PETITION TO LIST THE LAKE SAMMAMISH KOKANEE (*Oncorhynchus nerka*) AS THREATENED OR ENDANGERED UNDER THE FEDERAL ENDANGERED SPECIES ACT

Photo by Vali Eberhardt

Ebright Creek Late-Run Kokanee

July 9, 2007

Executive Summary

Trout Unlimited, City of Issaquah, King County, People for Puget Sound, Save Lake Sammamish, Snoqualmie Tribe, and Wild Fish Conservancy are petitioning U.S. Fish and Wildlife Service (FWS) to define and list all wild, indigenous, naturally-spawned, kokanee (*Oncorhynchus nerka*) in Lake Sammamish, Washington, as a threatened or endangered species under the Endangered Species Act, 16 U.S.C. 1533 (ESA). The listing of Lake Sammamish kokanee is warranted because of their declining numbers, reduced productivity, a decline in the quantity and quality of their habitat, and narrowing temporal, spatial and genetic diversity. The loss of these viability characteristics is a direct result of the present and ongoing destruction, modification and curtailment of habitat and the inadequacy of existing regulatory measures, as well as other legacy effects. In 2000, FWS received a petition to list the summer-run kokanee in Issaquah Creek but failed to take any action on that petition. As a direct result of that inaction, the Issaquah Creek kokanee, the main source of the summer-run life history, went extinct (Ervin and Welch, 2003). The listing of the remaining kokanee in Lake Sammamish and its tributaries is necessary to prevent the inevitable extinction of the entire kokanee population in this unique urban watershed.

Petitioners

The **City of Issaquah** is a community of 24,500 residents located 16 miles east of Seattle in suburban King County. The City is located at the downstream end of the Issaquah Creek basin and has several miles of Lake Sammamish shoreline within its jurisdiction. The City's unique geography, with several significant streams supporting salmon runs, the associated wetlands and floodplains, and varied topography created by the "Issaquah Alps", makes it desirable to preserve these natural resources. In addition to Issaquah Creek, the largest tributary to Lake Sammamish, other large streams passing through the City include East Fork Issaquah Creek, North Fork Issaquah Creek, Tibbetts Creek, Lewis Creek, and Laughing Jacobs Creek. Although Issaquah is one of the fastest growing communities in the State of Washington, and faces development pressures similar other nearby cities, the City is active in preserving open space and restoring habitat along its stream corridors. This commitment is a direct reflection of several goals of the Comprehensive Plan, including: protect the natural environment, protect water sources, protect the streams and enhance fish habitat, and manage flooding. The total amount of dedicated open space in the City now represents about 15% of the 10 square mile total City area, and large areas of protected public parkland lie adjacent to the City boundary.

King County is a general purpose local government located along the eastern shore of Puget Sound. King County is the home of 1.8 million people, 29 percent of the population of the State of Washington, and is the 14th largest county in the United States. Seattle is the county seat. The County comprises over 2,000 square miles that extend from the saltwater of Puget Sound to the Mount Baker-Snoqualmie National Forest and the crest of the Cascade Mountain Range. King County is the largest local government in the Puget Sound basin and the largest local government responding to Pacific salmon listings under the Endangered Species Act. It is home to a variety of salmon, including kokanee, chinook, coho, chum, sockeye and pink salmon and steelhead and bull trout. King County is a leader and partner in watershed-based and regional conservation efforts that contribute to the sustainability of our native biodiversity and to the quality of life for the people of the Puget Sound region.

People For Puget Sound is a citizens organization founded in 1991, whose mission is to protect and restore the health of the Puget Sound ecosystem, including the watersheds draining into the Sound. People For Puget Sound has more than 5000 household members throughout the Puget Sound basin, who use and enjoy the basin's fish and wildlife for recreation, sustenance and economic purposes. The impacts of development throughout the basin are a chief concern of People For Puget Sound, in large part because of the harm caused by increased stormwater runoff, both in terms of hydrologic changes and water pollution. People For Puget Sound seeks to reverse the decline of fish and wildlife species in the Puget Sound basin by engaging in policy advocacy, education, habitat restoration, scientific data collection and analysis, and citizen involvement.

Save Lake Sammamish is an all-volunteer, 501(c) 3 organization incorporated in 1989 in the State of Washington with the express purpose of protecting Lake Sammamish and its environmental values. SLS has approximately 600 members, publishes and mails two to four Newsletters annually to approximately 3,000 households in the Lake Sammamish watershed. Since 1990 SLS members have served on numerous citizen advisory committees in all of the jurisdictions surrounding the Lake, including King County Surface Water Management CAC (1990-1994), the Lake Sammamish Water Quality and Management Plan and WRIA 8 Steering Committee. SLS was named as an implementing agency in the Issaquah Creek and East Lake Sammamish Basin and Non-point Action Plans in the mid-1990's. SLS Board Members have been invited speakers to school children, university students, bureaucrats, garden clubs, decision-makers, and the media. SLS has appealed and/or commented on numerous development proposals within the watershed from 1989 to the present. The organization has successfully pursued appeals to the State's Pollution Control and Shorelines Hearings Boards, including actions that resulted in the inclusion of Sensitive Lake Protection Standards in the King County Stormwater Drainage Manual and limiting some shoreline development.

In March 2000 Save Lake Sammamish was the lead organization in developing the Petition to protect the early-run Lake Sammamish Kokanee under ESA. USFWS did not respond to that Petition and in 2003 the early-run was declared extinct officially.

The **Snoqualmie Indian Tribe**, a signatory to the Treaty of Point Elliott of 1855, is a federally recognized Indian Tribe with nearly 600 enrolled members. The aboriginal territory of the Tribe stretched from the Cedar River to the Skykomish River, and from Snoqualmie Pass to the shores of Puget Sound. The Tribe freely moved throughout this expansive area and beyond, on foot and by canoe, and flourished by hunting, fishing and gathering. Lake Sammamish and the surrounding creeks and lands were and are an important center of Snoqualmie culture. From time immemorial several Snoqualmie families lived along the shores of Lake Sammamish and there were long houses and cemeteries near the shoreline. Today, Tribal members travel by canoe on the lake and hold important ceremonies at Lake Sammamish State Park.

Tribal members traditionally fished for and feasted on the little red fish (now called Kokanee), among other species, that inhabit Lake Sammamish. Oral history shows that at one time, the fish were so plentiful that Tribal members could stand at the creeks that flowed into Lake Sammamish and scoop up the little red fish in their hands. To this day, the little red fish is an important species, culturally, spiritually and gastronomically to Snoqualmie Tribal members.

Trout Unlimited is a national organization of over 150,000 members. The rejuvenated Washington Council is made up of 16 chapters and 4500+ members. Lake Sammamish kokanee have been of particular interest to the Bellevue/Issaquah Chapter and our Washington Council President. The Bellevue/Issaquah Chapter has focused extensive efforts on inventorying the remaining kokanee and their habitat. The first project surveyed out-migrating fry on Lewis Creek in partnership with Boy Scout Troop 677 and Eagle Scout candidate Colin Wick, as well as Save Lake Sammamish, and the

Washington Department of Fish and Wildlife. Currently in the planning stage are two restoration projects in the Lake Sammamish Basin in conjunction with two Eagle Scout candidates.

Wild Fish Conservancy is a non-profit organization dedicated to the recovery and conservation of Washington's wild-fish ecosystems, representing approximately 2000 members in the region. Many Wild Fish Conservancy members use and enjoy rivers, streams, and lakes throughout the Northwest, including Lake Sammamish and its tributaries, for recreational, scientific, aesthetic, and commercial purposes, deriving benefits from robust wild-fish populations and healthy aquatic, lentic, and riparian habitats. Wild Fish Conservancy conducts recovery related research on wild-fish populations and habitats, advocates for scientifically and legally responsible wild-fish management, and develops habitat-conservation initiatives.

Wild Fish Conservancy and its members have taken an active role in the conservation and recovery of Lake Sammamish kokanee and their habitats. From 1989 to February 2007, the Wild Fish Conservancy operated under the name "Washington Trout." In 2000, Wild Fish Conservancy (then Washington Trout) co-signed and submitted a petition to the US Fish and Wildlife Service to list Lake Sammamish early-run kokanee as an endangered species. Wild Fish Conservancy has surveyed Sammamish Basin tributaries for fish presence for the city of Redmond, been involved in field research and habitat restoration initiatives in the Bear Creek watershed, and has assessed fish passage at selected instream structures on Issaquah Creek.

