Law Office of David H. Becker, LLC
917 SW Oak Street, Suite 409
Portland, OR 97205
Tel. (503) 525-0193
davebeckerlaw@gmail.com

April 13, 2011

VIA U.S. CERTIFIED MAIL, RETURN RECEIPT REQUESTED

Secretary Gary Locke
U.S. Department of Commerce
1401 Constitution Avenue, NW
Washington, DC 20230

William W. Stelle, Jr, Regional Administrator
National Marine Fisheries Service
Northwest Region
7600 Sand Point Way N.E., Bldg. 1
Seattle, WA 98115-0070

Scott Patterson, Fish Propagation Program Manager
Oregon Department of Fish and Wildlife
3406 Cherry Avenue NE
Salem, OR 97303

Todd Alsbury, District Fisheries Biologist
Oregon Department of Fish and Wildlife
17330 SE Evelyn Street
Clackamas, OR 97303

Ken Bourne, Hatchery Manger
Oregon Department of Fish and Wildlife
39800 SE Fish Hatchery Road
Sandy, OR 97055

Bruce McIntosh, Assistant Fish Division Administrator
3406 Cherry Avenue NE
Salem, OR 97303

Ed Bowles, Fish Division Director
Oregon Department of Fish and Wildlife
3406 Cherry Avenue NE
Salem, OR 97303

RE: 60-Day Notice Pursuant to 16 U.S.C. § 1540(g) of Violations of the Endangered Species Act and National Environmental Policy Act in Funding and Operation of Sandy Hatchery and of Intent to File Suit.

Dear Secretary Locke, Regional Administrator Stelle, Mr. Patterson, Mr. Alsbury, Mr. Bourne, Mr. McIntosh, and Director Bowles:

On behalf of the Native Fish Society and Pacific Rivers Council we write to provide you notice, pursuant to 16 U.S.C § 1540(g), of the intent to sue the National Marine Fisheries Service (NMFS), the Oregon Department of Wildlife (ODFW), and officials of the ODFW in their official capacities for violations of Endangered Species Act (ESA) and National Environmental Policy Act (NEPA) in the funding and operation of the Sandy Hatchery and in undertaking related activities in the Sandy River Basin. The individuals and members of the organizations providing this notice use the streams and natural resources affected by the Sandy Hatchery and have a long-standing interest in the preservation of wild fish stocks in the Sandy River Basin. The actions of the federal and state agencies and officials named in this notice have harmed and will continue to harm these interests in preservation of wild fish stocks and in the survival and recovery of the critically imperiled salmonid species which inhabit the Basin.

I. THE SANDY RIVER BASIN AND ESA PROTECTED SALMONIDS.

The Sandy River Basin[1] is one of the Northwest's last best places for salmon. Indeed, salmon and steelhead in the basin identified by both Oregon and Washington as a primary populations for the recovery of the Lower Columbia River coho and chinook and the Lower Columbia River steelhead.[2] Historically, runs of native fish to the Sandy River Basin ranged as high as 15,000 coho, 20,000 winter steelhead, 10,000 fall chinook and 8,000 to 10,000 spring chinook.[3] However, despite the fact that two 100 year-old dams have been removed, opening up 30 miles of the watershed, and nearly $100 million is being invested in habitat improvements by many parties, and the other protections afforded the area,[4] Chinook, coho and steelhead populations continue to decline.

In 1998–1999, and again in 2005–2006, NMFS designated Lower Columbia River Chinook, Coho and Chum Evolutionarily Significant Unit (ESUs) and the Lower Columbia River Steelhead Distinct Population Segment (DPS)[5] as threatened with extinction under the Endangered Species Act.[6]

Many streams in the Sandy River Basin (including the Sandy River, Salmon River, Zigzag River, and Still Creek) have been designated as critical habitat for Lower Columbia River chinook and/or steelhead. These streams currently are being evaluated for potential designation as critical habitat for Lower Columbia River coho.

---

[1] Defined as the Sandy River and its tributaries that originate high on the west and south slopes of Mount Hood, flow approximately 55 miles in a northwesterly direction and enter the Columbia River near Troutdale (Columbia RM 120.5). OAR 635-500-3400.

[2] *See, e.g.*, Oregon Dep't of Fish & Wildlife, Lower Columbia River Salmon and Steelhead Conservation and Recovery Plan (2010).

[3] Barbara Taylor, *Salmon and Steelhead Runs and Related Events of the Sandy River Basin – A Historical Perspective*, December 1998, at 1.

[4] The watershed above the former Marmot Dam site has been designated as a Wild Fish Sanctuary. *See, e.g.*, Oregon Dep't of Fish & Wildlife, Draft Habitat and Genetic Management Plan, Sandy River Winter Steelhead Program (March 2002), Appendix B (Wild fish sanctuary above Marmot Dam: Policies, Objectives and Assumption).

[5] The Endangered Species Act allows for the listing of species, subspecies, or distinct population segments as threatened or endangered. 16 U.S.C. §§ 1532(16), 1533. Evolutionarily Significant Units are the National Marine Fisheries Services' construct of "distinct population segments" and used exclusively for salmonids. Policy on Applying the Definition of Species Under the Endangered Species Act to Pacific Salmon, 56 Fed. Reg. 58,612 (Nov. 20, 1991).

[6] *See* 63 Fed. Reg. 13,347 (March 19, 1998); 64 Fed. Reg. 14,308 (March 24, 1999); 70 Fed. Reg. 37,160 (June 28, 2005);71 Fed. Reg. 834 (January 5, 2006).

The system in the Sandy River Basin involved a three dam complex – the Bull Run Dam, owned by the City of Portland, and the Little Sandy and Marmot Dams, owned by Portland General Electric (PGE). Through the FERC relicensing-turned-surrender process for the Little Sandy and Marmot Dams, multiple parties reached a settlement agreement, in 2002, that successfully removed the two dams by 2008. As part of that process, stakeholders agreed to certain hatchery operations and changes that have not occurred. These changes were written into the Oregon Administrative Rules that were supposed to protect and recover imperiled fish species. However, those rules have been diluted three times in the last 15 years in response to Oregon's inability to meet the goals. Indeed, the dam removal was delayed to allow more time for ODFW to implement changes in hatchery rearing and release strategies.[7]

Also in 2008, the City of Portland finalized a habitat conservation plan (HCP) that was approved by NMFS. The HCP includes over 100 measures and a dedication of $93 million to improve habitat and watershed conditions as mitigation for the impacts caused by the impoundment of the City of Portland's drinking water supply in the Bull Run tributary of the Sandy River.[8]

While FERC and the HCP addressed the dams and major habitat elements, ODFW addressed the fish management – harvest and hatchery issues – through targets set in the Oregon Administrative Rules and through annual Hatchery Operations Plans. For example, the OAR numerical targets for wild steelhead escapement and minimization of hatchery fish straying into wild fish habitat were intended as minimum thresholds and added triggers for more protective measures to insure protection and recovery of the species. Over the past decade, the rates of wild steelhead escapement and hatchery strays[9] have dramatically missed these targets, yet hatchery operations have proceeded without significant change.

The 1998 OARs, 635-500-3430(2), reflecting the original 1997 agreement between stakeholders and ODFW, initially set targets on Sandy River wild steelhead as:

(a) Rebuild the native wild winter steelhead run in the Sandy River basin by achieving an average annual spawning escapement of 4,900 adult winter steelhead at Marmot Dam: the short-term goal is to achieve an escapement of 4,900 wild adults during the months November to June and the long-term goal is to achieve an average annual spawning escapement of 4,900 that conforms to the historical run time of March to June; …

---

[7] Bull Run Hydroelectric Project FERC No. 477, Joint Explanatory Statement and Request for Approval of Decommissioning Settlement Agreement 9–10 (Nov. 12, 2002).

[8] City of Portland, Water Bureau. Bull Run Water Supply Habitat Conservation Plan. Sept. 2008. Portland, Oregon.

[9] A "stray" is "a hatchery fish that spawns naturally in a location different from the location intended when the fish was stocked." OAR 635-007-0501(63).

(e) Modify or discontinue hatchery steelhead releases in the Sandy River basin if:

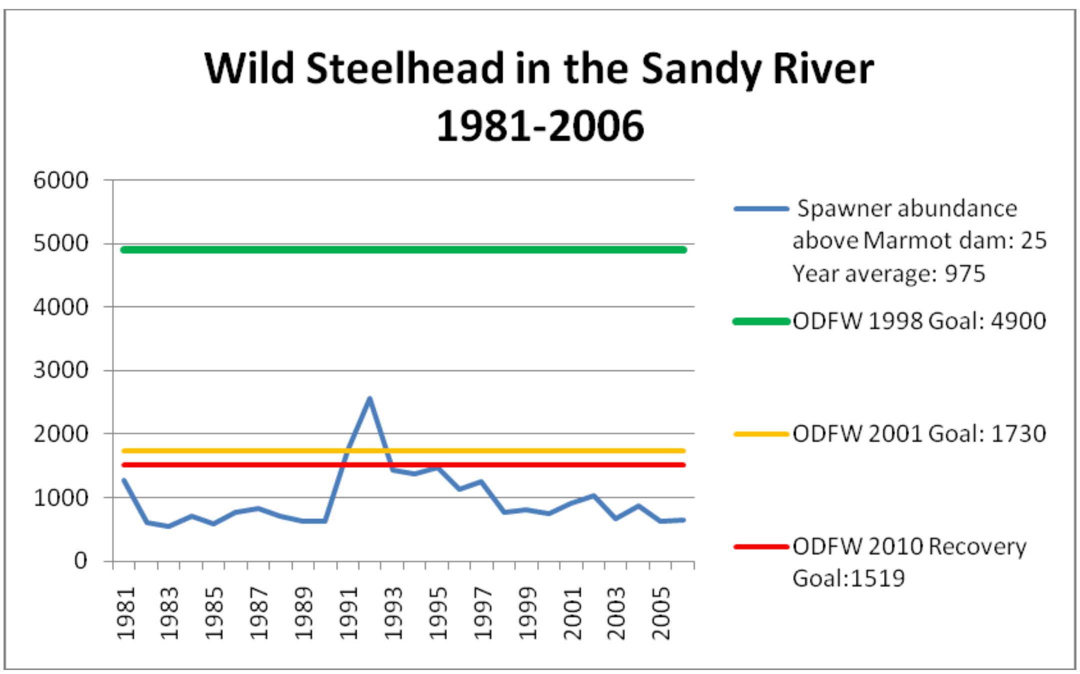
(A) It is determined that hatchery steelhead releases are principal causes of significant decline in wild winter steelhead abundance; or

(B) If Sandy River basin winter steelhead are listed as Threatened or Endangered under the federal Endangered Species Act.

