

**PETITION TO LIST PUGET SOUND COHO SALMON (*ONCORHYNCHUS KISUTCH*) AS AN ENDANGERED OR THREATENED SPECIES UNDER THE ENDANGERED SPECIES ACT (ESA)**

TO: SECRETARY OF COMMERCE, UNITED STATES DEPARTMENT OF COMMERCE, NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION, NATIONAL MARINE FISHERIES SERVICE

From: Sam Wright (Petitioner), 1522 Evanston Ct., NE, Olympia, Washington, 98506 (360-943-4424, samwright@scattercreek.com). Petitioner is a fish biologist with 45 years experience in managing fish populations and fish habitat.

Subject: Petition the Secretary of Commerce to list as Endangered or Threatened the Puget Sound populations of coho salmon (*Oncorhynchus kisutch*) and to designate critical habitat.

These same populations were previously evaluated for possible ESA listing in the following September 1995 report:

Weitkamp, L.A., T.C. Wainwright, G.J. Bryant, G.B. Milner, D.J. Teel, R.G. Kope, and R.S. Waples. Status review of coho salmon from Washington, Oregon, and California. U.S. Dep. Commer., NOAA Tech. Memo. NMFS-NMFSC-24, 258 p.

The report, herein defined as Weitkamp et al. (1995), under “Assessment of Extinction Risk” in the Executive Summary, makes the following statement about the Puget Sound/Georgia Strait evolutionarily significant unit: “The BRT was concerned that if present trends continue, this ESU is likely to become endangered in the foreseeable future. Although current population abundance is near historical levels and recent trends in overall population abundance have not been downward, there is substantial uncertainty relating to several of the risk factors considered. These risk factors include widespread and intensive artificial propagation, high harvest rates, extensive habitat degradation, a recent dramatic decline in adult size, and unfavorable ocean conditions. Further consideration of this ESU is warranted to attempt to clarify some of these uncertainties.”

The phrase “this ESU is likely to become endangered in the foreseeable future” is the exact language that NOAA Fisheries Service has used for other resources that have subsequently been ESA-listed as Threatened. Since the trends cited have continued, and in fact have been exacerbated in the past 15 years, it seems logical that a listing as Threatened is fully justified at this time. In addition, there is now a brand new problem for Puget Sound coho salmon that was not even recognized 15 years ago. This is the serious and widespread pre-spawning mortality of adult Puget Sound coho salmon. Weitkamp et al. (1995) did not even mention this 15 years ago, much less flag it as a serious problem.

Since all of the technical data considered in Weitkamp et al. (1995) is now at least 15 years old, a reconsideration of ESA listing for Puget Sound coho salmon is warranted on the basis of 15 years of new information that is now available and will be presented by Petitioner in the remainder of this Petition. A separate detailed report on the new problem of pre-spawning mortality is attached.

## **Deliberate and Planned Overfishing**

Table II-I (page 9) of the Final Environmental Impact Statement for the Wild Salmonid Policy lists 89 Washington Pacific salmon naturally spawning populations that are deliberately overfished in order to harvest comingled hatchery fish (Washington Department of Fish and Wildlife, 1997. Final environmental impact statement for the Wild Salmonid Policy. WDFW, Olympia, WA). The 14 populations that are listed for Puget Sound coho salmon are as follows:

Nooksack River coho

Lake Washington/Sammamish tributaries coho

Cedar River coho

Green River/Soos Creek coho

Newaukum Creek (Green River) coho

Puyallup River coho

White River coho

Nisqually River coho

Chambers Creek coho

Deep South Sound tributaries coho

Deschutes River coho

East Kitsap coho

Dungeness River coho

Elwha River coho

None of these populations have established spawning escapement objectives for natural spawning, thus fisheries are never constrained in order to put natural spawners on the available natural spawning grounds. None of these populations appear on the list that the Pacific Fishery Management Council (PFMC) must consider when managing the ocean salmon fisheries (PFMC, 2003. Fishery management plan for commercial and recreational salmon fishery off the coasts of Washington, Oregon and California as revised through amendment 14. Pacific Fishery Management Council, Portland, OR.). Eleven of the 14 populations form the immense South Puget Sound Hatchery Salmon Management Zone (HSMZ) which encompasses everything from the Lake Washington system southward. The only escapement goal given is as follows: "Hatchery rack return of 52,000 adults." (PFMC 2003, Table 3-1, p. 11). There are no quantified coho salmon escapement objectives in any form for the Nooksack, Dungeness and Elwha rivers. All three river systems are Hatchery Salmon Management Zones.

