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Accomplishments for 1983:

Run size and age composition was determined. Surveys of the Willamette Basin showed a total of 6,822 fall chinook redds and 182 spring chinook redds. Preliminary tag recovery information was gathered. Production efficiencies have been calculated for the 1981-and 1982-brood fall chinook rearing operation at Stayton Pond. An informational report listing all coho releases by stream was published. We completed a rough draft of a comprehensive report analyzing the past coho releases and suggesting future production potentials.

Findings for 1983:

The 1982 fall chinook run was 27,222 fish. Sixty-eight percent of these fish were pond reared, 32% were of natural origin and 0.6% were strays.

The loss of micro-tags from adipose marked adults captured was 5.9%, about 3 times higher than the loss of micro-tags in the juveniles at release.

Catch and escapement of 1978-brood fall chinook reared in Stayton pond was up to 6.5 and 5.2 times higher, respectively, than the same stock reared at 4 hatcheries located on the Columbia River.

Fall chinook reared and released in the upper Willamette Basin contributed 5,931 fish to the Columbia River commercial fishery in 1982. An additional 2,813 naturally-reared fish of Willamette Basin origin were caught in that fishery.

Fish culture operations at the Aumsville-Stayton Pond complex produced about 7 million juvenile fall chinook each year in 1982 and 1983 for release into the upper Willamette Basin. The cost of rearing was $1.05 per pound for the 1981 brood and $1.10 per pound for the 1982 brood. The maximum fish biomass in the pond has averaged 85,000 lbs for the last 5 years. When

biomass exceeded this amount, dissolved oxygen depletion has occurred, resulting in mortality or severe stress to the fish just prior to release.

Past releases of coho salmon into the basin above Willamette Falls have resulted in variable production of adult coho. The greatest production occurred during 1971 when 133,000 adults were estimated to have been produced. Factors limiting a self-sustaining population appeared to be overharvest, periodic droughts, and turbine-inflicted losses of juveniles.

Management Implications:

Rearing fall chinook in ponds and releasing them into the upper Willamette River provides substantial numbers of fish to the Columbia River fishery, as well as enhancing the natural spawning population within the Willamette Basin.

Loss of micro-tags from adipose marked fish after release may pose substantial problems with contribution and evaluation studies.

Maximum fish biomass should not exceed 85,000 lbs at Stayton Pond until water inflow can be substantially increased.

Modest numbers of coho can be produced in the upper Willamette River but annual releases of hatchery fish will be required.

Introduction

The Willamette River Salmon studies include five parts. The smolt survival study at South Santiam Hatchery, the stock comparative study at Marion Forks Hatchery, the evaluation of Oakridge-Dexter Hatchery, and the evaluation at McKenzie Hatchery compose our investigation on spring chinook salmon; the fall salmon studies include investigations of tule fall chinook and coho salmon introduced into the Willamette system.

Spring Chinook Stock Comparative Study-Marion Forks Hatchery

The 1980 brood was the final tagged group released in this study. We are currently recovering adults from the 1976, 1977, and 1979 brood releases.

Results and Discussion

The Carson stock returns, from both fall and spring release, are lower than returns of the North Santiam stock (Table 1).

Table 1. Combined estimated freshwater recovery of the 1975-1977 broods of spring chinook from Marion Forks Hatchery.

	Freshwater fishery catch	Hatchery return	Total recovery	Percent from smolts
Fall release Carson Stock	85	43	128	0.07
Spring release Carson Stock	145	139	284	0.10
Spring release North Santiam Stock	857	269	1,126	0.38

Oakridge-Dexter Hatchery Evaluation

The juvenile tagging portion of this study was completed with the release of 1980 brood smolts in spring 1982. We are currently recovering tagged adults returning from the 1977, 1978, and 1979 brood releases.

Results and Discussion

Tag recovery information for the 1977 brood indicated that all groups of smolts provided returns of adults (Table 2). Best-surviving groups were released in the spring. Smolts graded medium (130< >150 mm) in the fall and reared to 8 fish/lb at Dexter for spring release have contributed over 1.5% adult returns to freshwater. Ungraded smolts reared at Oakridge and small

smolts reared at Dexter, both for spring release, have contributed over 1% adult return to freshwater. The most effective group of fall-released smolts of the 1977 brood was ungraded and released from Dexter.

