Westslope Cutthroat Trout
Status Update Summary
2009

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Bruce E. May[1]

Introduction

This abbreviated status update for westslope cutthroat trout (*Oncorhynchus clarki lewisii, WCT*) relies primarily on information contained in a 2009 update of the WCT status database. This report is presented as a summary of information primarily obtained during nine (9) workshops held between January and March, 2009. Biologists and ArcGIS technical experts from several state, federal, and Tribal agencies along with representatives of private companies combined their collective knowledge and skills in the effort. The 2009 database update for WCT expands the information originally developed in 2002.

The database is managed and maintained as a component of the WCT interagency conservation working group's program for conservation of WCT. Coordination leadership for the WCT conservation effort and more specifically for management of the database is currently provided by Idaho Department of Fish and Game. This summary report relies heavily upon a number of database queries that were provided by Idaho Fish and Game.

This summary, updates previous WCT status assessments by using an updated version of the 2002 protocol which allowed for an expansion of information contained in the database. The informational components of the updated protocol included a further refinement of historically occupied range, a review and adjustment of the current distribution that included additional characterizations, and identification of "conservation populations" within the current distribution. The assessment of restoration and expansion possibilities for WCT within the context of the historical range was not completed. To the extent possible comparisons between the 2002 and 2009 reporting periods will be presented. A detailed range-wide status report (Shepard et al. 2003) and a scientific publication (Shepard et al. 2005) were developed from information contained in the 2002 WCT database. It is recommended that additional publications be prepared using the 2009 information.

The Procedures and Process

<u>Analysis Area</u> The analysis area included all of the likely historical range (circa 1800) of WCT within the United States (Figure 1). The 2002 status update relied on Behnke's (1992) delineation of the likely historical range of WCT as an initial historical representation. The 2002 effort refined Behnke's historical representation based on what was believed to be historically occupied in 1800. This area included, from east to west,

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the upper portions of the Missouri, Saskatchewan, Columbia, and Snake River Basins in Montana, Idaho, and Washington; the John Day basin in Oregon; and the Yakima, Methow and Lake Chelan basins in Washington. The 2002 and 2009 assessments do not include the Canadian portion of the WCT range. This 2009 update further refines the historical perspective by "fine tuning" the calls made in 2002 and by adding components in the Yakima River drainage as being historically occupied by WCT.

Figure 1 Map of 4th level hydrologic units (HUC) believed, as of the 2009 to have been historically occupied by WCT. Note: The North Fork John Day HUC should not be considered as historically occupied. The HUC's are grouped into geographical management units (GMU's) and labeled appropriately.

Geographic Information System (GIS). Information was gathered and entered into a geographic information system (ArcGIS). Within ArcGIS there were Access databases that were used to store the information. A series of workshops were conducted across the range of WCT. At each workshop fishery professionals and GIS/database technicians participated in developing and entering the information into ArcGIS. Many different sources of information were used in the 2009 update. Consistency was maintained by having one or two individuals attend all workshops to facilitate data entry and answer questions raised by workshop participants regarding the protocol.

The information contained in this database was primarily empirical in nature based on sampled data and professional judgment. Information sources were identified and linked to general levels of reliability to better judge information quality (Table 1). Information associated with judgment calls and anecdotal sources, in general, were viewed as being less reliable and/or accurate than information developed as part of detailed surveys and studies that had undergone substantial analysis and review. Similar to the 2002, this assessment relied upon existing information and sampling was not random, and in many cases not independent; therefore, there are undoubtedly biases associated with the information.

Table 1 Example look-up table for data sources with a relative index values for information reliability and accuracy.

Information ‘Source	Relative Degree of Reliability
Anecdotal Information	Low 1
Letter	Low 1
Professional Judgment	Moderate 2
Cursory Reconnaissance	Moderate 2
Information derived from minor sampling; Contained in agency databases, reports and summaries (generally, non-peer reviewed)	High 3
Information derived from major sampling; Generally contained in agency databases, a Thesis or Dissertation or a published paper (peer reviewed).	Highest 4

Hydrological Units (HUC) and Geographical Management Units (GMU) We chose to partition the information by 4th level HUC.'s and individual GMU's to accommodate accounting of the information at differing scales. Each individual HUC represented a separate distinct portion of a larger drainage basin. Each GMU represented a grouping of HUC's that form a logical unit for WCT conservation and management. Specific individuals were identified as primary leaders for each GMU. These GMU leaders assisted in organization of the respective workshops (i e. notification of potential attendees, selection of workshop location, identification of local accommodations, etc.).

Scale and Hydrography Coverage Scale and Hydrography Coverage Initially the intent was to utilize the National Hydrography Dataset (NHD) at the 1:24,000 scale. During the initial application of the NHD numerous inconsistencies within Idaho were discovered resulting in a change of approach. A Latitude-Longitude Identifier (LLID) hydrography layer that was edge-matched across state boundaries was used as the primary base-layer. This LLID hydrography coverage routes stream segments by uniquely identifying each stream and delineating lower and upper segment boundaries as distances above each stream's mouth identified each stream segment occupied by WCT. Source hydrography layers were supplied by the cooperating State Agencies. The Idaho and Montana Source hydrography layers were at a scale of 1:100,000. The Washington and Oregon Source hydrography layers were at a mixed scale of 1:100,000 and 1:24,000.

The Protocol and Assessment Teams

The 2009 Protocol   The 2009 status update protocol closely mirrored the approach applied in 2002 for WCT and the approaches used in other recent status updates for Bonneville, Colorado River, Lahontan, Yellowstone and Rio Grande cutthroat trout. In each case the protocol addressed the historical perspective, presented information on current distribution including information on specific attributes associated with the current distribution, identified and delineated discrete conservation populations and provided a brief analysis of potential for restoration and expansion within the context of the historical range. A "white paper" discussing the genesis and evolution of the current protocol being applied to the cutthroat trout subspecies was developed in 2007.[2] The protocol applied in the 2009 was modified to include valuable information not obtained in 2002. Even though, this update added a substantial number of new attributes and characterizations, a concerted effort was made to maintain a level of comparability for certain parameters of significance to evaluating the effectiveness of the conservation effort for WCT over the long term. The specific changes that were included in the 2009 database update will be identified in the results and discussion section of this report.

Assessment Teams   Over 80 fisheries professionals representing a number of state, federal, and tribal agencies, along with a few private firms, provided the information that was included in the 2009 database update. These individuals formed a number of assessment teams that met in 9 workshops. In addition, there were at least 12 GIS/database specialists that also participated in the effort. At each workshop, fishery professionals collaboratively reviewed the 2002 information and provided additional information called for in the 2009 protocol. The edits and new information was entered, by the GIS/database specialists, directly into a separate 2009 WCT database.

Results and Discussion

It should be noted that not all information contained in the 2009 database will be reported in this summary.   The intent of this report is to provide a summary of information associated with comparable metrics for the two reference periods. In addition, certain other parameters addressed in 2009 will be discussed. A notable omission in this report is the information that was collected on lakes and other standing water environments.

[2] "The Genesis and Evolution of the Status Assessment Protocol for Cutthroat Trout: A Methods Review".. Bruce E. May and Bradley B. Shepard. 2007. 12pp.

2007

There was a level of apprehension with regard to the reliability and quality of the lake information. Fine tuning the lake information will be a major focus of the next database update.

Historical Distribution

The 2002 status update utilized Behnke's (1992) historical range as a starting point. Behnke provided a caveat by stating that the distribution only applied to streams within the broad mapped area capable of supporting trout. In the 2002 effort, and this more recent effort, fishery professionals were asked to determine which streams or stream segments should be included or excluded from the historical range based on anecdotal evidence and professional judgment. Evidence for exclusion included geological barriers that would have blocked up stream migration, tectonic or climatic events that would have controlled WCT colonization prior to 1800, and habitat unsuitability based on thermal regimes, stream flows and gradients.

In 2002, the total of about 56,500 miles of stream habitat was estimated as being historically (circa 1800) occupied by WCT. The estimated amount of historical range in each state was about 33,000 miles in Montana (59%), over 19,000 miles in Idaho (34%), over 1,000 miles in Oregon (2%), almost 3,000 miles in Washington (5%), and under 100 miles in Wyoming (Yellowstone National Park; < 1%). Several 4th code river basins, including the Milk Headwaters, Upper Milk, Willow, Bullwhacker-Dog, Box Elder, and Upper and Middle, and Lower Musselshell in the Missouri River system, the Hangman basin in the Spokane system, and the North John Day system in Oregon were excluded as historical habitats, even though previous assessments may have included some or parts of these basins within the historical range (Shepard et al. 2003).

