

APPENDIX E
WILDLIFE RESOURCES

E. WILDLIFE RESOURCES

This appendix provides supporting information on wildlife resources in the proposed Port MacKenzie Rail Extension project area and Alaska Department of Fish and Game (ADF&G) Game Management Subunits 14A and 14B, which the rail line would cross (Figure E-1). The descriptions of wildlife occurrence, abundance, distribution, harvest, and life histories provided in this appendix and used in analyses were compiled by the Surface Transportation Board's (STB or Board) Office of Environmental Analysis (OEA) from various sources, including ADF&G Subunit 14A and 14B management reports and data (ADF&G, 2008a; 2008b), the ADF&G Wildlife Notebook Series, Alaska Natural Heritage Program (UAA, 2008), Arctos v3 database UAM Mammals (UAF, 2008), U.S. Fish and Wildlife Service (USFWS) data (Conant *et al.*, 2007; Platte *et al.*, 2008), and breeding bird survey data (Shook and Ritchie, 2008; Sauer *et al.*, 2008; Benson, 2001).

E.1 Affected Environment

Table E-1 lists mammals in the study area, which include 3 big game mammals, 14 furbearers, 10 other mammals, and 3 marine mammals. Migratory and resident birds in the study area include 20 waterfowl and waterbirds, 7 raptors and owls, 5 shorebirds, 2 seabirds, and 42 landbirds.

E.1.1 Bears

Both black and brown bears can become a problem when they have learned to associate humans with food. Bears become conditioned to human food when they access improperly stored garbage or human or animal foods. Bears have a keen sense of smell and habitually seek the same foods in the same places year after year. Because cubs learn from their mothers where and on what to forage, cubs conditioned to human foods condition their cubs to human foods. Once exposed to human foods and garbage, conditioned bears can become such a problem that they ultimately must be eradicated.

E.1.2 Moose

Moose are distributed throughout Alaska and are the primary large mammal harvested in the Matanuska-Susitna Valley. Primary predators of moose calves in the study area are wolves, black bears, and grizzly bears. The moose population in Subunit 14A has remained relatively stable at approximately 5,500 to 6,500 animals (Figure E-2); the moose population in Subunit 14B has remained relatively stable at approximately 1,500 moose (Figure E-3).

Based on early winter densities listed in Table E-1, there would be an estimated 2,873 moose within 5 miles of the proposed rail line. Assuming an estimated 30 percent of the moose in the project area are seasonal migrants from Subunit 14A, 862 moose would be expected to move into and out of the project area, potentially crossing the proposed rail line twice a year, once during spring and once during fall. Figure E-4 illustrates seasonal moose movement patterns based on information in Masteller (undated) and Modafferi (1988) and moose calving, rutting, and winter habitats (ADF&G, 1985).

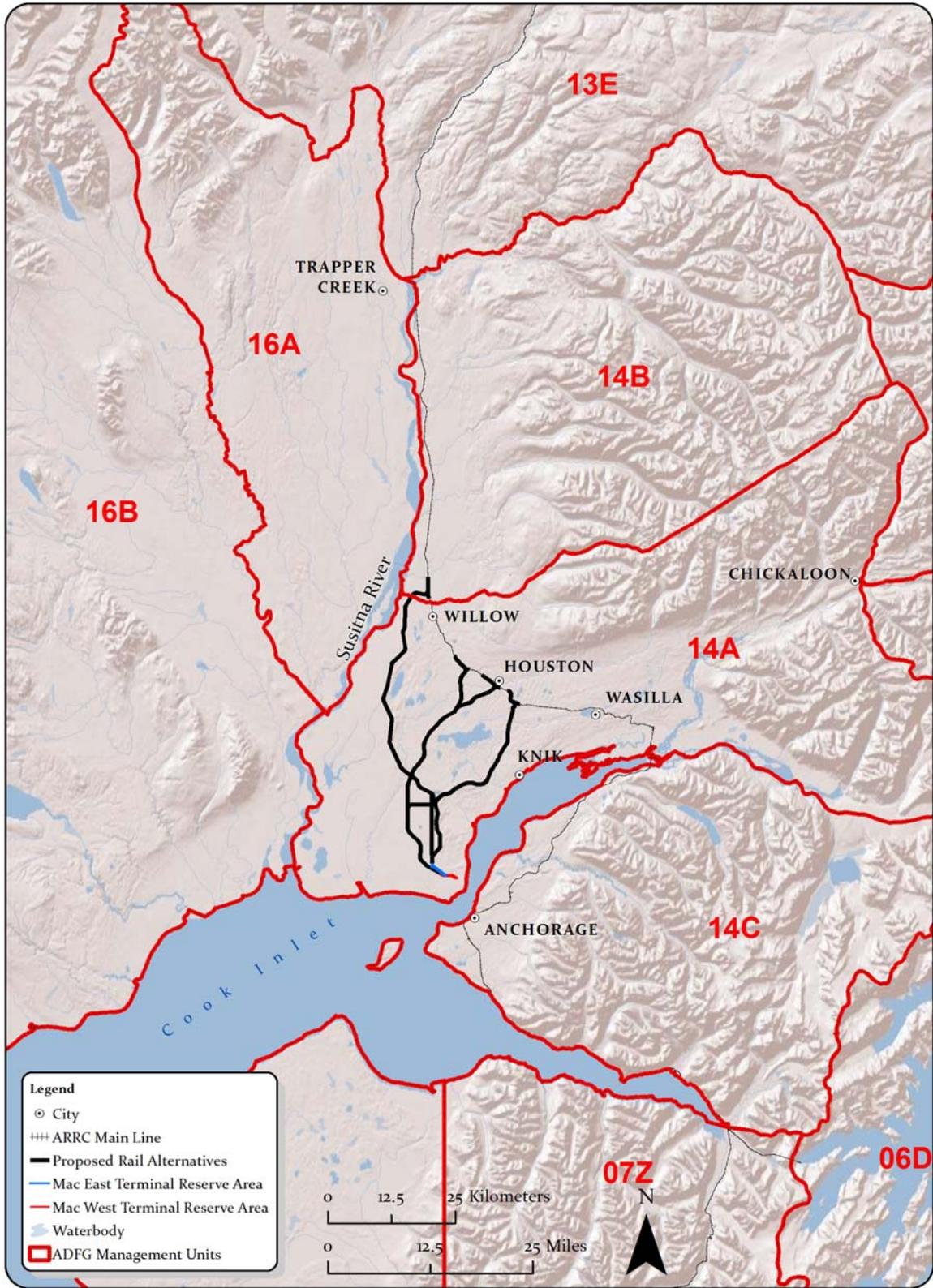


Figure E-1. Alaska Department of Fish and Game Management Units

**Table E-1
Mammals in the Port MacKenzie Rail Extension Project Area^a (page 1 of 5)**

Common Name	Scientific Name	Generalized Hunting Season	Mean Annual Harvest 2002-2007 (Game Management Unit 14)^b	Population Estimate (Game Management Unit 14)	Project Area Density
Big Game Mammals					
Black Bear	<i>Ursus americanus</i>	No closed season	153.2 (20 percent)	500 to 1,000	8 to 15 per 100 square miles
Brown Bear	<i>Ursus arctos</i>	September to June	10.2 (5 percent)	185 to 239	3 to 4 per 100 square miles
Moose	<i>Alces alces</i>	August and October	622.7 (6 percent)	10,213	Approximately 3.6 per square mile
Moose	<i>Alces alces</i>	August and October	467.8 (7 percent)	14A, 6,600	3.6 per square mile
Moose	<i>Alces alces</i>	August and October	61.7 (4 percent)	14B, 1,413	0.7 per square mile
Wolf	<i>Canis lupus</i>	August to May	23.6 (21 percent)	115	18 to 21 packs; 2 wolves per 100 square miles
Common Name	Scientific Name	Home Range Size	General Habitats	Breeding and Den Habitat	
Furbearers					
Beaver	<i>Castor canadensis</i>	0.6 mile stream channel; 43.5 acres, solitary; 19.0 acres, families	Streams, ponds, backwaters; forages on shrubs and aquatic vegetation	Breed January or February, young born late April to June; bank den or lodge near dammed streams or on ponds, 2 feet by 3 feet by 3 feet, used year-round	
Coyote	<i>Canis latrans</i>	2,471 to 24,710 acres	Forests, grasslands, shrub/scrub, agricultural; forage primarily on hares, rodents, carrion	Breed February and March; den in hills, floodplain terrace, aboveground or hollow logs, used only during whelping; dens might be occupied during March to July; might use more than one den; dens used repeatedly	

**Table E-1
Mammals Occurring Within the Port MacKenzie Rail Extension Project Area^a (page 2 of 5)**

Common Name	Scientific Name	Home Range Size	General Habitats	Breeding and Den Habitat
Furbearers				
Short-tailed Weasel (Ermine)	<i>Mustela erminea</i>	24.7 to 49.4 acres	Forests, riparian woodlands and shrub/scrub; forages primarily on small rodents and lemmings but will eat birds, eggs, frogs, fish, insects	Breed mid to late summer, young born early May through June; den in rodent burrows, stumps, rock outcrops; can remain June to August
Least Weasel	<i>Mustela nivalis</i>	17.3 acres females, 64.2 acres males	Woodlands, riparian, grassy fields and meadows; forages on small mammals, especially voles, lemmings, and other mice; might consume other small vertebrates, insects, or worms when rodents are scarce	Uses burrows made by voles
Lynx	<i>Lynx canadensis</i>	5 to 100 square miles (3,200 to 64,000 acres), depending on food abundance	Spruce and hardwood forest habitats, especially mosaic habitats caused by fire; forage primarily on hares, grouse, ptarmigan, squirrels, rodents	Breed March and early April, kittens born May to June; den in natural shelters such as windblown trees, hollow logs, log jams, rock crevices
Marten	<i>Martes americana</i>	1 to 15 square miles (640 to 9,600 acres), depending on food abundance	Black spruce forests and bogs; forage primarily on rodents, but also eat berries, small birds, eggs, vegetation, carrion	Breed July and August, young born in April or early May; den in natural shelters such as hollow logs, windblown trees, standing snags/hollow trees
Mink	<i>Mustela vison</i>	20 to 50 acres female, 1,900 acres male	Riparian forests, marshes and shrub/scrub; forage on fish, birds, eggs, rodents	Breed March to April, most young born in June; den in burrow or hollow log near a pond or stream; young remain in den through July
Muskrat	<i>Ondatra zibethicus</i>	2.5 to 4.9 acres, marshes; 0.25 mile, streams	Marshes, riparian areas, floodplains of large rivers, ponds; forage on aquatic plants, lilies, sedges, grasses, mussels, small fish	Breed during late April to mid-May, 2 litters per year, first mid-June, second mid-July; den in vegetation piles 2 to 3 feet above water and 5 to 6 feet in diameter; also might tunnel into banks used year-round
Red Fox	<i>Vulpes vulpes</i>	Summer, 150 to 1,300 acres; winter, 3,104 to 49,658 acres	Mosaic habitats, lowland marshes; forages on rodents, small mammals, birds, eggs, insects, vegetation, carrion	Breed February to March, young born April to May; dens 15 to 20 feet long, usually on the side of a hill with several entrances; might use abandoned wolf dens

