

# Alaska's Wildlife and Habitat

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Alaska Department of Fish and Game



JANUARY, 1973

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# STATE OF ALASKA

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# STATE OF ALASKA

## DEPARTMENT OF FISH AND GAME

OFFICE OF THE COMMISSIONER

WILLIAM A. EGAN, GOVERNOR

Support Building  
Juneau 99801

February 6, 1973

Honorable William A. Egan  
Governor  
State Capitol Building  
Juneau, Alaska 99801

Dear Governor Egan:

It gives me much pleasure to furnish you with a report entitled Alaska's Wildlife and Its Habitat prepared by the Department of Fish and Game. This publication provides factual and reasonably detailed information about Alaska's great and varied wildlife resources during a critical transition period for our State. The volume is large, but excusably so, for it treats a large subject with a thoroughness never before achieved in the presentation of current information about wildlife in a vast region. As a reference source for individuals or agencies involved in land use or resources planning, the volume should prove invaluable. But it likewise offers a wealth of information to all people who have their own special concern or interest in wildlife resources.

Policies, management practices, game population levels, habitat characteristics and relative values are all dynamic in nature, and this publication is designed to accommodate change. Pages may be printed in the future to reflect significant changes and these pages can be inserted to keep the volume accurate and up to date. In producing this publication, I believe that the Department of Fish and Game has made a major contribution toward assuring that Alaska's wildlife will receive proper and enlightened consideration through the coming years of land and resource development.

Sincerely yours,  
James W. Brooks  
Commissioner

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## FOREWORD

Alaska's Wildlife and Habitat represents many years of data gathering by wildlife biologists and interested citizens of Alaska. This effort to bring together an overview of big game, marine mammal, waterfowl and seabird distributions and habitats in Alaska is a landmark in development of game management and land-use planning programs.

With the advent of statehood in 1959, the Alaska Department of Fish and Game was formed and charged with the responsibility of managing the fish and game of the state. The Game Division immediately launched expanded programs to develop the knowledge needed to fulfill this responsibility. It was clear that knowledge of wildlife in the state must be accumulated more rapidly than it had been under the constraints of limited manpower and money in territorial days. Thus for the first few years heavy emphasis was laid on acquiring biological facts and figures with one hand, and applying them to the most immediately pressing management needs with the other.

The need to expand and refine present knowledge continues, just as change in the scope and nature of wildlife management continues. In the past year, however, we have reached a stage where we can profitably assemble what we have learned in a form that provides positive, broadly applicable guidelines for wildlife management and wildlife-oriented land-use planning. At the same time, we have accumulated a wealth of data concerning the distribution and general habitat requirements of wildlife in Alaska, and feel a pressing need to make these data available in a comprehensive form to planners, hunters, recreationists and others concerned with wildlife. The Division of Game's General Game Management Policy (reproduced below) with its corollary species management policies, and Alaska's Wildlife and Habitat are the results.

The reasons for publishing these data are at least twofold. First, it was clear that to implement our management policies through explicit plans we should reassess what we know about wildlife populations in specific areas of the state. To create management plans that would provide the variety of recreational opportunities outlined in the Policy, we needed a review of habitat requirements and seasonal use patterns. This inventory serves as an internal status report—an aid in planning for present and future recreational needs.

More importantly, it became abundantly clear with passage of the Native Claims Act of 1972, completion of land selection by the state under the Alaska Statehood Act, consideration of "four-systems" and "public interest" lands by the federal government, and acceleration of exploitation of petroleum and other nonrenewable resources, that a great deal of information about all of Alaska's resources is needed as a basis for logical, factual land-use decisions. Since the Department of Fish and Game is responsible for preserving and managing Alaska's wildlife, it is imperative that we provide a ready source of information on wildlife habitat, the key to our renowned wildlife populations, for use by resource management agencies, native corporations, private industry, and interested citizens.

If Alaska's unique wildlife is to be maintained in its present variety and abundance, the integrity of wildlife habitat must be maintained. A number of wild species are sufficiently adaptable to adjust to most of man's activities, but many species require some specialized or critical habitat at some stage of their annual cycle. This inventory provides a visual and written representation of many of these critical areas. The existing gaps in the information will be filled as time passes. The distribution of, and critical habitat for, many other species of Alaskan wildlife remain to be described. A second volume of Alaska's Wildlife and Habitat is anticipated to fill this need. Our earnest wish is that this first volume will contribute greatly to the development of a comprehensive land-use plan for Alaska, where there is still a chance to plan wisely.

## GENERAL GAME MANAGEMENT POLICY

The Alaska Department of Fish and Game recognizes the Constitutional mandate of the State of Alaska to manage all species on the sustained yield principle for the benefit of the resource and the people of the state, and also recognizes that national and international interests must be considered.

The Department recognizes the singular importance of maintaining suitable habitat for all wildlife species, and advocates the development and implementation of comprehensive resource use planning.

The Department recognizes that there are many uses of wildlife, that present priorities may not be the priorities of the future, and that management plans must consider all uses.

The Department recognizes that responsible wildlife management must be based on scientific knowledge.

The Department recognizes that many of the people of the state are substantially dependent on wildlife for sustenance. In areas where people are primarily dependent on wildlife for sustenance the Department will manage resources to meet their needs, within the limitation of maximum sustained yield.

In many areas of the state, recreation is the most important use of game. Recreational uses include: sport hunting and trapping in their various forms; observation, both incidental to other activities and as the primary objective; and wilderness experience, which includes the aesthetic rewards of being aware of or observing animals in natural interactions with their environment. The Department recognizes its responsibility to provide for all these uses in its management plans, and holds that they are generally compatible.

The Department recognizes recreational hunting and trapping as beneficial uses of game in parts of the state. Consistent with its responsibility to manage game species for the benefit of the resource and the people, the Department will manage the resource on the basis of a) maximum overall recreational opportunity, b) maximum sustained harvest, c) maximum aesthetic appeal to the user. Regulatory zoning of recreation in time and space may be used to obtain an optimum level of recreational wildlife uses.

In some areas game will be managed to provide maximum recreational opportunity. This concept recognizes the value of the opportunity to be selective in hunting, to enjoy uncrowded hunting conditions, to make use of remote areas, and to enjoy various other experiences which enhance wildlife-oriented activities.

In selected areas with highly developed access and intensive hunter use, certain game species will be managed consistent with the maximum sustained yield principle. Certain areas will be managed to provide hunting opportunities of the highest aesthetic quality. Management techniques may include, but are not limited to, regulation of access, regulation of sex and age of animals taken and population manipulation.

The Department will manage game species to provide sustained yields of animals for humans and for wild carnivore populations that depend upon them for food. Whenever substantial conflicts arise between humans and predators over the use of prey, the predator population will be managed to minimize such conflicts.

A few areas may be reserved for scientific studies where game populations and/or habitat can be manipulated.

The Department will encourage recreational observation of game through public information and education and will provide for such activities in its management plans.

The Department does not consider the harvest of bears (black, brown/grizzly, polar), bison, deer, elk, goat,

moose, muskox, sheep, waterfowl, game birds and unclassified game for the purpose of sale or barter of hides, meat, antlers, horns or other parts a proper use of the resource and will oppose it. However, when compatible with recreational and food resource demands, commercial utilization of other game species may be provided for in the Department's management plans.

Because wildlife belongs to all the people, the domestication of game animals for commercial purposes is normally not considered a wise use of the resource and usually will be discouraged by the Department.

When others conduct research on game species within Alaska, the Department will request a description of proposed studies and make recommendations in the best interest of the species and the people of the state. The Department will cooperate with other agencies or individuals whose research may provide useful information on game species.

