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A Salmon Eye Lens on Climate Adaption

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A SALMON EYE LENS ON CLIMATE ADAPTATION

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I. INTRODUCTION: AS INSTREAM TEMPERATURES RISE

In terms of climate change law and policy, at present there are efforts underway at the state, federal and international levels to curb greenhouse gas (GHG) emissions. These efforts to reduce GHG emissions (and thereby mitigate global warming and other climate changes resulting from such GHG emissions) are generally referred to as "climate mitigation" laws and policies.[1]

In addition to climate mitigation, however, there is increasing recognition that the global warming and climate changes resulting from past and present GHG emissions are happening now and will continue to happen for many decades to come, regardless of whether we are successful in curbing GHG emissions going forward.[2] This recognition has led to the development of legal and policy responses to anticipate and plan for the global warming and climate changes that are taking place.

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* Associate Professor, Golden Gate University School of Law. This Article developed out of a paper Professor Kibel presented at the November 2012 California State Bar Environmental Law Section Conference at Yosemite, titled *Coldwater Fisheries in Hot Water*, for the panel *Cry Me a Reservoir: Water Management and Climate Change Adaptati*on. A condensed version of this Article was also published in the summer of 2013 in *Environmental Law News* (a newsletter of the California State Bar Environmental Law Section) under the title *Can Salmon and Steelhead Weather Climate Change?* This Article covers developments through June 2013.

1. MICHAEL B. GERRARD, *Introduction and Overview*, to THE LAW OF ADAPTATION TO CLIMATE CHANGE: U.S. AND INTERNATIONAL ASPECTS 3 (2012) ("Since the emergence of climate change as a public policy concern in the later 1980s, most attention has focused on mitigation ─ reducing humanity's impact on the climate, principally by controlling the emissions of greenhouse gasses (GHGs).").

2. *Id.* ("More importantly and tragically, mitigation alone will not be sufficient. Even with the most aggressive plausible mitigation efforts, GHG emissions will continue to increase globally for decades before they peak and decline, and the effects of climate change will continue to worsen. Thus, while mitigation is essential, so is adaptation.").

Efforts to anticipate and plan for the effects of past and present GHG emissions are generally referred to as "climate adaptation" laws and policies.[3] As defined in the introduction to the American Bar Association's 2012 book *The Law of Adaptation to Climate Change*, climate adaptation encompasses "efforts to moderate, cope with, and prepare for the current and anticipated impacts of climate change on human and natural systems."[4]

In the water resources sector, to date, much of the climate adaptation focus has been on water supplies for out-of-stream uses (such as agriculture and municipal/urban uses) and on instream use of water for hydroelectric facilities — that is, on how climate change is affecting the supply of water we use for irrigation, drinking water and electric power generation.[5]

Less attention, however, has been given to how climate change is impacting and will continue to impact fisheries due to rising water temperatures. These impacts are particularly acute for coldwater fisheries such as salmon and steelhead trout, which have limited biological capacity to adapt when instream temperatures rise.[6]

This Article discusses the current gap in climate adaptation law and policy, emphasizing the potential role that the National Environmental Policy Act (NEPA)[7], Endangered Species Act (ESA)[8] and California Environmental Quality Act (CEQA)[9] could play in filling this gap. It focuses on the provisions in these laws that establish that agency planning and decision-making should be based on the best available science, and notes that the best available science now confirms that GHG emission-induced climate change is happening now and will continue to happen during this century. This Article posits that the most appropriate and effective way to factor expected climate change into NEPA, the ESA and CEQA analysis and determinations may be through the use of "future baseline conditions," against which project impacts are evaluated. The use of such future baseline conditions can provide a legal

3. *Id.*

4. *Id.*

5. Tim P. Barnett et al., *The Effects of Climate Change on Water Resources in the West: Introduction and Overview*, 61 CLIMATE CHANGE 1, 6-7 (2004); *see generally* JAMES LAWRENCE POWELL, DEAD POOL: LAKE POWELL, GLOBAL WARMING AND THE FUTURE OF WATER IN THE WEST (2008).

6. TROUT UNLIMITED, HEALING TROUBLED WATERS: PREPARING TROUT AND SALMON HABITAT FOR A CHANGING CLIMATE 3 (2007).

7. National Environmental Policy Act, 42 U.S.C. §§ 4321-4347 (1970).

8. Endangered Species Act, 16 U.S.C. §§ 1531-1544 (1988).

9. CAL. PUB. RES. CODE §§ 21000 − 21189.3 (1979).

mechanism to ensure that climate adaptation strategies to protect coldwater fisheries are properly incorporated into agency plans and projects.

Although the starting point for this Article's assessment is coldwater fisheries in California, this assessment identifies regulatory questions and offers recommendations that may apply to coldwater fisheries in other states as well.

II. ASSESSMENTS OF CLIMATE CHANGE IMPACTS ON COLDWATER FISHERIES: DIRE FORECASTS FOR SALMON AND STEELHEAD

In recent years, leading studies on water and climate change impacts in California have taken note of the nexus between rising instream temperatures and the fate of California's coldwater fisheries. These studies present a dire picture of how climate change will impact these fisheries in the years ahead.

A. Recent Assessments

The Public Policy Institute of California reported in its 2011 book, *Managing California's Water: From Conflict to Reconciliation*:

> [w]arming is likely to significantly complicate the management of water to maintain adequate habitat for such fish as salmon and steelhead, now confined to the lower-elevation portions of rivers and streams because of dams. . . . [T]he frequency of releases of warm water from reservoirs is likely to increase as conditions warm, increasing the temperatures of rivers and worsening conditions for many species of fish.[10]

The California Natural Resources Agency found, in its 2009 *California Climate Adaptation Strategy*, that "[i]n many low- and middle-elevation streams today, summer temperatures often approach the upper tolerance for salmon and trout; higher air and water temperatures will exacerbate this problem. Thus, climate change might require dedication of more water, especially cold water stored behind reservoirs, to simply maintain existing fish habitat."[11]

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10. HANAK ET AL., PUB. POLICY INST. OF CAL., MANAGING CALIFORNIA'S WATER: FROM CONFLICT TO RECONCILIATION 146-47 (2011).

11. CAL. NAT. RES. AGENCY, 2009 CALIFORNIA CLIMATE ADAPTATION STRATEGY: A REPORT TO THE GOVERNOR OF THE STATE OF CALIFORNIA IN RESPONSE TO EXECUTIVE ORDER S-13-2008 81 (2009).