**Assessment:** The current management system for 14 coho salmon populations in Puget Sound has been in place since the mid-1970s. There is no evolutionary future for any of these populations since artificial propagation has replaced natural selection for a period of at least 35 years for all of these populations.

## **Decline in Adult Size and Reproductive Viability**

The problem of reduced adult size was addressed from a long-term coast wide perspective in the following from WDFW (1997:E-6):

"The change in coho size Ricker (1980) observed from 1951 to 1979 was a decrease of 0.168 kg. He proposed that genetic changes were consistent with observed reductions in coho size. In the 25 year time period he studied (1951-1975), he found an average 1.22 kg (2.7 lb) decline in coho size when converted to size at maturity in areas outside the Strait of Georgia and Johnstone Strait (0.37 lb per generation). He used the difference in the mean size of fish harvested by selective gears (trolls and gillnets) to the size of coho caught by seines and the

mortality rate from fishing (75-85%) to estimate a selection differential of 0.5 kg (1.1 lb) to 0.73 kg (1.6 lb) smaller. These values correspond to a heritability of adult size between 0.23 and 0.35, which are reasonable values. Thus, he determined that it was quantitatively possible the “outside” cohos decreased in size because of genetic selection by the fisheries.”

The same problem, but specific to the more recent period in Washington, was documented in the following passage from WDFW (1997:E-8):

“Recent studies on coho salmon in Washington have found that the average size of fish harvested in many gill-net fisheries was significantly larger than the spawning population from the same stream or hatchery (S. Phelps and C. Knudsen, WDFW, personal communication). The studies also documented a significant decline in length since 1980 and a parallel decline in eggs per female since 1960. The number of eggs per female has declined by nearly 1,000 (about 40%). It now takes 1,700 spawners to produce the same number of eggs as 1,000 spawners did in 1960. This suggests that fishing may be one part of the cause of the decline in fish size. Other potential causes include environmental factors or hatchery programs.”

The recent dramatic decline in adult size recognized by Weitkamp et al. (1995) has not been reversed and in fact can never be reversed as long as many of the coho salmon populations are being subjected to intensive troll and gillnet fisheries that are continuously and selectively removing the larger fish. Salmonids have perpetuation values from larger fish that go far beyond the simple increase in fecundity.

Survivors during natural salmonid egg incubation come from the deepest egg pockets (van den Berghe and Gross 1984; De Vries 1997) in larger, more stable spawning gravel (Burner 1951; Hawke 1978). The eggs were placed there by large females (Hankin and McKelvey 1985; Forbes and Peterman 1994) who deliberately select large males as their mating partners (Schroder 1981; Hankin et al. 1993) and are better at defending their nests against dig-up by other fish (van den Berghe and Gross 1989). These same females also have larger eggs (Hankin and McKelvey 1985; Beacham and Murray 1990) which produce fry with higher pre- and post-emergence survival rates (Shelton 1955; Forbes and Peterman 1994).

Net result of these processes is that larger female salmonids have demonstrated a productivity that is much greater than can be explained by increase in fecundity alone. For coho salmon, van den Berghe and Gross (1989) estimated that the largest females within a population had a 23-fold fitness advantage (measured to time of fry emergence) over the smallest females. Only about one-third of this reproductive differential was attributable to differences in fecundity. Helle (1989) compared the largest and smallest size-classes of chum salmon and found only a 1.2 fold difference in fecundity per parent but a four-fold difference in surviving offspring per parent.

References for this section:

Beacham, T.D., and C.B. Murray. 1990. *Transactions of the American Fisheries Society* 119:927-945.

Burner, C.J. 1951. *U.S. Fish and Wildlife Service Bulletin* 61(52):97-110.

De Vries, P. 1997. *Canadian Journal of Fisheries and Aquatic Sciences* 54:1685-1698.

Forbes, L.S., and R.M. Peterman. 1994. *Canadian Journal of Fisheries and Aquatic Sciences* 51:603-616.

Hankin, D.G., and R. McKelvey. 1985. *Canadian Journal of Fisheries and Aquatic Sciences* 42:393-394.

Hankin, D.G., J.W. Nicholas, and T.W. Downey. 1993. *Canadian Journal of Fisheries and Aquatic Sciences* 50:347-358.

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- Helle, L.H. 1989. *Journal of Fish Biology* 35(Supplement A):99-107.
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- van den Berghe, E.P., and M.R. Gross. 1984. *Canadian Journal of Fisheries and Aquatic Sciences* 41:204-206.
- van den Berghe, E.P., and M.R. Gross. 1989. *Evolution* 43:125-140.

