SPRING CHINOOK PRESERVATION IN PUGET SOUND MANAGEMENT

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ABSTRACT: Populations of Puget Sound spring chinook salmon are seriously depressed. Important factors in their decline are overfishing by sport and commercial fisheries; loss of freshwater habitat; and vulnerability to poaching during their extended period in freshwater prior to spawning. In the Puget Sound area, only the Skagit, Nooksack, and Dungeness Rivers still support viable spawning runs. The U.S. Fish and Wildlife Service has chosen to concentrate its restoration activities on spring chinook because of their depressed status. A restoration plan for Puget Sound spring chinook was drafted in 1980 with the goals of 1) protecting existing stocks through habitat protection and enhancement efforts, 2) collecting data on critical information gaps in spring chinook life history, management, and husbandry, and 3) developing a broodstock program at Quilcene National Fish Hatchery for use in reestablishing spring chinook in at least portions of their former range. To achieve these goals, we have engaged in cooperative efforts to enhance Nooksack spring chinook through broodrun development, examination of early life history, and coded wire tagging studies. We are in the second year of a four-year effort to develop a spring chinook broodrun at Quilcene National Fish Hatchery using Nooksack males and Cowlitz females, the offspring of which would eventually be used to reseed drainages historically supporting spring chinook. Future efforts include continued development of spring chinook broodruns, assessment of marine contributions of hatchery and wild stocks, determination of Nooksack escapements, and development of better tools to assess impacts to freshwater habitat of Puget Sound spring chinook.

INTRODUCTION

Spring chinook, the first salmon to enter freshwater during the annual spawning cycle, are highly prized for the fresh fish trade and as a sport fish. Historically, they supported valuable sport, commercial and treaty Indian fisheries throughout the Pacific Northwest, but in recent years their numbers have declined to very low levels in the Puget Sound region (U.S. Fish and Wildlife Service 1980). Principal factors producing the decline include: increased sport and commercial fishing; inadequate hatchery rearing techniques; and damage to spawning and rearing habitat from urbanization, dams and diversions, agricultural practices, estuarine modification, dredging, and logging practices. In addition, spring chinook are highly vulnerable to poaching because of their extended period in freshwater prior to spawning. The deterioration of their freshwater habitat combined with overfishing has brought many spring chinook stocks in the Northwest to a point where their continued existence is threatened (U.S. Fish and Wildlife Service 1980). In the Puget Sound region, existing information indicates that only the Skagit, Nooksack, and possibly Dungeness Rivers presently retain viable natural runs (Washington Department of Fisheries 1983; U.S. Fish and Wildlife Service 1982).

The Washington Department of Fisheries' (WDF) assessment of the outlook for this species in Puget Sound continues to be poor (Washington Department of Fisheries 1983). The Department currently allows no fisheries which specifically target on Puget Sound spring chinook as all remaining stocks are producing well below minimum escapement goals. Present WDF restoration programs for Puget Sound spring chinook (Geist 1982) include a relatively low level enhancement effort at the WDF Marblemount Hatchery using native Skagit River stock (fig.1). In addition, WDF has transferred the few remaining White River spring chinook to the Minter Creek Hatchery in an effort to save this run. Also, a small portion of the Minter Creek Hatchery spring chinook production is being held to maturity at the National Marine Fisheries Service's salt water pens at Manchester, Washington to supplement White River eggs. These programs are still under evaluation.

The Olympia Fisheries Assistance Office (FAO) of the U.S. Fish and Wildlife Service drafted a restoration plan (U.S. Fish and Wildlife Service 1980) to assist in restoring Puget Sound spring chinook. The principal goals of this plan were:

1. Protect existing spring chinook stocks.

2. Provide technical support or applied research by collecting data on critical information voids.

3. Undertake a broodstock program at Quilcene National Fish Hatchery (NFH) to provide eggs or smolts for reestablishing spring chinook into suitable habitat or for appropriate hatchery runs.

Toward these ends, FAO initiated cooperative efforts with several Puget Sound Indian tribes and the Washington Department of Fisheries to restore Puget Sound spring chinook, with particular emphasis on restoration of the Nooksack River run and on development of a broodstock program at Quilcene NFH.

NOOKSACK RIVER RESTORATION ACTIVITIES

In 1980, FAO together with WDF and the Lummi and Nooksack Tribes initiated efforts to establish spring chinook broodruns at the Skookum and Kendall Hatcheries in the Nooksack River system using native broodstock from respective spawning populations in the south and north forks (fig. 1). Egg takes of approximately 100,000 per year in each fork were considered sufficient to establish the broodruns and still allow natural production to occur. Capture locations and methods were selected in part with information developed from 1980 adult radio tagging studies in the basin (Barclay undated). The high degree of water clarity in the south fork also allowed highly effective snorkel surveys of potential capture sites (MacKay 1983).