Kokanee

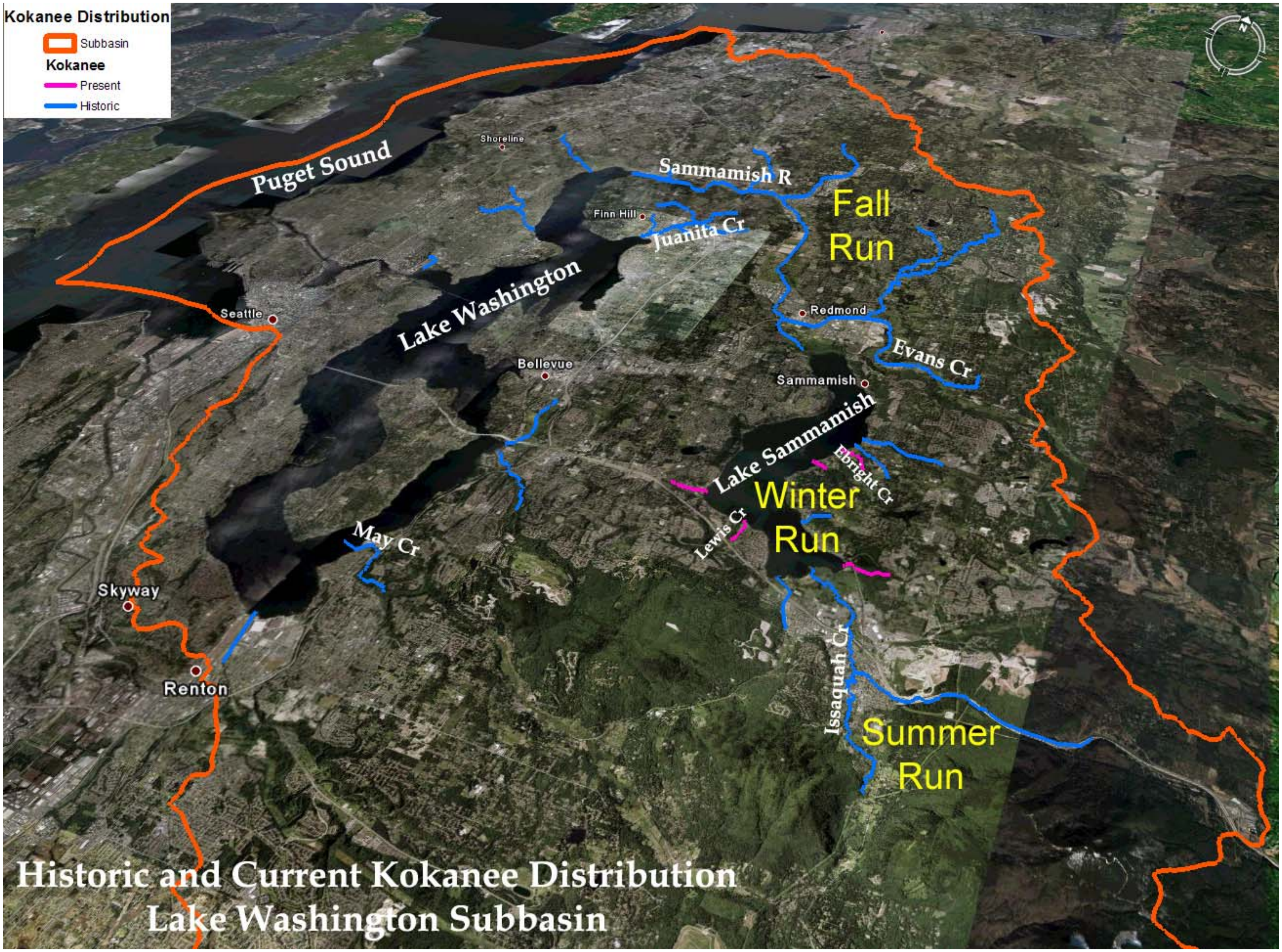
Kokanee are the freshwater resident form of *Oncorhynchus nerka* or sockeye salmon. The name 'kokanee' comes from the Kootenay Tribe meaning "red fish" (Behnke, 2002). Kokanee primarily utilize lakes for rearing and migrate into tributary streams to spawn; some kokanee will also spawn in lakes. Unlike the sockeye, they do not utilize the ocean and therefore are not subject to fluctuating ocean conditions or to harvest in saltwater areas. It is thought that the lake productivity and difficulty in migration make the resident life form more likely in particular places over the anadromous life form, although both life forms are found in some watersheds, including Lake Sammamish (Wood, 1995; Berge and Higgins, 2003). Kokanee are typically smaller and less fecund than sockeye (Behnke, 2002). However, like sockeye, kokanee are semelparous and die after spawning.

Juvenile kokanee rear in the pelagic zone of lakes, feeding on small zooplankton, *Daphnia* and other invertebrates for a few years before returning to the tributaries as early as age three to spawn and die (Berge and Higgins, 2003; Jackson, 2006). Indeed, *O. nerka* are unique among salmon in their number of gill rakers, to maximize this specialized feeding behavior (Behnke, 2002). Consequently, kokanee are highly susceptible to changes in the lowest levels of the food web, which are in turn, highly vulnerable to temperature fluctuations, nutrients, inorganic pollutants, dissolved oxygen and the effects of activities including land use, especially in the shoreline and upland areas. Kokanee are an important part of the food chain for other native fish, such as bull trout and cutthroat trout. The health of the kokanee population is a reflection of and a contributor to the overall health and function of the Lake Sammamish watershed.

In Washington, kokanee are native in Baker, Whatcom, Wenatchee, Chelan and the Washington-Sammamish lakes (Jackson, 2006). In addition there has been extensive artificial production and release of non-native kokanee throughout many lakes including Lake Sammamish (Seeb et al., 1977; Kvam et al., 1999; Berge and Higgins, 2003). Lake Sammamish is hydrologically connected to the more familiar Lake Washington, where there have been more extensive studies on local *O. nerka* populations (Seeb et al., 1977; Kvam et al., 1999; Young et al., 2004). Berge and Higgins, 2003, postulate the origins of the Washington-Sammamish kokanee populations based on the unique hydrological system that prevented the lakes from discharging directly into the ocean in most years and the sufficient food supply necessary to support a robust population of planktivorous fish. The connection to the ocean was made permanent in 1916 when the Cedar River, which was not originally a tributary to Lake Washington, was redirected into Lake Washington and the lake was given a permanent outlet to Puget Sound through Lake Union as a result of the Montlake Cut (Gustafson et al., 1997). As a result of this permanent connection and multiple, successful, attempts to introduce anadromous sockeye, currently resident kokanee and anadromous sockeye co exist throughout the watershed.

While kokanee and sockeye are difficult to distinguish at earlier life stages, there are some morphological differences that can be used to differentiate between the two forms (Berge and Higgins, 2003). Kokanee commonly reach maturity at sizes between 8 to 22 inches long and have spots on the dorsal surface (Behnke, 2002). They usually weigh between one and three pounds and spawn at age 3 or 4, and occasionally age 5 (Behnke, 2002; Berge and Higgins, 2003). In the field, biologists use a length requirement (usually between 16 and 22 inches) to differentiate kokanee and sockeye. Residualized sockeye that do not migrate to the ocean, although smaller in size from anadromous sockeye, are usually duller in color and tend to be male (Behnke, 2002; Berge and Higgins, 2003). Sockeye are generally 21 to 26 inches and roughly 4-7 lbs (Behnke, 2002). Sockeye usually migrate after 2 years in freshwater and return to spawn at age 4 or 5.

FIGURE 1


Kokanee Distribution
Subbasin
Kokanee
Present
Historic
Puget Sound
Shoreline
Sammamish R
Finn Hill
Juanita Cr
Fall Run
Lake Washington
Seattle
Redmond
Evans Cr
Bellevue
Sammamish
Lake Sammamish
Ebright Cr
Winter Run
Lewis Cr
May Cr
Skyway
Renton
Issaquah Cr
Summer Run
Historic and Current Kokanee Distribution
Lake Washington Subbasin

Lake Sammamish Kokanee

Lake Sammamish kokanee are unique in many ways. First, they have a wide diversity of spawn timing, also referred to as "run timing." There are three distinct spawn times in Lake Sammamish kokanee – an early summer spawning, a mid-run fall migration, and finally a late-run that migrates in the winter. These distinct run times are likely a result of the distinct tributaries in which each run spawns (Figure 1). According to Berge and Higgins, 2003, the early summer run migrated to Issaquah Creek between August and September. The middle run *O. nerka* spawn in tributaries of the Sammamish River (the lake outlet), namely Swamp, North, Bear, Little Bear and Cottage Lake Creeks from late September through November. Finally, the late run of kokanee spawn from late October through January primarily in lake tributaries Lewis, Ebright, and Laughing Jacobs Creeks, with some spawners recorded in Vasa, Pine Lake, Sammamish River, and East Fork Issaquah Creeks (Berge and Higgins, 2003; Young et al., 2004; Jackson, 2006). From 1940-1978, managers planted millions of hatchery kokanee from the Lake Whatcom kokanee strain, and until 2004 it was assumed that the late run kokanee were naturalized offspring of that hatchery stock (Berge and Higgins, 2003; Young et al., 2004).

The critical genetic study by Young et al., identified the unique genetic strain of Lake Sammamish kokanee relative to each of the distinct runs, as well as to other kokanee throughout Washington. The study makes very clear that there is a high level of intraspecies and interspecies diversity within the kokanee of Lake Sammamish and other native kokanee populations in Washington. There are two very important conclusions from the genetic studies. First, the late-run kokanee are not offspring of the extensively planted hatchery kokanee from Lake Whatcom. Indeed, Young et al. found no evidence that the Lake Whatcom hatchery plants had any genetic influence on the kokanee in Lake Sammamish.

