COMMITTEE ON THE
STATUS OF ENDANGERED
WILDLIFE IN CANADA

OTTAWA, ONT. K1A 0H3
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COMITÉ SUR LE STATUT
DES ESPÈCES MENACÉES
DE DISPARITION AU
CANADA

OTTAWA (ONT.) K1A 0H3
(819) 997-4991

UPDATED STATUS REPORT ON THE GOLDEN EAGLE *AQUILA CHRYSAETOS* IN CANADA

BY

DAVID A. KIRK

STATUS ASSIGNED IN 1996
NOT AT RISK

REASON: OCCURS OVER A WIDE GEOGRAPHIC AREA; HAS ALWAYS BEEN RELATIVELY RARE PARTICULARLY IN EASTERN NORTH AMERICA - NO CLEAR EVIDENCE OF ANY POPULATION CHANGES.

OCCURRENCE: ALBERTA, BRITISH COLUMBIA, MANITOBA, NEWFOUNDLAND; NORTHWEST TERRITORIES, ONTARIO, QUEBEC, SASKATCHEWAN, YUKON TERRITORY

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CSEMDC - Un comité de représentants d'organismes fédéraux, provinciaux et privés qui attribue un statut national aux espèces canadiennes en péril.

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UPDATED STATUS REPORT ON THE GOLDEN EAGLE *AQUILA CHRYSAETOS* IN CANADA

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Introduction:

The purpose of this report is to provide an update on the status of the Golden Eagle *Aquila chrysaetos* since the species was designated Not at Risk by COSEWIC in 1987 (De Smet 1987). At that time it was known that:

- although the breeding range of the Golden Eagle in North America is extensive, its distribution is discontinuous throughout much of this range and it is rare in all except western upland regions,
- the Golden Eagle declined throughout the 1900s due to massive eradication campaigns and the use of bounties until the 1960s and 1970s,
- numbers appeared to have rebounded slightly and the North American population estimate was 50 000 - 100 000 individuals,
- limiting factors included shooting, trapping, poisoning, human disturbance, and habitat loss.

A Population size and trends

Earlier this century populations of Golden Eagles declined dramatically due to massive eradication programs by government agencies and ranchers (see Palmer 1988). Changes in public opinion and protective legislation in the 1960s and 1970s allowed some recovery of the population. However, a further possible threat to eagles during this period was the use of persistent organochlorine pesticides. Although previously thought to have little effect on Golden Eagles, because they preyed on mammals that did not accummulate biocides (De Smet 1987), recent analyses of migration counts from Hawk Mountain, Pennsylvania, suggests that Golden Eagle populations were at least partly affected by pesticides (Bednarz et al. 1990). These chemicals may have impacted eastern eagle populations between 1946-1973 by reducing breeding success (Bednarz et al. 1990). Golden Eagles are top predators in the aquatic food chain in eastern North America and prey on waterbirds (Spofford 1971, Todd 1989; thus differing markedly from western subpopulations) and perhaps accounting for their vulnerability to biocides (Palmer 1988). Overwintering eagles from the northeast wintering in the southeastern states are also associated with aquatic ecosystems (Mitchell and Millsap 1990) and are susceptible to other contaminants (e.g., lead). In Scotland, dieldrin used in sheep dips resulted in declines in Golden Eagle populations (Newton 1979). After the DDT era, Golden Eagles apparently increased and recolonized parts of their vacated range, but their populations are well below former numbers. There is also some suggestive evidence for declines in both eastern and western populations from migration counts.