In 1999, Lower Columbia River steelhead *were* listed as threatened under the ESA. ODFW realized it would not be able to meet the goals set in the earlier rule, and by 2001 had revised the plan. Among the provisions of the revised plan were "Policies" that "[t]he Sandy River basin shall be managed for both wild and hatchery produced winter steelhead" and that "[t]he upper Sandy basin will be managed to limit hatchery winter steelhead stray rates to less than 10% in the upper basin, and no greater than 30% for the basin as an aggregate." OAR 635-500-3420(1)(a)-(b). The revised plan lowered the recovery threshold for steelhead by including among its "Objectives" to:

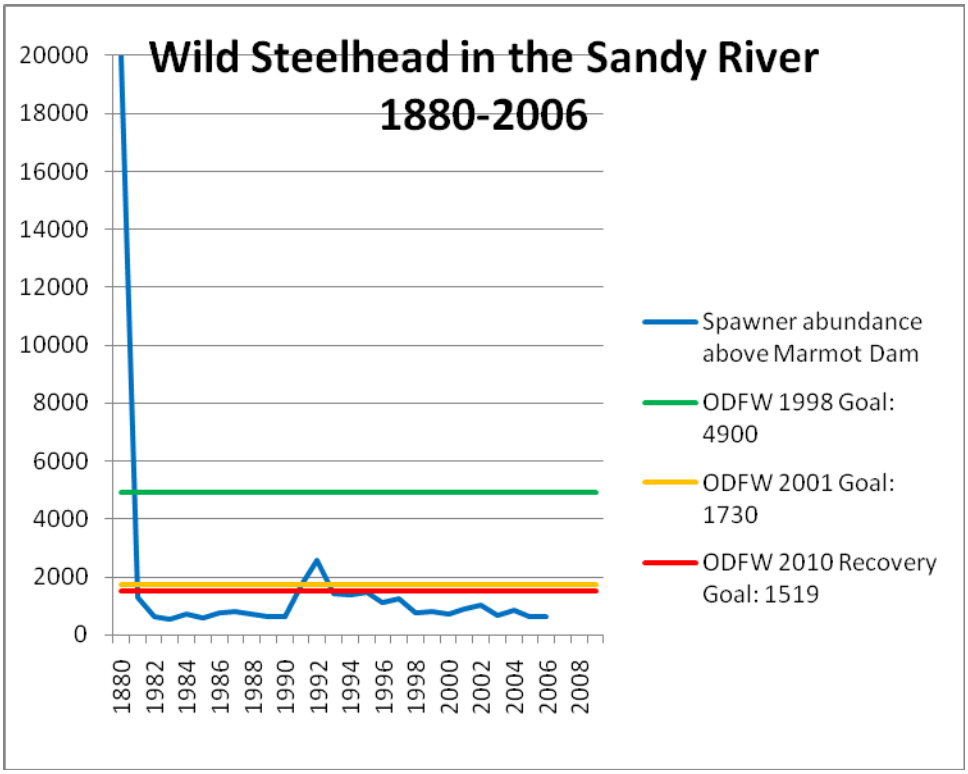
(a) Rebuild the wild winter steelhead runs in the Sandy River basin by achieving an average annual spawning escapement of 1,730 wild winter steelhead. Establish an increasing trend in the population of Sandy River wild winter steelhead.

Id. (2)(a). As demonstrated in the graph below, even this revised, significantly lower goal (shown as the "ODFW 2001 Goal") has proved unattainable.



Source: Oregon Administrative Rules; Lower Columbia River Salmon and Steelhead Conservation and Recovery Plan.

The current average abundance of wild steelhead, and ODFW's ever-shrinking goals, are also dramatically lower than the species's historical native population of 20,000 spawners in the Sandy River Basin, documenting a wild population in inexorable decline towards extinction:



Source: Oregon Administrative Rules; Lower Columbia River Salmon and Steelhead Conservation and Recovery Plan.

By 2002 the hatchery operations for steelhead had changed to incorporate wild, native steelhead into the broodstock, but the hatchery operations continued. In 2005, ODFW set out to write the Lower Columbia River Salmon and Steelhead Conservation and Recovery Plan, which the agency adopted in 2010. The 2010 Recovery Plan demonstrates that the hatchery operations are preventing these species from recovering because the current management approach will not achieve even the 2001 targets without changes to the hatchery and harvest management. Instead, the goals were again arbitrarily reduced to avoid changes to hatchery and harvest management. But the Recovery Plan also shows that changes in the hatchery operations, harvest management and improvements in habitat, when combined, could meet or exceed the original escapement goals that the stakeholders agreed to in 1997. While the removal of the Marmot and Little Sandy River dams will provide huge restoration potential for the listed species, appropriate and legally overdue changes must be made to the hatchery program to comply with the requirements of the ESA and NEPA.

II. HATCHERY IMPACTS TO WILD SALMON AND STEELHEAD SURVIVAL AND RECOVERY

The history of salmon hatcheries is nearly as old as that of Oregon itself. The first hatchery on the Sandy River came into operation in the late 1800s. Hatchery development in the Columbia Basin accelerated after passage of the Mitchell Act in 1938, which conceived of hatcheries as mitigation for habitat destruction caused by hydropower dams and other human factors. Hatcheries promised initially to increase fish populations to higher-than-natural levels. Then, as habitat degradation increased, hatcheries promised to substitute artificial propagation for healthy habitat to prevent declines in fish population. Hatcheries consistently have failed to duplicate the productivity of natural systems, and have become silent partners in the elimination of salmonid habitat by facilitating development within the Columbia Basin based on the false promise that hatcheries could substitute for healthy wild fish runs.

Hatchery production is one of the greatest threats to these populations of chum, coho, steelhead and chinook. In the Sandy River Basin, the Sandy Hatchery inhibits the ability of these stocks to recover – by the direct "take" of wild fish for use as breeding pairs for hatchery stocks, by the production of hatchery fish which compete for resources against the wild stocks, and by the uncontrolled straying of hatchery fish that reduce the productivity and survival of wild fish when the stray hatchery fish interbreed with wild salmon and steelhead, resulting in harm to wild fish and to each of the species' populations in the Sandy River Basin from habitat modification (including interspecies and intraspecies competition for food, interspecies and intraspecies predation, and negative impacts from genetic influence of hatchery fish).

NMFS and ODFW are directly taking wild steelhead, chinook and coho at the Sandy Hatchery. ODFW's trapping and collection of wild steelhead, chinook, and coho in conjunction with the Sandy Hatchery operations during 2009, 2010 and 2011 constituted take of listed species without incidental take protection under the ESA. NFMS funded this take. For example, the annual Fish Propagation Report[10] from 2009 identifies that the Sandy Hatchery harvested 75 wild spring chinook and spawned 59 of them (at the Clackamas Hatchery). The report also indicates that the Sandy Hatchery collected 36 wild winter steelhead some of which were released into the river after spawning even though they could no longer produce offspring. These ESA-protected chinook and steelhead were prevented from spawning in the wild.

Take of listed species at the Sandy Hatchery is ongoing and likely to recur: the 2011 Hatchery Operations Plan (HOP)[11] describes the intent to continue to collect natural, threatened steelhead and spring Chinook to supplement the hatchery broodstock and harm and harass these species and natural coho without incidental take protection under the ESA.

[10] http://www.dfw.state.or.us/fish/hatchery/docs/2009%20Fish%20Propagation%20Annual%20Report.pdf.

[11] http://www.dfw.state.or.us/fish/HOP/Sandy%20HOP.pdf.

In addition to this direct take of ESA threatened coho, steelhead and chinook by hatchery operations, the overwhelming weight of scientific evidence shows that hatchery-bred fish cause indirect take by harming wild fish and degrading their habitat, preventing their survival and recovery and that of the species as a whole. A few recent examples of this scientific evidence are described herein, and Attachment A lists a collection of over 70 years of studies that document the harmful impact of hatchery fish on wild fish.

For example, in the Hood River basin, a river not unlike the Sandy River and where the Powerdale Dam is scheduled for removal in 2010, researchers from Oregon State University have studied every steelhead (hatchery-bred or wild), that passed that dam since 1992.[12] Their seminal papers showed that when hatchery origin steelhead are allowed to reproduce in the wild, the offspring were 40% less likely to survive than if those fish had both been wild origin. Furthermore, when the offspring of those fish were then allowed to reproduce with additional hatchery-origin fish, the survival rate of the offspring (the "grand-salmon" of the original pairs) were further reduced by 63% if the parents were both offspring of hatchery-bred fish, and 13% less if one parent was the offspring of a hatchery fish. If the population had been all wild fish, it would have been 8% higher.[13] Simply put, allowing wild fish with hatchery fish to intermingle and breed prevents the survival and recovery of steelhead, chinook, coho and chum in the Sandy River Basin. The authors conclude, "the message should be clear: captive breeding for reintroduction or supplementation can have a serious, long-term downside in some taxa and so should not be considered a panacea for the recovery of all endangered populations."

The Sandy Hatchery releases millions of smolts every year and, with the exception of spring Chinook surveys completed in 2008-2010 that show significant, unintended hatchery fish spawning with wild fish in the upper Sandy River Wild Fish Sanctuary,[14] there are no data on the stray rates of steelhead and coho after Marmot Dam removal.[15] In the Sandy River, it is not known how many hatchery steelhead are allowed to interbreed with wild steelhead. What is known is that there was approximately a 10% stray rate of hatchery steelhead upstream of the Marmot dam when the dam was in place. That means that, of the steelhead counted at the dam, at least 10% were of hatchery origin, despite the expectation that these fish should have returned to the hatchery itself (hence they "strayed"). NMFS and ODFW do not know how many hatchery-bred fish

[12] Araki, H., Cooper, B., Blouin, M.S. 2007a. Genetic Effects of Captive Breeding Cause a Rapid, Cumulative Fitness Decline in the Wild. 2007. Science 318: 100-103. doi: 10.1126/science.1145621; Araki, H., Berejikian, B.A., Ford, MJ., and Blouin, M.S. 2008. Fitness of hatchery-reared salmonids fish in th wild. Evol. Appl., 1(2): 342-355. doi:10.1111/j.1752-4571.2008.000026x.

[13] Araki, H., Cooper, B., and Blouin, M.S. 2009. Carry-over effect of captive breeding reduces reproductive fitness of wild-born descendants in the wild. Biological Letters. doi: 10.1098/rsbl.2009.0315.

[14] U.S. Forest Service, personal communication, Sandy Basin Partners meeting. 2011. *See* attached table of results in Attachment B.

[15] Sandy Hatchery Operations Plan 2011.

were allowed to interbreed with wild steelhead below the dam. However, even ODFW acknowledges that only 30% of the steelhead spawning grounds lie above the dam site, and the remaining 70% of spawning habitat exists below the dam site—where it is completely unknown how many hatchery fish are interbreeding with wild spawning steelhead.[16]

Within the Sandy River Basin, the stray rates of spring chinook are much more sobering. Data from the U.S. Forest Service's spawning surveys and from ODFW's own researchers, shows significant stray rates of hatchery spring chinook into the upper basin wild salmon sanctuary, in some cases as high as 100%. *See* Attachment C. A recent study by researchers at NMFS and ODFW has demonstrated that it does not matter what the species, the hatchery breeding strategy, hatchery operations or condition of the receiving stream, the presence of hatchery releases results in a strong decline of wild steelhead or salmon.[17] Thus, a stray rate of 75-100% hatchery spring chinook harms wild spring chinook and is likely to result in the inability of wild spring chinook to survive and recover in the Sandy River and throughout the entire Lower Columbia River. At least one court has deemed the negative impact of hatchery fish on natural populations to be "undisputed." *Cal. State Grange v. NMFS*, 620 F. Supp. 2d 1111, 1157–60 (E.D. Cal. 2008).

Even if the protected wild fish were permitted to spawn naturally with other wild fish, the offspring would still be impacted by the presence of hatchery fish, including fish of other species. In the Clackamas River, a paper by ODFW researcher Katherine Kostow and colleagues[18] found that the impact of summer steelhead releases on the survival of wild, protected winter steelhead was so significant that the agency ceased hatchery releases of summer steelhead. In the Sandy River, the hatchery releases 80,000 non-native summer steelhead smolts every year. As a result of the Marmot Dam removal, ODFW had committed to reevaluating this program to assess both its impact and the determination of whether summer steelhead used to be native in the Sandy.[19] Neither of those projects has started. In the meantime, and despite any results that might come of the project, the summer steelhead program is impacting the survival and recovery of the wild winter steelhead population and the threatened species as a whole, and is operating

[16]Todd Alsbury, ODFW, 2010, personal communication.

[17] Chilcote, M.W., Goodson, K.W., and Falcy, M.R. 2011. Reduced recruit performance in natural populations of anadromous salmonids associated with hatchery-reared fish. Can. J. Fish. Aquat. Sci. 68: 511-522. doi:10.1139/F10-168.

[18] Kostow, K., Marshall, A., and Phelps, S. 2003. Naturally spawning hatchery steelhead contribute to smolt production but experience low reproductive success. Trans. Am. Fish. Soc. 132:780-790.