The Department may issue permits for capturing, holding, importing and exporting of game species, for stocking, public education and scientific study, but only after demonstration that suitable habitat or holding facilities are available to the permittee. Permits will not be issued unless substantial benefits which are consistent with the Department's management policies can be demonstrated.

The Department recognizes that transplanting game species for restocking former ranges or stocking vacant habitat may be a useful management tool. Because transplants often have unforeseen detrimental effects, importing and transplanting of game will be generally opposed, but may be approved if substantial public benefit can be shown. Proposed transplants will be reviewed by the Department and must meet the following minimum requirements to be approved: 1) The proposed transplant site must provide sufficient and suitable habitat to support a viable population of the transplanted species, as determined by comprehensive study; 2) Prior study must establish that the introduction of a species will not adversely affect the numbers, health, or utilization of resident species.

The Department recognizes that situations may arise requiring the removal of an animal or the reduction in numbers of a species in response to a specific problem. Control will be implemented only after an investigation by Department personnel has determined a valid need exists.

Whenever possible, control will be affected by recreational hunting. When control by the Department or its designees are necessary, humane methods will be employed. Poison bait and other nonselective means of control will not be used. Bounties are not considered a desirable means of effecting control.

The Department holds that it is the owner's responsibility to protect his property from damage by wildlife. Reasonable efforts must be made to protect life and property by means other than the destruction of game.

## **Introduction**

This volume is divided into four parts: Physiography of Alaska, Wildlife Species Accounts, Wildlife Distribution Maps, and Game Management Unit Discussions. Each section except the species accounts is further arranged by geographical area and wildlife species. Physiography of Alaska is a general discussion of each of the state's 12 physiographic regions in terms of topography, climate, geology and general vegetation characteristics. The Wildlife Species Accounts are general life-history accounts of each mammalian species considered and stress distribution within Alaska and the general habitat requirements of each species. Because so many waterfowl and seabirds species are considered, the "species accounts" of this group are arranged according to six waterfowl habitat regions. Each discussion describes the occurrence and habitat characteristics of important species within the region and presents selected life history information for some species. The Wildlife Distribution Maps are

marked to show distribution of each species (or, in some cases, group of species) throughout the state. Where knowledge is available, the maps show seasonal changes in distribution and critical habitat areas. Several species are sometimes represented on one map, as indicated in the legends. The Game Management Unit Accounts include general descriptions of each game management unit and specific information regarding historic and present distribution, abundance and human uses of each species within the unit. Emphasis is placed on the specific and critical habitat requirements of each species in the unit, and on land-use considerations and recommendations for land-use plans.

## ANIMAL REFERENCE LIST

This list includes only those species mentioned in the text of this volume, and is not intended as a complete listing of all species found in Alaska.

### TERRESTRIAL MAMMALS

#### Carnivores

Arctic Fox *Alopex lagopus*  
 Black Bear *Ursus americanus*  
 Brown-Grizzly Bear *Ursus arctos*  
 Cat *Felis domesticus*  
 Coyote *Canis latrans*  
 Dog *Canis familiaris*  
 Ermine *Mustela erminea*  
 Land Otter *Lutra canadensis*  
 Least Weasel *Mustela rixosa*  
 Lynx *Lynx canadensis*  
 Marten *Martes americana*  
 Mink *Mustela vison*  
 Polar Bear *Thalarctos maritimus*  
 Red Fox; Blue Fox *Vulpes vulpes*  
 Wolf *Canis lupus*  
 Wolverine *Gulo gulo*

#### Ungulates

Barren Ground Caribou *Rangifer tarandus granti*  
 Bison *Bison bison*  
 Sitka Black-Tailed Deer *Odocoileus hemionus sitkensis*  
 Dall Sheep *Ovis dalli*  
 Roosevelt Elk *Cervus canadensis roosevelti*  
 Horse *Equus caballus*  
 Moose *Alces alces*  
 Mountain Goat *Oreamnos americanus*  
 Muskox *Ovibos moschatus*  
 Mule Deer *Odocoileus hemionus hemionus*  
 Reindeer *Rangifer tarandus tarandus*  
 Sheep *Ovis aires*

#### Other Terrestrial Mammals

Beaver *Castor canadensis*  
 Ground Squirrel *Citellus parryii*  
 Marmot *Marmota caligata*  
 Rat *Rattus* spp.  
 Snowshoe Hare *Lepus americanus*

### MARINE MAMMALS

#### Seals

Bearded Seal *Erignathus barbatus*  
 Elephant Seal *Mirounga leonina*  
 Harbor Seal *Phoca vitulina*  
 Northern Fur Seal *Callorhinus ursinus*  
 Ribbon Seal *Phoca fasciata*  
 Ringed Seal *Phoca hispida*

#### Whales

Baird's Beaked Whale *Berardius bairdi*  
 Beluga Whale *Delphinapterus leucas*  
 Blue Whale *Balaenoptera musculus*  
 Bowhead Whale *Balaena mysticetus*  
 Cuvier's Whale *Ziphius cavirostris*  
 Finback Whale *Balaenoptera physalus*  
 Gray Whale *Eschrichtius gibbosus*  
 Humpback Whale *Megaptera novaeangliae*  
 Killer Whale *Orcinus orca*  
 Minke Whale *Balaenoptera acutorostrata*  
 Narwhal *Monodon monoceros*  
 North Pacific Right Whale *Eubalaena glacialis*  
 Pacific Blackfish (Pacific Pilot Whale) *Globicephala melaena*  
 Sei Whale *Balaenoptera borealis*  
 Stejneger's Beaked Whale *Mesoplodon stejnegeri*  
 Sperm Whale *Physeter catodon*

#### Porpoises

Dall Porpoise *Phocoenoides dalli*  
 Harbor Porpoise *Phocoena phocoena*

#### Other Marine Mammals

Pacific Walrus *Odobenus rosmarus*  
 Sea Otter *Enhydra lutris*  
 Steller Sea Lion *Eumetopias jubata*

### WATERFOWL AND SEABIRDS

Dabbling Ducks  
 Chinese Spot Bill \* *Anas poecilorhyncha zonorhyncha*  
 Duck, Black \* *Anas rubripes*  
 Duck, Wood\* *Aix sponsa*  
 Gadwall *Anas strepera*  
 Garganey\* *Anas querquedula*  
 Mallard *Anas platyrhynchos*  
 Pintail *Anas acuta*  
 Shoveler *Spatula clypeata*



Teal, Aleutian Common *Anas crecca nimia*  
Teal, Baikal \* *Anas formosa*  
Teal, Blue-Winged *Anas discors*  
Teal, Cinnamon\* *Anas cyanoptera*  
Teal, European Common\* *Anas crecca crecca*  
Teal, Falcated\* *Anas falcata*  
Teal, Green-Winged *Anas crecca carolinensis*  
Widgeon, American *Mareca americana*  
Widgeon, European\* *Mareca penelope*

#### Diving Ducks

Bufflehead *Bucephala albeola*  
Canvasback *Aythya valisineria*  
Common Pochard\* *Aythya ferina*  
Duck, Tufted\* *Aythya fuligula*  
Duck, Ruddy\* *Oxyura jamaicensis*  
Goldeneye, American *Bucephala clangula americana*  
Goldeneye, Barrow's *Bucephala islandica*  
Redhead\* *Aythya americana*  
Ringneck\* *Aythya collaris*  
Scaup, Greater *Aythya marila*  
Scaup, Lesser *Aythya affinis*