Similarly, in *Beyond Seasons' End: A Path Forward for Fish and Wildlife in the Era of Climate Change*, also published in 2009, a collaborative research initiative of conservation groups and the Association of Fish and Wildlife Agencies noted that:

> [w]ater temperature that is within the preferred range of coldwater fish, generally 50° F to 65° F, may be the most critical characteristic of high-quality habitat. Physiological effects of warm water on trout and salmon include increased metabolic demands, increased stress due to reduced levels of dissolved oxygen [and] greater susceptibility to toxins, parasites and disease.[12]

B. Predictions for Coldwater Fisheries

Other studies have gone beyond acknowledging the general interrelationship between rising instream temperatures and declining coldwater fisheries, and have run more detailed simulations to quantify these effects. The results of these simulations reveal a grim scenario for California's salmon and steelhead. For instance, Trout Unlimited found, in its 2007 report *Healing Troubled Waters: Preparing Trout and Salmon Habitat for a Changing Climate*, that "[m]odels of Pacific Northwest salmon populations predict losses of 20-40% by the year 2050 because of the effects of climate change. In California, where high temperatures and water availability already pose a significant source of stress, greater declines are likely."[13] These findings echo those of a 2002 joint study by Defenders of Wildlife and the Natural Resources Defense Council (NRDC), titled *Effects of Global Warming on Trout and Salmon in U.S. Streams*, which estimated that "individual species of trout and salmon could lose 5-17% of their existing habitat by the year 2030, 14-34% by 2060, and 21-42% by 2090. . . . For salmon, significant losses are projected throughout the current geographic range, with greatest losses expected for California."[14]

Most recently, in July 2012, the California Energy Commission's California Climate Change Center published a white paper, titled

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12. Jack E. Williams et al., *Coldwater Fish*, in BEYOND SEASONS' END: A PATH FORWARD FOR FISH AND WILDLIFE IN THE ERA OF CLIMATE CHANGE 31, 34 (Wildlife Mgmt. Inst. & Theodore Roosevelt Conservation Trust Eds., 2009).

13. TROUT UNLIMITED, *supra* note 6, at 3 (citation omitted).

14. KIRKMAN O'NEAL, DEFENDERS OF WILDLIFE & NATURAL RESOURCES DEFENSE COUNCIL EFFECTS OF GLOBAL WARMING ON TROUT AND SALMON IN U.S. STREAMS 3-4 (2002).

Projected Effects of Future Climates on Freshwater Fishes of California.[15] This paper, prepared by Professor Peter Moyle and other fishery biologists at the Center for Watershed Sciences at the University of California at Davis, developed individualized "vulnerability scores" for a broad range of fisheries to provide an objective comparative basis for determining which were most vulnerable to projected climate change impacts such as higher temperatures.[16] Per the paper's methodology, these vulnerability scores were categorized in the following manner: 17 or less (critically vulnerable); 17-22 (highly vulnerable); 23-27 (less vulnerable); 28-32 (least vulnerable); 32 or more (likely to benefit from climate change).[17] According to the paper, a "critically vulnerable" fishery species is "extremely likely to be driven toward extinction before the year 2100 without conservation measures," and a "highly vulnerable" fishery species is "on the path toward extinction as the result of climate change."[18]

Using this methodology and categorization scheme, the July 2012 California Climate Change Center white paper designated eleven separate native salmon and steelhead runs in California as "critically vulnerable" and eight separate native salmon and steelhead runs in California as "highly vulnerable."[19] The "critically vulnerable" listings were pink salmon, Central Coast coho salmon, Central Valley fall chinook salmon, Southern Oregon Northern California Coast coho salmon, Upper Klamath-Trinity spring chinook salmon, Northern California Coast summer steelhead, Central Valley spring chinook salmon, Central Valley late fall chinook salmon, Central Valley winter chinook salmon and Klamath Mountains Province summer steelhead. [20] The "highly vulnerable" listings were Klamath Mountains Province winter steelhead, Central California Coast winter steelhead, South Central California Coast steelhead, Upper Klamath-Trinity fall chinook salmon, chum salmon, California Coast fall chinook salmon, Southern Oregon Northern California Coast fall chinook salmon and Northern California Coast winter steelhead.[21]

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15. PETER B. MOYLE ET AL., CTR. FOR WATERSHED SCIS. & THE DEP'T OF WILDLIFE FISH & CONSERVATION BIOLOGY AT THE UNIV. OF CAL., PROJECTED EFFECTS OF FUTURE CLIMATES ON FRESHWATER FISHES OF CALIFORNIA (2012).

16. *Id.* at 2.

17. *Id.* at 6.

18. *Id.* at 9.

19. *Id.* at 19-20, fig. 6.

20. *Id.*

21. *Id.*

This body of scientific literature consistently shows that the higher temperatures induced by climate change will continue to harm California's coldwater fish, particularly salmon and steelhead.

C. Methodologies to Downscale Global Warming to the Local Level

Our ability to anticipate (and therefore potentially plan for) the effects of GHG emission-induced global warming on coldwater fisheries has been greatly enhanced in recent years through the development of improved "downscaling" methodologies.[22] "Downscaling" in this context is the process of deriving finer-resolution data about warming impacts from a coarser-resolution data set.[23] Such downscaling methodologies now enable climatologists to better predict the particular impacts of global warming on air and instream temperatures on a watershed basis, and even on a creek-by-creek or stream-by-stream basis.[24] Such information, when considered alongside information regarding salmon and steelhead migration patterns, spawning locations, and the specific temperature-related tolerance and vulnerability of particular coldwater species, can provide the scientific basis for more localized and geographically specific climate adaptation strategies.

Downscaling tools are becoming more widely available for use in climate change planning.[25] For example, the U.S. Department of Interior's Bureau of Reclamation, the Lawrence Livermore National Laboratory, the Santa Clara University Civil Engineering Department, Climate Central, and the Institute for Research on Climate Change and its Societal Impacts co-developed a data set of Global Climate Model simulations downscaled over the entire United States.[26] The data set is available as a public archive, and it is increasingly being used in planning studies to characterize and analyze climate change impacts.[27]

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22. John H. Matthews & A.J. Wickel, *Embracing Uncertainty in Freshwater Climate Change Adaptation: A Natural History Approach*, 1 CLIMATE & DEVELOPMENT 269, 272 (Jamie Pittock ed. 2009).

23. CAL. NATURAL RES. AGENCY DEP'T OF WATER RES., *CLIMATE CHANGE CHARACTERIZATION AND ANALYSIS IN CALIFORNIA WATER RESOURCES PLANNING STUDIES* 7 (2010) [hereinafter CAL. NATURAL RES. AGENCY].

24. *See* MOYLE ET AL., *supra* note 15.

25. Matthews & Wickel, *supra* note 22, at 272 ("A growing body of technical literature has been developed to describe the process of downscaling circulation and hydrological models from large spatial scales to guide particular projects and planning.").

26. CAL. NATURAL RES. AGENCY, *supra* note 23, at xv.

27. *Id.*

These downscaling methodologies are now being incorporated into climate change and global warming assessments prepared by the California Climate Action Team (created by the California Governor's Executive Order S-3-05 in 2005)[28] and the Cal-Adapt program of the California Energy Commission.[29] For instance, in 2012 the California Natural Resources Agency and the California Emergency Management Agency co-authored the publication *California Adaptation Planning Guide: Understanding Regional Characteristics*.[30] This publication included separate downscaled assessments of projected climate change impacts, including warming temperatures, for each of the different regions in the state.[31]

III. COLDWATER FISHERY CLIMATE ADAPTATION STRATEGIES

The literature suggests three alternative strategies for maintaining healthy salmon and steelhead fisheries in the face of rising instream temperatures. These climate adaptation strategy alternatives are not mutually exclusive and can be used in combination. If implemented, such adaptation strategies could help alleviate some of the adverse impacts that climate change will have on these coldwater species.

