Endemic Mammals of the Alexander Archipelago

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...should civilized man ever reach these distant lands, and bring moral, intellectual, and physical light into the recesses of these virgin forests, we may be sure that he will so disturb the nicely-balanced relations of organic and inorganic nature as to cause the disappearance, and finally the extinction of these very beings whose wonderful structure and beauty he alone is fitted to appreciate and enjoy.

Alfred Russell Wallace (1869)

During the last few decades, wildlife management and conservation across the Tongass National Forest has primarily focused on establishing priorities for the remaining old-growth forests (Samson et al. 1989, U.S. Forest Service [USFS] 1997), evaluating potential benefits of second-growth (Hanley 2005, Hanley et al. 2005), and managing old-growth affiliated species and charismatic species of economic or recreational importance. Largely neglected in current management and conservation priorities for the Tongass are the individual nature of islands, the biotic complexity within and across the islands, and most importantly, the endemic organisms found only within this archipelago (Fig 1).

FIG 1. Aerial view of southwestern Prince of Wales and adjacent islands in the southern Alexander Archipelago of southeastern Alaska. Many endemic species and subspecies are known to inhabit this archipelago but the inventory of endemics is far from complete. (John Schoen)

THE DEFINITION OF AN ENDEMIC

An endemic is a distinct, unique organism found within a restricted area or range. A restricted range may be an island, or a group of islands, and in the case of some endemic mammals within the Alexander Archipelago, a restricted region such as the North Pacific Coast.

The term "endemism" holds special importance on island systems, because many organisms are restricted in distribution to a single island or groups of islands. For example, of the known bird species throughout the world, 20% are considered "island endemics" because they are found only within island systems (Frankham 1998). The North Pacific Coast is a hot spot for endemism (Cook and MacDonald 2001; Cook et al. 2006) because of its historical isolation, ecological complexity, and narrow distribution between the Pacific Ocean and coastal mountain ranges. Within Southeastern Alaska (Southeast), almost 20% of known mammal taxa (species and subspecies) have been described as endemic to the region (MacDonald and Cook 1996). The long-term viability of these endemic populations is unknown, but of increasing concern.

Island endemics are extremely susceptible to extinction because of restricted ranges, specific habitat requirements, and sensitivity to human activities such as species introductions (Soule 1983). They usually experience high rates of inbreeding resulting from small population sizes and therefore suffer from the consequences of reduced genetic variation (Frankham 1998, Brown and Lomolino 1998). Finally, the land masses of islands are smaller than those of nearby continents, and are more susceptible to random climatic events (such as storms) or massive habitat disruption (Reichel et al. 1992). More than 81% of mammalian extinctions in the last 500 years have been insular, endemic mammals (Ceballos and Brown 1995). Islands, which tend to harbor extremely high biodiversity concentrated in a relatively small area, may be major driving forces in diversification and ultimately speciation. Therefore, archipelagos are essential to maintaining and increasing global biodiversity (Emerson and Kolm 2005, Filardi and Moyle 2005). It is impossible to measure the current susceptibility of endemics within the Alexander Archipelago because little information is known about their occurrence, distribution, population sizes, and vulnerabilities. Current research on endemics throughout the Alexander Archipelago is primarily focused on mammals, but should include other organisms. The number of endemic plants, birds, amphibians, and invertebrates are not known for this archipelago. Because mammals often have the lowest percentage of endemics within an island system (World Conservation Monitoring Centre 1992), other organisms may show much higher levels of endemism within the Alexander Archipelago.

ENDEMICS IN SOUTHEASTERN ALASKA

Early explorers and naturalists identified the Alexander Archipelago as a distinctive geographic region, the "Sitkan District" (Nelson, 1887; Swarth 1911, 1936). Distinctive organisms were described on several islands in the archipelago even though fewer than 25 islands were visited. Some endemics were described from only one specimen found on one island (for example, Suemez Island ermine *[Mustela erminea seclusa])* while others were described from multiple islands *(M. erminea celenda* on Prince of Wales [POW], Dall, and Long islands). Altogether, 24 of 107 mammal taxa were recognized as endemic based on morphological characteristics (MacDonald and Cook 1996). Recent technological advances provide independent perspectives on these endemics based on molecular genetic characters. Many of these new techniques provide a more rigorous assessment of levels of divergence among island endemics and mainland populations than the early surveys described above. These new approaches successfully evaluated the status of endemics on archipelagos elsewhere across the globe (Heaney et al. 2005) and now are being applied to endemics within the Alexander Archipelago (Table 1 on page 11). Molecular studies have uncovered hidden diversity and are providing new insight into the status of island populations as endemics. Eight endemic mammalian lineages have been identified within the Alexander Archipelago. More mammals and a suite of other organisms need to be examined to paint a more accurate picture of all endemics within the Alexander Archipelago.