#### Sea Ducks and Mergansers

Eider, King *Somateria spectabilis*  
Eider, Pacific Common *Somateria molissima*  
Eider, Spectacled *Lampronetta fischeri*  
Eider, Steller's *Polysticta stelleri*  
Harlequin *Histrionicus histrionicus*  
Merganser, American Common *Mergus merganser*  
Merganser, Hooded *Lophodytes cucullatus*  
Merganser, Red-Breasted *Mergus serra tor*  
Old Squaw *Clangula hyemalis*  
Scoter, American Common *Oidemia nigra*  
Scoter, Surf *Melanitta perspicillata*  
Scoter, Western White-Winged *Melanitta deglandi*  
Smew\* *Mergus albellus*

#### Geese

##### Canada

Aleutian *Branta canadensis leucopareia*  
Cackling *Branta canadensis minima*  
Dusky *Branta canadensis occidentalis*  
Lesser *Branta canadensis parvipes*  
Vancouver *Branta canadensis fulva*

##### Bean\* *Anser fabalis*

Brant, American \* *Branta bernic/a*  
Brant, Black *Branta nigricans*  
Emperor *Philacte canagica*  
Ross's\* *Chen rossi*  
Snow, Lesser *Chen hyperborea*  
White-Fronted *Anser albifrons*

#### Swans

Trumpeter *Olor buccinator*  
Whistling *Olor columbianus*

#### Whooper\* *Olor Cygnus*

Cranes, Loons, Grebes and Coots  
Coot, American \* *Fulica americana*  
Crane, (Common) Gray\* *Grus grus*  
Crane, Lesser Sandhill *Grus canadensis*  
Grebe, Horned *Podiceps auritus*  
Grebe, Pied-Bi lied \* *Podilymbus podiceps*  
Grebe, Red-Necked *Podiceps grisegena*  
Grebe, Western \* *Aechmophorus occidentalis*  
Loon, Arctic *Gavia arctica*  
Loon, Common *Gavia immer*  
Loon, Red-Throated *Gavia stellata*  
Loon, Yellow-Billed\* *Gavia adamsi*

#### Seabirds

Albatross, Black-Footed *Diomedea nigripes*  
Albatross, Laysan\* *Diomedea immutabilis*  
Albatross, Short-Tailed *Diomedea albatrus*  
Auklet, Cassin's *Ptychoramphus aleutica*  
Auklet, Crested *Aethia cristatella*  
Auklet, Least *Aethia pusilla*  
Auklet, Parakeet *Cyclorhynchus psittacula*  
Auklet, Rhinoceros *Cerorhinca monocerata*  
Auklet, Whiskered\* *Aethia pygmaea*  
Cormorant, Brandt's\* *Phalacrocorax penicillatus*  
Cormorant, Pelagic *Phalacrocorax pelagicus*  
Cormorant, Double-Crested *Phalacrocorax auritus*  
Cormorant, Red-Faced *Phalacrocorax urile*  
Dovekie, Common \* *Plautus aile*  
Fulmar, Pacific *Fulmarus glacialis*  
Guillemot, Mandt's Black *Cepphus grille*  
Guillemot, Pigeon *Cepphus columba*  
Gull, Black-Headed\* *Larus ridibundus*  
Gull, Bonaparte's\* *Larus philadelphia*  
Gull, California\* *Larus californicus*  
Gull, Glaucous *Larus hyperboreus*  
Gull, Glaucous-Winged *Larus glaucescens*  
Gull, Herring *Larus argentatus*  
Gull, Iceland\* *Larus glaucoides*  
Gull, Ivory\* *Pagophila eburnea*  
Gull, Ross's *Rhodostethia rosea*  
Gull, Sabine's *Xema sabini*  
Gull, Short-Billed (Mew) *Larus canus*  
Gull, Slaty-Backed\* *Larus schistisagus*  
Jaeger, Long-Tailed *Stercorarius longicaudus*  
Jaeger, Parasitic *Stercorarius parasiticus*  
Jaeger, Pomarine *Stercorarius pomarinus*  
Kittiwake, Pacific *Rissa tridactyla*  
Kittiwake, Red-Legged *Rissa brevirostris*  
Murre, Common *Uria aalge*  
Murre, Thick-Billed *Uria lomvia*  
Murrelet, Ancient *Synthliboramphus antiquum*  
Murrelet, Kittlitz's *Brachyramphus brevirostris*  
Murrelet, Marbled *Brachyramphus marmoratum*  
Petrel, Cook's\* *Pterodroma cookii*  
Petrel, Fork-Tailed *Oceanodroma furcata*  
Petrel, Leach's *Oceanodroma leucorhoa*  
Petrel, Scaled\* *Pterodroma inexpectata*  
Puffin, Horned *Fratercula corniculata*

Puffin, Tufted *Lunda cirrhata*  
 Shearwater, Pale-Footed\* *Puffinus carneipes*  
 Shearwater, Pink-Footed\* *Puffinus creatopus*  
 Shearwater, Slender-Billed *Puffinus tenuirostris*  
 Shearwater, Sooty *Puffinus griseus*  
 Tern, Aleutian *Sterna aleutica*  
 Tern, American Black\* *Chilidonias niger*  
 Tern, Arctic *Sterna paradisaea*\*

\*Denotes uncommon to very rare in Alaska. Others listed as common may be common only locally.

#### Other Birds

Eagle, Bald *Haliaeetus leucocephalus*  
 Eagle, Golden *Aquila chrysaetos*  
 Ptarmigan *Lagopus* spp.  
 Raven *Corvus corax*

#### Fish

Capelin . *Mallotus villosus*  
 Cod (Gadiformes; Gadidae - many species)  
 Cod, Arctic *Boregadus saida*  
 Cod, Saffron *Eleginus gracilis*  
 Flounder (Pleuronectiformes; many species)  
 Greenling (Hexagrammidae; many species)  
 Halibut *Hippoglossus stenolepis*  
 Herring *Clupea harengus*  
 Lantern Fish (Myctophidae; many species)  
 Needle Fish (Belonidae; many species)  
 Rockfish *Sebastes* spp  
 Salmon, King *Onchorynchus tshawytscha*  
 Salmon, Chum *Onchorynchus keta*  
 Salmon, Pink *Onchorynchus gorboscha*  
 Salmon, Red *Onchorynchus nerka*  
 Salmon, Silver *Onchorynchus kisutch*  
 Sand Lance *Ammodytes* spp. and *Hyperoplus* spp.  
 Saury *Cololabis saira*  
 Sculpin (Cottidae; many species)  
 Shark (Selachii; many species)  
 Smelt (Eulachon) *Thaleichthys pacificus*  
 Whitefish *Coregonus* spp. and *Prosopium cylindraceum*

#### INVERTEBRATES

Abalone *Haliotis* spp.  
 Amphids (Crustacea; Amphipoda; many general)  
 Annelids segmented worms (Annelata; Polychaeta)  
 Cephalopods octopus and squids (Mollusca; Cephalopoda)  
 Crabs (Arthropoda; Brachyura; many genera)  
 Crustaceans crabs, shrimps, etc. (Arthropoda; Crustacea)  
 Decapods Echinoderms crabs, shrimps (Crustacea; Decapoda)  
 starfish, sea urchins, etc. (Echinodermata)

Euphausiids small shrimp-like crustaceans; *Euphausia* spp.  
 Gastropods snails and sea slugs (Mollusca; Gastropoda)  
 Hermit Crabs *Pagurus* spp.  
 Mollusks chitons, snails, clams (Mollusca)  
 Mosquito (Culicida; many species)  
 Mussels (Mollusca; Mytilidae; many genera)