[19] The 2010 Lower Columbia River Salmon and Steelhead Conservation and Recovery Plan calls for the continued operation of hatcheries on top of a chum reintroduction and recovery strategy even though it is well documented that those hatchery fish prey on juvenile chum in the lower Sandy River and Columbia River estuary. *See* Lower Columbia River Salmon and Steelhead Conservation and Recovery Plan at 225, 292, 332, Appendix I.

without any incidental take approvals under the ESA, despite NMFS's continued funding of the program through the Mitchell Act.

Another example of cross-species impacts is the overcrowding hatchery fish cause to wild fish in the estuary. When juvenile salmon migrate towards the ocean they need critical areas to rest and feed along the way. A paper published by ODFW on the Alsea River found that competition in the estuary significantly reduced the survivability of wild coho in the river.[20] The Sandy River is a primary coho stream. Even if all the hatchery-reared coho at the hatchery are released in the Columbia River in the estuary, those hatchery-bred coho, and the other hatchery fish released in the Sandy River, are impacting the survival and recovery of the almost 1,000 wild coho returning annually on average to the Sandy River. Within the Sandy River itself, there are over 1,000,000 hatchery smolts released from all species combined.[21]

Beyond the Sandy River, the Biological Opinion on the Federal Columbia River Power System sets a target of a 20% survival improvement in the estuary, which is based on the draft NMFS Estuary recovery plan (Estuary Module).[22] These targets are impossible to meet given the current production of the Sandy hatchery among others, and the well-established science on the effects those hatchery fish have on wild salmon and steelhead in the estuary.

The wild populations in the Sandy River are significantly stressed. Wild spring chinook, which once averaged between 10,000 and 25,000 spawners, now average 1,200. Wild winter steelhead averaged between 12,000 and 20,000 spawners but now only average 975 spawners. Finally, wild coho ranged from 15,000 to 20,000 adults but now average just 860 spawners. The 2010 Lower Columbia River Salmon and Steelhead Conservation and Recovery Plan identifies habitat and habitat among the major factors inhibiting the survival and recovery of the species. Historic efforts have been made to restore the habitat but no efforts have been made to evaluate properly the hatchery effects.

III. VIOLATIONS OF LAW IN FUNDING AND OPERATION OF THE SANDY HATCHERY AND IN THE SANDY RIVER BASIN.

A. The Sandy Hatchery and the Mitchell Act.

The current Sandy Hatchery was built in 1951 as a state funded facility. Currently, it is funded primarily by annual funding from NMFS out of federal Mitchell Act appropriations, by state general funds, and by the City of Portland as mitigation for the

---

[20] Nickelson, T. 2003. The influence of hatchery coho (onchorynchus kisutch) on the productivity of wild coho salmon populations in Oregon coastal basins. Can. J. Fish. Aquat. Sci. 60(9): 1050-1056. doi:10.1139/f03-091.

[21] Sandy Hatchery Operations Plan 2011.

[22] National Marine Fisheries Service, Columbia River Estuary Endangered Species Act Recovery Plan Module for Salmon and Steelhead, at 5-35 (Feb. 14, 2011).

Bull Run project. In some years, NMFS provides all funding for the Hatchery. For example, in Fiscal Years 2000, 2005 and 2010, NMFS provided 100% of the Hatchery's annual budget.

The Mitchell Act was enacted in 1938 to provide for the "conservation of fishery resources" of the Columbia River system.[23] The Act authorizes and directs the Secretary of the Interior broadly to "direct and facilitate conservation of the fishery resources." As part of its conservation efforts, the Act currently authorizes funding of 18 hatcheries in the Columbia River basin—including the Sandy Hatchery. The Act was intended to compensate for the progressive decline of salmon in the Columbia River Basin caused by destruction of favorable environmental conditions by hydroelectric development, water diversions, deforestation and pollution. Congress annually appropriates a lump-sum of funds to NMFS to use for Mitchell Act-related activities. NMFS in turn makes decisions to fund specific hatchery operations and other operation and/or construction of in-stream barriers to fish migration, fish passage structures, or other in-stream or near-stream structures that are likely to adversely affect listed fish, such as weirs, fish passage facilities and structures, and other fish management and propagation facilities.

In the Sandy River Basin, chinook, winter steelhead, chum and coho are all listed as threatened species under the ESA.[24] With application of the ESA to these populations, substantial changes are required of the Mitchell Act Program and NMFS funding of state hatchery operations. Not only must the Mitchell Act system undergo comprehensive NEPA review, including site-specific review of individual hatchery operations, but all NMFS funding of hatchery programs—current operations and in-stream or near-stream construction activities using federal funds—that may affect ESA protected populations must be evaluated for compliance with the Endangered Species Act. NMFS funding of the Sandy Hatchery has been and is currently operating without any NEPA review or ESA authorization.

Currently, the physical presence of the Sandy Hatchery, and the production levels and management practices at the Sandy Hatchery are adversely impacting the natural populations in a manner that constitutes an unlawful taking under the ESA. NMFS funding of the hatchery, including funding for current and future fish production operations, and current and future operation and/or construction of in-stream barriers to fish migration or other structures that are likely to adversely affect listed fish, without having undertaken formal consultation and without issuance of a Biological Opinion, violates the ESA consultation requirements and take prohibitions, and is likely to continue to violate the ESA.

[23] Mitchell Act, 52 Stat. 345, amended 60 Stat. 932.

[24] *See* 63 Fed. Reg. 13,347 (March 19, 1998); 64 Fed. Reg. 14,308 (March 24, 1999); 70 Fed. Reg. 37,160 (June 28, 2005);71 Fed. Reg. 834 (January 5, 2006).

B. NMFS decisions to distribute Mitchell Act funding to the Sandy Basin Hatchery Program without programmatic and hatchery-specific Environmental Impact Statements violate NEPA.

NEPA requires that all federal agencies consider the likely environmental effects of their activities. Specifically, federal agencies must prepare an environmental impact statement (EIS) on major federal actions which significantly affect the quality of the environment. This document must include a detailed statement of environmental impacts, including an analysis of cumulative impacts, alternatives to the proposed action and identify any irretrievable commitments of resources involved. A major federal action includes "projects and programs entirely or partly financed, assisted, conducted, regulated, or approved by federal agencies" as well as "new or revised agency rules, regulations plans, policies, or procedures."[25]

One goal of the NEPA process is to trigger environmental review at the earliest possible stage to fully inform later commitments and to avoid commitments of resources that are later irreversible. *Connor v. Burford*, 848 F.2d 1441 (9th Cir. 1988); *Metcalf v. Daley*, 214 F.3d 1135 (9th Cir. 2001). Because the Mitchell Act hatcheries are funded by annual NMFS distributions of federal appropriations, each year the federal government commits resources to these projects and each year has failed to undertake the required environmental review.

In 2003, NMFS agreed to complete an EIS analyzing the environmental impacts of its funding and operation of the Mitchell Act hatcheries in the Columbia River Basin. In 2010, NMFS finally released a draft programmatic environmental impact statement that identifies significant impacts from the hatchery operations on the Sandy River. There is no timeline for a final programmatic EIS. Nonetheless, NMFS still distributes funds annually to the Sandy Hatchery despite a clear lack of compliance with NEPA.

NMFS's actions in funding the Sandy Hatchery in 2011, 2010, and in each of the prior five years are major federal actions significantly affecting the quality of the human environment, for which NMFS did not perform any environmental review, in violation of NEPA. Funding and operation of the Sandy Hatchery and related activities in the Sandy River Basin therefore are in violation of NEPA, NMFS must complete its programmatic EIS for the Columbia Basin hatchery operations and an EIS for the operations NMFS funds and authorizes at and related to the Sandy Hatchery.

C. State and Federal agencies and officials are in violation of the ESA.

1. The Endangered Species Act.

ESA § 7(a)(2) requires any federal agency to insure that any action it authorizes, funds, or carries out "is not likely to jeopardize the continued existence of any

---

[25] *See* 40 C.F.R. § 1508.18.

endangered species or threatened species or result in the destruction or adverse modification" of designated critical habitat. 16 U.S.C. § 1536(a)(2). This provision mandates that endangered and threatened species are "afforded the highest of priorities" when actions are taken that may affect such species. *TVA. v. Hill*, 437 U.S. 153, 174 (1978).

To guarantee compliance with the 'no-jeopardy' mandate, Section 7(a)(2) requires the action agency (in this case, NMFS) to consult with the appropriate wildlife agency—here, also NMFS. *See Thomas v. Peterson*, 753 F. 2d 754, 763 (9th Cir. 1985) ("without substantial compliance with those procedural requirements, there can be no assurance that a violation of the ESA's substantive provisions will not result."). If a proposed action "may affect" a listed anadromous fish or its critical habitat, the action agency (including NMFS itself) must engage in consultation with NMFS. 50 C.F.R. § 402.14(a); *see* 51 Fed. Reg. 19,926, 19,949 (June 3, 1986) ("*Any possible effect, whether beneficial, benign, adverse, or of an undetermined character*, triggers the formal consultation requirement . . . .") (emphasis added).[26]. For actions "not likely to adversely affect" listed species or critical habitat, consultation may be "informal." *See* 50 C.F.R. § 402.14(b). For actions "likely to adversely affect" a listed species or critical habitat, consultation must be "formal." *See id*. § 402.14(a). Formal consultation results in a biological opinion (BiOp) from NMFS determining whether the action is likely to jeopardize the listed species or adversely modify its critical habitat. 16 U.S.C. § 1536(b)(3)(A).[27]

If a no jeopardy or no adverse modification conclusion is reached, NMFS must include an Incidental Take Statement (ITS), identifying areas where members of the particular species are at risk, if take may occur. 16 U.S.C. § 1536(b)(4); 50 C.F.R. § 402.14(g)(7). The ITS serves to specify the impact of any incidental taking, specify reasonable and prudent measures (RPMs) to minimize such impact, and set forth terms and conditions to implement the RPMs. 16 U.S.C. § 1536(b)(4). The ITS functions as a safe harbor provision immunizing persons from Section 9 liability and penalties for takings committed during activities that are otherwise lawful and in compliance with its terms and conditions. *Id*. § 1536(o). If the terms and conditions of the ITS are disregarded and a taking does occur, however, the action agency or the third party funded or authorized by the action agency may be subject to civil and criminal penalties under Section 9.

Section 9 of the ESA prohibits any person—federal, state & local government agencies and officials as well as private individuals and entities—from "taking" a

---

[26] "[A]ll activities or programs of any kind authorized, funded, or carried out, in whole or in part, by Federal agencies in the United States or upon the high seas" are "actions" subject to consultation, and include, but are not limited to, "actions intended to conserve listed species or their habitat; [] the promulgation of regulations;[] or [] actions directly or indirectly causing modifications to the land, water, or air." 50 C.F.R. § 402.02(b).

[27] While consultation is taking place on the proposed action, the ESA prohibits the agency from taking or allowing any "irreversible or irretrievable commitment of resources with respect to the agency action which has the effect of foreclosing the formulation or implementation of any reasonable and prudent alternative measures which would not violate [Section 7(a)(2)]." 16 U.S.C. § 1536(d).

threatened or endangered species. 16 U.S.C. § 1538(a)(1); *see also* 50 C.F.R. § 17.31. "Take" is defined broadly under the ESA and its regulations to include harassing, harming, wounding, killing, trapping, capturing, or collecting a protected species either directly or by degrading its habitat sufficiently to impair essential behavior patterns. 16 U.S.C. § 1532(19). In the definition of take,"[*h]arass* … means an intentional or negligent act or omission which creates the likelihood of injury to wildlife by annoying it to such an extent as to significantly disrupt normal behavioral patterns which include, but are not limited to, breeding, feeding, or sheltering." 50 C.F.R. § 17.3. "*Harm* … means an act which actually kills or injures wildlife. Such act may include significant habitat modification or degradation where it actually kills or injures wildlife by significantly impairing essential behavioral patterns, including breeding, feeding or sheltering." *Id.*

NMFS funding of the Sandy Hatchery and related in-stream and near-stream activities undertaken by ODFW is a federal agency action that has adversely affected, and is likely to continue to adversely affect, threatened chinook, coho, chum and steelhead, and which has and is likely to continue to result in the destruction or adverse modification of designated critical habitat for chinook and steelhead in the Sandy River Basin. NMFS and ODFW are liable for direct and indirect take of wild chinook, steelhead and coho based on the operation of the Sandy Hatchery.

