

PROGRESS REPORT OF NATIONAL FISH HATCHERY
PROGRAMMING AND EVALUATION ACTIVITIES
PUGET SOUND AND COASTAL WASHINGTON, 1983-84

U.S. Fish & Wildlife Service
Fisheries Assistance Office
Olympia, Washington

February 1985

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Progress Report of National Fish Hatchery
Programming and Evaluation Activities
Puget Sound and Coastal Washington, 1983-84

INTRODUCTION

This report presents information regarding programming and evaluation activities at the Makah, Quinault and Quilcene National Fish Hatcheries (NFH) for the period August 1, 1983 - July 31, 1984. This information is summarized and presented here for use by the Fish and Wildlife Service (FWS) and other resource agencies. More detailed information is available from the Olympia Fisheries Assistance Office (FAO).

FWS hatchery programs in Puget Sound and North Coastal Washington contribute to a broad range of sport and commercial fisheries. FAO Olympia coordinated with hatchery staffs and state and tribal fishery resource managers to develop programs for FWS hatcheries that include the appropriate species combinations and stocks to meet fishery management, enhancement and restoration objectives. These programs were developed using the best available information regarding incubation, rearing, and release strategies. This was done to ensure that maximum benefits are obtained from the hatchery program while minimizing adverse species interactions with either wild or other hatchery stocks.

QUILCENE NFH .

Quilcene NFH produces spring chinook, coho and chum salmon. Fish distribution as reported by the hatchery is presented in Table 1. The hatchery's egg distribution is presented in Table 2.

Members of the Olympia FAO staff spent a substantial amount of time attending meetings, at both the administrative and technical levels, coordinating the fish production programs at Quilcene NFH. These meetings were mainly concerned with agency responsibilities under the Hood Canal Management Plan.

The FWS, Washington Department of Fisheries (WDF), and the Point-No-Point Treaty Council (PNPTC) agreed in 1981 to cooperatively work to restore Hood Canal salmon stocks and produce hatchery fish at 1970-1971 levels. The Hood Canal Management Plan resulted from this agreement. The parties designed the plan to provide the framework for programming salmon production within Hood Canal and to provide harvest management guidelines for Hood Canal stocks. Since signing the agreement, however, several problems arose regarding the interpretation and implementation of the plan.

In an effort to sort through these problems, the parties met a number of times during the year to exchange information regarding hatchery programs. The other agencies' concerns with FWS programs related primarily to our reductions in coho production to accommodate spring chinook and our elimination of fall chinook production because of low survival. These discussions resulted in an interim plan for the 1984 brood year and a commitment to continue discussions for future brood years.

Terminal Area Returns

Spring Chinook: Initial returns of three year old Quilcene NFH spring chinook were expected in the spring and early summer of 1984. These returns resulted from Cowlitz x North Fork (NF) Nooksack and Cowlitz X South Fork (SF) Nooksack releases made in 1982 and 1983, respectively. The 1982 plant of Cowlitz X NF Nooksack fish went out on October 28. The hatchery liberated 152,245 subyearlings (17 fish/lb.) at this time because of flooding. The 1983 plant of Cowlitz X SF Nooksack fish was made on May 9 when 155,051 yearlings (11/lb.) were released into the Quilcene River.

We began snorkel surveys in the Quilcene River on April 26, 1984 to enumerate the return, describe its timing, and locate holding areas. The results of these surveys are described in Appendix 1. A peak count of chinook in the river occurred on July 17. On July 23, Olympia FAO and Quilcene NFH staff captured 15 chinook in the river and moved them to the hatchery. On August 20, we captured another 5 chinook. In addition to the fish captured in the river, 31 chinook entered the hatchery voluntarily. The age composition of these fish was surprising. Scale patterns indicated that 37% were three year olds and 63% were four year old fish. The four year old fish were apparently strays from a Quilcene NFH plant of Hoodsport stock into the lower Dosewallips River on May 4, 1982. These fish were released into the Dosewallips because it was suspected that

Table 1. Quilcene NFH fish distribution, 1983-84.

<u>Species</u>	<u>Stock</u>	<u>Brood Year</u>	<u>Release Location</u>	<u>Release Date</u>	<u>Number</u>	<u>No./lb.</u>	<u>Weight</u>	<u>Tag Code</u>
Spring Chinook	S.F. Nooksack X Cowlitz	82	Quilcene R.	3/20/84	217,833	12.5	17,464	5-13-48
					55,010	9.6	5,730	5-13-47
					54,754	9.6	5,704	5-13-47
	N.F. Nooksack X Cowlitz	82	Quilcene R.	3/21/84	51,560	69.0	747	5-14-26
					150,392	67.0	2,245	5-14-54
					21,756	24.6	876	
Coho	Quilcene NFH	82	Quilcene R.	10/18/84	271,035	14.5	18,688	
				5/15/84	85,000	1500	57	
				1/13/84	29,595	1000	30	
				2/14/84	64,329	288	223	
Chum	Walcott	83	Walcott Sl.	5/18/84	64,000	125	510	
				5/2/84	434,400	600	724	
				5/3/84	446,175	675	661	
				5/3/84	406,800	610	667	
	Quilcene	83	Quilcene R.	5/3/84	28,000	718	39	
				5/2/84	406,500	535	760	
				5/2/84	345,892	525	659	
	Walcott	83	Quilcene R.	5/2/84	387,279	700	553	
				5/2/84	79,000	700	113	

Table 2. Quilcene NFH egg distribution, 1983-84.