A. Reservoir Releases

Additional quantities of cold water from upstream dams/reservoirs can be released to reduce the temperature of downstream waters. A case study of reservoir releases on Putah Creek in Northern California reported on the results of a "new flow regime" on Putah Creek that involved additional downstream releases of colder water stored in the Putah Creek Diversion Dam.[32] It found that, with the new flow regimes, native fish such as salmon and steelhead were able to regain dominance over non-native species due in large part to cooler water temperatures.[33] Based on the Putah Creek result, the paper concluded that "managing

28. *See* Cal. Exec. Order No. 5-3-05 (2005).

29. *See* CAL. ENERGY COMM'N, TEMPERATURE: DECADAL AVERAGES MAP, http://cal-adapt.org/temperature/decadal/ (last visited Jun. 14, 2013).

30. CAL. EMERGENCY MGMT. AGENCY & NATURAL RES. AGENCY, CALIFORNIA ADAPTATION PLANNING GUIDE: UNDERSTANDING REGIONAL CHARACTERISTICS (2012).

31. *Id.* at 13-93.

32. MOYLE ET AL., *supra* note 15, at 27.

33. *Id.*

flow regimes may be a powerful tool to counter the negative effects of climate change."[34]

The additional release of reservoir waters for this purpose, however, may be resisted by existing agricultural and municipal users of the water stored in reservoirs behind such dams.

B. Upstream Passage

The air and water temperatures in any given watershed tend to rise as the waters move further away from high elevation headwaters into lower reaches. One strategy to counter higher downstream water temperatures is to provide salmon and steelhead with improved access upstream. Presently, access to such higher-elevation upstream reaches is often blocked by dams that provide little or no fish passage.[35] Implementing this climate adaptation strategy for coldwater fisheries may therefore require modifying (or in some cases removing) existing dams.[36]

Trout Unlimited's 2007 *Healing Troubled Waters* report emphasized the role that greater stream habitat "connectivity" to cooler higher elevation waters can play in helping coldwater fisheries adapt to climate change-induced rising downstream temperatures.[37] The report identified "removing instream barriers" as important to providing a pathway for salmon and steelhead to reach these colder and more suitable high elevation aquatic habitats.[38] For example, in the Pacific Northwest, there are currently proposals to remove dams on the Klamath River and Elwha River;[39] dam removal has also been considered on the Snake River.[40] These dam removals would enable coldwater fisheries on the Klamath River, Elwha River and Snake River to reach cooler upstream waters.[41]

Proposals to modify current instream structures (e.g. dam removal, installation of fish ladders) on the Klamath, Elwha and Snake Rivers to allow coldwater fisheries to reach higher elevation waters can perhaps be understood as an example of what is now often referred to in the field of

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34. *Id.* at 30.

35. *See* TROUT UNLIMITED, *supra* note 6, at 3.

36. *See id.* at 9.

37. *Id.*

38. *Id.*

39. Laura Zuckerman, *Interior Department Recommends Removal of Dams on Klamath River* (REUTERS, Apr. 4, 2013); JEFF CRANE, FINDING THE RIVER: AN ENVIRONMENTAL HISTORY OF THE ELWHA 133-214 (Or. S. Univ. Press, 2011).

40. Scott Learn, *Salmon Bill Would Put Removal of Snake River Dams Back on the Table*, OR. ENVTL. NEWS, Aug. 3, 2009.

41. *See id.;* Zuckerman, *supra* note 39.

climate change adaptation law and policy as "assisted migration."[42] Professor J.B. Ruhl, now with Vanderbilt University Law School, explains that assisted migration posits that we "move stranded species away from their degrading natural habitat to suitable habitat located beyond the species' migratory capacity."[43] In the context of coldwater fisheries, whose upstream migration is blocked by instream structural barriers, the notion of assisted migration can become somewhat strained due to potentially divergent views as to what "natural" habitat means under these circumstances.

In another article, authors Julie Lurman Joly and Neil Fuller attempt to distinguish "assisted migration" from "species reintroduction," noting that "[r]eintroduction differs from the concept of assisted migration in one important regard; traditionally reintroductions occur within the historic range of the species in question."[44]

In the case of salmon and steelhead stocks vulnerable to higher water temperatures, climate adaptation may involve a bit of "assisted migration" and "species reintroduction."[45] Removing or modifying instream barriers may at times enable certain salmon and steelhead runs to return to their historic higher elevation spawning grounds, which had been cut off by structures such as dams.[46] At other times, such removal or modification may provide a migratory corridor for certain salmon and steelhead runs to move upstream even though these elevations were not part of their historic range.[47]

Regardless of whether efforts to facilitate such upstream passage are categorized as "assisted migration," "species reintroduction," or some combination of the two, there is likely to be some opposition to these efforts. That is, the modification or removal of existing dams for this purpose may be resisted by the owners of such dams and by water users and hydroelectric consumers who may be impacted by such changes.

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42. *See* Julie Lurman Joly & Neil Fuller, *Advising Noah: A Legal Analysis of Assisted Migration*, 39 ENVTL. L. REP. NEWS & ANALYSIS 10413 (2009); J.B. Ruhl, *Climate Change and the Endangered Species Act: Building Bridges to the No-Analog Future*, 88 B.U. L. REV. 1 (2008).

43. Ruhl, *supra* note 42, at 53.

44. Joly & Fuller, *supra* note 42, at 10423.

45. *See id.*

46. *See id.*

47. *See id.*

C. Riparian Shading

Particularly in the narrower and bankside reaches of streams and creeks that support salmon and steelhead runs, trees and vegetation can provide enhanced shading that keeps instream temperatures cooler.[48] The coldwater fishery benefits of enhanced riparian shading can be particularly pronounced for those waters that serve as spawning grounds, given the particular vulnerability of salmon and steelhead eggs to higher instream temperatures.[49]

The 2009 report *Beyond Seasons' End*, discussed above, highlighted the potential for riparian zone projects to preserve suitable instream temperatures for coldwater fisheries.[50] The publication noted that riparian restoration can play a critical role in "restoring native plants and fostering vegetation that shades and thereby cools water flows."[51] To promote enhanced riparian shading, *Beyond Seasons' End* recommends that "transportation and energy corridors should not run in close proximity nor parallel to streams," and that fencing be used to "define riparian zone boundaries and to exclude undesirable practices such as livestock grazing or unregulated off-trail vehicle use."[52]

The use of such riparian shading as a potentially appropriate measure to mitigate climate vulnerability for coldwater fisheries was also discussed in the 2007 paper *Adaptation Strategies for Trout, Salmon and Their Watersheds During Climate Change*.[53] This paper recounted efforts to improve the climate resiliency of salmon stocks on Oregon's Rogue River, specifically noting that "restoration of riparian habitat along those streams with higher temperatures" could be "important for salmon survival in the future."[54] The paper then detailed the elements of a 2008 climate change adaptation plan for Rogue River salmon that was developed jointly by the University of Oregon's Climate Leadership Initiative (CLI) and the National Center for Conservation Science and Policy (NCCSP).[55] Among other things, the CLI/NCCSP adaptation plan proposed $750,000 to "encourage riparian plantings on private lands"

48. Williams et al., *supra* note 12, at 38.

49. JACK W. WILLIAMS ET AL., ADAPTATION STRATEGIES FOR TROUT, SALMON AND THEIR WATERSHEDS DURING CLIMATE CHANGE (2007).

50. *See* Williams et al., *supra* note 12, at 38.

