Written Testimony of Peter B. Moyle
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I am a fish biologist whose general area of expertise is the ecology and conservation of freshwater and anadromous fishes, especially in California. A significant portion of my research has focused on regulated streams and the impacts of dams, diversions, and other factors on fish populations in northern California. I do not have any personal experience working on the Santa Ynez River, aside from compiling information on it to use in my latest book, *Inland Fishes of California* (2002, University of California Press, 505 pp.).

I have a B.S. in Zoology (Minnesota), an M.S. in Fisheries Biology (Cornell), and a Ph.D. in Zoology (Minnesota). I have been conducting research on freshwater and anadromous fish in California since 1969. I have served as a Professor of Fisheries Biology at the University of California at Davis since 1972, and was chair of the University's Department of Wildlife, Fish and Conservation Biology for five years. I have authored or co-authored over 170 publications, including *Inland Fishes of California* the standard reference work on California fishes, and four other books and monographs on fishes. My resume and list of publications is attached to this declaration.

I am a member of the American Fisheries Society, American Society of Ichthyologists and Herpetologists, Ecological Society of America, Society for Conservation Biology; American Association for the Advancement of Science, and American Institute of Biological Sciences.

Awards include: Award of Excellence, Western Division, American Fisheries Society (1991); Haig-Brown Award, California Trout (1993); Distinguished Fellow, Gilbert Ichthyological Society (1993); Fellow, California Academy of Sciences (1993); Bay Education Award, Bay Institute (1994); Public Service Award, University of California, Davis (1995); Outstanding Educator Award, American Fisheries Society (1995, with J. J. Cech); Streamkeeper Award, Putah Creek Council (1997); Distinguished Ecologist, Colorado State University (2001).

My expertise on the meaning of "good condition" in Section 5937 of the Fish and Game Code stems initially from years of research on the ecology of fishes in California streams, much of which was aimed at finding ways to improve conditions for native fish and fisheries. My research has dealt with fish at all ecological levels from individuals to populations to communities to ecosystems. My expertise on Section 5937 specifically stemmed from my work as an expert witness at a trial (Putah Creek Council vs. Solano Irrigation District, Sacramento Superior Court No. 515766, March 1996) over increasing the flows of Putah Creek, the stream that flows past the University of California, Davis, campus, to benefit native fishes. I had been studying the fishes of the stream for nearly 20 years at that time so had developed knowledge about the conditions that would favor the desired fishes and fisheries. This allowed me to develop a detailed definition of what, in my expert opinion, "fish in good condition" meant. Fish and Game Code Section 5937, was a key factor resulting in the successful outcome of the trial; in which the judge ordered flows for fish down Putah Creek from the Solano Water Project. The judgment was not appealed.

Following the trial, I published a peer-reviewed paper on the outcome that included a discussion of my definition of "good condition." The paper is: *Fish health and diversity: justifying flows for a California stream* (1998, Fisheries, Vol 23 No. 7, Pages 6-15). [Ex. CT 74] The paper has Michael P. Marchetti, Jean Baldrige, and Thomas L. Taylor as junior authors, fisheries biologists who assisted me in my preparation for the trial. The definition of good condition, however, was developed by me. The sections below essentially summarize the contents of this paper.

Section 5937 of the Fish and Game Code reads as follows: "The owner of any dam shall allow sufficient water at all times to pass through a fishway, or in the absence of a fishway, allow sufficient water to pass over, around, or through the dam to keep in good condition any fish that may be planted or exist below the dam." "Good condition" is not defined in the Section but use of the phrase "any fish" strongly suggests that Section 5937 was meant to be applied broadly to all fish species that depended on the stream for their existence, including anadromous fish such as steelhead. In a later section of the Code, "fish" is defined to include aquatic invertebrates as well as vertebrate fish.

