THE STATUS AND CONSERVATION OF THE ALEXANDER ARCHIPELAGO WOLF IN SOUTHEASTERN ALASKA

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ABSTRACT — The Alexander Archipelago wolf (*Canis lupus ligoni*) population inhabits the narrow strip of mainland and the islands that constitute southeastern Alaska. The population numbers about 900 to 1,000 animals, is relatively isolated from other North American wolf populations and may represent a remnant population of *Canis lupus nubilus*, a subspecies that once occupied most of the northwestern contiguous United States. Sitka black-tailed deer (*Odocoileus hemionus sitkensis*) are the principle prey comprising 70 to 85 percent of the diet. Extensive logging may have adverse consequences for wolves by causing declines in long-term carrying capacity for deer by as much as 50 to 70 percent in some portions of the region. In addition, road construction associated with logging operations will likely increase human-caused mortality. Analysis of annual wolf harvest data suggests that hunting and trapping mortality is expected to double when the density of roads below 400m elevation exceeds 0.3 km/km^2. Creating a system of large reserves containing high-quality habitat for deer, limiting road construction and access, and modifying existing harvest regulations may be necessary to assure the future viability of wolves in southeastern Alaska.

INTRODUCTION

The Alexander Archipelago wolf (*Canis lupus ligoni*) is a relatively small wolf that occupies most of the islands and narrow mainland strip that constitute southeastern Alaska (Fig. 1). Most of its range lies within the Tongass National Forest, the largest national forest in the United States. It is currently the subject of interest for conservationists, scientists and U.S. Forest Service managers because it is a small, potentially subdivided population that is being exposed to extensive changes in its habitat, due primarily to industrial-scale timber harvest. In 1990 it was identified by an interagency committee as one of eight species potentially at risk on the Tongass National Forest (Suring 1993). In 1993 the Biodiversity Legal Foundation petitioned the U. S. Fish and Wildlife Service to list the Alexander Archipelago wolf as threatened under the Endangered Species Act, citing habitat loss from clearcutting, road construction in wolf habitat, hunting and trapping, and inadequate state and federal regulatory mechanisms as threats to the wolf population. The petition was denied in 1994, in part because the Fish and Wildlife Service anticipated opportunities to work with the Forest Service to maintain viable wolf populations and habitat through modifications of the Tongass Land Management Plan (TLMP) (FWS 1994).

In this paper we summarize the available information regarding the status and conservation of the Alexander Archipelago wolf. This information is drawn primarily from research conducted on Prince of Wales Island (Person and Ingle 1995) and from a conservation assessment prepared for the TLMP planning process (Person et al. in press)

DISTRIBUTION AND TAXONOMIC STATUS

Distribution

Wolves are distributed throughout southeastern Alaska, from Dixon Entrance in the south to Yakutat Bay in the north (Fig. 2). The islands in the southern portion of the archipelago support most of the wolf population. Indeed, 30 to 40 percent of the total wolf population may occur on Prince of Wales Island alone, the largest island in the archipelago (Person et al. in press). Wolves are not found on Admiralty, Baranof and Chichagof (ABC) islands in the northern part of the archipelago. Based on analysis of the capability of habitat to support prey, population densities on the mainland are thought to be lower than those on the islands (Person et al. in press.). Wolf harvest statistics tend to support this conclusion (Fig. 2).

In the southern half of the archipelago, only the largest islands — Prince of Wales, Kuiu, Kupreanof, Mitkof, Etolin, Revillagigedo, Kosciusko and Dall — and the mainland probably support permanent populations of wolves (i.e., over the last 40 years). Persistence also varies within island groups. For example, in GMU 2 (Game Management Unit, an Alaska Department of Fish and Game [ADFG] designation) only the three largest islands — Prince of Wales, Kosciusko and Dall — are known to have been continuously occupied by wolves for more than 20 years. Groups of smaller islands (e.g., Baker, Lulu and Noyes) are used by wolf packs but are probably too small to support packs permanently (Person and Ingle 1995).

