



**U.S. Fish and Wildlife Service - Pacific Region  
Columbia River Basin Hatchery Review Team**

**Columbia River Basin, Columbia Cascade Province**  
*Wenatchee, Entiat and Methow River Watersheds*



**Leavenworth, Entiat and Winthrop National Fish Hatcheries  
Assessments and Recommendations**

**Final Report, Summary**

**April 2007**



# USFWS Columbia Basin Hatchery Review Team

## *Leavenworth NFH Complex Assessments and Recommendations Report – April 2007*

### Summary

The U.S. Fish and Wildlife Service (Service) initiated, in October 2005, a three-year review of 21 salmon and steelhead hatcheries that the Service owns or operates in the Columbia River Basin. The goal of the Service's review is to ensure that all federal hatcheries are operated in accordance with best scientific principles, and contribute to sustainable fisheries and the conservation of naturally-spawning populations of salmon, steelhead and other aquatic species. The Service's review process is modeled after the recent Puget Sound and Coastal Washington Hatchery Reform Project<sup>1</sup> and includes facilitation by Long Live the Kings (LLTK)<sup>2</sup>, a non-profit organization devoted to restoring wild salmon to the waters of the Pacific Northwest. The Service plans to complete its reviews of 12 National Fish Hatcheries by the end of 2007 and nine other hatcheries in the Snake River region by the end of 2008.

The report presented here provides benefit-risk assessments and recommendations for propagation programs at three National Fish Hatcheries (NFHs) in the Mid-Columbia River region of Washington State: Leavenworth, Entiat and Winthrop NFHs. These three hatcheries are located on streams draining the east slope of the Cascades Mountains and are managed together as the "Leavenworth Complex." Their construction and operation was initially authorized under the Grand Coulee Dam Project, 49 Statue 1028, on August 30, 1935 as part of the Rivers and Harbors Act. The hatcheries were reauthorized under the Columbia Basin Project Act, 57 Statue 14, on March 10, 1943, and subsequently under the Fish and Wildlife Coordination Act, 60 Statue 1080, on August 14, 1946. The three hatcheries were constructed by the U.S. Bureau of Reclamation (BOR) between 1939 and 1942 and are currently operated by the Service with funding from BOR and the Bonneville Power Administration (BPA, U.S. Department of Energy) via interagency agreements. The primary purpose of the three hatcheries is to maintain runs of anadromous salmonid fishes as continued mitigation for fish losses associated with Grand Coulee Dam which blocks anadromous salmonids from 1,140 miles of the upper Columbia River.

The Leavenworth, Entiat, and Winthrop NFHs each propagate and release spring Chinook salmon (*Oncorhynchus tshawytscha*) as part of their mitigation responsibilities. The Winthrop NFH also releases steelhead (anadromous *O. mykiss*) in collaboration with the Washington Department of Fish and Wildlife (WDFW). Those four programs and the facilities at the three hatcheries are the focus of the review described here.

The Review Team considered four characteristics of each salmonid population or stock within the watersheds affected by each hatchery program: *biological significance*, *population viability*, *habitat conditions*, and *harvest* goals or contributions. The Review Team used both short- (10-15 years) and long-term (50–75 years) goals, as identified by the fishery co-managers<sup>3</sup>, as a foundation for assessing the benefits and risks of the hatchery programs. Recommendations of the Review Team also reflect short-term and long-term perspectives, with recommendations for current programs addressing short-term needs and recommended alternatives to existing programs addressing long-term goals. Source

---

<sup>1</sup> [www.hatcheryreform.org](http://www.hatcheryreform.org)

<sup>2</sup> [www.LLTK.org](http://www.LLTK.org)

<sup>3</sup> *Comanagers are the Columbia River tribes, Washington Department of Fish and Wildlife, National Marine Fisheries Service (aka NOAA Fisheries), and U.S. Fish and Wildlife Service.*

# USFWS Columbia Basin Hatchery Review Team

## *Leavenworth NFH Complex Assessments and Recommendations Report – April 2007*

documents not readily available to the general public, including appendices and background documents for this report, are accessible via the Service's hatchery review website.<sup>4</sup>

The Review Team also examined the Master Plan of the Yakama Nation for reintroducing coho salmon (*O. kisutch*) to the mid-Columbia region. The Team also received oral reports from Yakama Nation biologists and a summary of major results to date. Although the Yakama Nation's coho reintroduction program is using some of the facilities at the three Leavenworth Complex hatcheries, that program is not explicitly reviewed here but is included with some of the Team's recommendations.

