RESPONSE TO COMMENTS ON TENTATIVE PERMIT

ENCLOSURE 5

Tentative Comment Letter No.	From	Received	Comment(s)	Response(s)
1	Don Erman	11/3/2009	1	The Dawson et al. method is no longer used. The CDFG lab now uses the methods given in Appendix A of a 2008 Publication on the Lake Davis rotenone project (Attached). The following citation will be used in the upcoming Proposed NPDES permit, replacing those in the previously circulated Tentative Permit: McMillin, S. and B.J. Finlayson. 2008. Chemical residues in water and sediment following rotenone application to Lake Davis, California 2007, Appendix A: Water Pollution Control Laboratory Analytical Methods. California Department of Fish and Game, Pesticide Investigations Unit, OSPR Administrative Report 08-01, Rancho Cordova, California.
2	Julia Olsen	6/7/2009	1	The comment period was extended. All comments received on the tentative permit were considered.
2			2	Comments 2 through 41 all concern specifics of the EIR. Water Board, as a Responsible Agency is relying on the FEIR as it relates to the proposed alternative and its effects on water quality. The Water Board is not required to specifically respond to comments on the DEIR. Staff has provided responses where relevant to issuance of the NPDES permit.
2			3	Comment noted
2			4	Comment noted
2			5	Comment noted
2			6	Comment noted
2			7	Comment noted
2			8	Comment noted
2			9	Comment noted
2			10	Comment noted
2			11	Comment noted
2			12	Water Board is relying on DFG's evaluation of electroshocking as presented in the FEIR/FEIS, including Appendix F, Master Response D.
2			13	Comment noted
2			14	Water Board is relying on DFG's evaluation of invertebrate as presented in the FEIR/FEIS, including Appendix F, Master Response B.
2			15	Comment noted
2			16	Please see Attachment 2, "Rare and Endemic Species, Response to Comments," and

RESPONSE TO COMMENTS ON TENATIVE PERMIT

Tentative Comment Letter No.	From	Received	Comment(s)	Response(s)
2			17	Comment noted
2			18	Comment noted
2			19	Comment noted
2			20	Please see Attachment 2, "Rare and Endemic Species, Response to Comments." Water Board is relying on DFG's evaluation of climate change as presented in the FEIR/FEIS, including Appendix F, Master Response I.
2			21	Comment noted
2			22	Comment noted
2			23	Comment noted. The Water Board must only determine the purpose of the project is restoration and protection of a threatened or endangered species and does not have to agree with whether the project restores PCT in its historic range. DFG has provided information in its EIR/EIS Appendix F, Master Response C: Paiute Cutthroat Trout Historic Range and the Water Board is relying on this information for its findings (although not a permit requirement).
2			24	Comment noted
2			25	Comment noted
2			26	Comment noted. The proposed permit requires monitoring of the inert ingredients along with rotenone.
2			27	Comment noted
2			28	Comment noted
2			29	Comment noted
2			30	Comment noted
2			31	Comment noted
2			32	Comment noted
2			33	Comment noted
2			34	Comment noted
2			35	Please see Attachment 2, "Rare and Endemic Species, Response to Comments."
2			36	Comment noted

RESPONSE TO COMMENTS ON TENATIVE PERMIT

Tentative Comment Letter No.	From	Received	Comment(s)	Response(s)
2			37	The Basin Plan conditions for rotenone projects states that: "Within two years of the last treatment for a specific project, a fisheries biologist or related specialist from the DFG must assess the restoration of applicable beneficial uses to the treated waters..." The Basin Plan does not require recovery, nor does it require compliance with any specific biological metric. The requirement is restoration of applicable beneficial uses, which are listed in Finding 16 of the proposed Order: "The beneficial uses of Silver King Creek as set forth and defined in the Basin Plan are: Municipal and Domestic Supply, Agricultural Supply; Groundwater Recharge; Water Contact Recreation; Non-contact Recreation; Commercial and Sport Fishing; Cold Freshwater Habitat, Wildlife Habitat; Rare, Threatened or Endangered Species; and Spawning, Reproduction, and Development."
2			38	The Basin Plan defines Cold Freshwater Habitat beneficial uses of waters as those that: "support cold water ecosystems including, but not limited to, preservation and enhancement of aquatic habitats, vegetation, fish, and wildlife, including invertebrates." The Discharger acknowledges that this project has potentially significant and unavoidable impacts which may result in "temporary changes in species composition in non-target aquatic invertebrate communities." This in and of itself is not a violation of the Basin Plan. The Basin Plan, including the rotenone provisions, is consistent with the Clean Water Act, having been reviewed and approved by USEPA. The Rotenone provisions of the Basin Plan acknowledge that there may be temporary violations of water quality objectives associated with these kinds of projects, but that it is in the public interest to restore threatened and endangered species.
2			39	The Water Board will consider the permit at its April 14, 2010 Board Meeting.
2			40	Comment noted. The USFS implements the Wilderness Act and the National Forest Management Act and must ensure compliance with these federal requirements.
2			41	See proposed Order, Finding 10 "Proposition 65 Considerations"

RESPONSE TO COMMENTS ON TENATIVE PERMIT

Tentative Comment Letter No.	From	Received	Comment(s)	Response(s)
2			42	See proposed Order, Finding 18 "California Toxics Rule"
3	Friends of Hope Valley	6/2/2009	1	Comment noted. See response to Comment Letter 2, comment 40.
3			2	The assumption that rotenone formulation ingredients will persist and continue into Nevada waters is incorrect. Potassium Permanganate released from the neutralization not only destroys rotenone in the water, but also attacks other organic compounds present in the water, including the inert ingredients. Photooxidation and volatilization, often aided by water turbulace, also disperse many of the inert ingredients (FEIR/EIS, Appendix C). Therefore, all rotenone formulation chemicals should be non-detect at the downstream project boundary located 30 minutes stream travel time below the neutralization station.
3			3	Water Board is relying on DFG's evaluation of invertebrate as presented in the FEIR/FEIS, including Appendix F, Master Response B.
3			4	Comment noted.
4	Kim Tisdale, Nevada Dept of Wildlife		1	Supports permit. No response needed.
5	Jenny Francis, California Trout		1	Supports permit. No response needed.
5			2	Comment noted

RESPONSE TO COMMENTS ON TENATIVE PERMIT

Tentative Comment Letter No.	From	Received	Comment(s)	Response(s)
6	Ann McCampbell	6/1/2009	1	This is a new project. Though it has similarities to the proposed project the Water Board considered in September 2004, the Discharger has performed and published a robust analysis of macroinvertebrate data in Silver King Creek (see EIR/EIS Appendix D, Vinson and Vinson, 2007. "An Analysis of the Effects of Rotenone on Aquatic Invertebrate Assemblages in the Silver King Creek Basin, California." This fulfils the Water Board's 2004 request for more information on macroinvertebrates in Silver King Creek. Additionally, the Discharger has incorporated mitigation measures in the proposed project, to protect rare and endemic species, whether or not they are present in springs, seeps, and headwaters within the project area. This mitigation measures is responsive to the Water Board's 2004 concern for protection of rare and endemic species.
6			2	Comment noted. The Water Board must only determine the purpose of the project is restoration and protection of a threatened or endangered species and does not have to agree with whether the project restores PCT in its historic range. DFG has provided information in its EIR/EIS Appendix F, Master Response C: Paiute Cutthroat Trout Historic Range and the Water Board is relying on this information for its findings (although not a permit requirement).
6			3	Comment noted. The USFS implements the Wilderness Act on its lands and ensures compliance is achieved.
6			4	The Water Board acknowledges the potential adverse impacts to aquatic life in the proposed permit.
6			5	The Basin Plan and the proposed Permit require certification by DFG that beneficial uses have been restored within two years. Note that this is restoration of beneficial uses, such as cold water habitat, not necessarily a certification that all the aquatic species in the same composition as pre-project.
6			6	Water Board is relying on DFG's evaluation of invertebrate as presented in the FEIR/FEIS, including Appendix F, Master Response B. Please also see monitoring and reporting program.