Southeastern Alaska wolf populations are separated from interior Alaska and Canada by the heavily glaciated Coast Mountains, which are breached by only six rivers or passes. Wolves occur in these valleys but the degree of interchange between interior and coastal populations is unknown, though it is probably small. Wolves are known to be able to swim distances of up to 4 km (Person and Ingle 1995). Nonetheless, distance, strong currents and frequent bad weather would likely limit the frequency of migrations between island groups and the mainland. Frederick Sound, Stephen's Passage and Icy Strait prevent immigration to the ABC islands, for example. In the south, Clarence Strait most likely restricts movement from the mainland to Prince of Wales Island. A series of stepping-stone islands could serve as a conduit, but at least eight directed swims would be required for this crossing, making it unlikely to occur very frequently. In some areas such as the Stikine River delta, short open-water distances at low tide may enable movements between some islands and the mainland (Person et al. in press).

Taxonomy

The Alexander Archipelago wolf is generally smaller, darker in normal coloration and shorter-haired than other wolves in Alaska. It was first described as a subspecies (*C. l. ligoni*) by taxonomist E. A. Goldman on the basis of morphological characteristics of skulls and other physical characteristics (Goldman 1944). More extensive morphometric analyses suggested that the Alexander Archipelago wolf is indeed distinct from wolves in the interior regions of Alaska and Canada (Pederson 1982), but may be related to wolves from

