

PROGRESS REPORT OF NATIONAL FISH HATCHERY
PROGRAMMING AND EVALUATION ACTIVITIES
PUGET SOUND AND COASTAL WASHINGTON, 1985-86

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INTRODUCTION

This report contains information regarding hatchery programming and evaluation activities at Makah and Quilcene National Fish Hatcheries (NFH) for the period, August 1, 1985 - July 31, 1986. This information has been compiled for use by the U.S. Fish and Wildlife Service (FWS) and other fishery resource agencies. More detailed information may be obtained from the Olympia Fisheries Assistance Office (FAO).

QUILCENE NATIONAL FISH HATCHERY

Spring Chinook

Restoration of Puget Sound spring chinook (SCS) continues to be a high priority program of the FWS. Working with state and tribal agencies, our goal is to restore particular stocks in Puget Sound to a level that will sustain direct harvest. The development of a SCS brood run at Quilcene NFH is an important part of the restoration program.

The hatchery reported releasing 204,355 yearling SCS in 1986. This release was comprised of 27,695 Quilcene stock at 24.2 fish/pound and 176,660 Soleduck stock (by way of Kendall Creek Hatchery) at 14.5 fish/pound (Table 1). There were no coded wire tag (CWT) groups included in the 1986 production release.

Terminal Area Returns, 1985: The hatchery reported a return of 68 males and 83 females, plus one SCS of undetermined sex, to their rack during 1985. This return was comprised of adults from releases for brood years 1980-82. Refer to Kenworthy (1986) for a description of total numbers, stock, time and size at release. Table 2 presents an estimate of the age and length of the 1985 SCS return to the Quilcene NFH rack. Approximately 98% of the return was biosampled.

Terminal Area Returns, 1986: During the spring of 1986 we monitored returning SCS adults in the Quilcene River by conducting snorkel surveys. Our objective was to estimate the abundance of returning adults and jacks, to describe their distribution, determine possible broodstock collection sites, and to document evidence of poaching.

The hatchery reported spring chinook began entering their holding pond on April 29. A snorkel survey of the river on that day observed 22 fish in the river. Counts of fish in the river and at the hatchery continued to increase through the spring and into mid summer (Table 3). By late July it was obvious from the snorkel survey data that the 1986 return would be approximately 1/3 of the Quilcene NFH escapement goal of 500 adults. Returning SCS did not accumulate in the hole below the hatchery as has occurred the past two return years. Other locations where small numbers of fish were observed to be concentrated were not easily accessible and a high percentage of the fish remaining in the

river appeared to be small males. We made no attempt to capture broodstock in the river during 1986.

It appears from the snorkle survey data that the timing of the 1986 return is approximately three weeks later (Figure 1) than the 1985 return. See Kenworthy (1986) for a description of the run timing of the 1985 return. This later run timing may be attributed to annual variation. We suspect that adults are lost to poaching in the Quilcene River. However, we are unable to document the magnitude of loss. As in past years, our snorkel surveys noted evidence of poaching. A gill net was observed early in the run and snagging gear was observed throughout the season. Also, the hatchery reported that several fish entering the holding pond had open wounds, apparently the result of snag hooks rather than injury due to seal predation. We recommend that a greater level of law enforcement be directed to protecting returning SCS in the Quilcene River.

Program Evaluation: We have made some observations regarding the length of Quilcene SCS at maturity based on the biodata collected at the hatchery rack. The average fork length of four-year-old fish at the Quilcene NFH rack in 1985 was 70.8 and 72.0 cm for males and females, respectively. This average size is considerably less than that observed for four-year-old fish at the rack in 1984, which was 78.7 cm and 81.0 cm for males and females, respectively. This difference in size may be indicative of a difference between the Hoodspout stock that returned as four-year-olds in 1984 and the SF Nooksack X Cowlitz stock that returned as four-year-olds this year or may simply be due to brood year differences. However, because of this relatively small size we are concerned that returning Quilcene SCS will not be adequately protected by the 30 inch maximum size limit used for sport caught chinook in the Strait of Juan de Fuca during the spring months. The 30 inch maximum size limit is designed to protect 80% of returning four-year-old fish. Our analysis of the biodata obtained at the rack, when corrected to total length according to the table given by the Pacific Marine Fisheries Commission (1951) shows that only 50% of the four-year-old fish would be protected.

Hatchery Rack: Only a limited amount of CWT recovery data for spring chinook released from Quilcene NFH is available at this time. Fish and Wildlife Service personnel mark sample the hatchery rack annually. During the 1985 return we recovered 19 tags from code 5-10-33 and one tag from code 5-14-19 (Table 4). This represents a 0.07% survival to the rack as four-year-olds for 5-10-33 and a less than 0.01% return to the rack for 5-14-19 as three-year-olds.

Fishery Recoveries: The Washington Department of Fisheries (WDF) and the Canadian Department of Fisheries and Oceans have reported recoveries of CWT spring chinook released from Quilcene NFH in sport and commercial fisheries (Table 5). Although some of the observed data have been expanded to final estimates, we consider the data to be preliminary at this time.

WDF reported 16 recoveries of tag code 5-10-33 during 1984-85 within Puget Sound. They did not observe any recoveries of this tag code in either the ocean sport or troll fisheries. Sport fishery recoveries of this tag code were reported from areas 7 and 12 during 1984 and areas 9, 10 and 12 in 1985. These sport recoveries occurred between December 1984 and May of 1985. Commercial fishery recoveries were observed in areas 8A and 10 in 1983 and areas 7 and 12 during 1985.

Canada reported 13 recoveries of tag code 5-10-33 during 1984-85 and 3 recoveries of tag code 5-14-19 during 1985. For tag code 5-10-33, sport catch recoveries occurred in Georgia Strait while commercial recoveries occurred in the Southwest Vancouver Island net and troll fisheries. For tag code 5-14-19, sport recoveries occurred in Georgia Strait and commercial catch recoveries occurred in the Northwest Vancouver Island troll fishery. No recoveries of any of the other Quilcene spring chinook have been observed in British Columbia fisheries.

