Coalition for a Sustainable Delta

June 9, 2010

VIA E-MAIL

Phil Isenberg
Chair, Delta Stewardship Council
650 Capitol Mall
Sacramento, CA 95814

Re: Second submission regarding the Interim Delta Plan

Dear Chairman Isenberg,

The Coalition for a Sustainable Delta ("Coalition") is writing to provide additional comments to the Delta Stewardship Council ("Council") regarding the development of the Interim Plan and the selection of the Independent Science Board members. We also offer information in response to a Council question at its May meeting regarding multi-species conservation planning and express our strong interest in participating in stakeholder work groups during the creation of the Interim and final Delta Plans.

On May 12, 2010, the Coalition submitted initial comments on the Interim Delta Plan. In our letter, we provided concrete and specific suggestions regarding actions that should be included in the Interim Plan. Those actions encompass short term actions—described in further detail in our letter—to address multiple stressors, respond to recommendations by the National Research Council (NRC), develop and implement a comprehensive monitoring and evaluation program with information that can be shared across agencies, and enforce existing obligations that have long been recognized but ignored. Our letter also suggests adaptive management and science program structures that will assist the Council in best achieving its dual ecosystem and water supply reliability objectives. We do not repeat our suggestions in this letter, but respectfully refer you to the detailed Coalition letter submitted on May 12.

Instead, we would like to highlight recent findings in the ongoing Endangered Species Act litigation in federal district court that underscore the need for the Council to conduct its own independent assessment of scientific data, analyses and assumptions underlying current management actions in the Delta and highlight the importance of looking beyond water project operations to pursue ecosystem-based management as that term is used in the report of the CALFED Science Program, *The State of Bay-Delta Science, 2008* (pages 147-150).

On May 27, 2010, Judge Oliver Wanger issued an order declaring unlawful several portions of the biological opinion and reasonable and prudent alternative prepared by the U.S. Fish and Wildlife Service (FWS) regarding continued operation of the Central Valley Project and State Water Project. The Court held that the federal government should have considered impacts on the human environment when implementing the pumping restrictions and that the specific restrictions imposed by the federal government were not "adequately justif[ied] by generally recognized scientific principles." (Findings of Fact and Conclusions of Law re Plaintiffs' Request for Preliminary Injunction Against Implementation of RPA Component 2 at 122, *The Consolidated Delta Smelt Cases* (Case No. 09-407).) Further finding that FWS failed to use the best available science in analyzing and addressing take of delta smelt at the project pumps, Judge Wanger writes: "[o]ther than endeavoring to structure a result, there is no explanation for [the agency's] departure from best available science." In fact, in the Court's view, the striking failure to use best available science *"raises the spectre of bad faith"* by FWS. (Findings of Fact and Conclusions of Law at 43 (emphasis added).) Judge Wanger made similar findings in a previous decision related to the biological opinion prepared to address water project operations on salmonid species.

Concerns about the triggers set by the wildlife agencies for water export restrictions are echoed by the NRC in its recent report *A Scientific Assessment of Alternatives for Reducing Water Management Effects on Threatened and Endangered Fishes in California's Bay Delta*, which found that the empirical basis for the RPA prescriptions in the biological opinion for the delta smelt was largely lacking, and that the dictated actions were mostly not supported by available science. (See, e.g. the discussion of Old and Middle river (OMR) flows, X2 and habitat restoration, NRC 2010, pp.38-42.) Likewise, the NRC echoed a number of the court's conclusions regarding the RPA measures under the salmon biop. (NRC 2010, p.42-46.) A summary of those parallel concerns is attached to this letter for the Council's reference. A more thorough discussion of the NRC findings and recommendations is included in the Coalition's May 12, 2010 letter regarding the Interim Delta Plan.