**Table E-1
Mammals Occurring Within the Port MacKenzie Rail Extension Project Area^a (page 3 of 5)**

Common Name	Scientific Name	Home Range Size	General Habitats	Breeding and Den Habitat
Furbearers				
Red Squirrel	<i>Tamiasciurus hudsonicus</i>	0.5 to 1 acre	Spruce forests; forages on seeds, berries, buds, fungi; occasionally insects, and bird eggs	Breed February and March, young born April to May; nest in holes in tree trunks or constructed mass of twigs, leaves, mosses, lichens; several nests maintained per territory; ground burrows or middens used primarily for food storage
River Otter	<i>Lontra canadensis</i>	1.2 to 48.5 miles, waterway	Riparian habitats, rivers, lakes, marshes; forage on fish, mussels, snails, birds, mammals, vegetation	Breed in May, young born in late January to June; burrows in soil or uses fallen/hollow logs, overturned tree root wads, might use year-round
Snowshoe Hare	<i>Lepus americanus</i>	Average 7 to 15 acres, up to 39.5 acres	Forests, woody wetlands, bogs; forages on succulent vegetation, in winter eats twigs, buds, bark of small trees	Breed February to mid-August, young born May to August; nest in ground depressions or hollow logs
Wolf	<i>Canis lupus</i>	600 square miles (384,000 acres) per pack	Variable; forages on moose, caribou, hares, rodents, birds	Breed February and March, young born in May or early June; den in well-drained soil up to 10 feet deep, young moved from den during mid to late summer
Wolverine	<i>Gulo gulo</i>	Female, 50 to 100 square miles (32,000 to 64,000 acres); male, 240 square miles (153,600 acres)	Variable, coniferous forests, riparian areas could be important winter habitat; forages on moose and caribou carcasses, rodents, squirrels, hares, birds	Breed May through August, young born January through April; den made in snow; occupies dens in caves, under fallen trees, or thickets when inactive
Other Mammals				
Little Brown Bat	<i>Myotis lucifugus</i>	Migratory; winters in caves, occur in area during spring through fall, summer home range poorly understood	Forest, woody wetlands, riparian; forages in woodlands near water; eats flying insects	Breed September to October, young born in late spring to early summer; use standing snags/hollow trees; availability of suitable maternity sites might limit abundance and distribution

Table E-1
Mammals Occurring Within the Port MacKenzie Rail Extension Project Area^a (page 4 of 5)

Common Name	Scientific Name	Home Range Size	General Habitats	Breeding and Den Habitat
Northern Bog Lemming	<i>Synaptomys borealis</i>	Less than 1 acre; sociable, may form small colonies	Bog, muskeg, mixed and coniferous forests; forages on grasses, sedges, other vegetation	Breed May to August, several litters per year; active year-round; nest in burrows in soil or uses logs/debris
Porcupine	<i>Erethizon dorsatum</i>	Summer range 125 to 250 acres; winter range smaller; densities 25 to 58 per square mile in good habitat	Coniferous and mixed forests and woodlands; forages on inner bark of trees, evergreen needles in winter, buds in spring, roots, leaves, fruits in summer, fruits in fall	Breed September to November or December, young born in spring to winter; den in rock outcrops, live hollow trees, hollow logs; shelter in dense conifers in winter
Northern Flying Squirrel	<i>Glaucomys sabrinus</i>	Up to 86.5 acres; summer, 7 to 12 acres	Coniferous and mixed forests, riparian woods; forages on fungi, lichens, insects, nuts, buds, seeds, fruit	Breed February to May; in lower latitudes might have 2 litters; nest in tree cavities, leaf nests, underground burrows; use large number of alternative den sites in Alaska
Dusky Shrew	<i>Sorex monticolus</i>	0.3 to 1 acre	Forest and wetland habitats, sphagnum bogs; forages on insects and other small invertebrates such as worms, sowbugs, mollusks	Breed April to August; nest in burrows or fallen logs/debris
Masked Shrew	<i>Sorex cinereus</i>	0.1 acre	Forest and wetland habitats; forages on insects, invertebrates, carrion, small vertebrates, occasionally seeds	Breed March to September, usually 2 litters; nest in shallow burrows or above ground in logs and stumps
Tundra Shrew	<i>Sorex tundrensis</i>	Less than 1 acre	Dwarf shrub habitats, tundra vegetation; forages on insects, invertebrates	Nest in soil or logs/debris
Meadow Vole	<i>Microtus pennsylvanicus</i>	0.25 acre; dispersal probably more than 0.6 mile	Grasslands, woody wetlands, bogs, riparian; forages on vegetation, grasses, roots, seeds; burrows and uses fallen logs/debris	Breed throughout year with sufficient snow cover; peak activity April to October

**Table E-1
Mammals Occurring Within the Port MacKenzie Rail Extension Project Area^a (page 5 of 5)**

Common Name	Scientific Name	Home Range Size	General Habitats	Breeding and Den Habitat
Northern Red-backed Vole	<i>Myodes rutilus</i>	Less than 1 acre	Coniferous forests; forages on fungi, berries, lichens, moss, insects, grass	Young born May to September; nest in burrows or fallen log/debris
Tundra Vole	<i>Microtus oeconomus</i>	Male, 0.9 acre; female, 0.3 acre	Muskeg, grasslands, coniferous and mixed woodlands; nests in shallow burrows in soil or uses logs/debris; forages on green grasses and sedges in summer, stores rhizomes and grass seeds for winter	Probably breed throughout the year; population densities can fluctuate
Marine Mammals				
Beluga Whale	<i>Delphinapterous leucas</i> Cook Inlet stock	Commonly occur in Knik Arm of Cook Inlet	Near shore, river mouth/tidal rivers; forage on fish (eulacoon, salmon; can follow prey up river); squid, crabs, clams; social	Concentrate near river mouths along the northern reaches of Cook Inlet in spring and early summer; calving areas near mouth of Susitna River, Turnagain Arm
Harbor Porpoise	<i>Phocoena phocoena</i>	Seasonal; inshore movements in summer, offshore in winter; movements follow prey species	Near shore, pelagic, river mouth/tidal rivers; forage on fish, squid, crustaceans; Shy, not often observed, but can be heard; solitary or social	Breed in summer, calf born May to early August; mothers and calves move to sheltered coves soon after parturition
Harbor Seal	<i>Phoca vitulina</i>	Can make seasonal migrations of hundreds of miles	Near shore, pelagic, river mouth/tidal rivers, can occur miles up river; forage on fish, squid, crustaceans; solitary	Young May to June in Gulf of Alaska; haul out on intertidal sandbars, rocky shores, ice

^a Sources: Kavalok, 2005; Kavalok, 2007; McDonough, 2002a; McDonough, 2002b; Peltier, 2006a; Peltier, 2006b; ADF&G Alaska Wildlife Notebook; NatureServe, Animal Diversity Web.

^b Harvest percentage of estimated population appears in parentheses. Mean annual harvest of moose for Subunits 14A and 14B are listed on separate table lines. All harvested wolves are required to be sealed (registered and recorded). Wolf harvest records are reported from sealing files. No same day airborne hunting of wolves was in affect for Game Management Unit 14 during the reporting period. The National Research Council estimated sustainable harvest rates for wolves from 30 percent up to 40 percent of early winter populations (NRC, 1997).

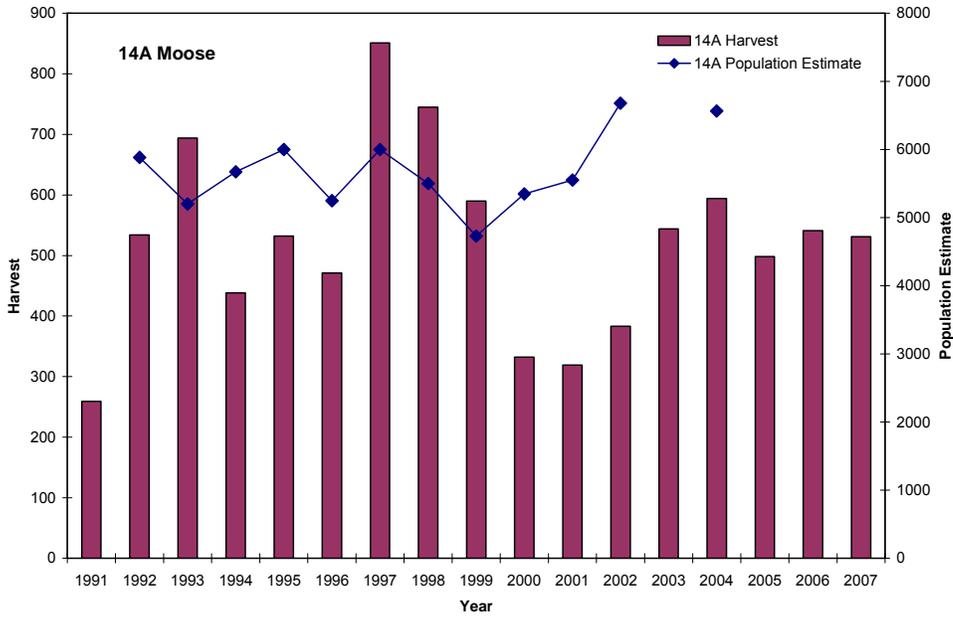


Figure E-2. Population and Harvest Trends for Subunit 14A Moose 1991 to 2007 (Peltier, 2006a)

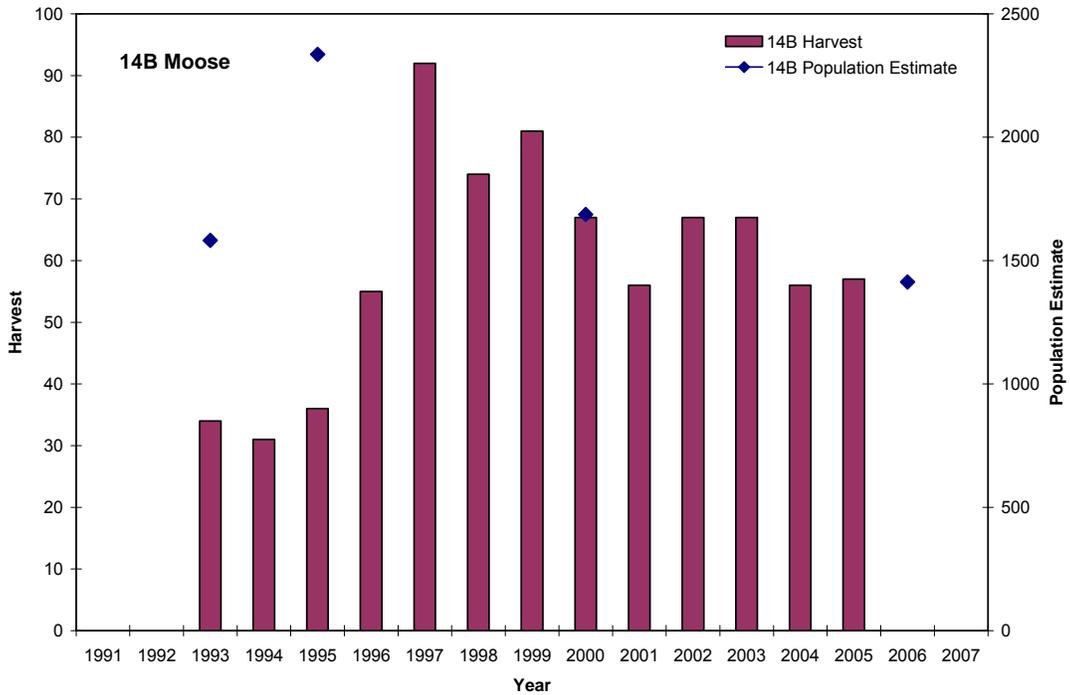


Figure E-3. Population and Harvest Trends for Subunit 14B Moose 1993 to 2005 (Peltier, 2006b)