Because of the limited amount of data available and its preliminary nature, very little analysis regarding either release strategy or stock influence is possible. However, some general observations can be made. For brood year 1981 CWT releases, fish represented by 5-10-33 survived better than those represented by 5-10-17. This group consisted of 152,245 N.F. Nooksack X Cowlitz stock released at 17.3 fish/pound. No recoveries from 5-10-17 have been made, indicating little or no survival. It is possible, however, that some recoveries of 5-10-17 may occur as five-year-old fish during 1986. This group was released prematurely when Quilcene NFH experienced a loss of water at their intake structure. Therefore, the group is not representative of a production release. No recoveries of tag codes 5-13-48 or 5-13-47 have been reported by Washington or Canada. These groups consisted of 217,833 S.F. Nooksack X Cowlitz stock released 3/20/84 at 12.5 fish/pound, and 109,764 N.F. Nooksack X Cowlitz stock released 3/20-21/84 at 9.6 fish/pound.

There is some indication in the recovery data that a difference in marine migration pattern exists between our yearling and subyearling releases. Although the data is limited and represents different brood years, yearlings released with tag code 5-10-33 apparently remained within Puget Sound, Georgia Strait, and the Strait of Juan de Fuca. However, subyearlings represented by tag code 5-14-19 apparently migrated out of Puget Sound to the ocean in the vicinity of the northwest coast of Vancouver Island. No Puget Sound recoveries of this tag code have been reported. However, this pattern of recovery may have been influenced by restrictions on chinook fishing in the 1985 Southwest Vancouver Island troll fishery and inadequate sampling of the B.C. sport fishery. Additional paired releases of yearlings and subyearlings are needed to corroborate our observation of yearling and subyearling migration patterns.

Coho

Coho production in 1986, as reported by the hatchery, included 542,480 yearlings in brood year 1984 at 19 fish/pound released directly into the Big Quilcene River (Table 1), 299,599 fed fry at 505 fish/pound transferred to the WDF (Table 6), and 90,000 eyed eggs transferred to Chimicum High School (Table 7).

This is the second year coho fingerlings have been transferred to WDF for release into under-seeded streams of Quilcene and Dabob Bays. WDF monitors escapement to index streams in the Hood Canal region. During 1985 they observed no adult coho escapement in either the little Quilcene River or Tarboo Creek, streams tributary to Quilcene and Dabob bays, respectively (Tim Flint, WDF, pers. comm.). We intend to conduct CWT evaluation of these fry plants when funds become available. At this time, however, their evaluation is below other priorities we have set for Quilcene NFH.

Terminal Area Returns, 1985: Coho returns provided sufficient spawners to meet program needs for 1985. The hatchery reported a total escapement to the rack of 1,200 fish. Of the total return, 42 males and 57 females were passed upstream to utilize the spawning habitat available above the hatchery. The 1985 adult return was represented by fish from the 1982 brood releases which consisted of 145,050 fed fry at 161 fish/pound, 21,756 fingerlings at 24.6 fish/pound and 271,035 yearlings at 14.5 fish/pound. The fingerlings were released in October as age zero fish and the yearlings were released in May. We assume that most of the returns are attributable to the production release of yearling fish that was made in May of 1983.

Accurate estimates of adult returns to the hatchery rack are needed by state and tribal harvest managers for the purpose of run reconstruction and post season analysis. Extremely small adult males and small bright females have, in the past, been inadvertently identified as jacks. Therefore, in an effort to estimate age composition of the 1985 coho return, we biosampled returning coho at the rack. Approximately 36% of the coho return was biosampled. We observed the mean fork length of females and males to be 521 mm and 589 mm, respectively (Table 8). The mean fork length of the jack coho was 334 mm. Based on an analysis of lengths of CWT coho for return years 1980, 1982 and 1983, we have recommended to the hatchery staff that a length of 430 mm be used to separate adult males and jacks (Kenworthy 1986). An analysis of the 1985 length data, however shows that 386 mm would have been the appropriate length for separation of adults and jacks this year. We anticipate that such annual variation will occur and its affect on accurately enumerating adult returns will be minimal if the hatchery continues to use 430 mm as a guide to separate jacks and adults.

Coho produced by Quilcene NFH returning to Puget Sound provide fishing opportunities to treaty and non-treaty fishermen. No CWT studies had been implemented for the 1983 brood release and we

therefore cannot provide any accurate estimates of contribution or survival. However, based on WDF's post-season run reconstruction estimate of Area 12A hatchery fish entering Puget Sound (Tim Flint, WDF, pers. comm.) and the hatchery escapement, we estimate that 10,598 Quilcene coho were caught in Puget Sound net fisheries. Approximately 5,122 and 221 of these fish were taken in Quilcene Bay and Quilcene River respectively. Some degree of error is present in this estimate because fish of hatchery and wild origin returning to the Big Quilcene River have been lumped together as hatchery fish for the purpose of reconstructing the Quilcene NFH run. In actuality, the wild fish included all those produced by naturally spawning adults, whether of hatchery or wild origin. There is no estimate of Puget Sound sport contribution for the 1983 brood. However, the preliminary sport catch estimate for Big Quilcene River is 71 fish (Hal Michael, WDF, pers. comm.).

Chum

The hatchery reported releasing 2,584,971 fed chum fry at a weighted average size of approximately 792 fish/pound into the Quilcene River (Table 1). This release consisted of fish spawned at Quilcene NFH and Walcott Slough. Since we now intend to maintain the chum brood run at the Quilcene NFH rather than at Walcott Slough, no chum were released at the Slough in 1985. The 1984 brood release was the last production release made at Walcott Slough.

Terminal Area Returns, 1985: Large numbers of chum salmon escaped to Walcott Slough and the Quilcene River during 1985. The hatchery used adults spawned at both locations for its broodstock. They reported that 999 males and 1,152 females were spawned at Quilcene NFH, and 2,329 males and 2,333 females were spawned at Walcott Slough. Chum returns to Quilcene NFH were sufficient to meet station production needs. Requests to provide eggs for the Makah NFH, Makah Tribe, and the Quileute Tribe were met from spawn taken at Walcott Slough (Table 7).