Mysids opossum shrimps (Crustacea; Mysidacea)  
 Octopus *Polypus* spp.  
 Pelecypods (Mollusca; clams and oysters Pelecypoda; many families)  
 Sea Urchins (Echinodermata; Echinoidea; many genera)  
 Shrimps (Arthropoda; Crustacea; many families)  
 Snails (Gastropoda; many families)  
 Squid (Cephalopoda; many families)  
 Tunicates sea squirts (Chordata; Tunicata; many orders)

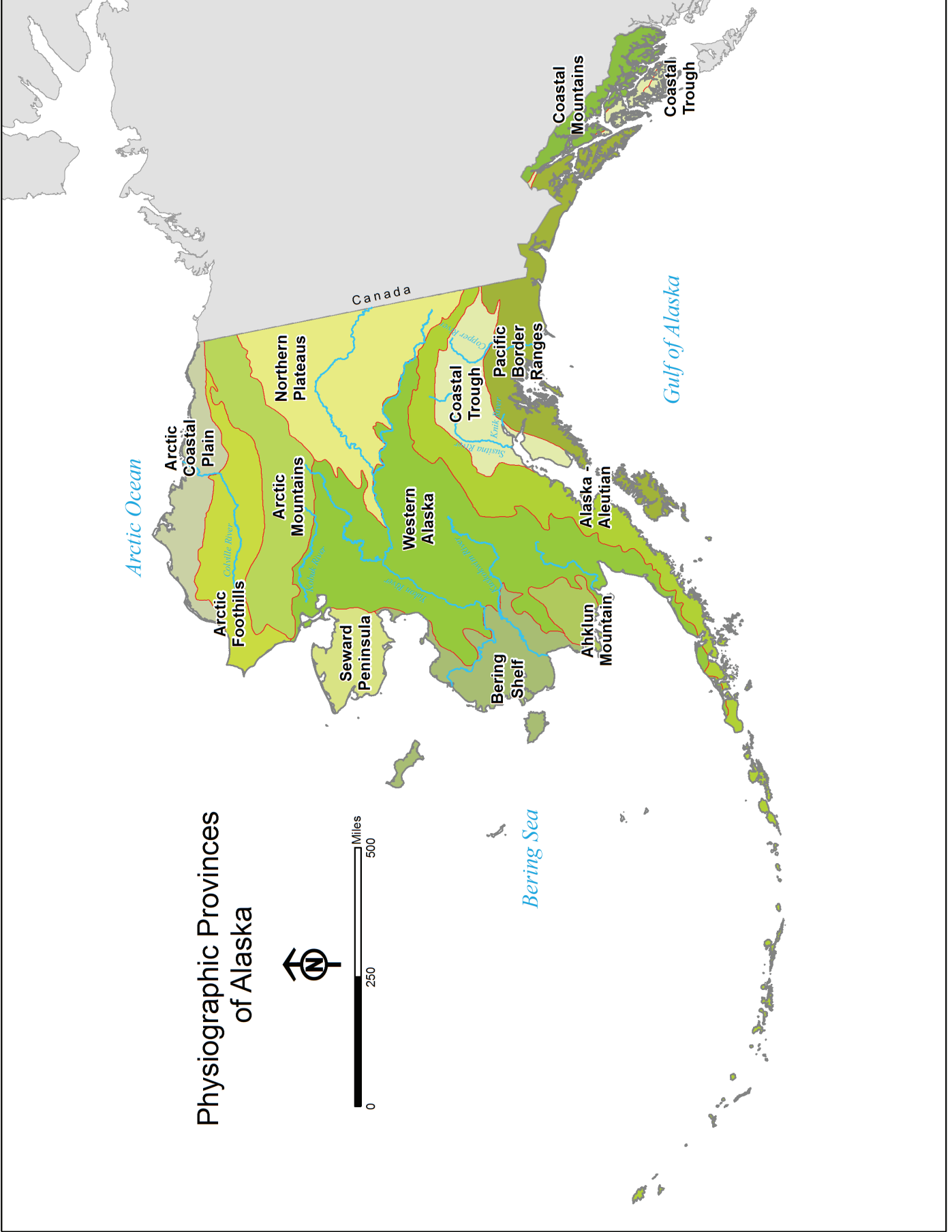
#### PLANT REFERENCE LIST

Alaska cedar *Chamaecyparis nootkatensis*  
 Alaska heather *Cassiope lycopodioides*  
 Alder *Alnus crispa* spp. *Polystichum* spp.  
 Alpine azalea *Loiseleuria procumbens*  
 Alpine bearberry *Arctostaphylos alpine*  
 Alpine fir *Abies lasiocarpa*  
 Angelica *Angelica lucida*  
 Arctic bearberry *Arctostaphylos alpina*  
 Arrowgrass *Triglochin* spp.  
 Aspen *Populus tremuloides*  
 Balsam poplar *Populus balsamifera*  
 Beach rye (Beach grass) *Elymus mollis*; *E. arenarius*  
 Bearberry *Arctostaphylos uva-ursi* *Diapensia*  
 Bent grass *Agrostis* spp.  
 Birch (Alaska paper birch) *Betula papyrifera*  
 Black cottonwood *Populus trichocarpa*  
 Black currant *Ribes hudsonianum*  
 Black spruce *Picea mariana*  
 Blueberry *Vaccinium ovalifolium*; *V. uliginosum*  
 Bluejoint *Calamagrostis canadensis*  
 Bog blueberry *Vaccinium uliginosum*  
 Buckbean *Menyanthes trifoliata*  
 Bunchgrass *Hierochloa alpine*  
 Burnet *Sanguisorba sitchensis*  
 Bur-reed *Sparganium* spp.  
 Buttercup *Ranunculus* spp.  
 Coontail *Ceratophyllum* spp.  
 Cotton grass *Eriophorum*  
 Cottonwood *Populus balsamifera*  
 (black cottonwood) Fivefinger *Potentilla* spp.  
 Cow parsnip *Heracleum lanatum*  
 Crabapple *Malus* spp.  
 Crowberry *Empetrum nigrum*  
 Currant *Ribes* spp.  
 Deerberry *Maianthemum dilatatum*  
 Deer cabbage *Veratrum viride*  
 Devil's club *Oplomanax horridus*  
*Diapensia lapponica*  
 Dock *Rumex* spp.  
 Dogwood (ground dogwood; dwarf dogwood; bunchberry)  
 Dryas *Dryas* spp.  
 Duck weed *Lemna* spp  
 Dwarf birch *Betula nana*  
 Dwarf willow *Salix rotundifolia*  
*S. reticulata*; *S. pulchra*  
 Eelgrass *Zostera marina*  
 Elderberry *Sambucus racemose*  
 False hellebore *Veratrum Eschscholtzii*

Ferns *Adiantum pedatum*  
*Athyrium* spp.  
*Blechnum spicant*  
*Dryopteris dilatata*  
Fireweed *Epilobium angustifolium*  
Fleabane *Senecio congestus*  
Foxtail *Alopecurus* spp.  
Geranium *Geranium erianthum*  
Goldthread *Coptis aspleniifolia*; *C. trifolia*  
Gooseberry *Ribes* spp.  
Goose tongue *Calamagrostis* spp.  
Ground dogwood *Cornus canadensis*  
Groundsel *Senecio pseudo-Arnica*  
Hairgrass *Deschampsia caespitosa*  
Hemlock, western *Tsuga heterophylla*  
Hemlock, mountain *T. Mertensiana*  
Highbush cranberry *Viburnum edule*  
Horsetail *Equisetum* spp.  
Kamchatka rhododendron *Rhododendron camtschaticum*  
Labrador tea *Ledum palustre*  
Larch *Larix laricina*  
Lodgepole pine *Pinus contorta*  
Lowbush cranberry *Vaccinium vitis-idaea*  
Lupine *Lupinus nootkatensis*  
Mannagrass *Glyceria* spp.  
Mares tail *Hippuris* spp.  
Marsh marigold *Caltha biflora*  
Mosses *Sphagnaceae* spp.  
Mountain ash *Sorbus scopulina*; *S. sitchensis*  
Mountain hemlock *Tsuga Mertensiana*  
Mountain maple *Acer glabrum*  
Nagoon berry *Rubus arcticus*  
Pea vine *Lathyrus* spp.  
Pondweed *Potamogeton* spp.  
Poplar (balsam poplar) *Populus balsamifera*  
Purple heather *Phyllodoce empetriformis*