The concerns shared by the Court and the NRC regarding the quality of the science underlying current assertions and management measures developed by the wildlife agencies highlight the importance of the Council's role in creating a Delta Plan that meets the statutory co-equal goals of ecosystem restoration and water supply reliability. *In light of these concerns, the Council must undertake its own independent analysis of agency assumptions to ensure that the best available science is utilized in the Delta Plan.* The Coalition also urges the Council to review the findings by the Court in the salmonid and delta smelt proceedings and the recommendations by the NRC regarding the appropriate use of science by federal agencies.

The recent findings by the Court in the delta smelt and salmonid proceedings highlight another very important principle for the Interim Delta Plan and the final Delta Plan. Ecosystem improvements must encompass measures beyond the operation of the state and federal water projects. For too long, efforts to improve the Delta ecosystem have

focused disproportionately on Project operations while ignoring serious but often addressable other stressors. In the Consolidated Delta Smelt Cases, the Court writes:

> [a]lthough the BiOp acknowledges that "not all" of the multiple factors negatively impacting the species "are directly influenced" by Project operations, the general assertion in the BiOp that other stressors are the result of (or at least exacerbated by) Project operations is not supported by the record. This error compounds the agency's failure to address alternative approaches to avoiding jeopardy, including whether other stressors can be mitigated or eliminated . . . .

Findings of Fact and Conclusions of Law at 33.

Similarly, in the hearing regarding the preliminary injunction ruling in the salmonid proceeding, Judge Wanger discussed Delta stressors such as contaminants, predators and temperature and salinity conditions. He criticized the current approach to Delta management, which attempts to protect threatened and endangered species primarily through restrictions on Project operations:

> [T]he Court does believe that it's irrational for the BiOp to, in effect, suggest that the operation of the projects somehow either causes or exacerbates those conditions. . . . Of the governments here, what did you do about it? Has anybody considered taking any action? Why is the entire burden of all these causes put on the water supply? And why is there not some other means of analysis and exercise of authority within the various jurisdictions of the state and federal governments that run these projects to address, through their lawful authority, the either mitigation or elimination of those conditions that can be addressed.

Rough Transcript of Hearing in *The Consolidated Salmonid Cases*, Case No. 09-1053 (May 25, 2010) at 209.

The misguided emphasis by the wildlife agencies on Project operations has led to the neglect of other causes of fish mortality. Measures to address these other stressors are ripe for inclusion in the Interim Delta Plan. For example, through the Fish and Game Code and California Water Code, both the California Department of Fish and Game and the State Board have existing enforcement authorities that authorize those agencies to address on-going, illegal water diversions. Thousands of water diversions, most of which are unscreened, entrain unknown numbers of fish protected under the federal and California Endangered Species Acts. A significant portion of these diversions lack valid water rights. The Interim Delta Plan and final Delta Plan must include measures to halt and address the impacts of these illegal diversions.

Decreasing water quality caused by discharges into the Delta in violation of the federal Clean Water Act and California Porter-Cologne Water Quality Control Act is also a problem that must be tackled in the Interim Delta Plan and final Delta Plan.

Contaminants negatively impact threatened and endangered species directly, along with the entire food web of the estuary. Despite existing enforcement authorities, federal and state agencies have failed to address this problem. Measures to prevent and remedy poor water quality and harmful contaminants must be addressed in the Interim Delta Plan and final Delta Plan.

Another measure that should be included in the Interim Delta Plan and final Delta Plan is the control of non-native striped bass, a major predator of delta smelt and salmonids. The federal wildlife agency charged with protecting threatened and endangered salmonids agrees. Attached is a recent letter from National Marine Fisheries Service (NMFS) to the California Fish and Game Commission recommending that the Commission "immediately review and amend striped bass sportfishing regulations in an attempt to reduce their predatory impact and thereby increase survival of native fish." Further, NMFS specifically recommends: *"No minimum size limit"* and "*No bag limit"* be imposed on striped bass fishing in the Delta. Citing multiple scientific reports and studies, NMFS concludes from the available literature that "striped bass predation on salmon and steelhead is an important stressor warranting action." Addressing striped bass predation is only one of many measures to address other stressors that should be included in the Interim and final Delta Plans. A more detailed list of other stressors is provided in the Coalition's May 12 letter.