A population of at least 10,000 pairs of Golden Eagles was estimated for Canada by De Smet (1987). This was based on there being 20,500 pairs in North America (Olendorff et al. (1981) and Canada constituting more than half of the breeding range in North America. This is 14% of the North American population of 70,000 estimated by Palmer (1988). However, 10,000 pairs is probably an upper limit to the number of Golden Eagles in Canada and there may be 2,000-10,000 pairs (Kirk and Hyslop in press). D. Mossop estimated 900-1,000 pairs in the Yukon, which has some of the highest densities of Golden Eagles in North

America. C. C. Shank knows of 302 nests in NWT and there may be 1,000 pairs in the Mackenzie mountains (assuming a coarse area estimate of 75,000 km^2 and density of eagles of one pair per 55 km^2 as in the Yukon). If a similar estimate is assumed for the Northwest Territories as for the Yukon, and we add 100-500 pairs for British Columbia, 100-500 pairs for Alberta (Semenchuk 1992), 50-100 pairs for Saskatchewan (Smith 1996)and 200-300 pairs in eastern Canada (atlas estimates and provincial authorities estimate < 10 pairs in Ontario, 50 pairs in Québec, < 10 pairs in the Maritimes and 28 pairs in Labrador, but migration counts suggest more breeding pairs), then the estimate of 2,000-10,000 pairs seems reasonable. Many of the birds passing through Mount Lorette near Calgary, Alberta are probably from Alaska, so the large numbers counted there do not represent Canadian populations alone. Nevertheless, this is the most promising source to monitor north-western populations of Golden Eagles.

Migration counts

Statistical significance throughout this report is considered at $P < 0.1$. Most Golden Eagles counted on migration counts in the United States are almost certainly of Canadian breeding origin (S. Hoffman pers. comm.). However, results from migration counts of Golden Eagles are equivocal and do not provide clear evidence of declines from any part of Canada.

Dunne and Sutton (1986) reported a 'dramatic decline' in Golden Eagle counts at Cape May. However, a recent analysis of trends in counts of Golden Eagle from eastern North America are the only long-term data that suggest a decline in eagle populations (Bednarz et al. 1990); over the shorter-term there were also marginally significant declines at Hawk Ridge, Duluth (1974-89; Hussell and Brown 1992) and three out of four western hawkwatches (various dates; Hoffman et al. 1992, in preparation). Using standardized data, the overall long-term trend data from Hawk Mountain in Pennsylvania between 1934-1986 indicated a highly significant decline (proportional annual change -0.010, $P < 0.001$). Analyses for a more recent period (1971-1986) indicated a negative, but nonsignificant regression coefficient (proportional annual change -0.071; Bednarz et al. 1990). However, numbers of immature birds have increased since 1970 (see Fig. 3 in Bednarz et al. 1990) suggesting that productivity is increasing. At least part of the population of migrants is from Québec (Millsap and Vana 1984), which may indicate that these populations are increasing (see Morneau et al. 1994).

No decline was found by Titus and Fuller (1990) in their combined analysis of migration count data from six hawk look-outs in eastern North America (% annual change 2.98). Titus and Fuller (1990) suggested that the inconsistency between their results and those from Hawk Mountain data analysed separately (Bednarz et al. 1990) could be due to small sample sizes at all hawkwatches. They proposed that various methods must be used to estimate trends in raptors, like the Golden Eagle, that have small populations. Titus and Fuller (1990) made no corrections for weather or effort, whereas Bednarz et al. (1990) did. Possible declines at Hawk Ridge, Duluth (proportional annual change -7.4, $P < 0.1$) might have been due to low counts in 1987-1989; numbers in 1990-1991 were similar to those seen in the previous period 1983-1986 (Hussell and Brown 1992).