### *Leavenworth National Fish Hatchery*

**Facility Overview:** The Leavenworth NFH is located at river mile (RM) 2.8 of Icicle Creek, a tributary to the Wenatchee River 26 miles upstream from the Columbia River near Leavenworth Washington. The Wenatchee River enters the Columbia River at RM 468 at the town of Wenatchee, Washington. Adult fish returning to the Leavenworth NFH must migrate upstream a total of 497 miles and must pass over seven Columbia River hydropower dams. Water sources at the hatchery include seven wells, Icicle Creek, and supplemental summer releases from Snow and Nada Lakes located in the Alpine Lakes Wilderness within the Icicle Creek watershed. The hatchery hosts the annual Wenatchee River Salmon Festival, an internationally-recognized public outreach and education event held each September. The Leavenworth NFH supports a spring Chinook program and provides facilities for the coho reintroduction program of the Yakama Nation. The operations and maintenance budget for Leavenworth NFH totaled approximately \$1.8 million in FY2007.

**Spring Chinook Program Overview:** This program is intended to operate as a *segregated-harvest* program with only returning hatchery-origin adults used for broodstock. The primary goal of the program is to provide harvest benefits from returning adults. The broodstock objective is to spawn approximately 1,000 adults annually with a release objective of 1.625 million yearling smolts. The propagated stock is largely an introduced stock from the Carson NFH (near Carson, Washington). The Carson NFH stock was developed in the late 1950's and early 1960's from a presumed mixture of upper Columbia and Snake River populations intercepted at Bonneville Dam in the Columbia River Gorge.

**Benefits:** The program provides significant tribal and recreational harvest benefits in Icicle Creek. The tribal (Yakama Nation) harvest in Icicle Creek averaged 2,905 spring Chinook per year, 1999-2003. In addition, during that same time period, an average of over 3,000 hatchery-origin adults, trapped at the hatchery but surplus to broodstock needs, were provided directly to Columbia River tribes (Yakama Nation, Colville Confederated Tribes, Spokane Tribe, Kalispell Tribe) and food banks. Harvest benefits from recreational non-tribal harvest in Icicle Creek averaged 1,252 fish per year, 1999-2003. In addition, commercial/tribal and recreational harvests averaged 835 and 732 fish per year, respectively, in the mainstem Columbia River. The harvest is restricted primarily to Icicle Creek because natural populations of spring Chinook in the Wenatchee River and mid-Columbia region are currently listed as endangered under the U.S. Endangered Species Act (ESA).

**Risks:** Water-use and fish passage issues in Icicle Creek are complex and present several problems (see pages 44-54 of main report). The surface water intake pipe for the hatchery is at risk of catastrophic failure. Such a failure places all fish reared on Icicle Creek water at immediate risk of

---

<sup>4</sup> [www.fws.gov/Pacific/fisheries/HatcheryReview/](http://www.fws.gov/Pacific/fisheries/HatcheryReview/)

## USFWS Columbia Basin Hatchery Review Team

### *Leavenworth NFH Complex Assessments and Recommendations Report – April 2007*

100% mortality. Such a failure would affect both the Service's spring Chinook program and the Yakama Nation's coho reintroduction program. In addition, spring Chinook from the introduced Leavenworth NFH stock pose a genetic risk to ESA listed populations in the upper Wenatchee River via straying and natural spawning. Current management practices increase this risk because (a) ESA-listed hatchery-origin fish released by WDFW for recovery are given the same adipose fin mark as fish released from the Leavenworth NFH and (b) marked fish are deliberately passed upstream at Tumwater Dam into the upper Wenatchee River to spawn naturally and assist with recovery. The Leavenworth NFH also poses a demographic risk to ESA-listed steelhead and bull trout (*Salvelinus confluentus*) because water intake screening does not comply with federal guidelines. In addition, passage facilities for upstream-migrating fish around hatchery instream structures are inadequate. Instream flows in Icicle Creek do not meet minimum requirements between the hatchery's intake at RM 4.5 and the hatchery outflow at RM 2.4. In some years, this latter section of Icicle Creek has gone completely dry during the summer, although the majority of water is withdrawn by irrigation companies during months of lowest flows.