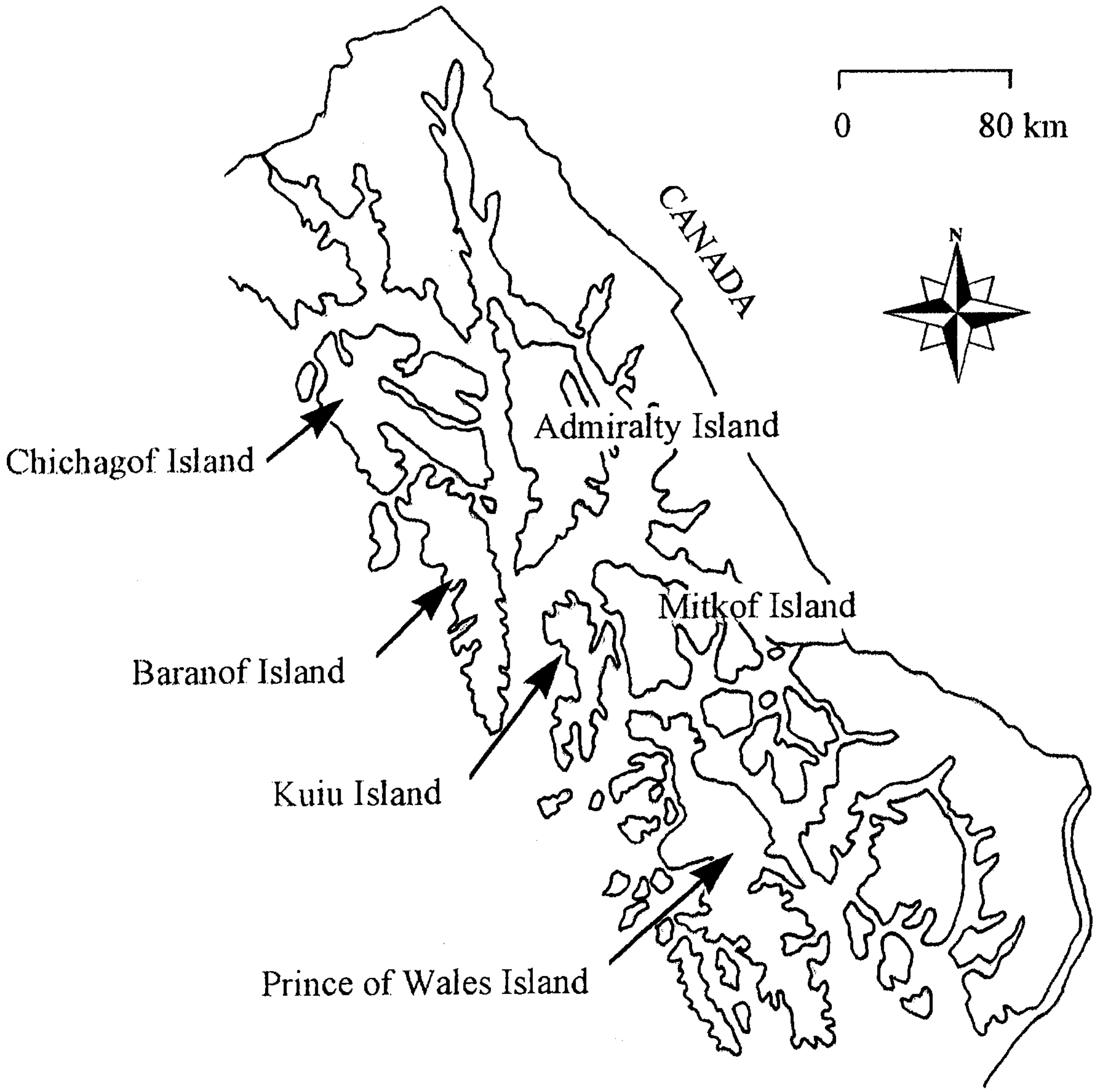
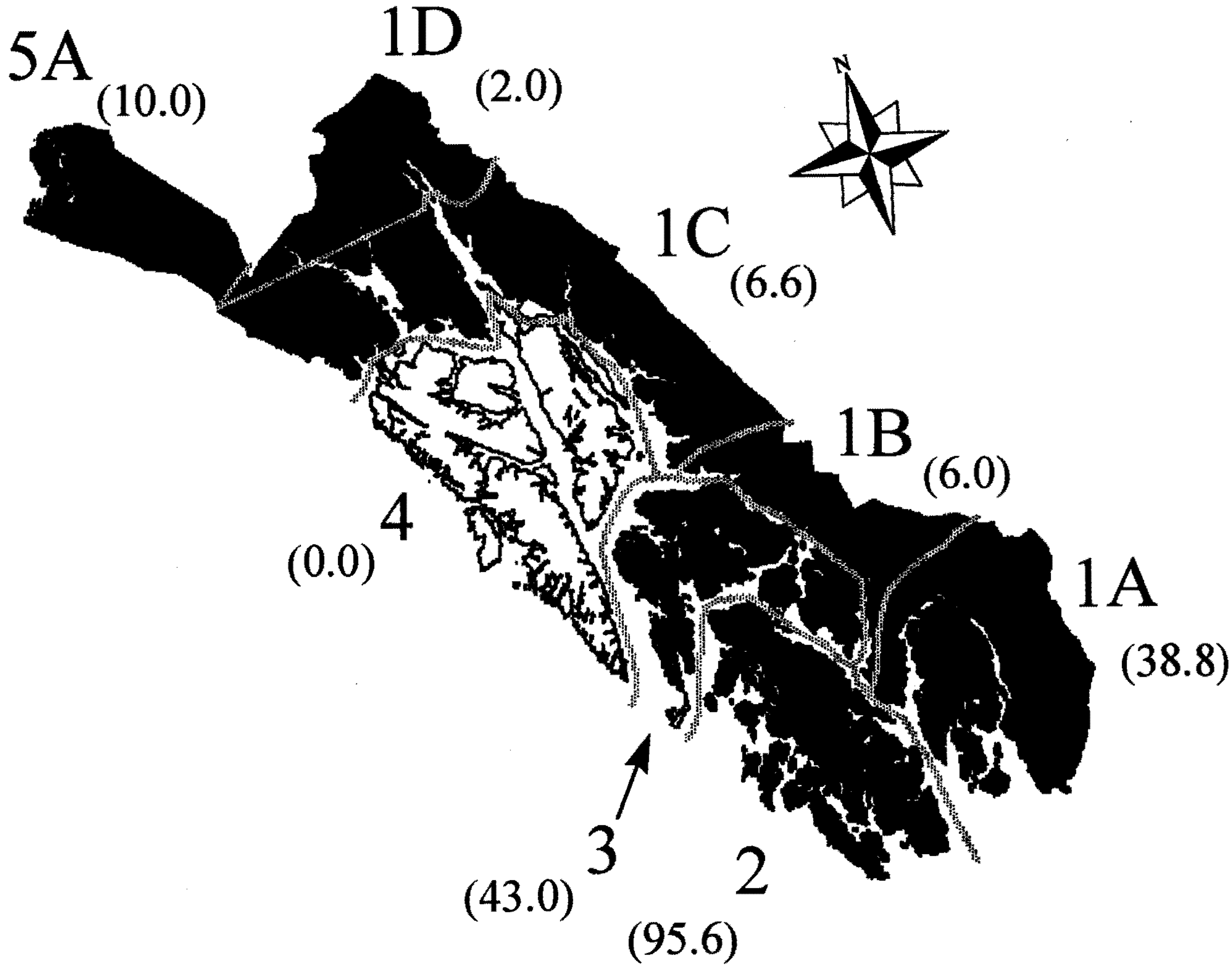