As the Council drafts the Interim Delta Plan and final Delta Plan, the Coalition urges Council members to pursue a comprehensive approach to achieving ecosystem health. As discussed above, the Council should also revisit and assess the science put forth by wildlife agencies to ensure that decision making is properly informed, that findings are not misinterpreted, and that uncertainties are not glossed over. Both the NRC report and the recent decisions by Judge Wanger underscore the need for such an independent and unbiased review. As the Council considers candidates for the Independent Science Board, the Coalition also asks that you ensure that Independent Science Board members are free of bias and open to conducting this important, independent science review. Where the Court has gone so far as to suggest bad faith on the part of wildlife agencies charged with regulating the water project operations, *it is imperative that Independent Science Board members appointed by the Council are truly independent and unbiased* and willing to take a hard look at the existing science and assumptions regarding the Delta. Independent Science Board candidates who have already expressed preconceived opinions regarding the science in the biological opinions or who have already expressed an inability to objectively review the science regarding the role of the Project operations cannot properly fulfill their required role on the Independent Science Board.

Finally, we have attached to this letter a list of reference materials (in order of suggested priority) and an article in response to the Council's question at the May Council meeting regarding the management of ecosystems for the benefit of multiple species. We hope that this reading list, as well as the attached article, *Conservation Planning for US National Forests: Conducting Comprehensive Biodiversity Assessments*, may be of some assistance in shedding light on this important topic. The article further discusses the pitfalls of attempting to manage multiple species using a "coarse-filter" assessment of

ecosystem-level surrogate measures without additional fine-filter, species-level assessments and viability assessments of the at-risk species.

The Coalition has been engaged in a wide array of activities to protect the Delta and its native species. At the May Council meeting, the Council directed staff to form working groups to assist the Council in addressing certain topics for the Interim Delta Plan and Delta Plan. The Coalition has a strong interest in participating in such working groups, particularly in the proposed Ecosystem Health working group. If desired, the Coalition is also happy to provide additional information regarding our science and ecosystem-related activities or any of the topics discussed in our letter.

Coalition for a Sustainable Delta

By: William D. Phillimore, President

Attachments (4)

Summary of Key Conclusions of the National Research Council and United States District Court for the Eastern District of California regarding the National Marine Fisheries Service Biological Opinion for Central Valley Project and State Water Project Operations

	National Research Council Conclusions	**Court Findings/Conclusions**
Action IV.2.1 (San Joaquin River E:I)	The rationale that increasing San Joaquin inflows to the delta will benefit smolt survival through this region of the delta is based on data from coded-wire tags on smolts. This statistical evidence provides only a coarse assessment of the action, but it indicates that increasing San Joaquin River flows can explain observed increases in escapement. (p.45.)	The evidence supports NMFS's general finding that some form of restriction on the Vernalis flow/export ratio is needed to prevent jeopardy to the SSNDG of CV Steelhead. (¶ 99.)
	The committee concludes that the rationale for increasing San Joaquin River flows has a stronger foundation than the prescribed action of concurrently managing inflows and exports. (p.45.)	NMFS determined that, because there was a limited amount of water available to increase flows at Vernalis, capping export levels would provide the greatest differential between flows at Vernalis and export levels…. This reason for controlling exports is unrelated to any direct scientific evidence connecting export levels to fish survival, making the reason arbitrary, capricious, unsupported by reasonable explanation, and not based on best available science. (¶¶ 94-95.)
	The choice of a 4:1 ratio of net flows to exports appears to be the result of coordinated discussions among the interested parties. (p.45.)	[W]ithout any biological explanation, the BiOp chose to impose a 1,500 cfs limit when flows at Vernalis are lower than 6,000 cfs, 9 and a ratio of 4:1 (as opposed to 2.5:1, or 3:1, or even 5:1 or higher) when Vernalis flows are between 6,000 cfs and 21,750 cfs. Id. at 71-72…. The absence of explanation and analysis for adoption of these limits uses no science, let alone the best available and is simply indefensible. (¶¶ 97-98.)

