Alexander Archipelago wolf
(Canis lupus ligoni)

John Schoen and David Person

Although the gray wolf (Fig 1) was once widely distributed and occupied a variety of habitats throughout the northern hemisphere, its current range is substantially reduced (Nowak 1979, Mech 1995). In North America, most people associate wolves with northern wilderness areas of Canada, Alaska, and Minnesota. Unlike most of the lower 48 states where wolf populations have been extirpated or significantly reduced in numbers and range and are now listed as threatened or endangered under the Endangered Species Act, the wildlands of Alaska still maintain secure and productive wolf populations.

Wolves are highly social, generally occur in packs, and defend territories from other packs. In most of Alaska, wolf packs depend on large ungulate populations—primarily moose *(Alces alces)* and caribou *(Rangifer tarrandus)*—as their major food resource. Wolves are endemic to Southeastern Alaska (Southeast), where they largely overlap their primary prey—the Sitka black-tailed deer *(Odocoileus hemionus sitkensis)* on the islands and southern mainland, as well as moose and mountain goats *(Oreamnos americanus)* along much of the mainland coast. The Alexander Archipelago wolf (Fig 2), the subspecies occurring in Southeast, is smaller and darker than other wolf populations in Alaska (Wood 1990, Goldman 1944) and more restricted in distribution. As a result of the isolated and naturally fragmented geography of Southeast, the Alexander Archipelago wolf is potentially more sensitive to human activity and habitat disturbance than elsewhere in the state. This greater sensitivity is particularly a concern in the southern archipelago where deer

FIG 1. Two gray wolves hunting along the Alsek River on the Southeast mainland north of Glacier Bay. (John Hyde)

FIG 2. A black wolf near Juneau. Southeast wolves are generally smaller and darker than interior Alaska wolves. (Bob Armstrong)

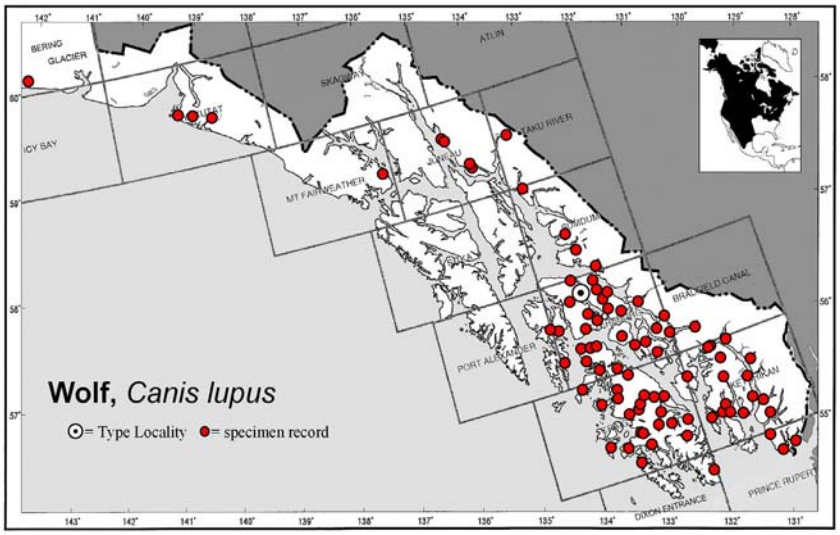

FIG 3. Range map showing the specimen records for the wolf throughout Southeast (from MacDonald and Cook in press). Note the distribution is broader than the specimen records indicate.

populations are strongly influenced by the loss and fragmentation of old-growth forest habitat.