More recent data from hawkwatches in eastern North America suggest increases in

Golden Eagle numbers, but some of these counts have not been analyzed rigorously or corrected for weather and observer effort. At the Niagara Peninsula Hawkwatch near Grimsby, Ontario, where data have been analyzed by Hussell and Brown (1992), numbers of Golden Eagles have apparently increased over the 15 years (1975-1990), despite wide annual fluctuations. Numbers have also increased dramatically at Holiday Beach and Hawk Cliff, Ontario since 1986, when there were 80 fall records of Golden Eagles. For example, at Holiday Beach, 145, 199 and 230 birds were recorded on fall migration in 1989, 1990 and 1991 respectively (Weir 1990, 1991, 1992). In 1995 there was a record high fall count of 234 Golden Eagles across Ontario (21 at Cranberry Marsh, 56 at Hawk Cliff and 76 at Holiday Beach (Ridout 1996). These apparent increases may be due to weather effects or be attributed to changes in migration routes, or possibly birds migrating west, rather than any increase (see Bednarz et al. 1990). The fall migration of Golden Eagles along the Appalachian corridor has been attributed largely to the Canadian population, since so few birds breed in the northeastern United States (Todd 1989). The Canadian population thus presents the best possibilities for research to assess the species' status in eastern North America.

In western North America analyses of migration counts from four mountain sites revealed significant declines at the Manzano Mountains, New Mexico, the Sandia Mountains, New Mexico and at the Wellsville Mountains, Utah, hawkwatches where sigificantly more birds were counted in 1977-1979 than 1987-1990 ($t = 8.23$, $P = 0.0004$; corrected for numbers of observers; Table 1). The only site where there was no significant decline was at the Goshute Mountains, Nevada (Table 1; Hoffman et al. 1992). An overall analysis for all count sites between 1977-1991 indicated that Golden Eagle populations have declined by 6.1% per annum (Table 1; Hoffman et al. 1992). However, it must be borne in mind that the western hawkwatches have been established for a short period of time and thus analyses should be viewed with caution until further data are available. More recent analyses (up to 1996) suggest slight declines in Golden Eagles only at the Wellsville Mountains (Hawkwatch International 1996). Fluctuations in prey populations can cause short-term changes in eagle in populations so count data are needed over longer time periods to confirm these trends.

Similarly, although only a few years of data are available, Golden Eagle counts have increased from a site near Mount Lorette, Calgary, although this could be due to changes in effort; in spring 1993 there were 4,175 birds, in fall 1993, 4,587; in spring 1994, 4,211 birds were counted, in fall 3,821. Of 22,775 raptors counted at this site since it was discovered in 1992, 19,224 have been Golden Eagles (P. Sherrington, pers. comm.). These birds are probably from Yukon, Northwest Territories and Alaska. This flyway could prove very useful in monitoring northern Golden Eagle populations, although it will not be possible to separate Canadian from Alaskan birds. However, the main problem with migration counts is that because this species is a partial migrant in many parts of its range only certain segments of the population migrate; also, fluctuations in prey species affect breeding densities, productivity and movement of birds, making long-term data necessary to determine population trends. It is also not known if juvenile Golden Eagles move northward when dispersing as is the case in Bald Eagles *Haliaeetus leucocephalus*.

Breeding Bird Survey (BBS)

The BBS has serious limitations for evaluating trends in Golden Eagle populations, because the species is recorded on so few routes, and has extremely low mean abundance values. While the analysis of Breeding Bird Survey (BBS) from 1966-1991 showed a significant long-term negative trend in Canada as a whole (proportional annual change -1.9, $P < 0.1$, $n = 19$; US Biological Service BBS analysis protocol; B. Peterjohn, pers. comm.) the most recent analysis indicated no significant change in populations (proportional annual change -0.8, $n = 20$; Canadian Wildlife Service (CWS), BBS protocol; Downes and Collins 1996). However, there was a marginally significant ($P = 0.08$) decrease for a recent 10-year period (1985-94; Kirk and Hyslop in press), but the trend estimate was based on only 12 routes and so should be viewed with caution (a minimum of 14 routes and 40 individuals is used by CWS, BBS protocol; Downes and Collins 1996). Separate analyses by ecozone indicated a significant decline in the Montane Cordillera ecozone over the 1985-94 period, but this result should be viewed with extreme caution for the reasons mentioned above (Kirk and Hyslop in press).