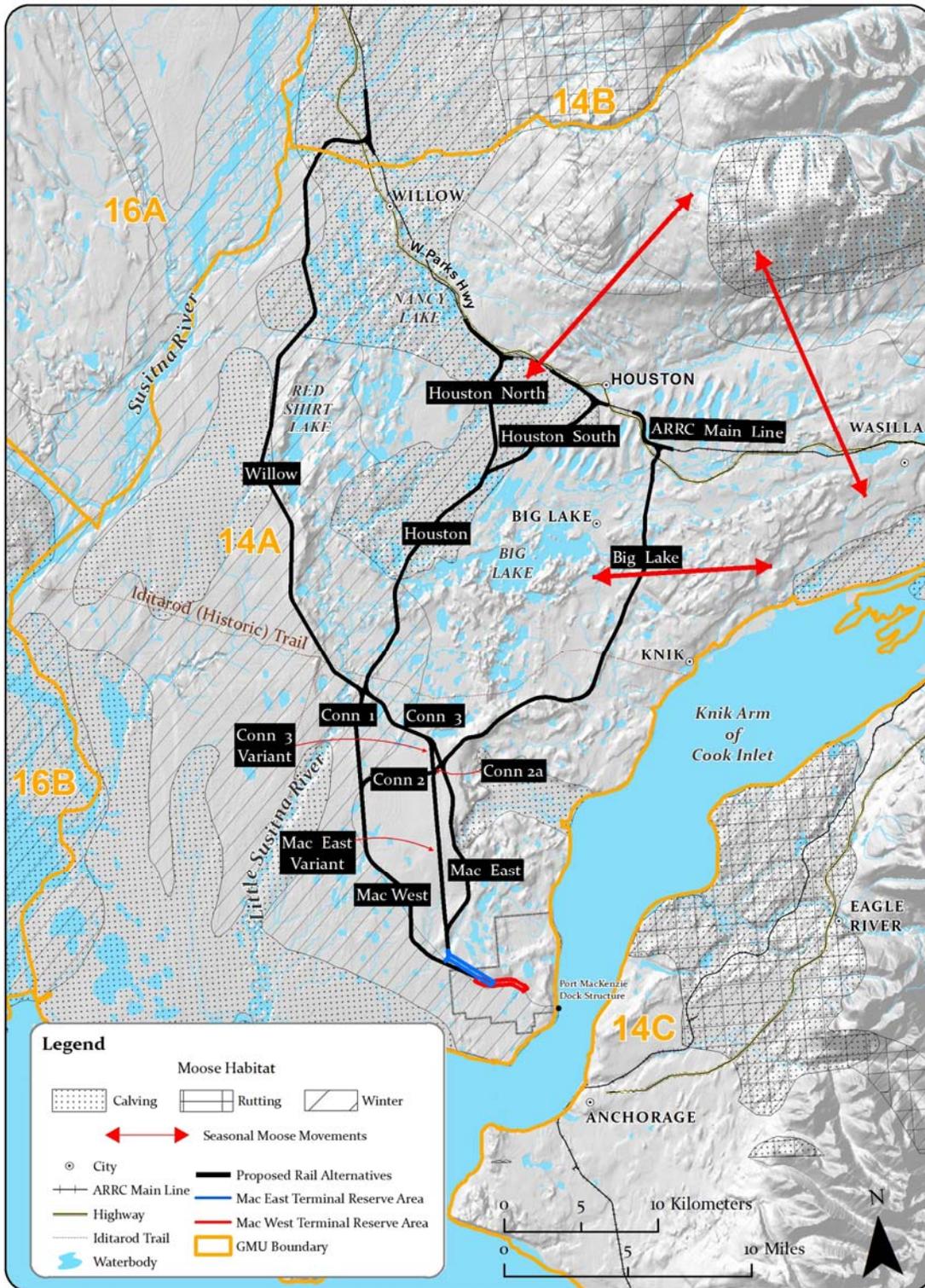


Figure E-4. Moose Habitats and Generalized Movement Patterns (ADF&G, 1985; Masteller, undated; Modafferi, 1988)

Increased development in the Matanuska-Susitna Valley has contributed to increased vehicle traffic killing more moose. Accidental death by collisions with vehicles and trains accounts for an average of 25 percent of combined accidental and harvest mortality for moose (McDonough, 2002b; Del Frate, 2004; Peltier, 2006a). Moose-train collision mortality accounted for an average of 9 percent of all accidental moose mortality during 1990 to 2007 (McDonough, 2002b; Del Frate, 2004; Peltier, 2006a; see additional discussion under *Moose-Train Collision Mortality*). A little more than half of the moose-vehicle collision mortalities occurred on 4 roadways during 2000 to 2008 (ADF&G, 2008b) – Parks Highway (26 percent), Glenn Highway (11 percent), Knik-Goose Bay Road (11 percent), and Point MacKenzie Road (4 percent). Moose-vehicle collisions increase in frequency during the dark winter months (Figure E-5). An average of 176 moose-vehicle collision mortalities occurred annually in Subunit 14A from 1990 to 2007 (McDonough, 2002b; Del Frate, 2004; Peltier, 2006a).

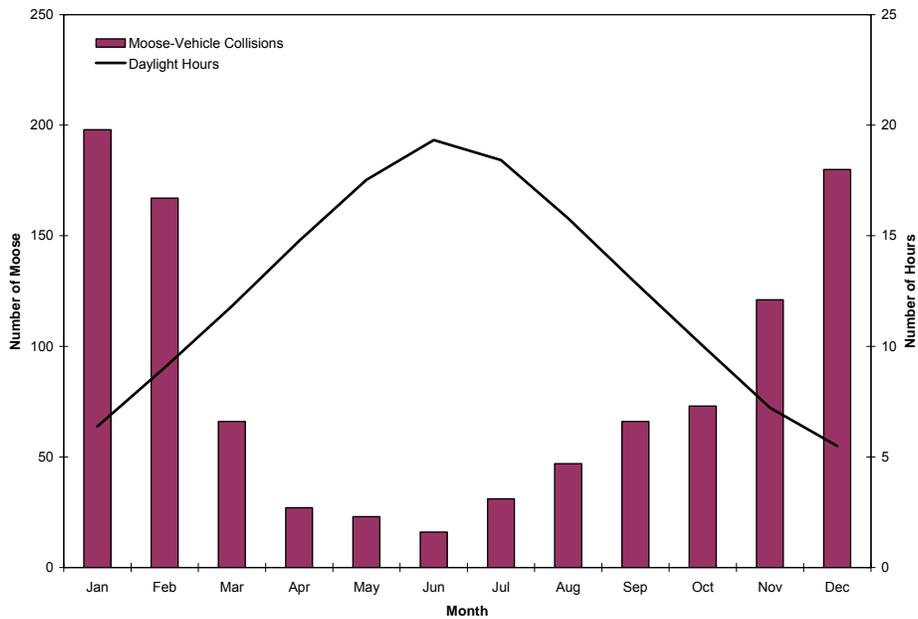


Figure E-5. Monthly Moose-Vehicle Collision Mortalities from 2000 to 2008 for Subunits 14A and 14B with Daylight Hours by Month (ADF&G, 2008b)

E.1.3 Wolves

Wolves are carnivorous and, in Game Management Unit 14, their primary foods are moose and caribou. During winter, a pack might kill a moose every few days. A number of factors, including weather and food availability, can affect wolf and prey populations. Severe winters coupled with active wolf and bear predation can contribute to local big game scarcities. Wolf populations increased during the 1990s, in part due to high prey densities and excess winter moose mortality caused by deep snows during the winters of 1989-1990 and 1994-1995, and because of high wolf densities in surrounding Game Management Units (Peltier, 2006c). Figure E-6 shows current population and harvest trends for wolves in Game Management Unit 14. Wolves in Subunit 14B have been infested with dog-biting louse (*Trichodectes canis*), which reduce the value of an animal’s pelt. This is a concern because it could lead to reduced harvest, which could exacerbate the spread of the dog-biting louse throughout other regions of the state as

wolves disperse from high population density areas (Peltier, 2006c). ADF&G attempted to capture and treat all members of the infested pack, and deployed medicated baits to treat coyotes, feral dogs, and wolves, although infested wolves were caught the following winter (Peltier, 2006c).

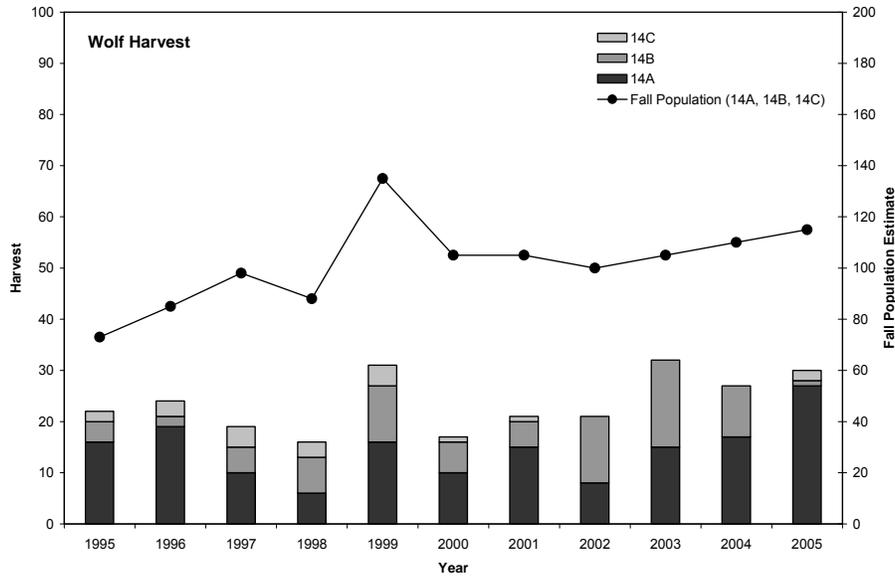


Figure E-6. Harvest and Population Trends for Wolves 1995 to 2005 in Game Management Unit 14 (Peltier, 2006c)

E.1.4 Furbearers and Other Mammals

There are no completed population surveys for furbearers or other nongame mammals. Wildlife managers request that trappers qualitatively evaluate furbearer abundance to indicate if populations appear to be increasing or decreasing. Table E-2 lists these qualitative trends (Blejwas, 2006).

Table E-2
Estimated Abundance, Population Trends, and Harvest of Furbearers for Subunits 14A and 14B in the Port MacKenzie Rail Extension Study Area^a (page 1 of 2)

Common Name	Species	Relative Abundance	Trend	14A Harvest Estimate ^b	14B Harvest Estimate ^b	Totals
Beaver	<i>Castor canadensis</i>	Common	None	6	6	12
Coyote	<i>Canis latrans</i>	Common	None	15	15	30
Short-tailed Weasel (Ermine)	<i>Mustela erminea</i>	Common	None	21	0	21
Lynx	<i>Lynx canadensis</i>	Scarce	None	0	0	0
Marten	<i>Martes americana</i>	Common	None	27	0	27
Mink	<i>Neovison vison</i>	Common	None	88	27	115
Muskrat	<i>Ondatra zibethicus</i>	Common	None	272	39	311
Red Fox	<i>Vulpes vulpes</i>	Common	None	124	52	176

**Table E-2
Estimated Abundance, Population Trends, and Harvest of Furbearers for Subunits 14A and 14B in the Port MacKenzie Rail Extension Study Area^a (page 2 of 2)**

Common Name	Species	Relative Abundance	Trend	14A Harvest Estimate ^b	14B Harvest Estimate ^b	Totals
Red Squirrel	<i>Tamiasciurus hudsonicus</i>	Abundant	None	15	15	30
River Otter	<i>Lontra canadensis</i>	Common	None	10	0	10
Wolf	<i>Canis lupus</i>	Common	None	4	4	8
Wolverine	<i>Gulo gulo</i>	Scarce	None	0	0	0
All Furbearers				582	158	740
Prey Species						
Hare	<i>Lepus americanus</i>	Common	Increasing	(Abundance, high levels still increasing; ADF&G 2008c)		
Grouse	<i>cf Falcipennis canadensis</i> or translocated <i>Bonasa umbellus</i>	Common	Decreasing	(Moderate levels; ADF&G 2008c)		
Ptarmigan	<i>Lagopus spp.</i>	Common	None	(Moderate numbers; ADF&G 2008c)		
Mice/Rodents		Abundant	Increasing			

^a Source: Blejwas, 2006.

^b Harvest estimates are for the 2004-2005 season based on the ADF&G Trapper Questionnaire. Questionnaire totals were adjusted by percent of sealed furs using either the reported percentages or the average percentage for Region 2 – Southcentral Alaska.

E.1.5 Birds

Resident birds (designated R in tables) in the study area include owls, magpies, ravens, jays, woodpeckers, chickadees, and finches. Many other birds in the project area are migratory, arriving or passing through in spring, beginning with raptors and waterfowl in April and continuing with the arrivals of songbirds through May and then passing through or leaving in late summer and fall (during July through October). Migratory birds fall into 2 classes, (1) long distance (designated L in tables) or Neotropical migrants (those that winter south of the Tropic of Cancer) and (2) short distance (designated S in tables) or Nearctic migrants (those that winter north of the Tropic of Cancer). Birds documented in the project area include 20 waterfowl and waterbirds, 5 shorebirds, 2 seabirds, and 42 landbirds.