51. *Id*.

52. *Id*.

53. WILLIAMS ET AL., *supra* note 49, at 9.

54. *Id*. at 21.

55. *Id*.

and $1.5 million to protect riparian systems on private lands through easements or acquisition.[56]

Efforts to establish riparian conservation zones to promote increased riparian shading along the lines proposed in the CLI/NCCSP plan for Rogue River salmon, however, may be resisted by the owners of riparian lands, ranchers who do not want their livestock excluded from such riparian areas, and proponents of transportation and energy projects adjacent to or nearby such proposed riparian conservation zones.[57]

IV. COLDWATER FISHERY CLIMATE CHANGE ADAPTATION UNDER NEPA, THE ESA, AND CEQA

Despite the consistent warnings that scientists have been providing for more than a decade about the threat climate change poses for coldwater fisheries, our environmental laws—and the government agencies tasked with implementing them—have been somewhat slow to react. Laws such as NEPA, the ESA, and CEQA are flexible enough in their design to allow agencies to effectively analyze and address emerging conditions like climate change, but to date climate adaptation has not been addressed in such a manner. Nevertheless, the potential for these laws to be used to identify and implement effective climate adaptation strategies exists. Several recent developments suggest that, going forward, agencies may be more prepared to acknowledge and take into account the emerging scientific evidence on the climate change impacts on coldwater fisheries.

One potential legal mechanism to do so is the inclusion of projected instream warming and related impacts in the baseline conditions under which NEPA, the ESA, and CEQA environmental analyses are performed. If such impacts are included in the environmental baseline against which the impacts of water resource projects are evaluated, then the projects can better incorporate needed adaptation measures to help impacted fisheries survive in a warmer climate.

A. National Environmental Policy Act (NEPA)

NEPA requires federal agencies to evaluate the environmental impacts of actions that they approve or carry out.[58] There are several types of federal agency actions subject to NEPA environmental review

56. *Id*. at 22-23.
57. *See id*. at 14.
58. Nat'l Envtl. Policy Act, 42 U.S.C. §§ 4321-4347 (1970).

that may involve impacts on coldwater fisheries, including water storage and diversion facilities projects operated by the United States Bureau of Reclamation (such as dams/pumps that are part of the Central Valley Project in California) and on-stream hydroelectric projects licensed by the Federal Energy Regulatory Commission (FERC).

There are presently no provisions in the NEPA statute, in the Council on Environmental Quality (CEQ) NEPA implementing regulations, or in formal NEPA policy guidance that explicitly address the issue of climate adaptation—i.e., the extent to which NEPA environmental impact assessment documents can or must consider the ways in which anticipated changes resulting from GHG emissions are expected to alter the environmental effects of a particular project. However, the current absence of any explicit guidance does not mean that the issue of climate change adaptation has not arisen in the NEPA context. The CEQ has issued draft guidance suggesting that federal agencies consider how climate change will affect a project's environmental impacts, and that considering climate change in the articulation of baseline conditions may be an appropriate way to accomplish this result.[59]

However, subsequent NEPA analyses for specific projects affecting coldwater fisheries have been uneven in their handling of climate adaptation, with some failing altogether to address climate change impacts on fish habitat and others doing so in a stand-alone fashion that is often detached from core elements of environmental impact assessment.

1. 2010 Draft NEPA Guidance on Climate Adaptation

In February 2010, the CEQ released its *Draft NEPA Guidance on Consideration of the Effects of Climate Change and Greenhouse Gas Emissions (2010 Draft NEPA Guidance)*.[60] Although to date no action has been taken to formally adopt this draft guidance, the document offers some insight into how the CEQ believes that climate adaptation considerations should be incorporated into NEPA documents.

The *2010 Draft NEPA Guidance* recognizes that the NEPA process can be used "to reduce vulnerability to climate change impacts, adapt to changes in our environment, and mitigate the impacts of Federal agency actions that are exacerbated by climate change."[61] The document further

59. COUNCIL ON ENVTL. QUALITY, DRAFT NEPA GUIDANCE ON CONSIDERATION OF THE EFFECTS OF CLIMATE CHANGE AND GREENHOUSE GAS EMISSIONS 6 (2010).

60. *Id*. at 1.

61. *Id*. at 2.

recommends that the articulation of baseline conditions may be the appropriate place in NEPA analysis to factor in the anticipated effects of global warming.[62] More specifically, the *2010 Draft NEPA Guidance* states that "it may also be useful to consider the effects of any proposed action or its alternatives against a baseline of reasonably foreseeable future conditions that is drawn as distinctly as the science of climate change effects will support."[63] That is, instead of evaluating the environmental effects of a proposed action solely against the conditions that exist at the time the NEPA document is prepared, it may be advisable to evaluate such environmental effects against the conditions that are expected to exist in the future as a result of climate change.[64]

The *2010 Draft NEPA Guidance* also notes that in projecting the impact of climate change on environmental conditions, "the outputs of coarse-resolution global climate models, commonly used to project climate change scenarios at a continental or regional scale, require downscaling . . . before they can be used in regional or local impact studies."[65] The document acknowledges, however, that NEPA incorporates a "rule of reason" regarding the extent of research and analysis that an agency must undertake in its environmental analyses, and also recognizes that "agencies need not undertake exorbitant research or analysis of projected climate change impacts in the project area or on the project itself."[66] The development and availability of downscaling data and methodologies, such as the one developed by the U.S. Department of the Interior/Lawrence Livermore National Laboratory, may make it increasingly difficult for federal agencies to credibly claim that "exorbitant" research and analysis is required to downscale projected climate change impacts to the regional or local level.

Although the CEQ has not yet finalized this draft guidance, the preparation of the draft evidences the CEQ's growing recognition that, for NEPA to remain scientifically credible, climate adaptation considerations must be factored into the NEPA environmental assessment process. The draft guidance also reflects CEQ's initial thinking that the use of a future environmental baseline may be the most appropriate way to achieve this incorporation.[67]

62. *See id*. at 7.
63. *Id*.
64. *See id*.
65. *Id*. at 8.
66. *Id*. at 7-8.
67. *See id*.

2. 2012 FERC EIS for Licensing of Middle Fork American River Hydroelectric Project

In July 2012, FERC released its Draft Environmental Impact Statement (FERC DEIS) in connection with a hydropower license for the Middle Fork American Hydroelectric Project in California.[68] The project will impact coldwater salmon and steelhead fisheries on the American River, and it is projected to have a lifetime of 30 to 50 years based on the terms of the license.[69] Although the FERC DEIS recognizes that climate change is an important environmental challenge facing these fisheries,[70] FERC did not follow the future baseline approach to climate adaptation recommended by CEQ in the *2010 Draft NEPA Guidance*.