Summary of Key Conclusions of the National Research Council and United States District Court for the Eastern District of California regarding the National Marine Fisheries Service Biological Opinion for Central Valley Project and State Water Project Operations

	National Research Council Conclusions	Court Findings/Conclusions
Action IV.2.3 (OMR)	[T]he threshold levels needed to protect fish is [sic] not definitively established. (p.44.)	The -5,000 cfs OMR ceiling is based, predominantly on speculation. (¶ 99.)
	The response of loss at the pumps to OMR flow (e.g. figure 6-65 from NMFS, 2009) does not suggest a significant change in the vicinity of the flow triggers, but it does suggest that the loss rate increases exponentially above the triggers. The PTM suggests a gradual linear response in the vicinity of the trigger. However, no analysis was presented for the entrainment rate above the trigger (Figure 6-68 from NMFS, 2009). (p.44.)	The only discernable and scientifically justifiable support provided in the BiOp for the negative 5,000 cfs ceiling on OMR flows under Action IV.2.3 is the salvage data, represented in Figures 6-65 and 6-66 of the BiOp…. The record does not explain whether NMFS utilized a statistical analysis to choose -5,000 cfs as the break point, or whether that figure was based on a visual inspection of Figures 6-65 and 6-66. (¶ 139.)
	[I]t is not clear whether the salvage *rates* as well as salvage numbers were modeled. (p.44.)	The comparisons of salvage to negative OMR flows relied upon in the BiOp utilize raw salvage numbers, rather than scaling salvage to population size…. NMFS's failure to evaluate the population level impacts of exports is inexplicable. (¶¶ 125, 131.)
	[T]he committee is unable to evaluate the validity of the exponential increase in loss rate above the trigger. Uncertainty in the effect of the flow triggers needs to be reduced, and more flexible triggers that might require less water should be evaluated. (p.44.)	Scaling salvage to population size is standard fisheries science practice and could have been accomplished for several of the Listed Species based on existing population data…. This failure is a fundamental and inexplicable error. Salvage may have been higher in some years simply because the population was higher, not because of any differences in negative OMR flows. Salvage may have been lower in other years because the population was lower. (¶ 125.)

UNITED STATES DEPARTMENT OF COMMERCE
National Oceanic and Atmospheric Administration
NATIONAL MARINE FISHERIES SERVICE
Sacramento Area Office
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May 13, 2010

Mr. Jim Kellogg
President, California Fish and Game Commission
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Sacramento, California 94244-2090

Dear Mr. Kellogg:

The purpose of this letter is to follow up on the California Fish and Game Commission (Commission) meeting held on April 7, 2010, in Monterey, CA. One of the agenda items at that meeting pertained to the Commission's consideration and direction to staff regarding a possible amendment to striped bass sport fishing regulations. NOAA's National Marine Fisheries Service (NMFS) is concerned about the impacts that non-native predators such as striped bass are having on native anadromous salmonids in the Central Valley. The public draft recovery plan for Sacramento River winter-run Chinook salmon, Central Valley spring-run Chinook salmon, and Central Valley steelhead has identified non-native predation as a key factor contributing to the precarious status of these species (see executive summary page 2; pages 4, 19, 36, 48, and 157 in the main document, and pages 33-35, and 40 in Appendix B).

We understand the Commission has a broad interest in taking a comprehensive view of all stressors affecting native fish that are listed as threatened or endangered under the State and Federal Endangered Species Acts. In this regard, we would be happy to provide a presentation to the Commission on those stressors and their associated effects on the three species covered under the Central Valley salmon and steelhead recovery plan.

With respect to striped bass, NMFS encourages the Commission to immediately review and amend striped bass sport fishing regulations in an attempt to reduce their predatory impact and thereby increase survival of native fish. Our recommendation are as follows:

Geographic Areas:

All anadromous waters of the Central Valley, including the Sacramento River and its major tributaries, the Sacramento/San Joaquin River Delta, the San Joaquin River and its major tributaries, and San Francisco Bay.

