February 14, 2025

California Department of Fish and Wildlife
Wildlife Diversity Program
Attention: Dr. Anne Hilborn

Via email to wildlifemgmt@wildlife.ca.gov

Re: Response of the American Clean Power Association – California and California Wind Energy Association to the *Petition before the California Fish and Game Commission to List California Populations of the Western Burrowing Owl (*Athene cunicularia hypugaea*) as Endangered or Threatened under the California Endangered Species Act*

This letter and attachment respond to the characterization of the impacts of wind turbines on burrowing owls presented in the *Petition before the California Fish and Game Commission to List California Populations of the Western Burrowing Owl (*Athene cunicularia hypugaea*) as Endangered or Threatened under the California Endangered Species Act* (Center for Biological Diversity et al. 2024; hereafter referred to as *the Petition*). The attachment contains a thorough scientific review of the Petition's assessment of the science on the impacts of wind turbines on burrowing owls.

The American Clean Power Association – California ("ACP-CA") is a state project of the American Clean Power Association, representing companies that develop, own, and operate utility-scale solar, storage, land-based wind, offshore wind, enhanced geothermal, conventional geothermal, and transmission assets to power a clean and renewable economy for California and the West.

The California Wind Energy Association ("CalWEA") is a 23-year-old trade association representing wind energy industry members focused on operating and developing wind energy resources within and directly interconnected to California, and off the coast of California, as well as capturing the related economic and workforce development benefits for California.

ACP-CA and CalWEA submit these comments to inform the California Department of Fish and Wildlife ("Department") in its review of the *Petition*. We suggest that the Department completely disregard the information presented in the *Petition* concerning the impact of operating wind turbines on burrowing owls and conduct its own analysis in its evaluation of the *Petition*.

That operating wind turbines can result in burrowing owl fatalities is not in dispute. However, the *Petition* cannot be used as a reliable source of information on the relationship between burrowing owl fatalities and wind turbine operation for the following reasons, as explained in the attached scientific review:

- It presents a brief, inaccurate discussion of the effects of repowering (i.e., replacing older-generation turbines with modern turbines) that omits much of the available data.

- It provides an "estimate" of the number of burrowing owls killed annually by wind turbines in California that was derived by extrapolating an incorrect fatality rate to the installed capacity across the state; currently available evidence indicates this estimate is inflated by an order of magnitude.
- It contains an extensive discussion of the impacts of older-generation turbines (generally those turbines with a nameplate capacity of < 0.66 MW) in a unique geographic location that are no longer extant and thus have no bearing on the current impact of wind turbines on burrowing owls. Much of the discussion in the *Petition* relies in one way or another on this inappropriate older body of work that is itself replete with uncertainty, poor study design, incorrect statistical analyses, and conclusions not supported by the data.

The attached scientific review responds solely to the section of the *Petition* addressing the impacts of wind turbines on burrowing owls and discusses the three main topics noted above.

Thank you for your consideration of these comments.

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Scientific Review of the Characterization of Impacts of Wind Turbines on Burrowing Owls Presented in the 2024 *Petition before the California Fish and Game Commission to List California Populations of the Western Burrowing Owl (*Athene cunicularia hypugaea*) as Endangered or Threatened under the California Endangered Species Act*

Effects of Repowering on Burrowing Owl Fatality Rates

The Department should accurately account for the effect of turbine repowering in its status assessment of the burrowing owl, as the best available scientific information indicates that fatality rates at repowered turbines are 86-89% lower than rates before repowering. This important fact was omitted from the *Petition*. The discussion of repowering in the *Petition* is incomplete and unclear at best. The discussion begins by stating the following:

> Smallwood (2023b) summarized burrowing owl fatalities documented in APWRA [Altamont Pass Wind Resource Area] from 1998-2020, and changes over time with greater MW capacity and fewer turbines (repowering). Annual estimated fatalities/MW were 1.148 for facilities <0.66 MW; 0.796 for facilities 0.66-1 MW; and 0.307 for facilities >1 MW. (Center for Biological Diversity et al. 2024:94)

There is no subsequent discussion of these values, although the values imply that larger-capacity turbines have a lower fatality rate than smaller ones. The citation supporting this statement is Smallwood (2023b; cited in this letter as Smallwood 2023), a presentation given at a symposium on burrowing owls for which only an abstract is available, and thus the information cited in the *Petition* cannot be verified. Additionally, the disparity between the information presented in the *Petition* and the information presented in the abstract indicates that the *Petition* authors provided the wrong citation for the statement.