Table 2. Estimated freshwater recoveries of tagged adults, Oakridge-Dexter Hatchery Evaluation, 1977 brood.

Treatment	Freshwater fishery catch	Hatchery return	Total recovery	Percent from smolts
Fall release Dexter Ungraded	88	154	242	1.05
Fall release Oakridge Graded large	61	107	168	0.70
Fall release Oakridge Graded medium	28	78	106	0.37
Fall release Oakridge Graded small	47	23	70	0.24
Spring release Oakridge Ungraded	154	250	404	1.34
Spring release Oakridge Graded large	63	193	256	0.78
Spring release Dexter Graded medium	161	287	448	1.52
Spring release Dexter Graded small	213	200	413	1.34

The age composition of adults returning from releases of 1977 brood smolts indicates that slower growing juveniles tend to produce adult returns comprised of a majority of age-5 fish (Fig. 2). Faster growing (larger)

juveniles appear to produce an adult return of mostly age-4 fish. Time of smolt release (fall or spring) did not affect this tendency. Results are consistent with preliminary tag recoveries from releases of 1978 brood smolts.

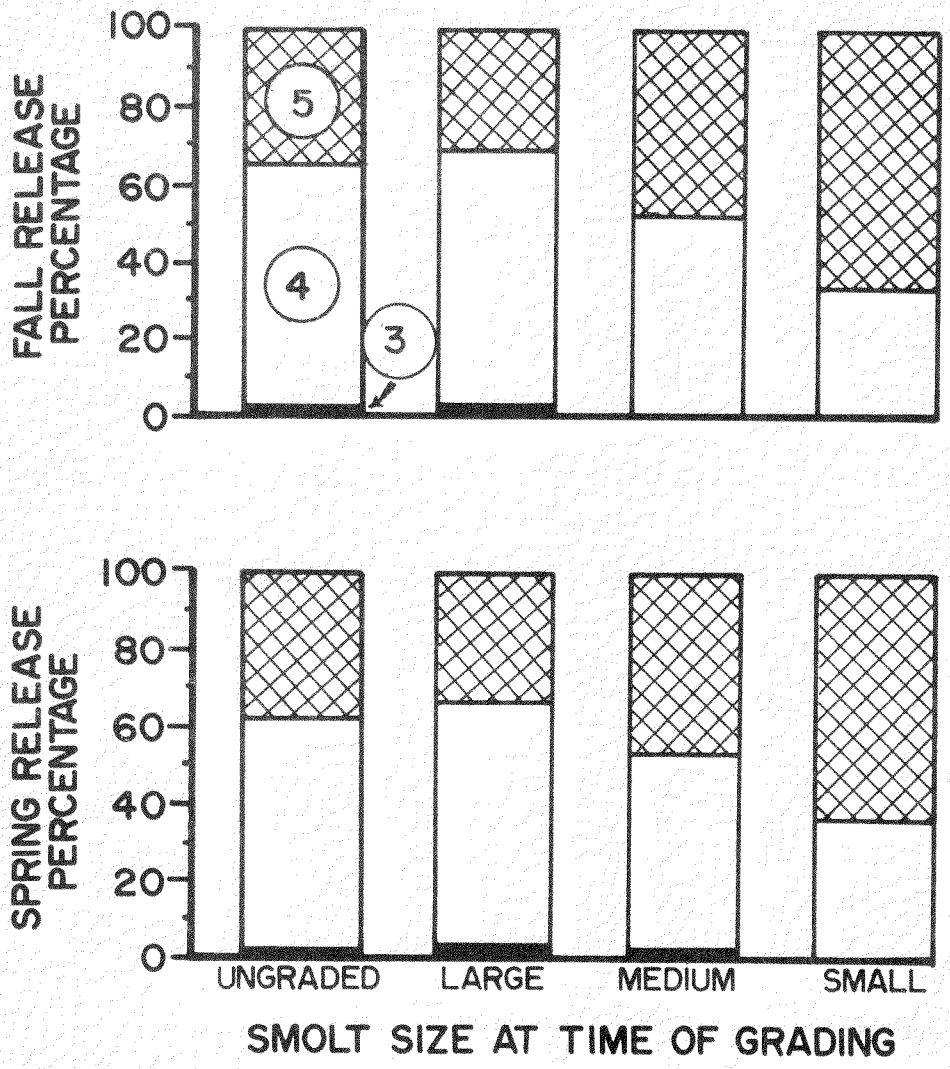

Fig. 2. Age composition of adult return resulting from the release of size-identified smolts of the 1977 brood, Oakridge-Dexter evaluation (through age-5 adult return).

McKenzie Hatchery Evaluation

The release of tagged 1981 brood smolts in fall 1982 and spring 1983 completed the smolt liberations for this study. The methods employed with the 1978, 1979, and 1980 broods were changed for the 1981 brood. As a BKD-control measure, all groups were administered two prophylactic feedings of erythromycin during their rearing phase in the hatchery. An ungraded control group, fed only untreated feed, was tagged AD-CWT and released with the spring release groups to detect potential survival benefits of prophylactic feedings of antibiotic.

Results and Discussion

The age-5 hatchery returns are in process. Currently available returns for this study are presented in Table 3.

Table 3. Estimated freshwater recoveries of tagged adults, McKenzie Hatchery evaluation, 1978 brood.

Treatment	Freshwater fishery catch	Hatchery [a] return	Total recovery
Fall release Ungraded	84	46	130
Fall release Graded large	41	48	89
Fall release Graded medium	33	3	36
Spring release Ungraded	23	10	33
