

# Conservation Status Report

## Golden Eagle

Scientific Name:	<i>Aquila chrysaetos</i>
French Name:	<i>Aigle Royal</i>
Spanish Name:	<i>Aguila Real</i>
Body length:	70-84 cm
Wingspan:	185-220 cm
Mass:	3.0-6.1 kg (female: 5.2 kg, male: 3.7 kg)

*Breeding Range* (words in italics are defined in the glossary):

From North Slope of the Brooks Range south throughout most of Alaska and western U.S. (west of 100° West longitude) to Central Mexico. In Canada, from the Beaufort Sea east to Coronation Gulf and south throughout western Canada to U.S. border, scattered in eastern Canada, including northern Laborador, northwestern Ontario, and northern and southeastern Quebec.

*Winter Range*:

Winters in coastal southern Alaska, and from southern British Columbia, Alberta, and Saskatchewan south throughout breeding range in western U.S. and northern and central Mexico, and including North and South Dakota, central Kansas, western Oklahoma, and western Texas. Also scattered, local distribution in winter throughout eastern U.S. from the Great Lakes and mid-Atlantic states south to Gulf Coast and Florida panhandle.

Type of Migrant: Partial

Nest Type: Large stick nest usually on a cliff, dominant mature tree or manmade structure.

Food Habits: Opportunistic feeder. In North America, primarily feeds on rabbits, hares, and squirrels, 0.5-2.0 kg. In eastern United States feeds on waterfowl and other birds.

Primary Flight Mode: Soaring with wings in a slight dihedral, and flapping with slow, powerful wingbeats.

## **ECOLOGY**

Found throughout the Northern Hemisphere, the Golden Eagle is one of only two species of eagle native to North America. It is a member of the genus *Aquila*, which, together with four sister genera, comprises the so-called “booted eagles”, named for the characteristic feathering of the legs down to the foot. In adult plumage, the species is a large, dark raptor, with golden feathers on its crown and nape, and a dark tail often with grayish mottling at the base. Golden Eagles take four to five years to reach definitive adult plumage. Immature eagles are mostly brown but the base of the tail starts out white and variable white patches are usually present at the base of the inner primaries for the first one to three years.

The breeding range of Golden Eagles in North America includes most of Alaska and western Canada south of the tree line, much of the inland western U.S, and parts of northern and central Mexico. In the East, Golden Eagles nest in Labrador and Quebec in riparian or coastal areas. Golden Eagles breed in shrubland, grassland, farmland, tundra, and open forests, and tend to avoid heavily forested areas. They are most common in

shrubby habitats containing cliffs for use as nest sites, but also are associated with mountainous regions throughout the species' range where large trees are more often the chosen nest substrate. Due to the distribution of such habitats in North America, the Golden Eagle is much more common in the West than in the East. Nests typically are found on cliffs, but also occur in trees, on embankments, on manmade structures, and rarely on the ground. Most nests are close to hunting areas, with a good view of the surrounding terrain, and are constructed of a wide variety of vegetation and even animal parts, depending on what is locally available. Diameter of nests ranges from 1.0 to at least 2.5 m, with some old perennially used cliff nests up to 5 m tall.

The diet consists primarily (80-90%) of small- to medium-sized mammals, including hares, rabbits, ground squirrels, prairie dogs, and marmots. Golden Eagles prey to a lesser extent upon birds (grouse, pheasants, partridge, waterfowl), reptiles, fish, ungulates (primarily juveniles), and domestic animals. Carrion also is included in the diet where carcasses of livestock or wild ungulates are available. In the East, the diet contains a greater proportion of waterfowl and wading birds.

The Golden Eagle is a short- to intermediate-distance *partial migrant*. Northern breeding populations are usually migratory and move farther from their breeding grounds than southern populations. Most individuals nesting below 55° North latitude in the western range are permanent residents. Within the Intermountain West, satellite tracking has shown that immature birds often wander extensively during their first few years of life (HawkWatch International unpublished data).

