Energy and Wildlife Action Coalition
c/o Nossaman LLP
1666 K Street, NW
Suite 500
Washington, DC 20006
www.energyandwildlife.com

August 20, 2018

Comments regarding the Notice of Updated Collision Risk Model Priors for Estimating Eagle Fatalities at Wind Energy Facilities

Submitted by:
Energy and Wildlife Action Coalition

Filed electronically to the attention of:
Public Comments Processing
Attn: FWS–HQ–MB–2017–0092
Division of Policy, Performance, and Management Programs
U.S. Fish and Wildlife Service
MS: BPHC
5275 Leesburg Pike
Falls Church, VA 22041–3803

The Energy and Wildlife Action Coalition ("EWAC")[1] submits these comments in response to the U.S. Fish and Wildlife Service's ("Service's") Notice of Updated Collision Risk Model Priors for Estimating Eagle Fatalities at Wind Energy Facilities (the "Notice").[2] EWAC appreciates that the Service has devoted time and resources to updating its Collision Risk Model ("CRM") priors and also appreciates the opportunity for public review and comment.[3] As you are already aware, EWAC has submitted a request for an extension of time of this public comment period. EWAC believes an extension would be helpful – the Notice did not provide enough data to allow for EWAC to provide a meaningful analysis of the CRM updates. From what EWAC can discern from the limited information provided in the Notice, the results of the CRM are contrary to and unsupported by available data.

The CRM has a significant impact in the eagle permitting process for wind energy projects. The take estimates produced by the CRM are the foundation upon which many of the permitting components are based. Depending on where the take estimate falls within an eagle management unit ("EMU") and the Local Area Population ("LAP"), this estimate impacts the availability of a permit, mitigation requirements, level of National Environmental Policy Act ("NEPA") analysis, and design of the post-construction monitoring program. All of these components have significant time and cost implications for a potential permittee. Moreover, the take estimates generated by the CRM impact the public's perception of projects seeking take authorization under the Bald and Golden Eagle Protection Act ("BGEPA"). Based on the limited information provided in the Notice, it is not clear that at rational basis exists for incorporating the new priors into the BGEPA permit program. Given the significant impact that the take estimate has on the permit process, the new priors should not be used unless and until additional information is provided to the regulated community that supports their use in the permit process.

I. The Federal Register Publication and Prior Analysis Do Not Provide Enough Information to Conduct a Meaningful Analysis, and the Service Should Provide Additional Information before Finalizing Any Updates to the CRM or Its Priors.

As mentioned above, EWAC would be able to provide a more meaningful analysis of the CRM updates if the Service provided more information. As written, the Notice has limited details about the data and approaches used to develop the updates to the CRM priors. Below are a number of areas in which more information would allow for meaningful analysis.

1. **Statistical methods:** The Service did not present the statistical methods used to develop the new priors. EWAC requests information on how the exposure priors and the collision priors were calculated with enough level of detail to allow replication, as would be presented in a scientific publication. In addition, the Service did not provide the parameters for the new priors. EWAC requests that the Service provide the parameters for the new priors for exposure rate and collision probability for bald and golden eagles.

2. **Use of Eagle Observations:** There is a lack of information presented to understand when eagle observations or eagle minutes were used in the Service's analysis. EWAC requests that

[1] EWAC is a national coalition formed in 2014 whose members consist of electric utilities, electric transmission providers, and renewable energy entities operating throughout the United States, and related trade associations. The fundamental goals of EWAC are to evaluate, develop, and promote sound environmental policies for federally protected wildlife and closely related natural resources while ensuring the continued generation and transmission of reliable and affordable electricity. EWAC supports public policies, based on sound science, that protect wildlife and natural resources in a reasonable, consistent, and cost-effective manner.

[2] 83 Fed. Reg. 28,591 (Jun. 20, 2018).

[3] 83 Fed. Reg. 32,071 (July 11, 2018).

the Service provides information regarding when eagle observations were used to estimate eagle minutes and how the Service adjusted eagle observations to eagle minutes.

3. **Fatality Estimate Methods.** The Notice does not provide the methods used to estimate fatality rates for the new collision rate priors, including how the Service addressed "zeroes" in monitoring data. The report suggests an unbiased estimator such as Huso (2009) or Péron et al. (2014) should be used to estimate fatality rates. However, these estimators presented either (1) are biased when the number of fatalities found during monitoring is 10 or fewer, which is inappropriate for eagles (Korner-Nievergelt 2011) or (2) use a multistate capture-recapture protocol (Péron et al. 2014) which is a data structure not found in most post-construction monitoring studies following the recommendations in the USFWS *Land-Based Wind Energy Guidelines* (USFWS 2012). Creating further confusion, the request for comments states "The Service uses models in our update that account for imperfect detection when dead eagles are not encountered during monitoring, because there is ample evidence that finding no dead eagles does not mean there were no eagle fatalities." This implies the use of a statistical method not identified in the CRM publication. Therefore, EWAC requests support for the statement that there is "ample evidence" and more detailed information on methods used to estimate fatality rates, including the specific statistical methods with respect to how zeros were treated in the analysis.

4. **Datasets:** The Service acknowledges that, "...to update the national priors, data must be available from a sufficient number of sites to ensure representation across the nation, both in terms of pre-construction exposure and post-construction fatalities." However, the Notice does not identify the data sets used nor does the Notice provide the criteria by which the Service chose to include or exclude individual datasets. What can be gleaned from the Notice given the small subset of data used, however, is that the Service's "defined set of criteria" for determining the suitability of data from each wind facility was too limiting and should be broadened. The *Eagle Conservation Plan Guidance* ("ECPG") states that the exposure rate prior is meant to include the range of possible exposure rates for any project considered and the collision rate probability distribution attempts to include the range of possible collision probabilities across the set of potential sites to be considered (USFWS 2013). Therefore, the projects selected for inclusion in the dataset to develop new priors should be representative of golden and bald eagle use, from high to low, and should include fatalities across the United States.