Red osier dogwood *Cornus stolonifera*  
Red poque *Boschniakia rossica*  
Reed canary grass *Phalaris* spp.  
Reed grass *Calamagrostis* spp.  
Rush *Juncus* spp.  
Rusty menziesia *Menziesia ferruginea*  
Salal *Gaultheria shallon*  
Salmonberry *Rubus spectabilis*  
Saltgrass *Distichlis* spp.  
Sandwort *Honckenya peploides*  
Sea lettuce *Fucus* spp.  
Sea lovage *Ligusticum Hultenii*  
Sedges *Carex* spp.; *Eriophorum* spp.  
Sitka spruce *Picea sitchensis*  
Skunk cabbage *Lysichiton americanum*  
Sloughgrass *Beckmannia* spp.  
Smartweed *Polygonum amphibium*  
Snakeweed *Polygonum* spp.  
Spike rush *Eleocharis* spp.  
Sweetgale *Myrica* spp.  
Trailing bramble *Rubus pedatus*  
Water chickweed *Montia* spp.  
Water milfoil *Myriophyllum* spp.  
Western hemlock *Tsuga heterophylla*  
Western red cedar *Thuja plicata*  
White spruce *Picea glauca*  
Widgeon grass *Ruppia* spp.  
Wild rose *Rosa nutkana*; *R. acicularis*  
Wild strawberry *Fragaria* spp.  
Willow *Salix* spp.  
Yellow cedar *Chamaecyparis nootkatensis*

# Physiographic Provinces of Alaska



## PART I: PHYSIOGRAPHY OF ALASKA

Alaska's vast expanse stretches some 2,000 miles east-west and 1,100 miles north-south, and encompasses several major geological formations with attendant differences in climate, soils, and plant and animal distribution. The state's northerly location produces a climate with dramatic seasonal contrasts in day length and temperature. Environmental factors are strongly influenced by land forms and their geologic origins. Distribution of major plant communities and resultant wildlife species distribution conforms somewhat to the major topographical regions.

This discussion follows the 12 physiographic divisions described in Wharhaftig's Physiographic Division of Alaska, which describes the major topographic and geologic features of the state. The 26 game management units conform somewhat to these divisions and will be referred to in the discussion to give the reader some understanding of each unit.

### ARCTIC COASTAL PLAIN, ARCTIC FOOTHILLS AND ARCTIC MOUNTAINS PROVINCES

The Arctic Coastal Plain and Arctic Foothills Provinces, and the northern drainages of the Arctic Mountains Province comprise Game Management Unit 26. Commonly referred to as the "North Slope," the area north of the Brooks Range divide has the severest Arctic climate in Alaska. Winter winds and low temperatures along the coast frequently combine to produce wind-chill factors far below the 15° F winter temperature average. Summer temperatures may reach the mid 60's inland and mid 50's along the coast. Average annual precipitation ranges from 4 inches near the coast to 10 inches in the Brooks Range. The extremes of 24 hour summer daylight and 24 hour winter darkness are striking climatic features. Permafrost underlies the entire area, and streams, lakes, and the Arctic Ocean are frozen during much of the year.

The Arctic Coastal Plain Province is a flat, treeless area covered by a network of ice-wedge polygons. There are scattered thaw lakes on the poorly drained, permafrost underlain soils, and standing water is abundant. Eastern drainages spread across the plain in multi-braided channels and form broad deltas at the Beaufort Sea. Western drainages meander along incised valleys to the Chukchi Sea. "Wet tundra" meadows of cotton grass and other sedges are nearly continuous, with low peat ridges of matted heath and dwarf shrub species and some tussock-covered areas also present.

The plain grades into the Arctic Foothills Province with its rolling plateaus, low linear mountains and intermittent plains. Fast streams braid gravel flats along which thickets of birch, alder and willow grow. "Moist tundra" communities consisting of cottongrass tussocks and intermittent patches of low heath shrubs, mosses, sedges, and lichens grow on these soils, which are somewhat drier than those of the coastal plain.

The foothills meet the abrupt peaks of the Brooks Range in the Arctic Mountains Province. The Brooks Range is a string of east-trending mountainous ridges of sedimentary and volcanic rock. Lower slopes and meadows support "moist tundra" vegetation and balsam poplar grows in scattered patches along river bottoms. At higher elevations "dry tundra" predominates. Here barren, rocky areas are interspersed with scattered mats of low flowering plants, grasses, dwarf shrubs, sedges and lichens.

South of the divide, the Arctic Mountains Province transects Game Management Units 23, 24, and 25. In addition to the vast Brooks Range, this province encompasses the rugged, glaciated Delong Mountains and the more subdued terrain of the Baird Mountains in the west. Vegetation in these mountains and on the Brooks Range's south slope is largely a continuation of the tundra types found on the North Slope. The appearance of small white spruce at 1,000-3,000 ft. elevation marks the edge of the boreal forest region of Interior Alaska.

## NORTHERN PLATEAUS PROVINCE

The Northern Plateaus Province includes portions of Game Management Units 12, 20,21,23,24 and 25. Included in this province are the Porcupine Plateau, Yukon Flats, Rampart Trough, Yukon-Tanana Upland, and the vast region known as Interior Alaska. South of the eastern Brooks Range the Porcupine Plateau's gently sloping ridges and rounded mountains are dissected by the Chandalar, Sheenjek and Coleen rivers, flowing through broad morainal valleys. The Porcupine River flows across the plateau through a cliff-lined canyon into the Yukon River. The Yukon itself drains most of Interior Alaska and is the state's major drainage.

The Yukon Flats occupy the broad lowland area from the Porcupine River to the uplands south of the Yukon River. Outwash fans of the Chandalar, Christian, and Sheenjek rivers enter the northern part of the Flats, flowing into the broader outwash fan of the Yukon River. River terraces slope gently through rolling terrain to the surrounding foothills. The slowly meandering multi-braided stream channels form a complex of sloughs, islands, and oxbow lakes. Thaw lakes and sinks dot the lowlands. Marsh and aquatic vegetation abound, making the flats one of the richest waterfowl habitats in North America.

The Yukon Flats narrows into the Rampart trough, a depression with gently rolling terrain to 1,500 ft. elevation. The Yukon here enters a narrow, rocky gorge and flows in serpentine loops through a constricted floodplain. The Kokrine-Hodanza Highlands, north of the Yukon River Rampart Trough, consists of rounded ridges and isolated rugged mountains. It includes the craggy Ray Mountains with peaks to 5,500 ft.

South of the Yukon Flats is the Yukon-Tanana Upland, an area of broad undulating divides with rounded, even-topped ridges and gentle slopes. These ridges become more rugged in the east and reach elevations exceeding 6,000 ft. Streams flow through in narrow, terraced canyons in the east and flat alluvial valleys in the west. A corner of the Ogilvie Mountains intrudes across the Canadian border north of the Yukon River. These mountains are sharp and steeply sloped with narrow valleys and peaks reaching 5,000 ft. Stretching southwesterly nearly the breadth of the state, Interior Alaska has a continental climate. Extremely cold winters are the rule, and summer temperatures often reach the 80's and occasionally the 90's. Precipitation is largely summer showers, with an annual range of 10-15 inches. Permafrost underlies much of the area but is not continuous in the southern section. Rivers and lakes are usually frozen from late October to April, with breakup occurring in late April or May. Ice jams and subsequent spring flooding frequently occur on the Yukon and other large rivers.

