# DISPARITIES BETWEEN RESULTS AND CONCLUSIONS: DO GOLDEN EAGLES WARRANT SPECIAL CONCERN BASED ON MIGRATION COUNTS IN THE WESTERN UNITED STATES?

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# COMMENTARY

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## DISPARITIES BETWEEN RESULTS AND CONCLUSIONS: DO GOLDEN EAGLES WARRANT SPECIAL CONCERN BASED ON MIGRATION COUNTS IN THE WESTERN UNITED STATES?

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*Abstract.* A recent summary of raptor migration count data concluded that the status of Golden Eagles (*Aquila chrysaetos*) in western North America warranted concern (Hoffman and Smith 2003). Our analysis of these data did not lead us to the same conclusion. We have three specific concerns. First, the regional characterizations of eagle migration in Hoffman and Smith (2003) are based on a very small sample of sites. Therefore, we recommend that these characterizations be considered as hypothetical in nature. Second, we suggest that the population cycles and patterns of age-specific population change described by Hoffman and Smith (2003) are neither as general nor as clear-cut as they indicated. Finally, although the authors expressed concern about the status of Golden Eagles based upon both their findings and data from other sources, we did not find compelling evidence for population declines in our inspection of those same data.

*Key words:* Aquila chrysaetos, *Golden Eagles, migration counts, population cycles, population trends.*

## Disparidad entre Resultados y Conclusiones: ¿Es el Estatus de *Aquila chrysaetos* Especialmente Preocupante de Acuerdo a los Conteos Migratorios del Oeste de los Estados Unidos?

*Resumen.* Un resumen de los datos de conteos de migración de rapaces realizado recientemente concluyó que el estatus de *Aquila chrysaetos* en el oeste de Norte América es preocupante (Hoffman y Smith 2003). Nuestro análisis de los mismos datos no nos llevó a la misma conclusión, y tenemos tres inquietudes específicas. Primero, las caracterizaciones regionales de la migración de las águilas en Hoffman y Smith (2003) están basadas en una muestra de sitios muy pequeña. Por tanto, recomendamos que dichas caracterizaciones se consideren hipotéticas. Segundo, sugerimos que los ciclos poblacionales y los patrones de cambio poblacional edad-específicos descritos por Hoffman y Smith (2003) no son tan generales ni tan claros como ellos lo indicaron. Finalente, aunque los autores se manifestaron preocupados por el estatus de *A. chrysaetos* basándose en sus hallazgos y en datos de otras fuentes, al inspeccionar los mismos datos nosotros no encontramos evidencia contundente de que existan tales disminuciones poblacionales.

Hoffman and Smith (2003) recently summarized over two decades of raptor migration data from the western United States. We applaud their ambitious approach, their meticulous efforts at standardization, and the care with which they evaluated the statistical tools used in the analysis. Their inferences, however, were often quite different from the ones we drew from the same data. In this paper, we focus on their conclusions regarding the Golden Eagle (*Aquila chrysaetos*) because it is the raptor species with which we are most familiar, and it is one of two species for which Hoffman and Smith (2003) concluded that concern was warranted based on their data. We have specific reservations about their sample sizes, the patterns of population change they describe, and their conclusions about the status of Golden Eagles in western North America.

## SAMPLE SIZES

Hoffman and Smith (2003) reported data from 15 species at six sites, collected for 10 to 19 years per site. Overall, the study reports and summarizes well over half a million observations of migrant raptors. Site-specific totals for some species, however, are quite low. For example, although about 1534 Golden Eagles are detected annually in the Bridger Mountains of Montana, only about 28 are sighted each year at Lipan Point, Arizona. In their analyses, however, Hoffman and Smith (2003) do not weight the significance of site-specific results by the volume of migration at those sites; the biological significance of trends at Lipan Point and in the Bridger Mountains are effectively equated.