The rack counts do not reflect the total escapement to either location since weir operation was discontinued when egg requirements were met. We observed surplus escapement at both locations after trapping was discontinued. A foot survey of the Quilcene River on December 27, approximately one week after the hatchery ladder was shut off, revealed 1,795 adult chum. Approximately 10% of these were dead. The hatchery terminated spawning at Walcott Slough December 24 and at that time we estimated 1,000 adult chum remained outside the trap.

Program Evaluation: We have developed estimates of age at return and mean fork length for fish returning to both Walcott Slough (Table 9) and the Quilcene NFH (Table 10) based on biodata obtained from fish sampled at each location. The biodata is used to monitor fish length and, in lieu of CWT data, monitor relative rates of return to the rack for each brood release to

provide a gross estimate of survival. The estimates of survival based on the 1985 biodata are conservative, however, because the rack counts do not reflect the total escapement at either location. Additionally, we have made several assumptions for the analysis which are possible sources of error. We have assumed that no difference in return timing exists between age class at Quilcene NFH. This assumption is based on a cursory examination of the biodata collected at Walcott Slough that shows no apparent difference in run timing between three and four-year-old fish returning to that location during 1985. Several more years of biodata collected across the entire run at Quilcene NFH are needed, however, to determine if a difference in timing between age class exists in the run returning to the Big Quilcene River. We also assumed that fish released from both locations are subject to the same rate of harvest. Directed chum fisheries primarily occur in the Strait of Juan de Fuca and Hood Canal where these fish would be comingled.

An analysis of the length data shows no significant difference in fish size between locations but, we note improved survival for chum fry released at Quilcene NFH. This was indicated by a 0.15% return of the 1982 brood as three-year-old fish (Table 11). Rate of survival to the rack for past releases into the Quilcene River had not been encouraging and seemed to indicate a differential rate of survival between release locations because of reasons not yet identified. These might include predation, conditions at the estuary, disease or release strategy. Chum salmon released at Quilcene NFH for the 1980 and 81 brood survived at a lower rate than cohorts released at Walcott Slough. The average return to the rack for the 1980 and 1981 brood releases was 0.08% (Table 12). Average return to the rack at Walcott Slough for these same brood releases was 0.20% (Table 13). Both these return rates are based on ages three and four only. An average return to the rack of 0.10% is required to maintain the brood run.

We strongly recommend that the hatchery continue releasing fed chum fry at a size of 700 to 400 fish/pound. During our analysis of the 1984 rack returns we attributed an observed increase in return to the rack at Walcott Slough to be indicative of increased survival due to the initiation of a strategy of releasing fish at 700-400/pound rather than the previously recommended 200 fish/pound; see Kenworthy (1986) for more details.

Chum salmon produced by Quilcene NFH contribute to commercial net fisheries in Puget Sound and Hood Canal. We have developed an estimate of this contribution using information developed by WDF in their run reconstruction model. The WDF model predicted 11,497 fish of Walcott Slough origin returning to Puget Sound (Jim Ames, WDF, pers. comm.). This was based on chum production released at Walcott Slough only. By subtracting the rack return at Walcott Slough and the estimated number of fish observed at the Slough after spawning was terminated, we get a fishery contribution estimate of 5,835 fish. Accurate estimates of

escapement are required for the model to work with any degree of confidence. Reconstruction of the Quilcene NFH run is subject to a high degree of error because of the difficulty in enumerating hatchery and wild escapement and the high number of hatchery fish remaining in the river. We can not be confident in developing estimates of contribution due to this error and therefore have not done so for the fish released at Quilcene NFH.

Estimates of contribution by the Walcott stock to Canadian fisheries are unknown. Studies utilizing CWT half tags or genetic stock indexing techniques are needed for the proper evaluation of Quilcene chum in terms of fishery contribution, survival, and run timing.

MAKAH NATIONAL FISH HATCHERY

Restoration of coastal stocks of salmon and steelhead are a high priority of the FWS. The FWS and the Makah Tribe work closely towards this goal. As part of this effort, the Tribe did not conduct any directed Sooes River fisheries on fall chinook (FCS), chum, or coho salmon during 1985 to ensure maximum hatchery escapement. A directed Tribal fishery on steelhead occurred because the run was strong enough to sustain a harvest without impacting hatchery broodstock needs or other species.

Fall Chinook

Restoration of the Sooes River FCS stock continues to be the number one priority at the Makah NFH. The hatchery reported releasing 160,722 FCS fingerlings at 79.5 fish/pound into the Sooes River at the hatchery and 14,645 presmolt fingerlings at 337 fish/pound into the upper Sooes River watershed (Table 14). The presmolt release program, agreed to by the Makah Steering Committee, is designed to mitigate for the loss of natural production since the hatchery diverts all returning FCS into its facility for broodstock.

Terminal Area Returns, 1985: The return of FCS to Makah NFH showed a promising increase over past years. The hatchery reported a total of 399 fish returning to the rack. We biosampled 78% of the fish and observed the run to be comprised of 37% two-year-old, 45% three-year-old, 15% four-year-old, and 3% five-year-old fish. Table 15 presents an estimate of the 1985 Makah NFH FCS return by sex, age, and mean fork length.

Fish representing the two through four-year-old age classes include returns of hatchery origin. Undoubtedly wild fish of these ages are also represented in the 1985 return. Three-year-old fish are expected from a hatchery release of 193,219 fingerlings at 82 fish/pound. Two-year-olds from a hatchery release of 42,364 fingerlings at 79 fish/pound and the four-year-old fish from a release of 68,948 fingerlings at 129 fish/pound were also expected to return. The relatively high rate of return

for the two and three-year-old fish may be an indication of good survival for these two broods and, if recent restrictions in the marine harvest of chinook afford this stock any degree of protection, we may anticipate higher levels of escapement to the hatchery.

Program Evaluations: During 1986 the Service initiated CWT studies to evaluate the survival and contribution of FCS produced at Makah NFH. These studies are designed to (1) assess the fishery distribution and survival of FCS production releases made by the Makah NFH directly into the Sooes River (Table 16), and (2) assess the fishery contribution and survival of FCS fingerlings released as presmolts into the upper Sooes River watershed (Table 17).