## **POPULATION STATUS**

North American Golden Eagles represent 47% of the global population and number an estimated 79,900 birds (Appendix B, Table 1). A recent aerial survey estimated the Golden Eagle population of the continental northwestern United States at 27,392 (Good et al. 2004). Data from *raptor migration counts* and *Christmas Bird Counts (CBCs)* indicate that populations of Golden Eagles have (1) increased in eastern North America since 1974; and (2) declined in western North America since the early 1980s, with an acceleration of declines coinciding with widespread drought from 1998 to the present.

#### Eastern North America

**Historic analyses.** Bednarz et al. (1990) reported a non-significant decline in counts of Golden Eagles at Hawk Mountain Sanctuary from 1934 to 1942. Non-significant increases in counts of eagles were recorded from 1946 to 1972 and 1973 to 1986, but a *statistically significant* long-term decline ( $P < 0.01$ ) was reported for 1934-1986 (Bednarz et al. 1990). This decline parallels declines seen in eastern Bald Eagles and was suggested to be related to organochlorine exposure. Subsequent rebounds in both species may reflect reduced exposure and persecution rates.

In a study of six raptor migration counts in eastern North America, Titus and Fuller (1990) reported a non-significant regional increase of 3.0% per year from 1972 to 1987. Hussell and Brown (1992) reported a non-significant decline of 1.3% per year in counts of Golden Eagles at Hawk Ridge Bird Observatory from 1974 to 1989, while those at Grimsby, Ontario (a spring count) increased 8.1% ( $P \leq 0.05$ ) per year from 1975 to 1990.

**Recent analyses.** Data from raptor migration counts and Christmas Bird Counts (CBCs) indicate that populations of the Golden Eagle have increased steadily in northeastern North America since 1974. The low sample sizes at some eastern raptor migration counts can potentially bias the Raptor Population Index (RPI) migration index, which is derived from multiple regression, and we therefore do not report trends at watchsites receiving <20 migrants per year (Lighthouse Point, Connecticut, Cape May Point, New Jersey, and Montclair Hawkwatch, New Jersey). From 1974 to 2004, *statistically significant* increases were recorded at Hawk Mountain Sanctuary, Pennsylvania (2.1% per year,  $P \leq 0.01$ ), Waggoner's Gap, Pennsylvania (3.1% per year,  $P \leq 0.01$ ), and Hawk Ridge Bird Observatory, Minnesota (5.7% per year,  $P \leq 0.01$ ). A non-significant increase was recorded at Holiday Beach, Ontario (1.5% per year).

From 1994 to 2004, statistically significant increases in Golden Eagle numbers were recorded at Hawk Mountain Sanctuary (2.1% per year,  $P \leq 0.01$ ), Waggoner's Gap (3.9% per year,  $P \leq 0.01$ ) and Hawk Ridge Bird Observatory (5.7% per year,  $P \leq 0.01$ ). Non-significant declines occurred at l'Observatoire d'oiseaux de Tadoussac, Quebec (-3.8% per year) and Holiday Beach (-0.2% per year) during this period (Fig. 1). Continued population change at the 1994–2004 rates would result in a 50% increase of Golden Eagle source populations in approximately 33 years at Hawk Mountain, 18 years at Waggoner's Gap, and 12 years at Hawk Ridge, and a 50% decline in 347 years at Holiday Beach.

An analysis of CBC data (National Audubon Society 2002) for the northeastern United States and eastern Canada (Massachusetts, Maine, New Hampshire, New Jersey, New York, Pennsylvania, Rhode Island, Vermont, New Brunswick, Nova Scotia,

Ontario, and Quebec) revealed a statistically significant increase of 4.1% per year ( $P \leq 0.01$ ) for 1974–2004 and a non-significant 6.9% per year increase for 1994–2004.

The trend in Golden Eagle numbers in the *CBC* for the southeastern United States (Delaware, Florida, Georgia, Kentucky, Maryland, North Carolina, South Carolina, Tennessee, Virginia, West Virginia) also was significantly positive (2.1% per year,  $P \leq 0.05$ ) for 1974–2004, and non-significantly positive for 1994–2004 (5.2% per year).