DESCRIPTIONS

Ermine

Ermine are small carnivores distributed across the Northern Hemisphere from Europe and Asia to North America. Five subspecies were originally described within Southeast (Hall 1951). Long considered one species, new molecular studies within the Alexander Archipelago have identified three distinct lineages within Southeast. These three groups may represent distinct species of ermine. One group, the "island" group has been found on only a few islands in the Alexander Archipelago and on Haida Gwaii (the Queen Charlotte Islands) in nearby British Columbia (Fleming and Cook 2002), where they are currently listed on the Canada List of Threatened and Endangered Species (Committee on the Status of Endangered Wildlife in Canada 2005). Current investigations are focused on measuring the geographic extent of this island clade (related taxonomic group), and the level of divergence within the other two lineages of ermine found within Southeast. Because the region is the only site worldwide that hosts all three distinctive ermine, it supports a large portion of the genetic diversity for this species (or set of species).

Marten

Using molecular techniques, researchers detected two distinct types of marten within the Alexander Archipelago, *Martes americana* (American marten) and *M. caurina* (Coastal marten). These two distinctive species were originally described as separate species (Merriam 1890) but later were reclassified as separate subspecies based on apparent introgression of morphological characters (Wright 1953). Molecular studies indicate that these two marten are distinct species (Carr and Hicks 1997, Small et al 2003, Cook et al. 2006). Both species of marten currently co-occur only on Kuiu Island within the archipelago (Fig 2). The coastal endemic marten are also found on Admiralty Island. These molecular studies also suggest that the Coastal marten found on Admiralty and Kuiu islands are genetically distinct from each other and from other populations of Coastal marten found farther south along the coast. This distinctive signature reflects long-term isolation of these endemic populations on these islands. Indeed, a recent examination of genetic variation in a parasitic nematode of marten (*Soboliphyme baturini*) indicates the presence of coastal marten on Chicagof Island prior to the introduction of American marten by humans (Koehler 2006). This limited distribution likely reflects a significant reduction in the former range of this coastal endemic.

In contrast, American marten have gone through a recent range expansion into Southeast (Small et al. 2003) and were subsequently introduced by humans to a number of islands across the Alexander Archipelago (Fig 2). Current investigations are focused on quantifying different levels of endemism, and characterizing potential hybridization between the two marten species within Southeast (N. Dawson, University of New Mexico, unpublished data).

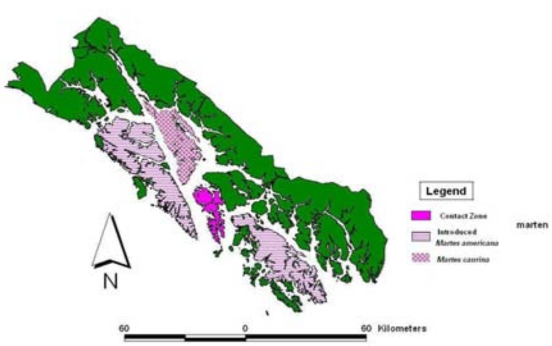

FIG 2. Map of coastal marten (*Martes caurina*) and introduced populations of widespread, American marten *(Martes americana).*

Black Bear

Two subspecies of black bear were described based on morphology within the Alexander Archipelago. *Ursus americanus pugnax* is a distinct subspecies found along the North Pacific Coast, including the Alexander Archipelago (based on 12 specimens by Swarth 1911).

Recent molecular studies (Stone and Cook 2000, Peacock 2004) also define two lineages of black bears: a continental lineage that recently entered the Alexander Archipelago after the last glaciation and an older (pre-last glacial) coastal lineage of black bears. Both lineages co-occur on several islands in the Alexander Archipelago (Peacock et al. in review), and low levels of hybridization do occur between lineages (Peacock 2004). Further investigation is needed to characterize the extent and dynamics of hybridization of these distinctive black bears in Southeast.

