

PROGRESS REPORT OF NATIONAL FISH HATCHERY
PROGRAMMING AND EVALUATION ACTIVITIES
PUGET SOUND AND COASTAL WASHINGTON, 1987-1988

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Olympia, Washington

October 1989

PREFACE

The purpose of this report is to provide an annual update of hatchery programming changes and evaluation activities. Although this report contains some analysis of existing data and recommends changes to programming activities, the intent is to provide periodic updates and not comprehensive analyses of the various programs. Rather, individual reports will be generated that will encompass many years of data concerning individual programs and will provide detailed analysis of the results. Those reports will normally address specific evaluations and will be generated by U.S. Fish and Wildlife Service, Fisheries Assistance Office, Olympia, Washington.

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INTRODUCTION

This report contains information regarding August 1, 1987 - July 31, 1988 hatchery programming and evaluation activities at Makah and Quilcene National Fish Hatcheries (NFH) (Figure 1). This information has been compiled using the hatchery evaluation database system designed by the Olympia Fisheries Assistance Office (USFWS, 1988). Much of the data collected using this system will allow extensive correlation of rearing variables to survival estimates in subsequent species-specific in-depth reports. A general summary of the various types of data routinely collected at each facility is presented in Appendix A. More detailed information may be obtained from the Olympia Fisheries Assistance Office (FAO).

QUILCENE NATIONAL FISH HATCHERY

FALL CHINOOK

Fall chinook have not been propagated at Quilcene NFH since the mid-1970's when the program was discontinued due to poor adult contribution and return. However, two broods of Nooksack chinook (84 and 86), brought into Quilcene to supplement the spring chinook program, were later suspected of being fall chinook. Electrophoretic analysis of the 1986 Nooksack adult return, performed by Washington Department of Fisheries (WDF) personnel, indicated that the fish were most likely Nooksack fall chinook (Bill Graeber, WDF, pers. comm.). The resulting fingerlings were released into the Dosewallips River in 1987 to prevent contamination of the Quilcene spring chinook program. The 1984-brood chinook, assumed to be falls because of similar spawn timing as the 1986 brood, had been reared to term and released directly from the hatchery as yearlings in 1986. Scale analysis, run timing, and mark presence were used to distinguish fall-return fish in 1987 and 1988 resulting from that 1984 release, to insure that no contamination occurred with spring-run spawning efforts. A total of 26 fall chinook returned at age three in 1987. The 1988 return will be reported next year.

Discussion/Recommendations: Over-escapement of fall chinook to Hoodspout and George Adams hatcheries has occurred during the 1988 return. In conjunction with WDF's desire to improve sport fishing in Puget Sound, we have been asked to hatch and rear some of the fall chinook excess experienced at their Hood Canal facilities. We have agreed to accept between 600,000 and 700,000 eggs for hatching and rearing to June, 1989 and transfer to another location for additional rearing. Results will be reported next year.

SPRING CHINOOK

Restoration of Puget Sound spring chinook continues to be a high priority program of the U.S. Fish and Wildlife Service (Service). Working with state and tribal agencies, our goal is to restore particular stocks in Puget Sound to a level that will sustain direct harvest. Development of a spring chinook brood run at Quilcene NFH is an important part of this restoration effort in Hood Canal.

Releases: The hatchery released 133,006 yearlings on May 10, 1988 at 20.2 fish/pound and 3,140 yearlings on May 11, 1988 at 17.8 fish/pound (Table 1). The second release was composed of progeny from parents exhibiting gross kidney lesions (assumed to be bacterial kidney disease (BKD)). Nearly all fish released were coded wire tagged to meet our commitment to the US/Canada effort as a designated spring chinook indicator stock. Specific tag information is presented in Appendix B. An additional 450 yearlings were transferred to Marrowstone Research Station for investigation of BKD transmission and incidence in saltwater net pen rearing.

Terminal Area Returns, 1987: The hatchery recorded a return of 67 males and 42 females to the rack during 1987. The entire return was biosampled and resulting age structure and length information is presented in Table 2. Most of the returning fish were age four. The total run fell short of our escapement requirement of 500.

Terminal Area Returns, 1988: During the spring and summer of 1988 we monitored returning adults in the Big Quilcene River by conducting snorkel surveys (Table 3). Our objectives were to estimate abundance, determine timing, document poaching, determine possible broodstock collection sites, and identify an expected return of four-year-old fall chinook. The first survey conducted on April 14 showed five fish in the river. Approximately half of the return had entered the system by mid-June with some fish showing poaching wounds. Virtually all of the run had entered the system by mid-July (Figure 2). Broodstock capture efforts were conducted in the river on August 11, 1988 which resulted in an additional 22 fish to the hatchery. Some chinook did enter the hatchery later in the season that were identified as fall chinook using scale analysis and absence of a fin clip. They were not used in 1988 spawn efforts. A summary of the 1988 run will be reported in next year's report.

Coded Wire Tag Recoveries: All returning hatchery fish were sampled for coded wire tags resulting in 25 tags, representing six different codes. The codes recovered are presented in Table 4 indicating that no group showed a strong return with the best rate being 0.04%. Tag recoveries also occurred in Canadian and Washington waters for several tag groups in 1987 (Table 5). Tag codes 5-13-48, 5-14-52, and 5-14-53 contributed to both British Columbia and Washington. Tag codes 5-10-33, 5-14-19, and 5-14-54 were not recovered in any of the reported fisheries in 1987. However, the data is preliminary and recoveries could be forthcoming. Release information about these tag groups may be found in FAO (1985) and Kenworthy (1986).