Source verification aside, the quoted values cannot be corroborated with other findings. Based on the sizes of turbines cited in the quote above, the first category corresponds with older-generation turbines, the second category represents the repowered Diablo Winds turbines (the only turbines in the "repowered" class that are smaller than 1MW in the APWRA), and the third corresponds with modern, recently repowered turbines in the APWRA. The fatality rates ascribed to each of the categories defined in the quote above do not correspond with any fatality rates published elsewhere that we could find (Alameda County Community Development Agency 2014; H.T. Harvey and Associates 2024).

To ensure that the Commission has the best and latest data available when making its determination regarding the effects of wind turbine operations on burrowing owls, we offer the following.

The 9-year average burrowing owl fatality rate across the APWRA primarily from non-repowered facilities is 0.66/MW (95% CI = 0.437–0.895) (ICF International 2016). This study, which was not cited in the *Petition*, is unquestionably the best and most reliable study of older-generation turbines in the APWRA for several reasons. Overseen by a Scientific Review Committee convened by Alameda County (with members selected by several stakeholders), the study was conducted continuously over 9 years and improved on previous studies conducted by Smallwood and colleagues by (1) stratifying the APWRA into distinct areas characterized by different turbine types,

geographies, and geographic locations to better control for large sources of variation in fatalities; (2) searching more turbines using shorter search intervals (the time between subsequent searches of a turbine), and (3) using a value for detection probability derived using carcasses obtained from the study area itself during the course of the study (as opposed to "borrowed" or "average" detection probabilities; see the *Other Issues* section below for details). We therefore use this point estimate of the burrowing owl fatality rate as the basis for evaluation of the effects of repowering, even though it is lower than the values presented by Smallwood and colleagues and thus the difference between older-generation turbines and repowered turbines would be less than if the comparison were made with estimates from Smallwood and colleagues.[1]

The most recent data available as of December 2024 from monitoring reports at repowered projects in the APWRA are presented in **Table 1**. The weighted average (weighted by the size of the project in MW) burrowing owl fatality rate of these projects is 0.09/MW or 0.07/MW, depending on which of the two values for detection probability provided in the Vasco Winds Project Final Monitoring Report (Ventus Environmental Solutions 2016) is used. Compared to the 9-year average fatality rate from primarily older-generation turbines (ICF International 2016), the burrowing owl weighted average fatality rate at repowered sites in the APWRA is between 86% and 89% lower than the average 9-year burrowing owl fatality rate prior to repowering.

Table 1. Burrowing Owl Fatality Rates at Five Facilities Repowered and Monitored as of December 31, 2024, in the Altamont Pass Wind Resource Area

Facility	Burrowing Owl Fatality Rate (fatalities/MW)	Size of Project (MW)
Vasco Winds[1]	0.12	78.2
Vasco Winds[2]	0.06	78.2
Golden Hills	0.19	85.9
Golden Hills North	0.04	46
Buena Vista	0.00	57.5
Summit Winds	0.00	78.2
Weighted Average (Vasco[1])	**0.09**	
Weighted Average (Vasco[2])	**0.07**	

Source: Ventus Environmental Solutions 2016
[1] Value based on standard carcass placement trials
[2] Value based on integrated detection probability trials

Estimate of State-Wide Impacts of Wind Turbine Operations on Burrowing Owls

The Department should not use the *Petition's* statewide burrowing owl fatality estimate whatsoever, since our review of a subset of the data available to the Department indicates the *Petition's*

[1] However, it should be noted that ICF International (2016) suffers from some of the same sources of overestimation bias as the studies cited in the *Petition* (bleed-through, background mortality, and to some extent, detection probability; see the *Other Issues* section below for a full description of these sources of overestimation bias).

estimate is inaccurate by at least an order of magnitude. The Department should instead rely on the reliable scientific information presented herein and, if possible, collect and analyze all available data at wind projects statewide.