Further, we are particularly concerned about the limited datasets used to develop the priors, particularly for bald eagles. Although 419 sites were evaluated, only 13 sites were used for the collision risk priors for bald eagles (3% of sites) and 21 sites were used for golden eagles (5% of sites). This indicates a highly reduced dataset; however, a justification is not provided for the exclusion of individual data sets nor is the geographic range of the datasets identified in the Service's final analysis. Similarly, for exposure priors, 59 sites of the 419 sites (14%) were included for bald eagles and 61 sites (14%) for golden eagles, yet there is no mention of the representation of eagle use among the projects to ensure that the exposure priors captures the ranges from low to high use nor is the geographic range of the final dataset referenced.

EWAC requests that the Service provide the criteria by which agency staff included and excluded the datasets and that all datasets reviewed whether included or excluded be provided to the public for consideration. This dataset should also include more information about the geographic distribution of the projects used to do the analysis, the eagle use of the project and where it falls on a spectrum from high to low, and whether the studies had been developed to estimate bird/bat take as opposed to eagle take (e.g., proportion of facility searched, plot size, species used for bias trials).

II. The collision rate priors presented by the Service are inexplicably higher than expected given available peer-reviewed approaches.

The Notice compares take predictions using the exposure rate presented in New et al. 2015 to the new priors. However, Service staff currently uses the ECPG priors, not the New et al. priors, to evaluate the permitted level of take for a project obtaining an eagle take permit. Therefore, in order to understand the implications of the new priors for real projects, we compared take predictions using the ECPG priors and the new priors. Given that the Service did not provide the details of its methods, EWAC estimated the new priors by assuming that methods similar to those provided in New et al. 2015 and the ECPG had been used to generate the distribution parameters of the priors (see Appendix A of this letter for details). Specifically, we predicted the golden eagle take for 26 wind projects presented in Bay et al. 2016 using the ECPG priors and the new golden eagle priors (Table 1).

The eagle minutes (see Appendix A in Bay et al. 2016) and survey hours (see Table 1 in Bay et al. 2016) were used to update the exposure rate priors to estimate a posterior distribution for exposure rate. The number of turbines and rotor diameter (see Appendix A in Bay et al. 2016) were used to estimate the expansion factor and it was assumed all facilities were operational for 12 hours per day. The ECPG collision probability prior and the new collision probability prior were used to predict fatalities at each facility. The new golden eagle priors predicted higher annual take for all 26 projects.

The biggest difference in predicted take for golden eagles using the new golden eagle priors and the ECPG priors was observed at Klondike (difference = 7.76 eagles per year at the 80th credible interval), followed by Vasco (difference = 4.11), Tuolumne (difference = 2.90 eagles per year), and Alta Oak Creek Mojave (difference = 2.12 eagles per year). These facilities had a lower survey effort (i.e., fewer than 110 hours of survey) relative to other facilities in the dataset and the new golden eagle exposure rate prior had more influence on the predictions relative to the ECPG exposure rate prior.

Foote Creek Rim Phase I and Foot Creek Rim Phases II-II had a difference in predicted take of less than 0.04 golden eagles per year using the new golden eagle priors and the ECPG priors. The facility had 1,290 hours of survey and relatively high eagle use compared to the rest of the projects in the dataset. Therefore, it appears that in these high survey effort, high eagle use projects, the new golden eagle exposure rate prior and the ECPG exposure rate prior had approximately the same influence on the take prediction.

We know from the post-construction mortality data available that this increase in the fatality prediction for golden eagles using the new priors does not provide a more accurate prediction of take for the 26 facilities presented in Bay et al. 2016, but rather increased the over-prediction of eagle fatalities. The number of golden eagle carcasses found during post-construction monitoring and incidentally are presented in Table 1. For most facilities, both the ECPG priors and the new priors provide a conservative take prediction (i.e., overestimate). The new golden eagle priors provide a more conservative take mean golden eagle fatality prediction than the ECPG priors, and over-predict take relative to observed take for 22 of the 26 facilities presented. Eighteen of the 26 facilities did not have eagle fatalities observed during post-construction monitoring. Annual fatality predictions for the 18 facilities with no observed golden eagle fatalities using the new priors ranged from 0.06 to 6.42 golden eagles per year while annual fatality predictions using the ECPG priors ranged from 0.02 to 1.38 golden eagles per year. At four facilities, an average of one eagle fatality was observed per year and using the new priors annual fatality predictions ranged from 2.27 to 4.29 golden eagles per year while annual fatality predictions using the ECPG priors ranged from 2.26 to 4.21 golden eagles per year. The ECPG priors already over-predicted take as compared to the results of the post-construction fatality monitoring. The new CRM priors further over-estimate take predictions. It is an unreasonable result for the updated priors to move further away from actual fatality data, particularly in light of the implications higher take estimates have for prospective permittees.

In addition, the difference between predicted golden eagle take using the new golden eagle priors compared to the ECPG priors was generally smaller for facilities with smaller turbines while the difference was generally larger for facilities with bigger turbines (Figure 1). Turbines with a rotor radius of 50 m or larger are being proposed at new wind facilities; therefore, the new priors will likely produce higher take predictions for golden eagles relative to the ECPG priors for these facilities, despite repowering finding the opposite relationship (Leslie et. Al., 2012). Take predictions for golden eagles using the ECPG priors are currently designed to be conservative (i.e., over-estimate). However, take predictions using the new golden eagle priors will be even more conservative because turbine rotor size are increasing and this change will result in an additional increase in predicted take when using the new golden eagle priors relative to the ECPG priors.

Table 1. Results from post-construction fatality monitoring studies and annual predicted take for golden eagles using the priors presented in the Eagle Conservation Plan Guidance and the new priors.