The vegetation of the Interior is a patchwork of evergreen and deciduous forest. Sharp vegetation boundaries reflect a history of repeated forest fires as well as abrupt local changes in site characteristics. White spruce, both in dense pure stands and mixed with balsam poplar, and birch grow in bands along the Yukon River and other major drainages. White spruce here is indicative of deep, moist soils which are well drained and deeply thawed. These spruce stands commonly have a dense understory of willow, alder, dogwood, Labrador tea, grass and herbs growing on a thick moss layer. Willow and alder thickets grow along the water's edge.

The intermontane basins, underlain by poorly drained soils over permafrost, support extensive black spruce stands; in more rolling, slightly better drained areas, a mixture of black spruce, birch, aspen and balsam poplar grow. Muskeg bogs are intermittent in low lying areas. Low willow, birch, heath shrubs, and a thick ground cover of cottongrass tussocks with moss and lichens make up the understory.

Better drained soils on upland slopes and valleys support a mixed evergreen-deciduous forest of white spruce in various combinations with black spruce, aspen, balsam poplar and paper birch. Recent burns are marked by the red-purple hue of dense stands of fireweed growing with grass and often dense brush. This community is common in the highlands and mountains surrounding the Yukon, Kuskokwim and other major Interior rivers.

Another vegetation type, "low brush muskeg", is largely confined to the Interior in wet, flat basins, river terraces

and broad valleys on silty peat soils overlying shallow permafrost. The largest areas of this deciduous brush type are found in river terraces along the Coleen, Tanana, Koyukuk and Yukon Rivers and Birch Creek. Willow, alder, dwarf birch, and heath shrubs are interspersed with large areas of cottongrass tussocks and small peat moss ridges.

## **WESTERN ALASKA PROVINCE**

The Western Alaska Province includes the bulk of Game Management Units 19 and 21 and parts of Units 9, 17, 18, 20, 22, and 23. This province is an alternating system of distinct lowlands and discrete upland areas, mostly below 4,000 ft. in elevation. One of the most extensive lowlands is the Koyukuk Flats, at the great south bend in the Yukon River. Flat plains up to 20 miles wide contain wandering, many-channeled streams. Silt plains, dunes, thaw lakes and sinks are abundant.

West of the Koyukuk Flats, the Nulato Hills extend from the eastern edge of the Seward Peninsula south along Norton Sound to the Yukon River. Major streams drain eastward through narrow, flat-floored valleys to the Yukon drainage; west flowing streams drain into Norton Sound. Topography is much dissected, with closely spaced tributary drainages.

The Kuskokwim Mountains are a series of northeast trending ridges with rounded or flat summits and gentle slopes. They separate the Tanana-Kuskokwim Lowlands from the Yukon-Kuskokwim Lowlands. Isolated groups of previously glaciated mountains 2,000 - 4,000 ft. in elevation surmount the ridges. Fast streams thread their ways into flat valleys and drain into the Yukon and Kuskokwim Rivers. The Tanana-Kuskokwim Lowland is made up of outwash fans from the Alaska Range and flood plains of the Kuskokwim, Kantishna and Tanana Rivers. The northern part of the lowland is covered by stabilized dunes. Thaw lakes and sinks are common, and twisting glacial streams flow north into the lowlands from the Alaska Range.

South of the Kuskokwim Mountains is the Bristol Bay watershed, the southwestern most extension of the Western Alaska Province, comprising Game Management Units 9 and 17. This region has a maritime climate with narrower seasonal and daily temperature ranges than those of Interior Alaska. Summer temperatures reach the 70's only occasionally. Winter temperatures may reach 30° F to 40° F below zero, but seldom for prolonged periods. Aleutian atmospheric lows bring strong winds from December through March. Precipitation averages 30 - 40 inches annually and occurs mostly during the summer. Bay ice is usually present from November to April.

The rounded, flat-topped ridges of the Nushagak-Big River Hills make up the northern part of the Bristol Bay drainage. Here the Mulchatna and Nushagak Rivers flow through gently sloping hills and broad valleys into the outwash and moraine covered Nushagak-Bristol Bay Lowland. Eastward the foothills of the Aleutian Range hold many large moraine-dammed lakes.

“Wet tundra” vegetation, with numerous thaw lakes and marshes, is common along much of the low coastal area in Bristol Bay. “Moist tundra” occupies the uplands to around 1,200 ft. elevation where it is replaced by “dry tundra”. A broad band of the “high brush” community, predominately alder, willow, and dense, tall grass, separates the two types along the length of the western side of the Aleutian Range. Extensive areas of pumice and volcanic rock, nearly barren of vegetation, are scattered throughout the Alaska Peninsula. This entire region is a volcanic zone and was the scene of major eruptions as recently as 1912.

## **SEWARD PENINSULA PROVINCE**

The Seward Peninsula Province, which includes much of Game Management Unit 22, is an irregular appendage of land partially separating the Chukchi and Bering Seas. It is an expanse of broad hills and flat divides 500 - 2,000 ft. high interrupted by scattered groups of rugged mountains. Small streams flow through sharp valleys to

the coastal lowlands where they meander through deltas to the sea. The lowlands contain many thaw lakes and occasional rock basin, morainal and volcanic crater lakes. Permafrost underlies the whole area and ice-wedge polygons are abundant.

The climate is less severe than Arctic or Interior climates, due to the moderating influence of the sea. The northern part of the peninsula has a more Arctic-like climate than does the southern part, with average annual precipitation in the north only about 9 inches, or half as much as in the south. Fog and cloudy skies are common during summer months.

Vegetation in the northwestern coastal lowlands is “wet tundra” with low sedges, grasses and aquatics. Slightly farther south, lowlands support “moist tundra” with cottongrass, moss, sedges, low shrubs and lichens. Higher slopes and summits have “dry tundra” of lichen covered rocks, heaths, and dwarf shrubs. “High brush” of dense willow thickets, scattered balsam poplar groves and dwarf shrubs covers the southwest peninsula. White spruce-birch forest extends into the southeastern portion.

## **BERING SHELF PROVINCE**

The Bering Shelf Province is a mostly submerged level plain joining Alaska to Siberia. It contains most of Game Management Unit 18 and parts of Units 19 and 22. The Yukon-Kuskokwim Coastal Lowland section is a thaw-lake dotted marsh, rising to 300 ft. elevation in the east. Low basaltic hills, cinder cones and broad shallow volcanic craters are common. The Yukon and Kuskokwim Rivers meander through braided channels until the Yukon builds a delta into the Bering Sea and the Kuskokwim becomes a marine estuary. More than a third of the lowland is lake surface. The Bering Platform section, largely a submarine plain, surfaces as several abruptly rising islands, mostly of volcanic origin. These include Nunivak, St. Lawrence, St. Matthew and the Pribilof Islands.

Maritime climate tempers the continental influences during most of the year, but for brief periods summer temperatures near 90° F and winter temperatures in the -50° F range occur on the mainland. Annual precipitation averages about 19 inches, with snowfall of about 60 inches. The climate of St. Lawrence Island, lying 125 miles off the Alaska mainland and only 36 miles from Siberia, is considerably more rigorous. Though extreme low temperatures seldom occur, neither does the island experience much summer warmth, and the annual average temperature is in the low 20's. Precipitation, fog, and northeasterly storms occur all year.