The *Petition* makes the following claim:

> Based on reviews of numerous fatality monitoring reports from wind and solar projects, Smallwood (2023b) determined that annual collision mortality of burrowing owls averaged 0.185/MW at wind turbines … The California Energy Commission reports that in 2021 the installed capacities of wind … was 6,280 MW for a total of 1,161.8 burrowing owls per year. (Center for Biological Diversity et al. 2024:93)

Like the quoted text in the previous section of this letter, this text cites Smallwood (2023b; in this letter, Smallwood 2023), a source for which only an abstract is available, so the basis for the value of 0.185 burrowing owl fatalities/MW is unknown. This value is substantially higher than the burrowing owl fatality rates of 0.07 and 0.09 fatalities/MW based on the weighted average of all repowered projects in the APWRA provided in Table 1. Given that the APWRA provides some of the best habitat for burrowing owls, golden eagles, and wintering raptors in the state, and is therefore considered to be the highest-risk Wind Resource Area (WRA) for raptors in the state, we would expect a *state-wide fatality rate* to be far lower than the *APWRA-specific fatality rate*. We are thus at a loss to explain or even hypothesize where this 0.185 value came from.

Interestingly, the *Petition* fails to cite information from any other wind facilities in the state, despite acknowledging that the Montezuma Hills WRA has been "extensively studied" (Center for Biological Diversity et al. 2024:93). Table 2 provides burrowing owl fatality rates from six facilities in the Montezuma Hills WRA. It should be noted that we did not attempt to obtain all fatality monitoring reports from the Montezuma Hills WRA. However, the full suite of Montezuma Hills reports should be accessible to the Department through the agency's own project files (and/or at the county level) for the Department to use in its burrowing owl status review. The values provided are from all reports already in the files of our consultant resulting from work performed in the Montezuma Hills WRA from 2011 through 2014 and are provided here as an example of the level of risk to the burrowing owl that exists elsewhere in the state.

Table 2. Burrowing Owl Fatality Rates at Six Facilities Monitored for Avian Fatalities in the Montezuma Hills Wind Resource Area

Facility	Burrowing Owl Fatality Rate (fatalities/MW)	Size of Project (MW)
Shilo 1	0.00	150
Shilo 2	0.00	150
Shilo 3	0.00	102.5
Montezuma 1	0.00	36.8
Solano	0.00	128
High Winds	0.00	162
Weighted Average	0.00	

No turbine-related burrowing owl fatalities were documented in any of these reports, even though the presence of burrowing owls in the vicinity of these wind projects was documented during avian use surveys at all six of these facilities.

Including the zero values from the six projects in the Montezuma Hills WRA in the calculation of the weighted average burrowing owl fatality rate for the APWRA results in a weighted average fatality rate of 0.022 or 0.027 fatalities per MW, depending on which value is used for the Vasco Winds facility. Based on this fatality rate, the number of burrowing owls killed per year at wind energy facilities across the entire state would be 137 or 169 depending on which value is used for the Vasco Winds Facility. These values are an than the value provided in the *Petition*.

The *Petition* states the following:

> The Altamont Pass Wind Resource Area (APWRA) in eastern Alameda County emerged as the site of a key population of burrowing owls in California. Numbers of burrowing owls in the APWRA are substantial, and productivity is high. There is likely also considerable movement of burrowing owls through the APWRA between the Bay Area and the Central Valley. Smallwood et al. (2013) estimated 537 breeding pairs of burrowing owls in the APWRA in 2011. (Center for Biological Diversity et al. 2024:42)

This statement indicates that the *Petition* authors recognize that the APWRA is not representative of other WRAs in the State and is likely to have a higher burrowing owl fatality rate than other WRAs. That being the case, the estimate based on the information provided in Tables 1 and 2 above, despite being at least 85% lower than the value presented in the *Petition*, is also highly likely to be biased high. We've provided it here to demonstrate the inaccuracy of the *Petition's* estimate but are not submitting it as a recommended replacement for a statewide estimate, which should be calculated through a thorough analysis inclusive of all reliable fatality monitoring data available to the Department, and a consideration of the relative risk profiles of facilities across the state.