<u>Species</u>	<u>Stock</u>	<u>Brood Year</u>	<u>Transfer Location</u>	<u>Date</u>	<u>Stage</u>	<u>Number</u>
Coho	Quilcene	83	Devil's Hole Bangor, WA	11/19/83	Eyed	40,000
		83	Chimicum High School Chimicum, WA	1/9/84	Eyed	40,000
Chum	Walcott	83	Enetai Cr. Skokomish Tribal Hatchery	12/83 - 1/84	Green	864,800
		83	Makah NFH	2/16/84	Green	873,750

they were a summer/fall chinook and not really spring chinook. However, their entry timing into the Quilcene River is characteristic of spring chinook (Appendix 1). Therefore, they were spawned along with the three year old Cowlitz X Nooksack fish.

The sex ratio and mean total length of the fish used for spawning is presented in Table 3. The mean length of all four year olds was 800 millimeters (mm). A 30 inch or 762 mm maximum size limit has been imposed upon the Strait of Juan de Fuca and northern Puget Sound sport fisheries during spring and early summer to protect mature spring chinook returning to their natal streams. This restriction was probably effective in providing protection to the majority of four year old Quilcene fish as they moved through northern Puget Sound.

Table 3. Age and mean total length of spring chinook spawned at Quilcene NFH, 1984.

Age	Male		Female	
	No.	Mean Length (mm)	No.	Mean Length (mm)
3	18	546	1	747
4	18	787	14	810
	36		15	

Three and four year old Cowlitz X Nooksack and five year old Hoodspout spring chinook are expected to return to Quilcene NFH in 1985. Closures of the terminal area are recommended to protect these fish. We believe a closure of Quilcene Bay (Washington Department of Fisheries Management Area 12A) to chinook fishing should be imposed from April 1 to June 30. The Quilcene River should remain closed to chinook fishing through September 30. Increased law enforcement effort is also needed. Snorkel surveys in 1984 indicate significant poaching during the spring chinook holding period. Additional length data will be collected in 1985 to reevaluate the effectiveness of the 30 inch maximum size limit. A maximum size restriction in the northern Hood Canal sport fishery may be necessary to provide adequate broodstock for Quilcene's spring chinook program.

Coho: Coho returns to Quilcene River and Bay are comprised primarily of hatchery fish plus some wild returnees. Returns to Quilcene NFH in 1983 were from a plant of 498,166 coho released on May 3, 1982 at 14/pound. Subyearling plants of 78,288 (474/lb.) and 244,165 (38/lb.) were released on March 6 and August 1, 1981, respectively. It is assumed that these subyearling plants did not contribute significant numbers of fish to the adult return. Jack returns in 1983 resulted from plants of 352,298 smolts (14/lb.) on May 6 and May 9, 1983.

Commercial and sport fisheries in Quilcene Bay and River target on these hatchery fish. During 1983, tribal fishermen caught 8,957 coho. Of this total, WDF's run reconstruction model allocates 6,842 coho to Quilcene NFH stock. The remaining catch is allocated to wild stock and to smolt plants (Dungeness stock) made by WDF into Tarboo Creek and the Little Quilcene River. The Quilcene River sport fishery took another 252 coho plus 256 jacks. (WDF catch statistics do not separate jacks by species so the jack catch cited here may include other species of salmon.)

The adult coho escapement to the hatchery was 5,602 fish (485 of these fish were passed upstream above the hatchery weir). The pattern of large jack returns was evident again this year (Table 4) with 6,550 jacks recorded at the hatchery. The broodstock needs plus the upper river escapement requirement is 800 fish, leaving approximately 4,800 adults and 6,550 jacks unharvested.

Table 4. Returns of coho adults and jacks to Quilcene NFH, 1979-83.

<u>Year</u>	<u>Adults</u>	<u>Jack</u>	<u>% Jacks</u>
1979	3,431	232	6.3
1980	3,422	2,110	38.14
1981	2,695	4,650	63.3
1982	4,644	2,191	32.0
1983	5,602	6,550	55.9

Some portion of these surplus coho could be caught in the sport fishery if it were allowed to open earlier. The traditional opening date is October 1. In 1983, at least 62% of the adults and 40% of the jacks had returned to the hatchery by September 26. This pattern of early returns is consistent with prior years. A September 1 opening date for the river sport fishery below Highway 101 would provide a much better opportunity to harvest these fish.

An earlier opening on September 1 could result in increased poaching of spring chinook. However, snorkel surveys last year (Appendix 1, Table 1) indicated that most of the spring chinook had migrated into the upper river by late August. This risk will be further reduced by our broodstock capture efforts. We plan on monitoring the movement of these fish again in 1985. If there are significant numbers of fish in the river in late August, we will capture them and move them into the hatchery.

Chum: During 1983, the hatchery reported an adult chum salmon escapement of 3,584 fish to the rack at Walcott Slough and another 128 chum salmon to the weir at the hatchery on the Big Quilcene River. This level of escapement provided the eggs required to meet the hatchery's fry program needs in addition to fulfilling two requests for off-station shipments of eggs.

Table 5 presents the age breakdown and mean fork lengths for both males and females that returned to Walcott Slough. We read scales from 31 percent of the fish returning to the rack at Walcott Slough. From this bio-sampling data we estimated the age composition of these fish to be 30, 69, and 1 percent for three, four, and five year olds, respectively.

Table 5. Age and mean fork length of chum salmon returns to Walcott Slough, 1983.

