# The Extent of Hatchery-Origin Fish Among Fall Chinook Salmon (*Oncorhynchus tshawytscha*) Observed in South Puget Sound Tributary Streams

by

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ABSTRACT

**The Extent of Hatchery-Origin Fish Among Fall Chinook Salmon (*Oncorhynchus tshawytscha*) Observed in South Puget Sound Tributary Streams**

Kevin M. Kennedy

Chinook salmon *(Oncorhynchus tshawytscha)* have been observed in small numbers, for over 50 years, in many of the small tributary streams that feed into Puget Sound south of the Tacoma Narrows Bridge. Observations do not predate the release of hatchery-reared Chinook salmon throughout the region, so the origin of the Chinook salmon presently observed in these streams, as well as any potential role they could serve in recovery efforts of the Puget Sound Chinook salmon evolutionary significant unit (ESU), remain unknown. The extent of hatchery-origin fish among the Chinook salmon observed in South Puget Sound tributary streams was assessed using existing hatchery release and spawning ground survey records. Hatchery mark rates from the Regional Mark Information System (RMIS) Database were compared with mark recovery rates from the Washington Department of Fish and Wildlife Spawning Ground Survey Database to see if similar mark rates existed between the two groups. Although the hatchery mark rates exceeded mark recovery rates of fish observed during spawning ground surveys in most instances, mark recovery data revealed that the majority of carcasses observed, at three of the four streams with adequate sample sizes, had clipped adipose fins or coded wire tags, suggesting an extensive presence of hatchery-origin fish among the Chinook salmon observed at these streams. This might indicate that these fish are primarily present due to previous or current releases of hatchery Chinook salmon in South Puget Sound. If this assumption is correct, designating these streams as critical habitat would not prove beneficial in aiding the recovery of the Puget Sound Chinook salmon ESU and could pose unintended consequences for the co-managers, Washington Department of Fish and Wildlife and Western Washington Treaty Indian Tribes, responsible for managing the salmonids present in these streams.

## Table of Contents

## List of Figures

## List of Tables

## List of Appendices

## List of Acronyms

| | |
|---|---|
| AD | Adipose fin marked |
| AUC | Area-under-the-curve |
| CWT | Coded wire tag |
| DPS | Distinct population segment |
| EDT | Ecosystem diagnosis treatment |
| ESA | Endangered Species Act |
| ESU | Evolutionary significant unit |
| FPP | Fish per pound |
| HGMP | Hatchery and Genetic Management Plan |
| NMFS | National Marine Fisheries Service |
| NOAA | National Oceanic and Atmospheric Administration |
| NWMT | Northwest Marine Tech |
| RM | River mile |
| RMIS | Regional Mark Information System |
| RSI | Remote site incubator |
| SaSI | Salmonid Stock Inventory |
| SaSSI | Salmon and Steelhead Stock Inventory |
| TRT | Technical Recovery Team |
| USFWS | United States Fish and Wildlife Service |
| USGS | United States Geological Survey |
| WDF | Washington Department of Fisheries |
| WDFW | Washington Department of Fish and Wildlife |
| WDW | Washington Department of Wildlife |
| WRIA | Water Resource Inventory Area |
| WWTIT | Western Washington Treaty Indian Tribes |

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## Introduction

Wild Chinook salmon (*Oncorhynchus tshawytscha*) populations have declined throughout the Puget Sound region in recent decades. These population declines prompted the National Marine Fisheries Service (NMFS) to designate the Puget Sound Chinook salmon evolutionary significant unit (ESU) as threatened under the Endangered Species Act (ESA), first in 1999 and again in 2005 (NMFS, 1999; NMFS, 2005a). In the South Puget Sound region, which encompasses all Puget Sound waterways that lie south of the Tacoma Narrows, there is currently only one independent population of Chinook salmon in the Puget Sound ESU, located in the Nisqually River. Due to its unique position, some policymakers and scientists deem this independent population important for the recovery of the entire Puget Sound ESU (Shared Strategy Development Committee, 2007). In addition to the Nisqually River population, Chinook salmon have been observed, in recent times, in the small, independent streams that feed into South Puget Sound. These small, independent tributaries, defined as individual streams that drain directly into Puget Sound, will hereafter be referred to as South Puget Sound tributaries (Figure 1). The number of Chinook salmon observed in South Puget Sound tributaries is small, in comparison to Chinook abundance in the Nisqually River, and also intermittent, with tens to hundreds of fish observed in some years but none in other years (Ruckelshaus et al., 2006). Historical records regarding the abundance and spawning presence of Chinook salmon in these tributary streams are lacking, so the origin of these fish, and their potential relationship to independent Puget Sound Chinook salmon populations, is currently unknown.

The historical presence, or absence, and origin of the Chinook salmon that currently return to South Puget Sound tributaries is alluded to in a document published by the Puget Sound Technical Recovery Team (TRT), a committee designated the task of identifying independent populations of Chinook salmon in the Puget Sound region. The TRT did not assign all groups of Chinook salmon, which are reported to spawn naturally in Puget Sound streams, to independent populations for two reasons. One reason is that the small numbers of Chinook, which intermittently return to certain streams, might be part of larger independent populations and only return to these small streams during years of high abundance or favorable habitat conditions. The second reason why Chinook salmon that return to these streams are not designated as an independent population is because the streams may not have supported naturally spawning Chinook populations historically, and the only reason Chinook return to these streams currently may be due to returning adults from hatchery production. In the interim, the TRT document suggests that Chinook salmon that return to these small streams, which are not within the geographic boundaries of independent Chinook populations, should be given consideration towards possibly contributing to the population dynamics of independent Puget Sound Chinook salmon populations (Ruckelshaus et al., 2006). The suggestion that small numbers of Chinook salmon returning to streams, for which historic presence or absence is unknown, might contribute to the population dynamics of independent Chinook populations in the Puget Sound could be an indication that the Chinook in these small streams might be considered as beneficial towards recovery efforts for the Puget Sound Chinook salmon ESU. If this hypothesis were proven true, or accepted as policy, it could potentially mean the designation of these small streams as critical habitat for the Puget Sound Chinook salmon ESU.

The origin of Chinook salmon that return to South Puget Sound tributaries has been studied from many angles, including genetic analysis comparing fish found in these small streams with fish from the Nisqually River and various South Puget Sound hatchery programs, as well as habitat surveys comparing the parameters of these small streams with known information on Chinook spawning needs and preferences. Another possible area of study is to summarize historical records of spawning presence, timing, and abundance of Chinook salmon in the small, independent tributaries of South Puget Sound in order to determine the origin of these fish (Ruckelshaus et al., 2006). An analysis of existing spawning ground surveys and hatchery release records pertaining to the small, independent tributaries of South Puget Sound will be conducted to assess how extensive the influence of hatchery-origin fish is among the Chinook salmon observed in these small streams.

This document is designed to test for indications of hatchery influence among the Chinook salmon using the small, independent tributary streams that feed into South Puget Sound. It will begin with a general description of Chinook life history, an in-depth review of this issue within the broader policy arena, existing genetic information about South Sound Chinook stocks, and a review of South Puget Sound hatchery releases of Chinook salmon. Past abundance estimates for both Nisqually and South Puget Sound Tributaries Chinook will be summarized, and a comparison of the characteristics of South Puget Sound streams with known Puget Sound Chinook salmon systems will be provided. Existing spawning ground survey and hatchery release records will be analyzed in three scenarios that test for indications of hatchery-origin fish among the Chinook salmon observed in these streams. These will be followed by results, a discussion of the results, and the implications of these results in relation to the recovery of the Puget Sound Chinook salmon ESU.

**Figure 1**. South Puget Sound study site map.


Source: Amy Callahan, Thurston County Geodata, 2008.

# Background

## Chinook Salmon Life History

Chinook salmon (*Oncorhynchus tshawytscha*) are the largest of the five species of Pacific salmon in the genus *Oncorhynchus,* and like the other four species Chinook are anadromous (migrate to sea and return to freshwater to spawn) and semelparous (spawn only once before dying). They are a commercially valuable species and are highly sought after by commercial, tribal, and recreational fisheries. There are two recognized forms or races of Chinook salmon, stream-type and ocean-type, which display differing life history attributes, including: length of freshwater, estuarine, and oceanic residence, age at seaward migration, ocean distribution and migratory patterns, and age and time of spawning migration. The two forms of Chinook salmon, stream-type and ocean-type, and their typical life history characteristics are summarized in Healey (1991).

Stream-type Chinook have a long freshwater residence time after emerging from the gravel of their natal streams, spending one or more years in freshwater, as fry, before migrating to sea as yearlings. While at sea, stream-type Chinook migrate into offshore waters, and return to their natal river in the spring or summer (typically February through July) several months prior to spawning. Stream-type Chinook salmon are typically found in Asia, and North American populations north of 56°N, but are also found in some headwater tributaries of southern North American populations. Ocean-type Chinook salmon, unlike stream-type Chinook, have a shorter freshwater residence period. They migrate to sea during their first year, as subyearlings, within three months of emergence from the gravel where they were spawned. Ocean-type Chinook typically spend most of their ocean residence in coastal waters and return to their natal river in late summer or fall (typically July through December), only a few days or weeks before spawning proceeds. The ocean form of Chinook salmon is typically found in North American coastal populations south of 56°N (Healey, 1991). In addition to the variation in life history characteristics between the two forms or types of Chinook salmon, there exists variation of life history characteristics within each form as well. Given these life history characteristics, the coastal and relatively southern latitude of Puget Sound, the tendency of Puget Sound Chinook to migrate north along the Canadian Coast (Shared Strategy

Development Committee, 2007), and because Puget Sound Chinook salmon return to their natal rivers in late summer or fall, it is presumed that Puget Sound Chinook are ocean-type; all subsequent references to Chinook salmon from South Puget Sound and other river systems will be in reference to ocean-type, and particularly fall, Chinook salmon unless otherwise noted.

Like other ocean-type Chinook, the majority of Puget Sound Chinook salmon migrate out of their natal, freshwater streams during their first year and make use of the productive estuarine and nearshore habitats of the Puget Sound. These waters provide an excellent environment for juvenile Chinook because they provide plenty of food in the form of insects and forage fish (Fresh et al., 1979), protection from predators (Beamer et al., 2003), and a place to undergo the physiological transition to saltwater (Simenstad et al., 1985). It is during their residence in the highly productive estuarine and nearshore waters that juvenile salmon experience the highest growth rates of their lives (Shared Strategy Development Committee, 2007). As juvenile Chinook continue to feed and grow in the estuarine environment of Puget Sound, they venture into deeper, and further offshore, habitats until they complete their migration to the ocean environment (Fresh, 2006).

Chinook salmon remain at sea from one to six years, but most commonly two to four years. Some yearling males, also known as "jacks", either mature exclusively in freshwater or enter the saltwater environment for only two or three months before returning to freshwater, but the proportion of these precocious males is normally small (Myers et al., 1998). The majority of Puget Sound Chinook stocks mature as three- or four-year olds (Shared Strategy Development Committee, 2007), and the distribution of age at return for the Nisqually River Chinook stock supports the findings of Myers et al., 1998. Unpublished hatchery return data from the Nisqually Indian tribe states that age at return rates of adult Chinook, from 1990-1999, are 49.0% for three-year olds, 48.4% for four-year olds, and 2.5% for five-year olds (Nisqually Indian Tribe, 2007a). Age at return data does not exist specifically for South Puget Sound Tributaries Chinook natural spawners, but is likely similar to that of the Nisqually stock, since 85% of the Green River Chinook stock, the main hatchery broodstock used throughout Puget Sound during the latter half of the twentieth century, return as three- and four-year olds (Shared Strategy Development Committee, 2007).

Scientific evidence suggests that the time of year at which adult Chinook salmon return to freshwater, and to spawn, is related to local temperature and flow regimes (Miller and Brannon, 1982). Adult Puget Sound Chinook salmon return to freshwater from late March to early December, with the peak spawning period occurring from mid- to late August through mid-October (Shared Strategy Development Committee, 2007). Summer and fall Chinook salmon runs predominate in Puget Sound, as many of the early, or spring, runs have been extirpated (Myers et al., 1998). In South Puget Sound, both Nisqually River and South Sound Tributaries Chinook salmon exhibit similar spawning behavior, with the former returning to the river from late July through mid-September and spawning from mid-September through October, and the later spawning from late-September through October (WDF et al., 1993). While numerous studies reveal that adult salmon return to their natal streams with high success (Quinn and Fresh, 1984; McIsaac and Quinn, 1988), adult salmon do sometimes stray to systems other than their natal stream. Straying is considered a response to perturbed or unfavorable conditions at one's natal stream (Quinn, 1993). Other important reasons why salmon stray include low competition for colonizing new systems, including newly created habitat following the recession of glaciers (Milner et al., 2000) or after natural disasters such as volcanic eruptions (Quinn, 2005).

## Policy

### *The Endangered Species Act and Evolutionary Significant Units*

The Endangered Species Act was enacted by Congress in 1973 to allow for the conservation of species that were in danger of or threatened with extinction (USFWS, 1973). NMFS, through the National Oceanic and Atmospheric Administration (NOAA), was assigned the task of designating anadromous salmonids under the ESA, while the United States Fish and Wildlife Service (USFWS) designated all non-anadromous fish. The initial enactment of the ESA only permitted the listing of full species, but the ESA was amended in 1978 to allow for the listing of distinct population segments (DPS) of vertebrates (including fish), as well as subspecies (Good et al., 2005). Since the ESA was ambiguous in providing guidelines for determining what constitutes a DPS, NMFS published a policy describing how the agency would apply the definition of species in the ESA towards anadromous salmonid species (Good et al., 2005). According to NMFS policy, a salmon population, or group of populations, is considered distinct for ESA purposes if it represents an ESU of the biological species (Waples, 1991). An ESU is defined as a population that 1) is reproductively isolated from conspecific populations (other population units of the same species), and 2) represents an important component in the evolutionary legacy of the species (Waples, 1991). Insight into evolutionary significance can be provided by data on genetic and life history characteristics, habitat differences, and the effects of supplementation efforts and stock transfers (hatchery releases). Information useful for determining the degree of reproductive isolation includes recolonization rates, incidences of straying, degree of genetic differentiation, and the existence of barriers to migration (Good et al., 2005).

In 1998, NMFS completed a status review of Chinook salmon from Washington, Oregon, Idaho, and California. The Biological Review Team that completed the status review reported that the overall abundance of Chinook salmon in the Puget Sound ESU had declined substantially from historical levels for a variety of reasons, including decreased access to spawning habitat, degraded freshwater habitat, and an increasing reliance on hatchery fish for achieving escapement and harvest goals (Myers et al., 1998). Following the status review of West Coast Chinook salmon, NMFS listed the Puget Sound Chinook salmon ESU as a threatened species under the ESA on March 24, 1999 (NMFS, 1999). According to Section 3.19 of the ESA, a threatened species is "any species which is likely to become an endangered species within the foreseeable future throughout all or a significant portion of its range". Thus, at the time of this listing, the Puget Sound Chinook Salmon ESU was at risk of becoming endangered, but not at risk of becoming extinct, in the foreseeable future.

Not long after the Puget Sound Chinook Salmon ESU was listed as threatened under the ESA, a few factors led NMFS to conduct a systematic update of all listed Pacific salmon and steelhead ESUs. First, a court ruling from September 2001 brought into question NMFS' decision not to list several hatchery populations that were considered to be part of the Oregon Coast coho salmon ESU (*Alsea Valley Alliance v. Evans*, 161 F. Supp. 2d 1154, D. Oreg.). The Alsea decision, as it will hereafter be called, held that the ESA does not permit the listing of any unit smaller that a DPS (in this case an ESU), and that NMFS had violated this provision of the ESA by listing only part of an ESU. Prior to this decision, NMFS had listed very few hatchery populations under the ESA, and those listed were either closely associated with natural salmon populations or ESUs considered at high risk of extinction (Good et al., 2005). In addition to the Alsea decision, this discrepancy regarding NMFS' interpretation of the ESA was raised by two additional, and similar, lawsuits regarding steelhead ESUs in California. In these lawsuits [*EDC v. Evans*, SACV-00-1212-AHS (EEA); *MID v. Evans*, CIV-F-02-6553 OWW DLB (E.D. Cal.)], it was determined that NMFS had violated the ESA by listing only the anadromous population of the ESU while excluding the resident population, part of the same ESU, from listing. The outcome of the Alsea decision, and steelhead lawsuits, meant that for any subsequent listings of Pacific salmon and steelhead, NMFS must list, or exclude from listing, an ESU in its entirety. It also meant that NMFS would now have to consider how to view hatchery populations of salmon that reside within an ESU containing natural populations.

These court decisions, coupled with the fact that nearly a decade had passed since the first ESUs were listed in the Sacramento and Snake Rivers and several years of additional data were available for other ESUs, prompted NMFS to begin an update of all listed ESUs of Pacific salmon and steelhead in 2002 (Good et al., 2005). An updated status review of listed ESUs of West Coast salmon and steelhead was completed in 2005, and the majority of the NMFS Biological Review Team members assigned to the Chinook salmon species decided that the Puget Sound Chinook Salmon ESU should be designated as threatened (Good et al., 2005). On June 28, 2005, NMFS reaffirmed threatened status for the Puget Sound Chinook salmon ESU under the ESA (NMFS, 2005a).

***The Puget Sound Technical Recovery Team and the 1992 Washington State Salmon and Steelhead Stock Inventory (SaSSI)***

Between the timing of NMFS' first and subsequent listings of the Puget Sound Chinook Salmon ESU, the Puget Sound Technical Recovery Team (TRT) was formed. The TRT was assigned the task, for recovery planning purposes, of identifying populations that historically existed and currently remain within the geographical boundaries that encompass the Puget Sound Chinook Salmon ESU (Ruckelshaus et al., 2006). The TRT, which began work in 2000, included one or more representatives from the following organizations: Northwest Fisheries Science Center, Northwest Indian Fisheries Commission, Washington Department of Natural Resources, National Marine Fisheries Service, King Country Department of Natural Resources and Parks, Tulalip Tribe, and Washington Department of Fish and Wildlife (WDFW). The process the TRT used to identify populations of Chinook salmon within the Puget Sound ESU was similar to the process used by NMFS to identify ESUs of Chinook salmon and other salmonids, in that both processes involved distinguishing a smaller, independent population from a larger population based on biological and geographical differences.

The TRT defined an independent population using Ricker's definition of a "stock" as "a group of fish of the same species that spawns in a particular lake or stream (or portion thereof) at a particular season and which, to a substantial degree, does not interbreed with fish from any other group spawning in a different place or in the same place at a different season" (Ricker, 1972). The significant information necessary to identify independent populations, under the previously mentioned definition, is migration rates between groups and their demographic distribution (Ruckelshaus et al., 2006). Since information regarding salmon straying between streams was lacking, the TRT had to rely on different types of information to infer the degree of reproductive isolation between Chinook salmon groups. The TRT decided on six indicators of historical population structure, ordered by the strength of inference: 1) geographic orientation of groups 2) migration rates 3) genetic attributes 4) patterns of life history or phenotypic characteristics 5) population dynamics 6) environmental/habitat characteristics. Not all of the indicators proved useful in this analysis, and only geography, genetics, and some life history information were used as indicators to distinguish independent populations within the Puget Sound Chinook Salmon ESU (Ruckelshaus et al., 2006).

In making decisions regarding designation of independent populations of Puget Sound Chinook salmon, the TRT reviewed all Chinook salmon groups that spawned naturally in Puget Sound streams. Information about Puget Sound Chinook salmon spawning groups was obtained from the 1992 Washington State Salmon and Steelhead Stock Inventory (SaSSI); updates to the 1992 version, completed in 2002, were also considered. (In 1997, SaSSI was renamed SaSI (Salmonid Stock Inventory) and stock assessments have been updated periodically since that time, with the last update for Chinook salmon stocks completed in 2002. The 1992 version will be referenced as SaSSI and be cited as WDF et al., 1993; the latter version will be referred to as SaSI and will be cited as WDF et al., 1993; updated 2002). SaSSI was written by Washington Department of Fisheries (WDF), Washington Department of Wildlife (WDW), and Western Washington Treaty Indian Tribes (WWTIT), hereafter referred to as the co-managers. The co-managers were given the task of identifying all existing stocks of salmon and steelhead that naturally reproduce in Washington waters, regardless of origin, including native, non-native and mixed stocks (WDF et al., 1993). In SaSSI, a native stock is defined as an indigenous stock that has not been substantially altered by genetic interactions with non-native stocks and is still present in all or part of its original range. A non-native stock is one that has established itself outside of its original range, and a mixed stock is one whose individuals originated from native and non-native parents. A mixed stock can also refer to a native stock that has undergone substantial genetic alteration (WDF et al., 1993). SaSSI also determined that some stocks had insufficient information to be adequately defined, so these stocks were listed as unknown.

The co-managers used a definition of stock that was very similar to that developed by Rickers, focused on a group of fish that spawns in a particular place at a particular season and does not substantially interbreed with other groups spawning in a different place, or in the same place at a different season (WDF et al., 1993). The co-managers used criteria to define stocks centered on distinct spawning distribution, temporal distribution, biological characteristics, and genetics. Despite differences in terminology, it appears that there are similarities in how both parties identified groups of spawning Chinook salmon. The co-manager's choice of the term "stock" and the TRT's use of the term "independent population" both are used to distinguish one group of fish from other groups on the basis of geography, genetics, and life history characteristics (i.e. spawning timing, freshwater entry). Given these similarities, it appears that the stock listings in SaSSI lent themselves well for use by the TRT in its designation of independent populations of Puget Sound Chinook salmon.

According to SaSSI, the Nisqually summer/fall Chinook stock, as it was referred to in 1992, was rated as a healthy stock, meaning that production levels were consistent with its available habitat and within the natural variations expected for survival in that stock. The origin of the Nisqually stock was listed as mixed, likely because of the influence of non-native Green River hatchery-origin fish, which, in combination with habitat loss and high harvest rates, is presumed to have extirpated the natural Nisqually stock (Nisqually Chinook Recovery Team, 2001). The Nisqually production type was listed as composite, meaning the stock is sustained through a combination of wild (natural) and artificial production. In 2002, SaSI rated Nisqually Chinook, the current name for that stock, as depressed. A depressed stock is one whose production level is below expected levels based on available habitat and natural variations in levels of survival. (While a "depressed stock" rating suggests that a stock is declining in abundance, it is not as serious a rating as that given to a critical stock, which is a stock that has such low production levels that permanent damage to the stock has likely occurred or will occur. Another way to comprehend this terminology is to view a depressed stock rating as similar to that of a threatened designation under the ESA, while a critical stock rating is similar to an ESA designation of endangered.) The Nisqually stock was rated as depressed because of low stock productivity, meaning the stock produced fewer returning offspring than would be expected given the estimated number of spawners. As in 1992, the Nisqually stock was listed as mixed and the production type was determined to be composite.

Using information regarding stock listings in SaSSI, the Puget Sound Technical Recovery Team determined that there were 22 historical populations that currently existed within the Puget Sound Chinook Salmon ESU, and 16 additional spawning aggregations or populations that were now putatively extinct. The Nisqually River is listed as one of the 22 existing historical populations, and is one of six independent populations classified in the Central and South Puget Sound Region. The Nisqually River independent population is the furthest south, geographically, of the 22 Puget Sound populations.

The TRT noted that both the early- and late-run Nisqually spawning aggregations are considered to be extinct (Ruckelshaus et al., 2006). Uncertainty over whether these aggregations of spawners might represent distinct populations led the TRT to term them as "spawning aggregations", split into early- and late-run times. While little historical information regarding early-run Nisqually Chinook salmon is available, Smoker et al. (1952) noted that historical peak harvest occurred more than a month earlier than the current harvest on naturalized, nonnative, Green River origin Chinook salmon. This observation might suggest that an earlier run timing of Nisqually River Chinook existed historically, and the lack of Chinook returning to the river earlier in the season in recent decades is presumably what prompted Nehlsen et al. (1991) to consider this early-run spawning aggregation extinct. It should be noted that Nehlsen et al. referred to the Nisqually River Chinook early-run spawning aggregation as the Nisqually spring/summer race, but it is assumed that these two different terms refer to the same spawning aggregation of Chinook salmon.

Although there is currently a late-run Nisqually River Chinook salmon spawning aggregation, stock origin is difficult to determine. Research suggests that Nisqually River Chinook are genetically similar to Green River Chinook (Marshall 1999; Marshall 2000), but genetic samples of Nisqually Chinook were not taken prior to the introduction of non-native, Soos Creek Hatchery (Green River) origin Chinook into the Nisqually River. Thus, this could imply that, genetically, either the native Nisqually stock may have resembled other South Puget Sound Chinook stocks, including Green River Chinook, or that the indigenous Nisqually River population has been replaced by Green River origin Chinook salmon (WDF et al,, 1993, updated 2002). Given that early-run Nisqually Chinook salmon, which may have contributed to the viability of Chinook salmon in the watershed, are considered to be extinct, and the fact that late-run Nisqually Chinook spawning aggregations have presumably been replaced by naturalized, non-native hatchery broodstock, recovery efforts for Nisqually River Chinook are currently focused on developing a locally adapted Chinook population in the long term (Nisqually Chinook Recovery Team, 2001). This course of action is considered essential to ensure that the Nisqually River Chinook population will provide a critically important contribution to the recovery of the Puget Sound Chinook Salmon ESU (Shared Strategy Development Committee, 2007).

In reviewing all Puget Sound Chinook salmon spawning groups, the TRT decided not to assign all of the spawning groups documented in SaSSI as independent populations for two reasons:

1) Spawning adults are known to occur intermittently in certain streams- spawning in groups of tens to hundreds of fish in some years and none in others. A plausible explanation for intermittent occurrence of Chinook salmon in some streams is that those adults are part of a larger independent population that uses some spawning habitats only during years of high abundance or favorable habitat conditions. The streams that intermittently harbor spawning adults also could contain fish from more that one independent population, depending on their locations relative to the primary spawning areas of independent populations.

2) It is possible that some streams presently containing Chinook salmon never supported naturally spawning Chinook salmon historically. In many of these instances, the origin of the naturally spawning Chinook salmon present is most likely due to returning adults from hatchery production. Some streams may therefore contain Chinook salmon only because of the presence of a hatchery or releases of hatchery fish, and these streams would not have represented historical Chinook salmon spawning habitat that could sustain an independent population (Ruckelshaus et al., 2006).

These two statements are representative of the differing theories, referred to in the introduction, regarding the population structure of Chinook salmon in the small, independent tributaries of South Puget Sound. The first theory, which suggests that the Chinook salmon intermittently observed in small tributaries to Puget Sound might be part of larger independent Puget Sound populations, appears to rely on information from SaSSI's 1992 stock list for summer/fall Chinook in South Sound tributaries. The second population structure theory for these small groups of Chinook salmon suggests that their current presence in these streams is due to hatchery releases, and appears to rely on the co-managers 2002 SaSI stock list for South Sound Tributaries Chinook. There exists a significant difference between the 1992 and 2002 stock listing for Chinook salmon from South Sound tributaries, and these differences are most likely responsible for the differing theories regarding the population structure of these salmon groups.

The 1992 SaSSI stock list rated Chinook salmon from South Sound tributaries as a healthy stock of mixed origin and composite production type. This stock was described as one dependent upon hatchery production, from Green River hatchery stock, with some sustained natural spawning occurring (WDF et al., 1993). The stock had a listed spawn timing of September through October, and a spawning distribution that included Chambers Creek, McAllister Creek, Deschutes River, Carr Inlet Streams, and other South Sound streams. Another notable statement from the stock listing is a suggestion that some of these fish may be part of a self-sustainable population of natural spawners, but no data exists to quantify that statement (WDF et al., 1993).

The co-managers came to a much different conclusion in their 2002 rating of South Sound Tributaries Chinook. In SaSI, the fall Chinook spawning aggregations, as they were now referred to, were not rated and were no longer considered a distinct stock. The co-managers supported this course of action based on the following rationale. First, the streams in South Puget Sound are not typical Chinook habitat due to their relatively small size and low flows during the typical fall Chinook spawning season (late summer/early fall). Second, low escapement numbers from streams without on-site Chinook hatchery operations likely resulted from past hatchery plants, or straying from either current South Sound hatchery programs or viable South Puget Sound natural populations. Third, fall Chinook were likely not historically self-sustaining in South Sound streams and have little chance of establishing self-sustaining populations through natural production. The co-managers concluded that Chinook salmon present in South Sound tributaries in recent times are due to the large, numerous releases of Chinook from South Sound hatcheries, and suggested that the large escapement numbers that led them to classify the naturally spawning Chinook aggregations as a stock in 1992 consisted of hatchery returns released or escaping above hatchery racks (WDF et al., 1993; updated 2002).

*Critical Habitat Designation and its Application in South Puget Sound*

The designation of critical habitat under the ESA is an important conservation tool for listed species because it designates, and protects, habitat important to the recovery of that species. Land designated as critical habitat is afforded protection from human activities, such as development or resource extraction, which could potentially degrade the condition of the land and further imperil the plight of a listed species. Section 3(5)(A) of the ESA defines critical habitat for a threatened or endangered species as:

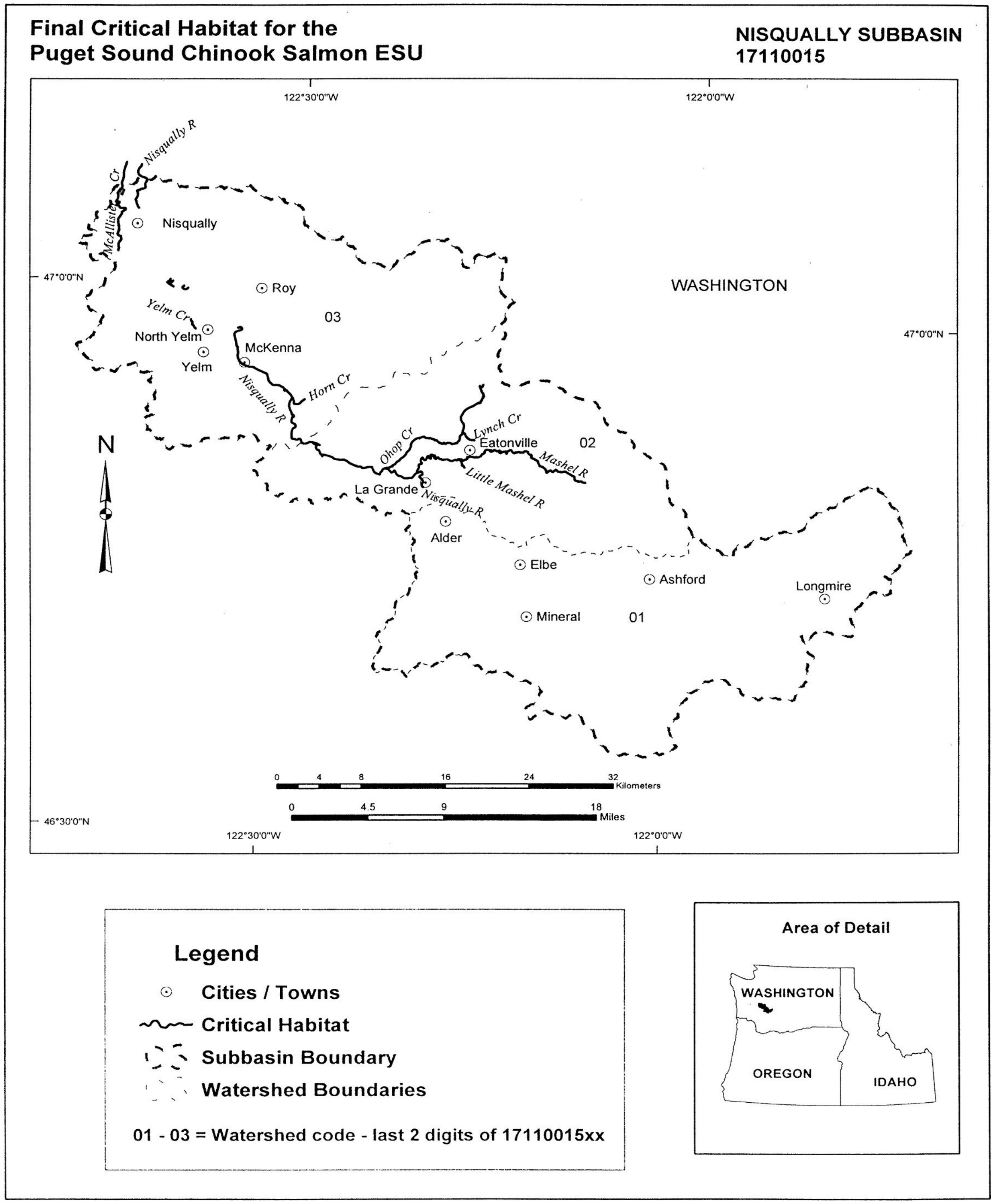
> (i) the specific areas within the geographical area occupied by the species, at the time it is listed … on which are found those physical or biological features (I) essential to the conservation of the species and (II) which may require special management considerations or protection; and
>
> (ii) specific areas outside the geographical area occupied by the species at the time it is listed upon a determination by the Secretary that such areas are essential for the conservation of the species.

Section 4 of the ESA requires the Secretary of the Department of the Interior to designate critical habitat for listed species, and make revisions thereto, "on the basis of the best scientific data available". In deciding which lands to designate as critical habitat, the Secretary looks at all lands that are eligible for inclusion, under Section 3(5)(A) of the ESA, minus some lands that are eligible for exclusion due to reasons of economy, national security, or Tribal/private ownership. Lands eligible for exclusion from critical habitat designation include Department of Defense Lands, Tribal Lands, and private landholdings with contractual commitments to conservation. The Secretary can also exclude lands from critical habitat designation, under Section 4(b)(2) of the ESA, on economic grounds if it is determined that the economic benefits of excluding an area from critical habitat designation outweigh the conservation benefits of designating that area. It merits noting that the Secretary is not permitted to exclude an area from critical habitat designation if such an exclusion would result in the extinction of that species.

In September of 2005, critical habitat was designated for 12 ESUs of salmon and steelhead in Washington, Oregon, and Idaho, including the Puget Sound Chinook salmon ESU. Areas that were designated in the Nisqually Sub-basin include the entire mainstem

Nisqually River from its outlet in Puget Sound to the city of La Grande, McAllister Creek, the nearshore marine area of the Nisqually Sub-basin, and numerous tributaries to the Nisqually River, many of which serve as spawning grounds for Chinook and other Pacific salmon species. Those areas of the Nisqually Sub-basin which were excluded from critical habitat designation include the segment of the lower Nisqually River which lies adjacent to the Nisqually Indian Reservation and the Fort Lewis Military Reservation (NMFS, 2005b). Figure 2 provides a detailed map of the areas, within the Nisqually Sub-basin, that were included in the final critical habitat designation for the Puget Sound Chinook salmon ESU. The only other areas of South Puget Sound which were designated as critical habitat for the Puget Sound Chinook ESU are the nearshore marine areas of the Deschutes, Shelton, and Kitsap Sub-basins. Nearshore marine areas are areas adjacent to the shoreline that span from the line of extreme high tide out to a depth of no more then 30 meters relative to the mean lower low water. These areas are important to Puget Sound Chinook because they provide food (aquatic invertebrates and fishes) and cover (submerged and overhanging trees, aquatic vegetation, and boulders) that permit juveniles to successfully transition from their natal streams to offshore marine areas (NMFS, 2005b).

**Figure 2.** Areas designated as critical habitat within the Nisqually Sub-basin for the Puget Sound Chinook Salmon ESU.




Source: NMFS, 2005b.

### Genetic Samples from Nisqually River and South Puget Sound Tributary Streams

Very little genetic analysis has been conducted on Nisqually River Chinook salmon and none has been done for South Sound Tributaries Chinook. An analysis of Chinook spawning in the mainstem Nisqually River, Mashel River, and Ohop Creek in 1998 through 2000 revealed that the allele frequencies of the combined samples were similar to those of some South Puget Sound hatchery and wild populations, but the extent of hatchery-origin fish in the genetic samples is unknown (WDF et al., 1993; updated 2002). While the Nisqually summer/fall Chinook stock is identified as a stock based on their distinct spawning distribution (WDF et al., 1993), it is currently believed that the indigenous population may have been replaced by Soos Creek Hatchery (Green River) origin Chinook salmon (Marshall et al., 1995). Given the massive influx of South Sound hatchery-origin Chinook salmon in South Puget Sound, and the lack of information regarding the life history and genetic composition of both the native Nisqually stock and South Sound tributaries spawning aggregation, the use of these attributes to determine whether or not these two Chinook spawning aggregations coincided historically, and potentially shared members of the same population, is not currently relevant.

### Review of South Puget Sound Hatchery Releases of Chinook Salmon

Hatchery-origin Chinook salmon have been released in the Nisqually River, and other South Puget Sound rivers and streams, since at least 1943 (WDFW, 2000). The Regional Mark Information System (RMIS) is a comprehensive database that summarizes all known releases and recoveries of hatchery-origin Pacific salmon in the Pacific Northwest for brood years 1950-2007. The RMIS Database will serve as the main record for summarizing releases of hatchery-origin Chinook salmon in the South Puget Sound region for brood years 1952-2004. In compiling these records for summation, certain assumptions and guidelines were made that will likely result in a negative bias toward estimating the actual number of Chinook salmon released during this time period. First, sites where releases of Chinook salmon occurred were only included in this summary if the total number of fish released exceeded 500,000 for the entire 53 year time period. Half a million was chosen as an arbitrary number to permit focus on areas with large and/or consistent releases of hatchery-origin Chinook salmon. Choosing 500,000 as a minimum total release number did exclude many release locations from the summary, but considering the small number of fish released, and the scarcity of overall releases at many of these sites, the impact of their exclusion from the summary of hatchery-origin Chinook salmon released in the South Puget Sound region should be minimal.

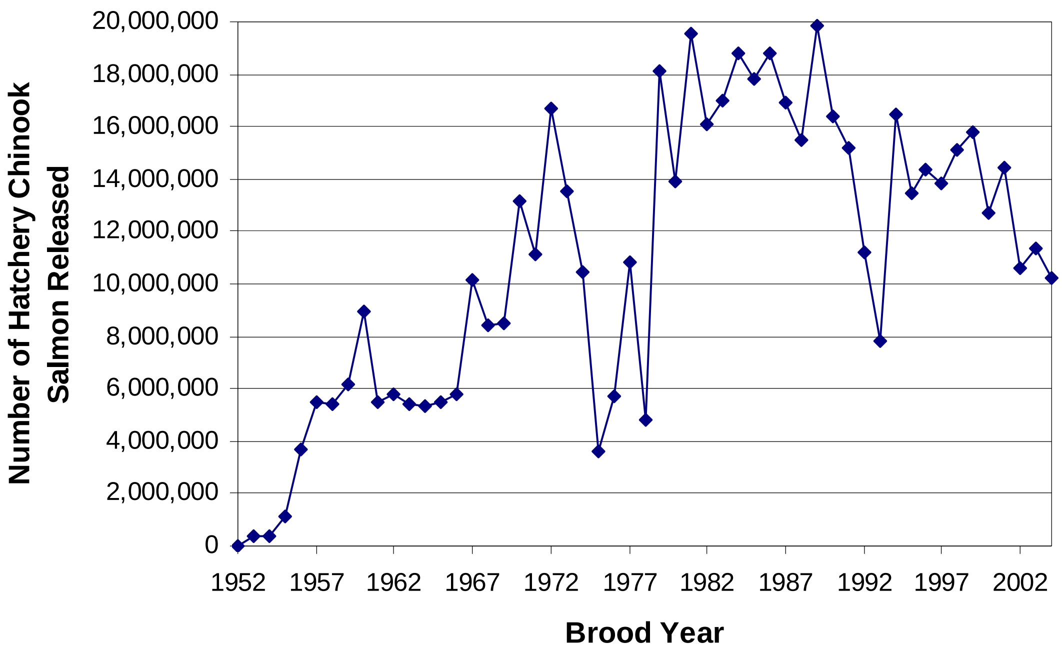
Second, although the RMIS Database summarizes releases of Chinook salmon from WDFW, USFWS, WWTIT, and local salmon enhancement groups, there exists a likelihood that the actual number of Chinook salmon released exceeds the numbers reported. Some releases of Chinook salmon may have been misreported or unreported over this time period, especially towards the beginning of the time period when computer usage for database management was not prevalent. Another reason to expect that the actual number of Chinook salmon released in the region may exceed reported releases is due to the fact that small releases by local salmon enhancement groups, and potential releases by private citizens, are less likely to be reported than releases made by federal, state, and tribal resource managers. While these events cannot be accounted for, the effects of these plantings is likely minimal in comparison to the massive amount of hatchery-origin Chinook salmon released into Southern Puget Sound since 1953.

The results of this summary are provided in Tables A-1 through A-5 and Figure 3. Tables A-1- A-5 summarized brood year releases of Chinook salmon by WRIA (Watershed Resource Inventory Area), while Figure 3 displays annual brood year releases for the entire South Puget Sound region from 1952-2004. The annual brood year release totals are included in Table A-5. Since the overwhelming majority of Chinook releases occurred from hatchery facilities, a summary of the production facilities used by WDFW, and the Nisqually Indian Tribe, was provided.

WDFW manages or co-manages ten facilities which produced, reared, or served as release locations for fall Chinook salmon. The Nisqually Indian Tribe currently manages two facilities which produce, rear, and release Chinook salmon, and the Squaxin Island Indian Tribe managed or co-managed two facilities which released Chinook salmon. All WDFW hatcheries, as well as Squaxin Island Indian Tribal facilities, produce or produced Chinook salmon for the purpose of harvest by tribal, commercial, and recreational fisheries. One of these facilities, Minter Creek Hatchery, also operates for the purpose of recovering White River spring Chinook, listed as critical in SaSI

(WDF et al., 1993; updated 2002). The Nisqually hatcheries serve the dual purpose of providing fish for harvest opportunity, while also aiding in the long-term recovery goal of establishing a self-sustaining, locally adapted spawning population. The hatchery facilities will be summarized according to the basin they occupy. Of the five basins summarized, only the Nisqually River Basin is cited as historically supporting native populations of Chinook salmon, and it is currently believed that the native population has been replaced by fall Chinook salmon of various hatchery origins (WDFW, 2000). A table summarizing the individual South Puget Sound Chinook salmon hatchery release facilities is provided in Table 1.

**Figure 3.** Hatchery fall Chinook salmon releases in South Puget Sound, brood years 1952-2004.




Source: RMIS Database, 2008.

**Table 1**. Summary of South Puget Sound Chinook salmon hatchery facilities, brood years 1952-2004.

| Basin | Hatchery Facility | Year Program Established | Original Broodstock Source | Self-sustaining Egg Take from Returning Adults | On-site Release Goal | Releases Still Occurring |
|---|---|---|---|---|---|---|
| Nisqually | Kalama Creek | 1980 | Green River origin (Soos Creek, Puyallup, Tumwater Falls, McAllister Creek, and George Adams Hatcheries) | Yes, exclusively since 1988 | 600,000 fingerlings | Yes |
| Nisqually | Clear Creek | 1991 | Kalama Creek Hatchery | Yes, exclusively since 1996 | 3,500,000 fingerlings | Yes |
| Nisqually | McAllister Creek | 1982 | Green River origin (Tumwater Falls Hatchery) | Yes, exclusively since late 1980's | 1,000,000 fingerlings, 300,000 yearlings | No, 2001 last brood year release |
| Tacoma | Garrison Springs | 1980 | Green River origin (Soos Creek, Tumwater Falls, and Puyallup Hatcheries) | Yes, but often supplemented with Minter Creek and Tumwater Falls stocks. | 1,100,000 fingerlings; 850,000 at Chambers Creek trap, 250,000 at Steilacoom Lake | Yes |
| Tacoma | Chambers Creek | 1998 | Green River origin (Soos Creek, Tumwater Falls, and Puyallup Hatcheries) | Yes, but often supplemented with Minter Creek and Tumwater Falls stocks. | 70,000 yearlings into Chambers Creek | Yes |
| Tacoma | Lakewood | 1999 | Green River origin (Soos Creek, Tumwater Falls, and Puyallup Hatcheries) | Yes, but often supplemented with Minter Creek and Tumwater Falls stocks. | 330,000 yearlings into Chambers Creek | Yes |

Sources: HSRG, 2004; NMFS, 2003; WDFW, 2000; WDFW, 2002; RMIS Database, 2008.

**Table 1**. Summary of South Puget Sound Chinook salmon hatchery facilities, brood years 1952-2004.

| Basin | Hatchery Facility | Year Program Established | Original Broodstock Source | Self-sustaining Egg Take from Returning Adults | On-site Release Goal | Releases Still Occurring |
|---|---|---|---|---|---|---|
| Deschutes | Tumwater Falls | 1946 | Green River origin | Yes, exclusively since 1992 | 3,800,000 fingerlings, 200,000 yearlings | Yes |
| Kennedy-Goldsborough | South Sound Net Pens | 1972 | Green River origin (Finch Creek, Coulter Creek, and Tumwater Falls Hatcheries) | No, did not produce or collect any returning fish | Actual releases averaged ~ 387,000 yearlings | No, 1998 last brood year release |
| Kennedy-Goldsborough | Elson Creek | 1980 | Green River origin (Soos Creek, Voight Creek, and Tumwater Falls Hatcheries) | No, mostly relied on transfers of eggs from Tumwater Falls stock | Acutal releases averaged ~ 305,000 fingerlings | No, 1986 last brood year release |
| Kitsap | Minter Creek | 1946 | Green River origin (Soos Creek, Samish, and Tumwater Falls Hatcheries) | Yes, exclusively since 1999 | 1,800,000 fingerlings | Yes |
| Kitsap | Coulter Creek | 1980 | Green River origin (Minter Creek and Tumwater Falls Hatcheries) | No, often relied on transfers of Minter Creek stock to meet egg take goals | 1,000,000 fingerlings | No, 2000 last brood year release |
| Kitsap | Fox Island Net Pens | 1975 | Green River origin (Minter Creek Hatchery) | No, did not produce or collect any returning fish | Annual estimate of 240,000 yearlings, actual releases averaged ~ 212,000 | No, discontinued in July 2001 |

Sources: HSRG, 2004; NMFS, 2003; WDFW, 2000; WDFW, 2002; RMIS Database, 2008.

### *Nisqually River Hatchery Facilities*

The earliest recorded releases of fall Chinook salmon in the Nisqually Basin date back to 1943, and it has been estimated that the total number of Chinook released since 1943 exceeds 65 million (NMFS, 2003). There are currently two hatchery production facilities in operation in the Nisqually Basin, Clear Creek and Kalama Creek, both of which are currently managed by the Nisqually Indian Tribe. Kalama Creek Hatchery, which is located on a left bank tributary at river mile (RM) 9.2 on the Nisqually River, began releasing Chinook of Soos Creek (Green River) and Puyallup Hatchery origin in 1980 (HSRG, 2004), and has been self-sustaining (able to collect sufficient eggs from hatchery returns) since 1988 (RMIS Database, 2008). Clear Creek Hatchery, located on a right bank tributary at RM 6.3 on the Nisqually River, began releases in 1991 using Kalama Creek Hatchery Chinook stock, and has been self-sustaining since 1996 (HSRG, 2004). Prior to the operation of these two facilities, WDFW released Chinook salmon into the mainstem Nisqually River from 1956 to 1988, with some gaps between years (see Table A-1). These Chinook were spawned, incubated, and reared at numerous WDFW South and Central Puget Sound hatchery facilities (RMIS Database, 2008). Currently, enough eggs are collected from returning hatchery adults to satisfy the following hatchery production goals: 3.5 million smolts (sub-yearlings) for the Clear Creek Hatchery and 600,000 smolts for the Kalama Creek Hatchery (WDFW, 2006; WDFW 2007a).

### *McAllister Creek Hatchery*

McAllister Creek Hatchery is located at RM 4.0 of McAllister Creek, an independent stream that flows into the Nisqually River estuary. Chinook were first released at this hatchery site in 1982 (1981 brood year), and the stock is of Green River origin and became self-sufficient in the late 1980’s (HSRG, 2004). The McAllister Creek Hatchery had the following yearly hatchery Chinook production goals: 1.0 million sub-yearlings and 300,000 yearlings. The presence of a parasite in the watershed required that fish be sent to other facilities, both in- and out-of-basin, for rearing. Given the potential for disease transmission to stocks in other basins, the Hatchery Scientific Review Group recommended that WDFW stop Chinook production at the McAllister

Creek Hatchery (HSRG, 2004). WDFW agreed with this recommendation, and Chinook salmon releases at McAllister Creek ceased after 2002.

***Chambers Creek Basin Hatchery Facilities***

WDFW has three facilities in the Chambers Creek Basin: Garrison Springs Hatchery, Chambers Creek Hatchery, and Lakewood Hatchery. The Chambers Creek Basin hatchery fall Chinook salmon program was established in 1980, at the Garrison Springs Hatchery, with fish of Green River origin from the Soos Creek, Deschutes, and Puyallup Hatcheries (HSRG, 2004). Garrison Springs Hatchery, located on a tributary to Chambers Creek, produces the majority of fish released into Chambers Creek. The stock is maintained through hatchery returns to the Chambers Trap, located at RM 0.5, but is often supplemented with Minter Creek and Deschutes stocks (RMIS Database, 2008). Since the waterway from Garrison Springs Hatchery to Chambers Creek is blocked by numerous man-made structures, fish from the hatchery are trucked out to Chambers Creek and released at the Chambers trap (HSRG, 2004). On a yearly basis, the Garrison Springs Hatchery program produces 850,000 fingerlings (sub-yearlings) for release into Chambers Creek and 250,000 for release at Steilacoom Lake (RM 5.5) (WDFW, 2007a). The Chambers Creek and Lakewood Hatcheries began releases of fall Chinook salmon yearlings in 1998 and 1999, respectively, and receive eggs from the Garrison Springs Hatchery (NMFS, 2003). These programs currently aim to contribute 400,000 Chinook yearlings annually to the Chambers Creek Basin (WDFW, 2007a).

***Deschutes Basin Hatchery Facilities***

Fall Chinook fingerlings, of Green River hatchery origin, were first released into the lower Deschutes River in 1946. The Tumwater Falls Hatchery fall Chinook salmon program was established in 1953 with Green River origin stock, and the stock has been maintained almost exclusively with hatchery returns to the Tumwater Falls trap since 1992 (NMFS, 2003; HSRG 2004; RMIS Database, 2008). Current annual hatchery production goals for the basin call for the release of 3.8 million sub-yearlings and 200,000 yearlings into Percival Cove/Tumwater Falls Hatchery (WDFW, 2007a). Tumwater Falls Hatchery is located at RM 2.0 of the Deschutes River, and the Percival

Cove Net Pens are located at the mouth of Percival Cove, which flows into Capitol Lake on its west shore and midpoint. Capitol Lake was previously the mouth of the Deschutes River, but was dammed and became a lake in the early 1950's (HSRG, 2004).

The Tumwater Falls Hatchery does not have the capacity to hatch, rear, and raise the fish that are released on-site, so all sub-yearlings are eyed at McAllister and Minter Creek Hatcheries, and hatched and reared at Coulter Creek Hatchery (via Minter Creek Hatchery) and Wallace River Hatchery (Snohomish Drainage). Yearling production is eyed at McAllister Hatchery and fish are hatched and reared at McKernan Hatchery (Skykomish drainage) (HSRG, 2004). The need for extensive transfer of fish to in- and out-of-basin facilities increases the risk of transferring pathogens between basins, causing the HSRG to recommend that WDFW decrease the number of out-of-basin facilities used in the hatching and rearing of fish. The HSRG also recommended that WDFW find new sites for rearing and releasing fish that would eliminate the need to use Percival Cove Net Pens, which suffer from poor water quality (HSRG, 2004). The Percival Cove Net Pens subsequently closed in May 2007 after the Washington State Department of Ecology did not renew permits due to water quality concerns (Ron Warren, personal communication). Hatchery returns to the Tumwater Falls trap have periodically been passed above Tumwater Falls, which historically presented a barrier to fish passage. Recent studies indicate that returning, predominately hatchery-origin Chinook salmon that are passed upstream have had success spawning naturally in the wild, but since 100% of hatchery-produced Chinook were not marked during the time of this study, deciphering between natural-origin and unmarked hatchery adults was not possible, making results inconclusive (NMFS, 2003).

### *South Sound Net Pens*

The South Sound Net Pens are located on the eastern side of Squaxin Island, across from Harstine Island, in Peale Passage. The facility is co-managed by WDFW and the Squaxin Island Indian Tribe, and has released Chinook and coho salmon dating back to 1972. Chinook salmon of Finch Creek, Deschutes River, and Coulter Creek stock were reared and released at the South Sound Net Pens in brood years 1971, and 1985-1998. The releases have consisted mostly of yearling Chinook and have averaged approximately 387,000 in the 15 release years. The fall Chinook program was displaced by the coho program due to net pen space limitations, and the last releases of yearling Chinook salmon occurred in April 2000 with 1998 brood year Chinook (RMIS Database, 2008).

### *Elson Creek Hatchery*

Elson Creek Hatchery is located on Elson Creek, a tributary which flows into Skookum Inlet above Skookum Creek. The facility released Chinook and chum salmon, and steelhead, from 1979 to 1995, and was managed by the Squaxin Island Indian Tribe. Chinook salmon stock from the Deschutes River, Soos Creek, Elson Creek, and the Puyallup/White River Basin, were used for 1979-1986 brood year releases. All releases were fingerling Chinook salmon and averaged 305,000 during the eight release years. Elson Creek Hatchery has since been closed, with the last release of chum salmon occurring in March 1995 (RMIS Database, 2008).

### *Minter Creek Hatchery*

The Minter Creek Hatchery is located on Minter Creek, a tributary to Carr Inlet, at RM 0.5. Fall Chinook were first released at Minter Creek in 1946, and consisted of either direct imports of Green River hatchery-origin stock or transfers of Green River hatchery-origin stocks established at Samish and Tumwater Falls Hatcheries (NMFS, 2003). It is believed that an indigenous fall Chinook salmon stock did not exist historically at Minter Creek (WDFW, 2002; NMFS, 2003). In the past, fall Chinook were occasionally passed upstream of the hatchery, but this practice was discontinued with the 2000 return group. The hatchery currently aims to release 1.8 million fingerlings into Minter Creek each year (WDFW, 2007).

In addition, Minter Creek Hatchery previously provided small numbers of Chinook salmon eggs to local schools and regional enhancement groups for release into other watersheds. Production goals for Minter Creek Hatchery called for the transfer of 10,000 unfed fry (at 1,000 fish per pound (FPP)) for release into Sherwood Creek and Kingman Creek, a tributary that drains into Case Inlet; WDFW also provided 15,000 fish at 80 FPP for transfer to Rosedale Pond, and those fish were designated for release into

Carr Inlet (WDFW, 2002). These transfer and release goals stated in the Minter Creek Hatchery and Genetic Management Plan are not documented in the RMIS Database, except for one record indicating that 10,000 Chinook salmon at 1,000 FPP were released at Sherwood Creek on November 09, 2002. Minter Creek is also the site of Hupp Springs Hatchery, where recovery efforts for the ESA listed White River spring Chinook stock occur. Releases of sub-yearlings and yearlings occur at the Hupp Springs site, which is located three-quarters of a mile upstream of Minter Creek Hatchery. Since the fish released at Hupp Springs Hatchery are spring Chinook, they will not be included in this summary.

***Coulter Creek Hatchery***

Coulter Creek Hatchery is located at RM 0.25 on Coulter Creek, a tributary to Case Inlet. Although a few releases of fall Chinook, ranging from 2,805 to 253,640 per brood year, are documented from the late 1950's and early 1960's, a fall Chinook hatchery program did not begin until releases of Minter Creek and Tumwater Falls Hatchery stocks (Green River lineage) occurred in 1980 (NMFS, 2003). Coulter Creek was used as a rearing facility for fry hatched at Minter Creek Hatchery. Fry reared at Coulter Creek were either transferred to other locations for release, including Tumwater Falls Hatchery (1.8 million sub-yearlings, annually) and Fox Island Net Pens (numbers unknown), or released on-site at Coulter Creek (1.0 million sub-yearlings, annually) (HSRG, 2004). The fall Chinook salmon release program at Coulter Creek was discontinued in 2000, with the final release of fall Chinook salmon in spring 2001. Reasons suggested by the HSRG for terminating this program included the limited contribution the fall Chinook hatchery run provided to a terminal Chinook harvest, and possible negative interactions posed by returning hatchery Chinook salmon towards a naturally producing chum stock native to Coulter Creek. Due to the presence of chum in Coulter Creek, both chum and Chinook salmon returning to Coulter Creek were permitted to pass upstream, and the large numbers of hatchery Chinook caused problems to the chum run through either digging up chum salmon redds, or contributing to poor water quality following large return years (HSRG, 2004). Coulter Creek is still currently used to rear 2.8 million sub-yearlings for release in the Deschutes Basin (WDFW, 2007a).

### *Fox Island Net Pens*

The Fox Island Net Pens are located on the north side of Fox Island, in Echo Bay. They were established by WDFW in 1975 to augment the South Puget Sound sport fishery through residualization of both fall Chinook and coho salmon. The program was discontinued in July of 2001 over concerns posed by the HSRG, including straying in South Puget Sound and negative interactions, including predation, upon other salmon stocks (HSRG, 2004). This program was dependent on both Minter Creek and Coulter Creek Hatcheries: Minter Creek provided eggs, incubation, and hatching, and unfed fry were subsequently transferred to Coulter Creek for rearing, before finally being transferred to the net pens. The HSRG states that the Fox Island Net Pens annually released 240,000 yearling fall Chinook into Echo Bay. Actual Chinook releases from the Fox Island Net Pens averaged just under 212,000 yearlings for brood years 1974-1999 (RMIS Database, 2008).

### *Mass Marking of South Puget Sound Hatchery Fall Chinook Salmon*

Mass marking of Chinook salmon released from South Puget Sound hatchery facilities is a relatively recent endeavor. A review of all Chinook hatchery releases from the RMIS Database, summarized in Tables A-1- A-5, indicated that the overwhelming majority of fish released in South Puget Sound since 1953 have not been marked, with an adipose fin clip, and that mass marking on a large scale did not begin at WDFW hatcheries until the 1998 brood year release, with fingerlings released in the spring of 1999. Prior to the 1998 brood year release, Chinook salmon were almost entirely unmarked, with rates of marked Chinook salmon- including those unmarked but inserted with a coded wire tag (CWT), or marked with a clipped adipose fin (with or without a CWT)- at less than 10%. Adipose mark and tagging rates of all South Puget Sound 1997-2004 brood year releases is summarized, by WRIA, in Tables A-6- A-10.

Records from the RMIS Database reveal that beginning with the 1998 brood year, hatchery Chinook salmon released as sub-yearlings and fingerlings were mass-marked (adipose fin clipped) or tagged at rates exceeding 90%, with the exception of a few release sites in the Nisqually River and Chambers Creek Basins (Clear Creek Hatchery (1998 and 2000); Kalama Creek Hatchery (1998); Chambers Creek (1998, 2000, and 2001); Steilacoom Lake (Pier) (2001)). These records collaborate with the Hatchery and Genetic Management Plans for WDFW hatcheries, all completed in 2002, which note that 100% of all hatchery Chinook releases are to be mass-marked (adipose clipped only) for Tumwater Falls, Minter Creek, Garrison Springs, and Chambers Creek Hatcheries. Also mentioned is that a portion of each hatcheries annual release group will have coded wire tags inserted so that studies can be conducted on fishery contributions, survival rates, and straying levels of hatchery Chinook releases to other Puget Sound watersheds (WDFW, 2002). As for the Nisqually River hatcheries, the Hatchery Genetic Management Plans for Kalama and Clear Creek Hatcheries state that an effort was made, at both facilities, to mass mark all hatchery releases of Chinook salmon for brood year 1999 (WDFW, 2000). The Hatchery Scientific Review Group notes in its 2002 assessment of the Nisqually River fall Chinook program that all released fish are marked to assess the contribution of hatchery returns to natural spawning populations, and to allow better assessment of the status of natural populations (HSRG, 2004). Thus, most brood year releases of hatchery Chinook salmon in the South Puget Sound region have been adipose marked or tagged at a rate of 90% or greater since 1998.

**Historical and Current Escapement Estimates for Nisqually River Chinook Salmon**

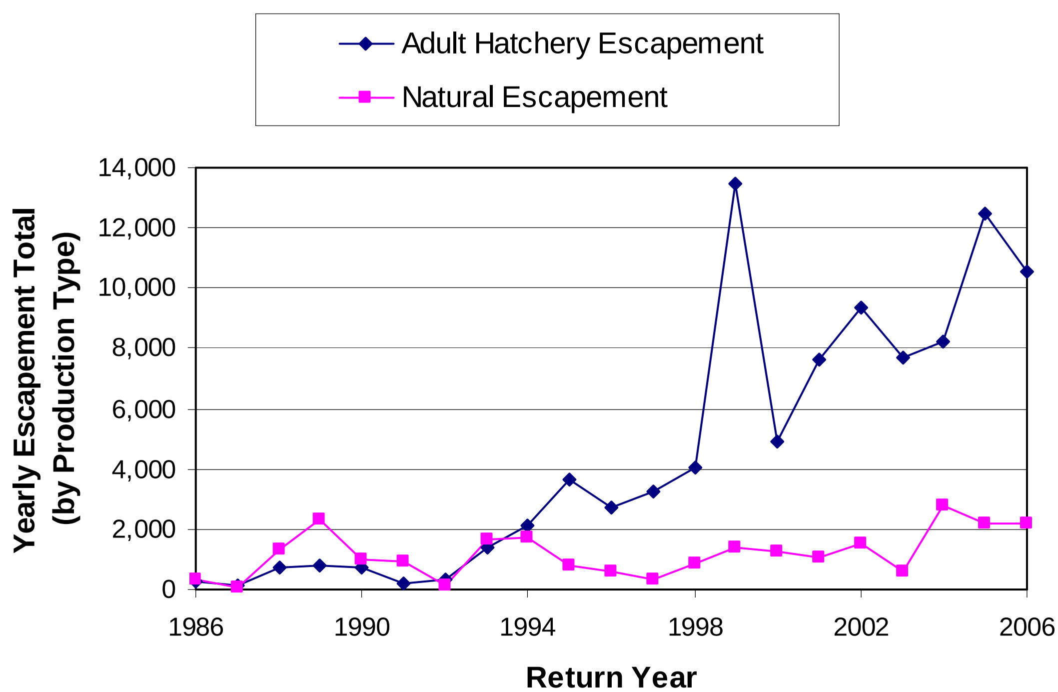
There exist no known scientific records of abundance for Nisqually River Chinook salmon prior to 1956, the year in which Chinook salmon hatchery releases began in the basin (RMIS Database, 2008). An ecosystem diagnosis treatment (EDT) analysis of the Nisqually River and its tributaries suggests that the habitat of the Nisqually system could historically, prior to1850, support 14,000 Chinook adults in the mainstem, and 5,000 adults in tributaries, primarily the Mashel River and Ohop Creek. This same analysis suggests that the Nisqually system, in its current habitat condition, can only support 4,200 adult Chinook in the Nisqually mainstem and 1,500 adults in its tributaries (Nisqually Chinook Recovery Team, 2001). It should be noted that the EDT analysis merely suggests the number of adult Chinook that historic and current habitat conditions in the Nisqually River could support, and does not account for factors such as harvest or loss of genetic fitness.

The earliest records of Chinook escapement estimates appear in *A Catalog of Washington Streams and Salmon Utilization*. This document estimated that Chinook salmon escapement to the Nisqually system, including main tributaries, ranged from 300 to 3,500 fish from 1966 to 1971, with an annual average of about 1,470. They estimated a 3:1 catch to escapement ratio, so an average annual escapement of 1,500 Chinook would relate to a total commercial and sport fisheries catch of approximately 4,500 Chinook salmon (Williams et al., 1975). Another WDF document published a couple of years later suggested the same Nisqually escapement range of 300 to 3,500 Chinook from 1965-1976, but calculated that escapement in the later years (1970-1976) ranged from 450 to 900. This document reported that escapement in the later years was lower than in the earlier years because the earlier years had lower levels of in-river harvest, and these estimates included hatchery-origin fish. (Ames and Phinney, 1977).

Data on natural spawner escapement to the Nisqually system from 1977-2002 comes from SaSSI/SaSI. Natural spawner escapement in the Nisqually system ranged from 85 to 2,332 for the years 1977 to 1991, and SaSSI states that escapement values are considered to be a fairly good estimate of relative abundance. Natural spawner escapement for the Nisqually system from 1992 to 2003 was estimated to be 106 to 1,730 fish. These estimates were based on mainstem Nisqually redd counts (RM 21.8- RM 26.2) and Mashel River peak live plus dead fish counts (RM 0.0- RM 3.2). SaSI notes that spawning in the Nisqually system occurs in the mainstem Nisqually River (RM 15.0- RM 40.0) and numerous tributaries, including the Mashel River, Ohop Creek, Twenty-five Mile Creek, Yelm Creek, Horn Creek, and Muck Creek (WDF et al., 1993, updated 2002).

Escapement data from the Nisqually Indian Tribe estimates natural spawner escapement in the Nisqually system at 2,788, 2,159, and 2,179, respectively, from 2004 to 2006 (Nisqually Indian Tribe, 2007b). This information is summarized in Table A-11, which provides the Nisqually River Chinook salmon run reconstruction from 1986 through 2006. Although the last three years of records indicate that natural escapement in the Nisqually system has increased, this increase has likely been aided by the successful production of hatchery-origin Chinook salmon at the Clear Creek and Kalama Creek Hatcheries. Figure 4 displays both natural and total adult hatchery escapement for the Nisqually River from 1986 through 2006. Since Chinook salmon adults began returning to the Clear Creek Hatchery in 1992, the total run size, which includes all returning fish headed for the Nisqually River, has steadily increased over that time period, from a minimum of 730 in 1992 to a maximum of 34,282 in 2006 (Table A-11). While total run size has increased in recent years to levels above the estimated historical abundance of 19,000, at least according to the EDT analysis, natural escapement levels, as a percentage of total run size, remain low due to continued, high in-river harvest rates by the Nisqually Indian Tribe.

**Figure 4.** Nisqually River Chinook salmon escapement totals for adult hatchery and naturally spawning fish, 1986-2006.




Source: Nisqually Indian Tribe, 2007b.

**Historical and Current Abundance Estimates for South Sound Tributaries Chinook Salmon**

As with the Nisqually River, there exist no known scientific records of abundance for South Sound Tributaries Chinook salmon prior to 1953. The earliest known natural escapement estimates, which date back to 1966, are provided in *A Catalog of Washington Streams and Salmon Utilization* and are broken down by Water Resource Inventory Area (WRIA). Combined escapement estimates for the Deschutes River and Percival Creek, in WRIA 13 (Deschutes Basin), for 1966 to 1971 averaged 11,355 fish (Williams et al., 1975). Yet, these systems will not be further analyzed, as it is believed that these fish are all descendents of hatchery production due to a natural fish passage barrier, in the form of Tumwater Falls, located at RM 2.0 of the Deschutes River, which prevented passage upstream before a fish ladder was installed in 1954. Percival Creek, which flows into Capitol Lake upstream of the historic boundary of the Deschutes River, likely attracts Chinook salmon due to its location near, but before, Tumwater Falls Hatchery.

In WRIA 14 (Shelton Basin), there are eleven larger salmon producing streams, but only two of them, Deer and Sherwood Creeks, were considered to have consistent small runs of fall Chinook salmon (Williams et al., 1975). The stream catalog suggested minimal use of the systems in WRIA 14 due to the very low flows exhibited during normal Chinook adult migration and spawning periods. They further suggested that the Chinook in these streams have had to adapt their specific life history attributes to fit into these non-typical Chinook salmon environments and successfully perpetuate their kind. Annual estimates of natural escapement for Chinook salmon in the Shelton Basin systems ranged from 40 to 220 for the years 1966-1971, with an average of 148 (Williams et al., 1975).

The Kitsap Basin, WRIA 15, includes systems that drain into both Puget Sound (Central and South) and Hood Canal, with the majority of systems flowing into Hood Canal. Only four streams within the basin, that flow into Southern Puget Sound, were cited as having Chinook present: Coulter, Minter, Rocky, and Burley Creeks (Williams et al., 1975). For the years 1966-1971, the average annual escapement for East Kitsap streams was estimated at 1,470. Yet, this estimate includes three streams that flow into Central Puget Sound, which lie outside of the geographical area of this study, so the estimates for South Puget Sound streams in WRIA 15 was likely less than this total. Burley Creek was cited as the only stream within its sub-basin, which includes Minter Creek, as having a wild Chinook stock (Williams et al., 1975), suggesting that all Chinook returns to Minter Creek are due to the on-site hatchery which produces Chinook salmon.

Another WDF document, published in 1977, estimated average escapement to South Puget Sound independent streams at 408 from the period 1965-1976, with a range of 165 to 910. The independent streams in the estimate included all streams that flowed into South Puget Sound below the Tacoma Narrows, excluding the Nisqually and Deschutes systems, with the most significant use occurring in Chambers, Deer, Sherwood, Coulter, Rocky, and Burley Creeks. These estimates were based on the mean of peak fish per mile counts from three index areas in Coulter, Rocky, and Burley Creeks, multiplied by a factor of four- a base year estimate (Ames and Phinney, 1977).

SaSSI provided escapement estimates for the South Sound Tributaries Chinook stock for the period from 1984-1991 that ranged from 9,600-37,000, with an average of 19,700 (WDF et al., 1993). These estimates included Chinook salmon from the Deschutes River, McAllister Creek, Minter Creek, additional Carr Inlet streams, Chambers Creek, Coulter Creek, Gorst Creek, and Grovers Creek. Five of these systems, the Deschutes River, McAllister Creek, Minter Creek, Chambers Creek, and Coulter Creek, had Chinook salmon hatchery production facilities in operation at the time of these estimates. While suggesting that sustained natural production might have occurred in some of these streams, the co-managers (the authors of SaSSI) acknowledged there was no data to quantify that statement, and suggested that the status of the stock depended largely on hatchery production. In an updated stock report in 2002, the co-managers no longer considered the South Sound Tributaries Chinook spawning aggregation to be a distinct stock, suggesting that previous high escapement estimates in their prior rating could be attributed to hatchery fish permitted to spawn above hatchery racks (WDF et al., 1993; updated 2002).

An additional WDFW document, published in 1994, estimated escapement for Chinook salmon in various Puget Sound systems, including miscellaneous South Puget Sound streams. The methodology used in this document centered on taking peak live, dead, or total fish counts multiplied by an expansion factor (Smith and Castle, 1994). The expansion factor was based on a highly surveyed index reach on Newaukum Creek, which is a tributary to the Green River. The projected escapement estimates for streams within WRIA 14 and 15, for 1991, are summarized in Table 2. The escapement estimates produced from this publication are quite high in comparison to other publications from the 1970's. This suggests that either the number of Chinook salmon escaping to these systems has increased since that time period or that these escapement estimates, which rely on an out-of-basin expansion factor, overestimate the escapement of Chinook salmon to miscellaneous streams in South Puget Sound, particularly Burley Creek.

**Table 2.** 1991 escapement estimates of Chinook salmon for miscellaneous South Puget Sound tributary streams.

| System(s) Surveyed | Escapement Estimate |
| --- | --- |
| Burley Creek | 1,555 Adults |
| Johns Creek and Deer Creek | 308 Adults |
| Mill Creek and Kennedy Creek | 11 Adults |
| Coulter Creek, Rocky Creek, and Sherwood Creek | 210 Adults |

Source: Smith and Castle, 1994.

**Comparison of the Physical Characteristics of South Puget Sound Streams with Known Chinook Salmon Systems**

The basin size, flows, and temperatures of numerous South Puget Sound streams are summarized and compared against three other Puget Sound systems with fall Chinook salmon runs: Lower Skagit River, Snohomish River, and Nisqually River. These three systems were chosen to allow for comparison of a system from each of the three geographic regions of Puget Sound: northern, central, and southern. All three of these systems have their headwaters in the Cascade Mountain Range, are snow pack or glacier fed, and have the majority of Chinook salmon spawning occurring in the months of September and October. A brief description of the Skagit and Snohomish systems will be provided; a description of the main spawning areas and escapement estimates for the

Nisqually River have been discussed in a previous section. The Nisqually River has its headwaters in the Nisqually Glacier on Mt. Rainier.

The Skagit River is the largest river system and drainage basin into Puget Sound, and has its headwaters are in the Canadian Cascade Range (Williams et al., 1975). It is the most prolific Chinook system in the Puget Sound Basin, historically and currently. The majority of spawning for the Lower Skagit Mainstem/Tributaries Chinook Stock occurs in the mainstem Skagit River (RM 0.0-RM 67.2), and tributaries downstream from the Sauk River, from early September through mid-November. It is listed as a native stock with wild production, and escapement estimates range from 400- 5,000 for the years 1986-2003, with an average escapement of approximately 2,000 (WDF et al., 1993; updated 2002).

The Snohomish River is the second largest drainage system within Puget Sound. The system consists of two main rivers, the Skykomish and Snoqualmie, which have their confluence at RM 20.5 of the Snohomish River. From the confluence, the Snohomish River continues upstream as the Skykomish River. Both the Skykomish and Snoqualmie Rivers have their headwaters in the snow packs of the Cascade Mountains. SaSI lists two different stocks of Chinook salmon in the Snohomish Basin. The Snohomish-Snoqualmie Chinook Stock spawns in the Snoqualmie River and some of its major tributaries, including the Raging and Tolt Rivers, and Tokul Creek, from mid-September through October. It is listed as a native stock with wild production, and escapement estimates range from 400- 3,600 for the years 1986-2001, with an average escapement of 1,300 (WDF et al., 1993; updated 2002). The Snohomish-Skykomish Chinook Stock spawns from September through October throughout the Snohomish and Middle Fork Skykomish Rivers, as well as many tributaries to this system. The stock is listed as native with composite production, and escapement estimates range from 1,700- 4,700 for the years 1986-2001, with an average escapement of 3,200 (WDF et al., 1993; updated 2002).

Unlike these three fall Chinook systems, which have origins in the Cascade Mountains, the small tributaries that feed into South Puget Sound are exclusively rainwater and groundwater fed. All of the streams in the Shelton Basin (WRIA 14) are typical lowland type streams with their headwaters originating from surface water drainages and natural springs, swampy beaver ponds, or small lakes in the foothills; the streams in the eastern half of the Kitsap Basin (WRIA 15) are also typical lowland type streams which originate from lakes, ground water run-off, or swamp-like basins (Williams et al., 1975). Table 3 summarizes basin size and stream length data for the Skagit, Snohomish, and Nisqually Rivers, as well miscellaneous South Puget Sound tributaries. Included in this chart are basin size and stream length data for tributaries to the Skagit, Snohomish, and Nisqually Basins that have Chinook salmon spawners. An analysis of these data reveal that the basin size of these three systems are at least an order of magnitude larger than the basin sizes of the South Puget Sound streams listed, excluding the Deschutes River. The tributaries to the Skagit and Nisqually Rivers also exhibit basin sizes numerous times larger than the independent tributaries, with only Goldsborough Creek exceeding the basin size of Ohop Creek. Although data indicating minimum basin sizes for Chinook salmon does not exist, the large discrepancy between the basin sizes of these three fall Chinook river systems, and their tributaries, versus the basin sizes of the small independent tributaries that drain into South Puget Sound might indicate that these small systems are not typical fall Chinook salmon habitat.

While data indicating basin sizes of South Puget Sound tributaries is ample, data on stream flows for these systems is harder to locate. Currently, only one of the small streams which feeds into South Puget Sound has an active stream gage, and that gage is located on Huge Creek, a small tributary to Minter Creek. Stream flow data from previous decades does exist for some of these small streams, and these data are summarized in Tables A-12 and A-13. An analysis of these data show that flows in South Puget Sound streams are also at least one order of magnitude smaller than those found in the Nisqually River and, with the exception of Goldsborough Creek, three of the streams have flows at least two magnitudes smaller than those found in the Skagit and Snohomish Rivers. One similarity between all of these systems is that they exhibit their lowest flows in late summer and early fall. All of these rivers and creeks, except for Woodland Creek, exhibit their lowest mean flows in the months of August and September. The presence of low flows during the period of adult Chinook salmon migration (late August to mid-October) would seem to be a larger problem in smaller systems, such as the tributaries that feed into South Puget Sound, versus larger systems throughout Puget Sound. While no minimum flow requirements exist for Chinook salmon migration and spawning, the low flows observed in these small streams during adult Chinook migration could pose problems for returning fish, due to higher stream temperatures expected with low flows and limited movement through shallow water.

Information regarding specific stream temperatures for many of the South Puget Sound tributaries was difficult to find, but indications are that many of the streams in the Shelton basin exhibit warmer temperatures in late summer months than are recorded in the Skagit and Snoqualmie River basins, and in some parts of the Nisqually River basin. Temperature data from two United States Geological Survey (USGS) stream gages, one located in the Skagit River near Marblemount and the other two in the Tolt River, a lower tributary to the Snoqualmie River, indicate that monthly average stream temperatures generally range from about 4.0°– 12.0° C, with the highest monthly average temperature occurring in the months of July, August, and September (www.usgs.gov). These results, and information regarding the location and years of operation for the stream gages, are summarized in Table A-14. Stream temperature information for the Nisqually River basin is provided by Whiley and Walter (2000). Summer temperatures in the mainstem Nisqually River meet Washington State Class AA and Class A water quality standards, for temperature, most of the time. This report determined that current water temperatures in lower Nisqually River Basin tributaries are determined primarily by geological setting. Tributaries which are dependent on groundwater discharge, including Yelm and Muck Creeks, exhibit temperatures of approximately 12.0° C with little variation during the months of July through September. Ohop Creek, Tanwax Creek, and the Mashel River, tributaries which do not receive large contributions from groundwater, exhibited high water temperatures during summer months, and the Mashel River was found to exceed state water quality standards for temperature (Whiley and Walter, 2000).

**Table 3.** Comparison of stream characteristics of miscellaneous South Puget Sound tributary streams with three Puget Sound fall Chinook systems.

| Basin | System | Tributary | Stream Length (miles) | Drainage Basin Area (sq. mi.) |
|---|---|---|---|---|
| Skagit | Skagit River | - | 162.0 [1] | 3,093.0 [3] |
| | Skagit River | Baker River | 32.8 [3] | 297.0 [3] |
| | Skagit River | Sauk River | 56.7 [1] | 714.0 [3] |
| | | | | |
| Snohomish | Snohomish River | - | 80.5 [1] | 1,780.0 [1] |
| | Snohomish River | Skykomish River | 60.0 [1] | 844.0 [1] |
| | Snohomish River | Snoqualmie River | Three forks of varying lengths | 693.0 [1] |
| | | | | |
| Nisqually | Nisqually River | - | 78.5 [1] | 712.0 [4] |
| | Nisqually River | Muck Creek | 20.9 [1] | 92.0 [1] |
| | Nisqually River | Ohop Creek | 11.9 [1] | 43.6 [1] |
| | Nisqually River | Mashel River | 20.5 [1] | 83.5 [1] |
| | | | | |
| Deschutes | Deschutes River | - | 52.2 [1] | 162.0 [4] |
| | | | | |
| Shelton | Cranberry Creek | - | 9.4 [5] | 15.2 [5] |
| | Deer Creek | - | 8.5 [5] | 13.7 [5] |
| | Johns Creek | - | 8.3 [5] | 11.2 [5] |
| | Goldsborough Cr. | - | 14.0 [5] | 51.4 [5] |
| | Kennedy Creek | - | 9.6 [5] | 20.3 [5] |
| | Mill Creek | - | 16.0 [5] | 30.0 [5] |
| | Skookum Creek | - | 9.0 [5] | 23.6 [6] |
| | Sherwood Creek | - | 18.3 [1] | 20.2 [4] |
| | | | | |
| Kitsap | Burley Creek | - | 5.2 [1] | 10.7 [4] |
| | Coulter Creek | - | 8.0 [1] | 14.1 [4] |
| | Minter Creek | - | 6.3 [1] | ?? |
| | Minter Creek | Huge Creek | 7.6 [2] | 6.47 [2] |
| | Rocky Creek | - | 5.0 [1] | 18.1 [4] |

Sources: (1) Williams et al., 1975; (2)(3) Williams et al., 1985a & 1985b; (4) Williams & Riis, 1989; (5) Schuett-Hames et al., 1996; (6) Ahmed & Hempleman, 2006.

A report was located which suggested that many of the streams in the Shelton Basin are not capable of maintaining summer stream temperatures within state water quality standards, set by the Washington Department of Ecology, due to inadequate canopy closure provided by existing riparian vegetation (Schuett-Hames et al., 1996). This report mentioned that many stream reaches in Kennedy and Skookum Creeks exceeded 16° C, while numerous reaches in Deer, Johns, Goldsborough, and Mill Creeks were expected to exceed 18° C (Schuett-Hames et al., 1996). Stream gaging stations with capabilities to record water temperature were placed in Mill, Cranberry, Johns, and Skookum Creeks, and water temperature data was collected from 2000-2004. Although each of these creeks had numerous stream gages at various locations throughout their respective watersheds, temperature data from stream gaging stations furthest downstream was summarized, as these spots are most likely to be occupied by Chinook salmon. All of these creeks exhibited temperatures in excess of temperature total maximum daily load standards established by the State of Washington, but the degree to which temperatures violated standards were variable. Mill Creek exhibited stream temperatures in excess of 18° C for the majority of July and August during all three years surveyed (2000, 2002, and 2003). Cranberry Creek had temperatures in excess of the state established water quality standard for the later part of July in three of the four years surveyed (2000, 2002, and 2003). Johns Creek, on the other hand, only exhibited temperatures in excess of 18° C for a handful of days in July and August in one of the three years surveyed (2002) (Ahmed and Hempleman, 2006). Skookum Creek was in excess of 16° C from late June until early September during the only year surveyed (2004). The same data set also indicated that Skookum Creek was in excess of 18° C from late July to late August (Ahmed and Sullivan, 2005). A limiting factors analysis conducted for streams in the Shelton Basin corroborated these reports, rating water temperatures in Mill Creek, Johns Creek, Cranberry Creek, and Sherwood Creek as poor. Goldsborough Creek was the only stream in this basin that received a rating of good for water temperatures (Kuttel, 2002).

The presence of high water temperatures during times of adult salmon migration and spawning can potentially be detrimental to returning fish. Warmer temperatures can simultaneously increase the virulence of fish pathogens, and stress, upon fish, thereby decreasing the ability of a fish to withstand disease (Fryer and Pilcher, 1974; Materna, 2001). State of Washington Water Quality Standards (WAC 173-201A) call for 7-day average of daily maximum (7-DADM) temperatures at the initiation of spawning for salmon, and at fry emergence for salmon and trout, not to exceed 13° C (Ahmed and Sullivan, 2005). This document noted stocks of chum, coho, and steelhead which utilized the Oakland Bay/Hammersley Inlet Watershed. Only one stock, Hammersley Inlet summer Chum, had a listed spawning time of September through October, which means that fish from this stock might return while elevated stream temperatures are present. Given that 7-DADM temperatures in Oakland Bay/Hammersley Inlet streams during the months of August and September are usually in excess of 13° C (Ahmed and Sullivan, 2005), at least in the years surveyed, these stream temperatures could likely pose problems, in the form of stress and disease, for Chinook returning to these streams at that time of year. Stream temperatures in excess of 13° C were not noted in the Skagit and Snohomish River Basins, and likely only exceed this temperature in select tributaries in the Nisqually River Basin, potentially indicating that streams in the Shelton Basin are not suitable for Chinook salmon returning in August and September.

## Methods

This study is designed to determine the extent of hatchery-origin Chinook salmon returning to South Puget Sound tributaries based on abundance estimates and mark recovery data from Chinook salmon observed in these streams. Recent abundance estimates of Chinook salmon in South Puget Sound streams, generated from spawning ground surveys, will be compared against regionwide Chinook hatchery releases and run reconstruction data to reveal whether these abundance estimates might be explained by the large volume of hatchery releases dating back to the 1950's. Spawning ground survey data will be applied in three different scenarios that attempt to determine if the presence of Chinook salmon in these streams can be attributed to hatchery-origin fish. The first scenario will attempt to determine whether the presence of Chinook salmon in specific South Puget Sound streams can be directly attributed to in-stream hatchery releases. The second scenario is designed to see whether the abundance of Chinook salmon in streams without extensive hatchery releases is related to regionwide hatchery releases of Chinook salmon. The third scenario compares mark recovery data from Chinook spawning ground surveys with mark rates from Chinook hatchery releases to determine if similar rates between the two data sets exist, which could suggest that the fish observed on the spawning grounds of South Puget Sound streams consist entirely of hatchery-origin fish. Since WDFW spawning ground surveys of Chinook salmon in South Puget Sound Streams serve as the main source of evidence for these analyses, a summary of WDFW surveys, and the procedures employed in their undertaking, is provided. These procedures are summarized below from a manual written about Puget Sound Chinook spawning ground survey methods for WDFW employees, (WDF, 1992), and also include first-hand observations from a spawning ground survey conducted by WDFW employee Chuck Baranski, at Coulter Creek, in October of 2007.

The WDFW spawning ground surveys included in this analysis are foot surveys, and each survey is conducted by a pair of WDFW employees. WDFW spawning ground surveys are species specific and are classified by survey length, with an indicated lower and upper river mile (RM). The survey stream reach is divided between the two surveyors, so that one starts at the upper end of the stream reach while the other surveyor begins at the middle of the stream reach, with both employees walking downstream. As the surveyors walk downstream, they tally the number of live and dead fish, by species, that are observed along the way. They also record general observations about the stream (i.e. flow, water clarity, visibility, redd counts) and make note of any unusual occurrences (i.e. beaver dams, potential poaching of fish). In the instance that a Chinook salmon carcass is observed, it is checked for indications of hatchery origin (adipose fin clip or coded wire tag (CWT)). The presence of a clipped adipose fin is visually observed, while a CWT is detected using a Northwest Marine Tech (NWMT) handheld wand detector. If a CWT is present, the snout of the fish is cut off and placed in a bag, along with scale samples from the carcass, for future laboratory analysis. The tail is then cut off from the carcass to indicate to future surveyors that the carcass has been previously sampled. If no CWT is present, the tail is cut off the carcass and no scale samples are taken (WDF, 1992).

The survey length, when coupled with the surveyed species of concern, determines the type of survey count being conducted. WDFW uses four types of counts, two of which pertain to this study. An index area survey encompasses an index area that is counted on a regular basis for a given species. A supplemental survey encompasses either an area outside of the index area, or represents an area which is not regularly surveyed for a given species (WDF, 1992). Ideally, all Chinook salmon spawning ground surveys used in this study would consist of index type counts, since this would provide a consistent study reach focused on Chinook salmon live and dead counts. Unfortunately, this was not possible because most observations of Chinook salmon were not recorded during Chinook specific surveys. The majority of Chinook data are incidental observations documented while surveyors were conducting chum or coho index, or supplemental, area surveys. For this reason, an emphasis was placed on using surveys with consistent stream reaches, as opposed to using surveys based on type counts, as this permitted inclusion of a larger sample of spawning ground surveys in the analysis, while also insuring consistency of areas surveyed both within and between years.