Spring release Graded large	26	25	51
Spring release Graded medium	3	2	5

[a] *Age-5 hatchery returns currently in process.*

Fall Chinook and Coho Studies

Introduction

In 1978 we began evaluating a program of rearing juvenle fall chinook in ponds in the upper Willamette watershed. We cooperated with the National Marine Fisheries Service in their evaluation of fall chinook hatcheries in the Columbia Basin during conduct of portions of this study. In addition to contribution and survival studies we gathered data on life history, distribution and population trends of fall chinook produced in the Willamette River system. Study objectives appear in Hansen and Williams (1979) and the Willamette Basin fish Management Plan (ODFW, 1980).

Methods

We set out to determine how many fall chinook in the annual runs were the result of our pond rearing operations. We accomplished this by tagging from 2 to 6% of the juveniles released from Stayton pond each year. We then counted marked adults which passed through the Willamette Falls fishway and captured a sample of these fish for tag identification. Using these data, we applied appropriate expansions to estimate the number of pond-reared adults returning (Smith et al. 1982). The remainder of adults in the run were ascribed to result from natural spawning and rearing.

Results and Discussion

We released about 7 million pond-reared chinook in the Willamette Basin in 1983. These releases included 256,000 tagged fish (Table 4). We produced these fish at a cost of $1.10 per pound (Appendix Table 1).

Table 4. Summary of fall chinook releases from Stayton Pond into the Willamette River, 1978-82 broods.

Brood year	Release period	Size (gr)	Total	Percentage marked Ad-CWT
1978	05/07-29/79	6.8	4,691,685	6.3
1979	03/28-06/21/80	5.2	6,348,695	4.5
1980	04/28-06/15/81	6.1	5,902,731	4.3
1981	04/03-05/21/82	5.2	6,750,813	4.0
1982	04/25-05/19/83	5.8	6,912,074	2.4

Of the 27,069 fall chinook which passed Willamette Falls in 1982, we estimated that 68% originated from pond-rearing and the residual 32% resulted from natural spawning and rearing. We revised our estimate for the 17,890 Willamette fall chinook run of 1981; we calculate that 47% were pond-reared and 53% were reared naturally.