Age	Male			Female		
	No.	%	Mean Length (mm)	No.	%	Mean Length (mm)
3	583	36	674	491	25	645
4	1021	63	766	1453	74	704
5	<u>16</u>	1	773	<u>20</u>	1	714
Total	1620			1964		

Quilcene NFH began releasing a portion of its chum fry directly into the Quilcene River in 1980. This change was made to meet a Hood Canal Management Plan goal of transferring the returning adults from Management Area 12B to Area 12A. The adult chum which returned to the hatchery weir in 1983 were primarily three year olds (Table 6). These fish were from a release of 1,053,255 fed fry in 1981. We attribute the presence of four and five year old fish to juveniles that had escaped from the hatchery raceways during rearing of their respective broods and to wild fish.

Table 6. Age and mean fork length of chum salmon returns to the Quilcene Hatchery weir, 1983.

Age	Male			Female		
	No.	%	Mean Length (mm)	No.	%	Mean Length (mm)
3	68	81	686	33	76	647
4	11	13	737	11	24	725
5	<u>5</u>	6	771	<u>0</u>	--	--
Total	84			44		

In addition to the chum which were enumerated at Walcott Slough and the hatchery, a number of fish remained in the river below the hatchery. Foot surveys conducted by FAO, PNPTC and WDF provided an escapement estimate of 205 fish spawning in the river (Jim Ames, personal communication). We estimated a total escapement of 263 three year old fish to the Big Quilcene River. This number is derived by adding the number of three year olds observed at the hatchery rack (101) to the estimated number of three year olds in the river (162). We assumed that the age ratio of the fish sampled at the hatchery rack also applies to the fish in the river below the hatchery. If we assume all the three year olds in the river are from Quilcene NFH (there are undoubtedly some wild fish in the river but the number is unknown and probably small), survival of age three chum to the river was .02%. Survival of three year olds to Walcott Slough in the same year was considerably higher at .07%. Because of this apparent difference in survival rates, the transfer of the chum program to the river should be phased in over several years.

For fishery management purposes, WDF estimated the 1983 Quilcene chum run size at 17,571 fish entering Puget Sound. If the escapement is subtracted from this number, the estimated fishery contribution is 13,654. However, the WDF run reconstruction model assumes the timing of the Quilcene stock is similar to that of the Hoodspout stock. Rack returns and a mark-recapture study conducted by the PNPTC indicates that the Quilcene stock is later than the Hoodspout run. The Point-No-Point study indicates that only 55 percent of the Quilcene run was subject to the same exploitation rate as the Hoodspout stock. Therefore, contribution to the fisheries is less than 13,654. More accurate contribution and survival estimates will have to be developed through coded-wire tag (CWT) studies.

Without CWT data or a reconstruction model which accounts for run timing, our best means of monitoring and evaluating Quilcene NFH chum releases is through returns to the hatchery rack. Complete returns from the 1977-78 runs have been sampled and analyzed. The age and sex of these fish is shown in Table 7. The 1977 brood year returned from a plant of 4,799,670 fingerlings. These fingerlings were large, ranging in size from 390-176 per pound. Survival to the hatchery was low at .03%. The total plant of

1978 brood year chum was 4,231,655 fingerlings. Again, these fish were large (440-212/lb.) and survival to the hatchery rack was low (.01%). These rates of return are insufficient to maintain the run. These returns were obviously of concern to the hatchery manager and Olympia FAO. Other hatcheries were experiencing higher survival with releases of smaller fish. Beginning with the 1979 brood year, Quilcene NFH began releasing a portion of their chum production at a smaller size of 400-700 per pound. This plant consisted of 3,396,522 fry and fingerlings between 338-630 per pound. Although five year old fish from this plant have not returned, the survival of three and four year old fish to the hatchery increased to .1%. The 1980 brood year plant was smaller with 2,554,115 fry planted into Walcott Slough and the Quilcene River. All of these fish except a group 586,836 were planted at the target size of 400-700 per pound. Four year olds will return in 1984. Sampling of the 1984 return will provide additional data upon which to analyze the effects of the change in release size.

Table 7. Age and sex of 1977 and 1978 brood year chum at return to Quilcene NFH.

<u>Brood Year</u>	<u>Return Year</u>	<u>Age</u>	<u>Male</u>	<u>Female</u>	<u>Total</u>
1977	1980	3	182	457	639
	1981	4	278	355	633
	1982	5	21	19	40
		Total	481	831	1,312
1978	1981	3	5	17	22
	1982	4	56	98	154
	1983	5	21	20	41
		Total	82	135	217

Coded-Wire Tag Evaluations

Spring Chinook: Four groups of spring chinook were tagged at Quilcene NFH in 1984 (Table 8). These studies were directed at two objectives. The first is an evaluation of yearling vs. subyearling releases and the second dealt with the performance of the two crosses (north and south fork Nooksack) used in the program. Unfortunately, the discovery of the virus IHN at Cowlitz Hatchery has interrupted our brood stock development plans and it will not be possible to continue the stock comparison studies as originally planned. All spring chinook returning to Quilcene NFH will be used for spawning. If existing tagging information does demonstrate a significant advantage to one of the stocks, we will explore the option of infusing sperm from that stock.

Small numbers of CWT spring chinook returned to Quilcene in 1983 (Table 9). These fish were captured by seine in the river below the hatchery during August. Six jacks (two years old) from the first Cowlitz X Nooksack plant were captured. A four year old spring chinook from a release of Hoodspout

Table 8. Spring chinook tag groups processed at Quilcene NFH, 1983-84.