RESPONSE TO COMMENTS ON TENATIVE PERMIT

Tentative Comment Letter No.	From	Received	Comment(s)	Response(s)
6			7	Comment noted
6			8	Comment noted
6			9	This is handled by requiring that these chemicals be destroyed by permanganate oxidation in the project neutralization zone, verified by the monitoring program in the MRP.
6			10	See response to Comment Letter 6, Response 9
6			11	See response to Comment Letter 6, Response 9
6			12	The MOU and Basin Plan amendment for rotenone were done in 1990. The proposed rotenone formulation does not contain piperonyl butoxide.
6			13	Comment noted – See project description in permit and in FEIR. Nusyn-Noxfish will not be used. Monitoring requirements will verify proper application.
6			14	Comment noted. Since no specific reference is given supporting the claim that potassium permanganate does not neutralize all the inerts, we can't respond to that other than to reiterate that it should attack functional groups of the inerts, based on it's strong oxidant chemical nature. Additionally, photooxidation and volatilization enhanced by turbulence are modes of dissipation of these volatile to semivolitile chemicals.
6			15	All chemical constituents of CFT Legumine, its allowed treatment concentrations and analytical reporting limits are given in Table 1 of the Order. The MRP clearly identifies the required monitoring of all these chemical constituents.
6			16	The label for CFT Legumine states "Properly dispose of unused product. Do not use dead fish for food or feed." 'Product' refers to the pesticide formulation, not dead fish. Use for food and feed clearly refers to deliberate human consumption and domestic animal consumption. The Discharger will collect as many dead fish as possible, and bury them "no closer than 300 feet from the stream and away from known camping areas to minimize bear/human interactions" (please see Finding 8 of the proposed Order). Leaving uncollectable dead fish to decompose in-stream is not prohibited by the pesticide label.

RESPONSE TO COMMENTS ON TENATIVE PERMIT

Tentative Comment Letter No.	From	Received	Comment(s)	Response(s)
6			17	Temporary degradation of water quality is allowable under Nondegradation/Antidegradation policies if a finding of benefit or overriding considerations is made for projects necessary to protect and maintain important economic and social resources, consistent with maximum benefit to the people of the state. Please read proposed Order Finding 20 for further discussion.
7	Don and Nancy Erman	5/18/2009	1	Comment noted
7			2	This is a key question, involving issues of whether the project's impacts are acceptable to achieve the project goal. The precedent for this has been set in the 1990 amendment to the Basin Plan for projects involving rotenone. The Basin Plan, Chapter 4.9, page 25 states: "The temporary deterioration of water quality due to the use of rotenone by the DFG is justifiable in certain situations. The Regional Board recognizes that the State and federal Endangered Species Acts require the restoration and preservation of threatened and endangered species. The Regional Board also recognizes that situations may arise where outbreaks of fish disease or the threat presented by prohibited or exotic species may require immediate action to prevent serious damage to valuable fisheries resources and aquatic habitat. These resources are of important economic and social value to the people of the State, and the transitory degradation of water quality and short-term impairment of beneficial uses that would result from rotenone application is therefore justified, provided suitable measures are taken to protect water quality within and downstream of the project area."
7			3	DFG has provided evidence regarding the sufficiency of the downstream barriers to fish.
7			4	Issue regarding genetic strain is not within Water Board's jurisdiction. WE rely on DFG's professional judgment and experience.
7			5	DFG proposed Alternative 2 and applied to the Water Board for a permit for this alternative.
7			6	Water Board is relying on DFG's evaluation of invertebrate as presented in the FEIR/FEIS, including Appendix F, Master Response B. . Please also see Attachment 2, "Rare and Endemic Species, Response to Comments."

RESPONSE TO COMMENTS ON TENATIVE PERMIT

Tentative Comment Letter No.	From	Received	Comment(s)	Response(s)
7			7	Issue is not within the Water Board's jurisdiction.
7			8	Water Board is relying on DFG's evaluation of invertebrate as presented in the FEIR/FEIS, including Appendix F, Master Response B.
7			9	While Silver King Creek (SKC) can be considered a "High Quality of Water," it is not an Outstanding National Resource Water (ONRW). There are two ONRW's in the Lahontan Region of California -- Lake Tahoe and Mono Lake. Therefore the discussion of SKC as an ONRW is invalid. However, State and Federal Nondegradation/Antidegradation policies do apply. They are discussed in the proposed Order, Finding 20.
7			10	Issue is not within the Water Board's jurisdiction.
7			11	Comment noted.
7			12	Water Board is relying on DFG's evaluation of potential impacts to amphibians as presented in the FEIR/FEIS.
7			13	Water Board is relying on DFG's evaluation of potential impacts to other aquatic species as presented in the FEIR/FEIS.
7			14	Water Board is relying on DFG's evaluation of invertebrate as presented in the FEIR/FEIS, including Appendix F, Master Response B Please also see Attachment 2, "Rare and Endemic Species, Response to Comments."
7			15	Issue is not within the Water Board's jurisdiction.
7			16	Please see final EIR/EIS Master Response I: Climate Change
7			17	Water Board is relying on DFG evidence regarding the sufficiency of the downstream barriers to fish.
7			18	Comment noted.
7			19	Issue is not within the Water Board's jurisdiction.
7			20	Issue is not within the Water Board's jurisdiction.
7			21	Issue is not within the Water Board's jurisdiction.
7			22	Issue is not within the Water Board's jurisdiction.
7			23	Comment noted.
7			24	Comment noted.
7			25	The Discharger is required to submit and implement a Spill Constinegency Plan and chemical handling and disposal plans in the proposed Order, and as part of the CTR Chapter 5.3 requirements.
7			26	Water Board is relying on DFG's evaluation of potential impacts to sediment. CFT Legumine will be used which does not contain piperonyl