STATUS IN SOUTHEASTERN ALASKA

Distribution

Wolves are distributed throughout the Southeast mainland and most of the larger islands south of Frederick Sound (Klein 1965, MacDonald and Cook 1999) (Fig 3). They do not currently occur on Coronation Island, Forrester Island, or many of the very small islands (MacDonald and Cook 1999). It is likely that only the largest islands (including Prince of Wales, Kuiu, Kupreanof, Mitkof, Etolin, Revillagigedo, Kosciusko, Zarembo, and Dall islands) maintain persistent wolf populations (Person et al. 1996). Wolf packs may occur on smaller islands and overlap several islands at a time, but usually do not persist there permanently (Klein 1965, Person et al. 1996). The occurrence of wolves in Southeast closely overlaps the distribution of black bears (*Ursus americanus).* Neither wolves nor black bears occur on the northern islands of Admiralty, Baranof, or Chichagof where brown bears *(U. Arctos)* are abundant.

Wolves are good swimmers and regularly travel between nearby islands. Although wolves can swim up to 2.5 mi (4 km) (Person et al. 1996), large water barriers appear to limit their distribution and movements throughout Southeast (Person et al. 1996). The most significant dispersal corridor between the southern islands and mainland is associated with the Stikine River Delta in central Southeast.

Abundance

Person et al. (1996) estimated the population of wolves in Southeast to be from 700–1,000 animals during the fall of 1995. Current data are inadequate, however, to estimate annual numbers or trends in wolf populations. In general, island populations likely occur at higher densities than mainland populations. From an average of two independent estimates, Person et al. (1996) estimated the number of wolves in autumn on Prince of Wales and Koskiusko islands at 269 (Standard Error = 80). Prince of Wales and adjacent islands likely represent a third of the Southeast wolf population and have the highest-density wolf population in the state (Person et al. 1996, Person 2001).

Taxonomic Considerations

Goldman (1944) described the wolves from Southeast as distinct from other Alaska and Canadian wolf populations and coined the name “Alexander Archipelago Wolf.” The subspecies C. l. ligoni is still considered distinct and is confined to the islands and mainland of Southeast (Pedersen 1982, Shields 1995, Nowak 1996, Weckworth et al. 2005). Recent genetic analyses of Southeast wolves suggest they have undergone a distinct evolutionary history and have been isolated from continental wolf populations (Weckworth et al. 2005). Because fossil evidence of wolves has not been found in Southeast, it appears that wolves have occurred in the region only during the last 10,000 years and likely colonized the area from glacial refugia to the south (Klein 1965, Weckworth et al. 2005). Within Southeast, Weckworth et al. (2005) have described two distinct genetic clusters of wolves: the Prince of Wales Island complex, which appears quite isolated, and wolves in the rest of Southeast. This relationship parallels the high level of endemism (i.e., taxonomic group restricted to a particular region) found in that area for other species (MacDonald and Cook 1996, Bidlack and Cook 2002, Fleming and Cook 2002, Lucid and Cook 2004). The Southeast archipelago wolf appears to represent a significant component of wolf diversity in North America, suggesting this unique endemism should be considered

in any population and habitat management plans for this area of Southeast (Weckworth et al. 2005).

Significance of the Wolf to the Region and the Tongass National Forest

To many people, both in Alaska and the lower 48 states, Alaska wolves represent a symbol of wilderness and ecosystem integrity. In the lower 48 states, wolf populations are listed as endangered or threatened under the Endangered Species Act and are being recovered at great expense and effort. Alaska has the opportunity and responsibility to avoid the mistakes that lead to this situation in the lower 48 states. Because of its large area requirements and ecological position as a top-level carnivore, the wolf represents an important umbrella species for maintaining ecosystem integrity throughout its range in Southeast. And because of its vulnerability to cumulative human activities, the wolf also serves as an indicator of wildland values. These attributes justify identifying the wolf as a focal species for ecosystem management throughout its range in Southeast and the Tongass National Forest.