Purpose: Age at release and stock cross comparison
 Investigator: FAO-Olympia, USFWS
 Project Length: 4 years
 Year of Project: Third
 Brood Year: 1983

Subyearlings released during 1984

Tag Code:	5-14-26	5-14-54
Tag Date:	April 25-27, 30, 1984	April 23-25, 1984
Stock:	S.F. Nooksack X Cowlitz	N.F. Nooksack X Cowlitz
Size at Tagging:	200/lb.	180/lb.
Release Location:	Big Quilcene R.	Big Quilcene R.
Release Date:	June 4, 1984	June 4, 1984
Size at Release:	69.0/lb.	67.0/lb.
Number Marked Released:	51,560	52,789
Tag Retention Rate (%):	91.2	90.7
Number Unmarked Released:	0	97,603
Percent Marked at Release:	100	35.1

Yearlings to be released in 1985

Tag Code:	5-14-52	5-14-53
Tag Date:	April 20, 23, 1984	April 30 and May 1, 1984
Stock:	N.F. Nooksack X Cowlitz	S.F. Nooksack X Cowlitz
Size at Tagging:	180/lb.	200/lb.
Tag Retention (%)	91.9	87.9

Comments: FAO-Olympia was conducting a downstream migrant sampling program during release of code 5-14-26 and 5-14-54. The methods used by FAO included trapping, seining, and electroshocking. Results of this activity are described in a report evaluating outmigration patterns of fish released from Quilcene NFH (Kenworthy et al. 1985).

stock was also captured. The Hoodspout fish were released into the Quilcene River as subyearlings in September of 1980. This was the only CWT recovered from the Hoodspout group to date. A more thorough assessment of the CWT studies involving spring chinook stocks will be made when the recovery data is complete.

During the broodstock development stage, the spring chinook restoration program at Quilcene NFH is dependent upon maximum returns of adults to the facility. These returns will be significantly influenced by smolt quality and an appropriate release strategy. There is little information available to describe an optimum release strategy for spring chinook in Puget Sound. Current CWT evaluations are evaluating yearling and subyearling release strategies. However, recent evidence indicates juvenile salmon out-migration and seawater survival depends on the proper combination of a complicated set of biological factors. Additional CWT evaluations are needed to evaluate the effectiveness of using such smolt indicators as Na⁺-K⁺ ATPase activity and survival to saltwater challenge as a basis for release strategy.

Coho: No CWT studies were initiated on coho in 1983-84. Tags from previous studies were recovered at the Quilcene NFH weir. Both jacks and adults were sampled with 422 and 308 tagged fish recovered, respectively (Table 10). These evaluations are production group survival and contribution studies. Survival to the weir for the adult group was good (1.1%) providing the hatchery's egg needs plus surplus carcasses. Returns at age two (jacks) was higher than desired (Table 4). When final marine recovery information is available, these studies will be analyzed and total survival estimates developed. Final recovery data from the 1977-79 brood years is now available and is being analyzed. A report covering these studies should be available sometime in 1985.

Large numbers of jacks have returned to Quilcene NFH for several years. These fish have very limited value to the commercial and sport fisheries. At the completion of on-going coho evaluations, it would be desirable to analyze this problem. Another evaluation of interest would be the effects of the present scheme of selecting the largest adult coho for broodstock.

Other Evaluations and Activities

During 1984 we initiated a project to determine the rate of juvenile spring chinook migration, their incidence of residualism, and degree of predation on chum salmon. Post release out-migration patterns of spring chinook and chum salmon were monitored using a fyke trap and electrofishing gear. This was done to determine if any interactions or deviations from normal out-migration patterns occurred that could effect the survival of the immigrating juveniles. Results of this study and recommendations to reduce negative species interactions are reported by Kenworthy et al. (1985).

1/ Kenworthy, B., J. Meyer and R. Boomer. 1985. Quilcene National Fish Hatchery Outmigrant Evaluation Study. Fisheries Assistance Office, U.S. Fish and Wildlife Service, Olympia, Wash. 30 p.

Table 9. Spring chinook coded-wire tag recoveries at Quilcene NFH, 1983.

<u>Number Killed</u>	<u>Number Sampled</u>	<u>Sampling Rate (%)</u>	<u>Tag Code</u>	<u>Agency</u>	<u>Number Observed</u>	<u>Number Expanded</u>	<u>Age</u>	<u>Survival to Rack (%)</u>	<u>Origin</u>
23	23	100.0	5-7-20	USFWS	1	1	4	--	Big Quilcene R.
			5-10-33	USFWS	6	6	2	.02	Big Quilcene R.

Table 10. Coho coded-wire tag recoveries at Quilcene NFH, 1983.

<u>Number Killed</u>	<u>Number Sampled</u>	<u>Sampling Rate (%)</u>	<u>Tag Code</u>	<u>Agency</u>	<u>Number Observed</u>	<u>Number Expanded</u>	<u>Age</u>	<u>Survival to Rack (%)</u>	<u>Origin</u>
12,152	12,152	100.0	5-8-54	USFWS	308	308	3	1.1	Big Quilcene R.
			5-11-19	USFWS	422	422	2	1.4	Big Quilcene R.

MAKAH NFH

Coho, fall chinook, and chum salmon plus steelhead trout were reared and released at Makah NFH during the reporting period. Fish distribution as reported by the hatchery is presented in Table 11.

Terminal Area Returns

Coho and chum returning to the Sooes River in 1983-84 were comprised of hatchery and wild fish. The fall chinook which returned in 1983 were wild. A portion of these returns were captured in the Makah Tribal net fishery or at Makah NFH. All adult steelhead returning to the Sooes in 1983-84 were wild.