Facility	Number of Golden Eagle Fatalities Found During Carcass Searches	Number of Golden Eagle Fatalities Found Incidentally	Post-Construction Monitoring Survey Length (months)	Annual Take Prediction (80th Credible Interval): ECPG Priors	Annual Take Prediction (80th Credible Interval): new Golden Eagle Priors
Alta-Oak Creek Mojave (Alta I)	0	0	12.5	0.41 (0.61)	1.05 (1.61)
Alta-Oak Creek Mojave (Alta II-V)	0	2	14.5	0.43 (0.65)	1.81 (2.77)
Campbell Hills	0	1	12	4.21 (6.21)	4.29 (6.58)
Combine Hills	1	0	24	0.39 (0.57)	0.71 (1.09)
Diablo Winds	1	1	24	0.54 (0.80)	0.59 (0.91)
Dry Lake I	0	0	14	0.13 (0.19)	0.29 (0.44)
Dry Lake II	0	0	12	0.13 (0.19)	0.30 (0.45)
Elkhorn	2	0	24	3.28 (4.84)	3.53 (5.41)
Foote Creek Rim (Phase I)	0	0	36	0.96 (1.41)	0.94 (1.44)
Foote Creek Rim (Phase II and III)	1	0	18	0.55 (0.81)	0.54 (0.83)
High Winds	1	1	24	2.26 (3.33)	2.27 (3.49)
Hopkins	0	0	24	0.15 (0.23)	0.59 (0.90)
Kittitas Valley	0	0	12	0.32 (0.48)	0.70 (1.07)
Klondike	0	0	72	1.36 (2.06)	6.42 (9.82)
Leaning Juniper	0	0	24	0.32 (0.47)	0.70 (1.08)
Nine Canyon	0	0	12	0.02 (0.04)	0.17 (0.25)
Shiloh I	1	0	36	0.24 (0.35)	0.38 (0.58)
Shiloh II	0	0	12	0.11 (0.16)	0.27 (0.42)
Stateline	0	0	30	0.67 (0.99)	1.45 (2.22)
Tuolumne	0	0	12	1.38 (2.06)	3.24 (4.97)
Vansycle	0	0	12	0.03 (0.04)	0.06 (0.09)
Vantage	0	0	12	0.14 (0.21)	0.50 (0.77)
Vasco	0	1	12	3.47 (5.16)	6.05 (9.27)
Wessington Springs	0	0	8	0.09 (0.14)	0.41 (0.62)
White Creek	0	0	48	0.17 (0.27)	1.04 (1.59)
Wildhorse	0	0	12	1.21 (1.79)	1.99 (3.06)
Windy Flats	0	0	12	0.37 (0.56)	1.39 (2.13)

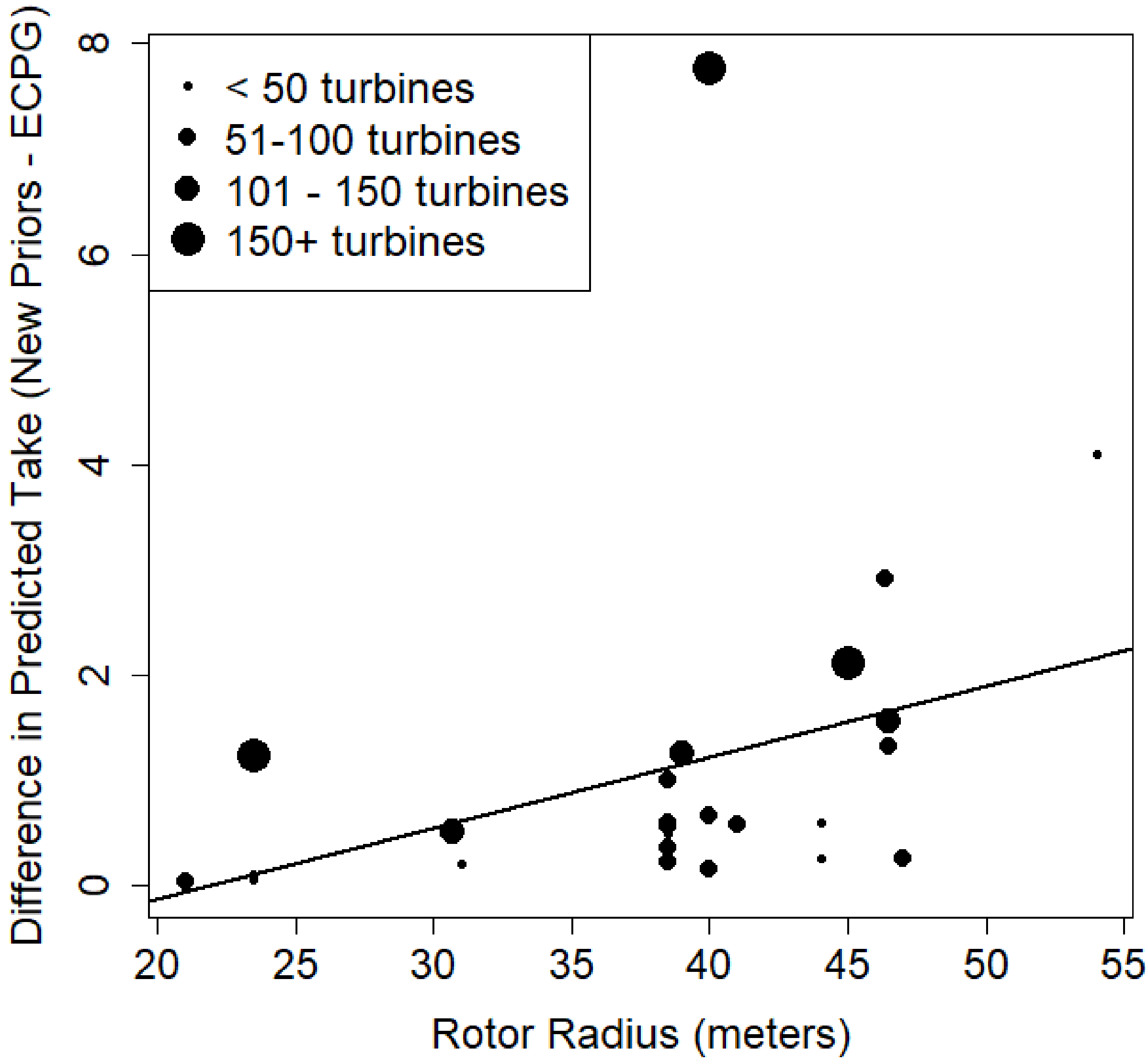

Figure 1. Difference in take annual take predictions for golden eagles for 26 projects in Bay et al. 2016 using the priors presented in the Eagle Conservation Plan Guidance (ECPG) and the new priors by rotor radius.