In 1993, Darrell Wong, a biologist with the California Department of Fish and Game (DFG), developed a definition of "good condition" for a hearing by the State Water Resources Control Board. This definition was focused on the single species (brown trout) present in the stream in question and basically stated that "good condition " meant that the stream contained fish in good physical health with a population age structure that indicated the population was large and self-sustaining. He also stated that under this definition, maintaining fish in good condition required a stream with high "ecological health." I used Mr. Wong's definition as a starting place for the definition I developed, for a stream containing many species of fish.

Because Putah Creek supported over 20 species of fish, including anadromous chinook salmon and Pacific lamprey, I developed a definition of "good condition" which encompassed the DFG definition but which would also protect (1) an unusual assemblage of native fishes, (2) fisheries for non-native game fishes, and (3) anadromous fishes. This definition put "good condition" at three successive levels: individual, population, and community. To satisfy Section 5937, a fish has to be in good condition at all three levels.

At the individual level, fish in good condition must be healthy. This means they have to be relatively free of diseases and parasites, have robust appearance (i.e., have a suitable weight for a given length), have a growth rate appropriate for the region (i.e., not be stunted), and should respond in an appropriate manner to stimuli (e.g., can avoid predators, including anglers). If water releases from a dam are unfavorable (e.g., too warm, too low, too turbid) to species of fish, it is likely that individuals will be underweight, suffer from outbreaks of parasitic infections, and be more susceptible to predators, especially non-native predators such as largemouth bass, or to dying of stress-related disease.

At the population level, to be in good condition under my, and Mr. Wong's definition, each population must (1) be made up of healthy individuals as indicated in the previous section,

(2) have multiple age classes, which is evidence of successful reproduction and recruitment, and (3) have a viable population size. A viable population is one that is large enough so it will not go extinct from random factors or unusual events, such as a major drought. Steelhead in the Santa Ynez River have been listed as "endangered" under the federal Endangered Species Act, which means they are a population considered to have a high risk of extinction in the near future. The fact they are listed strongly suggests the population is not in good condition at the population level. Determination of the actual viable population size for a species usually requires extensive study of their demographic characteristics (age structure, mortality rates, growth rates, etc.) but a reasonable surrogate for an actual population estimate from a 'good condition' point of view is the presence of extensive habitat for all life history stages over long reaches of stream. Thus in Putah Creek, I determined that most native fish were not in good condition because their populations existed only in a short reach below the dam (into which water was released to satisfy riparian rights of streamside landowners) where habitat was limited in quantity and quality.

At the community level, "good condition" under my definition means that a dynamic assemblage of fish exists that will predictably inhabit a given range of environmental conditions, usually the historic range that existed on or near the site prior to the construction of a given dam. This concept is essentially equivalent to concept of *biotic integrity* developed by Dr. James A. Karr (1981, 1993) and widely used a measure of stream health, as I have done for California streams, including Putah Creek (Moyle and Marchetti 1999). [Ex. CT 72, 73]. Thus a fish community in good condition is one that (1) is dominated by co-evolved species, (2) has a predictable structure as indicated by limited niche overlap among the species and the presence of multiple trophic levels, (3) is resilient in recovering from extreme events, (4) is persistent in species membership through time, and (5) is replicated geographically. The Santa Ynez River only contains 2-7 species of native fish (steelhead, threespine stickleback, Pacific lamprey, prickly sculpin, tidewater goby, striped mullet, staghorn sculpin) with the latter three found mainly in the estuary/lagoon. Because only the first four species, including steelhead, presumably occur in the river above the estuary on a year around basis (Moyle 2002) this community level definition of good condition is less important than for streams with more complex communities. The number of species undoubtedly becomes progressively smaller in an upstream direction. Historically, steelhead was presumably the principal, if not the only species, in headwater streams and likely the most abundant fish where water was permanent and summer temperatures remained cool in the main river.

Overall, under my definition, for an individual fish to be in good condition it has to be a healthy individual that is part of a self-sustaining population that is an interacting part of a community of fish species with similar characteristics.

References

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