The total amount of stream habitat identified in the 2009 status update as historical habitat was about 58, 000. The estimated amount of historical range in each state was about 29,543 miles in Montana (51%), 21,542 miles in Idaho (37%), over 1,000 miles in Oregon (2%), almost 5,609 miles in Washington (9%), and about 244 miles in Wyoming (Yellowstone National Park; < 1%). The most significant change in historical distribution between the 2002 and 2009 status update was within Washington where three additional HUC's (the Upper Yakima, Naches and the Upper Yakima) all within the Yakima River drainage were included within the historical range. There were two HUC's that were included in 2002 that were dropped in 2009. Both of these watersheds were on the extreme outer edge of the historical range. There were slight changes to the historically occupied stream habitat for several HUC's. Most of the changes were associated with removal of the upper most headwater portions of numerous streams. In total there were 71 HUC's identified as being historically occupied.

Current Distribution

In the 2002 status update (Shepard et al. 2003), WCT were identified as occupying about 33,500 miles (59%) of the nearly 56,500 miles of historically occupied habitats. WCT were reported to occupy over 18,000 miles in Idaho (95% of historical), almost 13,000 miles in Montana (39% of historical), about 250 miles in Oregon (21% of historical), and almost 2,000 miles in Washington (66% of historical).

In the 2009 status update, WCT were estimated to currently occupy about 33,608 miles (58%) of the nearly 58,030 miles of historically occupied habitats. WCT were reported to occupy 17,268 miles in Idaho (51% of current), 12,741 miles in Montana (38% of current), about 338 miles in Oregon (1% of current), 3,246 miles in Washington (10% of current) and a small portion of habitat (14 miles; less than 1% of current) within Wyoming. A total of 9,112 stream habitat segments were associated with the 33,608 miles of occupied habitat. .

With regard to certain specific characterizations associated with the currently occupied WCT habitat, it should be noted that in 2002 only genetic status and abundance (adult and sub-adult) relative to habitat capacity based on habitat condition were the only attributes included in the database. In 2009, genetic status was based on the same approach used in 2002. WCT abundance, however, was changed to address actual population density (fish/mile) for sexually mature fish (generally ages three and older). This abundance characterization was intended to approximate the "effective population size" density for each occupied stream segment.

Genetics Associated with the Current WCT Distribution As of 2009, genetic sampling had been conducted on approximately 8,414 miles of occupied habitats (25% of occupied habitats; Table 2). No evidence of introgression was found from samples covering about 4,308 miles (51% of tested area and about 13% of the total occupied habitats), By comparison, the 2002 status assessment reported that genetic sampling had been conducted in over 6,100 miles of occupied habitats (18% of occupied habitats) and no evidence of introgression was found from samples covering about 3,400 miles (56% of the area tested and 10% of the total occupied habitats). Introgression, in varying degrees, was slightly different for the two reporting periods (Table 2). In 2009, WCT in about 10,299 miles (31% of occupied habitats) were untested and viewed as being potentially unaltered because there were no records of stocking within the supporting stream segments and no evidence of hybridizing species being present in the supporting streams. This contrasted with the 2002 information where 9,108 miles (27%) of occupied habitat segments were judged to be unaltered due to there being no stocking records of hybridizing fish nor were hybridizing fish present.

WCT Abundance The 2009 status protocol called for addressing WCT abundance (expressed as fish/mile) based on the number of sexually mature fish within a given stream segment. Addressing WCT abundance in this fashion allowed for a subsequent approximation of effective population size for each WCT population. Total WCT densities would be considerably greater if juvenile fish were included in the density estimates. The protocol provided two options: 1. density ranges were provided; or, 2 a specific density value could be entered into the database. The majority of density information was derived from using the density ranges. These density ranges included: 0 to 50 fish per mile; 51 to 150 fish per mile; 151 to 400 fish per mile; 401 to 1000 fish per mile; 1001 to 2000 fish per mile; and, over 2000 fish per mile. There was an unknown category provided also. The density ranges and the associated miles of occupied stream within each state are provided in Table 3. Due to the different ways of deriving abundance between the 2002 and this reporting period, it was impossible to make reasonable comparisons.

Table 2 Genetic status for WCT by stream lengths (miles) within the occupied habitat reported for 2002 and 2009[3].

	2002		2009	
Genetic Status	Stream Miles	% of Occupied	Stream Miles	% of Occupied
Tested, Unaltered	3,473	10.3	4,308	13
Tested; 1% to 10% Introgression	1,234	3.7	2,042	6
Tested;11% to 25% Introgression	501	1.5	643	2
Tested; >25% Introgression	920	2.7	576	2
Suspected Unaltered	9,108	27.1	10,299	31
Potentially Altered	17,285	51.5	14,658	44
Mixed Stock; Altered and Unaltered	1,037	3.1	796	2
Unknown			236	<1
Totals	33,557		33,608	33,470

Other Characterizations of Currently Occupied Habitat In 2009, there were four (4) additional metrics, associated with the current distribution of WCT, that were added to the database. These new metrics included; origin of WCT, habitat quality, record of stocking and presence of competitive/hybridizing species (the primary focus being on introduced non-native fish).

3 It should be noted that mileages presented for 2009 do not equal the number of miles reported as being currently occupied. No explanation is currently available.).

Table 3 Density ranges of reproductively mature WCT that currently occupy stream habitat. Percentages are indicated in Parentheses.

	Idaho	Montana	Oregon	Washington	Wyoming	Totals
0-50 fish/mile	7,284	3,200	52	1,986	--	12,522 (31)
51-150 fish/mile	5,039	5,394	161	331	14	10,939 (33)
151-400 fish/mile	1,781	2,317	36	20	--	4,154 (12)
401-1000 fish/mile	284	383	--	--	--	667 (2)
1001-2000 fish/mile	339	56	--	--	--	395 (1)
>2000 fish/mile	10	--	--	49	--	59 (<1)
Unknown	2,441	1,391	89	813	--	4,734 (14)
Totals	17,178	12,741	338	3,199	14	33,470

Origin -- The vast majority of WCT (93.6%) within the current distribution were considered to be descendants of ancestral stocks of WCT. There was uncertainty regarding the ancestral origin of 5.6% or the current distribution and only 1.2% of the current distribution as linked to efforts to restore or expand WCT (Figure 2)

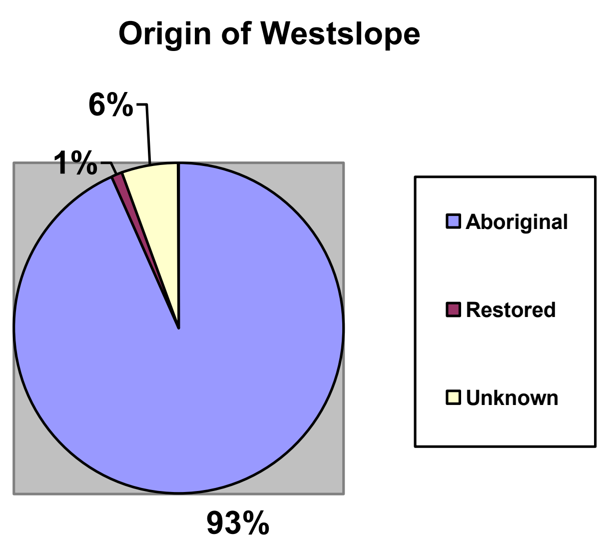


Figure 2 The assumed ancestry of WCT within the current distributional range.

Habitat Quality -- Habitat quality was viewed as an important addition to the WCT database. Across the WCT range a high percentage (59%) of WCT habitats were judged to be in either excellent (18 %) or good condition (41%). Fair habitat conditions were assigned to 24% of the currently occupied habitat and only 4% of WCT habitat was judged to be in poor condition (Figure 3). Habitat quality for 13% of the occupied habitat was unknown.

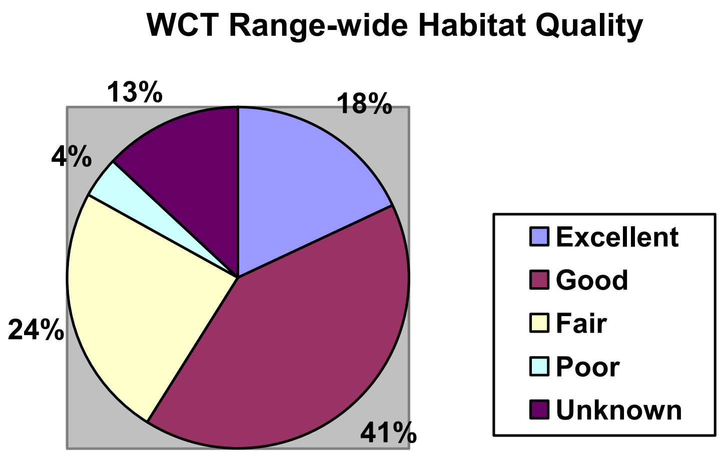


Figure 3 Habitat quality associated with the current distribution of WCT based on stream miles for each habitat quality rating.

Habitat quality estimates for the current distribution for each state reflect a somewhat finer level of resolution (Table 4) of habitat quality based on the stream mileage within each state.

Table 4 Habitat quality estimates within the states supporting current distributions of WCT.