Figure 1. Map of southeastern Alaska showing the major islands.



GMU	% OF TOTAL POPULATION
1 (A,B,C,D)	33
2	37
3	28
4	0
5	2

Figure 2. Map of southeastern Alaska showing the range of the Alexander Archipelago wolf (black areas) and the ADFG designated Game Management Units (GMU). The numbers in parentheses represent the average annual reported wolf harvests for the period 1991-1995. The table shows the estimated proportion of the total wolf population occurring within each GMU.

coastal British Columbia and Vancouver Island (Nowak 1983; Friis 1985).

A recent taxonomic revision proposed by Nowak (1996) groups the Alexander Archipelago wolf with *C. l. nubilus*, a subspecies that currently occurs in central Canada and Minnesota but formerly extended across much of the northwestern United States. The Alexander Archipelago wolf is thought to have followed Sitka black-tailed deer (*Odocoileus hemionus sitkensis*) north from the Pacific Northwest following retreat of the Wisconsin glaciation from southeastern Alaska (Klein 1965). This hypothesis is supported by Nowak's (1996) inclusion of these wolves with historic populations in coastal British Columbia and the Pacific Northwest.

Genetics

A preliminary genetic analysis of mitochondrial DNA (mtDNA) from southeastern Alaska wolves identified a fixed allele within a 310 base-pair portion of the control region that may be used to distinguish these wolves from others in interior Alaska and the Yukon (Shields 1995). In addition, Alexander Archipelago wolves failed to exhibit variation at eight other nucleotide sites that were polymorphic in wolves from interior Alaska and the Yukon. These data are consistent with the morphometric data provided by Pedersen (1982), Friis (1985) and Nowak (1996) and may support the hypothesis of a southern origin for the Alexander Archipelago wolf.

Although, recent studies (Kennedy et al. 1991, Wayne et al. 1992) suggest that North American wolves may be a single large population, none of these studies included the Alexander Archipelago wolf. Published information concerning wolf genetics has focused primarily on results from allozyme electrophoresis of nuclear DNA (Kennedy et al. 1991) and restriction fragment analysis of mtDNA (Wayne et al. 1992). Studies that directly sequence hypervariable regions of mtDNA or that employ nuclear markers may be needed to adequately address the issue of phylogenetic relationships amongst wolves.

The genetic analyses conducted to date do not demonstrate evidence of distinct subpopulations within the archipelago (Shields 1995). These results suggest that some degree of gene flow has occurred within the region in the past, but they are inadequate to determine whether and to what extent gene flow continues to occur among island groups and the mainland (Person et al. in press).

POPULATION STATUS AND TRENDS

The wolf population of southeastern Alaska is currently estimated by ADFG to be about 1,200 wolves. This estimate is based on harvest data and speculation by trappers, hunters and biologists. The estimate is subjective and allows no assessment of accuracy or precision. Alternatively, Person et al. (in press) incorporated data on pack size, number of packs, home-range sizes and reproductive rates into a simulation model to estimate seasonal populations for Prince of Wales and Kosciusko Islands (which probably function as one island because barriers between them are minimal). The estimates were refined by comparing them with observed wolf densities on the islands. This process resulted in a population estimate for autumn 1994 of 269 wolves (SE = 80) on Prince of Wales and Kosciusko Islands. For spring 1995 the estimate was 174 wolves (SE = 68), with the difference attributable to overwinter mortality, primarily from trapping.