In addition, Hoffman and Smith (2003) discuss spatial and temporal patterns based on small sample sizes. For example, generalizations about eagle migration in the Intermountain West Flyway were based on two sites (Goshute Mountains, Nevada and Lipan Point, Arizona; according to the authors, the flyway affinities of the Wellsville Mountains, Utah are not clear-cut).

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The sample size for characterizing the Rocky Mountain Flyway is also effectively two, the Bridger Mountains, Montana and the two New Mexico sites (Manzano and Sandia Mountains). The two sites in New Mexico probably do not represent independent samples from the Rocky Mountain Flyway because of their close proximity, the likelihood that they sample from the same population (Hoffman and Smith 2003), and the fact that they are sampled during different seasons.

We believe that small sample sizes per flyway limit the degree of confidence in regional generalizations. For example, the authors suggest that there is a latitudinal gradient in the tendency of Rocky Mountain migrant eagles to follow a 10-year cycle. This latitudinal gradient hypothesis, however, was based upon just a single northern fall migration site (Bridger Mountains, averaging 1534 eagles per year with no evidence for 10-year cycles) and a single southern fall migration site (Manzano Mountains, averaging only 116 eagles per year with limited evidence for decadal cycling). Elsewhere, conclusions about age-related patterns of population change in the Intermountain Flyway are derived from their sample of two sites in the region. Similarly, their characterization of Golden Eagle ecology in Alaska is based upon data from a single site (Denali National Park, McIntyre and Adams 1999). Although not explicitly cited by Hoffmann and Smith (2003), this Denali study is the one referenced in the paper they do cite (Sherrington 2003), and is the only long-term Alaskan study with published estimates of annual productivity and correlations with prey abundance. These patterns of productivity at one Alaska site may or may not be representative of the species statewide.

In terms of temporal patterns, there is a similar paucity of replication. The suggestion that eagles are tracking cyclic fluctuations in favored prey abundance is intuitively appealing. At some sites described by Hoffman and Smith (2003), there is the appearance of such tracking (see below), but the duration of the study precluded observing even two full cycles. Thus, conclusions about cycling are based on at most one full transition from an early population peak to a later one. We suggest that patterns based on small sample sizes (i.e., sites, population cycles) should be presented explicitly as hypotheses to be tested when more sites or years are added to the data.

## PATTERNS OF POPULATION CHANGE

The caption for the cover photo of Condor 105 (Issue 3) states, ''In western North America, declines in migration counts of immature Golden Eagles tend to precede peaks in adult abundance, perhaps reflecting declining productivity in response to prey cycles. Hoffman and Smith's comprehensive summary of 24 years of migration data at six count sites (p. 397) identifies this trend.'' We suggest that the patterns described here are neither as general nor as clear-cut as both the caption and the article indicate.

Hoffman and Smith (2003) state that at five of the six sites (all except the Bridger Mountains), ''adult passage rates followed a similar pattern through at least the mid-1990's: high abundance in the mid-1980s (the Wellsville Mountains surveys may have missed this period), generally sharp declines the next 2–3 years, then mostly steady increases through the mid-1990s (Fig. 5)''. Figure 5, however, does not appear to support these generalizations. In terms of high numbers in the mid-1980s, one of the five sites (Lipan Point) had no data for this period, and, as noted by the authors, a second site (Wellsville Mountains) began too late to verify if it is consistent with the pattern. Thus, the high in the mid-1980s high is demonstrated at only three of the five sites. The subsequent 2–3 year sharp decline is clear only at Goshute and Manzano Mountains, while at Sandia Mountains, the decline is gradual from 1985 through 1991. The third element of the pattern, a steady increase through the mid-1990s, was not found at Wellsville, and the steep drop at Lipan in 1993 precludes describing the increase at that site as steady. The increase by the mid-1990s at Sandia is relatively small when compared to the dramatic spike in 1998; in fact, the eight-year period from 1987 to 1995 comprised the longest interval of generally stable numbers found at any of the sites. Thus, the three-part pattern in adult passage rates only applies to the Goshute Mountains in the Intermountain Flyway, and to the Manzano Mountains in the Rocky Mountain Flyway.