The second critical finding regarded the genetic history of the middle run kokanee. Young et al. concluded that the middle run kokanee are in fact residulized sockeye and were most closely related to Baker Lake sockeye.[1] However a 1977 study by Seeb et al., found a high level of divergence between the kokanee and sockeye in Bear Creek, the main spawning area of the mid-run kokanee. A review of the record by Berge and Higgins in 2003 found documentation that there was a native middle run kokanee in the Lake Sammamish watershed at least through 1946. The most abundant mid-run tributary, Bear Creek, was even mined for 14 million eggs in the 1940s. However, by the 1970's the population was considered extinct and the remaining kokanee thought to be related to the Lake Whatcom kokanee hatchery plants. The Seeb et. al. study from 1977 indicates that there may have been some native kokanee in Bear Creek that displayed a difference

[1] Seeb et al., 1977 considered the sockeye run in Cedar River, a tributary of Lake Washington, to be a naturalized run from Baker Lake (WA) sockeye that were planted in the system in the early 20th century. Young et al., 2004, did not perform any genetics on sockeye, residual or otherwise, in Cedar River, therefore it is unclear if the residualized sockeye that Young et al. identified were originally from the Cedar River population.

from the sockeye, however by 2004, Young et. al. could no longer detect that difference (See also Gustafson et al., 1997 at 123). Notably, Young et al., did not conclude that the kokanee in Bear Creek were offspring of the Lake Whatcom plants, but rather residual sockeye more closely related to the Baker Lake strain of sockeye. Thus, historically there was an abundant mid-run of native kokanee in Bear Creek and possibly the other Sammamish River tributaries, but those rivers do not appear to support a native mid-run any longer. More genetic studies should be conducted to confirm this theory. This petition includes the native early- and mid- runs of kokanee in the DPS because there still may be remnants of those populations and they are critically important to the recovery of Lake Sammamish kokanee. The studies by Seeb et al., and Young et al., scientifically preclude the inclusion of Lake Sammamish sockeye or Whatcom hatchery kokanee in the DPS.

Berge and Higgins, 2003, identified historical accounts of extensive native kokanee in the Lake Washington system prior to the Montlake cut (see also Gustafson et al., 1997; Kvam et al., 1999). Because of the lack of current data on kokanee in Lake Washington and the lack of historical specimens, this petition does not include Lake Washington kokanee in the DPS designation; however Fish and Wildlife should investigate the relationship of Lake Washington kokanee during the status review.[2] To the extent that there were kokanee in Lake Washington that may have been considered the same DPS as the Lake Sammamish kokanee identified in this petition, their absence presently furthers the biological justification to protect the remaining Lake Sammamish kokanee under the ESA because their abundance, distribution, diversity and productivity are even more restricted and depleted than described herein.

Distinct Population Segments

The Endangered Species Act, 16 U.S.C. § 5131 *et. seq.*, as amended, authorizes the U.S. Fish and Wildlife Service (FWS) to list as threatened or endangered those “species” facing threats to their existence. The statute defines the term “species” to include subspecies, as well as “any distinct population segment of any species of vertebrate fish or wildlife which interbreeds when mature.” 16 U.S.C. § 1532(15) (2001). The language was introduced in the 1978 amendments without comment from the Committee on Merchant Marine and Fisheries, H.Rep. 95-1625 (H.R. 14104), and was not present anywhere in the Senate version of the bill, S. 2899. The only reference to the definition of “species” is in the floor statements in the U.S. House of Representatives when Representative Duncan from Oregon offered an unsuccessful amendment to alter the definition of “species” to exclude any categorization below that of species, namely that of “subspecies” and “distinct population segment.” Cong. Rec. 96th Congress, 2nd Session, 38155 (Oct. 14, 1978). In a pertinent response, Representative Dingell retorted that

[2] According to H. Berge, King County, pers. comm., kokanee are found every year in Lake Washington but are not seen in spawning surveys. A few kokanee have been found spawning in the maintstem Sammammish River, but their origin is unknown.

> [t]he provisions of the amendment offered by the gentleman from Oregon (Mr. Duncan) would say that if a buffalo and a cow occupy the same physical habitat that because they can produce fertile offspring they are cataloged as the same species. So if the buffalo is really approaching extinction and there are cows occupying the same range, the protections of the statute [under the proposed amendment to eliminate "subspecies" and "distinct population segment"] will not apply to the buffalo.

(*Id.*). This example could easily be substituted with kokanee and sockeye, and the artificial production of those fish, in Lake Sammamish, and as Representative Dingell's comments indicate, the subdivisions of "subspecies" and "distinct population segment" are exactly the mechanisms designed to distinguish between very biologically different fish in the same lake system.

Since the phrase "distinct population segment" (DPS) is not one ordinarily employed by biologists, its meaning is not otherwise readily apparent from the ESA's language. Though the agencies employed their authority to list groups of organisms other than species or subspecies, FWS did not provide any clarification as to the meaning of this phrase for more than a decade after lawmakers wrote it into law in 1978. During this period, the agency made listing delineations by distinguishing between captive and wild populations (split listing of chimpanzees), and often listed groupings below the subspecies level based on political boundaries. With respect to the latter type of listings, the FWS delineated protected groupings by employing international boundaries (e.g. grizzly bears), state boundaries (e.g. bald eagles), and even county or parish boundaries (e.g. American alligators). None of those distinctions apply here.

Only when it was faced with the first petitions to list salmon in the Columbia Basin did National Marine Fisheries Service fine tune its effort to develop guidance on defining distinct population segments eligible for listing. In 1991, NMFS finalized a policy (which the agency did not codify as part of its ESA regulations) applicable to all Pacific salmonids for determining whether a given grouping of salmon satisfies the definition and listing requirement. (56 Fed. Reg. 58612 (Nov. 20, 1991)). In this policy, NMFS announced that in order to qualify for listing consideration, a group of salmon must constitute an "evolutionarily significant unit" (ESU). (*Id.*). An ESU, according to NMFS, is distinguishable from other salmon of the same species by two factors: 1) it is "substantially reproductively isolated," and 2) it "represents an important component in the evolutionary legacy of the species." (*Id.* at 58618). Elaborating on these criteria, NMFS explained that an ESU's reproductive isolation need not be absolute, but must allow for "evolutionarily important differences" in genetic makeup and other characteristics, elaborating that "a lack of direct genetic information… [or] a finding of 'no significant difference' on the basis of protein electrophoresis or DNA analysis does not rule out consideration of a population as an ESU." (*Id.* at 58616, 58617). The second factor, according to the agency, emphasizes a prospective ESU's genetic uniqueness; in order to qualify as an ESU, a grouping must "contribute substantially" to the "ecological/genetic diversity" of the species as a whole. (*Id.*). Of important note here is the emphasis on both ecological and genetic diversity, indicating that how the species interacts in its environment, i.e. how locally adapted traits improve its fitness, is one of the main components of the very diversity that the ESA seeks to protect.

FWS did not adopt the ESU policy for its approach to distinct population listings, but instead in 1996, FWS and NMFS developed a joint policy (hereinafter "DPS Policy") that was considered consistent with the ESU policy. 61 Fed. Reg. 4722 (Feb. 7, 1996). According to the DPS policy, the agencies declared that they would delineate groupings eligible for ESA listings based on two factors: 1) "discreteness," measured by whether the population is "markedly separated" from others by "physical, physiological, ecological, or behavioral factors" or by international boundaries; and 2) "significance," a measure of the population's "importance to the taxon in which it belongs." *Id.* at 4725. Indications that a particular population is "significant" include (but are not restricted to) its persistence in a unique or unusual ecological setting, evidence that loss of the discrete population would "result in a significant gap in the range of a taxon," and evidence that the population "differs markedly" from others in the species in its genetic characteristics (*Id.* at 4725).

In 2006, National Marine Fisheries Service returned to using the "distinct population segment" delineation over their more frequently used "evolutionarily significant unit" (ESU) delineation to evaluate and list ten populations of anadromous trout, *Oncorhynchus mykiss*, known as steelhead. 71 Fed Reg. 834 (Jan. 5, 2006). Like sockeye and kokanee, *O. mykiss* has both an anadromous form, steelhead, and a resident form, rainbow trout. NMFS returned to the DPS policy for a number of reasons. First, the use of the DPS policy maintains consistency with species that require joint management from both NMFS and FWS. *Id.* Second, and more pertinent to this case, NMFS felt that the DPS policy was more appropriate biologically to meet the unique needs of steelhead that have a common resident life history. In other words, the anadromous life history was "discrete" in terms of the physical, physiological, ecological and behavioral differences from the resident rainbow trout, and the migratory life history was of such significance to the overall persistence of the *O. mykiss* species and the ten particular DPSs, that the anadromous life history warranted separate consideration as a DPS. *Id.* at 838. This approach to using the ESU policy for anadromous fish and the DPS policy for those with both a resident and anadromous life history is instructive for kokanee.

Kokanee as a Distinct Population Segment

Wood, in his extensive 1995 review of sockeye population structure, commented that "clearly, sockeye salmon and kokanee can exist as ecologically distinct, reproductively isolated populations and warrant consideration as separate ESUs." (Wood, 1995 at 204). In 1997, National Marine Fisheries Service addressed this question directly when it convened a Biological Review Team (BRT) that applied the ESU policy to evaluate anadromous sockeye salmon in response to a petition to list sockeye in Baker River (Gustafson et al., 1997). Most notably, the BRT directly asked the question whether co-occurring sockeye and kokanee could constitute distinct, reproductively isolated populations instead of merely alternative life history types. The answer was very directly, yes. The question was prompted because kokanee have differentiated from sockeye salmon on multiple occasions (polyphyletic). Research into populations of sockeye and kokanee that coexist have found that they can be both sympatric (distinct) or allopatric (interbreed). In fact, there is no evidence that kokanee or even kokanee that spawn with sockeye, will produced anadromous offspring (although the reverse is true – sockeye can produced resident *O. nerka*). Gustafson et al. did not include kokanee in the ESU determinations and because kokanee are within the jurisdiction of FWS, no further action was taken on their ESA-listing status.