Northern Flying Squirrel

The northern flying squirrel *(Glaucomys sabrinus)* has been found on 15 islands within the southern half of the Alexander Archipelago (south of Frederick Sound). Historically, a distinct subspecies of flying squirrel *(G. sabrinus griseifrons)* was described for POW Island (Howell 1934) based on two specimens. Additional specimens from nearby islands, combined with recent molecular research, corroborate the distinctiveness of this endemic flying squirrel (Demboski et al 1998a, Bidlack and Cook 2001; Bidlack and Cook 2002) on 11 islands within the POW Island complex. This squirrel is the only island endemic within the Alexander Archipelago to be listed as endangered by the International Union for the Conservation of Nature (IUCN) and previously was considered a Category II subspecies *(Glaucomys sabrinus griseifrons)* by the U.S. Fish and Wildlife Service (Demboski et al. 1998b).

Brown Bear

Two distinct brown bear *(Ursus arctos)* lineages exist in Southeast: brown bears of the ABC (Admiralty, Baranof, and Chichagof) islands and mainland populations of brown bears (Talbot and Shields 1996a, 1996b). The ABC brown bear population represents an ancient and unique lineage that apparently separated from other brown bear populations approximately 550,000–700,000 years ago. The antiquity of the ABC bears also supports the hypothesis that portions of the Alexander Archipelago encompassed a nonglaciated refugium during the Wisconsin glaciation (Heaton et al. 1996, Talbot and Shields 1996b). Paetkau et al. (1998) determined that the Baranof and Chichagof island populations are distinct from the Admiralty Island population of brown bears.

Alexander Archipelago Wolf

The distinctive Alexander Archipelago wolf *(Canis lupus ligoni)* was first described by Goldman (1944) as a subspecies of the widespread North American gray wolf *(C. lupus)*. Investigations have uncovered distinctive ecological and behavioral adaptations within the endemic wolf, such as feeding habits that differ from other wolf populations within North America (Szepanski et al. 1999). Recent molecular studies have confirmed the unique genetic insularity of *C. l. ligoni* and have illustrated the presence of this endemic wolf throughout the southern Alexander Archipelago and along the coastal mainland (Weckworth et al. 2005). This endemic wolf is divergent from all other North American wolves (Weckworth et al. 2005), and Southeast populations retain a significant portion of the genetic variation found among all extant wolf populations in North America.

Dusky Shrew

Five subspecies of dusky shrew *(Sorex monticolus)* are currently recognized in Southeast (Hall 1981, Alexander 1996). One of these, *S. m. malitiosus*, is known only from Warren and Coronation islands. However, as pointed out by Alexander (1996), further analysis is needed to clarify the status of the dusky shrews from the coastal islands of Southeast, including Forrester Island, and British Columbia. Using molecular techniques, only two distinct lineages (highly divergent and likely representing separate species) occur within Southeast: a coastal clade (Glacier Bay south to coastal Oregon) and a continental clade (upper Lynn Canal and Yakutat, as well as elsewhere in Alaska and western Canada southward) (Demboski and Cook 2001).

Other Endemics

The Keen's mouse *(Peromyscus keeni)* has several endemic forms within Southeast (Table 1) with an especially deep lineage found on Gravina Island (Lucid and Cook 2004). Similarly, five species of bats have been recorded within Southeast (MacDonald and Cook 1999). Of these, only *Myotis lucifigus* has been examined genetically and Southeast populations represent a new species endemic to the region, *M. alascensis* (Baker et al. 2003; T. Dewey, University of Michigan, Ann Arbor Michigan, personal communication 2005). Of the other endemic mammals (Table 1), none has been reevaluated with molecular tools. These endemics include the Glacier Bay hoary marmot *(Marmota caligata vigilis)*, restricted to Glacier Bay National Park, and an endemic beaver *(Castor canadensis phaeus)* and meadow vole *(Microtus pennsylvanicus admiraltiae)*, found only on Admiralty Island.

HISTORICAL COMPLEXITY

Genetic analyses of endemic mammals within Southeast also provide a framework for deciphering the historical processes that drove the formation of the temperate rainforest ecosystem. Reconstruction of the past histories of individual species has identified routes of colonization into this coastal region and approximate times when particular species colonized Southeast. The trans-coastal river systems (such as Stikine and Taku rivers) were major historical colonization routes, and are currently critical corridors for faunal exchange between interior and coastal populations (Fig 3). Evidence of movement down these natural corridors includes recent colonization into the region by moose *(Alces alces)*, and possibly fisher *(Martes pennanti)* and cougar *(Puma concolor)*.