Discussion/Recommendations: Spring chinook continue to be a priority program of the Service at Quilcene. The Service has continued its effort to produce quality smolts by injecting returning adults with erythromycin to control BKD, individual spawning and incubation to alleviate health risks, and feeding antibiotics to juveniles to control BKD. We fed Gallamycin (TM) to approximately 83% of the yearlings released in 1988. The on-station mortality rate for the treated group was 0.68% compared to 2.85% for the untreated fish. We are in the process of testing two antibiotics (Brunson et al. 1988) on the 1987 brood and plan to continue this evaluation on the 1988 brood as well. We

are also considering releasing yearlings at a somewhat larger size because of the apparent success experienced using antibiotics to control BKD. We expect that larger sizes at release would increase survivability. (Prior to initiation of the antibiotic program, releases made at a larger size suffered more BKD, probably negating any increased benefit expected from releasing at the larger size.)

Another evaluation conducted during the reporting period involved seal predation on outmigrants and returning adults in Quilcene Bay (Knudsen et al. 1988). The authors concluded that smolts and probably adults are consumed by seals, but to what degree is uncertain. They also noted that bird predation on smolts may have more of an impact than the seals.

We have attempted to supplement poor adult returns with eggs from WDF hatcheries at Nooksack and Cowlitz. However, eggs received from Nooksack in 1984 and 1986 were suspected to be fall chinook and identification of IHN virus at Cowlitz severely restricts our use of either stock in the near future. The 1988 brood has been supplemented with 100,000 fish from Solduc. This was accomplished through a proposed investigation of rearing two separate stocks at Quilcene and the same two stocks at Hoodsport (WDF). This scenario allows determination of which stocks and locations could further improve the restoration program in Hood Canal.

We have continued to recommend fishery restrictions (area closures, season dates, and revised maximum catch lengths), including a proposed early closure of the sport steelhead season on the Quilcene River, to reduce incidental catch of spring chinook, and increased enforcement to reduce poaching (Hiss and Zajac, 1987). However, coded wire tag recovery data indicates that neither fishery contribution nor hatchery returns are particularly strong. A model developed by FAO to predict the influence of various parameters on the spring chinook run, shows that in the long term we must increase the survival rate. However, both supplementation and increased fishery regulation could help as well (Hiss et al. 1988). In the meantime, we will continue our efforts to improve our adult return through fish health management, input to development of fishery regulations, and maintenance of spring timing by removing returning fall chinook.

COHO

Releases and Transfers: Coho production included 574,171 yearlings released on-station (Table 1), 272,200 fingerlings transferred to WDF (Table 6) for seeding under-utilized tributaries in the area, 61,700 eyed eggs transferred to Chimacum High School, and 240,000 eyed eggs transferred to Bangor Naval Station (Table 7).

Terminal Area Returns, 1987: Coho returns provided sufficient spawners to meet program needs for 1987. The hatchery reported an escapement to the rack of 2,759 fish. Of this return, 420 fish were passed upstream to utilize habitat above the hatchery. Although no Quilcene coho returning in 1987 were expected to contain coded wire tags, 102 fish entered the hatchery in December that exhibited a high frequency of adipose marks. We sampled 55 of the fish and subsequently recovered 33 coded wire tags. Thirty-two of the tags

originated from Quilcene Bay net pen releases in 1986 and the other tag originated from Port Gamble Bay net pen releases during the same year. The net pen program is cooperative between Point No Point Treaty Council (PNPTC) tribes and WDF using Dungeness stock. These fish were not spawned.

Catch records show 31,681 coho were harvested in area 12A net fisheries, 537 in Big Quilcene River net fisheries, and 509 in the Big Quilcene River sport fishery (Dale Ward, WDF; Peter Dygert, PNPTC; pers. comm.) for a total of approximately 32,727 fish. Based on coded wire tag recoveries in the 12A net fishery originating from the 1986 Quilcene Bay net pen releases, it is estimated that as many as 28,000 coho in the catch may have originated from Quilcene Hatchery (Peter Dygert, PNPTC, pers. comm.).

Discussion/Recommendations: Current return records indicate that the Quilcene coho program continues to be successful. However, coded wire tagging hadn't occurred since brood year 1981. Subtle changes in hatchery practices and marine environment have probably caused contribution and distribution differences not accurately represented by the earlier tagging. Tagging was initiated with progeny from the 1987 return to assess current contribution rates and distribution rates and patterns.

During years when shortfalls occur in the spring chinook program, we request permission from the Hood Canal Management Plan cooperators to increase our yearling coho program to more fully utilize our production capacity. We have requested and received permission to release 700,000 smolts in 1989 and 1990.

During recent years egg eye-up has averaged about 85% and has become a concern to the staff (Larry Telles, USFWS, pers. comm.). To correct the problem, the staff tested a bicarbonate of soda rinse on some of the eggs before fertilization. Preliminary results show an improved eye-up rate for rinsed eggs of 93% compared to 84% for unrinsed eggs. The test is being repeated in 1988.

CHUM

Releases and Transfers: The hatchery released a total of 2,182,147 chum fry at Quilcene NFH (Table 1) consisting of both Quilcene and Walcott stocks. Releases at Walcott were discontinued in 1986 for harvest management reasons. In addition, 1,499,750 eggs were spawned at Walcott Slough, eyed at Quilcene, and transferred to Makah NFH and Makah Tribe to supplement their programs (Table 7).

Terminal Area Returns, 1987: Adults returned to both Quilcene NFH and Walcott Slough. Records show a return of 228 males and 247 females to Quilcene and 1,790 males and 1,808 females to Walcott Slough. Biosampling was conducted at both sites with 48.6% of the return sampled at Quilcene and 17.4% at Walcott. Scale analysis showed age four predominated at both locations (Table 8 and 9). Walcott Slough returns were more successful than Quilcene for all ages (Table 10). However, an impassible log jam developed in the lower Quilcene River during the chum return which would have influenced our reported escapement (Grant Fiscus, WDF, pers. comm.). It has since been removed. Also, counts of fish remaining in the Big Quilcene River and Walcott Slough after spawning

operations are completed are unknown. Therefore, the rates presented are both underestimates and the apparent difference observed between return rates at the two facilities might have been influenced if that information was available.