The use of spawning ground foot surveys to generate abundance estimates for salmon stocks tends to generate a negative bias for two reasons: observer efficiency and partial assessment of a larger system. Observer efficiency, defined as the ability of the observer to identify all live and dead fish present, can be affected by stream characteristics such as turbidity, deep water and pools, and high discharges, which either obscure visibility or wash carcasses out of view of the observer (Cousens et al., 1982). Personnel experience and changes in personnel can also affect observer efficiency, as inexperienced surveyors tend to greatly underestimate fish counts, while constantly switching surveyors both within and between years can lead to inconsistency in survey counts. WDFW avoids using inexperienced personnel for visual surveys and employs a policy of using experienced personnel to train new personnel before sending them out to make independent counts (Cousens et al., 1982). These procedures, and conversations observed while accompanying the aforementioned WDFW surveyor- Chuck Baranski- at Coulter Creek, suggest that negative bias caused by inexperienced personnel and personnel changes is minimized for WDFW spawning ground foot surveys. Chuck, who displayed a very keen eye for spotting fish, mentioned apprehension about the first few surveys he took part in but stated that he was trained by experienced personnel (Chuck Baranski, personal communication). Although this same surveyor mentioned that he had surveyed many of the same sites over the past 20 years, it is not possible to assume that his experience is broadly applicable to the agency's other surveyors since information providing the names of surveyors in the spawning ground survey database were not included until 2002.

Another reason to expect negative bias when using spawning ground foot surveys to generate abundance estimates is due to the fact that surveys only encompass partial stretches of the stream. Surveying an entire system, particularly large rivers, by foot expends lots of agency time and resources, so index and supplemental reaches are set up to represent the entire watershed. In generating escapement or abundance estimates for systems with only a portion of the total length surveyed, an expansion factor is often used to produce an estimate indicative of the entire system. This expansion factor may be calculated off of a base year, a year in which extensive surveys of a system are performed, so that a figure can be derived for relating index area totals to watershed totals. Expansion factors may also be based on out-of-basin systems where extensive surveys are conducted for a given year, as in the case of the South Puget Sound abundance estimates for 1991 that were expanded using survey data from Newaukum Creek. For this study, expansion factors will not be used for generating abundance estimates for two reasons. First, WDFW did not invest much time or resources towards generating abundance estimates of Chinook salmon for South Puget Sound tributaries, so a base-year figure does not exist. Second, a decision was made to exclude Newaukum Creek because the use of that system as an expansion factor is likely only specific to that year, making its use in other years improper.

Although calculating abundance estimates based on Chinook salmon index reaches, without the use of an expansion factor, will likely result in a negative bias, it is believed that this bias will be minimized for three reasons. First, these streams are relatively small in size, and have very few tributaries of their own, when compared to other known Chinook systems, so the areas surveyed represent a larger proportion of the system in comparison. Second, the areas surveyed tend to be areas in the system where Chinook are found, or suspected, to be present, so their use to determine presence of Chinook is likely sufficient. Third, fall Chinook salmon are classified as low river spawners. A review of Chinook salmon in the Columbia River Basin suggests that fall Chinook tend to spawn in sections of the lower and middle mainstem of the Columbia River, as well as tributaries in the lower section of the river (Fulton, 1968). Although the

Columbia River is several magnitudes larger than the tributaries to southern Puget Sound, this life history characteristic would likely also apply to Chinook entering streams that are much smaller. The suggestion that Chinook salmon in certain South Puget Sound streams, particularly Coulter Creek and Rocky Creek, tend to return to the lower reaches of those streams was corroborated by a WDFW employee responsible for overseeing that agency's spawning ground surveys (Bill Evans- WDFW, personal communication). Thus, the expectation that not too many live or dead Chinook salmon were missed by relying on spawning ground surveys confined to commonly surveyed reaches was presumed.

The three methods chosen to determine if Chinook salmon that return to South Puget Sound tributary streams are hatchery-origin fish was designed to provide a complete picture in answering this question. The first two scenarios generated abundance estimates to determine if trends in abundance followed trends in Chinook hatchery releases. The first scenario took a small-scale approach by studying whether in-stream abundance trends at a specific creek followed patterns that would be expected with the starting and stopping of in-stream hatchery releases. The second scenario took a regionwide approach in calculating abundance estimates at many South Puget Sound tributaries. Abundance trends at these streams were compared with regionwide hatchery release trends to determine whether the two data sets appear similar. The third scenario searched for indications of hatchery-origin fish by using mark recovery data from Chinook carcasses observed on spawning ground surveys. The mark recovery data from carcasses was compared with hatchery mark and tagging rates from Chinook hatchery releases to determine whether similar mark rates exist between the two groups. The first two scenarios, which generated abundance estimates at South Puget Sound tributaries, were intended to reveal whether abundance trends mimicked expected and actual hatchery release trends on both a small scale and regionwide level. If abundance trends mimic hatchery release trends, this could indicate that the majority of Chinook observed at these streams are hatchery-origin fish. Unfortunately, abundance estimates cannot definitively tell us whether fish observed on spawning grounds are the progeny of hatchery or naturally produced fish, so mark recovery data from spawning ground surveys was employed to provide definitive answers for this question. If mark recovery rates closely mimic, or equate, with mark and tagging rates from hatchery-released fish, this would strongly indicate that the Chinook salmon observed in these streams are entirely hatchery-origin fish.

**Comparing In-stream Abundance with In-stream Hatchery Releases**

Calculating abundance estimates in time periods preceding, running concurrently, and following hatchery releases might indicate whether Chinook returning to these systems could be attributed to on-site hatchery releases. The rationale for that test was as follows: if few, or no, fish appeared before hatchery releases, more started appearing while releases occurred, and fish started declining four to five years after the last hatchery release, then an inference could be made that fish were only appearing due to hatchery releases. Systems with both annual hatchery Chinook releases over at least a five year period, and spawning ground survey records that pre-dated, existed concurrently, and post-dated hatchery releases, were queried within the RMIS Database. Coulter Creek, the site of Chinook hatchery releases from brood years 1979 to 2000, was chosen as the site to test this scenario. This site had spawning ground survey records dating back to 1960, and has been surveyed every year since, so the conditions existed to test this scenario.

The following trends would likely indicate if the abundance of Chinook salmon observed at Coulter Creek could be attributed to the on-site hatchery releases which occurred there from 1980 to 2001. First, little to no abundance of Chinook would be observed at Coulter Creek from 1960-1981, but abundance of Chinook at Coulter Creek would increase from 1982 onwards, as hatchery fish started returning. From 2004 onward, the abundance of Chinook at Coulter Creek would begin to decline, as fish returning in the fall of 2004 would be four-year olds from the last hatchery brood year release in 2000. Abundance in 2005 and 2006 would decline rapidly, as fish returning during these years would be attributed to either naturally producing progeny from their natal stream (of hatchery or wild origin), or straying from other South Puget Sound hatchery facilities.

It should be noted that a few problems exist with Coulter Creek, and the data collected on-site, which make this scenario less preferable to the one originally formulated. First, Coulter Creek was the site of a hatchery production facility, so complications exist regarding the accuracy of spawning ground surveys conducted on-site. Coulter Creek Hatchery is located within a quarter of a mile from the mouth of Coulter Creek and, like most hatchery facilities, has a trap and fish ladder to control upstream passage of returning fish. The policy employed during operations at Coulter Creek Hatchery included collecting returning Chinook salmon as broodstock for future releases, while simultaneously permitting upstream passage either when enough broodstock had been collected or when naturally spawning chum returned to the system. Given that spawning ground surveys at Coulter Creek are conducted entirely upstream of the hatchery trap, and that the presence of Chinook upstream of the trap was controlled by trap operations, spawning ground surveys conducted during the years of hatchery operations were not used in this analysis. Instead, adult hatchery escapement figures were provided to estimate fish returns for those years.

Second, the RMIS Database indicated that a few releases of Chinook salmon occurred at Coulter Creek in the late 1950's and early 1960's (see Table 4). While it is important to note these releases, they were not factored into this analysis as significant hatchery releases for two reasons. First, the overwhelming majority of the fish released, all but those from the 1954 brood year, were physically small. It has been suggested that hatchery release groups with fish of a small physical size, groups where the number of fish per pound measured exceeds 200 fish per pound, have very low survival rates and do not likely contribute much towards hatchery returns (Larry Phillips- WDFW, personal communication). Second, releases at Coulter Creek during this time period did not occur for five consecutive years, so their overall contribution towards on-site returns was likely minimal. Thus, the small physical size of Chinook releases, and the short time period of their release, suggests that their contribution towards returning Chinook at Coulter Creek was not likely significant.

An additional problem with this site is that spawning ground survey records were sometimes sparse, particularly towards the beginning of the study period. Some years had only one or two surveys on record. Due to this fact, spawning ground survey records, at best, provide figures indicative of relative Chinook presence versus relative abundance. Finally, spawning ground survey records began in 1960, after hatchery releases of Chinook salmon had already begun in South Puget Sound. This made it difficult to speculate as to the origin of fish observed in those early surveys- specifically whether they were the progeny of naturally producing fish at Coulter Creek or other Sound Puget Sound systems, or consisted of strays from South Puget Sound hatchery releases. Considering all those potential problems, this scenario was designed to show the relative presence of Chinook salmon at Coulter Creek from 1960-2006, in relation to on-site hatchery releases from 1980-2001.

**Table 4.** Hatchery fall Chinook salmon releases at Coulter Creek, 1957-1962.

| Brood Year | Release Year | Number released | Fish per pound measured |
|---|---|---|---|
| 1954 | 1957 | 2,805 | 15.00 |
| 1956 | 1957 | 175,000 | 1,007.99 |
| 1957 | 1958 | 188,020 | 341.05 |
| 1958 | 1959 | 253,640 | 677.01 |
| 1961 | 1962 | 224,910 | 458.18 |

Source: RMIS Database, 2008.

Spawning ground surveys from consistently surveyed reaches, within and between years, were used. At Coulter Creek, the preferred stream survey reach was RM 0.0- RM 1.1, which was identified as the Chinook index reach for this stream (WDF, 1992). Surveys whose stream lengths did not fit exactly within this preferred stream reach were used if the reach surveyed coincided, even partially, with that of the preferred stream reach. For each year between 1960-1979 and 2000-2006 at Coulter Creek, the spawning ground survey with the highest combined live and dead counts of Chinook salmon was selected. Hatchery escapement figures, from WDFW annual hatchery escapement reports, were used to estimate returning adult Chinook salmon at Coulter Creek from 1980-1999 (WDFW, 2008).

A decision was made to use the peak observed live and dead counts to project relative presence of Chinook salmon at Coulter Creek because of a lack of repeated spawning ground surveys at this site within a given year, particularly for the earlier survey years. The term “peak observed” was chosen to denote the largest combined live and dead survey count from a given survey year, and should not be confused with peak live plus dead count, a term suggesting that a survey is conducted at the time of expected peak live and dead fish within a system for a given year (Cousens et al., 1982). Given the minimal number of WDFW spawning ground surveys conducted at Coulter Creek, during times of expected Chinook presence, from 1960 to 1979, it was not possible to assume that surveys were conducted with peak Chinook timing in mind. It is likely that surveys were conducted at times indicative of the presence of other salmonid stocks, primarily chum and coho salmon, within this same system.

Spawning ground surveys conducted between August 15 and November 15 were considered, as this provided a buffer of at least two weeks on each end of the expected presence of Chinook salmon at Coulter Creek- late-September through October. The spawning ground survey data for Coulter Creek was summarized in Table B-1. Some parameters were set to clear up discrepancies in this data set. First, if surveys were conducted on consecutive days, only one was included in the data set. Preference was given to surveys that indicated a presence of Chinook, and if each survey revealed counts of Chinook, the survey with the largest count was chosen. If neither survey indicated a presence of Chinook, the survey with a stream reach nearest to the preferred survey reach was selected. Second, surveys conducted within the stated Chinook stream reach were included even if no Chinook were spotted. An assumption was made that surveyors would tally live and dead counts of Chinook, even if observing Chinook was not the intention of the survey. When surveys conducted for the purpose of coho or chum salmon were included in the data set, dashes were placed in the count section to indicate that no live or dead Chinook salmon were observed. Third, if two separate surveys were conducted on the same day, they were viewed as one survey and the survey counts were tallied together. Fourth, observations of Chinook salmon outside of the designated stream reaches, and before August 15 or after November 15, were included in the data set, but they were not considered in this analysis. These counts were conducted on an inconsistent basis and, normally, only excluded large totals of live and dead Chinook during years with large returns; these surveys were italicized. All surveys were conducted by WDFW unless otherwise noted. If a survey was conducted by a different agency, a double asterisk was placed next to the date and an explanation appears at the bottom of the data set.

**Comparing Regionwide Abundance Estimates with Regionwide Hatchery Releases**

Another potential use of spawning ground surveys as an indicator of whether Chinook salmon returning to South Puget Sound tributaries could be attributed to hatchery releases is to generate abundance estimates for these streams, and compare these estimates to South Puget Sound hatchery release records to see if any trends appear. This scenario was designed to reveal whether Chinook salmon that appeared at these small streams might be explained indirectly by out-of-basin hatchery releases. Since it tested for an indirect relationship between abundance and regional Chinook hatchery releases, systems that have served as hatchery, or release, sites for Chinook salmon have been excluded from this analysis, namely the Deschutes River, Percival Creek, McAllister Creek, Chambers Creek, and Coulter Creek. The streams selected for this analysis did not have any extensive in-basin hatchery releases between 1953 and 2005; any existing records of Chinook hatchery releases for these streams was summarized in Table C-1.

It is difficult to correlate hatchery release numbers with subsequent returns of Chinook salmon for a couple of reasons. First, Chinook salmon usually return to their natal stream as two- to five-year olds, with the majority of Puget Sound Chinook returning at ages three and four (Shared Strategy Development Committee, 2007). Determining the age of a fish on spawning grounds, through only visual observations, is not possible, which makes attributing a fish to a certain brood year release group difficult. Second, survival rates of returning adult salmon varies from year to year. Factors such as ocean conditions and ocean harvest, among others, collectively determine survival return rates for outgoing brood year releases, making it impossible to use release numbers alone as a comparative figure.

One way to estimate the impact of hatchery releases is to use run reconstruction data for the South Puget Sound region. Run reconstruction figures estimate the number of Chinook salmon that attempt to return to South Puget Sound systems in a given year, successfully or unsuccessfully. These figures include both hatchery and naturally produced fish from all South Puget Sound Chinook systems, and provide a regionwide total. Run reconstruction data can account for factors such as ocean survival and marine harvest, by revealing both how many Chinook salmon successfully returned to the region, and how many would have returned if not for Puget Sound commercial, tribal, and recreational fisheries, for a given year. No known statistical tests exist to accurately test for correlation between these two data sets, so run reconstruction data was visually compared with abundance estimates of Chinook salmon at South Puget Sound tributaries to see if any trends between the two data sets appeared.

The intention was to include as many South Puget Sound tributaries as possible in generating abundance estimates so that a thorough assessment of the region could be completed. Unfortunately, this was not possible because many of the streams had few, if any, spawning ground surveys conducted at the expected time of Chinook salmon presence in these areas, August 15 through November 15. For this reason, numerous South Puget Sound tributaries were excluded from this analysis, most notably Woodland Creek and Mill Creek, which were mentioned in SaSSI as sites where Chinook salmon spawn. The streams that were selected for analysis included: Goldsborough Creek, Johns Creek, Cranberry Creek, and Deer Creek (Hammersley Inlet), Sherwood Creek and Rocky Creek (Case Inlet), and Burley Creek (Carr Inlet). The period selected for analysis was 1987 through 2006, because larger numbers of spawning ground surveys were conducted in recent times. The stream lengths of surveys used in this analysis were selected based on consistency of stream reaches within and between years, and favored surveys that were conducted on lower portions of systems. The selected stream reaches included: Cranberry Creek (RM 0.0- RM 2.6), Deer Creek (RM 0.0- RM 1.3), Goldsborough Creek (RM 0.5- RM 2.2), Johns Creek (RM 0.0- RM 1.8), Sherwood Creek (RM 0.0- RM 0.7), Rocky Creek (RM 0.3- RM 1.6), and Burley Creek (RM 0.0- RM 1.9). All sites had sufficient survey data for the years 1987 through 2006 except for Goldsborough Creek, which only had sufficient data from 1998 to 2006. The spawning ground survey data for these selected streams was provided in Tables C-5 through C-11.

Two methods for estimating abundance were selected for this analysis. The first involved collecting the peak combined live and dead counts from each stream for a given year. As mentioned in the previous section, this method estimates relative presence of Chinook as opposed to relative abundance, but it will be included for comparison and to provide data for years with few surveys conducted (low survey effort). The second estimation method, an area-under-the-curve (AUC) analysis, estimates relative abundance of returning Chinook salmon. This methodology uses live counts from surveys to generate an abundance curve, and relies on multiple survey counts during a spawning season to ensure accuracy. The AUC method is usually applied as follows: estimates of fish abundance, generated from live counts in stream surveys, are plotted over the course of a run and connect to form an escapement curve. The area that falls under this curve calculates the total number of spawner days, or fish days. This total is divided by an estimated survey life, defined as the average number of days that a spawning fish is alive in a survey area, and the result is an estimate of escapement (Hill, 1997; Parken et al., 2003; Perrin and Irvine, 1990). Although WDFW prefers using redd counts to estimate escapement in Chinook systems, they have used AUC when difficulties with using redd counts arose (i.e. visibility problems or overlapping redd construction by other salmonid species). In these instances, WDFW uses an AUC analysis if live counts are available on a weekly basis for a given area. The number of live fish is plotted on the Y-axis, while survey date is plotted on the X-axis. The AUC produces the number of fish days, which is divided by 10, to generate an escapement estimate for that area. Ten days is a WDFW convention which estimates the number of days a Chinook salmon remains in a spawning area, hereafter referred to as survey life (Smith and Castle, 1994).

Estimates of relative abundance for South Puget Sound streams will be calculated using an area-under-the-curve methodology as it is applied by WDFW. For the available data set, it is not realistic to use the AUC method to estimate escapement of South Puget Sound Chinook salmon, as many problems exist. First, spawning ground surveys were rarely consistently conducted at any of these streams on a weekly basis. This is likely because many of the surveys were not conducted with Chinook salmon in mind and only included incidental observances of this species. When surveys are not conducted on a consistent basis, and include time periods between surveys which exceed the estimated residence time for a run, the risk of missing returning fish increases (Cousens et al., 1982). Uncertainty also increases substantially at sites, with a residence time (survey life) between 8 and 12 days, when surveys are spaced by an interval of greater than 17 days (Hill, 1997). Since the spawning ground surveys for these streams have long time gaps between them (often exceeding 10 days and sometimes 18 or more days), an AUC analysis that sometimes relies on sparse survey data can produce an estimate of relative abundance at best. Second, accurate escapement estimates from an AUC analysis require that survey life be determined on a site specific basis each time the analysis is used (Perrin and Irvine, 1990). WDFW's survey life estimate of ten days is very general, applying to all Puget Sound Chinook salmon stocks. Coupling this with the fact that survey life and run timing can vary greatly between years, the use of ten days as an accurate estimate of survey life, with which to generate escapement estimates, is suspect. Third, problems occur when an AUC analysis relies on surveys with nonzero first or last counts. In these instances an estimate must be made as to the date(s) at which fish first enter the stream, and are all deceased. Fourth, as with other escapement estimation methods that rely on visual observations of fish, a negative bias likely exists because observers are unlikely to spot all live fish present. Given WDFW's policy about using experienced personnel, sources of bias due to observer efficiency are likely minimized.

To account for these potential sources of error in estimating abundance of Chinook at these streams, the following parameters were set. First, an AUC analysis was only calculated at a site, for a given year, if a minimum of four spawning ground surveys existed. Four was chosen as a minimum number because it permitted a beginning, peak, and end point to complete the curve, but covered a longer time period then three surveys, thereby minimizing large time gaps between surveys that could increase chances for error. If three or less surveys existed at a site for a given year, an AUC estimate was not calculated, and that survey was denoted as NC (not calculated). Second, relative abundance estimates generated using survey data with large time gaps between surveys increases chances for error. If time gaps of greater than 14 days existed for a survey year, that site's AUC estimate was denoted with an asterisk (*). Third, survey data from the late 1980's often lacked early season surveys. Few surveys were conducted in the month of September, but this occurrence became less prevalent as time progressed. Abundance estimates from years that lacked early season spawning ground surveys, none prior to September 25, were denoted with a carrot (^).

Finally, modifications were made to account for problems posed by nonzero first and last live counts. If a nonzero, first live count did not exist, a point with a live count of zero was plotted ten days before the first live count was recorded. In some rare instances a first point was plotted seven days back, but this was only done if the number of dead fish was greater than the number of live fish on the date of first observance. To account for nonzero last counts, a last point was plotted seven days following the last live survey count. These figures were chosen because evidence suggests that fish returning earlier in a run season tend to have a longer survey life than fish returning later in a run season (Neilson and Geen, 1981). The ten day first live count estimate was chosen because the area-under-the-curve software program, provided by WDFW (WDFW, 2007b), would not permit placing a point more than ten days before the first observed live count. Estimating beginning and end points has a minimal effect on abundance estimates if the first live counts are small in number, but potential for error increases if the first live count is large. Abundance estimates from survey data with a nonzero beginning or endpoint, and a first or last survey live count greater than 60, were denoted with a double asterisk (**). Yearly summaries of both the peak observed survey counts and AUC abundance estimates for the creeks analyzed are provided in Tables C-2 and C-3.

**Comparing Mark Recovery Data with Hatchery Mark Rates**

While the first two analyses of spawning ground surveys used live counts to generate estimates of relative presence and abundance of Chinook salmon in South Puget Sound tributaries, the last analysis employed data from carcasses observed on the spawning grounds. Beginning with surveys conducted in 2002, the WDFW spawning ground survey database included specific data about Chinook carcasses found in these streams. The data included observations of carcasses, by surveyors, for both hatchery marks (clipped adipose fins) and the presence of coded wire tags. These data were compared with hatchery mark and tag rates from hatchery Chinook releases for brood years 1997-2003 to see if mark and tag rates between the two data sets were similar. This information could prove useful, since large numbers of hatchery-marked and tagged Chinook observed at the spawning grounds, at rates similar to hatchery-marked and tagged Chinook releases, could suggest an extensive hatchery influence on the fish that return to these streams.

This analysis used mark recovery data from spawning ground surveys conducted between 2002 and 2006. Streams included in this analysis were all streams used in the previous analysis (Goldsborough, Johns, Cranberry, Deer, Sherwood, Rocky, and Burley Creeks) as well as Coulter Creek. When carcasses were spotted during spawning ground surveys, they were tallied into one of many categories. These mark recovery categories are listed and explained in Table 5. While a larger sample size, in years, would be preferable, mark recovery data from years prior to 2002 would likely not be very helpful since mass marking (adipose fin clips) of hatchery Chinook at WDFW facilities was not implemented until the 1998 brood year. This 1998 brood year release group had four-year olds returning in 2002, so the timing of the data is nearly in sync to analyze the first return group of mass-marked hatchery Chinook.

**Table 5.** Explanation of mark recovery categories used in WDFW spawning ground surveys.

| Category | Explanation of Category | Status as Hatchery-Origin Fish |
|---|---|---|
| AdClipped, No Beep | Fish has a clipped adipose fin, but no coded wire tag (CWT). | Hatchery fish, but unable to track to a hatchery or release group. |
| AdClipped, Beep | Fish has a clipped adipose fin, and a coded wire tag (CWT). | Hatchery fish, ability to track to a hatchery or release group. |
| AdClipped, NoHead | Fish has a clipped adipose fin, but head is missing or deteriorated so that checking for CWT is not possible. | Hatchery fish, but unable to track to a hatchery or release group. |
| Previously Sampled | Fish has its tail cut off, indicating that it was previously sampled. | Unknown. |
| Unknown Mark, No Beep | Presence or absence of adipose fin could not be positively determined, no CWT. | Unknown. |
| Unknown Mark, Beep | Presence or absence of adipose fin could not be positively determined, CWT present. | Hatchery fish, ability to track to a hatchery or release group. |
| Unknown Mark, No Head | Presence or absence of adipose fin could not be positively determined and unable to sample for CWT; otherwise, the carcass was not sampled. | Unknown. |
| Unmarked, no Beep | Fish has an intact adipose fin, and no CWT. | Unlikely. Either an unmarked hatchery fish or from naturally producing progeny. |
| Unmarked, Beep | Fish has an intact adipose fin, and a CWT. | Hatchery fish, ability to track to a hatchery or release group. |
| Unmarked, No Head | Fish has an intact adipose fin, but unable to sample for CWT. | Unlikely. Either an unmarked hatchery fish or from naturally producing progeny. |

Source: WDF, 1992.

## Results

### Comparing In-stream Abundance with In-stream Hatchery Releases

Relative presence estimates at Coulter Creek from 1960-2006 were summarized in graphical form in Figures 5 and 6, and the spawning ground surveys for this site were compiled in Table B-1. Coulter Creek exhibited modest presence of Chinook salmon from 1960-1979, with peak combined live and dead counts ranging between 1 and 69 (Figure 5). Chinook presence at Coulter Creek increased substantially for the period from 1982 to 2004, with 1,000 or more Chinook observed through either hatchery escapement or peak observed counts for all but seven years (Figure 6). In 2004, the number of returning fish declined to 1,146 from 1,907 in 2003, and dramatic declines in peak observed counts continued for 2005 (239) and 2006 (105).

**Figure 5.** Coulter Creek relative presence estimates, 1960-1979.

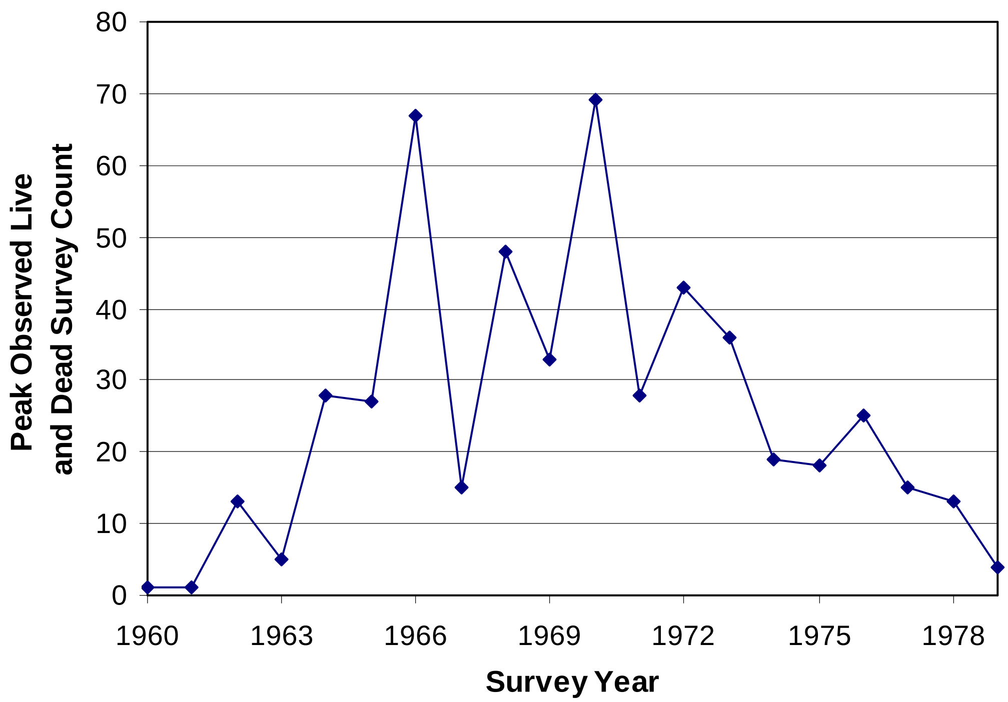
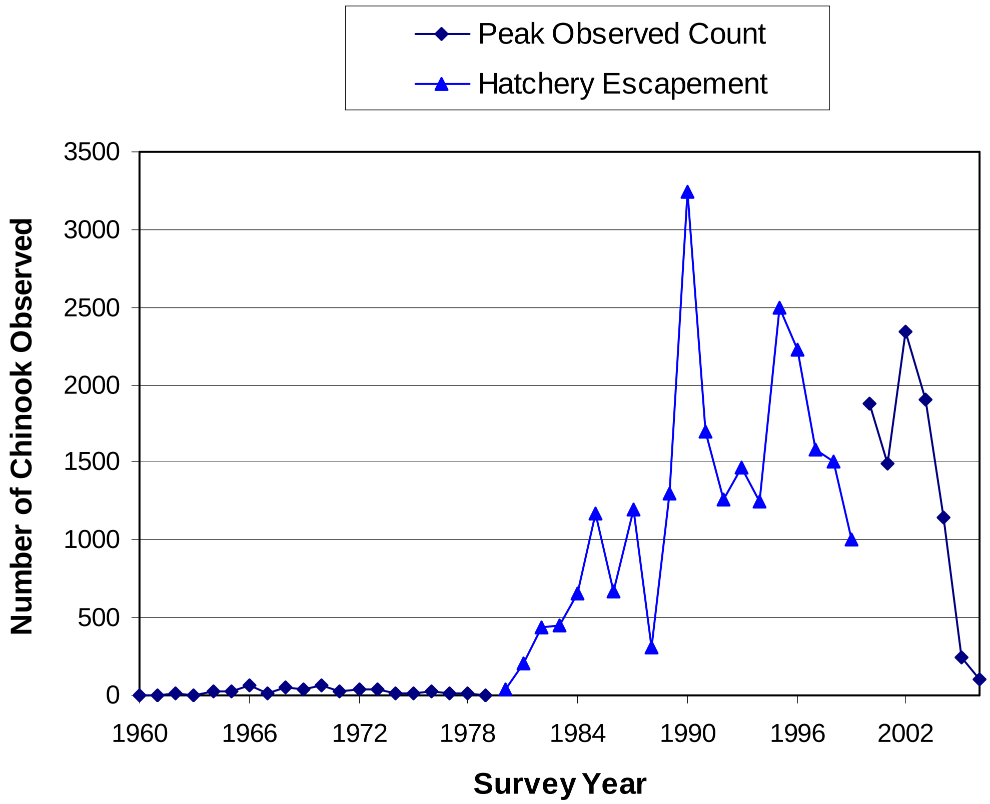


**Figure 6.** Coulter Creek relative presence estimates and hatchery escapement counts, 1960-2006.




**Comparing Regionwide Abundance Estimates with Regionwide Hatchery Releases**

Peak observed live and dead counts in South Puget Sound tributaries were summarized in graphical form in Figure 7, and in tabular form in Table C-2. Figure 7 revealed a gradually increasing trend in peak counts as time progressed, and an average peak observed live and dead count of 296. This graph also revealed large fluctuations over time, with two pronounced peaks (1991-1994 and 1998-2002) and three valleys (1987-1989, 1995-1997, and 2003-2004). Area-under-the-curve relative abundance estimates were also summarized graphically in Figure 7, and in tabular form in Table C-3. The AUC estimates appeared to follow a trend similar to that of the peak observed counts, with an overall increase over time and numerous peaks and valleys. There were three pronounced peaks (1992-1994, 1999-2002, and 2006) and three valleys (1987-1991, 1995-1997, 2004-2005).

Run Reconstruction data for the entire Southern Puget Sound region from 1987 through 2006 are displayed in Figure 8, and the data for each South Puget Sound Chinook salmon run is provided in Table C-4. Much like the abundance estimates for South Puget Sound streams, the run reconstruction data consisted of many peaks and valleys, and increased as time progressed. The yearly average from 1987 through 2006 was 44,869. The first twelve years of this time period exhibited large peaks and valleys, as nine of the twelve years produced below average adult Chinook returns. The period from 1999 through 2006 revealed increased production, as seven of these eight years achieved above average production. Also notable is that the large peaks and valleys declined during this period, with the exception of 2006, the largest Chinook run reconstruction total for the entire twenty year period.

Visual observations of the trends between the two estimation methods and run reconstruction figures revealed both similarities and differences. The best way to describe these trends is by splitting this 20 year time period into two ten-year intervals. The first ten-year period, 1987-1996, revealed that the two estimation methods did not mimic the pattern shown by the run reconstruction data. From 1987-1990, both the estimation methods and run reconstruction figures increased on a yearly basis, but from 1991 to 1995 the two data sets exhibited an inverse relationship. Relative presence estimates from 1991-1994, and relative abundance estimates from 1992 to 1994, remained at relatively high levels while run reconstruction figures dropped and remained below average during this time. In 1995, both relative presence and abundance estimates dropped dramatically and remained low in 1996; meanwhile, run reconstruction figures exhibited a large increase in 1995, but then dropped below average in 1996, more in tune with low presence and abundance estimates for that year.

The second ten-year period, 1997-2006, revealed that the two estimation methods, and the run reconstruction data, appeared to exhibit similar trends. Both data sets had low figures in 1997, but increased the following two years, resulting in a peak in 1999. Except for a sharp decrease in adult Chinook returns in 2000, both estimation methods and the run reconstruction data remained relatively stable, and above average, through

2002. Run reconstruction figures remained above average through 2006, reaching their largest total in that year. Meanwhile, the two estimation methods loosely followed this trend, although estimates for 2004 and 2005 displayed lower totals relative to the run reconstruction data. While the AUC relative abundance estimate for 2006 reached its highest total for the entire study period, the relative presence estimate did not increase substantially, but was above the average for the 20 year period.

**Figure 7.** South Puget Sound AUC and peak abundance estimates, 1987-2006.

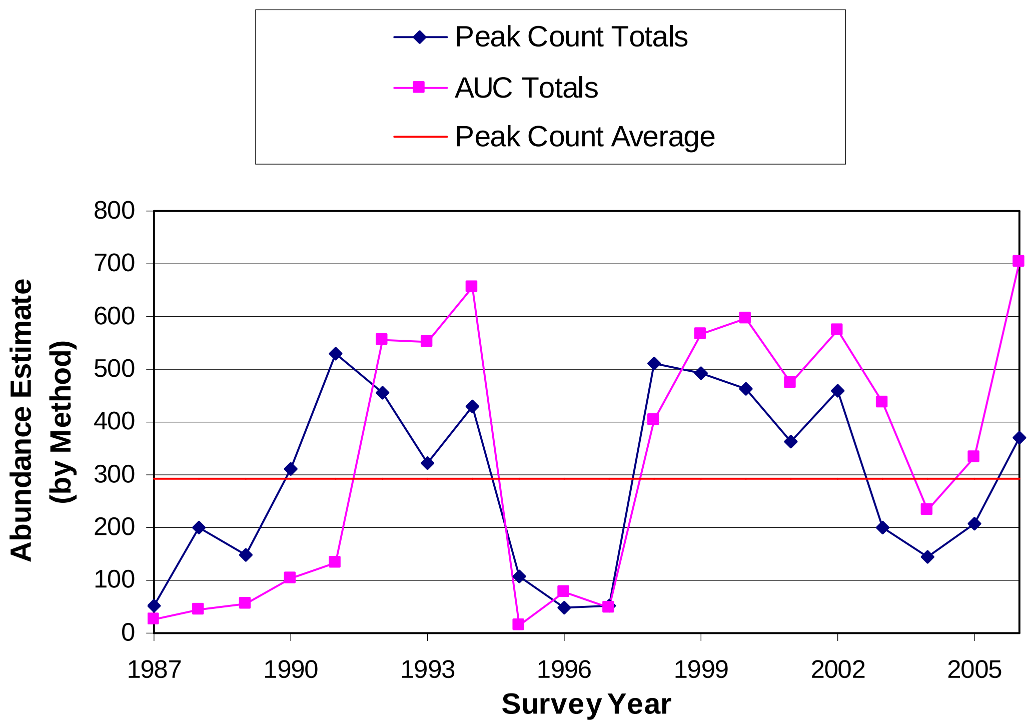
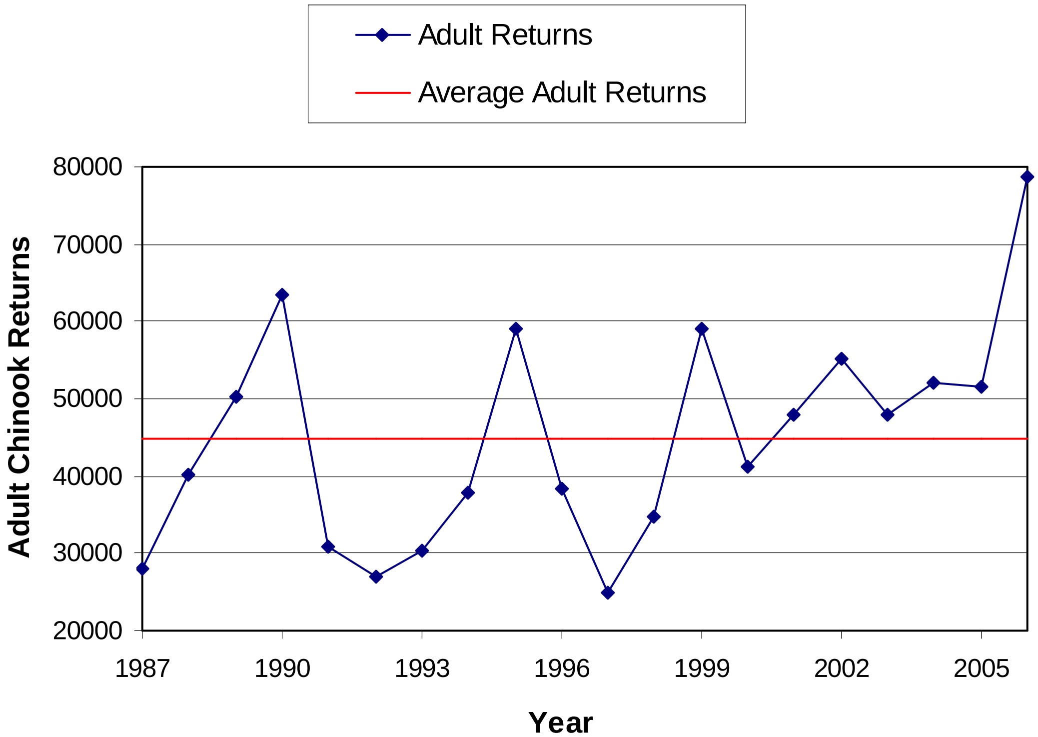


**Figure 8.** South Puget Sound Chinook salmon run reconstruction, 1987-2006.




Source: WDFW, 2007c.

## Comparing Mark Recovery Data with Hatchery Mark Rates

Mark recovery data from spawning ground surveys were summarized by inlet in Tables D-1 and D-2. Table D-1 contains mark recovery data from four streams (Cranberry, Deer, Goldsborough, and Johns Creeks) in Hammersley Inlet, while Table D-2 summarizes data from three streams in Case Inlet (Coulter, Rocky, and Sherwood Creeks) and one stream in Carr Inlet (Burley Creek). In addition to indicating the number of fish observed by mark recovery category, columns indicating sums of live and dead counts were included to provide an overall indication of the number of Chinook that returned to a site for a given year. The most important count is the sum of carcasses that were used in the mark recovery data, since this column included all fish categorized by mark recovery category. Theoretically the sum of dead counts and carcasses used in mark recovery should have equated, but that was not always true. In instances where the two counts did not equate, the carcass count was bolded and italicized.

An analysis of the mark recovery categories in Tables D-1 and D-2 revealed that many fish were tallied as either previously sampled or unknown mark, no head. This indicated that many of the fish tallied were either mark sampled during a prior survey, or were not sampled. Fish would be left non-sampled, presumably, for two reasons; either because the fish was deteriorated beyond the ability of the surveyor to positively identify the presence or absence of an adipose fin, or due to large numbers of carcasses present on the spawning grounds. At some sites, Burley Creek and Coulter Creek, the number of non-sampled carcasses totaled in the hundreds or thousands for some survey years (Table D-2). Given the large numbers of non-sampled, and previously sampled, carcasses included in mark recovery counts, it was necessary to analyze the mark recovery data exclusive of non-sampled and previously sampled fish. Although this shrunk the sample size, excluding non-sampled and previously sampled fish from the analysis was necessary to permit a definitive assessment of the carcasses that were adequately identified. By excluding non-sampled and previously sampled fish from the analysis, an assumption was made that mark recovery rates of sampled carcasses were the same as the rates of non-sampled carcasses. While this assumption cannot be scientifically proven retrospectively, it was assumed so that this analysis could be conducted.

Mark recovery data with three categories excluded- non-sampled, previously sampled, and carcasses whose adipose marks could not be determined (unknown mark, no beep)- were summarized in Tables D-3 through D-5. Table D-3 contains revised mark recovery data for Hammersley Inlet, Table D-4 summarizes this information for Case Inlet, and Table D-5 for Carr Inlet. The revised mark recovery data summarized retrievals into four categories: adipose marked, CWT; adipose unmarked, CWT; adipose marked, no CWT; and adipose unmarked, no CWT. Adipose marked fish have their adipose fin clipped to indicate that they were released from a hatchery facility. Fish with an unmarked adipose fin but a coded wire tag are also hatchery-released fish. Fish with an unmarked adipose fin and no CWT potentially represent either an unmarked hatchery fish, or a fish that was naturally spawned. These categories are summed, and represented as percentages in both tabular form, in Tables D-3, D-4, and D-5, and graphical form, in Figures 9, 10, and 11.

The revised mark recovery data revealed that for every year sampled at two of the three inlets, Case and Carr, the majority of sampled carcasses were of hatchery origin. At Case Inlet, the percentage of fish that had hatchery marks or CWTs ranged from 69 to 89%, while at Carr Inlet the range was 60 to 97%. In Hammersley Inlet, the percentage of fish with clipped adipose fins and/or CWTs ranged from 0-100%. The sample size, defined as number of carcasses sampled, at Hammersley Inlet was much smaller than the sample size at Case and Carr Inlets; the former's ranged from 1 to 7 while the later two inlets' ranged from 15 to 180 and 20 to 185, respectively. Of the eight streams analyzed in the three inlets, three exhibited a majority of hatchery fish for every year surveyed- Coulter Creek and Rocky Creek in Case Inlet, and Burley Creek in Carr Inlet (Tables D-4 and D-5). Three streams, Cranberry Creek and Deer Creek in Hammersley Inlet, and Sherwood Creek in Case Inlet, exhibited a greater percentage of non-hatchery fish versus hatchery fish for some of the survey years (Tables D-3 and D-4). While this trend occurred at Sherwood Creek for every year from 2002 to 2006, it only occurred at Cranberry Creek in 2003 and 2006 and at Deer Creek in 2003 and 2004. Two creeks, Johns Creek and Goldsborough Creek in Hammersley Inlet, did not have any Chinook carcasses sampled from 2002-2006 (Table D-3). The sample sizes of the six creeks, in descending order by the largest number of carcasses surveyed, was as follows: Burley Creek (20-185), Coulter Creek (4-174), Rocky Creek (0-34), Sherwood Creek (2-16), Deer Creek (1-5), and Cranberry Creek (0-2).

Mark and tagging rates for Chinook salmon released from South Puget Sound hatchery facilities and streams, for brood years 1997-2004, were summarized by release location, organized by WRIA, in Tables A-6 through A-10; these same rates, totaled exclusively by WRIA, are summarized in Table 6. Table 6 revealed that regionwide, mark and tagging rates for hatchery-released Chinook salmon have increased substantially since the 1997 brood year, when only a small percentage (10.5 %) of hatchery Chinook releases were either marked and/or tagged. The rate of marked and/or tagged fish increased substantially for 1998 brood year releases (78.8 %), and further increased, and remained at consistently higher rates, for 1999 through 2004 brood year releases (93.4- 98.0%).

**Figure 9.** Hammersley Inlet streams revised mark recovery data, 2002-2006.

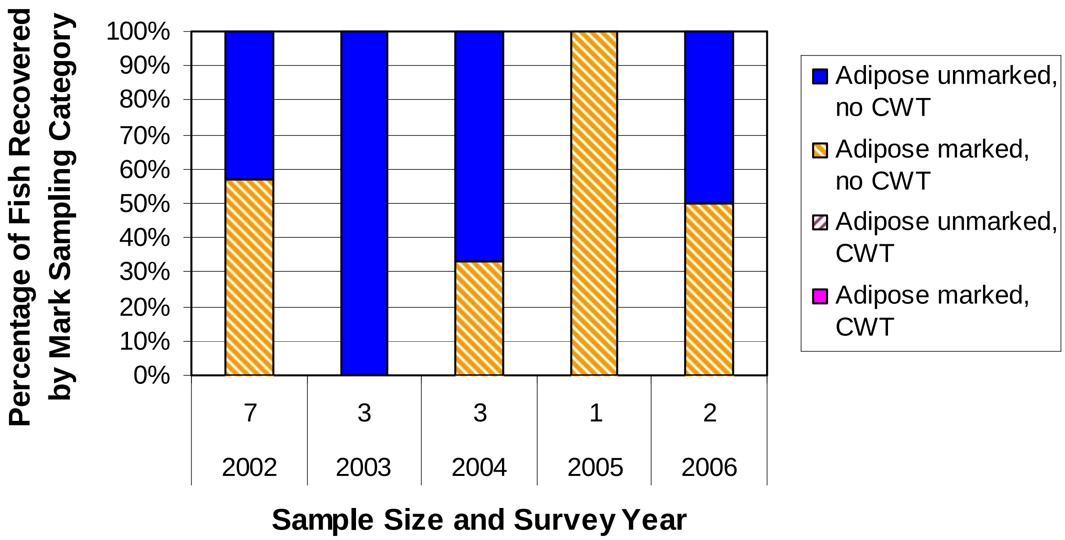



**Figure 10.** Case Inlet streams revised mark recovery data, 2002-2006.

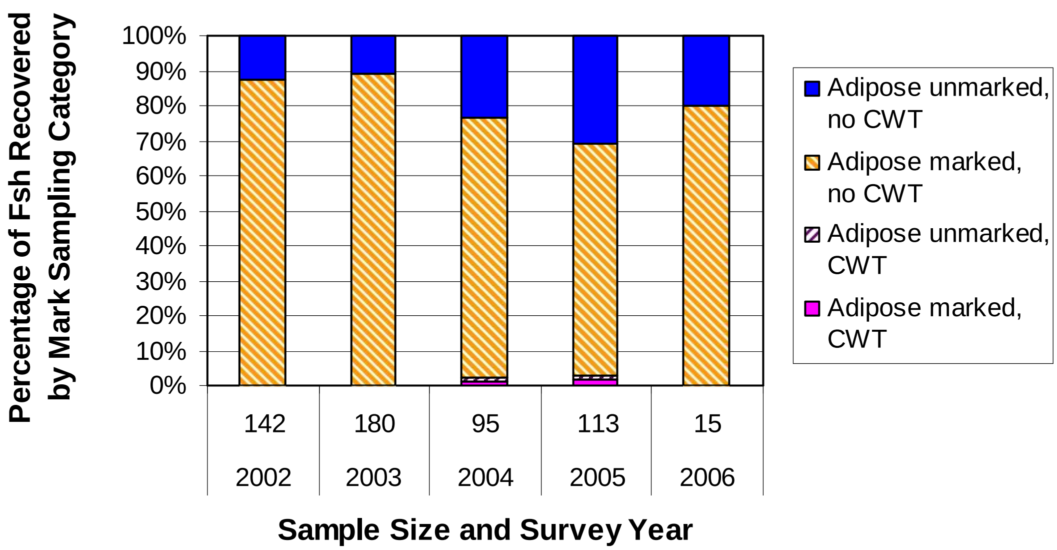


**Figure 11.** Carr Inlet streams revised mark recovery data, 2002-2006.

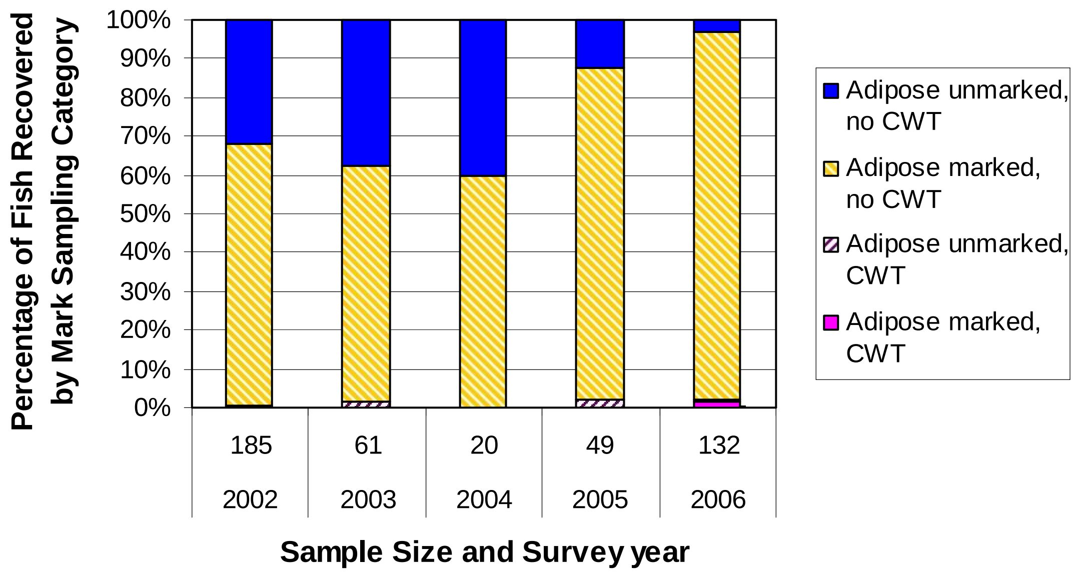


**Table 6.** South Puget Sound hatchery-released Chinook salmon adipose mark and CWT rates, brood years 1997-2004.

| | **WRIA 11** | | | **WRIA 12** | | | **WRIA 13** | | |
|---|---|---|---|---|---|---|---|---|---|
| *Brood Year* | Unmarked, no CWT | Total released | Unmarked, no CWT (%) | Unmarked, no CWT | Total released | Unmarked, no CWT (%) | Unmarked, no CWT | Total released | Unmarked, no CWT (%) |
| 1997 | 4,233,637 | 4,859,565 | 87.12 % | 1,004,020 | 1,099,511 | 91.32 % | 3,848,935 | 4,052,235 | 94.98 % |
| 1998 | 2,654,823 | 5,670,792 | 46.82 % | 510,270 | 1,500,386 | 34.01 % | 103,303 | 4,153,665 | 2.49 % |
| 1999 | 88,711 | 5,503,395 | 1.61 % | 37,970 | 1,115,495 | 3.40 % | 58,012 | 5,940,304 | 0.98 % |
| 2000 | 354,851 | 4,777,819 | 7.43 % | 294,103 | 913,339 | 32.20 % | 119,705 | 4,051,844 | 2.95 % |
| 2001 | 127,932 | 5,469,218 | 2.34 % | 463,062 | 2,693,201 | 17.19 % | 26,170 | 4,392,150 | 0.60 % |
| 2002 | 227,981 | 3,514,024 | 6.49 % | 29,528 | 1,076,794 | 2.74 % | 96,069 | 4,130,274 | 2.33 % |
| 2003 | 120,617 | 4,166,184 | 2.90 % | 61,494 | 1,200,297 | 5.12 % | 227,814 | 4,286,736 | 5.31 % |
| 2004 | 187,302 | 3,443,874 | 5.44 % | 26,425 | 1,198,995 | 2.20 % | 123,904 | 3,732,855 | 3.32 % |
| **Totals** | 7,995,854 | 37,404,871 | - | 2,426,872 | 10,798,018 | - | 4,603,912 | 34,740,063 | - |
| | **WRIA 14** | | | **WRIA 15** | | | **South Puget Sound Region** | | |
| *Brood Year* | Unmarked, no CWT | Total released | Unmarked, no CWT (%) | Unmarked, no CWT | Total released | Unmarked, no CWT (%) | Unmarked, no CWT | Total released | Unmarked, no CWT (%) |
| 1997 | 23,665 | 149,950 | 15.78 % | 3,406,000 | 3,664,525 | 92.95 % | 12,516,257 | 13,825,786 | 90.53 % |
| 1998 | 3,210 | 160,500 | 2.00 % | 79,709 | 3,636,958 | 2.19 % | 3,351,315 | 15,122,301 | 22.16 % |
| 1999 | 0 | 0 | - | 133,027 | 3,194,070 | 4.16 % | 317,720 | 15,753,264 | 2.02 % |
| 2000 | 0 | 0 | - | 69,335 | 2,947,650 | 2.35 % | 837,994 | 12,690,652 | 6.60 % |
| 2001 | 0 | 0 | - | 3,658 | 1,892,500 | 0.19 % | 620,822 | 14,447,069 | 4.30 % |
| 2002 | 10,000* | 10,000* | 100.00 % | 18,436 | 1,876,675 | 0.98 % | 382,014 | 10,607,767 | 3.60 % |
| 2003 | 0 | 0 | - | 6,049 | 1,714,725 | 0.35 % | 415,974 | 11,367,942 | 3.66 % |
| 2004 | 0 | 0 | - | 2,502 | 1,869,623 | 0.13 % | 340,133 | 10,245,347 | 3.32 % |
| **Totals** | 26,875 | 310,450 | - | 3,718,716 | 20,796,726 | - | 18,782,229 | 104,060,128 | - |

Source: RMIS Database, 2008.

* Release of 10,000 unfed fry at 1,000 FPP

In order to compare hatchery release mark and tagging rates with mark recovery rates, it was necessary to look at brood year hatchery release rates three, four, and five years prior to the return year being studied. Since Chinook salmon in the Puget Sound region return primarily as three- and four-year olds (Shared Strategy Development Committee, 2007), it was necessary to calculate a weighted average for each brood year release that contributed to a given return year. The weighted average hatchery mark rates for a given return year were calculated by multiplying each years mark rate by the expected age of return rate for Nisqually River hatchery fall Chinook, which was 49.04%, 48.43%, and 2.5% for three-, four-, and five-year olds, respectively (Nisqually Indian Tribe, 2007a). (South Puget Sound tributaries specific distribution of age at return data could not be located, but Nisqually data were selected because the Nisqually River is located within the South Puget Sound region and had these data available). The results for all South Puget Sound hatchery releases, as well as those within WRIA 15, were summarized in Table 7. Rates for WRIA 15 were provided because this region included the Case and Carr Inlet streams that were mark sampled. Weighted average mark rates for WRIA 14 were not calculated due to the small number of recent Chinook hatchery releases in this area, and because collective recovery rates at Hammersley Inlet streams were minimal, ranging from 1 to 7 sampled carcasses. Its use in this analysis was excluded so as not to skew the results.

Hatchery mark and tagging rates from carcasses recovered on the spawning grounds of South Puget Sound streams were compared with mark and tagging rates from Chinook salmon released from South Puget Sound hatchery facilities and streams to see if the rates were similar. A similar rate was defined as a mark recovery rate that was within ± 3% of the hatchery mark and tagging rate. This number was chosen because the likelihood that mark rates between the two data sets will match identically is minimal, given the much smaller numbers of carcasses recovered and sampled on the spawning grounds. A comparison of hatchery mark and tagging rates from streams, lumped together by inlet, with mark and tagging rates from hatchery-released Chinook salmon revealed that the rates of the latter were greater than the rates of the former for all but one year at both inlets, even with the adjustment rate factored in. In 2002, mark and tag recovery rates from carcasses sampled at Case Inlet streams was 87.3%, which was within the ± 3% range of the South Puget Sound weighted average mark rate of 86.0%, but not the WRIA 15 rate of 94.5%. In 2006, the mark and tagging recovery rate at Burley Creek, the only stream sampled in Carr Inlet, was 97%. This rate was within the range of both the weighted average mark rates for South Puget Sound and WRIA 15, which were 96.4% and 99.4% respectively.

**Table 7.** Weighted average mark rates for Chinook salmon hatchery brood year releases that contributed to return years 2002-2006 (South Puget Sound and WRIA 15).

| Region | Brood Year Releases | Weighted Average Mark Rates for Brood Year Releases | Return Year |
|---|---|---|---|
| South Puget Sound | 1997, 1998, 1999 | 85.99 % | 2002 |
| | 1998, 1999, 2000 | 95.22 % | 2003 |
| | 1999, 2000, 2001 | 94.64 % | 2004 |
| | 2000, 2001, 2002 | 95.99 % | 2005 |
| | 2001, 2002, 2003 | 96.35 % | 2006 |
| | | | |
| WRIA 15 | 1997, 1998, 1999 | 94.54 % | 2002 |
| | 1998, 1999, 2000 | 96.77 % | 2003 |
| | 1999, 2000, 2001 | 98.66 % | 2004 |
| | 2000, 2001, 2002 | 99.37 % | 2005 |
| | 2001, 2002, 2003 | 99.35 % | 2006 |

The same analysis was also performed with mark recovery rates for individual streams. A minimum sample size of five carcasses for a given survey year was selected to prevent small numbers of carcasses from skewing results. Five of the eight streams surveyed, which fit this criteria, were listed with the number of survey years that met the minimum sample size - Burley Creek (2002-2006), Coulter Creek (2002-2005), Rocky Creek (2002, 2005-2006), Sherwood Creek (2003-2005), and Deer Creek (2002). Of the five streams and sixteen return years studied, only three streams and four return years had mark recovery rates within the ± 3% range of hatchery-marked Chinook releases. The mark recovery rate at Rocky Creek in 2002 was 89.3%, which was slightly in excess of the South Puget Sound weighted average hatchery mark rate of 86.0%, but not within the adjusted range of the WRIA 15 rate of 94.5%. At Coulter Creek in 2002, the mark recovery rate was 89.0%, which was within range of the South Puget Sound weighted average hatchery mark rate, but not the WRIA 15 rate. In 2006, mark recovery rates at Rocky and Burley Creeks were 100% and 97.0%, respectively. The rate at Rocky Creek was within range of the WRIA 15 rate of 99.4%, but slightly in excess of the South Puget Sound rate of 96.4%. The rate at Burley Creek was within range of both the South Puget Sound and WRIA 15 hatchery mark rates.

## Discussion

### Comparing In-stream Abundance with In-stream Hatchery Releases

The relative presence of Chinook salmon observed at Coulter Creek from 1960-2006 generally followed the pattern previously described in the methods section. Coulter Creek exhibited modest presence of Chinook salmon, with peak combined live and dead counts ranging between 1 and 69, from 1960-1979 (Figure 5), the time period during which no significant in-stream hatchery releases occurred. Chinook presence at Coulter Creek increased substantially for the period from 1982 to 2004, with 1,000 or more Chinook observed by either hatchery escapement totals or peak observed counts for all but seven years (Figure 6). This increase was not unexpected, as the first brood year release in 1979 would be expected to produce a group of three-year old hatchery returns in 1982. Peak observed counts from 2000-2003 ranged from 1,492 to 2,338, with the peak total occurring in 2002. This trend was also expected, as four-year olds from 1999 brood year releases and three-year olds from the last brood year release in 2000 would be expected to contribute to 2003 returns. (It merits noting that the hatchery escapement totals often did not indicate how many Chinook were passed upstream, so it is very likely that hatchery escapement totals from years during hatchery operations, 1980-1999, underestimated the true number of fish that attempted to return to Coulter Creek spawning grounds). In 2004, peak observed counts declined to 1,146, from 1,907 in 2003, as only four-year olds from the 2000 brood year release and, to a much smaller extent, five-year olds from the 1999 brood year release would be expected to contribute to 2004 returns. Dramatic declines in peak observed counts continued in 2005 (239), as only five-year olds from the 2000 brood year would be expected to contribute to 2005 returns.  The 2006 peak observed counts (105) are the lowest observed since the advent of hatchery returns in 1982, which is not unexpected as previous hatchery broods no longer contributed to fish returning in that year.

Although peak observed live and dead survey counts from spawning ground surveys conducted at Coulter Creek before, during, and after on-site Chinook salmon hatchery releases revealed that trends in Chinook presence followed a pattern expected with on-site hatchery releases, it was not possible to presume that Chinook hatchery releases were the only factor affecting presence estimates at this site.  It was deemed necessary to look at the spawning ground survey data to see if anomalies in this data set affected the relative presence trends observed at Coulter Creek.  An analysis of the spawning ground survey data from Coulter Creek revealed two problems with this data set.  First, there were many years with very few surveys conducted, especially towards the beginning of this time period.  Second, very few surveys were conducted during the month of September, suggesting that a significant portion of the expected Chinook salmon migration and spawning period, September through early November, was missing from the data set.  Both of these problems likely contributed to low presence estimates of Chinook salmon on spawning grounds and were explored further.  Table B-2 displays the annual survey effort, defined as the number of surveys conducted at a site in a given year, for Coulter Creek.  These data revealed an increasing trend in survey effort as time progressed.  Survey effort at Coulter Creek from 1980 through 1999 was not included due to hatchery operations at that site, but spawning ground surveys were still conducted during this time period and generally followed an increasing trend as time progressed. Table B-3 displays the date of peak observed survey counts at Coulter Creek from 1960-1979 and 2000-2006.

Table B-2 reveals that survey effort was greater, on an annual basis, from 2000-2006, ranging from 8-11 surveys, than from 1960-1979, when 1-8 surveys were completed.  Greater survey effort from 2000-2006 corresponded with larger peak observed survey counts at Coulter Creek, but this relationship lessened in 2005 and 2006. The large peak observed survey counts from 2000-2004 were likely attributed to Chinook salmon returning from previous hatchery releases at this site.  This likely explains why peak observed counts for 2004-2006 were lower than counts observed in the years prior, despite that fact that survey effort from 2004-2006 remained at levels similar to, and in some years greater than, those for 2000-2003, years with much higher peak observed counts. Although trends in peak observed survey counts from 2000-2006 were more likely explained by the cessation of in-stream hatchery releases than survey effort, it was necessary to examine survey data from 1960-1979 to discern how low survey effort during this time may have affected peak observed counts. Of the five highest peak observed counts at Coulter Creek- 69, 67, 48, 43, and 36- four of them occurred in years with only one or two surveys conducted (1966, 1970, 1972 and 1973), while the count of 48 was observed in 1968, which had a survey effort of 5. Also notable is that the three years with the greatest survey effort-1974 (6), 1975 (6), and 1976 (8)- had respective peak observed counts of 19, 18, and 24. Thus, although survey effort tended to increase at Coulter Creek as time progressed, it does not appear that peak observed counts at this site were affected greatly by the number of surveys conducted. A more likely explanation for the large peak observed counts documented from 2000-2004 is the in-stream Chinook hatchery releases that occurred until the spring of 2001.

Table B-3 reveals that the date of peak observed survey counts at Coulter Creek was earlier from 2000-2006 than it was for 1960-1979. The peak observed survey date in the 1960's and 1970's occurred from mid- to late October, while for the current decade it occurred in mid- to late September. These data indicated that either the run timing at Coulter Creek has changed in recent times, with Chinook salmon returning earlier in the season, or that survey data from earlier decades likely missed a large portion of the Chinook salmon migration and spawning season. The lack of early season spawning ground surveys conducted from 1960-1979 likely indicates that WDFW was surveying other salmon species during these years, meaning that observations of Chinook salmon were incidental. Given the lack of early season spawning ground surveys conducted at Coulter Creek from 1960-1979, data from those years are likely inadequate to estimate past abundance estimates of Chinook salmon at this site, but data from 2000 onward are likely adequate to perform this task.

One thing that has been revealed through this scenario was that relative presence of Chinook salmon at Coulter Creek dropped significantly from 2004 to 2006, presumably as a result of discontinued Chinook salmon hatchery releases at Coulter

Creek. These declines in Chinook presence at Coulter Creek likely suggest that hatchery releases did not create a naturally producing, self-sufficient population. More years of data are required to see whether Chinook presence in subsequent years returns to levels seen during the 1960's and 1970's, or declines to levels where few, if any, Chinook return from year to year. If the latter scenario were revealed, this would serve as a strong indication that Chinook returning to this system in the past were likely attributed to previous hatchery releases.

**Comparing Regionwide Abundance Estimates with Regionwide Hatchery Releases**

Visual observations of the trends between the two estimation methods (peak observed live and dead counts and area-under-the-curve) and run reconstruction figures revealed both similarities and differences, with the first ten years exhibiting more differences in trends than the last ten years. The first ten-year period, 1987-1996, revealed that the two estimation methods did not mimic the pattern shown by the run reconstruction data. From 1987 to 1990, both of the estimation methods and run reconstruction figures increased on a yearly basis, but from 1991-1995 the two data sets appeared to exhibit an inverse relationship, with the two estimation methods indicating larger abundance estimates through 1994 while run reconstruction figures remained below average through that same year. In 1995, both relative presence and abundance estimates dropped dramatically and remained low in 1996; meanwhile, run reconstruction figures exhibited a large increase in 1995, but then dropped below average in 1996, more in line with low presence and abundance estimates for that year.

The second ten-year period, 1997-2006, revealed that the two estimation methods and run reconstruction figures appeared to exhibit similar trends. Both data sets revealed low figures in 1997, but increased in each of the next two years, resulting in a peak in 1999. Except for a sharp decrease in adult Chinook returns in 2000, both estimation methods and run reconstruction data remained relatively stable, and above average, through 2002. Run reconstruction figures remained above average through 2006, reaching its largest total in that year. Meanwhile, the two estimation methods loosely followed this trend, although estimates for 2004 and 2005 displayed lower totals than the run reconstruction figures suggested. While the AUC relative abundance estimate for

2006 reached its highest total for the entire period, the relative presence estimate did not increase substantially, but was above the average for the 20 year period.

Since this method of comparison between the two data sets, abundance estimates and run reconstruction figures, was not statistically comparable, it was necessary to look at the raw data from each set to see if that could explain the trends exhibited by the data. Yearly summaries of both the peak observed survey counts and AUC abundance estimates for the creeks analyzed are provided in Tables C-2 and C-3. The spawning ground survey data that were used in calculating both estimation methods at each stream are provided in Tables C-5 through C-11. Table C-3 reveals that many problems existed with spawning ground survey data for these streams from 1987 through 1998. Many of these sites had long gaps (greater than 14 days) between surveys, lacked early season surveys (prior to September 25), and some sites did not have enough surveys to calculate an AUC abundance estimate (three or fewer surveys). Burley Creek did not have AUC abundance estimates calculated for eight of the twelve years between 1987 and 1998, while Rocky Creek did not have AUC abundance estimates calculated for two of these years (1989 and 1993). In addition, Goldsborough Creek did not have any spawning ground surveys conducted during the Chinook run season from 1987 through 1997.

These problems with the spawning ground survey data indicated that six of these twelve years (1987-1989 and 1995-1997) cumulatively exhibited very poor data for the study sites. An analysis of Tables C-2 and C-3 indicated that Burley Creek consistently had the largest returns of Chinook salmon of any creek analyzed. Assuming this observation to be indicative of actual abundance at this site, the fact that AUC estimates were not calculated at Burley Creek for eight of the first twelve years analyzed suggested that AUC estimates for all years, except 1992-1994 and 1996, likely underestimated the true relative abundance of Chinook salmon in South Puget Sound tributaries from 1987 through 1998. Coupling this with the fact that poor regionwide data existed for two, three-year periods during these twelve years, it appears that data was only adequate to predict relative presence estimates from 1990-1994 and in 1998. An analysis of Figure 7 revealed that both estimation methods showed larger estimates during years with better survey data than years with poor survey data. Given the lack of consistent and adequate spawning ground survey data from 1987-1998, it was not possible to definitively correlate Chinook abundance estimates at these streams with run reconstruction data during this time period.

While poor spawning ground data, as a whole, existed from 1987-1998, better data were available from 1999-2006. Table C-3 indicated that there were fewer problems with spawning ground survey data (i.e. long gaps between surveys or a lack of early season surveys) during this time period. These data produced more accurate AUC relative abundance estimates, making an attempt to correlate relative abundance with run reconstruction figures more pertinent. AUC estimates from 1999-2003 correlated fairly well with run reconstruction data during this time, but estimates for 2004, and to some extent 2005, were lower than run reconstruction data indicated. AUC estimates and run reconstruction data for 2006 both revealed the highest levels recorded during this 20 year period. Survey effort at Rocky Creek during 2004 was so low that an AUC abundance estimate was not calculated for that year (Table C-3). Table C-10 indicated that no spawning ground surveys were conducted during the majority of the Chinook run season, evidenced by a large gap between surveys conducted on September 8 and November 10. A month long gap between surveys in 2005 was also indicated in Table C-10, with most of September missing from the data set. These data gaps at Rocky Creek in 2004 and 2005 could potentially explain the low abundance estimates regionwide for these years, considering that Rocky Creek often exhibited the second highest abundance and presence estimates of the seven streams analyzed. Yet, Table C-3 also indicated that all the other streams, except for Sherwood Creek, exhibited rather modest abundance estimates as well, so it was not possible to attribute the low totals in those two years directly to poor survey data at Rocky Creek.

Although the last eight years (1999-2006) possessed reasonably adequate spawning ground survey data, and revealed relatively similar trends between relative abundance estimates and run reconstruction data, the same was not true for the period from 1987-1998. This conclusion is not surprising, given that spawning ground surveys at many of these streams were not conducted for the sole purpose of observing Chinook salmon, and, thereby, merely provided incidental observations of this species. Only recently, 1999-2006, does it appear that WDFW conducted surveys at times of expected Chinook presence in these streams. Inconsistent survey data at many of these streams, over the time period surveyed, made the assumption of an indirect correlation between relative abundance estimates and run reconstruction data, due to visual trends between the two data sets, inappropriate.

Still, these results reveal useful information regarding Chinook salmon that returned to South Puget Sound tributaries. First, the abundance estimates revealed that Chinook salmon returned to these streams in modest numbers for years, usually in the hundreds of fish. There existed periodic, large fluctuations between years, with peaks and valleys that often lasted several years. These peaks existed during periods with both poor and sufficient spawning ground survey data, and seemed to mimic fluctuations often observed in both naturally produced and hatchery salmon stocks. These fluctuations likely ranged somewhere from a couple hundred to over a thousand fish, given that true relative abundance estimates were likely underestimated due to poor data from many of the years within the study period. Regardless, the relative abundance estimates at these streams was rather small when compared to both the large number of hatchery Chinook salmon released regionwide from 1983-2003, approximately 9 to 21 million (Figure 3), and run reconstruction figures from 1987-2006, estimated at 25,000 to 79,000 adult Chinook returns (Figure 8).

Second, the majority of the Chinook salmon observed in spawning ground surveys were found in Case and Carr Inlets, with far fewer spotted in Hammersley Inlet. Chinook salmon relative abundance estimates for the four streams surveyed within Hammersley Inlet during this twenty-year period ranged from 2 to 95. Relative abundance estimates for Case and Carr Inlets were much greater, ranging from 0 to 507 and 16 to 671 respectively, excluding years where relative abundance estimates were not calculated at Burley Creek due to poor data. Of all the streams analyzed, Burley Creek exhibited the largest, regular returns. An analysis of spawning ground survey data from 1987-2006 revealed that survey effort and timing at the four streams in Hammersley Inlet were similar to the streams surveyed in Case and Carr Inlets. The data were poor from 1987-1998, but improved from 1999-2006; thus, it did not appear that the differences in relative abundance at the streams surveyed could be attributed solely to survey effort and timing.

A look at hatchery release records revealed that Chinook abundance in these three inlets might have been influenced by the proximate location of hatchery releases. Hatchery release records indicated that Hammersley Inlet did not have extensive in-basin hatchery releases during the past 55 years (Table A-4). Meanwhile, Case Inlet had Chinook hatchery releases from Coulter Creek Hatchery from 1980-2001, and Carr Inlet is the location of Minter Creek Hatchery, one of the larger Chinook salmon production facilities, which has been releasing Chinook salmon since 1953 (Table A-5). Abundance estimates were larger in streams that were in close proximity to, or within the same inlet of, hatchery Chinook salmon release sites. Research suggests that salmon reared in hatcheries tend to stray more than their wild counterparts. A study of a wild stock of autumn (fall) Chinook salmon in the Lewis River (Southwest Washington) indicated that wild fish that were caught, tagged, and reared at a hatchery site strayed at a greater rate (10.3% versus 3.2%) than wild fish from the same stock that were caught, tagged, and released. The same study also found that when hatchery fish strayed, approximately 55% of them strayed to an adjacent river, defined as one tributary above or below the Lewis River (McIsaac, 1990). The results of this study on straying might help explain why Chinook salmon abundance estimates were greater at streams in close proximity to hatchery Chinook salmon release sites than streams that are further away.

If small numbers of Chinook salmon annually stray from nearby hatcheries, they could be responsible for the numbers of Chinook observed at these streams. Another question, which is very difficult to answer, is whether some of these hatchery Chinook salmon, which might stray, spawn successfully at these streams and produce natural progeny. A possibility exists that a combination of Chinook production, consisting of hatchery strays and hatchery-origin recruits from strays that successfully spawn, is responsible for the abundance of Chinook salmon observed at these streams. There could be other explanations as to why more Chinook are spotted in Case Inlet and Carr Inlet streams as opposed to Hammersley Inlet (i.e. basin size, flow regimes, and temperatures). Although data regarding the stream characteristics of South Puget Sound tributaries, particularly stream flow and temperature data from Case and Carr Inlet streams, are lacking, it is presumed that the majority of the streams in these two inlets exhibit relatively similar flow and temperature regimes to streams located in Hammersley Inlet, due to the relatively small basin sizes of all these streams. Thus, it is unlikely that stream characteristics could explain the differences in Chinook salmon abundance observed in the streams within these three inlets.

## Comparing Mark Recovery Data with Hatchery Mark Rates

Although the mark recovery rates from carcasses sampled at selected South Puget Sound streams fell within the adjusted weighted average hatchery release mark rates only a minority of the time, these results revealed some trends that might be useful in assessing the extent of hatchery-origin fish among the carcasses observed in these streams. Two of the three inlets exhibited a majority of hatchery-marked carcasses for every year survey from 2002-2006, with carcass mark recovery rates ranging from 69-89% at Case Inlet, and 60-97% at Carr Inlet. Carcass mark recovery rates at Hammersley Inlet were more variable, ranging from 0-100%. In this inlet, a majority of hatchery-marked carcasses were observed in 2002 and 2005, a majority of unmarked hatchery carcasses were observed in 2003 and 2004, and an equal number of both were observed in 2006. The sample sizes at Case and Carr Inlet , ranging from 15- 180 and 20- 185, respectively, were much larger than those observed at Hammersley Inlet, which ranged from only 1- 7. These results suggest that consistently greater hatchery mark recovery rates were observed on carcasses at the two inlets with larger sample sizes versus the inlet with much smaller sample sizes.

The same trend seems to apply to individual streams, but to a lesser degree than with inlets. The three streams with the largest sample sizes, defined as the largest individual observed carcass count, had consistently higher hatchery mark recovery rates than the three streams with the smallest sample sizes. Burley Creek, Coulter Creek, and Rocky Creek, which had respective sample sizes ranging from 20-185, 4-174, and 0-34, exhibited carcass hatchery mark recovery rates of 60-97%, 75-91%, and 82-100%, respectively. Meanwhile, Sherwood Creek, Deer Creek, and Cranberry Creek, which had respective sample sizes ranging from 2-16, 1-5, and 0-2, exhibited carcass hatchery mark recovery rates ranging from 0-25%, 0-100%, and 0-50% respectively. Goldsborough Creek and Johns Creek had no sampled carcasses from 2002-2006.

Yet, it is not possible to presume that sample size was largely responsible for the percentage of hatchery-marked and tagged carcasses observed at spawning grounds in South Puget Sound streams. First, Rocky Creek exhibited a larger percentage of hatchery-marked carcasses than Coulter Creek for each of the four years that carcasses were observed at Rocky Creek (2002-2003, 2005-2006). When compared to Burley Creek, Rocky Creek had a larger percentage in three of these four years (2002-2003, 2006). These results are observed despite the fact that Rocky Creek had a smaller sample size than Burley Creek for every year surveyed, and for every year surveyed at Coulter Creek, except 2006. Second, streams and inlets with smaller sample sizes, with the exception of Sherwood Creek, exhibited a larger variation in the percentage of hatchery-marked carcasses recovered. This was likely due to the fact that the number of sampled carcasses at Hammersley Inlet streams, ranging from 0-2 at Cranberry Creek and 1-5 at Deer Creek, skewed the results when viewed as percentages. For example, the 100% hatchery mark rate observed at Deer Creek, and Hammersley Inlet as a whole, in 2005 was attributable to the fact that the only carcass recovered in that year was adipose marked. Results from streams with sample sizes so small tell us little when compared with hatchery release mark rates, other than the fact that few carcasses, or live fish, were observed at these four streams from 2002-2006.

Perhaps the reason why the streams and inlets with larger numbers of recovered carcasses tended to have a higher percentage of hatchery-marked carcasses could be better explained by those streams' proximity to Chinook salmon hatchery facilities and release locations. Carr and Case Inlet streams, which consistently exhibited a greater number and percentage of hatchery-marked carcasses than Hammersley Inlet streams, are much closer to former and current hatchery Chinook salmon release sites than are Hammersley Inlet streams. Burley Creek shares the same inlet, and is located approximately seven miles northeast of Minter Creek, the site of a salmon hatchery facility that has annually released Chinook salmon since 1953. Coulter Creek is currently the site of a rearing pond for juvenile Chinook salmon, and also was a release site for Chinook salmon from 1980-2001. Coulter Creek shares Case Inlet with Rocky Creek and Sherwood Creek, which are located approximately five miles southeast and three miles south of Coulter Creek, respectively. The closest hatchery release site to the four streams in Hammersley Inlet is the South Sound Net Pens, located on the eastern side of Squaxin Island. The proximity of the South Sound Net Pens to Hammersley Inlet streams is as follows: Goldsborough Creek (12 miles), Johns Creek (14 miles), Cranberry Creek (16 miles), and Deer Creek (16 miles). Releases of yearling Chinook salmon from the South Sound Net Pens have since been discontinued, with the last release group in April of 2000 using 1998 brood year Chinook salmon. Presuming that hatchery Chinook salmon released from South Puget Sound hatchery facilities strayed to South Puget Sound streams, and tended to stray to streams within close proximity at a greater rate than streams located further away, the expectation would be to find larger numbers and percentages of hatchery-marked carcasses on the spawning grounds of streams located closer to these release sites versus further away.

One way to test this theory is to analyze coded wire tag recoveries from South Puget Sound streams to ascertain from which hatchery sites these fish strayed. A review of CWT recoveries for South Puget Sound streams was conducted using the RMIS Database. CWTs have been recovered at six of the eight streams studied (Burley Creek, Coulter Creek, Rocky Creek, Sherwood Creek, Deer Creek, and Goldsborough Creek). These data, along with recoveries from four additional South Puget Sound streams (Skookum Creek, Moxlie Creek, Percival Creek, and Woodland Creek), are summarized in Table 8. CWT recoveries from hatcheries outside of South Puget Sound are italicized.

CWT recoveries indicated that fish strayed to these ten streams from nearby South Puget Sound hatchery production facilities, Fox Island and South Sound Net Pens, and hatcheries located outside of South Puget Sound, including many located in Hood Canal. Of the 34 CWTs recovered at Burley Creek, 16 were recovered from Minter Creek Hatchery and Hupp Springs Rearing Pond, both located on Minter Creek. Six CWTs were recovered from South Puget Sound Net Pens, five from nearby Fox Island Net Pens, and one from South Sound Net Pens. Twelve CWTs were recovered from outside South Puget Sound, including eleven from Grovers Creek Hatchery and one from the Sund Rock Net Pens, located in Central Puget Sound and Hood Canal, respectively. Coulter Creek had 18 CWT recoveries and of these, nine were from Minter Creek facilities and six were from Fox Island Net Pens. The other three were recovered from two Hood Canal hatcheries, George Adams and Hoodsport. Rocky Creek had only four CWT recoveries, two from both the Fox Island and South Sound Net Pens. The two CWT recoveries from Sherwood Creek were both from Hood Canal hatcheries, George Adams and Long Live the Kings in Lilliwaup, a regional salmon enhancement group. Deer Creek had two CWT recoveries, one from South Sound Net Pens and the other from George Adams Hatchery in Hood Canal. Meanwhile, Goldsborough Creek had one CWT recovery from South Sound Net Pens. CWT recoveries from Skookum Creek and Moxlie Creek indicate that three and nine recoveries from South Sound Net Pens were made at each stream, respectively. The six CWTs recovered at Percival Creek were from sites within the Deschutes Basin, including Capitol Lake Rearing Pond, Allison Springs Rearing Pond, and Percival Cove Net Pens. One CWT was recovered at Woodland Creek and this came from Fox Island Net Pens.

The CWT results from the RMIS Database indicated three general characteristics of tagged, hatchery Chinook salmon that strayed to South Puget Sound streams. First, most Chinook straying from South Puget Sound hatchery facilities, excluding net pen releases, were recovered at streams in close proximity to their release site. This occurred at Burley Creek, where nearly half of the CWTs recovered, 16 out of 34, came from Chinook released at nearby Minter Creek. This also occurred at Percival Creek, where all six of the CWTs recovered came from fish released at sites within the Deschutes River Basin. Nine of the 18 CWTs recovered at Coulter Creek came from Minter Creek facilities. While Coulter Creek is not in close proximity to Minter Creek, located one inlet over in Carr Inlet, straying by Minter Creek and Hupp Springs Hatchery Chinook salmon might be explained by the fact that the two hatchery facilities occasionally transferred eggs in the 1980's and 1990's (RMIS Database, 2008).

**Table 8.** Coded wire tag recoveries at South Puget Sound streams, 1984-2006.

| Inlet | Stream | Hatchery Release Location | CWTs Recovered | Recovery Year(s) |
|---|---|---|---|---|
| Carr | Burley Creek | Hupp Springs Rearing | 13 | 1991, 1993, 1994, 1996, 2005 |
| | | Minter Creek | 3 | 1984, 2006 |
| | | Fox Island Net Pens | 5 | 1992, 1993 |
| | | South Sound Net Pens | 1 | 1993 |
| | | *Grovers Creek* | *11* | *1989, 1993, 1996, 2001-2003, 2006* |
| | | *Sund Rock Net Pens* | *1* | *2001* |
| | | | | |
| Case | Coulter Creek | Hupp Springs Rearing | 7 | 1990, 1993, 2000, 2005 |
| | | Minter Creek | 2 | 2005 |
| | | Fox Island Net Pens | 6 | 1993-1995, 2000 |
| | | *George Adams* | *2* | *1993, 2004* |
| | | *Hoodsport* | *1* | *2001* |
| | Rocky Creek | Fox Island Net Pens | 2 | 1999, 2001 |
| | | South Sound Net Pens | 2 | 1992 |
| | Sherwood | *George Adams* | *1* | *2004* |
| | | *Long Live the Kings-Lilliwaup* | *1* | *1999* |
| | | | | |
| Hammersley | Deer Creek | South Sound Net Pens | 1 | 1993 |
| | | *George Adams* | 1 | 2000 |
| | Goldsborough | South Sound Net Pens | 1 | 1999 |
| | | | | |
| Little Skookum | Skookum | South Sound Net Pens | 3 | 1989 |
| | | | | |
| Budd | Moxlie Creek | South Sound Net Pens | 9 | 1993, 1994, 2001 |
| | Percival | Capitol Lake Rearing | 3 | 1989 |
| | | Allison Springs Rearing | 1 | 1989 |
| | | Percival Cove Net Pens | 2 | 1999, 2000 |
| | Woodland | Fox Island Net Pens | 1 | 1999 |

Source: RMIS Database, 2008.

Second, Chinook salmon released from Fox Island and South Sound Net Pens were recovered at streams throughout the South Puget Sound region, indicating that they strayed to sites both and close and far from their release site. CWTs released from the two net pen sites were recovered at all but two of the streams, Sherwood Creek and Percival Creek. Chinook salmon released from Fox Island Net Pens strayed to locations both in close (Burley Creek) and far (Coulter Creek, Rocky Creek, and Woodland Creek) proximity from their release site. The same was observed for Chinook released from South Sound Net Pens, which were recovered at streams within close proximity (Deer Creek, Goldsborough Creek, and Skookum Creek) as well as further proximity (Rocky Creek and Burley Creek) from the net pens. Third, some Chinook salmon released from hatcheries outside of South Puget Sound were recovered in South Puget Sound streams. Most of these recoveries were from Chinook released at Hood Canal facilities, although 11 CWTs from Grovers Creek Hatchery, located in Central Puget Sound on the North Kitsap Peninsula, were recovered at Burley Creek.

Although it is difficult to account for Chinook salmon from outside the South Puget Sound region that strayed to streams within the region, CWT recoveries from these streams suggested that most straying within the region occurred from either nearby hatchery releases sites, or net pen release sites. Releases of yearling Chinook salmon from both South Sound and Fox Island Net Pens have been discontinued, with the last brood year release group of 1998 for the former and 1999 for the latter. With the cessation of hatchery releases from these net pen sites, the number of Chinook straying from net pen sites would be expected to diminish after 2003, the year that four-year olds from the 1999 brood year returned. Thus, most straying of post 1999 brood year hatchery Chinook released within South Puget Sound would be expected to come from fish released at sites in close proximity to the streams where the fish strayed. Yet, if proximity to a Chinook hatchery release site were primarily responsible for the number and percentage of hatchery-marked carcasses observed at South Puget Sound streams, then all streams within close proximity to a Chinook salmon hatchery release site should have exhibited larger numbers and percentages of hatchery-marked carcasses than streams that are located further away from a hatchery release site. While this rationale might explain the numbers and percentages of hatchery-marked carcasses observed in Burley Creek, Rocky Creek, Coulter Creek, and the four Hammersley Inlet streams, it does not explain the low numbers and percentages of hatchery-marked carcasses observed at Sherwood Creek.

Despite being in closer proximity to Coulter Creek than is Rocky Creek, Sherwood Creek had a smaller sample size and much lower percentage of hatchery-marked carcasses than the other two nearby streams located in Case Inlet. This might imply that fish straying from Coulter Creek preferred Rocky Creek to Sherwood Creek. Yet, the most recent releases of hatchery Chinook from Coulter Creek, brood years 1998-2000, were entirely untagged, so there exists no definitive way to prove this theory. Another possible explanation for the unexpected trend observed at Sherwood Creek might be unmarked hatchery Chinook salmon releases within Sherwood Creek itself. The Hatchery and Genetic Management Plan for Minter Creek stated that 10,000 unfed fry, at 1,000 FPP, were provided to regional enhancement groups for release into Sherwood Creek in April or May of the following year (WDFW, 2002). Hatchery release records from the RMIS Database indicated that at least one release of 10,000 unmarked, unfed fry, at 1,000 FPP, occurred at Sherwood Creek in November of 2002, through a RSI Cooperative project. RSI stands for remote site incubator and is a device that permits on-site rearing of salmonid eggs in remote stream reaches.