Other Issues and Errors in the *Petition* Regarding Impacts on Burrowing Owls Resulting from Wind Turbine Operation

The *Petition* authors provide an uncritical recitation of irrelevant and highly flawed information that provides a highly inaccurate characterization of the impacts of operating wind turbines on burrowing owls. Much of the discussion in the *Petition* concerning the impacts on burrowing owls from wind turbine operations is derived from—or relies to some extent on—studies of older-generation turbines (many of which were often inoperable and supported by lattice towers) that are no longer extant; accordingly, the body of evidence presented in the *Petition*, while potentially interesting from the perspective of historical impacts of wind turbine operations on burrowing owls, is irrelevant for characterizing the impact of modern wind turbine operation on burrowing owls. And because these studies were conducted when the science of fatality estimation was in its infancy and are dominated by a single primary investigator, apparently without the statistical or study design expertise to appreciate or fully understand the limitations of the data, the result has been the uncritical acceptance of—and continuing propagation of—unsupported conclusions based on poorly designed studies and analyses by the authors of the *Petition* and presumably by members of the conservation community and the general public.

A review of the science behind the APWRA reports cited in the *Petition* reveals a pattern of overestimation, a lack of understanding about the limitations of the data, and outright errors in the analyses.

For example, according to Smallwood et al. (2013):

> [burrowing owl] estimated fatality rates [in the APWRA] have been 99–380/year (Smallwood et al. 2007) and 241–1,475/year (Smallwood and Karas 2009) during 1998–2002, 736–1,438/year during 2005–2007 (Smallwood and Karas 2009), and 474–960/year during 2005–2009 (Smallwood 2013). The estimates have varied greatly because of a difference in estimation methods applied to data collected during 1998–2002, and because of inter-annual variation in fatalities.

In this section Smallwood et al. (2013) cites three of his own analyses of fatality rates at older-generation turbines but fails to include other estimates he produced using the exact same dataset such as 440 burrowing owls/year (80% CI = -133–1,013) (Smallwood and Thelander 2008, also cited in the *Petition*). The number of different estimates, the variation in point estimates, and the width and characteristics of the confidence intervals is indicative of the unreliability of the estimates. While Smallwood (2013) attributes these differences to annual variation in fatalities, this conclusion is unsupported because detection probability was not measured, and thus there is no way to know if the differences are due to annual variation in fatality rates or annual variation in detection probability (see *Detection Probability* subsection below). The negative value for the lower confidence interval clearly indicates that the variance of that estimate is incorrect—something that should have prevented it from being published at all, especially in a peer-reviewed journal. Indeed, similar work by Smallwood et al. (2010) was criticized by two of the most prominent statisticians working in the field of mortality estimation at wind facilities for poor study design, incorrect statistical analyses, and unsupported conclusions (Huso and Erickson 2010).

All values provided by Smallwood and colleagues cited in the *Petition* are over-estimates and suffer from at least three known sources of error that are important to understand to properly evaluate the conclusions—yet are not discussed in the reports. These include (1) no measurements of detection probability; (2), no estimation or discussion of the effects of bleed-through; and (3) no estimation or discussion of background mortality.

Detection Probability

Not all bird carcasses will be detected during searches, so to estimate the true number of fatalities, estimates of detection probability must be obtained. *Detection probability* is the probability that a searcher will detect a carcass that has been deposited by a wind turbine. If one can accurately estimate the proportion of carcasses that are not found, then a reliable estimate of the true number of carcasses can be calculated by dividing the number of carcasses found by the proportion of carcasses found.

The importance of estimating detection probability when attempting to estimate population size (in this case, the size of the population of animals killed by operating wind turbines) cannot be overstated. For example, the original estimate from Smallwood and Thelander (2004) was 0.66

fatalities/MW/year or 380 total fatalities per year. The value chosen (not measured) for detection probability was "borrowed" from a previous study by a different investigator using different searchers in a different year. In a follow-up publication using the same dataset, the authors chose to use a different value for detection probability that they considered "more accurate" (Smallwood and Thelander 2008), although there is no basis for the "more accurate" claim because the true value was never measured and can therefore never be known. The new estimate was 0.759 fatalities/MW/Year or 440 (80% CI = -133–1,013) burrowing owl deaths per year.