Christmas Bird Counts (CBC)

According to an overall analysis of CBC data for North America as a whole from 1959-1988, there was a significant decline in the continent-wide population of wintering Golden Eagles, based on route regression analyses (proportional change -0.1, $n = 722$ circles, $P < 0.1$; Sauer et al. 1996).

Breeding bird atlases and regional studies

During the Maritime Breeding Bird Atlas (1986-1990), there were no proven breeding records for the Golden Eagle; only six records resulted from the atlas; two probable and four possible breeding pairs (Erskine 1992). Erskine (1992) suggested a total population of fewer than 10 pairs (half in New Brunswick and half in Nova Scotia).

No Golden Eagles breed on Newfoundland itself; however there are 28 known pairs on the Labrador peninsula (surveys have been conducted from Nam northwards to Cape Chedley, and southwards from Nam). Not all of this area has been surveyed intensively and there may be more pairs in this area (J. Brazil pers. comm.).

During Québec's Breeding Bird Atlas (1984-1989), only one confirmed Golden Eagle nest was found; the remaining breeding records were of two probable (0.08% of 2,464 squares surveyed) 11 possible nesting sites (0.4%) and 17 sightings (Robert 1995, J. Gauthier pers comm.). The paucity of breeding records is not surprising, given that the Québec atlas extended to only 50° north; most of the Golden Eagle population in the province breeds to the north of this latitude. Golden Eagle eyries have been found on the Gaspé peninsula (two active eeries - P. Laporte pers. comm.) and also in coastal Labrador (W. Spofford unpubl. data, T. Bownan unpubl. data). A recent analysis of data (1969-1989) based on the

occurrence of Golden Eagles in birder's checklists and using linear regression indicated no significant change in populations in Québec (proportional annual change 0.01, correlation 0.31, n = 388; Cyr and Larivée 1995). Both Robert (1989) and Brodeur and Morneau (1991) considered the species vulnerable in Québec; a provincial estimate of 50 pairs was given by Brodeur and Morneau (1991).

De Smet (1987) stated that there were only 'half a dozen known nest sites in Ontario'. According to De Smet and James (1987) the Golden Eagle may never have been common in Ontario because of lack of suitable habitat. The species is a rare breeding bird and there was only one confirmed breeding site during the Atlas years (1981-1985; De Smet and James 1987). Although Ontario comprises 8% of the North American range for the species the population of Golden Eagles in Ontario likely contributes only 1% to the entire population (ORBBP 1994). Only eight nest records have been reported to the Ontario nest record scheme (Peck 1993). Four records were reported to the ORBBP (ORBBP 1994); three of non-breeders, one at Otty Lake and Pike Lake, respectively, Lanark County, and the other at Muskrat Lake, Renfrew County (1989). Another bird was seen at Coe Hill, Hastings County in the mid-1980s (ORBBP 1994; see also Austen et al. 1994).

Prior to 1994, there were fewer than 20 records of Golden Eagle territories in Canada, east of Manitoba (Snyder 1949, Baillie 1955, Spofford 1959, Millsap and Vana 1984, Todd 1989). In 1990-1993, Morneau et al. (1994) surveyed intensively an area of 10,600 km^2 on the eastern shore of the Hudson Bay, from the mouth of the Great Whale River to Umiujaq and found 20 nesting areas that were occupied for at least one year. In any one year up to 14 nesting areas were occupied. Overall densities were 1.04 pairs per 1,000 km^2, with inter-nest distances ranging from 9.8-44.7 km (mean 26.5 $\pm$ SD 11.0, n = 16). In a second study area, that was not surveyed as intensively, inter-nest distances were 12.2-36.1 km (mean 20.1 $\pm$ 8.2, n = 6). Further, based on sightings elsewhere in the region, Morneau et al. (1994) suggested that this population was not isolated; a pair was observed at Lac des Loups Marins, two unoccupied nests were found at the headwaters of the de Gué River and to the east in 1990, two nests were found in the Caniapiscau River valley (F. Morneau unpubl. data) as well as three nesting territories in Labrador (J. Brazil in pers. comm. to Morneau et al. 1994). In addition 'several' nests have been found in the Ungava Bay area (Spofford 1959, Millsap and Vana 1984, J.D. Weaver and D.M. Bird unpubl. data). Based on this evidence, Morneau et al. (1994) suggested that Golden Eagles are distributed over 'a large part of the Québec-Labrador peninsula'. However, they breed at very low density and are scattered through the region (Todd 1963).

