COMMENT

REVISITING *SMALL POPULATIONS IN JEOPARDY*: A REJOINDER TO BÖRK ET AL.

by Paul S. Weiland and Dennis D. Murphy

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In a recent Comment[1] in these pages, five researchers affiliated with the University of California, Davis critiqued a biological opinion issued by the U.S. Fish and Wildlife Service (FWS) under §7(a)(2) of the Endangered Species Act (ESA)[2] that analyzes the effects of ongoing operations of the Central Valley Project (CVP) and State Water Project (SWP) on the Delta smelt.[3] The subject is consequential because the Delta smelt's historical habitat has been transformed and severely degraded since the California Gold Rush, leading to a significant decline in the size of its population[4]; and because the CVP and SWP are far and away the two largest water supply projects in California, delivering water to some 25 million Californians and irrigating more than three million acres of farmland.[5] It is also a complex subject because agency determinations under the interagency consultation provisions of the ESA[6] occur at the intersection of science, law, and policy, and require a technically demanding, structured decisionmaking process.

The Comment eschews this complexity. In juxtaposition, with little scientific support, its authors advance two reductionist arguments. First, they argue that the inclusion of real-time monitoring of Delta smelt, restoration of its habitat, and a conservation hatchery among the actions identified in the Bureau of Reclamation's consultation with FWS to benefit the Delta smelt has "inherent flaws."[7] And second, they propose a pair of alternative actions, introducing Delta smelt into novel ecological circumstances and creating a water allocation for Delta smelt, that they contend are superior means to benefit the species.[8]

In this response to the Comment by Karrigan Börk et al., we describe the federal ESA consultation process and its reliance on effects analysis, an analytical technique analogous to risk assessment, whereby FWS is obliged to follow a stepwise process to evaluate presumptive effects of agency actions on listed species and their designated critical habitat. We then contrast effects analysis with the approach taken by the authors in evaluating the adequacy of FWS' determination and developing an alternative.

Authors' Note: Dennis Murphy submitted an expert declaration in support of the opposition of State Water Contractors as intervenor-defendants to a motion for interim injunctive relief in cases challenging the 2019 biological opinion discussed in this Comment. Paul Weiland was counsel of record for then-plaintiffs, the Coalition for a Sustainable Delta and Kern County Water Agency, in a separate matter challenging the 2008 biological opinion regarding the effects of the Central Valley Project and State Water Project operations on the Delta smelt.

1. Karrigan Börk, Peter Moyle, John Durand, Tien-Chieh Hung & Andrew L. Rypel, *Small Populations in Jeopardy: A Delta Smelt Case Study*, 50 ELR 10714 (Sept. 2020).
2. 16 U.S.C. §1536(a)(2), ELR Stat. ESA §7(a)(2).
3. FWS, Biological Opinion for the Reinitiation of Consultation on the Coordinated Operations of the Central Valley Project and State Water Project (2019).
4. The extent of alteration of the Delta smelt's habitat is difficult to overstate and includes massive increases in sediment inputs associated with mining in the late 1800s, large-scale conversion of wetlands in the late 1800s and early 1900s, channelization and hardening of waterways in the mid- to late-1900s, construction of upstream dams and reservoirs that altered the natural hydrograph and reduced sediment input, introduction of non-native species, construction of thousands of water diversions, and discharge of pollutants from point and nonpoint sources. Many of these factors are described in Jay Lund et al., Public Policy Institute of California, Envisioning Futures for the Sacramento-San Joaquin Delta (2007), https://www.ppic.org/content/pubs/report/R_207JLR.pdf.
5. Charles V. Stern & Pervaze A. Sheikh, Congressional Research Service, Central Valley Project: Issues and Legislation 3 (2021), https://fas.org/sgp/crs/misc/R45342.pdf.
6. 16 U.S.C. §1536(a)(2).
7. Börk et al., *supra* note 1, at 10717.
8. *Id.* at 10721-22.

I. Interagency Consultation and Effects Analysis

The purposes of the ESA are to "provide a means whereby the ecosystems upon which endangered species and threatened species depend may be conserved" and to "provide a program for the conservation of such endangered species and threatened species."[9] The statute includes provisions for listing species as either threatened or endangered, and provides tools for protecting and, ultimately, recovering such species. Interagency consultation under §7(a)(2) of the ESA is one such tool.[10] The provisions in §7(a)(2) require all federal agencies in consultation with and with the assistance of the federal wildlife agencies—FWS or the National Marine Fisheries Service (NMFS)—to ensure that any action authorized, funded, or carried out by the agency is not likely to jeopardize the continued existence of any listed species or result in the destruction or adverse modification of critical habitat of such species.[11]

The federal wildlife agencies have promulgated regulations to implement the ESA's consultation provisions, requiring evaluation of the effects of any proposed action undertaken by a federal agency on a listed species or the designated critical habitat of that species.[12] The regulations further define the effects of the action as "all consequences to listed species or critical habitat that are caused by the proposed action, including the consequences of other activities that are caused by the proposed action."[13] Evaluation of the effects of an action undertaken by a federal agency (or applicant) that may affect a listed species is the focus of an effects analysis. The principal purpose of the effects analysis is to inform the determination of FWS or NMFS as to whether a proposed action is either likely or not likely to jeopardize the continued existence of a listed species or result in the destruction or adverse modification of its critical habitat.[14] In addition, the effects analysis informs the development of an incidental take statement in circumstances where the proposed action is anticipated to result in incidental take of listed species.[15]