In addition to strong returns to the facilities, the Quilcene and Walcott programs contributed well to Hood Canal net fisheries. Run reconstruction estimates indicate 9,000 Walcott chum and 3,000 Quilcene chum were caught in terminal area net fisheries.

Discussion/Recommendations: The transition of the chum program from Walcott Slough to Quilcene NFH and current rearing and release strategies have resulted in a successful program at Quilcene. Although releases are no longer made at Walcott, returns occurred during 1987 and are expected in 1988 and 1989. These returns will be utilized to supplement Makah NFH and tribal programs as requested. Coded wire tagging has not been done with chum at either facility. However, a reasonable evaluation may be possible using run reconstruction estimates, catch records, and escapement data. The feasibility of performing such an evaluation in the near future should be investigated.

MAKAH NATIONAL FISH HATCHERY

Restoration of coastal stocks of salmon and steelhead are a high priority of the Service. Successful programs are now being realized at Makah NFH with coho and steelhead, and the chinook program appears to be improving. Large scale evaluations are currently being performed using coded wire tags and fin marks to assess relative program success and to satisfy our commitment to US/Canada as a major fall chinook production facility.

FALL CHINOOK

The fall chinook program remains the highest priority effort at Makah NFH. Return numbers have continued to improve and the Makah Tribe has continued its support of the program by not allowing a directed fishery upon the run in 1987.

Releases: The hatchery released 296,388 fall chinook on-station as well as 76,454 fall chinook upstream to meet our required mitigation to Makah Steering Committee for trapping and using all returning fish for broodstock (Table 11). All release groups contained coded wire tags to meet our evaluation and US/Canada identification requirements. Specific tag-related information is presented in Appendix B.

In addition to our own releases, the hatchery incubated Hoko fall chinook eggs for the Makah Tribe and transferred the resulting 239,576 fingerlings to Hoko pond on May 11 and 12 at 99.9 fish/pound. This group had also been coded wire tagged with assistance from the Service.

Terminal Area Returns, 1987: The hatchery return totaled 435 fish including 23 age two, 310 age three, 48 age four, 53 age five fish and one age six fish. A small number of fish not needed for broodstock was passed upstream. This group included 32 males and three green females. Biosampling of 90.3% of the

fish indicated three-year-olds predominated returning males and five-year-olds predominated females. There were more than three times as many males as females (Table 12). The first fish entered the hatchery on October 19 with 50% of run having entered by the first of November (Figure 3). This timing is late and unusual due to low water conditions as described below.

Coded Wire Tag Recoveries: All returning hatchery fish were sampled for coded wire tags resulting in 15 tags, representing four different codes (Table 13). These two-year-old fish represent the first returns of marked fish since tagging was initiated in 1986. Also, all codes recovered resulted from on-station releases. Survival to the rack was estimated to be 0.01% for all four tag codes recovered. Although upstream releases of tagged fish occurred in the same release year, no tags were recovered from those releases at the hatchery in 1987. Also, no tags resulting from any of the groups were recovered in the ocean fisheries. Release information about these tag groups can be found in Kenworthy (1986).

Discussion/Recommendations: Extreme low and warm water conditions occurred during the chinook return. Contingency plans were developed concerning early release of over-summering coho and steelhead juveniles, so that water could be diverted for fish ladder operation. Also, two attempts were made using drift gill nets to secure adults below the weir. Fortunately, an alternate scheme was developed in which water was pumped from the basin above the weir to the ladder for up to 18 hours. This scenario of occasional pumping from the basin and then letting it recharge for several days allowed chinook that had accumulated at the ladder entrance to ascend into the hatchery volitionally. Low water conditions will probably recur in future years. However, this method of occasional ladder operation should work again if the situation recurs.

Also, critical incubation temperatures were reached although no significant losses resulted. However, a chilling unit should be considered as a necessary acquisition.

Fall chinook continue to be the priority program at this facility. Evaluation of the production and mitigation releases should continue as well as our commitment to coded wire tagging US/Canada indicator stocks. Directed terminal fisheries should not occur on chinook and incidental catch during coho fisheries and should be monitored closely to prevent significant impact on the return.

COHO

Releases: Coho production included 253,566 yearlings released at the hatchery and 49,097 yearlings transferred to Educket Creek pond for release into the Waatch River. Also, 327,822 fingerlings were released into various on-reservation tributaries (Table 11). Both yearling releases contained coded wire tags to compare relative success of the two releases and to assess the degree of straying at return, which is expected since the release locations are geographically close together. Specific tag-related information is presented in Appendix B.

Terminal Area Returns, 1987: A total of 2,698 coho returned to the Sooes River during 1987. River net fisheries harvested 708 (Table 14) and 793 were passed upstream to use available habitat. The remainder of the return was used as broodstock or excessed to the tribe. Broodstock was successfully taken from fish entering the facility according to guidelines established during a steering committee meeting on August 18, 1987 (minutes dated August 26, 1987).

Discussion/Recommendations: The recorded river catch and return numbers indicate that the coho program is successful. We have initiated tagging programs with the 1986 brood to identify distribution patterns and contribution rates of the yearling production release. In addition, tagging was accomplished on the Waatch yearling release. This release had been made directly from Makah NFH to lower Waatch River through 1987. Since no facility was available for the group to imprint on the Waatch system, we believed large numbers would return to the Sooes River instead of the Waatch River. However, the Makah Tribe now has an imprint facility available on the Waatch system for future releases. We will be able to evaluate the relative success of the imprint location with the scheduled coded wire tagging. The programming document now reflects the release site change from the Waatch River to the imprint facility. Also, currently programmed reservation tributary fry releases reflect adjustments made for carrying capacities.