E.1.6 Raptors and Owls

Bald eagles in Cook Inlet can be either summer residents, arriving in late April and departing by freeze-up in mid-to-late September, or residents. Bald-eagle nests in the project area during 2008 were primarily associated with habitats along the Little Susitna River and Willow Creek, occurring primarily in deciduous trees (92 percent), balsam poplar (54 percent), birch (23 percent), and aspen (15 percent) (Shook and Ritchie, 2008). Waterfowl are important in the diet of nesting bald eagles, especially in spring. Salmon are more important prey in late summer and fall.

E.1.7 Landbirds

Landbirds belong to many diverse groups and include both migrant and resident birds. Resident birds remain active during the winter. Resident woodpeckers, chickadees, crossbills, and redpolls rely primarily on fruit and seed crops. Resident ravens and gray jays scavenge on winter or predator-killed carrion. However, many landbirds feed primarily on insects, which are not available during winter, and these birds remain in Southcentral Alaska only during the summer breeding season when insects are abundant.

E.1.8 Birds of Conservation Concern

Various reviews and listings of birds in need of conservation have been developed. Table E-3 lists birds featured in the ADF&G Comprehensive Wildlife Conservation Plan (ADF&G, 2006) that have been documented to occur in the project area during the breeding season. Footnotes in Table E-3 also indicate other conservation designations by the USFWS, International Wader Study Group, and Boreal Partners in Flight (a working group made up of government representatives and individuals). There are no Federal- or state-listed threatened or endangered bird species in the project area. The USFWS defines Birds of Conservation Concern as species, subspecies, and populations that are not already federally listed as threatened or endangered but that without additional conservation actions, are likely to become candidates for Federal listing (USFWS, 2008).

Table E-3
Birds of Conservation Concern Documented During the Breeding Season Within the Study Area^a
(page 1 of 3)

Species (Migration) ^b	Status ^c	Global Rank ^d	Alaska Rank ^d	Alaska Abundance	Alaska Trend ^e	Rationale
Three-toed Woodpecker (R)	ADF&G	G5	S4	200,000	+6.5%	Sensitive to forest management – cavity nester
Arctic Tern (L)	BCC,ADF &G	G5	S4B	~10,000	–	Long-term decline, sensitive to disturbance
Bald Eagle (S)	BCC, PIF, ADF&G	G4	S4B/S4 N	20,000	+	Contaminant-affected, sensitive to changes in forests
Bank Swallow (L)	ADF&G	G5	S5B	3,000,000	+4.1%	Long-term declines
Belted Kingfisher (S)	ADF&G	G5	S5	140,000	-2.5%	Widespread long-term population declines
Blackpoll Warbler (L)	PIF, ADF&G	G5	S4B	4,000,000	-3.8%	Long-term declines, sensitive to changes in riparian habitats
Boreal Chickadee (R)	ADF&G	G5	S5	1,100,000	-0.5%	Sensitive to forest management – cavity nester
Brown Creeper (R)	ADF&G	G5	S4	50,000	-22.3%	Sensitive to forest management – cavity nester
Cliff Swallow (L)	ADF&G	G5	S4B	1,700,000	-6.0%	Long-term Alaska declines
Common Loon (S)	ADF&G	G5	S4/S5B, S4N	9,000	±	Sensitive to disturbance, contaminants
Dark-eyed Junco (S)	ADF&G	G5	S3N/S5 B	40,000,000	-1.1%	Widespread long-term population declines

Table E-3
Birds of Conservation Concern Documented During the Breeding Season Within the Study Area^a
 (page 2 of 3)

Species (Migration)^b	Status^c	Global Rank^d	Alaska Rank^d	Alaska Abundance	Alaska Trend^e	Rationale
Golden-crowned Kinglet (R)	ADF&G	G5	S5	170,000	-0.5%	Sensitive to forest management – canopy nester
Great Gray Owl (S)	PIF, ADF&G	G5	S3	10,000	UNK	Sensitive to forest management – canopy nester
Great Horned Owl (S)	ADF&G	G5	S5	140,000	UNK	Sensitive to forest management – canopy nester
Hairy Woodpecker (R)	ADF&G	G5	S4	120,000	+6.8%	Sensitive to forest management – cavity nester
Hermit Thrush (S)	ADF&G	G5	S4B	1,300,000	-1.8%	Long-term declines
Horned Grebe (S)	BCC, ADF&G	G5	S5	UNK	UNK	Long-term range contraction
Lesser Yellowlegs (L)	BCC, ADF&G	G5	S5B	150,000	-4%	Boreal forest habitat loss, alteration
Long-tailed Duck (S)	ADF&G	G5	S5B, S4N	220,000	-5.5%	Significant long-term declines
Murrelet species (S)	BCC, ADF&G	G3/G4	S2/S3	850,000	–	Significant long-term declines, marbled murrelet sensitive to forest management
Merlin (S)	ADF&G	G5	S3/S4B, S3N	40,000	±	Sensitive to contaminants
Northern Flicker (S)	ADF&G	G5	S5B	180,000	+0.2%	Sensitive to forest management – cavity nester
Northern Harrier (L)	ADF&G	G5	S4B, S3N	7,000	UNK	Sensitive to disturbance, contaminants
<i>Olive-sided Flycatcher (L)</i>	BCC, PIF & ADF&G	G4	S3/S4B	200,000	-3.3%	Long-term decline, sensitive to forest management – canopy nester
Osprey (L)	ADF&G	G5	S2B	1,900	±	Sensitive to disturbance, contaminants
Pacific Loon (S)	ADF&G	G5	S5B, S4/S5N	69,000	±	Sensitive to disturbance, contaminants
Pine Siskin (S)	ADF&G	G5	S5	500,000	+5.5%	Long-term declines, sensitive to forest management – canopy nester
Red-breasted Nuthatch (R)	ADF&G	G5	S4	110,000	-0.6%	Sensitive to forest management – cavity nester
Red-necked Grebe (S)	ADF&G	G5	S4/S5B, S4N	12,000	–	Long-term declines, sensitive to disturbance
Red-tailed Hawk (L)	ADF&G	G5	S5B	20,000	UNK	Sensitive to disturbance, habitat loss
Red-throated Loon (L)	ADF&G	G5	S3B, S2/S3N	10,000	±	Sensitive to disturbance, contaminants
Rusty Blackbird (S)	BCC, PIF, ADF&G	G4	S4B	400,000	-5.8%	Long-term declines, sensitive to climate and riparian habitat changes

**Table E-3
Birds of Conservation Concern Documented During the Breeding Season Within the Study Area^a
(page 3 of 3)**

Species (Migration) ^b	Status ^c	Global Rank ^d	Alaska Rank ^d	Alaska Abundance	Alaska Trend ^e	Rationale
Sharp-shinned Hawk (L)	ADF&G	G5	S4B, S3N	15,000	UNK	Migrant raptor, sensitive to habitat loss or alteration
Solitary Sandpiper (L)	BCC, ADF&G	G5	S2B	4,000	-4.1%	Long-term declines, sensitive to changes in boreal wetlands
Surf Scoter (S)	ADF&G	G5	S4B, S4N	275,000	-2%	Significant long-term declines
<i>Townsend's Warbler (L)</i>	PIF, ADF&G	G5	S5B	1,500,000	+0.2%	Sensitive to forest management – canopy nester
Varied Thrush (S)	PIF, ADF&G	G5	S5	6,000,000	-0.1%	Sensitive to forest management – canopy nester
Violet-green Swallow (L)	ADF&G	G5	S4B	800,000	-5.1%	Long-term Alaska declines
White-crowned Sparrow (L)	ADF&G	G5	S5B	13,000,000	-1.9%	Long-term Alaska declines
White-winged Crossbill (R)	PIF, ADF&G	G5	S5	2,000,000	+4.3%	Sensitive to forest management – canopy nester
White-winged Scoter (S)	ADF&G	G5	S4B, S4N	100,000	-2%	Significant long-term declines
Wilson's Warbler (L)	PIF & ADF&G	G5	S3B	7,000,000	+1%	Sensitive to changes in riparian habitats

^a Sources: Rosenberg, 2004; ADF&G, 2006; Shook and Ritchie, 2008; Sauer *et al.*, 2008; Platte *et al.*, 2008; URS, 2006.

^b (R) = Resident; (S) = Short-distance migrant; (L) = Long-distance migrant.

^c Status: BCC (Birds of Conservation Concern) – USFWS, 2008; PIF (Partners in Flight) – Rosenberg, 2004; ADF&G – ADF&G, 2006. Bold italic type indicates ADF&G Species of Special Concern (ADF&G, 1998).

^d Rankings: G5 = Globally secure; G4 = Globally apparently secure; S5 = State secure; S4 = State apparently secure; S3 = State vulnerable; SNR = State not ranked; N = Non-breeding; B = Breeding.

^e Average annual long-term population trend in Alaska portion of the Boreal Partners in Flight Bird Conservation Region 4 (the Bird Conservation Region within which the project would lie and for which population estimates have been generated) (Rosenberg, 2004; ADF&G, 2006). UNK represents unknown condition; – represents declining trend of unknown magnitude; + represents increasing trend of unknown magnitude; ± represents stable population trend.

E.2 Environmental Consequences

E.2.1 Wildlife Habitat Loss and Alteration

Construction of the proposed rail line would result in habitat loss and alteration along the rail line alternatives. This section describes the expected level of wildlife use and habitat loss within the rail line footprint. Habitat loss for all habitat types at the level of habitat mapping used for analysis (Homer *et al.*, 2004) would represent less than 1 percent of available habitats for wildlife within 5 miles of the project alternatives.

E.2.1.1 Furbearers

Furbearers are a diverse group. Table E-4 lists and describes habitat use, breeding season, den type and use, home range size estimates, and estimated habitat impact area for common furbearers in the project area. The table includes estimates of average impacts to furbearer and other mammal habitat from the 12 proposed alternatives.

Table E-4

OEA's Estimated Average Habitat Loss Impacts for Mammals Within the Rail Line Footprint^a (page 1 of 2)

Common Name	Scientific Name	Home Range Size	General Habitats	Estimated Impacts ^b
Furbearers				
Beaver	<i>Castor canadensis</i>	0.6 mile stream channel; 43.5 acres, solitary; 19.0 acres, families	Streams, ponds, backwaters; forages on shrubs and aquatic vegetation	Wetlands Average is 185 acres or 5 to 10 beavers
Short-tailed Weasel (Ermine)	<i>Mustela erminea</i>	24.7 to 49.4 acres	Forests, riparian woodlands, shrub/scrub; forages primarily on small rodents and lemmings, but will eat birds, eggs, frogs, fish, insects	Forested and wetland habitats Average is 686 acres or 14 to 28 ermine
Least Weasel	<i>Mustela nivalis</i>	17.3 acres, females; 64.2 acres, males	Woodlands, riparian, grassy fields, meadows; forages on small mammals, especially voles, lemmings, other mice; might consume other small vertebrates, insects, worms when rodents are scarce	Forested and wetland habitats Average is 686 acres or 11 to 40 least weasels
Mink	<i>Mustela vison</i>	20 to 50 acres, female; 1,900 acres, male	Riparian forests, marshes and shrub/scrub; forages on fish, birds, eggs, rodents	Wetlands Average is 185 acres or 4 to 10 female mink
Muskrat	<i>Ondatra zibethicus</i>	2.5 to 4.9 acres marshes; 0.25 mile streams	Marshes, riparian areas, floodplains of large rivers, ponds; forages on aquatic plants, lilies, sedges, grasses, mussels, small fish	Emergent wetland and shrub/scrub Average is 91 acres or 19 to 37 muskrats
Red Squirrel	<i>Tamiasciurus hudsonicus</i>	0.5 to 1 acre	Spruce forests; forages on seeds, berries, buds, fungi; occasionally insects, bird eggs	Evergreen and mixed closed forests Average is 317 acres or 317 to 634 red squirrels