An effects analysis is analogous to other structured decisionmaking procedures, such as risk assessment.[16] Carried out correctly, it is a stepwise process that allows the relevant wildlife agency to use the best available scientific information to draw conclusions regarding the effects of a proposed action, and to devise reasonable and prudent measures to include in an incidental take statement that will minimize the impact of incidental take on the listed species. Broadly speaking, three steps are essential to the effects analysis[17]:

1. Collecting reliable scientific information (that is, the best available scientific information) on the relevant listed species and its critical habitat;
2. Critically assessing and synthesizing available data and analyses, including through the use of quantitative models; and
3. Linking scientific data and model results to resource management options and agency determinations in an assessment of the ecological costs and benefits of the proposed action.

The effects analysis provides an informed evaluation of the effects of a proposed action in the context of an environmental baseline. That noted, it is necessary to distinguish between the action and the environmental baseline in order to evaluate whether the action itself will jeopardize the continued existence of a listed species.[18]

II. Judicial Review of Biological Opinions and Incidental Take Statements

Section 7(a)(2) of the ESA provides that "[i]n fulfilling the requirements of this paragraph, each agency shall use the best scientific and commercial data available."[19] That said, as Börk et al. acknowledge, judicial review of biological opinions and incidental take statements is governed by the Administrative Procedure Act (APA).[20] Section 706(2) of the APA provides that a reviewing court must uphold an agency action unless it is "arbitrary, capricious, an abuse of discretion, or otherwise not in accordance with law."[21] This standard is deferential to the agency, as the U.S. Court of Appeals for the Ninth Circuit explained in upholding the previous biological opinion that analyzed the effects of the CVP and SWP on Delta smelt: "the standard of review is highly deferential; the agency's decision is 'entitled to a presumption of regularity,' and we may not substitute our judgment for that of the agency."[22]

9. 16 U.S.C. §1531(b).
10. *Id.* §1536(a)(2).
11. *Id.*
12. 50 C.F.R. pt. 402 (2020). These regulations most recently were revised by the federal wildlife agencies in August 2019. 84 Fed. Reg. 44976 (Aug. 27, 2019).
13. 50 C.F.R. §402.02 (2020).
14. 16 U.S.C. §1536(a)(2).
15. *Id.* §1536(b)(4)(C); 50 C.F.R. §402.14(i) (2020).
16. Dennis D. Murphy & Paul S. Weiland, *The Route to Best Science in Implementation of the Endangered Species Act's Consultation Mandate: The Benefits of Structured Effects Analysis*, 47 Env't Mgmt. 161 (2010).
17. *Id.* at 165-66; *see also* Robert B. Jacobson et al., Missouri River Scaphirhynchus Albus (Pallid Sturgeon) Effects Analysis—Integrative Report 2016 (2016).
18. Center for Biological Diversity v. U.S. Fish & Wildlife Serv., 807 F.3d 1031, 1051 (9th Cir. 2015); National Wildlife Fed'n v. National Marine Fisheries Serv., 524 F.3d 917, 930, 38 ELR 20099 (9th Cir. 2008). Börk et al. concur that the jeopardy determination is made with respect to the action, referencing both of these cases, but they also advocate for the concept of baseline jeopardy, Börk et al., *supra* note 1, at 10715, which the agency has considered and rejected in notice-and-comment rulemaking, 84 Fed. Reg. 44976, 44987 (Aug. 26, 2019).
19. 16 U.S.C. §1536(a)(2).
20. San Luis & Delta-Mendota Water Auth. v. Jewell, 747 F.3d 581, 601, 44 ELR 20056 (9th Cir. 2014). Börk et al., *supra* note 1, at 10715.
21. 5 U.S.C. §706(2)(A).
22. *San Luis & Delta-Mendota Water Auth.*, 747 F.3d at 601. Put more simply by the U.S. Court of Appeals for the Fifth Circuit, judicial review is based on a "narrow and highly deferential standard." Medina Cnty. Env't Action Ass'n v. Surface Transp. Bd., 602 F.3d 687, 699, 40 ELR 20113 (5th Cir. 2010).

While the Comment's authors do not explicitly opine on the legality of FWS' 2019 biological opinion, they do argue that there are inherent flaws in the Service's approach to the consultation.[23] At the same time, they make a case that assessing the impacts of the proposed action is "very difficult,"[24] "a guessing game,"[25] and "almost impossible."[26] Where an expert agency is making a complex determination in the context of uncertainty and that determination is within the area of expertise of the agency, appellate courts have been clear that the reviewing court should accord significant deference to the agency.[27] The dispute Börk et al. evoke in their Comment is a classic battle of the experts in the face of significant uncertainty. In the context of an agency action being subjected to judicial review, it is largely irrelevant.[28]

III. Evaluation of FWS 2019 Biological Opinion

After providing a brief overview of interagency consultation and describing their assessment of the status of Delta smelt, the authors turn to FWS' 2019 biological opinion. Unfortunately, their description of this complex agency determination, including the effects analysis, is simplistic and falls short in considering the data presentation, analytical treatment of those data, and likely trends in Delta smelt numbers in light of deleterious impacts from the breadth of environmental stressors acting on Delta smelt and its habitat. They assert that FWS' conclusions with respect to effects of the proposed action on Delta smelt are dependent on real-time monitoring, habitat improvements, and reliance on hatchery production of Delta smelt.[29] In doing so, they disregard other components of the action that contribute to mitigating and minimizing impacts of CVP and SWP operations on Delta smelt, including Old and Middle Rivers management, a summer-fall habitat-enhancement action, and predator removal.[30]

At least as important, the authors presume, apparently without conducting analysis, that the proposed action "will likely increase extinction risk for Delta smelt."[31] They go further to argue that "absent wholesale management changes," Delta smelt are likely to go extinct before the biological opinion expires.[32] These conclusions are not the result of a structured decisionmaking exercise akin to effects analysis; rather, they are a reflection of the authors' views.