RESPONSE TO COMMENTS ON TENATIVE PERMIT

Tentative Comment Letter No.	From	Received	Comment(s)	Response(s)
				butoxide.
7			27	Water Board is relying on DFG's evaluation of potential impacts from rotenone as acknowledged in the FEIR/FEIS.
7			28	Comment noted.
7			29	Water Board is relying on DFG's evaluation of electroshocking as presented in the FEIR/FEIS, including Appendix F, Master Response D.
7			30 This comment is located at Pg 07-0197 of Board's agenda packet	See attached letter from Water Board former staff Jason Churchill, dated September 2, 2004 (attachment 1)
8	Don Erman	5/15/2009	1 Page 07-0372 of Board's agenda packet	Carrier-free powdered rotenone was considered only for treatment of Tamarack Lake, which is no longer in the project area. Therefore references to carrier-free powdered rotenone have been removed from the Proposed permit.
			2	Nusyn-Noxfish, which contains piperonyl butoxide, has been dropped from the permit. CFT Legumine, the only rotenone formulation allowed in the Proposed permit, does not contain piperonyl butoxide. Rotenone is obtained by processing the roots of plants such as Derris and Lonchocarpus species. Consequently, the materials from which rotenone formulations are made consist of complex mixtures of rotenone and other plant materials commonly referred to on the product labels as other associated resins or other associated extracts. These compounds are generally less toxic than rotenone by factors of about 4-5, and because of the complex heterogeneous nature of these "cube resins," individual constituents in these mixtures are not required to be listed, as meaningful characterization of chemical, physical, and toxicological properties of "cube resin" is not possible.
			3	The information cited in the permit refers to CFT Legumine.

California Regional Water Quality Control Board
Lahontan Region

Terry Tamminen
Secretary for Environmental Protection

2501 Lake Tahoe Boulevard, South Lake Tahoe, California 96150
(530) 542-5400 • Fax (530) 544-2271
http://www.swrcb.ca.gov/rwqcb6

Arnold Schwarzenegger
Governor

September 2, 2004

ATTACHMENT 1
OF ENCLOSURE 5

Nancy A. Erman and
Don C. Erman
43200 E. Oakside Place
Davis, CA 95616

RESPONSE TO COMMENTS ON THE TENTATIVE NATIONAL POLLUTANT DISCHARGE ELIMINATION SYSTEM (NPDES) PERMIT FOR SILVER KING CREEK ROTENONE PROJECT--ALPINE COUNTY

We are responding to your August 5, 2004 comment letter, with Exhibits, regarding the above-referenced draft permit. The Regional Board will consider comments received, and consider adopting the proposed NPDES permit at the September 8 and 9, 2004 Regional Board meeting in South Lake Tahoe. Your position is that the Regional Board should not adopt the NPDES permit or authorize the discharge of rotenone formulation or potassium permanganate by the Department of Fish and Game (DFG). We are also responding in this letter to your July 8, 2004 comments to the Regional Board members, in which you also urged the Regional Board not to adopt the permit. Staff has not yet completed our analysis of all the Exhibits submitted, but we intend to complete this review and present additional responses (if any) at the Regional Board meeting.

Our response to comments in your July 8 letter are as follows:

1. You refer to a June 3, 2004 letter from me, in which you say I recognized "that it is unlikely the proposed project will meet Basin Plan objectives." You argue that if the project can't meet Basin Plan objectives, it should not be authorized under the proposed NPDES permit. In my letter, I acknowledged that DFG's data suggest short-term impacts to invertebrates may last several years, and that longer-term effects are possibly indicated. The duration of those impacts has not, in our opinion, been conclusively established.

   The Basin Plan recognizes that short-term impacts to invertebrate communities will occur with rotenone use. The policy explicitly allows short-term impacts, provided that DFG biologists certify that beneficial uses of water have been restored within two years following the last treatment date. This provision in effect requires that the DFG demonstrate that a healthy assemblage of invertebrates has reoccupied the treated area within that period of time, and that applicable beneficial uses have been restored. It does not require that the precise pre-project invertebrate community structure be restored within that two-year period. The Basin Plan water quality objectives for rotenone do require (at p. 3-12) that "where species composition objectives are established for specific water bodies or hydrologic units, the established objective(s) shall be met for all non-target aquatic organisms within one year

following rotenone treatment." However, no species composition objective has been established in the Basin Plan specifically for Silver King Creek or the East Fork Carson River Hydrologic Unit in which Silver King Creek is located; therefore the one-year recovery requirement for species composition does not apply in this case.

For these reasons, we do not find that the project would violate Basin Plan objectives if conducted according to information submitted by DFG, and in compliance with the terms of the proposed NPDES permit.

Regional Board staff believes that the above-cited one-year species composition objective for rotenone projects is probably unrealistic. It may have been based on a misinterpretation of information contained in DFG planning and environmental documents, containing statements indicating that healthy invertebrate populations would "repopulate" treated areas as soon as one year following treatment. We do not believe those statements were meant to imply that the pre-project invertebrate community structure could be fully restored in one year. In the absence of a demonstrably sound basis for the one-year species composition recovery objective for rotenone use, Regional Board staff may recommend that the Regional Board consider revising that requirement in future Basin Plan revisions.

2. You state that required monitoring after poisoning does not mitigate impacts to invertebrate communities, or mitigate failure to meet Basin Plan objectives. As explained in our response to comment #1 above, the Basin Plan recognizes that temporary impacts to water quality and invertebrate communities are expected to occur with rotenone projects. The Basin Plan concludes that these temporary impacts are justified for purposes of establishing threatened and endangered fish species when the project meets the Basin Plan eligibility criteria and conditions. The project meets those criteria. The existing data from earlier projects by DFG do not conclusively establish the duration of impacts to invertebrates. The monitoring program required under the Proposed Permit is designed to address shortcomings of the earlier studies and is a marked improvement over past DFG monitoring efforts. In our opinion, it will characterize impacts to invertebrates, and the duration of those impacts. We find that the project will not violate Basin Plan objectives if conducted according to the terms of the Proposed Permit. The required monitoring is not intended to be a mitigation measure; it will enable us to verify compliance.

3. You contend that rotenone projects to restore native fish species are often unsuccessful in the long term, because well-meaning persons may move unwanted fish back into the restored area. However, available information submitted by DFG indicates that the treatments conducted in upper portions of the Silver King Creek drainage in 1991-93 were indeed successful, and that a thriving population of pure Paiute Cutthroat Trout (PCT) is still maintained at that site more than ten years later. In fact, the stated goal of the current project is to secure that population by establishing a six mile "buffer-zone" of PCT downstream of the existing one, to prevent a transfer of non-native fish that could readily occur from below the natural fish barrier, Llewellyn Falls. You suggest that native fish restoration projects with rotenone will be "unsuccessful in the long term," but offer no viable alternative to preserve

the PCT from hybridization with non-native fish. We concur with DFG that, in the absence of other effective methods, the proposed project is the most effective way to secure the existing PCT population against non-native fish introductions.

4. You note that there is "long and well-documented history" of water quality violations as a result of DFG rotenone projects, including projects in the Lahontan Region. We have revised the permit to include (in the Findings) a summary of violations for projects in the Lahontan Region. Those projects were conducted under a waiver of waste discharge requirements granted by the Regional Board. Waste discharge requirements are not being waived for the current project. We find that corrective measures proposed by DFG, and Best Management Practices required in the permit, will prevent recurrences, and will be adequate to protect water quality. Any permit violations will be subject to enforcement action pursuant to Regional Board authorities under the California Water Code, including revocation of a permit, should it be issued.