As suggested, the coho return has been relatively large and can support directed harvest. However, the run timing overlaps with fall chinook entry. Since chinook have been identified as the priority species and that run is currently rebuilding, it cannot support a directed harvest and incidental catch during coho fisheries is damaging as well. The broodstock acquisition date of November 1 was established to create run time separation between chinook and coho returns to more effectively harvest excess coho. However, coho broodstock needs had not been met during most returns. The Makah Steering Committee re-examined chinook timing and concluded that the November 1 date could be changed to October 15, at least on a trial basis. This new date has apparently worked successfully in 1987 and 1988 to harvest excess coho, as well as provide sufficient broodstock for hatchery needs. At any rate, coho fisheries are closely monitored and managed to reduce incidental catch of fall chinook.

CHUM

Releases: A total of 1,185,093 chum fry were released into the Sooes River during April and May (Table 11). Most of this production resulted from eyed egg transfers to Makah from Quilcene NFH in January and February.

Terminal Area Returns, 1987: A total of 187 chum returned to the facility in 1987 (Table 15). Fifty-four of these fish were four-year-olds, 132 were three-year-olds, and one was a five-year-old. In addition to the hatchery escapement, 86 chum were harvested incidentally during the coho and steelhead fisheries (Table 14).

Discussion/Recommendations: The status of the Makah NFH chum program has been discussed by the Makah Steering Committee. Outside stocks (other than

Walcott) have been discussed for supplemental use. However, nearby stocks are depressed and use of Nitinat stock (Canada) is precluded by international harvest management concerns of the impact on the genetic stock identification program. With no other stock available, two courses of action have been taken including rearing and release to a larger size at the hatchery and the tribal net pen release in Neah Bay. It is hoped that net pen releases can be made at a larger size, increase survival, and perhaps provide broodstock.

WINTER STEELHEAD

In terms of release numbers, the steelhead program is the smallest program at the Makah NFH. However, returns have been strong and provide quality fish for both commercial net fisheries and river sport fisheries. In addition to our own program, we incubated eggs for the Makah Tribe's Hoko pond program and transferred the resulting 32,107 fingerlings to Hoko on June 15, 1988.

Releases: The hatchery released 9,891 yearlings into the Waatch River on April 12, 1988 and 33,751 yearlings into the Sooes River at the hatchery on April 15, 1988. The number of Sooes River yearlings released was short of the programmed 65,000 because of fingerling releases that occurred the summer before to alleviate suspected density problems during the low water conditions. In addition to the yearling release, 28,050 fingerlings were released into the Waatch River and 34,381 into Sail River (Table 11). All yearlings released were fin-clipped to allow accurate identification of hatchery versus wild returns and to determine relative survival of the Sooes and Waatch releases. The pertinent marking information is presented in Appendix B.

Terminal Area Returns, 1987: A total of 465 steelhead returned to the hatchery. Biosampling was performed on the return to determine age structure and wild composition of the run (Table 16). Approximately 98% of the fish trapped by the hatchery were of hatchery origin and 81.5% were age three fish. The Makah Tribal Fisheries staff estimated upstream escapement to be approximately 121 fish of hatchery origin and 301 fish of wild origin for a total of 422. These estimates are based on the assumption used by Washington Department of Wildlife (WDW) that hatchery stocks construct redds before March 15 and assuming two adults per redd (Mark LaRiviere, Makah Tribe, pers. comm.).

A substantial commercial net fishery harvested a total of 4,932 during the 1987-88 winter season (Table 14). The biosampling and mark sampling performed on the catch indicated that 97.3% were of hatchery origin and 1.7% were wild. The major age class was three for hatchery fish and four for wild fish (Table 17). The estimated survival rate to age three of the 1985 brood is 5.9%.

In addition to the successful net fishery, approximately 15 steelhead were harvested by sports anglers. This estimate was generated from WDW punch card data and Makah Tribal Fisheries staff estimates (Mark LaRiviere, Makah Tribe, pers. comm.).

Mark Recoveries: All returning fish were sampled at the hatchery for adipose marks. Approximately 60% of the fish were marked. Release information about these mark groups may be found in Kenworthy (1986).

Discussion/Recommendations: Our goal with the steelhead program is to maintain temporal separation between hatchery and wild stocks. This would allow river net fisheries to target on hatchery fish and allow the wild run to maintain itself in the natural environment without competition and genetic dilution occurring from hatchery stock. To achieve this, we have in the past assumed that hatchery fish return before February 1 and have secured our broodstock before that date. Fish returning after that date were assumed to be wild and were allowed to pass upstream. During 1987-88, we reviewed past age data and weir operation dates and continued biosampling through February 1988. Based on this information, it appears that returning steelhead are of hatchery origin until late February (Zajac, 1988). We have proposed to operate the weir through February 1989 to further assess hatchery/wild composition and hopefully identify a calendar date that will allow a reasonably accurate separation technique in lieu of fin clipping or scale analysis.

A change to the Annual Division One Stocking Plan has been included for FY-89. This is a reduction of the steelhead fingerling release in reservation creeks from 100,000 to 56,000, a number more closely aligned with carrying capacity.

ACKNOWLEDGEMENTS

Much of the data required for hatchery evaluation, programming, and coordination is collected solely by hatchery staff. That which is not, is collected cooperatively by Olympia Fisheries Assistance Office staff. Also, many of the suggested program changes and evaluation ideas originate from hatchery personnel. Both Makah and Quilcene hatchery staff have contributed significantly to the current success and future direction of the hatcheries through their innovative ideas and continuing cooperation with fisheries assistance staff. I thank the staff at both Makah and Quilcene hatcheries for their continued support and look forward to working with them each year. J.M. Hiss and several other fisheries assistance staff members collected the snorkel survey data reported here.