Whereas Reclamation and FWS take the step of collecting reliable scientific information regarding the effects of the proposed action on the Delta smelt—gathering relevant data, results from pertinent analyses, and findings that accompany those analyses—Börk et al. do not. In fact, even with respect to the small number of issues that they cherry-pick from the biological opinion to evaluate, Börk et al. do not reference or otherwise acknowledge the relevant best available scientific information, as we demonstrate below. Further, while FWS both (1) assesses and synthesizes available data and analyses, including through the use of quantitative models, and (2) links results of analyses and predictions from models to its determinations, Börk et al. neither provide an evidence-based critique of the Service's stepwise effects analysis nor attempt to trace those steps on their own in a parallel effects analysis.

The views of the authors come into sharper relief when they attribute bad faith to FWS, arguing that crafting a "no-jeopardy" biological opinion in the context of a small and declining population, such as the current population of Delta smelt in the wild, "is more an exercise in how to define the environmental baseline and portray limited agency discretion than a serious effort to avoid extinction."[33] This assertion is itself serious and unsubstantiated. Having made the claim, the authors do not attempt to articulate an argument that FWS improperly defined the environmental baseline here. Nor do they attempt to articulate an argument that the Service improperly defined the extent of agency discretion in an overly narrow manner in order to avoid consulting on certain facets of Reclamation's proposed actions.

23. Börk et al., *supra* note 1, at 10717.
24. *Id*. at 10716.
25. *Id*. at 10719.
26. *Id*. at 10721.
27. Baltimore Gas & Elec. Co. v. Natural Res. Def. Council, 462 U.S. 87, 103, 13 ELR 20544 (1983) (holding that a reviewing court must be at its most deferential when reviewing a scientific determination by an agency that is within its special expertise); *see also* Northwest Ecosystem All. v. U.S. Fish & Wildlife Serv., 475 F.3d 1136, 1150, 37 ELR 20034 (9th Cir. 2007) (opining "we must defer to the agency's interpretation of complex scientific data"). Elsewhere we have argued that the degree of deference afforded the federal wildlife agencies by the federal courts is inconsistent with the ESA's requirement that those agencies must use the best available scientific information, but in the same article we acknowledge our position is out of step with recent jurisprudence. Dennis D. Murphy & Paul S. Weiland, *Guidance on the Use of Best Available Science Under the U.S. Endangered Species Act*, 58 Env't Mgmt. 1 (2016).
28. Marsh v. Oregon Natural Res. Council, 490 U.S. 360, 378, 19 ELR 20749 (1989) ("When specialists express conflicting views, an agency must have discretion to rely on the reasonable opinions of its own qualified experts even if, as an original matter, a court might find contrary views more persuasive."); Shafter & Freeman Lakes Env't Conservation Corp. v. Federal Energy Regul. Comm'n, No. 19-1066, slip op. at 25 (D.C. Cir. Mar. 26, 2021) (opining that "when the science is uncertain, courts must 'proceed with particular caution, avoiding all temptation to direct the agency in a choice between rational alternatives'").
29. Börk et al., *supra* note 1, at 10717-21.
30. These components are analyzed in some detail in the biological opinion and summarized in a table describing the components of the proposed action. *See* FWS, *supra* note 3, at 40-49, 51-54, 56.
31. Börk et al., *supra* note 1, at 10714. They reach this conclusion because the Delta smelt population "is so small as to be almost undetectable," *id*. at 10716, so that the species is "in crisis," *id*. at 10721. At the same time, they contend that population estimates of Delta smelt are unreliable, noting that the so-called Enhanced Delta Smelt Monitoring program generated estimates of Delta smelt in 2020 ranging from zero to 1.3 million, *id*. at 10718.
32. *Id*. at 10721.
33. *Id*.

IV. Real-Time Monitoring, Habitat Restoration, and a Conservation Hatchery

As referenced above, the focus of the Comment authors' critique is on three components of the proposed action that are intended to benefit Delta smelt, taken in isolation from the analysis of the effects of the proposed action and other contributing efforts to mitigate and minimize its deleterious effects. The three components are real-time monitoring, habitat restoration, and a conservation hatchery.