Coho. A plant of 187,000 coho smolts (12.7/lb.) was released into the Sooes River in 1982. These fish were relatively early returning Quilcene NFH stock. Their early timing overlaps the fall chinook run and the Makah Tribal net fishery remained closed during September and October to protect chinook. Fishing during November-January only took 45 coho. Closure of the net fishery to protect chinook resulted in a relatively large escapement of 2,523 hatchery and wild coho to the hatchery rack (Table 12). An additional unknown number of coho escaped past the weir. A later returning coho stock is now being used at Makah NFH in an attempt to reduce the overlap with fall chinook. This will allow the Makah Tribe to more effectively manage their net fisheries to take advantage of harvestable hatchery fish. The broodstock now being used are coho which return to Quinault NFH after early November.

Chum. Chum returning to the Sooes in 1983 were primarily wild plus some five year old hatchery fish. The hatchery fish returned from a plant of 1,000,000 fry at 275 per pound. Return rates for chum planted at this large size have been relatively low at Quilcene NFH. The tribal net fishery only took 46 chum with another 65 returning to the hatchery weir. The number of scale samples was too small to determine the return by age. The limited biological data indicated an average fork length of 685 mm for three year olds, 730 mm for four year olds and 741 mm for five year olds.

Coded-Wire Tagging Evaluations

To date, no on-station tagging has occurred at this facility. However, tagged coho from Quilcene NFH have been released into the Sooes River. Some of these fish were reared at Makah NFH before release. Tagged fish were released into the Sooes for seven consecutive years ending in 1982. The tagging was done to evaluate off-station releases from Quilcene NFH and to gather some information regarding expected contribution of eventual coho releases at Makah NFH. Unfortunately, this contribution information is of reduced value since another broodstock is now being used.

Tagged coho which returned this year were mark sampled by hatchery and FAO staff. Tag extraction and reading was done by FAO staff. The results of the tag extraction are presented in Table 13.

Table 11. Makah NFH fish distribution, 1983-84.

<u>Species</u>	<u>Stock</u>	<u>Brood Year</u>	<u>Release Location</u>	<u>Release Date</u>	<u>Number</u>	<u>No./lb.</u>	<u>Weight (lb.)</u>
Coho	Makah NFH <u>a/</u>	83	Waatch R.	3/28/84	100,686	582	173
			Village Cr.	3/28/84	30,264	582	52
			Agency Cr.	3/28/84	30,264	582	52
			Sail Cr.	3/28/84	97,786	582	168
	Quinalt NFH	82	Waatch R.	4/11/84	50,000	12.7	3,937
			Sooes R.	4/11/84	187,700	12.7	14,780
Fall Chinook	Sooes Hoko <u>b/</u>	83	Sooes R.	5/31/84	42,364	79	534
			Hoko R.	4/2/84	71,665	241	297
Steelhead	Sooes <u>c/</u>	82	Sooes R.	4/30/84	71,827	6.6	10,883
Chum	Sooes Walcott Slough	83	Sooes R.	4/9/84	48,218	143	337
			Sooes R.	4/18/84	854,940	548	1,560

a/ These fish were originally Quilcene stock.

b/ Cooperative program with the Makah Tribe.

c/ This release is a mixture of Quinalt NFH stock crossed with Sooes wild stock.

Table 12. Returns of salmon and steelhead (includes hatchery and wild fish) to Sooes River fisheries and hatchery, 1983-84.

<u>Species</u>	<u>Tribal Fishery <u>a/</u></u>	<u>Hatchery Rack</u>				<u>Total</u>
		<u>Males</u>	<u>Females</u>	<u>Unknown</u>	<u>Jacks</u>	
Coho	45	925	1,339	4	255	2,568
Chum	46	30	34	1		111
Chinook	2	18	14		5	39
Steelhead	111					111

a/ Reported by Makah Tribe.

Table 13. Makah NFH recovery of tagged coho, 1983.

<u>Number Killed</u>	<u>Number Sampled</u>	<u>Sampling Rate (%)</u>	<u>Tag Code</u>	<u>Agency</u>	<u>Number Observed</u>	<u>Number Expanded</u>	<u>Age</u>	<u>Survival to Rack (%)</u>	<u>Origin</u>
2,523	1,765	69.9	5-8-55	USFWS	67	96	3	1.3	Sooes R
			5-8-56	USFWS	173	247	3	1.3	Sooes R

Final recovery data are available for 1974-79 brood year releases into the Waatch and Sooes rivers. This information is being analyzed and will be reported sometime in 1985. No new tagging studies are planned at this time although it would be desirable to begin evaluations as soon as possible with chinook and coho.

QUINAULT NFH

Coho, fall chinook, and chum salmon plus steelhead trout were reared at Quinault NFH during the reporting period. Fish distribution as reported by the hatchery is presented in Table 14. Distribution of eggs is presented in Table 15.

Responsibility for programming and evaluation of Quinault NFH was assumed by the Quinault Tribe in 1985. Future evaluation reports will only present fish and egg distribution for this hatchery.

Terminal Area Returns

Fall Chinook. The return of fall chinook to Quinault NFH was below the station's egg needs again in 1983. Low rates of return for fall chinook have been a perennial problem since the facility began operations. Two hundred and seventy-two fish returned to the hatchery. Of this total, 63 were females (Table 16).

Releases from the 1978 brood year have now returned to the hatchery (except for six year old females which will return in 1984 and two year old males which were not bio-sampled in 1980). These fish resulted from a plant of 1,204,000 fingerlings planted in June and July of 1979. The total return to the hatchery was 134 fish of which 63 were females. This is a return to the hatchery of .01%. The age at return for this brood year is presented in Table 17. This low rate of return is attributable to a number of factors which have been discussed in a previous report (Wampler, 1983). Additional information regarding total survival and contribution from coded-wire tag recoveries is available through this office.