2. NMFS funding of the Sandy Basin Hatchery violates the ESA Section 7 jeopardy prohibition and consultation requirements.

Currently, the federal government, through NMFS, funds, in whole or in part, the operation of the Sandy Hatchery. Because this funding constitutes a federal action, and the action (and resulting hatchery operation) is likely to adversely affect listed species as described above, the federal action agency (in this case, NMFS) must engage in formal consultation leading to a Biological Opinion. In 2011, 2010, and the previous five years, NMFS has taken action to fund the Sandy Hatchery without engaging in informal or formal consultation and has not issued any consultation document related to its funding of the Hatchery's operations, in violation of the consultation requirements in ESA § 7(a)(2) and the implementing regulations. NMFS must initiate consultation and avoid irreversible or irretrievable commitment of resources to hatchery operations or in-stream or near-stream activities that would foreclose the implementation of reasonable and prudent alternative measures until such consultation is complete and a Biological Opinion is issued. 16 U.S.C. § 1536(d).

In addition, the Sandy Hatchery activities funded by NMFS during 2011, 2010 and the past five years have caused and are currently causing harm to listed steelhead, coho, chum and chinook and adverse modification to designated critical habitat for chinook and steelhead, resulting in jeopardy to the listed species and adverse modification to critical habitat, and impeding the recovery of these species, in violation of NMFS's obligation as an action agency under § 7(a)(2). NMFS likewise has violated its on-going obligation under § 7(a)(2) to avoid jeopardy and adverse modification of critical habitat by allowing adverse effects to the listed fish species from hatchery operations to accumulate.

Disbursement of funds by NMFS for the Sandy Hatchery, operation of the hatchery, and use, construction or operation of any related in-stream structures in the Sandy River Basin, including capture or release of listed fish, until NMFS has completed the required consultation violates and will continue to violate ESA § 7(d)'s prohibition against irreversible or irretrievable commitment of resources. NMFS and ODFW must cease or dramatically restrict operations at the Sandy Hatchery and related activities (including use or construction of weirs, barriers to passage, or acclimation facilities for non-wild fish) until NMFS produces a biological opinion covering the hatchery's funding and related operations.

3. NMFS and ODFW are in violation of ESA Section 9.

NMFS and ODFW are liable for direct and indirect unlawful take of steelhead, chinook, chum and coho in their respective funding and operation of the Sandy Hatchery and associated in-stream and near-stream structures. ODFW's operation of the Sandy Hatchery has violated and is continuing to violate ESA § 9 by trapping, capturing, collecting and otherwise harming listed wild (natural) fish, and by releasing hatchery fish which adversely affect wild fish and harm populations of the four listed species in the Sandy River Basin. The hatchery directly takes threatened wild chinook and steelhead for breeding stock and other natural members of the chinook, steelhead and coho species by collecting fish and impeding fish passage. The hatchery indirectly takes listed fish by releasing hatchery-reared fish which affect wild populations through competition for resources and predation and which cause uncontrollable stray rates that result in cross-breeding between wild and hatchery salmonids and result in a lower reproductive fitness and survival of wild chinook, steelhead, chum and coho in the Sandy River Basin, impeding the recovery of these populations. ODFW and its officials use and are continuing to use in-stream and near-stream structures that harm listed fish, including weirs and acclimation and release facilities. NMFS is liable for take because it funds ODFW's operations that cause take.

ODFW and its officials have been engaged in direct take of threatened wild chinook and steelhead to serve as breeding stock or "broodstock" for the hatchery. ODFW never received a Section 10 take permit or a Biological Opinion authorizing this direct take under the ESA. In 2009, 2010, and 2011, ODFW and its officials violated and will continue to violate the ESA § 9 take prohibition by capturing wild chinook and steelhead for broodstock. In addition, ODFW has captured, collected or trapped other wild chinook, steelhead and coho in each of the past six years, at the traps and other physical structures associated with the Sandy Hatchery operation, and plans (in its 2011 Hatchery Operations Plan) to continue to capture, collect or trap members of these listed species, in violation of ESA § 9. NMFS, by funding the operation of the hatchery and its take of listed species also has violated and is violating ESA § 9. 16 U.S.C. 1538(g).

If an action will or is likely to result in "take" to a listed species, a person engaged in take may seek ESA coverage to allow the action to proceed either through the consultation process under § 7 (federal actors) or through an incidental take permit (ITP) issued pursuant to § 10 (non-federal actors). In 1999, NMFS issued a Biological Opinion on the artificial propagation in the Columbia River basin—including the Sandy River—that may have satisfied the § 7 and § 10 ESA requirements at that time. Since that time, chinook, chum and coho in the Sandy River Basin have been listed as threatened, critical habitat has been designated for chinook and steelhead, and additional research has clarified the extent of harm caused by hatchery operations. As a result, the 1999 Biological Opinion no longer satisfies legal requirements and NMFS must reinitiate consultation regarding effects of its funding of the Sandy Hatchery on steelhead and steelhead critical habitat and initiate consultation regarding effects on chinook, chum, coho, and designated chinook critical habitat. Because this consultation has not yet occurred, the state and federal actors are operating this hatchery without incidental take authorization under ESA §§ 7 and 10.

As an alternative to § 7 and 10, ODFW and NMFS may seek ESA compliance through administrative rules created pursuant to § 4(d) of the Act. Section 4(d) requires that the Secretary issue regulations deemed "necessary and advisable" to conserve threatened species. 16 U.S.C. § 1533(d). Pursuant to this authority, in July 2000, NMFS published its final protective regulations for 14 Pacific salmon and steelhead—extending the take prohibition to threatened stocks including the four listed stocks at issue here.[28] The final 4(d) rule, amended in 2005, allows for artificial propagation activities notwithstanding § 9 of the ESA, provided that they are conducted in accordance with an approved Hatchery Genetic Management Plan (HGMP) and a letter of concurrence from NMFS, among other requirements.

The ESA's conservation mandate requires that a 4(d) rule must not only protect threatened species from extinction but must also include measures necessary to recover the species to the point where ESA protection is no longer necessary. The record does not support a finding that this hatchery is meeting—or even is designed to meet—the recovery standard required under the ESA. In fact, the hatchery production levels do not even comply with the state's own standards established through the Sandy River Basin Fish Management Plan, nor with ODFW's Native Fish Conservation Policy. The Management Plan—embodied in OAR 645-500-3400—established a minimum expectation for what is needed to meet ESA recovery goals. The analysis conducted by ODFW and NMFS for the development of the Lower Columbia River Salmon Recovery Plan shows the exact opposite: that the hatchery is actually harming the species, precluding the recovery of the species, damaging the wild, naturally produced native fish stocks, and that in order to "delist" the species, the goals originally proposed in the Management Plan would have to be artificially and unscientifically lowered.

For the Sandy Hatchery, NMFS has not conducted public notice and comment on, nor approved, any HGMP satisfying the strict conservation requirements of § 4(d), and could not do so regardless unless and until the requirements for completing NEPA and public notice and comment under the § 4(d) rule are satisfied. Consequently the Hatchery has no protection from take under ESA § 4(d). Without an applicable 4(d) exception, the hatchery can only operate under § 10 or pursuant to a lawful consultation. As noted above, there also is currently no § 7 consultation (and ITS shield) or § 10 permit. As a

[28] 65 Fed. Reg. 42,421, 42,481 (July 10, 2000).

result, the Hatchery's operations cause unlawful direct take of chinook, coho, and steelhead in violation of ESA § 9 by the annual capture of wild and hatchery-raised members of these species.

Each of the releases of hatchery-raised fish by ODFW and its officials in 2011, 2010 and the previous five years in the Sandy River Basin caused and has continued to cause take of listed species through interspecies and intraspecies effects that result in direct harm to the species and harm to the species through habitat modification. Stray rates (the percentage of hatchery fish found in the upper Sandy River Basin above the Sandy Hatchery, see Attachment C)[29] approaching 100% for some species as a result of hatchery releases have caused the decline of wild populations of listed chinook, steelhead, coho and chum in the Sandy River Basin, due to competition for food and predation of wild fish by hatchery fish (within and across species), increased pressure from fishing on wild stock because of the presence of hatchery fish, and negative genetic impacts from cross-breeding of hatchery strays with wild fish. These effects, in turn, have harmed the populations of the species in the basin and reduced their chance for survival and recovery in violation of ESA § 9. NMFS, by funding these harmful releases, also has violated ESA § 9.

In addition, ODFW and its officials operating in their official capacity currently operate or intend to construct in-stream or stream-affecting facilities or structures in the Sandy River Basin, including fish traps, weirs and fish holding and acclimation facilities, that cause and will cause take of listed coho, chinook, chum and steelhead and result in destruction or adverse modification of designated critical habitat for chinook and steelhead. Operation and/or construction of such facilities and structures have increased or will increase the rate at which hatchery fish stray into the Sandy River Basin, resulting in take of coho, chinook, chum, and steelhead by significant habitat modification from interspecies and intraspecies effects, and continued decline in the populations of the species that rely on habitat in the Sandy River Basin. Construction or use of weirs and traps, including at Cedar Creek and elsewhere near the Sandy Hatchery, has also resulted in the direct take of the four listed species by impeding passage and otherwise causing harm to fish. ODFW and its officials' operation and/or construction of facilities and structures that increase the presence of hatchery fish or decrease the presence of wild fish in the Sandy River Basin results and will continue to result in a take of listed fish in violation of ESA § 9. Impacts from construction or operation of weirs necessarily involve consideration of the related impacts of the hatchery operations under both NEPA and the ESA, and cannot be segmented into a separate analysis.

NMFS funding of ODFW's operation and/or construction of in-stream barriers to fish migration or other structures that are likely to adversely affect listed fish, and result in the take of listed fish, without having undertaken formal consultation and without issuance of a Biological Opinion, also violates and is likely to continue to violate the ESA. Operation of the Hatchery by ODFW officials, including current or future operation and/or construction of in-stream barriers to fish migration, fish passage structures, or other in-stream or near-stream structures that are likely to adversely affect listed fish

[29] ODFW personal communication, Sandy Basin Partners meeting, 2011.

(including acclimation facilities for non-naturally-produced fish, holding ponds, or other related structures), result in and are likely to continue to result in take of listed fish, in violation of the ESA.

III. CONCLUSION

Given the above violations of law, dramatic and immediate change in NMFS and ODFW operations related to the Sandy Hatchery is needed to meet recovery needs of wild coho, chinook and winter steelhead—including reduction or elimination of hatchery impacts on listed fish. This notice serves to indicate our intent to sue concerning these violations if dramatic changes to the current Hatchery operations—including necessary environmental reviews before any further operations or in-stream or near-stream activities are undertaken or completed—do not occur immediately to resolve these violations of law. Please contact Bill Bakke at (503) 246-5890, John Kober at (503) 228-3555, or Dave Becker at (503) 525-0193 to discuss this matter further, or if you believe any of the above statements to be in error or any critical information is missing.

Sincerely,

Bill Bakke
Executive Director
Native Fish Society
221 Molalla Ave., Suite 100
Oregon City, OR 97045
Tel: (503) 246-5890

John Kober
Executive Director
Pacific Rivers Council
1326 Southwest 16th Ave.
Portland, OR 97201-2516
Tel: (503) 228-3555

Dave Becker
Law Office of David H. Becker, LLC
917 SW Oak Street, Suite 409
Portland, OR 97205
Tel. (503) 525-0193

ATTACHMENT A

HATCHERY SALMON ARE DIFFERENT FROM AND HAVE IMPACTS ON WILD SALMON QUOTES FROM THE SCIENTIFIC LITERATURE

Selected Quotations and Abstracts

Allendorf et al. 1994: We are not aware of a single empirical example in which (hatchery) supplementation has been successfully used as a temporary strategy to permanently increase abundance of naturally spawning populations of Pacific salmon.