Hoffman and Smith (2003) also state that, ''In the Intermountain Flyway, as illustrated by the Goshute Mountains, Lipan Point, and to a lesser degree Wellsville Mountains transition-zone counts, it appeared that the cycle began repeating after a mid-1990s peak. In comparison, except for an unusually high 1998 spike in the Sandia Mountains, adult passage rates remained relatively stable after the mid-1990s at the three other Rocky Mountain sites'' (p. 413). These generalizations do not appear to be supported by the data presented in the paper. The cycle suggested for the Intermountain sites is clear only at Goshute Mountains. As Hoffman and Smith (2003) indicate, the dramatic annual fluctuations through the 1990s at Wellsville Mountains obscure the significance of declines at that transitional site, and Lipan Point lacks data for the early phase of the putative cycle and depicts two or three peaks during the 1990s. The outlying peaks could be population responses similar in causality to, but lower in amplitude than, the highest peak in 1996. Conversely, they could simply be noise (either sampling error or rapid responses to short-term environmental phenomena) superimposed on a longer-term, larger-scale pattern of population change. Unfortunately, there are no data presented to clarify this question.

Similarly, we do not see relatively stable passage rates when we inspect the Rocky Mountains data. As the authors note, the 1998 peak at Sandia is inconsistent with the hypothesized pattern. If there were a large number of Rocky Mountain sites, a single exception might not fundamentally alter the picture. There are, however, only three sites being characterized. Sandia clearly doesn't show stability, and based on the ''M''-shaped population graph for the Bridger Mountains, an argument could be made that cycles are exhibited at that site, but with a higher frequency and lower amplitude than at Goshute Mountains. Finally, the data from the Manzano Mountains show a very different pattern than the data from either of the other two locations. We conclude that after the mid-1990s, adult passage rates in the Rocky Mountains varied considerably, both among years and among sites.

The authors next suggest ''that the migratory abundance of eagles within the Intermountain Flyway cycles with a periodicity of ~10 years. This tendency is less pronounced in the Rocky Mountain Flyway. . . '' (Hoffman and Smith 2003:413). The Goshute Mountains data show a single interpeak interval of 10 years, which is consistent with hare population cycles of 10–11 years, and the Lipan Point data suggest an intertrough interval of about 11–12 years (if the two lateral peaks are ignored; otherwise, a three- to four-year cycle is suggested). If the quadratic regression line at Wellsville Mountains roughly traces a cycle, however, the period of this population cycle has a frequency of about 14 years (1987–2001). Potential cycles can be superimposed on the data from the Rocky Mountain sites at Bridger, Manzano, and Sandia as well, but one could interpret the data to suggest that these cycles have frequencies of about four, ≥16, and ≥13 years, respectively. Thus, a cycle of approximately 10 years does not seem to be a general pattern.

Based on Goshute Mountains and Lipan Point data, the authors also suggest that multiyear declines in the numbers of immature eagles tend to precede peaks in adult abundance. Three major peaks in adult numbers are depicted in Figure 5 (two at Goshute and one at Lipan Point). Two minor peaks may also occur at Lipan Point. The first multi-year decline in immatures at Goshute Mountains (1983–1985) precedes the first peak of adults (1986). Similarly at Lipan Point, the major adult peak (1996) is preceded by a dramatic drop in the number of immatures (1992–1995). The second multi-year decline in immatures at Goshute Mountains (1993–1995), however, is of much smaller magnitude than the earlier one, and actually switches to an increase coincident with the peak in adult numbers (1996). Further, this second adult peak at Goshute Mountains was reached after a nearly decade-long increase that markedly predated the small decline in immatures from 1993 to 1995. Thus, a causal link between declines in immatures and subsequent peaks in adults seems unsupported over this interval. At Lipan Point, although the postulated pattern holds for the major peak, the minor peaks in adult numbers do not follow multiyear declines in immatures. Rather, they coincide with a major (1992) and minor (1999) peak of immatures, respectively, followed by immediate declines in both classes. At the other four sites, trends of the two age classes show a variety of patterns, from one which parallels that described by the authors (Bridger Mountains), to those at other sites with no apparent correlation between multiyear declines in immatures and peaks in adults. Therefore, the pattern is neither common to most sites, nor consistent at all times at Goshute Mountains and Lipan Point.