FERC did, however, undertake an analysis of the effects of the proposed project on instream water temperatures, and it acknowledges the relationship between instream water temperature and coldwater fisheries.[71] To address the potential water temperature impacts of the project, the FERC DEIS calls for implementation of a proposed "Water Temperature Monitoring Plan" to "confirm whether flows are protective of the basin plan designated beneficial uses of cold freshwater habitat," which would be used as a "key input" to monitor project impacts on coldwater fisheries whose "distribution and population vitality . . . are strongly related to water temperature."[72] However, the document analysis relied on "existing conditions" as the benchmark for evaluating the project's impacts on coldwater fisheries as a result of changes in instream temperature.[73] In contrast to the climate adaptation approach suggested in the *2010 Draft NEPA Guidance*, the FERC DEIS does not adopt a baseline for instream water temperatures that reflects the anticipated rise in instream water temperatures due to GHG emissions that is expected to occur during the 30-50 year term of the licensed project.

Additionally, the FERC DEIS analysis makes no attempt to downscale the effects of climate change on increased instream water temperatures in the project area, nor does it analyze the effects of

68. FED. ENERGY REGULATORY COMM'N, FINAL ENVIRONMENTAL IMPACT STATEMENT FOR HYDROPOWER LICENSE (2012) [hereinafter "HYDROPOWER LICENSE EIS"].

69. *Id*.

70. *Id*. at 109 ("The American River population is classified at high risk of extinction; increasing demands for water and the potential effects of climate change are likely to increase this risk") (internal citation omitted).

71. *Id.*

72. *Id.* at 125-30.

73. *Id*. at 131-34.

increased instream water temperatures on coldwater fisheries in the project area. As a result, the FERC DEIS proposes no alternatives or mitigation to explicitly address these climate adaptation considerations.

3. 2012 Bay Delta Conservation Plan Draft Joint EIS/EIR

In February 2012, the California Natural Resources Agency released its administrative draft of the Joint EIR/EIS for the Bay Delta Conservation Plan (*2012 BDCP EIR/EIS*) prepared pursuant to NEPA and CEQA.[74] The *2012 BDCP EIR/EIS* proposes, among other things, a new "isolated conveyance facility," such as a canal or tunnel that would divert substantial portions of water from the higher elevation upstream reaches of the Sacramento River.[75] This proposed isolated conveyance facility would replace current water diversions that occur in the lower elevation downstream reaches of the Sacramento River near the Bay Delta, where the Sacramento and San Joaquin Rivers converge.[76]

One of the rationales for the BDCP isolated conveyance facility was that fewer juvenile salmon and steelhead were anticipated to become entrained in the diversion pumps if the pumps were relocated further upstream.[77] However, as noted above, the higher elevation upstream reaches of a watershed tend to have colder instream temperatures than the lower elevation downstream reaches.[78] Therefore, while the relocation of diversion structures to points further upstream may reduce entrainment of salmon and steelhead, the increased diversion of the colder water upstream, which is prime coldwater fishery habitat, could have other potential adverse impacts on salmon and steelhead.[79]

The *2012 BDCP EIR/EIS* devotes a chapter to climate change adaptation considerations. The chapter "analyzes changes in future climate that could affect the water conveyance facilities and natural resources in the Plan area" and evaluates how the various action alternatives evaluated in the EIR/EIS would affect the project area's resiliency to climate change impacts.[80] In doing so, the Plan explains

74. CAL. DEP'T OF WATER RES., ADMINISTRATIVE DRAFT OF EIR/EIS FOR BAY DELTA CONSERVATION PLAN (2012).

75. *See generally id.* at 3-11 to 3-13.

76. *Id*.

77. *Id*.

78. *See supra* Part III.B.

79. CAL. DEP'T OF WATER RES., *supra* note 74, at 11-5 to 11-6.

80. *Id*. at 29-2.

that "[t]he current environmental setting for climate change is the baseline conditions detailed in the other resource chapters."[81]

The *2012 BCDP EIR/EIS* finds that "future changes in water temperatures of rivers below Central Valley Project (CVP) and State Water Project (SWP) reservoirs are likely to occur as a result of the combination of changes in reservoir operations caused by the BDCP Delta operations and by climate change effects."[82] It notes further that such increased water temperatures "may have adverse effects on fish spawning (reduced egg survival) and may reduce the habitat zone (reduced abundance) of fish that are sensitive to high temperatures."[83] It also projects that less water may be available from the reservoir each year as a result of such impacts because "[i]ncreased water temperatures can alter reservoir stratification and reduce the cold water volume (i.e. volume with temperatures of less than 55°), which may increase the minimum carryover storage required to protect downstream fish spawning and rearing."[84] However, the Plan concedes that none of the considered project alternatives would "provide additional resiliency to this climate change effect."[85]

While the NEPA document did not adopt the future baseline suggested in the *2010 Draft NEPA Guidance*, it nonetheless did contain some substantive analysis of how global warming is expected to increase instream water temperatures in the project area; these projected increases in instream water temperatures were then considerations built into the models to assess the impacts of the BDCP alternatives on coldwater fisheries. Moreover, the NEPA document contains an express acknowledgement that the BDCP as currently conceived does not include measures or components to increase the ability of coldwater fisheries to adapt to such rising instream temperatures.[86]

On the one hand, therefore, the inclusion of more substantive analysis of climate change impacts on instream water temperatures and coldwater fisheries in the draft *2012 BDCP EIR/EIS* can be seen as an improvement over the NEPA analysis in the *2012 Draft FERC DEIS*. However, there remains a disconnect between this climate adaptation analysis and the alternatives and mitigation set forth in the draft *2012 BDCP EIR/EIS*. That is, the analysis did not lead to the inclusion of

81. *Id.*
82. *Id.* at 29-20.
83. *Id.*
84. *Id.* at 29-22.
85. *Id.*
86. *Id.* at 29-33.

appropriate climate adaptation strategies, alternatives, or mitigation in the proposed project (e.g. additional reservoir releases, improved upstream passage, expanded riparian shading on creeks and streams).

This disconnect appears to have been by design rather than by oversight; the introductory section to the climate change adaptation chapter in the *2012 Draft BCDP EIR/EIS* acknowledges that

> [t]his chapter is organized differently from the other resource chapters because analyzing the effect of climate change on the study area is a fundamentally different analysis than those presented in the other resource chapters. Whereas the other chapters are organized to identify effects of the action alternatives and how to mitigate them, this chapter's is to analyze and disclose how the action alternatives affect the project area's resiliency to expected changes in climate.[87]

This acknowledgement evidences that even within NEPA documents climate adaptation, unfortunately, continues to be treated as a stand-alone question somehow unrelated to traditional NEPA environmental impact assessment rather than a critical component of such assessment.