The authors correctly identify efforts to monitor the status of Delta smelt, trends in its numbers, and responses of the species to management actions as a challenging endeavor.[34] And they correctly observe that the long-running fish surveys in the upper San Francisco Estuary—even when supplemented with an enhanced Delta smelt monitoring program—do not provide information needed to produce a reliable estimate of Delta smelt numbers and to assess accurately the performance of conservation actions intended to benefit Delta smelt.[35]

But when the authors observe that "standard surveys that once readily found smelt no longer detect them," and "[s]pecial surveys designed to catch Delta smelt find them only rarely," on the way to concluding that "there are too few Delta smelt to detect in a meaningful way,"[36] they miss the mark. Individual organisms in small populations are detected "meaningfully" when monitoring is designed to sample comprehensively the landscape areas occupied by them and overcome impediments to encountering them.[37] Reclamation has initiated an effort to improve upon the standing data-collection scheme via the Delta Coordination Group, as contemplated in its proposed action.[38] Börk et al.'s argument that in the meantime the agencies should dispense with real-time monitoring as one of the numerous tools used to determine the circumstances in which the agencies should restrict operations to minimize entrainment defies logic. As the Ninth Circuit explains, FWS is required to act on the basis of the best available data, not on the best data possible.[39]

Reclamation and FWS use real-time monitoring in conjunction with a Delta smelt life-cycle model and hydrodynamic modeling to determine the circumstances in which the agencies should restrict water export operations to minimize entrainment.[40] Thus, the agencies propose to use the best available data and contemporary modeling tools to inform efforts to minimize take. While Börk et al. characterize management informed by real-time monitoring as "a guessing game,"[41] they fail to make the case that the agencies erred by disregarding available data or failing to utilize available analytical tools.[42]

Further, the authors are critical of FWS for its use of surrogates for Delta smelt or environmental proxy measures for the species' local occurrences.[43] It is unclear what they would have the Service do, in light of their position that monitoring for the species is inadequate and monitoring for surrogates for the species is inadequate. In any event, FWS is on reasonable footing when it uses turbidity as a surrogate for Delta smelt detection to restrict water export operations in the south Delta.

"Integrated early winter pulse protection" and "turbidity bridge avoidance" are the two components of the agency effort to minimize take that rely on turbidity as a surrogate to trigger adjustments in water export volumes in the 2019 biological opinion.[44] Analyses indicating that Delta smelt have an affinity for turbidity are referenced in the biological opinion.[45] If anything, the turbidity-related minimization measures are overly protective rather than under-protective in light of distributional data demonstrating that the vast majority of Delta smelt reside outside the south Delta throughout the fish's life cycle,[46] and the fact that Delta smelt are often absent from turbid waters.

The authors are also critical of Reclamation and FWS for their decision to incorporate restoration of 8,000 acres of tidal and subtidal habitat into the proposed action. They pose the rhetorical question, "how likely is habitat restoration to support the flagging smelt population?"[47] Without reference to empirical research, they assert that "there is probably not enough additional habitat (or water) to increase Delta smelt numbers significantly."[48] This is pure

34. *Id.* at 10718.
35. *Id.*
36. *Id.* at 10716, 10719.
37. Lyman L. McDonald, *Sampling Rare Populations*, *in* Sampling Rare or Elusive Species (William L. Thompson ed., Island Press 2004).
38. FWS, *supra* note 3, at 53.
39. San Luis & Delta-Mendota Water Auth. v. Jewell, 747 F.3d 581, 602, 44 ELR 20056 (9th Cir. 2014) (quoting Building Indus. Ass'n v. Norton, 247 F.3d 1241, 1246 (D.C. Cir. 2001)).
40. FWS, *supra* note 3, at 41-47, 151.
41. Börk et al., *supra* note 1, at 10719.
42. *Compare San Luis & Delta-Mendota Water Auth.*, 747 F.3d at 602.
43. Börk et al., *supra* note 1, at 10719 n.42.
44. FWS, *supra* note 3, at 40-42.
45. *E.g.*, *id.* at 104 (citing, inter alia, Lenny F. Grimaldo et al., *Factors Affecting Fish Entrainment Into Massive Water Diversions in a Tidal Freshwater Estuary: Can Fish Losses Be Managed?*, 29 N. Am. J. Fisheries Mgmt. 1253 (2009)).
46. The vast majority of Delta smelt reside in an area that spans from the Cache Slough complex in the north Delta west into Suisun Bay and Suisun Marsh. Peter B. Moyle et al., *Delta Smelt: Life History and Decline of a Once-Abundant Species in the San Francisco Estuary*, 14(2) San Francisco Estuary & Watershed Sci. 3-4 (2016). This area is referred to as the Northern Arc. Historical trawl survey data demonstrate that 90+% of the distribution of Delta smelt is outside of the zone of influence of Delta flows to the water export facilities during all but a brief period in the spring when some subjuveniles and juveniles appear to disperse into portions of the south Delta. Dennis D. Murphy & Paul S. Weiland, *The Low-Salinity Zone in the San Francisco Estuary as a Proxy for Delta Smelt Habitat: A Case Study in the Misuse of Surrogates in Conservation Planning*, 105 Ecological Indicators 29, 30 (2019).