III. The Results of the Updated CRM Are Counter-Intuitive with respect to bald eagles.

The Notice notes that bald eagle fatality estimates from the new priors are higher than those of golden eagles, and that this result is not counterintuitive. EWAC respectfully disagrees. In the following subsections, EWAC provides biological support, studies, and examples that demonstrate that the Service's conclusion with respect to bald eagles does not align with the best available science. In sum, the use of CRM collision priors that suggest bald eagles are at higher risk for collision than golden eagles, based solely on eagle use and collision data from a few limited sites, would seem to unreasonably ignore significant evidence to the contrary. Accordingly, the new CRM priors should not be used to estimate bald eagle take for purposes of implementing the eagle permit program.

A. Differences in behavior between the two eagle species.

The ECPG notes that there are a wide variety of factors that may put raptors at risk of turbine collision (USFWS 2013). However, a key risk factor that appears to put raptors at particularly high risk is active hunting or diving for prey – a behavior that might distract raptors and presumably makes them more susceptible to turbine collisions (Hunt 2002, Barrios and Rodriguez 2004, Hoover and Morrison 2005, DeLucas et al. 2008, Smallwood et al. 2009). Crucial to this risk factor are differences in foraging habitat selection and flight behaviors between bald and golden eagles, which we believe will result in higher collision risk for golden eagles.

Bald and golden eagles generally have different diets, thus influencing their habitat selection. Golden eagles use a variety of habitats, but are often found in open areas, where open landscapes provide prey resources that frequently include prairie dogs, grounds squirrels, or rabbits (Kochert et al. 2002). Primary habitats for bald eagles are typically tied to large aquatic ecosystems where foraging opportunities are readily available (i.e., fish and waterfowl availability), although they also scavenge in terrestrial landscapes for small mammals or carrion from road kill or livestock operations (Watson et al. 1991, Buehler 2000). Across the U.S., wind turbines are most commonly sited in open landscapes that include grasslands/pasture, shrub-steppe habitats, or cultivated agricultural lands. Generally, these habitats would be expected to provide more typical foraging areas, and thus higher risk areas, for golden eagles compared to bald eagles.

When hunting, golden eagles might more frequently engage in flight behaviors that puts them at higher risk of turbine collisions. Golden eagles are much more active fliers, estimated to spend between 15 and 28 percent of their time flying (depending on sex and season), and more time hunting while in flight than bald eagles (Bergo 1987, Collopy and Edward 1989). In one study, golden eagles spent over 40% of their time in flight "slow gliding", an aerial behavior associated with hunting activity (Bergo 1987). Alternatively, bald eagles tend to spend more time perched and when they are flying, only a relatively small portion of this time is spent actively hunting. For example, bald eagles only spent between 1% and 7% of their daily activity in flight throughout the year; of the time in flight, 56.0% was directional flight and only 3.9% was described as predation flights (Stalmaster and Gessaman 1984, Watson et al. 1991, Buehler 2000). Therefore, the amount of time that bald eagles are engaging in risky behaviors is significantly less than golden eagles.

While the underlying assumption of the Notice is that there is a general relationship between eagle use (i.e., exposure) and fatalities, we suggest the Service more closely consider the specific type of eagle activity. The available information suggests that differences in expected habitat use, daily activity budgets, and, in particular, flight styles are likely to make bald eagles less susceptible to turbine collision than golden eagles.

B. Existing data and studies do not support the contention that behaviors create elevated risk to bald eagles.

In the Notice, there is the suggestion that bald eagles might be at higher risk to collision than golden eagles because bald eagles "engage in social behaviors and intra-specific interactions that may make them more vulnerable than golden eagles to collisions." There are no citations provided for this and we find this argument purely speculative and not supported by the available data on eagle fatalities at wind energy facilities nor by available information on bald eagle flight behaviors.

The bald eagle population in the contiguous U.S. is nearly twice that of golden eagles, the bald eagle population is growing significantly whereas the golden eagle population is stable, and bald eagles have a wider distribution than golden eagles (USFWS 2016a). Nevertheless, eagle carcasses found at wind energy facilities currently suggests that golden eagles are at greater risk to turbine collisions than bald eagles – only 7.1% of carcasses reported by Pagel et al (2013) were from bald eagles, while 92.9% were from golden eagles despite the differences in population size. At a single wind energy facility in Wyoming, as many as 12 golden eagles carcasses were reported (Pagel et al. 2013). Similar levels of bald eagle fatalities have not yet been reported at any wind facilities (Pagel et al. 2013, USFWS 2016a), even though in some cases wind turbines are located in areas with relatively high levels of bald eagle activity. As an example, up to 20% of the contiguous U.S. bald eagle population migrates through or winters in Iowa (IADNR 2007), where there were over 4,000 operating utility-scale wind turbines as of 2012 (AWEA 2017). Although extensive fatality monitoring studies have been completed at wind energy facilities across Iowa, only a three known bald eagles were reported across the state as fatalities at wind energy facilities from 1997 to June 2012 (Pagel et al. 2013). If the Service has data supporting a different conclusion, EWAC request that it be presented to support the conclusions drawn.

Only a relatively small percentage of time that bald eagles are flying actually involves social or intra-specific interactions such as territorial aggression among eagles (Watson et al. 1991, Buehler 2000), making the contention that these behaviors put bald eagles at high risk for collision seems unlikely, given that these behaviors are undertaken by both bald and golden eagles (Kochert et al. 2002). As these behaviors are more frequently associated with winter roosts, nest sites, or communal feeding areas (Stalmaster and Gessaman 1984, Fisher 1985, Watson et al. 1991, Buehler 2000), it would be these features that create potential elevated risk scenarios and not general eagle flight time captured in the CRM exposure distributions. Furthermore, these intra-specific interactions are typically very brief (e.g., less than one minute), limiting the duration of hypothetical elevated collision risk (Fischer 1985). Finally, given that the population size of bald eagles is notably larger than golden eagles, if these behaviors were increasing risk, then fatalities of bald eagles should already be greater than golden eagles, which has not been documented to date.

In sum, rather than reasoning that bald eagles "engage in social behaviors and intra-specific interactions that may make them more vulnerable than golden eagles to collisions," it appears that a more plausible justification for the differences in documented fatalities is that there is an actual disparity in collision risk between bald and golden eagles due to their different habitat and hunting behaviors described Section III(A) above. EWAC recommends that the Service reevaluate their results and conclusions in the context of the known biology of both species.

C. EWAC produced examples comparing new priors at low, moderate, and higher eagle use facilities to see how site-specific data interacted with the new priors.