**Assessment:** Intensive and selective long-term removals of larger coho salmon by troll and gillnet fisheries has had a profound adverse impact on productivity potential of Puget Sound populations. This problem can only be further exacerbated by continuation of the current fisheries management regimes.

### **Deschutes River Coho Smolt Production**

Natural coho smolt production is the key to understanding coho salmon populations because it integrates a wide array of variables into a single quantitative final value. Two stream systems in Puget Sound have had long term monitoring programs to accurately measure adult spawning escapements and their resultant smolt production. The largest is the Deschutes River, a 186 square mile watershed at the extreme southern end of Puget Sound.

The following from WDFW (1997:B-6) describes status of the resource until the late 1990s:

“The Deschutes River wild coho population appears in Table II-1 (Chapter II) but has persisted much better than most of the other stocks listed. There is no hatchery coho program in the system itself, thus the immediate terminal area does not attract concentrated fishing effort. (Note: By agreement with the Squaxin Tribe, net fishing is not conducted in Budd Inlet.) The population data presented in Figure B-10 show that spawning escapements were inadequate in most years. Still, production prior to the 1989 brood year always exceeded 50,000 wild coho smolts per year. Massive landslides and culvert failures from the January 1990 flood reduced smolt production all the way down to 10,000 fish. The system’s fish production capacity has not recovered from these events.

The Deschutes River data show the expected relationship between adult females and smolts produced per female (Figure B-11). At small adult population sizes, there is a general tendency for each individual female to produce more smolts. However, as several low data points show, this relationship fails in the face of adverse environmental conditions.”

In a subsequent discussion of coho survival rates (as determined from marked fish experimental groups), the following was reported by WDFW (1997:B-8):

“The apparent downward trend in recent years is a cause for concern, particularly with the Deschutes River stock. There have been recent increases in both the South Sound net pen program for coho and the delayed release program for chinook. We have not established any cause-and-effect relationship between these increases and the apparent decline in wild coho marine survival. However, the fact that the Deschutes survival has declined lower than the other stocks indicates that a negative interaction may exist.”

Coho salmon are essentially all 3-year-old adults and one-year-old smolts in the southern part of their range and this produces three very distinct cycles that have no overlap as adult spawners or as juveniles rearing in streams. The three cycles in the Deschutes River had the following estimated smolt production by brood year:

1977-60,275	1978- 65,776	1979-131,261
1980-64,757	1981- 65,518	1982-101,901
1983-64,452	1984- 99,241	1985- 91,057
1986-54,397	1987-117,164	1988-133,198
1989-10,101	1990- 76,438	1991- 29,652
1992-19,686	1993- 23,912	1994- 38,197
1995- 6,356	1996- 8,259	1997- 23,535
1998- 4,144	1999- 892	2000- 73,299
2001- 2,340	2002- 7,423	2003- 61,090
2004- 4,215	2005- 2,372	2006- 35,000

The first cycle, beginning with the 1977 brood year, plummeted in abundance after the January 1990 flood, recovered somewhat in the 1992 brood year, and then fell again to a very low level of abundance for four consecutive recent brood years. The second cycle, beginning with the 1978 brood year, showed its initial steep decline with the 1993 brood year, but also followed this with a decline to very low levels of abundance for the four most recent brood years. The third cycle, beginning with the 1979 brood year, was definitely the strongest of the three cycles in earlier years. It shows a definite declining trend in abundance over time but never reached the very low abundance levels of the other two cycles. Thus, it can be concluded that the river system still has the capability of producing coho smolts at a level shown by recent brood years of the third cycle.

**Assessment:** Productivity of the freshwater system has definitely declined over time but this cannot fully explain the decline actually observed. Overfishing continues to be a major problem but the worst culprit is consistently poor marine survival rates in South Puget Sound. Coho populations in this entire region face a very uncertain future.

### **Big Beef Creek Coho Smolt Production**

The second area is a smaller watershed but has the additive benefit of a productive lake system. The following narrative is provided in WDFW (1997:B-6,7):

“Big Beef Creek is in Hood Canal where coho populations are supposedly managed to achieve wild fish spawning escapement objectives. However, as the data in Figure B-12 demonstrate, there have been many inadequate spawning escapements. During dry years, spawners congregate off the creek mouth and are harvested during the chum salmon management period. The Big Beef Creek data also demonstrate a case where the system’s coho rearing capabilities have diminished in recent years. Lower summer stream flows and adverse stream channel changes have been the visible result of cumulative development activities in the watershed. No single action seemed significant by itself, but the system can no longer produce the quantities of coho smolts that it did just a few years ago.”