A conversation with John McAllister, a volunteer with the Sherwood Creek Cooperative, which later merged with the Allyn Salmon Enhancement Group (ASEG), revealed that these organizations received eyed Chinook salmon eggs from WDFW's Minter Creek Hatchery for release into Sherwood Creek in 1990, and from 1995-2003. The mission and objectives of the Allyn Salmon Enhancement Group include enhancing, protecting, and recovering indigenous populations of North Bay salmon, including Sherwood Creek, where they still occur (Allyn Salmon Enhancement Group, 2008). Eyed eggs were placed inside corrugated plastic tubes, with crushed rock above and below the eggs and metal screening covering the top of the tube, at locations throughout Sherwood and Schumocher Creek to permit the release of Chinook salmon fry directly into the watershed (John McAllister- ASEG, Personal Communication). A summary of these releases of eyed Chinook salmon eggs from the Sherwood Creek Cooperative and Allyn Salmon Enhancement Group, which ranged from 10,000-100,000 per release year, are summarized in Table D-6. A search of WDFW Future Brood Documents for 2004-2007 indicated no transfers of unfed fry from Minter Creek to regional enhancement groups for release into Sherwood Creek (WDFW, 2004- WDFW, 2006; WDFW, 2007a).

There exists a possibility that at least some of the small numbers of mostly unmarked fish observed at Sherwood Creek could be attributed to the on-site release of unfed fry. The number of Chinook salmon returning to Sherwood Creek as a result of tube and RSI releases from 1995-2003 is likely minimal, given that survival of groups of fish released in excess of 200 FPP are considered to have very low survival rates (Larry Phillips- WDFW, personal communication). Yet, given the small numbers of Chinook carcasses observed at Sherwood Creek from 2002-2006, even a small contribution from these releases might explain the low percentage of unmarked hatchery carcasses observed. A calculation of expected returns of eyed eggs released at Sherwood Creek from 1995-2003 revealed that 1.4 and 1.3 unmarked fish would be expected to return as three- and four-year olds following a release of 10,000 eyed eggs in years prior. Expected contributions from five-year olds are so small from a release group of 10,000 (<0.1 fish) that it was ignored in this analysis. These figures, documented in Table D-7, were calculated using Nisqually River fall Chinook salmon return rates per pounds of hatchery fish released. This method of calculation is different than that used for Nisqually River Chinook, which averages the projected return numbers that are calculated using both fish returning per number released and fish returning per pounds of fish released. The latter figure was chosen to calculate return rates in this instance, because using the return rate per number released would project a much larger number of returns than would be expected from a group of such a small physical size.

Assuming that these projected return rates for releases from 1995-2003 are relatively accurate, expected contributions to returning Chinook salmon would be as follows: two to three fish from 1999-2003, four fish in 2004 and 2005, and 15 fish in 2006 (Table D-7). While four fish returning per year, due to eyed egg releases, would not explain the 13 unmarked carcasses observed at Sherwood Creek in 2004 and 2005, it would definitely seem more plausible in years such as 2002 and 2003, when three and four unmarked carcasses were recovered. The year 2006 appears to be an anomaly as only two unmarked carcasses were recovered, although 15 fish were expected to return due to the large, and last, release of 100,000 eyed eggs in Sherwood Creek. Still, it is unlikely that the numbers of unmarked hatchery carcasses observed at Sherwood Creek could be attributed solely to unmarked releases of fed fry, since AUC estimates at Sherwood Creek from 2002-06 suggested larger numbers of live Chinook in the system, ranging from 10-103, than observations of carcasses accounted for (Table C-3). This indicated that greater numbers of live versus dead Chinook were observed in Sherwood Creek from 2002-2006, which could be attributed to scavenging by predators, poaching by humans, or carcasses being washed downstream or above the creek bank due to high flows. Although all of the unmarked carcasses observed in Sherwood Creek cannot be directly attributed to releases of unfed fry into the watershed from 1995-2003 by regional enhancement groups, the expected contribution of Chinook returning due to these releases could account for some of the unmarked carcasses observed during these years.

Unmarked carcasses observed at Sherwood Creek, and other South Puget Sound tributaries, could be attributed to three groups of Chinook salmon: unmarked and untagged hatchery strays, hatchery-origin recruits, or strays from naturally producing, self-sustained populations within Puget Sound. There exits a distinct possibility that unmarked carcasses recovered on South Puget Sound spawning grounds could be attributed to one or all of these groups of unmarked Chinook salmon. With the advent of mass marking of hatchery Chinook released from South Puget Sound hatchery facilities, beginning with the 1998 brood year, an effort has been made to mark or tag 100% of all fish released. Yet, hatchery release records from the RMIS Database indicate that a 100% mark or tagging rate has never been achieved at any South Puget Sound hatchery facility. Rates of marked and tagged hatchery releases have ranged from 77.8- 98.0% at all South Puget Sound hatchery facilities and from 95.8- 99.9% for WRIA 15 facilities for brood years 1998-2003 (Table 6). Despite the high percentage of hatchery-released fish marked and tagged, large numbers of unmarked releases have occurred during these years, ranging from 318,000- 3,351,000 for all South Puget Sound hatchery facilities and 2,500- 133,000 for WRIA 15 facilities (Table 6).

Given the numbers of unmarked hatchery Chinook salmon released from WRIA 15 hatchery facilities during these brood years, and the small numbers of unmarked fish observed in Hammersley, Case, and Carr Inlet streams, cumulatively ranging from 8 to 80 fish (Tables D-3 through D-5), the contribution of unmarked hatchery fish towards unmarked carcasses observed at these streams could be significant. Yet, assuming that both marked and unmarked hatchery-released fish strayed to these streams at the same rate, it must also be assumed that unmarked hatchery Chinook strayed to these streams at a rate equal to their proportion of overall hatchery-released Chinook salmon. Given the recent high percentages of marked hatchery releases from WRIA 15 hatchery facilities, an expectation would be to observe only one to four unmarked hatchery carcasses per 96-99 hatchery-marked carcasses observed on the spawning grounds, depending on the hatchery mark release rates from brood years three, four, and five years prior. The mark recovery data revealed very few instances where this occurred, other than at Rocky Creek and Burley Creek in 2006, so it was not possible to attribute all of the unmarked carcasses observed to unmarked and untagged hatchery-released fish.

The other two options explaining how unmarked Chinook salmon could return to South Puget Sound streams- attributing their presence to hatchery-origin recruits, or strays from naturally producing, self-sustained populations within Puget Sound- are more difficult to account for. There exists a possibility that hatchery strays that returned to the spawning grounds in these streams could have successfully spawned, but it is difficult to prove this with existing data. As for determining whether Chinook salmon from naturally producing, self-sustained Puget Sound populations are returning to South Puget Sound tributaries, CWT recoveries of Chinook from these populations could help answer this question. Yet, only one naturally producing Chinook salmon population exists in South Puget Sound, in the Nisqually River, and this population currently depends on hatchery returns for the large numbers of Chinook returning to the system in recent years. A search for CWT releases from Clear Creek and Kalama Creek Hatcheries in the Nisqually River Basin was made using the RMIS Database. This search indicated that no CWTs from Nisqually River hatchery Chinook salmon, out of 23,940 recoveries throughout Puget Sound, were recovered in any South Puget Sound tributary streams located in WRIAs 14 or 15. While this information only indicates that tagged releases of Nisqually River hatchery Chinook salmon have not strayed to South Puget Sound tributaries located in other inlets within the greater region, an inference could be made that the same would hold true for other Chinook salmon which are released or spawned naturally in the Nisqually River Basin.

## Implications

### Potential Role of South Puget Sound Tributaries Chinook Salmon in Recovery Efforts of Nisqually River Chinook and the Puget Sound Chinook Salmon ESU

An attempt to establish the extent of hatchery-origin fish among Chinook salmon observed in South Puget Sound streams has been made. While mark recovery rates and certain abundance trends observed in these streams suggest a large influence of hatchery Chinook straying from South Puget Sound hatchery facilities and release sites, the current data are insufficient to attribute all the fish observed at spawning grounds to these hatchery releases. The unmarked carcasses observed at South Puget Sound tributaries were likely the result of unmarked hatchery releases, hatchery-origin recruits, or strays from independent populations. Given these collective results, and the relatively small size of these streams in comparison to other Puget Sound Chinook systems, it is unlikely that the Chinook salmon observed in South Puget Sound tributaries could realistically contribute to the recovery of Chinook salmon in South Puget Sound, and to further extent, the recovery of the entire Puget Sound Chinook salmon ESU.

It is not possible to determine whether the presence of small numbers of unmarked and untagged Chinook salmon observed in South Puget Sound tributary streams could be attributed to fish that strayed from larger independent populations such as the Nisqually River. Even if it were determined that these small aggregations of unmarked and untagged fish strayed from the Nisqually River, two potential problems exist which might suggest that Chinook salmon in small tributary streams could not likely aid in the recovery of the Nisqually River Chinook salmon population. The first problem is the current genetic state of the Nisqually River Chinook salmon stock. As previously stated, genetic analysis suggests that the historic Nisqually fall Chinook salmon population is likely now extant, as recent evidence revealed that this stock was genetically similar to Green River hatchery-origin broodstock. Presuming that the historically present Nisqually Chinook salmon stock, from which these small aggregations of Chinook salmon theoretically strayed, is likely extant due to hatchery releases of out-of-basin Chinook salmon stocks, an expectation should exist that these fish, which may have historically strayed from the Nisqually River, would also be extant.

It appears that the only way that these small numbers of Chinook, which supposedly strayed from the Nisqually River, could have served this historic role is if they managed to avoid 50 plus years of hatchery supplementation within a basin with extensive records of Chinook hatchery releases. The fact that no tagged Chinook salmon released from Nisqually River hatcheries have been recovered at any of the South Puget Sound tributary streams, which are not currently hatchery release sites, suggests that this theory is not currently plausible.

Another reason to expect that small numbers of Chinook salmon that return to South Puget Sound tributaries could not realistically contribute to recovery efforts for the Nisqually River Chinook salmon independent population can be explained by population viability. Theories on population viability suggest that salmon populations require numbers of returning salmon above immediate replacement levels in order to prevent extinction and ensure genetic integrity. NOAA fisheries generally employs a 50 fish quasi-extinction threshold and 500 fish minimum population viability level to ensure that normal environmental variation (i.e. floods, volcanic eruptions, and poor ocean conditions) does not result in critically low return numbers for independent salmon populations (McElhany, et al., 2003). Quasi-extinction is defined as abundance at a low level which does not guarantee extinction, but cannot ensure recovery of the population (Lower Columbia Fish Recovery Board, 2004). This "50/500 rule" is a general guideline for minimum effective population size, identified in Thompson (1991), which relies on studies by Soule (1980) and Franklin (1980), respectively. Since these minimum numbers serve merely as rules of thumb that are used in relation to independent salmon populations, or ESUs, their use to interpret minimum population viability of a potential sub-population of a larger independent population is problematic. Yet, the numbers of unmarked carcasses observed at South Puget Sound streams from 2002-2006 were quite small, collectively ranging from 8 to 80 (Tables D-3 through D-5). These numbers indicate that even if all of these unmarked carcasses observed could be attributed to naturally produced Chinook that strayed from larger independent Puget Sound populations, these numbers are often less than the 50 fish required to prevent abundance from falling below levels from which recovery cannot be assured, raising doubt over the recovery role that these small aggregations of Chinook salmon could potentially serve.

The role that small aggregations of Chinook salmon that appear in South Puget Sound streams might provide towards the recovery of Nisqually River Chinook salmon can also be questioned due to current management practices within the Nisqually River itself. The Nisqually River Chinook stock is currently managed to provide for tribal treaty and non-treaty sport and commercial harvest opportunities, with a long-term goal of establishing a locally adapted Chinook salmon population. Yet, an analysis of recent hatchery releases and harvest rates by the Nisqually Indian Tribe suggests that only the former goal is currently being met. Recent in-river harvest rates by the Nisqually Indian Tribe are indicative of harvest rates normally attributed to hatchery-managed runs, not stocks managed for natural production (WDFW, 2000). Current hatchery and harvest practices in the Nisqually River Basin suggest that the goal of establishing a locally adapted Chinook salmon population will not be met in the near future. One way to accomplish this goal would be to continue with in-basin hatchery releases, but cut harvest rates so that larger numbers of Chinook salmon could naturally spawn. Once numbers of naturally spawning fish reached a level where hatchery releases could be discontinued, harvest of Chinook salmon could proceed. Yet complications in establishing a locally adapted Chinook population in the Nisqually River Basin exist. The Nisqually Indian Tribe currently has an annual in-river harvest management goal of 10,000- 15,000 Chinook salmon (WDFW, 2000). This a legally protected tribal treaty obligation granted to the tribe through the Boldt decision of 1974 [*U.S. vs. Washington,* 384 F. Supp. 312 (W.D. Wash.)]. The level of Chinook production to meet this tribal harvest goal, as well as provide for recreational harvest opportunities in the South Puget Sound region, cannot currently be met without artificial production of Chinook salmon.

It is also unlikely that the Nisqually River Basin could produce enough Chinook salmon to provide these levels of harvest, even if Chinook were returning at historic levels. The EDT analysis previously mentioned suggests that the Nisqually River could potentially support 19,000 Chinook salmon if the estuarine and riparian habitat within the basin were restored to historic levels (Nisqually Chinook Recovery Team, 2001). Even assuming that the conditions of the Nisqually River Basin could be restored to historic conditions, it is unlikely that this number of returning Chinook salmon (19,000) would support current levels of Chinook salmon in-river and sport harvest, which ranged from

11,000- 21,000 (Table A-11) and 1,200- 2,700 (WDFW, 2007d) for 2003-2006, respectively. Thus, it appears that current harvest practices for fish returning to the Nisqually River Basin and the goal of establishing a locally adapted Chinook salmon population are mutually exclusive. Given the current management system in place for the Nisqually River, it does not appear that small aggregations of Chinook salmon observed at South Puget Sound streams, which may or may not have historically strayed from the Nisqually River Basin, could aid in the recovery of the Nisqually River Chinook salmon independent population.

**Designation of South Puget Sound Tributaries as Critical Habitat for Nisqually River Chinook Salmon: Context, Benefits, and Consequences**

Although critical habitat designation of South Puget Sound tributary streams for the sake of recovering the Nisqually River Chinook salmon independent population has not been proposed as legislation, the issue remains unresolved, as evidenced by the two theories of origin outlined in the Puget Sound Technical Recovery Team document. In addition to uncertainty among policy makers, there also appears to be a belief held by certain citizens, including some regional salmon enhancement groups, that Chinook utilized these streams historically. This is likely evidenced by the recovery efforts of the Allyn Salmon Enhancement Group in the Sherwood Creek watershed. This organization, which aims to recover indigenous salmon populations in North Bay streams where they still occur, might have requested and planted eyed Chinook salmon eggs, supplied from WDFW, in Sherwood Creek from 1995-2003 in the belief that these efforts could restore a historically present Chinook salmon population within this watershed. Thus, a lack of historical evidence as to the presence or absence of Chinook salmon in these small streams, combined with political pressure from certain private citizens, regional salmon enhancement groups, and policy makers who believe that these fish may have been present in these streams historically, suggests that designation of South Puget Sound tributary streams as critical habitat for the recovery of the Puget Sound Chinook salmon ESU could remain a pertinent issue for years to come.

Considering the speculation over whether or not South Puget Sound tributaries Chinook salmon could aid in the recovery of the Nisqually River Chinook independent population, and to some extent the entire Puget Sound Chinook salmon ESU, it is necessary to discuss how critical habitat designation of these small streams would affect both the people and biota that utilize these ecosystems. There are certainly some benefits that would come with listing these streams as critical habitat for Puget Sound Chinook salmon. Federal funds would be provided which could be used to either restore degraded riparian areas or protect existing, in-tact riparian areas from further development. This could provide benefits not only to Chinook salmon that return to these streams, but also for other salmon stocks and animal species that currently reside in or use these habitats. Critical habitat designation could also prove beneficial to citizens and government officials concerned with the pressures that residential or commercial development pose to salmon and their ecosystems. Yet, protections provided to ecosystems through critical habitat designation only apply to a specific habitat during the interval that the listed species is recovering, so these protections would likely disappear if the listed species successfully recovered.

Despite the benefits of critical habitat designation for organisms that utilize South Puget Sound tributary streams, unintended consequences could result from designating these streams as critical habitat for the recovery of Puget Sound Chinook salmon. One potential drawback to designating these small streams as critical habitat is that funds granted to these sites might subsequently take money away from existing, and proven, Chinook salmon recovery efforts in the greater Puget Sound region. Recovery efforts for Chinook salmon populations in systems where Chinook occurred both historically and presently could be negatively affected by recovery efforts in streams where historical presence of Chinook salmon is currently unknown. A second concern with listing South Puget Sound streams as critical habitat for the recovery of Puget Sound Chinook salmon is that these listings would make the co-managers, including WDFW and the Squaxin Island Indian Tribe, legally responsible for recovering Chinook salmon in these streams. This could prove to be a large burden, since the co-managers would be legally mandated to recover Chinook salmon in streams that may not have historically provided habitat suitable to this species.

Another concern with listing these small streams as critical habitat for the sake of recovering the Puget Sound Chinook salmon ESU is the potential precedent it could establish in regards to listing hatchery-origin fish under the ESA. NOAA currently defines fish returning to spawning grounds as either hatchery-origin or natural-origin fish; a natural-origin fish is defined as the progeny of naturally spawning fish (Ruckelshaus, et al., 2006). This means that hatchery-origin recruits, which are the progeny of hatchery-origin fish that successfully spawn in natural habitats, are considered to be natural-origin fish, whether or not the place where they were spawned historically had salmon populations. There presently exists no evidence suggesting that Chinook salmon historically returned to these small streams. Listing these streams as critical habitat for the recovery of Puget Sound Chinook salmon, without sufficient historic or current evidence suggesting that these fish represent a sub-population of a larger independent population, could potentially allow the inclusion of South Puget Sound Chinook hatchery strays under the ESA. This could set a bad precedent of permitting the listing of salmon populations or sub-populations that may or may not have historically existed. Although the Endangered Species Act does permit the listing and inclusion of independent salmon populations in basins where that species was not historically present (USFWS, 1973), this clause is meant to be used only if it is determined that the existing habitat available to the species is so limited, or degraded, that recovery of the species confined to those areas could potentially contribute to the permanent extinction of that species. Given the current status of the Puget Sound Chinook salmon ESU, and the doubt surrounding whether or not Chinook salmon historically appeared in South Puget Sound tributaries, it would appear to be both a violation and misuse of the ESA, in its current state, to designate these streams as critical habitat for the sake of recovering the Puget Sound Chinook salmon ESU.

## Conclusion

An attempt has been made to establish the extent of hatchery-origin fish among Chinook salmon observed in South Puget Sound streams. While mark recovery rates, and certain abundance trends, suggest that large numbers and percentages of Chinook salmon observed in these streams can be attributed to Chinook released from South Puget Sound hatchery facilities and release sites, it is not possible to attribute all the fish observed at spawning grounds to hatchery releases. The small numbers of unmarked carcasses observed at South Puget Sound streams might be attributed to unmarked hatchery fish, hatchery-origin recruits, or fish that stray from independent Puget Sound populations. Based on the data presently available, it is difficult to account for the origin of the unmarked fish observed in these streams. Many attributes that would prove helpful in identifying the origin of unmarked Chinook observed in these streams, including historic evidence indicating the abundance or presence of Chinook, current and historic genetic information, and consistent spawning ground survey data, are lacking. Meanwhile, hatchery records from South Puget Sound production facilities indicate that millions to tens of millions of unmarked hatchery Chinook salmon have been released throughout the region for at least 50 years, with mass marking of hatchery-released fish becoming a regionwide practice as recently as 1999.

Mark recovery data from WFDW spawning ground surveys conducted between 2002 and 2006 revealed a rather large (majority) presence of hatchery markings on Chinook salmon carcasses. Relative presence and abundance estimates generated from spawning ground surveys indicated that the numbers of fish returning to these streams was rather modest in comparison to both the large numbers of hatchery-released Chinook salmon, and run reconstruction figures for South Puget Sound Chinook salmon. The abundance of Chinook tended to be greater in streams with previous or current hatchery releases of Chinook salmon within the same inlet (Case and Carr Inlets) versus streams flowing into inlets that did not have records indicating extensive hatchery releases (Hammersley Inlet). Mass marking or tagging of 100% of all future hatchery releases, combined with consistent or increased spawning ground surveys by WDFW at the small streams where these fish return, could prove useful in providing information on the numbers and percentages of hatchery-origin Chinook salmon that return to South Puget Sound tributary streams. Presence and abundance trends could assist policy makers in making tough decisions about when and where to survey to effectively estimate Chinook salmon abundance in South Puget Sound streams, given limited resources of time and money. In the interim, given the large numbers and percentages of hatchery-marked and tagged Chinook salmon observed in South Puget Sound streams, and the lack of definitive evidence to discern either the origin of the unmarked carcasses or the historic presence of Chinook salmon in these streams, it would be imprudent to suggest listing these streams as critical habitat to aid in the recovery of the Puget Sound Chinook salmon ESU.

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**Table A-1.** Hatchery Chinook salmon brood year releases in the Nisqually Basin (WRIA 11), 1952-2004.

| Brood Year | Nisqually R | Clear Cr | Kalama Cr | McAllister Cr | Mashel R | Ohop Cr | Schorno Cr | Schorno Pond | WRIA Total |
|---|---|---|---|---|---|---|---|---|---|
| 1952 | | | | | | | | | |
| 1953 | | | | | | | | | |
| 1954 | | | | | | | | | |
| 1955 | 500 | | | | | | | | |
| 1956 | | | | | 150,000 | | | | |
| 1957 | 149,800 | | | | 100,000 | | | | |
| 1958 | 205,350 | | | | 76,782 | | | | |
| 1959 | 648,591 | | | | 175,230 | | | | |
| 1960 | | | | | | | | | |
| 1961 | 499,380 | | | | | | | | |
| 1962 | 726,160 | | | | | | | | |
| 1963 | 933,006 | | | | | | | | |
| 1964 | | | | | | | | | |
| 1965 | | | | | | | | | |
| 1966 | | | | | | | | | |
| 1967 | 150,142 | | | | | | | | |
| 1968 | | | | | | | | | |
| 1969 | | | | | | | | | |
| 1970 | 841,888 | | | | 150,000 | 50,000 | | | |
| 1971 | 2,076,304 | | | | | | | | |
| 1972 | 1,317,760 | | | | 146,000 | | | | |
| 1973 | 400,000 | | | | | | | | |
| 1974 | | | | | | | | | |
| 1975 | | | | | | | | 1,000,000 | |
| 1976 | 439,000 | | | | | | | | |
| 1977 | 601,381 | | | | 300,000 | | | | |
| 1978 | 491,011 | | | | | | | | |
| 1979 | 1,388,500 | | 815,810 | | | | | | |

Source: RMIS Database, 2008.

**Table A-1.** Hatchery Chinook salmon brood year releases in the Nisqually Basin (WRIA 11), 1952-2004.

| Brood Year | Nisqually R | Clear Cr | Kalama Cr | McAllister Cr | Mashel R | Ohop Cr | Schorno Cr | Schorno Pond | WRIA Total |
|---|---|---|---|---|---|---|---|---|---|
| 1980 | 1,407,789 | | 308,900 | | | | | | |
| 1981 | 1,002,718 | | 762,893 | 3,872,633 | | | | | |
| 1982 | | | 730,965 | | | | | 1,634,800 | |
| 1983 | | | 753,275 | 3,246,100 | | | | 1,837,000 | |
| 1984 | | | 1,920,576 | 1,391,400 | | 193,008 | | 2,087,600 | |
| 1985 | 1,251,490 | | 1,688,664 | 1,286,300 | 371,800 | 67,555 | | 894,000 | |
| 1986 | 282,035 | | 1,035,072 | 1,232,200 | 778,235 | 216,435 | | 1,868,200 | |
| 1987 | 193,900 | 229,200 | 1,045,000 | 1,648,300 | 476,100 | 193,900 | | 193,900 | |
| 1988 | 682,300 | | 900,000 | 1,205,800 | | | | | |
| 1989 | | | 1,100,000 | 1,257,200 | | | 1200000 | | |
| 1990 | | 940,000 | 1,100,000 | 1,065,300 | | 12,000 | 850000 | | |
| 1991 | | 1,094,040 | 648,000 | 1,339,800 | | | | | |
| 1992 | | 536,000 | 527,000 | | | | | | |
| 1993 | | 985,000 | 802,000 | 76,000 | 3,400 | 6,000 | | | |
| 1994 | | 2,222,400 | 913,500 | 1,320,984 | | | | | |
| 1995 | | 2,269,599 | 589,900 | 1,373,600 | | | | | |
| 1996 | | 3,293,000 | 1,102,000 | 1,321,000 | | | | | |
| 1997 | | 2,704,000 | 553,000 | 1,602,565 | | | | | |
| 1998 | | 3,135,000 | 1,047,042 | 1,488,750 | | | | | |
| 1999 | | 3,187,514 | 1,089,381 | 1,226,500 | | | | | |
| 2000 | | 2,708,308 | 567,599 | 1,501,912 | | | | | |
| 2001 | | 3,463,953 | 633,513 | 1,371,752 | | | | | |
| 2002 | | 2,864,133 | 649,891 | | | | | | |
| 2003 | | 3,539,184 | 627,000 | | | | | | |
| 2004 | | 2,942,414 | 501,460 | | | | | | |
| | | | | | | | | | |
| Totals | 15,689,005 | 36,113,745 | 22,412,441 | 28,828,096 | 2,727,547 | 738,898 | 2,050,000 | 9,515,500 | |
| WRIA Total | | | | | | | | | 118,075,232 |

Source: RMIS Database, 2008.

**Table A-2.** Hatchery Chinook salmon brood year releases in the Tacoma Basin (WRIA 12), 1952-2004.

| Brood Year | American Lk (pier) | Chambers Cr | Lake Sequalitchew | Steilacoom Lk | Steilacoom Lk (pier) | Titlow Lagoon | WRIA Total |
|---|---|---|---|---|---|---|---|
| 1952 | | | | | | | |
| 1953 | | | | | | | |
| 1954 | | | | | | | |
| 1955 | | | | | | | |
| 1956 | | | | | | | |
| 1957 | | | | | | | |
| 1958 | | | | | | 83,975 | |
| 1959 | | | 496,200 | | | 119,280 | |
| 1960 | | | | | | 313,500 | |
| 1961 | | | | | | 90,720 | |
| 1962 | | | | | | 80,520 | |
| 1963 | | | | | | 82,560 | |
| 1964 | | | | | | | |
| 1965 | | | | | | | |
| 1966 | | | | | | | |
| 1967 | | | | | | | |
| 1968 | | | | | | | |
| 1969 | | | | | | | |
| 1970 | | | | | | | |
| 1971 | | | | | | | |
| 1972 | | | | | | | |
| 1973 | 466,550 | | | | | | |
| 1974 | 225,000 | 45,000 | 37,102 | | | | |
| 1975 | | 1,000 | | | | | |
| 1976 | | | | | | | |
| 1977 | | 162,300 | | | | | |
| 1978 | | 2,000 | | | | | |
| 1979 | | 717,922 | | | | | |

Source: RMIS Database, 2008.

**Table A-2.** Hatchery Chinook salmon brood year releases in the Tacoma Basin (WRIA 12), 1952-2004.

| Brood Year | American Lk (pier) | Chambers Cr | Lake Sequalitchew | Steilacoom Lk | Steilacoom Lk (pier) | Titlow Lagoon | WRIA Total |
|---|---|---|---|---|---|---|---|
| 1980 | | 798,471 | | 72,930 | | | |
| 1981 | | 866,378 | | | | | |
| 1982 | | 1,336,900 | | 102,000 | | | |
| 1983 | | 834,700 | | 9,300 | | | |
| 1984 | | 775,900 | | 50,000 | | | |
| 1985 | | 1,032,240 | | | | | |
| 1986 | | 888,600 | | | | | |
| 1987 | | 837,895 | | | | | |
| 1988 | | 853,410 | | 100,250 | | | |
| 1989 | | 994,132 | | 88,350 | | | |
| 1990 | | 967,800 | | 285,800 | | | |
| 1991 | | 839,060 | | 139,900 | | | |
| 1992 | | 864,850 | | 298,240 | | | |
| 1993 | | 735,720 | | | | | |
| 1994 | | 922,300 | | | 314,000 | | |
| 1995 | | 885,631 | | | 321,000 | | |
| 1996 | | 954,275 | | | | | |
| 1997 | | 1,099,511 | | | | | |
| 1998 | | 1,423,886 | | | 76,500 | | |
| 1999 | | 861,167 | | | 254,328 | | |
| 2000 | | 689,844 | | | 223,495 | | |
| 2001 | | 1,087,330 | | 1,172,603 | 433,268 | | |
| 2002 | | 1,076,794 | | | | | |
| 2003 | | 1,200,297 | | | | | |
| 2004 | | 1,198,995 | | | | | |
| | | | | | | | |
| Totals | 691,550 | 24,954,308 | 533,302 | 2,319,373 | 1,622,591 | 770,555 | |
| WRIA Total | | | | | | | 30,891,679 |

Source: RMIS Database, 2008.

**Table A-3.** Hatchery Chinook salmon brood year releases in the Deschutes Basin (WRIA 13), 1952-2004.

| Brood Year | Capitol Lake | Deschutes River | McLane Cr | Percival Cr | Silver Spring Cr | Woodland Cr | WRIA Total |
|---|---|---|---|---|---|---|---|
| 1952 | | | | | | | |
| 1953 | | 281,820 | | | | | |
| 1954 | | | | | | | |
| 1955 | | 1,016,743 | | | | | |
| 1956 | | 762,427 | | | | | |
| 1957 | 1,854,033 | 1,520,070 | | | | | |
| 1958 | 2,075,801 | | | | | | |
| 1959 | 2,842,008 | | | | | | |
| 1960 | 5,560,652 | | | | 1,035,050 | | |
| 1961 | 1,529,000 | 500,800 | | | | | |
| 1962 | 1,501,550 | 498,870 | | | | | |
| 1963 | 1,544,794 | 500,500 | | | | | |
| 1964 | 2,296,080 | | | | | | |
| 1965 | 3,012,795 | | | | | | |
| 1966 | 3,616,412 | | | | | | |
| 1967 | 5,678,072 | 1,542,474 | | | | | |
| 1968 | 5,544,446 | | | | | | |
| 1969 | 5,415,940 | | | | | | |
| 1970 | 10,555,127 | | | | | | |
| 1971 | 7,868,185 | | | | | | |
| 1972 | 13,601,564 | | | | | | |
| 1973 | 11,398,816 | | | | | | |
| 1974 | 7,741,005 | | | | | | |
| 1975 | 635,646 | | | | | | |
| 1976 | 2,656,500 | 703,000 | | | | | |
| 1977 | 5,371,155 | 1,074,920 | 232,868 | | | | |
| 1978 | 1,181,283 | 599,866 | 41,880 | | | | |
| 1979 | 8,002,757 | | 146,633 | | | | |

Source: RMIS Database, 2008.

**Table A-3.** Hatchery Chinook salmon brood year releases in the Deschutes Basin (WRIA 13), 1952-2004.

| Brood Year | Capitol Lake | Deschutes River | McLane Cr | Percival Cr | Silver Spring Cr | Woodland Cr | WRIA Total |
|---|---|---|---|---|---|---|---|
| 1980 | 5,629,449 | | 75,582 | | | | |
| 1981 | 9,781,826 | | 71,599 | | | | |
| 1982 | 9,022,900 | | 128,100 | | | | |
| 1983 | 7,075,400 | | 140,100 | | | | |
| 1984 | 7,036,100 | 1,625,900 | 136,000 | | | | |
| 1985 | 7,595,900 | | 121,000 | | | | |
| 1986 | 8,108,668 | | 34,000 | | | | |
| 1987 | 8,165,340 | | | | | | |
| 1988 | 5,710,375 | 1,918,200 | | | | | |
| 1989 | 4,963,000 | 1,149,100 | | 1,000,000 | | 746,600 | |
| 1990 | 6,563,850 | | 82,000 | | | | |
| 1991 | 5,414,400 | 795,500 | 969,400 | | | | |
| 1992 | 6,000,070 | 1,482,100 | | | | | |
| 1993 | 3,770,600 | | | | | | |
| 1994 | 6,205,250 | 1,002,000 | | | | | |
| 1995 | 4,028,248 | | | | | | |
| 1996 | 2,450,188 | 470,000 | | 740,000 | | | |
| 1997 | 2,980,110 | 1,006,125 | 12,000 | 54,000 | | | |
| 1998 | 3,272,945 | 691,830 | | 188,890 | | | |
| 1999 | 2,016,177 | 3,924,127 | | | | | |
| 2000 | 4,041,800 | 10,044 | | | | | |
| 2001 | 4,308,000 | 84,150 | | | | | |
| 2002 | 691,750 | 3,438,524 | | | | | |
| 2003 | 1,303,600 | 2,983,136 | | | | | |
| 2004 | | 3,732,855 | | | | | |
| | | | | | | | |
| Totals | 237,619,567 | 33,315,081 | 2,191,162 | 1,982,890 | 1,035,050 | 746,600 | |
| WRIA Total | | | | | | | 276,890,350 |

Source: RMIS Database, 2008.

**Table A-4.** Hatchery Chinook salmon brood year releases in the Shelton Basin (WRIA 14), 1952-2004.

| Brood Year | Goldsborough Cr | Sherwood Cr | Schumocher Cr | Johns Cr | Kennedy Cr | Elson Cr | Cranberry Cr | South Sound Net Pens | WRIA Total |
|---|---|---|---|---|---|---|---|---|---|
| 1952 | | | | | | | | | |
| 1953 | | | | | | | | | |
| 1954 | | | | | | | | | |
| 1955 | | | | | | | | | |
| 1956 | | | 630,000 | | | | | | |
| 1957 | | 316,260 | | | | | | | |
| 1958 | | 251,600 | | | | | | | |
| 1959 | | | | | | | 505,050 | | |
| 1960 | | | | | | | | | |
| 1961 | 286,000 | | | | | | 249,796 | | |
| 1962 | 254,375 | | | | | | | | |
| 1963 | 508,335 | | | | | | | | |
| 1964 | 467,200 | | | | | | | | |
| 1965 | 203,770 | | | | | | | | |
| 1966 | | | | | | | | | |
| 1967 | | | | | | | | | |
| 1968 | | | | | | | | | |
| 1969 | | | | | | | | | |
| 1970 | | 466,480 | | | 263,700 | | | | |
| 1971 | | | | | | | | 353,933 | |
| 1972 | | | | | | | | | |
| 1973 | | | | | | | | | |
| 1974 | | | | | | | | | |
| 1975 | | | | | | | | | |
| 1976 | | | | | | | | | |
| 1977 | | | | | | | | | |
| 1978 | | | | 552,218 | | | | | |
| 1979 | | 44,500 | | | | 231,919 | | | |

Source: RMIS Database, 2008.

**Table A-4.** Hatchery Chinook salmon brood year releases in the Shelton Basin (WRIA 14), 1952-2004.

| | | | | | | | | South Sound | |
|---|---|---|---|---|---|---|---|---|---|
| Brood Year | Goldsborough Cr | Sherwood Cr | Schumocher Cr | Johns Cr | Kennedy Cr | Elson Cr | Cranberry Cr | Net Pens | WRIA Total |
| 1980 | | | | | | 222,641 | | | |
| 1981 | | 44,800 | | | | 559,902 | | | |
| 1982 | | | | | | 293,208 | | | |
| 1983 | | | | | | 221,227 | | | |
| 1984 | | | | | | 299,300 | | | |
| 1985 | | | | | | 276,640 | | 63,080 | |
| 1986 | | | | | | 334,478 | | 776,500 | |
| 1987 | | | | | | | | 814,860 | |
| 1988 | | | | | | | | 838,800 | |
| 1989 | 1,198,500 | | | | 824,400 | | | 821,850 | |
| 1990 | | | | | | | | 494,112 | |
| 1991 | | | 11,000 | | | | | 591,400 | |
| 1992 | | | | | | | | 170,850 | |
| 1993 | | | | | | | | 81,000 | |
| 1994 | | | | | | | | 191,700 | |
| 1995 | | | | | | | | 185,860 | |
| 1996 | | | | | | | | 114,700 | |
| 1997 | | | | | | | | 149,950 | |
| 1998 | | | | | | | | 160,500 | |
| 1999 | | | | | | | | | |
| 2000 | | | | | | | | | |
| 2001 | | | | | | | | | |
| 2002 | | 10,000 | | | | | | | |
| 2003 | | | | | | | | | |
| 2004 | | | | | | | | | |
| | | | | | | | | | |
| Totals | 2,918,180 | 1,133,640 | 641,000 | 552,218 | 1,088,100 | 2,439,315 | 754,846 | 5,809,095 | |
| WRIA Total | | | | | | | | | 15,336,394 |

Source: RMIS Database, 2008.

**Table A-5.** Hatchery Chinook salmon brood year releases in the Kitsap Basin (WRIA 15), and WRIA's 11-15, 1952-2004.

| | | | | Fox Island | | Hupp Springs | | Yearly totals |
|---|---|---|---|---|---|---|---|---|
| Brood Year | Minter Cr | Coulter Cr | Burley Cr | Net Pens | Huge Cr | Rearing | WRIA Total | (All WRIA's) |
| 1952 | 4,659 | | | | | | | 4,659 |
| 1953 | 123,568 | | | | | | | 405,388 |
| 1954 | 380,767 | 2,805 | | | | | | 383,572 |
| 1955 | 130,805 | | | | | | | 1,148,048 |
| 1956 | 1,972,083 | 175,000 | | | | | | 3,689,510 |
| 1957 | 1,380,327 | 188,020 | | | | | | 5,508,510 |
| 1958 | 2,495,457 | 253,640 | | | | | | 5,442,605 |
| 1959 | 1,360,348 | | | | | | | 6,146,707 |
| 1960 | 2,013,588 | | | | | | | 8,922,790 |
| 1961 | 2,075,650 | 224,910 | | | | | | 5,456,256 |
| 1962 | 2,728,261 | | | | | | | 5,789,736 |
| 1963 | 1,863,181 | | | | | | | 5,432,376 |
| 1964 | 2,571,060 | | | | | | | 5,334,340 |
| 1965 | 2,287,775 | | | | | | | 5,504,340 |
| 1966 | 2,178,552 | | | | | | | 5,794,964 |
| 1967 | 2,751,600 | | | | | | | 10,122,288 |
| 1968 | 2,840,424 | | | | | | | 8,384,870 |
| 1969 | 3,043,394 | | | | | | | 8,459,334 |
| 1970 | 850,511 | | | | | | | 13,177,706 |
| 1971 | 840,751 | | | | | | | 11,139,173 |
| 1972 | 1,646,260 | | | | | | | 16,711,584 |
| 1973 | 1,292,424 | | | | | | | 13,557,790 |
| 1974 | 2,293,341 | | | 92,555 | | | | 10,434,003 |
| 1975 | 1,869,798 | | | 73,575 | | | | 3,580,019 |
| 1976 | 1,689,453 | | | 210,733 | | | | 5,698,686 |
| 1977 | 2,808,558 | | | 188,346 | 100,000 | | | 10,839,528 |
| 1978 | 1,705,982 | | | 258,042 | | | | 4,832,282 |
| 1979 | 4,902,078 | 1,424,208 | | 390,184 | | 91,728 | | 18,156,239 |

Source: RMIS Database, 2008.

**Table A-5.** Hatchery Chinook salmon brood year releases in the Kitsap Basin (WRIA 15), and WRIA's 11-15, 1952-2004.

| Brood Year | Minter Cr | Coulter Cr | Burley Cr | Fox Island Net Pens | Huge Cr | Hupp Springs Rearing | WRIA Total | Yearly totals (All WRIA's) |
|---|---|---|---|---|---|---|---|---|
| 1980 | 3,085,850 | 2,068,718 | | 176,551 | | 85,464 | | 13,932,345 |
| 1981 | 1,126,846 | 1,249,532 | | 181,006 | | | | 19,520,133 |
| 1982 | 1,949,200 | 685,343 | | 181,000 | | | | 16,064,416 |
| 1983 | 1,700,800 | 761,100 | | 157,500 | | 236,000 | | 16,972,502 |
| 1984 | 1,763,000 | 1,071,500 | | 187,100 | | 224,300 | | 18,761,684 |
| 1985 | 2,010,000 | 1,009,000 | | 162,600 | | | | 17,830,269 |
| 1986 | 1,820,400 | 1,173,000 | | 219,500 | | | | 18,767,323 |
| 1987 | 1,471,000 | 1,186,200 | | 193,500 | | 299,600 | | 16,948,695 |
| 1988 | 1,910,700 | 1,140,000 | | 205,700 | | | | 15,465,535 |
| 1989 | 2,705,700 | 1,273,000 | 299,000 | 198,899 | | | | 19,819,731 |
| 1990 | 2,006,800 | 1,057,000 | 777,200 | 204,400 | | | | 16,406,262 |
| 1991 | 2,105,000 | 900,000 | 50,000 | 303,082 | | | | 15,200,582 |
| 1992 | | 1,082,500 | | 270,553 | | | | 11,232,163 |
| 1993 | | 1,117,500 | | 226,624 | | | | 7,803,844 |
| 1994 | 2,073,000 | 1,098,300 | | 237,170 | | | | 16,500,604 |
| 1995 | 2,042,800 | 1,286,000 | | 212,100 | 227,000 | | | 13,421,738 |
| 1996 | 2,135,600 | 1,230,000 | | 252,600 | 276,000 | | | 14,339,363 |
| 1997 | 2,084,100 | 1,337,000 | | 243,425 | | | | 13,825,786 |
| 1998 | 2,091,748 | 1,294,000 | | 251,210 | | | | 15,122,301 |
| 1999 | 1,975,600 | 989,270 | | 228,750 | | | | 15,752,814 |
| 2000 | 2,113,950 | 833,700 | | | | | | 12,690,652 |
| 2001 | 1,892,500 | | | | | | | 14,447,069 |
| 2002 | 1,876,675 | | | | | | | 10,607,767 |
| 2003 | 1,714,725 | | | | | | | 11,367,942 |
| 2004 | 1,869,623 | | | | | | | 10,245,347 |
| | | | | | | | | |
| Totals | 97,626,272 | 26,111,246 | 1,126,200 | 5,506,705 | 603,000 | 937,092 | | |
| WRIA Total | | | | | | | 131,910,515 | 573,104,170 |

Source: RMIS Database, 2008.

**Table A-6.** Adipose mark and CWT rates for hatchery Chinook salmon brood year releases in the Nisqually Basin, 1997-2003.

| | **Clear Creek** | | | | | | | **Percentages** | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | CWT & | CWT, no | | No | Total | | CWT & | CWT, no | | No |
| Brood Year | AD Clipped | AD Clipped | AD Clipped | AD Clipped | released | | AD Clipped | AD Clipped | AD Clipped | AD Clipped |
| 1997 | 207,617 | 0 | 11,389 | 2,484,994 | 2,704,000 | | 7.68% | 0.00% | 0.42% | 91.90% |
| 1998 | 202,103 | 192,165 | 1,088,683 | 1,652,049 | 3,135,000 | | 6.45% | 6.13% | 34.73% | 52.70% |
| 1999 | 199,030 | 194,985 | 2,764,867 | 28,632 | 3,187,514 | | 6.24% | 6.12% | 86.74% | 0.90% |
| 2000 | 169,143 | 176,207 | 2,068,077 | 294,881 | 2,708,308 | | 6.25% | 6.51% | 76.36% | 10.89% |
| 2001 | 214,490 | 215,639 | 2,943,702 | 90,122 | 3,463,953 | | 6.19% | 6.23% | 84.98% | 2.60% |
| 2002 | 180,294 | 192,554 | 2,280,038 | 211,247 | 2,864,133 | | 6.29% | 6.72% | 79.61% | 7.38% |
| 2003 | 207,975 | 204,889 | 3,007,493 | 118,827 | 3,539,184 | | 5.88% | 5.79% | 84.98% | 3.36% |
| 2004 | 208,724 | 211,107 | 2,354,207 | 168,376 | 2,942,414 | | 7.09% | 7.17% | 80.01% | 5.72% |
| | | | | | | | | | | |
| | **Kalama Creek** | | | | | | | **Percentages** | | |
| | CWT & | CWT, no | | No | Total | | CWT & | CWT, no | | No |
| Brood Year | AD Clipped | AD Clipped | AD Clipped | AD Clipped | released | | AD Clipped | AD Clipped | AD Clipped | AD Clipped |
| 1997 | 0 | 0 | 0 | 553,000 | 553,000 | | 0.00% | 0.00% | 0.00% | 100.00% |
| 1998 | 94,723 | 0 | 7,239 | 945,080 | 1,047,042 | | 9.05% | 0.00% | 0.69% | 90.26% |
| 1999 | 88,949 | 0 | 1,000,432 | 0 | 1,089,381 | | 8.17% | 0.00% | 91.83% | 0.00% |
| 2000 | 83,178 | 3,655 | 471,237 | 9,529 | 567,599 | | 14.65% | 0.64% | 83.02% | 1.68% |
| 2001 | 82,860 | 6,951 | 532,428 | 11,274 | 633,513 | | 13.08% | 1.10% | 84.04% | 1.78% |
| 2002 | 95,101 | 1,758 | 536,298 | 16,734 | 649,891 | | 14.63% | 0.27% | 82.52% | 2.57% |
| 2003 | 96,131 | 342 | 528,737 | 1,790 | 627,000 | | 15.33% | 0.05% | 84.33% | 0.29% |
| 2004 | 56,177 | 2,859 | 423,498 | 18,926 | 501,460 | | 11.20% | 0.57% | 84.45% | 3.77% |
| | | | | | | | | | | |
| | **McAllister Creek** | | | | | | | **Percentages** | | |
| | CWT & | CWT, no | | No | Total | | CWT & | CWT, no | | No |
| Brood Year | AD Clipped | AD Clipped | AD Clipped | AD Clipped | released | | AD Clipped | AD Clipped | AD Clipped | AD Clipped |
| 1997 | 397,306 | 8,053 | 1,563 | 1,195,643 | 1,602,565 | | 24.79% | 0.50% | 0.10% | 74.61% |
| 1998 | 79,782 | 873 | 1,350,401 | 57,694 | 1,488,750 | | 5.36% | 0.06% | 90.71% | 3.88% |
| 1999 | 0 | 0 | 1,166,421 | 60,079 | 1,226,500 | | 0.00% | 0.00% | 95.10% | 4.90% |
| 2000 | 240,320 | 0 | 1,211,151 | 50,441 | 1,501,912 | | 16.00% | 0.00% | 80.64% | 3.36% |
| 2001 | 0 | 0 | 1,345,216 | 26,536 | 1,371,752 | | 0.00% | 0.00% | 98.07% | 1.93% |

Source: RMIS Database, 2008.

**Table A-7.** Adipose mark and CWT rates for hatchery Chinook salmon brood year releases in the Tacoma Basin, 1997-2003.

| **Chambers Creek** | | | | | | | | **Percentages** | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | CWT & | CWT, no | | No | Total | | CWT & | CWT, no | | No |
| Brood Year | AD Clipped | AD Clipped | AD Clipped | AD Clipped | released | | AD Clipped | AD Clipped | AD Clipped | AD Clipped |
| 1997 | 92,884 | 1,910 | 697 | 1,004,020 | 1,099,511 | | 8.45% | 0.17% | 0.06% | 91.32% |
| 1998 | 0 | 0 | 913,616 | 510,270 | 1,423,886 | | 0.00% | 0.00% | 64.16% | 35.84% |
| 1999 | 0 | 0 | 827,808 | 33,359 | 861,167 | | 0.00% | 0.00% | 96.13% | 3.87% |
| 2000 | 0 | 0 | 405,128 | 284,716 | 689,844 | | 0.00% | 0.00% | 58.73% | 41.27% |
| 2001 | 0 | 0 | 919,672 | 167,658 | 1,087,330 | | 0.00% | 0.00% | 84.58% | 15.42% |
| 2002 | 262,038 | 3,348 | 781,880 | 29,528 | 1,076,794 | | 24.34% | 0.31% | 72.61% | 2.74% |
| 2003 | 404,162 | 24,429 | 710,212 | 61,494 | 1,200,297 | | 33.67% | 2.04% | 59.17% | 5.12% |
| 2004 | 436,675 | 7,733 | 728,162 | 26,425 | 1,198,995 | | 36.42% | 0.64% | 60.73% | 2.20% |
| | | | | | | | | | | |
| **Steilacoom Lake (Pier)** | | | | | | | | **Percentages** | | |
| | CWT & | CWT, no | | No | Total | | CWT & | CWT, no | | No |
| Brood Year | AD Clipped | AD Clipped | AD Clipped | AD Clipped | released | | AD Clipped | AD Clipped | AD Clipped | AD Clipped |
| 1998 | 0 | 0 | 76,500 | 0 | 76,500 | | 0.00% | 0.00% | 100.00% | 0.00% |
| 1999 | 0 | 0 | 249,717 | 4,611 | 254,328 | | 0.00% | 0.00% | 98.19% | 1.81% |
| 2000 | 0 | 0 | 214,108 | 9,387 | 223,495 | | 0.00% | 0.00% | 95.80% | 4.20% |
| 2001 | 0 | 0 | 184,768 | 248,500 | 433,268 | | 0.00% | 0.00% | 42.65% | 57.35% |
| | | | | | | | | | | |
| **Steilacoom Lake** | | | | | | | | **Percentages** | | |
| | CWT & | CWT, no | | No | Total | | CWT & | CWT, no | | No |
| Brood Year | AD Clipped | AD Clipped | AD Clipped | AD Clipped | released | | AD Clipped | AD Clipped | AD Clipped | AD Clipped |
| 2001 | 0 | 0 | 1,125,699 | 46,904 | 1,172,603 | | 0.00% | 0.00% | 96.00% | 4.00% |

Source: RMIS Database, 2008.

**Table A-8.** Adipose mark and CWT rates for hatchery Chinook salmon brood year releases in the Deschutes Basin, 1997-2003.

| | **Capitol Lake** | | | | | | | **Percentages** | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | CWT & | CWT, no | | No | Total | | CWT & | CWT, no | | No |
| Brood Year | AD Clipped | AD Clipped | AD Clipped | AD Clipped | released | | AD Clipped | AD Clipped | AD Clipped | AD Clipped |
| 1997 | 190,356 | 0 | 944 | 2,788,810 | 2,980,110 | | 6.39% | 0.00% | 0.03% | 93.58% |
| 1998 | 0 | 0 | 3,182,830 | 90,115 | 3,272,945 | | 0.00% | 0.00% | 97.25% | 2.75% |
| 1999 | 67,926 | 1,965 | 1,943,211 | 3,075 | 2,016,177 | | 3.37% | 0.10% | 96.38% | 0.15% |
| 2000 | 178,011 | 2,814 | 3,741,270 | 119,705 | 4,041,800 | | 4.40% | 0.07% | 92.56% | 2.96% |
| 2001 | 72,937 | 0 | 4,208,893 | 26,170 | 4,308,000 | | 1.69% | 0.00% | 97.70% | 0.61% |
| 2002 | 0 | 0 | 681,582 | 10,168 | 691,750 | | 0.00% | 0.00% | 98.53% | 1.47% |
| 2003 | 0 | 0 | 1,229,483 | 74,117 | 1,303,600 | | 0.00% | 0.00% | 94.31% | 5.69% |
| | | | | | | | | | | |
| **Deschutes River** | | | | | | | | **Percentages** | | |
| | CWT & | CWT, no | | No | Total | | CWT & | CWT, no | | No |
| Brood Year | AD Clipped | AD Clipped | AD Clipped | AD Clipped | released | | AD Clipped | AD Clipped | AD Clipped | AD Clipped |
| 1997 | 0 | 0 | 0 | 1,006,125 | 1,006,125 | | 0.00% | 0.00% | 0.00% | 100.00% |
| 1998 | 0 | 0 | 679,131 | 12,699 | 691,830 | | 0.00% | 0.00% | 98.16% | 1.84% |
| 1999 | 0 | 0 | 3,869,190 | 54,937 | 3,924,127 | | 0.00% | 0.00% | 98.60% | 1.40% |
| 2000 | 0 | 10,044 | 0 | 0 | 10,044 | | 0.00% | 100.00% | 0.00% | 0.00% |
| 2001 | 0 | 0 | 84,150 | 0 | 84,150 | | 0.00% | 0.00% | 100.00% | 0.00% |
| 2002 | 266,087 | 18,430 | 3,068,106 | 85,901 | 3,438,524 | | 7.74% | 0.54% | 89.23% | 2.50% |
| 2003 | 257,134 | 10,224 | 2,562,081 | 153,697 | 2,983,136 | | 8.62% | 0.34% | 85.89% | 5.15% |
| 2004 | 272,010 | 2,175 | 3,334,766 | 123,904 | 3,732,855 | | 7.29% | 0.06% | 89.34% | 3.32% |
| | | | | | | | | | | |
| **Deschutes River** | | | | | | | | **Percentages** | | |
| | CWT & | CWT, no | | No | Total | | CWT & | CWT, no | | No |
| Brood Year | AD Clipped | AD Clipped | AD Clipped | AD Clipped | released | | AD Clipped | AD Clipped | AD Clipped | AD Clipped |
| 1997 | 0 | 0 | | 54,000 | 54,000 | | 0.00% | 0.00% | 0.00% | 100.00% |
| 1998 | 75,498 | 329 | 112,574 | 489 | 188,890 | | 39.97% | 0.17% | 59.60% | 0.26% |
| **McLane Creek** | | | | | | | | **Percentages** | | |
| | CWT & | CWT, no | | No | Total | | CWT & | CWT, no | | No |
| Brood Year | AD Clipped | AD Clipped | AD Clipped | AD Clipped | released | | AD Clipped | AD Clipped | AD Clipped | AD Clipped |
| 1997 | 10,800 | 0 | 1,200 | 0 | 12,000 | | 90.00% | 0.00% | 10.00% | 0.00% |

Source: RMIS Database, 2008.

**Table A-9.** Adipose mark and CWT rates for hatchery Chinook salmon brood year releases in the Shelton Basin, 1997-2003.

| Sherwood Creek | | | | | | | Percentages | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | CWT & | CWT, no | | No | Total | | CWT & | CWT, no | | No |
| Brood Year | AD Clipped | AD Clipped | AD Clipped | AD Clipped | released | | AD Clipped | AD Clipped | AD Clipped | AD Clipped |
| 2002 | 0 | 0 | 0 | 10,000 | 10,000 | | 0.00% | 0.00% | 0.00% | 100.00% |
| | | | | | | | | | | |
| **South Sound Net Pens** | | | | | | | **Percentages** | | | |
| | CWT & | CWT, no | | No | Total | | CWT & | CWT, no | | No |
| Brood Year | AD Clipped | AD Clipped | AD Clipped | AD Clipped | released | | AD Clipped | AD Clipped | AD Clipped | AD Clipped |
| 1997 | 126,032 | 0 | 253 | 23,665 | 149,950 | | 84.05% | 0.00% | 0.17% | 15.78% |
| 1998 | 0 | 0 | 157,290 | 3,210 | 160,500 | | 0.00% | 0.00% | 98.00% | 2.00% |

Source: RMIS Database, 2008.

**Table A-10.** Adipose mark and CWT rates for hatchery Chinook salmon brood year releases in the Kitsap Basin, 1997-2003.

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| **Coulter Creek** | | | | | | | | **Percentages** | | |
| | CWT & | CWT, no | | No | Total | | CWT & | CWT, no | | No |
| Brood Year | AD Clipped | AD Clipped | AD Clipped | AD Clipped | released | | AD Clipped | AD Clipped | AD Clipped | AD Clipped |
| 1997 | 0 | 0 | 0 | 1,337,000 | 1,337,000 | | 0.00% | 0.00% | 0.00% | 100.00% |
| 1998 | 0 | 0 | 1,269,229 | 24,771 | 1,294,000 | | 0.00% | 0.00% | 98.09% | 1.91% |
| 1999 | 0 | 0 | 947,237 | 42,033 | 989,270 | | 0.00% | 0.00% | 95.75% | 4.25% |
| 2000 | 0 | 0 | 819,428 | 14,272 | 833,700 | | 0.00% | 0.00% | 98.29% | 1.71% |
| | | | | | | | | | | |
| **Fox Island Net Pens** | | | | | | | | **Percentages** | | |
| | CWT & | CWT, no | | No | Total | | CWT & | CWT, no | | No |
| Brood Year | AD Clipped | AD Clipped | AD Clipped | AD Clipped | released | | AD Clipped | AD Clipped | AD Clipped | AD Clipped |
| 1997 | 239,089 | 4,336 | 0 | 0 | 243,425 | | 98.22% | 1.78% | 0.00% | 0.00% |
| 1998 | 0 | 0 | 249,395 | 1,815 | 251,210 | | 0.00% | 0.00% | 99.28% | 0.72% |
| 1999 | 0 | 0 | 213,967 | 14,783 | 228,750 | | 0.00% | 0.00% | 93.54% | 6.46% |
| | | | | | | | | | | |
| | **Minter Creek** | | | | | | | **Percentages** | | |
| | CWT & | CWT, no | | No | Total | | CWT & | CWT, no | | No |
| Brood Year | AD Clipped | AD Clipped | AD Clipped | AD Clipped | released | | AD Clipped | AD Clipped | AD Clipped | AD Clipped |
| 1997 | 13,496 | 302 | 1,302 | 2,069,000 | 2,084,100 | | 0.65% | 0.01% | 0.06% | 99.28% |
| 1998 | 0 | 0 | 2,038,625 | 53,123 | 2,091,748 | | 0.00% | 0.00% | 97.46% | 2.54% |
| 1999 | 0 | 0 | 1,899,839 | 76,211 | 1,976,050 | | 0.00% | 0.00% | 96.14% | 3.86% |
| 2000 | 0 | 0 | 2,058,887 | 55,063 | 2,113,950 | | 0.00% | 0.00% | 97.40% | 2.60% |
| 2001 | 0 | 0 | 1,888,842 | 3,658 | 1,892,500 | | 0.00% | 0.00% | 99.81% | 0.19% |
| 2002 | 192,690 | 2,407 | 1,663,142 | 18,436 | 1,876,675 | | 10.27% | 0.13% | 88.62% | 0.98% |
| 2003 | 196,942 | 810 | 1,510,924 | 6,049 | 1,714,725 | | 11.49% | 0.05% | 88.11% | 0.35% |
| 2004 | 199,863 | 1,395 | 1,665,863 | 2,502 | 1,869,623 | | 10.69% | 0.07% | 89.10% | 0.13% |

Source: RMIS Database, 2008.

**Table A-11.** Nisqually River fall Chinook salmon run reconstruction, 1986-2006.

| Run Year | Clear Creek Adults | Kalama Creek Adults | Total Adult Hatchery Escapement | Natural Escapement | Commercial Catch | Sports Catch | Test Fishery | Total Runsize without Jacks and Sports Catch |
|---|---|---|---|---|---|---|---|---|
| 1986 | | 281 | 281 | 300 | 1,025 | 0 | 0 | 1,606 |
| 1987 | | 117 | 117 | 85 | 2,100 | 0 | 0 | 2,302 |
| 1988 | | 735 | 735 | 1,342 | 1,573 | 0 | 0 | 3,650 |
| 1989 | | 794 | 794 | 2,332 | 4,008 | 0 | 0 | 7,134 |
| 1990 | | 700 | 700 | 994 | 4,606 | 0 | 0 | 6,300 |
| 1991 | | 201 | 201 | 953 | 428 | 0 | 0 | 1,582 |
| 1992 | 12 | 311 | 323 | 106 | 301 | 0 | 0 | 730 |
| 1993 | 629 | 743 | 1,372 | 1,655 | 4,163 | 0 | 0 | 7,190 |
| 1994 | 401 | 1703 | 2,104 | 1,730 | 6,123 | 0 | 0 | 9,957 |
| 1995 | 1,607 | 2,016 | 3,623 | 817 | 7,171 | 0 | 0 | 11,611 |
| 1996 | 1,826 | 875 | 2,701 | 606 | 5,365 | 0 | 0 | 8,672 |
| 1997 | 2,853 | 398 | 3,251 | 340 | 4,309 | 0 | 0 | 7,900 |
| 1998 | 2,894 | 1,173 | 4,067 | 834 | 7,990 | 0 | 0 | 12,891 |
| 1999 | 11,132 | 2,349 | 13,481 | 1,399 | 14,614 | 0 | 0 | 29,494 |
| 2000 | 3,759 | 1,164 | 4,923 | 1,253 | 6,836 | 0 | 0 | 13,012 |
| 2001 | 7,094 | 518 | 7,612 | 1,079 | 14,098 | 0 | 0 | 22,789 |
| 2002 | 8,025 | 1,316 | 9,341 | 1,542 | 11,737 | 0 | 16 | 22,636 |
| 2003 | 6,235 | 1,462 | 7,697 | 627 | 14,583 | 0 | 73 | 22,980 |
| 2004 | 7,255 | 970 | 8,225 | 2,788 | 13,850 | 0 | 90 | 24,953 |
| 2005 | 11,557 | 913 | 12,470 | 2,159 | 11,066 | 0 | 125 | 25,820 |
| 2006 | 10,003 | 532 | 10,535 | 2,179 | 21,443 | 0 | 125 | 34,282 |

No data for sports catch but Nisqually harvest management biologist, Craig Smith, estimates 1,000- 1,500 for 2003-2006.
Data for hatchery jacks excluded.

Source: Nisqually Indian Tribe, 2007b.

**Table A-12.** Mean monthly stream flow averages (cubic feet per second) for miscellaneous South Puget Sound streams and three fall Chinook salmon systems (Lower Skagit, Snohomish, and Nisqually Rivers).

| **River/Creek** | **Jan.** | **Feb.** | **Mar.** | **Apr.** | **May** | **Jun.** | **Jul.** | **Aug.** | **Sep.** | **Oct.** | **Nov.** | **Dec.** |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Huge Creek | 24 | 22 | 16 | 10 | 7.4 | 6.0 | 5.0 | 4.6 | 4.6 | 5.6 | 10 | 18 |
| Goldsborough Creek | 256 | 236 | 190 | 133 | 73 | 45 | 30 | 25 | 25 | 52 | 138 | 197 |
| Kennedy Creek | 170 | 130 | 108 | 60 | 27 | 12 | 5.4 | 3.9 | 4.8 | 17 | 77 | 134 |
| Woodland Creek | 41 | 47 | 44 | 36 | 28 | 22 | 17 | 15 | 13 | 14 | 19 | 29 |
| | | | | | | | | | | | | |
| Deschutes River | 778 | 801 | 590 | 462 | 296 | 191 | 129 | 104 | 98 | 160 | 480 | 710 |
| | | | | | | | | | | | | |
| Nisqually River | 2,180 | 2,180 | 1,570 | 1,320 | 1,140 | 890 | 571 | 438 | 521 | 822 | 1,610 | 2,280 |
| Mashel River | 376 | 377 | 305 | 280 | 211 | 147 | 55 | 25 | 35 | 109 | 313 | 427 |
| Ohop Creek | 126 | 116 | 91 | 81 | 56 | 41 | 20 | 12 | 16 | 34 | 86 | 124 |
| | | | | | | | | | | | | |
| Snohomish River | 13,200 | 10,900 | 9,230 | 10,300 | 12,900 | 12,400 | 6,680 | 2,990 | 3,390 | 6,140 | 12,400 | 13,200 |
| | | | | | | | | | | | | |
| Skagit River | 17,900 | 16,700 | 14,200 | 15,000 | 20,200 | 24,300 | 19,900 | 11,600 | 9,380 | 12,400 | 18,200 | 18,700 |

Source: USGS website (www.usgs.gov).

**Table A-13.** USGS Stream gaging stations, locations, and years of operation.

| River/Creek | Stream Gaging Station | Location of Stream Gage | Years of operation |
|---|---|---|---|
| Huge Creek | 12073500 | Huge Creek (RM 0.2), upstream of outlet to Minter Creek | 1947-Present |
| Goldsborough Creek | 12076500 | Goldsborough Creek (RM 5.8), near Shelton, WA | 1951-1971 |
| Kennedy Creek | 12078400 | Kennedy Creek (RM 2.2), near Kamilche, WA | 1960-1971 |
| Woodland Creek | 12081000 | Woodland Creek (RM 1.3), near Olympia, WA | 1949-1969 |
| Deschutes River | 12080010 | Deschutes River (RM 3.5) at E St Bridge at Tumwater, WA | 1945-1964, 1990-Present |
| Nisqually River | 12089500 | Nisqually River (RM 21.7) at McKenna, WA | 1947-1968, 1978-Present |
| Mashel River | 12087000 | Mashel River (RM 3.0), near La Grande, WA | 1940-1957, 1991-Present |
| Ohop Creek | 12088000 | Ohop Creek (RM 6.1), near Eatonville, WA | 1941-1971, 1993-Present |
| Snohomish River | 12150800 | Snohomish River, near Monroe, WA | 1963-Present |
| Skagit River | 12200500 | Skagit River, near Mt. Vernon, WA | 1940-Present |

Sources: USGS website (www.usgs.gov); Williams et al., 1975.

**Table A-14.** Mean monthly average stream temperatures (° C) for three USGS gaging stations in the Skagit River and Snohomish River Basins.

| River/Creek | Jan. | Feb. | Mar. | Apr. | May | Jun. | Jul. | Aug. | Sep. | Oct. | Nov. | Dec. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Skagit River | 4.7 | 4.2 | 4.4 | 5.7 | 7.2 | 8.7 | 10.1 | 11.2 | 10.6 | 9.4 | 7.7 | 5.8 |
| North Fork Tolt River | 5.1 | 5.0 | 5.6 | 6.5 | 7.9 | 9.7 | 11.7 | 11.7 | 10.5 | 8.6 | 6.4 | 5.3 |
| South Fork Tolt River | 4.4 | 4.6 | 5.5 | 7.2 | 8.8 | 10.3 | 11.4 | 11.9 | 11.6 | 10.4 | 7.4 | 5.3 |

Source: USGS website (www.usgs.gov).

USGS Stream gaging stations, locations, and years of operation.

| River/Creek | Stream Gaging Station | Location of Stream Gage | Years temperature data collected |
|---|---|---|---|
| Skagit River | 12181000 | Skagit River at Marblemount, WA | 1986-2003 |
| North Fork Tolt River | 12148000 | North Fork Tolt River near Carnation, WA | 1994-2007 |
| South Fork Tolt River | 120148300 | South Fork Tolt River near Carnation, WA | 1994-2007 |

Sources: USGS website (www.usgs.gov).

**Table B-1.** Coulter Creek spawning ground surveys- 1960-1979, 2000-2006.

| Date | RunYear | RMLower | RMUpper | Length | Species | Live Count | Dead Count | Total Count |
|---|---|---|---|---|---|---|---|---|
| **10/31/1960** | **1960** | **0.0** | **0.9** | **0.9** | **CHIN** | **1** | **0** | **1** |
| | | | | | | | | |
| **10/19/1961** | **1961** | **0.0** | **0.9** | **0.9** | **CHIN** | **1** | **0** | **1** |
| 11/6/1961 | 1961 | 0.0 | 0.9 | 0.9 | CHIN | 1 | 0 | 1 |
| | | | | | | | | |
| **10/15/1962** | **1962** | **0.0** | **0.9** | **0.9** | **CHIN** | **13** | **0** | **13** |
| | | | | | | | | |
| **11/4/1963** | **1963** | **0.0** | **0.9** | **0.9** | **CHIN** | **2** | **3** | **5** |
| | | | | | | | | |
| 10/14/1964 | 1964 | 0.0 | 0.9 | 0.9 | CHIN | 20 | 1 | 21 |
| **10/29/1964** | **1964** | **0.0** | **0.9** | **0.9** | **CHIN** | **22** | **6** | **28** |
| | | | | | | | | |
| **10/22/1965** | **1965** | **0.0** | **0.9** | **0.9** | **CHIN** | **5** | **22** | **27** |
| | | | | | | | | |
| **10/21/1966** | **1966** | **0.0** | **0.9** | **0.9** | **CHIN** | **59** | **8** | **67** |
| | | | | | | | | |
| 10/5/1967 | 1967 | 0.0 | 0.4 | 0.4 | CHIN | 4 | 0 | 4 |
| **10/20/1967** | **1967** | **0.0** | **0.9** | **0.9** | **CHIN** | **10** | **5** | **15** |
| | | | | | | | | |
| 9/28/1968 | 1968 | 0.4 | 0.9 | 0.5 | CHUM | - | - | - |
| 10/7/1968 | 1968 | 0.0 | 0.9 | 0.9 | CHIN | 18 | 0 | 18 |
| **10/18/1968** | **1968** | **0.9** | **1.2** | **0.3** | **CHIN** | **41** | **7** | **48** |
| 10/30/1968 | 1968 | 0.0 | 0.9 | 0.9 | CHIN | 9 | 13 | 22 |
| 11/13/1968 | 1968 | 0.0 | 0.4 | 0.4 | CHUM | - | - | - |
| | | | | | | | | |
| **10/15/1969** | **1969** | **0.0** | **0.9** | **0.9** | **CHIN** | **27** | **6** | **33** |
| 11/5/1969 | 1969 | 0.9 | 2.9 | 2.0 | CHIN | 8 | 17 | 25 |
| | | | | | | | | |
| **10/14/1970** | **1970** | **0.0** | **0.9** | **0.9** | **CHIN** | **41** | **12** | **53** |
| **10/14/1970** | **1970** | **0.9** | **1.4** | **0.5** | **CHIN** | **13** | **3** | **16** |
| 11/10/1970 | 1970 | 2.3 | 3.2 | 0.9 | COHO | - | - | - |

**Table B-1.** Coulter Creek spawning ground surveys- 1960-1979, 2000-2006.

| Date | RunYear | RMLower | RMUpper | Length | Species | Live Count | Dead Count | Total Count |
|---|---|---|---|---|---|---|---|---|
| **10/12/1971** | **1971** | **0.0** | **1.4** | **1.4** | **CHIN** | **22** | **6** | **28** |
| | | | | | | | | |
| 10/20/1972 | 1972 | 0.9 | 4.0 | 3.1 | CHIN | 27 | 9 | 36 |
| **10/27/1972** | **1972** | **0.0** | **0.9** | **0.9** | **CHIN** | **32** | **11** | **43** |
| | | | | | | | | |
| **10/12/1973** | **1973** | **0.0** | **0.9** | **0.9** | **CHIN** | **35** | **1** | **36** |
| | | | | | | | | |
| 9/26/1974 | 1974 | 0.0 | 0.9 | 0.9 | COHO | - | - | - |
| 10/8/1974 | 1974 | 0.0 | 0.9 | 0.9 | CHIN | 1 | 0 | 1 |
| **10/18/1974** | **1974** | **0.0** | **0.9** | **0.9** | **CHIN** | **15** | **4** | **19** |
| 10/24/1974 | 1974 | 0.9 | 1.9 | 1.0 | CHIN | 3 | 0 | 3 |
| 10/30/1974 | 1974 | 0.0 | 0.9 | 0.9 | CHIN | 8 | 0 | 8 |
| 10/30/1974 | 1974 | 0.9 | 1.8 | 0.9 | CHIN | 1 | 0 | 1 |
| | | | | | | | | |
| 9/30/1975 | 1975 | 0.6 | 0.9 | 0.3 | CHIN | 0 | 1 | 1 |
| 10/3/1975 | 1975 | 0.0 | 0.9 | 0.9 | CHIN | 9 | 0 | 9 |
| 10/10/1975 | 1975 | 0.0 | 0.9 | 0.9 | CHIN | 5 | 1 | 6 |
| **10/20/1975** | **1975** | **0.0** | **0.9** | **0.9** | **CHIN** | **17** | **1** | **18** |
| 10/27/1975 | 1975 | 0.1 | 0.2 | 0.1 | CHUM | - | - | - |
| 11/1/1975 | 1975 | 0.0 | 0.9 | 0.9 | CHIN | 0 | 1 | 1 |
| | | | | | | | | |
| 9/13/1976 | 1976 | 0.0 | 0.9 | 0.9 | CHUM | - | - | - |
| 9/23/1976 | 1976 | 0.0 | 0.9 | 0.9 | CHIN | 5 | 0 | 5 |
| 9/29/1976 | 1976 | 0.0 | 0.9 | 0.9 | CHIN | 1 | 0 | 1 |
| 10/6/1976 | 1976 | 0.0 | 0.9 | 0.9 | CHIN | 12 | 0 | 12 |
| **10/13/1976** | **1976** | **0.0** | **0.9** | **0.9** | **CHIN** | **18** | **6** | **24** |
| 10/13/1976 | 1976 | 0.9 | 1.4 | 0.5 | CHIN | 0 | 1 | 1 |
| 10/27/1976 | 1976 | 0.0 | 0.9 | 0.9 | CHIN | 2 | 5 | 7 |
| 11/1/1976 | 1976 | 0.0 | 0.9 | 0.9 | CHIN | 3 | 0 | 3 |
| 11/15/1976 | 1976 | 0.9 | 2.3 | 1.4 | CHIN | 0 | 1 | 1 |

**Table B-1.** Coulter Creek spawning ground surveys- 1960-1979, 2000-2006.

| Date | RunYear | RMLower | RMUpper | Length | Species | Live Count | Dead Count | Total Count |
|---|---|---|---|---|---|---|---|---|
| 9/28/1977 | 1977 | 0.0 | 0.9 | 0.9 | CHUM | - | - | - |
| **10/13/1977** | **1977** | **0.0** | **0.9** | **0.9** | **CHIN** | **15** | **0** | **15** |
| 10/26/1977 | 1977 | 0.0 | 0.9 | 0.9 | COHO | - | - | - |
| 11/10/1977 | 1977 | 0.0 | 0.5 | 0.5 | COHO | - | - | - |
| | | | | | | | | |
| 9/15/1978 | 1978 | 0.0 | 0.9 | 0.9 | COHO | - | - | - |
| 10/6/1978 | 1978 | 0.0 | 0.9 | 0.9 | CHIN | 1 | 0 | 1 |
| **10/20/1978** | **1978** | **0.0** | **0.9** | **0.9** | **CHIN** | **11** | **2** | **13** |
| 11/6/1978 | 1978 | 0.0 | 0.9 | 0.9 | CHIN | 2 | 1 | 3 |
| | | | | | | | | |
| **10/5/1979** | **1979** | **0.0** | **0.9** | **0.9** | **CHIN** | **4** | **0** | **4** |
| 11/9/1979 | 1979 | 0.0 | 0.9 | 0.9 | COHO | - | - | - |
| 11/13/1979 | 1979 | 0.9 | 2.3 | 1.4 | COHO | - | - | - |
| | | | | | | | | |
| | | | | | | | | |
| 9/1/2000 | 2000 | 0.0 | 1.1 | 1.1 | CHIN | 341 | 8 | 349 |
| 9/11/2000 | 2000 | 0.0 | 1.1 | 1.1 | CHIN | 1135 | 66 | 1201 |
| 9/18/2000 | 2000 | 0.0 | 1.1 | 1.1 | CHIN | 917 | 355 | 1272 |
| **9/28/2000** | **2000** | **0.0** | **1.1** | **1.1** | **CHIN** | **1280** | **605** | **1885** |
| 10/5/2000 | 2000 | 0.0 | 1.1 | 1.1 | CHIN | 776 | 565 | 1341 |
| 10/12/2000 | 2000 | 0.0 | 1.1 | 1.1 | CHIN | 282 | 1577 | 1859 |
| 10/19/2000 | 2000 | 0.0 | 1.1 | 1.1 | CHIN | 110 | 385 | 495 |
| 10/27/2000 | 2000 | 0.0 | 1.1 | 1.1 | CHIN | 5 | 0 | 5 |
| 11/6/2000 | 2000 | 0.0 | 1.1 | 1.1 | CHIN | 0 | 1 | 1 |

**Table B-1.** Coulter Creek spawning ground surveys- 1960-1979, 2000-2006.

| Date | RunYear | RMLower | RMUpper | Length | Species | Live Count | Dead Count | Total Count |
|---|---|---|---|---|---|---|---|---|
| 9/5/2001 | 2001 | 0.0 | 1.1 | 1.1 | CHIN | 754 | 76 | 830 |
| 9/11/2001 | 2001 | 0.0 | 1.1 | 1.1 | CHIN | 883 | 171 | 1054 |
| **9/20/2001** | **2001** | **0.0** | **1.1** | **1.1** | **CHIN** | **1213** | **279** | **1492** |
| 10/1/2001 | 2001 | 0.0 | 1.1 | 1.1 | CHIN | 497 | 491 | 988 |
| 10/9/2001 | 2001 | 0.0 | 1.1 | 1.1 | CHIN | 321 | 351 | 672 |
| 10/18/2001 | 2001 | 0.0 | 1.1 | 1.1 | CHIN | 123 | 81 | 204 |
| *10/18/2001* | *2001* | *1.1* | *3.2* | *2.1* | *CHIN* | *23* | *101* | *124* |
| 10/26/2001 | 2001 | 0.0 | 1.1 | 1.1 | CHIN | 9 | 0 | 9 |
| 11/5/2001 | 2001 | 0.0 | 1.1 | 1.1 | COHO | - | - | - |
| 11/13/2001 | 2001 | 0.0 | 1.1 | 1.1 | COHO | - | - | - |
| | | | | | | | | |
| **9/17/2002** | **2002** | **0.0** | **1.1** | **1.1** | **CHIN** | **1846** | **492** | **2338** |
| 9/27/2002 | 2002 | 0.0 | 1.1 | 1.1 | CHIN | 529 | 1028 | 1557 |
| *9/27/2002* | *2002* | *1.1* | *2.3* | *1.2* | *CHIN* | *73* | *87* | *160* |
| 10/4/2002 | 2002 | 0.0 | 1.1 | 1.1 | CHIN | 734 | 1355 | 2089 |
| 10/14/2002 | 2002 | 0.0 | 1.1 | 1.1 | CHIN | 36 | 1386 | 1422 |
| 10/24/2002 | 2002 | 0.0 | 1.1 | 1.1 | CHIN | 1 | 10 | 11 |
| *10/24/2002* | *2002* | *2.3* | *3.2* | *0.9* | *CHIN* | *3* | *4* | *7* |
| 11/1/2002 | 2002 | 0.0 | 1.1 | 1.1 | COHO | - | - | - |
| 11/8/2002 | 2002 | 0.0 | 1.1 | 1.1 | CHIN | 0 | 1 | 1 |
| 11/15/2002 | 2002 | 0.0 | 1.1 | 1.1 | COHO | - | - | - |
| | | | | | | | | |
| 8/22/2003 | 2003 | 0.0 | 1.1 | 1.1 | CHIN | 66 | 0 | 66 |
| 9/3/2003 | 2003 | 0.0 | 1.1 | 1.1 | CHIN | 926 | 6 | 932 |
| 9/10/2003 | 2003 | 0.0 | 1.1 | 1.1 | CHIN | 1771 | 121 | 1892 |
| **9/18/2003** | **2003** | **0.0** | **1.1** | **1.1** | **CHIN** | **1450** | **457** | **1907** |
| 9/25/2003 | 2003 | 0.0 | 1.1 | 1.1 | CHIN | 695 | 842 | 1537 |
| 10/2/2003 | 2003 | 0.0 | 1.1 | 1.1 | CHIN | 336 | 1180 | 1516 |
| *10/2/2003* | *2003* | *1.1* | *2.3* | *1.2* | *CHIN* | *65* | *345* | *410* |
| 10/10/2003 | 2003 | 0.0 | 1.1 | 1.1 | CHIN | 65 | 20 | 85 |

**Table B-1.** Coulter Creek spawning ground surveys- 1960-1979, 2000-2006.

| Date | RunYear | RMLower | RMUpper | Length | Species | Live Count | Dead Count | Total Count |
|---|---|---|---|---|---|---|---|---|
| 10/24/2003 | 2003 | 0.0 | 1.1 | 1.1 | COHO | - | - | - |
| *10/29/2003* | *2003* | *2.3* | *3.2* | *0.9* | *CHIN* | *1* | *0* | *1* |
| 11/3/2003 | 2003 | 0.0 | 1.1 | 1.1 | COHO | - | - | - |
| 11/7/2003 | 2003 | 0.0 | 1.1 | 1.1 | COHO | - | - | - |
| 11/13/2003 | 2003 | 0.0 | 1.1 | 1.1 | COHO | - | - | - |
| | | | | | | | | |
| 8/26/2004 | 2004 | 0.0 | 1.1 | 1.1 | CHIN | 199 | 5 | 204 |
| 9/3/2004 | 2004 | 0.0 | 1.1 | 1.1 | CHIN | 383 | 2 | 385 |
| 9/13/2004 | 2004 | 0.0 | 1.1 | 1.1 | CHIN | 569 | 9 | 578 |
| **9/20/2004** | **2004** | **0.0** | **1.1** | **1.1** | **CHIN** | **1053** | **93** | **1146** |
| *9/20/2004* | *2004* | *1.1* | *2.3* | *1.2* | *CHIN* | *460* | *59* | *519* |
| 9/27/2004 | 2004 | 0.0 | 1.1 | 1.1 | CHIN | 624 | 395 | 1019 |
| 10/6/2004 | 2004 | 0.0 | 1.1 | 1.1 | CHIN | 118 | 304 | 422 |
| 10/13/2004 | 2004 | 0.0 | 1.1 | 1.1 | CHIN | 31 | | |
| 10/20/2004 | 2004 | 0.0 | 1.1 | 1.1 | CHIN | 1 | | |
| *10/28/2004* | *2004* | *2.3* | *3.2* | *0.9* | *CHIN* | *0* | *0* | |
| 10/28/2004 | 2004 | 0.0 | 1.1 | 1.1 | CHIN | 1 | | |
| 11/4/2004 | 2004 | 0.0 | 1.1 | 1.1 | COHO | - | - | - |
| 11/10/2004 | 2004 | 0.0 | 1.1 | 1.1 | COHO | - | - | - |
| | | | | | | | | |
| **9/30/2005** | **2005** | **0.0** | **1.1** | **1.1** | **CHIN** | **190** | **49** | **239** |
| 10/7/2005 | 2005 | 0.0 | 1.1 | 1.1 | CHIN | 83 | 63 | 146 |
| 10/14/2005 | 2005 | 0.0 | 1.1 | 1.1 | CHIN | 11 | 43 | 54 |
| *10/14/2005* | *2005* | *1.1* | *2.3* | *1.2* | *CHIN* | *0* | *0* | *0* |
| 10/21/2005 | 2005 | 0.0 | 1.1 | 1.1 | CHIN | 8 | 9 | 17 |
| *10/26/2005* | *2005* | *2.3* | *3.2* | *0.9* | *CHIN* | *0* | *0* | *0* |
| 11/2/2005 | 2005 | 0.0 | 1.1 | 1.1 | COHO | - | - | - |
| 11/9/2005 | 2005 | 0.0 | 1.1 | 1.1 | COHO | - | - | - |

**Table B-1.** Coulter Creek spawning ground surveys- 1960-1979, 2000-2006.

| Date | RunYear | RMLower | RMUpper | Length | Species | Live Count | Dead Count | Total Count |
|---|---|---|---|---|---|---|---|---|
| 8/21/2006 | 2006 | 0.0 | 1.1 | 1.1 | CHIN | 0 | 0 | 0 |
| 9/1/2006 | 2006 | 0.0 | 1.1 | 1.1 | CHIN | 5 | 0 | 5 |
| 9/11/2006 | 2006 | 0.0 | 1.1 | 1.1 | CHIN | 68 | 0 | 68 |
| 9/18/2006 | 2006 | 0.0 | 1.1 | 1.1 | CHIN | 84 | 3 | 87 |
| **9/26/2006** | **2006** | **0.0** | **1.1** | **1.1** | **CHIN** | **103** | **2** | **105** |
| 10/3/2006 | 2006 | 0.0 | 1.1 | 1.1 | CHIN | 35 | 10 | 45 |
| 10/11/2006 | 2006 | 0.0 | 1.1 | 1.1 | CHIN | 16 | 4 | 20 |
| 10/19/2006 | 2006 | 0.0 | 1.1 | 1.1 | CHIN | 4 | 1 | 5 |
| 10/23/2006 | 2006 | 0.0 | 1.1 | 1.1 | CHUM | - | - | - |
| 10/23/2006 | 2006 | 0.0 | 1.1 | 1.1 | CHIN | 0 | 0 | 0 |
| *10/23/2006* | *2006* | *2.3* | *3.2* | *0.9* | *CHIN* | *0* | *0* | *0* |
| 11/1/2006 | 2006 | 0.0 | 1.1 | 1.1 | CHUM | - | - | - |
| 11/9/2006 | 2006 | 0.0 | 1.1 | 1.1 | CHUM | - | - | - |

Source: Spawning Ground Survey Database, 2007.