**Recommendations:** The Review Team identified 10 specific recommendations to reduce risks and/or improve benefits of the current spring Chinook program. The Review Team was concerned that inter-related water issues for the hatchery and Icicle Creek are being addressed separately and not holistically. The Review Team concluded that a collaborative strategy with stakeholders, similar to the *Project Alternatives Solutions Study* (PASS) process initiated recently by BOR, was highly desirable to address these water issues in a holistic and scientifically defensible manner. For example, these strategies should include options for providing hatchery outflow water directly for irrigation, rather than dewatering Icicle Creek to meet water rights of the hatchery and irrigation companies. The Review Team believed that the BOR could play a key intermediary role to facilitate those options. The Review Team also proposed three water intake and fish passage alternatives that combined elements of alternatives developed separately for intake and passage by an engineering firm. Regardless of which alternatives are selected, replacement of the existing water intake system to the hatchery needs to occur as soon as possible. A specific recommendation of the Review Team is to move promptly to unique marks or tags for Leavenworth NFH and upper Wenatchee River hatchery programs to allow sorting and removal of returning Leavenworth NFH adult spring Chinook at Tumwater Dam. The Team also recommends reducing the rearing densities of juvenile spring Chinook by 25% in raceways at Leavenworth NFH. While these reduced densities will result in reducing the number of smolts released annually, density studies conducted previously at Leavenworth NFH for brood years (BY) 1994-1996 indicate that reduced densities will not decrease the number of returning adults because of increased individual survival.

**Program Alternatives:** The Review Team considered the pros and cons of seven alternatives to the existing spring Chinook program, including the current program with full implementation of all program-specific recommendations (Alternative 1). The Review Team recommends continuation of the existing spring Chinook program (Alternative 1) until the water intake system for the hatchery is replaced. Once the existing intake system is replaced, the Review Team recommends transitioning the existing broodstock to a native spring Chinook broodstock that is integrated genetically with an existing Wenatchee River ESA recovery hatchery broodstock according to a proposed "stepping stone" model. Implementation of this latter recommendation would be contingent upon the issuance of ESA permits to allow continued tribal and recreational harvests in Icicle Creek on Leavenworth NFH spring Chinook. The Review Team concluded that those latter fishery benefits should not be diminished.

## USFWS Columbia Basin Hatchery Review Team

### *Leavenworth NFH Complex Assessments and Recommendations Report – April 2007*

#### ***Entiat National Fish Hatchery***

**Facility Overview:** The Entiat NFH is located at RM 6.3 of the Entiat River, a tributary to the Columbia River at RM 485 between Wenatchee and Chelan, Washington. Adult fish returning to the Entiat NFH must migrate upstream a total of 491 miles and must pass over eight Columbia River hydropower dams. Water sources for the hatchery are the Entiat River, Packwood Spring, and six wells. However, Entiat River water is no longer used because of the presence of a *Myxosporidian* parasite. No barrier weir is present in the Entiat River to facilitate capture of broodstock or preclude hatchery-origin adults from migrating upstream of the hatchery into natural spawning areas. The Entiat NFH supports a spring Chinook program. It also provides facilities for the coho reintroduction program of the Yakama Nation. The operations and maintenance budget for Entiat NFH totaled approximately \$425,000 in FY2007.