In Manitoba, occasional sightings of Golden Eagles are made in the boreal forest and tundra zones. Although there are breeding records in similar habitats to those in Ontario and Saskatchewan, there are no recent records of nesting (De Smet in Curtis et al. in preparation). In southwestern Manitoba, the Golden Eagle is a rare spring and fall migrant (Cuthbert et al. 1990). In southeastern Manitoba, the species is 'widespread in migration and in winter in all habitats'. Golden Eagles are occasional from late April to late September in southeastern Manitoba (Cleveland et al. 1988).

In Saskatchewan, Smith (1996) described the Golden Eagle as 'an uncommon and local breeding bird'. Breeding was confirmed in 33 squares (5% of province), and was probable in a further six squares (1%) and possible in 18 (2%) (total breeding squares was 55 or 8% of the province). Most records were of winter residents (76, 10% of total) (Smith 1996).

The population of Golden Eagles in Alberta is currently estimated at 100-500 pairs (Semenchuk 1992). During the Atlas years (1987-1991) breeding was confirmed in 46 squares (2.1% of total of 2,206 surveyed), was probable in 10 squares (0.5%) and possible in 35 squares (1.6%; Semenchuk 1992).

Populations in British Columbia are apparently stable (Campbell et al. 1990); 52 nests were reported by Campbell et al. (1990). There are a total of 58 breeding records, mostly from June (24) and July (17) with some in May (9) and August (3). Golden Eagles recently began breeding along the southeastern coast of Vancouver Island, and Campbell et al. (1990) suggest that this may be a result of the introduction of the eastern cottontail *Sylvilagus floridanus*, as well as logging providing more open country for hunting. On Christmas Bird Counts, Golden Eagles were recorded on 38% of all counts and from nine of 19 localities in the interior and 12 of 28 on the coast (Campbell et al. 1990).

There are fifteen years of systematic survey data from the Yukon (D. Mossop pers. comm.). Southern Yukon is believed to harbour the highest densities of Golden Eagles in North America (Beebe 1974, Mossop and Hayes 1982). Indeed during raptor surveys in the Yukon, the Golden Eagle is by far the most common nesting bird of prey (Mossop 1988). The overall density of Golden Eagles nesting in the Yukon is estimated at one pair per 55 km^2, but this must be based on estimates from the most suitable habitat. If this estimate is extrapolated to the area of the Yukon (536,000 km^2) the resulting population estimate is 9,750 pairs, which is clearly much too high; D. Mossop estimates that the breeding population of Golden Eagles in the Yukon is about 900-1,000 pairs.

In the Northwest Territories aerial surveys have been conducted in the Hope Bay (2,000 km^2) and Coppermine (4,000 km^2) areas since 1982 (C. C. Shank pers. comm.). Occupancy rates are determined according to whether adults are detected around known nest sites. Table 2 shows the number of occupied nests, productive nests and the mean number of young produced (data courtesy of C. C. Shank, pers. comm.). Numbers of nests and productivity were apparently low at both the Coppermine ahd Hope Bay site in the mid-1980s; C. Shank (pers. comm.) suggests that this was not an artifact of data collection. It could be due to fluctuations in the prey population base (particularly ground squirrels *Spermophilus* spp.) or snowshoe hares (*Lepus californicus*). Eagle populations were low in the mid-1980s, very high in 1990 and higher than ever in 1995 (C. C. Shank in pers. comm. to C. Hyslop); these fluctuations follow the well-known hare cycle in the region which is of 10-12 years duration. C. Shank believed that the breeding population of Golden Eagles in the Northwest was increasing (C. C. Shank pers. comm.).