**Figure B-2.** Coulter Creek spawning ground survey effort- 1960-1979, 2000-2006.

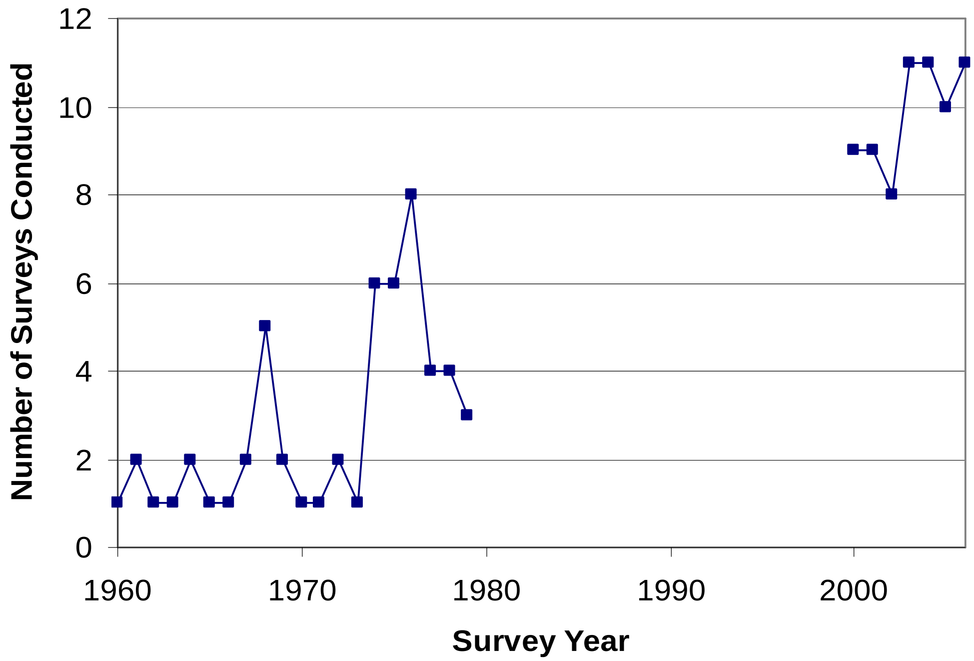


**Figure B-3.** Coulter Creek peak observed survey count dates- 1960-1979, 2000-2006.

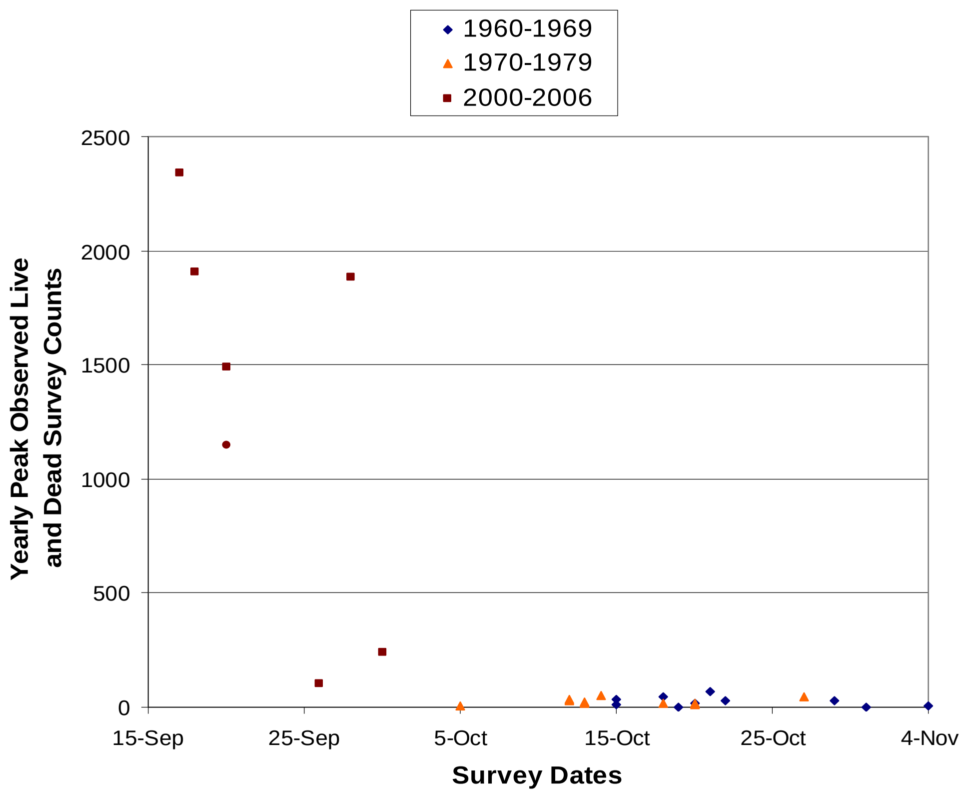

**Table C-1.** Chinook salmon hatchery releases in South Puget Sound tributaries, brood years 1952-2004.

| Release Location | Brood Year | Release Year | Number of fish released | Fish per pound Measured |
|---|---|---|---|---|
| Burley Creek | 1989 | 1990 | 430,800 | 1,008 |
| Burley Creek | 1990 | 1991 | 645,400 | 965- 1,008 |
| Burley Creek | 1991 | 1992 | 50,000 | 945 |
| | | | | |
| Cranberry Creek | 1959 | 1960 | 505,050 | 648 |
| Cranberry Creek | 1961 | 1962 | 249,796 | 782 |
| | | | | |
| Goldsborough Creek | 1961 | 1962 | 286,000 | 440 |
| Goldsborough Creek | 1962 | 1963 | 254,375 | 401- 477 |
| Goldsborough Creek | 1963 | 1964 | 508,335 | 234- 477 |
| Goldsborough Creek | 1964 | 1965 | 467,200 | 639 |
| Goldsborough Creek | 1965 | 1966 | 203,770 | 354 |
| Goldsborough Creek | 1989 | 1989 | 1,198,500 | 1,463 |
| | | | | |
| Johns Creek | 1978 | 1980 | 1,118,058 | 15 |
| | | | | |
| Schumocher Creek* | 1956 | 1957 | 630,000 | 1008 |
| Schumocher Creek | 1991 | 1992 | 11,000 | 100- 597 |
| | | | | |
| Sherwood Creek* | 1957 | 1958 | 316,260 | 251- 488 |
| Sherwood Creek | 1958 | 1959 | 251,600 | 677 |
| Sherwood Creek | 1970 | 1971 | 466,480 | 840 |
| Sherwood Creek | 1979 | 1980 | 44,500 | 889 |
| Sherwood Creek | 1981 | 1982 | 48,800 | 1,163 |

Source: RMIS Database, 2008.

* Note: Sherwood Creek and Schumocher Creek are part of the same system. Sherwood Creek is the name of the stream below Mason Lake (RM 0.0- RM 8.5), and Schumocher Creek is the name of the stream above Mason Lake (RM 12.9- RM 18.3).

**Table C-2.** South Puget Sound tributaries peak observed live and dead survey counts, 1987-2006.

| | 1987 | 1988 | 1989 | 1990 | 1991 | 1992 | 1993 | 1994 | 1995 | 1996 |
|---|---|---|---|---|---|---|---|---|---|---|
| **Hammersley** | | | | | | | | | | |
| *Cranberry* | 1 | 1 | 5 | 3 | 0 | 0 | 2 | 0 | 0 | 0 |
| | | | | | | | | | | |
| *Deer* | 20 | 13 | 12 | 34 | 68 | 13 | 4 | 3 | 0 | 1 |
| | | | | | | | | | | |
| *Goldsborough* | NS | NS | NS | NS | NS | NS | NS | NS | NS | NS |
| | | | | | | | | | | |
| *Johns* | 0 | 1 | 13 | 21 | 22 | 14 | 5 | 0 | 6 | 2 |
| | | | | | | | | | | |
| ***Totals*** | **21** | **15** | **30** | **58** | **90** | **27** | **11** | **3** | **6** | **3** |
| | | | | | | | | | | |
| | | | | | | | | | | |
| **Case** | | | | | | | | | | |
| *Sherwood* | 11 | 7 | 12 | 28 | 28 | 6 | 2 | 11 | 9 | 0 |
| | | | | | | | | | | |
| *Rocky* | 4 | 17 | 9 | 30 | 14 | 39 | 3 | 2 | 9 | 0 |
| | | | | | | | | | | |
| **Totals** | **15** | **24** | **21** | **58** | **42** | **45** | **5** | **13** | **18** | **0** |
| | | | | | | | | | | |
| | | | | | | | | | | |
| **Carr** | | | | | | | | | | |
| *Burley* | 16 | 160 | 98 | 196 | 396 | 385 | 307 | 414 | 84 | 47 |
| | | | | | | | | | | |
| **Totals** | **16** | **160** | **98** | **196** | **396** | **385** | **307** | **414** | **84** | **47** |
| | | | | | | | | | | |
| | | | | | | | | | | |
| **South Sound Totals** | 52 | 199 | 149 | 312 | 528 | 457 | 323 | 430 | 108 | 50 |

NS- No surveys conducted for that year.

**Table C-2.** South Puget Sound tributaries peak observed live and dead survey counts, 1987-2006.

| | 1997 | 1998 | 1999 | 2000 | 2001 | 2002 | 2003 | 2004 | 2005 | 2006 |
|---|---|---|---|---|---|---|---|---|---|---|
| **Hammersley** | | | | | | | | | | |
| *Cranberry* | 3 | 3 | 4 | 3 | 2 | 16 | 2 | 4 | 6 | 2 |
| | | | | | | | | | | |
| *Deer* | 2 | 10 | 7 | 5 | 16 | 14 | 23 | 15 | 8 | 2 |
| | | | | | | | | | | |
| *Goldsborough* | NS | 9 | 8 | 14 | 9 | 6 | 1 | 3 | 2 | 0 |
| | | | | | | | | | | |
| *Johns* | 2 | 0 | 0 | 2 | 1 | 0 | 0 | 0 | 1 | 0 |
| | | | | | | | | | | |
| ***Totals*** | **7** | **22** | **19** | **24** | **28** | **36** | **26** | **22** | **17** | **4** |
| | | | | | | | | | | |
| | | | | | | | | | | |
| **Case** | | | | | | | | | | |
| *Sherwood* | 0 | 8 | 22 | 9 | 12 | 30 | 13 | 80 | 29 | 8 |
| | | | | | | | | | | |
| *Rocky* | 19 | 360 | 196 | 397 | 132 | 43 | 2 | 0 | 77 | 16 |
| | | | | | | | | | | |
| **Totals** | **19** | **368** | **218** | **406** | **144** | **73** | **15** | **80** | **106** | **24** |
| | | | | | | | | | | |
| | | | | | | | | | | |
| **Carr** | | | | | | | | | | |
| *Burley* | 25 | 121 | 257 | 33 | 191 | 350 | 160 | 42 | 83 | 341 |
| | | | | | | | | | | |
| **Totals** | **25** | **121** | **257** | **33** | **191** | **350** | **160** | **42** | **83** | **341** |
| | | | | | | | | | | |
| | | | | | | | | | | |
| **South Sound** | 51 | 511 | 494 | 463 | 363 | 459 | 201 | 144 | 206 | 369 |
| **Totals** | | | | | | | | | | |

NS- No surveys conducted for that year.

**Table C-3.** South Puget Sound tributaries AUC relative abundance estimates, 1987-2006.

| | 1987 | 1988 | 1989 | 1990 | 1991 | 1992 | 1993 | 1994 | 1995 | 1996 |
|---|---|---|---|---|---|---|---|---|---|---|
| **Hammersley** | | | | | | | | | | |
| *Cranberry* | 1^ | 0^ | 8 | 2 | 0 | 0* | 2 | 0 | 0* | 0* |
| | | | | | | | | | | |
| *Deer* | 22^ | 16^ | 21 | 57 | 83 | 19* | 9 | 5 | 0* | 1* |
| | | | | | | | | | | |
| *Goldsborough* | NS | NS | NS | NS | NS | NS | NS | NS | NS | NS |
| | | | | | | | | | | |
| *Johns* | 0* | 1* | 10 | 7 | 12 | 10 | 3 | 0 | 6* | 1 |
| | | | | | | | | | | |
| ***Totals*** | **23** | **17** | **39** | **66** | **95** | **29** | **14** | **5** | **6** | **2** |
| | | | | | | | | | | |
| | | | | | | | | | | |
| **Case** | | | | | | | | | | |
| *Sherwood* | 3^ | 8 | 15^ | 37 | 30 | 6 | 2 | 12 | 4* | 0* |
| | | | | | | | | | | |
| *Rocky* | 0^ | 18 | NC | 0* | 9^* | 33 | NC | 0 | 5* | 0* |
| | | | | | | | | | | |
| **Totals** | **3** | **26** | **15** | **37** | **39** | **39** | **2** | **12** | **9** | **0** |
| | | | | | | | | | | |
| **Carr** | | | | | | | | | | |
| *Burley* | NC | NC | NC | NC | NC | 487* | 535 | 640** | NC | 74 |
| | | | | | | | | | | |
| **Totals** | **0** | **0** | **0** | **0** | **0** | **487** | **535** | **640** | **0** | **74** |
| | | | | | | | | | | |
| | | | | | | | | | | |
| **South Sound Totals** | **26** | **43** | **54** | **103** | **134** | **555** | **551** | **657** | **15** | **76** |

*   Data includes a gap of more than 14 days between surveys
** Data includes a first or last survey with a live count of 60 or greater
^   Data does not include a survey prior to September 25
NC-  AUC not calculated because less than four surveys conducted.   NS-  No surveys conducted for that year.

**Table C-3.** South Puget Sound tributaries AUC relative abundance estimates, 1987-2006.

| | 1997 | 1998 | 1999 | 2000 | 2001 | 2002 | 2003 | 2004 | 2005 | 2006 |
|---|---|---|---|---|---|---|---|---|---|---|
| **Hammersley** | | | | | | | | | | |
| *Cranberry* | 7^ | 1 | 4 | 3 | 4 | 17 | 2 | 6 | 7 | 1 |
| | | | | | | | | | | |
| *Deer* | 2 | 12 | 21 | 5 | 33 | 19 | 20 | 17 | 11 | 4 |
| | | | | | | | | | | |
| *Goldsborough* | NS | 10^ | 5^* | 16* | 21 | 4 | 1 | 6^ | 2 | 0 |
| | | | | | | | | | | |
| *Johns* | 2 | 0 | 0 | 2 | 1 | 0 | 0* | 0 | 1 | 0 |
| | | | | | | | | | | |
| ***Totals*** | **11** | **23** | **30** | **26** | **59** | **40** | **23** | **29** | **21** | **5** |
| | | | | | | | | | | |
| | | | | | | | | | | |
| **Case** | | | | | | | | | | |
| *Sherwood* | 0* | 11 | 33 | 12 | 28 | 36 | 24 | 103 | 61 | 10 |
| | | | | | | | | | | |
| *Rocky* | 36* | 368 | 220 | 495 | 72 | 29 | 2 | NC | 70* | 16* |
| | | | | | | | | | | |
| **Totals** | **36** | **379** | **253** | **507** | **100** | **65** | **26** | **103** | **131** | **26** |
| | | | | | | | | | | |
| **Carr** | | | | | | | | | | |
| *Burley* | NC | NC | 285 | 65 | 316 | 468 | 387* | 103 | 181 | 671* |
| | | | | | | | | | | |
| **Totals** | **0** | **0** | **285** | **65** | **316** | **468** | **387** | **103** | **181** | **671** |
| | | | | | | | | | | |
| | | | | | | | | | | |
| **South Sound Totals** | **47** | **402** | **568** | **598** | **475** | **573** | **436** | **235** | **333** | **702** |

* Data includes a gap of more than 14 days between surveys
** Data includes a first or last survey with a live count of 60 or greater
^ Data does not include a survey prior to September 25
NC- AUC not calculated because less than four surveys conducted. NS- No surveys conducted for that year.

**Table C-4.** South Puget Sound Chinook salmon run reconstruction, 1987-2006.

| **Run Year** | *1987* | *1988* | *1989* | *1990* | *1991* | *1992* | *1993* | *1994* | *1995* | *1996* |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | | |
| **Run Area** | | | | | | | | | | |
| Misc. 13- McAllister Creek | 5,345 | 8,670 | 4,326 | 5,464 | 2,849 | 2,944 | 2,523 | 3,931 | 9,032 | 4,281 |
| Chambers Creek | 3,272 | 4,079 | 2,378 | 3,737 | 3,784 | 3,961 | 2,767 | 2,303 | 4,517 | 3,441 |
| Nisqually River | 2,679 | 4,273 | 7,860 | 6,670 | 1,719 | 791 | 7,494 | 10,454 | 11,528 | 8,746 |
| Mics 13A- Minter Creek | 4,494 | 4,744 | 5,261 | 7,011 | 5,914 | 4,963 | 3,157 | 4,624 | 1,730 | 366 |
| Deschutes River | 9,913 | 15,645 | 25,877 | 27,757 | 12,310 | 10,106 | 9,173 | 13,046 | 29,025 | 18,014 |
| Misc 13B Streams- Coulter Creek | 2,334 | 2,857 | 4,639 | 12,735 | 4,197 | 4,091 | 5,276 | 3,551 | 3,115 | 3,478 |
| | | | | | | | | | | |
| **Total Run Size** | **28,037** | **40,268** | **50,341** | **63,374** | **30,773** | **26,856** | **30,390** | **37,909** | **58,947** | **38,326** |

| **Run Year** | *1997* | *1998* | *1999* | *2000* | *2001* | *2002* | *2003* | *2004* | *2005* | *2006* |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | | |
| **Run Area** | | | | | | | | | | |
| Misc. 13- McAllister Creek | 3,898 | 3,699 | 3,454 | 3,805 | 4,414 | 863 | 0 | 0 | 0 | 0 |
| Chambers Creek | 2,708 | 3,140 | 1,212 | 1,994 | 969 | 1,418 | 1,750 | 5,044 | 5,052 | 8,934 |
| Nisqually River | 8,267 | 11,958 | 24,499 | 12,024 | 19,091 | 27,730 | 26,294 | 24,895 | 26,785 | 34,333 |
| Mics 13A- Minter Creek | 3,665 | 8,635 | 14,608 | 9,904 | 13,741 | 10,835 | 7,174 | 5,904 | 6,843 | 15,155 |
| Deschutes River | 4,237 | 4,348 | 7,947 | 9,007 | 6,005 | 8,559 | 8,412 | 13,419 | 12,250 | 20,288 |
| Misc 13B Streams- Coulter Creek | 2,216 | 2,909 | 7,312 | 4,467 | 3,833 | 5,884 | 4,692 | 2,718 | 568 | 0 |
| | | | | | | | | | | |
| **Total Run Size** | **24,991** | **34,689** | **59,032** | **41,201** | **48,053** | **55,289** | **48,322** | **51,980** | **51,498** | **78,710** |

Source: WDFW, 2007b.

**Table C-5.** Cranberry Creek spawning ground surveys, 1987-2006.

| Date | RunYear | RMLower | RMUpper | Length | Species | Live Count | Dead Count | Total Count |
|---|---|---|---|---|---|---|---|---|
| **10/12/1987**** | **1987** | **0.0** | **0.2** | **0.2** | **CHIN** | **1** | **0** | **1** |
| 10/15/1987 | 1987 | 0.0 | 0.4 | 0.4 | COHO | - | - | - |
| 10/29/1987 | 1987 | 0.0 | 0.5 | 0.5 | CHUM | - | - | - |
| 11/5/1987 | 1987 | 0.0 | 3.5 | 3.5 | COHO | - | - | - |
| 11/13/1987 | 1987 | 0.0 | 3.5 | 3.5 | CHUM | - | - | - |
| | | | | | | | | |
| **10/11/1988** | **1988** | **0.0** | **3.5** | **3.5** | **CHIN** | **0** | **1** | **1** |
| 10/21/1988 | 1988 | 0.0 | 3.5 | 3.5 | COHO | - | - | - |
| 10/24/1988** | 1988 | 0.0 | 3.5 | 3.5 | CHUM | - | - | - |
| 11/4/1988 | 1988 | 0.0 | 3.5 | 3.5 | COHO | - | - | - |
| | | | | | | | | |
| 9/19/1989 | 1989 | 0.1 | 1.0 | 0.9 | CHUM | - | - | - |
| 9/29/1989 | 1989 | 0.0 | 2.5 | 2.5 | CHIN | 3 | 0 | 3 |
| **10/10/1989** | **1989** | **0.0** | **3.5** | **3.5** | **CHIN** | **5** | **0** | **5** |
| 10/17/1989 | 1989 | 0.0 | 3.5 | 3.5 | CHIN | 1 | 3 | 4 |
| 10/25/1989 | 1989 | 0.0 | 3.5 | 3.5 | CHUM | - | - | - |
| 10/30/1989** | 1989 | 0.0 | 3.5 | 3.5 | CHUM | - | - | - |
| 11/10/1989** | 1989 | 0.0 | 3.5 | 3.5 | CHUM | - | - | - |
| | | | | | | | | |
| 9/21/1990 | 1990 | 0.0 | 1.0 | 1.0 | CHUM | - | - | - |
| 10/4/1990 | 1990 | 0.0 | 3.5 | 3.5 | CHUM | - | - | - |
| 10/16/1990 | 1990 | 0.0 | 3.5 | 3.5 | COHO | - | - | - |
| 10/25/1990 | 1990 | 0.1 | 2.6 | 2.5 | CHUM | - | - | - |
| *10/25/1990* | *1990* | *2.6* | *3.5* | *0.9* | *CHIN* | *0* | *1* | *1* |
| 11/2/1990 | 1990 | 0.0 | 3.5 | 3.5 | CHUM | - | - | - |
| **11/8/1990** | **1990** | **0.0** | **2.6** | **2.6** | **CHIN** | **2** | **1** | **3** |
| 11/15/1990 | 1990 | 0.0 | 2.6 | 2.6 | COHO | - | - | - |

** Survey conducted by Squaxin Island Indian Tribe.

**Table C-5.** Cranberry Creek spawning ground surveys, 1987-2006.

| Date | RunYear | RMLower | RMUpper | Length | Species | Live Count | Dead Count | Total Count |
|---|---|---|---|---|---|---|---|---|
| 9/19/1991 | 1991 | 0.0 | 0.8 | 0.8 | CHUM | - | - | - |
| 10/2/1991 | 1991 | 0.0 | 0.7 | 0.7 | CHUM | - | - | - |
| 10/11/1991 | 1991 | 0.0 | 0.7 | 0.7 | CHUM | - | - | - |
| 10/22/1991 | 1991 | 0.0 | 0.7 | 0.7 | CHUM | - | - | - |
| 10/31/1991 | 1991 | 0.0 | 2.5 | 2.5 | CHUM | - | - | - |
| 11/7/1991 | 1991 | 0.0 | 2.5 | 2.5 | CHUM | - | - | - |
| | | | | | | | | |
| 9/11/1992 | 1992 | 0.0 | 0.8 | 0.8 | CHUM | - | - | - |
| 9/21/1992 | 1992 | 0.0 | 0.2 | 0.2 | CHUM | - | - | - |
| 10/2/1992 | 1992 | 0.0 | 0.8 | 0.8 | CHUM | - | - | - |
| **10/19/1992** | **1992** | **0.0** | **3.5** | **3.5** | **CHIN** | **0** | **0** | **0** |
| 10/28/1992 | 1992 | 0.0 | 3.5 | 3.5 | CHUM | - | - | - |
| 11/5/1992 | 1992 | 0.0 | 3.5 | 3.5 | CHUM | - | - | - |
| | | | | | | | | |
| 9/13/1993 | 1993 | 0.0 | 0.8 | 0.8 | CHUM | - | - | - |
| 9/20/1993 | 1993 | 0.0 | 3.5 | 3.5 | CHUM | - | - | - |
| 10/4/1993 | 1993 | 0.0 | 0.7 | 0.7 | CHUM | - | - | - |
| 10/11/1993 | 1993 | 0.0 | 2.6 | 2.6 | CHUM | - | - | - |
| **10/20/1993** | **1993** | **0.0** | **3.0** | **3.0** | **CHIN** | **2** | **0** | **2** |
| 11/1/1993 | 1993 | 0.0 | 3.5 | 3.5 | CHUM | - | - | - |
| 11/10/1993 | 1993 | 0.0 | 2.6 | 2.6 | COHO | - | - | - |
| | | | | | | | | |
| 9/21/1994 | 1994 | 0.0 | 2.6 | 2.6 | CHUM | - | - | - |
| 10/3/1994 | 1994 | 0.0 | 2.6 | 2.6 | CHUM | - | - | - |
| 10/11/1994 | 1994 | 0.0 | 3.5 | 3.5 | CHUM | - | - | - |
| 10/18/1994 | 1994 | 0.0 | 2.6 | 2.6 | COHO | - | - | - |
| 10/28/1994 | 1994 | 0.0 | 2.6 | 2.6 | CHUM | - | - | - |
| 11/8/1994 | 1994 | 0.0 | 3.5 | 3.5 | CHUM | - | - | - |

**Table C-5.** Cranberry Creek spawning ground surveys, 1987-2006.

| Date | RunYear | RMLower | RMUpper | Length | Species | Live Count | Dead Count | Total Count |
|---|---|---|---|---|---|---|---|---|
| 9/12/1995 | 1995 | 0.0 | 0.8 | 0.8 | CHUM | - | - | - |
| 9/27/1995 | 1995 | 0.0 | 2.6 | 2.6 | CHUM | - | - | - |
| 10/12/1995 | 1995 | 0.0 | 3.5 | 3.5 | CHUM | - | - | - |
| 10/20/1995 | 1995 | 0.0 | 3.5 | 3.5 | CHUM | - | - | - |
| 11/2/1995 | 1995 | 0.0 | 3.5 | 3.5 | CHUM | - | - | - |
| | | | | | | | | |
| 9/17/1996 | 1996 | 0.0 | 2.6 | 2.6 | CHUM | - | - | - |
| 9/26/1996 | 1996 | 0.0 | 2.6 | 2.6 | CHUM | - | - | - |
| 10/3/1996 | 1996 | 0.0 | 2.6 | 2.6 | CHUM | - | - | - |
| 10/14/1996 | 1996 | 0.0 | 3.5 | 3.5 | CHUM | - | - | - |
| 10/29/1996 | 1996 | 0.0 | 3.5 | 3.5 | CHUM | - | - | - |
| 11/8/1996 | 1996 | 0.0 | 3.5 | 3.5 | CHUM | - | - | - |
| | | | | | | | | |
| **9/26/1997** | **1997** | **0.0** | **3.5** | **3.5** | **CHIN** | **3** | **0** | **3** |
| 10/8/1997 | 1997 | 0.0 | 3.5 | 3.5 | CHIN | 3 | 0 | 3 |
| 10/21/1997 | 1997 | 0.0 | 3.5 | 3.5 | CHUM | - | - | - |
| 10/29/1997 | 1997 | 0.0 | 3.5 | 3.5 | CHUM | - | - | - |
| 11/12/1997 | 1997 | 0.0 | 3.5 | 3.5 | CHUM | - | - | - |
| | | | | | | | | |
| 9/9/1998 | 1998 | 0.0 | 2.6 | 2.6 | CHUM | - | - | - |
| 9/17/1998 | 1998 | 0.0 | 2.6 | 2.6 | CHUM | - | - | - |
| 9/25/1998 | 1998 | 0.0 | 2.6 | 2.6 | COHO | - | - | - |
| **10/5/1998** | **1998** | **0.0** | **2.6** | **2.6** | **CHIN** | **1** | **2** | **3** |
| 10/15/1998 | 1998 | 0.0 | 2.6 | 2.6 | COHO | - | - | - |
| 10/22/1998 | 1998 | 0.0 | 3.5 | 3.5 | CHUM | - | - | - |
| 10/30/1998 | 1998 | 0.0 | 3.5 | 3.5 | CHUM | - | - | - |
| 11/9/1998 | 1998 | 0.0 | 3.5 | 3.5 | CHUM | - | - | - |

**Table C-5.** Cranberry Creek spawning ground surveys, 1987-2006.

| Date | RunYear | RMLower | RMUpper | Length | Species | Live Count | Dead Count | Total Count |
|---|---|---|---|---|---|---|---|---|
| 9/10/1999 | 1999 | 0.0 | 3.5 | 3.5 | CHUM | - | - | - |
| 9/17/1999 | 1999 | 0.0 | 2.6 | 2.6 | COHO | - | - | - |
| **9/28/1999** | **1999** | **0.0** | **0.8** | **0.8** | **CHIN** | **4** | **0** | **4** |
| 10/6/1999 | 1999 | 0.0 | 2.6 | 2.6 | CHIN | 0 | 1 | 1 |
| 10/13/1999 | 1999 | 0.0 | 2.6 | 2.6 | CHUM | - | - | - |
| 10/20/1999 | 1999 | 0.0 | 3.5 | 3.5 | CHUM | - | - | - |
| 10/27/1999 | 1999 | 0.0 | 3.5 | 3.5 | CHUM | - | - | - |
| 11/3/1999 | 1999 | 0.0 | 3.5 | 3.5 | CHUM | - | - | - |
| 11/15/1999 | 1999 | 0.0 | 3.5 | 3.5 | CHUM | - | - | - |
| | | | | | | | | |
| 9/5/2000 | 2000 | 0.0 | 2.6 | 2.6 | CHUM | - | - | - |
| 9/12/2000 | 2000 | 0.0 | 2.6 | 2.6 | CHUM | - | - | - |
| 9/21/2000 | 2000 | 0.0 | 2.6 | 2.6 | CHUM | - | - | - |
| 9/29/2000 | 2000 | 0.0 | 2.6 | 2.6 | CHUM | - | - | - |
| 10/6/2000 | 2000 | 0.0 | 1.6 | 1.6 | CHUM | - | - | - |
| **10/16/2000** | **2000** | **0.0** | **2.6** | **2.6** | **CHIN** | **3** | **0** | **3** |
| 10/25/2000 | 2000 | 0.0 | 3.5 | 3.5 | CHUM | - | - | - |
| 11/2/2000 | 2000 | 0.0 | 3.5 | 3.5 | CHUM | - | - | - |
| 11/14/2000 | 2000 | 0.0 | 3.5 | 3.5 | CHUM | - | - | - |
| | | | | | | | | |
| 9/12/2001 | 2001 | 0.0 | 0.6 | 0.6 | CHUM | - | - | - |
| 9/19/2001 | 2001 | 0.0 | 0.6 | 0.6 | CHIN | 1 | 0 | 1 |
| 9/28/2001 | 2001 | 0.0 | 0.8 | 0.8 | CHUM | - | - | - |
| **10/8/2001** | **2001** | **0.0** | **3.5** | **3.5** | **CHIN** | **2** | **0** | **2** |
| 10/17/2001 | 2001 | 0.0 | 3.5 | 3.5 | CHUM | - | - | - |
| 10/25/2001 | 2001 | 0.0 | 3.5 | 3.5 | CHUM | - | - | - |
| 11/2/2001 | 2001 | 0.0 | 3.5 | 3.5 | CHUM | - | - | - |
| 11/13/2001 | 2001 | 0.0 | 2.6 | 2.6 | COHO | - | - | - |

**Table C-5.** Cranberry Creek spawning ground surveys, 1987-2006.

| Date | RunYear | RMLower | RMUpper | Length | Species | Live Count | Dead Count | Total Count |
|---|---|---|---|---|---|---|---|---|
| 9/19/2002 | 2002 | 0.0 | 2.6 | 2.6 | CHUM | - | - | - |
| **9/30/2002** | **2002** | **0.0** | **3.5** | **3.5** | **CHIN** | **15** | **1** | **16** |
| 10/8/2002 | 2002 | 0.0 | 2.6 | 2.6 | CHIN | 4 | 1 | 5 |
| *10/8/2002* | *2002* | *2.6* | *3.5* | *0.9* | *CHIN* | *0* | *0* | *0* |
| 10/16/2002 | 2002 | 0.0 | 2.6 | 2.6 | COHO | - | - | - |
| 10/23/2002 | 2002 | 0.0 | 2.6 | 2.6 | COHO | - | - | - |
| 11/1/2002 | 2002 | 0.0 | 2.6 | 2.6 | CHIN | 0 | 1 | 1 |
| 11/8/2002 | 2002 | 0.0 | 2.6 | 2.6 | CHUM | - | - | - |
| | | | | | | | | |
| 9/17/2003 | 2003 | 0.0 | 0.8 | 0.8 | CHIN | 0 | 0 | 0 |
| *9/23/2003* | *2003* | *2.6* | *3.5* | *0.9* | *CHIN* | *0* | 0 | *0* |
| 9/23/2003 | 2003 | 0.0 | 2.6 | 2.6 | CHIN | 0 | 0 | 0 |
| **10/1/2003** | **2003** | **0.0** | **2.6** | **2.6** | **CHIN** | **1** | **1** | **2** |
| *10/8/2003* | *2003* | *2.6* | *3.5* | *0.9* | *CHIN* | *0* | *0* | *0* |
| 10/8/2003 | 2003 | 0.0 | 2.6 | 2.6 | CHIN | 1 | 0 | 1 |
| 10/15/2003 | 2003 | 0.0 | 2.6 | 2.6 | CHIN | 1 | 0 | 1 |
| 10/28/2003 | 2003 | 0.0 | 2.6 | 2.6 | CHUM | - | - | - |
| 11/5/2003 | 2003 | 0.0 | 2.6 | 2.6 | CHUM | - | - | - |
| 11/12/2003 | 2003 | 0.0 | 2.6 | 2.6 | COHO | - | - | - |
| | | | | | | | | |
| 9/8/2004 | 2004 | 0.0 | 0.8 | 0.8 | CHIN | 0 | 0 | 0 |
| 9/14/2004 | 2004 | 0.0 | 0.8 | 0.8 | CHIN | 0 | 0 | 0 |
| 9/22/2004 | 2004 | 0.0 | 2.6 | 2.6 | CHIN | 3 | 0 | 3 |
| **9/28/2004** | **2004** | **0.0** | **2.6** | **2.6** | **CHIN** | **4** | **0** | **4** |
| *10/11/2004* | *2004* | *2.6* | *3.5* | *0.9* | *CHIN* | *0* | 0 | *0* |
| 10/11/2004 | 2004 | 0.0 | 2.6 | 2.6 | CHIN | 0 | 0 | 0 |
| 10/21/2004 | 2004 | 0.0 | 2.6 | 2.6 | CHIN | 0 | 0 | 0 |
| *10/21/2004* | *2004* | *2.6* | *3.5* | *0.9* | *CHIN* | *0* | 0 | *0* |
| 10/28/2004 | 2004 | 0.0 | 2.6 | 2.6 | COHO | - | - | - |
| 11/8/2004 | 2004 | 0.0 | 2.6 | 2.6 | CHUM | - | - | - |

**Table C-5.** Cranberry Creek spawning ground surveys, 1987-2006.

| Date | RunYear | RMLower | RMUpper | Length | Species | Live Count | Dead Count | Total Count |
|---|---|---|---|---|---|---|---|---|
| 9/19/2005 | 2005 | 0.0 | 2.6 | 2.6 | CHIN | 0 | 0 | 0 |
| 9/27/2005 | 2005 | 0.0 | 2.6 | 2.6 | CHIN | 0 | 0 | 0 |
| 10/5/2005 | 2005 | 0.0 | 2.6 | 2.6 | CHIN | 2 | 0 | 2 |
| **10/12/2005** | **2005** | **0.0** | **2.6** | **2.6** | **CHIN** | **6** | **0** | **6** |
| 10/20/2005 | 2005 | 0.0 | 2.6 | 2.6 | CHIN | 0 | 0 | 0 |
| *10/20/2005* | *2005* | *2.6* | *3.5* | *0.9* | *CHIN* | *0* | 0 | *0* |
| 10/27/2005 | 2005 | 0.0 | 2.6 | 2.6 | CHIN | 1 | 0 | 1 |
| 11/4/2005 | 2005 | 0.8 | 2.6 | 1.8 | CHUM | - | - | - |
| 11/4/2005 | 2005 | 0.0 | 0.8 | 0.8 | CHUM | - | - | - |
| 11/14/2005 | 2005 | 0.8 | 2.6 | 1.8 | CHUM | - | - | - |
| 11/14/2005 | 2005 | 0.0 | 0.8 | 0.8 | CHUM | - | - | - |
| | | | | | | | | |
| 9/6/2006 | 2006 | 0.0 | 0.8 | 0.8 | CHIN | 0 | 0 | 0 |
| 9/12/2006 | 2006 | 0.0 | 0.5 | 0.5 | CHUM | - | - | - |
| 9/25/2006 | 2006 | 0.0 | 2.6 | 2.6 | CHIN | 0 | 0 | 0 |
| 10/4/2006 | 2006 | 0.0 | 0.8 | 0.8 | CHIN | 0 | 0 | 0 |
| 10/4/2006 | 2006 | 0.8 | 2.6 | 1.8 | CHIN | 0 | 0 | 0 |
| **10/12/2006** | **2006** | **0.0** | **2.6** | **2.6** | **CHIN** | **1** | **1** | **2** |
| 10/19/2006 | 2006 | 0.0 | 0.8 | 0.8 | COHO | - | - | - |
| 10/19/2006 | 2006 | 0.8 | 2.6 | 1.8 | COHO | - | - | - |
| *10/26/2006* | *2006* | *2.6* | *3.5* | *0.9* | *CHIN* | *0* | *0* | *0* |
| 10/26/2006 | 2006 | 0.0 | 2.6 | 2.6 | CHIN | 0 | 0 | 0 |
| 11/2/2006 | 2006 | 0.0 | 2.6 | 2.6 | COHO | - | - | - |

Source: Spawning Ground Survey Database, 2007.

**Table C-6.** Deer Creek spawning ground surveys, 1987-2006.

| Date | RunYear | RMLower | RMUpper | Length | Species | Live Count | Dead Count | Total Count |
|---|---|---|---|---|---|---|---|---|
| 10/12/1987 | 1987 | 0.3 | 0.5 | 0.2 | CHIN | 0 | 1 | 1 |
| 10/12/1987** | 1987 | 0.0 | 0.3 | 0.3 | CHIN | 1 | 11 | 12 |
| 10/12/1987 | 1987 | 1.0 | 1.1 | 0.1 | CHIN | 9 | 2 | 11 |
| **10/15/1987** | **1987** | **0.0** | **1.3** | **1.3** | **CHIN** | **13** | **7** | **20** |
| 10/29/1987 | 1987 | 0.0 | 1.3 | 1.3 | COHO | - | - | - |
| 11/5/1987 | 1987 | 0.0 | 1.3 | 1.3 | CHIN | 0 | 3 | 3 |
| | | | | | | | | |
| 9/30/1988 | 1988 | 0.0 | 1.3 | 1.3 | CHIN | 6 | 3 | 9 |
| **10/11/1988** | **1988** | **0.0** | **1.3** | **1.3** | **CHIN** | **9** | **4** | **13** |
| 10/11/1988 | 1988 | 0.0 | 1.3 | 1.3 | CHUM | - | - | - |
| 10/11/1988 | 1988 | 0.0 | 1.3 | 1.3 | COHO | - | - | - |
| 10/21/1988 | 1988 | 0.0 | 1.3 | 1.3 | CHUM | - | - | - |
| 10/24/1988** | 1988 | 0.0 | 1.3 | 1.3 | CHUM | - | - | - |
| | | | | | | | | |
| 9/19/1989 | 1989 | 0.0 | 1.3 | 1.3 | CHUM | - | - | - |
| 9/29/1989 | 1989 | 0.0 | 1.3 | 1.3 | CHIN | 11 | 0 | 11 |
| **10/10/1989** | **1989** | **0.0** | **1.3** | **1.3** | **CHIN** | **9** | **3** | **12** |
| 10/17/1989 | 1989 | 0.0 | 1.3 | 1.3 | CHUM | - | - | - |
| 10/25/1989** | 1989 | 0.0 | 1.3 | 1.3 | CHUM | - | - | - |
| 10/30/1989** | 1989 | 0.0 | 1.3 | 1.3 | CHUM | - | - | - |
| 11/8/1989** | 1989 | 0.0 | 1.3 | 1.3 | CHUM | - | - | - |
| 11/14/1989** | 1989 | 0.0 | 1.3 | 1.3 | CHUM | - | - | - |
| | | | | | | | | |
| 9/21/1990 | 1990 | 0.0 | 1.3 | 1.3 | CHUM | - | - | - |
| **10/4/1990** | **1990** | **0.0** | **1.3** | **1.3** | **CHIN** | **33** | **1** | **34** |
| 10/16/1990 | 1990 | 0.0 | 1.3 | 1.3 | CHIN | 20 | 7 | 27 |
| 10/25/1990 | 1990 | 0.3 | 1.3 | 1.0 | CHIN | 0 | 1 | 1 |
| 11/2/1990 | 1990 | 0.0 | 1.3 | 1.3 | CHIN | 0 | 1 | 1 |
| 11/8/1990 | 1990 | 0.2 | 1.3 | 1.1 | COHO | - | - | - |

** Survey conducted by Squaxin Island Indian Tribe.

**Table C-6.** Deer Creek spawning ground surveys, 1987-2006.

| Date | RunYear | RMLower | RMUpper | Length | Species | Live Count | Dead Count | Total Count |
|---|---|---|---|---|---|---|---|---|
| 9/19/1991 | 1991 | 0.0 | 0.6 | 0.6 | CHUM | - | - | - |
| 10/2/1991 | 1991 | 0.0 | 1.3 | 1.3 | CHIN | 20 | 0 | 20 |
| **10/11/1991** | **1991** | **0.0** | **1.3** | **1.3** | **CHIN** | **61** | **7** | **68** |
| 10/22/1991 | 1991 | 0.0 | 1.3 | 1.3 | CHIN | 3 | 5 | 8 |
| 10/31/1991 | 1991 | 0.0 | 1.3 | 1.3 | CHIN | 0 | 3 | 3 |
| 11/7/1991 | 1991 | 0.0 | 1.3 | 1.3 | CHUM | - | - | - |
| | | | | | | | | |
| | | | | | | | | |
| 9/11/1992 | 1992 | 0.0 | 0.5 | 0.5 | CHUM | - | - | - |
| 9/21/1992 | 1992 | 0.0 | 1.3 | 1.3 | CHUM | - | - | - |
| **10/6/1992** | **1992** | **0.0** | **1.3** | **1.3** | **CHIN** | **13** | **0** | **13** |
| 10/14/1992 | 1992 | 0.0 | 1.3 | 1.3 | CHIN | 7 | 4 | 11 |
| 10/20/1992 | 1992 | 0.0 | 1.3 | 1.3 | CHIN | 4 | 3 | 7 |
| 10/28/1992 | 1992 | 0.0 | 1.3 | 1.3 | COHO | - | - | - |
| 11/5/1992 | 1992 | 0.0 | 1.3 | 1.3 | CHUM | - | - | - |
| | | | | | | | | |
| 9/13/1993 | 1993 | 0.0 | 0.7 | 0.7 | CHUM | - | - | - |
| 9/20/1993 | 1993 | 0.0 | 1.3 | 1.3 | CHUM | - | - | - |
| 10/1/1993 | 1993 | 0.0 | 1.3 | 1.3 | CHUM | - | - | - |
| **10/4/1993** | **1993** | **0.0** | **1.3** | **1.3** | **CHIN** | **4** | **0** | **4** |
| 10/11/1993 | 1993 | 0.0 | 1.3 | 1.3 | CHUM | - | - | - |
| 10/20/1993 | 1993 | 0.0 | 1.3 | 1.3 | CHIN | 3 | 1 | 4 |
| 11/1/1993 | 1993 | 0.0 | 1.3 | 1.3 | CHUM | - | - | - |
| 11/12/1993 | 1993 | 0.0 | 1.3 | 1.3 | CHUM | - | - | - |
| | | | | | | | | |
| 9/21/1994 | 1994 | 0.0 | 1.3 | 1.3 | CHUM | - | - | - |
| 10/3/1994 | 1994 | 0.0 | 1.3 | 1.3 | CHUM | - | - | - |
| 10/11/1994 | 1994 | 0.3 | 1.3 | 1.0 | COHO | - | - | - |
| **10/18/1994** | **1994** | **0.0** | **1.3** | **1.3** | **CHIN** | **2** | **1** | **3** |
| 10/28/1994 | 1994 | 0.2 | 1.3 | 1.1 | COHO | - | - | - |
| 11/8/1994 | 1994 | 0.0 | 1.3 | 1.3 | CHUM | - | - | - |

**Table C-6.** Deer Creek spawning ground surveys, 1987-2006.

| Date | RunYear | RMLower | RMUpper | Length | Species | Live Count | Dead Count | Total Count |
|---|---|---|---|---|---|---|---|---|
| 9/12/1995 | 1995 | 0.0 | 1.3 | 1.3 | CHUM | - | - | - |
| 9/27/1995 | 1995 | 0.0 | 1.3 | 1.3 | CHUM | - | - | - |
| 10/12/1995 | 1995 | 0.0 | 1.3 | 1.3 | CHUM | - | - | - |
| 10/20/1995 | 1995 | 0.0 | 1.3 | 1.3 | CHUM | - | - | - |
| 10/31/1995** | 1995 | 0.0 | 0.5 | 0.5 | CHUM | - | - | - |
| 11/2/1995 | 1995 | 0.0 | 1.3 | 1.3 | CHUM | - | - | - |
| | | | | | | | | |
| 9/13/1996 | 1996 | 0.0 | 0.7 | 0.7 | CHUM | - | - | - |
| 9/17/1996 | 1996 | 0.2 | 1.3 | 1.1 | CHUM | - | - | - |
| 9/26/1996 | 1996 | 0.0 | 1.3 | 1.3 | CHUM | - | - | - |
| **10/3/1996** | **1996** | **0.0** | **1.3** | **1.3** | **CHIN** | **1** | **0** | **1** |
| 10/14/1996 | 1996 | 0.3 | 1.3 | 1.0 | CHUM | - | - | - |
| 11/4/1996 | 1996 | 0.0 | 1.3 | 1.3 | CHUM | - | - | - |
| 11/14/1996 | 1996 | 0.0 | 1.3 | 1.3 | CHUM | - | - | - |
| | | | | | | | | |
| 9/26/1997 | 1997 | 0.0 | 1.3 | 1.3 | CHUM | - | - | - |
| 10/9/1997 | 1997 | 0.2 | 1.3 | 1.1 | CHIN | 0 | 1 | 1 |
| 10/13/1997** | 1997 | 0.4 | 0.6 | 0.2 | CHUM | - | - | - |
| **10/13/1997**** | **1997** | **0.0** | **0.4** | **0.4** | **CHIN** | **2** | **0** | **2** |
| 10/13/1997** | 1997 | 0.6 | 4.4 | 3.8 | CHUM | - | - | - |
| 10/20/1997 | 1997 | 0.0 | 1.3 | 1.3 | COHO | - | - | - |
| 10/28/1997 | 1997 | 0.0 | 1.3 | 1.3 | COHO | - | - | - |
| 11/6/1997 | 1997 | 0.0 | 1.3 | 1.3 | CHUM | - | - | - |
| | | | | | | | | |
| 9/8/1998 | 1998 | 0.0 | 1.3 | 1.3 | CHUM | - | - | - |
| 9/16/1998 | 1998 | 0.0 | 1.3 | 1.3 | CHIN | 2 | 0 | 2 |
| 9/25/1998 | 1998 | 0.0 | 1.3 | 1.3 | CHIN | 1 | 0 | 1 |
| 10/2/1998 | 1998 | 0.0 | 1.3 | 1.3 | CHIN | 4 | 0 | 4 |
| 10/15/1998 | 1998 | 0.0 | 1.3 | 1.3 | CHIN | 0 | 1 | 1 |
| 10/22/1998 | 1998 | 0.0 | 1.3 | 1.3 | CHIN | 0 | 1 | 1 |
| **10/29/1998** | **1998** | **0.2** | **1.3** | **1.1** | **CHIN** | **7** | **3** | **10** |

**Table C-6.** Deer Creek spawning ground surveys, 1987-2006.

| Date | RunYear | RMLower | RMUpper | Length | Species | Live Count | Dead Count | Total Count | |
|---|---|---|---|---|---|---|---|---|---|
| 11/5/1998 | 1998 | 0.0 | 1.3 | 1.3 | COHO | - | - | - | |
| 11/12/1998 | 1998 | 0.0 | 1.1 | 1.1 | CHUM | - | - | - | |
| | | | | | | | | | |
| 9/10/1999 | 1999 | 0.0 | 1.3 | 1.3 | CHIN | 1 | 0 | 1 | |
| 9/17/1999 | 1999 | 0.0 | 1.3 | 1.3 | CHUM | - | - | - | |
| **9/29/1999** | **1999** | **0.0** | **1.3** | **1.3** | **CHIN** | **7** | **0** | **7** | |
| 10/5/1999 | 1999 | 0.0 | 1.3 | 1.3 | CHIN | 6 | 0 | 6 | |
| 10/13/1999 | 1999 | 0.1 | 1.3 | 1.2 | CHUM | - | - | - | |
| 10/20/1999 | 1999 | 0.0 | 1.3 | 1.3 | CHUM | - | - | - | |
| 10/27/1999 | 1999 | 0.0 | 1.3 | 1.3 | CHIN | 2 | 0 | 2 | |
| 11/3/1999 | 1999 | 0.3 | 1.3 | 1.0 | CHUM | - | - | - | |
| 11/15/1999 | 1999 | 0.2 | 1.3 | 1.1 | CHUM | - | - | - | |
| | | | | | | | | | |
| 9/6/2000 | 2000 | 0.0 | 1.3 | 1.3 | CHUM | - | - | - | |
| 9/13/2000 | 2000 | 0.0 | 1.3 | 1.3 | CHIN | 0 | 1 | 1 | |
| 9/21/2000 | 2000 | 0.0 | 1.3 | 1.3 | CHIN | 1 | 0 | 1 | |
| **9/29/2000** | **2000** | **0.0** | **1.3** | **1.3** | **CHIN** | **4** | **1** | **5** | |
| 10/6/2000 | 2000 | 0.0 | 1.3 | 1.3 | CHUM | - | - | - | |
| 10/16/2000 | 2000 | 0.0 | 1.3 | 1.3 | CHUM | - | - | - | |
| 10/25/2000 | 2000 | 0.0 | 1.3 | 1.3 | CHUM | - | - | - | |
| 11/2/2000 | 2000 | 0.0 | 1.3 | 1.3 | COHO | - | - | - | |
| 11/14/2000 | 2000 | 0.0 | 1.3 | 1.3 | CHUM | - | - | - | |
| | | | | | | | | | |
| 9/11/2001 | 2001 | 0.0 | 1.3 | 1.3 | CHIN | 4 | 2 | 6 | |
| 9/19/2001 | 2001 | 0.0 | 1.3 | 1.3 | CHIN | 6 | 0 | 6 | |
| 9/27/2001 | 2001 | 0.0 | 1.3 | 1.3 | CHIN | 12 | 1 | 13 | |
| **10/5/2001** | **2001** | **0.0** | **1.3** | **1.3** | **CHIN** | **16** | **0** | **16** | |
| 10/15/2001 | 2001 | 0.0 | 1.3 | 1.3 | CHIN | 1 | 0 | 1 | |
| 10/25/2001 | 2001 | 0.2 | 1.3 | 1.1 | COHO | - | - | - | |
| 11/2/2001 | 2001 | 0.0 | 1.3 | 1.3 | CHUM | - | - | - | |
| 11/9/2001 | 2001 | 0.0 | 1.3 | 1.3 | COHO | - | - | - | |

**Table C-6.** Deer Creek spawning ground surveys, 1987-2006.

| Date | RunYear | RMLower | RMUpper | Length | Species | Live Count | Dead Count | Total Count |
|---|---|---|---|---|---|---|---|---|
| 9/19/2002 | 2002 | 0.0 | 2.6 | 2.6 | CHUM | - | - | - |
| **9/30/2002** | **2002** | **0.0** | **3.5** | **3.5** | **CHIN** | **15** | **1** | **16** |
| 10/8/2002 | 2002 | 0.0 | 2.6 | 2.6 | CHIN | 4 | 1 | 5 |
| *10/8/2002* | *2002* | *2.6* | *3.5* | *0.9* | *CHIN* | *0* | *0* | *0* |
| 10/16/2002 | 2002 | 0.0 | 2.6 | 2.6 | COHO | - | - | - |
| 10/23/2002 | 2002 | 0.0 | 2.6 | 2.6 | COHO | - | - | - |
| 11/1/2002 | 2002 | 0.0 | 2.6 | 2.6 | CHIN | 0 | 1 | 1 |
| 11/8/2002 | 2002 | 0.0 | 2.6 | 2.6 | CHUM | - | - | - |
| | | | | | | | | |
| 9/17/2003 | 2003 | 0.0 | 0.8 | 0.8 | CHIN | 0 | 0 | 0 |
| *9/23/2003* | *2003* | *2.6* | *3.5* | *0.9* | *CHIN* | *0* | 0 | *0* |
| 9/23/2003 | 2003 | 0.0 | 2.6 | 2.6 | CHIN | 0 | 0 | 0 |
| **10/1/2003** | **2003** | **0.0** | **2.6** | **2.6** | **CHIN** | **1** | **1** | **2** |
| *10/8/2003* | *2003* | *2.6* | *3.5* | *0.9* | *CHIN* | *0* | *0* | *0* |
| 10/8/2003 | 2003 | 0.0 | 2.6 | 2.6 | CHIN | 1 | 0 | 1 |
| 10/15/2003 | 2003 | 0.0 | 2.6 | 2.6 | CHIN | 1 | 0 | 1 |
| 10/28/2003 | 2003 | 0.0 | 2.6 | 2.6 | CHUM | - | - | - |
| 11/5/2003 | 2003 | 0.0 | 2.6 | 2.6 | CHUM | - | - | - |
| 11/12/2003 | 2003 | 0.0 | 2.6 | 2.6 | COHO | - | - | - |
| | | | | | | | | |
| 9/8/2004 | 2004 | 0.0 | 0.8 | 0.8 | CHIN | 0 | 0 | 0 |
| 9/14/2004 | 2004 | 0.0 | 0.8 | 0.8 | CHIN | 0 | 0 | 0 |
| 9/22/2004 | 2004 | 0.0 | 2.6 | 2.6 | CHIN | 3 | 0 | 3 |
| **9/28/2004** | **2004** | **0.0** | **2.6** | **2.6** | **CHIN** | **4** | **0** | **4** |
| *10/11/2004* | *2004* | *2.6* | *3.5* | *0.9* | *CHIN* | *0* | 0 | *0* |
| 10/11/2004 | 2004 | 0.0 | 2.6 | 2.6 | CHIN | 0 | 0 | 0 |
| 10/21/2004 | 2004 | 0.0 | 2.6 | 2.6 | CHIN | 0 | 0 | 0 |
| *10/21/2004* | *2004* | *2.6* | *3.5* | *0.9* | *CHIN* | *0* | 0 | *0* |
| 10/28/2004 | 2004 | 0.0 | 2.6 | 2.6 | COHO | - | - | - |
| 11/8/2004 | 2004 | 0.0 | 2.6 | 2.6 | CHUM | - | - | - |

**Table C-6.** Deer Creek spawning ground surveys, 1987-2006.

| Date | RunYear | RMLower | RMUpper | Length | Species | Live Count | Dead Count | Total Count |
|---|---|---|---|---|---|---|---|---|
| 9/19/2005 | 2005 | 0.0 | 2.6 | 2.6 | CHIN | 0 | 0 | 0 |
| 9/27/2005 | 2005 | 0.0 | 2.6 | 2.6 | CHIN | 0 | 0 | 0 |
| 10/5/2005 | 2005 | 0.0 | 2.6 | 2.6 | CHIN | 2 | 0 | 2 |
| **10/12/2005** | **2005** | **0.0** | **2.6** | **2.6** | **CHIN** | **6** | **0** | **6** |
| 10/20/2005 | 2005 | 0.0 | 2.6 | 2.6 | CHIN | 0 | 0 | 0 |
| *10/20/2005* | *2005* | *2.6* | *3.5* | *0.9* | *CHIN* | *0* | 0 | *0* |
| 10/27/2005 | 2005 | 0.0 | 2.6 | 2.6 | CHIN | 1 | 0 | 1 |
| 11/4/2005 | 2005 | 0.8 | 2.6 | 1.8 | CHUM | - | - | - |
| 11/4/2005 | 2005 | 0.0 | 0.8 | 0.8 | CHUM | - | - | - |
| 11/14/2005 | 2005 | 0.8 | 2.6 | 1.8 | CHUM | - | - | - |
| 11/14/2005 | 2005 | 0.0 | 0.8 | 0.8 | CHUM | - | - | - |
| | | | | | | | | |
| 9/6/2006 | 2006 | 0.0 | 0.8 | 0.8 | CHIN | 0 | 0 | 0 |
| 9/12/2006 | 2006 | 0.0 | 0.5 | 0.5 | CHUM | - | - | - |
| 9/25/2006 | 2006 | 0.0 | 2.6 | 2.6 | CHIN | 0 | 0 | 0 |
| 10/4/2006 | 2006 | 0.0 | 0.8 | 0.8 | CHIN | 0 | 0 | 0 |
| 10/4/2006 | 2006 | 0.8 | 2.6 | 1.8 | CHIN | 0 | 0 | 0 |
| **10/12/2006** | **2006** | **0.0** | **2.6** | **2.6** | **CHIN** | **1** | **1** | **2** |
| 10/19/2006 | 2006 | 0.0 | 0.8 | 0.8 | COHO | - | - | - |
| 10/19/2006 | 2006 | 0.8 | 2.6 | 1.8 | COHO | - | - | - |
| *10/26/2006* | *2006* | *2.6* | *3.5* | *0.9* | *CHIN* | *0* | *0* | *0* |
| 10/26/2006 | 2006 | 0.0 | 2.6 | 2.6 | CHIN | 0 | 0 | 0 |
| 11/2/2006 | 2006 | 0.0 | 2.6 | 2.6 | COHO | - | - | - |

Source: Spawning Ground Survey Database, 2007.

**Table C-7.** Goldsborough Creek spawning ground surveys, 1998-2006.

| Date | RunYear | RMLower | RMUpper | Length | Species | Live Count | Dead Count | Total Count |
|---|---|---|---|---|---|---|---|---|
| 9/29/1998 | 1998 | 0.5 | 2.2 | 1.7 | CHIN | 1 | 1 | 2 |
| **10/8/1998** | **1998** | **0.5** | **2.2** | **1.7** | **CHIN** | **8** | **1** | **9** |
| 10/14/1998 | 1998 | 0.5 | 2.2 | 1.7 | CHIN | 2 | 0 | 2 |
| 10/22/1998 | 1998 | 0.5 | 2.2 | 1.7 | CHIN | 2 | 1 | 3 |
| 10/27/1998 | 1998 | 0.5 | 2.2 | 1.7 | CHUM | - | - | - |
| 11/2/1998 | 1998 | 0.7 | 2.2 | 1.5 | CHUM | - | - | - |
| 11/9/1998 | 1998 | 0.5 | 2.2 | 1.7 | CHUM | - | - | - |
| | | | | | | | | |
| 9/28/1999 | 1999 | 0.5 | 2.2 | 1.7 | CHUM | - | - | - |
| 10/5/1999 | 1999 | 0.5 | 2.2 | 1.7 | CHUM | - | - | - |
| **10/13/1999** | **1999** | **0.5** | **2.2** | **1.7** | **CHIN** | **6** | **2** | **8** |
| 10/15/1999** | 1999 | 0.5 | 1.5 | 1.0 | CHIN | 0 | 0 | 0 |
| 10/15/1999** | 1999 | 1.5 | 2.2 | 0.7 | CHUM | - | - | - |
| 10/21/1999 | 1999 | 0.5 | 2.2 | 1.7 | CHUM | - | - | - |
| 10/25/1999** | 1999 | 1.5 | 2.2 | 0.7 | CHIN | 2 | 0 | 2 |
| 10/25/1999** | 1999 | 0.5 | 1.5 | 1.0 | CHUM | - | - | - |
| 11/10/1999** | 1999 | 0.5 | 2.2 | 1.7 | CHUM | - | - | - |
| | | | | | | | | |
| 9/15/2000** | 2000 | 0.5 | 2.2 | 1.7 | CHIN | 2 | 0 | 2 |
| 9/28/2000** | 2000 | 0.5 | 2.2 | 1.7 | CHIN | 1 | 0 | 1 |
| 10/4/2000 | 2000 | 0.8 | 2.2 | 1.4 | CHIN | 0 | 0 | 0 |
| **10/6/2000**** | **2000** | **0.5** | **2.2** | **1.7** | **CHIN** | **14** | **0** | **14** |
| 10/11/2000 | 2000 | 0.5 | 2.2 | 1.7 | CHIN | 7 | 0 | 7 |
| 10/19/2000** | 2000 | 0.5 | 2.2 | 1.7 | COHO | - | - | - |
| 10/19/2000** | 2000 | 0.5 | 2.2 | 1.7 | CHIN | 5 | 0 | 5 |
| 11/3/2000** | 2000 | 0.5 | 2.2 | 1.7 | CHUM | - | - | - |
| 11/15/2000** | 2000 | 0.5 | 2.2 | 1.7 | COHO | - | - | - |

** Survey conducted by R2 Resource Consultants

**Table C-7.** Goldsborough Creek spawning ground surveys, 1998-2006.

| Date | RunYear | RMLower | RMUpper | Length | Species | Live Count | Dead Count | Total Count |
|---|---|---|---|---|---|---|---|---|
| 8/27/2001** | 2001 | 0.5 | 2.3 | 1.8 | CHUM | - | - | - |
| 9/4/2001 | 2001 | 0.5 | 2.2 | 1.7 | CHUM | - | - | - |
| 9/10/2001** | 2001 | 0.5 | 2.3 | 1.8 | CHIN | 3 | 1 | 4 |
| 9/17/2001 | 2001 | 0.5 | 2.2 | 1.7 | CHIN | 3 | 0 | 3 |
| 9/25/2001** | 2001 | 0.5 | 2.3 | 1.8 | CHIN | 4 | 0 | 4 |
| 9/27/2001 | 2001 | 0.5 | 2.2 | 1.7 | CHIN | 8 | 0 | 8 |
| **10/9/2001** | **2001** | **0.5** | **2.2** | **1.7** | **CHIN** | **9** | **0** | **9** |
| *10/11/2001*** | *2001* | *2.3* | *3.4* | *1.1* | *CHIN* | *1* | 0 | *1* |
| 10/11/2001** | 2001 | 0.5 | 2.3 | 1.8 | CHIN | 3 | 0 | 3 |
| 10/18/2001 | 2001 | 0.5 | 2.2 | 1.7 | CHIN | 1 | 0 | 1 |
| 10/25/2001** | 2001 | 0.5 | 2.3 | 1.8 | CHUM | - | - | - |
| | | | | | | | | |
| 8/28/2002 | 2002 | 0.5 | 2.2 | 1.7 | CHUM | - | - | - |
| 9/11/2002 | 2002 | 0.5 | 2.2 | 1.7 | CHUM | - | - | - |
| 9/20/2002 | 2002 | 0.5 | 2.2 | 1.7 | CHIN | 0 | 0 | 0 |
| 9/30/2002 | 2002 | 0.5 | 2.2 | 1.7 | CHIN | 2 | 0 | 2 |
| 10/3/2002 | 2002 | 0.5 | 2.2 | 1.7 | CHIN | 0 | 1 | 1 |
| 10/10/2002 | 2002 | 0.5 | 2.2 | 1.7 | CHIN | 1 | 0 | 1 |
| **10/14/2002** | **2002** | **0.5** | **2.2** | **1.7** | **CHIN** | **5** | **1** | **6** |
| 10/17/2002 | 2002 | 0.5 | 2.2 | 1.7 | CHIN | 0 | 1 | 1 |
| 10/24/2002 | 2002 | 0.5 | 2.2 | 1.7 | CHUM | - | - | - |
| 10/28/2002 | 2002 | 0.5 | 2.2 | 1.7 | COHO | - | - | - |
| 10/31/2002 | 2002 | 0.5 | 2.2 | 1.7 | COHO | - | - | - |
| 11/6/2002 | 2002 | 0.5 | 2.2 | 1.7 | COHO | - | - | - |
| 11/11/2002 | 2002 | 0.5 | 2.2 | 1.7 | CHUM | - | - | - |
| | | | | | | | | |
| 9/9/2003 | 2003 | 0.5 | 2.2 | 1.7 | CHIN | 0 | 0 | 0 |
| 9/22/2003 | 2003 | 0.5 | 2.2 | 1.7 | CHIN | 0 | 0 | 0 |
| **9/29/2003** | **2003** | **0.5** | **2.2** | **1.7** | **CHIN** | **1** | **0** | **1** |
| 10/8/2003 | 2003 | 0.5 | 2.2 | 1.7 | CHIN | 0 | 0 | 0 |

** Survey conducted by R2 Resource Consultants

**Table C-7.** Goldsborough Creek spawning ground surveys, 1998-2006.

| Date | RunYear | RMLower | RMUpper | Length | Species | Live Count | Dead Count | Total Count |
|---|---|---|---|---|---|---|---|---|
| 10/15/2003 | 2003 | 0.5 | 2.2 | 1.7 | COHO | - | - | - |
| 10/29/2003 | 2003 | 0.5 | 2.2 | 1.7 | COHO | - | - | - |
| 11/6/2003 | 2003 | 0.5 | 2.2 | 1.7 | COHO | - | - | - |
| | | | | | | | | |
| 9/7/2004 | 2004 | 0.5 | 2.2 | 1.7 | CHIN | 0 | 0 | 0 |
| 9/21/2004 | 2004 | 0.5 | 2.2 | 1.7 | CHIN | 1 | 0 | 1 |
| **10/6/2004** | **2004** | **0.5** | **2.2** | **1.7** | **CHIN** | **3** | **0** | **3** |
| 10/21/2004 | 2004 | 0.5 | 2.2 | 1.7 | CHIN | 0 | 0 | 0 |
| 10/28/2004 | 2004 | 0.5 | 2.2 | 1.7 | COHO | - | - | - |
| 11/8/2004 | 2004 | 0.5 | 2.2 | 1.7 | COHO | - | - | - |
| | | | | | | | | |
| 9/7/2005 | 2005 | 0.5 | 2.2 | 1.7 | CHIN | 0 | 0 | 0 |
| 9/13/2005 | 2005 | 0.5 | 2.2 | 1.7 | CHIN | 0 | 0 | 0 |
| 9/19/2005 | 2005 | 0.5 | 2.2 | 1.7 | CHIN | 0 | 0 | 0 |
| **9/28/2005** | **2005** | **0.5** | **2.2** | **1.7** | **CHIN** | **2** | **0** | **2** |
| 10/6/2005 | 2005 | 0.5 | 2.2 | 1.7 | CHIN | 0 | 0 | 0 |
| 10/17/2005 | 2005 | 0.5 | 2.2 | 1.7 | CHIN | 0 | 0 | 0 |
| 10/25/2005 | 2005 | 0.5 | 2.2 | 1.7 | COHO | - | - | - |
| | | | | | | | | |
| **9/6/2006** | **2006** | **0.5** | **2.2** | **1.7** | **CHIN** | **0** | **0** | **0** |
| 9/12/2006 | 2006 | 0.5 | 2.2 | 1.7 | CHIN | 0 | 0 | 0 |
| 9/20/2006 | 2006 | 0.5 | 2.2 | 1.7 | CHIN | 0 | 0 | 0 |
| 9/26/2006 | 2006 | 0.5 | 2.2 | 1.7 | CHIN | 0 | 0 | 0 |
| 10/4/2006 | 2006 | 0.5 | 2.2 | 1.7 | CHIN | 0 | 0 | 0 |
| 10/13/2006 | 2006 | 0.5 | 2.2 | 1.7 | CHIN | 0 | 0 | 0 |
| 10/20/2006 | 2006 | 0.5 | 2.2 | 1.7 | CHIN | 0 | 0 | 0 |
| 10/27/2006 | 2006 | 0.5 | 2.2 | 1.7 | CHUM | - | - | - |
| 11/1/2006 | 2006 | 0.5 | 2.2 | 1.7 | COHO | - | - | - |

Source: Spawning Ground Survey Database, 2007.

**Table C-8.** Johns Creek spawning ground surveys, 1987-2006.

| Date | RunYear | RMLower | RMUpper | Length | Species | Live Count | Dead Count | Total Count |
|---|---|---|---|---|---|---|---|---|
| 9/8/1987** | 1987 | 0.0 | 0.4 | 0.4 | COHO | - | - | - |
| 9/15/1987** | 1987 | 0.0 | 0.4 | 0.4 | CHUM | - | - | - |
| 9/22/1987** | 1987 | 0.0 | 0.4 | 0.4 | CHUM | - | - | - |
| 9/30/1987** | 1987 | 0.0 | 0.4 | 0.4 | CHUM | - | - | - |
| 10/15/1987 | 1987 | 0.0 | 0.4 | 0.4 | CHUM | - | - | - |
| 10/30/1987 | 1987 | 0.0 | 1.6 | 1.6 | CHUM | - | - | - |
| 11/2/1987** | 1987 | 0.0 | 1.8 | 1.8 | COHO | - | - | - |
| 11/11/1987** | 1987 | 0.0 | 0.4 | 0.4 | CHUM | - | - | - |
| | | | | | | | | |
| 9/8/1988 | 1988 | 0.0 | 0.3 | 0.3 | CHUM | - | - | - |
| 9/30/1988 | 1988 | 0.0 | 1.6 | 1.6 | COHO | - | - | - |
| 9/30/1988 | 1988 | 1.6 | 1.7 | 0.1 | CHUM | - | - | - |
| **10/11/1988** | **1988** | **0.0** | **1.6** | **1.6** | **CHIN** | **1** | **0** | **1** |
| 10/21/1988 | 1988 | 0.0 | 0.4 | 0.4 | CHUM | - | - | - |
| 10/21/1988 | 1988 | 0.4 | 1.6 | 1.2 | CHUM | - | - | - |
| 11/4/1988 | 1988 | 0.0 | 1.6 | 1.6 | CHUM | - | - | - |
| 11/15/1988 | 1988 | 0.0 | 1.6 | 1.6 | CHUM | - | - | - |
| | | | | | | | | |
| 9/19/1989 | 1989 | 0.0 | 0.4 | 0.4 | CHUM | - | - | - |
| 9/29/1989 | 1989 | 0.0 | 0.4 | 0.4 | CHIN | 3 | 0 | 3 |
| 9/29/1989 | 1989 | 0.0 | 1.6 | 1.6 | CHUM | - | - | - |
| 10/10/1989 | 1989 | 0.0 | 0.4 | 0.4 | CHIN | 6 | 0 | 6 |
| **10/17/1989** | **1989** | **0.0** | **1.6** | **1.6** | **CHIN** | **2** | **11** | **13** |
| 10/25/1989** | 1989 | 0.4 | 1.6 | 1.2 | CHIN | 0 | 10 | 10 |
| 10/25/1989** | 1989 | 0.0 | 0.4 | 0.4 | CHUM | - | - | - |
| 11/3/1989** | 1989 | 0.4 | 1.6 | 1.2 | CHUM | - | - | - |
| 11/3/1989** | 1989 | 0.0 | 0.4 | 0.4 | CHUM | - | - | - |
| 11/10/1989** | 1989 | 0.4 | 1.6 | 1.2 | CHUM | - | - | - |
| 11/10/1989** | 1989 | 0.0 | 0.4 | 0.4 | CHUM | - | - | - |

** Survey conducted by Squaxin Island Indian Tribe.

**Table C-8.** Johns Creek spawning ground surveys, 1987-2006.

| Date | RunYear | RMLower | RMUpper | Length | Species | Live_Count | Dead_Count | Total_Count |
|---|---|---|---|---|---|---|---|---|
| 9/21/1990 | 1990 | 0.0 | 0.4 | 0.4 | CHUM | - | - | - |
| 10/4/1990 | 1990 | 0.0 | 0.4 | 0.4 | CHUM | - | - | - |
| 10/4/1990 | 1990 | 0.0 | 0.0 | 0.0 | CHIN | 6 | 3 | 9 |
| 10/16/1990 | 1990 | 0.0 | 0.4 | 0.4 | CHIN | 0 | 1 | 1 |
| 10/19/1990 | 1990 | 0.0 | 0.4 | 0.4 | CHUM | - | - | - |
| 10/19/1990 | 1990 | 0.4 | 1.8 | 1.4 | CHUM | - | - | - |
| **10/30/1990** | **1990** | **0.0** | **0.4** | **0.4** | **CHIN** | **0** | **3** | **3** |
| **10/30/1990** | **1990** | **0.4** | **1.8** | **1.4** | **CHIN** | **0** | **18** | **18** |
| 11/8/1990 | 1990 | 0.0 | 0.4 | 0.4 | CHUM | - | - | - |
| 11/8/1990 | 1990 | 0.4 | 1.8 | 1.4 | CHUM | - | - | - |
| 11/15/1990 | 1990 | 0.0 | 0.4 | 0.4 | CHUM | - | - | - |
| 11/15/1990 | 1990 | 0.4 | 1.8 | 1.4 | CHUM | - | - | - |
| | | | | | | | | |
| 9/18/1991 | 1991 | 0.0 | 0.4 | 0.4 | CHUM | - | - | - |
| 10/2/1991 | 1991 | 0.0 | 0.4 | 0.4 | CHIN | 1 | 0 | 1 |
| 10/11/1991 | 1991 | 0.0 | 0.4 | 0.4 | CHIN | 8 | 7 | 15 |
| **10/22/1991** | **1991** | **0.0** | **0.4** | **0.4** | **CHIN** | **3** | **19** | **22** |
| 10/31/1991 | 1991 | 0.0 | 0.6 | 0.6 | CHIN | 0 | 2 | 2 |
| 11/7/1991 | 1991 | 0.0 | 1.6 | 1.6 | CHUM | - | - | - |
| | | | | | | | | |
| 9/11/1992 | 1992 | 0.0 | 0.7 | 0.7 | CHUM | - | - | - |
| 9/21/1992 | 1992 | 0.0 | 1.6 | 1.6 | CHUM | - | - | - |
| 10/2/1992 | 1992 | 0.0 | 1.6 | 1.6 | CHIN | 4 | 7 | 11 |
| 10/9/1992 | 1992 | 0.0 | 1.6 | 1.6 | CHIN | 5 | 1 | 6 |
| 10/19/1992 | 1992 | 0.0 | 1.6 | 1.6 | CHIN | 2 | 9 | 11 |
| **10/28/1992** | **1992** | **0.0** | **1.6** | **1.6** | **CHIN** | **1** | **13** | **14** |
| 11/5/1992 | 1992 | 0.0 | 1.6 | 1.6 | CHUM | - | - | - |
| | | | | | | | | |
| 9/1/1993 | 1993 | 0.0 | 0.5 | 0.5 | CHUM | - | - | - |
| 9/13/1993 | 1993 | 0.0 | 0.4 | 0.4 | CHUM | - | - | - |
| 9/20/1993 | 1993 | 0.0 | 1.6 | 1.6 | CHIN | 0 | 1 | 1 |
| 10/4/1993 | 1993 | 0.0 | 1.6 | 1.6 | CHIN | 0 | 2 | 2 |

**Table C-8.** Johns Creek spawning ground surveys, 1987-2006.

| Date | RunYear | RMLower | RMUpper | Length | Species | Live_Count | Dead_Count | Total_Count |
|---|---|---|---|---|---|---|---|---|
| **10/11/1993** | **1993** | **0.0** | **1.6** | **1.6** | **CHIN** | **4** | **1** | **5** |
| 10/20/1993 | 1993 | 0.0 | 1.6 | 1.6 | CHUM | - | - | - |
| 11/1/1993 | 1993 | 0.0 | 1.6 | 1.6 | CHUM | - | - | - |
| 11/10/1993 | 1993 | 0.0 | 1.8 | 1.8 | CHUM | - | - | - |
| | | | | | | | | |
| 9/14/1994 | 1994 | 0.0 | 1.8 | 1.8 | CHUM | - | - | - |
| 9/21/1994 | 1994 | 0.0 | 1.8 | 1.8 | CHUM | - | - | - |
| 10/3/1994 | 1994 | 0.0 | 1.8 | 1.8 | CHUM | - | - | - |
| 10/11/1994 | 1994 | 0.0 | 1.8 | 1.8 | CHUM | - | - | - |
| 10/18/1994 | 1994 | 0.0 | 1.8 | 1.8 | CHUM | - | - | - |
| 10/28/1994 | 1994 | 0.0 | 1.8 | 1.8 | CHUM | - | - | - |
| 11/8/1994 | 1994 | 0.0 | 1.8 | 1.8 | CHUM | - | - | - |
| | | | | | | | | |
| 8/30/1995 | 1995 | 0.0 | 0.4 | 0.4 | CHUM | - | - | - |
| 9/13/1995 | 1995 | 0.0 | 0.4 | 0.4 | CHUM | - | - | - |
| **9/27/1995** | **1995** | **0.0** | **1.8** | **1.8** | **CHIN** | **6** | **0** | **6** |
| 10/12/1995 | 1995 | 0.0 | 1.8 | 1.8 | CHUM | - | - | - |
| 10/20/1995 | 1995 | 0.0 | 1.8 | 1.8 | CHUM | - | - | - |
| 10/30/1995 | 1995 | 0.0 | 1.6 | 1.6 | CHUM | - | - | - |
| 11/2/1995 | 1995 | 0.0 | 1.8 | 1.8 | CHUM | - | - | - |
| | | | | | | | | |
| 9/3/1996 | 1996 | 0.0 | 0.4 | 0.4 | CHUM | - | - | - |
| 9/13/1996 | 1996 | 0.0 | 0.2 | 0.2 | CHUM | - | - | - |
| 9/17/1996 | 1996 | 0.0 | 1.8 | 1.8 | CHUM | - | - | - |
| 9/26/1996 | 1996 | 0.0 | 1.8 | 1.8 | CHUM | - | - | - |
| **10/3/1996** | **1996** | **0.0** | **1.8** | **1.8** | **CHIN** | **1** | **1** | **2** |
| 10/14/1996 | 1996 | 0.0 | 1.8 | 1.8 | CHUM | - | - | - |
| 10/28/1996 | 1996 | 0.0 | 1.8 | 1.8 | CHUM | - | - | - |
| 11/8/1996 | 1996 | 0.0 | 1.8 | 1.8 | CHUM | - | - | - |

**Table C-8.** Johns Creek spawning ground surveys, 1987-2006.

| Date | RunYear | RMLower | RMUpper | Length | Species | Live_Count | Dead_Count | Total_Count |
|---|---|---|---|---|---|---|---|---|
| 9/29/1997 | 1997 | 0.0 | 1.8 | 1.8 | CHUM | - | - | - |
| **10/9/1997** | **1997** | **0.0** | **1.8** | **1.8** | **CHIN** | **2** | **0** | **2** |
| 10/21/1997 | 1997 | 0.0 | 1.8 | 1.8 | COHO | - | - | - |
| 10/29/1997 | 1997 | 0.0 | 1.8 | 1.8 | CHUM | - | - | - |
| 11/12/1997 | 1997 | 0.0 | 1.8 | 1.8 | CHUM | - | - | - |
| | | | | | | | | |
| 9/11/1998 | 1998 | 0.0 | 0.4 | 0.4 | CHUM | - | - | - |
| 9/18/1998 | 1998 | 0.0 | 1.8 | 1.8 | CHUM | - | - | - |
| 10/2/1998 | 1998 | 0.0 | 1.8 | 1.8 | CHUM | - | - | - |
| 10/15/1998 | 1998 | 0.0 | 1.8 | 1.8 | CHUM | - | - | - |
| 10/23/1998 | 1998 | 0.0 | 1.8 | 1.8 | CHUM | - | - | - |
| 11/2/1998 | 1998 | 0.0 | 1.8 | 1.8 | CHUM | - | - | - |
| 11/9/1998 | 1998 | 0.0 | 1.8 | 1.8 | CHUM | - | - | - |
| | | | | | | | | |
| 9/1/1999 | 1999 | 0.0 | 0.4 | 0.4 | CHUM | - | - | - |
| 9/10/1999 | 1999 | 0.0 | 1.8 | 1.8 | CHUM | - | - | - |
| 9/17/1999 | 1999 | 0.0 | 1.8 | 1.8 | CHUM | - | - | - |
| 9/28/1999 | 1999 | 0.0 | 1.8 | 1.8 | CHUM | - | - | - |
| 10/6/1999 | 1999 | 0.0 | 1.8 | 1.8 | CHUM | - | - | - |
| 10/13/1999 | 1999 | 0.0 | 1.8 | 1.8 | CHUM | - | - | - |
| 10/20/1999 | 1999 | 0.0 | 1.8 | 1.8 | CHUM | - | - | - |
| 10/27/1999 | 1999 | 0.0 | 1.8 | 1.8 | CHUM | - | - | - |
| 11/3/1999 | 1999 | 0.0 | 1.8 | 1.8 | CHUM | - | - | - |
| 11/15/1999 | 1999 | 0.0 | 1.8 | 1.8 | CHUM | - | - | - |
| | | | | | | | | |
| 9/5/2000 | 2000 | 0.0 | 1.8 | 1.8 | CHUM | - | - | - |
| 9/12/2000 | 2000 | 0.0 | 1.8 | 1.8 | CHUM | - | - | - |
| 9/21/2000 | 2000 | 0.0 | 1.8 | 1.8 | CHUM | - | - | - |
| 9/29/2000 | 2000 | 0.0 | 1.8 | 1.8 | CHUM | - | - | - |
| **10/6/2000** | **2000** | **0.0** | **1.8** | **1.8** | **CHIN** | **2** | **0** | **2** |
| 10/16/2000 | 2000 | 0.0 | 1.8 | 1.8 | COHO | - | - | - |
| 10/25/2000 | 2000 | 0.0 | 1.8 | 1.8 | CHUM | - | - | - |

**Table C-8.** Johns Creek spawning ground surveys, 1987-2006.

| Date | RunYear | RMLower | RMUpper | Length | Species | Live_Count | Dead_Count | Total_Count |
|---|---|---|---|---|---|---|---|---|
| 11/2/2000 | 2000 | 0.0 | 1.8 | 1.8 | CHUM | - | - | - |
| 11/14/2000 | 2000 | 0.0 | 1.8 | 1.8 | CHUM | - | - | - |
| | | | | | | | | |
| 9/4/2001 | 2001 | 0.0 | 0.5 | 0.5 | CHUM | - | - | - |
| 9/12/2001 | 2001 | 0.0 | 0.4 | 0.4 | CHUM | - | - | - |
| 9/19/2001 | 2001 | 0.0 | 0.4 | 0.4 | CHUM | - | - | - |
| **9/28/2001** | **2001** | **0.0** | **1.8** | **1.8** | **CHIN** | **1** | | **1** |
| 10/8/2001 | 2001 | 0.0 | 1.8 | 1.8 | CHUM | - | - | - |
| 10/17/2001 | 2001 | 0.0 | 1.8 | 1.8 | CHIN | 1 | | 1 |
| 10/25/2001 | 2001 | 0.0 | 1.8 | 1.8 | COHO | - | - | - |
| 11/2/2001 | 2001 | 0.0 | 1.8 | 1.8 | CHUM | - | - | - |
| 11/11/2001 | 2001 | 0.0 | 1.8 | 1.8 | CHUM | - | - | - |
| | | | | | | | | |
| 9/10/2002 | 2002 | 0.0 | 1.8 | 1.8 | CHUM | - | - | - |
| 9/20/2002 | 2002 | 0.0 | 1.8 | 1.8 | CHUM | - | - | - |
| 9/30/2002 | 2002 | 0.0 | 1.8 | 1.8 | CHUM | - | - | - |
| 10/7/2002 | 2002 | 0.0 | 1.8 | 1.8 | CHUM | - | - | - |
| 10/16/2002 | 2002 | 0.0 | 1.8 | 1.8 | CHUM | - | - | - |
| 10/24/2002 | 2002 | 0.0 | 1.8 | 1.8 | COHO | - | - | - |
| 11/1/2002 | 2002 | 0.0 | 1.8 | 1.8 | COHO | - | - | - |
| 11/8/2002 | 2002 | 0.0 | 1.8 | 1.8 | CHUM | - | - | - |
| 11/15/2002 | 2002 | 0.0 | 1.8 | 1.8 | CHUM | - | - | - |
| | | | | | | | | |
| 9/8/2003 | 2003 | 0.0 | 1.8 | 1.8 | CHUM | - | - | - |
| 9/23/2003 | 2003 | 0.0 | 1.8 | 1.8 | CHUM | - | - | - |
| 10/1/2003 | 2003 | 0.0 | 1.8 | 1.8 | CHUM | - | - | - |
| 10/9/2003 | 2003 | 0.0 | 1.8 | 1.8 | CHUM | - | - | - |
| 10/24/2003 | 2003 | 0.0 | 1.8 | 1.8 | CHUM | - | - | - |
| 10/31/2003 | 2003 | 0.0 | 1.8 | 1.8 | CHUM | - | - | - |
| 11/7/2003 | 2003 | 0.0 | 1.8 | 1.8 | CHUM | - | - | - |
| 11/14/2003 | 2003 | 0.0 | 1.8 | 1.8 | COHO | - | - | - |

**Table C-8.** Johns Creek spawning ground surveys, 1987-2006.

| Date | RunYear | RMLower | RMUpper | Length | Species | Live_Count | Dead_Count | Total_Count |
|---|---|---|---|---|---|---|---|---|
| 9/1/2004 | 2004 | 0.0 | 1.8 | 1.8 | CHUM | - | - | - |
| 9/8/2004 | 2004 | 0.0 | 1.8 | 1.8 | CHUM | - | - | - |
| 9/14/2004 | 2004 | 0.0 | 1.8 | 1.8 | CHUM | - | - | - |
| 9/22/2004 | 2004 | 0.0 | 1.8 | 1.8 | COHO | - | - | - |
| **9/30/2004** | **2004** | **0.0** | **1.8** | **1.8** | **CHIN** | **0** | **0** | **0** |
| 10/7/2004 | 2004 | 0.0 | 1.8 | 1.8 | CHIN | 0 | 0 | 0 |
| 10/14/2004 | 2004 | 0.0 | 1.8 | 1.8 | CHIN | 0 | 0 | 0 |
| 10/21/2004 | 2004 | 0.0 | 1.8 | 1.8 | CHUM | - | - | - |
| 10/29/2004 | 2004 | 0.0 | 1.8 | 1.8 | COHO | - | - | - |
| 11/4/2004 | 2004 | 0.0 | 1.8 | 1.8 | CHUM | 0 | 0 | 0 |
| | | | | | | | | |
| 9/8/2005 | 2005 | 0.0 | 0.8 | 0.8 | CHIN | 0 | 0 | 0 |
| 9/13/2005 | 2005 | 0.0 | 1.8 | 1.8 | CHIN | 0 | 0 | 0 |
| 9/20/2005 | 2005 | 0.0 | 1.8 | 1.8 | CHUM | - | - | - |
| 9/27/2005 | 2005 | 0.0 | 1.8 | 1.8 | CHIN | 0 | 0 | 0 |
| 10/5/2005 | 2005 | 0.0 | 1.8 | 1.8 | CHIN | 0 | 0 | 0 |
| **10/12/2005** | **2005** | **0.0** | **1.8** | **1.8** | **CHIN** | **1** | **0** | **1** |
| 10/20/2005 | 2005 | 0.0 | 1.8 | 1.8 | CHIN | 0 | 0 | 0 |
| 10/27/2005 | 2005 | 0.0 | 1.8 | 1.8 | CHUM | - | - | - |
| 11/4/2005 | 2005 | 0.0 | 1.8 | 1.8 | CHUM | - | - | - |
| 11/14/2005 | 2005 | 0.0 | 1.8 | 1.8 | COHO | - | - | - |
| | | | | | | | | |
| **9/6/2006** | **2006** | **0.0** | **0.6** | **0.6** | **CHIN** | **0** | **0** | **0** |
| 9/12/2006 | 2006 | 0.0 | 1.8 | 1.8 | CHUM | - | - | - |
| 9/19/2006 | 2006 | 0.0 | 0.8 | 0.8 | CHUM | - | - | - |
| 9/21/2006 | 2006 | 0.0 | 1.8 | 1.8 | CHUM | - | - | - |
| 9/29/2006 | 2006 | 0.0 | 1.8 | 1.8 | CHUM | - | - | - |
| 10/9/2006 | 2006 | 0.0 | 1.8 | 1.8 | COHO | - | - | - |
| 10/18/2006 | 2006 | 0.0 | 1.8 | 1.8 | CHUM | - | - | - |
| 10/26/2006 | 2006 | 0.0 | 1.8 | 1.8 | COHO | - | - | - |
| 11/1/2006 | 2006 | 0.0 | 1.8 | 1.8 | CHUM | - | - | - |

Source: Spawning Ground Survey Database, 2007.