5. You mentioned information you previously provided to Regional Board staff regarding the likelihood of endemic species of aquatic invertebrates. A copy of that information is being provided to the Regional Board along with your comment letters. The issue of endemic species is discussed in more detail in our response to comments below.

Our response to comments in your August 5 letter are as follows:

6. Your general comments, listed on page 1 of your August 5 letter, assert that the draft NPDES permit: 1) fails to consider or disclose significant adverse effects of past rotenone projects; 2) fails to disclose that stream ecology experts have expressed serious concerns and opposition to the project; and 3) fails to mention public opposition to the project.

   Regarding disclosure of adverse impacts, both the permit and the policy for DFG rotenone use contained in the Water Quality Control Plan for the Lahontan Region (Basin Plan) recognize that rotenone use will result in temporary degradation of water quality, and that non-target aquatic communities, including invertebrates, will experience temporary impacts from which they are expected to recover. Chemical residues from rotenone treatment are expected to dissipate within two weeks. However, we find that the actual duration of impacts to non-target aquatic organisms has not been conclusively established. Therefore, the permit requires DFG to implement a monitoring program to establish the timeframe for recovery of invertebrate communities. We respond in more detail to your concerns regarding invertebrates in our detailed comments, below.

   Regarding disclosure of public opposition, and disclosure of concerns and opposition expressed by stream ecology experts, we respond that opposition and criticisms by the public and scientific experts are expressed through the public review and comment process, which the Regional Board considers prior to and during the public hearing. Where significant issues are identified through the public comment process, staff may revise the permit before the public hearing, or the Regional Board may direct that changes be made before permit

adoption. We have received a number of comments on the Tentative Permit from both opponents and proponents of the project (including several stream ecology experts), and have revised the Proposed Permit sent to our list of interested parties. The mailing list has grown considerably since the Tentative Permit was circulated for comment, and we find that it represents a broad and diverse group of interested parties and experts both for and against the project.

7. You expressed the opinion (p. 2) that the Tentative Permit prepared by staff will mislead the Regional Board and public regarding the impacts of the current project, and of the Silver King Creek rotenone treatments conducted from 1991-1993.

   The Tentative Permit was circulated to interested parties, and numerous responses have been received both for and against the project. Staff has considered these comments in developing the Proposed Permit (the version that will be considered by the Regional Board at the meeting and public hearing), and made revisions where appropriate to address concerns raised by interested parties. Please refer to our responses to your other comments to see how we have addressed your specific concerns regarding the impacts of the current project and previous project.

8. You contend (p. 2) that because there is evidence that impacts from rotenone treatment to invertebrates may last more than two years, these must be considered "long-term" impacts according to the definition in the Basin Plan. You further contend that we have "re-defined" (in my June 3, 2004 letter to you) the term "short-term" impacts as defined in the Basin Plan, and suggest we may not be aware that DFG's data show impacts to invertebrates that may have lasted beyond two years. You suggest that these were therefore long-term impacts, not short-term impacts.

   The Basin Plan defines short-term and long-term impacts on p. 4.9-24. It defines long-term impacts as "temporary loss of beneficial uses, specifically aquatic habitat and recreational fishing opportunities" (emphasis added). It explains, "long-term impacts result because the treatments are typically repeated at a given project site for several consecutive years, after which time the treated waters are restocked with fish." In other words, long-term impacts as defined by the Basin Plan arise because the treated waters are unsuitable as aquatic habitat during the multi-year treatment period, and, because fish have been extirpated, recreational fishing opportunities are lost during that time (the Basin Plan recognizes that where the project objective is threatened or endangered species restoration, fishing opportunities may be permanently lost). After the final treatment, the receiving waters are expected to be suitable again as aquatic habitat, capable of supporting aquatic organisms including invertebrates. According to that definition, long-term impacts cease once beneficial uses have been restored. A "healthy" population of invertebrates is expected to repopulate the treated area, and the waters are expected to "support cold water ecosystems" (per the definition of the Cold Freshwater Habitat beneficial use) within 2 years following the final treatment, with recognition that treatments will occur annually over a 2-3 year period. That definition does

not require that the exact pre-project invertebrate community structure be reproduced within that time.

The Basin Plan defines short-term impacts in terms of the persistence of chemical residues, and recognizes that residues may persist for up to two weeks.

In short, the Basin Plan defines short- and long-term impacts in terms of chemical persistence, and temporary loss of beneficial uses, respectively. Although we agree the data suggest invertebrate community structure may not be fully restored within two years of treatment, we do not find that there was long-term persistence of chemicals, or long-term loss of beneficial uses.

Because the Basin Plan definitions of short-term and long-term impacts do not consider alterations to invertebrate community structure, in my June 3, 2004 letter, when discussing the results of DFG's invertebrate surveys, I was not using the terms in the sense in which the Basin Plan uses them. I acknowledged staff's opinion that the data from DFG's invertebrate surveys suggest some effects on invertebrate communities may have lasted beyond the post-project study period (i.e., more than three years). However, due to the limited number of treatment and reference monitoring sites, and inadequate metrics, we find the data are inconclusive. Because monitoring ceased after three years, it is presently unknown how long the effects persisted. We have added language to the Proposed Permit, in response to comments like yours, to clarify that DFG's studies are regarded as controversial, and that additional monitoring is needed to characterize impacts to invertebrates, and the duration of those impacts.

DFG has submitted an Aquatic Macroinvertebrate Study Proposal that addresses inadequacies of the 1990s studies that were pointed out to us. The Study Proposal calls for six monitoring stations within the treatment area, and eight reference sites (four of these reference sites are within the area treated during the 1991-1993 treatments of Silver King Creek), and improved metrics (including a measure of community similarity) that will provide more conclusive information about the nature and duration of impacts. The NPDES permit requires that DFG implement the Study Proposal as part of the current Silver King Creek rotenone project, and that midges and mites be keyed to genus level. Midges and mites are reportedly expected to account for as much as 40-50% of the taxa diversity (Dr. David Herbst, Ph.D., Sierra Nevada Aquatic Research Laboratory, personal communication, 2003).

9. You express concern (p. 2) that rare invertebrate species exist in the treated area that could be eliminated by treatment, and note that no species inventory has ever been made for the Silver King Creek basin.

We recognize that neither the invertebrate surveys conducted by DFG in the past, nor the currently proposed studies, are capable of ruling out the possibility of rare species in the project area. Although no unique or rare species were identified, those surveys considered only larval forms. An exhaustive species inventory would reportedly require collecting and

analyzing adult life stages of aquatic invertebrates. We note your assertion that such an inventory might feasibly be done for $50,000 to $75,000 over a three-year period, and that this is perhaps reasonable if it could definitively answer questions regarding rare or endemic species.

In a June 30, 2004 e-mail to me, you contended, "In a drainage this size in a Wilderness Area (that should be relatively undisturbed), we might expect several endemic species . . ." You summarized supporting literature, and provided a reference list. We are providing a copy of your e-mail to the Regional Board members, and are taking this information under consideration. Considering that the Silver King Creek area has been subject to disturbances including historic logging and more recently sheep and cattle-grazing, we think it is arguable to what degree the area is "relatively undisturbed."