EWAC also evaluated the eagle take estimates generated by the new priors in the context of different levels of eagle use at a project to see how site-specific data interact with the new priors. We did this using the estimated parameters from Appendix A and we assumed the facility has 100 turbines with a 65 meter (m) rotor radius and operates 4,400 daylight hours per year. To evaluate different levels of eagle use, we considered facilities with low (6 eagle minutes), moderate (30 eagle minutes), and high eagle use (100 eagle minutes) during 200 hours of eagle use surveys (Table 3).

The priors provide a "generic" basis for the CRM model, but ideally, site-specific data should overcome the priors when calculating a take estimate to ensure that a take estimate is properly tailored to the specifics of a particular wind energy facility. Site-specific data are used to update the prior to obtain the posterior distribution when predicting annual take for a project. The point at *when (or how much)* site-specific data overcomes the "generic" priors differs in the new CRM priors as compared to the ECPG priors. In our example, golden eagle exposure was roughly the same for the new and ECPG priors for the medium and high use examples, indicating that the site-specific data had overcome the priors. However, in the low use example, the exposure rate using the new golden eagle priors was almost twice as high as the exposure rate from the ECPG priors (Table 2). Therefore, the new prior developed for golden eagles decreases the influence of site-specific data on the take predictions at facilities with low eagle use that, in turn, results in higher take predictions when eagle use is low. Priors should be more readily influenced by site-specific data to more accurately tailor take estimates at a particular wind energy facility.

The updated bald eagle prior for exposure rate has less of an influence on take predictions than the new golden eagle prior when adding in site specific data. When we evaluated the differences between the ECPG and new priors for bald eagles, the mean exposure rates were comparable (Table 2). Therefore, the new bald eagle prior allows the site-specific data to define the exposure rate posterior distribution in the model.

The difference in the take predictions between the new golden eagle priors and the ECPG priors are highest at low risk sites and decrease as the use at a facility increase (Table 5). Using the new golden eagle priors, take predictions using the new priors were 72% higher than take predictions using the ECPG priors for low use facilities and 3% lower for high use facilities. Take predictions for bald eagles using the new priors are higher compared to take predictions using the ECPG priors for low, moderate, and high use facilities. This occurs as a result of the new higher collision priors. The bald eagle take predictions using the new priors are 30% higher than take predictions using the ECPG priors for low use facilities and 22% higher for high use facilities. Again, these higher results do not align with post-construction mortality data. Given the ECPG priors already overestimated take at wind energy facilities, any prior that moves further away from actual fatality data should not be acceptable for the eagle permit process.

Table 2. Estimated Exposure Rate (λ).

Variable	Low Use			Moderate Use			High Use		
	ECPG	Golden Eagles	Bald Eagles	ECPG	Golden Eagles	Bald Eagles	ECPG	Golden Eagles	Bald Eagles
1) Survey hours	200	200	200	200	200	200	200	200	200
2) Survey radius (m)	800	800	800	800	800	800	800	800	800
3) Recorded flight minutes below 200 m at points	6	6	6	30	30	30	100	100	100
4) Eagle flight minutes (α ': Line 3 + α)	6.97	13.82	7.53	30.97	41.82	31.53	100.97	111.82	101.53
5) Effort (β '; survey hours x km^3 of area surveyed + β)	80.78	90.19	80.90	80.78	90.19	80.90	80.78	90.19	80.90
6) Mean exposure rate (Line 5 / Line 6)	0.08	0.15	0.09	0.38	0.46	0.39	1.25	1.24	1.26

Table 3. Expansion Factors (ε).

Variable	Spring
7) Estimated Annual Operating Time	4,400
8) Rotor Radius (meters)	65.0
9) Number of Turbines	100
10) Overall Expansion Factor	1178.66

Table 4. Collision Probability (C).

Variable	ECPG	Golden Eagles	Bald Eagles
12) Prior Fatalities	2.31	1.62	2.55
13) Prior exposure events not resulting in fatality	396.69	285.76	360.23
14) Prior mean collision probability	0.0058	0.0057	0.0070

Table 5. Take predictions at the mean and 80^{th} credible interval.

Variable	Low Use			Moderate Use			High Use		
	ECPG	Golden Eagles	Bald Eagles	ECPG	Golden Eagles	Bald Eagles	ECPG	Golden Eagles	Bald Eagles
Mean Take	0.59	1.02	0.77	2.61	3.08	3.23	8.51	8.24	10.40
80^{th} Credible Interval	0.87	1.56	1.14	3.85	4.72	4.71	12.54	12.65	15.12

D. <u>EWAC produced an example demonstrating that the dataset used to develop the bald eagle collision probability prior is likely biased.</u>

As the Service did not provide the datasets or the statistical methods to allow EWAC to recreate the Service's approach, the only avenue left to EWAC was to create an unbiased simulation to further evaluate the new priors. EWAC, with the assistance of its technical consultant, produced simulated datasets based using the exposure priors and other simulated information to try and recreate the Service's collision prior with an unbiased dataset. This simulation demonstrated that the dataset used to develop the bald eagle collision probability prior is likely biased.

Based on the number of facilities used by the Service, EWAC developed collision probabilities using the new updated exposure priors assuming 21 wind facilities in the dataset for golden eagles and a subset of 13 facilities comprised the dataset for bald eagles. To evaluate the collision probabilities estimated from this dataset, an example was developed using simulated data.

The number of turbines at each facility was randomly selected from a uniform distribution with a range of values from 10 to 150 turbines. The rotor radius in meters was also randomly selected from a uniform distribution with a range of values from 40 to 65 meters. The exposure rate was calculated for each facility assuming 4,440 daylight hours per year and using the randomly selected number of turbines and rotor radius (Table 6).

The number of golden and bald eagle exposures during one year of post-construction monitoring was estimated as the product of the new mean exposure rates presented by the Service (1.21 and 3.19 eagle exposures per $hour \cdot km^3$ for golden and bald eagles, respectively) and the expansion factor ($hour \cdot km^3$).

Estimated eagle fatalities for one year of post-construction monitoring were randomly selected for each facility uniformly between 0 and 5 fatalities and it was assumed that the bald and golden eagle fatality rate was the equal at each project. The collision probability was estimated for each facility as the estimated eagle fatalities divided by the estimated exposures during post-construction monitoring. We assumed the same estimated fatality rate for golden and bald eagles at each facility to help evaluate the difference in the collision probabilities between the two species.