Willamette-produced fall chinook have contributed heavily to the fall season gillnet fishery in the lower Columbia River. The 1982 fishery harvested 74,000 fall chinook of which 11.8% originated in the Willamette River system. We estimated the Willamette component of the catch included 5,931 fish from Stayton Pond and 2,813 naturally-reared fish. A comparison of relative survival rates in several recent years indicates that Stayton Pond is consistently among the most successful fall chinook artificial propagation facilities on the Columbia system (Tables 5-7).

Fall chinook apparently continue to lose coded-wire tags after their release. Adults sampled at Willmette Falls in 1982 displayed 5.9% tag loss, a rate approximately 2.7 times that of observed tag loss in the juveniles at time of release.

Table 5. Escapement of fall chinook from four selected Columbia River rearing stations, 1980-82 run years.

Origin [a]	Brood year	Adjusted [b] escapement	Comparison ratio [c]
Stayton	1978	683	52:1
Bonneville	1978	237	18:1
Big Creek	1978	147	11:1
Klaskanine	1978	13	-
Stayton	1979	125	125:1
Big Creek	1979	68	68:1
Bonneville	1979	11	11.1
Klaskanine	1979	1	-

[a] *Stayton escapements include all fish counted past Willamette Falls, other stations include hatchery returns, strays and spawning ground recoveries.*
[b] *Adjusted to common unit of release for compariosns.*
[c] *Based on least-contributing station in these analyses.*

Table 6. Preliminary estimates and comparison of the catch of selected hatchery groups of fall chinook in the Columbia River commercial fishery, 1982.

Origin	Brood year	Adjusted [a] escapement	Comparison ratio [b]
Stayton	1978	92	1.7:1
Klaskanine	1978	78	1.4:1
Big Creek	1978	61	1.1:1
Bonneville	1978	55	-
Big Creek	1979	44	3.7:1
Stayton	1979	42	3.5:1
Klaskanine	1979	26	2.2:1
Bonneville	1979	12	-

[a] *Adjusted to common unit of release for comparison.*
[b] *Based on least-contribuitng station in these analyses.*

Table 7. Preliminary total fishery contribution of selected Ad+CWT groups of 1978 brood fall chinook from Columbia Basin rearing stations during 1980 and 1981 fishery seasons.

Origin	Adjusted [a]	Comparison ratio [b]
Stayton	1,061	6.6:1
Bonneville	430	2.7:1
Big Creek	269	1.7:1
Klaskanine	161	-

[a] *Adjusted to common unit of release for comparison.*
[b] *Based on least-contributing station in these analyses.*

Age composition of the fall chinook run can be determined adequately by sampling adults at the Willamette Falls trap. We determined this by statistically comparing age data derived at the adult trap with similar information obtained from carcass surveys. These results appear to eliminate the need for labor-intensive carcass surveys to determine required age parameters.

We prepared a report titled "Release of Coho Salmon in the Upper Willamette River, Oregon" (ODFW Information Report No. 83-03). We drafted another report which analyzes past data related to Willamette coho and the potential for increasing this run. Based on these analyses we conclude:

1. Releases of large numbers of hatchery fish into the upper Willamette River in past years resulted in an estimated annual total production of between 62,000 and 87,000 adult coho.
2. We calculate that rates of harvest of these fish have been consistently in excess of the theoretical Maximum Sustained Yield rate. We believe overharvest was one of the main causes of the failure of this program to establish a self-sustaining run of coho in the Willamette system. Coho smolts released into the upper
3. Willamette River do not survive as well as smolts released directly from Sandy, Big Creek and Eagle Creek hatcheries.
4. High rates of harvest dictate that any renewed coho enhancement program for the Willamette system will have to be predicated upon extensive releases of hatchery-produced fish. Given the current stocking restrictions, we estimate the basin's capability to be 1.36 million smolts which should yield an annual total production of about 41,000 adult coho.

Appendix

Appendix Table 1. Summary of fall chinook pond culture operations in the Willamette Valley, 1981 and 1982 broods.