Coho

The hatchery reported releasing 50,000 and 256,000 coho yearlings at 17.9 fish/pound into the Waatch and Sooes rivers, respectively (Table 14). They also provided the Makah Tribe with 213,241 fed fry. The Tribe planted the coho fry into under-seeded streams on the Reservation (Table 18).

Terminal Area Returns, 1985: The 1985 coho escapement to the rack provided sufficient broodstock to meet program production goals. The hatchery reported a total of 797 adults (367 males and 430 females) and 2977 jacks returned in 1985. Of this return the hatchery staff passed 41 males and 21 females upstream. The three-year-old adults were from a release of 187,700 yearlings at 12 fish/pound. The two year-old jacks were from a release of 257,091 yearlings at 11.7 fish/pound.

Program Evaluation: No evaluations using CWT have been conducted on Makah NFH coho production. The FWS intends to begin implementing such studies beginning with the 1985 brood.

Chum

The FWS, through the Makah Steering Committee, has made a concerted effort to restore chum salmon to the Sooes River using the Walcott stock transferred from Quilcene NFH. The hatchery reported releasing 2,351,900 fed chum fry at approximately 476 fish/pound (Table 14). The majority of this release was Walcott stock. Transfers of the Walcott stock to Makah NFH began with the 1983 brood. We anticipate the first returns of three-year-olds in 1986.

Terminal Area Returns, 1985: The hatchery reported a total of 136 chum adults handled at the rack. Of this total 67 were males and 69 females. Table 19 presents an estimate of the age and length of the 1985 return.

Program Evaluation: We intend to continue biosampling at the rack to monitor trends in length and to identify age at return of the various broods released. Relative rates of return to the rack will aid in determining the appropriateness of using Walcott stock at Makah NFH.

Steelhead

The hatchery reported releasing 64,477 and 16,050 steelhead yearlings at five fish/pound into the Sooes and Waatch rivers, respectively, in 1986 (Table 14). Approximately 50% of the combined release consisted of eggs transferred from Quinault NFH. The remaining fish were spawned from broodstock that returned to the hatchery rack during the 1984-85 season. The hatchery also reported that 228,020 steelhead fingerlings from broodyear 1986 were provided to the Makah Tribe (Table 20). Of this total, 29,820 fingerlings were transferred to the Tribe's Hoko rearing pond for further rearing and the remaining 198,200 were released into the Waatch River at approximately river mile seven.

Program Evaluation: During 1985-86 we began an effort to evaluate the Makah NFH steelhead program. Our objective for the evaluation was to determine the rate of survival for Makah hatchery steelhead, their contribution to the Sooes River Indian gill net fishery and the run's relative time of entry to the river. The hatchery had begun annual releases of steelhead smolts in 1983. Since this was a new program, we needed to begin developing data to determine how well the program was working and establish a baseline of data for evaluation of future brood releases. Furthermore, we were interested in determining if the Makah NFH steelhead program was adversely impacting the Sooes River wild steelhead run.

We based our evaluation on the analysis of biodata collected in two major recovery strata: the Sooes River Indian gill net fishery and the Makah NFH rack. We anticipated that adults from the 1982 and 1983 brood releases would return during the 1985-86 steelhead season. These releases consisted of 33,553 fish at 9.5 fish/pound and 72,827 fish at 6.6 fish/pound, respectively. The Makah Tribe provided us with the biodata they collected from steelhead sampled in the fishery and the daily catch data. The Makah NFH collected biodata from steelhead sampled during spawning at the hatchery. FAO-Olympia read the scales and had Bob Leland of the Washington Department of Game verify the readings.

Our analysis assumes that no Makah NFH steelhead were caught in the ocean and that all returning hatchery fish were of Sooes River origin. Without the benefit of CWT, however, the validity of either assumption is impossible to confirm. Furthermore, we did not collect any biodata from the sport catch in the river and assume that because of the low sport effort and presumably low catch this additional data would have minimal impact on the

results. In the future, however, it may be necessary to sample the sport catch in order to determine contribution to the sport fishery.

Tribal Gill Net Fishery. The Makah Tribal net fishery occurred between December 1 and February 23. We stratified the catch by week beginning on Monday, January 6 and ending on Sunday, February 23. Catch was recorded for two days in December and was therefore pooled. No biosampling occurred during December or during the weeks of January 27, February 3, and February 10. Therefore it was necessary to extrapolate the age, sex, and origin during those periods. We apportioned the December catch by the ratio of each category observed during the week of January 6 through 12. For the week of January 27 we apportioned the catch by the ratio of each category observed during the week of January 20. For the weeks of February 3 and February 10, we apportioned the catch by the ratio of each category observed during the week of February 17.

The Makah Tribal gill net fishery caught a total of 1,169 steelhead. Hatchery fish comprised the major portion of the catch. Based on 15% of the catch sampled, approximately 95.5% (1,117 fish) were of hatchery origin; the remaining 4.5% (52 fish) were of wild origin (Table 21). The age composition varied between the wild and hatchery components of the catch. Age three fish predominated in the hatchery component of the catch. The age composition of the hatchery fish was 89.8% three-year-olds (2-salt marine life history) and 10.2% four-year-olds (three-salt marine life history). In the wild fish component, age four fish predominated with some five-year-old fish observed. The age composition of the wild fish was 3.8%, 71.2% and 25.0% three, four, and five-year-old fish, respectively. A 2-salt marine life history characterized both three and four-year-old fish, whereas five-year-old fish were repeat spawners. We did not observe any wild fish with a three-salt marine life history.

Only a slight difference in size was observed between hatchery and wild fish in our sample. The average fork length of the hatchery fish caught in the net fishery was 662mm whereas the average length of wild fish was 669 mm. The larger average size of the wild fish was most likely due to the presence in our sample of two large five-year-old females that were repeat spawners. However, between age classes 2-salt hatchery fish were larger than two-salt wild fish.

Makah NFH Rack. During the 1985-86 season, the hatchery reported that 593 steelhead returned to the rack. Of this total, 268 fish were either spawned or killed by the hatchery and 325 fish were passed upstream. Of the fish passed upstream, 261 were determined to be wild fish by the hatchery staff on the basis of dorsal fin condition. Prior to implementing the plan of sorting hatchery and wild fish on the basis of dorsal fin condition, however, 64 fish had been passed upstream. We assume that this group were of hatchery origin because they entered the hatchery prior to January 6, when hatchery fish predominated.