For this example, we assumed facilities 14-21 did not have data collected on bald eagles, consistent with the dataset used to develop the new collision probability priors. The mean collision probability for golden eagles was 0.0054 while the mean collision probability for bald eagles was 0.0025. However, the new collision probability presented by the Service showed contrary results (i.e., the collision probability for bald eagles was higher than the collision probability for golden eagles). This difference indicates that the datasets used by agency staff may not be representative of existing wind projects.

The new mean collision probability priors presented by the Service were 0.0056 and 0.0070 for golden and bald eagles, respectively. Based on the example outlined above, for the bald eagle collision probability to be higher than the golden eagle collision probability one of the following must be true:

- the estimated bald eagle fatality rates had to be higher than the estimated golden eagle fatality rates at facilities; or
- the dataset used to estimate the exposure rate prior for bald eagles likely contains higher bald eagle use than the dataset used for the collision prior.

It is unlikely that the estimated bald eagle fatality rates was higher than the estimated golden eagle fatality rates at facilities based on our knowledge of the composition of known bald and golden eagle fatalities at wind facilities (Pagel et al. 2013). This means that the dataset used by the Service to estimate the collision probability was likely developed using facilities with lower bald eagle use relative to the dataset used to estimate the exposure rate. Therefore, it is likely that the dataset agency staff used to develop the new collision probability priors for bald eagles is not representative of wind energy facilities across the United States. Generally, site-specific data are not used to update the collision probability prior and therefore, accurate collision probability priors are important. A biased dataset could lead to over-predicting eagle take for most wind energy facilities.

Table 6. Example of golden and bald eagle collision probability calculations.

Facility	Number of Turbines	Rotor Radius (meters)	Expansion Factor (hour·km^3)	Estimated Exposures during Post-Construction Monitoring (one year)		Estimated Eagle Fatalities	Collision Probability	
				Golden Eagle	Bald Eagle		Golden Eagle	Bald Eagle
Facility 1	118	58	1,107	1,340	3,533	4.31	0.0032	0.0012
Facility 2	15	58	141	170	449	2.26	0.0133	0.0050
Facility 3	91	60	914	1,106	2,915	1.25	0.0011	0.0004
Facility 4	46	50	321	388	1,023	1.78	0.0046	0.0017
Facility 5	42	61	436	528	1,391	2.40	0.0045	0.0017
Facility 6	18	53	141	171	450	4.73	0.0277	0.0105
Facility 7	76	54	618	748	1,972	2.12	0.0028	0.0011
Facility 8	51	65	601	727	1,918	1.53	0.0021	0.0008
Facility 9	115	46	679	821	2,166	0.59	0.0007	0.0003
Facility 10	120	52	905	1,095	2,888	1.52	0.0014	0.0005
Facility 11	118	62	1,265	1,531	4,037	4.61	0.0030	0.0011
Facility 12	99	62	1,062	1,285	3,387	1.24	0.0010	0.0004
Facility 13	31	44	167	203	534	4.33	0.0214	0.0081
Facility 14	82	46	484	586	-	3.79	0.0065	-
Facility 15	98	49	656	794	-	1.65	0.0021	-
Facility 16	61	64	697	843	-	1.27	0.0015	-
Facility 17	83	58	779	943	-	3.82	0.0041	-
Facility 18	34	59	330	400	-	1.39	0.0035	-
Facility 19	130	49	871	1,054	-	1.00	0.0009	-
Facility 20	113	64	1,291	1,562	-	3.02	0.0019	-
Facility 21	86	40	384	464	-	2.96	0.0064	-
Average	**77**	**55**	**659**	**798**	**2,051**	**2.46**	**0.0054**	**0.0025**

IV. EWAC Does Not Agree with the Proposed Alternatives and Recommends that the Service Consider Additional Alternatives.

EWAC thanks the Service for providing potential alternatives for assessing eagle collision risk at a given wind energy facility and soliciting public input on the alternatives; however we generally disagree with the alternatives presented and discussed below. EWAC is committed to working with the Service and other stakeholders on an approach that allows for implementation of the eagle permit program in a way that is supported by sound science and offers some suggestions below. Our specific recommendations are discussed in Section IV(B) below.

A. Why the Suggested Alternatives Do Not Work

1. *Current Practice Alternative:*

The Service could continue its current practice of applying the CRM using the previous priors for golden eagles to both species of eagles and using the 80^{th} confidence interval estimates as the basis for the number of eagles for which take will be authorized. This approach results in an overestimate of eagle fatalities 80% of the time if the models are correctly estimating fatalities. However, based on the biology described above, the bald eagle priors do not appear to be supported by the best available science.

As stated at the outset of these comments, this estimate impacts all aspects of permitting – cost, timing, mitigation, and monitoring. The more eagle take permitted due to overestimates, the faster the 5% LAP thresholds will be reached. This result, in turn, further impacts the availability of permits, the cost and time of NEPA, and the amount and cost of mitigation. An overestimate means that permittees will consistently be subject to higher costs for eagle take than is likely to occur. This is an unreasonable burden for the regulated community to bear, particularly given that neither species are endangered or threatened.

2. *Risk Tolerant Alternative:*

The appropriate credible interval is specific to the model to which it applies. The current credible intervals used in the eagle permit program for the take predictions are based on the ECPG priors (Table 5). The variability in the exposure rate and collision probability priors in the updated CRM is different than what was provided in the ECPG. Model validation should be done to evaluate the appropriate credible interval that should be used to permit take under the updated CRM priors. A confidence interval should not be prematurely selected until the Service has validated the model. This validation process should include public input to ensure that those impacted by the take estimates have an opportunity to evaluate and opine on the impacts of any confidence interval selected.

3. *Expert Elicitation Alternative*

Expert elicitation in this context would likely be done by gathering responses from individuals who have significant experience with eagles and, in general, these are people whose careers have been dedicated to saving and protecting eagles. In our experience, it is challenging for individuals whose entire professional career has focused on the conservation of a species to be unbiased in evaluating human-induced impacts. Expert elicitation is generally used when solid data is not available; however, as evidenced in the 400+ datasets obtained by the USFWS, the wind industry has data that can be leveraged. However, if the Expert Elicitation Alternative is chosen, EWAC strongly recommends that experts with on the ground experience with wind energy facilities and eagle interactions with wind turbines be included in any elicitation.