Table E-4
Estimated Average Habitat Loss Impacts for Mammals Within the Rail Line Footprint^a (page 2 of 2)

Common Name	Scientific Name	Home Range Size	General Habitats	Estimated Impacts ^b
Other Mammals				
Snowshoe Hare	<i>Lepus americanus</i>	Average 7 to 15 acres, up to 39.5 acres	Forests, woody wetlands, bogs; forages on succulent vegetation, in winter eats twigs, buds bark of small trees	Forested and wetland habitats Average is 686 acres or 18 to 98 hares
Northern Bog Lemming	<i>Synaptomys borealis</i>	Less than 1 acre; sociable, can form small colonies	Bog, muskeg, mixed and coniferous forests; forages on grasses, sedges, other vegetation	Evergreen and mixed forests and wetland habitats Average is 513 acres or 513 lemmings
Northern Flying Squirrel	<i>Glaucomys sabrinus</i>	Up to 86.5 acres, summer 7 to 12 acres	Coniferous and mixed forests, riparian woods; forages on fungi, lichens, insects, nuts, buds, seeds, fruit	Evergreen and mixed closed forests Average is 317 acres or 4 to 46 flying squirrels
Porcupine	<i>Erethizon dorsatum</i>	Summer range 125 to 250 acres, winter range smaller; densities 25 to 58 per square mile in good habitat (11 to 25.6 acres)	Coniferous and mixed forests and woodlands; forages on inner bark of trees, evergreen needles in winter, buds in spring, roots, leaves, fruits in summer and fall	Evergreen and mixed forests Average is 328 acres or 2 to 30 porcupine
Shrews	<i>Sorex</i> spp.	0.3 to 1 acre	Forest and wetland habitats, sphagnum bogs; forages on insects and other small invertebrates such as worms, sowbugs, mollusks	Forested and wetland habitats Average is 686 acres or 686 to 2,287 shrews
Voles	<i>Microtus</i> spp. and <i>Myodes rutilus</i>	0.25 acre, less than 1 acre	Grasslands, woody wetlands, bogs, riparian; forages on vegetation, grasses, roots and seeds; burrows and uses fallen log/debris. Coniferous forests; forages on fungi, berries, lichens, moss, insects, grass	Forested and wetland habitats Average is 686 acres or 686 to 2,744 voles

^a Source: Compiled from various sources including the ADF&G Alaska Wildlife Notebook; NatureServe, Animal Diversity Web; habitat from Homer *et al.*, 2004.

^b Average impact within the rail line footprint, stream relocation, and road relocation areas by habitat type for the 12 proposed alternatives. Does not represent an alternative.

E.2.1.2 Birds

Tables E-5, E-6, and E-7 list bird species present in the study area based on ground-based surveys (Sauer *et al.*, 2008; URS, 2006; Benson, 2001); OEA estimated numbers within 5 miles of the proposed rail line alternatives (798-square-mile area) are based on regional aerial waterfowl surveys (Conant *et al.*, 2007; Mallek and Groves, 2008; Platte *et al.*, 2008). Raptor surveys were completed for the proposed alternatives by the Applicant (Shook and Ritchie, 2008). Some waterfowl and waterbirds nest in habitats the proposed rail line would cross and many more waterfowl and waterbirds migrate through the Cook Inlet region on their way to and from nesting grounds in Western and Arctic Alaska. Spring and fall waterbird migration and summer occurrence data for the Port MacKenzie area were collected during 2005 by the Knik Arm Bridge and Toll Authority (URS, 2006). Most waterfowl and waterbirds nest on the ground near waterbodies. Tables E-8, E-9, and E-10 list habitat loss or disturbance (as the number of affected birds) due to construction of the alternatives based on project area nest season densities or nest occurrence within 0.5 mile of the alternatives. OEA estimated impacts to birds of conservation concern due to habitat loss (Table E-8).

E.2.2 Wildlife Habitat Fragmentation

This section provides detailed results for habitat fragmentation analyses completed by OEA for the proposed rail line segments and alternatives summarized in Chapter 5. Across the project area, habitat patch (habitat areas of a single type) sizes averaged larger for open water, agriculture, and developed habitat types, with a mean shape index of 1.4 hectares (about 3.5 acres) (Table E-9). The small mean patch size, generally less than 1.4 hectares, and low perimeter values, generally less than 600 meters (about 1,970 feet), indicate that most habitat patches were defined by 16, 30 meter by 30 meter (about 98 by 98 feet) pixels (Table E-9). Core areas, interior areas of habitat patches greater than 40 hectares (about 99 acres) in size, averaged larger for open water and agriculture habitat types (Table E-9). Core areas of wildlife habitats the proposed rail line segment combinations would cross averaged 6 to 49 times larger than core areas of habitat patches greater than 40 hectares distributed throughout the project area (Table E-9).

Table E-10 lists habitat core areas the proposed rail line alternatives would cross and fragment. The Mac East-Big Lake Alternative would potentially fragment the smallest number and area of core forested and wetland habitats; the Mac West-Connector 1-Willow Alternative would potentially fragment the greatest number of core forested and wetland habitats; and the Mac West-Connector 1-Houston-Houston South Alternative would potentially fragment the largest area of core forested and wetland habitat (Table E-10). The Mac West-Connector 1-Houston-Houston North and Mac West-Connector 1-Houston-Houston South alternatives would potentially fragment the smallest area of core forested habitat, while the Mac West-Connector 1-Willow and Mac East-Connector 3-Willow alternatives would potentially fragment the largest area of core forested habitat (Table E-10). The Mac East-Connector 3-Willow and Mac East Variant-Connector 3 Variant-Willow alternatives would potentially fragment the smallest area of core wetland habitat, while the Mac West-Connector 1-Houston-Houston South Alternative would potentially fragment the largest area of core wetland habitat (Table E-10).

**Table E-5
Shorebirds, Seabirds, and Landbirds Occurring During the Breeding Season and OEA's Estimated Habitat Loss Impacts Due to
Construction of the Alternatives^a (page 1 of 4)**

Common Name	Species	Primary Habitats	Study Area Density (birds per mile)	Alaska BCR 4 ^b Population Size (annual trend, Data Quality) ^c	Estimated Study Area Population ^d	Estimated Average Impact (number of birds) ^{e,f}	Estimated Minimum Impact (number of birds) ^{g,f}	Estimated Maximum Impact (number of birds) ^{h,f}
Shorebirds								
Greater Yellowlegs	<i>Tringa melanoleuca</i>	Forest, near water	0.12	j	Unknown	5	4	6
Lesser Yellowlegs	<i>Tringa flavipes</i>	Forest, near water	0.25	j	Unknown	10	8	12
Solitary Sandpiper	<i>Tringa solitaria</i>	Near water	0.03	j	Unknown	2	1	2
Spotted Sandpiper	<i>Actitis macularia</i>	Near water	j	j	Unknown	j	j	j
Common Snipe	<i>Gallinago gallinago</i>	Forest, near water	0.53	j	Unknown	20	17	25
Total Shorebirds					Unknown	35	30	44
Seabirds								
Herring Gull	<i>Larus argentatus</i>	Near water	0.07	j	Unknown	3	3	4
Glaucous-winged Gull	<i>Larus glaucescens</i>	Near water	0.03	j	Unknown	2	1	2
Total Seabirds					Unknown	4	4	5
Landbirds								
Belted Kingfisher (S)	<i>Ceryle alcyon</i>	Riparian shrub and forest	0.01	140,000 (-2.4%, 2 Y)	400	1	1	1
Downy Woodpecker (R)	<i>Picoides pubescens</i>	Forest	0.06	150,000	428	3	2	3
Hairy Woodpecker (R)	<i>Picoides villosus</i>	Needleleaf forest	0.06	120,000 (4.2%, 2 Y)	343	3	2	3
Three-toed Woodpecker (R)	<i>Picoides dorsalis</i>	Needleleaf forest	0.12	200,000 (1.2%, 3 O)	571	5	4	6
Northern Flicker (S)	<i>Colaptes auratus</i>	Needleleaf forest	0.01	180,000 (-0.7%, 2 Y)	514	1	1	1
Olive-sided Flycatcher (L)	<i>Contopus cooperi</i>	Needleleaf forest - black spruce	0.40	200,000 (-1.5%, 2 Y)	571	16	13	19
Western Wood-Pewee (L)	<i>Contopus sordidulus</i>	Riparian shrub - black spruce bogs/successional	0.14	200,000 (-4.0%, 2 Y)	571	6	5	7
Alder Flycatcher (L)	<i>Empidonax alnorum</i>	Shrub/successional	4.46	11,000,000 (-0.4%, 2 Y)	31,411	168	140	208

Table E-5
Shorebirds, Seabirds, and Landbirds Occurring During the Breeding Season and Estimated Habitat Loss Impacts Due to Construction of the Alternatives^a (page 2 of 4)

Common Name	Species	Primary Habitats	Study Area Density (birds per mile)	Alaska BCR 4 ^b Population Size (annual trend, Data Quality) ^c	Estimated Study Area Population ^d	Estimated Average Impact (number of birds) ^{e,f}	Estimated Minimum Impact (number of birds) ^{g,f}	Estimated Maximum Impact (number of birds) ^{h,f}
<i>Landbirds (continued)</i>								
Say's Phoebe (L)	<i>Sayornis saya</i>	Tundra and shrub	0.00	40,000	114	0	0	0
Gray Jay (R)	<i>Perisoreus canadensis</i>	Needleleaf and mixed forest	0.26	3,000,000 (2.2%, 2 Y)	8,567	10	9	13
Black-billed Magpie (R)	<i>Pica pica</i>	Forest	0.06	50,000	143	3	2	3
Common Raven (R)	<i>Corvus corax</i>	Needleleaf forest	0.18	60,000 (2.5%, 2 Y)	171	7	6	9
Tree Swallow (L)	<i>Tachycineta bicolor</i>	Broadleaf and needleleaf forests	0.48	700,000 (3.8%, 2 Y)	1,999	19	15	23
Violet-green Swallow (L)	<i>Tachycineta thalassina</i>	Forest, near water	0.27	800,000	2,284	11	9	13
Bank Swallow (L)	<i>Riparia riparia</i>	Bluff, near water	0.03	3,000,000	8,567	2	1	2
Cliff Swallow (L)	<i>Petrochelidon pyrrhonota</i>	Bluff, near water	0.04	1,700,000	4,854	2	2	2
Black-capped Chickadee (R)	<i>Poecile atricapillus</i>	Riparian broadleaf, and needleleaf forests	0.31	1,400,000 (1.9%, 2 Y)	3,998	12	10	15
Boreal Chickadee (R)	<i>Poecile hudsonia</i>	Needleleaf forest	0.07	1,100,000 (0.7%, 2 Y)	3,141	3	3	4
Red-breasted Nuthatch (R)	<i>Sitta canadensis</i>	Forest	0.01	110,000	314	1	1	1
Brown Creeper (R)	<i>Certhia americana</i>	Forest	0.00	50,000	143	0	0	0
Golden-crowned Kinglet (S)	<i>Regulus satrapa</i>	Forest	0.01	170,000	485	1	1	1
Ruby-crowned Kinglet (S)	<i>Regulus calendula</i>	Open needleleaf and mixed forests	0.97	6,000,000	17,133	37	31	46
Swainson's Thrush (L)	<i>Catharus ustulatus</i>	Riparian needleleaf and mixed forests	3.17	18,000,000	51,399	119	99	148

Table E-5
Shorebirds, Seabirds, and Landbirds Occurring During the Breeding Season and Estimated Habitat Loss Impacts Due to Construction of the Alternatives^a (page 3 of 4)