B. Endangered Species Act (ESA)

The ESA requires, among other things, that federal agencies ensure that any actions they approve or carry out will not jeopardize the continued existence of any endangered or threatened species or result in adverse impacts on such species' critical habitats.[88] These federal agency responsibilities are administered jointly by the United States Fish and Wildlife Service (FWS) and the National Marine Fisheries Services (NMFS). Several types of FWS and NMFS actions under the ESA may involve assessing impacts on coldwater fisheries. These assessments may include Biological Opinions (BiOps) on whether federal agency actions will put a listed species in jeopardy or adversely modify its critical habitat, decisions on whether to list or delist species as endangered or threatened, and approval of incidental take permits and habitat conservation plans. Several recent court cases have determined that FWS and NMFS need to take into account the growing body of scientific evidence regarding the effects of climate change when taking such actions. These decisions potentially bode well for the prospects of

87. *Id.* at 29-1.
88. 16 U.S.C. § 1536(a)(2) (2013).

incorporating climate change adaptation into water resource management decisions affecting coldwater fisheries.

1. Litigation on Bay Delta NMFS/FWS Biological Opinions

In the past decade, there has been extensive ESA litigation over the effects of the federal Central Valley Project and California's State Water Project on the condition of salmon, steelhead, and smelt fisheries in the Sacramento River, San Joaquin River, San Francisco Bay Delta (Delta) watershed.[89] The litigation has challenged the BiOps issued by FWS and NMFS evaluating the projects' impacts on these species and their habitat. In two prominent decisions — *Natural Resources Defense Council v. Kempthorne*[90] and *Pacific Coast Federation of Fishermen's Ass'n v. Gutierrez*[91] — former Judge Oliver Wanger of the U.S. District Court for the Central District of California invalidated the BiOps because they failed to adequately address the anticipated effects of climate change on the habitat of the endangered coldwater fisheries.

In *Kempthorne*, the court observed that there were a number of studies in the record predicting that anticipated climate change will adversely impact future water availability, suggesting that climate change will be an important problem facing fish species in the project area that should be analyzed in the BiOp.[92] However, the BiOp did not provide any meaningful discussion of the issue and failed to evaluate the potential effect of climate change on Delta hydrology.[93] The court therefore held that FWS acted arbitrarily and capriciously, explaining that the "absence of any discussion in the BiOp of how to deal with … climate change is a failure to analyze a potential important aspect of the problem."[94]

In *PCFFA v. Gutierrez*, the court noted readily available scientific data showing that climate change is projected to greatly reduce the Sierra

89. Paul Stanton Kibel, *The Public Trust Navigates California's Bay Delta*, 51 NAT. RESOURCE J. 35, 37-8 (2011) ("Given the strong agricultural and urban demands for river diversions of Sacramento and San Joaquin freshwater, and the competing natural resource ecosystem and fishery-related economic interests reliant on adequate instream flow, contention over the Bay Delta—in the court, in Congress and federal agencies, and in the California legislature and state agencies—has been constant and fierce.")

90. Nat'l Res. Def. Council v. Kempthorne, 506 F. Supp. 2d 322 (E.D. Cal. 2007).

91. Pac. Coast Fed'n of Fishermen's Ass'n v. Gutierrez, 606 F.Supp. 2d 1122 (E.D. Cal. 2008).

92. *Kempthorne*, 506 F.Supp.2d at 367.

93. *Id*.

94. *Id*. at 370 (internal citation omitted).

snowpack and summer stream flow.[95] But the BiOp did not discuss this data or indicate that NMFS had considered it.[96] "Instead, the BiOp relie[d] on past hydrology and temperature models that assume[d] the historical temperature, hydrologic, and climactic conditions experienced from 1922 through 1994 [would] continue" for the 25-year duration of project operations.[97] The court set aside the BiOp and remanded it back to NMFS to address these deficiencies.[98]

These cases do not explicitly hold that BiOps must consider the effects of GHG-emission-induced rising instream temperatures on coldwater fisheries protected under the ESA. Nevertheless, the cases do establish generally that ESA BiOps may not lawfully rely on historical data regarding instream flow and temperatures if there is substantial evidence that such flow and temperatures will be significantly altered by global warming during the term of the project.

2. Litigation on Proposed Grizzly Bear Delisting

In its 2011 decision in *Greater Yellowstone Coalition v. Servheen*, the Ninth Circuit Court of Appeals affirmed a Montana district court ruling that blocked the FWS from removing Yellowstone grizzly bears from the ESA's threatened species list because the agency had failed to consider the potential impacts of climate change on the bears' continued survival.[99]

The FWS had delisted the grizzly bears in the Greater Yellowstone Area based on an increase in their population from between 136 and 312 at the time of the listing in 1975 to more than 500 in 2007.[100] The district court invalidated the delisting because it found that the FWS had failed to adequately consider the anticipated impacts of global warming on the whitebark pine, an important food source for grizzly bears.[101] In affirming this ruling, the Ninth Circuit noted that the FWS itself had found that whitebark pine seeds were a food source important to grizzly bear survival; that a well-documented association exists between reduced whitebark pine seed abundance and increased grizzly mortality; and that global warming was expected to lessen whitebark pine abundance.[102]

95. *Pac. Coast Fed'n of Fishermen's Ass'n*, 606 F. Supp. 2d at 1184.
96. *Id.*
97. *Id*.
98. *Id.* at 1194.
99. Great Yellowstone Coalition v. Servheen, 665 F.3d 1015, 1032 (9th Cir. 2011).
100. *Id.* at 1020.
101. *Id.*
102. *Id.* at 1025.

The Ninth Circuit went on to find that the best science indicates that whitebark pines are expected to decline due to global warming,[103] and that the FWS failed to articulate "a rational connection" between the best available science and the conclusion that grizzly bears would be able to adapt to the decline of whitebark pines.[104] The Ninth Circuit concluded that the FWS "must rationally explain why the uncertainty regarding the impact of whitebark pine loss on the grizzly counsels in favor of delisting now, rather than, for example, more study. Otherwise, we might as well be deferring to a coin flip."[105]

The decision in *Greater Yellowstone Coalition* did not directly address fisheries, fisheries habitat, or rising instream temperatures. However, the case does stand for the more general proposition that to the extent best available science indicates that anticipated global warming may affect the survival of a particular species protected under the ESA, a decision by FWS or NMFS to delist a particular species must directly and meaningfully address such impacts and provide a rational explanation for why delisting is nonetheless warranted.[106]

C. California Environmental Quality Act (CEQA)

There are many types of projects that may impact coldwater fisheries that are subject to CEQA review, including California Department of Water Resources (DWR) water storage and diversion projects, projects involving appropriative diversion and storage rights for surface water, projects requiring streambed alteration agreements from the California Department of Fish and Wildlife, and logging activities in areas near streams that support coldwater fisheries requiring California Department of Forestry approval of a timber harvesting plan.[107] As with NEPA, however, there are presently no statutory or regulatory provisions in CEQA or its guidelines that explicitly address the issue of climate adaptation. For example, the extent to which CEQA environmental impact assessment documents must consider how climate change may alter the environmental effects of a particular project. Nevertheless, the 2012 California Court of Appeal decision in *Neighbors for Smart Rail v. Exposition Metro Line Construction Authority* — in which the court

103. *Id.*
104. *Id.* at 1020.
105. *Id.* at 1028 (internal citation omitted).
106. *See id.*
107. *See* Cal. Pub. Res. Code §§ 21000-21189.3.

affirmed the use of a "future baseline" approach to CEQA[108] similar to the approach proposed in the CEQ's *2010 CEQA Draft NEPA Guidance* discussed above — may shed some light on how to approach climate adaptation considerations under this statute.