The authors cite data from Alberta (Sherrington 2003) that ''also indicate a negative correlation between immature and adult abundance'' (Hoffman and Smith 2003:413). We do not believe the authors have demonstrated a negative correlation between immature and adult abundance from their migration data. Instead, they have proposed that multiyear declines in immatures precede adult peaks. That pattern may or may not result in a negative correlation in abundance depending upon the temporal scale of the changes and the relative abundance of the two age classes. We used the authors' data (Fig. 5, p. 408) to compare annual changes in abundance in the two age classes. Considering only Goshute Mountains and Lipan Point, annual changes in adult and immature abundance estimates were in the same direction 69% of the time (18 of 26 changes). Among all six sites combined, changes were in the same direction 68% of the time (51 of 75 changes), significantly more frequently than expected ($\chi^2_1 = 4.7$, $P = 0.03$). Thus, year-to-year population trajectories for the two age classes were much more likely to go in the same direction than in the opposite direction, i.e., the adult and immature components of the population usually responded synchronously.

Hoffman and Smith (2003) then attempt to reconcile paradoxical data, the long-term increase in immatures at Goshute with previous studies that found long-term declines in nesting territories in the Snake River area of Idaho. ''Thus counts of immature eagles in the Goshute Mountains appear to accurately reflect major cyclical productivity declines in the northern Great Basin, but overall most likely represent a broad source population that includes birds from the northern Great Basin, which may not be doing particularly well, and birds from more northerly latitudes (i.e., Canada and Alaska) where populations are relatively stable and productive'' (p. 414). We find this solution unsatisfying, and will consider the two components of this explanation in turn.

In order to conclude that the Goshute Mountains migration data accurately reflect major cyclical productivity declines in the Great Basin, these data should be compared to, and be correlated with, productivity data collected at multiple breeding sites from throughout the region. In their paper, only productivity data from the Snake River area of Idaho were compared to the Goshute migration site, the very comparison that is problematic because of the contradictory trends. The authors document that there were 10 years between successive population peaks of adults at the Goshute Mountains, which suggests the possibility of a 10-year cycle. From the data presented or cited in their paper, however, we see no basis for generally concluding that there are cyclical productivity declines in the northern Great Basin, or that the Goshute Mountains data reflect such declines.

Hoffman and Smith (2003) explain the increasing number of immatures in the Goshute Mountains by postulating that this growing population is comprised of two components, a relatively unproductive Great Basin population plus birds from more successful northern populations. Elsewhere, however, the authors state that most of the eagles counted at the migration sites are probably relatively short-distance migrants, with the Bridger Mountains being an exception. If the authors are correct, then long-distance migrants from northern populations probably do *not* make up a significant fraction of the birds detected in the Goshute Mountains. In addition, the most compelling evidence that concern for this species is warranted is the marginally significant negative trend at the Bridger Mountains. Because this site has the most eagles, and is the only site (of the six sites) apparently sampling significant numbers of Canadian or Alaskan birds (Kochert and Steenhof 2002, Kochert et al. 2002), their data suggest that northern populations may be *less* healthy than those comprised of primarily short-distance migrants moving within the western United States.