    While Börk et al. contend that the south Delta was "an important part of the historic range of Delta smelt," Börk et al., *supra* note 1, at 10716, and that south Delta habitat for the species "must be restored," *id.* at 10719, there is a paucity of evidence that the south Delta was historically habitat for the species, and any Delta smelt habitat restoration efforts in the south Delta are almost certain to fail in light of present and anticipated future conditions in the area. *See* Alison Whipple et al., San Francisco Estuary Institute-Aquatic Science Center, Sacramento-San Joaquin Delta Historical Ecology Investigation: Exploring Pattern and Process (2012), https://www.sfei.org/sites/default/files/biblio_files/Delta_HistoricalEcologyStudy_SFEI_ASC_2012_lowres.pdf.
47. Börk et al., *supra* note 1, at 10719.
48. *Id.*

speculation. If the population is as small as the authors assume, then even a modest amount of habitat restoration could be beneficial. Habitat conditions can frequently be locally unsuitable for one or more life stages in any given season, particularly in years with extremely high or low through-Delta flows; therefore, Delta smelt are likely to benefit from targeted habitat restoration efforts.[49]

After arguing that habitat restoration cannot be expected to yield benefits for Delta smelt, Börk et al. claim that "[t]he 8,000 acres scattered around the Delta are insufficient to maintain even a small self-sustaining smelt population."[50] This claim and the subsequent argument that "habitat restoration must at a minimum include multiple large sites adjacent to the open water corridors,"[51] are advanced without reference to empirical research.[52] Further, their suggestion that restored habitat must, by itself, maintain a self-sustaining population of Delta smelt, is flawed both on legal and scientific grounds.

From a legal standpoint, the relevant inquiry is whether it was arbitrary for FWS to conclude that habitat restoration will improve food availability for Delta smelt, which is anticipated to have the effect of increasing Delta smelt abundance.[53] To support a no-jeopardy determination, the agency was not obliged to determine that restored habitat, by itself, must support a self-sustaining Delta smelt population. From a scientific standpoint, the point of habitat restoration is to supplement rather than supplant existing habitat. Strategic habitat restoration would ordinarily be pursued adjacent to existing, high-quality habitat in order to maximize the benefits for the species.[54] There is no scientific support for the vague claim that habitat restoration will not succeed, hence should not be undertaken, unless it were to include multiple large sites.

The authors conclude their suite of arguments that habitat restoration is an exercise in futility with the argument that "the population is small enough that individuals may be unable to find both mates (the Allee effect) and suitable spawning habitat."[55] The decreasing numbers of Delta smelt surviving in a patchy distribution is the reason for, not an argument against, habitat restoration—particularly in areas adjacent to those currently occupied by Delta smelt—and habitat enhancement—where Delta smelt numbers are likely to respond to directed management actions that ameliorate localized degraded habitat conditions. In the event that the population is so low that reproduction is foreclosed, the wild population is then functionally extinct, and the authors' objections to a conservation hatchery, discussed next, are inexplicable.

The Comment authors are critical of FWS' decision to pursue captive breeding of Delta smelt through the development of a conservation hatchery, asserting that the effort "has a high risk of failure."[56] They make the case that salmon hatcheries demonstrate the difficulties the Service will face in developing a conservation hatchery for Delta smelt.[57] This analogy is misleading—salmon hatcheries operated for the purpose of conservation can be effective.[58] Salmon hatcheries that compromise conservation efforts typically result from a focus on operations to maximize production to support commercial and recreational fisheries, rather than for conservation purposes.[59]

Captive breeding of endangered species is challenging, but it has been a critically important component of

49. Recent analyses show that the selection and implementation of management actions in habitat restoration and enhancement efforts can target specific locations where environmental-factor conditions may seasonally or periodically become unacceptable to one or more Delta smelt life stages. *E.g.*, Scott A. Hamilton & Dennis D. Murphy, *Use of Affinity Analysis to Guide Habitat Restoration and Enhancement for the Imperiled Delta Smelt*, 43 Endangered Species Rsch. 103 (2020); Scott A. Hamilton & Dennis D. Murphy, *Analysis of Limiting Factors Across the Life Cycle of Delta Smelt*, 62 Env't Mgmt. 365 (2018). See also Brian Mahardja et al., *Role of Freshwater Floodplain-Tidal Slough Complex in the Persistence of the Endangered Delta Smelt*, 14 PLoS One e0208084 (2019), for an assessment of a site-specific management action and its outcomes under varying environmental (water-year) conditions.
50. Börk et al., *supra* note 1, at 10719.
51. *Id.*
52. For example, the authors fail to reference investigations that document the distribution of Delta smelt, hence the distribution of its habitat. Joseph E. Merz et al., *Spatial Perspective for Delta Smelt: A Summary of Contemporary Survey Data*, 97 Cal. Fish & Game 164 (2011); Dennis D. Murphy & Scott A. Hamilton, *Eastward Migration or Marsh-Ward Dispersal: Exercising Survey Data to Elicit an Understanding of Seasonal Movement in Delta Smelt*, 11(3) San Francisco Estuary & Watershed Sci. 1-20 (2013).
53. This is the determination by FWS that the agency then relied upon when determining that the components of the proposed action, taken as a whole, are not likely to jeopardize the continued existence of Delta smelt. *See* FWS, *supra* note 3, at 220.
54. Examples of recent habitat restoration projects implemented in the Northern Arc, where most of the high-quality Delta smelt habitat exists, include the Tule Red Habitat Restoration Project in Suisun Marsh and the Lower Yolo Ranch Tidal Habitat Restoration Project in the southern Yolo Bypass. Information on these and other Delta smelt habitat restoration projects can be found on the California EcoRestore website, https://water.ca.gov/Programs/All-Programs/EcoRestore (last visited May 16, 2021). While we concur with Börk et al. that restoration of habitat that does not overlap with the Delta smelt's contemporary distribution would be problematic, there is no evidence that Reclamation and the California Department of Water Resources are pursuing habitat restoration at locations outside the Delta smelt's recent historical distribution.
55. Börk et al., *supra* note 1, at 10720.
56. *Id.*
57. *Id.* The authors cite to Paul Stanton Kibel, *Salmon Lessons for the Delta Smelt: Unjustified Reliance on Hatcheries in the USFWS October 2019 Biological Opinion*, 47 Ecology L. Currents 209 (2020), to support their position. Kibel makes the widely acknowledged point that salmon hatcheries constructed decades ago and operated to maximize production have harmful impacts on wild runs of species of conservation concern. But he does not distinguish between those hatcheries focused on production and conservation hatcheries. In addition, he implies, without evidence, that FWS would make the same mistakes made in the past. And he characterizes the federal government's approach to minimizing and mitigating CVP and SWP impacts on Delta smelt as a hatchery-reliant strategy, which inappropriately ignores other components of the action.
58. Recent research on the contribution of hatchery winter-run Chinook salmon to conservation efforts indicates the Livingston Stone National Fish Hatchery is supplementing the winter-run Chinook salmon population and contributing to the overall health and diversity of the population. Neil Thompson, Delta Stewardship Council Delta Science Program & California Sea Grant, Evaluating Contributions of Hatchery-Origin Fish to Conservation of Endangered Sacramento River Winter-Run Chinook Salmon During a Drought (2019), https://caseagrant.ucsd.edu/sites/default/files/Thompson.Profile.2019.pdf.
59. California Hatchery Scientific Review Group, California Hatchery Review Report 1 (2012) (prepared for FWS and Pacific States Marine Fisheries Commission), http://cahatcheryreview.com/wp-content/uploads/2012/08/CA%20Hatchery%20Review%20Report%20Final%207-31-12.pdf ("Most hatcheries were producing fish for harvest primarily to mitigate for past habitat loss (rather than for conservation of at-risk populations) and were not taking into account the effects of their programs on naturally spawning populations.").