To date, set netting has been effectively employed by WDF as a collection technique in a north fork side-slough (Hendricks 1982) whereas drift netting has been successfully used by FAO and the tribes in mainstem holding areas of the south fork where net avoidance is a problem because of water clarity. Further, due to the inaccessibility of the south fork capture sites, fish have been transported to the south fork hatchery via helicopter for the last two years to reduce transportation time and associated handling stress. Fish "totes" holding 400 liters of water suspended by specially designed slings have safely transported up to seven fish per load without supplemental oxygen during the five-minute flight to the hatchery. No mortalities or observable stress have occurred with this transportation scheme.

In 1980 and 1981, egg takes from collection efforts were relatively successful and met or approached the intended goal of approximately 100,000 eggs from each fork. Unfortunately, in 1982, an unusually low escapement resulted in egg takes of 10,000 and 25,000 in the north and south forks, respectively. Fortunately, no substantial problems have occurred in other aspects of this program, such as adult holding and spawning and juvenile rearing at each hatchery.

FAO conducted studies of the native Nooksack spring chinook outmigration in 1981 to define an optimal time and size of release for the ongoing hatchery programs in the basin. Simulating the natural life history of a stock can have substantial benefits in a hatchery program (Reimers 1979), but knowledge of the early life history of Puget Sound spring chinook was lacking. Accordingly, in 1981 emergent spring chinook fry from the upper reaches of both forks were cold branded and then recovered by seining and trapping in the lower river (Wunderlich et al. 1982). In 1982