The hatchery staff biosampled approximately 96% (256 fish) of the fish killed at the rack (Table 22). Only one wild fish, an age-five female, was observed in this group. Based on the hatchery rack biodata, the age composition of the fish returning to the Makah NFH rack was 0.6%, 89.0%, 10.0%, and 0.3% for two, three, four and five-year-old fish, respectively. The average fork length of adults of hatchery origin observed at the rack was 621 mm.

The peak catch of Makah NFH steelhead (based on analysis of biodata collected in the fishery) occurred during the third week of January (Figure 2). A sharp decline in total catch was noted after this time. Wild steelhead were observed in the catch beginning the week of January 12 and were observed in small numbers throughout the remainder of the fishery. We do not have sufficient data to estimate the peak entry of the wild stock since the fishery ended February 22 and the hatchery discontinued trapping on February 26. No spawning ground surveys were conducted above the hatchery to estimate the total wild escapement. We presume that the wild stock would continue to return through April.

The estimated contribution to the fishery from the 1982 (four-year-olds) and 83 (three-year-olds) brood releases was 0.34% and 1.38%, respectively (Table 23).

We have no information regarding the three-year old contribution or escapement of the 1982 brood release and four-year-old fish from the 1983 brood will not return until the 1986-87 season. Therefore, we can not estimate total survival for either brood year.

We are interested in ensuring that the Makah NFH steelhead program has a minimum impact on the Sooes River wild stock. Our principal objective is to maintain temporal separation between the two stocks. This would allow river net fisheries to target on hatchery fish and reduce the possibility of hatchery fish interbreeding with the wild stock or displacing the them in natural habitat. The data, at this time, indicates that there is fairly good separation in timing between the two stocks. We observed a peak catch of hatchery fish in mid-January while observing a relatively low catch of wild fish during this period. However, we have no data regarding the number of wild fish that returned after February and therefore can not describe the magnitude of the wild run or its specific timing.

The following recommendations have been developed regarding the operation of the Makah NFH steelhead program and its evaluation:

1. Continue biosampling efforts at the Makah NFH rack and in the Sooes River net fishery. This will provide the data necessary to estimate fishery contribution and total survival of Makah NFH steelhead; monitor trends in fish size, age composition, and run timing; and estimate the number of wild fish caught in the fishery.

2. Mark all Makah NFH steelhead releases into the Sooes River with an adipose clip and all Waatch River releases with a combination adipose-left ventral fin clip. Fin marking hatchery releases will enable fish samplers and hatchery staff to readily separate hatchery and wild stock. Additionally, distinct fin marks would allow an estimation of straying of Waatch River releases back to the Sooes River. Information regarding the marking of the 1984 brood steelhead released into the Sooes River is presented in Table 24. The 1984 brood released into the Waatch River were not marked.

3. Trap all returning steelhead escapement at the hatchery rack through April 1. This would require operation of the hatchery weir and fish ladder until this date. Hatchery and wild steelhead would be sorted at the rack by the hatchery staff; wild fish would be passed upstream and hatchery fish returning prior to February 1 would be spawned. This is the date now being used to separate hatchery and wild stock. Hatchery fish returning after February 1 would be surplused. Data generated by monitoring the steelhead escapement through April 1 would enable us to make a better estimate of the hatchery and wild stock run timing, determine the extent of overlap between the two stocks, establish a more definitive cut-off date for spawn taking operations, and accurately enumerate hatchery and wild escapement. Additionally, by preventing the escapement of hatchery adults upstream to spawn we can minimize the potential for any adverse impact on the wild stock.

REFERENCES

- Kenworthy, B. 1986. Progress report of national fish hatchery programming and evaluation activities, Puget Sound and coastal Washington, 1984-85. Fisheries Assistance Office, U.S. Fish and Wildlife Service, Olympia, Washington.
- Pacific Marine Fishery Commission. 1951. A table to convert chinook salmon fork length (F.L.) measurements in centimeters to total length (T.L.) measurements in inches. Pacific Marine Fishery Commission Bulletin 2.

Table 1. Record of Quilcene National Fish Hatchery salmon releases made into the open waters of Washington State during 1986.

<u>Species</u>	<u>Stock</u>	<u>Brood Year</u>	<u>Date</u>	<u>Number</u>	<u>Size (No/lb)</u>	<u>Weight (lbs)</u>
Spring Chinook	Quilcene NFH	84	5/14/86	27,695	24.2	1,144
	Soleduck	84	5/14/86	176,660	14.5	12,183
Coho	Quilcene NFH	84	5/14/86	105,039	19.5	5,387
	Quilcene NFH	84	5/15/86	437,441	19.0	23,023
Chum	Quilcene NFH	85	5/9/86	1,345,552	822.0	1,637
	Quilcene NFH	85	5/8/86	289,453	769.0	376
	Walcott	85	5/8/86	594,855	736.0	809
	Quilcene NFH	85	5/19/86	355,111	487.0	729

Table 2. Estimated returns of spring chinook during 1985 to the Quilcene National Fish Hatchery. 98% sampled.

<u>Age</u>	<u>Male</u>		<u>Female</u>	
	<u>Expanded Number</u>	<u>Mean Fork Length (mm)</u>	<u>Expanded Number</u>	<u>Mean Fork Length (mm)</u>
3	5	585	0	--
4	62	708	70	720
5	2	818	13	847
Totals	68		84	

Table 3. Counts of brood year 1986 spring chinook (all ages) in the Quilcene River and Quilcene National Fish Hatchery. Counts in the river are estimates based on snorkel observations.

<u>Count</u>	<u>4/29</u>	<u>5/28</u>	<u>6/6</u>	<u>6/24</u>	<u>7/11</u>	<u>7/23</u>	<u>8/8</u>
Hatchery	2	5 ^{1/}	14 ^{3/}	28	89	117 ^{4/}	156
River	<u>22</u>	<u>23</u> ^{2/}	<u>56</u>	<u>68</u>	<u>71</u>	<u>63</u>	<u>47</u>
Totals	24	28	70	96	160	180	203

1/ Hatchery count made on 5/30.