Coho. A total of 3,882 coho returned to Quinault NFH in 1983. Thirty-two percent or 1,230 were jacks. The adult coho returned from a plant of 684,467 fish at 13.6 per pound made on April 1, 1982. The return to the station was .39% (does not include jacks which returned in 1982). This is about twice the return rate observed at the hatchery from 1976-78. This increase in escapement to the hatchery rack may be attributable to a number of factors including marine survival, ocean fishing rates and terminal fishing patterns. Total survival estimates can be developed when CWT recoveries are available.

Chum. One thousand six hundred and sixty-nine chum returned to Quinault NFH in 1983. This is well below the number which returned in 1982 (3,074) but well above the 465 which returned in 1981. The mean fork length, age and sex composition of the run are shown in Table 18.

Table 14. Quinault NFH fish distribution, 1983-84.

<u>Species</u>	<u>Stock</u>	<u>Brood Year</u>	<u>Release Location</u>	<u>Release Date</u>	<u>Number</u>	<u>No./lb.</u>	<u>Weight</u>	<u>Tag Code</u>
Coho	Quinault NFH	82	Cook Cr.	4/6/84	708,151	14.4	49,179	5-14-55
			Salmon R.	4/3/84	422,400	12.2	34,623	
			Quinault R.	4/4/84	105,600	12.2	8,656	
	Quinault NFH	83	Quinault Tribe	5/1/84	537,693	197	2,729	B 5-8-2
			Makah Tribe	3/29/84	55,389	396	140	
Steelhead	Quinault NFH	83	Cook Cr.	5/1/84	156,690	6.7	23,387	5-14-56
			Hoh R.	5/1/84	5,000	7.2	694	21-16-15
			(Chalaat Cr.)					
		84	Hoh R.	5/1/84	36,747	7.2	5,104	5-14-61
			(Allens Bar)					
			Hatchery Cr.	3/16/84	31,494	2300	14	
			Cook Cr.	3/28/84	75,000	2300	33	
			Elk Cr.	3/29/84	236,667	2300	103	
			Red Cr.	3/29/84	236,667	2300	103	
			Moclips R.	3/29/84	236,667	2300	103	
Quinault R.	6/1/84	216,371	524	413				
(Amanda Pk)								
Chum	Quinault NFH	83	Cook Cr.	4/20/84	2,309,392	393	5,878	
Fall Chinook	Quinault NFH	82	Cook Cr.	9/1/83	311,000	24	12,669	
	Quinault NFH	83	Cook Cr.	8/2/83	181,843	30	6,061	

Table 15. Quinault NFH egg distribution, 1983-84.

<u>Species</u>	<u>Stock</u>	<u>Brood Year</u>	<u>Transfer Location</u>	<u>Date</u>	<u>Stage</u>	<u>Number</u>
Coho	Quinault NFH	83	Quinault Tribe	Nov.	Green	501,000
			Quinault Tribe	Dec.	Eyed	112,000
			Makah NFH	Dec.	Eyed	360,000
Steelhead	Quinault NFH	84	Makah NFH	Feb.	Eyed	102,600
			Quileute Tribe	Feb.	Eyed	25,000
			Suquamish Tribe	Feb.	Eyed	50,000
			Squaxin Tribe	Feb.	Eyed	70,000
			Puyallup Tribe	Feb.	Eyed	150,000
			Lummi Tribe	Feb.	Eyed	300,000
			Tulalip Tribe	Feb.	Eyed	100,000

Table 16. Age, sex, and mean fork length of fall chinook returns to Quinault NFH, 1983.

<u>Age</u>	<u>Male</u>			<u>Female</u>		
	<u>No.</u>	<u>%</u>	<u>Mean Length (mm)</u>	<u>No.</u>	<u>%</u>	<u>Mean Length (mm)</u>
2	35	17	411	0	--	--
3	107	51	647	2	3	740
4	62	30	830	30	48	855
5	5	2	874	27	43	963
6	<u>0</u>	--	--	<u>4</u>	6	967
Total	209			63		

Table 17. Age and sex of 1978 brood year fall chinook at return to Quinault NFH. 1/

<u>Return Year</u>	<u>Age</u>	<u>Male</u>	<u>Female</u>	<u>Total</u>
1981	3	30	1	31
1982	4	36	35	71
1983	5	<u>5</u>	<u>27</u>	<u>32</u>
Total		71	63	134

1/ Does not include two year old males which were not sampled in 1980 and six year olds which will return in 1984.

Table 18. Age, sex, and mean fork length of chum returns to Quinault NFH, 1983.

Age	Male			Female		
	No.	%	Mean Length (mm)	No.	%	Mean Length (mm)
3	203	29	729	299	31	668
4	434	61	795	581	61	727
5	72	10	816	78	8	736
6	<u>2</u>	1	--	<u>0</u>	--	--
Total	711			958		

Five year old chum from the 1978 brood year returned to Quinault NFH in 1983 completing returns for this brood year. The total return is 1,428 fish. The sex ratio and age is shown in Table 19.

These fish returned from a plant of 2,750,000 fingerlings (272-375/lb.) and 168,600 fry (884-909/lb.) in 1979. Since these plants were made, we have adjusted our target size at release to 400-700 per pound. The rate of return to the hatchery was .05%. Returns to the hatchery from the 1974-76 brood years were .13, .03, and .03 percent, respectively. Using this year's sex ratio, a higher rate of return to the hatchery than the .05% exhibited by the 1978 brood year will be required to maintain a self-sufficient run. However, higher rates of return are expected from recent plants at a more favorable size at release.

Table 19. Age and sex of 1978 brood year chum at return to Quinault NFH.