Altukhov et al 1991: Artificial reproduction, commercial fisheries, and transfers result in the impairment of gene diversity in salmon populations, and so cause their biological degradation.

Araki et al. 2008: Captive breeding is used to supplement populations of many species that are declining in the wild. The suitability of and long-term species survival from such programs remain largely untested, however. We measured lifetime reproductive success of the first two generations of steelhead trout that were reared in captivity and bred in the wild after they were released. By reconstructing a three-generation pedigree with microsatellite markers, we show that genetic effects of domestication reduce subsequent reproductive capabilities by ~40% per captive-reared generation when fish are moved to natural environments. These results suggest that even a few generations of domestication may have negative effects on natural reproduction in the wild and that the repeated use of captive-reared parents to supplement wild populations should be carefully reconsidered.

Araki et al. 2008: "Our review indicates that salmonids appear to be very susceptible to fitness loss while in captivity. The degree of fitness loss appears to be mitigated to some extent by using local, wild fish for broodstock, but we found little evidence to suggest that it can be avoided altogether. The general finding of low relative fitness of hatchery fish combined with studies that have found broad scale negative associations between the presence of hatchery fish and wild population performance, should give fisheries managers pause as they consider whether to include hatchery production in their conservation toolbox."

Bachman 1984: Hatchery brown trout fed less, moved more, and expended more energy than wild brown trout in streams.

Bams 1970: Hatchery pink salmon migrated to the ocean one to two weeks earlier than wild pinks.

Berejikian and Ford 2004: All of the studies we found for Scenarios 1 (nonlocal, domesticated hatchery stocks) and 4 (captive and farmed stocks) found evidence of highly reduced relative fitness for nonlocal, domesticated hatchery stocks, captive broodstocks, and farmed populations. We therefore conclude that it is reasonable to assume that steelhead, coho, and Atlantic salmon stocks in these categories will have low (<30%) lifetime relative fitness in the wild compared to native, natural populations.

Blouin 2003: Non-local domesticated hatchery summer-run steelhead achieved 17-54% the lifetime fitness of natural native fish.

Blouin 2009: "If anyone ever had any doubts about the genetic differences between hatchery and wild fish, the data are now pretty clear. The effect is so strong that it carries over into the first wild-born generation. Even if fish are born in the wild and survive to reproduce, those adults that had hatchery parents still produce substantially fewer surviving offspring than those with wild parents. That's pretty remarkable."

Blouin 2009: "The implication is that hatchery salmonids – many of which do survive to reproduce in the wild– could be gradually reducing the fitness of the wild populations with which they interbreed. Those hatchery fish provide one more hurdle to overcome in the goal of sustaining wild runs, along with problems caused by dams, loss or degradation of habitat, pollution, overfishing and other causes. Aside from weakening the wild gene pool, the release of captive-bred fish also raises the risk of introducing diseases and increasing competition for limited resources."

ATTACHMENT A

Blouin 2009: There is about a 40% loss in reproductive fitness for each generation spent in a hatchery.
Brannon et al. 1999: (Independent Scientific Advisory Board) : The three recent independent reviews of fish and wildlife recovery efforts in the Columbia River Basin addressed hatcheries. There was consensus among the three panels (National Fish Hatchery Review Panel, National Research Council, Independent Science Group), which underscores the importance of their contributions in revising the scientific foundation for hatchery policy. The ten general conclusions made by the panels are listed below.

1. Hatcheries generally have failed to meet their objectives
2. Hatcheries have imparted adverse effects on natural populations
3. Managers have failed to evaluate hatchery programs
4. Rationale justifying hatchery production was based on untested assumptions.
5. Hatchery supplementation should be linked with habitat improvements
6. Genetic considerations have to be included in hatchery programs.
7. More research and experimental approaches are required.
8. Stock transfers and introductions of non-native species should be discontinued.
9. Artificial production should have a new role in fisheries management.
10. Hatcheries should be used as temporary refuges rather than for long-term production.

Brauner 1994: In freshwater swimming velocity tests, wild coho salmon smolts swam faster than hatchery fish. In seawater hatchery fish performance compared to wild fish was poor. Hatchery fish had more difficulty osmoregulating.

Buhle et al. 2009: "Our analyses highlight four critical factors influencing the productivity of these populations: (1) negative density-dependent effects of hatchery-origin spawners were ~5 times greater than those of wild spawners; (2) the productivity of wild salmon decreased as releases of hatchery juveniles increased; (3) salmon production was positively related to an index of freshwater habitat quality; and (4) ocean conditions strongly affect productivity at large spatial scales, potentially masking more localized drivers. These results suggest that hatchery programs' unintended negative effects on wild salmon populations, and their role in salmon recovery, should be considered in the context of other ecological drivers.

"We found that wild populations of Oregon coast coho salmon responded to changing hatchery practices during the 1990s. Productivity, expressed as the per capita growth rate in the absence of harvest, improved with reductions in the density of hatchery origin fish spawning in the wild and the numbers of hatchery smolts released into rivers. The strongest negative effects of hatcheries were associated with hatchery-reared adults breeding in the wild, precisely the pathway that might be expected to contribute most to population rebuilding."

Byrne et al. 1992: Building more hatcheries should cause alarm to biologists concerned with the preservation of native stocks until it is demonstrated that supplementation can be done in a way that does not reduce fitness of the native stock.

Chilcote et al. 1986: Hatchery steelhead are only 38% as successful in producing smolts as wild steelhead.

Chilcote 2002: "…there will be little benefit to bringing some of the wild fish into the hatchery environment if the resulting hatchery smolts will have ocean survival rates that are 1/10 of those for wild smolts….all indications are that hatchery fish, even from wild broodstocks, are not as successful as wild fish in producing viable offspring under natural conditions…."

Chilcote 2003: Naturally spawning population comprised of equal numbers of hatchery and wild fish would produce 63% fewer recruits per spawner than one comprised entirely of wild fish. For natural populations, removal rather than addition of hatchery fish may be the most effective strategy to improve productivity and resilience.

ATTACHMENT A

Chilcote 2008**:** At a recent meeting of lower Columbia River Salmon Recovery Stakeholders, the document , *Recovery Strategies to Close the Conservation Gap Methods and Assumptions,* hatchery fish impacts are discussed. It says, "…relative population survival rates (recruits produced per spawner) were found to decrease at a rate equal to or greater than the proportion of hatchery fish in the natural spawning population. In other words, a spawning population with 20% hatchery strays (regardless of the type of hatchery program and whether they are integrated or segregated) had the net survival rate (recruits per spawner) that was 20% less than a population comprised entirely of wild fish (0% hatchery strays). Likewise, a population with 40% hatchery strays had a population survival rate that was 40% lower than a population comprised entirely of wild fish."

ODFW 2010: "Chilcote and Goodson examined data sets on population abundance for 121 populations of coho, steelhead, and Chinook in Oregon, Washington, and Idaho. They found that population productivity was inversely related to the average proportion of hatchery fish in the naturally-spawning population, consistent with the findings of Buhle et al. (2009). The magnitude of this effect was substantial. For example, a population comprised entirely of hatchery fish would have one tenth the intrinsic productivity of one comprised entirely of wild fish. There was no indication that the significance or strength of this relationship was different among the three species examined (chinook, coho and steelhead). In addition, there was no indication that the type of broodstock (integrated with the local natural-origin population versus segregated) affected the significance or intensity of the response." (Section 2: Updating the Scientific Information in the 2008 FCRPS BiOp May 20, 2010, Page 118 and Lower Columbia River Salmon Recovery Plan 9-2010 ODFW)

Chilcote et al. 2011: "We found a negative relationship between the reproductive performance in natural populations of steelhead, coho, and Chinook salmon and the proportion of hatchery fish in the spawning population. We used intrinsic productivity as estimated from fitting a variety of recruitment models to abundance data for each population as our indicator of reproductive performance. The magnitude of this negative relationship is such that we predict the recruitment performance for a population comprised entirely of hatchery fish would be 0.128 of that for a population comprised entirely of wild fish. The effect of hatchery fish was the same among all three species. Further, the impact of hatchery fish from 'wild type' hatchery broodstocks was no less adverse than hatchery fish from traditional, domesticated broodstocks. We also found no support for the hypothesis that a population's productivity was affected by the length of exposure to hatchery fish. In most cases, measures that minimize the interactions between wild and hatchery fish will be the best long-term conservation strategy for wild populations."

Dickson 1982: Juvenile hatchery fish show a behavioral shift in stream feeding position compared to wild fish. Hatchery fish feed nearer the surface. This may expose them to greater predation.

Ersbak et al. 1983: Hatchery trout conditions declined after stocking. Hatchery fish were less flexible in switching to available food in the stream.

Fenderson, 1968: Hatchery fish are more aggressive and dominate wild fish, and hatchery fish have a higher mortality.

Flagg and Nash, 1999: The reviews conclude that artificial culture environments condition salmonids to respond to food, habitat, conspecifics and predators differently than fish reared in natural environments. It is now recognized that artificial rearing conditions can produce fish distinctly different from wild cohorts in behavior, morphology, and physiology

Fleming and M.R. Gross 1993: The divergence of hatchery fish in traits important for reproductive success has raised concerns. This study shows that hatchery coho salmon males are competitively inferior to wild fish, and attained only 62% of the breeding success of wild males. Hatchery females had more difficulty in spawning than wild fish and hatchery fish had only 82% of the breeding success of wild fish. These results indicate hatchery fish may pose an ecological and genetic threat to wild fish.

Fleming et al. 1994: Results of this study imply that hatchery fish have restricted abilities to rehabilitate wild populations, and may pose ecological and genetic threats to the conservation of wild populations.

ATTACHMENT A

Fleming et al. 1997: Reproductive success defined in the study as the ability to produce viable eyed embryos did not differ between hatchery and natural females. Hatchery males, however, achieved only 51% the estimated relative reproductive success of natural males under conditions of mutual competition. Hatchery males were less able to monopolize access to spawning females and suffered more severe wounding and greater mortality than natural males.

Fleming and Einum 1997: Our results thus indicate that the farming of Atlantic salmon can generate rapid genetic change in fitness related traits as a result of domestication due to intentional and unintentional selection. As much of this change appears to be an adaptive response to the culture environment, it can be of value for programmes attempting to improve aquaculture production (e.g. Doyle *et al.*, 1991). This change, however, is a threat to wild populations when these fish escape, and compete and breed with wild salmon. The invasion of escaped farmed salmon into rivers not only increases competition for resources, but also results in the infusion of different genetic traits into wild populations. Many of these traits are likely to be maladaptive for the local environment both because of the non-indigenous origins of the farmed salmon (Einum and Fleming, 1997) and because of the changes that have occurred due to culturing. While natural selection may be able to purge wild populations of such maladaptive traits, its actions are severely hindered by the year-after-year introgression of farmed salmon. The net result is almost certainly a decline in population fitness, as the influence of selection from the culture environment overrides that in the wild.

Flick, et al. 1964: Wild brook trout had higher summer and winter survival than hatchery fish.

Ford, 2002: Substantial phenotypic changes and fitness reductions can occur even if a large fraction of the captive broodstock is brought in from the wild every generation. This suggests that regularly bringing wild-origin broodstock into captive populations cannot be relied upon to eliminate the effects of inadvertent domestication selection.

Ford 2010: What is known from peer-reviewed scientific studies on the impact of hatchery salmonids on wild salmonids? Hatchery fish reproductive success in poor; there is a large scale negative correlation between the presence of hatchery fish and wild population performance; hatchery fish reproductive success is lower than for wild fish and this is true for both supplementation and production hatchery programs; there is evidence of both environmental and heritable effects; effects were detected for both release and proportion of hatchery spawners; negative correlations between hatchery influence and wild productivity are widespread; habitat or ocean conditions do not appear to explain the pattern; current science indicates that limiting natural spawning of hatchery fish is generally beneficial to wild populations; there is evidence that reducing hatchery production leads to increased wild production, and cumulative effects of hatchery could be a factor limiting recovery of some ESUs.