Open Season:

Year-round

Minimum Size:

No minimum size limit

Bag Limit:

No bag limit

We are aware that striped bass have co-existed with salmon and steelhead in the Central Valley since striped bass were introduced in 1879. Given the population crashes of salmon and steelhead that occurred as the region was developed; however, and the current serious declines in salmon stocks that are already threatened or endangered, it is necessary to reexamine the ecosystem effects of maintaining a striped bass sport fishery. In our review of the available literature regarding striped bass predation on native fish, NMFS has concluded that striped bass predation on salmon and steelhead is an important stressor warranting action. Some key points from that we would like to highlight include:

- Hanson (2009): *"Striped bass predation in rivers tributary to the Delta appears to be the largest single cause of mortality of juvenile salmon migrating through the Delta. The high rates of striped bass predation within the Sacramento River are supported by, inter alia, striped bass diet studies and recent survival studies that have shown high mortality of salmon and steelhead – approximately 90%-before they reach the Delta."*

- DWR (2008): *"In 2007, the PIT tagged steelhead pre-screen loss rate within Clifton Court Forebay was between 77 ±4% and 82 ±3% (Mean ±95% Confidence Interval)."* Much of this loss is presumably striped bass predation based on striped bass abundance and behavior information obtained during the study.

- Lindley and Mohr (2003): "*According to our analysis, the current striped bass population of roughly 1×10^6 adults consumes about 9% of winter-run chinook salmon outmigrants.*"

- Gingras (1997): *"Pre-screen loss estimates for juvenile Chinook salmon were 63-99%." "Predation by adult and subadult striped bass may account for much of the pre-screen loss."*

Salmon and steelhead are experiencing sharp declines as a result of the cumulative effects and interactions of multiple stressors. Actions to address stressors such as Delta water withdrawals and ocean harvest are being taken. We believe it is necessary to address the full range of stressors if we are to recover these species, including a concentrated effort to reduce predation by non-native species.

Sincerely,

Maria Rea

Maria Rea
Sacramento Area Office Supervisor

NMFS-PRD, Long Beach, CA

Reading List for Delta Governance Legislation

F. Brie VanCleve et al., Application of Best Available Science in Ecosystem Restoration, Lessons Learned from Large Scale Restoration Efforts in the U.S. (Puget Sound Nearshore Ecosystem Restoration Project 2003).

Kai Lee, Compass & Gyroscope (1993).

Thomas Dietz et al., The Struggle to Govern the Commons, Science 302: 1907-1912 (2003).

Bruce Ackerman et al., The Uncertain Search for Environmental Quality (1974).

Mark Edward Gaden, Bridging Jurisdictional Divides: Collective Action through a Joint Strategic Plan for Management of Great Lakes Fisheries (2007).

Conservation Planning for US National Forests: Conducting Comprehensive Biodiversity Assessments

BARRY R. NOON, DENNIS D. MURPHY, STEVEN R. BEISSINGER, MARK L. SHAFFER, AND DOMINICK DELLASALA

The US Forest Service has proposed new regulations under the National Forest Management Act that would replace a long-standing requirement that the agency manage its lands "to maintain viable populations of existing native and desired non-native vertebrate species." In its place, the Forest Service would be obligated merely to assess ecosystem and species diversity. A landscape assessment process would rely on ecosystem-level surrogate measures, such as maps of vegetation communities and soils, to estimate species diversity. Reliance on such "coarse-filter" assessment techniques is problematic because there tends to be poor concordance between species distributions predicted by vegetation models and observations from species surveys. The proposed changes would increase the likelihood of continued declines in biodiversity and fail to address the original intent of the act. We contend that responsible stewardship requires a comprehensive strategy that includes not only coarse-filter, ecosystem-level assessment but also fine-filter, species-level assessments and viability assessments for at-risk species.