These trends suggest steady increases in numbers of Golden Eagles wintering in eastern North America over the last 30 years; however, *CBCs* have limited value for estimating trends in Golden Eagles (see Kochert et al. 2002), and the trends should therefore be interpreted with caution.

#### Western North America

**Historic analyses.** In the Western United States, Hoffman and Smith (2003) reported a *statistically significant* increase in migrating immature Golden Eagles from 1983 to 2001 at the Goshute Mountains, and significant declines in immature eagles from 1987 to 2001 at the Wellsville Mountains, and from 1992–2001 at Lipan Point. No significant trends were recorded at the Bridger Mountains (1992–2001), Manzano Mountains (1983–2001), or Sandia Mountains (1985–2001; Hoffman and Smith 2003). They noted that trajectories for Golden Eagles at all of these sites save the Bridger Mountains followed a quadratic shape, with declines in the early 1990s followed by increases in the middle of the decade (Hoffman and Smith 2003).

**Recent analyses.** Long-term trends from raptor migration counts and *CBCs* indicate that populations of the Golden Eagle have declined in much of the western United States since the mid-1980s. The low sample size (<20/yr) at Yaki Point, Arizona

can potentially bias the RPI migration index and we therefore do not report trends for that raptor migration count. Statistically significant long-term declines in raptor migration counts of eagles were recorded from 1983 to 2005 at the Goshute Mountains, Nevada (-2.4% per year,  $P < 0.01$ ), from 1985 to 2005 at the Manzano Mountains, New Mexico (-1.9 % per year,  $P < 0.05$ ), and from 1991 to 2005 at Lipan Point, Arizona (-10.0% per year,  $P < 0.01$ ). Marginally significant ( $0.05 < P \leq 0.10$ ) declines were also recorded at Mt. Lorette, Alberta from 1993 to 2005 (-2.2% per year,  $P = 0.08$ ) and in the Bridger Mountains, Montana from 1992 to 2005 (-2.3% per year,  $P = 0.10$ ). In contrast, a non-significant increase was recorded from 1987 to 2004 at the Wellsville Mountains, Utah (0.6% per year).

More recently, from 1995 to 2005 the magnitude of significant rates of decline increased markedly in the Goshute Mountains (-8.6% per year,  $P < 0.01$ ) and Manzano Mountains (-5.3% per year,  $P < 0.01$ ), a marginally significant decline occurred in the Wellsville Mountains (-6.0% per year,  $P = 0.10$ ), a non-significant 3.8% per year decline occurred at Bonney Butte, Oregon ( $P = 0.16$ ), and no trend occurred at Boise Ridge, Idaho (0.1% per year). In addition, a non-significant increase of 4.5% per year was detected at Chelan Ridge, Washington (1998-2005) (Fig. 1).

An analysis of CBC data (National Audubon Society 2002) for the western United States and Canada (Alaska, Arizona, California, Idaho, Montana, Nevada, New Mexico, Oregon, Utah, Washington, Wyoming, Alberta, British Columbia, Northwest Territories, Yukon Territory) indicated that winter populations of Golden Eagles declined non-significantly (0.4% per year) from 1983 to 2005, and significantly (-3.4% per year,  $P < 0.01$ ) from 1995 to 2005.

The Golden Eagle is not monitored by *BBSs* in North America making migration counts extremely important for monitoring populations of this species in combination with breeding-season surveys (e.g. Kochert and Steenhof 2002).

In sum, trends in migration counts and CBCs indicate that Golden Eagle populations are decreasing in western North America. Common patterns are apparent across most of the available migration datasets. The longest-term migration datasets tracked regional drought patterns fairly well, with declining counts in both the mid-1980s and late 1990s/early 2000s corresponding to major droughts throughout much of the interior West. Other possible factors contributing to the observed patterns may be responses to cyclical prey fluctuations or the loss of shrub habitat due to fire (Kochert et al. 1999).