Extrapolating the population estimate for Prince of Wales and Kosciusko islands to the rest of GMU 2 yielded an estimate of 336 wolves. Data on pack and home-range sizes are not available for the rest of southeastern Alaska, consequently, a model linking wolf numbers to habitat capability for deer and other prey (Suring and DeGayner 1988) was used to estimate the proportion of the total wolf population that GMU 2 probably represents. GMU 2 may support about 37 percent of the total wolf population in southeastern Alaska (fig. 2); therefore, the autumn 1994 total population estimate was 908 wolves (336/0.37, SE = 216, Person et al. in press).

In a sample of radio-collared wolves on Prince of Wales and Kosciusko islands, mortality was estimated to be 61 percent (SE = 11%) during 1993-1994 and 38 percent (SE = 13%) during 1994-1995 (Person et al. in press). Of the 24 radio-collared wolves, nine (38%) were legally killed during the trapping seasons, five (21%) were illegally killed by humans and three (12%) died of natural causes. Analysis of birth and mortality rates for wolves on Prince of Wales and Kosciusko islands suggests that the finite rate of increase (λ) for wolves was less than one for the period between June 1993 and June 1995, indicating a decline in population (Person et al. in press). This result is consistent with observations by biologists and trappers that indicate the population peaked in 1992-93 and has declined since, primarily because of hunting and trapping. The wolf population in GMU 2 may be resilient because of adequate numbers of prey and may quickly rebound if hunting and trapping pressure decreases. Data currently available are inadequate to assess population trends outside GMU 2.

CONSERVATION CONCERNS

The Alexander Archipelago wolf population is small and exists in a naturally fragmented, insular environment that is changing radically and rapidly. An increasing human population plus the cumulative effects of road-building and habitat degradation may compromise the long-term viability of some segments of the wolf population and put the wolf on a collision course with human interests with respect to timber harvest and subsistence deer hunting. The major areas of concern are: habitat loss and fragmentation, mortality from exploitation by humans and the construction of roads that allow human access to previously roadless areas.

Habitat

Concerns for maintaining wolf habitat in the Tongass revolve around maintaining adequate habitat for deer, their primary prey. Deer constitute 70-80 percent of the diet of wolves on the islands and on some portions of the mainland (Smith et al. 1987; Kohira 1995; Person et al. in press). Deer are also important to human subsistence hunters. Consequently, sufficient deer habitat must be preserved to provide for both wolves and humans.

Old-growth forest stands are generally uneven-aged and structurally diverse with numerous vegetative layers (Alaback 1982; Alaback and Juday 1989). Intermittent openings in the forest canopy allow shrubs and forbs to develop near the forest floor, where they are available to deer. Because the forest canopy intercepts snow, old-growth forest is particularly important for deer during winter when snow prevents foraging in open areas (Wallmo and Schoen 1980; Schoen and Kirchhoff 1985; Kirchhoff and Schoen 1987). Clearcut logging removes old growth and replaces it with even-aged second-growth forest (Alaback 1982). Clearcuts less than 20 years old can provide forage for deer during snow-free periods, however, the forage is typically of poorer nutritional value than that found under old-growth stands (Hanley and McKendrick 1985; Hanley et al. 1989). Twenty to thirty years after logging the second-growth forest canopy closes over and shades out vegetation growing on the forest floor, creating a virtual desert with respect to forage for deer (Wallmo and Schoen 1980). This condition lasts for at least 150-200 years before old-growth forest characteristics return (Wallmo and Schoen 1980; Alaback 1982). The current forest plan calls for 100-year harvest rotations (USFS 1996); therefore, once old-growth stands are cut they will probably never be allowed to regain their original structure.

By 2090, logging will have removed approximately 70-80 percent and 40-50 percent of the commercially valuable old-growth forest growing on federal and private lands in GMUs 2 and 3, respectively. The overall capability of the habitat to support deer is expected to decline at least 30 percent from current levels in these GMUs (USFS 1996), which support 60-70 percent of the total wolf population in southeastern Alaska (Person et al. in press). In the most intensively logged areas within GMUs 2 and 3, declines in deer habitat capability may be 50-70 percent (USFS 1996). The long-term consequences of such reductions in deer habitat may be to place the viability of some segments of the wolf population at serious risk and put wolves in direct conflict with human subsistence hunters.