In a recent review of raptors in the western United States, White (1994) suggested that Golden Eagle populations were currently stable in some areas, while declining in others. Long-term data from Idaho suggest that Golden Eagles may be declining there (K. Steenhof, pers. comm.). In the northeastern United States, the Golden Eagle is the rarest extant raptor (Todd 1989); only one nest, a 300 year old site in Maine, has been recorded over the last five years, and there are only five other reports of possible breeding (Todd 1989). Thus, despite signs of a recovery - Golden Eagles returned to breed at many sites in the eastern United States in the 1980s (references in Todd 1989) - the species has been almost extirpated. Direct human persecution and accumulative biocides have likely caused this decline (Todd 1989).

Nature Conservancy rankings

Nature Conservancy rankings for the Golden Eagle in Canada are S2 (imperiled because of rarity, 6-20 occurrences) for Québec (M. Huot pers. comm.), S1 (critically imperilled, 5 or fewer occurrences) for Ontario (D. Sutherland, pers. comm.), SHB (historical breeding species) for Manitoba, S4B (breeding populations widespread, abundant and apparently secure), for Saskatchewan (J. Duncan pers. comm.), S3B for the Rocky Mountain and Foothills Natural Region in Alberta (Alberta Natural Heritage Information Centre 1995), S4 for British Columbia (S. Cannings pers. comm.). Note that in Québec, the rankings do not reflect the size of the northern breeding populations, and presumably the ranking will be altered to account for this. The Golden Eagle is on the yellow list in Alberta; it is not at risk because of an apparently stable population estimated at 100-500 pairs.

Recent research

There are long-term survey data from both the Yukon and Northwest Territories that suggest that Golden Eagle breeding success fluctuates according to prey population levels.

A long-term ecological study is underway on Golden Eagle populations on the east coast of Hudson Bay with a view to investigating breeding densities, distribution and the origin of birds that winter in the United States (Morneau et al. 1994, Brodeur et al. 1996). An estimated 20-30 pairs occur in this area and recently S. Brodeur has found another five pairs on the Ste. Margarite river (D. Bird pers. comm.). However, densities of Golden Eagles in this study in Québec are very low when compared to other studies; for example in the central Canadian arctic, Poole and Bromley (1988) found the mean distance between adjacent occupied nests was 10.4 km. Also, reproductive performance in the Québec study is low (0.89-1.22 young per successful pair) compared to that found in the central arctic (1.14-1.50 - Poole and Bromley 1988).

Satellite radiotracking of birds caught in the Hudson Bay area indicated that of five radio-tagged birds, two disappeared, one migrated south in the fall through Ontario and wintered in Michigan. The remaining three birds followed the Appalachian mountains, wintering in Pennsylvania, West Virginia, and the third bird moving south to Alabama. Return migration followed after 3-4 months for the Pennsylvania and Alabama birds; the Virginia

bird disappeared (Brodeur et al. 1996).

Synopsis

Population trends in Golden Eagles may be partly linked to pesticides in eastern North America, where migration count data suggest declines during the DDT era (Bednarz et al. 1990), as well as direct persecution. However, there have been recent increases in the proportion of immature birds which may indicate a recovery (Bednarz et al. 1990). In parts of the western United States, which is the stronghold for the species, Golden Eagle populations may be declining because of human-caused habitat alteration which has affected prey populations and breeding sites (Hoffman et al. 1992). Pesticides may also be contributing to this decline, particularly the misuse of organophosphate and carbamate compounds used to control predators of livestock. A recent count of Golden Eagles killed by these pesticides in the United States revealed about 160 birds had been killed from the mid-1980s to present (Mineau et al. in preparation). However, because eagle populations in the west can fluctuate (depending on the prey species) in relation to prey abundance, this could account for the relatively short-term declines at the western hawkwatches (Hoffman et al. 1992) rather than a long-term downward trend. Long-term data are needed to evaluate the significance of these migration counts.