Keywords: forestry, forests, management, policy, conservation

The US National Forest Management Act (NFMA) is an essential statute for maintaining biotic diversity on 192 million acres of national forests and national grasslands. It was enacted in 1976 as reform legislation in response to environmental impacts from timber harvest, grazing, and mining on national forest lands, which the public and Congress found increasingly unacceptable (Wilkinson and Anderson 1987). Among many provisions for resource protection, a primary emphasis was the protection of individual species. The statutory language of NFMA requires management of the national forests and grasslands to "provide for diversity of plant and animal communities based on the suitability and capability of the specific land area in order to meet overall multiple-use objectives" (16 US Code 1604[g][3][B]). Since 1982, the regulations governing implementation of the NFMA have addressed this diversity provision by requiring that "fish and wildlife habitat shall be managed to maintain viable populations of existing native and desired non-native vertebrate species in the planning area" (36 Code of Federal Regulations, sec. 219.19, app. 13). Revisions to NFMA regulations adopted in 2000 retained the requirement for viable populations and expanded it to include all plant and animal species (Federal Register 65 [218]: 67514–67581).

Although NFMA has remained essentially unchanged since its enactment, the US Forest Service has now proposed regulations that eliminate an explicit population viability requirement and that restrict management responsibility to vertebrates and vascular plants (Federal Register 67 [235]: 72770–72816). The proposed regulations require only a "hierarchical, sequential approach to consider and assess both ecosystem diversity and species diversity" and that the Forest Service "identify species for which substantive evidence exists that continued persistence in the planning or assessment area is at risk, specific risks or threats to these species, and measures required for their conservation or restoration" (Federal Register 67 [235]: 72801). No specific language to compel species-level analyses of viability has been proposed. Moreover, the proposed regulations would subsume the existing species conservation requirement into a landscape assessment process that would use a variety of unproven

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ecosystem-level surrogates to estimate species diversity without necessarily examining the condition or status of individual species. Although not explicitly stated, the substance of these proposed regulations hinges on two underlying assumptions: (1) Land-use planning that relies solely on such "coarse-filter" (Hunter et al. 1988) approaches to assess the distributions and status of ecological communities is adequate to assess how well the needs of all their constituent species will be met, and (2) the uncertainty that accompanies indirect assessments of species status provided by coarse-filter tools is acceptable because species-level assessments are too difficult or too expensive to implement. These assumptions are not only counter to current understanding of the role and dynamics of specific species in sustaining ecosystem processes (e.g., Kinzig et al. 2002), they also negate the nature and appropriate role of population viability analyses in land-use planning.

Inadequacies of assessments employing only a coarse-filter approach

To understand the functioning of any complex system, it is necessary to identify and attempt to elucidate the parts that it comprises. For ecological systems, the most fundamental "parts" are species. Sir Arthur Tansley originally defined ecosystems as biotic communities or assemblages of species and their physical environment in specific places (Tansley 1935). Directly contradicting this view of ecosystems as collections of interacting species, the proposed regulations focus resource assessments almost entirely on vegetation types and successional stages, geology, landforms, and soils. The logic behind this coarse-filter approach is that the majority of species can be protected by conserving examples of natural vegetation communities, obviating the need to evaluate the status of each species individually (Noss 1987, Noss and Cooperrider 1994).

The original intent of coarse-filter approaches to landscape planning was to provide distribution maps of land cover that could be used to inform the conservation of entire species assemblages, including communities of interacting or potentially interacting species (Jennings 2000, Groves et al. 2002). Broad-scale applications of coarse-filter methods have relied on ecoregional classifications determined by a variety of measures of climate, substrate, and plant composition. However, they commonly and often exclusively default to dominant vegetation, because vegetation types can be assessed by remote-sensing technologies and have been linked, using general habitat models, to the distributions of many vertebrate species (Scott et al. 1993). For example, recent planning efforts by the Forest Service for 4.4 million hectares of public forests and grasslands in the Sierra Nevada of California assessed the effects of various management alternatives on vertebrate species using wildlife–habitat relationship models (Mayer and Laudenslayer 1988) to classify habitats based on three attributes—dominant vegetation type, successional stage, and canopy closure. When these models were coupled with a vegetation growth and yield model (Davis and Johnson 1987), they allowed a comparison of how competing forest management scenarios would be likely to affect future wildlife populations (Forest Service 2001).