The *Smart Rail* case involved a challenge to the baseline conditions used in an environmental impact report (EIR) addressing the impacts of an urban rail transportation project in Los Angeles.[109] Under Section 15125 of the CEQA Guidelines, the environmental conditions "as they exist at the time" of the EIR "will normally constitute the baseline physical conditions by which a lead agency determines whether an impact is significant."[110] In *Smart Rail*, however, the lead agency departed from the default "existing conditions" approach set forth in Section 15125 in its analysis of traffic levels, and instead relied upon future anticipated population growth to establish the "baseline" traffic conditions against which it evaluated the project's impacts.[111] The petitioner challenged this "future baseline" under CEQA, but the Court of Appeal upheld the use of the future baseline approach.[112] The court reasoned that the conditions that existed at the time of the EIR would no longer exist when the project came online, let alone over the life of the project, and therefore reliance on the existing conditions at that time "would rest on the false hypothesis that everything [would] be the same 20 years later."[113] The court continued, "[t]he important point, in our view, is the reliability of the projections and the inevitability of the changes on which those projections are based. . . . Population growth, with its concomitant effects on traffic and air quality, is not hypothetical in Los Angeles County; it is inevitable."[114]

Smart Rail's approach to projected climate change under CEQA is an interesting companion to the California Court of Appeal's 2011 decision in *Ballona Wetlands Land Trust v. City of Los Angeles*.[115] *Ballona Wetlands* involved a coastal development in Playa Del Rey, California, in which the petitioner alleged that the CEQA EIR was inadequate because it did not address the impact of climate-induced sea

108. *Neighbors for Smart Rail v. Exposition Metro Line Constr. Auth.*, 2012 WL 1739685, at *8 (Cal. Ct. App. 2012), *aff'd,* 57 Cal. 4th 439 (Cal. 2013).

109. Neighbors for Smart Rail, 57 Cal. 4th 439, 446 (Cal. 2013).

110. *Neighbors for Smart Rail*, 2012 WL 1739685, at *11.

111. *Id.*

112. *Id.* at *15.

113. *Id.*

114. *Id.* at **17-18.

115. Ballona Wetlands Land Trust v. City of Los Angeles, 201 Cal. App. 4th 455 (Cal. Ct. App. 2011).

level rise on the proposed project.[116] The *Ballona Wetlands* Court did not accept the petitioner's argument, finding: "[t]he purpose of an EIR is to identify the significant effects of a project on the environment, not the significant effects of the environment on the project."[117]

Ballona Wetlands' holding on sea level rise did not reference baseline conditions per se, but rather focused on the scope of CEQA project impact analysis. Some have interpreted *Ballona Wetlands* more broadly, however, as standing for the premise that a CEQA EIR should exclude consideration of the extent to which anticipated climate change (occurring independent of a proposed project) may alter physical conditions in the vicinity of a proposed project. *Smart Rail* suggests that this expansive reading of *Ballona Wetlands* is not warranted.[118]

Smart Rail's holding on future baseline conditions provides a potential roadmap for how to address projected climate change impacts in the context of CEQA EIRs. As a result of the work of the United Nations Intergovernmental Panel on Climate Change and other scientific bodies, there now appears to be substantial evidence of the inevitability of certain projected climate-change-induced alterations in the physical environment, such as higher stream temperatures.[119]

What *Smart Rail* suggests, which is in no way inconsistent with *Ballona Wetlands*, is that the appropriate place in a CEQA EIR to account for anticipated climate change impacts on the location where a project is proposed is through the lead agency's reliance on "future baseline conditions" for its environmental analysis.[120]

The California Supreme Court has granted certiorari to review *Smart Rail* and the California Court of Appeal decision has been depublished pending this appeal. Notably, however, the Association of California Water Agencies (ACWA) filed an amicus brief with the California Supreme Court that speaks directly to the potential impact of the case on CEQA EIRs involving water resources.[121] ACWA's brief advocated for

116. *Id.* at 462.

117. *Id.* at 473.

118. Paul Stanton Kibel, *California Court of Appeal Smart Rail CEQA Decision – Rethinking Baseline Conditions in Light of Projected Climate Change*, CUEL (June 7, 2012) http://ggucuel.org/california-court-of-appeal-smart-rail-ceqa-decision_-_rethinking-baseline-conditions-in-light-of-projected-climate-change.

119. *Id.*

120. *Id.*

121. Application by Association of California Water Agencies for Leave to File Amicus Curiae Brief and Amicus Curiae Brief in Support of Respondents, Neighbors for Smart Rail v. Exposition Metro Line Constr. Auth., 2012 WL 1739685 (Cal. Ct. App. 2012).

affirming *Smart Rail* not because of the organization's concerns regarding coldwater fisheries, but rather to help better insulate water agencies (some of whom operate large-scale water diversion and storage projects) from future liabilities for water resource impacts caused by climate change.[122] These motivations aside, the ACWA amicus brief argues that

> [b]oth common sense and scientific methodology lead to the conclusion that, in appropriate circumstances, a future or predicted baseline must be utilized because a comparison to conditions at the time [the CEQA document is prepared] will not result in an accurate portrayal of actual conditions against which the project will operate.[123]

The ACWA brief further explained that public water infrastructure projects often will not come on line for many years and then will operate for many decades, and that during that time "ambient conditions in the project vicinity often change significantly from those in existence at the time of project approval."[124]

Although the ACWA brief does not specifically mention climate change or global warming, its argument regarding changed "ambient conditions" appears to encompass these changes.[125] A reformulation of ACWA's point in the context of salmon and steelhead might, therefore, be that evaluating the operational impact of water storage/diversion projects (such as California's State Water Project or the federal Central Valley Project) against a baseline of anticipated higher instream temperatures will result in a more accurate assessment of the impact of these projects on the coldwater fisheries present in the waters diverted/stored during the extended lifetime of the project.

As the California Supreme Court takes up the issue of the CEQA future baselines in the *Smart Rail* appeal, the County of Sacramento Superior Court's June 2013 ruling in another matter, the *QSA Coordinated Civil Cases*, is evidence that California trial courts continue to opine on this issue, as well.[126] The litigation in the *QSA Coordinated Civil Cases* focused on California's diversion and use of Colorado River water pursuant to a series of contracts, transfers and projects known

122. *See id.* at *25.
123. *Id.* at *9.
124. *Id*. at *2.
125. *See id.*
126. QSA Coordinated Civil Cases, Ruling on Submitted Matter, Qualification Settlement Agreement Cases, 201 Cal. App. 4th 758 (June 4, 2013) (No. JCCP 4353).

collectively as the "Quantification Settlement Agreement" (QSA).[127] One of the QSA projects involved a proposed 75-year plan related to an inland terminal lake in Imperial County called the Salton Sea, whose surface area has diminished and whose salinity levels have been rising for many years due to evaporation and reduced inflow.[128] In evaluating the environmental impacts of the 75-year QSA project on the Salton Sea, the lead agencies that prepared the CEQA EIR for the QSA opted to rely, in part, on a future baseline that took account of the anticipated reduced surface area and increased salinity of the waterbody during the life of the project.[129] The use of this future baseline was challenged by the Imperial County Air Pollution Control District (Air District) and an environmental organization, Protect Our Water and Environmental Rights (POWER).[130]