We received similar comments from another stream ecologist, Robert R. Curry, Ph.D., who asserts that "This basin . . . almost certainly harbors unique species of insects and other invertebrates." You and Dr. Curry have both expressed a particular concern that headwater areas slated for treatment may harbor unique or rare species.

It is not clear from the information that you or Dr. Curry provided whether you believe it likely that there are invertebrate species that are strictly endemic to the Silver King Creek basin (i.e., locally endemic as opposed to regionally endemic, or endemic to the Sierra Nevada). Species that are locally endemic would be of greater concern, since such species may depend upon drift from nearby refugia populations (if refugia populations exist) to repopulate, if they are eradicated by rotenone treatment.

We are asking the Regional Board to consider whether the project objective, to extend the range and secure the existing restored population of a known threatened species, the PCT, outweighs the risk to endemic species that may potentially exist, but have not been demonstrated to exist.

10. You state (p. 3), "The draft permit fails to take into consideration or disclose for the Board and public, the significant adverse effects of past poisoning projects."

Both the Basin Plan, and the permit, recognize that rotenone use will temporarily impact invertebrate communities. What has not been established, to our satisfaction, is the precise nature and duration of those impacts. We find that the invertebrate monitoring program required by the permit will allow us to better ascertain the nature and duration of those impacts. We have added language to the permit findings, recognizing that the existing and proposed invertebrate surveys cannot rule out the possibility of endemic or unique species.

Past rotenone projects were conducted subject to waivers of waste discharge requirements granted by the Regional Board. Violations of waiver conditions occurred on several occasions. We have added language to the permit findings summarizing these violations. The DFG proposed additional control measures for future projects, to prevent recurrences of these

violations. A waiver of waste discharge requirements is not being granted for the current project at Silver King Creek. Rather, the permit establishes waste discharge requirements for the project, including receiving water limits and BMPs adequate to protect water quality. Violations will be subject to enforcement action pursuant to Regional Board authorities under the California Water Code.

11. You object (p. 3) that the permit does not mention the opposition and concerns expressed by some stream ecologists.

    We have received comment letters from several stream ecologists. Those comments will be entered into the public record, and are being provided to the Regional Board. Where appropriate, staff has revised the Proposed Permit to reflect those comments, and the Regional Board may also direct that changes be made prior to considering adoption.

12. You object (p. 4) that the permit fails to mention public opposition to the project.

    The project has proponents and opponents. The purpose of the Tentative Permit is to gather public comment. The Regional Board considers public opposition during the public comment period, and the public hearing for the permit, and the permit may be revised before adoption as necessary to address substantive comments. We have prepared a Fact Sheet to accompany the Proposed Permit, which recognizes there is substantial controversy regarding the project and the permit.

13. You request (p. 4) that we provide you a list of interested parties to whom the Tentative Permit was circulated. We have attached a list (Attachment 1) of interested parties that were included in the mailing for the Tentative Permit, as well as a list of interested parties to whom the Proposed Permit (the version that will be presented to the Regional Board for consideration) will be sent (Attachment 2).

14. You questioned (p. 4) claims reportedly made in the 2004 U.S. Forest Service Environmental Assessment for the project, to the effect that the project "already has an NPDES" permit. In fact, DFG obtained coverage for the project in 2003 under a statewide NPDES permit issued by the State Water Resources Control Board (State Board), Water Quality Order No. 2001-12-DWQ (For Discharges of Aquatic Pesticides to Waters of the United States). Order No. 2001-12-DWQ was adopted on an emergency basis, in response to a 2001 9th U.S. Circuit Court of Appeals decision (Headwaters, Inc. versus Talent Irrigation District) which found that use of aquatic pesticides in U.S. waters requires an NPDES permit. The NPDES permit referred to in the Environmental Assessment is Order No. 2001-12-DWQ, which was in effect when the Environmental Assessment was prepared.

    Order No. 2001-12-DWQ expired in January 2004. The State Board subsequently adopted (in 2004) statewide NPDES permits allowing the conditional use of certain aquatic pesticides for vector control, and weed control, respectively, however, those permits do not authorize the use of rotenone. Therefore, the DFG applied to the Regional Board for an individual NPDES

permit to allow use of rotenone at Silver King Creek; that is the NPDES permit that will be considered by the Regional Board at the September 8 and 9, 2004 meeting. The EA has no bearing on the approval being considered by the Regional Board.

15. You questioned (p. 5) whether Regional Board staff have sufficient experience to advise the Regional Board on the potential impacts of rotenone use.

    Qualified staff has carefully reviewed material and data provided by interested parties (both for and against the project) and agencies involved in the project, and information regarding the potential impacts of the project has been provided to the Regional Board.

16. You assert that "The Nondegradation Objective . . . should be considered in the interpretation of the Basin Plan in reviewing this latest request by CDFG and has not been in this NPDES permit."

    We direct your attention to Findings #17 and #18 of the Tentative Permit you received. Those Findings contain a detailed discussion of nondegradation/antidegradation as it applies to rotenone use by DFG.

17. You suggest (p. 5-6) that the project fails to meet requirements of the federal antidegradation policy. As explained in the permit, antidegradation was considered by the Regional Board in adopting the Basin Plan rotenone policy. As explained in the permit (and page 4.9-24 of the Basin Plan), the federal antidegradation policy (Code of Federal Regulations, Title 40, Part 131.12) expresses that water quality shall be preserved unless deterioration is necessary to accommodate important economic or social development. In adopting the Basin Plan rotenone policy, the Regional Board made appropriate findings consistent with federal antidegradation rules. The Regional Board found that the temporary loss of beneficial uses associated with rotenone treatments may be necessary for restoration of threatened or endangered fish species (an important social value), provided that suitable measures are taken to protect water quality within and downstream of the project area.

18. You assert (p. 6) that authorizing the project is contrary to federal antidegradation policy restrictions that disallow "permanent or long-term reduction in water quality" in specially protected areas including Outstanding National Resource Waters (ONRWs). You assert that the project fails to meet the Basin Plan's "three-part test" (p. 3-14) for implementing state and federal antidegradation policies.

    Chemical residues associated with rotenone treatment are expected to dissipate rapidly (within two weeks). The Basin Plan and permit require that beneficial uses be restored within two years of the last treatment date. To demonstrate that beneficial uses have been restored, the DFG need only show that the waters are sustaining those uses. This requires that DFG demonstrate that the treated area has been repopulated by a healthy community of invertebrates, not necessarily that the pre-project invertebrate community structure has been replicated. In fact, changes in community structure are a goal of the project, with regards to

the fish species that prey on invertebrates. Therefore, we do not find that the project will lead to "permanent or long-term reduction" in water quality. We recognize (as the Basin Plan does) that invertebrate communities are impacted in the short-term by rotenone, but find that there is insufficient information to determine the duration of those impacts.