## THE STATUS OF GOLDEN EAGLES

Hoffman and Smith (2003) concluded that an evaluation of migration data and other sources should generate concern about the status of the Golden Eagle in the western United States. Based on their data, and the data they summarize from other sources, we disagree with this conclusion. For each of the six sites, Hoffman and Smith (2003) performed linear regression on continuous data to evaluate long-term trends in total eagles, adult eagles, immature eagles, and age ratios. Among those 24 analyses, only three produced significant results (i.e., $P \leq 0.05$): an increase in the number of immatures at Goshute Mountains, and decreases in immatures and age ratios at Lipan Point. Given the general lack of significant trends, and considering that the annual mean number of eagles observed at Goshute Mountains (the site with a significant increase) is nearly 10 times higher that at Lipan Point, concern about the status of Golden Eagles is unwarranted based on the linear regression analyses.

A cautionary note is appropriate, however, given the results from the Bridger Mountains, the site with the largest flight of migrant eagles among the sites analyzed (i.e., nearly 60% of all eagle detections reported during fall migration). Hoffman and Smith (2003:404) reported a marginally significant (i.e., $0.05 < P \leq 0.10$) decline in total eagles in the Bridger Mountains over the 10 years for which they have data, but no declines for either age class alone at this site (Fig. 5, p. 408). The Bridger Mountains certainly merit continued monitoring due to the large volume of eagle migration, but we would argue that, despite the marginally significant trend in the overall population numbers, the sum total of linear regression data do not generate concern about the species' status in western North America.

Hoffman and Smith (2003) also present several supplemental analyses, including quadratic regressions, rank-trend analysis, and, for Wellsville Mountains, *t*-tests to compare temporally discontinuous datasets. Significant quadratic trends were found for total birds and adults at Lipan Point, and adults at Wellsville Mountains. Such trends do not necessarily indicate a deterioration of status and in fact, are not unexpected in a species that may be cycling over a period roughly comparable to the study duration. In other words, the quadratic regression may just be tracking the increasing and declining phases of population cycles.

Three other supplemental analyses yielded significant results. A rank-trends analysis of the Goshute Mountains data yielded a marginally significant increase in numbers, and *t*-tests identified significant long-term declines in both immatures and age-ratios at Wellsville Mountains between the periods 1977–1979 and 1987–2001. As noted by the authors, however, there were no significant linear trends for any of the four variables at Wellsville Mountains over just the last 15 years. Overall, the analyses supplementing the linear regression data produced few significant results, and those results were decidedly mixed relative to the status of the species at various sites. Finally, the Breeding Bird Survey and Christmas Bird Count analyses presented by the authors showed no trend and an increasing trend, respectively, for Golden Eagles in western North America.

Hoffman and Smith (2003) have produced a major contribution to our understanding of raptor migration in North America. We conclude, however, that their analyses do not make a compelling case for concern about the status of Golden Eagles. In coming to that conclusion, we neither disparage the value of raptor migration data generally, nor do we argue that concern for Golden Eagles in the western United States is unwarranted. In the first case, we recognize that raptor migration data can be an important, often critical, component of large-scale raptor population assessments. Titus and Fuller (1990), Lewis and Gould (2000), Kjellen and Roos (2000), and Kochert and Steenhof (2002) all argue convincingly about the value of standardized, long-term datasets for tracking population trends in migrant raptors. Regarding the need for concern about Golden Eagles in the western United States, ongoing habitat change across much of this region (Kochert and Steenhof 2002, Kochert et al. 2002, Knick et al. 2003) provides a convincing rationale for carefully monitoring eagle population trends. We do argue, however, that the datasets analyzed and presented by Hoffman and Smith (2003) do not, in and of themselves, provide evidence of Golden Eagle populations at risk.

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# DO GOLDEN EAGLES WARRANT SPECIAL CONCERN BASED ON MIGRATION COUNTS IN THE WESTERN UNITED STATES? REPLY TO MCCAFFERY AND MCINTYRE