Hilborn 1992: Pacific salmon hatcheries have failed to deliver expected benefits and they pose the greatest single threat to the long-term maintenance of salmonids.

Hjort and Schreck 1982: the results of this study also suggest a potential weakness in hatchery supplementation. Selection through hatchery environment and hatchery practices may be changing the overall phenotype of hatchery stocks, as well as the between-year variability of individual genotypes (as we found for transferrin). If these changes result in reduced performance of the donor stocks in other stream systems, practices designed to increase hatchery production must be weighed against the actual benefits to wild production.

Hulett et al. 1994: Hatchery winter steelhead were about one-half as effective as wild winter-run steelhead in naturally producing smolt offspring. Hatchery winter steelhead were about one sixth as effective as wild winter steelhead in naturally produced adult offspring.

Independent Economic Advisory Board (IEAB) 2002: Augmentation and mitigation hatcheries, which seek to enhance fish harvests, can be judged by the cost incurred per additional fish harvested. The costs per harvested hatchery fish ranged from $23 for Priest Rapids fall chinook, to $55 per Spring Creek fall chinook, to $453 for Irrigon hatchery summer steelhead, to $1,051 for McCall summer chinook, to $4,800 - $68,031 at the Leavenworth hatchery complex.

<u>**Hatchery**</u>	<u>**Species Produced**</u>	<u>**Cost of a Salmon that is caught**</u>
Leavenworth	spring chinook	$4,800
Entiat	spring chinook	$68,031 (Highest $891,000)
Winthrop	spring chinook	$23,068
Priest Rapids	fall chinook	$12.00 (Highest - $293)
Irrigon	summer steelhead	$453
Spring Cr.	fall chinook	$237 (range 14.53 - $460)
Clatsop	coho	$124
	Spring chinook	$233
	Fall chinook	$65
Nez Perce	fall and spring chinook	$3,700
McCall	spring chinook	$786 (range $522 to $1,051)

The benefit of the fishery is $45 to $77 per fish for the commercial fishery and $60 per fish for the sport fisheries.

<u>ISAB 2002</u>. "We believe that available empirical evidence demonstrates a potential for deleterious interactions, both demographic and genetic, from allowing hatchery-origin salmon to spawn in the wild. Because it is virtually impossible to 'undo' the genetic changes caused by allowing hatchery and wild salmon to interbreed, the ISAB advocates great care in permitting hatchery-origin adult salmon to spawn in the wild."

<u>Jonsson et al. 1993</u>: Differences were evident for hatchery Atlantic salmon relative to wild salmon, with common genetic backgrounds, in breeding success after a single generation in the hatchery. Hatchery females averaged about 80% the breeding success of wild females. Hatchery males had significantly reduced breeding success, averaging about 65% of the success of wild males.

<u>Jonsson and Jonsson 2002:</u> "During the past 150 years, (hatchery) enhancement and supplementation have become essential parts of salmonid management. Interaction is likely to have a negative effect on the viability of wild populations."

<u>Knudson et al. 2006.</u> "Perhaps the most important conclusion of our study is that even a hatchery program designed to minimize differences between hatchery and wild fish did not produce fish that were identical to wild fish."

<u>Kostow 2003 :</u> Our data support a conclusion that hatchery summer steelhead adults and their offspring contribute to wild steelhead population declines through competition for spawning and rearing habitats.

<u>Kostow 2004</u>: "In conclusion, this study demonstrated large average phenotype and survival differences between hatchery-produced and naturally produced fish from the same parent gene pool. These results indicate that a different selection regime was affecting each of the groups. The processes indicated by

these results can be expected to lead to eventual genetic divergence between the new hatchery stock and its wild source population, thus limiting the usefulness of the stock for conservation purposes to only the first few generations.

Leider, et. al., 1990: The mean percentage of offspring from naturally spawning hatchery steelhead decreased at successive life history stages, compared to wild steelhead, from a potential of 85-87% at the egg stage to 42% at the adult stage. Reproductive success of naturally spawning hatchery steelhead compared to wild steelhead decreases from 75-78% at the subyearling stage to 10.8-12.9% at the adult stage.

Levings, et al., 1986: Hatchery chinook used the estuary a shorter period of time than wild chinook. The greatest overlap between hatchery and wild chinook in the estuary is in the transition zone where greater competition could occur.

Lynch and O'Hely 2001: "Our results suggest that the apparent short-term demographic advantages of a supplementation program can be quite deceiving. Unless the selective pressures of the captive environment are closely managed to resemble those in the wild, long-term supplementation programs are expected to result in genetic transformation that can eventually lead to natural population no longer capable of sustaining themselves."

Marchetti and Nevitt 2003: "Our work may suggest a mechanistic basis for the observed vulnerability of hatchery fish to predation and their general low survival upon release into the wild. The brains of hatchery raised rainbow trout are smaller in 7 out of 8 critical neuroanatomical measures than those of their wild reared counterparts. Our results are the first to highlight the effects of hatchery rearing on changes in brain development in fishes."

Mason, et al., 1997: Hatchery x wild and wild x wild crosses had higher survival in the natural stream compared to hatchery x hatchery crosses.

McClure et al. 2008: "Continued interbreeding with hatchery-origin fish of lower fitness can lower the fitness of the wild population. Generally, large, long-term hatchery programs that dominate production of a population is a high risk factor for certain viability criteria and can lead to increased risk for the population. The populations meeting 'high viability' criteria will necessarily be large and spatially complex. In order to meet these criteria (spatial structure and diversity) there should be little or no introgression between hatchery fish and the wild component of the population. Populations supported by hatchery supplementation for more than three generations do not in most cases meet ICTRT viability criteria at the population level."

"Artificial propagation does not contribute to increased natural productivity needed for viability, and appears in most cases, to erode productivity of wild populations."

McLean et al. 2003: Hatchery steelhead spawning in the wild had markedly lower reproductive success than native wild steelhead. Wild females that spawned in 1996 produced 9 times as many adult offspring per carpita as did hatchery females that spawned in the wild. Wild females that spawned in 1997 produced 42 times as many adult offspring as hatchery females. The wild steelhead population more than met replacement requirements (approximately 3.7 – 6.7 adult offspring were produced per female), but the hatchery steelhead were far below replacement (<0.5 adults per female).

Meffe 1992: Countless salmon stocks have declined precipitously over the last century as a result of overfishing and widespread habitat destruction. A central feature of recovery efforts has been to build many hatcheries to produce large quantities of fish to restock streams. This approach addresses the symptoms but not the causes of the declines.

Miller, 1953: Hatchery cutthroat trout had lower survival compared to wild fish due to absence of natural selection at early life stages.

ATTACHMENT A

Miller et al. 1990: Over 300 (hatchery) supplementation projects were reviewed and the authors found: 1) examples of success at rebuilding self-sustaining anadromous fish runs with hatchery fish are scarce (22 out of 316 projects reviewed), 2) success was primarily from providing fish for harvest, and 3) adverse impacts to wild stocks have been shown or postulated for every type of hatchery fish introduction to rebuild runs.

Mobrand et al. 2005: "We concluded that hatcheries must operate in new modes with increased scientific oversight and that they cannot meet their goals without healthy habitats and self-sustaining naturally-spawning populations."

Moran and Waples 2007: "…we show some compelling differences in reproductive success of hatchery and wild fish. Naturally spawning hatchery fish are less than half as productive as wild fish."

Mullan, "Mean hatchery spring chinook smolt to adult survival ranged from 0.16 to 0.55%, 1976-1988 compared to wild spring chinook survival rate of from 1.6 to 8.1%. Naturally produced smolts were about 10 – 80 times as viable as hatchery smolts."

Mullan, James. Status of chinook salmon stocks in the Mid-Columbia. In Status and future of spring chinook salmon in the Columbia River Basin-conservation and enhancement. NOAA Fisheries. NOAA F/NWC -187. Session II Stock Status and carrying capacity.

Naish et al. 2008: If one concern has been identified, it is that many hatchery programmes continue to be operated with few objectives, and with a poor understanding of the magnitude and importance of the impacts of genetic effects of hatchery releases and the role of this information in informing remedial actions.

A rapidly growing body of literature points towards detrimental behavioural interactions between hatchery and wild fish. More is known about these interactions in freshwater rearing habitats than in estuarine and marine environments. There is also, however, a paucity of information on whether risk avoidance measures are effective at reducing competition and predation and, as far as we know, little attention is directed towards carrying capacity when the size of release is considered.

Naylor et al. 2005: Interbreeding between wild and farmed fish can result in mixing gene pools if the hybrids can reproduce, and eventually can lead to a wild population composed entirely of individuals descended from hatchery fish. In a Norwegian study (Fleming et al. 2000), 55% of hatchery salmon in the experimental spawning population contributed 19% of the genes to adult fish in one generation later. Continued one-way gene flow at this rate would halve the genetic difference between hatchery and wild salmon every 3.3 generations and lead to rapid genetic homogenization.

Naylor et al. 2005: In McGinnity and colleagues' (2003) recent farm release study in Ireland, the lifetime success of hybrids was only 27% to 89% as high as that of their wild cousins, and 70% of the embryos in the second generation died. These results provide strong evidence of how interbreeding might drive vulnerable salmon populations to extinction.

Naylor et al. 2005: Aggressive farm and hybrid fish can also result in shifts of wild counterparts to poorer habitats, increasing mortality. The productivity of the native juvenile salmon population was depressed by more than 30% in the presence of farm and hybrid juveniles.

Naylor et al. 2005: An earlier review (Hindar et al. 1991) of the genetic effects following releases of nonnative salmonids reached two broad conclusions. First, the genetic effects of intentionally or accidentally released salmonids on natural populations are often unpredictable and may vary from no detectable effects to complete introgression or displacement. Second, when genetic effects on performance traits (e.g. survival in fresh water and seawater) have been detected, they appear always to be negative in comparison with the traits of unaffected native populations.

ATTACHMENT A

Nickelson 1986: Hatchery coho juveniles are more abundant after stocking in streams but the result is fewer adult returns and fewer juvenile coho salmon in the next generation than in streams that were not stocked.

Nickelson 2003: Hatchery programs designed for harvest augmentation should be removed from basins with habitat that has high potential to produce wild salmonids. To aid recovery of depressed wild salmon, the operation of hatcheries must be changed to reduce interactions of hatchery smolts with wild smolts. A program that reduces harvest, restores habitat, and reduces hatchery effects is necessary.

NMFS 2010: "Hatchery production has been reduced to a small fraction of the natural-origin production. Nickelson (2003) found that reduced hatchery production led directly to higher survival of naturally produced fish, and Buhle et al. (2009) found that the reduction in hatchery releases of Oregon coast coho salmon in the mid1990's resulted in increased natural coho salmon abundance."

ODFW 2010a: "For example, the reduction in productivity between a population comprised entirely of wild fish and one comprised of equal numbers of hatchery and wild fish is 66 percent for steelhead, 76 percent for coho, and 43 percent for Chinook."

ODFW 2010b: "Hatchery programs have the potential to benefit or harm salmonid population viability by affecting abundance, productivity, distribution, and/or diversity. Hatchery related risks to salmon population viability include genetic changes that reduce fitness of wild fish, increase risk of disease outbreaks, and/or alter life history traits, and ecological effects—such as increased competition for food and space or amplified predation—that reduce population productivity and abundance. Hatcheries can also impose environmental changes by creating migration barriers that reduce a population's spatial structure by limiting access to historical habitat."

Perry, et al. 1993: Idaho has been trying to unravel the secrets of hatchery and wild salmon interactions in nature. Since hatchery salmon do not survive as well as wild salmon, it is important to fix this problem. It is possible that a hatchery supplementation program may inadvertently replace the target natural population with one having lower survival and reproductive potential.