“Wet tundra”, aquatic, and marsh communities occur in the Yukon River delta and in the plain south of the Kuskokwim River. Uplands support “moist tundra” much like that of the Seward Peninsula, and scattered areas of “high brush” occur adjacent to the major rivers. Mixed white spruce-deciduous forests extend northeast along the north banks of the Yukon River.

## **AHKLUN MOUNTAINS PROVINCE**

Southwest of the Kuskokwim River, the rugged, steep Ahklun Mountains rise above the lowlands to 5,000 ft. elevation. Clear streams, some cut deep into bedrock gorges, drain into the Bering Sea and Kuskokwim and Nushagak Rivers. Long, narrow glacial lakes, the Wood River-Tikchik complex, occur in the eastern part of the range. Permafrost is spotty and temperatures are moderate by Alaskan standards. Annual precipitation averages 20 to 24 inches. Vegetation is primarily “moist tundra” in the foothills, grading to “dry tundra” at higher elevations. This province includes parts of Game Management Units 17, 18, and 19.

## **ALASKA-ALEUTIAN PROVINCE**

The Alaska-Aleutian Province begins in the Aleutian Islands and curves through southern mainland Alaska. The Aleutian Island chain rides the crest of a submarine volcanic ridge, with volcano cone peaks characteristically



occupying the northern part of each island, sometimes reaching 9,000 ft. elevation. Streams are short and swift, often plunging over sheer cliffs into the sea. Permafrost is not present. Winter pack ice forms in the Bering Sea, but the Pacific side of the chain remains open. "Moist tundra" on the lower slopes and coastal area is hummocky, water-soaked turf and peat composed of heath shrubs, mosses and lichens. Barren lava flows are interspersed with "dry tundra" at higher elevations. The Aleutian Islands are included in Game Management Unit 10.

The Aleutian Mountain Range occupies the eastern side of the Alaska Peninsula. The range is heavily glaciated and contains numerous volcanoes. The Pacific coast of the Alaska Peninsula has a maritime climate, with twice the precipitation of the Bristol Bay side. Extensive areas of ice and snow cap the mountains all year. "Dry tundra" occupies the higher areas and "high brush" communities spread from the western slope through low passes to occupy the lower slopes to the beach line on the Pacific coast.

The southern part of the Alaska Range, lying north of the Alaska Peninsula, is composed of a series of rugged, glaciated ridges 7,000 - 12,000 ft. high. Braided glacial streams flow west into the Kuskokwim, Nushagak and Kvichak Rivers and east into the Susitna River and Cook Inlet. Elongate lakes occupy some valleys and an extensive system of valley glaciers radiates from the higher mountains. Game Management Units 9 and 16 are transected by this part of the Alaska Range.

The central and eastern Alaska Range curves eastward in a series of glaciated ridges surmounted by some of the highest peaks in North America, including 20,320 foot Mt McKinley. "Dry tundra" vegetation predominates, with scattered areas of "high brush" and valley fingers of mixed spruce-deciduous forest. Game Management Units 12, 13, and 20 are partially included in this area.

## **COASTAL TROUGH PROVINCE**

The Coastal Trough Province parallels the south side of the Alaska Range in an arc continuing into Southeastern Alaska. It is chiefly a series of lowlands broken by oval groups of mountains. The Cook Inlet-Susitna Lowland is extensively glaciated, with numerous ground moraines, eskers, drumlins and outwash plains. It includes the lower Susitna River drainages, the western Kenai Peninsula and the lower Matanuska Valley. The climate is moderated by the Japanese current and other maritime influences. Temperatures seldom exceed the 70's in summer and do not reach the extreme lows of Interior Alaska in winter. Precipitation is low (only about 15 inches annually) as a result of the moisture barrier formed on the east by the Chugach Mountains. The climate east of the Matanuska Valley is dominated by continental influences, with long periods of subzero winter weather and warm summers. The Coastal Trough Province supports the majority of the Alaskan human population. It includes parts of Game Management Units 13, 14, 15, and 16.

East of the Cook Inlet Susitna Lowland are the rugged radial ridges of the Talkeetna Mountains. The Broad Pass Depression occupies rolling, tundra covered morainal lowlands bordering the foothills of the Talkeetnas. Farther east, the Gulkana Upland occupies an area of east-trending ridges separated by narrow low areas. Glacial streams cut the Talkeetnas and the Gulkana Upland, spilling into glacial deposits in the lowlands. The Clearwater Mountains, a heavily glaciated series of ridges, about the central Alaska Range and are drained by the Susitna River. The Copper River Lowland is composed of the rolling, morainal Lake Louise Plateau and the glacially scoured Copper and Chitina valleys. The high, glacier covered Wrangell Mountains overlook these two valleys.

The vegetation of the Coastal Trough is complex, varying according to a wide range of site characteristics. White spruce-black spruce-birch-aspen mosaics occupy much of the Cook Inlet-Susitna Lowland, with scattered patches of "high brush", "wet tundra" and "moist tundra". Along the northern side of Cook Inlet and on the tip of the Kenai Peninsula are scattered areas of spruce-hemlock forest more typical of southeastern coastal Alaska. Extensive areas of black spruce and muskeg occur in low areas. On better drained uplands, white spruce becomes a prominent species and is frequently mixed with black spruce, birch and aspen. Cottonwood grows in

thick stands along river bottoms. Scattered areas of “high brush” and extensive areas of “dry tundra” occupy the Wrangells, Talkeetnas, and other highlands.

## **PACIFIC BORDER RANGES PROVINCE**

The Pacific Border Ranges Province is composed of several mountain ranges and an intermittent coastal shelf. The westernmost range, the Kodiak Mountains, occupies the eastern two-thirds of Kodiak Island. Separated only by a narrow channel, Afognak Island adjoins Kodiak on the north and the two islands are included in Game Management Unit 8. Kodiak Island has been heavily glaciated and has an irregular coastline with many fiords and islands. It has a maritime climate with a high humidity, frequent clouds and annual precipitation of 60 inches. Temperatures seldom drop below freezing.

Extensive stands of Sitka spruce cover most of Afognak Island, but this community is found only in isolated areas on Kodiak. The higher mountains are covered with “dry tundra” vegetation, but most of the western portion of Kodiak is “high brush”, a tangle of dense alder and willow. Local areas of grass and herbaceous vegetation are sufficient to support limited livestock grazing.

The Kenai-Chugach Mountains border the north coast of the Gulf of Alaska from the Kenai Peninsula to near Alaska’s eastern boundary. Rugged, east-trending ridges and massive mountain peaks are separated by a network of narrow valleys and passes. The area has been heavily glaciated and vast icefields and glaciers persist throughout. The south coast is cut by many fiords and the ridges extend into Southeast Alaska as islands. Streams are short, swift and mostly glacial. Climate is controlled largely by the mountain barrier and the Gulf of Alaska. The northern slope’s more continental climate contrasts with the warmer winter and cooler summer temperatures of the southern coast. Annual precipitation increases gradually from west to east and heavy snowfall and frequent rain push average precipitation to over 100 inches a year in coastal areas. The moderate climate and high precipitation produce forests of Sitka spruce and western hemlock. Dense alder patches occur near timberline and on steep exposures. A heavy undergrowth of ferns, mosses, grasses and brush is common. These mountains include parts of Game Management Units 6, 7, 11, 13, and 14.

The massive, jagged St. Elias Mountains, with peaks to 19,000 ft., edge into Alaska southeast of the Wrangell and Chugach Mountains. They are largely ice covered and are drained by extensive glaciers. These mountains mark the edge of “Southeastern” Alaska, which includes Game Management Units 1 - 5. They extend south to Glacier Bay where they meet the Chilkat-Baranof Mountains, an area of diverse topography with its southern extension forming numerous islands. The Prince of Wales Mountains, with rugged, glaciated peaks, occupy Prince of Wales Island and several smaller islands.