**Spring Chinook Program Overview:** This program is intended to operate as a *segregated-harvest* program with only returning hatchery-origin adults used for broodstock. The primary goal of the program is to provide harvest benefits from returning adults. The broodstock objective is to spawn approximately 300 adults annually with a release objective of 400,000 yearling smolts. An additional 100 adults are retained for experimental releases of progeny in the Okanogan River as part of a spring Chinook reintroduction study by the Colville Confederated Tribes. Over the past several years, up to 50,000 spring Chinook pre-smolts were transferred in October for acclimation and release into Omak Creek, a tributary to the Okanogan River. The propagated stock is largely an introduced stock from the Carson NFH with an ancestry similar to that of spring Chinook at the Leavenworth NFH.

**Benefits:** The program provides little or no terminal harvest benefit because natural populations of spring Chinook in the Entiat River and mid-Columbia region are currently listed as endangered under the ESA, thus precluding direct harvest opportunities. Less than 10% of all returning adults from this program contribute to harvest, primarily in lower Columbia River commercial and recreational fisheries. On the other hand, adult returns to Omak Creek have provided “first salmon ceremonies” to the Colville Confederated Tribes for the first time in decades.

**Risks:** The absence of a barrier weir results in a significant straying genetic risk to ESA listed natural populations in the Entiat River. From 2000-2005, the Entiat NFH contributed an average of 31.4% of the estimated natural spawning escapement of spring Chinook salmon in the Entiat River. The lack of shade covers and screening over outside raceways poses demographic survival risks to the hatchery stock from behavioral crowding and bird predation.

**Recommendations:** The Review Team recommends termination of the current spring Chinook program and implementation of alternative programs. The Review Team concluded that the risks of the current program significantly outweigh benefits with little opportunity to alter this balance in the immediate future. In the interim, the Review Team recommends inclusion of the Entiat NFH as part of an emergency fish rearing plan for the Leavenworth NFH until the water intake system at Leavenworth is replaced. The Review Team also recommends that the Entiat NFH continue to provide facilities for the Yakama Nation’s coho reintroduction program consistent with their Master Plan.

**Program Alternatives:** The Review Team considered the pros and cons of five alternatives to the existing spring Chinook program. The Team recommends that the Service use the Entiat NFH for the propagation of Columbia River basin species of high conservation or harvest importance (Alternative 4) including - but not limited to – reintroduction of coho salmon in the Wenatchee and Methow rivers, consistent with the Yakama Nation’s Master Plan, and reintroduction of spring Chinook salmon to the upper Columbia and Okanogan rivers consistent with the Colville Confederated Tribe’s restoration

## USFWS Columbia Basin Hatchery Review Team

### *Leavenworth NFH Complex Assessments and Recommendations Report – April 2007*

plans. Under this recommended alternative, the Entiat NFH would focus on the conservation, recovery, and reintroduction of native fish species in the upper Columbia River to support long-term conservation and harvest goals. These latter goals include use of the spring Chinook stock at the Winthrop NFH to assist with development of a tribal hatchery program and terminal fisheries immediately downstream of Chief Joseph Dam, contingent upon the ability of the spring Chinook program at the Winthrop NFH to first meet its intended goals within the Methow River (see below). Under this recommended alternative, hatchery-origin fish would not necessarily be released into the Entiat River which could serve as a “reference stream” for assessing ESA hatchery recovery efforts elsewhere (e.g. Wenatchee and Methow rivers).

### *Winthrop National Fish Hatchery*

**Facility Overview:** The Winthrop NFH is located near Winthrop, Washington at RM 44.8 of the Methow River, a tributary to the Columbia River at RM 524. Adult fish returning to the Winthrop NFH must migrate 569 miles upstream and pass over nine Columbia River hydropower dams. Water sources for the hatchery are the Methow River, two wells, and one natural spring. No barrier weir is present in the Methow River to collect broodstock or preclude hatchery-origin adults from migrating upstream into natural spawning areas, although a passable boulder dam (Foghorn Dam) impounds water for the hatchery intake and provides some adult trapping capability. The Winthrop NFH supports a spring Chinook program and a steelhead program. It also provides facilities for the coho reintroduction program of the Yakama Nation. The operations and maintenance budget for Winthrop NFH totaled approximately \$660,000 in FY2007.