Wolf Hunting and Trapping

Wolves are classified in Alaska as both furbearers and big-game species and can be harvested both by trapping and hunting. Since the mid-1980s, the average annual wolf harvest for Southeast (Game Management Units [GMUs] 1–5) was 173 animals (Alaska Department of Fish and Game [ADF&G] 2003). Approximately 70% of the harvest is from trapping or snaring and 30% from hunting. During this time, the average annual harvests were 52 wolves for the mainland (GMUs 1 and 5) and 121 wolves for the islands (GMUs 2–3). The area consisting of Prince of Wales and adjacent islands (GMU 2) consistently has the highest annual harvest of wolves in Southeast, averaging 75 wolves. Harvest in GMU 2 has frequently exceeded 100 wolves, a level that is unsustainable. On the southern islands (GMUs 2 and 3) transportation by highway and off-highway vehicles is used for more than 40% of the harvest.

The trapping season for wolves in Southeast is open from November 10 through April 30, except in GMU 2 (Prince of Wales and adjacent islands), where the trapping season is December 1 through March 31. There is no limit on the number of wolves that can be taken. The hunting season for wolves is August 1 through April 30, except in GMU 2, where it is December 1 through March 31. There is a 5-wolf bag limit. On the southern islands (GMUs 2 and 3), hunting and trapping mortality of wolves was significantly higher in areas with the highest road densities (Person et al. 1996). There is growing concern that expanding road access, particularly on Prince of Wales Island, may increase mortality of wolves there beyond sustainable levels (Person 2001).

Special Management or Conservation Designations

The wolf is identified as a Management Indicator Species under the U.S. Forest Service (USFS) Tongass Land Management Plan (TLMP) of 1997. Management Indicator Species are selected by the USFS for emphasis in planning, and are monitored during forest plan implementation to assess the effects of management activities on their populations and the populations of other species whose habitat needs are similar (USFS 1997). Wolves are also one of six Southeast species that have been identified by the USFS (1997) as having special management concerns.

HABITAT RELATIONSHIPS

Throughout much of Southeast, particularly on the southern islands and portions of the mainland, deer are the primary prey of the wolf and represent the largest component (up to 77%) of its diet (Smith et al. 1987, Kohira 1995, Person et al. 1996) (Fig 4). Person et al. (1996) estimated that the annual predation rate was approximately 26 deer per wolf. Other important food items consumed by deer include beaver *(Castor canadensis)*, moose, mountain goats, and spawning salmon *(Onchoryncus spp.)* (Smith et al. 1986, Wood 1990, Kohira 1995). Pack size on the southern islands ranged from 2–16 wolves per pack, and home range size was correlated with pack size, which is positively

FIG 4. Deer carcass killed by wolves on Heceta Is. in southern Southeast. Deer are the primary prey of wolves on the southern islands while moose and mountain goats are also major prey taken on the mainland coast. (Dave Person)

correlated with the area of winter deer habitat (Person 2001).

Critical winter deer habitat was considered by Person (2001) to be a good measure of habitat quality for wolves in southern Southeast. On northern Prince of Wales Island (which has been extensively logged during the last 50 years), clearcuts (<30 years post logging) and old-growth hemlock forests received the highest proportion of winter use by radio-collared deer (Yeo and Peek 1992). During winters with increasing snow depths, deer used old growth more than clearcuts. Optimal habitat conditions for deer in Southeast must encompass a diversity of habitats that provide deer with a variety of options to satisfy changing seasonal needs and variable weather conditions (Fig 5). Large- and medium-tree old growth (particularly at low elevations and on southerly exposures) has high habitat value for deer, particularly when deep snow accumulations occur (Hanley and Rose 1987, Kirchhoff and Schoen 1987, Schoen and Kirchhoff 1990).