Exploitation

Liberal hunting and trapping seasons contribute to the exploitation of wolves in southeastern Alaska. The trapping season extends from November to May with no bag limit, and up to five wolves per person may be shot during the hunting season which begins in August and ends in May. Hunting and trapping seasons are regulated by the Alaska Department of Fish and Game and the Federal Subsistence Board.

Easy access and intense trapping effort have led to potentially unsustainable levels of mortality in some areas. Of most concern is GMU 2 where harvest rates may exceed 45 percent in some years when both legal and illegal killing is accounted for (Person and Ingle 1995). Mortality rates due to hunting and trapping will likely rise in GMU 2 because the human population is increasing rapidly along with greater access to wolves facilitated by the construction of roads associated with logging. The human population on Prince of Wales Island and the immediate area has increased from about 1,000 in 1960 to over 7,000 in 1995 (U.S. Census Bureau 1996). Since 1990 the population has grown 13 percent (U.S. Census Bureau 1996). This expanding population also carries with it an increasing demand for deer for sport and subsistence hunting.

Road Access

Logging roads present two major problems for wolves in the Tongass. First, the existence of roads represents habitat loss from logging, although roads are used by wolves as travel corridors. Second, roads enable human access into the interior of islands that previously were only accessible by boat, resulting in increased wolf mortality. Although 55 percent of wolves in southeastern Alaska are trapped from the shoreline, in recent years a growing proportion (44%) has been trapped along the road system.[1]

Since 1954, over 4,800 km (3,000 miles) of roads have been built on Prince of Wales and the immediately adjacent islands, primarily for logging. Under current Forest Service management plans, road building is expected to continue at a very high rate. For example, in GMUs 1A and 2, kilometers of road are expected to double in 30 years, and in GMUs 1B and 3, roads will double in 20 years (USFS 1991).

GMU 2, which includes Prince of Wales Island, is the area of most concern with respect to roads. GMU 2 is subdivided by ADFG into smaller Wildlife Analysis Areas (WAA) that are usually associated with individual watersheds. Over 70 percent of the WAAs in GMU 2 are accessible by road. Road densities in 50 percent of WAAs in GMU 2 exceed 0.6 km/km^2, the density of road suggested by researchers in other areas of North America to be inimical to wolves (Jensen et al. 1986; Mech et al. 1988; Mech 1989). Wolves in GMU 2 use heavily roaded landscapes, but pack core areas are located in the least densely roaded portions of home ranges.[2] Wolf harvest rates were significantly higher in more densely roaded WAAs in GMU 2 and harvest rate was related to length of road within a WAA, regardless of the size of WAAs (Person et al. in press). Reported wolf harvest doubled when the length of road exceeded 95 km, corresponding to a road density of 0.4 km/km^2 of road below 370 m elevation (Person et al. in press). Wolves spend most of their time at low elevation and road density calculations should reflect this relation (Person et al. in press).

Many logging roads are scheduled to be closed following timber harvest but are left open to allow additional harvest or thinning. Attempts by the Forest Service to close roads have been ineffectual in many instances and road closure policy has not been systematically applied. On Prince of Wales Island, roads closed by "signing" were often driven over.[3] In two cases where roads were gated, the gates were vandalized repeatedly to enable vehicular traffic. Physical barriers (e.g., pulled culverts) can be avoided by people on ATVs or snowmachines.

CONCLUSIONS

The conservation of wolves in southeastern Alaska will require long-term and short-term commitments. In the long-term, carrying capacity for deer must be maintained at levels capable of supporting densities of deer sufficient to sustain wolves and human subsistence needs. This effort is complicated by the island topography of the region which mandates that habitat management strategies be tailored for individual island groups representing largely discrete habitat units and wolf and deer population segments. In the short-term, management of road access and construction must be improved and regulatory changes in hunting and trapping seasons may be required in some areas of southeastern Alaska. In addition, research is needed to determine wolf population trends throughout the region and to identify intrinsic and extrinsic factors influencing wolf population dynamics.

Footnotes

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[2] Person, D. K. Unpublished data. On file with the author.

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