a broader conservation strategy. FWS has implemented captive breeding as a key component of a broader conservation strategy for the California condor,[60] Mexican wolf,[61] and whooping crane,[62] among other species. While none of those species has been delisted, the captive breeding program for each has been essential to the survival of the species and has contributed to significant increases in the wild populations. For example, captive breeding and release of individuals in the wild played a fundamental role in increasing the whooping crane population from a low of just 22 individuals in the 1940s to more than 700 today.[63] Recovery plans for the pallid sturgeon and Topeka shiner incorporate captive breeding as essential elements of their respective recovery strategies.[64] In each of those cases, in contrast to the salmon example, the focus of the captive breeding effort was on species conservation,[65] not maximizing production for the purpose of harvest.

Doubtless captive breeding of Delta smelt, a short-lived species that has high reproductive output, poses distinct and significant challenges. But in light of the precarious status of the species, as the Comment authors go to pains to describe, the contention that development of a conservation hatchery for Delta smelt by Reclamation and FWS is unsupported and unlawful, is unpersuasive. Scientists across federal and state agencies and academia—including one of the Comment's co-authors, Peter Moyle—have indicated a captive breeding program could contribute to the conservation of Delta smelt.[66] JoAnna Lessard and 13 colleagues—including another Comment co-author, Tien-Chieh Hung—state that "the status of Delta smelt is serious enough that hatchery supplementation needs to be considered as part of future management strategies developed within a decision-analysis framework."[67] This does not diminish the challenges associated with implementing hatchery supplementation.[68] But the Comment authors have simply failed to make the case that implementation of a conservation hatchery is misguided, much less arbitrary.

V. Introduction to Novel Habitats and a Water Allocation

After concluding that FWS' approach to completing the effects analysis has "inherent flaws,"[69] and stating that no actions in the Service's biological opinion "will change its population trajectory for the better,"[70] the Comment authors go on to advocate for an alternative approach. In doing so, they contend that "[f]ocusing on increasing smelt numbers could increase the population, making future [biological opinions] more defensible."[71] Notably, this approach has not been informed by an analysis of the effects of the action on Delta smelt; rather, it appears that the authors have identified "aggressive experimental actions" they believe are superior to the three components of Reclamation's proposed action that are the focus of their discontent. The two actions they advocate are assisted migration of Delta smelt into novel habitats, and creation of a water allocation for Delta smelt.[72]

The Comment authors contend that assisted migration of Delta smelt into novel habitats "could enhance genetic diversity and provide another backup habitat to prevent extinction."[73] More specifically, they appear to be advocating for transplanting Delta smelt to deep, cold reservoirs.[74] It is perplexing that they make the case for transplanting Delta smelt from the Delta to freshwater reservoirs for a number of reasons. First and foremost, it is unclear why the authors believe that Delta smelt, a euryhaline fish that is endemic to a brackish estuary,[75] will persist in freshwater reservoirs. It is believed that euryhaline fishes, such as Delta smelt, are able to eliminate external parasites by spending some portion of their life cycle in brackish water.[76] In any event, we are unaware of any research to assess whether Delta smelt have the potential to persist in freshwater reservoirs, and it would be irresponsible for FWS to commence a transplantation effort absent such information.[77]