There are numerous human-induced factors that could be affecting Golden Eagle populations; illegal killing of birds; incidental trapping; electrocution from power lines; adult mortality from pesticide poisoning or contamination with heavy metals (e.g., lead shot ingested from carcasses disgarded after pest control programs, from wildfowl carcasses left by hunters, from seabirds at coastal sites, or from mining operations; pesticide accumulation at sufficiently high levels to cause mortality or reproductive failure; and habitat alterations causing declines in prey populations (see Bortolotti 1984, Palmer 1988, Harlow and Bloom 1989, Furness et al. 1989). Another potential threat in parts of Canada, is the illegal trade in feathers or body parts.

Direct human disturbance is a critical factor in the success of nesting in Golden Eagles and there are many accounts of nest sites being abandoned (Palmer 1988); such disturbance is likely to be an increasing problem as people gain access to remote regions. In much of Canada human disturbance is probably neglible but it is likely to increase. Killing of eagles by native peoples has been reported in the eastern Hudson Bay lowlands (D. Chevrier in pers. comm. to Morneau et al. 1994) but its impact and scale is unknown. There is also some threat from poaching for feathers and body parts in Saskatchewan, and the feather trade may also be a problem in Ontario; however, the scale or impact of this is uncertain. Even though it is insignificant, predation on livestock by some Golden Eagles is perceived as a problem in part of their range and has led to illegal killing. This is not likely a very important factor in most of Canada since most Golden Eagles breed to the north of livestock rearing areas. However, birds wintering in the United States may be affected. Although carcasses examined from Canada indicated low levels of organochlorine pesticides, other contaminants may have significant effects on eagle populations. In particular, ingestion of lead from wildfowl shot on

the wintering grounds could affect even the northern Canadian populations. In addition, less persistent but more lethal pesticides than the organochlorines (organophosphates and carbamates) may contribute to mortality in eagle populations (see Elliot and Wilson 1993 in Mineau 1993).

B Habitat

The most important requisite for Golden Eagle habitat is remote, open (often wilderness) areas for hunting. Slopes and plateaus are favoured because they provide updrafts for soaring and allow all-round vision (Cramp and Simmons 1980). During the breeding season suitable foraging habitat must be close to ledges on cliffs or along river canyons or large trees for nesting (DeGraaf et al. 1991, Palmer 1988). Thus, a vast range of habitat types are used, from arctic tundra and alpine areas to open or fragmented forested areas and deserts (Palmer 1988) or coastal islands (Campbell et al. 1990). In forested areas in eastern North America, open bogs or burned forest are used for hunting.

Trends in habitat

In relation to land-use changes the Golden Eagles is a 'sensitive species' (Palmer 1988). By affecting prey abundance, land use changes can have dramatic effects on breeding densities and productivity of Golden Eagles (e.g.,Watson et al. 1989, 1992). In much of the western United States, where many Canadian Golden Eagles spend the winter, overgrazing has reduced habitat quality for eagles by altering foraging habitat, reducing prey populations, and changing the vulnerability of prey (see Kochert 1989). Loss of suitable habitat has affected Golden Eagle populations detrimentally in the western United States (White 1994). In the midwest, poisoning campaigns for prairie dogs and jackrabbit populations have been reduced by shooting (Wingfield 1991). In the eastern United States (e.g. New York), loss of suitable habitat (wild open and edge habitat) with an abundant food supply is thought to have contributed to the extirpation of the Golden Eagle as a breeding species (Carroll 1988). Hoffman et al. (1992) suggested that the spread of the introduced grass *Bromus tectorum* in many western states had increased the incidence of grassland fires and thereby contributed to degradation of native shrubland habitat. Increased incidence of fire and consequent invasion by alien plant species and increase in scrub and tree cover has caused a decline in habitat quality in many parts of the Golden Eagle's range. On the other hand fire suppression in some more forested regions has resulted in increased forest cover and fewer openings and thus reduced foraging opportunities for eagles. In some areas, timber harvesting has increased foraging habitat for eagles (Palmer 1988), but clearcuts are rather transitory in nature.