Common Name	Species	Primary Habitats	Study Area Density (birds per mile)	Alaska BCR 4 ^b Population Size (annual trend, Data Quality) ^c	Estimated Study Area Population ^d	Estimated Average Impact (number of birds) ^{e,f}	Estimated Minimum Impact (number of birds) ^{g,f}	Estimated Maximum Impact (number of birds) ^{h,f}
<i>Landbirds (continued)</i>								
Hermit Thrush (S)	<i>Catharus guttatus</i>	Riparian needleleaf forest and tall shrub	0.07	1,300,000 (-1.1%, 2 Y)	3,712	3	3	4
American Robin (S)	<i>Turdus migratorius</i>	Forest and shrub	2.44	14,000,000 (1.6%, 2 Y)	39,977	92	77	114
Varied Thrush (S)	<i>Ixoreus naevius</i>	Forest and shrub	0.33	6,000,000	17,133	13	11	16
Orange-crowned Warbler (L)	<i>Vermivora celata</i>	Low and tall shrub	1.60	13,000,000 (-0.3%, 2 Y)	37,122	61	50	75
Yellow Warbler (L)	<i>Dendroica petechia</i>	Needleleaf forest and shrub	0.06	1,600,000 (-0.7%, 2 Y)	4,569	3	2	3
Yellow-rumped Warbler (L)	<i>Dendroica coronata</i>	Needleleaf forest	2.82	16,000,000 (0.9%, 2 Y)	45,688	106	89	131
Townsend's Warbler (L)	<i>Dendroica townsendi</i>	Mature needleleaf forest	0.00	1,500,000 (0.9%, 3 O)	4,283	0	0	0
Blackpoll Warbler (L)	<i>Dendroica striata</i>	Riparian forest and shrub	0.94	4,000,000 (-2.7%, 2 Y)	11,422	36	30	44
Northern Waterthrush (L)	<i>Seiurus noveboracensis</i>	Black spruce forest	0.45	3,000,000 (7.8%, 2 Y)	8,567	17	15	21
Wilson's Warbler (L)	<i>Wilsonia pusilla</i>	Mixed forest and shrub	0.15	7,000,000 (1.1%, 2 Y)	19,989	6	5	7
Savannah Sparrow (L)	<i>Passerculus sandwichensis</i>	Low shrub and graminoid	0.19	2,000,000 (-0.2%, 2 Y)	5,711	8	6	9
Fox Sparrow (S)	<i>Passerella iliaca</i>	Low and tall shrub	0.34	2,000,000 (2.4%, 2 Y)	5,711	13	11	16
Song Sparrow (S)	<i>Melospiza melodia</i>	Riparian and shrub	0.00	30,000	86	0	0	0
Lincoln's Sparrow (L)	<i>Melospiza lincolni</i>	Low shrub and black spruce bog	0.88	2,000,000 (7.8%, 2 Y)	5,711	34	28	41
White-crowned Sparrow (L)	<i>Zonotrichia leucophrys</i>	Low shrub	0.69	13,000,000 (-1.3%, 2 Y)	37,122	26	22	33

Table E-5
Shorebirds, Seabirds, and Landbirds Occurring During the Breeding Season and Estimated Habitat Loss Impacts Due to Construction of the Alternatives^a (page 4 of 4)

Common Name	Species	Primary Habitats	Study Area Density (birds per mile)	Alaska BCR 4 ^b Population Size (annual trend, Data Quality) ^c	Estimated Study Area Population ^d	Estimated Average Impact (number of birds) ^{e,f}	Estimated Minimum Impact (number of birds) ^{g,f}	Estimated Maximum Impact (number of birds) ^{h,f}
Landbirds (continued)								
Dark-eyed Junco (S)	<i>Junco hyemalis</i>	Mix and needleleaf forests and tall shrub	2.42	40,000,000 (-0.3%, 2 Y)	114,220	91	76	113
Rusty Blackbird (L)	<i>Euphagus carolinus</i>	Needleleaf and mixed forests with wet graminoid	0.04	400,000 (6.3%, 2 Y)	1,142	2	2	2
White-winged Crossbill (R)	<i>Loxia leucoptera</i>	Mature needleleaf forest	0.27	2,000,000 (31.0%, 2 Y)	5,711	11	9	13
Pine Siskin (R)	<i>Carduelis pinus</i>	Needleleaf forest	0.46	500,000 (3.5%, 3 O)	1,428	18	15	22
Total Landbirds^{i,k}					507,422	950	792	1,175
Total Resident^k Landbirds					24,957	71	59	87
Total Long-Distance Migrant Landbirds^k					283,094	631	525	781
Total Short-Distance Migrant Landbirds^k					199,371	249	208	308
^a Sources: Sauer <i>et al.</i> , 2008; Mallek and Groves, 2008; Platte <i>et al.</i> , 2008; Benson, 2001; Shook and Ritchie, 2008; Blancher <i>et al.</i> , 2007. ^b Boreal Partners in Flight Bird Conservation Region 4 (the Bird Conservation Region within which the project would lie and for which population estimates have been generated). ^c Blancher <i>et al.</i> , 2007; ADF&G, 2006: Estimate Accuracy 2 = Poor, 3 = Fair; Breeding Bird Survey Data Quality Y=yellow-10% or more of the range covered, O = orange-<10% of range covered. ^d OEA estimates based on project region density and area within 5 miles of all proposed segments (990 square miles) were generated only for species with an abundance estimate within the region. ^e Average of 12 proposed alternatives. Does not represent an alternative. ^f Number of nesting birds impacted is based on the estimated project area linear nesting density multiplied by the route length for each of 12 proposed alternatives. ^g Minimum value for 12 proposed alternatives. ^h Maximum value for 12 proposed alternatives. ⁱ Resident, Long-Distance Migrants, and Short-Distance Migrants are categories of Landbirds. ^j No available data; the species have been reported to occur in the area. ^k Totals might not equal sums of values due to rounding.								

**Table E-6
Waterbird Nesting Season Densities, Estimated Study Area Populations, and OEA Estimated Habitat Loss^a by Alternative^b**

Common Name	Species	Kenai-Susitna Density (birds per square mile) ^d	Kenai-Susitna Population ^d	Estimated Study Area Population	Alternative ^c												Mac East Var-Conn 3 Var-Houston-Houston North	Mac East Var-Conn 3 Var-Houston-Houston South
					Mac West-Conn 1-Willow	Mac West-Conn 1-Houston-Houston North	Mac West-Conn 1-Houston-Houston South	Mac West-Conn 2-Big Lake	Mac East-Conn 3-Willow	Mac East-Conn 3-Houston-Houston North	Mac East-Conn 3-Houston-Houston South	Mac East-Big Lake	Mac East Var-Conn 2a-Big Lake	Mac East Var-Conn 3 Var-Willow				
Waterbirds																		
Common Loon	<i>Gavia immer</i>	0.82	1,810	657	2	1	1	1	2	1	1	1	1	2	1	1		
Pacific Loon	<i>Gavia pacifica</i>	0.18	390	141	1	1	1	1	1	1	1	1	1	1	1	1		
Red-throated Loon	<i>Gavia stellata</i>	0.01	30	11	1	1	1	1	1	1	1	1	1	1	1	1		
Sandhill Crane	<i>Grus Canadensis</i>	0.12	263	95	1	1	1	1	1	1	1	1	1	1	1	1		
Merganser	<i>Mergus spp.</i>	0.86	1,883	683	2	1	1	2	2	1	1	2	2	2	1	1		
Geese and Swans																		
Canada Goose	<i>Branta Canadensis</i>	0.40	878	319	1	1	1	1	1	1	1	1	1	1	1	1		
Trumpeter Swan	<i>Cygnus buccinator</i>	0.28	618	224	1	1	1	1	1	1	1	1	1	1	1	1		
Ducks																		
American Green-winged Teal	<i>Anas crecca</i>	5.39	11,847	4,298	7	6	6	7	8	7	6	7	7	8	7	6		
American Wigeon	<i>Anas americana</i>	2.96	6,522	2,366	4	4	3	4	4	4	4	4	4	4	4	4		
Bufflehead	<i>Bucephala albeola</i>	0.54	1,189	431	1	1	1	1	1	1	1	1	1	1	1	1		
Goldeneye	<i>Bucephala spp.</i>	1.99	4,371	1,586	3	3	2	3	3	3	3	3	3	3	3	3		
Long-tailed Duck	<i>Clangula hyemalis</i>	0.15	329	119	1	1	1	1	1	1	1	1	1	1	1	1		
Mallard	<i>Anas platyrhynchos</i>	5.57	12,244	4,442	7	6	6	7	8	7	7	7	7	8	7	6		
Northern Pintail	<i>Anas acuta</i>	1.53	3,372	1,223	2	2	2	2	3	2	2	2	2	3	2	2		
Northern Shoveler	<i>Anas clypeata</i>	1.00	2,201	798	2	2	1	2	2	2	2	2	2	2	2	2		
Redhead	<i>Aythya americana</i>	0.08	171	62	1	1	1	1	1	1	1	1	1	1	1	1		
Ring-necked Duck	<i>Aythya collaris</i>	0.87	1,911	693	2	1	1	2	2	1	1	2	2	2	1	1		
Canvasback	<i>Aythya valisineria</i>	0.44	962	349	1	1	1	1	1	1	1	1	1	1	1	1		
Scaup	<i>Aythya spp.</i>	4.47	9,832	3,567	6	5	5	6	7	6	5	6	6	6	6	5		
Scoter	<i>Melanitta spp.</i>	1.47	3,239	1,175	2	2	2	2	2	2	2	2	2	2	2	2		

^a Number of nesting birds impacted is based on the estimated project area nesting density multiplied by the area of footprint impact for the alternatives.

^b Sources: Conant *et al.*, 1999, 2000; Conant and Groves, 2001, 2002, 2003, 2004, 2005; Conant and Mallek, 2006; Mallek and Groves, 2007, 2008.

^c Mac West-Conn 1-Willow (1.26 square miles); Mac West-Conn 1-Houston-Houston North (1.05 square miles); Mac West-Conn 1-Houston-Houston South (0.98 square miles); Mac West-Conn 2-Big Lake (1.17 square miles); Mac East-Conn 3-Willow (1.35 square miles); Mac East-Conn 3-Houston-Houston North (1.15 square miles); Mac East-Conn 3-Houston-Houston South (1.08 square miles); and Mac East-Big Lake (1.2 miles); Mac East Var-Conn 2a-Big Lake (1.17 square miles); Mac East Var-Conn 3 Var-Houston-Houston North (1.13 square miles); (Mac East Var-Connector 3 Var-Houston-Houston South (1.05 square miles); Mac East Var-Conn 3 Var-Willow(1.33 square miles).

^d Ten-year average 1999 to 2008, Stratum 1 Kenai-Susitna (2,200 square miles); population based on 10-year average.

**Table E-7
Raptors and Owls Potentially Impacted by Habitat Loss or Disturbance Due to Construction of the Alternatives^a**

Common Name (Migration & Annual Alaska Trend 1966-2005)	Species	OEA Estimated Nests or Density in Study Area ^b	Alternatives											
			Mac West- Conn 1- Willow	Mac West- Conn 1- Houston- Houston North	Mac West- Conn 1- Houston- Houston South	Mac West- Conn 2- Big Lake	Mac East- Conn 3- Willow	Mac East- Conn 3- Houston- Houston North	Mac East- Conn 3- Houston- Houston South	Mac East- Big Lake	Mac East Variant - Conn 2a-Big Lake	Mac East Variant- Conn 3 Variant- Willow	Mac East Variant- Conn 3 Houston- Houston North	Mac East Variant- Conn 3 Houston- Houston South
Bad Eagle (S) (5.8%)	<i>Haliaeetus leucocephalus</i>	30	6 nests	2 nests	2 nests	1 nest	5 nests	1 nest	1 nest	1 nest	1 nests	5 nest	1 nest	1 nest
Osprey	<i>Pandion haliaetus</i>	7	1 nest	1 nest	1 nest	1 nest	0 nest	1 nest	1 nest	0 nest	0 nest	0 nest	0 nest	0 nest
Red-tailed Hawk (L) (-4.7%)	<i>Buteo jamaicensis</i>	44	0 nest	6 nests	5 nests	0 nest	0 nest	6 nests	5 nests	0 nest	0 nest	0 nests	6 nests	5 nest
Great Horned Owl (R) (9.4%)	<i>Bubo virginianus</i>	7	0 nest	1 nest	0 nest	0 nest	1 nest	2 nests	1 nest	0 nest	0 nest	1 nests	2 nest	1 nest
Great Gray Owl ^c (R)	<i>Strix nebulosa</i>	7	0 nest	1 nest	1 nest	0 nest	0 nest	1 nest	1 nest	0 nest	0 nest	0 nest	1 nest	1 nest
Northern Saw- whet Owl	<i>Aegolius acadicus</i>	1.51 per square mile	2 nests	2 nests	1 nest	2 nests	2 nests	2 nests	2 nests	2 nests	2 nests	2 nests	2 nests	2 nests
Boreal Owl ^c (R)	<i>Aegolius funereus</i>	1.96 per square mile	2 nests	2 nests	2 nests	2 nests	3 nests	2 nests	2 nests	2 nests	3 nests	2 nests	2 nests	2 nests

^a Sources: Shook and Ritchie, 2008; Benson, 2001.