<u>Return Year</u>	<u>Age</u>	<u>Male</u>	<u>Female</u>	<u>Total</u>
1981	3	53	26	79
1982	4	457	742	1199
1983	5	<u>72</u>	<u>78</u>	<u>150</u>
Total		582	846	1428

Steelhead. The winter steelhead return to Quinault NFH in 1983-1984 was the largest on record with 4,603 adults and 29 jacks returning to the facility. Winter steelhead returned to the hatchery weir from late-November through late-March. The sex ratio and ages of the adults are shown in Table 20. Three year olds have been dominant in two of the past three years (Table 21). In 1981-82, 86% and 14% were age three and four, respectively. In 1982-83, only 25% were age three and 73% were age four. This year's return was comprised of 98% three year olds and only 1% fours.

Returns from the 1979 brood year are now complete. These fish originated from a release of 198,700 smolts planted at 6.6 per pound on April 30, 1980. Their survival to the hatchery rack was .65%. Excluding five year olds, survival of the 1980 brood release was much lower at .13%. These fish are from plants of 103,353 (9.4/lb.) and 98,953 (9.0/lb.) on March 27, and May 22, 1981, respectively. Complete CWT recoveries will allow an examination of these differences and a determination as to whether they carry over into total survival.

Coded-Wire Tagging Evaluations

Approximately 230,000 tagged fish were released at Quinault NFH during the reporting period (Table 22). Most of these fish were tagged at the request of the Quinault and Hoh tribes. FWS continued our evaluation of the low returns of fall chinook (tag codes 5-11-18 and 5-14-63). Information relative to the fish coded-wire tagged in 1983-84 is presented in Table 23.

Previous releases of tagged coho, winter steelhead and fall chinook returned this year as adults. Mark sampling of these groups was accomplished at a 100% rate. Results of the tag extraction are presented in Tables 24-26. Detailed analysis of complete marine and freshwater recoveries will provide estimates of survival and contribution. It is interesting to note in Table 26 the high number of recoveries of steelhead released from other facilities. Many of these strays are from the Quinault Tribe's facility on Lake Quinault. It is also interesting to note the number of recoveries from Quinault stock steelhead planted into the Hoh, Queets and Humptulips rivers. Contribution to the Quinault NFH weir was computed for each of these tagged groups from mark to unmarked ratios at release. This computation reveals that approximately 6% of the returns were from steelhead planted into other river systems.

Table 20. Sex, age and mean fork length of steelhead returning to Quinault NFH in 1983-84.

<u>Age</u>	<u>Male</u>			<u>Female</u>		
	<u>No.</u>	<u>%</u>	<u>Mean Length (mm)</u>	<u>No.</u>	<u>%</u>	<u>Mean Length (mm)</u>
2	29	1		0	--	--
3	2346	98	634	2190	98	621
4	16	1	804	47	2	763
5	<u>2</u>	1		<u>2</u>	1	
Total	2393			2239		

Table 21. Percentage age composition of steelhead returns to Quinault NFH.

<u>Age</u>	<u>1981-82</u>	<u>1982-83</u>	<u>1983-84</u>
2	< 1	1	< 1
3	86	25	98
4	14	73	1
5	0	1	< 1

Table 22. Summary of tag groups released from Quinault NFH, 1983-84.

<u>Species</u>	<u>Tag Code</u>	<u>Agency</u>	<u>Release Location</u>	<u>No./lb.</u>	<u>Number Marked Released</u>	<u>Number Unmarked Released</u>	<u>Percent Marked</u>
Winter Steelhead	21-16-15	Hoh	Chalaat Cr.	7.2	4,938	62	98.8
Winter Steelhead	5-14-56	QDNR	Cook Cr.	6.7	18,205	138,485	11.6
Winter Steelhead	5-14-61	Hoh	Hoh R.	7.2	36,048	699	98.1
Coho	85-8-2	QDNR	Quinault R.	197.0	84,725	452,968	93.1
Coho	5-14-55	QDNR	Cook Cr.	14.4	29,079	679,072	15.7
Fall Chinook <u>a/</u>	5-11-18	USFWS	Cook Cr.	24.5	50,460	260,540	16.2
Fall Chinook <u>b/</u>	5-14-63	USFWS	--	--	--	--	--

a/ Tagged last year and released this year.

b/ Will be released August/September, 1984.

Table 23. Salmon and steelhead tag groups processed at Quinault NFH, 1983-84.

Winter Steelhead

Tag Code: 21-16-15
Purpose: Harvest management
Investigator: Jim Jorgensen, Hoh Tribe
Project Length: Negotiable
Year of Project: First

Tag Date: January 26, 1984
Stock: Quinault NFH Brood Year: 1983 Size at Tagging: 15/lb.
Release Location: Chalaat Cr. (Hoh System) Release Date: May 1, 1984
Size at Release: 7.2/lb.

Number Marked Release: 4,938
Tag Retention Rate (%): 94.0
Number Unmarked Release: 62
Percent Marked at Release: 98.8

Winter Steelhead

Tag Code: 5-14-56
Purpose: Harvest management
Investigator: Larry Lestelle, QDNR
Project Length: Ongoing
Year of Project: 11th year

Tag Date: January 25, 1984
Stock: Quinault NFH Brood Year: 1983 Size at Tagging: 15/lb.
Release Location: Cook Cr. Release Date: May 1, 1984
Size at Release: 6.7/lb.

Number Marked Released: 18,205
Tag Retention Rate (%): 94.0
Number Unmarked Release: 138,485
Percent Marked at Release: 11.6

Comments: The stock has been tagged for 11 years. The first several years were processed for USFWS production evaluation reasons. The later years have been tagged by request of QDNR for harvest management reasons.

