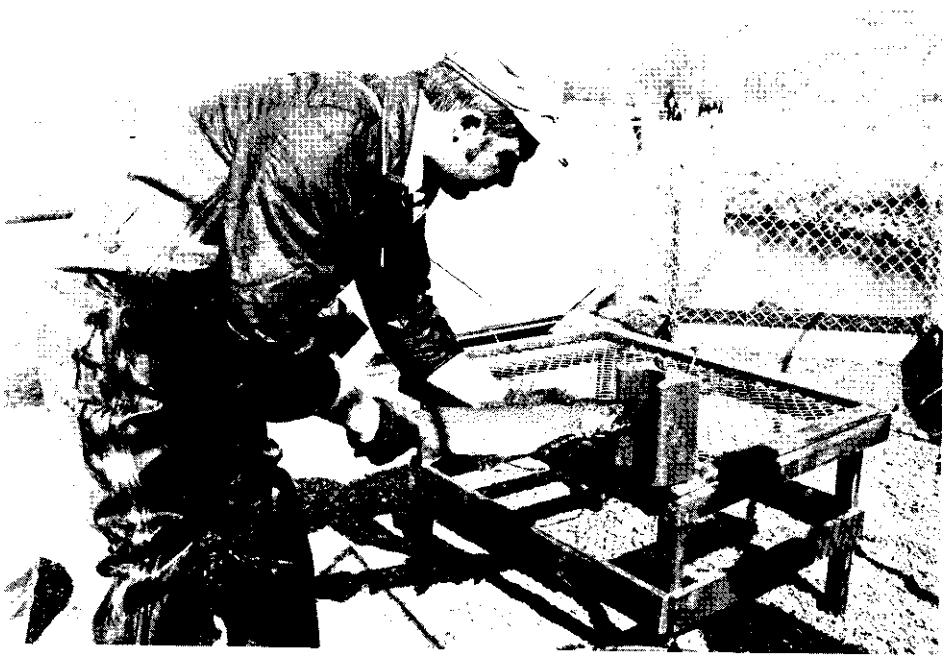

Figure 4. Pahsimeroi station Superintendant Tom Levendofske checks a steelhead spawner for the presence of a magnetic coded wire tag.

I classified the 147 inspected fish as follows:

Class I	-	104 (71%)
Class II	-	24 (16%)
Class III	-	19 (13%)

Eighty-seven percent of the 1976 hatchery adult returnees were recognizable by deformed dorsal fins.

The Idaho Department of Fish and Game is presently using posters, notices on regulations and articles in newspapers and magazines urging anglers to look for this fin deformity on the steelhead they catch and to voluntarily release alive those fish that do not have it (Fig. 5). This is a laudable attempt to relieve some of the angler harvest on beleagured wild stocks and transfer it to hatchery stocks more capable of withstanding it.

Contact with anglers in the field and at check stations indicate that the majority of steelhead fishermen are in accord with this idea and many had released wild fish.

AGE AND GROWTH

In past years, observation of body scales and return of marked fish have indicated that most Pahsimeroi origin steelhead that spend one growing season in the ocean return at 66 cm (26 in) or less total length. Those that spend two growing seasons in the ocean are generally 68.5 cm (27 in) or longer. A small percentage of individuals fall outside these limits but I have considered the 66-68.5 cm (26-27 in) division of 1 and 2-ocean steelhead to be adequately accurate for the purposes of this project.

There was some indication from looking at the last couple of years' data that this 66-68.5 cm (26-27 in) division might not be as strong for females as it is for males. To investigate this, I collected body scales from 34 steelhead that returned to the weir in April 1976. I examined them for the presence of annuli during the winter of 1976-77, to determine the number of winters spent at sea. All were female steelhead of which 20 were 66 cm (26 in) in length and 14 were 68.6 cm (27 in). I identified all 66-cm (26-in) fish as having spent one winter at sea. Of the 14 steelhead 68.6 cm (27 in) in length, I identified 10 as having one annuli and 4 as having two annuli. It appears that for Pahsimeroi origin females, 75% or so of the 68.6 cm (27 in) length group may be 1-ocean fish. Past scale readings and returns of marked adults indicate that this subtle shift has occurred recently; in the last couple of years' returns. This may be a reflection of selection of large male spawners during Pahsimeroi spawn-taking operations. It may also be natural variation.

When coded wire tagging fish begin returning in 1979, I will no longer use total length to determine age. I believe I can adequately separate year classes by fin clips and lengths until that time.