FIG 3. Aerial view looking up the mouth of the Stikine River. The Stikine River is one of the major transboundary rivers of southeastern Alaska and a major colonization route from interior to coastal regions. (John Schoen)

Evidence of colonization is also recorded in the molecular genetic variation of species within Southeast. Coastal lineages have persisted for a long time and have characteristic genetic signals, whereas continental lineages represent recent colonizers (Cook et al. 2001, Cook et al. 2006). These shared patterns illustrate the influence of a complex geologic history of the region on the structure of biotic diversity and periods of recolonization after glaciations. Mammals that have a deep history in the region (and therefore are of great conservation concern) can be distinguished from those that are recent (<12,000 years old). For example, black bear have been found deep in the fossil record (Heaton and Grady 2003), and these likely reflect the coastal lineage that is found in the Alexander Archipelago and farther south along the North Pacific Coast. In contrast, the Alexander Archipelago wolf is a recent colonizer, arriving in the last 10,000 years (Weckworth et al. 2005).

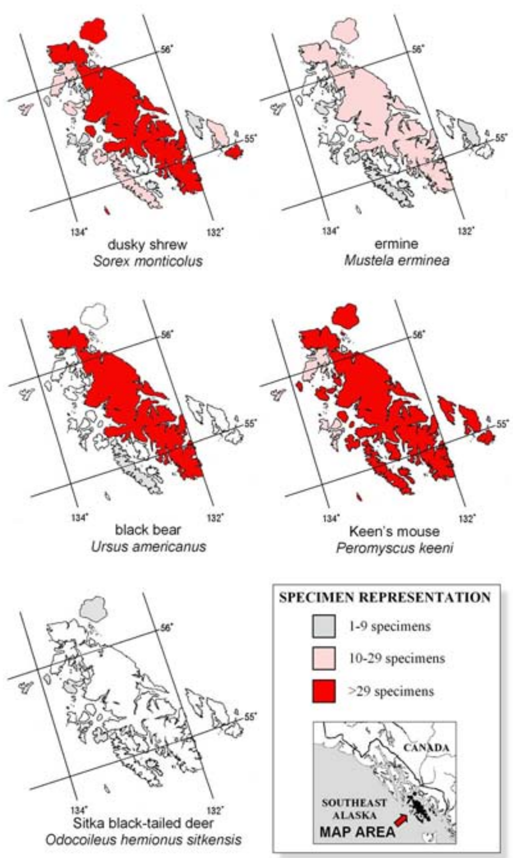

FIG 4. Number of specimens for 5 mammals found on Prince of Wales and nearby islands in the southern Alexander Archipelago.

ISLAND BIOGEOGRAPHY

Mammalian species within the Alexander Archipelago are currently distributed according to both area and isolation (Conroy et al 1999). Endemic organisms within the Alexander Archipelago are not structured (nested) by area or isolation, meaning that neither the distance from the island of occurrence to the mainland, nor the size of the island, explains their distributions (N. Dawson, University of New Mexico, unpublished data). Therefore, management decisions cannot simplistically assume that protecting islands of a particular size or generalized location will account for the phenomenal diversity of endemics found in this archipelago. An incomplete understanding of endemic lineages will miss significant components of structure and diversity.

From review of mammalian distributions, five biogeographic provinces within the Alexander Archipelago have been proposed (MacDonald and Cook 1996; Cook et al. 2006). These biogeographic provinces were reevaluated with the use of information about endemic organisms, and clear patterns began to emerge (Fig 4). For example, a majority of endemic organisms within the Alexander Archipelago are restricted to southern outer islands such as POW, which also has one of the longest and most complete fossil records of any of the islands across the archipelago (Heaton and Grady 2003). POW may have been a refugial region during the last glaciation (~12,000 years before present) (Carrara et al 2003), and the incredible endemic diversity on this complex of islands (Kondzela et al. 1994, Dickerman and Gustafson 1996) likely reflects the long-term isolation of these organisms. Community assemblages and geological history are comparable to nearby Haida Gwaii, which has also been described as a possible refugium during the last glacial period (Byun et al. 1997).