Coarse-filter approaches to assess the viability of species for land-use planning purposes can provide cost-efficient, indirect methods of assessing species distributions, but to assess the viability of species, at least three assumptions must hold true: (1) Attributes that define the coarse filter (i.e., dominant vegetation types) are sufficient and reliable surrogates for habitat and can effectively predict the occurrence of a given species; (2) managing coarse-filter attributes will address the factor(s) currently limiting abundance, density, and persistence of each species; and (3) the spatial resolution of the coarse filter matches the scale at which given species respond to environmental heterogeneity. Although these assumptions may be valid for some species in many circumstances, especially species that are small-bodied, abundant, and tightly linked to a particular vegetation community, the likelihood that the assumptions are met for all, or even most, species in an assemblage is low. For that reason, landscape planning employs "fine-filter" assessments, which are based on direct measures of the status and trends of individual species or on models of population viability to evaluate the needs of species at risk of decline.

The utility of the coarse-filter approach has been tested for many individual species with equivocal success (see Scott et al. [2002]). In general, there has been poor concordance between predicted and observed distributions. Commission errors (false positives, or predictions that a species is present when it is absent) have been shown to be more common than omission errors (false negatives, or predictions that a species is absent when it is present) at spatial scales appropriate to regional conservation planning—for example, vertebrates in the state of Maine and in national parks in Utah and breeding birds in California (Edwards et al. 1996, Boone and Krohn 1999, 2000, Garrison et al. 2000, Garrison and Lupo 2002, Robertson et al. 2002). Thus, coarse-filter assessments often overestimate the presence and, presumably, the viability of species on the planning landscape.

Only by increasing the resolution of the coarse filter (which reduces the area predicted to be suitable habitat for the species), as well as the number of land-cover types (usually by stratifying the vegetation communities more finely), can commission and omission errors be simultaneously reduced (Karl et al. 2000). Prediction errors are also related to ecological attributes of a species: Species that are rare, colonial, or habitat specialists, or that have small home ranges, are most likely to be misclassified (Karl et al. 2000, Scott et al. 2002). The misclassified groups of species usually include those most likely to be at risk of population declines or extirpation—that is, those that should be targets of conservation planning efforts (McKinney 1997). In sum, these prediction errors suggest that employing a coarse-filter approach alone is inadequate to meet NFMA require-

ments to provide for the diversity and viability of plant and animal communities.

Integrating the fine filter with population viability analysis

Coarse- and fine-filter approaches to conservation planning differ in both the extent and resolution of measurement employed and the targeted level of biological organization. In general, mapped coarse-filter attributes reflect higher-level processes and patterns that arise, for example, from disturbance processes that operate across entire landscapes. For pragmatic reasons, coarse-filter attributes considered during the planning process are often those that can be measured inexpensively using remote imagery. Coarse filters rarely will accurately reflect the complex and dynamic habitat requirements of any individual species. In contrast, a fine filter makes measurements directly at the species level for the subset of species whose habitat requirements were not captured by the attributes that define the coarse filter.

Neither coarse- nor fine-filter assessments alone can prescribe the extent or area of habitat necessary to maintain viable populations of plant and animal species on the landscape. Many rare and declining species are limited primarily by the availability of suitable habitat (Wilcove et al. 1998), and the viability of such species depends to a great extent on how much of their habitat is conserved. Population viability analysis (PVA) is an in-depth method of fine-filter assessment used to evaluate habitat loss or similar risk factors for specific species (Boyce 2002, Shaffer et al. 2002).