2/ Visibility in the river was extremely poor.

3/ Hatchery count made on 6/9.

4/ Hatchery count made on 7/18.

Table 4. Spring chinook coded-wire tag recoveries at Quilcene National Fish Hatchery, 1985.

<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>
148	148	100.0	5-14-19	USFWS	1	1	3	< 0.01	Big Quilcene R.
			5-10-33	USFWS	19	19	4	0.07	Big Quilcene R.

Table 5. Estimated and observed recoveries (observed recoveries in parenthesis) of tag codes 5-10-33 and 5-14-19 released from Quilcene National Fish Hatchery.

Tag Code 5-10-33								
Brood Year: 1981			Date Released: May 9, 1983			Number Released: 155,051		
Stock: SF Nooksack X Cowlitz			Size at Release: 11.9			No. Tagged Released: 28,442		
Washington						British Columbia		
Recovery Year	Puget Sound Sport	Puget Sound Net	Ocean Sport	Ocean Troll	Hatchery Rack	Georgia Str Sport	SW Van Is Net	SW Van Is Troll
1983	0	10(2)	0	0	6(6)	0	0	0
1984	(3)	(3)	0	0	2(2)	17(4)	4(1)	0
1985	(8)	0	0	0	19(19)	3(1)	4(1)	24(6)

Tag Code 5-14-19								
Brood Year: 1982			Date Released: June 3, 1983			Number Released: 51,928		
Stock: SF Nooksack X Cowlitz			Size at Release: 92.1			No. Tagged Released: 46,505		
Washington						British Columbia		
Recovery Year	Puget Sound Sport	Puget Sound Net	Ocean Sport	Ocean Troll	Hatchery Rack	Georgia Str Sport	SW Van Is Net	SW Van Is Troll
1985	0	0	0	0	1(1)	3(1)	0	10(2)

Table 6. Fingerling releases of brood year 1985 Quilcene National Fish Hatchery coho made by Washington Department of Fisheries into various streams of the Northeast Olympic Peninsula. 1/ All releases were made on 4/21 at a size of 505/lb.

<u>Location</u>	<u>Number 2/</u>	<u>Lbs.</u>
Little Quilcene R.	104,500	207
Tarboo Creek	96,500	191
Little Tarboo Creek	22,200	44
Chimacum Creek	56,100	111
Naylor Creek	7,600	15
Totals	286,900	568

1/ Any discrepancies between numbers of fry transferred by the hatchery and number of fish actually planted by WDF are attributed to differences in weighing techniques and rounding methods.

2/ Number rounded to the nearest 100 by WDF.

Table 7. Record of egg transfers made by the Quilcene National Fish Hatchery, 1986. All were for Brood Year 1985.

<u>Species</u>	<u>Stock</u>	<u>Release Location</u>	<u>Date</u>	<u>Number</u>	<u>Stage of Development</u>
Coho	Quilcene NFH	Chimicum High School	1/23/86	90,000	Eyed eggs
Chum	Walcott Sl.	Quileute Tribe	12/18/85	407,500	Green eggs
	Walcott Sl.	Makah Tribe	12/23/85	465,000	Green eggs
	Walcott Sl.	Makah Tribe	12/24/85	525,000	Green eggs
	Walcott Sl.	Makah NFH	2/4/86	937,750	Eyed eggs
	Walcott Sl.	Makah NFH	2/21/86	1,352,750	Eyed eggs

Table 8. Estimated return of coho salmon during 1985 to the Quilcene National Fish Hatchery. 36% sampled.

<u>Age</u>	<u>Male</u>		<u>Female</u>		<u>Total Number In Age Class</u>
	<u>Expanded Number</u>	<u>Mean Fork Length(mm)</u>	<u>Expanded Number</u>	<u>Mean Fork Length(mm)</u>	
2	65	334	0	-	65
3	484	571	651	589	1,135
Totals	549		651		1,200

Table 9. Estimated return of chum salmon during 1985 to the Walcott Slough trap. 14% sampled.

<u>Age</u>	<u>Male</u>		<u>Female</u>		<u>Total Number In Age Class</u>
	<u>Expanded Number</u>	<u>Mean Fork Length(mm)</u>	<u>Expanded Number</u>	<u>Mean Fork Length(mm)</u>	
3	971	678	1,144	631	2,115
4	1,316	748	1,170	693	2,486
5	42	773	19	710	61
Totals	2,329		2,333		4,662

Table 10. Estimated return of chum salmon during 1985 to Quilcene National Fish Hatchery. 14% sampled.

<u>Age</u>	<u>Male</u>		<u>Female</u>		<u>Total Number In Age Class</u>
	<u>Expanded Number</u>	<u>Mean Fork Length(mm)</u>	<u>Expanded Number</u>	<u>Mean Fork Length(mm)</u>	
3	676	691	847	641	1,523
4	308	734	281	695	589
5	15	760	24	737	39
Totals	99		1,152		2,151

Table 11. Percent return of chum salmon to Walcott Slough and Guilcene National Fish Hatchery, 1985.

Brood Year	Release Site	Release Number	Size at Release	Age at Return	Number Return	% Return To Rack
1982	Walcott Sl.	1,644,865	763 ^{1/}	3	2,115	0.13
	Guilcene R.	995,738	696	3	1,523	0.15 ^{3/}
1981	Walcott Sl.	2,210,040	517	4	2,486	0.11
	Guilcene R.	1,474,949	502 ^{2/}	4	589	0.04 ^{3/}
1980	Walcott Sl.	1,500,860	561	5	61	(0.01
	Guilcene R.	1,053,255	537	5	39	(0.01 ^{3/}

^{1/} Weighted average size of fed fry only; approximately 618,050 fry (38%) were released unfed.

^{2/} Weighted average size of fed fry only; 414,540 fry (28%) were released unfed.

^{3/} Does not include estimate of escapement to the river.

Table 12. Estimated survival by sex and age of 1980-82 brood chum at return to Guilcene National Fish Hatchery.