	Excellent	Good	Fair	Poor	Unknown
Idaho	21%	44%	19%	3%	13%
Montana	16%	40%	30%	5%	9%
Oregon	4%	38%	19%	11%	28%
Washington	11%	29%	30%	3%	27%
Wyoming		100%			

Record of Stocking -- Information related to the record of fish stocking within the current distribution area of WCT and the presence of other fish that could create detrimental competition or hybridization was also added to the database. It should be noted that both Chinook salmon and redband (rainbow) trout were tracked in the stocking records and presence of other fish. Both of these species are native to significant portions of the WCT distributional area and are generally not considered to create detrimental influences on WCT. Species such as brook, brown, rainbow, and other cutthroat trout are not native within the WCT range and do create conditions associated with detrimental competition and, in the case of rainbow trout and other cutthroat trout subspecies, hybridization.

There were no records of reported fish stocking within 63% of the current distributional area of WCT (Figure 4). Records of rainbow trout, of non-native origin, were the most stocked species followed by other cutthroat trout subspecies, brook trout and brown trout..

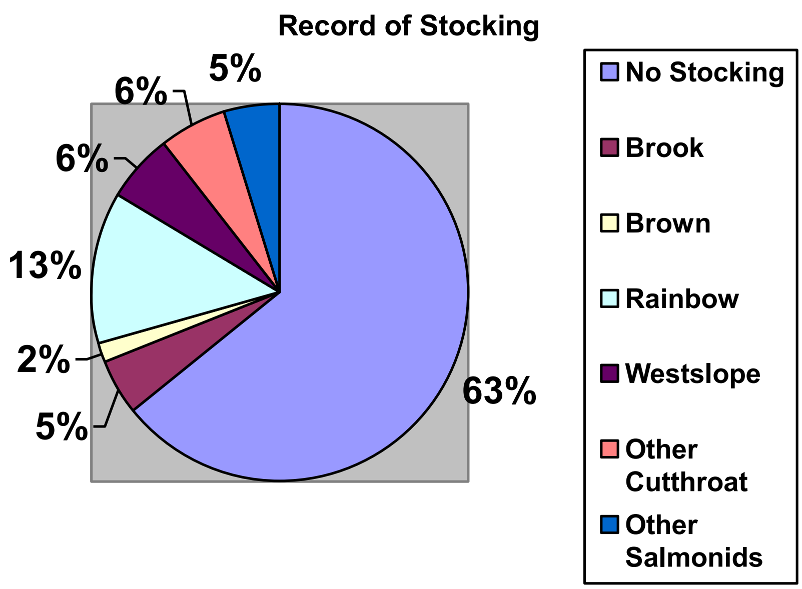


Figure 4 Record of fish stocking within the current distributional area of WCT.

The other salmonid stocking category included both Chinook salmon and redband trout (anadromous and resident forms). Both Chinook salmon and redband trout were native to the areas stocked. They could, however, exert detrimental influences if the numbers stocked surpassed the carrying capacity of the individual habitats being stocked. Record of stocking was added to the database to assist in projecting possible negative influences to WCT from other fish species in situations where the actual presence of other fish species was unknown.

Presence of Other Fish Species -- A significantly more important metric was the information on the actual presence of other fish species, both native and non-native, currently occupying WCT habitat. In contrast to the 63% of WCT habitat that did not have records of other fish being stocked, only 20 % of WCT stream habitats were judged to have no additional native or non-native fish (primarily salmonids) present (Figure 5).

Presence of native and non-native fish (primarily salmonids) estimates for the currently occupied habitat by WCT for each state again reflects a somewhat finer level of resolution (Table 5). Native redband trout and Chinook salmon were tracked along with the presence of non-native species of significance. Both native redband trout and Chinook salmon were considered to have co-evolved with WCT and as such were not viewed as being incompatible with WCT. In general, non-native salmonids and other non-native fish species are viewed as negative stressors to WCT and other cutthroat trout subspecies.

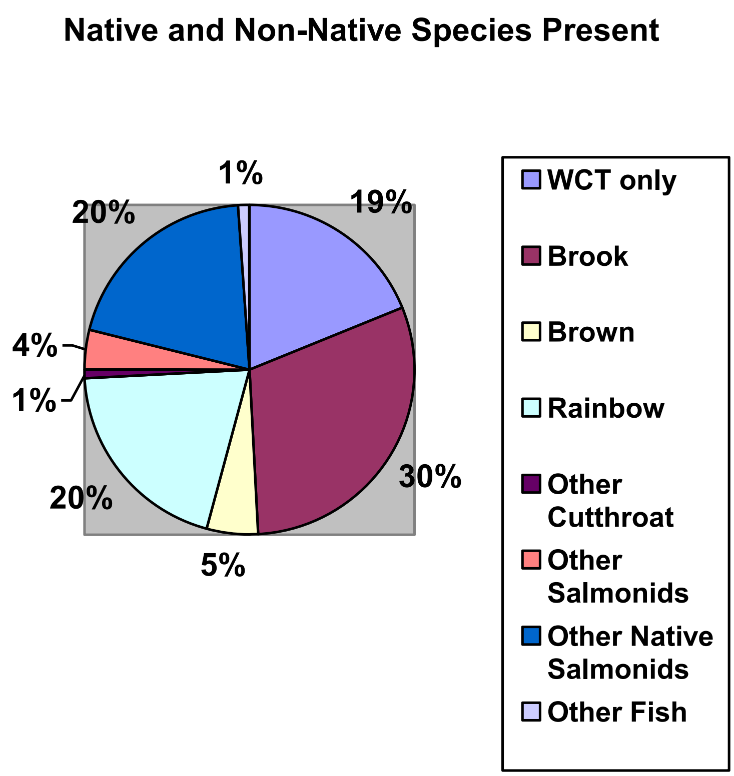


Figure 5 The record of native and non-native species present (primarily salmonids) within the current distributional area of WCT based on the percentage of stream miles.

Table 5 Presence of native and non-native fish (primarily salmonids) within the occupied habitat for each state. Numbers represent a percentage of the stream miles occupied by WCT habitat

	No Other Non-native Present	Brook	Brown	Rainbow	Other Cutthroat	Other Non-native Salmonids	Other Native Salmonids[4]	Other Fish Species
Idaho	16%	26%	<1%	19%	11%	<1%	34%	1%
Montana	29%	37%	9%	20%	1%	2%	!%	2%
Oregon	55%	21%	--	2%	22%	--	--	--
Washington	4%	25%	5%	25%	1%	20%	28%	<1%
Wyoming			100%					

Conservation Populations

In 2009, there were 672 populations of WCT considered to be conservation populations as defined in the status protocol. As such, conservation populations represent a combination of mapping segments that when combined represent a discrete conservation unit of WCT. Within each conservation population, it was assumed that there was the potential for genetic exchange at a frequency adequate to minimize the risks of inbreeding and to maintain genetic variation (Rieman and Allendorf 2001). Within a given conservation population the exchange of genetic material could not be obstructed by a complete passage barrier. Each conservation population was believed to be an intact, separate entity. These 672 conservation populations occupied in about 23, 840 miles of habitat (71% of the currently occupied habitat projected in 2009) and were represented by 6,090 mapping segments. Conservation populations were found within 67 of the 71 HUC's that supported the historical distribution of WCT. The number of conservation populations within each HUC's ranged from 1 to 55. In several instances, conservation populations occupied portions of more than one HUC and more than one state.

By comparison, there were 563 conservation populations (occupying 24,450 miles of habitat) identified in 2002 and these conservation populations occurred in 67 of the 70 HUC's identified as historical range. The difference between the two reporting periods was accounted for by some original populations being subdivided as a result of identification of complete passage barriers, improper inclusion of some occupied segments and in some cases the inclusion of some stream segments as conservation populations that were not included as such in 2002. There was a slight reduction (approximately 3%) in the miles of habitat occupied by conservation populations in 2009 resulting from the fine turning of the upper and lower boundaries of some populations.

In 2009, a sub-set of 575 individual conservation populations indicated that WCT conservation populations occupied from 0.1 to 5,849 miles of habitat (median = 4.6

[4] Primarily native redband trout (resident and anadromous) and Chinook salmon.

miles) with the distribution of lengths being greatly skewed toward shorter habitat lengths (Figure 6). Approximately 73% of conservation populations identified in 2009 occupied habitats of 10 miles or less. By comparison, the mileages associated with the 2002 dataset were also skewed toward shorter stream lengths and indicated that individual conservation populations occupied from 0.3 to over 6,000 miles of habitat (median = 5.6).