An assessment approach that includes both coarse and fine filters and PVA was recommended by the Committee of Scientists to the US Forest Service and incorporated into the 2000 NFMA regulations (COS 1999). In addition to rare and at-risk species, the committee recommended that two groups of species be evaluated using fine filters—those that provide comprehensive information on the state of a given ecosystem (indicator species) and those that play significant functional roles in ecosystems (focal species). The latter category includes species that contribute disproportionately to the transfer of matter and energy (e.g., keystone species), structure the environment and create opportunities for additional species (e.g., ecological engineers), or exercise control over competitive dominants, thereby promoting increased biotic diversity (e.g., strong interactors). Thus, fine-filter assessments might be needed for 10 to 50 of the 200 to 1100 species typically evaluated in regional planning efforts carried out by the Forest Service and may need to include select invertebrates as well as vertebrates and plants.

Formal PVAs are needed only for species in decline or at high risk or for species with such functional significance that their loss might have unacceptable ecological effects. Many methods of viability assessment exist to accommodate diverse sources and amounts of data (Beissinger and Westphal 1998, Andelman et al. 2001). All methods explicitly or implicitly require some sort of model that relates population dynamics to environmental variables, including variables affected by management. The range of available methods offers a tradeoff between complexity of analysis and generality of results.

Population viability analysis is neither inherently difficult nor expensive, but it does require thoughtful model choice and construction and good judgment in the implementation of analyses. Perhaps the most demanding aspect of building realistic PVA models for assessment of alternative management scenarios is acquisition of sufficient data to yield accurate and precise parameter estimates (Beissinger and Westphal 1998). These models then permit reliable assessments of alternative management scenarios (Noon and McKelvey 1996). The choice of models and data collection methods depends in part on the life history characteristics of the species to be assessed, the quality and quantity of existing data, the time and money available for additional data acquisition, and the resolution and extent of analysis (Beissinger and Westphal 1998, Andelman et al. 2001). A method that uses a formal mathematical model of analysis is often preferable to less quantitative methods for analyzing viability when there is sufficient knowledge of demography, dispersal, habitat use, and threats.

Currently, population viability analyses are required to address the viability requirements of NFMA. In the context of the act, viable populations consist of "self-sustaining and interacting populations that are well distributed through the species' range. Self-sustaining populations are those that are sufficiently abundant and have sufficient diversity to display the array of life history strategies and forms to provide for their long-term persistence and adaptability over time" (Federal Register 65 [218]: 67580–67581). Many population attributes included in this definition can be evaluated using population viability analyses, but they cannot be addressed solely through the application of coarse-filter analyses.

A scientifically credible approach to national forest planning

An expert panel convened by the National Center for Ecological Analysis and Synthesis, at the request of the Forest Service, concluded that "viability assessment is an essential component of ongoing forest management and forest planning processes. A variety of methods can and should be incorporated into viability assessments" (Andelman et al. 2001, p. 136). A scientifically credible approach to management of a diversity of plant and animal communities in US national forests and national grasslands combines coarse-filter and fine-filter approaches to identify conservation targets, including the judicious use of PVA for focal species and species at risk. Scientifically valid and pragmatic management does not require that the status of all species be directly assessed. But failure to detect declining species and to address the putative threats to their persistence leaves only the prohibitive provisions of the Endangered Species Act to serve as a safety net.

Although coarse-filter, fine-filter, and PVA assessment tools are imperfect, their weaknesses are sufficiently understood that the information they provide is, on balance,

useful, and the Forest Service's failure to require their use is irresponsible. Insights provided by the use of these tools will inform managers about the condition of the ecosystems they are charged with protecting and the likely consequences of the management decisions they are empowered to make. Acting on these insights to change management practices when needed will aid biodiversity conservation and enable the Forest Service to meet its stewardship responsibilities.

References cited

Andelman SJ, et al. 2001. Scientific Standards for Conducting Viability Assessments under the National Forest Management Act: Report and Recommendations of the NCEAS Working Group. Santa Barbara: National Center for Ecological Analysis and Synthesis, University of California. (2 November 2003; *www.fs.fed.us/psw/rsl/projects/wild/lee/lee3.pdf*)

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