**Table C-9.** Sherwood Creek spawning ground surveys, 1987-2006.

| Date | RunYear | RMLower | RMUpper | Length | Species | Live Count | Dead Count | Total Count |
|---|---|---|---|---|---|---|---|---|
| **10/15/1987** | **1987** | **0.0** | **0.7** | **0.7** | **CHIN** | **3** | **8** | **11** |
| 10/29/1987 | 1987 | 0.0 | 0.7 | 0.7 | CHIN | 0 | 2 | 2 |
| 11/3/1987 | 1987 | 0.0 | 0.7 | 0.7 | COHO | - | - | - |
| 11/9/1987** | 1987 | 0.1 | 0.7 | 0.6 | COHO | - | - | - |
| | | | | | | | | |
| 9/19/1988 | 1988 | 0.0 | 0.7 | 0.7 | COHO | - | - | - |
| 9/28/1988 | 1988 | 0.0 | 0.7 | 0.7 | CHIN | 1 | 0 | 1 |
| **10/6/1988** | **1988** | **0.0** | **0.7** | **0.7** | **CHIN** | **5** | **2** | **7** |
| 10/18/1988 | 1988 | 0.0 | 0.7 | 0.7 | COHO | - | - | - |
| 10/27/1988 | 1988 | 0.0 | 0.7 | 0.7 | CHIN | 0 | 1 | 1 |
| 11/4/1988** | 1988 | 0.0 | 0.7 | 0.7 | CHUM | - | - | - |
| | | | | | | | | |
| 9/27/1989 | 1989 | 0.0 | 0.7 | 0.7 | CHIN | 2 | 0 | 2 |
| **10/10/1989** | **1989** | **0.0** | **0.7** | **0.7** | **CHIN** | **11** | **1** | **12** |
| 10/17/1989 | 1989 | 0.0 | 0.7 | 0.7 | CHUM | - | - | - |
| 10/25/1989 | 1989 | 0.0 | 0.7 | 0.7 | CHUM | - | - | - |
| 11/1/1989 | 1989 | 0.0 | 0.7 | 0.7 | CHUM | - | - | - |
| 11/3/1989** | 1989 | 0.0 | 0.7 | 0.7 | CHUM | - | - | - |
| 11/10/1989** | 1989 | 0.0 | 0.7 | 0.7 | CHUM | - | - | - |
| 11/13/1989 | 1989 | 0.0 | 0.7 | 0.7 | CHUM | - | - | - |
| | | | | | | | | |
| 9/21/1990 | 1990 | 0.0 | 0.7 | 0.7 | CHUM | - | - | - |
| **10/4/1990** | **1990** | **0.0** | **3.5** | **3.5** | **CHIN** | **28** | **0** | **28** |
| 10/16/1990 | 1990 | 0.0 | 0.7 | 0.7 | CHIN | 6 | 5 | 11 |
| 10/25/1990 | 1990 | 0.1 | 0.7 | 0.6 | CHIN | 0 | 1 | 1 |
| 11/2/1990 | 1990 | 0.0 | 1.3 | 1.3 | COHO | - | - | - |
| 11/8/1990 | 1990 | 0.3 | 0.7 | 0.4 | COHO | - | - | - |
| 11/15/1990 | 1990 | 0.0 | 0.7 | 0.7 | COHO | - | - | - |

** Survey conducted by Squaxin Island Indian Tribe.

**Table C-9.** Sherwood Creek spawning ground surveys, 1987-2006.

| Date | RunYear | RMLower | RMUpper | Length | Species | Live Count | Dead Count | Total Count |
|---|---|---|---|---|---|---|---|---|
| 9/19/1991 | 1991 | 0.0 | 0.7 | 0.7 | CHUM | - | - | - |
| 10/2/1991 | 1991 | 0.0 | 0.7 | 0.7 | CHIN | 5 | 2 | 7 |
| **10/11/1991** | **1991** | **0.2** | **0.7** | **0.5** | **CHIN** | **21** | **7** | **28** |
| 10/22/1991 | 1991 | 0.0 | 0.7 | 0.7 | CHIN | 3 | 17 | 20 |
| 10/31/1991 | 1991 | 0.0 | 0.7 | 0.7 | CHIN | 2 | 8 | 10 |
| 11/4/1991 | 1991 | 0.0 | 0.7 | 0.7 | CHIN | 0 | 2 | 2 |
| 11/7/1991 | 1991 | 0.0 | 0.7 | 0.7 | COHO | - | - | - |
| 11/12/1991 | 1991 | 0.0 | 0.7 | 0.7 | COHO | - | - | - |
| | | | | | | | | |
| 9/11/1992 | 1992 | 0.0 | 0.7 | 0.7 | CHUM | - | - | - |
| 9/21/1992 | 1992 | 0.0 | 0.7 | 0.7 | CHUM | - | - | - |
| 10/2/1992 | 1992 | 0.0 | 0.7 | 0.7 | CHIN | 3 | 1 | 4 |
| 10/9/1992 | 1992 | 0.0 | 0.7 | 0.7 | CHIN | 0 | 1 | 1 |
| **10/19/1992** | **1992** | **0.0** | **0.7** | **0.7** | **CHIN** | **4** | **2** | **6** |
| 10/28/1992 | 1992 | 0.0 | 0.7 | 0.7 | CHIN | 0 | 5 | 5 |
| 11/5/1992 | 1992 | 0.0 | 0.7 | 0.7 | CHUM | - | - | - |
| | | | | | | | | |
| 9/1/1993 | 1993 | 0.0 | 0.7 | 0.7 | CHUM | - | - | - |
| 9/13/1993 | 1993 | 0.0 | 0.7 | 0.7 | CHUM | - | - | - |
| 9/20/1993 | 1993 | 0.0 | 0.7 | 0.7 | CHUM | - | - | - |
| **10/4/1993** | **1993** | **0.0** | **0.7** | **0.7** | **CHIN** | **2** | **0** | **2** |
| 10/11/1993 | 1993 | 0.0 | 0.7 | 0.7 | CHIN | 0 | 2 | 2 |
| 10/20/1993 | 1993 | 0.0 | 0.7 | 0.7 | CHIN | 0 | 1 | 1 |
| 11/1/1993 | 1993 | 0.0 | 0.7 | 0.7 | CHUM | - | - | - |
| 11/12/1993 | 1993 | 0.0 | 0.7 | 0.7 | COHO | - | - | - |

**Table C-9.** Sherwood Creek spawning ground surveys, 1987-2006.

| Date | RunYear | RMLower | RMUpper | Length | Species | Live Count | Dead Count | Total Count |
|---|---|---|---|---|---|---|---|---|
| 9/22/1994 | 1994 | 0.0 | 0.7 | 0.7 | CHUM | - | - | - |
| 10/3/1994 | 1994 | 0.0 | 0.7 | 0.7 | CHIN | 3 | 2 | 5 |
| **10/11/1994** | **1994** | **0.0** | **0.7** | **0.7** | **CHIN** | **9** | **2** | **11** |
| 10/18/1994 | 1994 | 0.0 | 0.7 | 0.7 | CHIN | 3 | 2 | 5 |
| 10/28/1994 | 1994 | 0.0 | 0.7 | 0.7 | COHO | - | - | - |
| 11/8/1994 | 1994 | 0.0 | 0.7 | 0.7 | CHUM | - | - | - |
| | | | | | | | | |
| 8/30/1995 | 1995 | 0.0 | 0.7 | 0.7 | CHUM | - | - | - |
| 9/12/1995 | 1995 | 0.0 | 0.7 | 0.7 | CHUM | - | - | - |
| 9/27/1995 | 1995 | 0.0 | 0.7 | 0.7 | CHUM | - | - | - |
| **10/12/1995** | **1995** | **0.0** | **0.7** | **0.7** | **CHIN** | **4** | **5** | **9** |
| 10/20/1995 | 1995 | 0.0 | 0.7 | 0.7 | CHUM | - | - | - |
| 11/2/1995 | 1995 | 0.0 | 0.7 | 0.7 | CHUM | - | - | - |
| | | | | | | | | |
| 9/3/1996 | 1996 | 0.0 | 0.7 | 0.7 | CHUM | - | - | - |
| 9/13/1996 | 1996 | 0.0 | 0.7 | 0.7 | COHO | - | - | - |
| 10/1/1996 | 1996 | 0.0 | 0.7 | 0.7 | CHUM | - | - | - |
| 10/8/1996 | 1996 | 0.0 | 0.7 | 0.7 | COHO | - | - | - |
| 10/17/1996 | 1996 | 0.0 | 0.7 | 0.7 | CHUM | - | - | - |
| 10/29/1996 | 1996 | 0.0 | 0.7 | 0.7 | CHUM | - | - | - |
| 11/8/1996 | 1996 | 0.0 | 0.7 | 0.7 | COHO | - | - | - |
| | | | | | | | | |
| 9/19/1997 | 1997 | 0.0 | 0.7 | 0.7 | CHUM | - | - | - |
| 10/8/1997 | 1997 | 0.0 | 0.7 | 0.7 | CHUM | - | - | - |
| 10/20/1997 | 1997 | 0.0 | 0.7 | 0.7 | CHUM | - | - | - |
| 10/28/1997 | 1997 | 0.0 | 0.7 | 0.7 | COHO | - | - | - |
| 11/6/1997 | 1997 | 0.0 | 0.7 | 0.7 | COHO | - | - | - |

**Table C-9.** Sherwood Creek spawning ground surveys, 1987-2006.

| Date | RunYear | RMLower | RMUpper | Length | Species | Live Count | Dead Count | Total Count |
|---|---|---|---|---|---|---|---|---|
| 9/3/1998 | 1998 | 0.2 | 0.7 | 0.5 | CHUM | - | - | - |
| 9/16/1998 | 1998 | 0.0 | 0.7 | 0.7 | CHIN | 3 | 0 | 3 |
| **9/25/1998** | **1998** | **0.0** | **0.7** | **0.7** | **CHIN** | **8** | **0** | **8** |
| 10/5/1998 | 1998 | 0.0 | 0.7 | 0.7 | CHIN | 1 | 5 | 6 |
| 10/13/1998 | 1998 | 0.0 | 0.7 | 0.7 | CHIN | 0 | 5 | 5 |
| 10/20/1998 | 1998 | 0.0 | 0.7 | 0.7 | CHIN | 0 | 1 | 1 |
| 10/28/1998 | 1998 | 0.0 | 0.7 | 0.7 | COHO | - | - | - |
| 11/5/1998 | 1998 | 0.0 | 0.7 | 0.7 | COHO | - | - | - |
| 11/12/1998 | 1998 | 0.0 | 0.7 | 0.7 | COHO | - | - | - |
| | | | | | | | | |
| 9/1/1999 | 1999 | 0.0 | 0.7 | 0.7 | CHUM | - | - | - |
| 9/13/1999 | 1999 | 0.0 | 0.7 | 0.7 | CHUM | - | - | - |
| 9/23/1999 | 1999 | 0.0 | 0.7 | 0.7 | CHIN | 10 | 0 | 10 |
| **9/30/1999** | **1999** | **0.0** | **0.7** | **0.7** | **CHIN** | **22** | **0** | **22** |
| 10/7/1999 | 1999 | 0.0 | 0.7 | 0.7 | CHIN | 9 | 6 | 15 |
| 10/13/1999 | 1999 | 0.0 | 0.7 | 0.7 | COHO | - | - | - |
| 10/20/1999 | 1999 | 0.0 | 0.7 | 0.7 | CHIN | 0 | 1 | 1 |
| 10/27/1999 | 1999 | 0.0 | 0.7 | 0.7 | CHUM | - | - | - |
| 11/4/1999 | 1999 | 0.0 | 0.7 | 0.7 | CHUM | - | - | - |
| 11/15/1999 | 1999 | 0.0 | 0.7 | 0.7 | CHUM | - | - | - |
| | | | | | | | | |
| 9/6/2000 | 2000 | 0.0 | 0.7 | 0.7 | CHUM | - | - | - |
| 9/13/2000 | 2000 | 0.0 | 0.7 | 0.7 | CHIN | 0 | 0 | 0 |
| 9/21/2000 | 2000 | 0.0 | 0.7 | 0.7 | CHUM | - | - | - |
| 9/29/2000 | 2000 | 0.0 | 0.7 | 0.7 | CHIN | 2 | 0 | 2 |
| **10/6/2000** | **2000** | **0.0** | **0.7** | **0.7** | **CHIN** | **7** | **2** | **9** |
| 10/16/2000 | 2000 | 0.0 | 0.7 | 0.7 | CHIN | 3 | 1 | 4 |
| 10/24/2000 | 2000 | 0.0 | 0.7 | 0.7 | CHIN | 1 | 0 | 1 |
| 10/31/2000 | 2000 | 0.0 | 0.7 | 0.7 | CHIN | 1 | 0 | 1 |
| 11/9/2000 | 2000 | 0.0 | 0.7 | 0.7 | COHO | - | - | - |

**Table C-9.** Sherwood Creek spawning ground surveys, 1987-2006.

| Date | RunYear | RMLower | RMUpper | Length | Species | Live Count | Dead Count | Total Count |
|---|---|---|---|---|---|---|---|---|
| 9/7/2001 | 2001 | 0.0 | 0.7 | 0.7 | CHUM | - | - | - |
| 9/14/2001 | 2001 | 0.0 | 0.7 | 0.7 | CHUM | - | - | - |
| 9/24/2001 | 2001 | 0.0 | 0.7 | 0.7 | CHIN | 7 | 0 | 7 |
| 10/4/2001 | 2001 | 0.0 | 0.7 | 0.7 | CHIN | 9 | 0 | 9 |
| **10/15/2001** | **2001** | **0.0** | **0.7** | **0.7** | **CHIN** | **8** | **4** | **12** |
| 10/25/2001 | 2001 | 0.0 | 0.7 | 0.7 | CHIN | 4 | 3 | 7 |
| 11/1/2001 | 2001 | 0.0 | 0.7 | 0.7 | CHIN | 0 | 3 | 3 |
| 11/9/2001 | 2001 | 0.0 | 0.7 | 0.7 | COHO | - | - | - |
| | | | | | | | | |
| 9/10/2002 | 2002 | 0.0 | 0.7 | 0.7 | CHIN | 9 | 1 | 10 |
| 9/17/2002 | 2002 | 0.0 | 0.7 | 0.7 | CHIN | 1 | 0 | 1 |
| **9/27/2002** | **2002** | **0.0** | **0.7** | **0.7** | **CHIN** | **26** | **4** | **30** |
| 10/3/2002 | 2002 | 0.0 | 0.7 | 0.7 | CHIN | 7 | 1 | 8 |
| 10/10/2002 | 2002 | 0.0 | 0.7 | 0.7 | CHIN | 3 | 1 | 4 |
| 10/16/2002 | 2002 | 0.0 | 0.7 | 0.7 | CHIN | 0 | 1 | 1 |
| 10/23/2002 | 2002 | 0.0 | 0.7 | 0.7 | CHUM | - | - | - |
| 10/31/2002 | 2002 | 0.0 | 0.7 | 0.7 | CHUM | - | - | - |
| 11/7/2002 | 2002 | 0.0 | 0.7 | 0.7 | COHO | - | - | - |
| 11/15/2002 | 2002 | 0.0 | 0.7 | 0.7 | COHO | - | - | - |
| | | | | | | | | |
| 9/2/2003 | 2003 | 0.0 | 0.7 | 0.7 | CHUM | - | - | - |
| 9/10/2003 | 2003 | 0.0 | 0.7 | 0.7 | CHIN | 1 | 0 | 1 |
| 9/17/2003 | 2003 | 0.0 | 0.7 | 0.7 | CHIN | 0 | 0 | 0 |
| 9/25/2003 | 2003 | 0.0 | 0.7 | 0.7 | CHIN | 7 | 0 | 7 |
| **10/3/2003** | **2003** | **0.0** | **0.7** | **0.7** | **CHIN** | **13** | **0** | **13** |
| 10/9/2003 | 2003 | 0.0 | 0.7 | 0.7 | CHIN | 7 | 3 | 10 |
| 10/14/2003 | 2003 | 0.0 | 0.7 | 0.7 | CHIN | 7 | 4 | 11 |
| 10/27/2003 | 2003 | 0.0 | 0.7 | 0.7 | COHO | - | - | - |
| 11/3/2003 | 2003 | 0.0 | 0.7 | 0.7 | COHO | - | - | - |
| 11/6/2003 | 2003 | 0.0 | 0.7 | 0.7 | COHO | - | - | - |
| 11/14/2003 | 2003 | 0.0 | 0.7 | 0.7 | COHO | - | - | - |

**Table C-9.** Sherwood Creek spawning ground surveys, 1987-2006.

| Date | RunYear | RMLower | RMUpper | Length | Species | Live Count | Dead Count | Total Count |
|---|---|---|---|---|---|---|---|---|
| 9/1/2004 | 2004 | 0.0 | 0.7 | 0.7 | CHIN | 0 | 0 | 0 |
| 9/8/2004 | 2004 | 0.0 | 0.7 | 0.7 | CHIN | 0 | 0 | 0 |
| 9/13/2004 | 2004 | 0.0 | 0.7 | 0.7 | CHIN | 2 | 0 | 2 |
| 9/22/2004 | 2004 | 0.1 | 0.7 | 0.6 | CHIN | 40 | 2 | 42 |
| **9/27/2004** | **2004** | **0.0** | **0.7** | **0.7** | **CHIN** | **73** | **7** | **80** |
| 10/6/2004 | 2004 | 0.0 | 0.7 | 0.7 | CHIN | 23 | 11 | 34 |
| 10/13/2004 | 2004 | 0.0 | 0.7 | 0.7 | CHIN | 2 | 4 | 6 |
| 10/21/2004 | 2004 | 0.2 | 0.7 | 0.5 | CHIN | 4 | 0 | 4 |
| 10/28/2004 | 2004 | 0.0 | 0.7 | 0.7 | COHO | - | - | - |
| 11/4/2004 | 2004 | 0.0 | 0.7 | 0.7 | COHO | - | - | - |
| 11/11/2004 | 2004 | 0.0 | 0.7 | 0.7 | CHUM | - | - | - |
| | | | | | | | | |
| 9/6/2005 | 2005 | 0.0 | 0.7 | 0.7 | CHIN | 0 | 0 | 0 |
| 9/12/2005 | 2005 | 0.0 | 0.7 | 0.7 | CHIN | 5 | 0 | 5 |
| 9/20/2005 | 2005 | 0.0 | 0.7 | 0.7 | CHIN | 11 | 2 | 13 |
| 9/27/2005 | 2005 | 0.0 | 0.7 | 0.7 | CHIN | 17 | 0 | 17 |
| **10/4/2005** | **2005** | **0.0** | **0.7** | **0.7** | **CHIN** | **27** | **2** | **29** |
| 10/11/2005 | 2005 | 0.0 | 0.7 | 0.7 | CHIN | 20 | 7 | 27 |
| 10/18/2005 | 2005 | 0.0 | 0.7 | 0.7 | CHIN | 6 | 11 | 17 |
| 10/25/2005 | 2005 | 0.1 | 0.7 | 0.6 | CHIN | 0 | 3 | 3 |
| 11/7/2005 | 2005 | 0.0 | 0.7 | 0.7 | COHO | - | - | - |
| | | | | | | | | |
| 9/12/2006 | 2006 | 0.0 | 0.7 | 0.7 | CHIN | 1 | 0 | 1 |
| 9/22/2006 | 2006 | 0.0 | 0.7 | 0.7 | CHIN | 3 | 0 | 3 |
| **10/2/2006** | **2006** | **0.0** | **0.7** | **0.7** | **CHIN** | **6** | **2** | **8** |
| 10/12/2006 | 2006 | 0.0 | 0.7 | 0.7 | CHIN | 0 | 0 | 0 |
| 10/23/2006 | 2006 | 0.0 | 0.7 | 0.7 | COHO | - | - | - |
| 10/31/2006 | 2006 | 0.0 | 0.7 | 0.7 | COHO | - | - | - |

Source: Spawning Ground Survey Database, 2007.

**Table C-10.** Rocky Creek spawning ground surveys, 1987-2006.

| Date | RunYear | RMLower | RMUpper | Length | Species | Live Count | Dead Count | Total Count |
|---|---|---|---|---|---|---|---|---|
| **10/15/1987** | **1987** | **0.3** | **0.7** | **0.4** | **CHIN** | **0** | **4** | **4** |
| 10/29/1987 | 1987 | 0.3 | 0.8 | 0.5 | CHIN | 0 | 2 | 2 |
| 11/5/1987 | 1987 | 0.3 | 1.6 | 1.3 | CHIN | | 0 | 0 |
| 11/12/1987 | 1987 | 0.3 | 1.6 | 1.3 | CHIN | 0 | 2 | 2 |
| | | | | | | | | |
| 9/8/1988 | 1988 | 0.3 | 1.6 | 1.3 | COHO | - | - | - |
| 9/19/1988 | 1988 | 0.3 | 1.6 | 1.3 | CHUM | - | - | - |
| 9/28/1988 | 1988 | 0.3 | 1.6 | 1.3 | CHIN | 2 | 0 | 2 |
| 10/6/1988 | 1988 | 0.0 | 1.6 | 1.6 | CHIN | 8 | 0 | 8 |
| **10/18/1988** | **1988** | **0.3** | **1.6** | **1.3** | **CHIN** | **8** | **9** | **17** |
| 10/28/1988 | 1988 | 0.3 | 1.6 | 1.3 | CHIN | 0 | 6 | 6 |
| 11/4/1988 | 1988 | 0.3 | 1.6 | 1.3 | CHUM | - | - | - |
| 11/11/1988 | 1988 | 0.3 | 1.6 | 1.3 | CHUM | - | - | - |
| | | | | | | | | |
| 9/6/1989 | 1989 | 0.3 | 1.6 | 1.3 | CHUM | - | - | - |
| **9/27/1989** | **1989** | **0.3** | **1.6** | **1.3** | **CHIN** | **8** | **1** | **9** |
| 11/2/1989 | 1989 | 0.3 | 1.6 | 1.3 | CHUM | - | - | - |
| 11/9/1989 | 1989 | 0.3 | 1.6 | 1.3 | CHUM | - | - | - |
| | | | | | | | | |
| 9/23/1990 | 1990 | 0.3 | 1.6 | 1.3 | CHIN | 0 | 4 | 4 |
| **10/16/1990** | **1990** | **0.3** | **1.6** | **1.3** | **CHIN** | **0** | **30** | **30** |
| 10/23/1990 | 1990 | 0.3 | 1.6 | 1.3 | CHUM | - | - | - |
| 10/31/1990 | 1990 | 0.3 | 1.6 | 1.3 | CHUM | - | - | - |
| 11/1/1990 | 1990 | 0.0 | 1.6 | 1.6 | CHIN | 0 | 2 | 2 |
| 11/7/1990 | 1990 | 0.3 | 1.6 | 1.3 | COHO | - | - | - |
| 11/15/1990 | 1990 | 0.3 | 1.6 | 1.3 | CHUM | - | - | - |
| | | | | | | | | |
| 10/9/1991 | 1991 | 0.3 | 1.6 | 1.3 | CHIN | 9 | 3 | 12 |
| **10/11/1991** | **1991** | **0.0** | **1.0** | **1.0** | **CHIN** | **8** | **6** | **14** |
| 10/18/1991 | 1991 | 0.3 | 1.6 | 1.3 | CHIN | 1 | 3 | 4 |
| 10/21/1991 | 1991 | 0.0 | 1.0 | 1.0 | CHIN | 0 | 3 | 3 |

**Table C-10.** Rocky Creek spawning ground surveys, 1987-2006.

| Date | RunYear | RMLower | RMUpper | Length | Species | Live Count | Dead Count | Total Count |
|---|---|---|---|---|---|---|---|---|
| 11/8/1991 | 1991 | 0.3 | 1.6 | 1.3 | CHUM | - | - | - |
| 11/15/1991 | 1991 | 0.3 | 1.6 | 1.3 | CHUM | - | - | - |
| | | | | | | | | |
| 9/22/1992 | 1992 | 0.3 | 1.6 | 1.3 | CHIN | 13 | 2 | 15 |
| **9/30/1992** | **1992** | **0.1** | **1.6** | **1.5** | **CHIN** | **14** | **25** | **39** |
| 10/7/1992 | 1992 | 0.3 | 1.6 | 1.3 | CHIN | 4 | 31 | 35 |
| 10/14/1992 | 1992 | 0.3 | 1.6 | 1.3 | CHIN | 3 | 17 | 20 |
| 10/21/1992 | 1992 | 0.3 | 1.6 | 1.3 | CHIN | 7 | 31 | 38 |
| 10/28/1992 | 1992 | 0.3 | 1.6 | 1.3 | CHIN | 1 | 9 | 10 |
| 11/9/1992 | 1992 | 0.3 | 1.6 | 1.3 | CHUM | - | - | - |
| | | | | | | | | |
| **9/20/1993** | **1993** | **0.3** | **0.8** | **0.5** | **CHIN** | **3** | **0** | **3** |
| 9/20/1993 | 1993 | 0.3 | 1.6 | 1.3 | COHO | - | - | - |
| 11/2/1993 | 1993 | 0.3 | 1.6 | 1.3 | CHIN | 0 | 3 | 3 |
| 11/9/1993 | 1993 | 0.3 | 1.6 | 1.3 | CHUM | - | - | - |
| | | | | | | | | |
| 9/20/1994 | 1994 | 0.0 | 1.6 | 1.6 | CHIN | 0 | 1 | 1 |
| 10/4/1994 | 1994 | 0.3 | 1.6 | 1.3 | CHUM | - | - | - |
| **10/12/1994** | **1994** | **0.3** | **1.6** | **1.3** | **CHIN** | **0** | **2** | **2** |
| 10/19/1994 | 1994 | 0.3 | 1.6 | 1.3 | CHUM | - | - | - |
| 11/2/1994 | 1994 | 0.3 | 1.6 | 1.3 | CHUM | - | - | - |
| 11/8/1994 | 1994 | 0.3 | 1.6 | 1.3 | CHUM | - | - | - |
| 11/15/1994 | 1994 | 0.3 | 1.6 | 1.3 | CHUM | - | - | - |
| | | | | | | | | |
| 9/11/1995 | 1995 | 0.1 | 0.7 | 0.6 | CHUM | - | - | - |
| **10/3/1995** | **1995** | **0.0** | **1.6** | **1.6** | **CHIN** | **5** | **4** | **9** |
| 10/13/1995 | 1995 | 0.3 | 1.6 | 1.3 | CHIN | 1 | 0 | 1 |
| 10/25/1995 | 1995 | 0.3 | 1.6 | 1.3 | CHUM | - | - | - |
| 10/27/1995 | 1995 | 0.3 | 1.6 | 1.3 | CHUM | - | - | - |
| 11/3/1995 | 1995 | 0.3 | 1.6 | 1.3 | CHUM | - | - | - |
| 11/10/1995 | 1995 | 0.3 | 1.6 | 1.3 | CHUM | - | - | - |

**Table C-10.** Rocky Creek spawning ground surveys, 1987-2006.

| Date | RunYear | RMLower | RMUpper | Length | Species | Live Count | Dead Count | Total Count |
|---|---|---|---|---|---|---|---|---|
| 9/23/1996 | 1996 | 0.3 | 1.6 | 1.3 | CHUM | - | - | - |
| 10/8/1996 | 1996 | 0.3 | 1.6 | 1.3 | CHUM | - | - | - |
| 10/16/1996 | 1996 | 0.3 | 1.6 | 1.3 | CHUM | - | - | - |
| 10/25/1996 | 1996 | 0.3 | 1.6 | 1.3 | CHUM | - | - | - |
| 11/1/1996 | 1996 | 0.3 | 1.6 | 1.3 | CHUM | - | - | - |
| 11/8/1996 | 1996 | 0.3 | 1.6 | 1.3 | CHUM | - | - | - |
| | | | | | | | | |
| 9/15/1997 | 1997 | 0.3 | 1.6 | 1.3 | CHIN | 3 | 0 | 3 |
| **10/3/1997** | **1997** | **0.3** | **1.6** | **1.3** | **CHIN** | **18** | **1** | **19** |
| 10/20/1997 | 1997 | 0.3 | 1.6 | 1.3 | CHIN | 0 | 2 | 2 |
| 11/4/1997 | 1997 | 0.3 | 1.6 | 1.3 | COHO | - | - | - |
| *11/4/1997* | *1997* | *1.6* | *3.1* | *1.5* | *CHIN* | *0* | *1* | *1* |
| 11/11/1997 | 1997 | 0.3 | 1.6 | 1.3 | CHUM | - | - | - |
| | | | | | | | | |
| 9/15/1998 | 1998 | 0.3 | 1.6 | 1.3 | CHIN | 14 | 2 | 16 |
| 9/23/1998 | 1998 | 0.3 | 1.6 | 1.3 | CHIN | 78 | 44 | 122 |
| **10/2/1998** | **1998** | **0.3** | **1.6** | **1.3** | **CHIN** | **267** | **93** | **360** |
| 10/12/1998 | 1998 | 0.3 | 1.6 | 1.3 | CHIN | 30 | 271 | 301 |
| 10/21/1998 | 1998 | 0.3 | 1.6 | 1.3 | CHIN | 4 | 110 | 114 |
| 10/30/1998 | 1998 | 0.3 | 1.6 | 1.3 | CHIN | 3 | 149 | 152 |
| 11/6/1998 | 1998 | 0.3 | 1.6 | 1.3 | CHIN | 0 | 15 | 15 |
| 11/13/1998 | 1998 | 0.0 | 1.0 | 1.0 | COHO | - | - | - |
| | | | | | | | | |
| 9/8/1999 | 1999 | 0.3 | 1.6 | 1.3 | CHIN | 5 | 2 | 7 |
| 9/16/1999 | 1999 | 0.3 | 1.6 | 1.3 | CHIN | 29 | 8 | 37 |
| 9/24/1999 | 1999 | 0.3 | 1.8 | 1.5 | CHIN | 117 | 28 | 145 |
| **10/5/1999** | **1999** | **0.3** | **1.6** | **1.3** | **CHIN** | **85** | **111** | **196** |
| 10/12/1999 | 1999 | 0.3 | 1.8 | 1.5 | CHIN | 6 | 107 | 113 |
| 10/19/1999 | 1999 | 0.3 | 1.8 | 1.5 | CHIN | 0 | 36 | 36 |
| 10/26/1999 | 1999 | 0.3 | 1.8 | 1.5 | CHIN | 0 | 21 | 21 |
| 11/2/1999 | 1999 | 0.3 | 1.6 | 1.3 | CHUM | - | - | - |

**Table C-10.** Rocky Creek spawning ground surveys, 1987-2006.

| Date | RunYear | RMLower | RMUpper | Length | Species | Live Count | Dead Count | Total Count |
|---|---|---|---|---|---|---|---|---|
| 11/4/1999 | 1999 | 0.3 | 1.6 | 1.3 | CHIN | 0 | 5 | 5 |
| 11/9/1999 | 1999 | 0.3 | 1.6 | 1.3 | CHUM | - | - | - |
| | | | | | | | | |
| 9/1/2000 | 2000 | 0.3 | 1.6 | 1.3 | CHIN | 19 | 1 | 20 |
| 9/11/2000 | 2000 | 0.3 | 1.6 | 1.3 | CHIN | 140 | 40 | 180 |
| 9/18/2000 | 2000 | 0.3 | 1.6 | 1.3 | CHIN | 107 | 70 | 177 |
| **9/28/2000** | **2000** | **0.3** | **1.6** | **1.3** | **CHIN** | **187** | **210** | **397** |
| 10/5/2000 | 2000 | 0.3 | 1.6 | 1.3 | CHIN | 90 | 108 | 198 |
| 10/12/2000 | 2000 | 0.3 | 1.6 | 1.3 | CHIN | 45 | 276 | 321 |
| 10/19/2000 | 2000 | 0.3 | 1.6 | 1.3 | CHIN | 18 | 125 | 143 |
| 10/27/2000 | 2000 | 0.3 | 1.6 | 1.3 | CHIN | 1 | 20 | 21 |
| 11/6/2000 | 2000 | 0.3 | 1.6 | 1.3 | CHUM | - | - | - |
| 11/8/2000 | 2000 | 0.3 | 1.6 | 1.3 | CHUM | - | - | - |
| | | | | | | | | |
| 9/5/2001 | 2001 | 0.3 | 0.8 | 0.5 | CHIN | 0 | 1 | 1 |
| 9/11/2001 | 2001 | 0.3 | 0.8 | 0.5 | CHIN | 0 | 2 | 2 |
| 9/20/2001 | 2001 | 0.3 | 0.8 | 0.5 | CHIN | 18 | 8 | 26 |
| **10/1/2001** | **2001** | **0.3** | **1.6** | **1.3** | **CHIN** | **29** | **103** | **132** |
| 10/9/2001 | 2001 | 0.3 | 1.6 | 1.3 | CHIN | 27 | 84 | 111 |
| 10/18/2001 | 2001 | 0.3 | 1.6 | 1.3 | CHIN | 4 | 41 | 45 |
| 10/26/2001 | 2001 | 0.3 | 1.6 | 1.3 | CHIN | 0 | 6 | 6 |
| 11/1/2001 | 2001 | 0.3 | 3.1 | 2.8 | CHIN | 0 | 4 | 4 |
| 11/6/2001 | 2001 | 0.3 | 1.6 | 1.3 | CHUM | - | - | - |
| | | | | | | | | |
| 9/17/2002 | 2002 | 0.3 | 1.6 | 1.3 | CHIN | 16 | 4 | 20 |
| **9/30/2002** | **2002** | **0.3** | **1.6** | **1.3** | **CHIN** | **9** | **34** | **43** |
| 10/8/2002 | 2002 | 0.3 | 1.6 | 1.3 | CHIN | 1 | 18 | 19 |
| 10/16/2002 | 2002 | 0.3 | 1.6 | 1.3 | CHIN | 0 | 14 | 14 |
| 10/24/2002 | 2002 | 0.3 | 1.6 | 1.3 | CHIN | 0 | 1 | 1 |
| 11/4/2002 | 2002 | 0.3 | 1.6 | 1.3 | CHUM | - | - | - |
| 11/12/2002 | 2002 | 0.3 | 1.6 | 1.3 | CHUM | - | - | - |

**Table C-10.** Rocky Creek spawning ground surveys, 1987-2006.

| Date | RunYear | RMLower | RMUpper | Length | Species | Live Count | Dead Count | Total Count |
|---|---|---|---|---|---|---|---|---|
| 9/15/2003 | 2003 | 0.3 | 1.6 | 1.3 | CHIN | 0 | 0 | 0 |
| **9/25/2003** | **2003** | **0.3** | **1.6** | **1.3** | **CHIN** | **0** | **2** | **2** |
| 10/3/2003 | 2003 | 0.3 | 1.6 | 1.3 | CHIN | 0 | 1 | 1 |
| 10/10/2003 | 2003 | 0.3 | 1.6 | 1.3 | CHIN | 0 | 1 | 1 |
| 10/24/2003 | 2003 | 0.3 | 1.6 | 1.3 | COHO | - | - | - |
| 10/31/2003 | 2003 | 0.3 | 1.6 | 1.3 | CHIN | 1 | 0 | 1 |
| *10/31/2003* | *2003* | *1.6* | *3.1* | *1.5* | *CHIN* | *0* | *0* | *0* |
| 11/7/2003 | 2003 | 0.3 | 1.6 | 1.3 | COHO | - | - | - |
| 11/14/2003 | 2003 | 0.3 | 1.6 | 1.3 | CHUM | - | - | - |
| | | | | | | | | |
| **9/8/2004** | **2004** | **0.3** | **0.6** | **0.3** | **CHIN** | **0** | **0** | **0** |
| 9/8/2004 | 2004 | 0.3 | 0.6 | 0.3 | CHUM | - | - | - |
| 11/10/2004 | 2004 | 0.3 | 1.6 | 1.3 | COHO | - | - | - |
| | | | | | | | | |
| 9/6/2005 | 2005 | 0.3 | 1.6 | 1.3 | CHIN | 0 | 0 | 0 |
| 10/3/2005 | 2005 | 0.3 | 1.6 | 1.3 | CHIN | 51 | 23 | 74 |
| **10/11/2005** | **2005** | **0.3** | **1.6** | **1.3** | **CHIN** | **32** | **45** | **77** |
| 10/18/2005 | 2005 | 0.3 | 1.6 | 1.3 | CHIN | 0 | 18 | 18 |
| *10/18/2005* | *2005* | *1.6* | *3.1* | *1.5* | *CHIN* | *0* | *0* | *0* |
| 10/26/2005 | 2005 | 0.3 | 1.6 | 1.3 | CHIN | 0 | 7 | 7 |
| 11/3/2005 | 2005 | 0.3 | 1.6 | 1.3 | COHO | - | - | - |
| 11/10/2005 | 2005 | 0.3 | 1.6 | 1.3 | COHO | - | - | - |
| | | | | | | | | |
| 9/12/2006 | 2006 | 0.3 | 0.5 | 0.2 | CHIN | 1 | 2 | 3 |
| **9/26/2006** | **2006** | **0.3** | **1.6** | **1.3** | **CHIN** | **10** | **6** | **16** |
| 10/12/2006 | 2006 | 0.3 | 1.6 | 1.3 | CHIN | 0 | 11 | 11 |
| 10/23/2006 | 2006 | 0.3 | 1.6 | 1.3 | CHUM | - | - | - |
| 11/1/2006 | 2006 | 0.3 | 1.6 | 1.3 | CHUM | - | - | - |
| 11/9/2006 | 2006 | 0.3 | 1.6 | 1.3 | COHO | - | - | - |
| 11/14/2006 | 2006 | 0.3 | 1.6 | 1.3 | COHO | - | - | - |

Source: Spawning Ground Survey Database, 2007.

**Table C-11.** Burley Creek spawning ground surveys, 1987-2006.

| Date | RunYear | RMLower | RMUpper | Length | Species | Live Count | Dead Count | Total Count |
|---|---|---|---|---|---|---|---|---|
| **11/5/1987** | **1987** | **0.3** | **1.4** | **1.1** | **CHIN** | **0** | **16** | **16** |
| 11/13/1987 | 1987 | 0.3 | 1.4 | 1.1 | COHO | - | - | - |
| | | | | | | | | |
| **10/21/1988** | **1988** | **0.0** | **1.9** | **1.9** | **CHIN** | **29** | **131** | **160** |
| 11/15/1988 | 1988 | 0.3 | 1.4 | 1.1 | CHUM | - | - | - |
| | | | | | | | | |
| **10/17/1989** | **1989** | **0.0** | **1.9** | **1.9** | **CHIN** | **5** | **93** | **98** |
| 11/6/1989 | 1989 | 0.3 | 1.4 | 1.1 | CHUM | - | - | - |
| | | | | | | | | |
| **10/5/1990** | **1990** | **1.4** | **1.7** | **0.3** | **CHIN** | **43** | **18** | **61** |
| **10/5/1990** | **1990** | **0.5** | **1.4** | **0.9** | **CHIN** | **35** | **33** | **68** |
| **10/5/1990** | **1990** | **1.7** | **1.9** | **0.2** | **CHIN** | **51** | **16** | **67** |
| *10/5/1990* | *1990* | *1.9* | *2.5* | *0.6* | *CHIN* | *48* | *27* | *75* |
| 10/12/1990 | 1990 | 0.0 | 1.4 | 1.4 | CHIN | 0 | 122 | 122 |
| 11/7/1990 | 1990 | 0.3 | 1.4 | 1.1 | CHIN | 0 | 1 | 1 |
| | | | | | | | | |
| **10/1/1991** | **1991** | **1.4** | **1.9** | **0.5** | **CHIN** | **92** | **18** | **110** |
| **10/1/1991** | **1991** | **0.5** | **1.4** | **0.9** | **CHIN** | **195** | **71** | **266** |
| **10/1/1991** | **1991** | **0.0** | **0.5** | **0.5** | **CHIN** | **19** | **1** | **20** |
| *10/1/1991* | *1991* | *1.9* | *2.2* | *0.3* | *CHIN* | *156* | *48* | *204* |
| 10/10/1991 | 1991 | 1.4 | 1.9 | 0.5 | CHIN | 33 | 76 | 109 |
| 10/10/1991 | 1991 | 0.5 | 1.4 | 0.9 | CHIN | 30 | 92 | 122 |
| 10/10/1991 | 1991 | 0.0 | 0.5 | 0.5 | CHIN | 50 | 90 | 140 |
| *10/10/1991* | *1991* | *1.9* | *2.2* | *0.3* | *CHIN* | *77* | *91* | *168* |
| 10/15/1991 | 1991 | 0.5 | 2.2 | 1.7 | CHIN | 28 | 236 | 264 |
| 10/15/1991 | 1991 | 0.0 | 0.5 | 0.5 | CHIN | 25 | 98 | 123 |
| | | | | | | | | |
| *9/17/1992* | *1992* | *1.9* | *2.6* | *0.7* | *CHIN* | *56* | *1* | *57* |
| 9/17/1992 | 1992 | 0.0 | 0.5 | 0.5 | CHIN | 4 | 0 | 4 |
| 9/17/1992 | 1992 | 0.5 | 1.9 | 1.4 | CHIN | 68 | 10 | 78 |

**Table C-11.** Burley Creek spawning ground surveys, 1987-2006.

| Date | RunYear | RMLower | RMUpper | Length | Species | Live Count | Dead Count | Total Count |
|---|---|---|---|---|---|---|---|---|
| *9/24/1992* | *1992* | *1.9* | *2.6* | *0.7* | *CHIN* | *111* | *17* | *128* |
| 9/24/1992 | 1992 | 0.0 | 1.9 | 1.9 | CHIN | 295 | 15 | 310 |
| **10/1/1992** | **1992** | **0.0** | **0.5** | **0.5** | **CHIN** | **5** | **1** | **6** |
| **10/1/1992** | **1992** | **0.5** | **1.9** | **1.4** | **CHIN** | **234** | **145** | **379** |
| *10/1/1992* | *1992* | *1.9* | *2.6* | *0.7* | *CHIN* | *158* | *65* | *223* |
| *10/8/1992* | *1992* | *1.9* | *2.6* | *0.7* | *CHIN* | *34* | *85* | *119* |
| 10/8/1992 | 1992 | 0.0 | 0.5 | 0.5 | CHIN | 1 | 0 | 1 |
| 10/8/1992 | 1992 | 0.5 | 1.9 | 1.4 | CHIN | 63 | 233 | 296 |
| 10/15/1992 | 1992 | 0.5 | 1.9 | 1.4 | CHIN | 18 | 85 | 103 |
| *10/15/1992* | *1992* | *1.9* | *2.6* | *0.7* | *CHIN* | *7* | *90* | *97* |
| 11/3/1992 | 1992 | 0.3 | 1.4 | 1.1 | COHO | - | - | - |
| 11/12/1992 | 1992 | 0.3 | 1.4 | 1.1 | CHUM | - | - | - |
| | | | | | | | | |
| 9/16/1993 | 1993 | 0.5 | 1.4 | 0.9 | CHIN | 4 | 3 | 7 |
| 9/16/1993 | 1993 | 1.4 | 1.7 | 0.3 | CHIN | 3 | 1 | 4 |
| 9/16/1993 | 1993 | 1.7 | 1.9 | 0.2 | CHIN | 7 | 0 | 7 |
| *9/23/1993* | *1993* | *2.5* | *3.7* | *1.2* | *CHIN* | *38* | *15* | *53* |
| 9/23/1993 | 1993 | 0.5 | 2.5 | 2.0 | CHIN | 177 | 15 | 192 |
| 9/23/1993 | 1993 | 0.0 | 0.5 | 0.5 | CHIN | 17 | 1 | 18 |
| **9/30/1993** | **1993** | **1.7** | **1.9** | **0.2** | **CHIN** | **71** | **4** | **75** |
| **9/30/1993** | **1993** | **1.4** | **1.7** | **0.3** | **CHIN** | **71** | **8** | **79** |
| **9/30/1993** | **1993** | **0.5** | **1.4** | **0.9** | **CHIN** | **139** | **14** | **153** |
| *9/30/1993* | *1993* | *1.9* | *2.5* | *0.6* | *CHIN* | *84* | *10* | *94* |
| *10/7/1993* | *1993* | *1.9* | *2.6* | *0.7* | *CHIN* | *49* | *25* | *74* |
| 10/7/1993 | 1993 | 0.5 | 1.9 | 1.4 | CHIN | 187 | 112 | 299 |
| *10/14/1993* | *1993* | *1.9* | *2.6* | *0.7* | *CHIN* | *38* | *41* | *79* |
| 10/14/1993 | 1993 | 0.5 | 1.9 | 1.4 | CHIN | 71 | 210 | 281 |
| 10/21/1993 | 1993 | 0.5 | 1.9 | 1.4 | CHIN | 17 | 155 | 172 |
| *10/21/1993* | *1993* | *1.9* | *2.5* | *0.6* | *CHIN* | *0* | *40* | *40* |

**Table C-11.** Burley Creek spawning ground surveys, 1987-2006.

| Date | RunYear | RMLower | RMUpper | Length | Species | Live Count | Dead Count | Total Count |
|---|---|---|---|---|---|---|---|---|
| 9/15/1994 | 1994 | 0.5 | 1.9 | 1.4 | CHIN | 226 | 9 | 235 |
| *9/15/1994* | *1994* | *1.9* | *2.6* | *0.7* | *CHIN* | *104* | *11* | *115* |
| 9/21/1994 | 1994 | 0.5 | 1.9 | 1.4 | CHIN | 214 | 15 | 229 |
| *9/21/1994* | *1994* | *1.9* | *2.6* | *0.7* | *CHIN* | *124* | *12* | *136* |
| 9/28/1994 | 1994 | 0.5 | 1.9 | 1.4 | CHIN | 247 | 97 | 344 |
| *9/28/1994* | *1994* | *1.9* | *2.6* | *0.7* | *CHIN* | *74* | *55* | *129* |
| **10/5/1994** | **1994** | **0.5** | **1.9** | **1.4** | **CHIN** | **211** | **203** | **414** |
| *10/5/1994* | *1994* | *1.9* | *2.6* | *0.7* | *CHIN* | *20* | *61* | *81* |
| | | | | | | | | |
| 9/13/1995 | 1995 | 0.5 | 1.9 | 1.4 | CHIN | 0 | 2 | 2 |
| *9/13/1995* | *1995* | *1.9* | *2.6* | *0.7* | *CHIN* | | *0* | *0* |
| 9/19/1995 | 1995 | 0.5 | 1.9 | 1.4 | CHIN | 5 | 1 | 6 |
| *9/19/1995* | *1995* | *1.9* | *2.6* | *0.7* | *CHIN* | | *0* | *0* |
| *9/26/1995* | *1995* | *1.9* | *2.6* | *0.7* | *CHIN* | *11* | *2* | *13* |
| **9/26/1995** | **1995** | **0.5** | **1.9** | **1.4** | **CHIN** | **74** | **10** | **84** |
| | | | | | | | | |
| *9/20/1996* | *1996* | *1.9* | *2.6* | *0.7* | *CHIN* | *50* | *4* | *54* |
| 9/20/1996 | 1996 | 0.5 | 1.9 | 1.4 | CHIN | 31 | 8 | 39 |
| **9/26/1996** | **1996** | **0.0** | **0.5** | **0.5** | **CHIN** | **0** | **0** | **0** |
| *9/26/1996* | *1996* | *1.9* | *2.6* | *0.7* | *CHIN* | *44* | *10* | *54* |
| **9/26/1996** | **1996** | **0.5** | **1.9** | **1.4** | **CHIN** | **41** | **6** | **47** |
| 10/1/1996 | 1996 | 0.0 | 0.5 | 0.5 | CHIN | 0 | 0 | 0 |
| *10/1/1996* | *1996* | *1.9* | *2.6* | *0.7* | *CHIN* | *50* | *14* | *64* |
| 10/1/1996 | 1996 | 0.5 | 1.9 | 1.4 | CHIN | 29 | 15 | 44 |
| *10/10/1996* | *1996* | *1.9* | *2.6* | *0.7* | *CHIN* | *10* | *31* | *41* |
| 10/10/1996 | 1996 | 0.5 | 1.9 | 1.4 | CHIN | 8 | 32 | 40 |
| | | | | | | | | |
| **9/25/1997** | **1997** | **0.0** | **0.5** | **0.5** | **CHIN** | **2** | **0** | **2** |
| **9/25/1997** | **1997** | **0.5** | **1.9** | **1.4** | **CHIN** | **20** | **3** | **23** |
| *9/25/1997* | *1997* | *1.9* | *2.5* | *0.6* | *CHIN* | *27* | *0* | *27* |

**Table C-11.** Burley Creek spawning ground surveys, 1987-2006.

| Date | RunYear | RMLower | RMUpper | Length | Species | Live Count | Dead Count | Total Count |
|---|---|---|---|---|---|---|---|---|
| 10/13/1997 | 1997 | 0.0 | 0.5 | 0.5 | CHIN | 0 | 0 | 0 |
| 10/13/1997 | 1997 | 0.5 | 1.9 | 1.4 | CHIN | 2 | 7 | 9 |
| *10/13/1997* | *1997* | *1.9* | *2.5* | *0.6* | *CHIN* | *4* | *1* | *5* |
| 11/14/1997 | 1997 | 0.3 | 1.4 | 1.1 | CHUM | 2 | 10 | 12 |
| | | | | | | | | |
| 9/14/1998 | 1998 | 0.0 | 0.5 | 0.5 | CHIN | 0 | 1 | 1 |
| 9/14/1998 | 1998 | 0.5 | 1.9 | 1.4 | CHIN | 74 | 6 | 80 |
| *9/14/1998* | *1998* | *1.9* | *2.2* | *0.3* | *CHIN* | *14* | *1* | *15* |
| **9/22/1998** | **1998** | **0.0** | **0.5** | **0.5** | **CHIN** | **1** | **0** | **1** |
| **9/22/1998** | **1998** | **0.5** | **1.9** | **1.4** | **CHIN** | **86** | **34** | **120** |
| 9/30/1998 | 1998 | 0.0 | 0.5 | 0.5 | CHIN | 2 | 0 | 2 |
| 9/30/1998 | 1998 | 0.5 | 1.9 | 1.4 | CHIN | 70 | 35 | 105 |
| 11/2/1998 | 1998 | 0.3 | 1.4 | 1.1 | CHUM | - | - | - |
| 11/9/1998 | 1998 | 0.3 | 1.4 | 1.1 | CHUM | - | - | - |
| | | | | | | | | |
| 9/7/1999 | 1999 | 0.0 | 0.5 | 0.5 | CHIN | 0 | 0 | 0 |
| 9/7/1999 | 1999 | 0.5 | 1.4 | 0.9 | CHIN | 0 | 0 | 0 |
| 9/7/1999 | 1999 | 1.4 | 1.7 | 0.3 | CHIN | 6 | 0 | 6 |
| 9/7/1999 | 1999 | 1.7 | 1.9 | 0.2 | CHIN | 3 | 1 | 4 |
| 9/13/1999 | 1999 | 0.0 | 0.5 | 0.5 | CHIN | 4 | 1 | 5 |
| 9/13/1999 | 1999 | 0.5 | 1.9 | 1.4 | CHIN | 29 | 0 | 29 |
| 9/20/1999 | 1999 | 0.0 | 0.5 | 0.5 | CHIN | 3 | 0 | 3 |
| 9/20/1999 | 1999 | 0.5 | 1.9 | 1.4 | CHIN | 105 | 4 | 109 |
| **9/30/1999** | **1999** | **0.5** | **1.9** | **1.4** | **CHIN** | **191** | **60** | **251** |
| **9/30/1999** | **1999** | **0.0** | **0.5** | **0.5** | **CHIN** | **3** | **3** | **6** |
| 10/2/1999** | 1999 | 0.2 | 1.5 | 1.3 | CHIN | 60 | 43 | 103 |
| 10/11/1999 | 1999 | 0.0 | 0.5 | 0.5 | CHIN | 0 | 3 | 3 |
| 10/11/1999 | 1999 | 0.5 | 1.9 | 1.4 | CHIN | 17 | 105 | 122 |

** Survey conducted by Suquamish Indian Tribe.

**Table C-11.** Burley Creek spawning ground surveys, 1987-2006.

| Date | RunYear | RMLower | RMUpper | Length | Species | Live Count | Dead Count | Total Count |
|---|---|---|---|---|---|---|---|---|
| 10/18/1999 | 1999 | 0.0 | 0.5 | 0.5 | CHIN | 0 | 1 | 1 |
| 10/18/1999 | 1999 | 0.5 | 1.9 | 1.4 | CHIN | 1 | 114 | 115 |
| 10/26/1999 | 1999 | 0.5 | 1.4 | 0.9 | CHIN | 0 | 5 | 5 |
| 11/2/1999 | 1999 | 0.0 | 1.4 | 1.4 | CHUM | - | - | - |
| 11/15/1999 | 1999 | 0.3 | 1.4 | 1.1 | CHUM | - | - | - |
| | | | | | | | | |
| 9/6/2000 | 2000 | 0.0 | 0.5 | 0.5 | CHIN | 0 | 0 | 0 |
| 9/6/2000 | 2000 | 0.5 | 1.9 | 1.4 | CHIN | 0 | 2 | 2 |
| 9/13/2000 | 2000 | 0.0 | 0.5 | 0.5 | CHIN | 1 | 0 | 1 |
| 9/13/2000 | 2000 | 0.5 | 1.4 | 0.9 | CHIN | 0 | 0 | 0 |
| 9/13/2000 | 2000 | 1.4 | 1.7 | 0.3 | CHIN | 0 | 0 | 0 |
| 9/13/2000 | 2000 | 1.7 | 1.9 | 0.2 | CHIN | 1 | 0 | 1 |
| 9/22/2000 | 2000 | 0.0 | 0.5 | 0.5 | CHIN | 0 | 0 | 0 |
| 9/22/2000 | 2000 | 0.5 | 1.9 | 1.4 | CHIN | 16 | 4 | 20 |
| **10/3/2000** | **2000** | **0.0** | **0.5** | **0.5** | **CHIN** | **0** | **0** | **0** |
| **10/3/2000** | **2000** | **0.5** | **1.9** | **1.4** | **CHIN** | **29** | **4** | **33** |
| 10/11/2000 | 2000 | 0.0 | 0.5 | 0.5 | CHIN | 0 | 0 | 0 |
| 10/11/2000 | 2000 | 0.5 | 1.4 | 0.9 | CHIN | 12 | 2 | 14 |
| 10/11/2000 | 2000 | 1.4 | 1.7 | 0.3 | CHIN | 11 | 1 | 12 |
| 10/11/2000 | 2000 | 1.7 | 1.9 | 0.2 | CHIN | 1 | 2 | 3 |
| 10/18/2000 | 2000 | 0.0 | 0.5 | 0.5 | CHIN | 0 | 0 | 0 |
| 10/18/2000 | 2000 | 0.5 | 1.4 | 0.9 | CHIN | 1 | 0 | 1 |
| 10/18/2000 | 2000 | 1.4 | 1.7 | 0.3 | CHIN | 2 | 1 | 3 |
| 10/18/2000 | 2000 | 1.7 | 1.9 | 0.2 | CHIN | 0 | 3 | 3 |
| 10/31/2000 | 2000 | 0.5 | 1.4 | 0.9 | CHUM | - | - | - |
| 11/9/2000 | 2000 | 0.0 | 1.4 | 1.4 | COHO | - | - | - |
| 11/14/2000 | 2000 | 0.3 | 1.4 | 1.1 | CHUM | - | - | - |

**Table C-11.** Burley Creek spawning ground surveys, 1987-2006.

| Date | RunYear | RMLower | RMUpper | Length | Species | Live Count | Dead Count | Total Count |
|---|---|---|---|---|---|---|---|---|
| 9/10/2001 | 2001 | 0.0 | 0.5 | 0.5 | CHIN | 0 | 1 | 1 |
| 9/10/2001 | 2001 | 0.5 | 1.9 | 1.4 | CHIN | 11 | 2 | 13 |
| 9/18/2001 | 2001 | 0.0 | 0.5 | 0.5 | CHIN | 3 | 0 | 3 |
| 9/18/2001 | 2001 | 0.5 | 1.9 | 1.4 | CHIN | 57 | 3 | 60 |
| **9/27/2001** | **2001** | **0.0** | **0.5** | **0.5** | **CHIN** | **11** | **1** | **12** |
| **9/27/2001** | **2001** | **0.5** | **1.9** | **1.4** | **CHIN** | **165** | **14** | **179** |
| 10/5/2001 | 2001 | 0.0 | 0.5 | 0.5 | CHIN | 2 | 1 | 3 |
| 10/5/2001 | 2001 | 0.5 | 1.9 | 1.4 | CHIN | 92 | 48 | 140 |
| 10/16/2001 | 2001 | 0.0 | 0.5 | 0.5 | CHIN | 1 | 2 | 3 |
| 10/16/2001 | 2001 | 0.5 | 1.4 | 0.9 | CHIN | 9 | 13 | 22 |
| 10/16/2001 | 2001 | 1.4 | 1.7 | 0.3 | CHIN | 4 | 11 | 15 |
| 10/16/2001 | 2001 | 1.7 | 1.9 | 0.2 | CHIN | 3 | 18 | 21 |
| 10/23/2001 | 2001 | 0.0 | 0.5 | 0.5 | CHIN |  | 0 | 0 |
| 10/23/2001 | 2001 | 0.5 | 1.9 | 1.4 | CHIN | 0 | 10 | 10 |
| 11/1/2001 | 2001 | 0.3 | 1.4 | 1.1 | COHO | - | - | - |
| 11/8/2001 | 2001 | 0.3 | 1.4 | 1.1 | CHUM | - | - | - |
|  |  |  |  |  |  |  |  |  |
| 9/9/2002 | 2002 | 0.0 | 0.5 | 0.5 | CHIN | 1 | 0 | 1 |
| 9/9/2002 | 2002 | 0.5 | 1.4 | 0.9 | CHIN | 23 | 1 | 24 |
| 9/9/2002 | 2002 | 1.4 | 1.7 | 0.3 | CHIN | 22 | 1 | 23 |
| 9/9/2002 | 2002 | 1.7 | 1.9 | 0.2 | CHIN | 6 | 0 | 6 |
| 9/19/2002 | 2002 | 0.0 | 0.3 | 0.3 | CHIN | 0 | 0 | 0 |
| 9/19/2002 | 2002 | 0.3 | 0.5 | 0.2 | CHIN | 2 | 0 | 2 |
| 9/19/2002 | 2002 | 0.5 | 1.4 | 0.9 | CHIN | 43 | 1 | 44 |
| 9/19/2002 | 2002 | 1.4 | 1.7 | 0.3 | CHIN | 50 | 9 | 59 |
| 9/19/2002 | 2002 | 1.7 | 1.9 | 0.2 | CHIN | 50 | 0 | 50 |
| **9/26/2002** | **2002** | **0.0** | **0.3** | **0.3** | **CHIN** | **0** | **0** | **0** |
| **9/26/2002** | **2002** | **0.3** | **0.5** | **0.2** | **CHIN** | **3** | **0** | **3** |
| **9/26/2002** | **2002** | **0.5** | **1.4** | **0.9** | **CHIN** | **129** | **29** | **158** |
| **9/26/2002** | **2002** | **1.4** | **1.7** | **0.3** | **CHIN** | **82** | **37** | **119** |
| **9/26/2002** | **2002** | **1.7** | **1.9** | **0.2** | **CHIN** | **49** | **21** | **70** |

**Table C-11.** Burley Creek spawning ground surveys, 1987-2006.

| Date | RunYear | RMLower | RMUpper | Length | Species | Live Count | Dead Count | Total Count |
|---|---|---|---|---|---|---|---|---|
| 10/4/2002 | 2002 | 0.0 | 0.5 | 0.5 | CHIN | 3 | 4 | 7 |
| 10/4/2002 | 2002 | 0.5 | 1.4 | 0.9 | CHIN | 71 | 62 | 133 |
| 10/4/2002 | 2002 | 1.4 | 1.7 | 0.3 | CHIN | 40 | 36 | 76 |
| 10/4/2002 | 2002 | 1.7 | 1.9 | 0.2 | CHIN | 12 | 42 | 54 |
| 10/11/2002 | 2002 | 0.0 | 0.3 | 0.3 | CHIN | 0 | 1 | 1 |
| 10/11/2002 | 2002 | 0.3 | 0.5 | 0.2 | CHIN | 0 | 2 | 2 |
| 10/11/2002 | 2002 | 0.5 | 1.4 | 0.9 | CHIN | 2 | 60 | 62 |
| 10/11/2002 | 2002 | 1.4 | 1.7 | 0.3 | CHIN | 0 | 53 | 53 |
| 10/11/2002 | 2002 | 1.7 | 1.9 | 0.2 | CHIN | 3 | 46 | 49 |
| 10/18/2002 | 2002 | 0.3 | 1.4 | 1.1 | CHIN | 0 | 25 | 25 |
| 10/28/2002 | 2002 | 0.3 | 1.4 | 1.1 | COHO | - | - | - |
| 11/5/2002 | 2002 | 0.3 | 1.4 | 1.1 | CHUM | - | - | - |
| 11/14/2002 | 2002 | 0.3 | 1.4 | 1.1 | CHUM | - | - | - |
| | | | | | | | | |
| 8/28/2003 | 2003 | 1.7 | 1.9 | 0.2 | CHIN | 0 | 0 | 0 |
| 8/28/2003 | 2003 | 0.3 | 0.5 | 0.2 | CHIN | 1 | 0 | 1 |
| 8/28/2003 | 2003 | 1.4 | 1.7 | 0.3 | CHIN | 1 | 0 | 1 |
| 8/28/2003 | 2003 | 0.5 | 1.4 | 0.9 | CHIN | 5 | 0 | 5 |
| 8/28/2003 | 2003 | 0.0 | 0.3 | 0.3 | CHIN | 0 | 0 | 0 |
| 9/8/2003 | 2003 | 0.0 | 0.3 | 0.3 | CHIN | 0 | 0 | 0 |
| 9/8/2003 | 2003 | 1.4 | 1.7 | 0.3 | CHIN | 23 | 0 | 23 |
| 9/8/2003 | 2003 | 0.3 | 0.5 | 0.2 | CHIN | 0 | 0 | 0 |
| 9/8/2003 | 2003 | 1.7 | 1.9 | 0.2 | CHIN | 9 | 0 | 9 |
| 9/8/2003 | 2003 | 0.5 | 1.4 | 0.9 | CHIN | 45 | 0 | 45 |
| 9/15/2003 | 2003 | 0.0 | 0.3 | 0.3 | CHIN | 3 | 1 | 4 |
| 9/15/2003 | 2003 | 0.5 | 1.4 | 0.9 | CHIN | 43 | 4 | 47 |
| 9/15/2003 | 2003 | 1.4 | 1.7 | 0.3 | CHIN | 11 | 1 | 12 |
| 9/15/2003 | 2003 | 0.3 | 0.5 | 0.2 | CHIN | 0 | 0 | 0 |
| 9/15/2003 | 2003 | 1.7 | 1.9 | 0.2 | CHIN | 25 | 0 | 25 |

**Table C-11.** Burley Creek spawning ground surveys, 1987-2006.

| Date | RunYear | RMLower | RMUpper | Length | Species | Live Count | Dead Count | Total Count |
|---|---|---|---|---|---|---|---|---|
| **9/24/2003** | **2003** | **0.0** | **0.3** | **0.3** | **CHIN** | **0** | **0** | **0** |
| **9/24/2003** | **2003** | **1.4** | **1.7** | **0.3** | **CHIN** | **34** | **8** | **42** |
| **9/24/2003** | **2003** | **1.7** | **1.9** | **0.2** | **CHIN** | **35** | **2** | **37** |
| **9/24/2003** | **2003** | **0.5** | **1.4** | **0.9** | **CHIN** | **77** | **4** | **81** |
| **9/24/2003** | **2003** | **0.3** | **0.5** | **0.2** | **CHIN** | **0** | **0** | **0** |
| 10/3/2003 | 2003 | 0.0 | 0.3 | 0.3 | CHIN | 0 | 0 | 0 |
| 10/3/2003 | 2003 | 1.7 | 1.9 | 0.2 | CHIN | 16 | 16 | 32 |
| 10/3/2003 | 2003 | 0.3 | 0.5 | 0.2 | CHIN | 0 | 2 | 2 |
| 10/3/2003 | 2003 | 0.5 | 1.4 | 0.9 | CHIN | 57 | 23 | 80 |
| 10/3/2003 | 2003 | 1.4 | 1.7 | 0.3 | CHIN | 14 | 16 | 30 |
| 10/13/2003 | 2003 | 0.0 | 0.3 | 0.3 | CHIN | 0 | 0 | 0 |
| 10/13/2003 | 2003 | 0.3 | 0.5 | 0.2 | CHIN | 0 | 0 | 0 |
| 10/13/2003 | 2003 | 0.5 | 1.4 | 0.9 | CHIN | 4 | 19 | 23 |
| 10/13/2003 | 2003 | 1.7 | 1.9 | 0.2 | CHIN | 10 | 10 | 20 |
| 10/13/2003 | 2003 | 1.4 | 1.7 | 0.3 | CHIN | 10 | 15 | 25 |
| 10/28/2003 | 2003 | 0.3 | 0.5 | 0.2 | CHIN | 0 | 0 | 0 |
| 10/28/2003 | 2003 | 1.4 | 1.7 | 0.3 | CHIN | 0 | 0 | 0 |
| 10/28/2003 | 2003 | 1.7 | 1.9 | 0.2 | CHIN | 0 | 0 | 0 |
| 10/28/2003 | 2003 | 0.5 | 1.4 | 0.9 | CHIN | 1 | 3 | 4 |
| 10/28/2003 | 2003 | 0.0 | 0.3 | 0.3 | CHIN | 0 | 0 | 0 |
| 11/5/2003 | 2003 | 0.3 | 1.4 | 1.1 | COHO | - | - | - |
| 11/10/2003 | 2003 | 0.3 | 1.4 | 1.1 | CHUM | - | - | - |
| | | | | | | | | |
| 8/27/2004 | 2004 | 0.5 | 1.4 | 0.9 | CHIN | 4 | 2 | 6 |
| 8/27/2004 | 2004 | 0.3 | 0.5 | 0.2 | CHIN | 0 | 0 | 0 |
| 8/27/2004 | 2004 | 1.4 | 1.7 | 0.3 | CHIN | 4 | 0 | 4 |
| 8/27/2004 | 2004 | 1.7 | 1.9 | 0.2 | CHIN | 5 | 0 | 5 |

**Table C-11.** Burley Creek spawning ground surveys, 1987-2006.

| Date | RunYear | RMLower | RMUpper | Length | Species | Live Count | Dead Count | Total Count |
|---|---|---|---|---|---|---|---|---|
| 9/3/2004 | 2004 | 0.5 | 1.4 | 0.9 | CHIN | 6 | 3 | 9 |
| 9/3/2004 | 2004 | 0.3 | 0.5 | 0.2 | CHIN | 0 | 0 | 0 |
| 9/3/2004 | 2004 | 1.4 | 1.7 | 0.3 | CHIN | 8 | 0 | 8 |
| 9/3/2004 | 2004 | 0.0 | 0.3 | 0.3 | CHIN | 1 | 0 | 1 |
| 9/3/2004 | 2004 | 1.7 | 1.9 | 0.2 | CHIN | 3 | 0 | 3 |
| 9/9/2004 | 2004 | 0.5 | 1.4 | 0.9 | CHIN | 5 | 0 | 5 |
| 9/9/2004 | 2004 | 1.7 | 1.9 | 0.2 | CHIN | 5 | 0 | 5 |
| 9/9/2004 | 2004 | 0.3 | 0.5 | 0.2 | CHIN | 0 | 0 | 0 |
| 9/9/2004 | 2004 | 1.4 | 1.7 | 0.3 | CHIN | 5 | 0 | 5 |
| 9/9/2004 | 2004 | 0.0 | 0.3 | 0.3 | CHIN | 0 | 0 | 0 |
| **9/20/2004** | **2004** | **0.3** | **0.5** | **0.2** | **CHIN** | **0** | **0** | **0** |
| **9/20/2004** | **2004** | **1.4** | **1.7** | **0.3** | **CHIN** | **4** | **0** | **4** |
| **9/20/2004** | **2004** | **0.5** | **1.4** | **0.9** | **CHIN** | **11** | **3** | **14** |
| **9/20/2004** | **2004** | **1.7** | **1.9** | **0.2** | **CHIN** | **23** | **1** | **24** |
| 9/30/2004 | 2004 | 1.4 | 1.7 | 0.3 | CHIN | 4 | 4 | 8 |
| 9/30/2004 | 2004 | 0.3 | 1.4 | 1.1 | CHIN | 9 | 5 | 14 |
| 9/30/2004 | 2004 | 1.7 | 1.9 | 0.2 | CHIN | 8 | 11 | 19 |
| 10/11/2004 | 2004 | 0.5 | 1.4 | 0.9 | CHIN | 4 | 3 | 7 |
| 10/11/2004 | 2004 | 0.3 | 0.5 | 0.2 | CHIN | 0 | 0 | 0 |
| 10/11/2004 | 2004 | 1.7 | 1.9 | 0.2 | CHIN | 0 | 10 | 10 |
| 10/11/2004 | 2004 | 1.4 | 1.7 | 0.3 | CHIN | 0 | 0 | 0 |
| 10/21/2004 | 2004 | 0.3 | 1.4 | 1.1 | CHIN | 2 | 2 | 4 |
| 11/5/2004 | 2004 | 0.3 | 1.4 | 1.1 | COHO | - | - | - |
| 11/15/2004 | 2004 | 0.3 | 1.4 | 1.1 | CHUM | - | - | - |
| | | | | | | | | |
| 9/1/2005 | 2005 | 0.3 | 0.5 | 0.2 | CHIN | 1 | 0 | 1 |
| 9/1/2005 | 2005 | 0.5 | 1.4 | 0.9 | CHIN | 1 | 3 | 4 |
| 9/1/2005 | 2005 | 1.4 | 1.7 | 0.3 | CHIN | 5 | 1 | 6 |
| 9/1/2005 | 2005 | 1.7 | 1.9 | 0.2 | CHIN | 1 | 0 | 1 |

**Table C-11.** Burley Creek spawning ground surveys, 1987-2006.

| Date | RunYear | RMLower | RMUpper | Length | Species | Live Count | Dead Count | Total Count |
|---|---|---|---|---|---|---|---|---|
| 9/8/2005 | 2005 | 0.5 | 1.4 | 0.9 | CHIN | 4 | 0 | 4 |
| 9/8/2005 | 2005 | 1.4 | 1.7 | 0.3 | CHIN | 2 | 1 | 3 |
| 9/8/2005 | 2005 | 0.3 | 0.5 | 0.2 | CHIN | 2 | 0 | 2 |
| 9/8/2005 | 2005 | 1.7 | 1.9 | 0.2 | CHIN | 7 | 2 | 9 |
| 9/15/2005 | 2005 | 1.7 | 1.9 | 0.2 | CHIN | 28 | 4 | 32 |
| 9/15/2005 | 2005 | 0.3 | 0.5 | 0.2 | CHIN | 5 | 0 | 5 |
| 9/15/2005 | 2005 | 1.4 | 1.7 | 0.3 | CHIN | 22 | 1 | 23 |
| 9/15/2005 | 2005 | 0.5 | 1.4 | 0.9 | CHIN | 6 | 0 | 6 |
| 9/21/2005 | 2005 | 1.7 | 1.9 | 0.2 | CHIN | 26 | 6 | 32 |
| 9/21/2005 | 2005 | 0.5 | 1.4 | 0.9 | CHIN | 3 | 2 | 5 |
| 9/21/2005 | 2005 | 1.4 | 1.7 | 0.3 | CHIN | 34 | 2 | 36 |
| 9/21/2005 | 2005 | 0.3 | 0.5 | 0.2 | CHIN | 3 | 1 | 4 |
| **10/3/2005** | **2005** | **0.5** | **1.4** | **0.9** | **CHIN** | **22** | **4** | **26** |
| **10/3/2005** | **2005** | **1.4** | **1.7** | **0.3** | **CHIN** | **16** | **8** | **24** |
| **10/3/2005** | **2005** | **0.3** | **0.5** | **0.2** | **CHIN** | **0** | **0** | **0** |
| **10/3/2005** | **2005** | **1.7** | **1.9** | **0.2** | **CHIN** | **20** | **13** | **33** |
| 10/11/2005 | 2005 | 0.3 | 0.5 | 0.2 | CHIN | 0 | 0 | 0 |
| 10/11/2005 | 2005 | 1.4 | 1.7 | 0.3 | CHIN | 3 | 18 | 21 |
| 10/11/2005 | 2005 | 0.5 | 1.4 | 0.9 | CHIN | 4 | 5 | 9 |
| 10/11/2005 | 2005 | 1.7 | 1.9 | 0.2 | CHIN | 3 | 15 | 18 |
| 10/18/2005 | 2005 | 0.0 | 0.3 | 0.3 | CHIN | 0 | 0 | 0 |
| 10/18/2005 | 2005 | 1.7 | 1.9 | 0.2 | CHIN | 0 | 3 | 3 |
| 10/18/2005 | 2005 | 1.4 | 1.7 | 0.3 | CHIN | 0 | 13 | 13 |
| 10/18/2005 | 2005 | 0.5 | 1.4 | 0.9 | CHIN | 0 | 2 | 2 |
| 10/18/2005 | 2005 | 0.3 | 0.5 | 0.2 | CHIN | 0 | 0 | 0 |
| 10/26/2005 | 2005 | 0.3 | 1.4 | 1.1 | COHO | - | - | - |
| 11/10/2005 | 2005 | 0.3 | 1.4 | 1.1 | CHUM | - | - | - |

**Table C-11.** Burley Creek spawning ground surveys, 1987-2006.

| Date | RunYear | RMLower | RMUpper | Length | Species | Live Count | Dead Count | Total Count |
|---|---|---|---|---|---|---|---|---|
| 9/6/2006 | 2006 | 0.3 | 0.5 | 0.2 | CHIN | 4 | 0 | 4 |
| 9/6/2006 | 2006 | 1.4 | 1.7 | 0.3 | CHIN | 8 | 0 | 8 |
| 9/6/2006 | 2006 | 1.7 | 1.9 | 0.2 | CHIN | 24 | 0 | 24 |
| 9/6/2006 | 2006 | 0.5 | 1.4 | 0.9 | CHIN | 15 | 0 | 15 |
| 9/13/2006 | 2006 | 0.3 | 0.5 | 0.2 | CHIN | 3 | 0 | 3 |
| 9/13/2006 | 2006 | 0.5 | 1.4 | 0.9 | CHIN | 18 | 0 | 18 |
| 9/13/2006 | 2006 | 1.4 | 1.7 | 0.3 | CHIN | 48 | 1 | 49 |
| 9/13/2006 | 2006 | 1.7 | 1.9 | 0.2 | CHIN | 43 | 3 | 46 |
| 9/20/2006 | 2006 | 0.5 | 1.4 | 0.9 | CHIN | 67 | 8 | 75 |
| 9/20/2006 | 2006 | 1.4 | 1.7 | 0.3 | CHIN | 91 | 2 | 93 |
| 9/20/2006 | 2006 | 0.3 | 0.5 | 0.2 | CHIN | 8 | 1 | 9 |
| 9/20/2006 | 2006 | 1.7 | 1.9 | 0.2 | CHIN | 81 | 10 | 91 |
| **9/27/2006** | **2006** | **0.5** | **1.4** | **0.9** | **CHIN** | **118** | **22** | **140** |
| **9/27/2006** | **2006** | **1.4** | **1.7** | **0.3** | **CHIN** | **73** | **11** | **84** |
| **9/27/2006** | **2006** | **0.3** | **0.5** | **0.2** | **CHIN** | **6** | **1** | **7** |
| **9/27/2006** | **2006** | **1.7** | **1.9** | **0.2** | **CHIN** | **104** | **13** | **117** |
| 10/4/2006 | 2006 | 1.4 | 1.7 | 0.3 | CHIN | 52 | 24 | 76 |
| 10/4/2006 | 2006 | 1.7 | 1.9 | 0.2 | CHIN | 44 | 39 | 83 |
| 10/4/2006 | 2006 | 0.3 | 0.5 | 0.2 | CHIN | 5 | 1 | 6 |
| 10/4/2006 | 2006 | 0.5 | 1.4 | 0.9 | CHIN | 76 | 33 | 109 |
| 10/11/2006 | 2006 | 0.5 | 1.4 | 0.9 | CHIN | 16 | 43 | 59 |
| 10/11/2006 | 2006 | 0.3 | 0.5 | 0.2 | CHIN | 0 | 0 | 0 |
| 10/11/2006 | 2006 | 1.7 | 1.9 | 0.2 | CHIN | 14 | 25 | 39 |
| 10/11/2006 | 2006 | 1.4 | 1.7 | 0.3 | CHIN | 14 | 34 | 48 |
| 10/17/2006 | 2006 | 0.5 | 1.4 | 0.9 | CHIN | 5 | 25 | 30 |
| 10/17/2006 | 2006 | 1.7 | 1.9 | 0.2 | CHIN | 2 | 22 | 24 |
| 10/17/2006 | 2006 | 1.4 | 1.7 | 0.3 | CHIN | 2 | 14 | 16 |
| 10/17/2006 | 2006 | 0.3 | 0.5 | 0.2 | CHIN | 0 | 0 | 0 |
| 11/1/2006 | 2006 | 0.3 | 1.4 | 1.1 | CHIN | 1 | 0 | 1 |

Source: Spawning Ground Survey Database, 2007.

**Table D-1.** Hammersley Inlet streams mark recovery data, 2002-2006.

| Creek | Year | Sum of live counts | Sum of dead counts | Carcass count from mark sampling data | ADClippedNoBeep | ADClippedBeep | ADClippedNoHead |
|---|---|---|---|---|---|---|---|
| *Hammesley Inlet* | | | | | | | |
| **Johns** | 2002 | 0 | 0 | - | - | - | - |
| | 2003 | 0 | 0 | - | - | - | - |
| | 2004 | 0 | 0 | - | - | - | - |
| | 2005 | 1 | 0 | - | - | - | - |
| | 2006 | 0 | 0 | - | - | - | - |
| | | | | | | | |
| **Cranberry** | 2002 | 19 | 3 | 3 | 1 | - | - |
| | 2003 | 3 | 1 | 1 | - | - | - |
| | 2004 | 7 | 0 | - | - | - | - |
| | 2005 | 9 | 0 | - | - | - | - |
| | 2006 | 1 | 1 | 1 | - | - | - |
| | | | | | | | |
| **Deer** | 2002 | 20 | 7 | 7 | 3 | - | - |
| | 2003 | 27 | 3 | 3 | - | - | - |
| | 2004 | 24 | 4 | 4 | 1 | - | - |
| | 2005 | 11 | 3 | ***1*** | 1 | - | - |
| | 2006 | 5 | 1 | 1 | 1 | - | - |
| | | | | | | | |
| **Goldsborough** | 2002 | 8 | 3 | ***2*** | - | - | - |
| | 2003 | 1 | 0 | - | - | - | - |
| | 2004 | 4 | 0 | - | - | - | - |
| | 2005 | 2 | 0 | - | - | - | - |
| | 2006 | 0 | 0 | - | - | - | - |
| | | | | | | | |
| **Hammersley Inlet** | 2002 | 47 | 13 | 12 | 4 | - | - |
| **Totals** | 2003 | 31 | 4 | 4 | - | - | - |
| | 2004 | 35 | 4 | 4 | 1 | - | - |
| | 2005 | 23 | 3 | 1 | 1 | - | - |
| | 2006 | 6 | 2 | 2 | 1 | - | - |

Source: Spawning Ground Survey Database, 2007.

**Table D-1.** Hammersley Inlet streams mark recovery data, 2002-2006.

| Creek | Year | Carcass count from mark sampling data | PreSampled | UnknownMarkNoBeep (Adipose unknown) | UnknownMarkBeep | UnknownMarkNoHead (No Head or non-sampled) |
|---|---|---|---|---|---|---|
| **Johns** | 2002 | - | - | - | - | - |
| | 2003 | - | - | - | - | - |
| | 2004 | - | - | - | - | - |
| | 2005 | - | - | - | - | - |
| | 2006 | - | - | - | - | - |
| | | | | | | |
| **Cranberry** | 2002 | 3 | - | - | - | 1 |
| | 2003 | 1 | - | - | - | - |
| | 2004 | - | - | - | - | - |
| | 2005 | - | - | - | - | - |
| | 2006 | 1 | - | - | - | - |
| | | | | | | |
| **Deer** | 2002 | 7 | - | - | - | 2 |
| | 2003 | 3 | - | - | - | 1 |
| | 2004 | 4 | - | - | - | 1 |
| | 2005 | ***1*** | - | - | - | - |
| | 2006 | 1 | - | - | - | - |
| | | | | | | |
| **Goldsborough** | 2002 | ***2*** | 1 | - | - | 1 |
| | 2003 | - | - | - | - | - |
| | 2004 | - | - | - | - | - |
| | 2005 | - | - | - | - | - |
| | 2006 | - | - | - | - | - |
| | | | | | | |
| **Hammersley Inlet** | 2002 | 12 | 1 | - | - | 4 |
| **Totals** | 2003 | 4 | - | - | - | 1 |
| | 2004 | 4 | - | - | - | 1 |
| | 2005 | 1 | - | - | - | - |
| | 2006 | 2 | - | - | - | - |

Source: Spawning Ground Survey Database, 2007.

**Table D-1.** Hammersley Inlet streams mark recovery data, 2002-2006.

| Creek | Year | Carcass count from mark sampling data | UnMarkNoBeep | UnMarkBeep | UnMarkNoHead |
|---|---|---|---|---|---|
| **Johns** | 2002 | - | - | - | - |
| | 2003 | - | - | - | - |
| | 2004 | - | - | - | - |
| | 2005 | - | - | - | - |
| | 2006 | - | - | - | - |
| | | | | | |
| **Cranberry** | 2002 | 3 | 1 | - | - |
| | 2003 | 1 | 1 | - | - |
| | 2004 | - | - | - | - |
| | 2005 | - | - | - | - |
| | 2006 | 1 | 1 | - | - |
| | | | | | |
| **Deer** | 2002 | 7 | 1 | - | 1 |
| | 2003 | 3 | 2 | - | - |
| | 2004 | 4 | 2 | - | - |
| | 2005 | ***1*** | - | - | - |
| | 2006 | 1 | - | - | - |
| | | | | | |
| **Goldsborough** | 2002 | ***2*** | - | - | - |
| | 2003 | - | - | - | - |
| | 2004 | - | - | - | - |
| | 2005 | - | - | - | - |
| | 2006 | - | - | - | - |
| | | | | | |
| **Hammersley Inlet** | 2002 | 12 | 2 | - | 1 |
| **Totals** | 2003 | 4 | 3 | - | - |
| | 2004 | 4 | 2 | - | - |
| | 2005 | 1 | - | - | - |
| | 2006 | 2 | 1 | - | - |

Source: Spawning Ground Survey Database, 2007.

**Table D-2.** Case and Carr Inlet streams mark recovery data, 2002-2006.

| Creek | Year | Sum of live counts | Sum of dead counts | Carcass count from mark sampling data | ADClippedNoBeep | ADClippedBeep | ADClippedNoHead |
|---|---|---|---|---|---|---|---|
| *Case Inlet* | | | | | | | |
| **Sherwood** | 2002 | 46 | 8 | 8 | 1 | - | - |
| | 2003 | 35 | 7 | 7 | 1 | - | - |
| | 2004 | 144 | 24 | 24 | 2 | 1 | - |
| | 2005 | 86 | 25 | ***21*** | 2 | - | - |
| | 2006 | 10 | 2 | 2 | - | - | - |
| **Rocky** | 2002 | 26 | 71 | 71 | 22 | - | 3 |
| | 2003 | 1 | 4 | 4 | - | - | - |
| | 2004 | 0 | 0 | - | - | - | - |
| | 2005 | 83 | 93 | **55** | 28 | - | - |
| | 2006 | 11 | 19 | ***14*** | 9 | - | - |
| **Coulter** | 2002 | 3146 | 4272 | 4272 | 97 | - | 1 |
| | 2003 | 5309 | 2626 | 2626 | 159 | - | - |
| | 2004 | 2979 | 808 | 808 | 69 | - | - |
| | 2005 | 727 | 180 | ***91*** | 45 | 2 | - |
| | 2006 | 315 | 20 | ***8*** | 3 | - | - |
| *Carr Inlet* | | | | | | | |
| **Burley** | 2002 | 591 | 430 | 430 | 121 | 1 | 4 |
| | 2003 | 424 | 124 | ***123*** | 37 | - | - |
| | 2004 | 111 | 44 | 44 | 12 | - | - |
| | 2005 | 218 | 104 | ***77*** | 42 | - | - |
| | 2006 | 942 | 332 | ***222*** | 125 | 2 | - |

Source: Spawning Ground Survey Database, 2007.

**Table D-2.** Case and Carr Inlet streams mark recovery data, 2002-2006.

| Creek | Year | Carcass count from mark sampling data | PreSampled | UnknownMarkNoBeep (Adipose unknown) | UnknownMarkBeep | UnknownMarkNoHead (No Head or non-sampled) |
|---|---|---|---|---|---|---|
| *Case Inlet* | | | | | | |
| **Sherwood** | 2002 | 8 | 2 | - | - | 2 |
| | 2003 | 7 | 2 | - | - | - |
| | 2004 | 24 | 2 | - | - | 6 |
| | 2005 | ***21*** | 6 | - | - | - |
| | 2006 | 2 | - | - | - | - |
| **Rocky** | 2002 | 71 | 12 | - | - | 31 |
| | 2003 | 4 | - | - | - | 3 |
| | 2004 | - | - | - | - | - |
| | 2005 | **55** | 21 | - | - | - |
| | 2006 | ***14*** | 5 | - | - | - |
| **Coulter** | 2002 | 4272 | 21 | - | - | 4141 |
| | 2003 | 2626 | 89 | - | - | 2363 |
| | 2004 | 808 | 9 | - | - | 720 |
| | 2005 | ***91*** | 26 | 1 | - | - |
| | 2006 | ***8*** | 4 | - | - | - |
| *Carr Inlet* | | | | | | |
| **Burley** | 2002 | 430 | 62 | 7 | - | 176 |
| | 2003 | ***123*** | 14 | - | - | 48 |
| | 2004 | 44 | 6 | - | - | 18 |
| | 2005 | ***77*** | 28 | - | - | - |
| | 2006 | ***222*** | 88 | 2 | - | - |

Source: Spawning Ground Survey Database, 2007.

**Table D-2.** Case and Carr Inlet streams mark recovery data, 2002-2006.

| Creek | Year | Carcass count from mark sampling data | UnMarkNoBeep | UnMarkBeep | UnMarkNoHead |
|---|---|---|---|---|---|
| *Case Inlet* | | | | | |
| **Sherwood** | 2002 | 8 | 3 | - | - |
| | 2003 | 7 | 4 | - | - |
| | 2004 | 24 | 13 | - | - |
| | 2005 | ***21*** | 13 | - | - |
| | 2006 | 2 | 2 | - | - |
| **Rocky** | 2002 | 71 | 1 | - | 2 |
| | 2003 | 4 | 1 | - | - |
| | 2004 | - | - | - | - |
| | 2005 | **55** | 6 | - | - |
| | 2006 | ***14*** | - | - | - |
| **Coulter** | 2002 | 4272 | 12 | - | - |
| | 2003 | 2626 | 15 | - | - |
| | 2004 | 808 | 9 | 1 | - |
| | 2005 | ***91*** | 15 | 1 | 1 |
| | 2006 | ***8*** | 1 | - | - |
| *Carr Inlet* | | | | | |
| **Burley** | 2002 | 430 | 59 | - | - |
| | 2003 | ***123*** | 23 | 1 | - |
| | 2004 | 44 | 8 | - | - |
| | 2005 | ***77*** | 6 | 1 | - |
| | 2006 | ***222*** | 4 | 1 | - |

Source: Spawning Ground Survey Database, 2007.