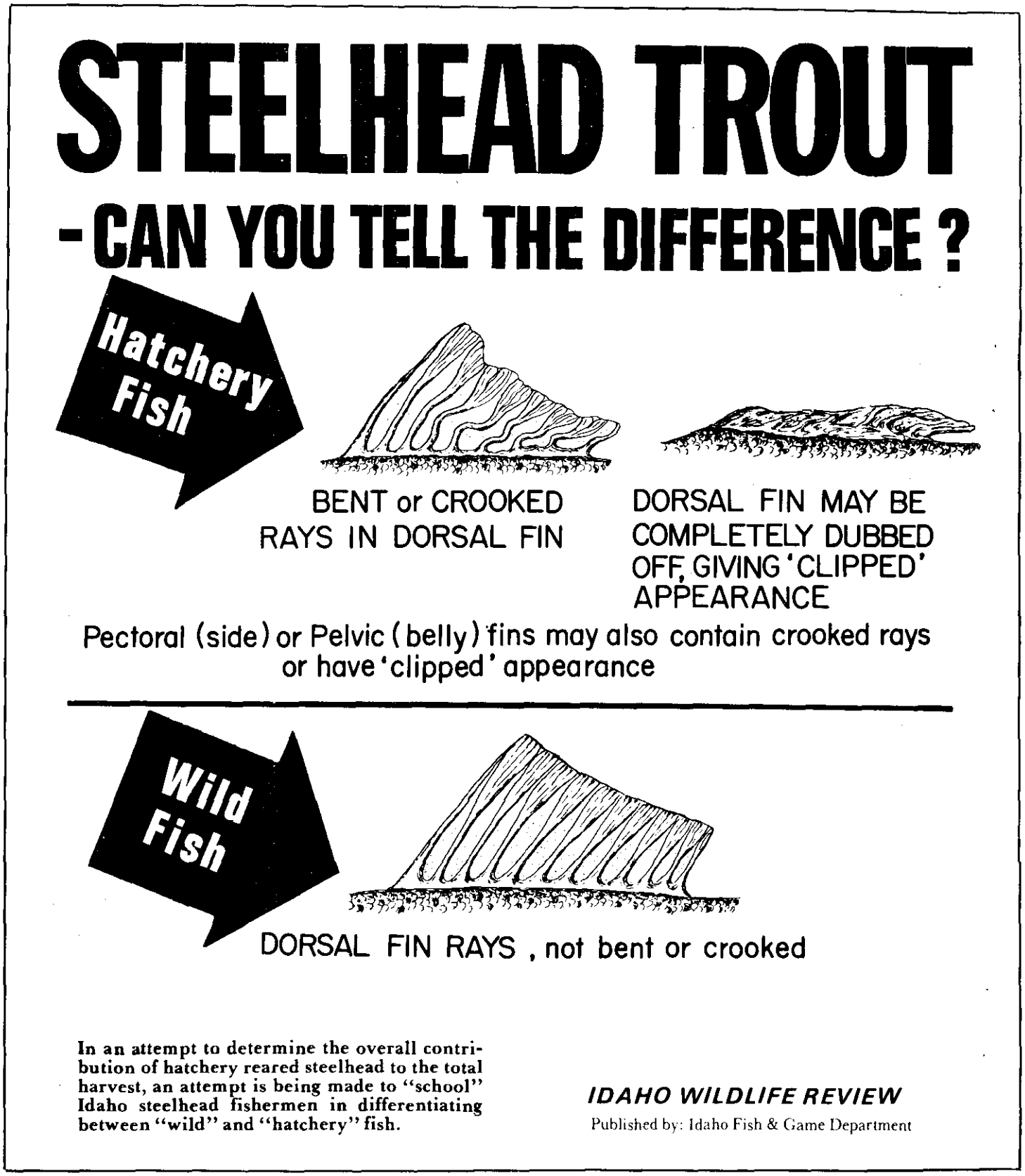

Figure 5. Information depicting differences in wild and hatchery steelhead that was distributed on posters and in news articles.

STEELHEAD CHECK STATION - FALL, 1976

There was no steelhead sport fishery on the Salmon River during the spring of 1976. On 1 October 1976, the river was reopened to the taking of steelhead trout. The season bag limit (1 October - 31 December 1976) was three fish, with a daily bag and possession of one. Anglers were allowed to continue fishing for steelhead after the one fish daily limit had been reached with the stipulation that they release any more steelhead caught back to the river.

Each Saturday and Sunday from 1 October through 28 November, we operated an angler check station on the Salmon River road near North Fork, Idaho. We set up the station at noon and operated until dark each day. We queried anglers on the hours they fished, fish caught, area fished, and inspected their catch whenever possible to define the percent of hatchery-origin steelhead (Table 6).

Check station operations will be continued in the spring of 1977 to monitor the complete sport fishery on this run of steelhead.

ACKNOWLEDGEMENTS

The research conducted on the Niagara Springs-Pahsimeroi project would not be possible without the joint efforts of the personnel who operate these facilities. The crew of Niagara Springs Steelhead Hatchery; Charles R. (Bob) Quidor, Jerry Mowery, Mike Graham and Paul Smith, have my gratitude for their hard work and dedication to the research projects initiated at that station.

Tom Levendofske and Albert Herrin of the Pahsimeroi Collection Facility have made research efforts there possible by their cooperation, dedicated labor and interest in the projects.

LITERATURE CITED

Anderson, Donald R., Jr. 1975, 1976. Evaluation of "quality" anadromous smolt production techniques. 1 July 1974 - 30 June 1975 and 1 July 1975 - 30 September 1976. Idaho Department of Fish and Game reports.

Table 6 . Summary of data collected at the steelhead angler check station operated near North Fork, Idaho. October - November 1976.

Dates	Anglers	Hours	Steelhead Kept	Steelhead Released	Hours per fish Kept	Hours per fish All	Percent hatchery
10/1-3	229	1749	14	4	125	97	36
10/9-10	137	975	12	2	81	70	42
10/16-17	144	1059	16	2	66	59	44
10/23-24	166	1185	38	12	31	24	50
10/30-31	125	1162	36	19	32	21	50
11/6-7	145	962	22	3	44	38	41
11/13-14	162	1066	30	18	35	22	60
11/20-21	130	733	20	6	37	28	40
11/27-28	26	124	2	0	62	62	50
Total	1264	9015	190	66	47	35	47

Submitted by:

Melvin Reingold
Principal Fishery Research Biologist

Approved by:

IDAHO DEPARTMENT OF FISH AND GAME

Joseph O. Greenley, Director

Stacy Gebhards, Chief
Bureau of Fisheries

Jerry Mallet
Fishery Research Supervisor
Bureau of Fisheries