In winter, Golden Eagles occur in mostly open country (e.g. in former range of bison and pronghorn). Most of this land is now cropped or used for livestock grazing (cattle, sheep and some goats; Palmer 1988). Palmer (1988) noted that wintering eagles tended to concentrate near livestock (especially sheep) and near sources of unfrozen water.

D Evaluation and proposed status

The Golden Eagle is considered endangered by the Ontario Ministry of Natural Resources (OMNR 1992). Over the whole of Canada, De Smet (1987) recommended that the Golden Eagle should be considered not at risk due to apparently healthy populations in some areas. Long-term studies in the Northwest Territories and southern Saskatchewan suggest that local populations are stable (C. C. Shank and W. C. Harris, pers. comm.). As well, the number of nests documented for Canada, east of Manitoba, has recently doubled with the recent discovery of 20 nests in the eastern Hudson Bay Lowlands by Morneau et al. (1994). In summary, although the population trend data for Canada are equivocal and some sources, with some sources (migration counts and the CBC) indicating declines, numbers remain high and stable (with some fluctuations in productivity in relation to prey abundance), the status if the Golden Eagle should thus remain 'not at risk'. However, the species should be watched closely and periodically reviewed by COSEWIC. The difficulty of assigning status in the case of the Golden Eagle is that the species was probably never occurs at low density over a vast geographical range and thus was probably never common.

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Table 1 Trends in migration counts for eastern and western North America

	Grimsby[1] 1975-1990	Duluth[1] 1974-1989	Six hawk look-outs[2] 1972-1987	Hawk Mountain 1934-1986[3]	Hawk Mountain 1971-1986[3]	Goshute Mountains[4] (1983-1990)	Manzano Mountains[4] (1985-1990)	Sandia Mountains[4] (1985-1991	Four western lookouts[4] (1983-1991)
Golden Eagle	10.8*	-7.4+	2.98	-0.010***	-0.071	-0.002	-0.469*	-0.044*	-6.10

Levels of significance

+ = P > 0.05 < 0.1, * = P < 0.05, ** = P < 0.01, *** = P < 0.001, # = trend non-linear)

[1] Proportional annual change calculated by logistic multiple regression (Hussell and Brown 1992)

[2] Proportional annual calculated by parametric route regression (Titus and Fuller 1990)

[3] Proportional annual change calculated by linear regression (Bednarz et al. 1990)

[4] Proportional annual change calculated by linear regression (Hoffman et al. 1993)

Table 2 Table 2 Productivity of Golden Eagles at Coppermine and Hope Bay, Northwest Territories between 1983-1993 (unpublished data courtesy of C. Shank, NWT Renewable Resources).

	Coppermine			Hope Bay		
Site and year	Occupancy	Productive	Mean no. young	Occupancy	Productive	Mean no. young
1982				16	14	1.67 (9)
1983	7	7	-	11	8	1.14 (7)
1984	11	6	1.33 (6)	18	9	1.22 (9)
1985	-	-	-	12	9	1.13 (8)
1986	5	2	-	17	9	1.33 (9)
1987	8	8	1.14 (7)	7	7	1.20 (5)
1988	12	9	1.89 (9)	7	6	1.50 (6)
1989	16	14	1.45 (11)	15	7	1.43 (7)
1990	15	13	1.33 (12)	15	11	1.60 (10)
1991	21	13	1.38 (13)	18	15	1.33 (15)
1992	19	16	1.19 (16)	12	9	1.88 (8)
1993	19	13	1.38 (13)	14	8	1.50 (4)
1994	11	13	1.22 (9)	26	21	1.64 (14)
1995	22	19	1.61 (18)	18	17	1.41 (17)