In his June 4, 2013 ruling in the QSA Coordinated Civil Cases, Judge Lloyd Connelly of the County of Sacramento Superior Court began his analysis of this challenge by noting "CEQA case law has not yet definitively addressed the validity of a predictive or future baseline like the baseline used in the Transfer EIR and the QSA PEIR to evaluate the impacts of conserved water transfers on the Salton Sea."[131] After acknowledging the absence of specific controlling CEQA case law on this question, Judge Connelly then went on to find:

> [W]here the surrounding physical conditions existing at the time of environmental review may vary independent of the project over the course of project implementation, the project's significant impacts on the environment can be accurately determined and disclosed in accordance with CEQA requirements only if the baseline is defined to include both the conditions existing at the time of environmental review and the changes predicted to occur in the environment during project implementation. Thus, to accurately assess the significance of the Transfer project's impacts on the Salton Sea, it was necessary and appropriate for the EIR to use a baseline which took account both of existing conditions and existing trends in the Sea's hydrology during the term of the project and used a

127. *Id*. at 1.
128. *Id*. at 2, 19, 29-30.
129. *Id*. at 29-30.
130. *Id*. at 30.
131. *Id*.

> baseline that included existing conditions and predicted future conditions at the Salton Sea.[132]

After determining that the use of a future baseline might potentially be permissible under CEQA to assess QSA impacts on the Salton Sea, Judge Connelly then turned to the more fact-specific question of whether there was substantial evidence in the administrative record to support the use of such a future baseline in this particular instance.[133] He was persuaded there was a future baseline due to the

> detailed explanations in the EIR and PEIR and related documents about the development and use of the baseline to predict Salton Sea salinity, elevation and surface area and to measure project impacts to those hydrologic conditions over the course of the 75-year project term. The record contains detailed information about the combined use of four hydrologic computer programs, previously developed and validated by the Bureau of Reclamation and other agencies, to model and analyze both existing conditions of the Salton Sea and project impacts over the 75-year terms. The specific assumptions used in developing the modeled baseline are identified and reasonably explained.[134]

In terms of the use of CEQA future baselines to assess impacts of GHG-induced rising temperatures on salmon and steelhead, the June 2013 County of Sacramento Superior Court ruling in the *QSA Coordinated Civil Cases* is noteworthy in at least two respects. First, although it did not specifically consider GHG-induced climate change, the ruling is the first CEQA decision to specifically uphold the use of a future baseline in regard to impacts on water resources. Second, its analysis of the types of hydrologic modeling and computer programs used to predict changes in the Salton Sea's surface area and salinity (and whether they constitute substantial evidence under CEQA) may provide guidance as to the types of downscaling data and methodologies that are legally sufficient to support modeling of instream temperature increases and associated coldwater fishery impacts resulting from GHG-induced climate change.

132. *Id*. at 32.
133. *Id.*
134. *Id.* at 33.

V. CONCLUSION: MOVING CLIMATE ADAPTATION FROM CONCEPT TO OPERATION

The impact of climate-change-induced rising instream temperatures is likely to be devastating on coldwater fisheries, such as salmon and steelhead, unless effective climate adaptation strategies are implemented. These climate adaptation strategies include increased releases of coldwater from upstream reservoirs to downstream waterways, improved fishery passage around existing dams to reach colder upstream waters, and increased shading along streams and creeks that serve as coldwater fishery spawning grounds.

Although there are now improved data and methodologies to downscale the effects of climate change to anticipate temperature rises in particular watersheds, and rivers and streams, and there is now an improved scientific understanding of how rising instream temperatures adversely affect coldwater fisheries, we are still at a relatively early stage in terms of integrating such information and analysis into environmental laws such as NEPA, the ESA, and CEQA.

This current disconnect was noted by Margot Hill with the University of Geneva's Institute of Environmental Sciences.[135] In the preface to her book, *Climate Change and Water Governance*, Hill observed that "even with the advances in the conceptualisation of adaptive capacity" there to date has been limited progress in terms of the "operationalization" of these conceptual frameworks.[136] That is, much work remains to be done in regard to creating the legal and regulatory processes to ensure that the concept of climate adaptation is reflected in what agencies and courts actually do.

As we move, as Margot Hill suggests, from the "concept" of climate change adaptation to the "operation" of climate change adaptation in regard to coldwater fisheries, efforts to more effectively engage NEPA, the ESA, and CEQA are likely to focus on questions related to "baseline conditions" and "adaptive management." These laws have traditionally looked to historical conditions to evaluate the severity of a proposed project's impacts and what mitigation is required. With a concern for certainty, these laws have also traditionally focused on specifically identifying what mitigation will, and will not, be required for the proposed project to go forward.

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135. Margot Hill, *Climate Change and Water Governance: Adaptive Capacity in Chile and Switzerland, in* ADVANCES IN GLOBAL CHANGE (Springer Book 54, 2013).

136. *Id.*

John H. Matthews and A.J. Wickel of the World Wildlife Fund's Conservation Science Department noted the climate adaptation challenge presented by shifting baseline conditions in the chapter they contributed to the 2009 book, *Lessons for Climate Change Adaption from Better Management of Rivers*.[137] In this chapter, titled "Embracing Uncertainty in Freshwater Climate Change Adaption: A Natural History Approach," Matthews and Wickel observe that:

> [u]ntil very recently, almost all water resources management practice had assumed that the best basis for infrastructure design and management was captured through the historical record of that basin's hydrological variability ─ an assumption of ecosystem 'stationarity' . . . . More recently, stationarity has been declared 'dead' as a result of human-induced climate change . . . emerging hydrological regimes may represent so-called 'no analog' climates ─ that is, they will be profoundly different from what has been seen over the past several millennia. Thus, the recent past will serve as an increasingly less reliable guide to the future.[138]

The observations of Matthews and Wickel suggest the need to reconceptualize baseline conditions in a way that properly accounts for projected future climate change impacts and to reconceptualize mitigation as adaptation management to preserve the flexibility to make appropriate adjustments and modifications in response to future climate change impacts.[139]

Looking ahead, if NEPA, the ESA, and CEQA are interpreted to require more quantified analysis of the impacts of rising instream temperatures on coldwater fisheries and formulation of specific project design and mitigation to address such impacts, these laws may play a more relevant role in the development and implementation of effective climate adaptation strategies to help California's already imperiled salmon and steelhead fisheries weather the hotter days that lie ahead.

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137. John H. Matthews & A.J. Wickel, *Embracing Uncertainty in Freshwater Climate Change Adaptation: A Natural History Approach*, *in* LESSONS FOR CLIMATE CHANGE ADAPTION FROM BETTER MANAGEMENT OF RIVERS 269 (Jamie Pittock ed., 2009).

138. *Id*. at 272 (citations omitted); *see also* Robin Kundis Craig, *Stationarity is Dead ─ Long Live Transformation: Five Principles for Climate Change Adaptation Law*, 34 HARV. ENVTL. L. REV. 7, 11 (2010).

139. *See id.*