Reisenbichler, et al. 1977: His research shows that hatchery x hatchery crosses of steelhead fry survival was lower than for wild x wild crosses and wild x hatchery crosses in streams. Likewise he found that hatchery x hatchery crosses survived better in the hatchery environment. The hatchery fish were derived from local wild steelhead and had changed in performance in two generations of hatchery rearing. Conclusion: differences in survival suggested that the short-term effect of hatchery adults spawning in the wild is the production of fewer smolts and ultimately, fewer returning adults than are produced from the same number of wild steelhead spawners.

Reisenbichler 1986: Most (hatchery fish) outplanting programs have been unsuccessful. Rigorous planning, evaluation, and investigation are required to increase the likelihood of success and the ability to promptly discern failure.

Reisenbichler 1992: "Because anadromous salmonids home to their natal streams to spawn, managers can expect the fish in different streams to be from genetically distinct stocks. We recommend that steelhead from different coastal drainages be considered and managed as distinct stocks."

Reisenbichler 1994: Gene flow from hatchery fish also is deleterious because hatchery populations genetically adapt to the unnatural conditions of the hatchery environment at the expense of adaptedness for living in natural streams. This domestication is significant even in the first generation of hatchery rearing.

Reisenbichler 1996: Available data suggest progressively declining fitness for natural rearing with increasing generations in the hatchery. The reduction in survival from egg to adult may be about 25% after one generation in the hatchery and 85% after six generations. Reduction in survival from yearling to adult may be about 15% after one generation in the hatchery and 67% after many generations.

ATTACHMENT A

RIST 2009: "Most information available indicates that artificially-propagated fish do have ecological impacts on wild salmonid populations under most conditions (e.g. a 50% reduction in productivity for steelhead in an Oregon population). To the degree that the trait distributions seen in wild salmon populations are adaptations to their environments, selection imposed by the hatchery environment could result in reduced fitness of hatchery fish in the wild."

Shrimpton, et al., 1994: Juvenile hatchery coho showed a reduced tolerance to salt water compared to wild coho.

Slaney, et al., 1993: Hatchery adult steelhead strayed more than wild steelhead

Sosiak, et al., 1979: As juveniles, hatchery fish had less stomach fullness and fed on fewer taxa than wild fish. This was determined after hatchery fish were in streams from one to three months.

Steward et al. 1990: Authors reviewed 606 hatchery supplementation studies and found that few directly assessed the effects on natural stocks. Genetic and ecological effects and changes in productivity of the native stocks that can result remain largely unmeasured. However, the general failure of supplementation to achieve management objectives is evident from the continued decline of wild stocks.

Swain, et al. 1991: Hatchery coho salmon diverged from the wild fish in fin size and body dimensions. These were considered adaptations to the hatchery environment.

Taylor, 1986: Hatchery coho salmon diverged in body structure and variation from that of the wild coho.

Vincent 1987: Hatchery stocking ended in a Montana stream and wild trout more than doubled (160%) and the wild trout biomass increased by 10 times.

Waples and Do 1991: Genetic interactions between hatchery and wild salmonids will increase as hatchery supplementation becomes a more dominate form of hatchery management.

Waples 1994: Hatchery captive brood stocks may shift genetic structure in natural populations.

Wohlfarth 1986: Stocking with hatchery stocks cannot replace wild productivity because hatchery fish are selected for adaptation to the hatchery environment and do not perform well in the natural environment.

Wood, et al., 1960: Hatchery coho salmon 14 months after release into a stream did not reach the body composition of the wild salmon in time for downstream migration and had lower ocean survival.

ATTACHMENT A

References:

Allendorf, Fred W. and Robin Waples. 1994. Conservation genetics of salmonid fishes. In Conservation Genetics: Case Histories from Nature. Edited by J.C. Avise and J. L. Hamrich. Chapman Hall.

Altukhov, Y. P, and E. A. Salmenkova. 1991. The genetic structure of salmon populations. Aquaculture 98:11-40.

Araki, Hitoshi, Barry A. Berejikian, Michael J. Ford, and Michael S. Blouin. 2008. Fitness of hatchery-reared salmonids in the wild. Blackwell Publishing Ltd. 1:342-355.

Bachman, R. A. 1984. Foraging behavior of free-ranging wild and hatchery brown trout in a stream. Transactions of the American Fisheries Society 113:1-32.

Bams, R. A. 1970. Evaluation of a revised hatchery method tested on pink and chum salmon fry. Journal of the Fisheries Research Board of Canada 27:1429–1452.

Berejikian, B.A., and M.J. Ford. 2004. Review of relative fitness of hatchery and natural salmon. U.S. Dept. Commerce., NOAA Tech. Memo. NMFSNWFSC-61, 28 p.

Blouin, Michael. 2003.Relative reproductive success of hatchery and wild steelhead in the Hood River. BPA Intergovernmental Project # 1988-053-12. ODFW Interagency agreement No. 001-2007s.

Blouin, Michael. June 13, 2009. Hatchery Fish May Hurt Efforts To Sustain Wild Salmon Runs. Science Daily

Brannon, Ernest L., James A. Lichatowich, Kenneth P. Currens, Brian E. Riddell, Daniel Goodman, Richard N. Williams, and Willis E. McConnaha. 1999. Review of Artificial Production of Anadromous and Resident Fish in the Columbia River Basin. Part I A Scientific Basis for Columbia River Production Programs. Northwest Power Planning and Conservation Council . Document 99-4. Portland, Oregon. http://www.nwppc.org/library/1999/99-4.htm

Brauner, C. J., G. K. Iwama, and D. J. Randall. 1994. The effect of short-duration seawater exposure on the swimming performance of wild and hatchery-reared juvenile coho salmon (Oncorhynchus kisutch) during smoltification Can. J. Fish. Aquat. Sci. 51:2188-2194

Buhle, E. R., K. K. Holsman, M. D. Scheuerell, and A. Albaugh. 2009. Using an unplanned experiment to evaluate the effects of hatcheries and environmental variation on threatened populations of wild salmon. Biological Conservation 142:2449-2455.

Byrne, Alan, T.C. Bjornn, and J.D. McIntyre. 1992. Response of native steelhead to hatchery supplementation programs in an Idaho river. North American Journal of Fisheries Management 12:62-78.

Chilcote, M. W., S. A. Leider, and J. J. Loch. 1986. Differential reproductive success of hatchery and wild summer-run steelhead under natural conditions. Transactions of the American Fisheries Society 115:726–735.

Chilcote, Mark 2002: ODFW memorandum regarding the low survival rate of wild coho that were brought into the hatchery in an effort to rescue a population.

Chilcote, Mark. 2003. Relationship between natural productivity and the frequency of wild fish in mixed spawning populations of wild and hatchery steelhead. Can. J. Fish. Aquat. Sci. 60(9): 1057-1067

Chilcote, Mark. 2008 Recovery Strategies to Close the Conservation Gap Methods and Assumptions, Oregon Department of Fish and Wildlife presentation to the Lower Columbia River Salmonid Recovery Stakeholders.

ATTACHMENT A

Chilcote, Mark W., K.W. Goodson, and M.R. Falcy. 2011. Reduced recruitment performance in natural populations of anadromous salmonids associated with hatchery-reared fish. Can. J. Fish. Aquat. Sci. 68: 511-522.

Dickson, T. A., and H. R. MacCrimmon. 1982. Influence of hatchery experience in growth and behaviour of juvenile Atlantic salmon (Salmo salar) with in allopatric and sympatric populations. Canadian Journal of Fisheries and Aquatic Sciences 39:1453-1458.

Ersbak, 1C, and B. L. Hasse. 1983. Nutritional deprivation after stocking as a possible mechanism leading to mortality in stream-stocked brook trout. North American Journal of Fisheries Management 3:142-151.

Fenderson, O. C., W. H. Everhart, and K. M. Muth. 1968. Comparative agonistic and feeding behavior of hatchery-reared and wild salmon in aquaria. Journal of the Fisheries Research Board of Canada 25:1-14.

Flagg, T.A., and C.E. Nash (editors). 1999. A conceptual framework for conservation hatchery strategies for Pacific salmonids. U.S. Dep. Commer., NOAA Tech. Memo. NMFS-NWFSC-38, 46 p. U.S. Dept. Commer., NOAA Tech. Memo. NMFS-NWFSC-38, 48 p.

Fleming, I. A., and M. R. Gross. 1993. Breeding success of hatchery and wild coho salmon (Oncorhynchus kisutch) in competition. Ecological Applications 3:230–245.

Fleming, I. A., and M. R. Gross. 1994. Breeding competition in a Pacific salmon (coho: *Oncorhynchus kisutch*): measures of natural and sexual selection. Evolution 48:637–657.

Fleming, I. A., A. Lamberg, and B. Jonsson, B. 1997.Effects of early experience on the reproductive performance of Atlantic salmon. Behavioral Ecology 8:470–480.

Fleming, I.A. and S. Einum. 1997. Experimental tests of genetic divergence of farmed from wild Atlantic salmon due to domestication. ICES Journal of Marine Science, 54: 1051-1063

Flick, William A | Webster, Dwight A. 1964. Comparative First Year Survival and Production in Wild and Domestic Strains of Brook Trout, Salvelinus fontinalis. Transactions of the American Fisheries Society. Vol. 93, no. 1, pp. 58-69.

Ford, M. J. 2002 Selection in captivity during supportive breeding may reduce fitness in the wild. Conserv. Biol. 16, 815–825.

Ford, Michael. 2010. Some trends in hatchery effects science. Presentation to the N.W. Power Planning and Conservation Council September 2010.

Hilborn, R. 1992. Can fisheries agencies learn from experience? Transactions American Fisheries Society. Fisheries. 17:4 6-14

Hjort, R. C, and C. B. Schreck. 1982. Phenotypic differences among stocks of hatchery and wild coho salmon, *Oncorhynchus kisutch*, in Oregon, Washington, and California. U.S. National Marine Fisheries Service Fishery Bulletin 80:105-119.

Hulett, P.L., Chris W. Wagemann, R. H. Bradford, and S.A. Leider. 1994. Studies of hatchery and wild steelhead in the lower Columbia region. Washington Department of Fish and Wildlife. Report No. 94-3.

IEAB 2002: Artificial production review – economics analysis, Phase I. Research approach, findings and recommendations. N.W. Power Planning and Conservation Council. Portland, Oregon.

Independent Scientific Advisory Board (ISAB). 2002. Hatchery Surpluses in the northwest. A Report to the N.W. Power Planning and Conservation Council. Vol. 27, No. 12. Portland, Oregon

ATTACHMENT A

Jonsson, Bror and Ian A. Fleming. 1993. Enhancement of wild salmonid populations. *In:* G. Sundnes (ed.) 1993 Human impact on self-recruiting populations. An International Symposium, Kongsvoll, Norway, 7-11 June 1993. Tapir, Trondheim, Norway.

Jonsson, Bror and Nina Jonnson. 2002. Cultured Atlantic salmon in nature: a review of their ecology and interaction with wild fish. ICES Journal of Marine Science, 63: 1162-1181.

Knudsen, Curtis M., Steve L. Schroder, Craig A. Busack, Mark V. Johnston, Todd N. Pearsons, William J. Bosch, David E. Fast. (2006) Comparison of Life History Traits between First-Generation Hatchery and Wild Upper Yakima River Spring Chinook Salmon. Transactions of the American Fisheries Society 135:4, 1130.

Kostow, Kathryn, Anne Marshall, and Stevan R. Phelps. 2003. Naturally spawning hatchery steelhead contribution to smolt production but experience low reproductive success. Trans. Am. Fish. Soc. 132:780-790.

Kostow, K. E. 2004. Differences in juvenile phenotypes and survival between hatchery stocks and a natural population provide evidence for modified selection due to captive breeding. Canadian Journal of Fisheries and Aquatic Sciences 61:577–589.

Leider, S. A., P. L. Hulett, J. J. Loch, and M. J. Chilcote. 1990. Electrophoretic comparison of the reproductive success of naturally spawning transplanted and wild steelhead trout through the returning adult stage. Aquaculture 88:239–252.