Golden Eagles breeding in the Great Basin and similar desert habitats within the Intermountain region rely on black-tailed jackrabbits as preferred prey, and eagle reproduction is tied to numbers of these rabbits (Steenhof et al. 1997, Kochert et al. 2002.) Similarly, previous analyses of migration data from Mt. Lorette, Alberta, indicated that the autumn abundance of immature migrants at this site correlates positively with fledgling production in interior Alaska (Sherrington 2003). Productivity in this Alaskan population is strongly correlated with cycles of snowshoe hare abundance, which also tend to have a periodicity of around 10–11 years (McIntyre and Adams 1999).

## **HISTORIC CONSERVATION CONCERN**

Unlike the Bald Eagle, which suffered dramatic population reductions in the mid-20<sup>th</sup> Century due to its sensitivity to *DDT* and other organochlorine pesticides, Golden

Eagles nesting in the western US and Canada were not severely impacted by misuse of these pesticides. Its lower susceptibility than most raptors to organochlorines stems from the high proportion of mammals and low proportions of birds and fish in the eagle's diet. In contrast, eastern Golden Eagles were probably affected by organochlorines, as they forage heavily on waterfowl and wading birds across their breeding and non-breeding ranges, and their numbers declined during the DDT era (Bednarz et al. 1990). Direct persecution by humans in the form of shooting, trapping, and nest destruction was historically the greatest threat to the Golden Eagle.

### **CURRENT STATUS AND CONCERNS**

Although it was given legal protection in the United States in 1962 with passage of the Bald and Golden Eagle Protection Act, the Golden Eagle suffers low levels of mortality from direct persecution, electrocution, collisions with human-made structures, and poisoning stemming from consumption of contaminated carcasses. Habitat changes including urbanization, agricultural development, wildfires, mining and energy development, and reforestation may reduce the availability of suitable nesting and foraging habitat. Human activities account for approximately 70% of all direct mortality of Golden Eagles continent-wide, with accidental trauma (27%), electrocution (25%), gunshot (15%), and poisoning (6%) causing most of these deaths (Franson et al. 1995).

The Golden Eagle is ranked as secure globally and in the United States and apparently secure in Canada (Appendix B, Table 1). U.S. Fish and Wildlife Region 6 (Colorado, Montana, Nebraska, Utah, Wyoming, Kansas, and Dakotas) and the Bird Conservation Regions in the west-central United States list it as a species of regional concern (Appendix B, Table 1).

The Golden Eagle is not currently listed as threatened or endangered in the U.S. In the breeding range believed to be monitored by raptor migration counts in northeastern North America, the Golden Eagle is considered vulnerable in one of the states and provinces, critically imperiled in two (Maine, Vermont) possibly extirpated in two, and is not known to breed in eight (NatureServe 2006; Appendix B, Table 2). Three southern and midwestern states also list the Golden Eagle as critically imperiled (Georgia, Tennessee, Kansas) although none of these states had historical nesting populations of note. Wintering birds are found in these states regularly.

In the breeding range believed to be monitored by *raptor migration counts* in western North America, the Golden Eagle is considered apparently secure in nine of the states and provinces, and vulnerable in four. In the Northwest Territories of Canada, it is not ranked or currently under review (NatureServe 2006; Appendix B, Table 2). Kirk and Hyslop (1998) rated the Golden Eagle as stable or possibly declining in Canada, but determined that populations there were not at risk. Kochert and Steenhof (2002) classified the Golden Eagle as stable in Canada.

## **SUMMARY**

Monitoring data indicate that Golden Eagles have increased over the last 30 years in areas of the breeding range that are sampled by raptor migration counts in the inland subregion of northeastern North America (e.g. northern Quebec, Brodeur et al.1996). These increases have continued into the most recent decade. Data for western North America indicate suggest long-term increases for this species tempered by more recent declines that are presumably associated with drought, changes in prey abundance, changes in land cover, or a combination of these factors. Monitoring of Golden Eagle

populations can be enhanced by the use of aerial surveys (Good et al. 2004) on an annual basis to provide estimates of population size and, eventually, trend.