B. EWAC's Recommended Alternatives for Consideration:

1. *Updating the bald eagle priors to more accurately and comprehensively address bald eagle behaviors, studies, and data.*

As described in Section III(A)-(B) above, EWAC believes that focusing on exposure data based on general eagle flights does not accurately reflect collision risk for bald eagles. A Bayesian analysis for bald eagles should instead focus on specific flights associated with hunting or intra- or inter-specific interactions (behaviors where eagles might be more distracted and potentially collide with a turbine) to more accurately predict bald eagle risk. These behaviors are not found widely across the landscape, and typically are observed only at wind energy facilities located where communal roosting, communal feeding, or nesting occurs. If the Bayesian approach continues to be used, we suggest updating to only include high risk exposure time and not general eagle flight time.

2. *Accounting for changes in eagle population size over time*

Given that bald eagle populations are expanding rapidly, the data collected during pre-construction studies likely underrepresents the bald eagle population at the time when the facility is operational. Accounting for this discrepancy may help correct the bald eagle fatality estimates.

3. *Qualitative adjustment of eagle fatality estimate*

An alternative to using a specific credible interval limit is to use a qualitative weight of evidence approach to determine the eagle fatality rate authorized in an eagle take permit. For example, the applicant could use the Bayesian model to generate the highest estimate and then work with the Service to determine a more appropriate fatality rate based on weight of evidence from current information available from other wind facilities in the area, geographic features, site-specific data, etc.

4. *Moving away from the CRM approach altogether, particularly for bald eagles.*

As noted in the preamble to the 2009 eagle permit regulations, the eagle permit program was never meant to be as complex as the Endangered Species Act ("ESA") permitting program, nor was it intended to be specifically for the wind energy industry, and yet, nearly a decade on neither has proven to be accurate. Thankfully, bald eagle populations have rebounded such that protection under the ESA is no longer warranted. Bald eagle populations are growing exponentially throughout the country. The application of the CRM to eagles requires significant Service resources, and the Service's use of CRM priors that consistently result in overestimation of eagle take has significant implications on the time and cost of obtaining a permit. EWAC recommends that the Service consider moving away from the Bayesian model entirely, particularly for bald eagles. Geographic or feature-based methods for estimating take would be more efficient and biologically supportable. EWAC believes that eagle populations will continue to stabilize and grow—the Service's ultimate objective—without the application of the CRM. The permit program also would gain efficiencies, which would ultimately result in better understanding eagles interactions with wind turbines and enhance conservation, while reducing the burden on the agency and cost to tax payers.

In summary, of the four EWAC recommendations outlined above, EWAC's preferred recommendation is item 4: *Moving away from the CRM approach altogether, particularly for bald eagles.* Perhaps the CRM and all the associated requirements of the ECPG have utility for wind energy facility sites with moderate to high golden eagle use, but for bald eagles and wind energy facility sites with low golden eagle use, which represents the vast majority of facilities across the country, for the reasons outlined in these comments, EWAC does not believe the use of the CRM is appropriate for estimating take. Less complex and time consuming options, such as landscape and/or project specific habitat analysis in a general permit framework could be used for bald eagles and low use golden eagle wind energy facility sites to ensure eagle populations remain stable or grow and could result in greater direct conservation benefits to bald and golden eagles. EWAC strongly recommends making this process more transparent.

EWAC thanks the Service for the opportunity to comment on the updated CRM priors. EWAC looks forward to the Service providing additional information so that we and others can provide a more comprehensive analysis of the updates to the CRM. Until the regulated community has had this opportunity, the updated CRM priors should not be used in the eagle permit process. We look forward to continued work with the Service to improve implementation of the eagle permit program.

*****

Please feel free to contact the following EWAC representatives:

Tim Rogers, EWAC Policy Chair, timothy.g.rogers@xcelenergy.com, 612-330-6590

John M. Anderson, EWAC Policy Director, janderson@nossaman.com, 202-887-1441

Alan M. Glen, Nossaman, LLP, Partner, aglen@nossaman.com, 512-813-7943

References

American Wind Energy Association (AWEA). 2017. Iowa Wind Energy State Fact Sheet. Available online: http://awea.files.cms-plus.com/FileDownloads/pdfs/Iowa.pdf

Barrios, L. and A. Rodriguez. 2004. Behavioral and environmental correlates of soaring-bird mortality at on-shore wind turbines. Journal of Applied Ecology 41:72-81.

Bay, K., K. Nasman, W. Erickson, K. Taylor, and K. Kosciuch. 2016. Predicting Eagle Fatalities at Wind Facilities. Journal of Wildlife Management 80(6): 1000-1010. doi: 10.1002/jwmg.21086.

Bergo, G. 1987. Territorial behavior of golden eagles in western Norway. British Birds 80: 361-376.

Buehler, D. A. 2000. Bald eagle (Haliaeetus leucocephalus). The Birds of North America no. 506 (A. Poole, ed.). The Birds of North America Online, Cornell Lab of Ornithology, Ithaca, New York, USA. http://bna.birds.cornell.edu/bna/species/506.

Collopy, M. W., and T. C. Edwards, Jr. 1989. Territory size, activity budget, and role of undulating flight in nesting golden eagles. Journal of Field Ornithology 60:43-51.

De Lucas, M., G. F. E. Janss, D. P. Whitfield and M. Ferrer. 2008. Collision fatality of raptors in wind farms does not depend on raptor abundance. Journal of Applied Ecology 45:1695–1703.

Fischer, D., 1985 Piracy Behavior of Wintering Bald Eagles. The Condor 87(2):246-251

Gelman, A., J. B. Carlin, H. S. Stern, and D. B. Rubin. 1995. Bayesian Data Analysis. Chapman and Hall, London, U.K.

Hoover, S. L., and M. L. Morrison. 2005. Behavior of red-tailed hawks in a wind turbine development. Journal of Wildlife Management 69:150-159

Hunt, G. 2002. Golden eagles in a perilous landscape: predicting the effects of mitigation for wind turbine bladestrike mortality. California Energy Commission Report P500-02-043F. Sacramento, California, USA.