Nonetheless, Gustafson et al., reviewed the kokanee and sockeye populations in Lake Sammamish and could not determine the origins of many of the kokanee populations in the basin but believed that at least some of them were native given the historical records. The study by Young et al., 2004, definitively identified the sockeye and kokanee in Lake Sammamish as sympatric and found the kokanee more genetically related to kokanee from outside the basin than to the sockeye in the basin (the exception being the Bear Creek kokanee which currently exhibit a mid-run timing), indicating that the kokanee are native fish and not derived from sockeye transplants or artificially produced kokanee or sockeye.[3] Within Lake Sammamish, the kokanee are discrete and significant for the purposes of delineating a distinct population.

Discreteness

Discreteness is measured by whether the population is unique in terms of its physical, physiological, ecological and behavioral factors. The 2000 petition from Save Lake Sammamish to list the summer-run resident form of *O. nerka* was the first look into the discreteness and significance of the Lake Sammamish kokanee (that analysis is incorporated here by reference (Wright, 2000)). That petition outlined the discreteness of the early-run kokanee from Issaquah Creek focusing on its unique run timing, its limited, unique habitat needs, and by the genetic differences. Furthermore, the petition appropriately argued that the early-run kokanee were significant for all of the same reasons, as well as the fact, confirmed post hoc, that the loss of this discrete population segment results in a significant gap in the taxon.

As described in detail above, the unique spawn timing of the three different segments of the Lake Sammamish kokanee are a key critical finding for the discreteness criterion. While the 2000 petition focused on the uniqueness of the early run timing with respect to other kokanee populations throughout the West, this petition includes all three run timings and highlights the uniqueness of any one lake having all three run timings as both

[3] The BRT (Gustafson et al., 1997) found that the sockeye population in Big Bear Creek (now known as simply Bear Creek) was genetically distinct from other sockeye in the Lake Washington and Lake Sammamish watersheds, however the BRT was split as to whether it was a distinct ESU because of the uncertainty with respect to the historical presence of sockeye in the basin and whether the current sockeye population was a population that had undergone founder effects or genetic drift, or was a kokanee population that had anadromized. As a result, the BRT categorized the Big Bear Creek sockeye as a provisional ESU. A review of the ESU led to the determination that the ESU was not at risk of extinction because of human intervention but that if the human activities that included trapping, hauling and enhancement of beach spawning stopped, the population might not persist into the foreseeable future (Gustafson et al., 1997).

discrete and significant relative to other kokanee populations. The spawn timing is also unique because it reflects key ecological differences between the different segments of the population as well as between populations of other lakes. (Figure 1). The ecological discreteness is reflected in the genetic data. The data by Seeb et al., 1977 and Young et al., 2004 highlight the unique genetic structure of the runs relative to other kokanee and sockeye across the West. Not only were Lake Sammamish kokanee populations significantly different genetically from other kokanee populations, but other wild and artificially produced kokanee from other watersheds were unable to persist in Lake Sammamish as evident by the lack of a genetic signal from those introduced populations. Quite clearly, in the event of a loss of any one of the three subpopulations of kokanee in Lake Sammamish, there are no other viable options to reintroduce or jump start a new population using kokanee from outside the basin. In addition, the genetic data highlights a genetic difference even within the kokanee in Lake Sammamish, further amplifying the importance of the ecological niches to the diversity and survival of kokanee. Had it not been for this genetic and ecological diversity, Lake Sammamish kokanee would have been extinct years ago, but because of the diversity, one remnant run remains.

There are physiological differences as well. Berge and Higgins, 2003, identify the differential length of the kokanee within the basin. The historic data from the early run has it maturing at roughly 13.5 inches, with later data identifying a span of 10 to over 14 inches. The historic middle run species is mature between 6.5 and 10 inches. Only recent data exist for the late-run and are on the very large end: Ebright Creek averages 16.5 inches, 16.8 inches for Laughing Creek kokanee, and 16 inches for Lewis Creek (Hans Berge, King County, unpublished data). Thus, the three run timings also exhibit different average lengths that correspond to their unique ecological settings and life histories.

Significance

After finding a population to be discrete from others in the same taxon, the DPS Policy calls for an assessment of the population's "significance," or in other words, "its importance to the taxon to which it belongs." (61 Fed. Reg. 4722, 4724 (Feb. 7, 1996)). Indications that a particular population is "significant" include (but are not restricted to) its persistence in a unique or unusual ecological setting, evidence that loss of the discrete population would "result in a significant gap in the range of a taxon," and evidence that the population "differs markedly" from others in the species in its genetic characteristics. (*Id.* at 4725). As elaborated in more detail in prior sections, each of these factors indicates that Lake Sammamish kokanee are significant to *O. nerka* as a species. The fact that two of these components have already been lost puts the DPS at a very high risk of endangerment or extinction in the foreseeable future, justifying its listing as a threatened or endangered species under the ESA.

Listing Distinct Population Segments pursuant to the Endangered Species Act

In order to list a species under the Endangered Species Act (ESA), the FWS must determine if the species is threatened or endangered based "solely on the basis of the best scientific and commercial data available to him after conducting a review of the status of the species and after taking into account those efforts, if any, being made by any State or foreign nation…to protect such species, whether by predator control, protection of habitat and food supply, or other conservation practices, within any area under its jurisdiction, or on the high seas." 16 U.S.C. Sec. 1533 (b). In this case, the best available science that would be considered in a status review, clearly demonstrates that the distinct population segment is "likely to become an endangered species within the foreseeable future throughout all or a significant portion of its range." 16 U.S.C. Sec. 1532 (20).

Once the agency reviews the best scientific information regarding the status of the species including the efficacy of statutorily allowed conservation measures that improve the status of the species, it must list the species as threatened or endangered if it finds that any one of five statutorily identified factors is impacting the species. Specifically, if the agency finds:

(a) the present or threatened destruction, modification, or curtailment of its habitat or range;
(b) overutilization for commercial, recreational, scientific, or educational purposes;
(c) disease or predation;
(d) the inadequacy of existing regulatory measures; or
(e) other natural or manmade factors affecting its continued existence

is causing the species to be either threatened or endangered, then it must list the species. 16 U.S.C. Sec. 1533 (a)(1)(A)-(E).

Viability – the best scientific and commercial data

The health and future of salmonid species are evaluated by a Viability Salmonid Population (VSP) approach that looks at four biological criteria: abundance, productivity, distribution and diversity (McElheny et al., 2000). Since the informal adoption of this approach, biological review teams have used VSP analysis during the status reviews of proposed and listed salmonids (See e.g. Good et al., 2005). Using this approach to evaluate the Lake Sammamish kokanee DPS reveals that the population is at serious risk of becoming endangered in the foreseeable future and at a high risk of going extinct.

<u>Abundance and Productivity</u>

Although little actual hard data exists about the historical abundance of kokanee, extensive efforts have been made to collect historical accounts of kokanee in the Lake Sammamish drainage to provide context to the years of data collected more recently (Gustafson et al., 1997; Kvam et al., 1999; Berge and Higgins, 2003; Young et al., 2004) (internal citations omitted). The abundance data are useful for relative comparison. However, because assumptions about run timing were wrong (Young et al., 2004) in large part because of the complication of millions of kokanee plants (Gustafson et al., 1997), the data should not be used beyond relative comparisons. Productivity data is inferred from the annual adult data. The first fry data collection effort started in 2007 by a group of Trout Unlimited volunteers (See Appendix A). Despite some of the limitations and gaps, the body of data available demonstrates a high risk to the species in terms of diversity, genetic bottlenecks and catastrophic loss (Table 1).

There is evidence that there were large numbers of kokanee at the turn of the century (Kvam et al., 1999; Young et al., 2004). In some streams, numbers were high enough that some people captured them to feed to cats and fertilize gardens (Kvam et al., 1999). Most information relates to the now extinct early run in Issaquah Creek, where abundance estimates ranged from 3,000 to 15,000 (Jackson, 2006 citing Pfeifer, 1995). Between 2000 and 2003, only two adult kokanee were found in Issaquah Creek, leading biologists to conclude that this run is functionally extinct, permanently eliminating a key element of diversity, distribution and abundance in the Lake Sammamish kokanee DPS (Berge and Higgins, 2003; Jackson, 2006). The mid-run, at least Bear Creek, was estimated to have at least 6,000 and as many as 30,000 spawners in the 1940's (Kvam et al., 1999). While these numbers are confounded by the high numbers of out of basin and in basin kokanee plants during this time period (Gustafson et al., 1997) (Table 2), it is a stark contrast to the current abundance data of zero (Young et al., 2004; Jackson 2006).