### **Spring Chinook**

**Program Overview:** The program is intended to operate as an *integrated conservation and harvest* program with natural-origin and hatchery-origin adults used for broodstock. The primary goal of the program is to assist with recovery of ESA listed spring Chinook in the Methow River and provide harvest benefits from returning adults. The program was recently transitioned from a *segregated-harvest* program that propagated an introduced Carson NFH stock (*Winthrop-Carson* stock) with an ancestry similar to stocks at the Leavenworth and Entiat NFHs. The Winthrop NFH now propagates the *Methow Composite* stock, derived historically from natural-origin fish in the Methow River subbasin, but with approximately 25-30% of its current genetic ancestry derived from hatchery-origin Winthrop-Carson fish. The broodstock objective is to collect and spawn approximately 400 adults annually with a release objective of 600,000 yearling smolts. The hatchery coordinates broodstock collection and spawning with the Methow State Hatchery (SH) approximately 1 mile upstream of the Winthrop NFH. The Methow SH is the original source of the Methow Composite stock.

**Benefits:** The program provides little or no terminal harvest benefit because natural populations of spring Chinook in the Methow River and mid-Columbia region are currently listed as endangered under the ESA, thus precluding harvest opportunities. Less than 5% of returning adults from this program contribute to harvest, primarily in lower Columbia River commercial and recreational fisheries. Conservation benefits from this program to naturally spawning populations are unknown (undocumented) but are presumed to indirectly reduce extinction risks of ESA listed fish by increasing the total number of returning adults each year. Methow Composite fish are included in the ESA listings for spring Chinook.

**Risks:** The inability to trap sufficient numbers of natural-origin adults for broodstock poses a domestication risk to the hatchery stock and natural populations via the potential spawning of large

## USFWS Columbia Basin Hatchery Review Team

### *Leavenworth NFH Complex Assessments and Recommendations Report – April 2007*

numbers of hatchery-origin adults in the Methow River. At the present time, all hatchery-origin adults surplus to broodstock needs are precluded from entering the hatchery and allowed to spawn naturally. This forced natural spawning, concentrated in the immediate vicinity of the Winthrop NFH, also poses ecological risks to ESA listed species and other fish species via competition.

**Recommendations:** The Review Team identified 12 program-specific recommendations. The Review Team concluded that conservation and mitigation goals for spring Chinook at the Winthrop NFH, including the defined roles of the Winthrop NFH and Methow SH within the Methow River watershed, are inadequate. The lack of specific goals and long-range plans for artificial propagation of spring Chinook in the Methow River creates many biological risks and conflicts. Consequently, the Review Team recommends that the Service work with other salmonid comanagers to establish specific goals and objectives for the Winthrop NFH and – more generally – for spring Chinook in the Methow River. These goals and objectives should be coordinated with the Methow SH and should include the intended contribution of hatchery-origin fish to the conservation and recovery of spring Chinook in the Methow River and elsewhere upstream of Wells Dam on the Columbia River (e.g., Okanogan River). Specific objectives should be quantified in terms of the number of natural and hatchery-origin adults needed for broodstock, proportion and number of hatchery-origin fish allowed to spawn naturally, the number of hatchery-origin fish to be released in defined locations, etc. In addition, the Service and other salmonid comanagers should review mitigation goals and objectives to ensure that mitigation activities of the Winthrop NFH are meeting federally-mandated obligations consistent with current conditions (e.g., endangered ESA status of spring Chinook). Based on the proposed goals and objectives, the Service should develop a new *Hatchery and Genetic Management Plan* (HGMP) for spring Chinook at the Winthrop NFH. The Review Team also recommends improvement of adult collection facilities at Foghorn Dam, or the creation of a new facility, as a critical need for trapping natural-origin adults for broodstock and for monitoring and controlling the upstream passage of natural and hatchery-origin adults in the Methow River. This latter recommendation has been identified as a critical need also by WDFW. As an interim measure, natural-origin broodstock could be collected at Wells Dam to reduce domestication risks to the Methow Composite stock. In addition, hatchery-origin adults returning to the Winthrop NFH in excess of broodstock needs should not be precluded from entering the hatchery and forced to spawn naturally in unintended areas. Instead, all Methow Composite fish returning to the Winthrop NFH should be trapped and either outplanted directly into designated recovery areas, or spawned and their progeny outplanted, consistent with comanager plans and approved NOAA Fisheries recovery plans. These latter objectives may require development of acclimation release sites and facilities in the upper Methow River watershed. A monitoring and evaluation (M&E) program should also be developed for monitoring progress towards meeting the conservation and mitigation goals of the program. Rehabilitation of the adult holding and spawning facilities at the Winthrop NFH is also needed.