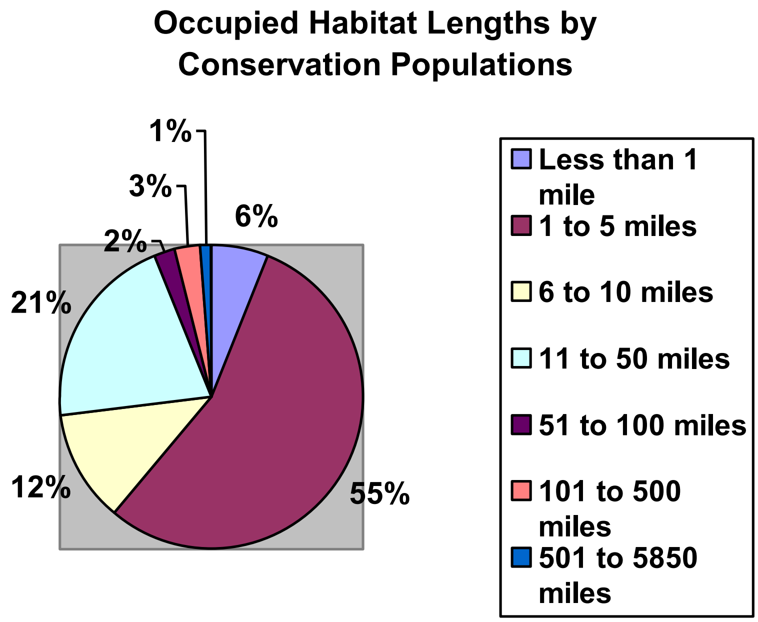


Figure 6 Partitioning of conservation populations based on the length of habitat occupied.

<u>Conservation Population Qualifier</u> For each population, a specific determination was made identifying the paramount reason for their inclusion as a conservation population. Core conservation populations were those with the highest potential of being genetically unaltered. They represented WCT populations that had been genetically tested and found to be unaltered (less than 1% variant genes) and there were no records of stocking of hybridizing fish and there were no hybridizing fish associated with the population. Other classifications included populations having a unique life history (e.g. fluvial, ad-fluvial, ad-fluvial-lacustrine or lacustrine outlet spawning), populations with known or probable ecological adaptations, populations having a predisposition for large size or unique coloration, and those populations that function as a mixed stock of genetically introgressed and non-introgressed sub-populations.

In 2009, there were 414 populations of WCT (approximately 62% of all conservation populations) that were identified as core conservation populations. This compares with 303 core conservation populations (approximately 54%) identified in 2002. The other conservation population categories in 2009 included 193 populations (29%) based on their life history, 9 populations (1%) based on a unique ecological adaptation, 1 population based on a unique trait and 55 populations (8%) being identified as mixed stocks.

Nature of Habitat Networks Associated with WCT Populations Another attribute of importance was the nature of the habitat network associated with each conservation population. Strongly networked populations were those that occupied habitats associated with more than 5 streams (some stream systems may have included lake habitats) with open unobstructed migration corridors. WCT in any individual stream may be considered as a sub-population within the overall population. At the other end of the network spectrum were those populations that occupied habitats in a single stream or even a segment of stream. As such these non-networked populations functioned as independent entities with no interaction with other populations or sub-populations.

There were 56 (8%) strongly networked WCT conservation populations identified in 2009. Even though, strongly networked populations made a fairly low percentage of the total number of populations, they occupied the greatest amount of habitat (19,303 miles; or about 81%). Table 6 provides information on the breakdown of the nature of habitat networks for all conservation populations.

Table 6 Habitat network information for the 672 WCT conservation populations identified.

Nature of Habitat Network	Number of Conservation Populations (%)	Miles of Occupied Habitat (%)	Number of Stream Segments (%)
Strongly Networked	56 (8%)	19,303 (81%)	4,675 (77%)
Moderately Networked	51 (8%)	1,219 (5%)	361 (6%)
Weakly Networked	121 (18%)	1,289 (5%)	403 (7%)
Non-Networked	421 (63%)	1,865 (8%)	621 (10%)
Unknown	23 (--%)	164 (1%)	30 (--%)
Totals	672	23,840	6,090

Genetic and Disease Risk Evaluations

Each of the 672 conservation populations were evaluated for risks associated with genetic contamination and catastrophic diseases. These evaluations rated the risks based primarily on the distance the conservation population was removed from a contamination source. The presence of a complete passage barrier also increased the protection to each population.

Genetic stability was ranked from 1 to 4 with a 1 representing the most secure situation (i.e. potentially hybridizing fish cannot interact with WCT population because a complete passage barrier is in place or hybridizing fish are not present in the same or any adjacent drainages). The opposite end of the ranking would be a 4 which reflected the least secure situation due to hybridizing fish being sympatric with WCT (Figure 7). A genetic risk ranking was not completed on 23 WCT populations and they were placed in an unknown category.

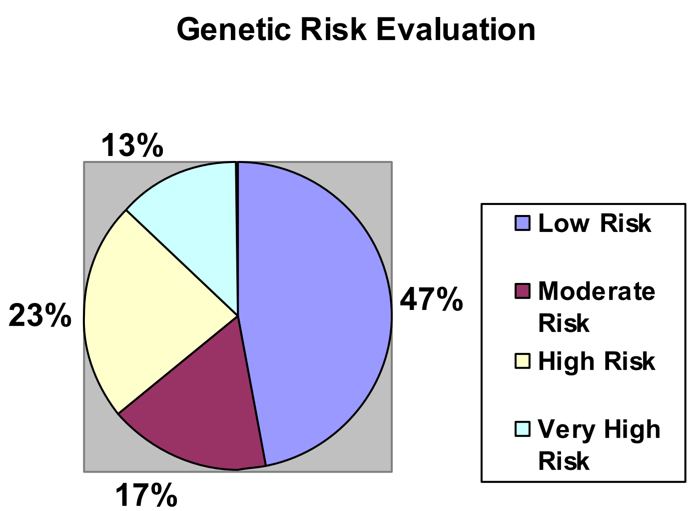


Figure 7 2009 genetic risk evaluation represented as a percentage of the number of populations (649) evaluated.

Comparison of the 2002 and 2009 genetic risk evaluations indicated differences in the percentages for both the low risk and moderate risk populations (Table 7). The percentages of WCT populations having high to very high risk rankings were fairly comparable between the two reporting periods.

Table 7 Comparison of genetic risk evaluations completed in 2002 and those completed in 2009. Values represent conservation population numbers and percentages.

Genetic Risk	2002		2009	
Low Risk	206	38%	303	47%
Moderate Risk	173	32%	108	17%
High Risk	110	21%	147	23%
Very High Risk	50	9%	91	13%

The results of the disease risk evaluation completed in 2009 are presented in Figure 8. Comparison of the 2002 and 2009 disease risk evaluations indicated differences in the percentages for several categories (Table 8). It should be noted that in 2002 only four categories were evaluated compared to 5 categories in 2009. An additional category was included in 2009 to reflect the reality that disease contamination can occur as a result of human and avian intervention. The percentages of WCT populations having high to very high risk rankings were comparable between the two reporting periods. A disease risk ranking was not completed on 25 WCT populations in 2009 and they were placed in an unknown category.

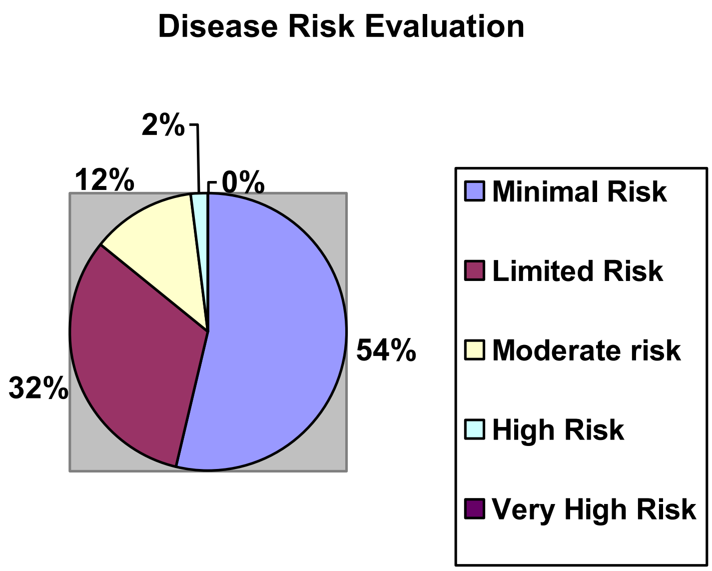


Figure 8 2009 disease risk evaluation represented as a percentage of the number of populations (647) evaluated.

Table 8 Comparison of disease risk evaluations completed in 2002 and 2009. Values represent conservation population numbers and percentages.

Disease Risk	2002		2009	
Limited Risk[5]			346	53%
Low Risk	213	40%	205	32%
Moderate Risk	246	45%	79	12%
High Risk	65	12%	16	2
Very High Risk	15	3%	1	--

5 In 2002, a minimal risk category was not included and these populations were combined into either the limited risk category or the moderate risk category.