Note that the second fatality estimate represents a 15% increase over the first estimate, and the only difference between the two estimates is the value ***chosen*** for detection probability, which was never measured. Note also the negative confidence interval, which indicates that wind turbines can actually create burrowing owls—a mistake repeated by the author in another publication concerning avian fatality rates at older-generation turbines (Smallwood et al 2010) that, as noted above, was criticized by professional statisticians for poor study design, incorrect statistical analyses, and unsupported conclusions (Huso and Erickson 2010).

The new value for detection probability came from Smallwood (2007) and was based on a compilation of detection probabilities measured in various places across the country to derive an "average" detection probability which, the author argued, could be used to make fatality estimates from different wind power facilities "more comparable." This is an obvious logical fallacy. If the "average" detection probability from Smallwood (2007) is used to compare fatality rates at one facility where the true detection probability is higher than the "average" with another facility where the true detection probability is lower than the "average" then the comparison has been made worse, not better.

There is a vast a body of scientific literature demonstrating that detection probability can vary substantially by year, searcher, season, habitat type, and a host of other factors which, if not accounted for properly, can result in biased estimates of population size and incorrect conclusions about ecological processes (Gu and Swihart 2004, Gimenez et al. 2008, Kéry and Schmidt 2008, Banks-Leite et al. 2011, Kellner and Swihart 2014). The contention in Smallwood (2007) that use of an "average" detection probability improves comparability of different wind energy facilities and his advocacy for using an "average" value instead of measuring detection probability in the field indicates a fundamental misunderstanding of the science behind estimating population size.

As a member of the Scientific Review Committee overseeing one of the largest studies of the impacts of wind turbines on raptors and other birds, Smallwood effectively advocated for terminating carcass placement trials in the field in favor of using his "average" detection probability. The result was an inability to draw any strongly supported conclusions about the effectiveness of any of the management measures implemented during the study based on fatality rates (ICF International 2016).

One example of many incorrect conclusions resulting from a lack of understanding of detection probability (which is reflected in the terminology "adjustment factor") is the conclusion in Smallwood et al. (2013) noted above that "The estimates have varied greatly because of..... inter-annual variation in fatalities." This conclusion cannot be supported because there is no way to know if the inter-annual variation is variation in fatalities or variation in detection probability.

Bleed-Through

A second known and potentially serious overestimation bias common to all studies at older-generation turbines is *bleed-through*, which occurs whenever a carcass is not found during an initial search but is found during a subsequent search. Bleed-through results in an overestimate because carcasses that are missed during an initial search are accounted for when the estimate is "adjusted" for detection probability, but the carcass is then found and included in the total. Therefore, every carcass that is missed on a first search and then found on a subsequent search is essentially counted, and adjusted for, twice. This known source of positive bias has been addressed in the latest fatality estimator GenEst (Dalthrorp et al. 2018), although this estimator cannot be used to "correct" estimates from the older-generation turbines in the APWRA because those studies rely on an "average" detection probability from Smallwood (2007), so no data were collected that could be used to correct for this bias using the new estimator.

Background Mortality

All estimates of burrowing owl mortality at older-generation turbines in the APWRA also suffer from an overestimation bias due to background mortality, an issue that was thoroughly investigated in ICF International (2016). Background mortality results in overestimation bias when a carcass that results from predation or some other factor is attributed to wind turbine collision. The Scientific Review Committee that oversaw the ICF International (2016) study recommended implementation of a background mortality study to address the concern that burrowing owl mortality estimates were unrealistically high. Burrowing owls are known to be predated on by most of the raptors present in the APWRA (Poulin et al. 2020), raptor use of the APWRA increases substantially during the winter, and a substantial proportion of burrowing owl carcasses found are "feather spots", which can result from either scavenging (i.e., a carcass deposited by a wind turbine collision that is eaten by a scavenger resulting in a feather spot) or predation (a bird killed by a predator and plucked and eaten resulting in a feather spot), which precludes an accurate assessment of the cause of death (ICF International 2016).