OLD-GROWTH FOREST ASSOCIATION

Some endemic mammals have clear associations with old-growth forests (Fig 5). For example, the marten requires expanses of old-growth because it

FIG 5. The structural characteristics of old-growth forest include: uneven-aged trees of variable size, multiple canopy layers, dominant trees > 300 years old, dead and down trees with large-diameter snags, productive understory plant communities, arboreal lichens, and structural diversity both vertically and horizontally across the stand. (John Schoen)

needs large stumps and tree hollows for denning (Chapter 6.5). Within Southeast, it spends most of its time in forested habitats. The marten has been characterized as an old-growth-restricted mammal across North America (Buskirk and Ruggiero 1994, Thompson and Harestad 1994). None of the previous ecological research on marten in Southeast has focused on the Coastal endemic marten found on Kuiu Island and Admiralty Island (Flynn and Schumacher 2001). Ecological and behavioral differences may exist between the two marten species with regard to use of old-growth forests and tolerance of disturbed areas such as roadsides (N. Dawson, University of New Mexico, unpublished data). Black and brown bears are also associated with old growth, particularly riparian forests with salmon spawning streams (Chapter 6.2, 6.3). The flying squirrel relies on old-growth habitat for denning sites (Bakker and Hastings 2002) and for the abundance of fungi and lichen associated with old trees (Kiester and Eckhardt 1994) (Chapter 6.6). It is usually found in highest densities within old-growth stands (Carey 1995).

Old-growth and riparian areas are especially important to bat species (Parker et al 1996). Second-growth does not provide suitable habitat for these organisms, and dense 30–90 year old second-growth is unproductive and supports relatively low vertebrate diversity (Schoen et al. 1988) (Fig 6).

FIG 6. Characteristics of second-growth forests in southeastern Alaska include: even-aged trees of similar size, dense single-layered canopy cover with little sunlight penetration to the forest floor, limited understory plant community, no large diameter snags, few arboreal lichens, and low structural diversity. (John Schoen)

MAMMALS AS MODELS

Most of the information on endemic organisms across the Alexander Archipelago has been limited to mammals. Only 5% of all recorded extinctions on islands worldwide have been mammals, compared to 30% of all insect species on islands and 20% of island bird species (World Conservation Centre 1992). Therefore, extinction probabilities within the Alexander Archipelago may be much higher for plants, birds, and other organisms. One way to evaluate potential areas of highest concern is to use the current information on endemic mammals to project important areas of endemism for other organisms. For example, based on genetic data from ermine, flying squirrels, and wolves (Bidlack and Cook 2001, Fleming and Cook 2002, Weckworth et al. 2005), POW and nearby islands are distinct. This pattern of high endemism occurs in other organisms. Preliminary studies of grouse (*Dendragapus* sp.) (Dickerman and Gustafson 1996) and salmon (*Oncoryhnchus* sp.) (Kondzela et al. 1994) also indicate that the POW Island complex is a "hot spot" of endemism. Corresponding "hot spots" of endemism for multiple taxa may occur throughout other islands across the archipelago (like Kuiu), but without investigations of multiple species, it is impossible to distinguish these patterns. Using mammal distributions as models, researchers can focus on certain regions with high potential for endemism.

ENDEMICS AND FOREST PLANS

The 1997 Tongass National Forest Land Management Plan (TLMP) (USFS 1997) lists the geographic, population, and habitat information for endemic mammals as important "information needs." During the TLMP Risk Assessment Panel process, one panel was specifically assigned to "other mammals – endemics" to evaluate the impact of various forest plans based on information that was available for endemic mammals in the mid-1990s. Although

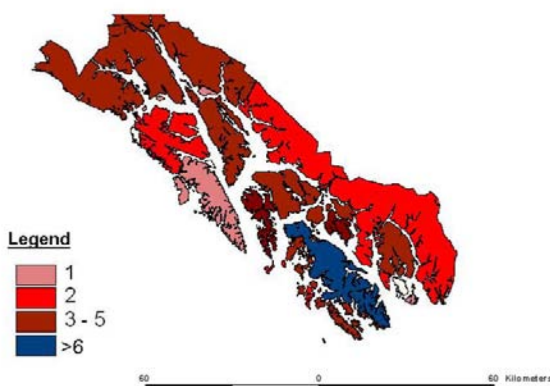

FIG 7. Map of endemic mammals across Alexander Archipelago (relative densities based on number of endemic lineages found on each island). High concentrations of endemics suggest that Prince of Wales Island is a hot spot of biodiversity.