Production category	Numbers 1981 brood	1982 brood
No. fish started in pond complex	9,338,635	8,993,838
Lbs fish started	8,535	8,195
No. fish released	6,750,813	6,912,074
Lbs fish released	76,886	87,580
Estimated No. fish not released [a]	895,902	900,678
Net gain in lbs (released)	68,331	79,385
Food conversion (fish released)	1.4:1	1.3:1
(all fish in pond)	1.3:1	1.2:1
Costs Total	$71,718	$87,597
Net per lb released	$1.05/lb	$1.10/lb
Percent released (inclusive) [b]	72%	77%
(from rearing pond) [c]	88%	88%

[a] *Rearing pond cannot be completely drained, therefore not all fish are released.*
[b] *Percent of fish released as smolts from number of fish started at fry stage.*
[c] *Percent of fish released as smolts from number of fish put into rearing pond as fingerling.*

Appendix Table 2. Estimated total poundage and sizes of fall chinook in Stayton Pond at release, 1978-82 broods.

Brood year	Pounds of Fish Released	In pond	Average size
1978	70,502	74,672	67 fish/lb
1979	72,999	82,364	87 fish/lb
1980**	78,951	83,288	75 fish/lb
1981	76,886	87,092	88 fish/lb
1982**	87,580	99,022	79 fish/lb
Average	77,384	85,288	

** Oxygen depletion occurred in pond just prior to release causing mortality or stress to fish.

Appendix Table 3. Age-specific lengths (cm) of Willamette River fall chinook, 1982 run.

Sample site	Age 2 Males	2 Females	3 Males	3 Females	4 Males	4 Females	5 Males	5 Females
Fishway (Ad-marked)	61	-	86	80	96	90	-	
Fishway (unmarked)	58	55	83	81	95	89	100	93
Spawning ground	61	-	84	79	95	87	100	

Appendix Table 4. Age composition of the Willamette River fall chinook runs in 1982 as determined at Willamette Falls and on the spawning grounds.

Sampling site	Group	Percentage of age 2	3	4	5
Fishway	Unmarked	3.0	64.6	32.1	0.4
Fishway	Ad marked	1.6	52.7	44.6	1.3
Spawning grounds		3.7	60.3	35.4	0.5

Appendix Table 5. Miscellaneous Ad+CWT fish captured and sacrificed at Willamette Falls in 1982.

Species	Tag code	Origin	Capture date	Fish length (cm)	Sex
Spring chinook	7-20-54	McKenzie H.	09/04/82	39	M
Coho	5-08-26	Eagle Creek H.	09/08/82	63	M
Fall chinook	6-61-09	Trinity R. H.	10/11/82	71	M
Coho	lost	--	09/18/82	61	F

Appendix Table 6. Results of spawning surveys of chinook salmon in the Willamette River System, October, 1982.

River	River section: Reference points	River km	Redds	Km surveyed	Redds/km
Willamette R.	Newberg to Wheatland Ferry	80.5-115.7	86	35.2	2.4
	Wheatland Ferry to Salem	115.7-135.2	120	19.5	6.2
	Salem to Independence	135.2-154.6	16	19.4	0.8
	Independence to Albany	154.6-192.0	147	37.4	3.9
	Albany to Marys R.	192.0-212.6	53	20.6	2.6
	Marys R. to American Can Co. (Concrete water intake structure)	212.6-237.2	132	24.7	5.3
	American Can Co. water intake to Harrisburg	237.2-259.4	250	22.2	11.4
	Harrisburg to McKenzie R.	259.3-281.3	249	21.9	11.4
	McKenzie R. to Jct. Coast & Middle Forks	281.3-300.9	15	19.6	0.8
	Total		1,608	220.4	21.8
Middle Fork Willamette R.	Mouth to Fall Cr.	8.0- 18.2	10	18.2	0.5
	Total		10	18.2	0.5
Coast Fork Willamette R.	Mouth to Row R.	0.0- 33.3	6	33.3	0.2
	Row R. to Cottage Grove Res.	33.3- 47.8	1	14.5	0.5
	Total		7	47.8	0.1
Row R.	Mouth to Dorena Dam	0.0- 12.2	1	12.2	0.1
	Total		1	12.2	0.1
Mill Cr. [b]	Mouth to Jct. of Stayton Ditch	0.0- 35.4	183	35.4	5.2
	Total		183	35.4	5.2