In general, wolves on Prince of Wales and Koskiusko islands concentrated much (50%) of their activities at lower elevations (<270 ft [82 m]) throughout the year and seldom spent time above 1,300 ft (396 m) (Person 2001). Dens and rendezvous sites on Prince of Wales Island were generally located at lower elevations near fresh water (Fig 6). Dens are usually under the roots of trees and often associated near beaver activity (Person, personal communication 2005). From November 15 to March 15, wolf packs on Prince of Wales Island (where snow accumulated) selected for closed-canopy old growth, whereas a Koskiusko Island pack with lower snow accumulation selected for open-canopy old growth (Person 2001). From review of radio-collared wolf relocations below 328 ft (100 m), wolves on Prince of Wales and Koskiusko islands selected closed-canopy and open-canopy old-growth forest and avoided clearcuts, second-growth forests, and roads (which they used most commonly at night) (Person et al. 2001).

FOREST ECOLOGY AND MANAGMENT

Forest Composition and Ownership

Temperate coniferous rainforests cover more than 11 million acres (4.5 million hectares), or about 46% of the land area of Southeast (Hutchison and LaBau 1975, Harris and Farr 1979). Old-growth rainforests are diverse and highly variable in structure. The majority of the forested land in Southeast occurs in the Tongass National Forest, which makes up 80% of the regional land base (USFS 2003). State and Native corporation lands encompass about 5% of Southeast and corporation lands are generally well forested. However, most of the productive old growth on state and private lands has been harvested over the last 40 years (USFS 2003). About two-thirds of the Tongass is forested, although productive (commercial-quality) old growth encompasses only 5 million acres (2 million hectares), or 30% of the land area (USFS 2003). Productive old growth below 800 ft (244 m) represents only 18% of the land base of the Tongass National Forest (USFS 2003).

FIG 5. (top) El Capitan Passage between northwest Prince of Wales Is. and Kosciusko Is. Good winter deer habitat, including old growth at lower elevations, is a good indicator of important wolf habitat. (John Schoen)

FIG 6. (below) Wolf den on Prince of Wales Island. (Dave Person)

Timber Harvest

Clearcutting is the dominant timber harvest method in Southeast (USFS 1997). Forest succession in Southeast following clearcutting has been described by Harris (1974), Harris and Farr (1974, 1979), Wallmo

and Schoen (1980), and Alaback (1982). In general, deer forage (herbs, ferns, and shrubs) and conifer seedlings grow abundantly several years post logging and peak at about 15 to 20 years. At about 20–30 years, young conifers begin to overtop shrubs and dominate the second-growth stand. After 35 years, conifers completely dominate second growth, the forest floor is continually shaded, and deer forage (including forbs, shrubs, and lichens) largely disappears from the even-aged, second-growth stand. The absence of deer forage in second growth generally continues for more than a century following canopy closure (30–130 years). Therefore, clearcutting old growth and managing second growth on 100-to 120-year rotations significantly reduces foraging habitat for deer for 70%–80% of the timber rotation (Harris 1974, Wallmo and Schoen 1980, Alaback 1982). This situation has been described by Person et al. (2001) as "succession debt" because the full impacts to wildlife, particularly deer, may not immediately be expressed but will be sustained for many decades after timber harvesting (Fig 7). Refer to Chapter 5 for a more detailed discussion of forest habitat and Chapter 6.1 for habitat relationships of deer.

Forage production for deer can be prolonged in young second growth by a series of precommercial thinnings (Kessler 1984, Doerr and Sandburg 1986, DellaSala et al. 1994, Doerr et al. 2005). The benefits of these techniques, however, appear to be relatively short-lived (15–25 years), costly, and diminished by occasionally deep snow accumulations (Alaback and Tapeiner 1984, Alaback and Herman 1988). Compared to clearcutting, removal of individual trees through partial harvest or selective logging may offer better potential for maintaining understory abundance and deer habitat values (Harris and Farr 1979, Kirchhoff and Thomson 1998, USFS 1999, Deal 2001). However, retention should be large (>50%), otherwise understory condition may be similar to even-aged second growth and many residual trees may blow down. Hanley (2005) suggested that additional research is needed to evaluate second-growth red alder stands and commercial thinning of older stands.