Silver King Creek is not a designated ONRW and therefore Part Three of the three-part test does not specifically apply. ONRWs are designated by the federal government (to date, the only designated ONRWs are Lake Tahoe and Mono Lake). We recognize that other outstanding waters exist, whether designated as ONRW or not.

For these reasons, we do not find that the project would be contrary to federal antidegradation policy provisions disallowing permanent long-term degradation of water quality in ONRWs, nor does it fail to meet the Basin Plan's "three-part test."

19. You take issue (p. 6) with the statement in my June 3, 2004 letter that "We cannot address resource management issues regarding the need for or anticipated effectiveness of the proposed project, and must defer such issues to resource management specialists including the CDFG and U.S. Fish & Wildlife Service." You assert: "You have an obligation to determine whether or not this project is necessary in Outstanding National Resource Waters."

    As explained above, Silver King Creek is not an ONRW. However, we agree that the need for and anticipated effectiveness of the project should be considered in permitting the project. As explained above in Response #3, we have considered DFG's position that in some situations, rotenone is the only means to ensure the eradication of non-native fish species, and that the proposed project is the most effective way to secure the existing PCT population. We have also considered the contrary position of project opponents. We find no sound evidence to refute DFG's position that the proposed project is the best way to achieve the project goal of preserving the threatened PCT.

20. You state (p. 7) that DFG "plans to have potassium permanganate residuals at detectable levels (1 mg/L) at the downstream boundary of the project" (project boundaries are defined as the point 30 minutes in-stream travel time past the detoxification station).

    The Basin Plan water quality objective for "Color" associated with rotenone use (also included in the Permit) states:

    > "The characteristic purple discoloration resulting from the discharge of potassium permanganate shall not be discernible more than two miles downstream of project boundaries at any time. Twenty-four (24) hours after shutdown of the detoxification operation, no color alteration(s) resulting from the discharge of potassium permanganate shall be discernible within or downstream of project boundaries."

This objective therefore does not prohibit permanganate at detectable levels downstream of project boundaries. This is in contrast to rotenone formulation constituents, which the Basin Plan prohibits downstream of project boundaries (with the exception of naphthalene at 25 micrograms/L).

Based on available information, permanganate is not expected to cause toxic effects downstream of project boundaries at residual concentrations.

21. You observe (p. 7) that rotenone formulations contain "rotenoids" other than rotenone that may be as toxic to invertebrates as rotenone itself. You also note that Nusyn-Noxfish (one of the formulations proposed for use at Silver King Creek) contains a synergist, piperonyl butoxide, to increases the toxicity of the rotenoids.

    We are aware that other potentially toxic rotenoids are present in the formulations, including rotenolone, a major degradation product of rotenone, for which DFG is required to monitor under permit provisions. We are also aware that Nusyn-Noxfish contains the synergist piperonyl butoxide, for which DFG is also required to monitor. We have considered the anticipated toxic effects of the rotenone formulations as a whole (i.e., with various rotenoids, synergist, and inert ingredients), including potential effects to invertebrates, when used at the target concentration of 1 mg/L. That is the concentration deemed necessary to achieve the project goal of eradicating non-native fish, and is in accordance with label directions.

22. You note (p. 7) that the permit is inconsistent about the dates of the Silver King Creek rotenone treatments that took place in the 1990s.

    Corrections have been made to the Proposed Permit to fix this inconsistency. The treatments took place in 1991, 1992, and 1993.

23. You state (p. 7) that no explanation was given for inclusion of "Appendix 1, Attachment 2, Interagency Study Proposal" with the Tentative Permit. You question the purpose of the table included in the document, identifying the taxonomic resolution for different invertebrate groups. You state "it is not possible to make species determinations from the larval forms of most aquatic invertebrates, if that's what the table is implying."

    The document in question is Attachment 2 to the Monitoring and Reporting Program, and is the "Aquatic Invertebrate Monitoring Study Proposal" referred to in the Monitoring and Reporting Program. The DFG is required under the Monitoring and Reporting Program to follow the invertebrate survey and analysis methods detailed in the proposal, with certain additional requirements specified in the Monitoring and Reporting Program. We agree the header on Attachment 2 was confusing. The attachment now has a revised header identifying it as an "Aquatic Invertebrate Monitoring Study Proposal" to avoid further confusion.

    The table you refer to is a table listing the taxonomic levels to which invertebrate samples will be analyzed by the DFG's contract invertebrate-identification laboratory, The Buglab.

(Note that the Monitoring and Reporting Program requires that midges and mites be keyed to genus level, for reasons explained in Response #8, above, which is a more stringent requirement than the Buglab's standard taxonomic level for those groups.) The table is not intended to imply that species-level determinations can generally be made from larval forms. The level of taxonomic resolution required in the Aquatic Invertebrate Monitoring Study Proposal is sufficient to compute the metrics called for in the proposal. The study is not designed to make species-level determinations for all invertebrate groups. We recognize that such a study cannot rule out the possibility that rare or unique species may be present in the treated area that could be affected by rotenone treatment.

24. You object (p. 8) to the description in the permit of rotenone as a "naturally-occurring pesticide found in the roots of certain plants," and imply that we are "downplaying" impacts to non-target species by saying that rotenone is "especially toxic to fish."

    The purpose of the first statement is simply to identify plant roots as the source of rotenone, and identify it as a material produced within the plant roots themselves. Since it is clearly understood and acknowledged throughout the permit that rotenone is a toxic substance, it should be obvious that the statement was not intended to perpetuate a fiction that "natural substances are non-toxic."

    The purpose of the second statement is clear when it is read in its context, namely to establish the fact that rotenone is particularly toxic to gill-breathing aquatic organisms (including fish) because they cannot escape from it, and because it is readily absorbed through the gills. This is not "downplaying" the toxicity of rotenone, but simply acknowledging the fact that in contrast to organisms that breathe through lungs, gill-breathing organisms are highly susceptible to rotenone at relatively low concentrations.

25. You express concern (p. 8) regarding potential effects on amphibians, including the mountain yellow-legged frog (a candidate for listing as an endangered species), and doubt regarding the effectiveness of pre-project amphibian surveys and relocation efforts in protecting amphibians. You cite evidence that mountain yellow-legged frogs spend an unusually long period (up to four years) in the tadpole stage, and that even adults are highly aquatic compared to other amphibian species, implying that this species may be particularly susceptible to rotenone toxicity. You dispute the claim that "adult frogs are not expected to be affected by rotenone treatment."

    In preparing the Proposed Permit, staff has added language to explain that DFG has recently completed four years of amphibian surveys in the Silver King Creek basin. Although mountain yellow-legged frogs have been found in certain areas upstream of the project area (Upper Fish Valley and Fly Valley Creek), none were observed in the project area itself. A few Western Toad/Yosemite Toad adult and terrestrial subadult hybrids were observed within the project area. DFG biologists determined that during the August 2004 survey, tadpoles within the project area had already metamorphosed into terrestrial lifestages due to an early spring/summer and low water year.

DFG is required under the permit to conduct additional amphibian surveys immediately before treatment. If adult or tadpole life stages of any threatened, endangered, sensitive, candidate or rare amphibians are found during pre-project surveys, they will captured by net and relocated out of the project area to suitable nearby habitat. We find that these measures are adequate to protect amphibians.