When a comparison was made between the habitat network information and the level of genetic risk for the number of conservation populations a reasonably strong inverse relationship was apparent. The greatest numbers of conservation populations were identified as occupying a single stream or a stream segment (non-networked habitats) and they had a low genetic contamination risk (Figure 9). At the other end of the spectrum, the lowest numbers of conservation populations were identified as occupying strongly or moderately networked habitats and having high to very high genetic risks. A similar comparison was made between the habitat network information and level of genetic risk based on miles of occupied habitat (Figure 10).

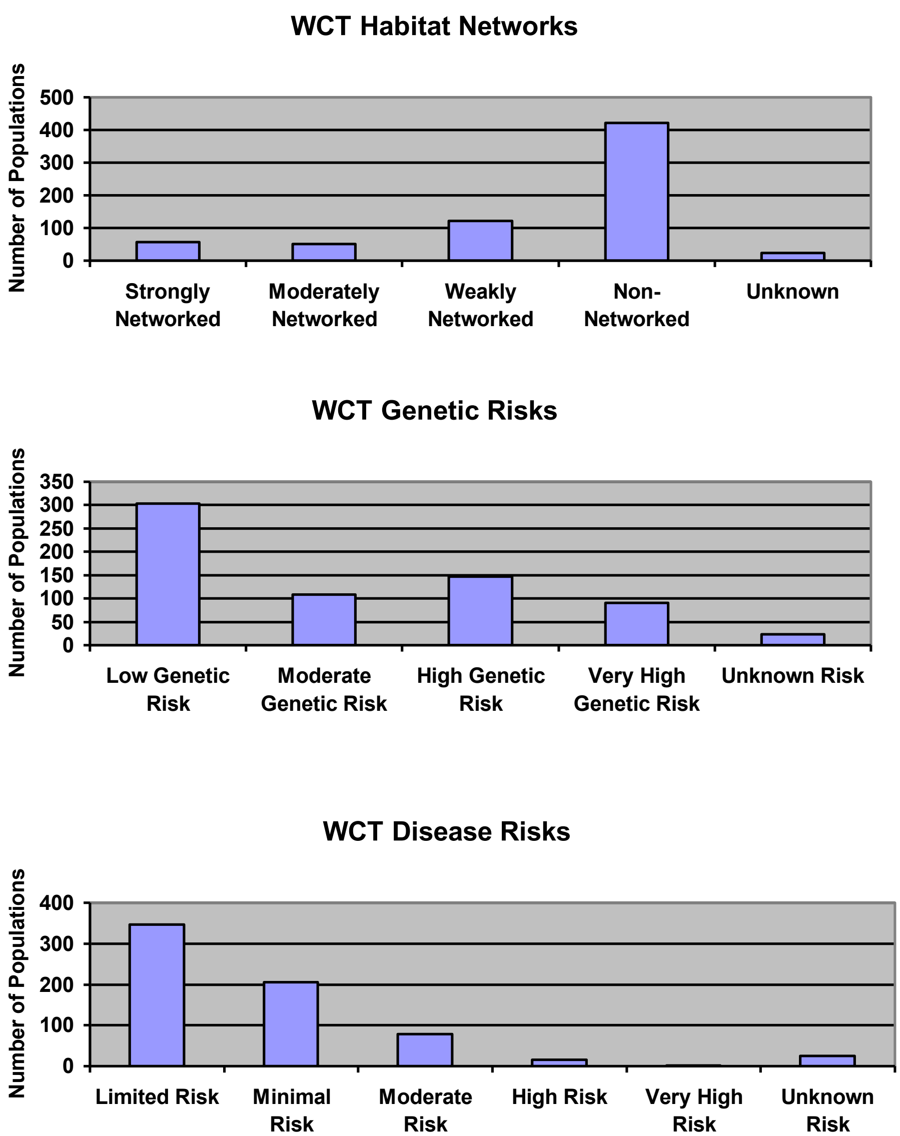
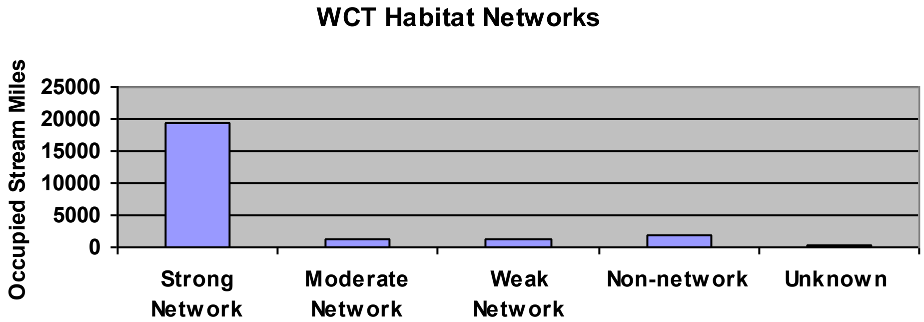


Figure 9 Comparison of WCT conservation population habitat network information to the risks associated with genetic contamination and catastrophic diseases based on the number of populations.

The comparison between the habitat network information and disease risks reflect similar relationships. It should be noted that the number of disease risk categories was expanded in 2009 to reflect the possibility of disease contamination resulting from human or avian transport of diseases (Figure 9). The comparison between the number of occupied stream miles linked to strong habitat networks and risks associated with catastrophic diseases reflected an inverse relationship (Figure).



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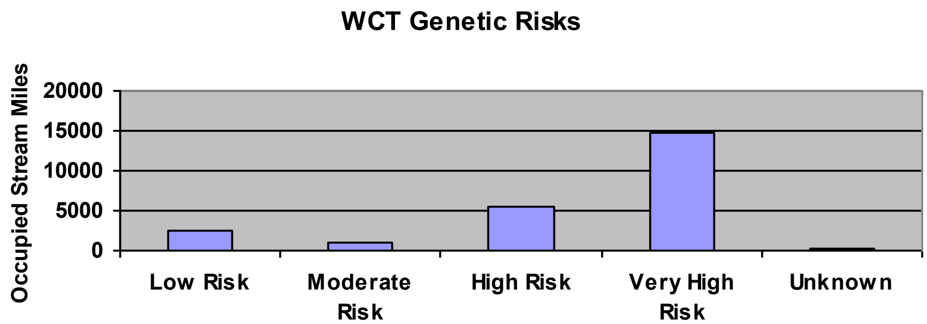

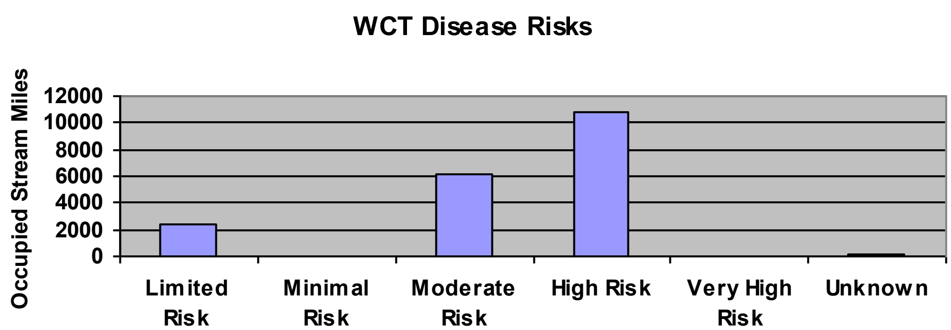

Figure 10 Comparison of WCT conservation population habitat network information to the risks associated with catastrophic diseases based on occupied stream miles.

Relative Conservation Population Health Evaluation

A generalized population health evaluation (adapted from Rieman et al. 1993) based on four indicators, viewed as being indicative of relative population health, was completed for 575 of the 672 conservation populations. Missing information for one or more of the health indicators for 97 populations made it impractical to complete the relative health evaluation for all conservation populations. Components of the health evaluation included: 1. temporal variability associated the amount of occupied stream habitat as an indicator of potential resiliency; 2. population size of sexually mature adults (≥15cm or larger) as a course estimator of effective population size; 3. population production based on habitat quality and presence of non-native competitive fish; and, 4. degree of habitat connectedness based on the nature of the stream network associated with each population. These indicators of general health were analyzed individually and as a composite based on a weighted formula.[6] It is important to note that individual health indicators and the composite rating for these indicators do not represent absolutes in terms of definitive population health. Rather they are presented as a relative indicator of general health much like a physician's general physical exam or a general health screening.

Temporal Variability – This component of the relative health evaluation addresses how stochastic events might influence a whole population by tracking the total length of habitat occupied by each conservation population. The assumption is that larger habitat patch sizes will be less likely to be in synchrony with regard to stochastic events. Inclusion of lake environments within the occupied habitat could increase a population's resistance to stochastic influences. Temporal variability information (i.e. length of occupied habitat) indicated that a large number (346) of conservation populations (60%) were associated with a very low health score due to the limited amount of habitat (1,012 miles) that was occupied (e.g., less than 6 miles per population) by those populations. One hundred and sixty five (165) populations (29%; 1,814 miles) were given a low temporal variability health score, 33 populations (6%1,013 miles) were assigned a moderate health score and 31 populations (5%; 17,598 miles) were characterized as having a high health score for temporal variability (Figure 11; Table 9).