60. FWS, Recovery Plan for the California Condor (1996).
61. FWS, Mexican Wolf Recovery Plan, First Revision (2017).
62. FWS, International Recovery Plan for the Whooping Crane (Crus Americana) (Third Revision) (2007).
63. Press Release, U.S. Geological Survey, Significant Milestone in Whooping Crane Recovery (Mar. 13, 2019), https://www.usgs.gov/news/significant-milestone-whooping-crane-recovery.
64. FWS, Revised Recovery Plan for the Pallid Sturgeon (Scaphirhynchus Albus) (2014), http://www.pallidsturgeon.org/wp-content/uploads/2012/11/Pallid-Sturgeon-Recovery-Plan-First-Revision-signed-version-012914_3.pdf; FWS, Draft Recovery Plan for the Topeka Shiner (Notropis Topeka) (2019), https://ecos.fws.gov/docs/recovery_plan/20190920_Topeka%20Shiner%20Draft%20Recovery%20Plan_signed_OCR.pdf.
65. Documentation on the science of captive rearing prepared with respect to the pallid sturgeon provides valuable guidance. FWS, Range-Wide Pallid Sturgeon Propagation Plan (2019); Eric A. Scholl et al., Density of Pallid Sturgeon and Food Web Dynamics in the Missouri River: Inferences Regarding Carrying Capacity and Density-Dependent Response of Pallid Sturgeon to the Contemporary Stocking Protocol (undated).
66. JoAnna Lessard et al., *Considerations for the Use of Captive-Reared Delta Smelt for Species Recovery and Research*, 16(3) San Francisco Estuary & Watershed Sci. 11 (2018); Moyle et al., *supra* note 46.
67. Lessard et al., *supra* note 66, at 11.
68. Noel F.R. Snyder et al., *Limitations of Captive Breeding in Endangered Species Recovery*, 10 Conservation Biology 338 (1996) (describing problems with captive breeding for species recovery and the circumstances in which it can play a crucial role).
69. Börk et al., *supra* note 1, at 10717.
70. *Id.* at 10721.
71. *Id.*
72. Notably, one of the actions involves translocation of Delta smelt to freshwater reservoirs that do not experience the type of dynamic flow conditions present in an estuary, and the other is premised on some combination of reliance of the species on brackish conditions and an increase in water flowing through the estuarine areas that constitute habitat for the Delta smelt. Logic would dictate that the likelihood that both these actions would benefit a species is vanishingly small.
73. Börk et al., *supra* note 1, at 10722.
74. *Id.* at 10721.
75. Peter B. Moyle, Inland Fishes of California 228 (revised and expanded 2002).
76. William A. Wurts, *Why Can Some Fish Live in Freshwater, Some in Salt Water, and Some in Both?*, 29 World Aquaculture 65 (1998).
77. Börk et al. appear to make the case that the success of species other than the Delta smelt in persisting and surviving in non-native habitats "raise[s] the possibility that Delta smelt could survive in some California reservoirs." Börk et al., *supra* note 1, at 10722. They point, for example, to rainbow smelt that are not native in the Great Lakes, but have persisted in an expanded range across that system over the past century. But there are important differences in the life histories of the two species; specifically, the rainbow smelt is quite adaptable, exhibiting anadromous and freshwater resident be-

Even if researchers establish that Delta smelt have the potential to persist in freshwater reservoirs, and that existing reservoirs have the environmental attributes necessary to support the species over time, the authors do not explain how they would propose to capture wild Delta smelt in sufficient numbers to establish one or more reservoir populations. The obstacles to any such effort appear insurmountable, including, principally, the inability to readily capture Delta smelt in large numbers in the wild, and the permitting obstacles given the potential for loss of individuals during capture and translocation. The logical source of Delta smelt for any such effort would be a conservation hatchery, but the authors are critical of agency efforts to establish a hatchery. Their position that a hatchery has a high risk of failure, while promoting Delta smelt translocation to freshwater reservoirs, is plainly a conservation strategy that lacks support from the best available science.

The Comment authors also argue that creation of a "water allocation" for Delta smelt—a volume of through-Delta flow that would be intended to directly benefit Delta smelt—would provide increased water for the species and offer a flexible approach to using that water.[78] They go on to suggest that some portion of that water "could be sold to provide necessary restoration funding."[79] The premise of this component of the conservation approach being advocated is that there are insufficient quantities of water flowing through the Delta and out to San Francisco Bay and the Pacific Ocean to support Delta smelt across its geographic range in the upper San Francisco Estuary. But the authors cite to no analyses to support their position that if Californians allocate "perhaps one or two million acre-feet per year"[80] to Delta smelt, then one could expect to see tangible benefits for the species.[81] In fact, published analyses spanning three decades have found that Delta smelt abundance has no discernible relationship to the location and extent of the low-salinity zone (a proxy for water flowing through the Delta).[82]

In any event, the existing regulatory regime provides multiple means for the operators of the CVP and SWP (that is, Reclamation and the California Department of Water Resources, respectively) and federal and state regulatory agencies to allocate water to benefit Delta smelt or other species or the ecosystem that supports them. For example, as the 2019 biological opinion explains, Reclamation and the California Department of Water Resources include a "summer-fall habitat action" intended to maintain X2,[83] a proxy measure for the position of the low-salinity zone, at a proscribed location in the Delta in September and October of above-normal and wet water years.[84] This requirement must be met through a combination of reservoir releases upstream from the Delta and water export reductions from the south Delta, and it equates to a water allocation intended to benefit Delta smelt.