The late run populations have hovered around an average of 946 fish (median is 594), with extreme lows at the quasi-extinction threshold of 54 in 1997, and a very unusual peak of 4,591 in 2003 (Jackson, 2006; H. Berge, King County, unpublished data) (Table 1).[4] Despite the lack of historical data for the late run kokanee, the near failure of the 1997 and 1998 broodyears has led to a year class crash and near extinction in Laughing Jacobs Creek (1998, 2001, and 2004). Most disturbingly, since the highs of 2002 and 2003, the populations in all of the streams have experienced recruitment

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[4] The spawning escapements are determined using an Area Under the Curve (AUC) calculation. AUC calculations involve live count surveys that are expanded into spawning ground escapements. Weekly live fish counts were conducted on the spawning grounds to calculate spawning ground escapement estimates for Lewis, Ebright, Laughing Jacobs, and Pine Creeks. The methodology is explained as follows:
Live counts are combined for a stream system and plotted by date on the x axis, and the number of live fish observed on the y axis. The first step is to calculate **F** (fish days):

$$F_{t+1} = \left(\frac{C_t - C_{t+1}}{2} \right) \bullet \left(J_{t+1} - J_t \right) \qquad \text{(Equation 1)}$$

where C_t is the live count for the first survey, C_{t+1} is the live count of the second survey, J_t and J_{t+1} corresponds to the Julian Day of each of the live counts, respectively, and α represents the initial survey date. The AUC (area under the curve index escapement) is then defined as:

$$AUC = \frac{\sum_{1}^{t_p} F}{V} \qquad \text{(Equation 2)}$$

where **F** represents fish days, **V** is the number of days a fish is susceptible to being counted by surveyors, and t_p represents the last survey date. The escapement goal set in the Bear Creek and Cedar River Basins is based upon the AUC index escapement estimate. For kokanee in the watershed, we assume **V** to be 10 days. By summing the fish days and dividing by the visibility life we generate a spawning ground escapement for the entire survey period. This method requires a survey with no live fish observed on the first and last date on the curve (i.e. the endpoints of the curve must be zero). It is also important that surveys are complete for the entire system as synchronously as possible.
(Berge et al., 2006 internal citations omitted).

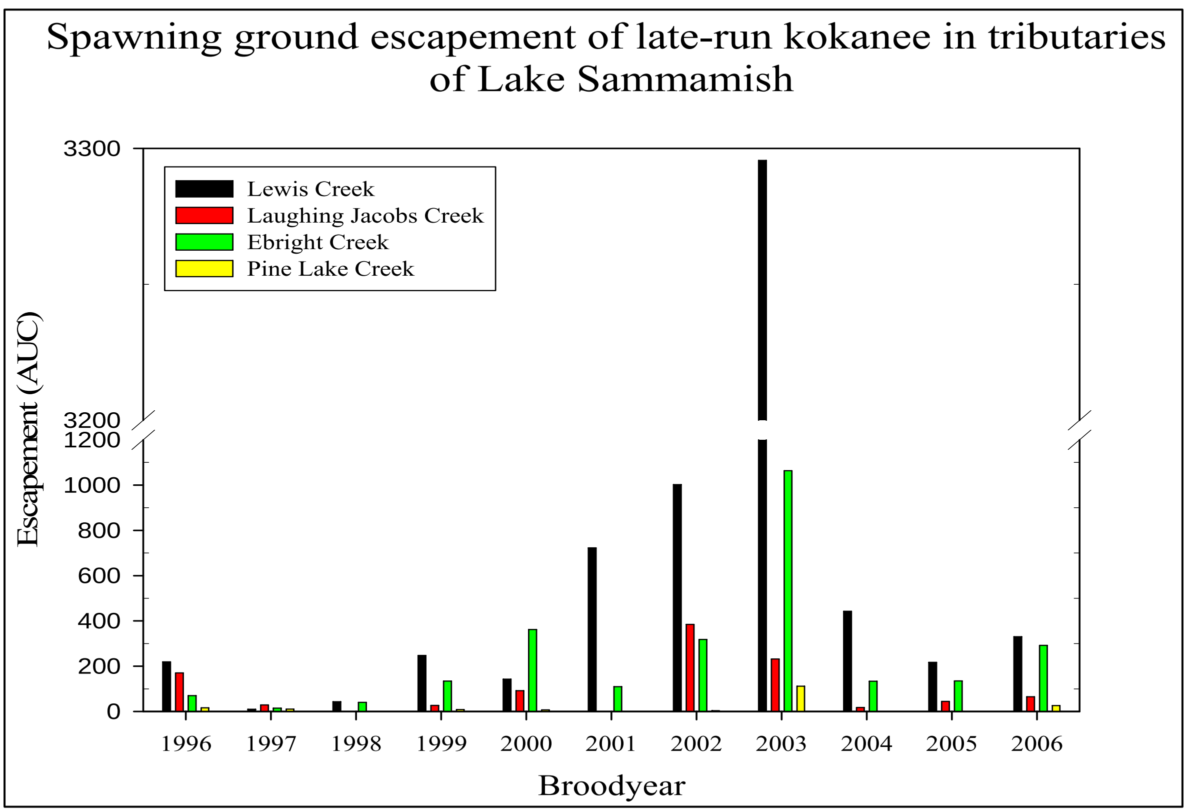
failure.[5] The low abundances, high variation in recruitment success, and loss of year classes significantly increases the extinction risk this species faces. Because the early- and mid-run kokanee are considered functionally extinct, the late-run populations represent the last remaining populations in the DPS. Thus, not only are the year class failures significant to the late-run, but to the overall existence of the species.

[5] The first fry sampling was conducted in 2007 (Appendix A) and for the total hours sampled, they collected 2200 live fry. The sampling was conducted at stream mouths (to represent the total watershed), on occasion from dusk to dawn (to account for peak migration times), and only ceased when no fry were recorded for consecutive days (to ensure the total migration was represented). These differential sampling techniques allow biologists to extrapolate the total number of fry to 13,942 and the overall egg to fry survival rate at roughly 17% (H. Berge, King County, pers. comm.). More sampling is necessary to identify annual trends and tighten assumptions. Despite the survival rate from egg to fry, the adult returns indicate that in most years, the adults are not replacing themselves.

Table 1: Lake Sammamish Kokanee Abundances data (Berge and Higgins, 2003; Jackson 2006; Berge, unpublished data)

	1992	93	94	95	96	97	98	99	2000	01	02	03	04	05	06
Issaquah Creek	11	27	39	3	17	12	0	3	2	0	0				
Lewis Creek					219	10	43	247	143	722	1002	3296	442	217	330
Ebright Creek					70	15	40	134	362	110	319	1063	134	135	292
Laughing Jacobs Creek					170	29	0	27	92	2	384	232	18	44	65
Pine Lake Creek					16	10	0	8	7	2	3	111	0	1	26

Figure 2: (H. Berge, King County, unpublished data)



Distribution

The Lake Sammamish basin covers 230 km^2, with the lake itself adding 19.8 km^2 (King County, 2005). Issaquah Creek is the largest subbasin providing nearly 70% of inflow to the lake, and other major rivers in the basin are the Bear Creek watershed, Sammamish River (both lake outflow rivers) and Tibbetts Creek. *Id.* Figure 1. There are reports that the kokanee were distributed throughout the entire Lake Sammamish and Lake Washington basins (Berge and Higgins, 2003). Currently, native kokanee are limited to a few southern creeks (late run) and are completely gone from the largest tributaries and subbasins in the Lake Sammamish basin (Figure 1). This represents a significant contraction of the spatial distribution of the population. In addition, the spawning habitat is very contracted. Currently because of fish passage barriers, the longest accessible spawning stream is only 0.75 miles and the total spawning area of all streams is less than one mile (Jackson, 2006). The lack of high quality and significant quantity of habitat no doubt affects the behavioral and life history diversity of the species. It also increases the likelihood that single harmful or catastrophic events of natural or anthropogenic origin, or both, like high flows from storms that occur during incubation, can affect the population over its entire distribution at one time and could result in complete failure of a particular year class.

Very little is known about kokanee behavior and distribution in the lake itself, where all of the rearing occurs. The lake seasonally stratifies and the hypolimnion becomes anaerobic in the summer, during the same time that the epilimnion approaches 20 °C (King County, 2005). The distribution and survival of kokanee is likely affected during this time either directly by temperature and pollutants or through the movement and distribution of its food sources such as zooplankton and its predators, including pelagic piscivores (Hans Berge, King County, unpublished data).

Diversity

The Young et al. (2004) analysis identifies the remaining distinct genetic diversity in Lake Sammamish. Their research and earlier analysis from Seeb et al., 1977, identifies three distinct kokanee populations separated both by run timing and distribution within the basin. Clearly, the diversity is a reflection of the unique ecosystems in the different regions of the basin and the kokanee's natural selection within those ecosystems. Figure 1. The loss of the early run from Issaquah Creek, the largest tributary to Lake Sammamish, coupled with the loss of the mid-run from the Sammamish River tributaries such as Bear Creek, another major subbasin at the outflow of the Lake Sammamish system, represents a significant loss in diversity and resilience within the species. Indeed, it is only because of the unique diversity and distribution of the kokanee within Lake Sammamish, that they even exist today. Were it not for the late run populations limited to Lewis, Ebright, and Laughing Jacobs Creeks, Lake Sammamish would be devoid of the little red fish entirely. Observations of pre-spawning mortality Lewis and Ebright Creeks suggest additional reductions in productivity (Hans Berge, King County, unpublished data).