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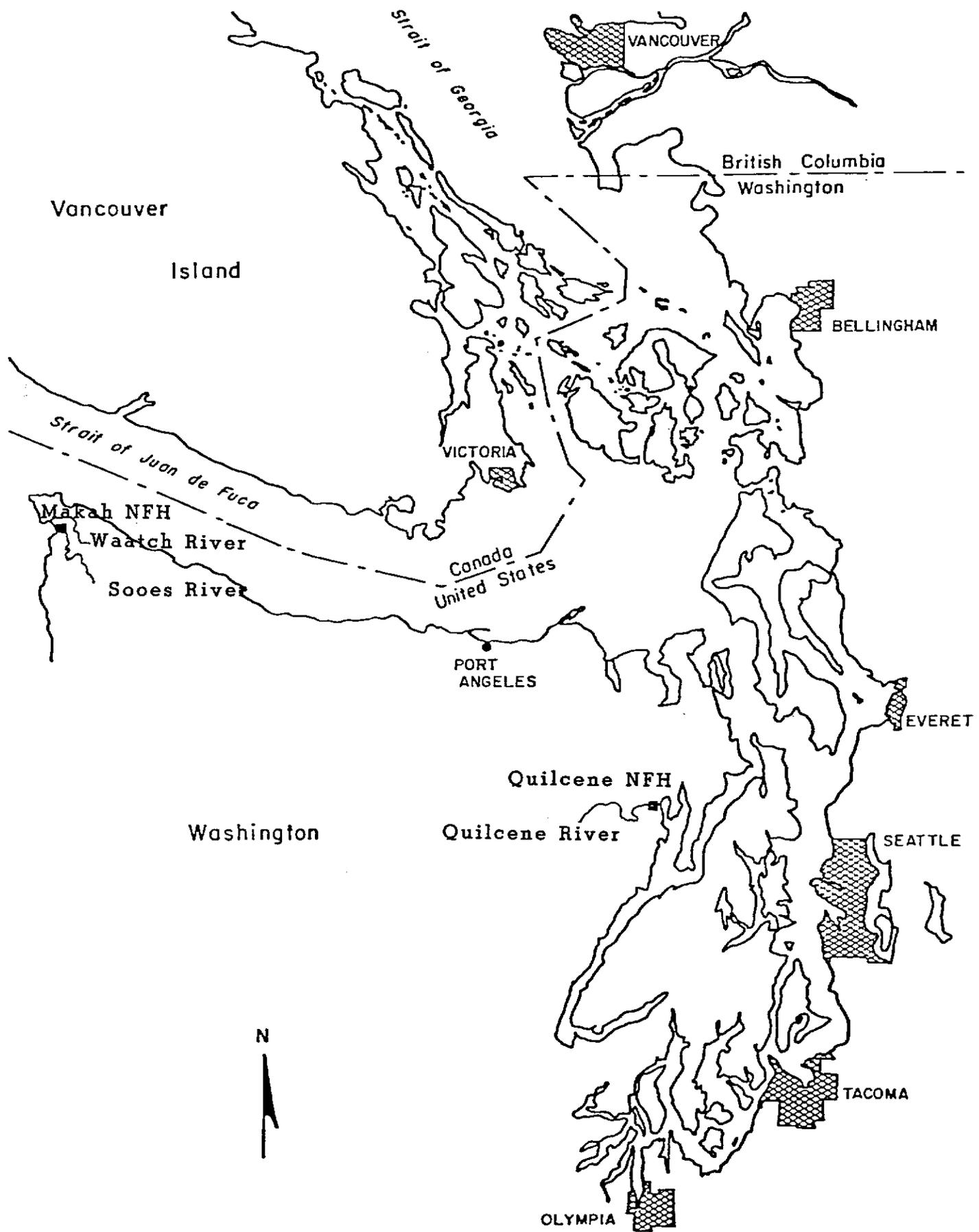


Figure 1. Location of Quilcene and Makah National Fish Hatcheries.