Further, restrictions on water export reductions during the winter and spring to protect Delta smelt and other listed fish, such as Chinook salmon runs, have the practical effect of increasing outflow in some circumstances. The resultant outflow is tantamount to a water allocation both for the species that triggers the reduction in exports and for other species that potentially can benefit from such outflow.[85] What these examples demonstrate is that multiple regulatory agencies have the authority to require water to be dedicated to protect Delta smelt and other species so that a separate water allocation is unnecessary.

VI. Conclusion

In light of the uncertain demographic status of the Delta smelt, the Comment authors' instincts to question the premises for the conservation measures and minimization measures incorporated into Reclamation's proposed action, and evaluated as components of that action in the

haviors in response to varying environmental conditions across their broad native and non-native geographic range, Andrew J. O'Malley, *Size and Age Structure of Anadromous and Landlocked Populations of Rainbow Smelt*, 37 N. Am. J. Fisheries Mgmt. 326 (2017), whereas the Delta smelt is confined to the low-salinity and freshwater reaches of the San Francisco Estuary, William A. Bennett, *Critical Assessment of the Delta Smelt Population in the San Francisco Estuary, California*, 3(2) San Francisco Estuary & Watershed Sci. 9 (2005).

Likewise, there are important life history differences between Delta smelt and Chinook salmon, steelhead, or even wakasagi, a closely related congener of Delta smelt. As a consequence of those life history differences, it would be improper to presume that any of the species of comparison are reliable surrogates for Delta smelt. In any event, it would be irresponsible for FWS to adopt translocation to freshwater reservoirs as a conservation measure, relying on a surrogate relationship, without first validating that relationship. Dennis D. Murphy & Paul S. Weiland, *The Use of Surrogates in Implementation of the Federal Endangered Species Act—Proposed Fixes to a Proposed Rule*, 4 J. Env't Stud. & Sci. 156 (2014); Dennis D. Murphy et al., *A Critical Assessment of the Use of Surrogate Species in Conservation Planning in the Sacramento-San Joaquin Delta, California (U.S.A.)*, 25 Conservation Biology 873 (2011); Seth J. Wenger, *Use of Surrogates to Predict the Stressor Response of Imperiled Species*, 22 Conservation Biology 1564 (2008); Tim Caro et al., *Use of Substitute Species in Conservation Biology*, 19 Conservation Biology 1821 (2005).

78. Börk et al., *supra* note 1, at 10722.
79. *Id.*
80. *Id.*
81. The price of an acre-foot of water fluctuates from year to year, but the water allocation the authors describe could be expected to cost hundreds of millions to more than a billion dollars annually.
82. Alan D. Jassby et al., *Isohaline Position as a Habitat Indicator for Estuarine Populations*, 5 Ecological Applications 272, 279 (1995) (analyzing whether there is a statistically verifiable relationship between outflow and the abundance of numerous aquatic organisms including Delta smelt and not finding such a relationship for Delta smelt); Wim J. Kimmerer, *Effects of Freshwater Flow on Abundance of Estuarine Organisms: Physical Effects or Trophic Linkages?*, 243 Marine Ecology Progress Series 39, 47 (2002) (analyzing whether freshwater outflow influences the abundance of various estuarine organisms including Delta smelt and finding no discernible relationship between outflow and Delta smelt abundance); Ralph Mac Nally et al., *Analysis of Pelagic Species Declines in the Upper San Francisco Estuary Using Multivariate Autoregressive Modeling (MAR)*, 20 Ecological Applications 1417, 1425 (2010) (using multivariate autoregressive modeling to analyze Delta smelt and three other aquatic species and not finding a relationship between Delta smelt abundance and outflow in the spring or fall).
83. X2 is the distance from the Golden Gate Bridge, where San Francisco Bay meets the Pacific Ocean, to the location of the two parts per thousand isohaline in the upper estuary.
84. FWS, *supra* note 3, at 51.
85. *Id.* at 40-49 (establishing water export reductions to protect Delta smelt); *see also* California Department of Fish and Wildlife, Incidental Take Permit No. 2081-2019-066-00 84-94 (2019) (establishing water export reductions to protect Delta smelt and Chinook salmon).

2019 biological opinion, are reasonable. In selecting conservation measures, Reclamation is obliged to "use the best scientific and commercial data available."[86] FWS is bound by the same standard when determining whether the proposed action, taken as a whole and including conservation and minimization measures, is likely to "jeopardize the continued existence" of the Delta smelt. Probing conservation and minimization measures using best professional standards of scientific practice to assess their effectiveness and efficacy is essential to determining whether those measures should be continued, refined, or reconsidered.

Monitoring, annual reporting, and use of independent review panels—all elements of the terms and conditions imposed by FWS on Reclamation and the California Department of Water Resources—provide the federal agencies with feedback regarding the performance of the measures. Researchers and modelers can analyze and assess whether conservation and minimization measures are likely to achieve or have achieved their objectives. But the authors' Comment does not offer technical analysis, evaluative assessment, or a fresh interpretation of available scientific information that might better resolve or otherwise advance the management action plan for Delta smelt. For that reason, although the subject matter certainly merits critical attention, their commentary has to be viewed as an opportunity lost.

86. 16 U.S.C. §1536(a)(2).