Winter Steelhead

Tag Code: 5-14-61
Purpose: Harvest management
Investigator: Jim Jorgensen, Hoh Tribe
Project Length: Being negotiated
Year of Project: Second

Tag Dates: January 25 - 26, 1984
Stock: Quinault NFH Brood Year: 1983 Size at Tagging: 15/lb.
Release Location: Allen's Bar (Hoh R.) Release Date: May 1, 1984
Size at Release: 7.2/lb.

Number Marked Released: 36,048
Tag Retention Rate (%): 93.1
Number Unmarked Released: 699
Percent Marked at Release: 98.1

Coho

Tag Code: 5-14-55
Purpose: Harvest management
Investigator: Larry Lestelle, QDNR
Project Length: Ongoing
Year of Project: Tenth

Tag Date: January 24, 1984
Stock: Quinault NFH Brood Year: 1982 Size at Tagging: 15/lb.
Release Location: Cook Cr. Release Date: April 6, 1984
Size at Release: 14.4/lb.

Number Marked Released: 29,079
Tag Retention Rate (%): 89.0
Number Unmarked Released: 679,072
Percent Marked at Release: 4.1

Comments: Many of the fish had scraped snouts. Fungus growths had started on most of those. We assume it was caused by the use of demand feeders.

Coho

Tag Code: B5-8-2
Purpose: Contribution and distribution of fry plant
Investigator: Larry Lestelle, QDNR
Project Length: Ongoing
Year of Project: First

Tag Dates: May 15-17, 1984
Stock: Quinault NFH Brood Year: 1983 Size at Tagging: 200/lb.
Release Location: Camp 7 (Quinault R.) Release Date: May 30, 1984
Size at Release: 197.0/lb.

Number Marked Released: 84,725
Tag Retention Rate (%): 93.1
Number Unmarked Released: 452,968
Percent Marked at Release: 15.7

Fall Chinook

Tag Code: 5-14-63
Purpose: Contribution and distribution of production releases
Investigator: FAO-Olympia, USFWS
Project Length: Ongoing
Year of Project: 11th year

Tag Dates: May 21 - 22, 1984
Stock: Quinault NFH Brood Year: 1983 Size at Tagging: 200/lb.
Tag Retention Rate (%): 92.2 Projected Release Location: Cook Cr.
Projected Release Date: August/September, 1984

Comments: Fish had to be sorted by size then tagged due to large size variation.

Table 24. Quinault NFH recoveries of CMT fall chinook, 1983.

<u>Number Killed</u>	<u>Number Sampled</u>	<u>Sampling Rate (%)</u>	<u>Tag Code</u>	<u>Agency</u>	<u>Number Observed</u>	<u>Number Expanded</u>	<u>Age</u>	<u>Survival to Rack (%)</u>	<u>Origin</u>
272	272	100.0	5-11-22	USFWS	12	12	2	.04	Cook Cr.
			5-8-36	USFWS	8	8	3	.01	Cook Cr.
			5-8-35	USFWS	5	5	3	.01	Cook Cr.

Table 25. Quinault NFH recoveries of CMT coho, 1983.

<u>Number Killed</u>	<u>Number Sampled</u>	<u>Sampling Rate (%)</u>	<u>Tag Code</u>	<u>Agency</u>	<u>Number Observed</u>	<u>Number Expanded</u>	<u>Age</u>	<u>Survival to Rack (%)</u>	<u>Origin</u>
3,882	3,882	100.0	5-10-30	USFWS	62	62	3	.18	Cook Cr.
			5-13-62	QDNR	17	17	2	--	Quinault R.
			5-12-61	USFWS	9	9	2	.03	Cook Cr.
			5-10-32	USFWS	2	2	3	--	Salmon R.
			5-13-61	QDNR	1	1	2	--	Raft R.

Table 26. Quinault NFH recoveries of CWT winter steelhead, 1983-84.

<u>Number Killed</u>	<u>Number Sampled</u>	<u>Sampling Rate (%)</u>	<u>Tag Code</u>	<u>Agency</u>	<u>Number Observed</u>	<u>Number Expanded</u>	<u>Age</u>	<u>Survival to Rack (%)</u>	<u>Origin</u>
4,624	4,624	100.0	5-10-31	USFWS	281	281	3	1.4	Cook Cr.
			5-9-57	QDNR	41	41	3	--	Lk. Quinault
			5-9-56	QDNR	38	38	3	--	Lk. Quinault
			5-9-55	QDNR	23	23	3	--	Lk. Quinault
			5-10-43	Hoh	16	16	3	--	Chalaat Cr.
			5-9-54	QDNR	13	13	3	--	Lk. Quinault
			5-9-61	Hoh	10	10	3	--	Chalaat Cr.
			5-9-58	QDNR	8	8	3	--	Salmon R.
			5-7-62	QDNR	3	3	4	--	Lk. Quinault
			5-10-42	USFWS	3	3	3	--	Hoh R.
			5-9-60	QDNR	3	3	3	--	Humtulis R.
			5-7-58	USFWS	2	2	4	.02	Cook Cr.
			5-6-26	USFWS	1	1	5	.01	Cook Cr.
			5-9-59	QDNR	1	1	3	--	Salmon R.
			5-10-44	Hoh	1	1	3	--	Chalaat Cr.
			5-7-63	QDNR	1	1	4	--	Salmon R.

Comments: A tribal sport fishery was opened in Cook Creek below the hatchery to harvest surplus winter steelhead. Although no sampling was done on the fishery, several USFWS staff have said that it appeared to be quite successful. We estimate that at least several hundred fish were taken.