FIG 7. Contrasting habitats of second growth (top) with old growth. Old growth provides significantly more deer forage than second growth. As more area becomes dominated by second growth, deer populations are expected to decline reducing carrying capacity for wolves. (John Schoen)

IMPLICATIONS FOR WOLF CONSERVATION

Timber harvest on Prince of Wales and adjacent islands is predicted to reduce the carrying capacity for deer by 8% during the next 50 years, which would be as much as 36% less than the level prior to 1955 when industrial logging began (USFS 1997). Simulation modeling predicted that deer populations on Prince of Wales and adjacent islands will likely decline more steeply, by 28% as a result of past and future timber harvest (as scheduled under the 1997 TLMP) and perhaps by as much as 63% from 1955 levels (Person 2001). If this decline occurs, deer populations may become further depressed by the effects of predation (Van Ballenberghe and Hanley 1984, Person 2001).

A significant population decline in deer will precipitate a consequent decline in the number of wolves in the region. For example, based on simulation modeling, Person (2001) predicted a 25% decline in the wolf population of Prince of Wales and adjacent islands between 1995 and 2045 and perhaps by as much as half of the level that existed before 1955.

Forest management not only has potential to reduce the primary density of wolf prey, it also has a direct effect on wolf mortality. Timber harvest in Southeast generally requires a substantial road infrastructure to transport equipment and logs. Wolf research in the lake

states has identified a strong negative correlation between road density and wolf abundance, with wolves being eliminated in areas where road densities exceeded 0.9 mi/mi2 (0.6 km/km2) (Jensen et al. 1986, Mech et al. 1988, Fuller 1989). Prince of Wales Island has more than 3,000 mi (4,800 km) of roads, and many areas have higher road densities than the threshold described for the lake states. Hunting and trapping are the dominant causes of wolf mortality in Southeast and are significantly correlated with increasing road densities (Person et al 1996, Person 2001). A road density of 1.6 mi/mi2 (1 km/km2) doubles the risk of overharvesting wolves on Prince of Wales and adjacent islands.

About 296,000 acres (120,000 hectares) have been logged on Prince of Wales and adjacent Islands (USFS 1997, Person 2001). As young clearcuts close over, habitat quality will be diminished and deer numbers will decline. Declining deer populations will stimulate more pressure by local hunters and trappers for reducing wolf numbers. The expanding road system will further increase hunting and trapping pressure on local wolf populations. Person et al. (1996) documented wolf mortality on Prince of Wales Island greater than 45% during some years. An expanding road system will enhance human access and increase both legal and illegal hunting and trapping of wolves in a region where enforcement is difficult (Person 2001) (Fig 8). Therefore, wolf populations on Prince of Wales and adjacent islands will be caught between two significant pressures: declining prey abundance and increasing hunting and trapping mortality.

The wolf population in Southeast likely numbers fewer than 1,000 animals. This population is further subdivided into mainland and island populations, potentially increasing the risks of maintaining long-term population viability. Person et al. (1996) stated "…maintaining large, un-fragmented, and un-roaded blocks of habitat within each bio-geographic province where wolves occur would reduce long-term risk to wolf viability. Making each 'reserve' large enough to encompass the core activity areas of at least one wolf pack markedly increases the likelihood of their effectiveness."

Conservation measures necessary to maintain viable and productive wolf populations in the southern archipelago should include (within each biogeographic province where wolves occur) the maintenance of large blocks of high-quality deer habitat, including medium- and large-tree old growth at lower elevations (Fig 9). These reserves should also prohibit or minimize road access to prevent overharvest of local wolf populations. In some areas with extensive logging and road infrastructure, road access may need to be closed and forest restoration activities initiated.

FIG 8. Logging roads on the Kasaan Peninsula of Prince of Wales Is (above). The extensive Prince of Wales road system has increased hunting and trapping pressure on wolves. (John Schoen)

FIG 9. The Honker Divide on east central Prince of Wales Is. is the largest block of intact forest left on the island and serves as a refuge for wolves and other wildlife. (John Schoen)

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