

circumstances and the values and attributes to be preserved"; and (3) cutthroat trout sport fish populations that, "at a minimum, meet the species (e.g., WCT) phenotypic expression defined by morphological and meristic characters of cutthroat trout." Conservation populations of cutthroat trout also include those believed to have uncommon, or important, genetic, behavioral, or ecological characteristics relative to other populations of the subspecies under consideration. Sport fish populations are those that conform morphologically (and meristically) to the scientific taxonomic description of the subspecies under consideration but do not meet the additional criteria of "conservation" or "core" populations. Consequently, the Service's criteria for including potentially introgressed populations of WCT with the WCT subspecies considered for listing under the Act include the first two tiers, as defined by the intermountain State fish and wildlife agencies, as well as those sport fish populations in the third tier for which morphological or genetic data are available. The implicit premise of the Position Paper is that populations must conform, "at a minimum," to the morphological and meristic characters of a particular cutthroat trout subspecies in order for those populations to be included in a State's conservation and management plan for that subspecies. Signatories to the Position Paper are the Colorado Division of Wildlife, Idaho Department of Fish and Game, Montana Department of Fish, Wildlife and Parks, Nevada Division of Wildlife, New Mexico Game and Fish Department, Utah Division of Wildlife Resources, and the Wyoming Game and Fish Department.

Molecular genetic methods for estimating percent introgression, or genetic admixture proportions, in natural populations of WCT need to be consistent to help guide the conservation decisions described here under the Act. The continual development of new types of molecular genetic markers for population-level evaluations complicates estimation of genetic admixture proportions in introgressed populations (e.g., Weigel *et al.* 2002). The most accurate estimates are obtained with codominant genetic markers in which heterozygotes and homozygotes at single loci can be distinguished. Allozymes and alleles at microsatellite nuclear DNA (nDNA) loci meet this "codominance" criterion. "Amplified fragment-length polymorphisms" (AFLPs) and "paired interspersed nuclear elements" (PINES; Weigel *et al.* 2002) do not. Also, a

minimum of four or five codominantly-expressed, diagnostic loci are usually required to attain sufficient statistical power in evaluations of introgressive hybridization (Fig. 2 in Campton 1990; Figure 1 in Epifanio and Phillip 1997; Figure 2 in Kanda *et al.* 2002). Under these conditions, percent introgression (P) in a population can be calculated as $P = (N_A / 2LN) \times 100$, where L = the number of diagnostic, codominantly expressed loci that distinguish the two taxa or species, N = the number of individual fish in a random sample of individuals from the population, and N_A = the number of alleles from another taxon observed at the diagnostic loci in the sample of individuals. This estimator is equally applicable to allozyme and microsatellite nDNA markers and is identical to the statistic proposed by the State fish and wildlife agencies (Utah Division of Wildlife Resources 2000). Consequently, this estimator provides a standardized approach for evaluating genetic introgression in natural populations. Evaluations of introgression based on dominant markers (Weigel *et al.* 2002) should computationally convert the observed data (e.g., percent of individuals with one or more rainbow trout alleles) into estimates of percent introgression on the basis of explicitly stated assumptions (e.g., that a single, random-mating population was sampled). If one or more codominantly expressed loci are not diagnostic between species, then the statistical methods of least squares or maximum likelihood can be used to estimate admixture proportions in introgressed populations (Campton 1987; Bertorelle and Excoffier 1998).

Further support for the morphological and genetic criteria developed by the Service and the State fish and wildlife agencies for classifying natural populations as WCT comes from field observations of the effects of natural and artificial selection in genetically introgressed populations of other taxa. Gerber *et al.* (2001) note that natural selection may act to retain the morphological phenotypes of native species despite introgressive hybridization resulting from secondary contact of a colonizing, congeneric species. Busack and Gall (1981) note a similar outcome resulting from artificial selection (i.e., selective removal of "hybrid-looking" individuals) for the Paiute cutthroat trout (*O. c. seleniris*) phenotype within introgressed populations of this latter subspecies. Those results suggest the lack of a genetic correlation between morphological phenotypes (i.e., the

genes affecting those phenotypes) and molecular genetic markers used to detect introgression in natural populations. In other words, molecular genetic markers (e.g., microsatellite DNA alleles, DNA fingerprint patterns) provide very sensitive methods for evaluating ancestral or pedigree relationships among populations, species, or individuals independent of the genes affecting morphology and other species-specific characters.

We now perform our new status review for WCT based on the described criteria for including potentially introgressed populations and populations of unknown genetic characteristics with the WCT subspecies considered for possible listing under the Act.

New Status Review

Background

In response to our September 3 and December 18, 2002, **Federal Register** notices, we received comments and information on WCT from several State fish and wildlife agencies, the U.S. Forest Service, private citizens and organizations, and other entities. Among the materials that we received, the most important was a status update report for WCT, a comprehensive document (Shepard *et al.* 2003) prepared by the fish and wildlife agencies of the States of Idaho, Montana, Oregon and Washington, and the U.S. Forest Service.

The WCT status update report (Shepard *et al.* 2003) and the comprehensive database that is the report's basis, presented to us the best scientific and commercial information available that describes the present-day rangewide status of WCT in the United States. To compile that important information, 112 professional fishery biologists from 12 State, Federal, and Tribal agencies and private firms met at 9 workshops held across the range of WCT in fall 2002. Those fishery biologists had a combined 1,818 years of professional experience, 63 percent of which involved work with WCT or other subspecies of cutthroat trout. At the workshops, the biologists submitted essential information on the WCT in their particular geographic areas of professional responsibility or expertise, according to standardized protocols. Presentation of information directly applicable to addressing the issues raised by the Court, as well as other concerns that we consider when making listing determinations under the Act, was central to those protocols.

In conducting the new status review for WCT in the United States described