#### **ADDITIONAL READING:**

- Bednarz, J.C., D. Klem, Jr., L.J. Goodrich, and S.E. Senner.** 1990. Migration counts of raptors at Hawk Mountain, Pennsylvania, as indicators of population trends, 1934-1986. *Auk* 107: 96-109.
- Bent, A.C.** 1937. Life histories of North American birds of prey, Part I. U.S. National Museum Bulletin 167. 409pp.
- Brodeur, S., R. Décarie, D.M. Bird, and M. Fuller.** 1996. Complete migration cycle of golden eagles breeding in northern Quebec. *Condor* 98: 293-99.
- Clark, W.S. and B. K. Wheeler.** 1987. *A Field Guide to Hawks of North America.* Houghton Mifflin Company, Boston, MA.
- Franson, J.C., C.L. Sileo, and N.J. Thomas.** 1995. Causes of eagle deaths. P 68 *in* Our living resources (E.T. LaRoe, G.S. Farris, C.E. Puckett, P.D. Doran, and M.J. Mac, eds.). U.S. Department of the Interior, National Biological Service, Washington, D.C.
- Good, R. E., R. M. Nielson, H. H. Sawyer, and L. L. McDonald.** 2004. Population level survey of Golden Eagles (*Aquila chrysaetos*) in the western United States. Final report prepared by Western EcoSystems Technology, Inc.. U. S. Fish and Wildlife Service, Arlington, VA.
- Hoffman, S.W. and J.P. Smith.** 2003. Population trends of migratory raptors in western North America, 1977-2001.
- Hussell, D.J.T. and L. Brown.** 1992. Population changes in diurnally-migrating raptors at Duluth, Minnesota (1974-1989) and Grimsby Ontario (1975-1990). Ontario Ministry of Natural Resources, Maple, Ontario, Canada. 67p.
- Keller, K.** 2006. Golden Eagle nesting survey report for the central Utah study area, February - July 2006. Unpublished report submitted to the Utah Division of Wildlife Resources, Salt Lake City, UT U.S.A.
- Kirk, D.A. and C. Hyslop.** 1998. Population status and recent trends in Canadian raptors: a review. *Biological Conservation* 83: 91-118.
- Kochert, M.N. and K. Steenhof.** 2002. Golden Eagles in the U.S. and Canada: status, trends and conservation challenges. *Journal of Raptor Research* 36 (S1): 32-40.
- Kochert M.N., K. Steenhof, L.B. Carpenter and J.M. Marzluff.** 1999. Effects of fire on Golden Eagle territory occupancy and reproductive success. *Journal of Wildlife Management* 63: 773-780.
- Kochert, M.N., K. Steenhof, C.L. McIntyre and E.H. Craig.** 2002. Golden Eagle (*Aquila chrysaetos*). In *The Birds of North America*, No. 684 (A. Poole and F. Gill, eds). The Birds of North America, Inc., Philadelphia, PA.
- McIntyre, C.L. and L.G. Adams.** 1999. Reproductive characteristics of migratory Golden Eagles in Denali National Park, Alaska. *Condor* 101: 115-123.
- Mueller, H.C., D.D. Berger, G. Allez, N.S. Mueller, W. G. Robichaud, and J.L. Kaspar.** 2001. Migrating raptors and vultures at Cedar Grove, Wisconsin, 1936-

1999: an index of population changes. Pp 1-22 *in* Hawkwatching in the Americas (K.L. Bildstein & D. Klem, Jr. eds). Hawk Migration Association of North America, North Wales, Pennsylvania, USA. 277p.

**Sherrington, P.** 2003. Trends in a migratory population of Golden Eagle (*Aquila chrysaetos*) in the Canadian Rocky Mountains. *Bird Trends Canada* 9:34–39.

**Steenhof, K., M.N. Kochert, and T.L. McDonald.** 1997. Interactive effects of prey and weather on Golden Eagle reproduction. *Journal of Animal Ecology* 66:350–362.

**Titus, K. and M.R. Fuller.** 1990. Recent trends in counts of migrant hawks from northeastern North America. *Journal of Wildlife Management* 54: 463-470.