In a subsequent discussion of total fishing rates (as determined from marked fish experimental groups), the following was reported by WDFW (1997:B-9):

“Figure B-17 shows recent exploitation history for the Big Beef Creek population. The high rates in earlier years were obviously not sustainable and led to the inadequate spawning escapement shown in Figure B-12. The lower rates in recent years demonstrate that the overfishing problem is being corrected.”

The three independent cycles of estimated coho smolt production in Big Beef Creek were as follows by brood year:

1976-17,619	1977-45,634	1978-20,493
1979-41,056	1980-25,217	1981-23,620
1982-36,564	1983-26,062	1984-23,994
1985-11,510	1986-26,534	1987-17,594
1988-19,740	1989-23,646	1990-18,677
1991-13,071	1992-18,431	1993-16,574
1994-25,820	1995-40,828	1996-22,222
1997-20,967	1998-47,087	1999-21,803
2000-24,352	2001-36,060	2002-25,062
2003-32,950	2004-38,579	2005-29,911
2006-27,416	2007-45,364	

This smaller system has much less potential for coho smolt production than the Deschutes River. However, there is no obvious strong cycle and the production is much less variable from year to year (an obvious benefit from having a lake in the system). All three cycles have maintained their production levels over time and there is no sign of any adverse impacts from the January 1990 flood (again, a benefit of flow buffering by the lake). Overfishing continues to occur in some years but partial resolution of this problem has masked the decline in inherent productivity seen earlier.

**Assessment:** Big Beef Creek coho smolt production has fared much better than has been the case in the Deschutes River. The only obvious difference is a major departure in marine survival rates. Very favorable survival rates have benefited the Big Beef Creek resource – an average of 13.3% for the most recent ten years of record. Deschutes River coho smolts have only had a 2.1% average marine survival rate in their most recent ten years of record.

### **Defining the Distinct Population**

The Distinct Population that Weitkamp et al. (1995) defined in their Executive Summary was as follows: “Puget Sound/Strait of Georgia. This ESU includes coho salmon from drainages of Puget Sound and Hood Canal, the eastern Olympic Peninsula (east of Salt Creek), and the Strait of Georgia from the eastern side of Vancouver Island and the British Columbia mainland (north to and including Campbell and Powell Rivers), excluding the upper Fraser River above Hope.”

The coho salmon populations in British Columbia have some, but not all, of the same problems impacting Puget Sound coho salmon populations. For example, abundance of coho has declined 90% in the Thompson River system due to the combination of overfishing, decreased adult size, landscape modification and changing ocean conditions (Bradford, M.J., and J.R. Irvine. 2000. Canadian Journal of Fisheries and Aquatic Sciences 57:13-16.).

However, any connectivity with Canadian stocks has been effectively severed by 35 years of managing the entire Nooksack River system as a Hatchery Salmon Management Zone. The Skagit River system now forms the northern boundary of a much smaller and isolated viable ESU that now has its southern boundary formed by the Snohomish River system. The new and much smaller viable ESU has also been compressed and isolated from the west by 35 years of managing the Dungeness River and Elwha River systems as Hatchery Salmon Management Zones.

## **The Case for Listing Puget Sound Coho Salmon**

The entire southern half of the Puget Sound Coho Salmon ESU (with 11 defined populations) has become the immense South Puget Sound Hatchery Salmon Management Zone (HSMZ) that extends from the Lake Washington system southward. Geographic extent of the remaining viable ESU (or northern half) has been further compressed from the north by the Nooksack River HSMZ and from the west by the Dungeness River and Elwha River HSMZs.

Puget Sound coho salmon have been adversely impacted by a serious decline in adult size and this is much more devastating than a simple decline in fecundity. Selective removals of larger coho salmon are continuing unabated in gillnet and hook-and-line fisheries. The latter gear type is not generally recognized as being selective. However, coho taken by commercial troll gear in a 1968 Washington study averaged 51 cm while coho taken by non-selective seine gear at the same place and time averaged only 43 cm (Wright, S. 1970. A review of the subject of hooking mortalities in Pacific salmon (*Oncorhynchus*). 23<sup>rd</sup> Annual Report of the Pacific Marine Fisheries Commission, p. 47-64.).

There is no question (or debate) that the inherent smolt production capabilities of Puget Sound stream habitat is in a long term downward trend that will continue far into the foreseeable future. The consistently poor marine survival rates of coho salmon smolts in South Puget Sound is a relatively new phenomenon as is the emergence of serious pre-spawning mortality for adult coho salmon. Both were not even mentioned as problems 15 years ago.