Population Size of Sexually Mature Adults (≥15cm or larger) – Population abundance provides an indication of the potential resilience to both stochastic and deterministic influences (Rieman et al. 1993). Tracking the number of sexually mature individuals within each conservation population provided a crude approximation of effective population size. This metric assisted in evaluating the potential for genetic exchange at a frequency adequate to minimize risks of inbreeding and to maintain genetic variation (Rieman and Allendorf 2001). There were 79 conservation populations (14%; 18,209 miles) associated with a high health score based on adult numbers exceeding 2,000 individuals (Figure 11; Table 9). The range in population abundance for this group of populations was 2,031 to over 455, 200 adult fish. Eighty six (86) populations (15%; 1,249 miles) were judged to have a moderate score based on population numbers ranging from 1,001 to 1,974 adult fish. There were 275 populations (48%; 1,714 miles) identified as having a low population health score (range: 100-997 fish) and 135 WCT conservation populations (23%; 265 miles) were rated with a very low health score (range: 98 to less than 10 fish).

[6] Personal communication with Dr. Danny Lee, systems analyst, Fisheries Research Office, USDA-Forest Service Rocky Mountain Research Station, Boise, Idaho.

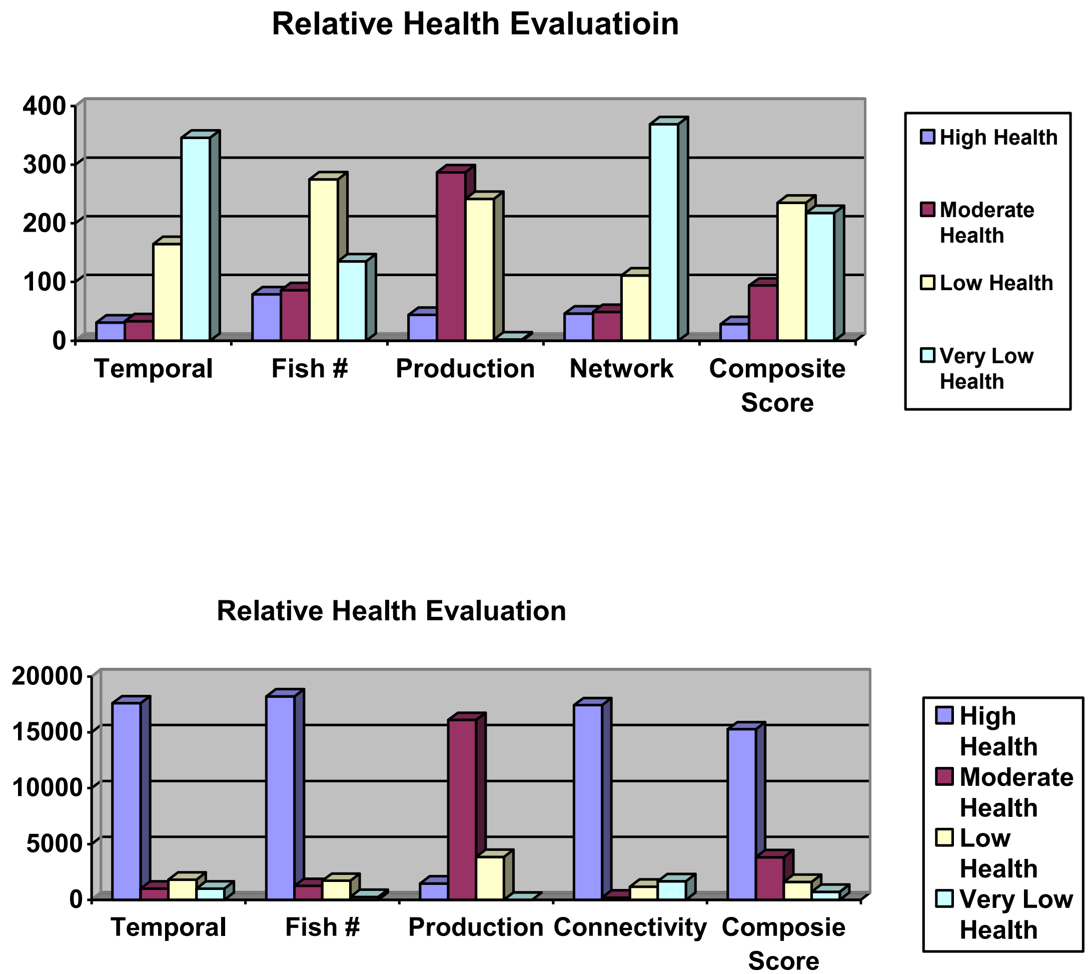

Figure 11 WCT relative health evaluation ranking's for the individual health components and the composite score for each conservation population. Top chart Y axis represents number of populations. Bottom chart Y axis represents miles of occupied stream habitat.

Population Production Potential – This population health evaluation component was associated with the deterministic influences of growth and survival factors upon a population. The population production score rated habitat quality and adjusted the score if competitive non-native fish were present. Of the 575 populations evaluated, 44(8%; 1,470 miles) were judged as having a high population health rating for production potential. Two hundred and eighty seven (287) populations (50%; 16,113 miles) were judged to have a moderate population health characterization related to factors associated with production potential (Figure 11; Table 9). The remaining 244 populations were judged to have either low production potential (242 populations; 42%; 3,851 miles) or very low production potential (2 populations; less than 1% in approximately 3 miles). The production potential ratings for some populations would have been higher if non-native fish had not been present. In total, there were 266 production potential scores that were adjusted to the next lower rating based on presence of non-native fish.

Table 9 Relative population health ratings by individual health component rating and by overall composite rating.

	Population Health by Number of Populations				Population Health by Miles of Stream Occupied			
Relative Health Factor	Very Low	Low	Moderate	High	Very Low	Low	Moderate	High
Temporal	346	165	33	31	1,012	1,814	1,013	17,598
Population Size	135	275	86	79	265	1,714	1,249	18,209
Production Potential	2	242	287	44	3	3,851	16,113	1,470
Network	369	111	49	46	1,668	1,186	211	17,430
Composite Score	218	235	94	28	728	1,615	3,817	15,278

The Nature of Habitat Networks – The fourth component of the relative health evaluation further addressed the complexity of habitat occupied by the respective conservation populations by defining the nature of the habitat network based on the number of streams associated with the occupied habitat. In essence, the habitat network information provided an additional quality component to the temporal variability associated with patch size. For the 575 conservation populations evaluated, 46 (8%; 17,430 miles) were identified as occupying habitat with more than five streams. Forty nine (49) populations (9%; 211 miles) occupied habitat contained in 4 to 5 streams. One hundred and eleven (111) populations (19%; 1,186 miles) occupied habitat contained in 2 to 3 streams with the largest number of populations (369; 64%; 1,668 miles) occupied habitat in a single stream or stream segment (Figure 11; Table 9).

Composite Score for the Four Health Components -- Composite scores of general population health for the 575 conservation populations (Figure 11; Table 9) allowed for a more balanced or perhaps tempered perspective of general health conditions associated with WCT conservation populations. The composite score for each population was derived by applying a weighting factor to each health component. The final composite score was adjusted by the following: Temporal Variability – 0.7; Population Size – 1.2; Population Production – 1.6; and, Habitat Network – 0.5. These weighting factors were provided by Dr. Danny Lee and were derived from his work with the BayVAM model that was applied to fish population modeling and analysis at the USDA-Forest Service, Rocky Mountain Research Station in Boise, Idaho.[7] For the 575 WCT populations evaluated for relative population health only 28 populations (5%; 15,278 miles) were judged to have a high degree of overall general population health. Ninety four (94) populations (16%; 3,817 miles) were judged to have overall population health rated as

[7] Dr. Danny Lee, personal communication in 1998 with follow up communication in 2008.

moderate quality. Of the remaining populations, 235 (41%; 1,615 miles) were judged to have low general health and 218 (38%; 728 miles) had a very low level of general health.

As a reminder, it is important to remember that individual health indicators and the overall composite ratings for these relative health indicators do not represent absolutes in terms of definitive population health. They do, however, provide a general or relative view of population health based on the four variables considered individually or in combination.

Conclusions, Observations, and Recommendations

The 2009 status and database updates were intended to provide a second appraisal of the status of WCT from a variety of perspectives and at various scales or levels. The perspectives included a historical point of view, a current distribution perspective based on habitat occupancy of phenotypically correct WCT, and a conservation population perspective based on efforts to identify and evaluate discrete populations of WCT. The various scales or levels, in ascending order, from which information was derived included: 1. a habitat feature level (e.g., a specific barrier); 2. a habitat segment scale level; 3. a stream or lake level; 4. a watershed level; 5. a geographical management unit (GMU) level; 6. an administrative unit level (e.g., state and/or agency boundaries); and, 7. a range-wide level. This report addresses only a fraction of the information that was included in the database update and, as such, the report is intended to serve only as a abbreviated summary. A similar effort for Yellowstone cutthroat trout, that contained information from 39 HUC's, resulted in more than 87,900 GIS records and 33,000 attribute records. By comparison, the WCT 2009 database contained information from 71 HUC's making it quite likely that the WCT database contains as much as 75% more GIS and attribute records. To complement this abbreviated report and to make fuller use of the ArcGIS database, it is recommended that other "peer reviewed" publications be developed.