**Table D-3.** Hammersley Inlet streams revised mark recovery data, 2002-2006.

| Creek | Year | Number of carcasses sampled | Adipose marked, CWT | Adipose unmarked, CWT | Adipose marked, no CWT | Adipose unmarked, no CWT |
|---|---|---|---|---|---|---|
| **Johns** | 2002 | 0 | 0 | 0 | 0 | 0 |
| | 2003 | 0 | 0 | 0 | 0 | 0 |
| | 2004 | 0 | 0 | 0 | 0 | 0 |
| | 2005 | 0 | 0 | 0 | 0 | 0 |
| | 2006 | 0 | 0 | 0 | 0 | 0 |
| | | | | | | |
| **Cranberry** | 2002 | 2 | 0 | 0 | 1 | 1 |
| | 2003 | 1 | 0 | 0 | 0 | 1 |
| | 2004 | 0 | 0 | 0 | 0 | 0 |
| | 2005 | 0 | 0 | 0 | 0 | 0 |
| | 2006 | 1 | 0 | 0 | 0 | 1 |
| | | | | | | |
| **Deer** | 2002 | 5 | 0 | 0 | 3 | 2 |
| | 2003 | 2 | 0 | 0 | 0 | 2 |
| | 2004 | 3 | 0 | 0 | 1 | 2 |
| | 2005 | 1 | 0 | 0 | 1 | 0 |
| | 2006 | 1 | 0 | 0 | 1 | 0 |
| | | | | | | |
| **Goldsborough** | 2002 | 0 | 0 | 0 | 0 | 0 |
| | 2003 | 0 | 0 | 0 | 0 | 0 |
| | 2004 | 0 | 0 | 0 | 0 | 0 |
| | 2005 | 0 | 0 | 0 | 0 | 0 |
| | 2006 | 0 | 0 | 0 | 0 | 0 |

Source: Spawning Ground Survey Database, 2007.

**Table D-3.** Hammersley Inlet streams revised mark recovery data, 2002-2006.

| | Year | Number of carcasses sampled | Adipose marked, CWT | Adipose unmarked, CWT | Adipose marked, no CWT | Adipose unmarked, no CWT |
|---|---|---|---|---|---|---|
| **Hammersley** | 2002 | 7 | 0 | 0 | 4 | 3 |
| **Inlet Totals** | 2003 | 3 | 0 | 0 | 0 | 3 |
| (by count) | 2004 | 3 | 0 | 0 | 1 | 2 |
| | 2005 | 1 | 0 | 0 | 1 | 0 |
| | 2006 | 2 | 0 | 0 | 1 | 1 |
| | | | | | | |
| | | | | | | |
| | Year | Number of carcasses sampled | Adipose marked, CWT | Adipose unmarked, CWT | Adipose marked, no CWT | Adipose unmarked, no CWT |
| **Hammersley** | 2002 | 7 | 0.00% | 0.00% | 57.14% | 42.86% |
| **Inlet Totals** | 2003 | 3 | 0.00% | 0.00% | 0.00% | 100.00% |
| (percentages) | 2004 | 3 | 0.00% | 0.00% | 33.33% | 66.67% |
| | 2005 | 1 | 0.00% | 0.00% | 100.00% | 0.00% |
| | 2006 | 2 | 0.00% | 0.00% | 50.00% | 50.00% |

Source: Spawning Ground Survey Database, 2007.

**Table D-4.** Case Inlet streams revised mark recovery data, 2002-2006.

| Creek | Year | Number of carcasses sampled | Adipose marked, CWT | Adipose unmarked, CWT | Adipose marked, no CWT | Adipose unmarked, no CWT |
|---|---|---|---|---|---|---|
| **Sherwood** | 2002 | 4 | 0 | 0 | 1 | 3 |
| | 2003 | 5 | 0 | 0 | 1 | 4 |
| | 2004 | 16 | 1 | 0 | 2 | 13 |
| | 2005 | 15 | 0 | 0 | 2 | 13 |
| | 2006 | 2 | 0 | 0 | 0 | 2 |
| | | | | | | |
| **Rocky** | 2002 | 28 | 0 | 0 | 25 | 3 |
| | 2003 | 1 | 0 | 0 | 0 | 1 |
| | 2004 | 0 | 0 | 0 | 0 | 0 |
| | 2005 | 34 | 0 | 0 | 28 | 6 |
| | 2006 | 9 | 0 | 0 | 9 | 0 |
| | | | | | | |
| **Coulter** | 2002 | 110 | 0 | 0 | 98 | 12 |
| | 2003 | 174 | 0 | 0 | 159 | 15 |
| | 2004 | 79 | 0 | 1 | 69 | 9 |
| | 2005 | 64 | 2 | 1 | 45 | 16 |
| | 2006 | 4 | 0 | 0 | 3 | 1 |
| | | | | | | |
| | | | | | | |
| | Year | Number of carcasses sampled | Adipose marked, CWT | Adipose unmarked, CWT | Adipose marked, no CWT | Adipose unmarked, no CWT |
| **Case Inlet** | 2002 | 142 | 0 | 0 | 124 | 18 |
| **Totals** | 2003 | 180 | 0 | 0 | 160 | 20 |
| (by count) | 2004 | 95 | 1 | 1 | 71 | 22 |
| | 2005 | 113 | 2 | 1 | 75 | 35 |
| | 2006 | 15 | 0 | 0 | 12 | 3 |
| | | | | | | |
| | | | | | | |
| | Year | Number of carcasses sampled | Adipose marked, CWT | Adipose unmarked, CWT | Adipose marked, no CWT | Adipose unmarked, no CWT |
| **Case Inlet** | 2002 | 142 | 0.00% | 0.00% | 87.32% | 12.68% |
| **Totals** | 2003 | 180 | 0.00% | 0.00% | 88.89% | 11.11% |
| (percentages) | 2004 | 95 | 1.05% | 1.05% | 74.74% | 23.16% |
| | 2005 | 113 | 1.77% | 0.88% | 66.37% | 30.97% |
| | 2006 | 15 | 0.00% | 0.00% | 80.00% | 20.00% |

Source: Spawning Ground Survey Database, 2007.

**Table D-5.** Carr Inlet streams revised mark recovery data, 2002-2006.

| Creek | Year | Number of carcasses sampled | Adipose marked, CWT | Adipose unmarked, CWT | Adipose marked, no CWT | Adipose unmarked, no CWT |
|---|---|---|---|---|---|---|
| **Burley** | 2002 | 185 | 1 | 0 | 125 | 59 |
| | 2003 | 61 | 0 | 1 | 37 | 23 |
| | 2004 | 20 | 0 | 0 | 12 | 8 |
| | 2005 | 49 | 0 | 1 | 42 | 6 |
| | 2006 | 132 | 2 | 1 | 125 | 4 |
| | | | | | | |
| | | | | | | |
| | Year | Number of carcasses sampled | Adipose marked, CWT | Adipose unmarked, CWT | Adipose marked, no CWT | Adipose unmarked, no CWT |
| **Carr Inlet** | 2002 | 185 | 1 | 0 | 125 | 59 |
| **Totals** | 2003 | 61 | 0 | 1 | 37 | 23 |
| (by count) | 2004 | 20 | 0 | 0 | 12 | 8 |
| | 2005 | 49 | 0 | 1 | 42 | 6 |
| | 2006 | 132 | 2 | 1 | 125 | 4 |
| | | | | | | |
| | | | | | | |
| | Year | Number of carcasses sampled | Adipose marked, CWT | Adipose unmarked, CWT | Adipose marked, no CWT | Adipose unmarked, no CWT |
| **Carr Inlet** | 2002 | 185 | 0.54% | 0.00% | 67.57% | 31.89% |
| **Totals** | 2003 | 61 | 0.00% | 1.64% | 60.66% | 37.70% |
| (percentages) | 2004 | 20 | 0.00% | 0.00% | 60.00% | 40.00% |
| | 2005 | 49 | 0.00% | 2.04% | 85.71% | 12.24% |
| | 2006 | 132 | 1.52% | 0.76% | 94.70% | 3.03% |

Source: Spawning Ground Survey Database, 2007.

**Table D-6.** Releases of eyed Chinook salmon eggs in Sherwood Creek by the Sherwood Creek Cooperative and Allyn Salmon Enhancement Group, brood years 1990-2003.

| Brood Year | Number of Chinook salmon released |
|---|---|
| 1990 | 10,000 |
| 1991 | 0 |
| 1992 | 0 |
| 1993 | 0 |
| 1994 | 0 |
| 1995 | 10,000 |
| 1996 | 10,000 |
| 1997 | 10,000 |
| 1998 | 10,000 |
| 1999 | 10,000 |
| 2000 | 10,000 |
| 2001 | 20,000 |
| 2002 | 10,000 |
| 2003 | 100,000 |

Source: John McAllister, Allyn Salmon Enhancement Group; personal communication.

**Table D-7.** Estimated return of Chinook salmon at Sherwood Creek due to eyed egg releases by regional enhancement groups, 1998-2006.

| **Brood Year** | **Pounds of eyed eggs released** | **1998** | **1999** | **2000** | **2001** | **2002** | **2003** | **2004** | **2005** | **2006** |
|---|---|---|---|---|---|---|---|---|---|---|
| 1995 | 10 | 1.39 | 1.34 | 0.06* | | | | | | |
| 1996 | 10 | | 1.39 | 1.34 | 0.06* | | | | | |
| 1997 | 10 | | | 1.39 | 1.34 | 0.06* | | | | |
| 1998 | 10 | | | | 1.39 | 1.34 | 0.06* | | | |
| 1999 | 10 | | | | | 1.39 | 1.34 | 0.06* | | |
| 2000 | 10 | | | | | | 1.39 | 1.34 | 0.06* | |
| 2001 | 20 | | | | | | | 2.77 | 2.68 | 0.12* |
| 2002 | 10 | | | | | | | | 1.39 | 1.34 |
| 2003 | 100 | | | | | | | | | 13.86 |
| | **Expected contribution** | 1.39 | 2.73 | 2.73 | 2.73 | 2.73 | 2.73 | 4.11 | 4.07 | 15.20 |

* Expected contributions from five-year olds were not included in the totals.

Expected contribution rates were calculated using number of hatchery returns per pounds of hatchery fish released rates for Nisqually Indian Tribe hatchery facilities. The rates for three-, four-, and five-year old returns from a contributing brood year release are as follows: 0.138583, 0.133796, and 0.005939. The weight of eyed eggs released at Sherwood Creek was estimated at 1,000 FPP.

**Table A-1.** Hatchery Chinook salmon brood year releases in the Nisqually Basin (WRIA 11), 1952-2004.

| Brood Year | Nisqually R | Clear Cr | Kalama Cr | McAllister Cr | Mashel R | Ohop Cr | Schorno Cr | Schorno Pond | WRIA Total |
|---|---|---|---|---|---|---|---|---|---|
| 1952 | | | | | | | | | |
| 1953 | | | | | | | | | |
| 1954 | | | | | | | | | |
| 1955 | 500 | | | | | | | | |
| 1956 | | | | | 150,000 | | | | |
| 1957 | 149,800 | | | | 100,000 | | | | |
| 1958 | 205,350 | | | | 76,782 | | | | |
| 1959 | 648,591 | | | | 175,230 | | | | |
| 1960 | | | | | | | | | |
| 1961 | 499,380 | | | | | | | | |
| 1962 | 726,160 | | | | | | | | |
| 1963 | 933,006 | | | | | | | | |
| 1964 | | | | | | | | | |
| 1965 | | | | | | | | | |
| 1966 | | | | | | | | | |
| 1967 | 150,142 | | | | | | | | |
| 1968 | | | | | | | | | |
| 1969 | | | | | | | | | |
| 1970 | 841,888 | | | | 150,000 | 50,000 | | | |
| 1971 | 2,076,304 | | | | | | | | |
| 1972 | 1,317,760 | | | | 146,000 | | | | |
| 1973 | 400,000 | | | | | | | | |
| 1974 | | | | | | | | | |
| 1975 | | | | | | | | 1,000,000 | |
| 1976 | 439,000 | | | | | | | | |
| 1977 | 601,381 | | | | 300,000 | | | | |
| 1978 | 491,011 | | | | | | | | |
| 1979 | 1,388,500 | | 815,810 | | | | | | |

Source: RMIS Database, 2008.

**Table A-1.** Hatchery Chinook salmon brood year releases in the Nisqually Basin (WRIA 11), 1952-2004.

| Brood Year | Nisqually R | Clear Cr | Kalama Cr | McAllister Cr | Mashel R | Ohop Cr | Schorno Cr | Schorno Pond | WRIA Total |
|---|---|---|---|---|---|---|---|---|---|
| 1980 | 1,407,789 | | 308,900 | | | | | | |
| 1981 | 1,002,718 | | 762,893 | 3,872,633 | | | | | |
| 1982 | | | 730,965 | | | | | 1,634,800 | |
| 1983 | | | 753,275 | 3,246,100 | | | | 1,837,000 | |
| 1984 | | | 1,920,576 | 1,391,400 | | 193,008 | | 2,087,600 | |
| 1985 | 1,251,490 | | 1,688,664 | 1,286,300 | 371,800 | 67,555 | | 894,000 | |
| 1986 | 282,035 | | 1,035,072 | 1,232,200 | 778,235 | 216,435 | | 1,868,200 | |
| 1987 | 193,900 | 229,200 | 1,045,000 | 1,648,300 | 476,100 | 193,900 | | 193,900 | |
| 1988 | 682,300 | | 900,000 | 1,205,800 | | | | | |
| 1989 | | | 1,100,000 | 1,257,200 | | | 1200000 | | |
| 1990 | | 940,000 | 1,100,000 | 1,065,300 | | 12,000 | 850000 | | |
| 1991 | | 1,094,040 | 648,000 | 1,339,800 | | | | | |
| 1992 | | 536,000 | 527,000 | | | | | | |
| 1993 | | 985,000 | 802,000 | 76,000 | 3,400 | 6,000 | | | |
| 1994 | | 2,222,400 | 913,500 | 1,320,984 | | | | | |
| 1995 | | 2,269,599 | 589,900 | 1,373,600 | | | | | |
| 1996 | | 3,293,000 | 1,102,000 | 1,321,000 | | | | | |
| 1997 | | 2,704,000 | 553,000 | 1,602,565 | | | | | |
| 1998 | | 3,135,000 | 1,047,042 | 1,488,750 | | | | | |
| 1999 | | 3,187,514 | 1,089,381 | 1,226,500 | | | | | |
| 2000 | | 2,708,308 | 567,599 | 1,501,912 | | | | | |
| 2001 | | 3,463,953 | 633,513 | 1,371,752 | | | | | |
| 2002 | | 2,864,133 | 649,891 | | | | | | |
| 2003 | | 3,539,184 | 627,000 | | | | | | |
| 2004 | | 2,942,414 | 501,460 | | | | | | |
| | | | | | | | | | |
| Totals | 15,689,005 | 36,113,745 | 22,412,441 | 28,828,096 | 2,727,547 | 738,898 | 2,050,000 | 9,515,500 | |
| WRIA Total | | | | | | | | | 118,075,232 |

Source: RMIS Database, 2008.

**Table A-2.** Hatchery Chinook salmon brood year releases in the Tacoma Basin (WRIA 12), 1952-2004.

| Brood Year | American Lk (pier) | Chambers Cr | Lake Sequalitchew | Steilacoom Lk | Steilacoom Lk (pier) | Titlow Lagoon | WRIA Total |
|---|---|---|---|---|---|---|---|
| 1952 | | | | | | | |
| 1953 | | | | | | | |
| 1954 | | | | | | | |
| 1955 | | | | | | | |
| 1956 | | | | | | | |
| 1957 | | | | | | | |
| 1958 | | | | | | 83,975 | |
| 1959 | | | 496,200 | | | 119,280 | |
| 1960 | | | | | | 313,500 | |
| 1961 | | | | | | 90,720 | |
| 1962 | | | | | | 80,520 | |
| 1963 | | | | | | 82,560 | |
| 1964 | | | | | | | |
| 1965 | | | | | | | |
| 1966 | | | | | | | |
| 1967 | | | | | | | |
| 1968 | | | | | | | |
| 1969 | | | | | | | |
| 1970 | | | | | | | |
| 1971 | | | | | | | |
| 1972 | | | | | | | |
| 1973 | 466,550 | | | | | | |
| 1974 | 225,000 | 45,000 | 37,102 | | | | |
| 1975 | | 1,000 | | | | | |
| 1976 | | | | | | | |
| 1977 | | 162,300 | | | | | |
| 1978 | | 2,000 | | | | | |
| 1979 | | 717,922 | | | | | |

Source: RMIS Database, 2008.

**Table A-2.** Hatchery Chinook salmon brood year releases in the Tacoma Basin (WRIA 12), 1952-2004.

| Brood Year | American Lk (pier) | Chambers Cr | Lake Sequalitchew | Steilacoom Lk | Steilacoom Lk (pier) | Titlow Lagoon | WRIA Total |
|---|---|---|---|---|---|---|---|
| 1980 | | 798,471 | | 72,930 | | | |
| 1981 | | 866,378 | | | | | |
| 1982 | | 1,336,900 | | 102,000 | | | |
| 1983 | | 834,700 | | 9,300 | | | |
| 1984 | | 775,900 | | 50,000 | | | |
| 1985 | | 1,032,240 | | | | | |
| 1986 | | 888,600 | | | | | |
| 1987 | | 837,895 | | | | | |
| 1988 | | 853,410 | | 100,250 | | | |
| 1989 | | 994,132 | | 88,350 | | | |
| 1990 | | 967,800 | | 285,800 | | | |
| 1991 | | 839,060 | | 139,900 | | | |
| 1992 | | 864,850 | | 298,240 | | | |
| 1993 | | 735,720 | | | | | |
| 1994 | | 922,300 | | | 314,000 | | |
| 1995 | | 885,631 | | | 321,000 | | |
| 1996 | | 954,275 | | | | | |
| 1997 | | 1,099,511 | | | | | |
| 1998 | | 1,423,886 | | | 76,500 | | |
| 1999 | | 861,167 | | | 254,328 | | |
| 2000 | | 689,844 | | | 223,495 | | |
| 2001 | | 1,087,330 | | 1,172,603 | 433,268 | | |
| 2002 | | 1,076,794 | | | | | |
| 2003 | | 1,200,297 | | | | | |
| 2004 | | 1,198,995 | | | | | |
| | | | | | | | |
| Totals | 691,550 | 24,954,308 | 533,302 | 2,319,373 | 1,622,591 | 770,555 | |
| WRIA Total | | | | | | | 30,891,679 |

Source: RMIS Database, 2008.

**Table A-3.** Hatchery Chinook salmon brood year releases in the Deschutes Basin (WRIA 13), 1952-2004.

| Brood Year | Capitol Lake | Deschutes River | McLane Cr | Percival Cr | Silver Spring Cr | Woodland Cr | WRIA Total |
|---|---|---|---|---|---|---|---|
| 1952 | | | | | | | |
| 1953 | | 281,820 | | | | | |
| 1954 | | | | | | | |
| 1955 | | 1,016,743 | | | | | |
| 1956 | | 762,427 | | | | | |
| 1957 | 1,854,033 | 1,520,070 | | | | | |
| 1958 | 2,075,801 | | | | | | |
| 1959 | 2,842,008 | | | | | | |
| 1960 | 5,560,652 | | | | 1,035,050 | | |
| 1961 | 1,529,000 | 500,800 | | | | | |
| 1962 | 1,501,550 | 498,870 | | | | | |
| 1963 | 1,544,794 | 500,500 | | | | | |
| 1964 | 2,296,080 | | | | | | |
| 1965 | 3,012,795 | | | | | | |
| 1966 | 3,616,412 | | | | | | |
| 1967 | 5,678,072 | 1,542,474 | | | | | |
| 1968 | 5,544,446 | | | | | | |
| 1969 | 5,415,940 | | | | | | |
| 1970 | 10,555,127 | | | | | | |
| 1971 | 7,868,185 | | | | | | |
| 1972 | 13,601,564 | | | | | | |
| 1973 | 11,398,816 | | | | | | |
| 1974 | 7,741,005 | | | | | | |
| 1975 | 635,646 | | | | | | |
| 1976 | 2,656,500 | 703,000 | | | | | |
| 1977 | 5,371,155 | 1,074,920 | 232,868 | | | | |
| 1978 | 1,181,283 | 599,866 | 41,880 | | | | |
| 1979 | 8,002,757 | | 146,633 | | | | |

Source: RMIS Database, 2008.

**Table A-3.** Hatchery Chinook salmon brood year releases in the Deschutes Basin (WRIA 13), 1952-2004.

| Brood Year | Capitol Lake | Deschutes River | McLane Cr | Percival Cr | Silver Spring Cr | Woodland Cr | WRIA Total |
|---|---|---|---|---|---|---|---|
| 1980 | 5,629,449 | | 75,582 | | | | |
| 1981 | 9,781,826 | | 71,599 | | | | |
| 1982 | 9,022,900 | | 128,100 | | | | |
| 1983 | 7,075,400 | | 140,100 | | | | |
| 1984 | 7,036,100 | 1,625,900 | 136,000 | | | | |
| 1985 | 7,595,900 | | 121,000 | | | | |
| 1986 | 8,108,668 | | 34,000 | | | | |
| 1987 | 8,165,340 | | | | | | |
| 1988 | 5,710,375 | 1,918,200 | | | | | |
| 1989 | 4,963,000 | 1,149,100 | | 1,000,000 | | 746,600 | |
| 1990 | 6,563,850 | | 82,000 | | | | |
| 1991 | 5,414,400 | 795,500 | 969,400 | | | | |
| 1992 | 6,000,070 | 1,482,100 | | | | | |
| 1993 | 3,770,600 | | | | | | |
| 1994 | 6,205,250 | 1,002,000 | | | | | |
| 1995 | 4,028,248 | | | | | | |
| 1996 | 2,450,188 | 470,000 | | 740,000 | | | |
| 1997 | 2,980,110 | 1,006,125 | 12,000 | 54,000 | | | |
| 1998 | 3,272,945 | 691,830 | | 188,890 | | | |
| 1999 | 2,016,177 | 3,924,127 | | | | | |
| 2000 | 4,041,800 | 10,044 | | | | | |
| 2001 | 4,308,000 | 84,150 | | | | | |
| 2002 | 691,750 | 3,438,524 | | | | | |
| 2003 | 1,303,600 | 2,983,136 | | | | | |
| 2004 | | 3,732,855 | | | | | |
| | | | | | | | |
| Totals | 237,619,567 | 33,315,081 | 2,191,162 | 1,982,890 | 1,035,050 | 746,600 | |
| WRIA Total | | | | | | | 276,890,350 |

Source: RMIS Database, 2008.

**Table A-4.** Hatchery Chinook salmon brood year releases in the Shelton Basin (WRIA 14), 1952-2004.

| | | | | | | | | South Sound | |
|---|---|---|---|---|---|---|---|---|---|
| Brood Year | Goldsborough Cr | Sherwood Cr | Schumocher Cr | Johns Cr | Kennedy Cr | Elson Cr | Cranberry Cr | Net Pens | WRIA Total |
| 1952 | | | | | | | | | |
| 1953 | | | | | | | | | |
| 1954 | | | | | | | | | |
| 1955 | | | | | | | | | |
| 1956 | | | 630,000 | | | | | | |
| 1957 | | 316,260 | | | | | | | |
| 1958 | | 251,600 | | | | | | | |
| 1959 | | | | | | | 505,050 | | |
| 1960 | | | | | | | | | |
| 1961 | 286,000 | | | | | | 249,796 | | |
| 1962 | 254,375 | | | | | | | | |
| 1963 | 508,335 | | | | | | | | |
| 1964 | 467,200 | | | | | | | | |
| 1965 | 203,770 | | | | | | | | |
| 1966 | | | | | | | | | |
| 1967 | | | | | | | | | |
| 1968 | | | | | | | | | |
| 1969 | | | | | | | | | |
| 1970 | | 466,480 | | | 263,700 | | | | |
| 1971 | | | | | | | | 353,933 | |
| 1972 | | | | | | | | | |
| 1973 | | | | | | | | | |
| 1974 | | | | | | | | | |
| 1975 | | | | | | | | | |
| 1976 | | | | | | | | | |
| 1977 | | | | | | | | | |
| 1978 | | | | 552,218 | | | | | |
| 1979 | | 44,500 | | | | 231,919 | | | |

Source: RMIS Database, 2008.

**Table A-4.** Hatchery Chinook salmon brood year releases in the Shelton Basin (WRIA 14), 1952-2004.

| | | | | | | | | South Sound | |
|---|---|---|---|---|---|---|---|---|---|
| Brood Year | Goldsborough Cr | Sherwood Cr | Schumocher Cr | Johns Cr | Kennedy Cr | Elson Cr | Cranberry Cr | Net Pens | WRIA Total |
| 1980 | | | | | | 222,641 | | | |
| 1981 | | 44,800 | | | | 559,902 | | | |
| 1982 | | | | | | 293,208 | | | |
| 1983 | | | | | | 221,227 | | | |
| 1984 | | | | | | 299,300 | | | |
| 1985 | | | | | | 276,640 | | 63,080 | |
| 1986 | | | | | | 334,478 | | 776,500 | |
| 1987 | | | | | | | | 814,860 | |
| 1988 | | | | | | | | 838,800 | |
| 1989 | 1,198,500 | | | | 824,400 | | | 821,850 | |
| 1990 | | | | | | | | 494,112 | |
| 1991 | | | 11,000 | | | | | 591,400 | |
| 1992 | | | | | | | | 170,850 | |
| 1993 | | | | | | | | 81,000 | |
| 1994 | | | | | | | | 191,700 | |
| 1995 | | | | | | | | 185,860 | |
| 1996 | | | | | | | | 114,700 | |
| 1997 | | | | | | | | 149,950 | |
| 1998 | | | | | | | | 160,500 | |
| 1999 | | | | | | | | | |
| 2000 | | | | | | | | | |
| 2001 | | | | | | | | | |
| 2002 | | 10,000 | | | | | | | |
| 2003 | | | | | | | | | |
| 2004 | | | | | | | | | |
| | | | | | | | | | |
| Totals | 2,918,180 | 1,133,640 | 641,000 | 552,218 | 1,088,100 | 2,439,315 | 754,846 | 5,809,095 | |
| WRIA Total | | | | | | | | | 15,336,394 |

Source: RMIS Database, 2008.

**Table A-5.** Hatchery Chinook salmon brood year releases in the Kitsap Basin (WRIA 15), and WRIA's 11-15, 1952-2004.

| | | | | Fox Island | | Hupp Springs | | Yearly totals |
|---|---|---|---|---|---|---|---|---|
| Brood Year | Minter Cr | Coulter Cr | Burley Cr | Net Pens | Huge Cr | Rearing | WRIA Total | (All WRIA's) |
| 1952 | 4,659 | | | | | | | 4,659 |
| 1953 | 123,568 | | | | | | | 405,388 |
| 1954 | 380,767 | 2,805 | | | | | | 383,572 |
| 1955 | 130,805 | | | | | | | 1,148,048 |
| 1956 | 1,972,083 | 175,000 | | | | | | 3,689,510 |
| 1957 | 1,380,327 | 188,020 | | | | | | 5,508,510 |
| 1958 | 2,495,457 | 253,640 | | | | | | 5,442,605 |
| 1959 | 1,360,348 | | | | | | | 6,146,707 |
| 1960 | 2,013,588 | | | | | | | 8,922,790 |
| 1961 | 2,075,650 | 224,910 | | | | | | 5,456,256 |
| 1962 | 2,728,261 | | | | | | | 5,789,736 |
| 1963 | 1,863,181 | | | | | | | 5,432,376 |
| 1964 | 2,571,060 | | | | | | | 5,334,340 |
| 1965 | 2,287,775 | | | | | | | 5,504,340 |
| 1966 | 2,178,552 | | | | | | | 5,794,964 |
| 1967 | 2,751,600 | | | | | | | 10,122,288 |
| 1968 | 2,840,424 | | | | | | | 8,384,870 |
| 1969 | 3,043,394 | | | | | | | 8,459,334 |
| 1970 | 850,511 | | | | | | | 13,177,706 |
| 1971 | 840,751 | | | | | | | 11,139,173 |
| 1972 | 1,646,260 | | | | | | | 16,711,584 |
| 1973 | 1,292,424 | | | | | | | 13,557,790 |
| 1974 | 2,293,341 | | | 92,555 | | | | 10,434,003 |
| 1975 | 1,869,798 | | | 73,575 | | | | 3,580,019 |
| 1976 | 1,689,453 | | | 210,733 | | | | 5,698,686 |
| 1977 | 2,808,558 | | | 188,346 | 100,000 | | | 10,839,528 |
| 1978 | 1,705,982 | | | 258,042 | | | | 4,832,282 |
| 1979 | 4,902,078 | 1,424,208 | | 390,184 | | 91,728 | | 18,156,239 |

Source: RMIS Database, 2008.

**Table A-5.** Hatchery Chinook salmon brood year releases in the Kitsap Basin (WRIA 15), and WRIA's 11-15, 1952-2004.

| | | | | Fox Island | | Hupp Springs | | Yearly totals |
|---|---|---|---|---|---|---|---|---|
| Brood Year | Minter Cr | Coulter Cr | Burley Cr | Net Pens | Huge Cr | Rearing | WRIA Total | (All WRIA's) |
| 1980 | 3,085,850 | 2,068,718 | | 176,551 | | 85,464 | | 13,932,345 |
| 1981 | 1,126,846 | 1,249,532 | | 181,006 | | | | 19,520,133 |
| 1982 | 1,949,200 | 685,343 | | 181,000 | | | | 16,064,416 |
| 1983 | 1,700,800 | 761,100 | | 157,500 | | 236,000 | | 16,972,502 |
| 1984 | 1,763,000 | 1,071,500 | | 187,100 | | 224,300 | | 18,761,684 |
| 1985 | 2,010,000 | 1,009,000 | | 162,600 | | | | 17,830,269 |
| 1986 | 1,820,400 | 1,173,000 | | 219,500 | | | | 18,767,323 |
| 1987 | 1,471,000 | 1,186,200 | | 193,500 | | 299,600 | | 16,948,695 |
| 1988 | 1,910,700 | 1,140,000 | | 205,700 | | | | 15,465,535 |
| 1989 | 2,705,700 | 1,273,000 | 299,000 | 198,899 | | | | 19,819,731 |
| 1990 | 2,006,800 | 1,057,000 | 777,200 | 204,400 | | | | 16,406,262 |
| 1991 | 2,105,000 | 900,000 | 50,000 | 303,082 | | | | 15,200,582 |
| 1992 | | 1,082,500 | | 270,553 | | | | 11,232,163 |
| 1993 | | 1,117,500 | | 226,624 | | | | 7,803,844 |
| 1994 | 2,073,000 | 1,098,300 | | 237,170 | | | | 16,500,604 |
| 1995 | 2,042,800 | 1,286,000 | | 212,100 | 227,000 | | | 13,421,738 |
| 1996 | 2,135,600 | 1,230,000 | | 252,600 | 276,000 | | | 14,339,363 |
| 1997 | 2,084,100 | 1,337,000 | | 243,425 | | | | 13,825,786 |
| 1998 | 2,091,748 | 1,294,000 | | 251,210 | | | | 15,122,301 |
| 1999 | 1,975,600 | 989,270 | | 228,750 | | | | 15,752,814 |
| 2000 | 2,113,950 | 833,700 | | | | | | 12,690,652 |
| 2001 | 1,892,500 | | | | | | | 14,447,069 |
| 2002 | 1,876,675 | | | | | | | 10,607,767 |
| 2003 | 1,714,725 | | | | | | | 11,367,942 |
| 2004 | 1,869,623 | | | | | | | 10,245,347 |
| | | | | | | | | |
| Totals | 97,626,272 | 26,111,246 | 1,126,200 | 5,506,705 | 603,000 | 937,092 | | |
| WRIA Total | | | | | | | 131,910,515 | 573,104,170 |

Source: RMIS Database, 2008.

**Table A-6.** Adipose mark and CWT rates for hatchery Chinook salmon brood year releases in the Nisqually Basin, 1997-2003.

| | **Clear Creek** | | | | | | | **Percentages** | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | CWT & | CWT, no | | No | Total | | CWT & | CWT, no | | No |
| Brood Year | AD Clipped | AD Clipped | AD Clipped | AD Clipped | released | | AD Clipped | AD Clipped | AD Clipped | AD Clipped |
| 1997 | 207,617 | 0 | 11,389 | 2,484,994 | 2,704,000 | | 7.68% | 0.00% | 0.42% | 91.90% |
| 1998 | 202,103 | 192,165 | 1,088,683 | 1,652,049 | 3,135,000 | | 6.45% | 6.13% | 34.73% | 52.70% |
| 1999 | 199,030 | 194,985 | 2,764,867 | 28,632 | 3,187,514 | | 6.24% | 6.12% | 86.74% | 0.90% |
| 2000 | 169,143 | 176,207 | 2,068,077 | 294,881 | 2,708,308 | | 6.25% | 6.51% | 76.36% | 10.89% |
| 2001 | 214,490 | 215,639 | 2,943,702 | 90,122 | 3,463,953 | | 6.19% | 6.23% | 84.98% | 2.60% |
| 2002 | 180,294 | 192,554 | 2,280,038 | 211,247 | 2,864,133 | | 6.29% | 6.72% | 79.61% | 7.38% |
| 2003 | 207,975 | 204,889 | 3,007,493 | 118,827 | 3,539,184 | | 5.88% | 5.79% | 84.98% | 3.36% |
| 2004 | 208,724 | 211,107 | 2,354,207 | 168,376 | 2,942,414 | | 7.09% | 7.17% | 80.01% | 5.72% |
| | | | | | | | | | | |
| **Kalama Creek** | | | | | | | | **Percentages** | | |
| | CWT & | CWT, no | | No | Total | | CWT & | CWT, no | | No |
| Brood Year | AD Clipped | AD Clipped | AD Clipped | AD Clipped | released | | AD Clipped | AD Clipped | AD Clipped | AD Clipped |
| 1997 | 0 | 0 | 0 | 553,000 | 553,000 | | 0.00% | 0.00% | 0.00% | 100.00% |
| 1998 | 94,723 | 0 | 7,239 | 945,080 | 1,047,042 | | 9.05% | 0.00% | 0.69% | 90.26% |
| 1999 | 88,949 | 0 | 1,000,432 | 0 | 1,089,381 | | 8.17% | 0.00% | 91.83% | 0.00% |
| 2000 | 83,178 | 3,655 | 471,237 | 9,529 | 567,599 | | 14.65% | 0.64% | 83.02% | 1.68% |
| 2001 | 82,860 | 6,951 | 532,428 | 11,274 | 633,513 | | 13.08% | 1.10% | 84.04% | 1.78% |
| 2002 | 95,101 | 1,758 | 536,298 | 16,734 | 649,891 | | 14.63% | 0.27% | 82.52% | 2.57% |
| 2003 | 96,131 | 342 | 528,737 | 1,790 | 627,000 | | 15.33% | 0.05% | 84.33% | 0.29% |
| 2004 | 56,177 | 2,859 | 423,498 | 18,926 | 501,460 | | 11.20% | 0.57% | 84.45% | 3.77% |
| | | | | | | | | | | |
| **McAllister Creek** | | | | | | | | **Percentages** | | |
| | CWT & | CWT, no | | No | Total | | CWT & | CWT, no | | No |
| Brood Year | AD Clipped | AD Clipped | AD Clipped | AD Clipped | released | | AD Clipped | AD Clipped | AD Clipped | AD Clipped |
| 1997 | 397,306 | 8,053 | 1,563 | 1,195,643 | 1,602,565 | | 24.79% | 0.50% | 0.10% | 74.61% |
| 1998 | 79,782 | 873 | 1,350,401 | 57,694 | 1,488,750 | | 5.36% | 0.06% | 90.71% | 3.88% |
| 1999 | 0 | 0 | 1,166,421 | 60,079 | 1,226,500 | | 0.00% | 0.00% | 95.10% | 4.90% |
| 2000 | 240,320 | 0 | 1,211,151 | 50,441 | 1,501,912 | | 16.00% | 0.00% | 80.64% | 3.36% |
| 2001 | 0 | 0 | 1,345,216 | 26,536 | 1,371,752 | | 0.00% | 0.00% | 98.07% | 1.93% |

Source: RMIS Database, 2008.

**Table A-7.** Adipose mark and CWT rates for hatchery Chinook salmon brood year releases in the Tacoma Basin, 1997-2003.

| **Chambers Creek** | | | | | | | | **Percentages** | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | CWT & | CWT, no | | No | Total | | CWT & | CWT, no | | No |
| Brood Year | AD Clipped | AD Clipped | AD Clipped | AD Clipped | released | | AD Clipped | AD Clipped | AD Clipped | AD Clipped |
| 1997 | 92,884 | 1,910 | 697 | 1,004,020 | 1,099,511 | | 8.45% | 0.17% | 0.06% | 91.32% |
| 1998 | 0 | 0 | 913,616 | 510,270 | 1,423,886 | | 0.00% | 0.00% | 64.16% | 35.84% |
| 1999 | 0 | 0 | 827,808 | 33,359 | 861,167 | | 0.00% | 0.00% | 96.13% | 3.87% |
| 2000 | 0 | 0 | 405,128 | 284,716 | 689,844 | | 0.00% | 0.00% | 58.73% | 41.27% |
| 2001 | 0 | 0 | 919,672 | 167,658 | 1,087,330 | | 0.00% | 0.00% | 84.58% | 15.42% |
| 2002 | 262,038 | 3,348 | 781,880 | 29,528 | 1,076,794 | | 24.34% | 0.31% | 72.61% | 2.74% |
| 2003 | 404,162 | 24,429 | 710,212 | 61,494 | 1,200,297 | | 33.67% | 2.04% | 59.17% | 5.12% |
| 2004 | 436,675 | 7,733 | 728,162 | 26,425 | 1,198,995 | | 36.42% | 0.64% | 60.73% | 2.20% |
| | | | | | | | | | | |
| **Steilacoom Lake (Pier)** | | | | | | | | **Percentages** | | |
| | CWT & | CWT, no | | No | Total | | CWT & | CWT, no | | No |
| Brood Year | AD Clipped | AD Clipped | AD Clipped | AD Clipped | released | | AD Clipped | AD Clipped | AD Clipped | AD Clipped |
| 1998 | 0 | 0 | 76,500 | 0 | 76,500 | | 0.00% | 0.00% | 100.00% | 0.00% |
| 1999 | 0 | 0 | 249,717 | 4,611 | 254,328 | | 0.00% | 0.00% | 98.19% | 1.81% |
| 2000 | 0 | 0 | 214,108 | 9,387 | 223,495 | | 0.00% | 0.00% | 95.80% | 4.20% |
| 2001 | 0 | 0 | 184,768 | 248,500 | 433,268 | | 0.00% | 0.00% | 42.65% | 57.35% |
| | | | | | | | | | | |
| **Steilacoom Lake** | | | | | | | | **Percentages** | | |
| | CWT & | CWT, no | | No | Total | | CWT & | CWT, no | | No |
| Brood Year | AD Clipped | AD Clipped | AD Clipped | AD Clipped | released | | AD Clipped | AD Clipped | AD Clipped | AD Clipped |
| 2001 | 0 | 0 | 1,125,699 | 46,904 | 1,172,603 | | 0.00% | 0.00% | 96.00% | 4.00% |

Source: RMIS Database, 2008.

**Table A-8.** Adipose mark and CWT rates for hatchery Chinook salmon brood year releases in the Deschutes Basin, 1997-2003.

| | **Capitol Lake** | | | | | | | **Percentages** | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | CWT & | CWT, no | | No | Total | | CWT & | CWT, no | | No |
| Brood Year | AD Clipped | AD Clipped | AD Clipped | AD Clipped | released | | AD Clipped | AD Clipped | AD Clipped | AD Clipped |
| 1997 | 190,356 | 0 | 944 | 2,788,810 | 2,980,110 | | 6.39% | 0.00% | 0.03% | 93.58% |
| 1998 | 0 | 0 | 3,182,830 | 90,115 | 3,272,945 | | 0.00% | 0.00% | 97.25% | 2.75% |
| 1999 | 67,926 | 1,965 | 1,943,211 | 3,075 | 2,016,177 | | 3.37% | 0.10% | 96.38% | 0.15% |
| 2000 | 178,011 | 2,814 | 3,741,270 | 119,705 | 4,041,800 | | 4.40% | 0.07% | 92.56% | 2.96% |
| 2001 | 72,937 | 0 | 4,208,893 | 26,170 | 4,308,000 | | 1.69% | 0.00% | 97.70% | 0.61% |
| 2002 | 0 | 0 | 681,582 | 10,168 | 691,750 | | 0.00% | 0.00% | 98.53% | 1.47% |
| 2003 | 0 | 0 | 1,229,483 | 74,117 | 1,303,600 | | 0.00% | 0.00% | 94.31% | 5.69% |
| | | | | | | | | | | |
| **Deschutes River** | | | | | | | | **Percentages** | | |
| | CWT & | CWT, no | | No | Total | | CWT & | CWT, no | | No |
| Brood Year | AD Clipped | AD Clipped | AD Clipped | AD Clipped | released | | AD Clipped | AD Clipped | AD Clipped | AD Clipped |
| 1997 | 0 | 0 | 0 | 1,006,125 | 1,006,125 | | 0.00% | 0.00% | 0.00% | 100.00% |
| 1998 | 0 | 0 | 679,131 | 12,699 | 691,830 | | 0.00% | 0.00% | 98.16% | 1.84% |
| 1999 | 0 | 0 | 3,869,190 | 54,937 | 3,924,127 | | 0.00% | 0.00% | 98.60% | 1.40% |
| 2000 | 0 | 10,044 | 0 | 0 | 10,044 | | 0.00% | 100.00% | 0.00% | 0.00% |
| 2001 | 0 | 0 | 84,150 | 0 | 84,150 | | 0.00% | 0.00% | 100.00% | 0.00% |
| 2002 | 266,087 | 18,430 | 3,068,106 | 85,901 | 3,438,524 | | 7.74% | 0.54% | 89.23% | 2.50% |
| 2003 | 257,134 | 10,224 | 2,562,081 | 153,697 | 2,983,136 | | 8.62% | 0.34% | 85.89% | 5.15% |
| 2004 | 272,010 | 2,175 | 3,334,766 | 123,904 | 3,732,855 | | 7.29% | 0.06% | 89.34% | 3.32% |
| | | | | | | | | | | |
| **Deschutes River** | | | | | | | | **Percentages** | | |
| | CWT & | CWT, no | | No | Total | | CWT & | CWT, no | | No |
| Brood Year | AD Clipped | AD Clipped | AD Clipped | AD Clipped | released | | AD Clipped | AD Clipped | AD Clipped | AD Clipped |
| 1997 | 0 | 0 | | 54,000 | 54,000 | | 0.00% | 0.00% | 0.00% | 100.00% |
| 1998 | 75,498 | 329 | 112,574 | 489 | 188,890 | | 39.97% | 0.17% | 59.60% | 0.26% |
| **McLane Creek** | | | | | | | | **Percentages** | | |
| | CWT & | CWT, no | | No | Total | | CWT & | CWT, no | | No |
| Brood Year | AD Clipped | AD Clipped | AD Clipped | AD Clipped | released | | AD Clipped | AD Clipped | AD Clipped | AD Clipped |
| 1997 | 10,800 | 0 | 1,200 | 0 | 12,000 | | 90.00% | 0.00% | 10.00% | 0.00% |

Source: RMIS Database, 2008.

**Table A-9.** Adipose mark and CWT rates for hatchery Chinook salmon brood year releases in the Shelton Basin, 1997-2003.

| Sherwood Creek | | | | | | | Percentages | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | CWT & | CWT, no | | No | Total | | CWT & | CWT, no | | No |
| Brood Year | AD Clipped | AD Clipped | AD Clipped | AD Clipped | released | | AD Clipped | AD Clipped | AD Clipped | AD Clipped |
| 2002 | 0 | 0 | 0 | 10,000 | 10,000 | | 0.00% | 0.00% | 0.00% | 100.00% |
| | | | | | | | | | | |
| **South Sound Net Pens** | | | | | | | **Percentages** | | | |
| | CWT & | CWT, no | | No | Total | | CWT & | CWT, no | | No |
| Brood Year | AD Clipped | AD Clipped | AD Clipped | AD Clipped | released | | AD Clipped | AD Clipped | AD Clipped | AD Clipped |
| 1997 | 126,032 | 0 | 253 | 23,665 | 149,950 | | 84.05% | 0.00% | 0.17% | 15.78% |
| 1998 | 0 | 0 | 157,290 | 3,210 | 160,500 | | 0.00% | 0.00% | 98.00% | 2.00% |

Source: RMIS Database, 2008.

**Table A-10.** Adipose mark and CWT rates for hatchery Chinook salmon brood year releases in the Kitsap Basin, 1997-2003.

| **Coulter Creek** | | | | | | | | **Percentages** | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | CWT & | CWT, no | | No | Total | | CWT & | CWT, no | | No |
| Brood Year | AD Clipped | AD Clipped | AD Clipped | AD Clipped | released | | AD Clipped | AD Clipped | AD Clipped | AD Clipped |
| 1997 | 0 | 0 | 0 | 1,337,000 | 1,337,000 | | 0.00% | 0.00% | 0.00% | 100.00% |
| 1998 | 0 | 0 | 1,269,229 | 24,771 | 1,294,000 | | 0.00% | 0.00% | 98.09% | 1.91% |
| 1999 | 0 | 0 | 947,237 | 42,033 | 989,270 | | 0.00% | 0.00% | 95.75% | 4.25% |
| 2000 | 0 | 0 | 819,428 | 14,272 | 833,700 | | 0.00% | 0.00% | 98.29% | 1.71% |
| | | | | | | | | | | |
| **Fox Island Net Pens** | | | | | | | | **Percentages** | | |
| | CWT & | CWT, no | | No | Total | | CWT & | CWT, no | | No |
| Brood Year | AD Clipped | AD Clipped | AD Clipped | AD Clipped | released | | AD Clipped | AD Clipped | AD Clipped | AD Clipped |
| 1997 | 239,089 | 4,336 | 0 | 0 | 243,425 | | 98.22% | 1.78% | 0.00% | 0.00% |
| 1998 | 0 | 0 | 249,395 | 1,815 | 251,210 | | 0.00% | 0.00% | 99.28% | 0.72% |
| 1999 | 0 | 0 | 213,967 | 14,783 | 228,750 | | 0.00% | 0.00% | 93.54% | 6.46% |
| | | | | | | | | | | |
| | **Minter Creek** | | | | | | | **Percentages** | | |
| | CWT & | CWT, no | | No | Total | | CWT & | CWT, no | | No |
| Brood Year | AD Clipped | AD Clipped | AD Clipped | AD Clipped | released | | AD Clipped | AD Clipped | AD Clipped | AD Clipped |
| 1997 | 13,496 | 302 | 1,302 | 2,069,000 | 2,084,100 | | 0.65% | 0.01% | 0.06% | 99.28% |
| 1998 | 0 | 0 | 2,038,625 | 53,123 | 2,091,748 | | 0.00% | 0.00% | 97.46% | 2.54% |
| 1999 | 0 | 0 | 1,899,839 | 76,211 | 1,976,050 | | 0.00% | 0.00% | 96.14% | 3.86% |
| 2000 | 0 | 0 | 2,058,887 | 55,063 | 2,113,950 | | 0.00% | 0.00% | 97.40% | 2.60% |
| 2001 | 0 | 0 | 1,888,842 | 3,658 | 1,892,500 | | 0.00% | 0.00% | 99.81% | 0.19% |
| 2002 | 192,690 | 2,407 | 1,663,142 | 18,436 | 1,876,675 | | 10.27% | 0.13% | 88.62% | 0.98% |
| 2003 | 196,942 | 810 | 1,510,924 | 6,049 | 1,714,725 | | 11.49% | 0.05% | 88.11% | 0.35% |
| 2004 | 199,863 | 1,395 | 1,665,863 | 2,502 | 1,869,623 | | 10.69% | 0.07% | 89.10% | 0.13% |

Source: RMIS Database, 2008.

**Table A-11.** Nisqually River fall Chinook salmon run reconstruction, 1986-2006.

| Run Year | Clear Creek Adults | Kalama Creek Adults | Total Adult Hatchery Escapement | Natural Escapement | Commercial Catch | Sports Catch | Test Fishery | Total Runsize without Jacks and Sports Catch |
|---|---|---|---|---|---|---|---|---|
| 1986 | | 281 | 281 | 300 | 1,025 | 0 | 0 | 1,606 |
| 1987 | | 117 | 117 | 85 | 2,100 | 0 | 0 | 2,302 |
| 1988 | | 735 | 735 | 1,342 | 1,573 | 0 | 0 | 3,650 |
| 1989 | | 794 | 794 | 2,332 | 4,008 | 0 | 0 | 7,134 |
| 1990 | | 700 | 700 | 994 | 4,606 | 0 | 0 | 6,300 |
| 1991 | | 201 | 201 | 953 | 428 | 0 | 0 | 1,582 |
| 1992 | 12 | 311 | 323 | 106 | 301 | 0 | 0 | 730 |
| 1993 | 629 | 743 | 1,372 | 1,655 | 4,163 | 0 | 0 | 7,190 |
| 1994 | 401 | 1703 | 2,104 | 1,730 | 6,123 | 0 | 0 | 9,957 |
| 1995 | 1,607 | 2,016 | 3,623 | 817 | 7,171 | 0 | 0 | 11,611 |
| 1996 | 1,826 | 875 | 2,701 | 606 | 5,365 | 0 | 0 | 8,672 |
| 1997 | 2,853 | 398 | 3,251 | 340 | 4,309 | 0 | 0 | 7,900 |
| 1998 | 2,894 | 1,173 | 4,067 | 834 | 7,990 | 0 | 0 | 12,891 |
| 1999 | 11,132 | 2,349 | 13,481 | 1,399 | 14,614 | 0 | 0 | 29,494 |
| 2000 | 3,759 | 1,164 | 4,923 | 1,253 | 6,836 | 0 | 0 | 13,012 |
| 2001 | 7,094 | 518 | 7,612 | 1,079 | 14,098 | 0 | 0 | 22,789 |
| 2002 | 8,025 | 1,316 | 9,341 | 1,542 | 11,737 | 0 | 16 | 22,636 |
| 2003 | 6,235 | 1,462 | 7,697 | 627 | 14,583 | 0 | 73 | 22,980 |
| 2004 | 7,255 | 970 | 8,225 | 2,788 | 13,850 | 0 | 90 | 24,953 |
| 2005 | 11,557 | 913 | 12,470 | 2,159 | 11,066 | 0 | 125 | 25,820 |
| 2006 | 10,003 | 532 | 10,535 | 2,179 | 21,443 | 0 | 125 | 34,282 |

No data for sports catch but Nisqually harvest management biologist, Craig Smith, estimates 1,000- 1,500 for 2003-2006.
Data for hatchery jacks excluded.

Source: Nisqually Indian Tribe, 2007b.

**Table A-12.** Mean monthly stream flow averages (cubic feet per second) for miscellaneous South Puget Sound streams and three fall Chinook salmon systems (Lower Skagit, Snohomish, and Nisqually Rivers).

| River/Creek | Jan. | Feb. | Mar. | Apr. | May | Jun. | Jul. | Aug. | Sep. | Oct. | Nov. | Dec. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Huge Creek | 24 | 22 | 16 | 10 | 7.4 | 6.0 | 5.0 | 4.6 | 4.6 | 5.6 | 10 | 18 |
| Goldsborough Creek | 256 | 236 | 190 | 133 | 73 | 45 | 30 | 25 | 25 | 52 | 138 | 197 |
| Kennedy Creek | 170 | 130 | 108 | 60 | 27 | 12 | 5.4 | 3.9 | 4.8 | 17 | 77 | 134 |
| Woodland Creek | 41 | 47 | 44 | 36 | 28 | 22 | 17 | 15 | 13 | 14 | 19 | 29 |
| | | | | | | | | | | | | |
| Deschutes River | 778 | 801 | 590 | 462 | 296 | 191 | 129 | 104 | 98 | 160 | 480 | 710 |
| | | | | | | | | | | | | |
| Nisqually River | 2,180 | 2,180 | 1,570 | 1,320 | 1,140 | 890 | 571 | 438 | 521 | 822 | 1,610 | 2,280 |
| Mashel River | 376 | 377 | 305 | 280 | 211 | 147 | 55 | 25 | 35 | 109 | 313 | 427 |
| Ohop Creek | 126 | 116 | 91 | 81 | 56 | 41 | 20 | 12 | 16 | 34 | 86 | 124 |
| | | | | | | | | | | | | |
| Snohomish River | 13,200 | 10,900 | 9,230 | 10,300 | 12,900 | 12,400 | 6,680 | 2,990 | 3,390 | 6,140 | 12,400 | 13,200 |
| | | | | | | | | | | | | |
| Skagit River | 17,900 | 16,700 | 14,200 | 15,000 | 20,200 | 24,300 | 19,900 | 11,600 | 9,380 | 12,400 | 18,200 | 18,700 |

Source: USGS website (www.usgs.gov).

**Table A-13.** USGS Stream gaging stations, locations, and years of operation.

| River/Creek | Stream Gaging Station | Location of Stream Gage | Years of operation |
|---|---|---|---|
| Huge Creek | 12073500 | Huge Creek (RM 0.2),<br>upstream of outlet to Minter Creek | 1947-Present |
| Goldsborough Creek | 12076500 | Goldsborough Creek (RM 5.8),<br>near Shelton, WA | 1951-1971 |
| Kennedy Creek | 12078400 | Kennedy Creek (RM 2.2),<br>near Kamilche, WA | 1960-1971 |
| Woodland Creek | 12081000 | Woodland Creek (RM 1.3),<br>near Olympia, WA | 1949-1969 |
| Deschutes River | 12080010 | Deschutes River (RM 3.5)<br>at E St Bridge at Tumwater, WA | 1945-1964, 1990-Present |
| Nisqually River | 12089500 | Nisqually River (RM 21.7)<br>at McKenna, WA | 1947-1968, 1978-Present |
| Mashel River | 12087000 | Mashel River (RM 3.0),<br>near La Grande, WA | 1940-1957, 1991-Present |
| Ohop Creek | 12088000 | Ohop Creek (RM 6.1),<br>near Eatonville, WA | 1941-1971, 1993-Present |
| Snohomish River | 12150800 | Snohomish River, near Monroe, WA | 1963-Present |
| Skagit River | 12200500 | Skagit River, near Mt. Vernon, WA | 1940-Present |

Sources: USGS website (www.usgs.gov); Williams et al., 1975.

**Table A-14.** Mean monthly average stream temperatures (° C) for three USGS gaging stations in the Skagit River and Snohomish River Basins.

| River/Creek | Jan. | Feb. | Mar. | Apr. | May | Jun. | Jul. | Aug. | Sep. | Oct. | Nov. | Dec. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Skagit River | 4.7 | 4.2 | 4.4 | 5.7 | 7.2 | 8.7 | 10.1 | 11.2 | 10.6 | 9.4 | 7.7 | 5.8 |
| North Fork Tolt River | 5.1 | 5.0 | 5.6 | 6.5 | 7.9 | 9.7 | 11.7 | 11.7 | 10.5 | 8.6 | 6.4 | 5.3 |
| South Fork Tolt River | 4.4 | 4.6 | 5.5 | 7.2 | 8.8 | 10.3 | 11.4 | 11.9 | 11.6 | 10.4 | 7.4 | 5.3 |

Source: USGS website (www.usgs.gov).

USGS Stream gaging stations, locations, and years of operation.

| River/Creek | Stream Gaging Station | Location of Stream Gage | Years temperature data collected |
|---|---|---|---|
| Skagit River | 12181000 | Skagit River at Marblemount, WA | 1986-2003 |
| North Fork Tolt River | 12148000 | North Fork Tolt River near Carnation, WA | 1994-2007 |
| South Fork Tolt River | 120148300 | South Fork Tolt River near Carnation, WA | 1994-2007 |

Sources: USGS website (www.usgs.gov).

**Table B-1.** Coulter Creek spawning ground surveys- 1960-1979, 2000-2006.

| Date | RunYear | RMLower | RMUpper | Length | Species | Live Count | Dead Count | Total Count |
|---|---|---|---|---|---|---|---|---|
| **10/31/1960** | **1960** | **0.0** | **0.9** | **0.9** | **CHIN** | **1** | **0** | **1** |
| | | | | | | | | |
| **10/19/1961** | **1961** | **0.0** | **0.9** | **0.9** | **CHIN** | **1** | **0** | **1** |
| 11/6/1961 | 1961 | 0.0 | 0.9 | 0.9 | CHIN | 1 | 0 | 1 |
| | | | | | | | | |
| **10/15/1962** | **1962** | **0.0** | **0.9** | **0.9** | **CHIN** | **13** | **0** | **13** |
| | | | | | | | | |
| **11/4/1963** | **1963** | **0.0** | **0.9** | **0.9** | **CHIN** | **2** | **3** | **5** |
| | | | | | | | | |
| 10/14/1964 | 1964 | 0.0 | 0.9 | 0.9 | CHIN | 20 | 1 | 21 |
| **10/29/1964** | **1964** | **0.0** | **0.9** | **0.9** | **CHIN** | **22** | **6** | **28** |
| | | | | | | | | |
| **10/22/1965** | **1965** | **0.0** | **0.9** | **0.9** | **CHIN** | **5** | **22** | **27** |
| | | | | | | | | |
| **10/21/1966** | **1966** | **0.0** | **0.9** | **0.9** | **CHIN** | **59** | **8** | **67** |
| | | | | | | | | |
| 10/5/1967 | 1967 | 0.0 | 0.4 | 0.4 | CHIN | 4 | 0 | 4 |
| **10/20/1967** | **1967** | **0.0** | **0.9** | **0.9** | **CHIN** | **10** | **5** | **15** |
| | | | | | | | | |
| 9/28/1968 | 1968 | 0.4 | 0.9 | 0.5 | CHUM | - | - | - |
| 10/7/1968 | 1968 | 0.0 | 0.9 | 0.9 | CHIN | 18 | 0 | 18 |
| **10/18/1968** | **1968** | **0.9** | **1.2** | **0.3** | **CHIN** | **41** | **7** | **48** |
| 10/30/1968 | 1968 | 0.0 | 0.9 | 0.9 | CHIN | 9 | 13 | 22 |
| 11/13/1968 | 1968 | 0.0 | 0.4 | 0.4 | CHUM | - | - | - |
| | | | | | | | | |
| **10/15/1969** | **1969** | **0.0** | **0.9** | **0.9** | **CHIN** | **27** | **6** | **33** |
| 11/5/1969 | 1969 | 0.9 | 2.9 | 2.0 | CHIN | 8 | 17 | 25 |
| | | | | | | | | |
| **10/14/1970** | **1970** | **0.0** | **0.9** | **0.9** | **CHIN** | **41** | **12** | **53** |
| **10/14/1970** | **1970** | **0.9** | **1.4** | **0.5** | **CHIN** | **13** | **3** | **16** |
| 11/10/1970 | 1970 | 2.3 | 3.2 | 0.9 | COHO | - | - | - |

**Table B-1.** Coulter Creek spawning ground surveys- 1960-1979, 2000-2006.

| Date | RunYear | RMLower | RMUpper | Length | Species | Live Count | Dead Count | Total Count |
|---|---|---|---|---|---|---|---|---|
| **10/12/1971** | **1971** | **0.0** | **1.4** | **1.4** | **CHIN** | **22** | **6** | **28** |
| | | | | | | | | |
| 10/20/1972 | 1972 | 0.9 | 4.0 | 3.1 | CHIN | 27 | 9 | 36 |
| **10/27/1972** | **1972** | **0.0** | **0.9** | **0.9** | **CHIN** | **32** | **11** | **43** |
| | | | | | | | | |
| **10/12/1973** | **1973** | **0.0** | **0.9** | **0.9** | **CHIN** | **35** | **1** | **36** |
| | | | | | | | | |
| 9/26/1974 | 1974 | 0.0 | 0.9 | 0.9 | COHO | - | - | - |
| 10/8/1974 | 1974 | 0.0 | 0.9 | 0.9 | CHIN | 1 | 0 | 1 |
| **10/18/1974** | **1974** | **0.0** | **0.9** | **0.9** | **CHIN** | **15** | **4** | **19** |
| 10/24/1974 | 1974 | 0.9 | 1.9 | 1.0 | CHIN | 3 | 0 | 3 |
| 10/30/1974 | 1974 | 0.0 | 0.9 | 0.9 | CHIN | 8 | 0 | 8 |
| 10/30/1974 | 1974 | 0.9 | 1.8 | 0.9 | CHIN | 1 | 0 | 1 |
| | | | | | | | | |
| 9/30/1975 | 1975 | 0.6 | 0.9 | 0.3 | CHIN | 0 | 1 | 1 |
| 10/3/1975 | 1975 | 0.0 | 0.9 | 0.9 | CHIN | 9 | 0 | 9 |
| 10/10/1975 | 1975 | 0.0 | 0.9 | 0.9 | CHIN | 5 | 1 | 6 |
| **10/20/1975** | **1975** | **0.0** | **0.9** | **0.9** | **CHIN** | **17** | **1** | **18** |
| 10/27/1975 | 1975 | 0.1 | 0.2 | 0.1 | CHUM | - | - | - |
| 11/1/1975 | 1975 | 0.0 | 0.9 | 0.9 | CHIN | 0 | 1 | 1 |
| | | | | | | | | |
| 9/13/1976 | 1976 | 0.0 | 0.9 | 0.9 | CHUM | - | - | - |
| 9/23/1976 | 1976 | 0.0 | 0.9 | 0.9 | CHIN | 5 | 0 | 5 |
| 9/29/1976 | 1976 | 0.0 | 0.9 | 0.9 | CHIN | 1 | 0 | 1 |
| 10/6/1976 | 1976 | 0.0 | 0.9 | 0.9 | CHIN | 12 | 0 | 12 |
| **10/13/1976** | **1976** | **0.0** | **0.9** | **0.9** | **CHIN** | **18** | **6** | **24** |
| 10/13/1976 | 1976 | 0.9 | 1.4 | 0.5 | CHIN | 0 | 1 | 1 |
| 10/27/1976 | 1976 | 0.0 | 0.9 | 0.9 | CHIN | 2 | 5 | 7 |
| 11/1/1976 | 1976 | 0.0 | 0.9 | 0.9 | CHIN | 3 | 0 | 3 |
| 11/15/1976 | 1976 | 0.9 | 2.3 | 1.4 | CHIN | 0 | 1 | 1 |

**Table B-1.** Coulter Creek spawning ground surveys- 1960-1979, 2000-2006.

| Date | RunYear | RMLower | RMUpper | Length | Species | Live Count | Dead Count | Total Count |
|---|---|---|---|---|---|---|---|---|
| 9/28/1977 | 1977 | 0.0 | 0.9 | 0.9 | CHUM | - | - | - |
| **10/13/1977** | **1977** | **0.0** | **0.9** | **0.9** | **CHIN** | **15** | **0** | **15** |
| 10/26/1977 | 1977 | 0.0 | 0.9 | 0.9 | COHO | - | - | - |
| 11/10/1977 | 1977 | 0.0 | 0.5 | 0.5 | COHO | - | - | - |
| | | | | | | | | |
| 9/15/1978 | 1978 | 0.0 | 0.9 | 0.9 | COHO | - | - | - |
| 10/6/1978 | 1978 | 0.0 | 0.9 | 0.9 | CHIN | 1 | 0 | 1 |
| **10/20/1978** | **1978** | **0.0** | **0.9** | **0.9** | **CHIN** | **11** | **2** | **13** |
| 11/6/1978 | 1978 | 0.0 | 0.9 | 0.9 | CHIN | 2 | 1 | 3 |
| | | | | | | | | |
| **10/5/1979** | **1979** | **0.0** | **0.9** | **0.9** | **CHIN** | **4** | **0** | **4** |
| 11/9/1979 | 1979 | 0.0 | 0.9 | 0.9 | COHO | - | - | - |
| 11/13/1979 | 1979 | 0.9 | 2.3 | 1.4 | COHO | - | - | - |
| | | | | | | | | |
| | | | | | | | | |
| 9/1/2000 | 2000 | 0.0 | 1.1 | 1.1 | CHIN | 341 | 8 | 349 |
| 9/11/2000 | 2000 | 0.0 | 1.1 | 1.1 | CHIN | 1135 | 66 | 1201 |
| 9/18/2000 | 2000 | 0.0 | 1.1 | 1.1 | CHIN | 917 | 355 | 1272 |
| **9/28/2000** | **2000** | **0.0** | **1.1** | **1.1** | **CHIN** | **1280** | **605** | **1885** |
| 10/5/2000 | 2000 | 0.0 | 1.1 | 1.1 | CHIN | 776 | 565 | 1341 |
| 10/12/2000 | 2000 | 0.0 | 1.1 | 1.1 | CHIN | 282 | 1577 | 1859 |
| 10/19/2000 | 2000 | 0.0 | 1.1 | 1.1 | CHIN | 110 | 385 | 495 |
| 10/27/2000 | 2000 | 0.0 | 1.1 | 1.1 | CHIN | 5 | 0 | 5 |
| 11/6/2000 | 2000 | 0.0 | 1.1 | 1.1 | CHIN | 0 | 1 | 1 |

**Table B-1.** Coulter Creek spawning ground surveys- 1960-1979, 2000-2006.

| Date | RunYear | RMLower | RMUpper | Length | Species | Live Count | Dead Count | Total Count |
|---|---|---|---|---|---|---|---|---|
| 9/5/2001 | 2001 | 0.0 | 1.1 | 1.1 | CHIN | 754 | 76 | 830 |
| 9/11/2001 | 2001 | 0.0 | 1.1 | 1.1 | CHIN | 883 | 171 | 1054 |
| **9/20/2001** | **2001** | **0.0** | **1.1** | **1.1** | **CHIN** | **1213** | **279** | **1492** |
| 10/1/2001 | 2001 | 0.0 | 1.1 | 1.1 | CHIN | 497 | 491 | 988 |
| 10/9/2001 | 2001 | 0.0 | 1.1 | 1.1 | CHIN | 321 | 351 | 672 |
| 10/18/2001 | 2001 | 0.0 | 1.1 | 1.1 | CHIN | 123 | 81 | 204 |
| *10/18/2001* | *2001* | *1.1* | *3.2* | *2.1* | *CHIN* | *23* | *101* | *124* |
| 10/26/2001 | 2001 | 0.0 | 1.1 | 1.1 | CHIN | 9 | 0 | 9 |
| 11/5/2001 | 2001 | 0.0 | 1.1 | 1.1 | COHO | - | - | - |
| 11/13/2001 | 2001 | 0.0 | 1.1 | 1.1 | COHO | - | - | - |
| | | | | | | | | |
| **9/17/2002** | **2002** | **0.0** | **1.1** | **1.1** | **CHIN** | **1846** | **492** | **2338** |
| 9/27/2002 | 2002 | 0.0 | 1.1 | 1.1 | CHIN | 529 | 1028 | 1557 |
| *9/27/2002* | *2002* | *1.1* | *2.3* | *1.2* | *CHIN* | *73* | *87* | *160* |
| 10/4/2002 | 2002 | 0.0 | 1.1 | 1.1 | CHIN | 734 | 1355 | 2089 |
| 10/14/2002 | 2002 | 0.0 | 1.1 | 1.1 | CHIN | 36 | 1386 | 1422 |
| 10/24/2002 | 2002 | 0.0 | 1.1 | 1.1 | CHIN | 1 | 10 | 11 |
| *10/24/2002* | *2002* | *2.3* | *3.2* | *0.9* | *CHIN* | *3* | *4* | *7* |
| 11/1/2002 | 2002 | 0.0 | 1.1 | 1.1 | COHO | - | - | - |
| 11/8/2002 | 2002 | 0.0 | 1.1 | 1.1 | CHIN | 0 | 1 | 1 |
| 11/15/2002 | 2002 | 0.0 | 1.1 | 1.1 | COHO | - | - | - |
| | | | | | | | | |
| 8/22/2003 | 2003 | 0.0 | 1.1 | 1.1 | CHIN | 66 | 0 | 66 |
| 9/3/2003 | 2003 | 0.0 | 1.1 | 1.1 | CHIN | 926 | 6 | 932 |
| 9/10/2003 | 2003 | 0.0 | 1.1 | 1.1 | CHIN | 1771 | 121 | 1892 |
| **9/18/2003** | **2003** | **0.0** | **1.1** | **1.1** | **CHIN** | **1450** | **457** | **1907** |
| 9/25/2003 | 2003 | 0.0 | 1.1 | 1.1 | CHIN | 695 | 842 | 1537 |
| 10/2/2003 | 2003 | 0.0 | 1.1 | 1.1 | CHIN | 336 | 1180 | 1516 |
| *10/2/2003* | *2003* | *1.1* | *2.3* | *1.2* | *CHIN* | *65* | *345* | *410* |
| 10/10/2003 | 2003 | 0.0 | 1.1 | 1.1 | CHIN | 65 | 20 | 85 |

**Table B-1.** Coulter Creek spawning ground surveys- 1960-1979, 2000-2006.

| Date | RunYear | RMLower | RMUpper | Length | Species | Live Count | Dead Count | Total Count |
|---|---|---|---|---|---|---|---|---|
| 10/24/2003 | 2003 | 0.0 | 1.1 | 1.1 | COHO | - | - | - |
| *10/29/2003* | *2003* | *2.3* | *3.2* | *0.9* | *CHIN* | *1* | *0* | *1* |
| 11/3/2003 | 2003 | 0.0 | 1.1 | 1.1 | COHO | - | - | - |
| 11/7/2003 | 2003 | 0.0 | 1.1 | 1.1 | COHO | - | - | - |
| 11/13/2003 | 2003 | 0.0 | 1.1 | 1.1 | COHO | - | - | - |
| | | | | | | | | |
| 8/26/2004 | 2004 | 0.0 | 1.1 | 1.1 | CHIN | 199 | 5 | 204 |
| 9/3/2004 | 2004 | 0.0 | 1.1 | 1.1 | CHIN | 383 | 2 | 385 |
| 9/13/2004 | 2004 | 0.0 | 1.1 | 1.1 | CHIN | 569 | 9 | 578 |
| **9/20/2004** | **2004** | **0.0** | **1.1** | **1.1** | **CHIN** | **1053** | **93** | **1146** |
| *9/20/2004* | *2004* | *1.1* | *2.3* | *1.2* | *CHIN* | *460* | *59* | *519* |
| 9/27/2004 | 2004 | 0.0 | 1.1 | 1.1 | CHIN | 624 | 395 | 1019 |
| 10/6/2004 | 2004 | 0.0 | 1.1 | 1.1 | CHIN | 118 | 304 | 422 |
| 10/13/2004 | 2004 | 0.0 | 1.1 | 1.1 | CHIN | 31 | | |
| 10/20/2004 | 2004 | 0.0 | 1.1 | 1.1 | CHIN | 1 | | |
| *10/28/2004* | *2004* | *2.3* | *3.2* | *0.9* | *CHIN* | *0* | *0* | |
| 10/28/2004 | 2004 | 0.0 | 1.1 | 1.1 | CHIN | 1 | | |
| 11/4/2004 | 2004 | 0.0 | 1.1 | 1.1 | COHO | - | - | - |
| 11/10/2004 | 2004 | 0.0 | 1.1 | 1.1 | COHO | - | - | - |
| | | | | | | | | |
| **9/30/2005** | **2005** | **0.0** | **1.1** | **1.1** | **CHIN** | **190** | **49** | **239** |
| 10/7/2005 | 2005 | 0.0 | 1.1 | 1.1 | CHIN | 83 | 63 | 146 |
| 10/14/2005 | 2005 | 0.0 | 1.1 | 1.1 | CHIN | 11 | 43 | 54 |
| *10/14/2005* | *2005* | *1.1* | *2.3* | *1.2* | *CHIN* | *0* | *0* | *0* |
| 10/21/2005 | 2005 | 0.0 | 1.1 | 1.1 | CHIN | 8 | 9 | 17 |
| *10/26/2005* | *2005* | *2.3* | *3.2* | *0.9* | *CHIN* | *0* | *0* | *0* |
| 11/2/2005 | 2005 | 0.0 | 1.1 | 1.1 | COHO | - | - | - |
| 11/9/2005 | 2005 | 0.0 | 1.1 | 1.1 | COHO | - | - | - |

**Table B-1.** Coulter Creek spawning ground surveys- 1960-1979, 2000-2006.

| Date | RunYear | RMLower | RMUpper | Length | Species | Live Count | Dead Count | Total Count |
|---|---|---|---|---|---|---|---|---|
| 8/21/2006 | 2006 | 0.0 | 1.1 | 1.1 | CHIN | 0 | 0 | 0 |
| 9/1/2006 | 2006 | 0.0 | 1.1 | 1.1 | CHIN | 5 | 0 | 5 |
| 9/11/2006 | 2006 | 0.0 | 1.1 | 1.1 | CHIN | 68 | 0 | 68 |
| 9/18/2006 | 2006 | 0.0 | 1.1 | 1.1 | CHIN | 84 | 3 | 87 |
| **9/26/2006** | **2006** | **0.0** | **1.1** | **1.1** | **CHIN** | **103** | **2** | **105** |
| 10/3/2006 | 2006 | 0.0 | 1.1 | 1.1 | CHIN | 35 | 10 | 45 |
| 10/11/2006 | 2006 | 0.0 | 1.1 | 1.1 | CHIN | 16 | 4 | 20 |
| 10/19/2006 | 2006 | 0.0 | 1.1 | 1.1 | CHIN | 4 | 1 | 5 |
| 10/23/2006 | 2006 | 0.0 | 1.1 | 1.1 | CHUM | - | - | - |
| 10/23/2006 | 2006 | 0.0 | 1.1 | 1.1 | CHIN | 0 | 0 | 0 |
| *10/23/2006* | *2006* | *2.3* | *3.2* | *0.9* | *CHIN* | *0* | *0* | *0* |
| 11/1/2006 | 2006 | 0.0 | 1.1 | 1.1 | CHUM | - | - | - |
| 11/9/2006 | 2006 | 0.0 | 1.1 | 1.1 | CHUM | - | - | - |

Source: Spawning Ground Survey Database, 2007.

**Figure B-2.** Coulter Creek spawning ground survey effort- 1960-1979, 2000-2006.

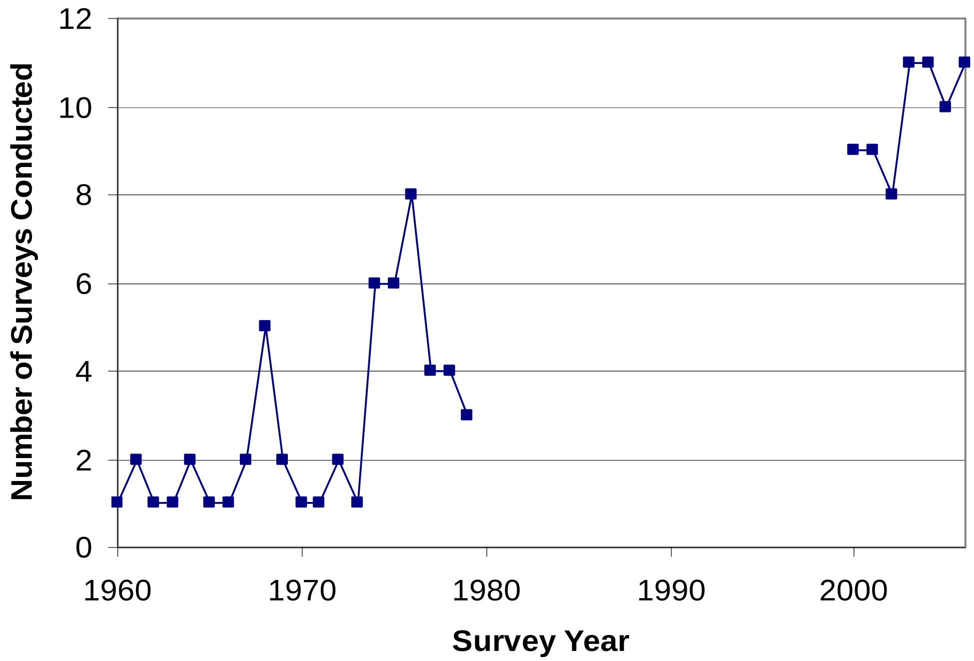


**Figure B-3.** Coulter Creek peak observed survey count dates- 1960-1979, 2000-2006.

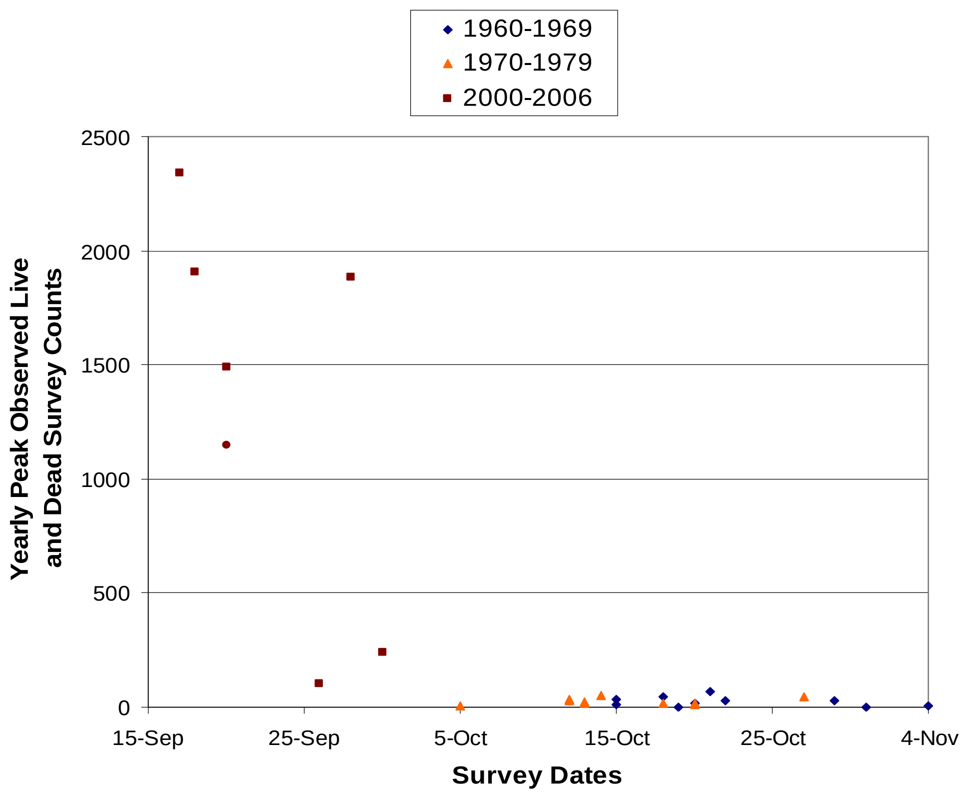

**Table C-1.** Chinook salmon hatchery releases in South Puget Sound tributaries, brood years 1952-2004.

| Release Location | Brood Year | Release Year | Number of fish released | Fish per pound Measured |
|---|---|---|---|---|
| Burley Creek | 1989 | 1990 | 430,800 | 1,008 |
| Burley Creek | 1990 | 1991 | 645,400 | 965- 1,008 |
| Burley Creek | 1991 | 1992 | 50,000 | 945 |
| | | | | |
| Cranberry Creek | 1959 | 1960 | 505,050 | 648 |
| Cranberry Creek | 1961 | 1962 | 249,796 | 782 |
| | | | | |
| Goldsborough Creek | 1961 | 1962 | 286,000 | 440 |
| Goldsborough Creek | 1962 | 1963 | 254,375 | 401- 477 |
| Goldsborough Creek | 1963 | 1964 | 508,335 | 234- 477 |
| Goldsborough Creek | 1964 | 1965 | 467,200 | 639 |
| Goldsborough Creek | 1965 | 1966 | 203,770 | 354 |
| Goldsborough Creek | 1989 | 1989 | 1,198,500 | 1,463 |
| | | | | |
| Johns Creek | 1978 | 1980 | 1,118,058 | 15 |
| | | | | |
| Schumocher Creek* | 1956 | 1957 | 630,000 | 1008 |
| Schumocher Creek | 1991 | 1992 | 11,000 | 100- 597 |
| | | | | |
| Sherwood Creek* | 1957 | 1958 | 316,260 | 251- 488 |
| Sherwood Creek | 1958 | 1959 | 251,600 | 677 |
| Sherwood Creek | 1970 | 1971 | 466,480 | 840 |
| Sherwood Creek | 1979 | 1980 | 44,500 | 889 |
| Sherwood Creek | 1981 | 1982 | 48,800 | 1,163 |

Source: RMIS Database, 2008.

* Note: Sherwood Creek and Schumocher Creek are part of the same system. Sherwood Creek is the name of the stream below Mason Lake (RM 0.0- RM 8.5), and Schumocher Creek is the name of the stream above Mason Lake (RM 12.9- RM 18.3).

**Table C-2.** South Puget Sound tributaries peak observed live and dead survey counts, 1987-2006.

| | 1987 | 1988 | 1989 | 1990 | 1991 | 1992 | 1993 | 1994 | 1995 | 1996 |
|---|---|---|---|---|---|---|---|---|---|---|
| **Hammersley** | | | | | | | | | | |
| *Cranberry* | 1 | 1 | 5 | 3 | 0 | 0 | 2 | 0 | 0 | 0 |
| | | | | | | | | | | |
| *Deer* | 20 | 13 | 12 | 34 | 68 | 13 | 4 | 3 | 0 | 1 |
| | | | | | | | | | | |
| *Goldsborough* | NS | NS | NS | NS | NS | NS | NS | NS | NS | NS |
| | | | | | | | | | | |
| *Johns* | 0 | 1 | 13 | 21 | 22 | 14 | 5 | 0 | 6 | 2 |
| | | | | | | | | | | |
| ***Totals*** | **21** | **15** | **30** | **58** | **90** | **27** | **11** | **3** | **6** | **3** |
| | | | | | | | | | | |
| | | | | | | | | | | |
| **Case** | | | | | | | | | | |
| *Sherwood* | 11 | 7 | 12 | 28 | 28 | 6 | 2 | 11 | 9 | 0 |
| | | | | | | | | | | |
| *Rocky* | 4 | 17 | 9 | 30 | 14 | 39 | 3 | 2 | 9 | 0 |
| | | | | | | | | | | |
| **Totals** | **15** | **24** | **21** | **58** | **42** | **45** | **5** | **13** | **18** | **0** |
| | | | | | | | | | | |
| | | | | | | | | | | |
| **Carr** | | | | | | | | | | |
| *Burley* | 16 | 160 | 98 | 196 | 396 | 385 | 307 | 414 | 84 | 47 |
| | | | | | | | | | | |
| **Totals** | **16** | **160** | **98** | **196** | **396** | **385** | **307** | **414** | **84** | **47** |
| | | | | | | | | | | |
| | | | | | | | | | | |
| **South Sound** | 52 | 199 | 149 | 312 | 528 | 457 | 323 | 430 | 108 | 50 |
| **Totals** | | | | | | | | | | |

NS- No surveys conducted for that year.

**Table C-2.** South Puget Sound tributaries peak observed live and dead survey counts, 1987-2006.

| | 1997 | 1998 | 1999 | 2000 | 2001 | 2002 | 2003 | 2004 | 2005 | 2006 |
|---|---|---|---|---|---|---|---|---|---|---|
| **Hammersley** | | | | | | | | | | |
| *Cranberry* | 3 | 3 | 4 | 3 | 2 | 16 | 2 | 4 | 6 | 2 |
| | | | | | | | | | | |
| *Deer* | 2 | 10 | 7 | 5 | 16 | 14 | 23 | 15 | 8 | 2 |
| | | | | | | | | | | |
| *Goldsborough* | NS | 9 | 8 | 14 | 9 | 6 | 1 | 3 | 2 | 0 |
| | | | | | | | | | | |
| *Johns* | 2 | 0 | 0 | 2 | 1 | 0 | 0 | 0 | 1 | 0 |
| | | | | | | | | | | |
| ***Totals*** | **7** | **22** | **19** | **24** | **28** | **36** | **26** | **22** | **17** | **4** |
| | | | | | | | | | | |
| | | | | | | | | | | |
| **Case** | | | | | | | | | | |
| *Sherwood* | 0 | 8 | 22 | 9 | 12 | 30 | 13 | 80 | 29 | 8 |
| | | | | | | | | | | |
| *Rocky* | 19 | 360 | 196 | 397 | 132 | 43 | 2 | 0 | 77 | 16 |
| | | | | | | | | | | |
| **Totals** | **19** | **368** | **218** | **406** | **144** | **73** | **15** | **80** | **106** | **24** |
| | | | | | | | | | | |
| | | | | | | | | | | |
| **Carr** | | | | | | | | | | |
| *Burley* | 25 | 121 | 257 | 33 | 191 | 350 | 160 | 42 | 83 | 341 |
| | | | | | | | | | | |
| **Totals** | **25** | **121** | **257** | **33** | **191** | **350** | **160** | **42** | **83** | **341** |
| | | | | | | | | | | |
| | | | | | | | | | | |
| **South Sound** | 51 | 511 | 494 | 463 | 363 | 459 | 201 | 144 | 206 | 369 |
| **Totals** | | | | | | | | | | |

NS- No surveys conducted for that year.

**Table C-3.** South Puget Sound tributaries AUC relative abundance estimates, 1987-2006.

| | 1987 | 1988 | 1989 | 1990 | 1991 | 1992 | 1993 | 1994 | 1995 | 1996 |
|---|---|---|---|---|---|---|---|---|---|---|
| **Hammersley** | | | | | | | | | | |
| *Cranberry* | 1^ | 0^ | 8 | 2 | 0 | 0* | 2 | 0 | 0* | 0* |
| | | | | | | | | | | |
| *Deer* | 22^ | 16^ | 21 | 57 | 83 | 19* | 9 | 5 | 0* | 1* |
| | | | | | | | | | | |
| *Goldsborough* | NS | NS | NS | NS | NS | NS | NS | NS | NS | NS |
| | | | | | | | | | | |
| *Johns* | 0* | 1* | 10 | 7 | 12 | 10 | 3 | 0 | 6* | 1 |
| | | | | | | | | | | |
| ***Totals*** | **23** | **17** | **39** | **66** | **95** | **29** | **14** | **5** | **6** | **2** |
| | | | | | | | | | | |
| | | | | | | | | | | |
| **Case** | | | | | | | | | | |
| *Sherwood* | 3^ | 8 | 15^ | 37 | 30 | 6 | 2 | 12 | 4* | 0* |
| | | | | | | | | | | |
| *Rocky* | 0^ | 18 | NC | 0* | 9^* | 33 | NC | 0 | 5* | 0* |
| | | | | | | | | | | |
| **Totals** | **3** | **26** | **15** | **37** | **39** | **39** | **2** | **12** | **9** | **0** |
| | | | | | | | | | | |
| **Carr** | | | | | | | | | | |
| *Burley* | NC | NC | NC | NC | NC | 487* | 535 | 640** | NC | 74 |
| | | | | | | | | | | |
| **Totals** | **0** | **0** | **0** | **0** | **0** | **487** | **535** | **640** | **0** | **74** |
| | | | | | | | | | | |
| | | | | | | | | | | |
| **South Sound Totals** | **26** | **43** | **54** | **103** | **134** | **555** | **551** | **657** | **15** | **76** |

* Data includes a gap of more than 14 days between surveys

** Data includes a first or last survey with a live count of 60 or greater

^ Data does not include a survey prior to September 25

NC- AUC not calculated because less than four surveys conducted. NS- No surveys conducted for that year.