^b Estimate based on stick nest survey data and regional densities for the northern saw-whet owl and the boreal owl multiplied by the area of the rail line footprint, including stream relocation and road relocation areas (Benson, 2001).

^c Number of nests impacted by disturbance is based on nests identified within 0.5 mile of alternatives.

Table E-8
Birds of Conservation Concern Estimated Nesting Habitat Loss Impacts from Alternatives^{a,b}
 (page 1 of 4)

Species (Migration)^c	Rationale	OEA Estimated Study Area Population^d	Habitat Impact Description	Estimated Average Project Impact (No. Birds)^e	Estimated Minimum Project Impact (No. Birds)^f	Estimated Maximum Project Impact (No. Birds)^g
Three-toed Woodpecker (R)	Sensitive to forest management - cavity nester	571	223 to 406 acres evergreen and mixed forests	5	4	6
Arctic Tern (L)	Long-term declines, sensitive to disturbance	Unknown	28 to 92 acres emergent wetlands	✓	✓	✓
Bald Eagle (S)	Sensitive to disturbance, contaminants	30	Disturbance to 1 to 6 nest trees	4	2	12
Bank Swallow (L)	Long-term declines	8,567	Bluff nesting habitat loss/disturbance, 30 to 145 acres agricultural and emergent wetlands	2	1	2
Belted Kingfisher (S)	Long-term declines	400	Riparian habitat loss, 6 to 50 acres shrub/scrub habitats	1	1	1
Blackpoll Warbler (L)	Population declines, sensitive to changes in riparian habitats	11,422	Riparian habitat loss, 49 to 211 acres shrub/scrub and woody wetlands	36	30	44
Boreal Chickadee (R)	Sensitive to forest management - cavity nester	3,141	223 to 406 acres evergreen and mixed forests	3	3	4
Brown Creeper (R)	Sensitive to forest management - cavity nester	143	266 to 567 acres evergreen and mixed forests, woody wetlands	✓	✓	✓
Cliff Swallow (L)	Long-term Alaska declines	4,854	Bluff nesting habitat loss/disturbance, 30 to 145 acres agricultural and emergent wetland habitats	2	2	2
Common Loon (S)	Sensitive to disturbance, contaminants	657	Disturbance to nesting lakes, aquatic habitat degradation	1	1	2
Dark-eyed Junco (S)	Widespread long-term population declines	114,220	229 to 456 acres evergreen and mixed forested and shrub/scrub habitats	91	76	113

Table E-8
Birds of Conservation Concern Estimated Nesting Habitat Loss Impacts from Alternatives^{a,b}
 (page 2 of 4)

Species (Migration)^c	Rationale	Estimated Study Area Population^d	Habitat Impact Description	Estimated Average Project Impact (No. Birds)^e	Estimated Minimum Project Impact (No. Birds)^f	Estimated Maximum Project Impact (No. Birds)^g
Golden-crowned Kinglet (S)	Sensitive to forest management - canopy nester	485	73 to 129 acres evergreen forests	1	1	1
Great Gray Owl (S)	Sensitive to forest management - canopy nester	7	433 to 840 acres forested and wetland habitat	2	0	4
Great Horned Owl (S)	Sensitive to forest management - canopy nester	7	375 to 751 acres forest and woody wetland habitat	2	0	2
Hairy Woodpecker (R)	Sensitive to forest management - cavity nester	343	73 to 129 acres evergreen forests	3	2	3
Hermit Thrush (S)	Long-term declines	3,712	79 to 179 acres evergreen forested and shrub/scrub habitats	3	3	4
Horned Grebe (S)	Long-term range contraction	Unknown	Disturbance to nesting lakes, 28 to 92 acres emergent wetlands	✓	✓	✓
Lesser Yellowlegs (L)	Boreal forest habitat loss, alteration	Unknown	174 to 379 evergreen forested and wetland habitat	10	8	12
Long-tailed Duck (S)	Significant long-term declines	119	Disturbance to nesting lakes, 101 to 250 acres wetlands	1	1	1
Murrelet species (S)	Significant long-term declines, marbled murrelet sensitive to forest management	Unknown	73 to 129 acres evergreen forests	✓	✓	✓
Merlin (L)	Sensitive to contaminants, habitat loss	Unknown	433 to 840 acres of forested and wetland habitats	✓	✓	✓
Northern Flicker (S)	Sensitive to forest management - cavity nester	514	223 to 406 acres evergreen and mixed forests	1	1	1
Northern Harrier (L)	Wetland and grassland habitat loss, in decline	Unknown	103 to 303 acres agricultural and wetland habitats	✓	✓	✓

Table E-8
Birds of Conservation Concern Estimated Nesting Habitat Loss Impacts from Alternatives^{a,b}
 (page 3 of 4)

Species (Migration) ^c	Rationale	Estimated Study Area Population ^d	Habitat Impact Description	Estimated Average Project Impact (No. Birds) ^e	Estimated Minimum Project Impact (No. Birds) ^f	Estimated Maximum Project Impact (No. Birds) ^g
<i>Olive-sided Flycatcher</i> (L)	Long-term decline, sensitive to forest management - canopy nester	571	223 to 406 acres evergreen and mixed forests	16	13	19
Osprey (L)	Sensitive to disturbance, contaminants	7	Disturbance to 0 to 1 nest tree	2	0	2
Pacific Loon (S)	Sensitive to disturbance, contaminants	390	Disturbance to nesting lakes, aquatic habitat degradation	1	1	1
Pine Siskin (S)	Long-term declines, sensitive to forest management - canopy nester	1,428	223 to 406 acres evergreen and mixed forests	18	15	22
Red-breasted Nuthatch (R)	Sensitive to forest management - cavity nester	314	223 to 406 acres evergreen and mixed forests	1	1	1
Red-necked Grebe (S)	Long-term declines, sensitive to disturbance	Unknown	Disturbance to nesting lakes, 28 to 92 acres emergent wetlands	✓	✓	✓
Red-tailed Hawk (L)	Sensitive to contaminants, habitat loss	44	75 to 262 open forest, woodland, shrub/scrub, and woody wetlands	6	0	12
Red-throated Loon (L)	Sensitive to disturbance, contaminants	11	Disturbance to nesting lakes, aquatic habitat degradation	1	1	1
Rusty Blackbird (S)	Long-term decline, sensitive to climate and riparian habitat changes	1,142	324 to 656 acres evergreen and mixed forested and wetland habitats	2	2	2
Sharp-shinned Hawk (L)	Sensitive to contaminants, habitat loss	Unknown	75 to 262 open forested, woodland, shrub/scrub, and woody wetland habitats	✓	✓	✓
Solitary Sandpiper (L)	Long-term declines, sensitive to changes in boreal wetlands	Unknown	111 to 323 acres woodland, wetland, and agricultural habitats	2	1	2
Surf Scoter (S)	Significant long-term declines	1,175 (scoter)	109 to 270 acres woodland and wetland habitats	2	2	2

Table E-8
Birds of Conservation Concern Estimated Nesting Habitat Loss Impacts from Alternatives^{a,b}
 (page 4 of 4)

Species (Migration) ^c	Rationale	Estimated Study Area Population ^d	Habitat Impact Description	Estimated Average Project Impact (No. Birds) ^e	Estimated Minimum Project Impact (No. Birds) ^f	Estimated Maximum Project Impact (No. Birds) ^g
<i>Townsend's Warbler (L)</i>	Sensitive to forest management - canopy nester	4,283	223 to 406 acres evergreen and mixed forests	✓	✓	✓
Varied Thrush (S)	Sensitive to forest management - canopy nester	17,133	332 to 590 acres forests	13	11	16
Violet-green Swallow (L)	Long-term Alaska declines	2,284	71 to 304 acres open forest, woodland, and emergent and woody wetland habitats	11	9	13
White-crowned Sparrow (L)	Long-term Alaska declines	37,122	Less than 200 acres low shrub and graminoid habitats removed, fragmented	26	22	33
White-winged Crossbill (R)	Sensitive to forest management - canopy nester	5,711	223 to 406 acres evergreen and mixed forests	11	9	13
White-winged Scoter (S)	Significant long-term declines	1,175 (scoter)	109 to 270 acres woodland and wetland habitats	2	1	2
Wilson's Warbler (L)	Sensitive to changes in riparian habitats	19,989	156 to 327 acres mixed forest and shrub/scrub habitats	6	5	7
Total Estimated Birds Impacted				288	229	362

^a Sources: Rosenberg, 2004; ADF&G, 2006; Shook and Ritchie, 2008; Sauer *et al.*, 2008; Platte *et al.*, 2008; URS, 2006; ADF&G, 1998; USFWS, 2008.

^b Number of nesting birds impacted is based on the OEA estimated project area nesting density multiplied by either the alternative length for linear densities or by the rail line footprint, including stream relocation and road relocation areas for the average, minimum, and maximum alternatives.

^c (R) = Resident; (S) = Short-distance migrant; (L) = Long-distance migrant; ✓ indicates the species has been documented in the project area and impacts would occur but data are insufficient to estimate the scale of impact. Bold-italics indicates ADF&G Species of Special Concern (ADF&G, 1998).

^d OEA estimates generated only for species with an abundance estimate within the project area.

^e Average of 12 proposed alternatives. Does not represent an alternative.

^f Minimum value for 12 proposed alternatives.

^g Maximum value for 12 proposed alternatives.

Table E-9
Proposed Port MacKenzie Rail Line Project Area Habitat Patch and Core Area Statistics^{a,b,c}

	Habitat										
	Evergreen Forest	Deciduous Forest	Mixed Forest	Emergent Wetlands	Shrub/ Scrub	Woody Wetlands	Agriculture	Barren Land	Open Water	Developed	All Classes
Project Area Habitat Patches											
Area (hectares)	26,852	37,825	39,394	28,506	5,497	33,427	4,935	1,800	23,294	6,394	207,925
Number	18,016	27,868	41,637	23,654	9,414	24,822	784	1,179	1575	2,946	151,895
Mean Size (hectares)	1.5	1.4	0.9	1.2	0.6	1.3	6.3	1.5	14.8	2.2	1.4
Mean Edge (meters)	560	507	456	457	348	528	805	565	1,293	737	500
Shape Index	1.45	1.39	1.41	1.38	1.36	1.40	1.47	1.45	1.47	1.55	1.40
Core Areas for Habitat Patches Larger than 40 hectares											
Area (hectares)	7,628	11,408	6,575	9,207	464	9,091	3,563	528	18,305	2,223	68,992
Number	6,154	7,582	10,879	5,254	1,332	7,201	258	353	1,054	1,250	41,317
Mean Size (hectares)	1.2	1.5	0.6	1.8	0.3	1.3	13.8	1.5	17.4	1.8	1.7
Mean Edge (meters)	395	457	277	419	218	411	961	465	1,060	309	394
Shape Index	1.71	1.72	1.67	1.70	1.67	1.71	1.74	1.72	1.71	1.68	1.70
Core Habitats Crossed by Proposed Rail Line Segments											
Area (hectares)	579	449	312	957	0	679	3,367	0	0	18	6,361
Number	21	53	49	13	0	32	5	0	0	9	182
Mean Size (hectares)	27.5	8.5	6.4	73.6	0	21.2	673.5	0	0	2.0	35.0
Mean Edge (meters)	3,741	1,784	1,516	8,622	0	3,967	33,340	0	0	670	3,622
Shape Index	2.25	2.03	1.98	2.67	0	2.45	3.53	0	0	1.76	2.19

^a Source: Homer *et al.*, 2004.
^b To convert hectares to acres, multiply by 2.471; to convert meters to feet, multiply by 3.2808.
^c Number = number of core areas crossed; area = total size of core areas.