The Procedures and Process

During the time frame between the initial effort in 2002 and 2009, a substantial number of changes in the procedures and process associated with the status protocol occurred. These changes, along with the inevitable changes in personal, that occurred during the 7 year time frame between reporting periods created significant challenges.

- Protocol Changes – The base protocol outlining the scale and scope of the status information associated with WCT was not substantially changed. The base components dealing with the historical perspective, current distribution and conservation populations remained. A fourth component was added to the protocol which addressed the potential for expansion or restoration of WCT within the context of historical habitat. The 2009 version of the protocol expanded the number of metrics associated with the current distributions and the conservation populations. Barrier information remained essentially the same for both the 2002 and 2009 status reviews and the historical part of the protocol was only slightly modified. The current distribution component of the protocol was substantially increased to include specific estimates of population abundance, determination of the origin of WCT, the status of fish stocking and non-native fish presence, genetic status, and a habitat quality determination. The habitat quality determination was supported by additional information regarding the habitat factors deemed important to the various quality determinations. An additional metric addressing the average width of each stream segment was also included. The conservation population component of the protocol was also substantially expanded to include information on the nature of habitat networks associated with WCT populations, the rational (i.e. the conservation qualifier) associated with each population, specific life history attributes, identification of conservation actions that have been implemented, and identification of human activities of concern, Risk assessments associated with genetic stability and catastrophic diseases were also undertaken for most conservation populations. A relative health evaluation was conducted on most of the WCT conservation populations. A fourth component was added to the revised protocol that addressed the potential for restoration and/or expansion of WCT conservation population. In total, the changes to the status protocol resulted in a significant increase in the amount of time needed to complete updating of the database.

- Analysis Area – In 2009, the analysis area for WCT was enlarged to include 3 HUC"s in the Yakima River Drainage within the state of Washington. In total there were 71 fourth levels HUC's associated with the 2009 status and database update. The expansion of the analysis area, the modification of the database protocol, and the amount of time that had elapsed between the initial effort in 2002 and the 2009 update all created a significant increase in the amount of time necessary to complete the effort.

- GIS and Database Considerations– Several significant changes to the technical framework of the database were undertaken prior to initiation of the 2009 update. Under the direction of Tim Williams, Idaho Department of Fish and Game's (IDFG) GIS and database specialist, a significant amount of time was expended in making changes viewed as beneficial to improving the structure of the database. The resulting changes made it advantageous to hold the workshops at locations where IDFG's computer system could be utilized. In addition to the changes to the database that occurred prior to the workshops, other changes were completed during the workshops that made the process more efficient.

  Data entry requirements for the effort required sufficient computer equipment (e.g. laptop computers, a portable hard drive storage device, projectors and screens, and all the associated cables and connectors) and proficient data entry personnel (i.e. experienced with ArcGIS and Access databases) sufficient to participate with the biologist in the assessment teams at each workshop. In general, there was sufficient computer equipment available to meet the needs at each workshop. There were, however, an insufficient number of proficient GIS/database personnel available for some workshops.

- GMU's, Assessment Teams and Workshops – In 2009, the analysis area was subdivided into nine (9) GMU's in an effort to enhance efficiency and effectiveness of the database update and for future WCT conservation planning and implementation (Figure 1). Each GMU was intended to reflect a logical conservation sub-unit within the broader WCT range. A specific individual was selected to serve as the primary contact person (i.e. GMU team leader) for each GMU. For the 2009 database update, the GMU team leaders were asked to determine the most logical location (e.g. city or town) to hold the respective workshop's, assist in selecting the time and local meeting place for the respective workshop, identification and notification of biologists that would make up the assessment teams charged with updating of the WCT database, and while not a specific expectation of the assignment, the GMU team leaders may have been asked to provide suggestions on individuals that could assist in GIS/database information entry. Each GMU team leader was provided with the 2009 version of the WCT protocol and identification of the HUC's for their respective GMU. The GMU team leaders were informed that completion of the database update for each GMU would likely take from 3 to 5 days depending on the number of HUC's to be evaluated, the number of biologists available, and the number of data entry stations that could be manned by proficient data entry personnel.

  A total of nine (9) workshops were held with over 80 biologists and more than 12 GIS/database personnel in attendance. In general there was a workshop scheduled for each GMU. The only exception was for the Missouri River GMU which was subdivided into sub-GMU's which resulted in two workshops scheduled to cover the 21 HUC's within the GMU. The GMU team leaders were allowed to structure the attendance of the biologists at their respective workshops. In general, most of the GMU team leaders and the biologists significantly under estimated the time required to complete the database update. Some biologists came to the workshops being unfamiliar with the protocol and not prepared to participate in an efficient manner.

<u>Recommendations Associated with Procedure and Process</u>

1. Make sure that changes in the WCT database protocol and changes to the framework of the WCT database are completed well in advance of the updating of the database. To the extent possible coordinate any changes with the other cutthroat trout subspecies efforts. Share this information with the GMU team leaders, the biologists and GIS/database entry personnel in a timely fashion and in a way that will allow for answering questions and providing training, if needed.
2. Consider combining the HUC's in Oregon and central Washington into a single GMU to make future database updates more efficient. For conservation planning and implementation this GMU could subdivided into sub-GMU's. If this can not

be accomplished, include these HUC's into the database update efforts for the Coeur d' Alene-Pend Oreille and the lower portion of the Salmon River GMUs.

3. Pre-organize the GMU assessment teams to make sure that all biologists within the GMU with pertinent WCT information are aware of the database update effort and the amount of time it will take to complete the effort. Also select and train specific GIS/database entry personnel for each GMU assessment team. It would be beneficial to include a significant number of biologists in the cadre of GIS/database personnel (Note: this will ensure that sufficient biologists are well versed in ArcGIS and are available to utilize the database in conservation planning and monitoring).
4. Allow each GMU team to organize and complete the scheduled database updates at their convenience and locations that will maximize participation. Each GMU team leader would be accountable to ensure that the protocol was followed and that the database updates were completed in a timely fashion. Oversight of the GMU efforts would remain with the range-wide coordination leader (IDFG) and the manager of the WCT database (IDFG).

Historical Distribution

The 2009 estimate of WCT historically occupied habitat reflected an increase of just under 1,600 miles of stream habitat. This increase was associated with increases in the projected historical habitat in both Idaho and Washington and a decrease of historical habitat in Montana. The primary factors influencing these changes were associated with adding historical habitat in the Yakima River Drainage of Washington and increasing the projected historical habitat in portions of Idaho that had been omitted in 2002. On the other hand, historical habitat in Montana was reduced by about 11% as a result of removing the upper most reaches of numerous streams (e.g. higher gradient sections with minimal flows and a few sections above complete passage barriers) and the removal of lower most reaches of tributaries entering the lower Missouri River where habitat conditions (e.g. high summer temperatures and high sediment loads) would have made year-long survival impossible. It is anticipated that, through time as the database is further refined, other modifications to the projected historical stream habitat will occur. This summary report does not include a discussion of lake environments that were identified as being historically occupied. During the 2009 database update inclusion of lake habitats in the database were addressed as a habitat component that was omitted in 2002. There was some uncertainty in the information that was associated with lakes occupied by WCT and it was decided to hold off of any significant discussion of lake use by WCT until after the next database update.

<u>Recommendations Associated with Historical Distribution</u>

1. Continue to review historical literature and other reports that could provide information pertinent to the historical distribution of WCT.
2. During the next update of the database focus on improving the information associated with historical use of WCT in lake environments.

Current Distribution

There was a very slight difference between the amount of stream habitat identified in 2002 (33,500 miles) as being currently occupied when compared to the amount identified in 2009 (33, 608 miles). There was a minor compensatory effect in place as nearly 600 miles were added to the current distribution associated with Yakima River Drainage and a similar amount of occupied habitat was reduced in other watersheds. What the 2009 database update did provide was a better picture of the conditions under which WCT current exist.

Genetic Composition within the Current Distribution of WCT With regard to genetic composition of WCT there was a substantial increase in the amount of stream miles that had been sampled during the 7 years between the 2002 assessment (6,100 miles) and the 2009 assessment (8,414 miles). There was only a minor change (about 3%) in the projected amount of stream habitat occupied by genetically unaltered WCT based on genetic testing. The 2009 update reported a 3% increase in the current habitat occupied by WCT tested and found to be genetically unaltered; the 2009 update also projected a 4 % increase in the current habitat occupied by WCT suspected as being unaltered.