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*Abstract.* In Hoffman and Smith (2003), we summarized two decades of raptor migration count data from western North America. McCaffery and McIntyre (2005) offer an extensive critique of the ‘‘conclusions’’ we drew from these data concerning the migration ecology and status of western Golden Eagles (*Aquila chrysaetos*). Many of their specific points about data limitations are well taken. Contrary to the flavor of their critique, however, we were not offering any definitive conclusions about the status or habits of eagles. Rather, we merely sought to describe the tendencies in the data and offer reasonable speculation about potential underlying causes of the documented patterns and trends. Our primary goal was to challenge colleagues to help us carefully consider our data and help formulate reasonable hypotheses about causal factors. We welcome and applaud McCaffery and McIntyre's (2005) thorough review of our work and genuine concern for guarding against unwarranted speculation. We believe, however that the depth of their critique was unjustified because the precision of the migration count data we presented simply is not sufficient to support detailed inspection of every annual change. Moreover, while we cannot disagree with them concerning the limits of the migration data we presented, we stand firmly behind our contention that there are indeed reasons to be concerned about the status of Golden Eagles in western North America, particularly within the sagebrush-steppe ecoregion.

*Key words:* Aquila chrysaetos, *conservation status, Golden Eagles, migration counts, population trends, western North America.*

## ¿Es el Estatus de *Aquila chrysaetos* Especialmente Preocupante de Acuerdo a los Conteos Migratorios del Oeste de los Estados Unidos?: Respuesta a McCaffery y McIntyre

*Resumen.* En un trabajo previo (Hoffman and Smith 2003), resumimos datos sobre conteos de migración de rapaces realizados en el oeste de Norte América. McCaffery y McIntyre (2005) presentan una extensa crítica de las ‘‘conclusiones’’ que sacamos a partir de esos datos con respecto a la ecología de migración y el estatus de la especie *Aquila chrysaetos*. Muchos de sus argumentos específicos sobre las limitaciones de los datos son acertados. Sin embargo, en contraste con el tono de su crítica, en nuestro estudio no ofrecimos conclusiones definitivas sobre el estatus o los hábitos de *A. chrysaetos*. En cambio, simplemente quisimos describir las tendencias de los datos y presentar especulaciones razonables sobre las posibles causas de los patrones y tendencias documentados. Nuestro principal objetivo era desafiar a nuestros colegas para que nos ayudaran a considerar nuestros datos cuidadosamente y a formular hipótesis razonables sobre los factores causales. Por tanto, recibimos con beneplácito la revisión exhaustiva de nuestro trabajo hecha por McCaffery y McIntyre (2005) y su interés genuino en evitar especulaciones no fundamentadas. Sin embargo, creemos que la profundidad de su crítica no es justificable porque la precisión de los datos de los conteos de migración que presentamos es simplemente insuficiente para permitir la inspección detallada de todos los cambios anuales. Más aún, aunque no podemos estar en desacuerdo con ellos en cuanto a las limitaciones de los datos que presentamos, mantenemos firmemente nuestro argumento de que de hecho existen razones para estar preocupados por el estatus de *A. chrysaetos* en el oeste de Norte América, particularmente en la ecorregión de estepas y matorrales de *Artemisia*.

Our primary objectives in publishing Hoffman and Smith (2003) were to present for the first time in the peer-reviewed literature a multisite, multispecies review of two decades of raptor migration count data from western North America, to draw attention to notable patterns and trends in the data, and to offer reasonable speculation about the underlying causes of those trends. McCaffery and McIntyre (2005) offer an extensive critique of the ‘‘conclusions’’ we drew from these data concerning the migration ecology and status of western Golden Eagles (*Aquila chrysaetos*). We do not offer here an equally detailed, point-by-point rebuttal of their criticisms, because we believe that is unwarranted. We do sincerely appreciate their interest in our work, however, and applaud their thorough review and genuine concern for guarding against un-

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warranted speculation in the pages of peer-reviewed scientific journals.

In fact, our primary goal in seeking to publish this paper was to challenge colleagues to help us carefully consider our data, help formulate reasonable hypotheses concerning the underlying causes of patterns and trends in the data, and ultimately seek ways to test these hypotheses to improve our ability to properly interpret the indicated trends, and thereby stimulate appropriate conservation action when needed. We genuinely value the constructive criticism of our colleagues, and hope it will stimulate further work so that more definitive answers will be forthcoming.