Table E-10
Statistics for Core Area Habitats Larger than 100 Acres the Proposed Port MacKenzie Rail Line Alternatives would Cross^a

Habitat	Alternative ^b																								
	Mac West-Conn 1-Willow		Mac West-Conn 1-Houston-North		Mac West-Conn 1-Houston-South		Mac West-Conn 2-Big Lake		Mac East-Conn 3-Willow		Mac East-Conn 3-Houston-North		Mac East-Conn 3-Houston-South		Mac East-Big Lake		Mac East Var-Conn 2a-Big Lake		Mac East Var-Conn 3 Var-Willow		Mac East Var-Conn 3 Var-Houston-North		Mac East Var-Conn 3 Var-Houston-South		
	No.	Area	No.	Area	No.	Area	No.	Area	No.	Area	No.	Area	No.	Area	No.	Area	No.	Area	No.	Area	No.	Area	No.	Area	No.
Wildlife Habitats																									
Evergreen Forest	10	290	5	104	5	104	6	139	9	333	4	147	4	147	5	91	5	91	9	333	4	147	4	147	
Deciduous Forest	30	201	19	46	19	46	12	203	25	200	14	45	14	45	7	202	7	202	25	200	14	45	14	45	
Mixed Forest	37	173	2	0	2	0	11	222	39	257	4	84	4	84	9	98	9	184	37	259	2	87	2	87	
Emergent Wetland	0	0	10	353	7	622	0	0	0	0	10	353	7	622	0	0	0	0	0	0	10	353	7	622	
Shrub/Scrub	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Woody Wetland	12	489	21	546	20	527	10	501	2	74	11	131	10	112	2	91	2	91	2	74	11	131	10	112	
Agriculture	3	2,857	3	2,857	3	2,857	4	3,367	1	1,127	1	1,127	1	1,127	1	1,127	2	1,637	2	1,637	2	1,637	2	1,637	
Forests	77	663	26	150	26	150	29	564	73	790	22	276	22	276	21	391	21	477	71	792	20	279	20	279	
Wetland	12	489	31	899	27	1,149	10	501	2	74	21	483	17	773	2	91	2	91	2	74	21	483	17	733	
Forest and Wetland	89	1,152	57	1,049	53	1,299	39	1,065	75	863	43	760	39	1,010	23	482	23	567	73	866	41	762	37	1,012	

^a Source: Homer *et al.*, 2004.

^b No. = number of core areas crossed; area = total size of core areas in hectares. To convert hectares to acres, multiply by 2.471.

E.2.3 Moose-Train Collision Mortality

This section provides information used by OEA to calculate and assess moose-train collision mortality summarized in Chapter 5. Rail collision mortality for moose was estimated based on the reported annual mortality for moose from the existing 51.4 miles of rail line running through Subunit 14A (Figure E-7). The existing 51.4 miles of rail line through Subunit 14A averages a reported annual moose-train collision mortality of 0.33 moose per mile, or about 17 moose per year (range 0.14 to 0.78 moose per mile; McDonough, 2002b; Del Frate, 2004; Peltier, 2006a). Moose-train collision mortality accounts for an average of 9 percent of accidental moose mortality, and accidental mortality (road and train collisions) accounts for an average of 25 percent of total accidental and harvest mortality for moose in Subunit 14A (McDonough, 2002b; Del Frate, 2004; Peltier, 2006a).

The frequency of trains along the proposed rail line would be 24 percent lower than the frequency of trains on the existing 51.4-mile rail line in the project area. Estimated moose-train collision mortality from operation of the proposed 31- to 46-mile rail line would average 3 to 4 moose per year (range of 1 to 9 collision mortalities per year). The frequency of trains would be increased on the existing rail line because of operation of the proposed rail line from an average of 8.5 trains per day to an average of 10.5 trains per day. The number of moose-train collision mortalities would then be expected to increase by 20 percent, or about 3 moose per year on the existing line from 17 moose per year to 20 moose per year (range of 0.17 to 0.94 moose per mile, or 2 to 8 moose per year). Combined direct and indirect moose-train collision mortality as a result of the proposed rail line would then average 6 to 7 moose per year (range of 3 to 17 moose per year).

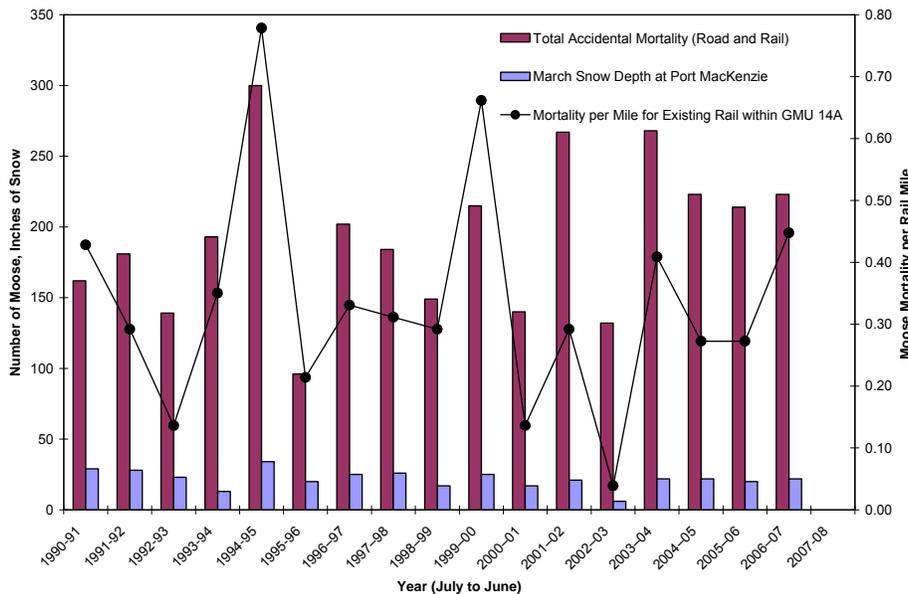


Figure E-7. Reported Annual Moose-Train Collision Mortality for 51.4 miles of the Existing Rail Line in Subunit 14A in the Proposed Port MacKenzie Rail Line Study Area with February Snow Depth at the Point MacKenzie Station (McDonough, 2002b; Del Frate, 2004; Peltier, 2006a; NRCS, 2008)

Most moose train kills along the existing rail line in the lower Susitna Valley occur during January, February, and March (Modafferi, 1991). Most (72 percent) moose-train kills along the existing rail line in Subunit 14A occurred during January, February, November, and December (ADF&G, 2008c; Figure E-8), when the frequency of trains averages 5 trains per day compared to the 10 to 12 trains per day during May to October. Collision mortality along the stretch of track in Subunit 14A appears to be influenced by February snow depth at the Point MacKenzie snow course (NRCS, 2008) (Figure E-7). Moose-train collision mortalities resulting from proposed rail line operation could range higher than the estimated values during years with snow depths greater than 34 inches, or if a greater proportion of seasonal moose movements occur across the alternatives than occurs across the existing 51.4-mile rail line in the study area.

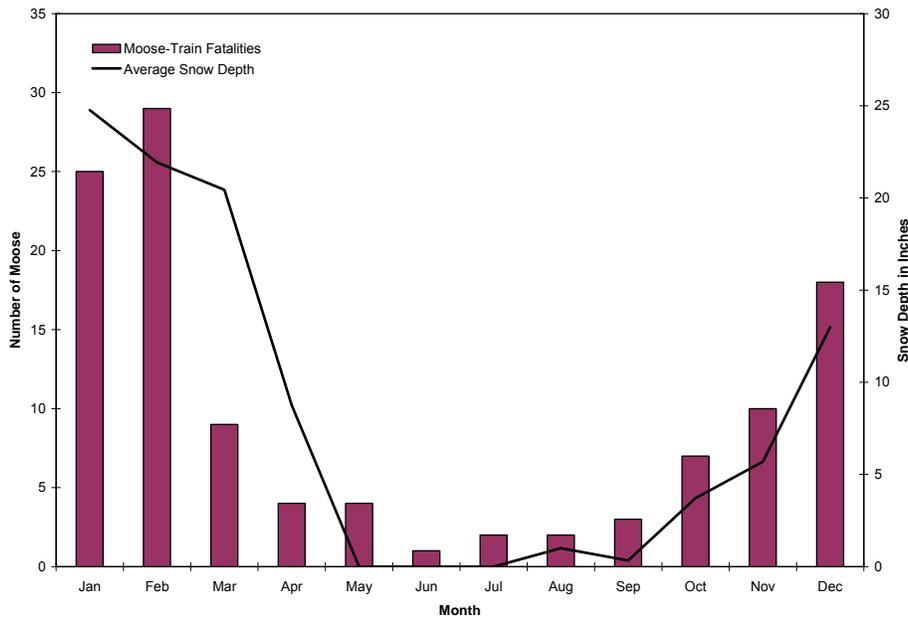


Figure E-8. Moose-Train Collision Mortality by Month for 51.4 miles of the Existing Rail Line in Subunit 14A in the Proposed Port MacKenzie Rail Line Project Area with Average Snow Depth at the Wasilla or Point MacKenzie Stations, 2000 to 2008 (ADF&G, 2008b; NRCS, 2008)

Moose-train collisions on the existing rail line occurred throughout the day with a bimodal pattern of increased mortality from 3:00 to 7:00 and 19:00 to 0:00 (Figure E-9). Because of the extreme seasonal changes in daylight hours, most collisions occurred during darkness (69 percent), followed by daylight hours (16 percent) and twilight hours at dawn and dusk (15 percent) (ADF&G, 2008b). Meat from about 40 percent of moose-train collision mortalities was salvaged for human consumption (ADF&G, 2008b).

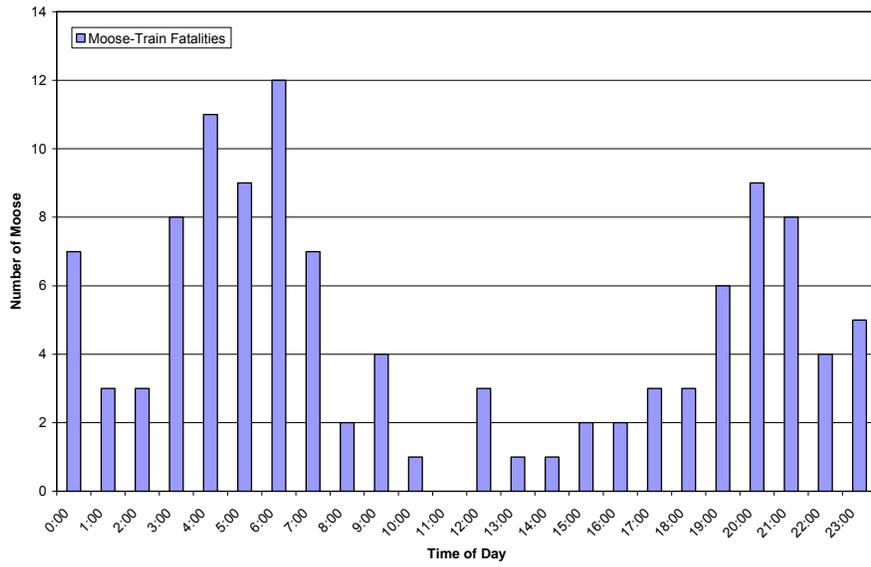


Figure E-9. Moose-Train Collision Mortality by Hour for 51.4 miles of the Existing Rail Line in Subunit 14A in the Proposed Port MacKenzie Rail Line Study Area, 2000 to 2008 (ADF&G, 2008b)

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