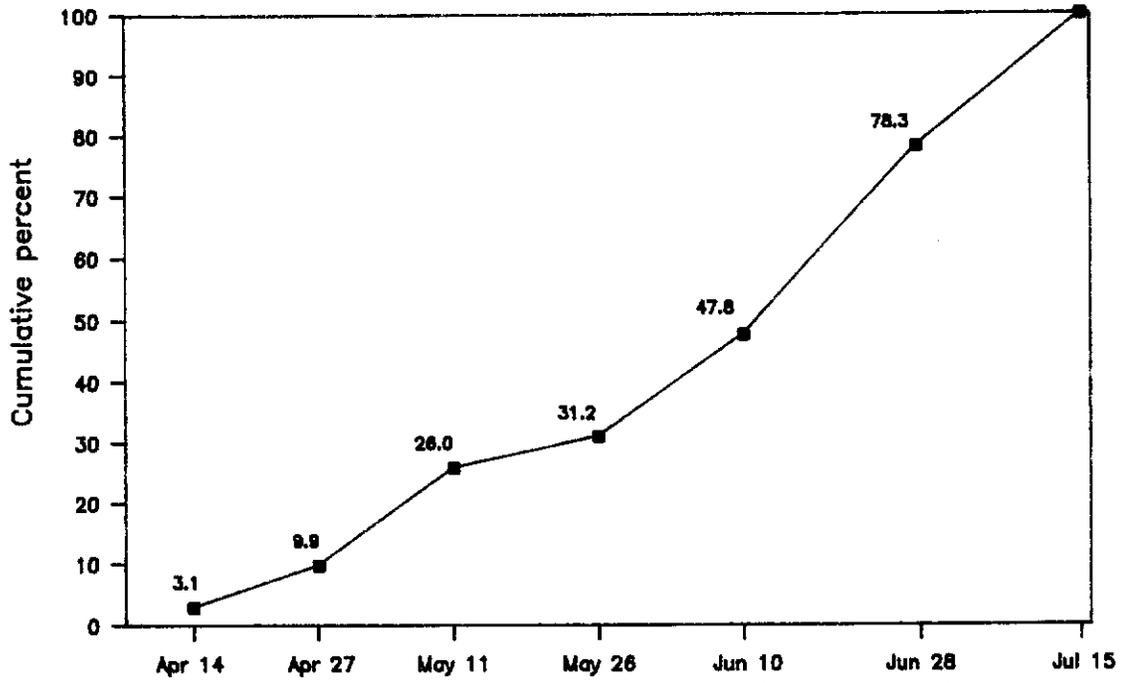


Figure 2. Timing of the 1988 spring chinook return to the Big Quilcene River

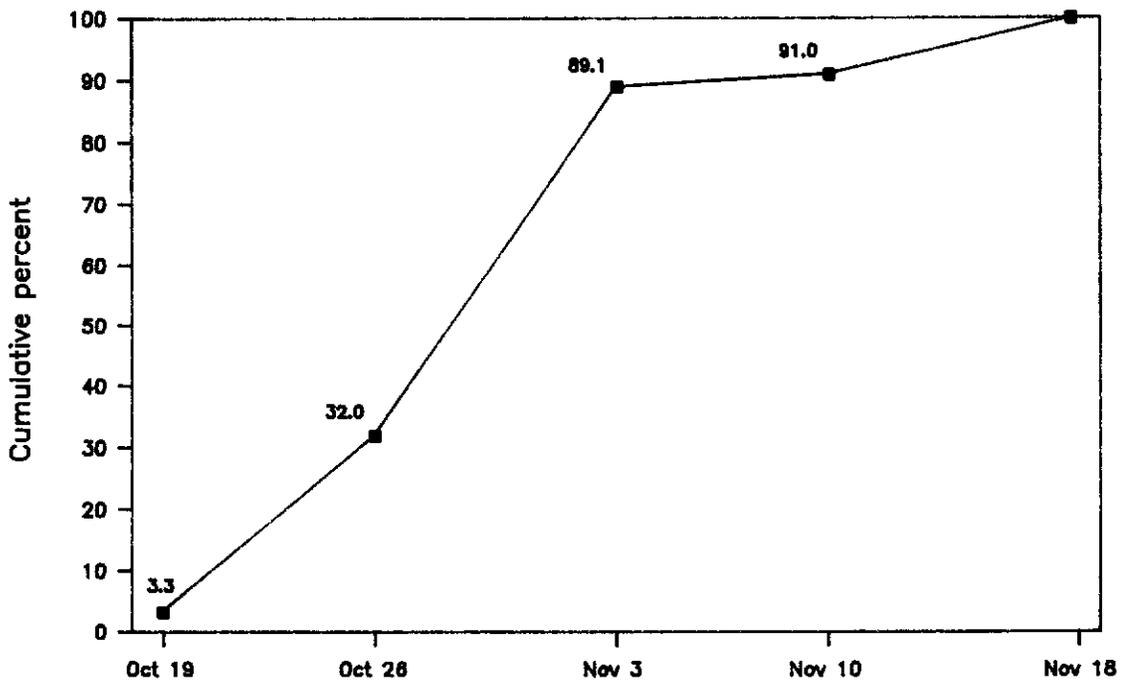


Figure 3. Timing of the 1987 fall chinook return to the Makah National Fish Hatchery.

Table 1. Record of Quilcene National Fish Hatchery salmon releases made into the open waters of Washington during 1988.

Species	Stock	Brood year	Release location	Date	Number	Size (No/lb)	Weight(lbs)
Spring Chinook	Quilcene NFH	86	Big Quilcene R.	5/10/88	133,006	20.2	6,585
		86	Big Quilcene R.	5/11/88	3,140	17.8	176
Coho	Quilcene NFH	86	Big Quilcene R.	5/10,11/88	574,171	21.3	26,893
Chum	Quilcene NFH	87	Big Quilcene R.	4/27/88	21,388	634.0	34
				5/3/88	419,054	747.0	561
	Walcott Slough	87	Big Quilcene R.	4/27/88	836,973	641.0	1,306
				5/3/88	904,732	616.0	1,469

Table 2. Spring chinook age at return to Quilcene National Fish Hatchery during 1987 (100% sampled).

Age	Male		Female		Total number in age class
	Expanded number	Mean fork length(mm)	Expanded number	Mean fork length(mm)	
3	8	453	0	-	8
4	52	686	32	741	84
5	6	827	10	870	16
6	1	550	0	-	1
Totals	67		42		109

Table 3. Actual counts of brood year 1988 spring chinook (all ages) in the Big Quilcene River and hatchery. Counts in the river are based on snorkel observations.

Date	4/14 ¹	4/17 ²	5/11	5/26	6/10	6/28	7/15	7/25	8/2	8/9	8/15 ³
Hatchery	-	-	8	16	34	54	77	82	85	88	109
River	5	16	34	35	43	72	84	72	68	69	39
Totals	5	16	42	51	77	126	161	154	153	157	148

¹ Rack was not yet operating.

² Rack was not yet operating.

³ A broodstock capture effort occurred on 8/11/88 which resulted in 22 fish being removed from the river and taken to hatchery. Counted 6 bright fish in the river that we assumed to be fall chinook.

Table 4. Spring chinook coded wire tag recoveries at Quilcene National Fish Hatchery, 1987.