The remaining populations in Lewis, Laughing Jacobs and Ebright Creeks are at critically low numbers, increasing the risk of a genetic bottleneck, the loss of any one age class which reduces the spatial distribution and diversity, and all out extinction (*See also* Gustafson et al., 2007).

Although information about abundance, distribution, diversity and productivity information is limited, taken together the available information indicates that the Lake Sammamish kokanee DPS is at significant viability risk in all four parameters. Their ability to persist into the future is highly unlikely unless significant changes and protections are implemented immediately.

The Five Listing Factors:

Overutilization and other manmade factors affecting its existence

Kokanee were never a commercially viable species, however they are a very important sport fish, and their anadromous cousins, sockeye, are highly prized as a commercial fish (Kvam et al., 1999). In 1917, Lake Washington was permanently connected to Puget Sound which started an ongoing and successful effort to introduce sockeye into the system. In addition to enhancement using local kokanee, nonnative kokanee of Lake Whatcom origin were planted in the system for nearly forty years (Gustafson et al., 1997). Table 2. In addition to the millions of kokanee transplanted into the system, many native kokanee eggs were collected for transport outside the system (Berge and Higgins, 2003). As a result of the frequent movement of kokanee and the lack of concrete historical records of kokanee in all of the rivers, most people assumed that many of the kokanee runs were as a result of the introduced Lake Whatcom stock (Gustafson et al., 1997). However, the 2004 Young et al. genetic analysis failed to uncover any evidence of the Lake Whatcom kokanee in the current kokanee populations. Young et al., 2004, postulate that the Lake Whatcom stock is IHN free while Lake Sammamish is IHN positive, making any Lake Whatcom introductions unlikely to succeed.

Table 2: Releases of Sockeye and Kokanee in the Lake Sammamish Basin (Gustafson et al., 1997)

Sockeye

Release Site	Number	Year	Origin
Issaquah Creek	112,200	1957, 1961	Issaquah Creek
	1,629,059	1935-1944	Grandy Creek (Birdsview Hatchery)
	1,256,079	1947-1963	Issaquah Creek
	59,613	1950, 1954	Cultus Lake, B.C.
Bear Creek	576,000	1937	Grandy Creek (Birdsview Hatchery)
North Creek	23,655	1944	Cultus Lake, B.C.
Total	3,656,606		

Kokanee

Release Site	Number	Year	Origin
Lake Sammamish	5,812,153	1938-1951	Lake Washington/Sammamish
	3,448,184	1976-1979	Lake Whatcom
Issaquah Creek	6,077,000	1923-1938	Lake Washington/Sammamish
	2,963,110	1926-1978	Lake Whatcom
Other tributaries	860,000	1924-1925	Lake Washington/Sammamish
Bear Creek	35,077,293	1917-1969	Lake Whatcom
	9,118,368	1923-1939	Lake Washington/Sammamish
Little Bear Creek	1,225,719	1962-1969	Unknown
	483,720	1968-1969	Unknown
North Creek	912,200	1931-1937	Lake Washington/Sammamish
	371,240	1932-1969	Lake Whatcom
Swamp Creek	486,166	1933-1939	Lake Washington/Sammamish
	526,000	1968	Lake Whatcom

Despite the inability of the hatchery kokanee to get a foothold in the lake, their competition for spawning grounds, food resources, and rearing areas likely had an impact that continues today as a legacy effect. Notably, the study by Young et al., 2004, did not find any genetic introgression, but for the purposes of the middle-run kokanee instead found genetic superimposition – the introduced sockeye had completely replaced the native kokanee. While the introduced kokanee did not introgress with the native kokanee, the WDFW (then the Washington Department of Game) installed traps to collect migrating kokanee that resulted in nearly 36 million kokanee fry being outplanted across the state (Kvam et al., 1999). This removal of eggs and intentional prevention of spawning had a significant impact on abundance and productivity, further depressing the population. Sockeye themselves are also direct competitors with kokanee (Berge and Higgins, 2003). Both kokanee and sockeye fry feed on the lake's phytoplankton and zooplankton, namely copepods and cladocerans and sockeye attract predators that target kokanee once the sockeye have left the system. *Id.*

While not intuitive, the artificial production of Puget Sound chinook and coho at the Issaquah Hatchery is likely having a legacy impact and preventing the recovery of kokanee in Issaquah Creek.[6] When the hatchery was built in 1937, the weir forced the kokanee into the holding ponds and preventing them from reaching the 32 miles of spawning habitat above the barrier. Once it was determined that there was no use for the kokanee and the ponds could instead be used for more desirable commercial and sport fish, the hatchery literally drained the ponds with the kokanee and left them to die (Kvam et al. 1999; Buehler, 2000). Depending on what year this happened it could have decimated a strong year class of the early-run kokanee, constricting the ability of the population to recover, ultimately creating a legacy effect for the entire DPS. Further, the production of hatchery chinook and coho may have had interspecific interactions and impacts. Berge and Higgins, 2003, postulated that the chinook may have superimposed on the kokanee redds given the timing of their runs and could be currently having some predatory impacts in the lake– as could coho and sockeye. The operation of the weir and the current production of chinook and coho could limit the recovery of the early run kokanee. Other introduced and native species such as pikeminnow, cutthroat trout, bass, and yellow perch also predate on young kokanee in the lake (H. Berge, King County, unpublished data).

<u>Present and ongoing destruction, modification and curtailment of habitat</u>

Very little is understood about how changes in water quality or lake limnology are impacting the kokanee, but the extent of habitat alteration is significant. As part of the conversion of Lake Washington to a tributary of Puget Sound, there was a massive channelization of the Sammamish River for flood control. The result was a significant loss or compromise of the available habitat for kokanee (Kvam et al., 1999). The maintenance of this project has completely transformed the Sammamish River from a meandering marshland to a narrow, steep sided, reduced gradient, and frequently dredged channel. The past and continued alteration of this channel and on the banks also results in significant sedimentation that superimposes on redds, killing the eggs (Id.). The effects of these alterations are permanent. They have removed rearing ponds and slow moving slack water where the kokanee can find reprieve from predators. The straightening of the stream channel also increases the intensity of flooding and in turn, scouring of the redds and displacement of spawning adults (Berge and Higgins, 2003; Jackson, 2006).

The physical changes to the channels are only one factor in the current and ongoing destruction, modification and curtailment of kokanee habitat. Habitat use is also creating a significant impact. In the 1960's, Issaquah Creek, the largest tributary to Lake Sammamish, was contributing effluent from a wastewater treatment plant, a milk

[6] Chinook are not considered native to Issaquah Creek. The hatchery used Green River chinook, which are in the ESU but outside of the basin, until 1992 and since then have been utilizing returning Issaquah Hatchery Chinook as broodstock. (SSHAG, 2003).

processing plant, a hatchery and mining operations (King County, 2005). While an effort was made to reduce some of the effluent, the limnology of Lake Sammamish and increased urbanization over the same period, has limited the success of those efforts. *Id.* In other parts of the basin, urbanization from the cities of Bellevue, Issaquah, Redmond and Sammamish, as well as King County itself, have reduced the riparian vegetation to less than half its original cover, replacing it with impervious surfaces that increase flashy runoff, nonpoint source pollutants and temperature. *Id.* In addition, the actual pollutants studied are limited. Only recently are scientists looking to other non-traditional (i.e. not nitrogen or phosphorus) pollutants such as caffeine, estrogen mimickers, and other drugs that escape treatment at wastewater plants or are found in stormwater discharges (King County, 2007; Milstein, 2007). Many of the effects of these pollutants on kokanee and other salmonids are unknown, but may be especially pronounced in resident fish that are constantly exposed to the effects or rely on benthic food sources where the pollutants accumulate.

In addition to increasing stormwater inputs, urbanization increases water withdrawals, changing flows from both surface and groundwater sources. These inputs and withdrawals affect the overall water balance, as well as the intensity of any "surge" event (Figure 3) (King County, 2005). A large flood can result in a significant sediment and pollutant discharge event into the lake. For example, in December, 2004, residents report a large increase in turbidity in the headwaters of Lewis Creek resulting in an extensive investigation (Horner, 2005) that pointed out the frequency and magnitude of turbidity violations from urbanization. Many residents remember the historic rainfall events in 1990 on the rain soaked Lewis River that cascaded down the river to a constrained channel under I-90, resulting in extensive channel reformation and legacy impacts throughout the system. Indeed, the urban footprint around Lewis Creek has changed dramatically over the past decades, allowing for increased sediment pulses, in conjunction with and independent of rain events. Lewis Creek is not unusual in the basin for these impacts, but is unusual in that it has one of the last remaining spawning kokanee populations. As Berge and Higgins, 2003, point out, the simultaneous occurrence of high flood events and the spawning time of kokanee likely results in repeated assaults on the kokanee populations every winter. In the spring of 2007, Trout Unlimited conducted a fry trapping project on Lewis Creek and trapped over 2000 fry, demonstrating that some of the kokanee redds survived the scour from the November, 2006 flood events (Appendix A).