[b] *Includes 137 redds in 4.8 km of Shelton Ditch.*

Appendix Table 2 (continued)

River	River section: Reference points	River km	Redds	Km surveyed	Redds/km
McKenzie R.	Mouth to Interstate 5 Br.	0.0- 7.1	1	7.1	0.1
	Interstate Br. to Mohawk R.	7.1-17.2	55	10.7	5.1
	Mohawk R. to Hendricks Br.	17.2-33.8	24	16.6	1.4
	Total		80	33.8	2.4
Calapooia R.	Mouth to Corvallis Hwy. Br.	0.0-13.2	--	--	--
	Corvallis to Hwy. Br. to SPRR Br.	13.2-27.5	--	--	--
	SPRR Br. to Brownsville	27.5-52.0	--	--	--
	Total		--	--	--
Santiam R.	Mouth to OERR Br.	0.0- 5.1	247	5.1	48.4
	OERR Br. to Interstate 5 Br.	5.1-10.3	411	5.2	79.0
	Interstate 5 Br. to Jefferson Br.	10.3-15.4	459	5.1	90.0
	Jefferson Br. to Jct. of N. & S. Santiam R.	15.4-18.8	374	3.4	110.0
	Total		1,491	18.8	79.3
North Santiam R. [b]	Mouth to First Hwy. Br.	0.0- 4.7		4.7	
	Hwy. Br. to SPRR Br.	4.7-17.9	51	13.2	2.8
	SPRR Br. to Stayton Br.	17.9-26.9	137	9.0	15.2
	Stayton Br. to L. N. Fork	26.9-43.0	9	17.0	0.5
	Total		197	43.0	4.6
South Santiam R.	Mouth to Crabtree Hwy. Br.	0.0-12.2	1,117	12.2	91.6
	Crabtree Hwy. Br. to Lebanon Br.	12.2-29.4	837	17.2	48.7
	Lebanon Br. to Lebanon Dam	29.4-33.5	296	4.1	72.2
	Lebanon Dam to Foster Dam	33.5-60.7	68	27.2	2.5
	Total		238	60.7	38.2
Thomas Cr.	Mouth to County Road Br.	0.0- 3.5	1	3.5	0.3
	County Rd. Br. to Covered Br. above Scio	3.5-19.3	0	15.8	--
	Total		1	19.3	0.3

b An additional 172 counted from Little North Fork to Minto. These are classified as spring chinook.

Appendix Table 6 (continued)

River	River section: Reference points	River km	Redds	Km surveyed	Redds/km
Crabtree Cr.	Mouth to SPRR Br.	0.0- 6.0	18	6.0	3.0
	SPRR Br. to Transmission Lines	6.0-15.9	0	9.9	0
	Total		18	15.9	1.1
Molalla R.	Mouth to Hwy. 99E Br.	0.0- 5.8	38	5.8	6.6
	Hwy. 99E Br. to Goods Br.	5.8- 9.7	94	3.9	24.1
	Goods Br. to SPRR Br.	9.7-16.3	330	6.6	33.0
	SPRR Br. to Hwy. 213 Br.	16.3-23.2	379	6.9	54.9
	Hwy. 213 Br. to Feyer Pk.	23.2-29.9	230	6.7	34.3
	Feyer Pk. to Robbins Rd.	29.9-33.3	5	3.4	1.5
	Robbins Rd. to N. F. Molalla	33.3-42.6	1	9.3	0.1
	Total		1,077	42.6	25.3
	Total above Willamette Falls		6,451	581.7	11.1
Clackamas R.	Mouth to 82nd Ave. Br.	0.0- 2.0	41	2.0	10.5
	82nd Ave. Br. to Carver Br.	2.0-13.2	158	11.2	14.1
	Carver Br. to Barton Br.	13.2-22.2	88	9.0	9.8
	Barton Br. to Eagle Cr.	22.2-27.8	64	5.6	11.4
	Eagle Cr. to River Mill	27.8-38.0	20	10.2	2.0
	Total Clackamas R.		371	38.0	9.8
	TOTAL WILLAMETTE SYSTEM		6,822	619.7	11.0

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