**Table C-3.** South Puget Sound tributaries AUC relative abundance estimates, 1987-2006.

| | 1997 | 1998 | 1999 | 2000 | 2001 | 2002 | 2003 | 2004 | 2005 | 2006 |
|---|---|---|---|---|---|---|---|---|---|---|
| **Hammersley** | | | | | | | | | | |
| *Cranberry* | 7^ | 1 | 4 | 3 | 4 | 17 | 2 | 6 | 7 | 1 |
| | | | | | | | | | | |
| *Deer* | 2 | 12 | 21 | 5 | 33 | 19 | 20 | 17 | 11 | 4 |
| | | | | | | | | | | |
| *Goldsborough* | NS | 10^ | 5^* | 16* | 21 | 4 | 1 | 6^ | 2 | 0 |
| | | | | | | | | | | |
| *Johns* | 2 | 0 | 0 | 2 | 1 | 0 | 0* | 0 | 1 | 0 |
| | | | | | | | | | | |
| ***Totals*** | **11** | **23** | **30** | **26** | **59** | **40** | **23** | **29** | **21** | **5** |
| | | | | | | | | | | |
| | | | | | | | | | | |
| **Case** | | | | | | | | | | |
| *Sherwood* | 0* | 11 | 33 | 12 | 28 | 36 | 24 | 103 | 61 | 10 |
| | | | | | | | | | | |
| *Rocky* | 36* | 368 | 220 | 495 | 72 | 29 | 2 | NC | 70* | 16* |
| | | | | | | | | | | |
| **Totals** | **36** | **379** | **253** | **507** | **100** | **65** | **26** | **103** | **131** | **26** |
| | | | | | | | | | | |
| **Carr** | | | | | | | | | | |
| *Burley* | NC | NC | 285 | 65 | 316 | 468 | 387* | 103 | 181 | 671* |
| | | | | | | | | | | |
| **Totals** | **0** | **0** | **285** | **65** | **316** | **468** | **387** | **103** | **181** | **671** |
| | | | | | | | | | | |
| | | | | | | | | | | |
| **South Sound Totals** | **47** | **402** | **568** | **598** | **475** | **573** | **436** | **235** | **333** | **702** |

* Data includes a gap of more than 14 days between surveys
** Data includes a first or last survey with a live count of 60 or greater
^ Data does not include a survey prior to September 25
NC- AUC not calculated because less than four surveys conducted. NS- No surveys conducted for that year.

**Table C-4.** South Puget Sound Chinook salmon run reconstruction, 1987-2006.

| Run Year | *1987* | *1988* | *1989* | *1990* | *1991* | *1992* | *1993* | *1994* | *1995* | *1996* |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | | |
| **Run Area** | | | | | | | | | | |
| Misc. 13- McAllister Creek | 5,345 | 8,670 | 4,326 | 5,464 | 2,849 | 2,944 | 2,523 | 3,931 | 9,032 | 4,281 |
| Chambers Creek | 3,272 | 4,079 | 2,378 | 3,737 | 3,784 | 3,961 | 2,767 | 2,303 | 4,517 | 3,441 |
| Nisqually River | 2,679 | 4,273 | 7,860 | 6,670 | 1,719 | 791 | 7,494 | 10,454 | 11,528 | 8,746 |
| Mics 13A- Minter Creek | 4,494 | 4,744 | 5,261 | 7,011 | 5,914 | 4,963 | 3,157 | 4,624 | 1,730 | 366 |
| Deschutes River | 9,913 | 15,645 | 25,877 | 27,757 | 12,310 | 10,106 | 9,173 | 13,046 | 29,025 | 18,014 |
| Misc 13B Streams- Coulter Creek | 2,334 | 2,857 | 4,639 | 12,735 | 4,197 | 4,091 | 5,276 | 3,551 | 3,115 | 3,478 |
| | | | | | | | | | | |
| **Total Run Size** | **28,037** | **40,268** | **50,341** | **63,374** | **30,773** | **26,856** | **30,390** | **37,909** | **58,947** | **38,326** |
| | | | | | | | | | | |
| | | | | | | | | | | |
| **Run Year** | *1997* | *1998* | *1999* | *2000* | *2001* | *2002* | *2003* | *2004* | *2005* | *2006* |
| | | | | | | | | | | |
| **Run Area** | | | | | | | | | | |
| Misc. 13- McAllister Creek | 3,898 | 3,699 | 3,454 | 3,805 | 4,414 | 863 | 0 | 0 | 0 | 0 |
| Chambers Creek | 2,708 | 3,140 | 1,212 | 1,994 | 969 | 1,418 | 1,750 | 5,044 | 5,052 | 8,934 |
| Nisqually River | 8,267 | 11,958 | 24,499 | 12,024 | 19,091 | 27,730 | 26,294 | 24,895 | 26,785 | 34,333 |
| Mics 13A- Minter Creek | 3,665 | 8,635 | 14,608 | 9,904 | 13,741 | 10,835 | 7,174 | 5,904 | 6,843 | 15,155 |
| Deschutes River | 4,237 | 4,348 | 7,947 | 9,007 | 6,005 | 8,559 | 8,412 | 13,419 | 12,250 | 20,288 |
| Misc 13B Streams- Coulter Creek | 2,216 | 2,909 | 7,312 | 4,467 | 3,833 | 5,884 | 4,692 | 2,718 | 568 | 0 |
| | | | | | | | | | | |
| **Total Run Size** | **24,991** | **34,689** | **59,032** | **41,201** | **48,053** | **55,289** | **48,322** | **51,980** | **51,498** | **78,710** |

Source: WDFW, 2007b.

**Table C-5.** Cranberry Creek spawning ground surveys, 1987-2006.

| Date | RunYear | RMLower | RMUpper | Length | Species | Live Count | Dead Count | Total Count |
|---|---|---|---|---|---|---|---|---|
| **10/12/1987**** | **1987** | **0.0** | **0.2** | **0.2** | **CHIN** | **1** | **0** | **1** |
| 10/15/1987 | 1987 | 0.0 | 0.4 | 0.4 | COHO | - | - | - |
| 10/29/1987 | 1987 | 0.0 | 0.5 | 0.5 | CHUM | - | - | - |
| 11/5/1987 | 1987 | 0.0 | 3.5 | 3.5 | COHO | - | - | - |
| 11/13/1987 | 1987 | 0.0 | 3.5 | 3.5 | CHUM | - | - | - |
| | | | | | | | | |
| **10/11/1988** | **1988** | **0.0** | **3.5** | **3.5** | **CHIN** | **0** | **1** | **1** |
| 10/21/1988 | 1988 | 0.0 | 3.5 | 3.5 | COHO | - | - | - |
| 10/24/1988** | 1988 | 0.0 | 3.5 | 3.5 | CHUM | - | - | - |
| 11/4/1988 | 1988 | 0.0 | 3.5 | 3.5 | COHO | - | - | - |
| | | | | | | | | |
| 9/19/1989 | 1989 | 0.1 | 1.0 | 0.9 | CHUM | - | - | - |
| 9/29/1989 | 1989 | 0.0 | 2.5 | 2.5 | CHIN | 3 | 0 | 3 |
| **10/10/1989** | **1989** | **0.0** | **3.5** | **3.5** | **CHIN** | **5** | **0** | **5** |
| 10/17/1989 | 1989 | 0.0 | 3.5 | 3.5 | CHIN | 1 | 3 | 4 |
| 10/25/1989 | 1989 | 0.0 | 3.5 | 3.5 | CHUM | - | - | - |
| 10/30/1989** | 1989 | 0.0 | 3.5 | 3.5 | CHUM | - | - | - |
| 11/10/1989** | 1989 | 0.0 | 3.5 | 3.5 | CHUM | - | - | - |
| | | | | | | | | |
| 9/21/1990 | 1990 | 0.0 | 1.0 | 1.0 | CHUM | - | - | - |
| 10/4/1990 | 1990 | 0.0 | 3.5 | 3.5 | CHUM | - | - | - |
| 10/16/1990 | 1990 | 0.0 | 3.5 | 3.5 | COHO | - | - | - |
| 10/25/1990 | 1990 | 0.1 | 2.6 | 2.5 | CHUM | - | - | - |
| *10/25/1990* | *1990* | *2.6* | *3.5* | *0.9* | *CHIN* | *0* | *1* | *1* |
| 11/2/1990 | 1990 | 0.0 | 3.5 | 3.5 | CHUM | - | - | - |
| **11/8/1990** | **1990** | **0.0** | **2.6** | **2.6** | **CHIN** | **2** | **1** | **3** |
| 11/15/1990 | 1990 | 0.0 | 2.6 | 2.6 | COHO | - | - | - |

** Survey conducted by Squaxin Island Indian Tribe.

**Table C-5.** Cranberry Creek spawning ground surveys, 1987-2006.

| Date | RunYear | RMLower | RMUpper | Length | Species | Live Count | Dead Count | Total Count |
|---|---|---|---|---|---|---|---|---|
| 9/19/1991 | 1991 | 0.0 | 0.8 | 0.8 | CHUM | - | - | - |
| 10/2/1991 | 1991 | 0.0 | 0.7 | 0.7 | CHUM | - | - | - |
| 10/11/1991 | 1991 | 0.0 | 0.7 | 0.7 | CHUM | - | - | - |
| 10/22/1991 | 1991 | 0.0 | 0.7 | 0.7 | CHUM | - | - | - |
| 10/31/1991 | 1991 | 0.0 | 2.5 | 2.5 | CHUM | - | - | - |
| 11/7/1991 | 1991 | 0.0 | 2.5 | 2.5 | CHUM | - | - | - |
| | | | | | | | | |
| 9/11/1992 | 1992 | 0.0 | 0.8 | 0.8 | CHUM | - | - | - |
| 9/21/1992 | 1992 | 0.0 | 0.2 | 0.2 | CHUM | - | - | - |
| 10/2/1992 | 1992 | 0.0 | 0.8 | 0.8 | CHUM | - | - | - |
| **10/19/1992** | **1992** | **0.0** | **3.5** | **3.5** | **CHIN** | **0** | **0** | **0** |
| 10/28/1992 | 1992 | 0.0 | 3.5 | 3.5 | CHUM | - | - | - |
| 11/5/1992 | 1992 | 0.0 | 3.5 | 3.5 | CHUM | - | - | - |
| | | | | | | | | |
| 9/13/1993 | 1993 | 0.0 | 0.8 | 0.8 | CHUM | - | - | - |
| 9/20/1993 | 1993 | 0.0 | 3.5 | 3.5 | CHUM | - | - | - |
| 10/4/1993 | 1993 | 0.0 | 0.7 | 0.7 | CHUM | - | - | - |
| 10/11/1993 | 1993 | 0.0 | 2.6 | 2.6 | CHUM | - | - | - |
| **10/20/1993** | **1993** | **0.0** | **3.0** | **3.0** | **CHIN** | **2** | **0** | **2** |
| 11/1/1993 | 1993 | 0.0 | 3.5 | 3.5 | CHUM | - | - | - |
| 11/10/1993 | 1993 | 0.0 | 2.6 | 2.6 | COHO | - | - | - |
| | | | | | | | | |
| 9/21/1994 | 1994 | 0.0 | 2.6 | 2.6 | CHUM | - | - | - |
| 10/3/1994 | 1994 | 0.0 | 2.6 | 2.6 | CHUM | - | - | - |
| 10/11/1994 | 1994 | 0.0 | 3.5 | 3.5 | CHUM | - | - | - |
| 10/18/1994 | 1994 | 0.0 | 2.6 | 2.6 | COHO | - | - | - |
| 10/28/1994 | 1994 | 0.0 | 2.6 | 2.6 | CHUM | - | - | - |
| 11/8/1994 | 1994 | 0.0 | 3.5 | 3.5 | CHUM | - | - | - |

**Table C-5.** Cranberry Creek spawning ground surveys, 1987-2006.

| Date | RunYear | RMLower | RMUpper | Length | Species | Live Count | Dead Count | Total Count |
|---|---|---|---|---|---|---|---|---|
| 9/12/1995 | 1995 | 0.0 | 0.8 | 0.8 | CHUM | - | - | - |
| 9/27/1995 | 1995 | 0.0 | 2.6 | 2.6 | CHUM | - | - | - |
| 10/12/1995 | 1995 | 0.0 | 3.5 | 3.5 | CHUM | - | - | - |
| 10/20/1995 | 1995 | 0.0 | 3.5 | 3.5 | CHUM | - | - | - |
| 11/2/1995 | 1995 | 0.0 | 3.5 | 3.5 | CHUM | - | - | - |
| | | | | | | | | |
| 9/17/1996 | 1996 | 0.0 | 2.6 | 2.6 | CHUM | - | - | - |
| 9/26/1996 | 1996 | 0.0 | 2.6 | 2.6 | CHUM | - | - | - |
| 10/3/1996 | 1996 | 0.0 | 2.6 | 2.6 | CHUM | - | - | - |
| 10/14/1996 | 1996 | 0.0 | 3.5 | 3.5 | CHUM | - | - | - |
| 10/29/1996 | 1996 | 0.0 | 3.5 | 3.5 | CHUM | - | - | - |
| 11/8/1996 | 1996 | 0.0 | 3.5 | 3.5 | CHUM | - | - | - |
| | | | | | | | | |
| **9/26/1997** | **1997** | **0.0** | **3.5** | **3.5** | **CHIN** | **3** | **0** | **3** |
| 10/8/1997 | 1997 | 0.0 | 3.5 | 3.5 | CHIN | 3 | 0 | 3 |
| 10/21/1997 | 1997 | 0.0 | 3.5 | 3.5 | CHUM | - | - | - |
| 10/29/1997 | 1997 | 0.0 | 3.5 | 3.5 | CHUM | - | - | - |
| 11/12/1997 | 1997 | 0.0 | 3.5 | 3.5 | CHUM | - | - | - |
| | | | | | | | | |
| 9/9/1998 | 1998 | 0.0 | 2.6 | 2.6 | CHUM | - | - | - |
| 9/17/1998 | 1998 | 0.0 | 2.6 | 2.6 | CHUM | - | - | - |
| 9/25/1998 | 1998 | 0.0 | 2.6 | 2.6 | COHO | - | - | - |
| **10/5/1998** | **1998** | **0.0** | **2.6** | **2.6** | **CHIN** | **1** | **2** | **3** |
| 10/15/1998 | 1998 | 0.0 | 2.6 | 2.6 | COHO | - | - | - |
| 10/22/1998 | 1998 | 0.0 | 3.5 | 3.5 | CHUM | - | - | - |
| 10/30/1998 | 1998 | 0.0 | 3.5 | 3.5 | CHUM | - | - | - |
| 11/9/1998 | 1998 | 0.0 | 3.5 | 3.5 | CHUM | - | - | - |

**Table C-5.** Cranberry Creek spawning ground surveys, 1987-2006.

| Date | RunYear | RMLower | RMUpper | Length | Species | Live Count | Dead Count | Total Count |
|---|---|---|---|---|---|---|---|---|
| 9/10/1999 | 1999 | 0.0 | 3.5 | 3.5 | CHUM | - | - | - |
| 9/17/1999 | 1999 | 0.0 | 2.6 | 2.6 | COHO | - | - | - |
| **9/28/1999** | **1999** | **0.0** | **0.8** | **0.8** | **CHIN** | **4** | **0** | **4** |
| 10/6/1999 | 1999 | 0.0 | 2.6 | 2.6 | CHIN | 0 | 1 | 1 |
| 10/13/1999 | 1999 | 0.0 | 2.6 | 2.6 | CHUM | - | - | - |
| 10/20/1999 | 1999 | 0.0 | 3.5 | 3.5 | CHUM | - | - | - |
| 10/27/1999 | 1999 | 0.0 | 3.5 | 3.5 | CHUM | - | - | - |
| 11/3/1999 | 1999 | 0.0 | 3.5 | 3.5 | CHUM | - | - | - |
| 11/15/1999 | 1999 | 0.0 | 3.5 | 3.5 | CHUM | - | - | - |
| | | | | | | | | |
| 9/5/2000 | 2000 | 0.0 | 2.6 | 2.6 | CHUM | - | - | - |
| 9/12/2000 | 2000 | 0.0 | 2.6 | 2.6 | CHUM | - | - | - |
| 9/21/2000 | 2000 | 0.0 | 2.6 | 2.6 | CHUM | - | - | - |
| 9/29/2000 | 2000 | 0.0 | 2.6 | 2.6 | CHUM | - | - | - |
| 10/6/2000 | 2000 | 0.0 | 1.6 | 1.6 | CHUM | - | - | - |
| **10/16/2000** | **2000** | **0.0** | **2.6** | **2.6** | **CHIN** | **3** | **0** | **3** |
| 10/25/2000 | 2000 | 0.0 | 3.5 | 3.5 | CHUM | - | - | - |
| 11/2/2000 | 2000 | 0.0 | 3.5 | 3.5 | CHUM | - | - | - |
| 11/14/2000 | 2000 | 0.0 | 3.5 | 3.5 | CHUM | - | - | - |
| | | | | | | | | |
| 9/12/2001 | 2001 | 0.0 | 0.6 | 0.6 | CHUM | - | - | - |
| 9/19/2001 | 2001 | 0.0 | 0.6 | 0.6 | CHIN | 1 | 0 | 1 |
| 9/28/2001 | 2001 | 0.0 | 0.8 | 0.8 | CHUM | - | - | - |
| **10/8/2001** | **2001** | **0.0** | **3.5** | **3.5** | **CHIN** | **2** | **0** | **2** |
| 10/17/2001 | 2001 | 0.0 | 3.5 | 3.5 | CHUM | - | - | - |
| 10/25/2001 | 2001 | 0.0 | 3.5 | 3.5 | CHUM | - | - | - |
| 11/2/2001 | 2001 | 0.0 | 3.5 | 3.5 | CHUM | - | - | - |
| 11/13/2001 | 2001 | 0.0 | 2.6 | 2.6 | COHO | - | - | - |

**Table C-5.** Cranberry Creek spawning ground surveys, 1987-2006.

| Date | RunYear | RMLower | RMUpper | Length | Species | Live Count | Dead Count | Total Count |
|---|---|---|---|---|---|---|---|---|
| 9/19/2002 | 2002 | 0.0 | 2.6 | 2.6 | CHUM | - | - | - |
| **9/30/2002** | **2002** | **0.0** | **3.5** | **3.5** | **CHIN** | **15** | **1** | **16** |
| 10/8/2002 | 2002 | 0.0 | 2.6 | 2.6 | CHIN | 4 | 1 | 5 |
| *10/8/2002* | *2002* | *2.6* | *3.5* | *0.9* | *CHIN* | *0* | *0* | *0* |
| 10/16/2002 | 2002 | 0.0 | 2.6 | 2.6 | COHO | - | - | - |
| 10/23/2002 | 2002 | 0.0 | 2.6 | 2.6 | COHO | - | - | - |
| 11/1/2002 | 2002 | 0.0 | 2.6 | 2.6 | CHIN | 0 | 1 | 1 |
| 11/8/2002 | 2002 | 0.0 | 2.6 | 2.6 | CHUM | - | - | - |
| | | | | | | | | |
| 9/17/2003 | 2003 | 0.0 | 0.8 | 0.8 | CHIN | 0 | 0 | 0 |
| *9/23/2003* | *2003* | *2.6* | *3.5* | *0.9* | *CHIN* | *0* | 0 | *0* |
| 9/23/2003 | 2003 | 0.0 | 2.6 | 2.6 | CHIN | 0 | 0 | 0 |
| **10/1/2003** | **2003** | **0.0** | **2.6** | **2.6** | **CHIN** | **1** | **1** | **2** |
| *10/8/2003* | *2003* | *2.6* | *3.5* | *0.9* | *CHIN* | *0* | *0* | *0* |
| 10/8/2003 | 2003 | 0.0 | 2.6 | 2.6 | CHIN | 1 | 0 | 1 |
| 10/15/2003 | 2003 | 0.0 | 2.6 | 2.6 | CHIN | 1 | 0 | 1 |
| 10/28/2003 | 2003 | 0.0 | 2.6 | 2.6 | CHUM | - | - | - |
| 11/5/2003 | 2003 | 0.0 | 2.6 | 2.6 | CHUM | - | - | - |
| 11/12/2003 | 2003 | 0.0 | 2.6 | 2.6 | COHO | - | - | - |
| | | | | | | | | |
| 9/8/2004 | 2004 | 0.0 | 0.8 | 0.8 | CHIN | 0 | 0 | 0 |
| 9/14/2004 | 2004 | 0.0 | 0.8 | 0.8 | CHIN | 0 | 0 | 0 |
| 9/22/2004 | 2004 | 0.0 | 2.6 | 2.6 | CHIN | 3 | 0 | 3 |
| **9/28/2004** | **2004** | **0.0** | **2.6** | **2.6** | **CHIN** | **4** | **0** | **4** |
| *10/11/2004* | *2004* | *2.6* | *3.5* | *0.9* | *CHIN* | *0* | 0 | *0* |
| 10/11/2004 | 2004 | 0.0 | 2.6 | 2.6 | CHIN | 0 | 0 | 0 |
| 10/21/2004 | 2004 | 0.0 | 2.6 | 2.6 | CHIN | 0 | 0 | 0 |
| *10/21/2004* | *2004* | *2.6* | *3.5* | *0.9* | *CHIN* | *0* | 0 | *0* |
| 10/28/2004 | 2004 | 0.0 | 2.6 | 2.6 | COHO | - | - | - |
| 11/8/2004 | 2004 | 0.0 | 2.6 | 2.6 | CHUM | - | - | - |

**Table C-5.** Cranberry Creek spawning ground surveys, 1987-2006.

| Date | RunYear | RMLower | RMUpper | Length | Species | Live Count | Dead Count | Total Count |
|---|---|---|---|---|---|---|---|---|
| 9/19/2005 | 2005 | 0.0 | 2.6 | 2.6 | CHIN | 0 | 0 | 0 |
| 9/27/2005 | 2005 | 0.0 | 2.6 | 2.6 | CHIN | 0 | 0 | 0 |
| 10/5/2005 | 2005 | 0.0 | 2.6 | 2.6 | CHIN | 2 | 0 | 2 |
| **10/12/2005** | **2005** | **0.0** | **2.6** | **2.6** | **CHIN** | **6** | **0** | **6** |
| 10/20/2005 | 2005 | 0.0 | 2.6 | 2.6 | CHIN | 0 | 0 | 0 |
| *10/20/2005* | *2005* | *2.6* | *3.5* | *0.9* | *CHIN* | *0* | 0 | *0* |
| 10/27/2005 | 2005 | 0.0 | 2.6 | 2.6 | CHIN | 1 | 0 | 1 |
| 11/4/2005 | 2005 | 0.8 | 2.6 | 1.8 | CHUM | - | - | - |
| 11/4/2005 | 2005 | 0.0 | 0.8 | 0.8 | CHUM | - | - | - |
| 11/14/2005 | 2005 | 0.8 | 2.6 | 1.8 | CHUM | - | - | - |
| 11/14/2005 | 2005 | 0.0 | 0.8 | 0.8 | CHUM | - | - | - |
| | | | | | | | | |
| 9/6/2006 | 2006 | 0.0 | 0.8 | 0.8 | CHIN | 0 | 0 | 0 |
| 9/12/2006 | 2006 | 0.0 | 0.5 | 0.5 | CHUM | - | - | - |
| 9/25/2006 | 2006 | 0.0 | 2.6 | 2.6 | CHIN | 0 | 0 | 0 |
| 10/4/2006 | 2006 | 0.0 | 0.8 | 0.8 | CHIN | 0 | 0 | 0 |
| 10/4/2006 | 2006 | 0.8 | 2.6 | 1.8 | CHIN | 0 | 0 | 0 |
| **10/12/2006** | **2006** | **0.0** | **2.6** | **2.6** | **CHIN** | **1** | **1** | **2** |
| 10/19/2006 | 2006 | 0.0 | 0.8 | 0.8 | COHO | - | - | - |
| 10/19/2006 | 2006 | 0.8 | 2.6 | 1.8 | COHO | - | - | - |
| *10/26/2006* | *2006* | *2.6* | *3.5* | *0.9* | *CHIN* | *0* | *0* | *0* |
| 10/26/2006 | 2006 | 0.0 | 2.6 | 2.6 | CHIN | 0 | 0 | 0 |
| 11/2/2006 | 2006 | 0.0 | 2.6 | 2.6 | COHO | - | - | - |

Source: Spawning Ground Survey Database, 2007.

**Table C-6.** Deer Creek spawning ground surveys, 1987-2006.

| Date | RunYear | RMLower | RMUpper | Length | Species | Live Count | Dead Count | Total Count |
|---|---|---|---|---|---|---|---|---|
| 10/12/1987 | 1987 | 0.3 | 0.5 | 0.2 | CHIN | 0 | 1 | 1 |
| 10/12/1987** | 1987 | 0.0 | 0.3 | 0.3 | CHIN | 1 | 11 | 12 |
| 10/12/1987 | 1987 | 1.0 | 1.1 | 0.1 | CHIN | 9 | 2 | 11 |
| **10/15/1987** | **1987** | **0.0** | **1.3** | **1.3** | **CHIN** | **13** | **7** | **20** |
| 10/29/1987 | 1987 | 0.0 | 1.3 | 1.3 | COHO | - | - | - |
| 11/5/1987 | 1987 | 0.0 | 1.3 | 1.3 | CHIN | 0 | 3 | 3 |
| | | | | | | | | |
| 9/30/1988 | 1988 | 0.0 | 1.3 | 1.3 | CHIN | 6 | 3 | 9 |
| **10/11/1988** | **1988** | **0.0** | **1.3** | **1.3** | **CHIN** | **9** | **4** | **13** |
| 10/11/1988 | 1988 | 0.0 | 1.3 | 1.3 | CHUM | - | - | - |
| 10/11/1988 | 1988 | 0.0 | 1.3 | 1.3 | COHO | - | - | - |
| 10/21/1988 | 1988 | 0.0 | 1.3 | 1.3 | CHUM | - | - | - |
| 10/24/1988** | 1988 | 0.0 | 1.3 | 1.3 | CHUM | - | - | - |
| | | | | | | | | |
| 9/19/1989 | 1989 | 0.0 | 1.3 | 1.3 | CHUM | - | - | - |
| 9/29/1989 | 1989 | 0.0 | 1.3 | 1.3 | CHIN | 11 | 0 | 11 |
| **10/10/1989** | **1989** | **0.0** | **1.3** | **1.3** | **CHIN** | **9** | **3** | **12** |
| 10/17/1989 | 1989 | 0.0 | 1.3 | 1.3 | CHUM | - | - | - |
| 10/25/1989** | 1989 | 0.0 | 1.3 | 1.3 | CHUM | - | - | - |
| 10/30/1989** | 1989 | 0.0 | 1.3 | 1.3 | CHUM | - | - | - |
| 11/8/1989** | 1989 | 0.0 | 1.3 | 1.3 | CHUM | - | - | - |
| 11/14/1989** | 1989 | 0.0 | 1.3 | 1.3 | CHUM | - | - | - |
| | | | | | | | | |
| 9/21/1990 | 1990 | 0.0 | 1.3 | 1.3 | CHUM | - | - | - |
| **10/4/1990** | **1990** | **0.0** | **1.3** | **1.3** | **CHIN** | **33** | **1** | **34** |
| 10/16/1990 | 1990 | 0.0 | 1.3 | 1.3 | CHIN | 20 | 7 | 27 |
| 10/25/1990 | 1990 | 0.3 | 1.3 | 1.0 | CHIN | 0 | 1 | 1 |
| 11/2/1990 | 1990 | 0.0 | 1.3 | 1.3 | CHIN | 0 | 1 | 1 |
| 11/8/1990 | 1990 | 0.2 | 1.3 | 1.1 | COHO | - | - | - |

** Survey conducted by Squaxin Island Indian Tribe.

**Table C-6.** Deer Creek spawning ground surveys, 1987-2006.

| Date | RunYear | RMLower | RMUpper | Length | Species | Live Count | Dead Count | Total Count |
|---|---|---|---|---|---|---|---|---|
| 9/19/1991 | 1991 | 0.0 | 0.6 | 0.6 | CHUM | - | - | - |
| 10/2/1991 | 1991 | 0.0 | 1.3 | 1.3 | CHIN | 20 | 0 | 20 |
| **10/11/1991** | **1991** | **0.0** | **1.3** | **1.3** | **CHIN** | **61** | **7** | **68** |
| 10/22/1991 | 1991 | 0.0 | 1.3 | 1.3 | CHIN | 3 | 5 | 8 |
| 10/31/1991 | 1991 | 0.0 | 1.3 | 1.3 | CHIN | 0 | 3 | 3 |
| 11/7/1991 | 1991 | 0.0 | 1.3 | 1.3 | CHUM | - | - | - |
| | | | | | | | | |
| | | | | | | | | |
| 9/11/1992 | 1992 | 0.0 | 0.5 | 0.5 | CHUM | - | - | - |
| 9/21/1992 | 1992 | 0.0 | 1.3 | 1.3 | CHUM | - | - | - |
| **10/6/1992** | **1992** | **0.0** | **1.3** | **1.3** | **CHIN** | **13** | **0** | **13** |
| 10/14/1992 | 1992 | 0.0 | 1.3 | 1.3 | CHIN | 7 | 4 | 11 |
| 10/20/1992 | 1992 | 0.0 | 1.3 | 1.3 | CHIN | 4 | 3 | 7 |
| 10/28/1992 | 1992 | 0.0 | 1.3 | 1.3 | COHO | - | - | - |
| 11/5/1992 | 1992 | 0.0 | 1.3 | 1.3 | CHUM | - | - | - |
| | | | | | | | | |
| 9/13/1993 | 1993 | 0.0 | 0.7 | 0.7 | CHUM | - | - | - |
| 9/20/1993 | 1993 | 0.0 | 1.3 | 1.3 | CHUM | - | - | - |
| 10/1/1993 | 1993 | 0.0 | 1.3 | 1.3 | CHUM | - | - | - |
| **10/4/1993** | **1993** | **0.0** | **1.3** | **1.3** | **CHIN** | **4** | **0** | **4** |
| 10/11/1993 | 1993 | 0.0 | 1.3 | 1.3 | CHUM | - | - | - |
| 10/20/1993 | 1993 | 0.0 | 1.3 | 1.3 | CHIN | 3 | 1 | 4 |
| 11/1/1993 | 1993 | 0.0 | 1.3 | 1.3 | CHUM | - | - | - |
| 11/12/1993 | 1993 | 0.0 | 1.3 | 1.3 | CHUM | - | - | - |
| | | | | | | | | |
| 9/21/1994 | 1994 | 0.0 | 1.3 | 1.3 | CHUM | - | - | - |
| 10/3/1994 | 1994 | 0.0 | 1.3 | 1.3 | CHUM | - | - | - |
| 10/11/1994 | 1994 | 0.3 | 1.3 | 1.0 | COHO | - | - | - |
| **10/18/1994** | **1994** | **0.0** | **1.3** | **1.3** | **CHIN** | **2** | **1** | **3** |
| 10/28/1994 | 1994 | 0.2 | 1.3 | 1.1 | COHO | - | - | - |
| 11/8/1994 | 1994 | 0.0 | 1.3 | 1.3 | CHUM | - | - | - |

**Table C-6.** Deer Creek spawning ground surveys, 1987-2006.

| Date | RunYear | RMLower | RMUpper | Length | Species | Live Count | Dead Count | Total Count |
|---|---|---|---|---|---|---|---|---|
| 9/12/1995 | 1995 | 0.0 | 1.3 | 1.3 | CHUM | - | - | - |
| 9/27/1995 | 1995 | 0.0 | 1.3 | 1.3 | CHUM | - | - | - |
| 10/12/1995 | 1995 | 0.0 | 1.3 | 1.3 | CHUM | - | - | - |
| 10/20/1995 | 1995 | 0.0 | 1.3 | 1.3 | CHUM | - | - | - |
| 10/31/1995** | 1995 | 0.0 | 0.5 | 0.5 | CHUM | - | - | - |
| 11/2/1995 | 1995 | 0.0 | 1.3 | 1.3 | CHUM | - | - | - |
| | | | | | | | | |
| 9/13/1996 | 1996 | 0.0 | 0.7 | 0.7 | CHUM | - | - | - |
| 9/17/1996 | 1996 | 0.2 | 1.3 | 1.1 | CHUM | - | - | - |
| 9/26/1996 | 1996 | 0.0 | 1.3 | 1.3 | CHUM | - | - | - |
| **10/3/1996** | **1996** | **0.0** | **1.3** | **1.3** | **CHIN** | **1** | **0** | **1** |
| 10/14/1996 | 1996 | 0.3 | 1.3 | 1.0 | CHUM | - | - | - |
| 11/4/1996 | 1996 | 0.0 | 1.3 | 1.3 | CHUM | - | - | - |
| 11/14/1996 | 1996 | 0.0 | 1.3 | 1.3 | CHUM | - | - | - |
| | | | | | | | | |
| 9/26/1997 | 1997 | 0.0 | 1.3 | 1.3 | CHUM | - | - | - |
| 10/9/1997 | 1997 | 0.2 | 1.3 | 1.1 | CHIN | 0 | 1 | 1 |
| 10/13/1997** | 1997 | 0.4 | 0.6 | 0.2 | CHUM | - | - | - |
| **10/13/1997**** | **1997** | **0.0** | **0.4** | **0.4** | **CHIN** | **2** | **0** | **2** |
| 10/13/1997** | 1997 | 0.6 | 4.4 | 3.8 | CHUM | - | - | - |
| 10/20/1997 | 1997 | 0.0 | 1.3 | 1.3 | COHO | - | - | - |
| 10/28/1997 | 1997 | 0.0 | 1.3 | 1.3 | COHO | - | - | - |
| 11/6/1997 | 1997 | 0.0 | 1.3 | 1.3 | CHUM | - | - | - |
| | | | | | | | | |
| 9/8/1998 | 1998 | 0.0 | 1.3 | 1.3 | CHUM | - | - | - |
| 9/16/1998 | 1998 | 0.0 | 1.3 | 1.3 | CHIN | 2 | 0 | 2 |
| 9/25/1998 | 1998 | 0.0 | 1.3 | 1.3 | CHIN | 1 | 0 | 1 |
| 10/2/1998 | 1998 | 0.0 | 1.3 | 1.3 | CHIN | 4 | 0 | 4 |
| 10/15/1998 | 1998 | 0.0 | 1.3 | 1.3 | CHIN | 0 | 1 | 1 |
| 10/22/1998 | 1998 | 0.0 | 1.3 | 1.3 | CHIN | 0 | 1 | 1 |
| **10/29/1998** | **1998** | **0.2** | **1.3** | **1.1** | **CHIN** | **7** | **3** | **10** |

**Table C-6.** Deer Creek spawning ground surveys, 1987-2006.

| Date | RunYear | RMLower | RMUpper | Length | Species | Live Count | Dead Count | Total Count | |
|---|---|---|---|---|---|---|---|---|---|
| 11/5/1998 | 1998 | 0.0 | 1.3 | 1.3 | COHO | - | - | - | |
| 11/12/1998 | 1998 | 0.0 | 1.1 | 1.1 | CHUM | - | - | - | |
| | | | | | | | | | |
| 9/10/1999 | 1999 | 0.0 | 1.3 | 1.3 | CHIN | 1 | 0 | 1 | |
| 9/17/1999 | 1999 | 0.0 | 1.3 | 1.3 | CHUM | - | - | - | |
| **9/29/1999** | **1999** | **0.0** | **1.3** | **1.3** | **CHIN** | **7** | **0** | **7** | |
| 10/5/1999 | 1999 | 0.0 | 1.3 | 1.3 | CHIN | 6 | 0 | 6 | |
| 10/13/1999 | 1999 | 0.1 | 1.3 | 1.2 | CHUM | - | - | - | |
| 10/20/1999 | 1999 | 0.0 | 1.3 | 1.3 | CHUM | - | - | - | |
| 10/27/1999 | 1999 | 0.0 | 1.3 | 1.3 | CHIN | 2 | 0 | 2 | |
| 11/3/1999 | 1999 | 0.3 | 1.3 | 1.0 | CHUM | - | - | - | |
| 11/15/1999 | 1999 | 0.2 | 1.3 | 1.1 | CHUM | - | - | - | |
| | | | | | | | | | |
| 9/6/2000 | 2000 | 0.0 | 1.3 | 1.3 | CHUM | - | - | - | |
| 9/13/2000 | 2000 | 0.0 | 1.3 | 1.3 | CHIN | 0 | 1 | 1 | |
| 9/21/2000 | 2000 | 0.0 | 1.3 | 1.3 | CHIN | 1 | 0 | 1 | |
| **9/29/2000** | **2000** | **0.0** | **1.3** | **1.3** | **CHIN** | **4** | **1** | **5** | |
| 10/6/2000 | 2000 | 0.0 | 1.3 | 1.3 | CHUM | - | - | - | |
| 10/16/2000 | 2000 | 0.0 | 1.3 | 1.3 | CHUM | - | - | - | |
| 10/25/2000 | 2000 | 0.0 | 1.3 | 1.3 | CHUM | - | - | - | |
| 11/2/2000 | 2000 | 0.0 | 1.3 | 1.3 | COHO | - | - | - | |
| 11/14/2000 | 2000 | 0.0 | 1.3 | 1.3 | CHUM | - | - | - | |
| | | | | | | | | | |
| 9/11/2001 | 2001 | 0.0 | 1.3 | 1.3 | CHIN | 4 | 2 | 6 | |
| 9/19/2001 | 2001 | 0.0 | 1.3 | 1.3 | CHIN | 6 | 0 | 6 | |
| 9/27/2001 | 2001 | 0.0 | 1.3 | 1.3 | CHIN | 12 | 1 | 13 | |
| **10/5/2001** | **2001** | **0.0** | **1.3** | **1.3** | **CHIN** | **16** | **0** | **16** | |
| 10/15/2001 | 2001 | 0.0 | 1.3 | 1.3 | CHIN | 1 | 0 | 1 | |
| 10/25/2001 | 2001 | 0.2 | 1.3 | 1.1 | COHO | - | - | - | |
| 11/2/2001 | 2001 | 0.0 | 1.3 | 1.3 | CHUM | - | - | - | |
| 11/9/2001 | 2001 | 0.0 | 1.3 | 1.3 | COHO | - | - | - | |

**Table C-6.** Deer Creek spawning ground surveys, 1987-2006.

| Date | RunYear | RMLower | RMUpper | Length | Species | Live Count | Dead Count | Total Count |
|---|---|---|---|---|---|---|---|---|
| 9/19/2002 | 2002 | 0.0 | 2.6 | 2.6 | CHUM | - | - | - |
| **9/30/2002** | **2002** | **0.0** | **3.5** | **3.5** | **CHIN** | **15** | **1** | **16** |
| 10/8/2002 | 2002 | 0.0 | 2.6 | 2.6 | CHIN | 4 | 1 | 5 |
| *10/8/2002* | *2002* | *2.6* | *3.5* | *0.9* | *CHIN* | *0* | *0* | *0* |
| 10/16/2002 | 2002 | 0.0 | 2.6 | 2.6 | COHO | - | - | - |
| 10/23/2002 | 2002 | 0.0 | 2.6 | 2.6 | COHO | - | - | - |
| 11/1/2002 | 2002 | 0.0 | 2.6 | 2.6 | CHIN | 0 | 1 | 1 |
| 11/8/2002 | 2002 | 0.0 | 2.6 | 2.6 | CHUM | - | - | - |
| | | | | | | | | |
| 9/17/2003 | 2003 | 0.0 | 0.8 | 0.8 | CHIN | 0 | 0 | 0 |
| *9/23/2003* | *2003* | *2.6* | *3.5* | *0.9* | *CHIN* | *0* | 0 | *0* |
| 9/23/2003 | 2003 | 0.0 | 2.6 | 2.6 | CHIN | 0 | 0 | 0 |
| **10/1/2003** | **2003** | **0.0** | **2.6** | **2.6** | **CHIN** | **1** | **1** | **2** |
| *10/8/2003* | *2003* | *2.6* | *3.5* | *0.9* | *CHIN* | *0* | *0* | *0* |
| 10/8/2003 | 2003 | 0.0 | 2.6 | 2.6 | CHIN | 1 | 0 | 1 |
| 10/15/2003 | 2003 | 0.0 | 2.6 | 2.6 | CHIN | 1 | 0 | 1 |
| 10/28/2003 | 2003 | 0.0 | 2.6 | 2.6 | CHUM | - | - | - |
| 11/5/2003 | 2003 | 0.0 | 2.6 | 2.6 | CHUM | - | - | - |
| 11/12/2003 | 2003 | 0.0 | 2.6 | 2.6 | COHO | - | - | - |
| | | | | | | | | |
| 9/8/2004 | 2004 | 0.0 | 0.8 | 0.8 | CHIN | 0 | 0 | 0 |
| 9/14/2004 | 2004 | 0.0 | 0.8 | 0.8 | CHIN | 0 | 0 | 0 |
| 9/22/2004 | 2004 | 0.0 | 2.6 | 2.6 | CHIN | 3 | 0 | 3 |
| **9/28/2004** | **2004** | **0.0** | **2.6** | **2.6** | **CHIN** | **4** | **0** | **4** |
| *10/11/2004* | *2004* | *2.6* | *3.5* | *0.9* | *CHIN* | *0* | 0 | *0* |
| 10/11/2004 | 2004 | 0.0 | 2.6 | 2.6 | CHIN | 0 | 0 | 0 |
| 10/21/2004 | 2004 | 0.0 | 2.6 | 2.6 | CHIN | 0 | 0 | 0 |
| *10/21/2004* | *2004* | *2.6* | *3.5* | *0.9* | *CHIN* | *0* | 0 | *0* |
| 10/28/2004 | 2004 | 0.0 | 2.6 | 2.6 | COHO | - | - | - |
| 11/8/2004 | 2004 | 0.0 | 2.6 | 2.6 | CHUM | - | - | - |

**Table C-6.** Deer Creek spawning ground surveys, 1987-2006.

| Date | RunYear | RMLower | RMUpper | Length | Species | Live Count | Dead Count | Total Count |
|---|---|---|---|---|---|---|---|---|
| 9/19/2005 | 2005 | 0.0 | 2.6 | 2.6 | CHIN | 0 | 0 | 0 |
| 9/27/2005 | 2005 | 0.0 | 2.6 | 2.6 | CHIN | 0 | 0 | 0 |
| 10/5/2005 | 2005 | 0.0 | 2.6 | 2.6 | CHIN | 2 | 0 | 2 |
| **10/12/2005** | **2005** | **0.0** | **2.6** | **2.6** | **CHIN** | **6** | **0** | **6** |
| 10/20/2005 | 2005 | 0.0 | 2.6 | 2.6 | CHIN | 0 | 0 | 0 |
| *10/20/2005* | *2005* | *2.6* | *3.5* | *0.9* | *CHIN* | *0* | 0 | *0* |
| 10/27/2005 | 2005 | 0.0 | 2.6 | 2.6 | CHIN | 1 | 0 | 1 |
| 11/4/2005 | 2005 | 0.8 | 2.6 | 1.8 | CHUM | - | - | - |
| 11/4/2005 | 2005 | 0.0 | 0.8 | 0.8 | CHUM | - | - | - |
| 11/14/2005 | 2005 | 0.8 | 2.6 | 1.8 | CHUM | - | - | - |
| 11/14/2005 | 2005 | 0.0 | 0.8 | 0.8 | CHUM | - | - | - |
| | | | | | | | | |
| 9/6/2006 | 2006 | 0.0 | 0.8 | 0.8 | CHIN | 0 | 0 | 0 |
| 9/12/2006 | 2006 | 0.0 | 0.5 | 0.5 | CHUM | - | - | - |
| 9/25/2006 | 2006 | 0.0 | 2.6 | 2.6 | CHIN | 0 | 0 | 0 |
| 10/4/2006 | 2006 | 0.0 | 0.8 | 0.8 | CHIN | 0 | 0 | 0 |
| 10/4/2006 | 2006 | 0.8 | 2.6 | 1.8 | CHIN | 0 | 0 | 0 |
| **10/12/2006** | **2006** | **0.0** | **2.6** | **2.6** | **CHIN** | **1** | **1** | **2** |
| 10/19/2006 | 2006 | 0.0 | 0.8 | 0.8 | COHO | - | - | - |
| 10/19/2006 | 2006 | 0.8 | 2.6 | 1.8 | COHO | - | - | - |
| *10/26/2006* | *2006* | *2.6* | *3.5* | *0.9* | *CHIN* | *0* | *0* | *0* |
| 10/26/2006 | 2006 | 0.0 | 2.6 | 2.6 | CHIN | 0 | 0 | 0 |
| 11/2/2006 | 2006 | 0.0 | 2.6 | 2.6 | COHO | - | - | - |

Source: Spawning Ground Survey Database, 2007.

**Table C-7.** Goldsborough Creek spawning ground surveys, 1998-2006.

| Date | RunYear | RMLower | RMUpper | Length | Species | Live Count | Dead Count | Total Count |
|---|---|---|---|---|---|---|---|---|
| 9/29/1998 | 1998 | 0.5 | 2.2 | 1.7 | CHIN | 1 | 1 | 2 |
| **10/8/1998** | **1998** | **0.5** | **2.2** | **1.7** | **CHIN** | **8** | **1** | **9** |
| 10/14/1998 | 1998 | 0.5 | 2.2 | 1.7 | CHIN | 2 | 0 | 2 |
| 10/22/1998 | 1998 | 0.5 | 2.2 | 1.7 | CHIN | 2 | 1 | 3 |
| 10/27/1998 | 1998 | 0.5 | 2.2 | 1.7 | CHUM | - | - | - |
| 11/2/1998 | 1998 | 0.7 | 2.2 | 1.5 | CHUM | - | - | - |
| 11/9/1998 | 1998 | 0.5 | 2.2 | 1.7 | CHUM | - | - | - |
| | | | | | | | | |
| 9/28/1999 | 1999 | 0.5 | 2.2 | 1.7 | CHUM | - | - | - |
| 10/5/1999 | 1999 | 0.5 | 2.2 | 1.7 | CHUM | - | - | - |
| **10/13/1999** | **1999** | **0.5** | **2.2** | **1.7** | **CHIN** | **6** | **2** | **8** |
| 10/15/1999** | 1999 | 0.5 | 1.5 | 1.0 | CHIN | 0 | 0 | 0 |
| 10/15/1999** | 1999 | 1.5 | 2.2 | 0.7 | CHUM | - | - | - |
| 10/21/1999 | 1999 | 0.5 | 2.2 | 1.7 | CHUM | - | - | - |
| 10/25/1999** | 1999 | 1.5 | 2.2 | 0.7 | CHIN | 2 | 0 | 2 |
| 10/25/1999** | 1999 | 0.5 | 1.5 | 1.0 | CHUM | - | - | - |
| 11/10/1999** | 1999 | 0.5 | 2.2 | 1.7 | CHUM | - | - | - |
| | | | | | | | | |
| 9/15/2000** | 2000 | 0.5 | 2.2 | 1.7 | CHIN | 2 | 0 | 2 |
| 9/28/2000** | 2000 | 0.5 | 2.2 | 1.7 | CHIN | 1 | 0 | 1 |
| 10/4/2000 | 2000 | 0.8 | 2.2 | 1.4 | CHIN | 0 | 0 | 0 |
| **10/6/2000**** | **2000** | **0.5** | **2.2** | **1.7** | **CHIN** | **14** | **0** | **14** |
| 10/11/2000 | 2000 | 0.5 | 2.2 | 1.7 | CHIN | 7 | 0 | 7 |
| 10/19/2000** | 2000 | 0.5 | 2.2 | 1.7 | COHO | - | - | - |
| 10/19/2000** | 2000 | 0.5 | 2.2 | 1.7 | CHIN | 5 | 0 | 5 |
| 11/3/2000** | 2000 | 0.5 | 2.2 | 1.7 | CHUM | - | - | - |
| 11/15/2000** | 2000 | 0.5 | 2.2 | 1.7 | COHO | - | - | - |

** Survey conducted by R2 Resource Consultants

**Table C-7.** Goldsborough Creek spawning ground surveys, 1998-2006.

| Date | RunYear | RMLower | RMUpper | Length | Species | Live Count | Dead Count | Total Count |
|---|---|---|---|---|---|---|---|---|
| 8/27/2001** | 2001 | 0.5 | 2.3 | 1.8 | CHUM | - | - | - |
| 9/4/2001 | 2001 | 0.5 | 2.2 | 1.7 | CHUM | - | - | - |
| 9/10/2001** | 2001 | 0.5 | 2.3 | 1.8 | CHIN | 3 | 1 | 4 |
| 9/17/2001 | 2001 | 0.5 | 2.2 | 1.7 | CHIN | 3 | 0 | 3 |
| 9/25/2001** | 2001 | 0.5 | 2.3 | 1.8 | CHIN | 4 | 0 | 4 |
| 9/27/2001 | 2001 | 0.5 | 2.2 | 1.7 | CHIN | 8 | 0 | 8 |
| **10/9/2001** | **2001** | **0.5** | **2.2** | **1.7** | **CHIN** | **9** | **0** | **9** |
| *10/11/2001*** | *2001* | *2.3* | *3.4* | *1.1* | *CHIN* | *1* | 0 | *1* |
| 10/11/2001** | 2001 | 0.5 | 2.3 | 1.8 | CHIN | 3 | 0 | 3 |
| 10/18/2001 | 2001 | 0.5 | 2.2 | 1.7 | CHIN | 1 | 0 | 1 |
| 10/25/2001** | 2001 | 0.5 | 2.3 | 1.8 | CHUM | - | - | - |
| | | | | | | | | |
| 8/28/2002 | 2002 | 0.5 | 2.2 | 1.7 | CHUM | - | - | - |
| 9/11/2002 | 2002 | 0.5 | 2.2 | 1.7 | CHUM | - | - | - |
| 9/20/2002 | 2002 | 0.5 | 2.2 | 1.7 | CHIN | 0 | 0 | 0 |
| 9/30/2002 | 2002 | 0.5 | 2.2 | 1.7 | CHIN | 2 | 0 | 2 |
| 10/3/2002 | 2002 | 0.5 | 2.2 | 1.7 | CHIN | 0 | 1 | 1 |
| 10/10/2002 | 2002 | 0.5 | 2.2 | 1.7 | CHIN | 1 | 0 | 1 |
| **10/14/2002** | **2002** | **0.5** | **2.2** | **1.7** | **CHIN** | **5** | **1** | **6** |
| 10/17/2002 | 2002 | 0.5 | 2.2 | 1.7 | CHIN | 0 | 1 | 1 |
| 10/24/2002 | 2002 | 0.5 | 2.2 | 1.7 | CHUM | - | - | - |
| 10/28/2002 | 2002 | 0.5 | 2.2 | 1.7 | COHO | - | - | - |
| 10/31/2002 | 2002 | 0.5 | 2.2 | 1.7 | COHO | - | - | - |
| 11/6/2002 | 2002 | 0.5 | 2.2 | 1.7 | COHO | - | - | - |
| 11/11/2002 | 2002 | 0.5 | 2.2 | 1.7 | CHUM | - | - | - |
| | | | | | | | | |
| 9/9/2003 | 2003 | 0.5 | 2.2 | 1.7 | CHIN | 0 | 0 | 0 |
| 9/22/2003 | 2003 | 0.5 | 2.2 | 1.7 | CHIN | 0 | 0 | 0 |
| **9/29/2003** | **2003** | **0.5** | **2.2** | **1.7** | **CHIN** | **1** | **0** | **1** |
| 10/8/2003 | 2003 | 0.5 | 2.2 | 1.7 | CHIN | 0 | 0 | 0 |

** Survey conducted by R2 Resource Consultants

**Table C-7.** Goldsborough Creek spawning ground surveys, 1998-2006.

| Date | RunYear | RMLower | RMUpper | Length | Species | Live Count | Dead Count | Total Count |
|---|---|---|---|---|---|---|---|---|
| 10/15/2003 | 2003 | 0.5 | 2.2 | 1.7 | COHO | - | - | - |
| 10/29/2003 | 2003 | 0.5 | 2.2 | 1.7 | COHO | - | - | - |
| 11/6/2003 | 2003 | 0.5 | 2.2 | 1.7 | COHO | - | - | - |
| | | | | | | | | |
| 9/7/2004 | 2004 | 0.5 | 2.2 | 1.7 | CHIN | 0 | 0 | 0 |
| 9/21/2004 | 2004 | 0.5 | 2.2 | 1.7 | CHIN | 1 | 0 | 1 |
| **10/6/2004** | **2004** | **0.5** | **2.2** | **1.7** | **CHIN** | **3** | **0** | **3** |
| 10/21/2004 | 2004 | 0.5 | 2.2 | 1.7 | CHIN | 0 | 0 | 0 |
| 10/28/2004 | 2004 | 0.5 | 2.2 | 1.7 | COHO | - | - | - |
| 11/8/2004 | 2004 | 0.5 | 2.2 | 1.7 | COHO | - | - | - |
| | | | | | | | | |
| 9/7/2005 | 2005 | 0.5 | 2.2 | 1.7 | CHIN | 0 | 0 | 0 |
| 9/13/2005 | 2005 | 0.5 | 2.2 | 1.7 | CHIN | 0 | 0 | 0 |
| 9/19/2005 | 2005 | 0.5 | 2.2 | 1.7 | CHIN | 0 | 0 | 0 |
| **9/28/2005** | **2005** | **0.5** | **2.2** | **1.7** | **CHIN** | **2** | **0** | **2** |
| 10/6/2005 | 2005 | 0.5 | 2.2 | 1.7 | CHIN | 0 | 0 | 0 |
| 10/17/2005 | 2005 | 0.5 | 2.2 | 1.7 | CHIN | 0 | 0 | 0 |
| 10/25/2005 | 2005 | 0.5 | 2.2 | 1.7 | COHO | - | - | - |
| | | | | | | | | |
| **9/6/2006** | **2006** | **0.5** | **2.2** | **1.7** | **CHIN** | **0** | **0** | **0** |
| 9/12/2006 | 2006 | 0.5 | 2.2 | 1.7 | CHIN | 0 | 0 | 0 |
| 9/20/2006 | 2006 | 0.5 | 2.2 | 1.7 | CHIN | 0 | 0 | 0 |
| 9/26/2006 | 2006 | 0.5 | 2.2 | 1.7 | CHIN | 0 | 0 | 0 |
| 10/4/2006 | 2006 | 0.5 | 2.2 | 1.7 | CHIN | 0 | 0 | 0 |
| 10/13/2006 | 2006 | 0.5 | 2.2 | 1.7 | CHIN | 0 | 0 | 0 |
| 10/20/2006 | 2006 | 0.5 | 2.2 | 1.7 | CHIN | 0 | 0 | 0 |
| 10/27/2006 | 2006 | 0.5 | 2.2 | 1.7 | CHUM | - | - | - |
| 11/1/2006 | 2006 | 0.5 | 2.2 | 1.7 | COHO | - | - | - |

Source: Spawning Ground Survey Database, 2007.

**Table C-8.** Johns Creek spawning ground surveys, 1987-2006.

| Date | RunYear | RMLower | RMUpper | Length | Species | Live Count | Dead Count | Total Count |
|---|---|---|---|---|---|---|---|---|
| 9/8/1987** | 1987 | 0.0 | 0.4 | 0.4 | COHO | - | - | - |
| 9/15/1987** | 1987 | 0.0 | 0.4 | 0.4 | CHUM | - | - | - |
| 9/22/1987** | 1987 | 0.0 | 0.4 | 0.4 | CHUM | - | - | - |
| 9/30/1987** | 1987 | 0.0 | 0.4 | 0.4 | CHUM | - | - | - |
| 10/15/1987 | 1987 | 0.0 | 0.4 | 0.4 | CHUM | - | - | - |
| 10/30/1987 | 1987 | 0.0 | 1.6 | 1.6 | CHUM | - | - | - |
| 11/2/1987** | 1987 | 0.0 | 1.8 | 1.8 | COHO | - | - | - |
| 11/11/1987** | 1987 | 0.0 | 0.4 | 0.4 | CHUM | - | - | - |
| | | | | | | | | |
| 9/8/1988 | 1988 | 0.0 | 0.3 | 0.3 | CHUM | - | - | - |
| 9/30/1988 | 1988 | 0.0 | 1.6 | 1.6 | COHO | - | - | - |
| 9/30/1988 | 1988 | 1.6 | 1.7 | 0.1 | CHUM | - | - | - |
| **10/11/1988** | **1988** | **0.0** | **1.6** | **1.6** | **CHIN** | **1** | **0** | **1** |
| 10/21/1988 | 1988 | 0.0 | 0.4 | 0.4 | CHUM | - | - | - |
| 10/21/1988 | 1988 | 0.4 | 1.6 | 1.2 | CHUM | - | - | - |
| 11/4/1988 | 1988 | 0.0 | 1.6 | 1.6 | CHUM | - | - | - |
| 11/15/1988 | 1988 | 0.0 | 1.6 | 1.6 | CHUM | - | - | - |
| | | | | | | | | |
| 9/19/1989 | 1989 | 0.0 | 0.4 | 0.4 | CHUM | - | - | - |
| 9/29/1989 | 1989 | 0.0 | 0.4 | 0.4 | CHIN | 3 | 0 | 3 |
| 9/29/1989 | 1989 | 0.0 | 1.6 | 1.6 | CHUM | - | - | - |
| 10/10/1989 | 1989 | 0.0 | 0.4 | 0.4 | CHIN | 6 | 0 | 6 |
| **10/17/1989** | **1989** | **0.0** | **1.6** | **1.6** | **CHIN** | **2** | **11** | **13** |
| 10/25/1989** | 1989 | 0.4 | 1.6 | 1.2 | CHIN | 0 | 10 | 10 |
| 10/25/1989** | 1989 | 0.0 | 0.4 | 0.4 | CHUM | - | - | - |
| 11/3/1989** | 1989 | 0.4 | 1.6 | 1.2 | CHUM | - | - | - |
| 11/3/1989** | 1989 | 0.0 | 0.4 | 0.4 | CHUM | - | - | - |
| 11/10/1989** | 1989 | 0.4 | 1.6 | 1.2 | CHUM | - | - | - |
| 11/10/1989** | 1989 | 0.0 | 0.4 | 0.4 | CHUM | - | - | - |

** Survey conducted by Squaxin Island Indian Tribe.

**Table C-8.** Johns Creek spawning ground surveys, 1987-2006.

| Date | RunYear | RMLower | RMUpper | Length | Species | Live_Count | Dead_Count | Total_Count |
|---|---|---|---|---|---|---|---|---|
| 9/21/1990 | 1990 | 0.0 | 0.4 | 0.4 | CHUM | - | - | - |
| 10/4/1990 | 1990 | 0.0 | 0.4 | 0.4 | CHUM | - | - | - |
| 10/4/1990 | 1990 | 0.0 | 0.0 | 0.0 | CHIN | 6 | 3 | 9 |
| 10/16/1990 | 1990 | 0.0 | 0.4 | 0.4 | CHIN | 0 | 1 | 1 |
| 10/19/1990 | 1990 | 0.0 | 0.4 | 0.4 | CHUM | - | - | - |
| 10/19/1990 | 1990 | 0.4 | 1.8 | 1.4 | CHUM | - | - | - |
| **10/30/1990** | **1990** | **0.0** | **0.4** | **0.4** | **CHIN** | **0** | **3** | **3** |
| **10/30/1990** | **1990** | **0.4** | **1.8** | **1.4** | **CHIN** | **0** | **18** | **18** |
| 11/8/1990 | 1990 | 0.0 | 0.4 | 0.4 | CHUM | - | - | - |
| 11/8/1990 | 1990 | 0.4 | 1.8 | 1.4 | CHUM | - | - | - |
| 11/15/1990 | 1990 | 0.0 | 0.4 | 0.4 | CHUM | - | - | - |
| 11/15/1990 | 1990 | 0.4 | 1.8 | 1.4 | CHUM | - | - | - |
| | | | | | | | | |
| 9/18/1991 | 1991 | 0.0 | 0.4 | 0.4 | CHUM | - | - | - |
| 10/2/1991 | 1991 | 0.0 | 0.4 | 0.4 | CHIN | 1 | 0 | 1 |
| 10/11/1991 | 1991 | 0.0 | 0.4 | 0.4 | CHIN | 8 | 7 | 15 |
| **10/22/1991** | **1991** | **0.0** | **0.4** | **0.4** | **CHIN** | **3** | **19** | **22** |
| 10/31/1991 | 1991 | 0.0 | 0.6 | 0.6 | CHIN | 0 | 2 | 2 |
| 11/7/1991 | 1991 | 0.0 | 1.6 | 1.6 | CHUM | - | - | - |
| | | | | | | | | |
| 9/11/1992 | 1992 | 0.0 | 0.7 | 0.7 | CHUM | - | - | - |
| 9/21/1992 | 1992 | 0.0 | 1.6 | 1.6 | CHUM | - | - | - |
| 10/2/1992 | 1992 | 0.0 | 1.6 | 1.6 | CHIN | 4 | 7 | 11 |
| 10/9/1992 | 1992 | 0.0 | 1.6 | 1.6 | CHIN | 5 | 1 | 6 |
| 10/19/1992 | 1992 | 0.0 | 1.6 | 1.6 | CHIN | 2 | 9 | 11 |
| **10/28/1992** | **1992** | **0.0** | **1.6** | **1.6** | **CHIN** | **1** | **13** | **14** |
| 11/5/1992 | 1992 | 0.0 | 1.6 | 1.6 | CHUM | - | - | - |
| | | | | | | | | |
| 9/1/1993 | 1993 | 0.0 | 0.5 | 0.5 | CHUM | - | - | - |
| 9/13/1993 | 1993 | 0.0 | 0.4 | 0.4 | CHUM | - | - | - |
| 9/20/1993 | 1993 | 0.0 | 1.6 | 1.6 | CHIN | 0 | 1 | 1 |
| 10/4/1993 | 1993 | 0.0 | 1.6 | 1.6 | CHIN | 0 | 2 | 2 |

**Table C-8.** Johns Creek spawning ground surveys, 1987-2006.

| Date | RunYear | RMLower | RMUpper | Length | Species | Live_Count | Dead_Count | Total_Count |
|---|---|---|---|---|---|---|---|---|
| **10/11/1993** | **1993** | **0.0** | **1.6** | **1.6** | **CHIN** | **4** | **1** | **5** |
| 10/20/1993 | 1993 | 0.0 | 1.6 | 1.6 | CHUM | - | - | - |
| 11/1/1993 | 1993 | 0.0 | 1.6 | 1.6 | CHUM | - | - | - |
| 11/10/1993 | 1993 | 0.0 | 1.8 | 1.8 | CHUM | - | - | - |
| | | | | | | | | |
| 9/14/1994 | 1994 | 0.0 | 1.8 | 1.8 | CHUM | - | - | - |
| 9/21/1994 | 1994 | 0.0 | 1.8 | 1.8 | CHUM | - | - | - |
| 10/3/1994 | 1994 | 0.0 | 1.8 | 1.8 | CHUM | - | - | - |
| 10/11/1994 | 1994 | 0.0 | 1.8 | 1.8 | CHUM | - | - | - |
| 10/18/1994 | 1994 | 0.0 | 1.8 | 1.8 | CHUM | - | - | - |
| 10/28/1994 | 1994 | 0.0 | 1.8 | 1.8 | CHUM | - | - | - |
| 11/8/1994 | 1994 | 0.0 | 1.8 | 1.8 | CHUM | - | - | - |
| | | | | | | | | |
| 8/30/1995 | 1995 | 0.0 | 0.4 | 0.4 | CHUM | - | - | - |
| 9/13/1995 | 1995 | 0.0 | 0.4 | 0.4 | CHUM | - | - | - |
| **9/27/1995** | **1995** | **0.0** | **1.8** | **1.8** | **CHIN** | **6** | **0** | **6** |
| 10/12/1995 | 1995 | 0.0 | 1.8 | 1.8 | CHUM | - | - | - |
| 10/20/1995 | 1995 | 0.0 | 1.8 | 1.8 | CHUM | - | - | - |
| 10/30/1995 | 1995 | 0.0 | 1.6 | 1.6 | CHUM | - | - | - |
| 11/2/1995 | 1995 | 0.0 | 1.8 | 1.8 | CHUM | - | - | - |
| | | | | | | | | |
| 9/3/1996 | 1996 | 0.0 | 0.4 | 0.4 | CHUM | - | - | - |
| 9/13/1996 | 1996 | 0.0 | 0.2 | 0.2 | CHUM | - | - | - |
| 9/17/1996 | 1996 | 0.0 | 1.8 | 1.8 | CHUM | - | - | - |
| 9/26/1996 | 1996 | 0.0 | 1.8 | 1.8 | CHUM | - | - | - |
| **10/3/1996** | **1996** | **0.0** | **1.8** | **1.8** | **CHIN** | **1** | **1** | **2** |
| 10/14/1996 | 1996 | 0.0 | 1.8 | 1.8 | CHUM | - | - | - |
| 10/28/1996 | 1996 | 0.0 | 1.8 | 1.8 | CHUM | - | - | - |
| 11/8/1996 | 1996 | 0.0 | 1.8 | 1.8 | CHUM | - | - | - |

**Table C-8.** Johns Creek spawning ground surveys, 1987-2006.

| Date | RunYear | RMLower | RMUpper | Length | Species | Live_Count | Dead_Count | Total_Count |
|---|---|---|---|---|---|---|---|---|
| 9/29/1997 | 1997 | 0.0 | 1.8 | 1.8 | CHUM | - | - | - |
| **10/9/1997** | **1997** | **0.0** | **1.8** | **1.8** | **CHIN** | **2** | **0** | **2** |
| 10/21/1997 | 1997 | 0.0 | 1.8 | 1.8 | COHO | - | - | - |
| 10/29/1997 | 1997 | 0.0 | 1.8 | 1.8 | CHUM | - | - | - |
| 11/12/1997 | 1997 | 0.0 | 1.8 | 1.8 | CHUM | - | - | - |
| | | | | | | | | |
| 9/11/1998 | 1998 | 0.0 | 0.4 | 0.4 | CHUM | - | - | - |
| 9/18/1998 | 1998 | 0.0 | 1.8 | 1.8 | CHUM | - | - | - |
| 10/2/1998 | 1998 | 0.0 | 1.8 | 1.8 | CHUM | - | - | - |
| 10/15/1998 | 1998 | 0.0 | 1.8 | 1.8 | CHUM | - | - | - |
| 10/23/1998 | 1998 | 0.0 | 1.8 | 1.8 | CHUM | - | - | - |
| 11/2/1998 | 1998 | 0.0 | 1.8 | 1.8 | CHUM | - | - | - |
| 11/9/1998 | 1998 | 0.0 | 1.8 | 1.8 | CHUM | - | - | - |
| | | | | | | | | |
| 9/1/1999 | 1999 | 0.0 | 0.4 | 0.4 | CHUM | - | - | - |
| 9/10/1999 | 1999 | 0.0 | 1.8 | 1.8 | CHUM | - | - | - |
| 9/17/1999 | 1999 | 0.0 | 1.8 | 1.8 | CHUM | - | - | - |
| 9/28/1999 | 1999 | 0.0 | 1.8 | 1.8 | CHUM | - | - | - |
| 10/6/1999 | 1999 | 0.0 | 1.8 | 1.8 | CHUM | - | - | - |
| 10/13/1999 | 1999 | 0.0 | 1.8 | 1.8 | CHUM | - | - | - |
| 10/20/1999 | 1999 | 0.0 | 1.8 | 1.8 | CHUM | - | - | - |
| 10/27/1999 | 1999 | 0.0 | 1.8 | 1.8 | CHUM | - | - | - |
| 11/3/1999 | 1999 | 0.0 | 1.8 | 1.8 | CHUM | - | - | - |
| 11/15/1999 | 1999 | 0.0 | 1.8 | 1.8 | CHUM | - | - | - |
| | | | | | | | | |
| 9/5/2000 | 2000 | 0.0 | 1.8 | 1.8 | CHUM | - | - | - |
| 9/12/2000 | 2000 | 0.0 | 1.8 | 1.8 | CHUM | - | - | - |
| 9/21/2000 | 2000 | 0.0 | 1.8 | 1.8 | CHUM | - | - | - |
| 9/29/2000 | 2000 | 0.0 | 1.8 | 1.8 | CHUM | - | - | - |
| **10/6/2000** | **2000** | **0.0** | **1.8** | **1.8** | **CHIN** | **2** | **0** | **2** |
| 10/16/2000 | 2000 | 0.0 | 1.8 | 1.8 | COHO | - | - | - |
| 10/25/2000 | 2000 | 0.0 | 1.8 | 1.8 | CHUM | - | - | - |

**Table C-8.** Johns Creek spawning ground surveys, 1987-2006.

| Date | RunYear | RMLower | RMUpper | Length | Species | Live_Count | Dead_Count | Total_Count |
|---|---|---|---|---|---|---|---|---|
| 11/2/2000 | 2000 | 0.0 | 1.8 | 1.8 | CHUM | - | - | - |
| 11/14/2000 | 2000 | 0.0 | 1.8 | 1.8 | CHUM | - | - | - |
| | | | | | | | | |
| 9/4/2001 | 2001 | 0.0 | 0.5 | 0.5 | CHUM | - | - | - |
| 9/12/2001 | 2001 | 0.0 | 0.4 | 0.4 | CHUM | - | - | - |
| 9/19/2001 | 2001 | 0.0 | 0.4 | 0.4 | CHUM | - | - | - |
| **9/28/2001** | **2001** | **0.0** | **1.8** | **1.8** | **CHIN** | **1** | | **1** |
| 10/8/2001 | 2001 | 0.0 | 1.8 | 1.8 | CHUM | - | - | - |
| 10/17/2001 | 2001 | 0.0 | 1.8 | 1.8 | CHIN | 1 | | 1 |
| 10/25/2001 | 2001 | 0.0 | 1.8 | 1.8 | COHO | - | - | - |
| 11/2/2001 | 2001 | 0.0 | 1.8 | 1.8 | CHUM | - | - | - |
| 11/11/2001 | 2001 | 0.0 | 1.8 | 1.8 | CHUM | - | - | - |
| | | | | | | | | |
| 9/10/2002 | 2002 | 0.0 | 1.8 | 1.8 | CHUM | - | - | - |
| 9/20/2002 | 2002 | 0.0 | 1.8 | 1.8 | CHUM | - | - | - |
| 9/30/2002 | 2002 | 0.0 | 1.8 | 1.8 | CHUM | - | - | - |
| 10/7/2002 | 2002 | 0.0 | 1.8 | 1.8 | CHUM | - | - | - |
| 10/16/2002 | 2002 | 0.0 | 1.8 | 1.8 | CHUM | - | - | - |
| 10/24/2002 | 2002 | 0.0 | 1.8 | 1.8 | COHO | - | - | - |
| 11/1/2002 | 2002 | 0.0 | 1.8 | 1.8 | COHO | - | - | - |
| 11/8/2002 | 2002 | 0.0 | 1.8 | 1.8 | CHUM | - | - | - |
| 11/15/2002 | 2002 | 0.0 | 1.8 | 1.8 | CHUM | - | - | - |
| | | | | | | | | |
| 9/8/2003 | 2003 | 0.0 | 1.8 | 1.8 | CHUM | - | - | - |
| 9/23/2003 | 2003 | 0.0 | 1.8 | 1.8 | CHUM | - | - | - |
| 10/1/2003 | 2003 | 0.0 | 1.8 | 1.8 | CHUM | - | - | - |
| 10/9/2003 | 2003 | 0.0 | 1.8 | 1.8 | CHUM | - | - | - |
| 10/24/2003 | 2003 | 0.0 | 1.8 | 1.8 | CHUM | - | - | - |
| 10/31/2003 | 2003 | 0.0 | 1.8 | 1.8 | CHUM | - | - | - |
| 11/7/2003 | 2003 | 0.0 | 1.8 | 1.8 | CHUM | - | - | - |
| 11/14/2003 | 2003 | 0.0 | 1.8 | 1.8 | COHO | - | - | - |

**Table C-8.** Johns Creek spawning ground surveys, 1987-2006.

| Date | RunYear | RMLower | RMUpper | Length | Species | Live_Count | Dead_Count | Total_Count |
|---|---|---|---|---|---|---|---|---|
| 9/1/2004 | 2004 | 0.0 | 1.8 | 1.8 | CHUM | - | - | - |
| 9/8/2004 | 2004 | 0.0 | 1.8 | 1.8 | CHUM | - | - | - |
| 9/14/2004 | 2004 | 0.0 | 1.8 | 1.8 | CHUM | - | - | - |
| 9/22/2004 | 2004 | 0.0 | 1.8 | 1.8 | COHO | - | - | - |
| **9/30/2004** | **2004** | **0.0** | **1.8** | **1.8** | **CHIN** | **0** | **0** | **0** |
| 10/7/2004 | 2004 | 0.0 | 1.8 | 1.8 | CHIN | 0 | 0 | 0 |
| 10/14/2004 | 2004 | 0.0 | 1.8 | 1.8 | CHIN | 0 | 0 | 0 |
| 10/21/2004 | 2004 | 0.0 | 1.8 | 1.8 | CHUM | - | - | - |
| 10/29/2004 | 2004 | 0.0 | 1.8 | 1.8 | COHO | - | - | - |
| 11/4/2004 | 2004 | 0.0 | 1.8 | 1.8 | CHUM | 0 | 0 | 0 |
| | | | | | | | | |
| 9/8/2005 | 2005 | 0.0 | 0.8 | 0.8 | CHIN | 0 | 0 | 0 |
| 9/13/2005 | 2005 | 0.0 | 1.8 | 1.8 | CHIN | 0 | 0 | 0 |
| 9/20/2005 | 2005 | 0.0 | 1.8 | 1.8 | CHUM | - | - | - |
| 9/27/2005 | 2005 | 0.0 | 1.8 | 1.8 | CHIN | 0 | 0 | 0 |
| 10/5/2005 | 2005 | 0.0 | 1.8 | 1.8 | CHIN | 0 | 0 | 0 |
| **10/12/2005** | **2005** | **0.0** | **1.8** | **1.8** | **CHIN** | **1** | **0** | **1** |
| 10/20/2005 | 2005 | 0.0 | 1.8 | 1.8 | CHIN | 0 | 0 | 0 |
| 10/27/2005 | 2005 | 0.0 | 1.8 | 1.8 | CHUM | - | - | - |
| 11/4/2005 | 2005 | 0.0 | 1.8 | 1.8 | CHUM | - | - | - |
| 11/14/2005 | 2005 | 0.0 | 1.8 | 1.8 | COHO | - | - | - |
| | | | | | | | | |
| **9/6/2006** | **2006** | **0.0** | **0.6** | **0.6** | **CHIN** | **0** | **0** | **0** |
| 9/12/2006 | 2006 | 0.0 | 1.8 | 1.8 | CHUM | - | - | - |
| 9/19/2006 | 2006 | 0.0 | 0.8 | 0.8 | CHUM | - | - | - |
| 9/21/2006 | 2006 | 0.0 | 1.8 | 1.8 | CHUM | - | - | - |
| 9/29/2006 | 2006 | 0.0 | 1.8 | 1.8 | CHUM | - | - | - |
| 10/9/2006 | 2006 | 0.0 | 1.8 | 1.8 | COHO | - | - | - |
| 10/18/2006 | 2006 | 0.0 | 1.8 | 1.8 | CHUM | - | - | - |
| 10/26/2006 | 2006 | 0.0 | 1.8 | 1.8 | COHO | - | - | - |
| 11/1/2006 | 2006 | 0.0 | 1.8 | 1.8 | CHUM | - | - | - |

Source: Spawning Ground Survey Database, 2007.

**Table C-9.** Sherwood Creek spawning ground surveys, 1987-2006.

| Date | RunYear | RMLower | RMUpper | Length | Species | Live Count | Dead Count | Total Count |
|---|---|---|---|---|---|---|---|---|
| **10/15/1987** | **1987** | **0.0** | **0.7** | **0.7** | **CHIN** | **3** | **8** | **11** |
| 10/29/1987 | 1987 | 0.0 | 0.7 | 0.7 | CHIN | 0 | 2 | 2 |
| 11/3/1987 | 1987 | 0.0 | 0.7 | 0.7 | COHO | - | - | - |
| 11/9/1987** | 1987 | 0.1 | 0.7 | 0.6 | COHO | - | - | - |
| | | | | | | | | |
| 9/19/1988 | 1988 | 0.0 | 0.7 | 0.7 | COHO | - | - | - |
| 9/28/1988 | 1988 | 0.0 | 0.7 | 0.7 | CHIN | 1 | 0 | 1 |
| **10/6/1988** | **1988** | **0.0** | **0.7** | **0.7** | **CHIN** | **5** | **2** | **7** |
| 10/18/1988 | 1988 | 0.0 | 0.7 | 0.7 | COHO | - | - | - |
| 10/27/1988 | 1988 | 0.0 | 0.7 | 0.7 | CHIN | 0 | 1 | 1 |
| 11/4/1988** | 1988 | 0.0 | 0.7 | 0.7 | CHUM | - | - | - |
| | | | | | | | | |
| 9/27/1989 | 1989 | 0.0 | 0.7 | 0.7 | CHIN | 2 | 0 | 2 |
| **10/10/1989** | **1989** | **0.0** | **0.7** | **0.7** | **CHIN** | **11** | **1** | **12** |
| 10/17/1989 | 1989 | 0.0 | 0.7 | 0.7 | CHUM | - | - | - |
| 10/25/1989 | 1989 | 0.0 | 0.7 | 0.7 | CHUM | - | - | - |
| 11/1/1989 | 1989 | 0.0 | 0.7 | 0.7 | CHUM | - | - | - |
| 11/3/1989** | 1989 | 0.0 | 0.7 | 0.7 | CHUM | - | - | - |
| 11/10/1989** | 1989 | 0.0 | 0.7 | 0.7 | CHUM | - | - | - |
| 11/13/1989 | 1989 | 0.0 | 0.7 | 0.7 | CHUM | - | - | - |
| | | | | | | | | |
| 9/21/1990 | 1990 | 0.0 | 0.7 | 0.7 | CHUM | - | - | - |
| **10/4/1990** | **1990** | **0.0** | **3.5** | **3.5** | **CHIN** | **28** | **0** | **28** |
| 10/16/1990 | 1990 | 0.0 | 0.7 | 0.7 | CHIN | 6 | 5 | 11 |
| 10/25/1990 | 1990 | 0.1 | 0.7 | 0.6 | CHIN | 0 | 1 | 1 |
| 11/2/1990 | 1990 | 0.0 | 1.3 | 1.3 | COHO | - | - | - |
| 11/8/1990 | 1990 | 0.3 | 0.7 | 0.4 | COHO | - | - | - |
| 11/15/1990 | 1990 | 0.0 | 0.7 | 0.7 | COHO | - | - | - |

** Survey conducted by Squaxin Island Indian Tribe.

**Table C-9.** Sherwood Creek spawning ground surveys, 1987-2006.

| Date | RunYear | RMLower | RMUpper | Length | Species | Live Count | Dead Count | Total Count |
|---|---|---|---|---|---|---|---|---|
| 9/19/1991 | 1991 | 0.0 | 0.7 | 0.7 | CHUM | - | - | - |
| 10/2/1991 | 1991 | 0.0 | 0.7 | 0.7 | CHIN | 5 | 2 | 7 |
| **10/11/1991** | **1991** | **0.2** | **0.7** | **0.5** | **CHIN** | **21** | **7** | **28** |
| 10/22/1991 | 1991 | 0.0 | 0.7 | 0.7 | CHIN | 3 | 17 | 20 |
| 10/31/1991 | 1991 | 0.0 | 0.7 | 0.7 | CHIN | 2 | 8 | 10 |
| 11/4/1991 | 1991 | 0.0 | 0.7 | 0.7 | CHIN | 0 | 2 | 2 |
| 11/7/1991 | 1991 | 0.0 | 0.7 | 0.7 | COHO | - | - | - |
| 11/12/1991 | 1991 | 0.0 | 0.7 | 0.7 | COHO | - | - | - |
| | | | | | | | | |
| 9/11/1992 | 1992 | 0.0 | 0.7 | 0.7 | CHUM | - | - | - |
| 9/21/1992 | 1992 | 0.0 | 0.7 | 0.7 | CHUM | - | - | - |
| 10/2/1992 | 1992 | 0.0 | 0.7 | 0.7 | CHIN | 3 | 1 | 4 |
| 10/9/1992 | 1992 | 0.0 | 0.7 | 0.7 | CHIN | 0 | 1 | 1 |
| **10/19/1992** | **1992** | **0.0** | **0.7** | **0.7** | **CHIN** | **4** | **2** | **6** |
| 10/28/1992 | 1992 | 0.0 | 0.7 | 0.7 | CHIN | 0 | 5 | 5 |
| 11/5/1992 | 1992 | 0.0 | 0.7 | 0.7 | CHUM | - | - | - |
| | | | | | | | | |
| 9/1/1993 | 1993 | 0.0 | 0.7 | 0.7 | CHUM | - | - | - |
| 9/13/1993 | 1993 | 0.0 | 0.7 | 0.7 | CHUM | - | - | - |
| 9/20/1993 | 1993 | 0.0 | 0.7 | 0.7 | CHUM | - | - | - |
| **10/4/1993** | **1993** | **0.0** | **0.7** | **0.7** | **CHIN** | **2** | **0** | **2** |
| 10/11/1993 | 1993 | 0.0 | 0.7 | 0.7 | CHIN | 0 | 2 | 2 |
| 10/20/1993 | 1993 | 0.0 | 0.7 | 0.7 | CHIN | 0 | 1 | 1 |
| 11/1/1993 | 1993 | 0.0 | 0.7 | 0.7 | CHUM | - | - | - |
| 11/12/1993 | 1993 | 0.0 | 0.7 | 0.7 | COHO | - | - | - |

**Table C-9.** Sherwood Creek spawning ground surveys, 1987-2006.

| Date | RunYear | RMLower | RMUpper | Length | Species | Live Count | Dead Count | Total Count |
|---|---|---|---|---|---|---|---|---|
| 9/22/1994 | 1994 | 0.0 | 0.7 | 0.7 | CHUM | - | - | - |
| 10/3/1994 | 1994 | 0.0 | 0.7 | 0.7 | CHIN | 3 | 2 | 5 |
| **10/11/1994** | **1994** | **0.0** | **0.7** | **0.7** | **CHIN** | **9** | **2** | **11** |
| 10/18/1994 | 1994 | 0.0 | 0.7 | 0.7 | CHIN | 3 | 2 | 5 |
| 10/28/1994 | 1994 | 0.0 | 0.7 | 0.7 | COHO | - | - | - |
| 11/8/1994 | 1994 | 0.0 | 0.7 | 0.7 | CHUM | - | - | - |
| | | | | | | | | |
| 8/30/1995 | 1995 | 0.0 | 0.7 | 0.7 | CHUM | - | - | - |
| 9/12/1995 | 1995 | 0.0 | 0.7 | 0.7 | CHUM | - | - | - |
| 9/27/1995 | 1995 | 0.0 | 0.7 | 0.7 | CHUM | - | - | - |
| **10/12/1995** | **1995** | **0.0** | **0.7** | **0.7** | **CHIN** | **4** | **5** | **9** |
| 10/20/1995 | 1995 | 0.0 | 0.7 | 0.7 | CHUM | - | - | - |
| 11/2/1995 | 1995 | 0.0 | 0.7 | 0.7 | CHUM | - | - | - |
| | | | | | | | | |
| 9/3/1996 | 1996 | 0.0 | 0.7 | 0.7 | CHUM | - | - | - |
| 9/13/1996 | 1996 | 0.0 | 0.7 | 0.7 | COHO | - | - | - |
| 10/1/1996 | 1996 | 0.0 | 0.7 | 0.7 | CHUM | - | - | - |
| 10/8/1996 | 1996 | 0.0 | 0.7 | 0.7 | COHO | - | - | - |
| 10/17/1996 | 1996 | 0.0 | 0.7 | 0.7 | CHUM | - | - | - |
| 10/29/1996 | 1996 | 0.0 | 0.7 | 0.7 | CHUM | - | - | - |
| 11/8/1996 | 1996 | 0.0 | 0.7 | 0.7 | COHO | - | - | - |
| | | | | | | | | |
| 9/19/1997 | 1997 | 0.0 | 0.7 | 0.7 | CHUM | - | - | - |
| 10/8/1997 | 1997 | 0.0 | 0.7 | 0.7 | CHUM | - | - | - |
| 10/20/1997 | 1997 | 0.0 | 0.7 | 0.7 | CHUM | - | - | - |
| 10/28/1997 | 1997 | 0.0 | 0.7 | 0.7 | COHO | - | - | - |
| 11/6/1997 | 1997 | 0.0 | 0.7 | 0.7 | COHO | - | - | - |

**Table C-9.** Sherwood Creek spawning ground surveys, 1987-2006.

| Date | RunYear | RMLower | RMUpper | Length | Species | Live Count | Dead Count | Total Count |
|---|---|---|---|---|---|---|---|---|
| 9/3/1998 | 1998 | 0.2 | 0.7 | 0.5 | CHUM | - | - | - |
| 9/16/1998 | 1998 | 0.0 | 0.7 | 0.7 | CHIN | 3 | 0 | 3 |
| **9/25/1998** | **1998** | **0.0** | **0.7** | **0.7** | **CHIN** | **8** | **0** | **8** |
| 10/5/1998 | 1998 | 0.0 | 0.7 | 0.7 | CHIN | 1 | 5 | 6 |
| 10/13/1998 | 1998 | 0.0 | 0.7 | 0.7 | CHIN | 0 | 5 | 5 |
| 10/20/1998 | 1998 | 0.0 | 0.7 | 0.7 | CHIN | 0 | 1 | 1 |
| 10/28/1998 | 1998 | 0.0 | 0.7 | 0.7 | COHO | - | - | - |
| 11/5/1998 | 1998 | 0.0 | 0.7 | 0.7 | COHO | - | - | - |
| 11/12/1998 | 1998 | 0.0 | 0.7 | 0.7 | COHO | - | - | - |
| | | | | | | | | |
| 9/1/1999 | 1999 | 0.0 | 0.7 | 0.7 | CHUM | - | - | - |
| 9/13/1999 | 1999 | 0.0 | 0.7 | 0.7 | CHUM | - | - | - |
| 9/23/1999 | 1999 | 0.0 | 0.7 | 0.7 | CHIN | 10 | 0 | 10 |
| **9/30/1999** | **1999** | **0.0** | **0.7** | **0.7** | **CHIN** | **22** | **0** | **22** |
| 10/7/1999 | 1999 | 0.0 | 0.7 | 0.7 | CHIN | 9 | 6 | 15 |
| 10/13/1999 | 1999 | 0.0 | 0.7 | 0.7 | COHO | - | - | - |
| 10/20/1999 | 1999 | 0.0 | 0.7 | 0.7 | CHIN | 0 | 1 | 1 |
| 10/27/1999 | 1999 | 0.0 | 0.7 | 0.7 | CHUM | - | - | - |
| 11/4/1999 | 1999 | 0.0 | 0.7 | 0.7 | CHUM | - | - | - |
| 11/15/1999 | 1999 | 0.0 | 0.7 | 0.7 | CHUM | - | - | - |
| | | | | | | | | |
| 9/6/2000 | 2000 | 0.0 | 0.7 | 0.7 | CHUM | - | - | - |
| 9/13/2000 | 2000 | 0.0 | 0.7 | 0.7 | CHIN | 0 | 0 | 0 |
| 9/21/2000 | 2000 | 0.0 | 0.7 | 0.7 | CHUM | - | - | - |
| 9/29/2000 | 2000 | 0.0 | 0.7 | 0.7 | CHIN | 2 | 0 | 2 |
| **10/6/2000** | **2000** | **0.0** | **0.7** | **0.7** | **CHIN** | **7** | **2** | **9** |
| 10/16/2000 | 2000 | 0.0 | 0.7 | 0.7 | CHIN | 3 | 1 | 4 |
| 10/24/2000 | 2000 | 0.0 | 0.7 | 0.7 | CHIN | 1 | 0 | 1 |
| 10/31/2000 | 2000 | 0.0 | 0.7 | 0.7 | CHIN | 1 | 0 | 1 |
| 11/9/2000 | 2000 | 0.0 | 0.7 | 0.7 | COHO | - | - | - |

**Table C-9.** Sherwood Creek spawning ground surveys, 1987-2006.

| Date | RunYear | RMLower | RMUpper | Length | Species | Live Count | Dead Count | Total Count |
|---|---|---|---|---|---|---|---|---|
| 9/7/2001 | 2001 | 0.0 | 0.7 | 0.7 | CHUM | - | - | - |
| 9/14/2001 | 2001 | 0.0 | 0.7 | 0.7 | CHUM | - | - | - |
| 9/24/2001 | 2001 | 0.0 | 0.7 | 0.7 | CHIN | 7 | 0 | 7 |
| 10/4/2001 | 2001 | 0.0 | 0.7 | 0.7 | CHIN | 9 | 0 | 9 |
| **10/15/2001** | **2001** | **0.0** | **0.7** | **0.7** | **CHIN** | **8** | **4** | **12** |
| 10/25/2001 | 2001 | 0.0 | 0.7 | 0.7 | CHIN | 4 | 3 | 7 |
| 11/1/2001 | 2001 | 0.0 | 0.7 | 0.7 | CHIN | 0 | 3 | 3 |
| 11/9/2001 | 2001 | 0.0 | 0.7 | 0.7 | COHO | - | - | - |
| | | | | | | | | |
| 9/10/2002 | 2002 | 0.0 | 0.7 | 0.7 | CHIN | 9 | 1 | 10 |
| 9/17/2002 | 2002 | 0.0 | 0.7 | 0.7 | CHIN | 1 | 0 | 1 |
| **9/27/2002** | **2002** | **0.0** | **0.7** | **0.7** | **CHIN** | **26** | **4** | **30** |
| 10/3/2002 | 2002 | 0.0 | 0.7 | 0.7 | CHIN | 7 | 1 | 8 |
| 10/10/2002 | 2002 | 0.0 | 0.7 | 0.7 | CHIN | 3 | 1 | 4 |
| 10/16/2002 | 2002 | 0.0 | 0.7 | 0.7 | CHIN | 0 | 1 | 1 |
| 10/23/2002 | 2002 | 0.0 | 0.7 | 0.7 | CHUM | - | - | - |
| 10/31/2002 | 2002 | 0.0 | 0.7 | 0.7 | CHUM | - | - | - |
| 11/7/2002 | 2002 | 0.0 | 0.7 | 0.7 | COHO | - | - | - |
| 11/15/2002 | 2002 | 0.0 | 0.7 | 0.7 | COHO | - | - | - |
| | | | | | | | | |
| 9/2/2003 | 2003 | 0.0 | 0.7 | 0.7 | CHUM | - | - | - |
| 9/10/2003 | 2003 | 0.0 | 0.7 | 0.7 | CHIN | 1 | 0 | 1 |
| 9/17/2003 | 2003 | 0.0 | 0.7 | 0.7 | CHIN | 0 | 0 | 0 |
| 9/25/2003 | 2003 | 0.0 | 0.7 | 0.7 | CHIN | 7 | 0 | 7 |
| **10/3/2003** | **2003** | **0.0** | **0.7** | **0.7** | **CHIN** | **13** | **0** | **13** |
| 10/9/2003 | 2003 | 0.0 | 0.7 | 0.7 | CHIN | 7 | 3 | 10 |
| 10/14/2003 | 2003 | 0.0 | 0.7 | 0.7 | CHIN | 7 | 4 | 11 |
| 10/27/2003 | 2003 | 0.0 | 0.7 | 0.7 | COHO | - | - | - |
| 11/3/2003 | 2003 | 0.0 | 0.7 | 0.7 | COHO | - | - | - |
| 11/6/2003 | 2003 | 0.0 | 0.7 | 0.7 | COHO | - | - | - |
| 11/14/2003 | 2003 | 0.0 | 0.7 | 0.7 | COHO | - | - | - |

**Table C-9.** Sherwood Creek spawning ground surveys, 1987-2006.

| Date | RunYear | RMLower | RMUpper | Length | Species | Live Count | Dead Count | Total Count |
|---|---|---|---|---|---|---|---|---|
| 9/1/2004 | 2004 | 0.0 | 0.7 | 0.7 | CHIN | 0 | 0 | 0 |
| 9/8/2004 | 2004 | 0.0 | 0.7 | 0.7 | CHIN | 0 | 0 | 0 |
| 9/13/2004 | 2004 | 0.0 | 0.7 | 0.7 | CHIN | 2 | 0 | 2 |
| 9/22/2004 | 2004 | 0.1 | 0.7 | 0.6 | CHIN | 40 | 2 | 42 |
| **9/27/2004** | **2004** | **0.0** | **0.7** | **0.7** | **CHIN** | **73** | **7** | **80** |
| 10/6/2004 | 2004 | 0.0 | 0.7 | 0.7 | CHIN | 23 | 11 | 34 |
| 10/13/2004 | 2004 | 0.0 | 0.7 | 0.7 | CHIN | 2 | 4 | 6 |
| 10/21/2004 | 2004 | 0.2 | 0.7 | 0.5 | CHIN | 4 | 0 | 4 |
| 10/28/2004 | 2004 | 0.0 | 0.7 | 0.7 | COHO | - | - | - |
| 11/4/2004 | 2004 | 0.0 | 0.7 | 0.7 | COHO | - | - | - |
| 11/11/2004 | 2004 | 0.0 | 0.7 | 0.7 | CHUM | - | - | - |
| | | | | | | | | |
| 9/6/2005 | 2005 | 0.0 | 0.7 | 0.7 | CHIN | 0 | 0 | 0 |
| 9/12/2005 | 2005 | 0.0 | 0.7 | 0.7 | CHIN | 5 | 0 | 5 |
| 9/20/2005 | 2005 | 0.0 | 0.7 | 0.7 | CHIN | 11 | 2 | 13 |
| 9/27/2005 | 2005 | 0.0 | 0.7 | 0.7 | CHIN | 17 | 0 | 17 |
| **10/4/2005** | **2005** | **0.0** | **0.7** | **0.7** | **CHIN** | **27** | **2** | **29** |
| 10/11/2005 | 2005 | 0.0 | 0.7 | 0.7 | CHIN | 20 | 7 | 27 |
| 10/18/2005 | 2005 | 0.0 | 0.7 | 0.7 | CHIN | 6 | 11 | 17 |
| 10/25/2005 | 2005 | 0.1 | 0.7 | 0.6 | CHIN | 0 | 3 | 3 |
| 11/7/2005 | 2005 | 0.0 | 0.7 | 0.7 | COHO | - | - | - |
| | | | | | | | | |
| 9/12/2006 | 2006 | 0.0 | 0.7 | 0.7 | CHIN | 1 | 0 | 1 |
| 9/22/2006 | 2006 | 0.0 | 0.7 | 0.7 | CHIN | 3 | 0 | 3 |
| **10/2/2006** | **2006** | **0.0** | **0.7** | **0.7** | **CHIN** | **6** | **2** | **8** |
| 10/12/2006 | 2006 | 0.0 | 0.7 | 0.7 | CHIN | 0 | 0 | 0 |
| 10/23/2006 | 2006 | 0.0 | 0.7 | 0.7 | COHO | - | - | - |
| 10/31/2006 | 2006 | 0.0 | 0.7 | 0.7 | COHO | - | - | - |

Source: Spawning Ground Survey Database, 2007.