WCT Abundance It was impossible to compare abundance estimates between the two reporting periods. The 2002 estimate of abundance was purely a qualitative exercise that used habitat quality as an indicator of potential population abundance. In 2009, WCT abundance was addressed as the density (fish per mile) of sexually mature cutthroat within each habitat segment. In general, WCT densities were rated as low to moderately low with 64% of the occupied stream miles being rated as having less than 150 fish/mile.

Other Characterizations of Currently Occupied WCT Habitat Four additional attributes associated with the current distribution of WCT were included in the 2009 database. The addition of these attributes was intended to provide information that could be helpful in developing an understanding the current conditions under which WCT exist and in providing information that would be of benefit in future conservation planning.

- Origin of WCT within the Current Distribution – This attribute helped to substantiate the view that most WCT that currently exist were from aboriginal stocks of WCT. This information may be of importance as conservation efforts to maintain genetic integrity and restore WCT to unoccupied habitats are considered.
- Habitat Quality – The 2009 protocol included a habitat quality rating to supplement the habitat quantity information associated with the current distribution of WCT. In addition, the protocol allowed for addressing the specific habitat attributes of significance in determining the respective quality rating. Due to time limitations associated with completion of the database updates at the workshops, it was decided to defer this determination until the next database update.
- Average Stream Width – The 2009 protocol included a metric associated with stream width for each occupied segment. This attribute was included to allow for analysis of WCT information based on area occupied in addition to the length of

habitat occupied. Completion of this component of the database update was also deferred until the next update as a result of time limitations.

- Records of Fish Stocking within the Stream Habitats Occupied by WCT – It was deemed important to add this metric to the protocol to assist in providing a better understanding of how fish stocking may have influenced the genetic status and competition with non-native fish. In addition, the protocol tracked the record of stocking of redband trout (rainbow) and Chinook salmon which are native species that have co-evolved with WCT. It should be noted that stocking of native species can exert negative influences on WCT if the stocking rates exceed the natural seeding rates of the native species and habitat carrying capacities are exceeded. The record of stocking was added to the database to assist in projecting possible negative influences to WCT from other fish species in situations where the actual presence of other fish species was unknown.
- Presence of Other Fish Species (primarily non-native species) – Adding of information on the presence of other fish (primarily non-natives) co-existing with WCT was viewed as a necessary element to understanding genetic and competitive factors that could be influencing WCT. When a comparison was made between the information associated with fish stocking and presence of other fish species it was apparent that certain non-native species (e.g. rainbow trout, brook trout and brown trout) have expanded their respective distributions beyond the areas where the stocking was reported.

Recommendations Associated with Current Distribution

1. In the next database update, schedule sufficient time to fully complete the protocol, especially the habitat quality and stream width characterizations.
2. During the next update of the database focus on improving the information associated with current use of WCT in lake environments. This information is essential to gaining a better understanding of the habitat complexity associated with the current WCT distribution. Information of lake environments is also important to better understanding the interactions of other fish species with WCT.
3. Continue to refine the information associated with fish stocking and the presence of other fish species. Consider adding an element that addresses the density of these other fish species.

Conservation Populations

There was a substantial increase in the numbers of conservation populations (672) identified in 2009 over the number (563) reported in 2002 and a slight decrease (3%) in the number of stream miles occupied by these populations. Conservation populations for both reporting periods were defined as being a combination of habitat mapping segments where there was the potential for genetic exchange at a frequency adequate to minimize risks of inbreeding and to maintain genetic variability. As such, the potential for genetic exchange could not be obstructed by a complete passage barrier. Each conservation population represented a discrete conservation unit. The difference between the two reporting periods could be accounted for by some original populations being subdivided as a result of identification of additional passage barriers, improper or invalid inclusion of some occupied segments as populations, and in some cases the valid inclusion of additional conservation populations It is highly unlikely that all populations identified in the 2009 database represent factual conservation populations.

Similar to the information from 2002, conservation population information developed in 2009 indicated that the majority of populations occupied stream habitat of 10 miles or less (73% based on a sub-sample of 575 populations). Hiltibrandt and Kershner 2000 addressed the question of how much stream habitat is enough to reasonably sustain cutthroat trout in small streams and they came to the conclusion approximately 6 miles were needed for populations with moderate densities of fish. The number of WCT populations meeting this threshold was approximately 40% (based on the 575 population sub-sample). Most populations (63%) were identified as core conservation populations meaning they had some genetic testing that reflected unaltered conditions in some occupied habitat segments and information indicating that there was no record of stocking or presence contaminating species in the untested habitat segments. It is also unlikely that all of the identified core conservation populations meet the strict definition of the "core" classification.

Nature of the Habitat Network Associated with WCT Conservation Populations -- Another important conservation population attribute was the identification of the nature of the habitat network (number of streams) associated with each population. There was a fairly obvious positive relationship between the nature of the habitat networks and the amount of habitat occupied by the conservation populations. Even though the majority of populations (63%) were identified as being non-networked (i.e. they occupied a single stream or single habitat segment of a stream), they occupied only 8% of the stream habitat occupied by WCT populations. In contrast, the 56 populations (8%) judged to have strongly networked habitats occupied approximately 81% of the stream habitat occupied by WCT populations. The relationships between genetic and disease risks and the nature of habitat networks associated with WCT populations was also of importance.

Genetic Risk Evaluation – The information collected in 2009 indicated that a majority of WCT populations (303 populations; 47%) were judged to be at low risk of genetic contamination. An additional 108 populations (17%) were judged to be a moderate risk. Populations judged as being at high to very high risk of genetic contamination were 23% and 13% of the total populations, respectively. When a comparison was made between the habitat network information, based on the number of populations and genetic risks, a reasonably strong inverse relationship became apparent (Figures 9) that indicated that the higher number of non-networked populations were associated with a lower genetic risk. The converse of this was shown in Figure 10 where populations judged to have strong habitat networks which occupied larger amounts of habitat (i.e. more stream miles per population) were judged to be at very high risk of genetic contamination. This information is of importance when considering actions to expand current conservation populations including actions associated with removal of downstream passage barriers.

Disease Risk Evaluation – Most WCT conservation populations (85%) were judged as being at limited to low (minimal) risk from catastrophic diseases for essentially the same reasons that the WCT populations were at risks from genetic contamination. The presence of total barriers, occupancy of smaller, cleaner non-networked habitats (Figure 9), and the relative isolation of WCT from disease pathogens and other organisms that carry these pathogens, all contributed to the increased security of WCT. The converse of this was also true for increased risks associated with catastrophic diseases for populations occupying larger amounts of connected habitat (Figure 10).

Relative Population Health Evaluation – A population health evaluation was conducted on 575 conservation populations. This health evaluation was not conducted on 97 populations because of missing information associated with one or more of the components of the evaluation procedure. The components of the health evaluation included: temporal variability associated with the number of stream miles occupied; population size of sexually mature WCT; production potential based on habitat quality and presence or absence of non-native competitors; and, the nature of the habitat network associated with each population. A weighted composite score was calculated for each conservation population reviewed in the relative health evaluation. While only 28 populations were rated as having relatively high overall health, these populations occupied approximately 71% of the stream habitat utilized by the 575 populations. By comparison, the 218 populations judged as having very low relative overall health occupied only 3% (728 miles) of stream habitat. As conservation actions that address the weaker components associated with population health are implemented it is anticipated that the number of populations reflecting moderate to high overall health will increase.

<u>Recommendations Associated with Conservation Populations</u>

1. The substantial increase in the number of conservation populations contained in the 2009 database, especially the number of populations that occupy less than 6 miles of habitat, create a significant challenge to future conservation efforts. It is recommended that a thorough analysis of the 672 conservation populations be made to determine if those populations factually meet the intended definition for conservation populations and represent meaningful WCT conservation units.
2. Likewise, an analysis of the "core" conservation populations should be made to determine if all of the identified populations meet the strict requirements associated with this classification (i.e. occupied habitat segments must have had genetic testing that verified that the WCT were unaltered and/or the habitat segments had to be suspected of being unaltered because there were no records of stocking of contaminating species or subspecies and no contaminating fish were present). Those populations that do not meet the "core" criteria can be re-designated to one of the other conservation population qualification categories.

3. It would be wise to re-validate the criteria used in the genetic and disease risk appraisals to ensure that these risk appraisals represent a factual display of potential risks to WCT populations.
4. Likewise, it would be reasonable to re-validate the criteria and the weighting of the criteria utilized in the relative population health evaluations.

WCT Population Restoration and Expansion Assessment

This part of the protocol was not addressed in the 2009 database update due to insufficient time. Even though the current approach for addressing restoration and expansion potential may be viewed as being cursory, it does provide a reasonable first step intended to provide the information needed to make an initial appraisal of potentials.

Recommendations Associated with the Restoration and Expansion Assessment

1. Complete this assessment during the next update of the WCT database and provide a summary of the findings in the subsequent status update report.

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