Levings, C. D., McAllister, C. D., and B. D. Chang. 1986. Differential use of the Campbell River estuary, British Columbia, by wild and hatchery reared juvenile chinook salmon (*Oncorhynchus tshawytscha*). Can. J. Fish. Aquat. Sci. 43:1386-1397.

Lynch, M., and M. O'Hely. 2001. Captive breeding and the genetic fitness of natural populations. Conservation Genetics 2:363–378.

Michael P. Marchetti and Gabrielle A. 2003.Nevitt.Effects of hatchery rearing on brain structures of rainbow trout, *Oncorhynchus mykiss*. Environmental Biology of Fishes 66:9-14.

Mason, John W., Oscar M. Brynildson, and Paul E. Degurse. 1997. Comparative survival of wild and domestic strains of brook trout in streams. Trans. Amer. Fish. Soc. 96(3) 313-319.

McClure, Michelle, Fred M. Utter, Casey Baldwin, Richard W. Carmichael, Peter F. Hassemer, Phillip J. Howell, Paul Spruell, Thomas D. Cooney, Howard A. Schaller and Charles E. Petrosky. 2008 Evolutionary effects of alternative artificial propagation programs: implications for viability of endangered anadromous salmonids. Blackwell Publishing Ltd. 356-375.

McLean, Jennifer E., Paul Bentzen, and Thomas P. Quinn 2003. Differential reproductive success of sympatric naturally spawning hatchery and wild steelhead trout through the adult stage. Can. J. Fish. Aquat. Sci. 60(4): 433-440.

Meffe, G. K. 1992. Techno-arrogance and halfway technologies: salmon hatcheries on the Pacific coast of North America. Conservation. Biol. 6:350-354.

Miller, R. B. 1953. Comparative survival of wild and hatchery-reared cutthroat trout in a stream Transactions of the American Fisheries Society 83:120-130.

Miller, W.H., T.C. Cole, H.L. Burge, T.T. Kisanuki. 1990. Analysis of salmon and steelhead supplementation: emphasis on unpublished reports and present programs Part 1. U.S. Fish and Wildlife Service, Dworshak Fisheries Assistance Office, Ahsahka, Idaho. September 1990.

ATTACHMENT A

Mobrand, Lars, E., John Barr, Lee Blankenship, Donald E. Camption, Trevor T.P. Evelyn, Tom A. Flagg, Conrad V. Mahnken, Lisa W. Seeb, Paul R. Seidel, William W. Smoker. 2005. Hatchery reform in Washington State: principles and emerging issues. Amer. Fish. Soc. Fisheries June 2005.

Moran, P., and R. S. Waples. 2007. Monitor and evaluate the genetic characteristics of supplemented salmon and steelhead. Project number 1989-096-00. Research Progress Report Oct 5, 2007. Report to Bonneville Power Administration. Available at: http://pisces.bpa.gov/release/documents/documentviewer.aspx?doc=P107430.

Mullan, James. Status of chinook salmon stocks in the Mid-Columbia. In Status and future of spring chinook salmon in the Columbia River Basin-conservation and enhancement. NOAA Fisheries. NOAA F/NWC -187. Session II Stock Status and carrying capacity.

Naish, K. A., J. E. Taylor, P. S. Levin, T. P. Quinn, J. R. Winton, J. Huppert, and R. Hilborn. 2008. An evaluation of the effects of conservation and fishery enhancement hatcheries on wild populations of salmon. Advances in Marine Biology 53:61–194.

Naylor, Rosamond, Kjetil Hindar, Ian A. Fleming, Rebecca Goldburg, Susan Williams, John Volpe, Fred Whoriskey, Josh Eagle, Dennis Kelso, and Marc Mangel. 2005. Fugitive Salmon: Assessing the Risks of Escaped Fish from Net-Pen Aquaculture. BioScience Vol. 55 No. 5.

Nickelson, T. E., Solazzi, M. F. and Johnson, S. L. 1986. Use of hatchery coho salmon (Oncorhynchus kisutch) presmolts to rebuild wild populations in Oregon coastal streams. Can. J. Fish. Aquat. Sci. 43, 2443–2449.

Nickelson, Tom. 2003. The influence of hatchery coho salmon on the productivity of wild coho salmon populations in Oregon coastal basins. Can. J. Fish. Aquat. Sci. 60: 1050-1056.

National Oceanic and Atmospheric Administration (NOAA). 2010.Listing Endangered and Threatened Species: Completion of a Review of the Status of the Oregon Coast Evolutionarily Significant Unit of Coho Salmon; Proposal to Promulgate Rule Classifying Species as Threatened. U.S. Department of Commerce.

ODFW, 2010a. Draft Lower Columbia River Salmonid Recovery Plan. Page 155.

ODFWb 2010: Upper Willamette River Conservation and Recovery Plan for chinook salmon and steelhead; Public Review Draft October 2010. Oregon Department of Fish and Wildlife, Salem, Oregon.

Peery, C.A. and T.C. Bjornn. 1993. Ecological effects of hatchery spring chinook on naturally produced chinook. Idaho Supplementation Studies. Annual Report 1991-1992, October 1993. Bonneville Power Administration.

Reisenbichler, R. R. & McIntyre, J. D. 1977 Genetic differences in growth and survival of juvenile hatchery and wild steelhead trout, Salmo gairdneri. Can. J. Fish. Res. Board 34, 123–128.

Reisenbichler, R. R. and J. D. McIntyre. 1986. Requirements for integrating natural and artificial production of anadromous salmonids in the Pacific Northwest, p. 365-374. *In* R.H. Stroud (ed.) Fish Culture in Fisheries Management. American Fisheries Society, Bethesda, Maryland

Reisenbichler, R.R., J.D. McIntyre, M. F. Solazzi, and S. W. Landino. 1992. Genetic variation in steelhead of Oregon and Northern California. Transactions American Fisheries Society 121:158-169.

Reisenbichler, R. R. 1994**.** Genetic factors contributing to declines of anadromous salmonids in the Pacific Northwest. D. Stouder and R. Naiman (eds.) Pacific Salmon and Their Ecosystems. Chapman Hall, Inc.

Reisenbichler, R. R. 1996. The risks of hatchery supplementation. The Osprey, Issue No. 27, June 1996.

ATTACHMENT A

Recovery Implementation Science Team (RIST). April 9, 2009. Hatchery Reform Science. National Marine Fisheries Service. Seattle, Washington. https://docs.google.com/viewer?url=http://www.nwfsc.noaa.gov/trt/puget_docs/hatchery_report_april92009.pdf

Shrimpton, J. M., N. J. Bernier, G. K. Iwama, and D. J. Randall. 1994. Differences in measurements of smolt development between wild and hatchery reared hatchery reared juvenile coho salmon (*Oncorhynchus kisutch*) before and after saltwater exposure. Canadian Journal of Fisheries and Aquatic Sciences 51:2170–2178.

Slaney, P. A., L. Berg, A. F. Tautz.1993. Returns of hatchery steelhead relative to site of release below an upper-river hatchery. North American Journal of Fisheries Management 13:558-566.

Sosiak, A. J., R. G. Randall, and J. A. McKenzie. 1979. Feeding by hatchery-reared and wild Atlantic salmon *(Salmo salar)* parr in streams. Journal of the Fisheries Research Board of Canada 36:1408-1412.

Steward, C. R., and T. C. Bjornn. 1990. Supplementation of salmon and steelhead stocks with hatchery fish: a synthesis of published literature. Technical Report 90-1. Idaho Cooperative Fish and Wildlife Research Unit, Moscow, ID.

Swain, D. P., B. E. Riddell, and C. B. Murray. 1991. Morphological differences between hatchery and wild populations of coho salmon *(Oncorhynchus kisutch):* environmental versus genetic origin. Canadian Journal of Fisheries and Aquatic Sciences 48:1783-1791.

Taylor, Eric, B. 1986. Differences in morphology between wild and hatchery populations of juvenile coho salmon. The Progressive Fish Culturist 48:171-176.

Vincent, E. R. 1987. Effects of stocking catchable-size hatchery rainbow trout on two wild trout species in the Madison River and O'Dell Creek, Montana. North American Journal of Fisheries Management 7:91-105.

Waples, R. S. 1991. Genetic interactions between hatchery and wild salmonids: Lessons from the Pacific Northwest. Can. J. Fish. Aquat. Sci. 48, 124–133.

Waples, R. S. and Do, C. 1994. Genetic risk associated with supplementation of pacific salmonids—Captive broodstock programmes. Can. J. Fish. Aquat. Sci. 51, 310–329.

Wohlfarth, G. 1986. Decline in natural fisheries—a genetic analysis and suggestion for recovery. Canadian Journal of Fisheries and Aquatic Sciences 43(6):1298-1306.

Wood, E. M., W. T. Yasutake, J. E. Halver, and A. N. Woodall. 1960. Chemical and histological studies of wild and hatchery salmon in fresh water. Transactions of the American Fisheries Society. Volume 89, Issue 3 (July 1960) pp. 301-307.

ATTACHMENT B

Table 1. Composition of spring Chinook salmon in the Upper Sandy basin (above Marmot Dam) based on carcasses recovered, and presence or absence of thermal marks in otoliths (source, ODFW annual spawning reports).

Year	Fin-Clipped	Un-clipped Hatchery[a]	Unclipped Wild	Percent Wild[b]
2002	3[c]	26 (18)	121	81 (19)
2003	9[c]	14 (12)	106	82 (18)
2004	2[c]	8 (4)	207	95 (5)
2005	0[c]	41 (16)	220	84 (16)
2006	9 [c]	24 (10)	207	86 (14)
2007[d]	2[c]	15 (8)	186	92 (8)
2008[e]				
2009[f]	32	--	52	40 (60)
2010[f]	42	--	32	24 (76)

a *Number in parentheses is percentage of unclipped fish that had a thermal mark (unclipped hatchery fish).*
b *Percentage hatchery is in parentheses.*
c *Fish were sorted at the dams and all or most of fin-clipped fish were removed.*
d *Marmot Dam was removed in 2007, fish ladder was operational to July 18; fish weir was operated until Oct. 19.*
e. Progress report not yet finalized. Non published data is available from Kirk Schroeder at ODFW. USFS did not conduct spawning surveys or carcass recovery in 2008.
f. Data is preliminary based on USFS carcass counts and does not include ODFW carcass counts or otolith thermal mark analysis.

References:

Schroeder, K., Kenaston, K.R., McLauglin, L.K. 2006,2007. ODFW Annual Progress Report – Fish Research Progress Report: Spring Chinook Salmon in the Willamette and Sandy River Basins.

ATTACHMENT C

Redds and percentage of spring Chinook carcasses with fin clips recovered in spawning areas of the upper Sandy River basin, 2010.

River/stream	Section	Percent clipped	N (sample size)	Redds
Salmon River	Final Falls–Forest Rd 2618	68%	304	387
	Forest Rd 2618–Arrah Wanna	75%	152	251
	Arrah Wanna–mouth	84%	49	168
	Cheeney Creek	100%	3	48
Salmon Total		78%	508	854
Still Creek	Above Rd 20 Bridge	66%	116	336
	Below Rd 20 Bridge	80%	302	271
Still Total		76%	418	550
Zigzag River	Above Camp Creek	63%	16	31
	Camp Creek–Still Creek	91%	34	49
	Below Still Creek	75%	67	59
Zigzag Total		78%	117	139
Camp Creek	Campground–mouth	93%	95	55
Lost Creek	Riley Campground–mouth	100%	4	5
Clear Fork	Mouth area	100%	2	2
Clear	Barlow Rd–mouth		0	3
Sandy River	Marmot Bridge–Marmot Dam		0	28
GRAND TOTAL		76%	1,144	1,636

Notes:

- Salmon River upstream of Forest Rd 2618 includes 5 redds in South Fork Salmon.
- 48 redds in Cheeney Creek were from Forest Service survey; 14 decomposed carcasses also found in creek.
- Does not include 1 carcass recovered in Lost Creek that was sampled for otoliths, but presence or absence of fin clip could not be determined.