Monitoring continues annually at each of the project sites represented in our paper, as well as at several other sites around the West where datasets have now exceeded, or are quickly approaching, a decade in length. Analyses of these datasets will be updated and expanded in a few years, at which point several of the datasets will exceed two decades in length and provide better coverage across multiple population cycles of primary Golden Eagle prey species. In addition, more sophisticated statistical models will be available to increase the precision of our trend estimates, and significant new information about the species' migratory habits (on-going satellite-tracking studies) and status in the West (a growing body of regional productivity and nest survey information), will be available to help improve both the quality of the data and our ability to interpret them accurately.

Many of McCaffery and McIntyre's (2005) points, such as concern for qualifying the importance of site-specific results based on count volume and the sparse spatial coverage of available migration data, are well taken. Contrary to the flavor of their critique, however, we were not offering any definitive conclusions about the status or habits of eagles, or any other species for that matter. Rather, we merely sought to describe the tendencies in the data and offer what we thought—based on our collective experiences, knowledge of each species, and review of other pertinent literature—was reasonable speculation about the potential underlying causes of the documented patterns and trends. Perhaps we did not pay enough attention to qualifying the speculative conclusions and interpretations we offered as just that, speculation. However, we believe that the depth of McCaffery and McIntyre's (2005) critique was unjustified because the data simply do not warrant such close inspection; that is, the precision of the data is not sufficient to support detailed inspection of every annual change. Instead, we focused only on broad, multiyear patterns, looking for commonalities across sites, and attempting to reconcile the longer-term patterns and trends we discerned in our data with other available, albeit equally limited in most cases, information about the species' status and ecology in western North America.

As discussed at length in the opening sections of the paper, a wide variety of both intrinsic (e.g., observer skill and effort) and extrinsic (e.g., weather and variable migration behavior) factors may influence the accuracy and precision of long-term raptor migration count data. Long-term methodological standardization is critical for reducing the influence of intrinsic confounders, but we have no control over the complex of extrinsic factors that may apply. There is the potential, however, to use sophisticated statistical tools to model the apparent influence of variables such as weather. In fact, HawkWatch International (HWI), the Hawk Migration Association of North America, and Hawk Mountain Sanctuary in Pennsylvania are currently partnering to develop and explore the efficacy of more sophisticated multivariate models for calculating annual indices from migration count data, analyzing long-term trends in site-specific indices, and using a network of sites to assess regional and continental population trends. Development of improved statistical tools will increase the precision of the annual indices derived from migration counts (in terms of reflecting true population trends) and improve our ability to accurately track long-term patterns and trends in those indices.

With the application of better analytical tools in combination with longer and more diverse datasets (by 2006 HWI will have three additional 10-year datasets), we expect that our ability to accurately discern regional patterns and trends in western migration count data will improve markedly. However, because the movement ecology of Golden Eagles is complex and still poorly understood for many regional populations, truly accurate assessments of the species' regional status and population trends will require more research to clarify how Golden Eagle migration and dispersal behavior varies across the continent and from year to year. Some of the needed research is underway in the form of satellite tracking of juvenile birds from Alaska and of birds outfitted at several migration sites in the western U.S.

In general, the long-term monitoring data currently available are far from adequate to accurately assess the current regional status and trends of Golden Eagles in western North America. In particular, we heartily agree with McCaffery and McIntyre (2005) that the spatial extent of available migration-monitoring data in western North America is still too limited. Unfortunately, financial support for significantly expanding the network is hard to come by. Nevertheless, HWI recently began a new long-term, monitoring project in southwest Wyoming where autumn Golden Eagle counts are as high or higher than at any other site in the western U.S. outside of Montana (HWI, technical reports available at www.hawkwatch.org), and the Rocky Mountain Eagle Research Foundation continues to explore western Canada for potential new eagle migration-monitoring sites. In addition, in the past five years HWI has established a new large-scale nesting study in the northern Great Basin that currently includes ~130 Golden Eagle nesting territories (HWI, tech. reps.); new Golden Eagle nesting surveys are underway in New Mexico; and the U.S. Fish and Wildlife Service recently contracted for a large-scale aerial survey of Golden Eagles in the western U.S. (Good et al. 2004). Thus, both monitoring and movement-ecology databases for this species are growing and, with time, improved understanding of Golden Eagle ecology will enhance our collective ability to accurately interpret migration count trends and assess this species' status and trends in western North America.