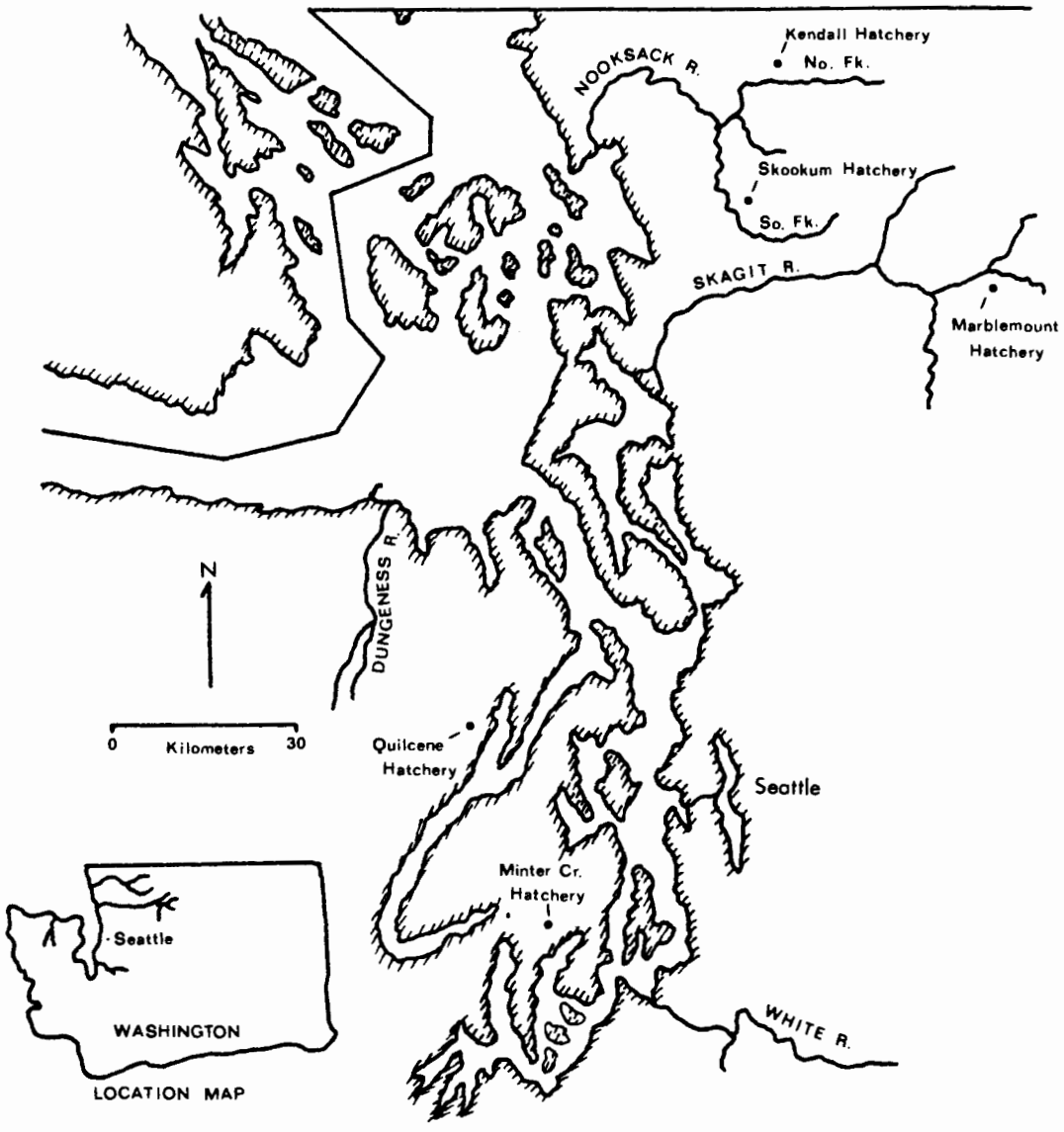

Figure 1. Puget Sound spring chinook streams and spring chinook enhancement facilities.

the study was restricted to north fork juveniles, in conjunction with field microtagging of these fish to develop much needed information regarding marine contribution and interception rates (Wunderlich and Boomer 1982). These investigations were only partially successful in that relatively few fish were recovered and nearly all recoveries occurred near the release sites soon after release. The constancy in recovery rates and the absence of larger-sized juvenile chinook in upriver catches did suggest, however, that residency in the upper watershed was relatively brief in both years. Additionally, the recovery in 1982 of four tagged subyearling fish in the lower river and estuary in May and June suggested that at least a portion of the north fork population may emigrate in their first spring. This finding was contrary to existing information regarding Puget Sound spring chinook early life history (Williams et al. 1975), but it was consistent with scale analysis of returning spawners from this population (Sneva 1981). These studies are continuing.

As a corollary to these investigations, we examined behavior of two south fork Nooksack hatchery spring chinook releases in 1981 to help define optimal time and size of release (Wunderlich et al. 1982). We compared movement rates to the estuary of one subyearling spring chinook group released in mid-June, and one released in September. Results indicated that the June release group moved at a rate of approximately three river miles per day to the estuary. This movement rate was estimated to be much greater than the September release group, which exhibited a high degree of residualism below the hatchery until the close of the study in late December 1981. This suggests that, of the two release times examined, June was preferable for rapid emigration of south fork spring chinook from the Nooksack River. Rapid movement of south fork

hatchery springs from the system should minimize competition with the wild stock, and improve early survival of the hatchery fish.

QUILCENE NFH BROODRUN DEVELOPMENT

The U.S. Fish and Wildlife Service's restoration plan for Puget Sound spring chinook (U.S. Fish and Wildlife Service 1980) established the following priorities for development of a broodrun at Quilcene NFH:

1. A pure strain of Puget Sound wild stock.
2. A mix of Puget Sound stocks.
3. A stock that is most representative of Puget Sound genealogy.
4. Any other remaining spring chinook stock which can successfully adapt to the Puget Sound region and present no pathological threat to existing Puget Sound fish populations.

All potential sources of spring chinook broodstock for Quilcene NFH were screened using the above criteria. From this evaluation Cowlitz River (Columbia drainage) females and Nooksack River males were selected. A cross of this nature would not jeopardize existing Puget Sound rehabilitation efforts, where all available Puget Sound spring chinook eggs are fully committed to existing programs. It would, however, incorporate desirable Puget Sound characteristics by using excess sperm from the Nooksack program. Continued crosses with Nooksack males in later generations would further increase the desirable Puget Sound component. Accordingly, beginning in 1981, Nooksack sperm was transported to the Cowlitz Hatchery to fertilize Cowlitz spring chinook eggs. To develop a range of spawning (and presumably) run timing at Quilcene NFH, we have crossed earlier timed north fork Nooksack males with earlier run Cowlitz females, and later timed south fork Nooksack males with later run Cowlitz females. Eyed eggs were transferred to Quilcene NFH and held in quarantine until certified to be viral free. We have, in each of the past two years, transferred approximately 450,000 Nooksack X Cowlitz eggs to Quilcene NFH. This number will expedite development of returning broodstock and also allow experimentation with time and size of release through coded wire tagging studies.

FUTURE DIRECTION

Future efforts by the U.S. Fish and Wildlife Service to restore Puget Sound spring chinook will continue to center on broodrun development at the Nooksack and Quilcene Hatcheries, coupled with coded wire tagging studies of various releases to evaluate optimal time and size of release as well as overall survival and contribution rates. Coded wire tagging of wild Nooksack stock will also continue for at least one full cycle, provided escapements are adequate to ensure sufficiently large tag groups for meaningful estimates of marine contribution and interception. Other efforts will include development of accurate run size estimates for the Nooksack population to improve management of the resource, and development of spring chinook habitat preference curves (Bovee 1982) to better assess the potential impacts of water development projects on the freshwater habitat of Puget Sound spring chinook salmon.

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