Huso, M. 2009. A Comparison of Estimators of Bat (and Bird) Fatality at Wind Power Generation Facilities. Presented at the National Wind Coordinating Collaborative (NWCC) Wildlife and Wind Research Meeting VII, October 28-29, 2008, Milwaukee, Wisconsin. Pre-Conference Session, October 27, 2008. Prepared for the NWCC by S.S. Schwartz. Published June 2009.

Iowa Department of Natural Resources (IADNR). 2007. Trends in Iowa Wildlife Populations and Harvest. Iowa Department of Natural Re-sources—Wildlife Bureau, Des Moines, Iowa, USA. www.iowadnr.gov

Kochert, M. N., K. Steenhof, C. L. McIntyre, and E. H. Craig. 2002. Golden Eagle (Aquila chrysaetos), version 2.0. In The Birds of North America (A. F. Poole and F. B. Gill, Editors). Cornell Lab of Ornithology, Ithaca, NY, USA. https://doi.org/10.2173/bna.684

Korner-Nievergelt, F., P. Korner-Nievergelt, O. Behr, I. Niermann, R. Brinkmann, and B. Hellriegel. 2011. A New Method to Determine Bird and Bat Fatality at Wind Energy Turbines from Carcass Searches. Wildlife Biology 17: 350-363.

Leslie, D., J. Schwartz, and B. Karas. 2012. Altamont Pass Wind Resource Area bird fatality study: bird years 2005–2010. http://yellowbilledtours.com/wp-content/uploads/2011/11/APWRA_Bird fatalityReport_120610_red.pdf. Accessed 20 Aug 2018.

New, L., E. Bjerre, B. Millsap, M. C. Otto, and M. C. Runge. 2015. A Collision Risk Model to Predict Avian Fatalities at Wind Facilities: An Example Using Golden Eagles, Aquila chrysaetos. PLoS ONE 10(7): e0130978. doi: 10.1371/journal.pone.0130978.

Pagel, J.E., K.J. Kritz, B.A. Milsap, R.K. Murhpy, E.L. Kershner, and S. Covington. 2013. Bald eagle and golden eagle mortalities at wind energy facilities in the contiguous United States. Journal of Raptor Research 47(3): 311-315.

Péron, G. and J. E. Hines. 2014. Fatalitycmr: A Capture-Recapture Software to Correct Raw Counts of Wildlife Fatalities Using Trial Experiments for Carcass Detection Probability and Persistence Time. US Geological Survey (USGS). Techniques and Methods 7-C11. US Department of the Interior, USGS. Prepared in cooperation with the US Fish and Wildlife Service (USFWS). 14 pp. Available online from: http://pubs.usgs.gov/tm/07/c11/

Smallwood, K. S., L. Rugge, M. L. Morrison. 2009. Influence of behavior on bird mortality in wind energy developments. Journal of Wildlife Management 73:1082–1098.

Stalmaster, M. V. and J. A. Gessaman. 1984. Ecological energetics and foraging behavior of overwintering bald eagles. Ecological Monographs. 54:407-428.

U.S. Fish and Wildlife Service (USFWS). 2012. Land-Based Wind Energy Guidelines. March 23, 2012. 82 pp. Available online: http://www.fws.gov/cno/pdf/Energy/2012_Wind_Energy_Guidelines_final.pdf

U.S. Fish and Wildlife Service. 2013. Eagle Conservation Plan Guidance: Module 1 – Land-based Wind Energy Versin 2. Available at: https://www.fws.gov/migratorybirds/pdf/management/eagleconservationplanguidance.pdf

U.S. Fish and Wildlife Service. 2016a. Bald and Golden Eagles: Population demographics and estimation of sustainable take in the United States, 2016 update. Division of Migratory Bird Management, Washington D.C., USA.

Watson, J. W., M. G. Garrett, R. G. Anthony. 1991. Foraging ecology of bald eagles in the Columbia River Estuary. Journal of Wildlife Management 55(3):492-499.

Appendix A. Methods for Calculating New Priors

The Notice does not provide the parameters for the exposure rate or collision probability priors. In addition, methods for calculating the priors are not presented. Given the limited information available, EWAC instead applied methods presented in the New et al. 2015 to estimate the parameters. The parameters for the exposure rate distribution were derived from the conditional distributions where the mean ($\bar{x}$) and variance (s^2) are given as:

$$\text{I.} \qquad \bar{x} = \frac{\alpha}{\lambda} \text{ and } s^2 = \frac{\alpha}{\lambda^2},$$

where α is the shape parameter and λ is the rate parameter. The parameters α and λ were estimated from the mean and variance as:

$$\text{II.} \qquad \alpha = \frac{\bar{x}^2}{s^2} \text{ and } \lambda = \frac{\sqrt{\alpha}}{s}$$

and are presented in Table A-1.

Table A-1. Parameters for exposure rate priors

Exposure Rate Prior	Mean	Standard Deviation	Alpha	Beta
New et al. 2015	8.79	13.64	0.42	0.05
Golden Eagles – New Prior	1.21	0.352	11.82	9.77
Bald Eagles – New Prior	3.19	2.583	1.53	0.48

To evaluate the updated collision probability priors, the methods presented in the ECPG were used to estimate the parameters (USFWS 2013). The parameters for the exposure rate distribution were derived from the conditional distributions (Gelman et al. 1995, p. 476–477) where the mean ($\bar{x}$) and variance (s^2) are given as:

$$\text{III.} \qquad \bar{x} = \frac{\alpha}{\lambda} \text{ and } s^2 = \frac{\alpha}{\lambda^2}.$$

The parameters α and β were estimated from the mean and variance as:

$$\text{IV.} \qquad \alpha = \bar{x}\left[\frac{\bar{x}(1-\bar{x})}{s^2} - 1\right] \text{ and } \beta = \frac{\alpha(1-\bar{x})}{\bar{x}}$$

and are presented in Table A-2.

Table A-2. Parameters for collision probability priors.

Collision Probability Prior	Mean	Standard Deviation	Alpha	Beta
ECPG	0.0058	0.0038	2.31	396.69
Golden Eagles – New Prior	0.005648	0.004413	1.62	285.76
Bald Eagles – New Prior	0.007025	0.004379	2.55	360.23