**Program Alternatives:** The Review Team considered the pros and cons of eight alternatives to the existing spring Chinook program, including the current program with full implementation of all recommendations (Alternative 1). The Team recommends modification of the present broodstock strategies for spring Chinook at the Winthrop NFH and Methow SH from their currently undefined roles to (a) establishment of a truly *integrated* Methow River conservation-recovery broodstock at the Methow SH, requiring systematic inclusion of natural-origin adults in the broodstock and the modification of the Foghorn Dam or other suitable location as an adult trapping site, and (b) establishment of a second broodstock at the Winthrop NFH that is genetically integrated with the Methow SH broodstock according to a proposed “stepping stone” model. As envisioned by the Review Team, the WDFW’s broodstock program at the Methow SH would focus strictly on recovery objectives within the Methow River watershed while the Winthrop NFH program would focus primarily on harvest objectives and restoration objectives outside the Methow watershed (e.g.,



## USFWS Columbia Basin Hatchery Review Team

### *Leavenworth NFH Complex Assessments and Recommendations Report – April 2007*

Okanogan River). This recommendation includes reducing the number of spring Chinook released from the Winthrop NFH into the Methow River to the degree they are not needed to meet in-basin conservation objectives. Fish from this program could then be available for restoration of spring Chinook in the Okanogan River and possibly also for developing a new segregated harvest program in the mainstem Columbia River immediately downstream from Chief Joseph Dam consistent with the Master Plan of the Colville Confederated Tribes. The Team also recommends reducing the size of the spring Chinook program at the Winthrop NFH, if necessary, to accommodate development of a self-sustaining steelhead broodstock program at the Winthrop NFH but only after spring Chinook conservation needs are met and assuming that one purpose of the steelhead program is to assist with recovery of natural populations (see steelhead program below).

### **Steelhead**

**Program Overview:** The program is intended to operate as an *integrated conservation and harvest* program with natural-origin and hatchery-origin adults used for broodstock. The primary goal of the program is to support recreational fisheries while contributing to recovery of ESA-listed (threatened) steelhead in the Methow River. At the present time, no adults are trapped for broodstock at the Winthrop NFH; rather, the program is a component of a state-run program where hatchery and natural-origin adults are trapped and spawned at Wells Dam on the mainstem Columbia River followed by the transfer of 125,000 eyed-egg embryos to the Winthrop NFH for hatching, rearing and release of yearling smolts one year later. Approximately 56 adults (28 females) are required to obtain 125,000 eyed-egg embryos for transfer. All fish currently transferred to the Winthrop NFH are the progeny of pairwise crosses between hatchery and natural-origin fish. An average of 118,400 yearlings per year were released from the Winthrop NFH into the Methow River, 1996-2005. WDFW has a release objective of an additional 320,000 smolts in the Methow River watershed, distributed equally among three release sites (upper Methow, Chewuch, and Twisp rivers), thus resulting in a total smolt release of approximately 420,000 smolts per year into the Methow River.

**Benefits:** Recreational fishery benefits are assumed in the Methow and mid-Columbia rivers, and downstream in tribal and non-tribal mixed stock fisheries in the lower Columbia River, but are undocumented because steelhead juveniles released from the Winthrop NFH are not coded wire tagged. However, beginning with BY 2006, all steelhead released from the Winthrop NFH will receive a coded wire tag. Contribution to recovery of naturally spawning populations is also undocumented, although total returns of natural-origin steelhead intercepted at Wells Dam have recently increased from an average of 368 adults per year (1998-2000) to 836 adults per year (2001-2005).