Brood Year	Number Released	Return Year	Age	Male	Female	Total Return	% Return To the Rack
1980	1,053,255	1983	3	68	33	101	0.01
		1984	4	638	408	1,046	0.10
		1985	5	15	24	39	0.01
		Totals		721	465	1,186	0.11
1981	1,474,949	1984	3	270	99	369	0.03
		1985	4	308	281	589	0.04
		Totals		578	380	958	0.06
1982	995,738	1985	3	676	842	1,518	0.15

Table 13. Estimated survival by sex and age of 1979-82 brood chum at return to Walcott Slough.

Brood Year	Number Released	Return Year	Age	Male	Female	Total Return	% Return To the Rack
1979	3,398,926	1982	3	155	352	507	0.01
		1983	4	1,021	1,453	2,474	0.07
		1984	5	193	77	270	0.01
		Totals		1,369	1,882	3,251	0.10
1980	1,500,860	1983	3	583	491	1,074	0.07
		1984	4	1,729	1,611	3,340	0.22
		1985	5	42	19	61	0.01
		Totals		2,354	2,121	4,475	0.30
1981	2,210,040	1984	3	1,408	1,186	2,594	0.12
		1985	4	1,316	1,170	2,486	0.11
		Totals		2,724	2,356	5,080	0.23
1982	1,644,865	1985	3	971	1,144	2,115	0.13

Table 14. Record of salmon and steelhead releases made by the Makah National Fish Hatchery into the open waters of Washington State, 1986.

Species	Stock	Brood Year	Location	Date	Number	Size No/lb	Weight (lbs)
Fall Chinook	Sooes	85	Sooes R.	5/27/86	160,722	79.5	2,022
	Sooes 1/	85	Sooes R.	4/17/86	14,645	337.0	43
Coho	Makah NFH	84	Sooes R.	4/22/86	256,000	17.9	14,302
	Makah NFH	84	Waatch R.	4/23/86	50,000	17.9	2,793
Chum	Combined Sooes and Walcott	85	Sooes R.	4/29/86	926,000	470.0	1,970
		85	Sooes R.	5/5/86	1,425,900	480.0	2,969
Steelhead 2/	Combined Sooes and Quinault	85	Sooes R.	4/16/86	64,477	5.0	12,895
		85	Waatch R.	4/16/86	16,050	5.0	3,210

1/ Released upstream from hatchery at river miles 6.6, 8.0 and 13.4.

2/ Steelhead released into Sooes River were 100% adipose-clipped.

Table 15. Estimated return of fall chinook salmon during 1985 to Makah National Fish Hatchery. 78% sampled.

Age	Male		Female		Total Number In Age Class
	Expanded Number	Mean Fork Length (mm)	Expanded Number	Mean Fork Length (mm)	
2	146	430	0	-	146
3	173	731	7	784	180
4	37	838	23	862	60
5	0	-	12	951	12
Totals	356		42		398

Table 16. Makah National Fish Hatchery fall chinook production release tag groups processed during FY'86.

Purpose: Assess survival and contribution of production release from Makah
 Investigator: FAO-Olympia, USFSW
 Project Length: Four years
 Year of Project: First
 Brood Year: 1985

	5-17-44	5-17-45	5-17-46	5-17-47
Tag Date:	4/30, 5/1/86	5/2-6/86	5/5-8/86	5/7-8/86
Stock:	Sooes	Sooes	Sooes	Sooes
Size at Tagging	200/lb.	200/lb.	200/lb.	200/lb.
Release Location: 1/	Sooes R.	Sooes R.	Sooes R.	Sooes R.
Release Date:	5/27/86	5/27/86	5/27/86	5/27/86
Size at Release:	79.5/lb.	79.5/lb.	79.5/lb.	79.5/lb.
Number Marked Released:	38,073	38,441	38,166	31,962
Tag Retention Rate (%):	94.1	94.1	94.1	94.1
Number Unmarked Released:	3,656	3,691	3,664	3,069
Percent Marked at Release:	91.2	91.2	91.2	91.2

Comments: Total release 160,722 (146,642 marked and 14,080 unmarked).

1/ Released directly from hatchery.

Table 17. Makah National Fish Hatchery fall chinook off-station release tag groups processed during FY'86.

Purpose: Assess survival of upstream Sooes River mitigation releases from Makah NFH
 Investigator: FAO-Olympia, USFSW
 Project Length: Four years
 Year of Project: First
 Brood Year: 1985

Tag Code:	B5-4-10	B5-4-11	B5-4-12
Tag Date:	4/7 - 8/86	4/8 - 9/86	4/9/86
Stock:	Sooes	Sooes	Sooes
Size at Tagging:	438/lb.	438/lb.	438/lb.
Release Location: <u>1/</u>	Sooes River	Sooes River	Sooes River
Release Date:	4/17/86	4/17/86	4/17/86
Size at Release:	337.0/lb.	337.0/lb.	337.0/lb.
Number Marked Released:	5,661	5,844	3,140
Tag Retention Rate (%):	99.0	99.0	99.0
Number Unmarked Released:	0	0	0
Percent Marked at Release:	100	100	100

Comments: Total release 14,645 (all marked).

1/ Released upstream from hatchery at river mile 6.6, 8.0 and 13.4.

Table 18. Record of Makah National Fish Hatchery coho fry releases made by the Makah Tribe, 1986. All releases were made on 6/3/86.

<u>Location</u>	<u>Number</u>	<u>Size</u>
Maatch R.	75,605	230
Educket Cr.	34,537	235
Red Cr.	34,563	235
Halfway Cr.	17,134	345
Sail Cr.	17,134	345
Village Cr.	17,134	345
Agency Cr.	<u>17,134</u>	<u>345</u>
Totals	213,241	267 <u>1/</u>

1/ Weighted average size.

Table 19. Estimated return of chum salmon during 1985 to the Makah National Fish Hatchery. 97% sampled.

Age	Male		Female		Total Number In Age Class
	Expanded Number	Mean Fork Length(mm)	Expanded Number	Mean Fork Length(mm)	
3	44	689	52	630	96
4	23	726	16	683	39
5	0	-	1	975	1
Totals	67		69		136

Table 20. Record of steelhead transfers made by the Makah National Fish Hatchery to the Makah Tribe.

Location	Date	Number	Size
Waatch R.	6/4/86	198,200	426
Hoko Ponds	6/4/86	29,820	426
Total		228,020	

Table 21. Estimate of wild Sooes River and Makah National Fish Hatchery steelhead caught in the 1985-86 Sooes River Tribal gill net fishery.