Tag Code	Agency	Number observed	Number expanded	Age	Survival to rack (%)	Origin
5-10-33	FWS	1	1	6	.003	Quilcene
5-14-52	FWS	12	12	4	.040	Quilcene
5-14-19	FWS	5	5	5	.010	Quilcene
5-14-53	FWS	2	2	4	.008	Quilcene
5-14-54	FWS	4	4	4	.008	Quilcene
5-13-48	FWS	1	1	5	.004	Quilcene

Table 5. Preliminary 1987 estimated and (observed) recoveries of spring chinook released from Quilcene National Fish Hatchery.

Tag code	Brood year	Washington		British Columbia		
		Troll	Puget Sound sport	Troll	Net	Georgia Straight sport
5-14-52	83	6(1)	4(1)	10(3)	(0)	7(1)
5-13-48	82	(0)	1(1)	(0)	(0)	(0)
5-14-53	83	(0)	3(1)	(0)	3(1)	(0)

Table 6. Fingerling releases of brood year 1987 Quilcene National Fish Hatchery coho made by Washington Department of Fisheries. (All releases were made on April 1, 1988 at 395/lb.).

Location	Number
East Fork Tarboo Creek	19,800
East Fork Chimacum Creek	24,500
West Fork Chimacum Creek	5,100
Chimacum Creek	55,300
Thorndyke Creek	13,800
Tarboo Creek	79,400
Leland Creek	24,900
Little Quilcene River	49,400
Total	272,200

Table 7. Record of eyed egg transfers from Quilcene National Fish Hatchery, 1988 (all were brood-year 1987).

Species	Stock	Location	Date	Number
Coho	Quilcene NFH	Chimacum High School	11/23/87	61,700
	Quilcene NFH	Bangor Naval Station	11/19/87	240,000
Chum	Walcott Slough	Makah NFH	2/11/88	297,000
			2/4/88	692,750
	Walcott Slough	Educket Hatchery (Makah Tribe)	2/11/88	510,000

Table 8. Chum age at return to Quilcene National Fish Hatchery during 1987 (48.6% sampled).

Age	Male		Female		Total number in age class
	Expanded number	Mean fork length(mm)	Expanded number	Mean fork length(mm)	
3	25	663	19	616	44
4	194	742	228	678	422
5	9	803	0	-	9
Totals	228		247		475

Table 9. Chum age at return to Walcott Slough during 1987 (17.4% sampled).

Age	Male		Female		Total number in age class
	Expanded number	Mean fork length(mm)	Expanded number	Mean fork length(mm)	
3	205	670	335	625	540
4	1,444	764	1,450	700	2,894
5	141	830	23	756	164
Totals	1,790		1,808		3,598

Table 10. Estimated return rates of chum to Quilcene National Fish Hatchery and Walcott Slough in 1987.

Brood year	Release location	Release number	Age at return	Number returned	% return to rack
1982	Quilcene NFH	995,738	5	9	.0009
	Walcott Slough	1,644,865	5	164	.01
1983	Quilcene NFH	1,218,671	4	422	.03
	Walcott Slough	1,315,375	4	2,894	.22
1984	Quilcene NFH	2,464,414	3	44	.0018
	Walcott Slough	832,715	3	540	.06

Table 11. Record of Makah National Fish Hatchery salmon and steelhead releases made into the open waters of Washington during 1988.

Species	Stock	Brood year	Release location	Date	Number	Size (No/lb)	Weight (lbs)
Fall chinook	Makah NFH	87	Sooes R. (at hatchery)	5/16,23	296,388	74.9	3,954
			Sooes R. ¹ (upstream)	4/22	76,454	257.4	297
Coho	Makah NFH and Quinault NFH	87	Sail R.	4/15-5/4	154,661	395-1005	274
			Agency Cr.	5/3	24,095	395	61
			Village Cr.	5/4	25,280	395	64
			Waatch Cr.	5/5	1,580	395	4
			Reservoir				
	Makah NFH	87	Waatch R.	3/18-5/6	117,071	395-986	241
			Educket Cr. Reservoir	5/5	5,135	395	13
	Makah NFH	86	Sooes R.	4/14	253,566	13.3	19,065
			Waatch R. (Educket Hatchery)	4/29	49,097	14.1	3,482
Chum	Walcott Slough Makah NFH	87	Sooes R.	5/6,7	972,334	288.3	3,373
		87	Sooes R.	4/29	212,759	453.6	469
Winter Steelhead	Makah NFH	87	Sooes R.	4/15	33,751	4.6	7,337
		87	Waatch R.	4/12	9,891	4.5	2,198
		88	Waatch R.	3/28-5/6	28,050	625-1866	29
		88	Sail R.	3/18-5/4	34,381	405-1724	52

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

Table 12. Fall chinook age at return to Makah National Fish Hatchery during 1987 (90.3% sampled).

Age	Male		Female		Total number in age class
	Expanded number	Mean fork length(mm)	Expanded number	Mean fork length(mm)	
2	23	427	0	-	23
3	292	749	18	799	310
4	22	857	26	888	48
5	5	975	48	955	53
6	0	-	1	1,055	1
Totals	342		93		435

Table 13. Fall chinook coded wire tag recoveries at Makah National Fish Hatchery, 1987.

Tag Code	Agency	Number observed	Number expanded	Age	Survival to rack (%)	Origin
5-17-44	FWS	4	4	2	.01	Makah
5-17-45	FWS	3	3	2	.01	Makah
5-17-46	FWS	5	5	2	.01	Makah
5-17-47	FWS	3	3	2	.01	Makah

Table 14. Monthly Indian set net harvest in the Sooes River during the 1987-1988 season (data provided by Makah Tribal Fisheries Management).