**Watson, J.** 1997. *The Golden Eagle*. T & AD Poyser, London, UK. 374pp.

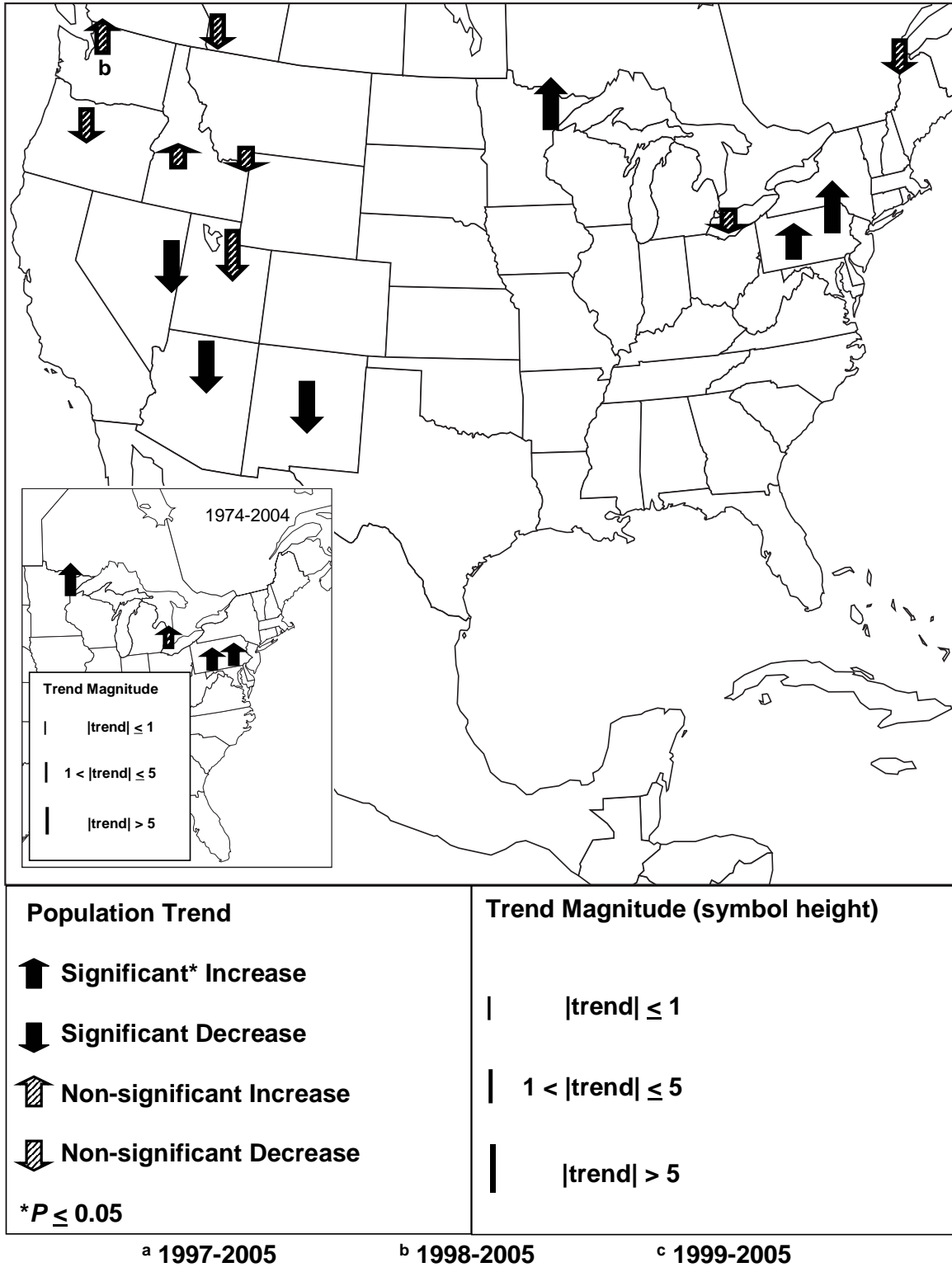


Figure 1. Population trends for Golden Eagles at 5 eastern and midwestern (1994-2004) and 9 western (1995-2005) raptor migration counts in North America, and long-term trends (1974-2004) at four eastern raptor migration counts (inset). Trend magnitudes are expressed in percent change per year.