Age	Hatchery				Wild			
	Male		Female		Male		Female	
	Expanded Number	Mean Fork Length(mm)						
3	517	666	486	650	2	653	0	-
4	53	746	61	681	16	643	21	645
5	0	-	0	-	0	-	13	698
Totals	570		547	662	18		34	669

Table 22. Estimate of hatchery and wild steelhead escapement to the Makah National Fish Hatchery rack during 1985-86.

Age	Hatchery				Wild			
	Male		Female		Male		Female	
	Expanded Number	Mean Fork Length(mm)	Expanded Number	Mean Fork Length(mm)	Expanded Number	Mean Fork Length(mm)	Expanded Number	Mean Fork Length(mm)
2	2	420	0	-	0	-	0	-
3	192	591	104	653	0	-	0	-
4	5	713	29	731	0	-	0	-
5	0	-	0	-	0	-	1	830
Totals	199		133	621	0		1	830

Table 23. Estimated contribution of the 1982 and 1983 brood Makah National Fish Hatchery steelhead production to the 1985-86 return.

Brood Year	Number Released	Size (No/lb)	% Contribution		
			Rack	Fishery	Total
1982	33,553	9.5	0.10	0.34	0.44
1983	72,827	6.6	0.41	1.38	1.79

Table 24. Makah National Fish Hatchery steelhead production release marked group processed during FY'86.

Purpose: Hatchery production evaluation and hatchery stock identification
Investigator: FAD-Olympia, USFWS
Project Length: Ongoing
Year of Project: First
Brood Year: 1985

Mark: Adipose Clip
Mark Date: 3/3 - 5/86
Stock: Combined Quinalt NFH and Makah NFH (not a cross)
Size at Marking: 15.0/lb.
Release Location: Sooes River at hatchery
Release Date: 4/16/86
Size at Release: 5.0/lb.
Number Marked Fish at Release: 64,477
Number Unmarked Fish at Release: 0

FIGURE 1. TIMING OF THE 1986 SPRING
CHINOOK RETURN TO THE QUILCENE RIVER

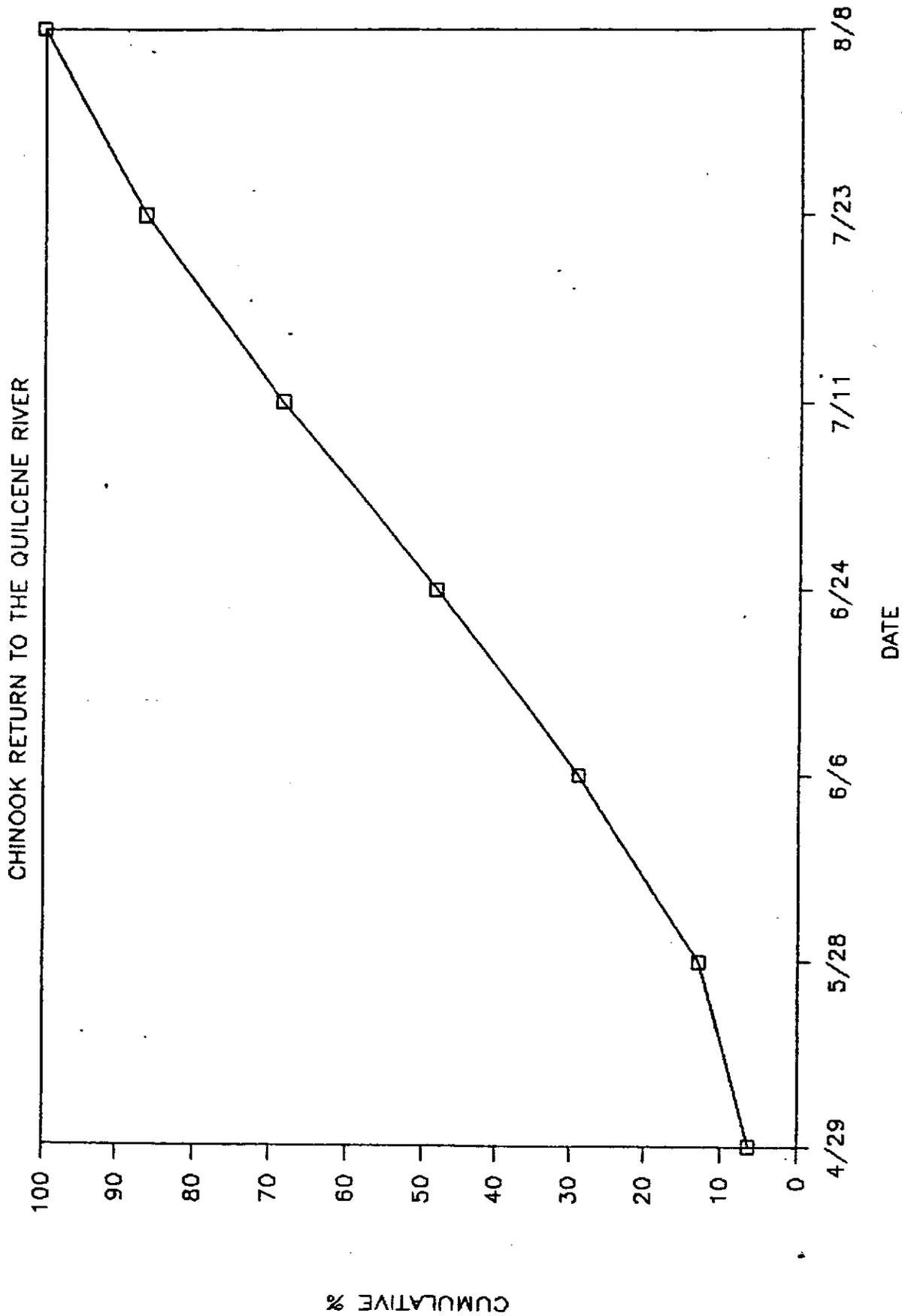


FIGURE 2. TIMING OF MAKAH NFH

STEELHEAD TO SOOES RIVER, 1985-86