Based on information available to us, we concur with DFG that adult frogs are not expected to be affected by rotenone. Adult frogs breathe with lungs rather than gills, and are able to escape from treated waters, and observations made during previous rotenone treatments by DFG and other agencies have not identified adverse effects. We are not aware of evidence to refute that position.

26. You state (p. 9) that "other government documents concerning this project . . . have stated that two treatments/year may be necessary," contrary to indications in the permit that one treatment per year is planned.

    DFG has indicated to us that it intends to conduct a single treatment lasting 12-16 hours, in each of two consecutive years (with a possible third year of treatment if deemed necessary). The permit does not authorize multiple treatments in a single year.

27. You refer to past DFG violations associated with rotenone projects in the Lahontan Region.

    As explained in Response #4 above, we have included a summary of these violations in the Proposed Permit, and explained that DFG has instituted corrective measures to prevent a recurrence of these problems. DFG may be liable for any violations of receiving water limits established in the permit, and the Regional Board could terminate the Permit if violations occur.

Thank you for providing us with your comments on the Tentative Permit. Your comments will be entered into the record for this matter, and provided to the Regional Board members for their consideration. The public hearing is scheduled to begin at 7 p.m., September 8, 2004 at the Inn by the Lake conference room, 3300 Lake Tahoe Blvd., South Lake Tahoe, California. We encourage you to submit any additional comments and/or your proposed presentation to the Regional Board office as soon as possible. The Regional Board may limit public testimony to five minutes per individual at the hearing.

Attachment 2 to Enclosure 5
Master Response: Rare and Endemic Species Impacts

The commenter has stated a need for a species-level inventory of all invertebrates in the watershed prior to implementation of the proposed Action. Species-level invertebrate inventories were not included as a method for establishing baseline information or assessing impacts because of the difficulties in developing a complete inventory, the lack of comparison data from other watersheds which would be needed to determine the rarity of any particular species, and the fact that the proposed Action avoids effects on unique macroinvertebrate habitats where potentially endemic species are most likely to occur.

A macroinvertebrate inventory provides a list of the species found to inhabit an area, but does not provide information as to the rarity of the species. For this, it is necessary to determine if each of these species occurs elsewhere - upstream, downstream, or in adjacent or nonadjacent watersheds.

If any species inventory is to be done in a consistent and defensible manner, what constitutes a species must be clearly defined. Otherwise, it is necessarily arbitrary. However, there is no universal definition of "species." Biologists have proposed a range of definitions.

- Typological species
- Morphological species
- Biological / Isolation species
- Biological / reproductive species
- Recognition species
- Mate-recognition species
- Evolutionary / Darwinian species
- Phylogenetic (Cladistic)
- Ecological species
- Genetic species
- Phenetic species
- Microspecies
- Cohesion species
- Evolutionarily Significant Units

Which definition is used ultimately affects the application of the study – is what some researchers consider "rare and endemic species" using one definition of species, may not be considered species at all by a different researcher using a different definition of species. The method used to define what a rare and/or endemic species may best be assessed by the scientific community subject to the rigors of independent peer review.

The commenter has previously supplied information to the Water Board assessing specifically endemic aquatic invertebrates in Sierra stream basins (see appended e-mail). The general concept for the probability of rare and endemic species in the Silver

King watershed is that, given the rare Paiute Cutthroat Trout (PCT) evolved therein, rare and endemic invertebrate species might co-evolve. However, natural barriers presumably excluded upstream migration of other trout species that might interbreed with PCT. Mobility, or lack thereof, might necessarily be important for magnitude and degree of potential genetic mixing in local invertebrates. This may be indicated in the appended information from the commenter: A majority of Sierra system rare or endemic species listed in peer-reviewed studies are relatively immobile—flatworms, amphipods, and spring snails. Most of the studies cited involving stoneflies and caddisflies are unpublished data or personal databases. This information must be subject to the rigors of public access and/or independent peer review to gain validity and acceptance in the scientific community.

The Discharger has supplied an argument that a species-level inventory is unnecessary because the proposed project contains mitigation measures to protect likely habitat for rare and endemic species, the habitat in the Silver King Creek Watershed is not unique (EIR/SIS, Appendix F, Master Responses B and C). Additionally, the Discharger has performed a feasibility study which finds that species-level inventory is economically infeasible, costing upwards of about $4.5M for a four-year inventory of Silver King Creek and surrounding watersheds (see DFG April 5, 2010 submittal, Exhibit 24).

Appended e-mail concerning rare and endemic species

From: "Nancy A. Erman" <naerman@ucdavis.edu>
To: Harold Singer <HSinger@rb6s.swrcb.ca.gov>, Jason Churchill <JChurchill@rb6s.swrcb.ca.gov>
Date: 6/30/04 3:35PM
Subject: Endemic aquatic invertebrates/Sierra stream basins

June 30, 2004

To:
Harold Singer
Jason Churchill

From:
Nancy A Erman

Harold and Jason,

In your letter to me of June 3, 2004, regarding the proposed rotenone poisoning of Silver King Creek, you asked for information to support my contention that "In a drainage this size in a Wilderness Area (that should be relatively undisturbed), we might expectŠseveral endemic species (Erman 1996)."

The reference that I cited (Erman 1996) was the chapter I wrote, Status of Aquatic Invertebrates, for the Sierra Nevada Ecosystem Project (SNEP), Final Report to Congress. I will

re-cap briefly here the evidence supplied in that publication and add a few additional details. The information on endemicity is scattered throughout the literature of many taxonomic groups of aquatic invertebrates in the Sierra. We can make estimates from the few stream basins and taxonomic groups that have been well-studied.

Many endemic and/or rare species have been found in Sierra spring systems where such systems have been studied. Examples are flatworms (Kenk 1970, 1972; Kenk and Hampton 1982; Hampton 1988), amphipods (Holsinger 1974), stoneflies (Surdick 1981, Szczytko and Bottorff 1987), caddisflies (Erman 1981, 1984, 1997; Erman and Erman 1990; Wiggins 1973, Wiggins and Erman 1987), and springsnails (Hershler 1994, 1995). This list is far from complete and is given for examples only.

The Sierra-Cascade system and the Appalachian system are considered the "two great centers of endemicity" for the North American Plecoptera (stoneflies). About 25 genera are thought to have evolved in each area (Stewart and Stark 1988). Plecoptera is one of the better known orders of freshwater invertebrates in California. It is also a small group (based on number of species) compared with the Trichoptera (caddisflies) or Diptera (true flies). At present, 167 species are known in the state; 122 of these are present in the Sierra and 31 are endemic to the Sierra (unpublished list by R. L. Bottorff, R. Baumann, B. P. Stark, and N. A. Erman).

One of the better-studied stream basins is Sagehen Creek on the east side of the Sierra, north of Truckee, where the University of California has operated a field station on the Tahoe National Forest since 1951. Aquatic habitats surveyed have included Sagehen Creek (a second-order stream), springs, spring streams, temporary streams, temporary ponds, and peatlands.