Figure 3: Lewis Creek. Photo courtesy of Save Lake Sammamish

King County's executive has acknowledged that the county's land use activities result in warmer temperatures, which lowers the dissolved oxygen, severely impacting the kokanee (Bennett, 2000). It is interesting to note that the last remaining habitat for kokanee also sees some of the biggest variations in temperature (King County, 2005). These variations only tell part of the story because they are averages. The daily swings in temperature may reach highs that create thermal barriers to kokanee that daily averages will not uncover. *Id.* The continued growth of the cities of Bellevue, Issaquah, Sammamish and Redmond, as well as King County, no doubt will put additional, compounding pressures on the remaining kokanee, and thus should be involved in a recovery strategy.

Roads are also very problematic for kokanee. Figure 1 represents the remaining accessible habitat. Notably, I-90 parallels over 13 miles of the southern end of Lake Sammamish (Modie, 2000) and East and West Sammamish Parkways parallel the east and west banks . The runoff from the highway and roads no doubt has a significant impact on water quality. More definitive is the effect of culverts on fish passage. The 1-90 culvert is a barrier to kokanee passage on Lewis Creek, leaving only 0.75 miles of spawning habitat for the fish (Jackson, 2006). On Issaquah Creek, the hatchery blocks 32 miles of potential kokanee spawning habitat (Berge and Higgins, 2003). On Ebright Creek, property owners blocked passage in 1973 because of foul odors, and although the weir was removed the same year, remnants of the weir may have blocked passage. *Id.* Additional low flows, created by urbanization, may also prevent migration upstream during the early, summer-run kokanee migration. Restoring kokanee to many of these tributaries will require a complete review of passage barriers along the lake.

<u>Lack of effective regulatory measures</u>

Kokanee in Lake Sammamish are regulated for natural production and limited harvest opportunities, however the lake itself is not regulated for natural production, hosting a wide variety of artificial production. These are the only affirmative, protective regulations for kokanee and do not address the factors limiting the survival and recovery of kokanee. Some tangential benefits from the Puget Sound chinook recovery plan (Shared Strategy) may carry over to kokanee, but as noted earlier streams such as Issaquah Creek that are critical for kokanee recovery are not considered historical habitat for chinook. In addition, kokanee have different habitat requirements at different life stages that are not addressed in the recovery plans.

The continued destruction, modification, and curtailment of its habitat, as well as other manmade factors are having a significant impact on the species and are not being regulated in a way that protects the species. For example, the lack of any affirmative action in response to the 2000 petition to list early run kokanee accelerated the extinction of that critical population component. As a result of the loss of both the early and middle runs, Lake Sammamish kokanee are disproportionately affected by any of the listing factors and no longer have the abundance, productivity, distribution and diversity to "spread the risk" in order to persist into the future. The kokanee are at a significant risk for a catastrophic loss.

There are significant data gaps for kokanee, such as direct productivity data, that preclude effective regulation. Monitoring and evaluation is happening in some key parameters, but an effective monitoring and evaluation program directed at kokanee specifically would significantly advance effective and targeted regulatory efforts. Thus, it is very clear that the species lacks effective regulatory measures to ensure its persistence into the foreseeable future.

One of the potentially largest future impacts to kokanee that lacks a regulatory regime is climate change. The impact of different climate scenarios on salmonids is an active area of scientific research, although the impact on kokanee has not been examined in detail (Mantua and Francis, 2004; Battin et al, 2007). In addition to increases in riverine and lake temperatures that may act as thermal barriers or fatal stressors, increased temperatures may alter chemical processes, food web dynamics, lake stratification and nutrient cycling. Increases in regional temperatures will also alter hydrological patterns such as increasing drought during the summer thereby reducing summer flows, increasing precipitation and intensity, resulting in scouring events, among other potential impacts. While the effects of climate change are harder to pinpoint, they are real, imminent and must be proactively addressed to ensure that kokanee survive into the future.

Protective efforts by Washington

The Endangered Species Act, section 4(b)(1)(A), 16 U.S.C. §1533(b)(1)(A), directs the Secretary of Interior to make a determination as to whether a species is threatened or endangered after conducting a status review based solely on the best scientific and commercial data, and after taking into account "*those efforts, if any, being made by any State or foreign nation, or any political subdivision of a State or foreign nation, to protect such species either by predator control, protection of habitat and food supply or other conservation practices*." Id. To guide this inquiry, FWS and NOAA Fisheries finalized the Policy for Evaluating Conservation Efforts (PECE) (68 Fed. Reg. 15100 (March 28, 2003)). The PECE policy uses15 guidelines to evaluate how formalized conservation efforts *that have yet to be implemented or show effectiveness* will contribute to the listing decision, with the intent of relying on those efforts to not list a species or list a species as threatened instead of endangered. Id. All that the State of Washington and King County have done is monitoring and evaluating the status and decline of Lake Sammamish kokanee. While these efforts will not in and of themselves lead to recovery, they do show that additional federal protection is required.

A notable decline in the early run kokanee in the 1980's lead King County to document the remaining abundance of kokanee through a status and sampling program for the early and late runs of kokanee (Berge and Higgins, 2003). The state stopped planting non-native kokanee in 1979 and now manages Lake Sammamish for natural production of kokanee. In 2000, Save Lake Sammamish, a local conservation group, petitioned FWS to list the early run kokanee as threatened under the ESA (Wright, 2000). FWS never issued a 90-day finding or took any other action on the petition, and no litigation was pursued. In the meantime, the early run kokanee were declared extinct by local biologists (Ervin and Welch, 2003). The petition to list summer run kokanee led to the development of the Sammamish Kokanee Technical Committee (Berge and Higgins, 2003). The committee oversaw the continued spawning surveys of the early run kokanee that ultimately documented the extinction of this run, and developed a supplementation plan for the early run kokanee. To start the supplementation program, WDFW installed a second weir on Issaquah Creek in 2001. However, no fish returned to this weir (Hunter, 2003). King County has also been developing hydrodynamic models for Lake Sammamish and its tributaries to identify water quality concerns, including the movement of pollutants through the system and how lake temperature patterns vary across depths and seasons. The evaluation of existing and potential water quality effects on salmonids in Lake Sammamish is an important contribution of these models to improving the health of kokanee, as they support a better understanding of what may be limiting kokanee survival and recovery.

In response to the decline in late-run kokanee, Washington Department of Fish and Wildlife has committed, as funding and staff resources allow, to monitor the spawning population in each of the three known streams, as well as hydrograph data (Jackson, 2006). While this information will help to refine future management options and creates the foundation for a recovery plan, it is not a robust enough approach to ensure the Lake Sammamish kokanee persist and recovery into the future. In addition, WDFW indicates that a new supplementation plan for late-run kokanee may be considered in the future (Pfeifer, 1999; Jackson, 2006). Currently this proposal is not certain to occur or benefit the species within the context of the PECE analysis. While a supplementation program may be necessary to bide time, it must be done in conjunction with a comprehensive program that addresses the primary limiting factors and factors for decline. In addition, it must address critical scientific reviews of captive broodstock and supplementation programs (Berejikian and Ford, 2003; ISAB, 2003; Hey, 2005; Oosterhaut et al., 2005).

The State, county and cities may rely on the recently adopted Shared Strategy for Puget Sound, a federally adopted recovery plan for threatened Puget Sound chinook. Indeed, there are many actions contemplated in that recovery plan that may also benefit kokanee, including the "wildcard" projects that were added specifically for their benefits to kokanee. However, the plan was not written or evaluated with kokanee in mind, and without a more complete understanding of the factors for decline and limiting factors for kokanee, it is impossible to determine that the actions under the Shared Strategy are sufficient for the recovery of kokanee.

It is fair to say that no proactive conservation measures have been officially considered or implemented to stop the decline. Many of the scientific reviewers have proposed further investigations and studies, but policy-makers have not made the next step of proposing changes to management actions. Therefore, there are no actions that fall under the FWS' PECE policy that can be relied on to preclude a listing of Lake Sammamish kokanee.

Conclusion

The petitioners do not request federal protection for Lake Sammamish kokanee lightly. Our intention in submitting this petition is to bring multiple jurisdictions together to seriously address needed management changes to improve the future for Lake Sammamish kokanee. The State and King County's efforts to date are necessary and commendable, but because of the multiple municipalities involved, those two jurisdictions can not recover kokanee by themselves. A listing of kokanee will force all jurisdictions to discuss and implement an integrated recovery plan. We believe that a listing through the ESA will open more opportunities for conservation incentives, such as tax credits recently proposed by Senator Crapo in Congress (SB 700). Any future recovery plan for kokanee can easily be wrapped into the Shared Strategy for Puget Sound with minimal additional burdens to the affected entities.

This petition identifies three unique populations of kokanee within Lake Sammamish that deserve protection as a singular distinct population segment under the Endangered Species Act. The petition lays out very troubling and threatening losses to the abundance, productivity, distribution and diversity to Lake Sammamish kokanee. In addition, it explores the five listing factors under the ESA and finds that at least three of the factors: habitat destruction, other manmade factors such as hatchery production, and the lack of protective regulatory measures, justify protecting Lake Sammamish kokanee under the Endangered Species Act.

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Appendix A

Lewis Creek Fry Collection data 2006 (Trout Unlimited, 2006):

Methodology

The trap was placed in Lewis Creek initially every night, fished for an hour and then raised out of the water to check the catch basin for fry. Debris was gently removed and the any fry were carefully netted out and placed into a 5 gallon bucket. The bucket was carefully dumped about 1/4 at a time into the white counting basin, where any fry were counted and then gently released downstream of the trap. The water temperature, in deg. Fahrenheit, was taken after the trap was initially placed in the stream. The trap was operated the first 2-3 hours of darkness with expanded hours on 3 occasions to check later out migration. Sampling was reduced to 3 nights a week as the project went on to more closely follow WDFW procedures and spare the volunteers.