In the meantime, two 25–30 year nesting studies representing substantial numbers of breeding territories in Idaho (Steenhof et al. 1997) and Utah (K. R. Keller, unpubl. data) clearly point to long-term declines in nesting activity that are strongly correlated with widespread loss and degradation of native sagebrush-steppe habitat and attendant declines in the abundance of black-tailed jackrabbits (*Lepus californicus*) throughout the Intermountain region. Moreover, data derived in conjunction with these studies clearly document three distinct 10–11-year cycles in the abundance of jackrabbits in the Intermountain region. Our Goshute Mountains migration data show a clear correspondence between cyclic crashes in jackrabbit abundance (and periods of minimal eagle nesting activity) in 1985 and 1994, and high migration counts of adult eagles in 1985–1986 and 1994–1996 (Hoffman and Smith 2003).

Thus, although we accept McCaffery and McIntyre's (2005) criticism that the same cyclic pattern is not as apparent in data from other migration sites, and that we may therefore have over-generalized our speculative conclusions, we firmly stand by our hypothesis that cyclical periods of low eagle nesting success due to jackrabbit population crashes result in upswings in adult migration counts at the Goshutes because such conditions stimulate greater movement of adult eagles within the Intermountain region. Similarly, despite their thorough discounting of our hypothesis, we also stand firmly behind our contention that, at least in the Goshutes in the heart of the Intermountain region, multiyear declines in counts of younger birds precede periods of high adult activity. One problem here is that, due to historic limitations concerning in-flight identification of different age classes (recently overcome through improved knowledge of plumage differentiation [Clark 2001]) our categorization of younger birds combines four age classes, rather than allowing for a strict comparison between the abundance of first-year birds and adults. This undoubtedly ''muddies'' the comparison and may preclude a clear demonstration of the hypothesized relationship based on our migration data. Nevertheless, another sharp decline in counts of immature/subadult birds has occurred in the Goshutes between 2000 and 2004 corresponding to the expected onset of another cyclical jackrabbit low (HWI, tech. rep.); should another spike in adult counts follow in the next 2–3 years, we will be even more confident in the validity of our hypothesis.

In summary, regardless of whether or not the migration data we presented in our paper, or other long-term monitoring datasets like the Breeding Bird Survey and Christmas Bird Count (both of which have marginal utility in assessing regional population trends of Golden Eagles due to poor coverage in prime eagle habitat and generally small sample sizes), provide strong corroborating data, there is little doubt that Golden Eagle populations in the Intermountain West are suffering from long-term habitat degradation. A long-term nesting study in southern California also points to significant declines in the abundance of nesting eagles (J. D. Bittner and J. Oakley, unpubl. data). Moreover, HWI migration data, now collected through 2004, continue to point to significant long-term declines in Golden Eagle migration counts in the Bridger Mountains, Montana, and in the Grand Canyon, Arizona, and the count in the Wellsville Mountains, Utah, dropped to a record low in 2004 (HWI, tech. reps.). Accordingly, while we cannot disagree with McCaffery and McIntyre (2005) concerning the limits of the migration data we presented in our paper and definitely agree that more spatially diverse data and a better overall understanding of the species' movement ecology would be very helpful, we stand firmly behind our contention that there are indeed reasons to be concerned about the status of Golden Eagles in western North America, particularly within the sagebrush-steppe ecoregion (Knick and Dyer 1997, Knick et al. 2003), and that we should be paying close attention to monitoring their regional status and trends.

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