endemics were addressed in the final TLMP (USFS 1997), a specific research and monitoring agenda was never developed. For example, rigorous surveys of endemic mammals (or other organisms) have yet to be implemented before preparing environmental impact statements for individual timber sales. Without adequate surveys of each island within the Alexander Archipelago, conclusive range maps cannot be produced. At this time, even the most common species have been minimally inventoried (Fig 7). Conclusive geographic ranges of many endemics cannot be produced because such a small portion of islands within the Alexander Archipelago have been at least minimally surveyed (~127 out of >2,000 named islands) or taxonomically reevaluated. Extensive habitat information for endemic mammals within the Alexander Archipelago is not available, and extrapolating ecological relationships from other systems, particularly those on the mainland should be done cautiously. Endemic mammals were listed as a priority in the TLMP (USFS 1997), but lack of a formal survey plan for endemic mammals has stalled efforts to evaluate their status.

Wildlife managers and conservation organizations are beginning to recognize the importance of endemic mammals (Smith 2005), but all efforts have suffered from lack of a management plan that is specifically centered on island systems (Samson et al. 1989). Endemics also have been included in subsequent forest plan revisions since the 1997 TLMP. Although roadless area designations and subsequent redesignations have attempted to include information on endemic mammals and the important role they played in the development of the 1997 TLMP (Johnston 2000), the plan offered no suggestions for roadless designations based on this information.

CONSERVATION IMPLICATIONS

> *Lest those islands still seem to you too remote in space and time to be relevant to our modern societies, just think about the risks... of our increasing globalization and increasing worldwide economic interdependence.*
>
> Jared Diamond

Global Significance

Across the globe, a number of areas of endemism have been identified as biodiversity hot spots (Myers et al. 2000), regions with disproportional numbers of endemic taxa under increasingly great development pressures. At this time, the Tongass National Forest is not recognized as a biodiversity hot spot because little attention has focused on the insularity of the region. Elsewhere (such as Chile) temperate rainforest systems have been identified as biodiversity hot spots. The POW Island complex is a center of endemism for the Alexander Archipelago, a finding with profound implications for management. In the last five decades, POW Island was extensively logged, leaving the greatest road infrastructure of any island (more than 2,500 mi [4,020 km] of roads) in the archipelago. POW is also the site of highest endemism. Therefore, the islands that should be designated biodiversity hot spots have instead experienced some of the greatest habitat alteration of any area within the Tongass. Careful delineation of centers of endemism would provide managers and conservation organizations with a foundation for establishing priorities for protecting specific islands, or in the case of POW, reducing further timber harvest and fragmentation caused by roads.

Managing a Land in Pieces (a Highly Fragmented Archipelago)

The inclusion of endemics in management plans for the Tongass National Forest will require developing an island-centered scheme, one that focuses on the individuality of islands instead of a single forest system. Patterns of endemism indicate the potential for substantial differences between geographically close islands (Fig 4). For example, Kuiu Island has few marten (Flynn et al. 2004, N. Dawson, University of New Mexico, unpublished data), but nearby Admiralty Island harbors very healthy marten populations. Flying squirrels on POW are morphologically (Howell 1934), genetically (Bidlack and Cook 2001), and ecologically distinctive (Pyare et al. 2002) from mainland flying squirrels and should be recognized as such when managers evaluate their status within Southeast (Winston and Nichols 2003). Individual islands harbor distinctive combinations of prey (such as small rodents) and predators. Substantial differences among islands, such as fluctuations in population numbers, are characteristic of this naturally fragmented landscape. Several important features of insular systems need to be addressed to properly manage and conserve the highly productive biomes of the Tongass:

1. Introductions of exotic species/diseases to islands within the Alexander Archipelago and their effects on native populations and functional ecosystems.

2. Increasing human disturbance on an already fragmented landscape. For example, some islands experience very heavy human use because of roads, towns, and tourism. Other islands do not have those same pressures.

3. Natural fragmentation of islands. Some islands are close to the mainland and have lots of species of mammals; other, remote islands have different species assemblages and often more endemics.

4. Scales of disturbance. The level of disturbance on one island does not constitute the same measure of disturbance on another island. For example, spraying herbicides across a small area of POW Island is very different from spraying herbicide across that same size of land on Long Island.