Species	November	December	January	February	Totals
Fall chinook	3	2	0	0	5
Coho	696	12	0	0	708
Chum	39	47	0	0	86
Steelhead	4	2,257	2,412	259	4,932

Table 15. Chum age at return to Makah National Fish Hatchery during 1987 (98.9% sampled).

Age	Male		Female		Total number in age class
	Expanded number	Mean fork length(mm)	Expanded number	Mean fork length(mm)	
3	70	672	62	648	132
4	22	745	32	703	54
5	0	-	1	751	1
Totals	92		95		187

Table 16. Winter steelhead age at return to the Makah National Fish Hatchery during 1987 (79.2% sampled).

Age	Male		Female		Total number in age class
	Expanded number	Mean fork length(mm)	Expanded number	Mean fork length(mm)	
2	3	447	0	-	3
3	192	640	130	607	322
4	22	662	43	701	65
5	5	821	0	-	5
Totals	222		173		395

Table 17. Winter steelhead age at harvest during 1987-88 set net fishery in Sooes River (48.4% sampled).

Age	Number of hatchery fish	Number of wild fish
3	1,647	1
4	139	32
5	11	16
Totals	1,797	49

Appendix A. Types of data collected at Quilcene and Makah National Fish Hatcheries for hatchery evaluation during the reporting period¹

Hatchery	Species			
	Fall Chinook	Spring Chinook	Coho	Chum
Quilcene	adult entry fish removal scale sample fish transfer	adult entry fish removal scale sample mark sampling mark recovery ind. spawning fish transfer environment marking specific rel. general rel.	fish removal group spawn. fish transfer environment marking specific rel. general rel.	fish removal scale sample group spawn. environment specific release general release
				N/A
Makah	adult entry fish removal scale sample mark sampling mark recovery group spawning fish transfer environment marking specific rel. general rel.	N/A	fish removal group spawn. fish transfer environment marking specific rel. general rel.	fish removal scale sample group spawn. fish transfer environment specific rel. general rel.
				fish removal scale sample mark sampling mark recovery group spawning fish transfer environment marking specific rel. general rel.

¹ See FRED Manual for variables included in the data types presented.

Appendix B. Information related to tag groups released from Quilcene and Makah National Fish Hatcheries

Hatchery and Species

Tagging information	Quilcene spring chinook		Makah fall chinook (on-station release)		Makah fall chinook (upstream release)		Makah coho (Sooes)		Makah coho (Waatch)		Makah steelhead (Sooes)		Makah Steelhead (Waatch)	
	indicator stock	indicator stock	indicator stock	release site	release site	release site	three years	three years	three years	three years	on-going	on-going	release site	release site
Project length	on-going	on-going	on-going	four years	four years	three years	three years	three years	three years	on-going	on-going	on-going	release site	release site
Year of project	n/a	n/a	n/a	third	third	first	first	first	first	n/a	n/a	n/a	five years	five years
Brood year	1986	1987	1987	1987	1987	1986	1986	1986	1986	1987	1987	1987	1987	1987
Tag code	05-19-11-R3	05-19-50-R3	05-19-03-02	85-03-01,85-03-02	85-03-01,85-03-02	05-17-40, 05-17-41 05-17-42, 05-17-43	05-17-40, 05-17-41 05-17-42, 05-17-43	05-19-49-R3	05-19-49-R3	adipose clip	adipose clip	adipose clip	adipose/left ventral clip	adipose/left ventral clip
Tag date	June 1987	April 1988	April 1988	April 1988	April 1988	December 1987	December 1987	December 1987	December 1987	December 1987	December 1987	December 1987	December 1987	December 1987
Stock	Quilcene NFH	Makah NFH	Makah NFH	Makah NFH	Makah NFH	Makah NFH	Makah NFH	Makah NFH	Makah NFH	Makah NFH	Makah NFH	Makah NFH	Makah NFH	Makah NFH
Size at tagging	125/lb	180/lb	180/lb	300/lb	300/lb	20/lb	20/lb	20/lb	20/lb	6/lb	6/lb	6/lb	6/lb	6/lb
Release location	Big Quilcene R.	Sooes R.	Sooes R.	Sooes R.	Sooes R.	Sooes R.	Sooes R.	Sooes R.	Sooes R.	Sooes R.	Sooes R.	Sooes R.	Sooes R.	Waatch R.
Release date	May 10, 1988	May 16, 23, 1988	May 16, 23, 1988	Apr. 22, 1988	Apr. 22, 1988	Apr. 14, 1988	Apr. 14, 1988	Apr. 14, 1988	Apr. 14, 1988	Apr. 15, 1988	Apr. 15, 1988	Apr. 15, 1988	Apr. 13, 1988	Apr. 13, 1988
Size at release	20.2/lb	74.9/lb	74.9/lb	257.4/lb	257.4/lb	13.3/lb	13.3/lb	16.1/lb	16.1/lb	4.6/lb	4.6/lb	4.6/lb	4.5/lb	4.5/lb
Number marked released	133,006	206,086	206,086	73,460	73,460	14,733; 14,883; 14,331; 14,886	14,733; 14,883; 14,331; 14,886	49,252	49,252	33,447	33,447	33,447	8,922	8,922
Tag retention rate (%)	96.1	98.9	98.9	92.9	92.9	86.8; 95.7; 97.1; 96.5	86.8; 95.7; 97.1; 96.5	89.1	89.1	99.1	99.1	99.1	90.2	90.2
Number unmarked released	0	90,302	90,302	1,205	1,205	34,949; 37,305; 35,453; 34,822	34,949; 37,305; 35,453; 34,822	0	0	304	304	304	969	969
Percent marked at release	100.0	69.5	69.5	96.1	96.1	29.6; 28.5; 28.8; 29.9	29.6; 28.5; 28.8; 29.9	100.0	100.0	99.1	99.1	99.1	90.2	90.2