

ESTIMATED EFFECTS OF FULL WINTER SHUTDOWN AND REMOVAL OF TIER I & II TURBINES

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The following assessment estimates the effectiveness of the measures committed so far, plus the adoption of a full winter shutdown instead of half the winter. To arrive at point estimates of percent fatality reduction gained by shutting down turbines in tiers 1 & 2 in Group C of Smallwood and Spiegel (June 1, 2005), the following steps were taken:

$$F_{-C} = ((F_{4074} - F_C) \div F_{4074}) \times F_{APWRA}$$

$$F_{-C,-W} = F_{-C} - \left(F_{-C} \times 0.146 \times \text{Winter} \frac{\text{Observed}}{\text{Expected}} \right)$$

$$\text{Percent fatality reduction} = (F_{APWRA} - F_{-C,-W}) \div F_{APWRA} \times 100\% .$$

F_{-C} is the estimated annual fatalities in the APWRA after turbines in Group C tiers 1 and 2 are shut down, where the fatalities documented at these turbines, F_C , are subtracted from the fatalities among the 4,074 turbines used in Smallwood and Spiegel's exercise, or F_{4074} , and where this difference is used to calculate the proportion of the APWRA's fatalities that would remain after shutdown. For this exercise, the annual fatalities were those composing the upper end of the uncertainty range reported in Smallwood and Thelander (2004). I used these because the Parties used them. This approach did not factor in relative abundance of birds.

$F_{-C,-W}$ is the estimated annual fatalities remaining in the APWRA after turbines in Group C tiers 1 & 2 are shutdown and after the remaining turbines are shut down during the winter. The value 0.292 is winter's portion of the year, and the ratio of observed to expected chi-square values represent the number of fatalities in the winter as a multiple of the number expected of a uniform distribution of fatalities through the year.

Species	F_{APWRA}	$F_{4,074}$	F_C	Obs ÷ Exp in winter	F_{-C}	$F_{-C,-W}$	Fatality reduction due to shutdown of select turbines & all remaining turbines during winter
Golden eagle	116.5	87.4	14	1	97.8	69.2	40.6%
Red-tailed hawk	300.4	225.3	27	1.35	264.4	160.2	46.7%
American kestrel	333.1	249.8	27	1.61	297.1	157.4	52.7%
Burrowing owl	380.2	285.2	16	1.2	358.9	233.1	38.7%
Pooled 4 raptors	1130.2	847.7	84	1.3	1018.2	631.7	44.1%
All raptors	1300	975	124	1.27	1134.7	713.9	45.1%
All birds	4721.3	3541.0	200	1.15	4454.6	2958.7	37.3%

Thus, assuming adoption of a full-winter turbine shutdown, and assuming all Tier 1 & 2 turbines are actually shutdown permanently, then the measures might achieve a 44% reduction in the mortality of the 4 pooled raptor species.