Endemic mammals provide a framework for initiating an individual-island management scheme. Preliminary investigations support the conclusion that the POW Island complex, Kuiu Island, and Admiralty Island are particularly important places for endemic mammals, and should be accorded additional protective measures. Further inventories of endemic organisms of all major taxonomic groups should become a priority for the Tongass National Forest. It is suspected that patterns of endemism reflected in the mammals may be even stronger in other species throughout the archipelago.

The Alexander Archipelago is slowly being recognized as a highly insular, ecologically distinct island archipelago (Hanley et al. 2005) that is facing many of the same management challenges and conservation concerns as other island archipelagos, such as the Galapagos and Hawaiian Islands. Researchers call the Queen Charlotte Islands to the south of Dixon Entrance “the Canadian Galapagos” (Vaillant 2005) because of their rich diversity and island-centered biogeographic structure. The Alexander Archipelago is no less an ecological and evolutionary focal area and constitutes a hot spot for endemism along the North Pacific Coast. With collaborative efforts among government agencies, independent researchers, community organizations, and nonprofits groups, the Tongass National Forest can be managed effectively as a highly fragmented island system. It has the potential to become a model system for future island-management plans across the globe as the major conservation concerns on island archipelagos become increasingly prominent in scientific research, resource management, and conservation.

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TABLE 1. Endemic Mammals in Southeast Alaska (original Taxa names based on morphological descriptions)

*Distinct lineage column refers to the species/subspecies across Southeast Alaska and may encompass more/other islands than those listed in Distribution column. Distinct lineages are defined as CNT=Continental lineage, BER=Beringian lineage, and ISL=island lineage.

**Not originally described as endemic, but later identified as endemic through molecular analyses.

Taxon	Distribution	N	IUCN Status	Distinct lineage*	Nuclear DNA	MtDNA
Sorex monticolus malitiosus	**Warren I., Coronation I.**	**21**		**Y**	**N**	**Y**
Sorex alaskanus	**Glacier Bay**	**2**		**?**		
Marmota caligata vigilis	**Glacier Bay**	**8**	**DD**	**?**		
Tamiasciurus hudsonicus picatus	**Southeast Alaska**	**36**		**?**		
Glacomys sabrinus griseifrons	**Prince of Wales I.**	**2**	**EN**	**Y**	**Y**	**Y**
Castor canadensis phaeus	**Admiralty I.**	**6**	**DD**	**?**		
Peromyscus keeni hylaeus	**Alexander Arch., coastal mainland**	**163**		**?**		**Y**
Peromyscys keeni oceanicus	**Forrester I.**	**2**		**?**		**Y**
Peromyscus keeni sitkensis	**Baranof I.,Chichagof I., Warren I., Duke I., Coronation I.**	**54**		**?**		**Y**
Clethrionomys rutilus glacialis	**Glacier Bay**	**18**		**?**		
Clethrionomys gapperi stikinensis	**Stikine River Delta, Cleveland Pen.**	**29**		**?**		
Clethrionomys gapperi solus	**Revillagigedo I.**	**31**	**DD**	**?**		
Clethrionomys gapperi wrangeli	**Wrangell I., Sergief I., Stikine River Delta**	**13**		**?**		
*Martes caurina***	**Admiralty I., Kuiu I.**	**110**		**Y**	**Y**	**Y**
Microtus pennsylvanicus admiraltiae	**Admiralty I.**	**53**		**?**		
Microtus oeconomus sitkensis	**Baranof I., Chichagof I.**	**10**	**DD**	**N**	**Y**	**Y**
Microtus longicaudus coronarius	**Coronation I., Warren I., Forrester I.**	**22**	**DD**	**Y**	**N**	**Y**
Canis lupus ligoni	**Southeast Alaska**	**27**		**Y**	**Y**	**Y**
Ursus americanus pugnax	**Southeast Alaska**	**9**		**Y**	**Y**	**Y**
Mustela erminea alascensis	**Coastal Mainland**	**24**	**DD**	**Y (CNT)**		**Y**
Mustela erminea initus	**Baranof I., Chichagof I.**	**6**	**DD**	**Y (BER)**		**Y**
Mustela erminea celenda	**Prince of Wales I., Long I., Dall I.**	**25**	**DD**	**Y (ISL)**		**Y**
Mustela erminea salva	**Admiralty I.**	**26**	**DD**	**Y (BER)**		**Y**
Mustela erminea seclusa	**Suemez I.**	**1**	**DD**	**Y (ISL)**		**Y**
Mustela vison nesolestes	**Alexander Archipelago**	**3**		**N**		