**Table C-10.** Rocky Creek spawning ground surveys, 1987-2006.

| Date | RunYear | RMLower | RMUpper | Length | Species | Live Count | Dead Count | Total Count |
|---|---|---|---|---|---|---|---|---|
| **10/15/1987** | **1987** | **0.3** | **0.7** | **0.4** | **CHIN** | **0** | **4** | **4** |
| 10/29/1987 | 1987 | 0.3 | 0.8 | 0.5 | CHIN | 0 | 2 | 2 |
| 11/5/1987 | 1987 | 0.3 | 1.6 | 1.3 | CHIN | | 0 | 0 |
| 11/12/1987 | 1987 | 0.3 | 1.6 | 1.3 | CHIN | 0 | 2 | 2 |
| | | | | | | | | |
| 9/8/1988 | 1988 | 0.3 | 1.6 | 1.3 | COHO | - | - | - |
| 9/19/1988 | 1988 | 0.3 | 1.6 | 1.3 | CHUM | - | - | - |
| 9/28/1988 | 1988 | 0.3 | 1.6 | 1.3 | CHIN | 2 | 0 | 2 |
| 10/6/1988 | 1988 | 0.0 | 1.6 | 1.6 | CHIN | 8 | 0 | 8 |
| **10/18/1988** | **1988** | **0.3** | **1.6** | **1.3** | **CHIN** | **8** | **9** | **17** |
| 10/28/1988 | 1988 | 0.3 | 1.6 | 1.3 | CHIN | 0 | 6 | 6 |
| 11/4/1988 | 1988 | 0.3 | 1.6 | 1.3 | CHUM | - | - | - |
| 11/11/1988 | 1988 | 0.3 | 1.6 | 1.3 | CHUM | - | - | - |
| | | | | | | | | |
| 9/6/1989 | 1989 | 0.3 | 1.6 | 1.3 | CHUM | - | - | - |
| **9/27/1989** | **1989** | **0.3** | **1.6** | **1.3** | **CHIN** | **8** | **1** | **9** |
| 11/2/1989 | 1989 | 0.3 | 1.6 | 1.3 | CHUM | - | - | - |
| 11/9/1989 | 1989 | 0.3 | 1.6 | 1.3 | CHUM | - | - | - |
| | | | | | | | | |
| 9/23/1990 | 1990 | 0.3 | 1.6 | 1.3 | CHIN | 0 | 4 | 4 |
| **10/16/1990** | **1990** | **0.3** | **1.6** | **1.3** | **CHIN** | **0** | **30** | **30** |
| 10/23/1990 | 1990 | 0.3 | 1.6 | 1.3 | CHUM | - | - | - |
| 10/31/1990 | 1990 | 0.3 | 1.6 | 1.3 | CHUM | - | - | - |
| 11/1/1990 | 1990 | 0.0 | 1.6 | 1.6 | CHIN | 0 | 2 | 2 |
| 11/7/1990 | 1990 | 0.3 | 1.6 | 1.3 | COHO | - | - | - |
| 11/15/1990 | 1990 | 0.3 | 1.6 | 1.3 | CHUM | - | - | - |
| | | | | | | | | |
| 10/9/1991 | 1991 | 0.3 | 1.6 | 1.3 | CHIN | 9 | 3 | 12 |
| **10/11/1991** | **1991** | **0.0** | **1.0** | **1.0** | **CHIN** | **8** | **6** | **14** |
| 10/18/1991 | 1991 | 0.3 | 1.6 | 1.3 | CHIN | 1 | 3 | 4 |
| 10/21/1991 | 1991 | 0.0 | 1.0 | 1.0 | CHIN | 0 | 3 | 3 |

**Table C-10.** Rocky Creek spawning ground surveys, 1987-2006.

| Date | RunYear | RMLower | RMUpper | Length | Species | Live Count | Dead Count | Total Count |
|---|---|---|---|---|---|---|---|---|
| 11/8/1991 | 1991 | 0.3 | 1.6 | 1.3 | CHUM | - | - | - |
| 11/15/1991 | 1991 | 0.3 | 1.6 | 1.3 | CHUM | - | - | - |
| | | | | | | | | |
| 9/22/1992 | 1992 | 0.3 | 1.6 | 1.3 | CHIN | 13 | 2 | 15 |
| **9/30/1992** | **1992** | **0.1** | **1.6** | **1.5** | **CHIN** | **14** | **25** | **39** |
| 10/7/1992 | 1992 | 0.3 | 1.6 | 1.3 | CHIN | 4 | 31 | 35 |
| 10/14/1992 | 1992 | 0.3 | 1.6 | 1.3 | CHIN | 3 | 17 | 20 |
| 10/21/1992 | 1992 | 0.3 | 1.6 | 1.3 | CHIN | 7 | 31 | 38 |
| 10/28/1992 | 1992 | 0.3 | 1.6 | 1.3 | CHIN | 1 | 9 | 10 |
| 11/9/1992 | 1992 | 0.3 | 1.6 | 1.3 | CHUM | - | - | - |
| | | | | | | | | |
| **9/20/1993** | **1993** | **0.3** | **0.8** | **0.5** | **CHIN** | **3** | **0** | **3** |
| 9/20/1993 | 1993 | 0.3 | 1.6 | 1.3 | COHO | - | - | - |
| 11/2/1993 | 1993 | 0.3 | 1.6 | 1.3 | CHIN | 0 | 3 | 3 |
| 11/9/1993 | 1993 | 0.3 | 1.6 | 1.3 | CHUM | - | - | - |
| | | | | | | | | |
| 9/20/1994 | 1994 | 0.0 | 1.6 | 1.6 | CHIN | 0 | 1 | 1 |
| 10/4/1994 | 1994 | 0.3 | 1.6 | 1.3 | CHUM | - | - | - |
| **10/12/1994** | **1994** | **0.3** | **1.6** | **1.3** | **CHIN** | **0** | **2** | **2** |
| 10/19/1994 | 1994 | 0.3 | 1.6 | 1.3 | CHUM | - | - | - |
| 11/2/1994 | 1994 | 0.3 | 1.6 | 1.3 | CHUM | - | - | - |
| 11/8/1994 | 1994 | 0.3 | 1.6 | 1.3 | CHUM | - | - | - |
| 11/15/1994 | 1994 | 0.3 | 1.6 | 1.3 | CHUM | - | - | - |
| | | | | | | | | |
| 9/11/1995 | 1995 | 0.1 | 0.7 | 0.6 | CHUM | - | - | - |
| **10/3/1995** | **1995** | **0.0** | **1.6** | **1.6** | **CHIN** | **5** | **4** | **9** |
| 10/13/1995 | 1995 | 0.3 | 1.6 | 1.3 | CHIN | 1 | 0 | 1 |
| 10/25/1995 | 1995 | 0.3 | 1.6 | 1.3 | CHUM | - | - | - |
| 10/27/1995 | 1995 | 0.3 | 1.6 | 1.3 | CHUM | - | - | - |
| 11/3/1995 | 1995 | 0.3 | 1.6 | 1.3 | CHUM | - | - | - |
| 11/10/1995 | 1995 | 0.3 | 1.6 | 1.3 | CHUM | - | - | - |

**Table C-10.** Rocky Creek spawning ground surveys, 1987-2006.

| Date | RunYear | RMLower | RMUpper | Length | Species | Live Count | Dead Count | Total Count |
|---|---|---|---|---|---|---|---|---|
| 9/23/1996 | 1996 | 0.3 | 1.6 | 1.3 | CHUM | - | - | - |
| 10/8/1996 | 1996 | 0.3 | 1.6 | 1.3 | CHUM | - | - | - |
| 10/16/1996 | 1996 | 0.3 | 1.6 | 1.3 | CHUM | - | - | - |
| 10/25/1996 | 1996 | 0.3 | 1.6 | 1.3 | CHUM | - | - | - |
| 11/1/1996 | 1996 | 0.3 | 1.6 | 1.3 | CHUM | - | - | - |
| 11/8/1996 | 1996 | 0.3 | 1.6 | 1.3 | CHUM | - | - | - |
| | | | | | | | | |
| 9/15/1997 | 1997 | 0.3 | 1.6 | 1.3 | CHIN | 3 | 0 | 3 |
| **10/3/1997** | **1997** | **0.3** | **1.6** | **1.3** | **CHIN** | **18** | **1** | **19** |
| 10/20/1997 | 1997 | 0.3 | 1.6 | 1.3 | CHIN | 0 | 2 | 2 |
| 11/4/1997 | 1997 | 0.3 | 1.6 | 1.3 | COHO | - | - | - |
| *11/4/1997* | *1997* | *1.6* | *3.1* | *1.5* | *CHIN* | *0* | *1* | *1* |
| 11/11/1997 | 1997 | 0.3 | 1.6 | 1.3 | CHUM | - | - | - |
| | | | | | | | | |
| 9/15/1998 | 1998 | 0.3 | 1.6 | 1.3 | CHIN | 14 | 2 | 16 |
| 9/23/1998 | 1998 | 0.3 | 1.6 | 1.3 | CHIN | 78 | 44 | 122 |
| **10/2/1998** | **1998** | **0.3** | **1.6** | **1.3** | **CHIN** | **267** | **93** | **360** |
| 10/12/1998 | 1998 | 0.3 | 1.6 | 1.3 | CHIN | 30 | 271 | 301 |
| 10/21/1998 | 1998 | 0.3 | 1.6 | 1.3 | CHIN | 4 | 110 | 114 |
| 10/30/1998 | 1998 | 0.3 | 1.6 | 1.3 | CHIN | 3 | 149 | 152 |
| 11/6/1998 | 1998 | 0.3 | 1.6 | 1.3 | CHIN | 0 | 15 | 15 |
| 11/13/1998 | 1998 | 0.0 | 1.0 | 1.0 | COHO | - | - | - |
| | | | | | | | | |
| 9/8/1999 | 1999 | 0.3 | 1.6 | 1.3 | CHIN | 5 | 2 | 7 |
| 9/16/1999 | 1999 | 0.3 | 1.6 | 1.3 | CHIN | 29 | 8 | 37 |
| 9/24/1999 | 1999 | 0.3 | 1.8 | 1.5 | CHIN | 117 | 28 | 145 |
| **10/5/1999** | **1999** | **0.3** | **1.6** | **1.3** | **CHIN** | **85** | **111** | **196** |
| 10/12/1999 | 1999 | 0.3 | 1.8 | 1.5 | CHIN | 6 | 107 | 113 |
| 10/19/1999 | 1999 | 0.3 | 1.8 | 1.5 | CHIN | 0 | 36 | 36 |
| 10/26/1999 | 1999 | 0.3 | 1.8 | 1.5 | CHIN | 0 | 21 | 21 |
| 11/2/1999 | 1999 | 0.3 | 1.6 | 1.3 | CHUM | - | - | - |

**Table C-10.** Rocky Creek spawning ground surveys, 1987-2006.

| Date | RunYear | RMLower | RMUpper | Length | Species | Live Count | Dead Count | Total Count |
|---|---|---|---|---|---|---|---|---|
| 11/4/1999 | 1999 | 0.3 | 1.6 | 1.3 | CHIN | 0 | 5 | 5 |
| 11/9/1999 | 1999 | 0.3 | 1.6 | 1.3 | CHUM | - | - | - |
| | | | | | | | | |
| 9/1/2000 | 2000 | 0.3 | 1.6 | 1.3 | CHIN | 19 | 1 | 20 |
| 9/11/2000 | 2000 | 0.3 | 1.6 | 1.3 | CHIN | 140 | 40 | 180 |
| 9/18/2000 | 2000 | 0.3 | 1.6 | 1.3 | CHIN | 107 | 70 | 177 |
| **9/28/2000** | **2000** | **0.3** | **1.6** | **1.3** | **CHIN** | **187** | **210** | **397** |
| 10/5/2000 | 2000 | 0.3 | 1.6 | 1.3 | CHIN | 90 | 108 | 198 |
| 10/12/2000 | 2000 | 0.3 | 1.6 | 1.3 | CHIN | 45 | 276 | 321 |
| 10/19/2000 | 2000 | 0.3 | 1.6 | 1.3 | CHIN | 18 | 125 | 143 |
| 10/27/2000 | 2000 | 0.3 | 1.6 | 1.3 | CHIN | 1 | 20 | 21 |
| 11/6/2000 | 2000 | 0.3 | 1.6 | 1.3 | CHUM | - | - | - |
| 11/8/2000 | 2000 | 0.3 | 1.6 | 1.3 | CHUM | - | - | - |
| | | | | | | | | |
| 9/5/2001 | 2001 | 0.3 | 0.8 | 0.5 | CHIN | 0 | 1 | 1 |
| 9/11/2001 | 2001 | 0.3 | 0.8 | 0.5 | CHIN | 0 | 2 | 2 |
| 9/20/2001 | 2001 | 0.3 | 0.8 | 0.5 | CHIN | 18 | 8 | 26 |
| **10/1/2001** | **2001** | **0.3** | **1.6** | **1.3** | **CHIN** | **29** | **103** | **132** |
| 10/9/2001 | 2001 | 0.3 | 1.6 | 1.3 | CHIN | 27 | 84 | 111 |
| 10/18/2001 | 2001 | 0.3 | 1.6 | 1.3 | CHIN | 4 | 41 | 45 |
| 10/26/2001 | 2001 | 0.3 | 1.6 | 1.3 | CHIN | 0 | 6 | 6 |
| 11/1/2001 | 2001 | 0.3 | 3.1 | 2.8 | CHIN | 0 | 4 | 4 |
| 11/6/2001 | 2001 | 0.3 | 1.6 | 1.3 | CHUM | - | - | - |
| | | | | | | | | |
| 9/17/2002 | 2002 | 0.3 | 1.6 | 1.3 | CHIN | 16 | 4 | 20 |
| **9/30/2002** | **2002** | **0.3** | **1.6** | **1.3** | **CHIN** | **9** | **34** | **43** |
| 10/8/2002 | 2002 | 0.3 | 1.6 | 1.3 | CHIN | 1 | 18 | 19 |
| 10/16/2002 | 2002 | 0.3 | 1.6 | 1.3 | CHIN | 0 | 14 | 14 |
| 10/24/2002 | 2002 | 0.3 | 1.6 | 1.3 | CHIN | 0 | 1 | 1 |
| 11/4/2002 | 2002 | 0.3 | 1.6 | 1.3 | CHUM | - | - | - |
| 11/12/2002 | 2002 | 0.3 | 1.6 | 1.3 | CHUM | - | - | - |

**Table C-10.** Rocky Creek spawning ground surveys, 1987-2006.

| Date | RunYear | RMLower | RMUpper | Length | Species | Live Count | Dead Count | Total Count |
|---|---|---|---|---|---|---|---|---|
| 9/15/2003 | 2003 | 0.3 | 1.6 | 1.3 | CHIN | 0 | 0 | 0 |
| **9/25/2003** | **2003** | **0.3** | **1.6** | **1.3** | **CHIN** | **0** | **2** | **2** |
| 10/3/2003 | 2003 | 0.3 | 1.6 | 1.3 | CHIN | 0 | 1 | 1 |
| 10/10/2003 | 2003 | 0.3 | 1.6 | 1.3 | CHIN | 0 | 1 | 1 |
| 10/24/2003 | 2003 | 0.3 | 1.6 | 1.3 | COHO | - | - | - |
| 10/31/2003 | 2003 | 0.3 | 1.6 | 1.3 | CHIN | 1 | 0 | 1 |
| *10/31/2003* | *2003* | *1.6* | *3.1* | *1.5* | *CHIN* | *0* | *0* | *0* |
| 11/7/2003 | 2003 | 0.3 | 1.6 | 1.3 | COHO | - | - | - |
| 11/14/2003 | 2003 | 0.3 | 1.6 | 1.3 | CHUM | - | - | - |
| | | | | | | | | |
| **9/8/2004** | **2004** | **0.3** | **0.6** | **0.3** | **CHIN** | **0** | **0** | **0** |
| 9/8/2004 | 2004 | 0.3 | 0.6 | 0.3 | CHUM | - | - | - |
| 11/10/2004 | 2004 | 0.3 | 1.6 | 1.3 | COHO | - | - | - |
| | | | | | | | | |
| 9/6/2005 | 2005 | 0.3 | 1.6 | 1.3 | CHIN | 0 | 0 | 0 |
| 10/3/2005 | 2005 | 0.3 | 1.6 | 1.3 | CHIN | 51 | 23 | 74 |
| **10/11/2005** | **2005** | **0.3** | **1.6** | **1.3** | **CHIN** | **32** | **45** | **77** |
| 10/18/2005 | 2005 | 0.3 | 1.6 | 1.3 | CHIN | 0 | 18 | 18 |
| *10/18/2005* | *2005* | *1.6* | *3.1* | *1.5* | *CHIN* | *0* | *0* | *0* |
| 10/26/2005 | 2005 | 0.3 | 1.6 | 1.3 | CHIN | 0 | 7 | 7 |
| 11/3/2005 | 2005 | 0.3 | 1.6 | 1.3 | COHO | - | - | - |
| 11/10/2005 | 2005 | 0.3 | 1.6 | 1.3 | COHO | - | - | - |
| | | | | | | | | |
| 9/12/2006 | 2006 | 0.3 | 0.5 | 0.2 | CHIN | 1 | 2 | 3 |
| **9/26/2006** | **2006** | **0.3** | **1.6** | **1.3** | **CHIN** | **10** | **6** | **16** |
| 10/12/2006 | 2006 | 0.3 | 1.6 | 1.3 | CHIN | 0 | 11 | 11 |
| 10/23/2006 | 2006 | 0.3 | 1.6 | 1.3 | CHUM | - | - | - |
| 11/1/2006 | 2006 | 0.3 | 1.6 | 1.3 | CHUM | - | - | - |
| 11/9/2006 | 2006 | 0.3 | 1.6 | 1.3 | COHO | - | - | - |
| 11/14/2006 | 2006 | 0.3 | 1.6 | 1.3 | COHO | - | - | - |

Source: Spawning Ground Survey Database, 2007.

**Table C-11.** Burley Creek spawning ground surveys, 1987-2006.

| Date | RunYear | RMLower | RMUpper | Length | Species | Live Count | Dead Count | Total Count |
|---|---|---|---|---|---|---|---|---|
| **11/5/1987** | **1987** | **0.3** | **1.4** | **1.1** | **CHIN** | **0** | **16** | **16** |
| 11/13/1987 | 1987 | 0.3 | 1.4 | 1.1 | COHO | - | - | - |
| | | | | | | | | |
| **10/21/1988** | **1988** | **0.0** | **1.9** | **1.9** | **CHIN** | **29** | **131** | **160** |
| 11/15/1988 | 1988 | 0.3 | 1.4 | 1.1 | CHUM | - | - | - |
| | | | | | | | | |
| **10/17/1989** | **1989** | **0.0** | **1.9** | **1.9** | **CHIN** | **5** | **93** | **98** |
| 11/6/1989 | 1989 | 0.3 | 1.4 | 1.1 | CHUM | - | - | - |
| | | | | | | | | |
| **10/5/1990** | **1990** | **1.4** | **1.7** | **0.3** | **CHIN** | **43** | **18** | **61** |
| **10/5/1990** | **1990** | **0.5** | **1.4** | **0.9** | **CHIN** | **35** | **33** | **68** |
| **10/5/1990** | **1990** | **1.7** | **1.9** | **0.2** | **CHIN** | **51** | **16** | **67** |
| *10/5/1990* | *1990* | *1.9* | *2.5* | *0.6* | *CHIN* | *48* | *27* | *75* |
| 10/12/1990 | 1990 | 0.0 | 1.4 | 1.4 | CHIN | 0 | 122 | 122 |
| 11/7/1990 | 1990 | 0.3 | 1.4 | 1.1 | CHIN | 0 | 1 | 1 |
| | | | | | | | | |
| **10/1/1991** | **1991** | **1.4** | **1.9** | **0.5** | **CHIN** | **92** | **18** | **110** |
| **10/1/1991** | **1991** | **0.5** | **1.4** | **0.9** | **CHIN** | **195** | **71** | **266** |
| **10/1/1991** | **1991** | **0.0** | **0.5** | **0.5** | **CHIN** | **19** | **1** | **20** |
| *10/1/1991* | *1991* | *1.9* | *2.2* | *0.3* | *CHIN* | *156* | *48* | *204* |
| 10/10/1991 | 1991 | 1.4 | 1.9 | 0.5 | CHIN | 33 | 76 | 109 |
| 10/10/1991 | 1991 | 0.5 | 1.4 | 0.9 | CHIN | 30 | 92 | 122 |
| 10/10/1991 | 1991 | 0.0 | 0.5 | 0.5 | CHIN | 50 | 90 | 140 |
| *10/10/1991* | *1991* | *1.9* | *2.2* | *0.3* | *CHIN* | *77* | *91* | *168* |
| 10/15/1991 | 1991 | 0.5 | 2.2 | 1.7 | CHIN | 28 | 236 | 264 |
| 10/15/1991 | 1991 | 0.0 | 0.5 | 0.5 | CHIN | 25 | 98 | 123 |
| | | | | | | | | |
| *9/17/1992* | *1992* | *1.9* | *2.6* | *0.7* | *CHIN* | *56* | *1* | *57* |
| 9/17/1992 | 1992 | 0.0 | 0.5 | 0.5 | CHIN | 4 | 0 | 4 |
| 9/17/1992 | 1992 | 0.5 | 1.9 | 1.4 | CHIN | 68 | 10 | 78 |

**Table C-11.** Burley Creek spawning ground surveys, 1987-2006.

| Date | RunYear | RMLower | RMUpper | Length | Species | Live Count | Dead Count | Total Count |
|---|---|---|---|---|---|---|---|---|
| *9/24/1992* | *1992* | *1.9* | *2.6* | *0.7* | *CHIN* | *111* | *17* | *128* |
| 9/24/1992 | 1992 | 0.0 | 1.9 | 1.9 | CHIN | 295 | 15 | 310 |
| **10/1/1992** | **1992** | **0.0** | **0.5** | **0.5** | **CHIN** | **5** | **1** | **6** |
| **10/1/1992** | **1992** | **0.5** | **1.9** | **1.4** | **CHIN** | **234** | **145** | **379** |
| *10/1/1992* | *1992* | *1.9* | *2.6* | *0.7* | *CHIN* | *158* | *65* | *223* |
| *10/8/1992* | *1992* | *1.9* | *2.6* | *0.7* | *CHIN* | *34* | *85* | *119* |
| 10/8/1992 | 1992 | 0.0 | 0.5 | 0.5 | CHIN | 1 | 0 | 1 |
| 10/8/1992 | 1992 | 0.5 | 1.9 | 1.4 | CHIN | 63 | 233 | 296 |
| 10/15/1992 | 1992 | 0.5 | 1.9 | 1.4 | CHIN | 18 | 85 | 103 |
| *10/15/1992* | *1992* | *1.9* | *2.6* | *0.7* | *CHIN* | *7* | *90* | *97* |
| 11/3/1992 | 1992 | 0.3 | 1.4 | 1.1 | COHO | - | - | - |
| 11/12/1992 | 1992 | 0.3 | 1.4 | 1.1 | CHUM | - | - | - |
| | | | | | | | | |
| 9/16/1993 | 1993 | 0.5 | 1.4 | 0.9 | CHIN | 4 | 3 | 7 |
| 9/16/1993 | 1993 | 1.4 | 1.7 | 0.3 | CHIN | 3 | 1 | 4 |
| 9/16/1993 | 1993 | 1.7 | 1.9 | 0.2 | CHIN | 7 | 0 | 7 |
| *9/23/1993* | *1993* | *2.5* | *3.7* | *1.2* | *CHIN* | *38* | *15* | *53* |
| 9/23/1993 | 1993 | 0.5 | 2.5 | 2.0 | CHIN | 177 | 15 | 192 |
| 9/23/1993 | 1993 | 0.0 | 0.5 | 0.5 | CHIN | 17 | 1 | 18 |
| **9/30/1993** | **1993** | **1.7** | **1.9** | **0.2** | **CHIN** | **71** | **4** | **75** |
| **9/30/1993** | **1993** | **1.4** | **1.7** | **0.3** | **CHIN** | **71** | **8** | **79** |
| **9/30/1993** | **1993** | **0.5** | **1.4** | **0.9** | **CHIN** | **139** | **14** | **153** |
| *9/30/1993* | *1993* | *1.9* | *2.5* | *0.6* | *CHIN* | *84* | *10* | *94* |
| *10/7/1993* | *1993* | *1.9* | *2.6* | *0.7* | *CHIN* | *49* | *25* | *74* |
| 10/7/1993 | 1993 | 0.5 | 1.9 | 1.4 | CHIN | 187 | 112 | 299 |
| *10/14/1993* | *1993* | *1.9* | *2.6* | *0.7* | *CHIN* | *38* | *41* | *79* |
| 10/14/1993 | 1993 | 0.5 | 1.9 | 1.4 | CHIN | 71 | 210 | 281 |
| 10/21/1993 | 1993 | 0.5 | 1.9 | 1.4 | CHIN | 17 | 155 | 172 |
| *10/21/1993* | *1993* | *1.9* | *2.5* | *0.6* | *CHIN* | *0* | *40* | *40* |

**Table C-11.** Burley Creek spawning ground surveys, 1987-2006.

| Date | RunYear | RMLower | RMUpper | Length | Species | Live Count | Dead Count | Total Count |
|---|---|---|---|---|---|---|---|---|
| 9/15/1994 | 1994 | 0.5 | 1.9 | 1.4 | CHIN | 226 | 9 | 235 |
| *9/15/1994* | *1994* | *1.9* | *2.6* | *0.7* | *CHIN* | *104* | *11* | *115* |
| 9/21/1994 | 1994 | 0.5 | 1.9 | 1.4 | CHIN | 214 | 15 | 229 |
| *9/21/1994* | *1994* | *1.9* | *2.6* | *0.7* | *CHIN* | *124* | *12* | *136* |
| 9/28/1994 | 1994 | 0.5 | 1.9 | 1.4 | CHIN | 247 | 97 | 344 |
| *9/28/1994* | *1994* | *1.9* | *2.6* | *0.7* | *CHIN* | *74* | *55* | *129* |
| **10/5/1994** | **1994** | **0.5** | **1.9** | **1.4** | **CHIN** | **211** | **203** | **414** |
| *10/5/1994* | *1994* | *1.9* | *2.6* | *0.7* | *CHIN* | *20* | *61* | *81* |
| | | | | | | | | |
| 9/13/1995 | 1995 | 0.5 | 1.9 | 1.4 | CHIN | 0 | 2 | 2 |
| *9/13/1995* | *1995* | *1.9* | *2.6* | *0.7* | *CHIN* | | *0* | *0* |
| 9/19/1995 | 1995 | 0.5 | 1.9 | 1.4 | CHIN | 5 | 1 | 6 |
| *9/19/1995* | *1995* | *1.9* | *2.6* | *0.7* | *CHIN* | | *0* | *0* |
| *9/26/1995* | *1995* | *1.9* | *2.6* | *0.7* | *CHIN* | *11* | *2* | *13* |
| **9/26/1995** | **1995** | **0.5** | **1.9** | **1.4** | **CHIN** | **74** | **10** | **84** |
| | | | | | | | | |
| *9/20/1996* | *1996* | *1.9* | *2.6* | *0.7* | *CHIN* | *50* | *4* | *54* |
| 9/20/1996 | 1996 | 0.5 | 1.9 | 1.4 | CHIN | 31 | 8 | 39 |
| **9/26/1996** | **1996** | **0.0** | **0.5** | **0.5** | **CHIN** | **0** | **0** | **0** |
| *9/26/1996* | *1996* | *1.9* | *2.6* | *0.7* | *CHIN* | *44* | *10* | *54* |
| **9/26/1996** | **1996** | **0.5** | **1.9** | **1.4** | **CHIN** | **41** | **6** | **47** |
| 10/1/1996 | 1996 | 0.0 | 0.5 | 0.5 | CHIN | 0 | 0 | 0 |
| *10/1/1996* | *1996* | *1.9* | *2.6* | *0.7* | *CHIN* | *50* | *14* | *64* |
| 10/1/1996 | 1996 | 0.5 | 1.9 | 1.4 | CHIN | 29 | 15 | 44 |
| *10/10/1996* | *1996* | *1.9* | *2.6* | *0.7* | *CHIN* | *10* | *31* | *41* |
| 10/10/1996 | 1996 | 0.5 | 1.9 | 1.4 | CHIN | 8 | 32 | 40 |
| | | | | | | | | |
| **9/25/1997** | **1997** | **0.0** | **0.5** | **0.5** | **CHIN** | **2** | **0** | **2** |
| **9/25/1997** | **1997** | **0.5** | **1.9** | **1.4** | **CHIN** | **20** | **3** | **23** |
| *9/25/1997* | *1997* | *1.9* | *2.5* | *0.6* | *CHIN* | *27* | *0* | *27* |

**Table C-11.** Burley Creek spawning ground surveys, 1987-2006.

| Date | RunYear | RMLower | RMUpper | Length | Species | Live Count | Dead Count | Total Count |
|---|---|---|---|---|---|---|---|---|
| 10/13/1997 | 1997 | 0.0 | 0.5 | 0.5 | CHIN | 0 | 0 | 0 |
| 10/13/1997 | 1997 | 0.5 | 1.9 | 1.4 | CHIN | 2 | 7 | 9 |
| *10/13/1997* | *1997* | *1.9* | *2.5* | *0.6* | *CHIN* | *4* | *1* | *5* |
| 11/14/1997 | 1997 | 0.3 | 1.4 | 1.1 | CHUM | 2 | 10 | 12 |
| | | | | | | | | |
| 9/14/1998 | 1998 | 0.0 | 0.5 | 0.5 | CHIN | 0 | 1 | 1 |
| 9/14/1998 | 1998 | 0.5 | 1.9 | 1.4 | CHIN | 74 | 6 | 80 |
| *9/14/1998* | *1998* | *1.9* | *2.2* | *0.3* | *CHIN* | *14* | *1* | *15* |
| **9/22/1998** | **1998** | **0.0** | **0.5** | **0.5** | **CHIN** | **1** | **0** | **1** |
| **9/22/1998** | **1998** | **0.5** | **1.9** | **1.4** | **CHIN** | **86** | **34** | **120** |
| 9/30/1998 | 1998 | 0.0 | 0.5 | 0.5 | CHIN | 2 | 0 | 2 |
| 9/30/1998 | 1998 | 0.5 | 1.9 | 1.4 | CHIN | 70 | 35 | 105 |
| 11/2/1998 | 1998 | 0.3 | 1.4 | 1.1 | CHUM | - | - | - |
| 11/9/1998 | 1998 | 0.3 | 1.4 | 1.1 | CHUM | - | - | - |
| | | | | | | | | |
| 9/7/1999 | 1999 | 0.0 | 0.5 | 0.5 | CHIN | 0 | 0 | 0 |
| 9/7/1999 | 1999 | 0.5 | 1.4 | 0.9 | CHIN | 0 | 0 | 0 |
| 9/7/1999 | 1999 | 1.4 | 1.7 | 0.3 | CHIN | 6 | 0 | 6 |
| 9/7/1999 | 1999 | 1.7 | 1.9 | 0.2 | CHIN | 3 | 1 | 4 |
| 9/13/1999 | 1999 | 0.0 | 0.5 | 0.5 | CHIN | 4 | 1 | 5 |
| 9/13/1999 | 1999 | 0.5 | 1.9 | 1.4 | CHIN | 29 | 0 | 29 |
| 9/20/1999 | 1999 | 0.0 | 0.5 | 0.5 | CHIN | 3 | 0 | 3 |
| 9/20/1999 | 1999 | 0.5 | 1.9 | 1.4 | CHIN | 105 | 4 | 109 |
| **9/30/1999** | **1999** | **0.5** | **1.9** | **1.4** | **CHIN** | **191** | **60** | **251** |
| **9/30/1999** | **1999** | **0.0** | **0.5** | **0.5** | **CHIN** | **3** | **3** | **6** |
| 10/2/1999** | 1999 | 0.2 | 1.5 | 1.3 | CHIN | 60 | 43 | 103 |
| 10/11/1999 | 1999 | 0.0 | 0.5 | 0.5 | CHIN | 0 | 3 | 3 |
| 10/11/1999 | 1999 | 0.5 | 1.9 | 1.4 | CHIN | 17 | 105 | 122 |

** Survey conducted by Suquamish Indian Tribe.

**Table C-11.** Burley Creek spawning ground surveys, 1987-2006.

| Date | RunYear | RMLower | RMUpper | Length | Species | Live Count | Dead Count | Total Count |
|---|---|---|---|---|---|---|---|---|
| 10/18/1999 | 1999 | 0.0 | 0.5 | 0.5 | CHIN | 0 | 1 | 1 |
| 10/18/1999 | 1999 | 0.5 | 1.9 | 1.4 | CHIN | 1 | 114 | 115 |
| 10/26/1999 | 1999 | 0.5 | 1.4 | 0.9 | CHIN | 0 | 5 | 5 |
| 11/2/1999 | 1999 | 0.0 | 1.4 | 1.4 | CHUM | - | - | - |
| 11/15/1999 | 1999 | 0.3 | 1.4 | 1.1 | CHUM | - | - | - |
| | | | | | | | | |
| 9/6/2000 | 2000 | 0.0 | 0.5 | 0.5 | CHIN | 0 | 0 | 0 |
| 9/6/2000 | 2000 | 0.5 | 1.9 | 1.4 | CHIN | 0 | 2 | 2 |
| 9/13/2000 | 2000 | 0.0 | 0.5 | 0.5 | CHIN | 1 | 0 | 1 |
| 9/13/2000 | 2000 | 0.5 | 1.4 | 0.9 | CHIN | 0 | 0 | 0 |
| 9/13/2000 | 2000 | 1.4 | 1.7 | 0.3 | CHIN | 0 | 0 | 0 |
| 9/13/2000 | 2000 | 1.7 | 1.9 | 0.2 | CHIN | 1 | 0 | 1 |
| 9/22/2000 | 2000 | 0.0 | 0.5 | 0.5 | CHIN | 0 | 0 | 0 |
| 9/22/2000 | 2000 | 0.5 | 1.9 | 1.4 | CHIN | 16 | 4 | 20 |
| **10/3/2000** | **2000** | **0.0** | **0.5** | **0.5** | **CHIN** | **0** | **0** | **0** |
| **10/3/2000** | **2000** | **0.5** | **1.9** | **1.4** | **CHIN** | **29** | **4** | **33** |
| 10/11/2000 | 2000 | 0.0 | 0.5 | 0.5 | CHIN | 0 | 0 | 0 |
| 10/11/2000 | 2000 | 0.5 | 1.4 | 0.9 | CHIN | 12 | 2 | 14 |
| 10/11/2000 | 2000 | 1.4 | 1.7 | 0.3 | CHIN | 11 | 1 | 12 |
| 10/11/2000 | 2000 | 1.7 | 1.9 | 0.2 | CHIN | 1 | 2 | 3 |
| 10/18/2000 | 2000 | 0.0 | 0.5 | 0.5 | CHIN | 0 | 0 | 0 |
| 10/18/2000 | 2000 | 0.5 | 1.4 | 0.9 | CHIN | 1 | 0 | 1 |
| 10/18/2000 | 2000 | 1.4 | 1.7 | 0.3 | CHIN | 2 | 1 | 3 |
| 10/18/2000 | 2000 | 1.7 | 1.9 | 0.2 | CHIN | 0 | 3 | 3 |
| 10/31/2000 | 2000 | 0.5 | 1.4 | 0.9 | CHUM | - | - | - |
| 11/9/2000 | 2000 | 0.0 | 1.4 | 1.4 | COHO | - | - | - |
| 11/14/2000 | 2000 | 0.3 | 1.4 | 1.1 | CHUM | - | - | - |

**Table C-11.** Burley Creek spawning ground surveys, 1987-2006.

| Date | RunYear | RMLower | RMUpper | Length | Species | Live Count | Dead Count | Total Count |
|---|---|---|---|---|---|---|---|---|
| 9/10/2001 | 2001 | 0.0 | 0.5 | 0.5 | CHIN | 0 | 1 | 1 |
| 9/10/2001 | 2001 | 0.5 | 1.9 | 1.4 | CHIN | 11 | 2 | 13 |
| 9/18/2001 | 2001 | 0.0 | 0.5 | 0.5 | CHIN | 3 | 0 | 3 |
| 9/18/2001 | 2001 | 0.5 | 1.9 | 1.4 | CHIN | 57 | 3 | 60 |
| **9/27/2001** | **2001** | **0.0** | **0.5** | **0.5** | **CHIN** | **11** | **1** | **12** |
| **9/27/2001** | **2001** | **0.5** | **1.9** | **1.4** | **CHIN** | **165** | **14** | **179** |
| 10/5/2001 | 2001 | 0.0 | 0.5 | 0.5 | CHIN | 2 | 1 | 3 |
| 10/5/2001 | 2001 | 0.5 | 1.9 | 1.4 | CHIN | 92 | 48 | 140 |
| 10/16/2001 | 2001 | 0.0 | 0.5 | 0.5 | CHIN | 1 | 2 | 3 |
| 10/16/2001 | 2001 | 0.5 | 1.4 | 0.9 | CHIN | 9 | 13 | 22 |
| 10/16/2001 | 2001 | 1.4 | 1.7 | 0.3 | CHIN | 4 | 11 | 15 |
| 10/16/2001 | 2001 | 1.7 | 1.9 | 0.2 | CHIN | 3 | 18 | 21 |
| 10/23/2001 | 2001 | 0.0 | 0.5 | 0.5 | CHIN |  | 0 | 0 |
| 10/23/2001 | 2001 | 0.5 | 1.9 | 1.4 | CHIN | 0 | 10 | 10 |
| 11/1/2001 | 2001 | 0.3 | 1.4 | 1.1 | COHO | - | - | - |
| 11/8/2001 | 2001 | 0.3 | 1.4 | 1.1 | CHUM | - | - | - |
|  |  |  |  |  |  |  |  |  |
| 9/9/2002 | 2002 | 0.0 | 0.5 | 0.5 | CHIN | 1 | 0 | 1 |
| 9/9/2002 | 2002 | 0.5 | 1.4 | 0.9 | CHIN | 23 | 1 | 24 |
| 9/9/2002 | 2002 | 1.4 | 1.7 | 0.3 | CHIN | 22 | 1 | 23 |
| 9/9/2002 | 2002 | 1.7 | 1.9 | 0.2 | CHIN | 6 | 0 | 6 |
| 9/19/2002 | 2002 | 0.0 | 0.3 | 0.3 | CHIN | 0 | 0 | 0 |
| 9/19/2002 | 2002 | 0.3 | 0.5 | 0.2 | CHIN | 2 | 0 | 2 |
| 9/19/2002 | 2002 | 0.5 | 1.4 | 0.9 | CHIN | 43 | 1 | 44 |
| 9/19/2002 | 2002 | 1.4 | 1.7 | 0.3 | CHIN | 50 | 9 | 59 |
| 9/19/2002 | 2002 | 1.7 | 1.9 | 0.2 | CHIN | 50 | 0 | 50 |
| **9/26/2002** | **2002** | **0.0** | **0.3** | **0.3** | **CHIN** | **0** | **0** | **0** |
| **9/26/2002** | **2002** | **0.3** | **0.5** | **0.2** | **CHIN** | **3** | **0** | **3** |
| **9/26/2002** | **2002** | **0.5** | **1.4** | **0.9** | **CHIN** | **129** | **29** | **158** |
| **9/26/2002** | **2002** | **1.4** | **1.7** | **0.3** | **CHIN** | **82** | **37** | **119** |
| **9/26/2002** | **2002** | **1.7** | **1.9** | **0.2** | **CHIN** | **49** | **21** | **70** |

**Table C-11.** Burley Creek spawning ground surveys, 1987-2006.

| Date | RunYear | RMLower | RMUpper | Length | Species | Live Count | Dead Count | Total Count |
|---|---|---|---|---|---|---|---|---|
| 10/4/2002 | 2002 | 0.0 | 0.5 | 0.5 | CHIN | 3 | 4 | 7 |
| 10/4/2002 | 2002 | 0.5 | 1.4 | 0.9 | CHIN | 71 | 62 | 133 |
| 10/4/2002 | 2002 | 1.4 | 1.7 | 0.3 | CHIN | 40 | 36 | 76 |
| 10/4/2002 | 2002 | 1.7 | 1.9 | 0.2 | CHIN | 12 | 42 | 54 |
| 10/11/2002 | 2002 | 0.0 | 0.3 | 0.3 | CHIN | 0 | 1 | 1 |
| 10/11/2002 | 2002 | 0.3 | 0.5 | 0.2 | CHIN | 0 | 2 | 2 |
| 10/11/2002 | 2002 | 0.5 | 1.4 | 0.9 | CHIN | 2 | 60 | 62 |
| 10/11/2002 | 2002 | 1.4 | 1.7 | 0.3 | CHIN | 0 | 53 | 53 |
| 10/11/2002 | 2002 | 1.7 | 1.9 | 0.2 | CHIN | 3 | 46 | 49 |
| 10/18/2002 | 2002 | 0.3 | 1.4 | 1.1 | CHIN | 0 | 25 | 25 |
| 10/28/2002 | 2002 | 0.3 | 1.4 | 1.1 | COHO | - | - | - |
| 11/5/2002 | 2002 | 0.3 | 1.4 | 1.1 | CHUM | - | - | - |
| 11/14/2002 | 2002 | 0.3 | 1.4 | 1.1 | CHUM | - | - | - |
| | | | | | | | | |
| 8/28/2003 | 2003 | 1.7 | 1.9 | 0.2 | CHIN | 0 | 0 | 0 |
| 8/28/2003 | 2003 | 0.3 | 0.5 | 0.2 | CHIN | 1 | 0 | 1 |
| 8/28/2003 | 2003 | 1.4 | 1.7 | 0.3 | CHIN | 1 | 0 | 1 |
| 8/28/2003 | 2003 | 0.5 | 1.4 | 0.9 | CHIN | 5 | 0 | 5 |
| 8/28/2003 | 2003 | 0.0 | 0.3 | 0.3 | CHIN | 0 | 0 | 0 |
| 9/8/2003 | 2003 | 0.0 | 0.3 | 0.3 | CHIN | 0 | 0 | 0 |
| 9/8/2003 | 2003 | 1.4 | 1.7 | 0.3 | CHIN | 23 | 0 | 23 |
| 9/8/2003 | 2003 | 0.3 | 0.5 | 0.2 | CHIN | 0 | 0 | 0 |
| 9/8/2003 | 2003 | 1.7 | 1.9 | 0.2 | CHIN | 9 | 0 | 9 |
| 9/8/2003 | 2003 | 0.5 | 1.4 | 0.9 | CHIN | 45 | 0 | 45 |
| 9/15/2003 | 2003 | 0.0 | 0.3 | 0.3 | CHIN | 3 | 1 | 4 |
| 9/15/2003 | 2003 | 0.5 | 1.4 | 0.9 | CHIN | 43 | 4 | 47 |
| 9/15/2003 | 2003 | 1.4 | 1.7 | 0.3 | CHIN | 11 | 1 | 12 |
| 9/15/2003 | 2003 | 0.3 | 0.5 | 0.2 | CHIN | 0 | 0 | 0 |
| 9/15/2003 | 2003 | 1.7 | 1.9 | 0.2 | CHIN | 25 | 0 | 25 |

**Table C-11.** Burley Creek spawning ground surveys, 1987-2006.

| Date | RunYear | RMLower | RMUpper | Length | Species | Live Count | Dead Count | Total Count |
|---|---|---|---|---|---|---|---|---|
| **9/24/2003** | **2003** | **0.0** | **0.3** | **0.3** | **CHIN** | **0** | **0** | **0** |
| **9/24/2003** | **2003** | **1.4** | **1.7** | **0.3** | **CHIN** | **34** | **8** | **42** |
| **9/24/2003** | **2003** | **1.7** | **1.9** | **0.2** | **CHIN** | **35** | **2** | **37** |
| **9/24/2003** | **2003** | **0.5** | **1.4** | **0.9** | **CHIN** | **77** | **4** | **81** |
| **9/24/2003** | **2003** | **0.3** | **0.5** | **0.2** | **CHIN** | **0** | **0** | **0** |
| 10/3/2003 | 2003 | 0.0 | 0.3 | 0.3 | CHIN | 0 | 0 | 0 |
| 10/3/2003 | 2003 | 1.7 | 1.9 | 0.2 | CHIN | 16 | 16 | 32 |
| 10/3/2003 | 2003 | 0.3 | 0.5 | 0.2 | CHIN | 0 | 2 | 2 |
| 10/3/2003 | 2003 | 0.5 | 1.4 | 0.9 | CHIN | 57 | 23 | 80 |
| 10/3/2003 | 2003 | 1.4 | 1.7 | 0.3 | CHIN | 14 | 16 | 30 |
| 10/13/2003 | 2003 | 0.0 | 0.3 | 0.3 | CHIN | 0 | 0 | 0 |
| 10/13/2003 | 2003 | 0.3 | 0.5 | 0.2 | CHIN | 0 | 0 | 0 |
| 10/13/2003 | 2003 | 0.5 | 1.4 | 0.9 | CHIN | 4 | 19 | 23 |
| 10/13/2003 | 2003 | 1.7 | 1.9 | 0.2 | CHIN | 10 | 10 | 20 |
| 10/13/2003 | 2003 | 1.4 | 1.7 | 0.3 | CHIN | 10 | 15 | 25 |
| 10/28/2003 | 2003 | 0.3 | 0.5 | 0.2 | CHIN | 0 | 0 | 0 |
| 10/28/2003 | 2003 | 1.4 | 1.7 | 0.3 | CHIN | 0 | 0 | 0 |
| 10/28/2003 | 2003 | 1.7 | 1.9 | 0.2 | CHIN | 0 | 0 | 0 |
| 10/28/2003 | 2003 | 0.5 | 1.4 | 0.9 | CHIN | 1 | 3 | 4 |
| 10/28/2003 | 2003 | 0.0 | 0.3 | 0.3 | CHIN | 0 | 0 | 0 |
| 11/5/2003 | 2003 | 0.3 | 1.4 | 1.1 | COHO | - | - | - |
| 11/10/2003 | 2003 | 0.3 | 1.4 | 1.1 | CHUM | - | - | - |
| | | | | | | | | |
| 8/27/2004 | 2004 | 0.5 | 1.4 | 0.9 | CHIN | 4 | 2 | 6 |
| 8/27/2004 | 2004 | 0.3 | 0.5 | 0.2 | CHIN | 0 | 0 | 0 |
| 8/27/2004 | 2004 | 1.4 | 1.7 | 0.3 | CHIN | 4 | 0 | 4 |
| 8/27/2004 | 2004 | 1.7 | 1.9 | 0.2 | CHIN | 5 | 0 | 5 |

**Table C-11.** Burley Creek spawning ground surveys, 1987-2006.

| Date | RunYear | RMLower | RMUpper | Length | Species | Live Count | Dead Count | Total Count |
|---|---|---|---|---|---|---|---|---|
| 9/3/2004 | 2004 | 0.5 | 1.4 | 0.9 | CHIN | 6 | 3 | 9 |
| 9/3/2004 | 2004 | 0.3 | 0.5 | 0.2 | CHIN | 0 | 0 | 0 |
| 9/3/2004 | 2004 | 1.4 | 1.7 | 0.3 | CHIN | 8 | 0 | 8 |
| 9/3/2004 | 2004 | 0.0 | 0.3 | 0.3 | CHIN | 1 | 0 | 1 |
| 9/3/2004 | 2004 | 1.7 | 1.9 | 0.2 | CHIN | 3 | 0 | 3 |
| 9/9/2004 | 2004 | 0.5 | 1.4 | 0.9 | CHIN | 5 | 0 | 5 |
| 9/9/2004 | 2004 | 1.7 | 1.9 | 0.2 | CHIN | 5 | 0 | 5 |
| 9/9/2004 | 2004 | 0.3 | 0.5 | 0.2 | CHIN | 0 | 0 | 0 |
| 9/9/2004 | 2004 | 1.4 | 1.7 | 0.3 | CHIN | 5 | 0 | 5 |
| 9/9/2004 | 2004 | 0.0 | 0.3 | 0.3 | CHIN | 0 | 0 | 0 |
| **9/20/2004** | **2004** | **0.3** | **0.5** | **0.2** | **CHIN** | **0** | **0** | **0** |
| **9/20/2004** | **2004** | **1.4** | **1.7** | **0.3** | **CHIN** | **4** | **0** | **4** |
| **9/20/2004** | **2004** | **0.5** | **1.4** | **0.9** | **CHIN** | **11** | **3** | **14** |
| **9/20/2004** | **2004** | **1.7** | **1.9** | **0.2** | **CHIN** | **23** | **1** | **24** |
| 9/30/2004 | 2004 | 1.4 | 1.7 | 0.3 | CHIN | 4 | 4 | 8 |
| 9/30/2004 | 2004 | 0.3 | 1.4 | 1.1 | CHIN | 9 | 5 | 14 |
| 9/30/2004 | 2004 | 1.7 | 1.9 | 0.2 | CHIN | 8 | 11 | 19 |
| 10/11/2004 | 2004 | 0.5 | 1.4 | 0.9 | CHIN | 4 | 3 | 7 |
| 10/11/2004 | 2004 | 0.3 | 0.5 | 0.2 | CHIN | 0 | 0 | 0 |
| 10/11/2004 | 2004 | 1.7 | 1.9 | 0.2 | CHIN | 0 | 10 | 10 |
| 10/11/2004 | 2004 | 1.4 | 1.7 | 0.3 | CHIN | 0 | 0 | 0 |
| 10/21/2004 | 2004 | 0.3 | 1.4 | 1.1 | CHIN | 2 | 2 | 4 |
| 11/5/2004 | 2004 | 0.3 | 1.4 | 1.1 | COHO | - | - | - |
| 11/15/2004 | 2004 | 0.3 | 1.4 | 1.1 | CHUM | - | - | - |
| | | | | | | | | |
| 9/1/2005 | 2005 | 0.3 | 0.5 | 0.2 | CHIN | 1 | 0 | 1 |
| 9/1/2005 | 2005 | 0.5 | 1.4 | 0.9 | CHIN | 1 | 3 | 4 |
| 9/1/2005 | 2005 | 1.4 | 1.7 | 0.3 | CHIN | 5 | 1 | 6 |
| 9/1/2005 | 2005 | 1.7 | 1.9 | 0.2 | CHIN | 1 | 0 | 1 |

**Table C-11.** Burley Creek spawning ground surveys, 1987-2006.

| Date | RunYear | RMLower | RMUpper | Length | Species | Live Count | Dead Count | Total Count |
|---|---|---|---|---|---|---|---|---|
| 9/8/2005 | 2005 | 0.5 | 1.4 | 0.9 | CHIN | 4 | 0 | 4 |
| 9/8/2005 | 2005 | 1.4 | 1.7 | 0.3 | CHIN | 2 | 1 | 3 |
| 9/8/2005 | 2005 | 0.3 | 0.5 | 0.2 | CHIN | 2 | 0 | 2 |
| 9/8/2005 | 2005 | 1.7 | 1.9 | 0.2 | CHIN | 7 | 2 | 9 |
| 9/15/2005 | 2005 | 1.7 | 1.9 | 0.2 | CHIN | 28 | 4 | 32 |
| 9/15/2005 | 2005 | 0.3 | 0.5 | 0.2 | CHIN | 5 | 0 | 5 |
| 9/15/2005 | 2005 | 1.4 | 1.7 | 0.3 | CHIN | 22 | 1 | 23 |
| 9/15/2005 | 2005 | 0.5 | 1.4 | 0.9 | CHIN | 6 | 0 | 6 |
| 9/21/2005 | 2005 | 1.7 | 1.9 | 0.2 | CHIN | 26 | 6 | 32 |
| 9/21/2005 | 2005 | 0.5 | 1.4 | 0.9 | CHIN | 3 | 2 | 5 |
| 9/21/2005 | 2005 | 1.4 | 1.7 | 0.3 | CHIN | 34 | 2 | 36 |
| 9/21/2005 | 2005 | 0.3 | 0.5 | 0.2 | CHIN | 3 | 1 | 4 |
| **10/3/2005** | **2005** | **0.5** | **1.4** | **0.9** | **CHIN** | **22** | **4** | **26** |
| **10/3/2005** | **2005** | **1.4** | **1.7** | **0.3** | **CHIN** | **16** | **8** | **24** |
| **10/3/2005** | **2005** | **0.3** | **0.5** | **0.2** | **CHIN** | **0** | **0** | **0** |
| **10/3/2005** | **2005** | **1.7** | **1.9** | **0.2** | **CHIN** | **20** | **13** | **33** |
| 10/11/2005 | 2005 | 0.3 | 0.5 | 0.2 | CHIN | 0 | 0 | 0 |
| 10/11/2005 | 2005 | 1.4 | 1.7 | 0.3 | CHIN | 3 | 18 | 21 |
| 10/11/2005 | 2005 | 0.5 | 1.4 | 0.9 | CHIN | 4 | 5 | 9 |
| 10/11/2005 | 2005 | 1.7 | 1.9 | 0.2 | CHIN | 3 | 15 | 18 |
| 10/18/2005 | 2005 | 0.0 | 0.3 | 0.3 | CHIN | 0 | 0 | 0 |
| 10/18/2005 | 2005 | 1.7 | 1.9 | 0.2 | CHIN | 0 | 3 | 3 |
| 10/18/2005 | 2005 | 1.4 | 1.7 | 0.3 | CHIN | 0 | 13 | 13 |
| 10/18/2005 | 2005 | 0.5 | 1.4 | 0.9 | CHIN | 0 | 2 | 2 |
| 10/18/2005 | 2005 | 0.3 | 0.5 | 0.2 | CHIN | 0 | 0 | 0 |
| 10/26/2005 | 2005 | 0.3 | 1.4 | 1.1 | COHO | - | - | - |
| 11/10/2005 | 2005 | 0.3 | 1.4 | 1.1 | CHUM | - | - | - |

**Table C-11.** Burley Creek spawning ground surveys, 1987-2006.

| Date | RunYear | RMLower | RMUpper | Length | Species | Live Count | Dead Count | Total Count |
|---|---|---|---|---|---|---|---|---|
| 9/6/2006 | 2006 | 0.3 | 0.5 | 0.2 | CHIN | 4 | 0 | 4 |
| 9/6/2006 | 2006 | 1.4 | 1.7 | 0.3 | CHIN | 8 | 0 | 8 |
| 9/6/2006 | 2006 | 1.7 | 1.9 | 0.2 | CHIN | 24 | 0 | 24 |
| 9/6/2006 | 2006 | 0.5 | 1.4 | 0.9 | CHIN | 15 | 0 | 15 |
| 9/13/2006 | 2006 | 0.3 | 0.5 | 0.2 | CHIN | 3 | 0 | 3 |
| 9/13/2006 | 2006 | 0.5 | 1.4 | 0.9 | CHIN | 18 | 0 | 18 |
| 9/13/2006 | 2006 | 1.4 | 1.7 | 0.3 | CHIN | 48 | 1 | 49 |
| 9/13/2006 | 2006 | 1.7 | 1.9 | 0.2 | CHIN | 43 | 3 | 46 |
| 9/20/2006 | 2006 | 0.5 | 1.4 | 0.9 | CHIN | 67 | 8 | 75 |
| 9/20/2006 | 2006 | 1.4 | 1.7 | 0.3 | CHIN | 91 | 2 | 93 |
| 9/20/2006 | 2006 | 0.3 | 0.5 | 0.2 | CHIN | 8 | 1 | 9 |
| 9/20/2006 | 2006 | 1.7 | 1.9 | 0.2 | CHIN | 81 | 10 | 91 |
| **9/27/2006** | **2006** | **0.5** | **1.4** | **0.9** | **CHIN** | **118** | **22** | **140** |
| **9/27/2006** | **2006** | **1.4** | **1.7** | **0.3** | **CHIN** | **73** | **11** | **84** |
| **9/27/2006** | **2006** | **0.3** | **0.5** | **0.2** | **CHIN** | **6** | **1** | **7** |
| **9/27/2006** | **2006** | **1.7** | **1.9** | **0.2** | **CHIN** | **104** | **13** | **117** |
| 10/4/2006 | 2006 | 1.4 | 1.7 | 0.3 | CHIN | 52 | 24 | 76 |
| 10/4/2006 | 2006 | 1.7 | 1.9 | 0.2 | CHIN | 44 | 39 | 83 |
| 10/4/2006 | 2006 | 0.3 | 0.5 | 0.2 | CHIN | 5 | 1 | 6 |
| 10/4/2006 | 2006 | 0.5 | 1.4 | 0.9 | CHIN | 76 | 33 | 109 |
| 10/11/2006 | 2006 | 0.5 | 1.4 | 0.9 | CHIN | 16 | 43 | 59 |
| 10/11/2006 | 2006 | 0.3 | 0.5 | 0.2 | CHIN | 0 | 0 | 0 |
| 10/11/2006 | 2006 | 1.7 | 1.9 | 0.2 | CHIN | 14 | 25 | 39 |
| 10/11/2006 | 2006 | 1.4 | 1.7 | 0.3 | CHIN | 14 | 34 | 48 |
| 10/17/2006 | 2006 | 0.5 | 1.4 | 0.9 | CHIN | 5 | 25 | 30 |
| 10/17/2006 | 2006 | 1.7 | 1.9 | 0.2 | CHIN | 2 | 22 | 24 |
| 10/17/2006 | 2006 | 1.4 | 1.7 | 0.3 | CHIN | 2 | 14 | 16 |
| 10/17/2006 | 2006 | 0.3 | 0.5 | 0.2 | CHIN | 0 | 0 | 0 |
| 11/1/2006 | 2006 | 0.3 | 1.4 | 1.1 | CHIN | 1 | 0 | 1 |

Source: Spawning Ground Survey Database, 2007.

**Table D-1.** Hammersley Inlet streams mark recovery data, 2002-2006.

| Creek | Year | Sum of live counts | Sum of dead counts | Carcass count from mark sampling data | ADClippedNoBeep | ADClippedBeep | ADClippedNoHead |
|---|---|---|---|---|---|---|---|
| *Hammesley Inlet* | | | | | | | |
| **Johns** | 2002 | 0 | 0 | - | - | - | - |
| | 2003 | 0 | 0 | - | - | - | - |
| | 2004 | 0 | 0 | - | - | - | - |
| | 2005 | 1 | 0 | - | - | - | - |
| | 2006 | 0 | 0 | - | - | - | - |
| | | | | | | | |
| **Cranberry** | 2002 | 19 | 3 | 3 | 1 | - | - |
| | 2003 | 3 | 1 | 1 | - | - | - |
| | 2004 | 7 | 0 | - | - | - | - |
| | 2005 | 9 | 0 | - | - | - | - |
| | 2006 | 1 | 1 | 1 | - | - | - |
| | | | | | | | |
| **Deer** | 2002 | 20 | 7 | 7 | 3 | - | - |
| | 2003 | 27 | 3 | 3 | - | - | - |
| | 2004 | 24 | 4 | 4 | 1 | - | - |
| | 2005 | 11 | 3 | ***1*** | 1 | - | - |
| | 2006 | 5 | 1 | 1 | 1 | - | - |
| | | | | | | | |
| **Goldsborough** | 2002 | 8 | 3 | ***2*** | - | - | - |
| | 2003 | 1 | 0 | - | - | - | - |
| | 2004 | 4 | 0 | - | - | - | - |
| | 2005 | 2 | 0 | - | - | - | - |
| | 2006 | 0 | 0 | - | - | - | - |
| | | | | | | | |
| **Hammersley Inlet** | 2002 | 47 | 13 | 12 | 4 | - | - |
| **Totals** | 2003 | 31 | 4 | 4 | - | - | - |
| | 2004 | 35 | 4 | 4 | 1 | - | - |
| | 2005 | 23 | 3 | 1 | 1 | - | - |
| | 2006 | 6 | 2 | 2 | 1 | - | - |

Source: Spawning Ground Survey Database, 2007.

**Table D-1.** Hammersley Inlet streams mark recovery data, 2002-2006.

| Creek | Year | Carcass count from mark sampling data | PreSampled | UnknownMarkNoBeep (Adipose unknown) | UnknownMarkBeep | UnknownMarkNoHead (No Head or non-sampled) |
|---|---|---|---|---|---|---|
| **Johns** | 2002 | - | - | - | - | - |
| | 2003 | - | - | - | - | - |
| | 2004 | - | - | - | - | - |
| | 2005 | - | - | - | - | - |
| | 2006 | - | - | - | - | - |
| | | | | | | |
| **Cranberry** | 2002 | 3 | - | - | - | 1 |
| | 2003 | 1 | - | - | - | - |
| | 2004 | - | - | - | - | - |
| | 2005 | - | - | - | - | - |
| | 2006 | 1 | - | - | - | - |
| | | | | | | |
| **Deer** | 2002 | 7 | - | - | - | 2 |
| | 2003 | 3 | - | - | - | 1 |
| | 2004 | 4 | - | - | - | 1 |
| | 2005 | ***1*** | - | - | - | - |
| | 2006 | 1 | - | - | - | - |
| | | | | | | |
| **Goldsborough** | 2002 | ***2*** | 1 | - | - | 1 |
| | 2003 | - | - | - | - | - |
| | 2004 | - | - | - | - | - |
| | 2005 | - | - | - | - | - |
| | 2006 | - | - | - | - | - |
| | | | | | | |
| **Hammersley Inlet** | 2002 | 12 | 1 | - | - | 4 |
| **Totals** | 2003 | 4 | - | - | - | 1 |
| | 2004 | 4 | - | - | - | 1 |
| | 2005 | 1 | - | - | - | - |
| | 2006 | 2 | - | - | - | - |

Source: Spawning Ground Survey Database, 2007.

**Table D-1.** Hammersley Inlet streams mark recovery data, 2002-2006.

| Creek | Year | Carcass count from mark sampling data | UnMarkNoBeep | UnMarkBeep | UnMarkNoHead |
|---|---|---|---|---|---|
| **Johns** | 2002 | - | - | - | - |
| | 2003 | - | - | - | - |
| | 2004 | - | - | - | - |
| | 2005 | - | - | - | - |
| | 2006 | - | - | - | - |
| | | | | | |
| **Cranberry** | 2002 | 3 | 1 | - | - |
| | 2003 | 1 | 1 | - | - |
| | 2004 | - | - | - | - |
| | 2005 | - | - | - | - |
| | 2006 | 1 | 1 | - | - |
| | | | | | |
| **Deer** | 2002 | 7 | 1 | - | 1 |
| | 2003 | 3 | 2 | - | - |
| | 2004 | 4 | 2 | - | - |
| | 2005 | ***1*** | - | - | - |
| | 2006 | 1 | - | - | - |
| | | | | | |
| **Goldsborough** | 2002 | ***2*** | - | - | - |
| | 2003 | - | - | - | - |
| | 2004 | - | - | - | - |
| | 2005 | - | - | - | - |
| | 2006 | - | - | - | - |
| | | | | | |
| **Hammersley Inlet** | 2002 | 12 | 2 | - | 1 |
| **Totals** | 2003 | 4 | 3 | - | - |
| | 2004 | 4 | 2 | - | - |
| | 2005 | 1 | - | - | - |
| | 2006 | 2 | 1 | - | - |

Source: Spawning Ground Survey Database, 2007.

**Table D-2.** Case and Carr Inlet streams mark recovery data, 2002-2006.

| Creek | Year | Sum of live counts | Sum of dead counts | Carcass count from mark sampling data | ADClippedNoBeep | ADClippedBeep | ADClippedNoHead |
|---|---|---|---|---|---|---|---|
| *Case Inlet* | | | | | | | |
| **Sherwood** | 2002 | 46 | 8 | 8 | 1 | - | - |
| | 2003 | 35 | 7 | 7 | 1 | - | - |
| | 2004 | 144 | 24 | 24 | 2 | 1 | - |
| | 2005 | 86 | 25 | ***21*** | 2 | - | - |
| | 2006 | 10 | 2 | 2 | - | - | - |
| **Rocky** | 2002 | 26 | 71 | 71 | 22 | - | 3 |
| | 2003 | 1 | 4 | 4 | - | - | - |
| | 2004 | 0 | 0 | - | - | - | - |
| | 2005 | 83 | 93 | **55** | 28 | - | - |
| | 2006 | 11 | 19 | ***14*** | 9 | - | - |
| **Coulter** | 2002 | 3146 | 4272 | 4272 | 97 | - | 1 |
| | 2003 | 5309 | 2626 | 2626 | 159 | - | - |
| | 2004 | 2979 | 808 | 808 | 69 | - | - |
| | 2005 | 727 | 180 | ***91*** | 45 | 2 | - |
| | 2006 | 315 | 20 | ***8*** | 3 | - | - |
| *Carr Inlet* | | | | | | | |
| **Burley** | 2002 | 591 | 430 | 430 | 121 | 1 | 4 |
| | 2003 | 424 | 124 | ***123*** | 37 | - | - |
| | 2004 | 111 | 44 | 44 | 12 | - | - |
| | 2005 | 218 | 104 | ***77*** | 42 | - | - |
| | 2006 | 942 | 332 | ***222*** | 125 | 2 | - |

Source: Spawning Ground Survey Database, 2007.

**Table D-2.** Case and Carr Inlet streams mark recovery data, 2002-2006.

| Creek | Year | Carcass count from mark sampling data | PreSampled | UnknownMarkNoBeep (Adipose unknown) | UnknownMarkBeep | UnknownMarkNoHead (No Head or non-sampled) |
|---|---|---|---|---|---|---|
| *Case Inlet* | | | | | | |
| **Sherwood** | 2002 | 8 | 2 | - | - | 2 |
| | 2003 | 7 | 2 | - | - | - |
| | 2004 | 24 | 2 | - | - | 6 |
| | 2005 | ***21*** | 6 | - | - | - |
| | 2006 | 2 | - | - | - | - |
| **Rocky** | 2002 | 71 | 12 | - | - | 31 |
| | 2003 | 4 | - | - | - | 3 |
| | 2004 | - | - | - | - | - |
| | 2005 | **55** | 21 | - | - | - |
| | 2006 | ***14*** | 5 | - | - | - |
| **Coulter** | 2002 | 4272 | 21 | - | - | 4141 |
| | 2003 | 2626 | 89 | - | - | 2363 |
| | 2004 | 808 | 9 | - | - | 720 |
| | 2005 | ***91*** | 26 | 1 | - | - |
| | 2006 | ***8*** | 4 | - | - | - |
| *Carr Inlet* | | | | | | |
| **Burley** | 2002 | 430 | 62 | 7 | - | 176 |
| | 2003 | ***123*** | 14 | - | - | 48 |
| | 2004 | 44 | 6 | - | - | 18 |
| | 2005 | ***77*** | 28 | - | - | - |
| | 2006 | ***222*** | 88 | 2 | - | - |

Source: Spawning Ground Survey Database, 2007.

**Table D-2.** Case and Carr Inlet streams mark recovery data, 2002-2006.

| Creek | Year | Carcass count from mark sampling data | UnMarkNoBeep | UnMarkBeep | UnMarkNoHead |
|---|---|---|---|---|---|
| *Case Inlet* | | | | | |
| **Sherwood** | 2002 | 8 | 3 | - | - |
| | 2003 | 7 | 4 | - | - |
| | 2004 | 24 | 13 | - | - |
| | 2005 | ***21*** | 13 | - | - |
| | 2006 | 2 | 2 | - | - |
| **Rocky** | 2002 | 71 | 1 | - | 2 |
| | 2003 | 4 | 1 | - | - |
| | 2004 | - | - | - | - |
| | 2005 | **55** | 6 | - | - |
| | 2006 | ***14*** | - | - | - |
| **Coulter** | 2002 | 4272 | 12 | - | - |
| | 2003 | 2626 | 15 | - | - |
| | 2004 | 808 | 9 | 1 | - |
| | 2005 | ***91*** | 15 | 1 | 1 |
| | 2006 | ***8*** | 1 | - | - |
| *Carr Inlet* | | | | | |
| **Burley** | 2002 | 430 | 59 | - | - |
| | 2003 | ***123*** | 23 | 1 | - |
| | 2004 | 44 | 8 | - | - |
| | 2005 | ***77*** | 6 | 1 | - |
| | 2006 | ***222*** | 4 | 1 | - |

Source: Spawning Ground Survey Database, 2007.

**Table D-3.** Hammersley Inlet streams revised mark recovery data, 2002-2006.

| Creek | Year | Number of carcasses sampled | Adipose marked, CWT | Adipose unmarked, CWT | Adipose marked, no CWT | Adipose unmarked, no CWT |
|---|---|---|---|---|---|---|
| **Johns** | 2002 | 0 | 0 | 0 | 0 | 0 |
| | 2003 | 0 | 0 | 0 | 0 | 0 |
| | 2004 | 0 | 0 | 0 | 0 | 0 |
| | 2005 | 0 | 0 | 0 | 0 | 0 |
| | 2006 | 0 | 0 | 0 | 0 | 0 |
| | | | | | | |
| **Cranberry** | 2002 | 2 | 0 | 0 | 1 | 1 |
| | 2003 | 1 | 0 | 0 | 0 | 1 |
| | 2004 | 0 | 0 | 0 | 0 | 0 |
| | 2005 | 0 | 0 | 0 | 0 | 0 |
| | 2006 | 1 | 0 | 0 | 0 | 1 |
| | | | | | | |
| **Deer** | 2002 | 5 | 0 | 0 | 3 | 2 |
| | 2003 | 2 | 0 | 0 | 0 | 2 |
| | 2004 | 3 | 0 | 0 | 1 | 2 |
| | 2005 | 1 | 0 | 0 | 1 | 0 |
| | 2006 | 1 | 0 | 0 | 1 | 0 |
| | | | | | | |
| **Goldsborough** | 2002 | 0 | 0 | 0 | 0 | 0 |
| | 2003 | 0 | 0 | 0 | 0 | 0 |
| | 2004 | 0 | 0 | 0 | 0 | 0 |
| | 2005 | 0 | 0 | 0 | 0 | 0 |
| | 2006 | 0 | 0 | 0 | 0 | 0 |

Source: Spawning Ground Survey Database, 2007.

**Table D-3.** Hammersley Inlet streams revised mark recovery data, 2002-2006.

| | Year | Number of carcasses sampled | Adipose marked, CWT | Adipose unmarked, CWT | Adipose marked, no CWT | Adipose unmarked, no CWT |
|---|---|---|---|---|---|---|
| **Hammersley** | 2002 | 7 | 0 | 0 | 4 | 3 |
| **Inlet Totals** | 2003 | 3 | 0 | 0 | 0 | 3 |
| (by count) | 2004 | 3 | 0 | 0 | 1 | 2 |
| | 2005 | 1 | 0 | 0 | 1 | 0 |
| | 2006 | 2 | 0 | 0 | 1 | 1 |
| | | | | | | |
| | | | | | | |
| | Year | Number of carcasses sampled | Adipose marked, CWT | Adipose unmarked, CWT | Adipose marked, no CWT | Adipose unmarked, no CWT |
| **Hammersley** | 2002 | 7 | 0.00% | 0.00% | 57.14% | 42.86% |
| **Inlet Totals** | 2003 | 3 | 0.00% | 0.00% | 0.00% | 100.00% |
| (percentages) | 2004 | 3 | 0.00% | 0.00% | 33.33% | 66.67% |
| | 2005 | 1 | 0.00% | 0.00% | 100.00% | 0.00% |
| | 2006 | 2 | 0.00% | 0.00% | 50.00% | 50.00% |

Source: Spawning Ground Survey Database, 2007.

**Table D-4.** Case Inlet streams revised mark recovery data, 2002-2006.

| Creek | Year | Number of carcasses sampled | Adipose marked, CWT | Adipose unmarked, CWT | Adipose marked, no CWT | Adipose unmarked, no CWT |
|---|---|---|---|---|---|---|
| **Sherwood** | 2002 | 4 | 0 | 0 | 1 | 3 |
| | 2003 | 5 | 0 | 0 | 1 | 4 |
| | 2004 | 16 | 1 | 0 | 2 | 13 |
| | 2005 | 15 | 0 | 0 | 2 | 13 |
| | 2006 | 2 | 0 | 0 | 0 | 2 |
| | | | | | | |
| **Rocky** | 2002 | 28 | 0 | 0 | 25 | 3 |
| | 2003 | 1 | 0 | 0 | 0 | 1 |
| | 2004 | 0 | 0 | 0 | 0 | 0 |
| | 2005 | 34 | 0 | 0 | 28 | 6 |
| | 2006 | 9 | 0 | 0 | 9 | 0 |
| | | | | | | |
| **Coulter** | 2002 | 110 | 0 | 0 | 98 | 12 |
| | 2003 | 174 | 0 | 0 | 159 | 15 |
| | 2004 | 79 | 0 | 1 | 69 | 9 |
| | 2005 | 64 | 2 | 1 | 45 | 16 |
| | 2006 | 4 | 0 | 0 | 3 | 1 |
| | | | | | | |
| | | | | | | |
| | Year | Number of carcasses sampled | Adipose marked, CWT | Adipose unmarked, CWT | Adipose marked, no CWT | Adipose unmarked, no CWT |
| **Case Inlet** | 2002 | 142 | 0 | 0 | 124 | 18 |
| **Totals** | 2003 | 180 | 0 | 0 | 160 | 20 |
| (by count) | 2004 | 95 | 1 | 1 | 71 | 22 |
| | 2005 | 113 | 2 | 1 | 75 | 35 |
| | 2006 | 15 | 0 | 0 | 12 | 3 |
| | | | | | | |
| | | | | | | |
| | Year | Number of carcasses sampled | Adipose marked, CWT | Adipose unmarked, CWT | Adipose marked, no CWT | Adipose unmarked, no CWT |
| **Case Inlet** | 2002 | 142 | 0.00% | 0.00% | 87.32% | 12.68% |
| **Totals** | 2003 | 180 | 0.00% | 0.00% | 88.89% | 11.11% |
| (percentages) | 2004 | 95 | 1.05% | 1.05% | 74.74% | 23.16% |
| | 2005 | 113 | 1.77% | 0.88% | 66.37% | 30.97% |
| | 2006 | 15 | 0.00% | 0.00% | 80.00% | 20.00% |

Source: Spawning Ground Survey Database, 2007.

**Table D-5.** Carr Inlet streams revised mark recovery data, 2002-2006.

| Creek | Year | Number of carcasses sampled | Adipose marked, CWT | Adipose unmarked, CWT | Adipose marked, no CWT | Adipose unmarked, no CWT |
|---|---|---|---|---|---|---|
| **Burley** | 2002 | 185 | 1 | 0 | 125 | 59 |
| | 2003 | 61 | 0 | 1 | 37 | 23 |
| | 2004 | 20 | 0 | 0 | 12 | 8 |
| | 2005 | 49 | 0 | 1 | 42 | 6 |
| | 2006 | 132 | 2 | 1 | 125 | 4 |
| | | | | | | |
| | | | | | | |
| | Year | Number of carcasses sampled | Adipose marked, CWT | Adipose unmarked, CWT | Adipose marked, no CWT | Adipose unmarked, no CWT |
| **Carr Inlet** | 2002 | 185 | 1 | 0 | 125 | 59 |
| **Totals** | 2003 | 61 | 0 | 1 | 37 | 23 |
| (by count) | 2004 | 20 | 0 | 0 | 12 | 8 |
| | 2005 | 49 | 0 | 1 | 42 | 6 |
| | 2006 | 132 | 2 | 1 | 125 | 4 |
| | | | | | | |
| | | | | | | |
| | Year | Number of carcasses sampled | Adipose marked, CWT | Adipose unmarked, CWT | Adipose marked, no CWT | Adipose unmarked, no CWT |
| **Carr Inlet** | 2002 | 185 | 0.54% | 0.00% | 67.57% | 31.89% |
| **Totals** | 2003 | 61 | 0.00% | 1.64% | 60.66% | 37.70% |
| (percentages) | 2004 | 20 | 0.00% | 0.00% | 60.00% | 40.00% |
| | 2005 | 49 | 0.00% | 2.04% | 85.71% | 12.24% |
| | 2006 | 132 | 1.52% | 0.76% | 94.70% | 3.03% |

Source: Spawning Ground Survey Database, 2007.

**Table D-6.** Releases of eyed Chinook salmon eggs in Sherwood Creek by the Sherwood Creek Cooperative and Allyn Salmon Enhancement Group, brood years 1990-2003.

| Brood Year | Number of Chinook salmon released |
|---|---|
| 1990 | 10,000 |
| 1991 | 0 |
| 1992 | 0 |
| 1993 | 0 |
| 1994 | 0 |
| 1995 | 10,000 |
| 1996 | 10,000 |
| 1997 | 10,000 |
| 1998 | 10,000 |
| 1999 | 10,000 |
| 2000 | 10,000 |
| 2001 | 20,000 |
| 2002 | 10,000 |
| 2003 | 100,000 |

Source: John McAllister, Allyn Salmon Enhancement Group; personal communication.

**Table D-7.** Estimated return of Chinook salmon at Sherwood Creek due to eyed egg releases by regional enhancement groups, 1998-2006.

| Brood Year | Pounds of eyed eggs released | 1998 | 1999 | 2000 | 2001 | 2002 | 2003 | 2004 | 2005 | 2006 |
|---|---|---|---|---|---|---|---|---|---|---|
| 1995 | 10 | 1.39 | 1.34 | 0.06* | | | | | | |
| 1996 | 10 | | 1.39 | 1.34 | 0.06* | | | | | |
| 1997 | 10 | | | 1.39 | 1.34 | 0.06* | | | | |
| 1998 | 10 | | | | 1.39 | 1.34 | 0.06* | | | |
| 1999 | 10 | | | | | 1.39 | 1.34 | 0.06* | | |
| 2000 | 10 | | | | | | 1.39 | 1.34 | 0.06* | |
| 2001 | 20 | | | | | | | 2.77 | 2.68 | 0.12* |
| 2002 | 10 | | | | | | | | 1.39 | 1.34 |
| 2003 | 100 | | | | | | | | | 13.86 |
| | **Expected contribution** | 1.39 | 2.73 | 2.73 | 2.73 | 2.73 | 2.73 | 4.11 | 4.07 | 15.20 |

* Expected contributions from five-year olds were not included in the totals.

Expected contribution rates were calculated using number of hatchery returns per pounds of hatchery fish released rates for Nisqually Indian Tribe hatchery facilities. The rates for three-, four-, and five-year old returns from a contributing brood year release are as follows: 0.138583, 0.133796, and 0.005939. The weight of eyed eggs released at Sherwood Creek was estimated at 1,000 FPP.