Stoneflies were comprehensively surveyed in 1967 (Sheldon and Jewett) and the list was revised and updated by R. Baumann, W. Shepard, B. Stark, and S. Szczytko for the first North American Plecoptera Conference in 1985 (unpublished data available from N. A. Erman and Sagehen Creek files).

Thirty-eight species of stoneflies have been identified in the stream system of the Sagehen Basin; six of these are endemic to the Sierra.

Of the 199 Trichoptera (caddisflies) species known from the Sierra, 37 are endemic to the Sierra (Morse 1993; John C. Morse, Clemson University, personal database of published literature; N. A. Erman, personal database. Estimates made for the SNEP report, Erman 1996).

Seventy-seven species of Trichoptera (caddisflies) have been identified from the Sagehen Creek basin (Erman 1989). Eleven of these are thought to be endemic to the Sierra.

In a review of caddisfly species listed as candidates for the Federal Endangered and Threatened list (Erman and Nagano 1992), we noted that most of the species and several genera listed for California and Oregon were restricted to upper watershed streams and were found in

clear, cold, rapidly moving water or in small spring streams, habitats that are under increasing threat of disturbance.

In recent years several new species of spring snails have been described in the Sierra. Pyrgulopsis is the second most diverse genus of freshwater snails. Seventy-two species were known and considered valid as of 1995 and eight of those are considered endemic to the Sierra study area (as defined by the SNEP) and are present in only a few spring systems (Hershler 1994, 1995).

Further information is available on other limited.taxonomic groups in Erman, 1996. The order Diptera probably has by far the largest number of endemic species because it is the most diverse of the aquatic groups, but it has been poorly studied in the Sierra.

Some species are extremely limited in distribution, based on current knowledge. For example, one caddisfly species endemic to the SagehenCreek basin has been found in only one small spring. Of the 77 caddisfly species in the Sagehen basin, 26 species were restricted to small water bodies (spring sources, seeps, spring streams, temporary ponds or intermittent streams).

Species assemblages can change rapidly along small spring streams (Erman and Erman 1990, Erman 1992). In one stream in the Sagehen basin, Trichoptera species similarity (Jaccard's index) was 38% between the spring source and a site 270 m downstream and only 20% between the spring source and a site 450 m downstream where the stream ended in a peatland.

In a second spring-fed stream, larger than the first, species similarities with the spring source were 40% at 1 km downstream and 22% at 1.8 km downstream just above the confluence of the spring stream with a larger second-order stream. In both streams species were both replaced and added to, along the stream gradient (Erman and Erman 1990, Erman 1992).

If I can be of further help, feel free to call me.

Literature Cited

Erman, N.A. 1981. Terrestrial feeding migration and life history of the stream-dwelling caddisfly, Desmona bethula (Trichoptera: Limnephilidae). Canadian Journal of Zoology 59(9): 1658-1665.

Erman, N. A. 1984. The mating behavior of Parthina linea (Trichoptera: Odontoceridae), a caddisfly of springs and seeps, 131-136. In Proceedings4th International Symposium on Trichoptera. Series Entomologica 30, J. C. Morse (ed.). Dr W. Junk, The Hague, Netherlands.

Erman, N. A. 1989. Species composition, emergence, and habitat preferences of Trichoptera of the Sagehen Creek basin, California, U.S.A. Great Basin Naturalist 49(2): 186-197.

Erman, N. A. 1992. Factors determining biodiversity in Sierra Nevada cold spring systems. Pp. 119-127. In The History of Water: Eastern Sierra Nevada, Owens Valley, White-Inyo Mountains. C. A. Hall, V. Doyle-Jones, B. Widawski (eds.), University of California, White Mountain Research Station, Symposium Vol. 4.

Erman, N. A. 1996. Status of aquatic invertebrates. Chapter 35, Pp. 987-1008. In Sierra Nevada Ecosystem Project: Final report to Congress, vol. II. Assessments and scientific basis for management options. Davis: University of California, Centers for Water and Wildland Resources.

Erman, N. A. 1997. Factors affecting the distribution of a new species of Allomyia (Trichoptera: Apataniidae) in cold springs of the Sierra Nevada, California, U.S.A. In R. W. Holzenthal and O. S. Flint, Jr., (eds.), Proceedings, 8th International Symposium on Trichoptera. Ohio Biological Survey.

Erman, N. A. and C. D. Nagano. 1992. A review of the California caddisflies (Trichoptera) listed as candidate species on the 1989 Federal "Endangered and threatened wildlife and plants; animal notice of review". California Fish and Game 78(2): 45-56.

Erman N. A. and D. C. Erman. 1990. Biogeography of caddisfly (Trichoptera) assemblages in cold springs of the Sierra Nevada (California, USA), California Water Resources Center, University of California, Contribution 200. 29 pp.

Hampton, A. M. 1988. Altitudinal range and habitat of triclads in streams of the Lake Tahoe Basin. American Midland Naturalist 120(2), 302-312.

Hershler, R. 1994. A review of the North American freshwater snail genus Pyrgulopsis (Hydrobiidae). Smithsonian Contributions to Zoology, 554. 115 pp.

Hershler, R. 1995. New freshwater snails of the genus Pyrgulopsis (Rissooidea: Hydrobiidae) from California. The Veliger 38(4): 343-373.

Holsinger, J. R. 1974. Systematics of the subterranean amphipod genus Stygobromus (Gammaridae), Part I: Species of the western United States. Smithsonian Contributions in Zoology 160. 63 pp.

Kenk, R. 1970. Freshwater triclads (Turbellaria) of North America. II. New or little known species of Phagocata. Proceedings of the Biological Society of Washington 83(2): 13-22.

Kenk, R. 1972. Freshwater Planarians of North America. Biota of Freshwater Ecosystems, Identification Manual No. 1. Environmental Protection Agency, Water Pollution Control Research Series 18050 ELDO 2/72. 81 pp.

Kenk, R. and A. M. Hampton. 1982. Freshwater triclads (Turbellaria) of North America XIII. Polycelis monticola, new species from the Sierra Nevada Range in California. Proceedings of the Biological Society of Washington 95: 567-570.

Stewart, K. W. and B. P. Stark. 1988. Nymphs of North American Stonefly Genera (Plecoptera). The Thomas Say Foundation, Volume XII, Entomological Society of America, 460 pp.

Surdick, R. F. 1981.New Nearctic Chloroperlidae (Plecoptera). Great Basin Naturalist 41(3): 349-359.

Szczytko S. W. and R. L. Bottorff. 1987. Cosumnoperla hypocrena, a new genus and species of western Nearctic Isoperlinae (Plecoptera: Perlodidae). Pan-Pacific Entomologist 63(1): 65-74.

Wiggins, G. B. 1973. New systematic data for the North American caddisfly genera Lepania, Goeracea, and Goerita (Trichoptera: Limnephilidae). Life Science Contribution of the Royal Ontario Museum 91, Toronto, Canada. 33 pp.

Wiggins, G. B. and N. A. Erman. 1987. Additions to the systematics and biology of the caddisfly family Uenoidae (Trichoptera). Canadian Entomologist 119: 867-872.