**Risks:** The trapping of adults at Wells Dam for broodstock poses a genetic diversity risk and a spatial structure demographic risk to naturally spawning populations in the Methow and Okanogan Rivers by preventing the establishment of locally-adapted populations. Adult steelhead returning to the Winthrop NFH are precluded from entering the hatchery and spawn in high concentration in the immediate vicinity of the hatchery, thus posing ecological risks to ESA listed species and other fish species via competition.

**Recommendations:** The Review Team identified 11 program-specific recommendations. These include development of a genetically-integrated broodstock at the Winthrop NFH derived from natural-origin adults in the Methow River and adults returning to the hatchery. The Review Team further recommends improvement of adult collection facilities at Foghorn Dam, or the creation of a new facility, as described for spring Chinook. As part of this new strategy to promote local adaptation, steelhead of Wells Dam origin should not be released upstream of Foghorn Dam. An improved fish sorting facility at Foghorn Dam should be used also to remove hatchery-origin steelhead surplus to

# USFWS Columbia Basin Hatchery Review Team

## *Leavenworth NFH Complex Assessments and Recommendations Report – April 2007*

supplementation goals in the upper Methow River. Heated water or rehabilitation of some rearing facilities at the Winthrop NFH may be necessary for producing smolt-size fish at one or two years of age, respectively.

**Program Alternatives:** The Review Team considered the pros and cons of three alternatives to the existing steelhead program, including the current program with full implementation of all recommendations (Alternative 1). The Team recommends adoption of all recommendations for the current program but increasing the size of the program to a minimum of 100 adults (50 natural and 50 hatchery-origin adults from a total of 56 adults) to meet minimum broodstock genetic guidelines (Alternative 2). If those recommendations are implemented, the total number of smolts released from the hatchery and/or outplanted in the upper Methow River basin could increase to approximately 200,000 smolts, thus eliminating the need to release – into the Methow River - progeny of adults trapped at Wells Dam. To accommodate an expanded steelhead program at Winthrop NFH, some reductions in the size of the spring Chinook program may be necessary. However, if conflicts should arise between the spring Chinook and steelhead programs at the Winthrop NFH, the Review Team notes that implementing our recommendations for spring Chinook should have a higher priority than those for steelhead because of the *endangered* listing of the former and their greater harvest value in tribal and non-tribal fisheries.

### **Conclusions**

The spring Chinook program at the Leavenworth NFH is the only program of the four programs reviewed here that is providing significant fishery benefits in the mid-Columbia region. Preservation of those fishery benefits to the Yakama Nation and recreational fishers in Icicle Creek should be a very high priority. The Review Team further recommends transitioning to a native Wenatchee River broodstock at the Leavenworth NFH after the failing water intake delivery system at the Leavenworth NFH is replaced.

In contrast to the Leavenworth NFH, the spring Chinook program at the Entiat NFH provides little or no measurable benefits, and the Review Team recommends its termination. The Review Team further concluded that the Entiat NFH should be used to propagate species of high conservation and harvest importance in the mid and upper Columbia River regions, including assisting with reintroduction of coho salmon in the Wenatchee and Methow rivers and reintroduction of spring Chinook to the Okanogan River in collaboration with the Winthrop NFH.

The Review Team concluded that the Winthrop NFH offers significant potential to achieve both conservation and fishery objectives for ESA-listed spring Chinook and steelhead in the Methow River and upper Columbia region, but those roles need to be redefined with explicit goals and objectives. The Review Team further concluded that the current spring Chinook programs at the Methow SH and Winthrop NFH will not achieve their intended goals unless capabilities to trap natural-origin adults for broodstock and monitor the escapement of hatchery-origin adults in the Methow River are developed. The Service and the Winthrop NFH should also work with the Colville Confederated Tribes to implement the Tribes' Master Plan for spring Chinook in the Okanogan River and the upper Columbia River immediately downstream from Chief Joseph Dam.

The Review Team was impressed with the Coho Restoration Master Plan of the Yakama Nation and the early successes of that program. Because of those early successes, the Review Team recommends that the Service continue to assist the Yakama Nation with their efforts to restore coho salmon to the mid-Columbia region.