Results

Date	Time in	Time Out	Kokanee Fry	Dead	Other	#	H2O Temp (F)	Flow	Hours
03/03/07	15:30	20:00	0	0	Sculpin	2	43	Med/Clear	30
					Cutthroat	1			
03/04/07	16:00	20:00	0	0	Sculpin	1	42	Med/Clear	30
03/05/07	18:05	21:00	0	0	Sculpin	5	48	Med/Clear	12
03/06/07	18:00	19:00	0	0	Sculpin	9	47	Med/Clear	12
	19:05	20:00	1	0		0			
	20:05	21:00	0	0		0			
03/07/07	18:00	21:00	0	0		0	47	Med/Clear	12
03/08/07	18:30	21:00	0	0	Sculpin	2	48	Med/Muddy	12
03/09/07	18:15	19:00	0	0		0	51	Med/Clear	3
03/10/07	18:15	21:00	0	0	Sculpin	2	50	Med-Fast/Clear	12
03/11/07	18:05	21:00	0	0	Sculpin	1	52	Med-Fast/Clear	12
					Cutthroat	2	(1-14")		
03/12/07	18:15	21:00	0	0	Sculpin	1	48	Med-Fast/Cloudy	11
03/13/07	18:15	21:00	0	0	0	0	48	Med/Clear	11
03/14/07	18:15	21:00	0	0	0	0	46	Med/Clear	11
03/15/07	18:10	21:00	0	0	Cutthroat	1	47	Low/Clear	11
03/16/07	18:20	20:30	0	0	Cutthroat	1	51	Low/Cloudy	12
	20:35	21:00	1	0	Sculpin	1			
03/17/07	18:00	20:50	0	0	0	0	No Data	Fast/Muddy	12
03/18/07	18:30	23:00	0	0	0	0	48	Med-Fast/Clear	17
03/19/07	18:00	20:00	0	0	0	0	No Data	Med-Fast/Cloudy	12
	20:00	21:00	1	0	0	0			
		Totals	**3**	**0**	**0**	**29**			
03/20/07	18:00	20:30	0	0	0	0	No Data	Med-Fast/Cloudy	12

	20:35	21:00	1	0	Sculpin	1	Rain and a lot of Debris		
		Totals	**1**	**0**	**0**	**1**			
03/22/07	19:30	20:31	0	0	0	0	50	Med-Fast/Cloudy	6
	20:38	21:05	2	0	0	0			
		Totals	**2**	**0**	**0**	**0**			
03/23/07	19:15	20:30	0	0	0	0	49	Med/Clear	15
	20:40	21:05	1	0	0	0			
	21:10	22:40	5	0	0	0			
	23:00	23:30	5	1	0	0			
		Totals	**11**	**1**	**0**	**0**			
03/28/07	20:15	20:40	2	0	Sculpin	4	48	Med-Fast/Clear	11
	20:45	21:10	5	0	Sculpin	1			
	21:15	22:00	4	0	Sculpin	1			
	22:05	22:30	2	0	0	0			
	22:35	23:00	2	0	0	0			
		Totals	**15**	**0**	**0**	**6**			
03/30/07	20:00	20:30	1	0	0	0	49	Low/Clear	11
	20:30	21:00	11	0	0	0			
	21:05	21:30	1	0	Sculpin	1			
	21:35	22:00	1	0	Sculpin	1			
	22:05	22:30	6	0	Tadpole	2			
		Totals	**20**	**0**	**0**	**4**			
04/01/07	20:00	20:40	0	0	0	0	46	Low/Clear	13
	20:45	21:05	7	0	Cutthroat	1	12"		
	21:10	22:07	5	1	0	0			
	22:18	23:30	0	0	0	0			
		Totals	**12**	**1**	**0**	**1**			
04/04/07	20:25	20:45	1	0	Lamprey	1	No Data	Low/Clear	8
	20:50	21:30	0	0	0				
	21:40	22:10	4	0	0	0			
	22:15	23:00	2	0	0	0			
		Totals	**7**	**0**	**0**	**1**			
04/06/07	20:10	20:35	2	0	0	0	No Data	Low/Clear	13
	20:45	21:05	5	0	0	0			
	21:10	21:45	21	0	0	0			
	21:45	22:15	8	1	0	0			
	22:20	22:50	2	0	0	0			
	22:55	23:25	5	0	Sculpin	1			
	23:25	23:55	7	0	0	0			
		Totals	**50**	**1**	**0**	**1**			
04/08/07	20:05	20:30	2	0	Sculpin	2	49	Low/Clear	11
	20:35	21:00	20	0	0	0			
	21:20	21:45	4	0	0	0			
	21:48	22:13	15	0	0	0			
	22:17	22:55	9	1	0	0			
		Totals	**50**	**1**	**0**	**2**			
04/11/07	20:52	21:22	27	1	0	0	45	Low/Clear	6
	21:30	22:01	14	0	0	0			
	22:07	22:43	10	1	Crayfish	1			

		Totals	**51**	**2**	**0**	**1**			
04/13/07	20:10	20:40	9	0	0	0	46	Low/Clear	9
	20:50	21:15	17	0	Sculpin	2			
	21:30	21:50	11	0	0	0			
	22:00	22:25	0	0	0	0			
	22:35	23:00	3	0	Sculpin	1			
		Totals	**40**	**0**	**0**	**3**			
04/15/07	21:05	21:31	12	0	0	0	44	Low/Clear	6
	21:40	22:10	15	0	0	0			
	22:15	22:50	3	1					
		Totals	**30**	**1**					
04/18/07	21:00	21:30	7	0	0	0	44	Low/Clear	11
	21:42	22:12	6	0	0	0			
	22:23	22:50	1	0	0	0			
		Totals	**14**	**0**					
04/20/07	20:30	20:50	0	0	0	0	44	Low/Clear	9
	20:50	21:20	1	0	0	0			
	21:22	21:50	18	0	0	0			
	22:11	22:45	20	0	0	0			
		Totals	**39**	**0**					
04/22/07	21:07	21:40	28	0	0	0	46	Low/Clear	9
	21:47	22:10	36	3	0	0			
	22:29	22:53	16	0	0	0			
		Totals	**80**	**3**					
04/25/07	21:00	21:30	49	0	0	0	46	Low/Clear	9
	21:40	22:10	33	1	0	0			
	22:20	22:50	15	0	0	0			
	23:00	23:29	8	0	0	0			
	23:34	23:59	5	0	0	0			
		Totals	**110**	**1**					
04/27/07	20:45	21:15	13	0	0	0	48	Low/Clear	18
	21:23	21:55	41	0	0	0			
	22:04	22:40	16	0	0	0			
	22:45	23:15	4	0	0	0			
	23:20	6:00	60						
		Totals	**134**	**0**					
04/29/07	21:05	21:35	49	1	0	0	48	Low/Clear	18
	21:42	22:12	58	2	0	0			
	22:20	22:50	48	0	0	0			
	23:00	23:55	61	0	0	0			
		Totals	**216**	**3**					
05/02/07	21:00	21:30	124	0	Sculpin/Eel	1/1	46	med/cloudy	10
	21:50	22:35	130	4	0	0			
	22:40	23:15	47	4	Sculpin	1			
		Totals	**301**	**8**					
05/04/07	20:55	21:30	42	1	0	0	48	Low/Clear	10
	21:40	22:10	82	4	0	0			
	22:30	23:21	55	5	0	0			
		Totals	**179**	**10**					
05/06/07	20:50	21:25	74	4	0	0	49	Low/Clear	14

	21:35	22:10	62	3	0	0			
	22:20	22:55	34	2	0	0			
	23:10	23:40	18	1	0	0			
	23:55	5:00	66	4	0	0			
		Totals	**254**	**14**					
05/09/07	21:35	22:05	51	1	Sculpin	1	49	Low/Clear	9
	22:15	23:15	50	0	Sculpin/Eel	1/3	lots of eggs		
		Totals	**101**	**1**					
05/11/07	21:05	21:40	34	2	0	0	48	Low/Clear	10
	21:50	22:25	78	0	0	0			
	22:35	23:02	83	0	0	0			
		Totals	**195**	**2**					
05/13/07	20:30	22:00	5	0	0	0	48	Low/Clear	3
	22:10	22:40	3	0	0	0			
	22:45	23:20	3	0	0	0			
		Totals	**11**	**0**					
05/16/07	21:05	22:00	111	0	0	0	50	Low/Clear	6
	22:10	22:45	83	0	Cutthroat	1			
		Totals	**194**	**0**					
05/18/07	21:00	22:00	52	0	0	0	50	Low/Clear	4
	22:10	23:00	58	2	Eel	1			
		Totals	**110**						
05/20/07	21:00	21:15	2	1	0	0	46	High/Muddy	3
		Totals	**2**	**1**			**Water too high to fish**		
05/23/07	20:45	**21:40**	0	0			50	Med/Clear	5
			Kok Fry	**Dead**					**Hours**
	Totals to Date		2232	50					501