During the ICF International (2016) study, various "treatments" were implemented to reduce avian mortality, one of which was shutting down turbines during the winter. The duration and intensity of the shutdown increased during the 9-year study, and a complete shutdown of all turbines for 3.5 months (29% of the year), from November 1 through February 15 of each year was implemented for the last 5 years of the study.

An in-depth analysis of the effects of the seasonal shutdown of turbines on burrowing owls strongly supports the hypothesis that predation was a significant factor contributing to the estimates of turbine-related burrowing mortality at older-generation turbines. Findings included the following:

- 48% of all annual burrowing owl fatalities occurred during the shutdown period even though the shutdown period lasted for only 29% of the year and the turbines were not operating during the shutdown period.
- Burrowing owl carcass detection rates were statistically significantly higher during the shutdown period than during the rest of the year.

- Conversely, golden eagles and red-tailed hawk carcass detection rates were statistically significantly lower during the shutdown period than during the rest of the year.
- For almost all small bird species potentially subject to predation for which a large enough sample size was available, carcass detection rates were statistically significantly higher during the shutdown period than during the rest of the year.
- For almost all large bird species in general, and all large predatory birds in particular, including barn owl and great-horned owl, carcass detection rates were statistically significantly lower during the shutdown period than during the rest of the year.
- There was a statistically significant increase over time in the proportion of annual burrowing owl fatalities occurring during the shutdown period as the duration and intensity of the shutdown period increased, a pattern that did not hold for larger predatory species not subject to predation.
- There was a statistically significant increase in use of the APWRA during the shutdown period by large avian predators known to predate on burrowing owls, including red-tailed hawk, golden eagle, peregrine falcon, prairie falcon, ferruginous hawk, rough-legged hawk, and Cooper's hawk.

These patterns were all statistically significant and cannot be accounted for or explained by the hypothesis in Smallwood et al. (2009) that burrowing owls collide with stationary turbines at a higher rate than other birds, a hypothesis repeated as fact in the *Petition* (Center for Biological Diversity et al. 2024:95) and for which there is no basis or evidence. These patterns are, however, consistent with the hypothesis that predatory birds are killing and eating burrowing owls, and those carcasses are then found by searchers and attributed to wind turbine collision.

While it is probable that older-generation turbines in the APWRA facilitated predation on burrowing owls by providing perches from which to hunt (perches that are not present on modern, tubular towers), it is also possible that the analysis of fatality rates has been confounded by predatory birds taking burrowing owl prey to a perch on a turbine tower, and then plucking, consuming, and dropping the carcass remains that were later found by searchers.

The implications of burrowing owl predation being a confounding factor in the analysis of mortality in the APWRA are substantial. The effects of predation were not accounted for when predictions of the effectiveness of hazardous turbine removals (removal of specific turbines identified as being particularly prone to collision risk due to geographic location and other factors) and shutting down turbines in the fall and winter were made (Smallwood and Spiegel 2005a, 2005b, 2005c). The failure to recognize this issue has led to unsupported conclusions about the effectiveness of shutting down turbines during the winter to reduce fatality rates (Smallwood and Bell 2020), and the analyses of factors influencing burrowing owl fatality rates would also be suspect because so many of the fatalities used in the analyses would be predation events rather than actual turbine strikes. In addition, the validity of models developed to micro-site turbines to reduce burrowing owl fatalities based in part on where fatalities were occurring (Smallwood and Bell 2009) would also be suspect. This might explain why Smallwood and Bell (2020) go to such great lengths to mischaracterize the results in ICF International (2016) and refute the predation hypothesis even though their own analysis produced no statistically significant results.

Conclusions

To summarize, the description of the impacts of wind turbines on burrowing owls presented in the *Petition* is incomplete, factually incorrect, biased, unreliable, and not credible. Given the issues elucidated here, ACP-CA and CalWEA strongly recommend that the California Fish and Game Commission and California Department of Fish and Wildlife completely disregard the information presented in the *Petition* concerning the impact of operating wind turbines on burrowing owls and conduct its own analysis in the evaluation of the *Petition*. We will make every effort to assist in this process if needed.

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