## **COAST MOUNTAINS PROVINCE**

The Coast Mountains Province is a massive mountain barrier whose crest forms the Canada-Alaska boundary. It is composed of the Boundary Range, a glacier-covered upland cut by deep U-shaped valleys with peaks to 10,000 ft., and the Coastal Foothills, a stretch of high mountains, mountainous islands, flat valleys and straits. Short, swift, mostly glacial streams form the characteristic drainage pattern of Southeastern Alaska. Much of the area is only recently free of glacial ice, and glaciers remain the dominant active geological features. The high peaks and ice covered uplands are broken along the coast by numerous straits, fiords and islands. The climate is maritime, with moderate temperatures, high precipitation and much cloudy weather. Annual precipitation averages well over 100 inches in much of the region.

The vegetation responds to the rainfall and temperature by producing a lush forest growth which contains most of Alaska’s merchantable timber. Western hemlock and Sitka spruce are the major species and much of the forest is over 100 ft. in height. Pure Sitka spruce stands commonly occur north of Glacier Bay. Western red cedar is

found locally on rocky sites and on poorly drained soils at lower elevations. Lodgepole pine, Alaska cedar, alpine fir, mountain hemlock, birch and black cottonwood are found under various site conditions. A dense brush undergrowth of devil's club, mountain ash, and mountain maple occurs, with some second story trees reaching 40 ft. in height. Lush ferns, flowering herbs, tall grass, moss and lichens cover the ground. Clearcuts are frequently recolonized in thick stands of brush.

## PART II: WILDLIFE SPECIES ACCOUNTS

### CARNIVORES

#### BLACK BEAR

Black bears are distributed over about three-fourths of Alaska, there being no consistent records of the species north of the Brooks Range, from the Seward Peninsula, the Kuskokwim Delta, the Alaska Peninsula south of the Branch River, the Kodiak Island group, nor from the islands in Southeastern Alaska north of Frederick Sound. Where they do occur, their distribution coincides closely with the distribution of forests. They have a decided preference, however, for "open" forests rather than heavy mixed timber, and maximum populations generally occur in areas of mixed habitat types. Semi-open forest areas composed primarily of fruit-bearing pioneer shrubs and herbs, lush grasses and succulent forbs are particularly favored. Extensive open areas are generally avoided by black bears.

Information on the population dynamics of black bears in Alaska is limited, but there is nothing to suggest that the basic life history of the species differs significantly from what has been reported elsewhere.

Both sexes attain sexual maturity at approximately 3-1/2 years, though females may not breed until five or six. Breeding occurs throughout the range of the species from mid-June through mid-July. During the breeding season the female is continually in heat (seasonally constant estrus) until bred, and ovulation is induced by mating.

The eight to ten ounce young are born in the den in late January or February following a gestation period of about seven months, which includes a long period of delayed implantation. Litters average about 2.5 cubs, with two the most frequent litter size, but three or four not uncommon. Litter sizes observed in late summer and fall suggests low cub mortality. Cubs are very precocious, and animals as young as five months have survived with no maternal care.

Cubs are normally weaned by September, when they are about eight months old, and enter the den with their mother. Family breakup occurs during the following spring when the female again breeds.

The life expectancy of wild black bears is unknown, but is probably much shorter than the 25 years attained by some captive bears.

Alaskan black bears vary considerably in size. The most common weight is 100 to 200 pounds, with few specimens exceeding 300 pounds. Bears weigh 20 to 30 percent more in autumn than in spring

The usual color of the black bear is jet black with a distinctive brown-yellow muzzle and a small white chest patch. Several color variants do occur, however, sometimes within a single litter. The glacier (blue) phase is uncommon and is principally confined to coastal areas between Cross Sound and Cape Suckling in the southeastern Gulf of Alaska.

Studies show that some black bears spend most of their lives within five miles of their birth sites. Males range more widely than females and dispersal of young is slight. On the other hand, a few bears transplanted long distances have shown a remarkable ability to return to their home ranges.

In addition to consuming great quantities of plant materials and carrion, black bears occasionally prey upon young deer and moose. This predation probably has insignificant effects on prey populations.

Although ordinarily quite wary of man, some black bears frequent garbage dumps in populated areas, often be-

ing encouraged as tourist attractions. Such displays have their drawbacks, for “dump bears” frequently become troublesome animals and raid human dwellings, and must be killed to protect the very people who originally encouraged them.

Black bears use a variety of sites and structures for denning. Most favor holes in hillsides or excavations beneath logs and other large objects, but hollow logs and trees and rock caves are also used. A few bears over-winter with little or no shelter at all. Others expend considerable effort in constructing dens and lining them with leaves, ferns and other materials.

The winter denning period is variable in timing and duration, depending upon location and the animal’s physical condition. In southern portions of the United States and in Mexico black bears, except pregnant females, may not den at all. By contrast, in Interior Alaska, black bears may spend almost half of their total lives in winter dens. Here denning generally begins in October and extends through April into May.

Very little is known of the abundance of the black bear in Alaska or elsewhere. Areas of relatively high abundance are known to occur in a few places such as Prince of Wales Island in Southeastern Alaska and the Kenai Peninsula. In Interior Alaska black bears are generally less dense than farther south, where longer foraging seasons and richer food complexes appear to favor greater densities. These populations also seem more subject to periodic build-ups and “crashes”.

Black bears in Alaska have diverse and variable diets. In the spring, grasses, sedges and other early herbaceous plants such as horsetails appear to constitute the bulk of the diet. With the approach of summer, these foods are supplemented by a variety of berries such as blueberry, lowbush cranberry, high bush cranberry, elderberry and Arctic bearberry. During late fall, foods are less plentiful unless food sources such as fish and some berries remain available, and so grasses again become a staple food.

As a rule, animal matter constitutes a minor portion of the black bear’s total food intake. In specific instances, however, such as in Prince William Sound and parts of Southeastern Alaska, fish may be a major portion of the diet. Invertebrates (particularly insects) and, along coast areas, mussels and small crabs are also actively sought by bears. Carrion and an occasional prey animal are taken as opportunity affords.

## **BROWN-GRIZZLY BEAR**

The earth’s largest terrestrial carnivore, the brown-grizzly bear is distributed over most of Alaska. Except for minor island areas, it is absent only from the Aleutian Islands beyond Unimak and from the islands south of Frederick Sound.

Like all bears, the brown-grizzly is bulky in build and quite variable in size depending upon sex, age, time of year and geographic location. The average coastal brown bear is considerably larger than the Interior “grizzly” bear. Exceptional specimens may weigh 1,300 pounds, although most are considerably smaller. Interior grizzlies are about a third smaller than coastal forms and mature females normally weigh only about half as much as equivalent aged males in given locales. In all areas, bears weigh 20 to 30 percent more in the fall than in the spring.

Most taxonomists believe that the “brown bear” and “grizzly bear” of the American continent and the European “brown bear” are all of a single species. Brown bears on the Kodiak-Afognak Island group are a reproductively isolated population with distinctive cranial features, and are considered a separate subspecies. Other reproductively isolated populations exist; at this time there are insufficient data to decide whether they deserve subspecific designation.

Throughout this volume “brown bear” and “grizzly bear” are taxonomically synonymous. However, reference to

the brown bear implies southern coastal populations; whereas, reference to the grizzly bear indicates northern and Interior Alaska populations.

The breeding biology of brown-grizzly bears is reasonably well known. Both sexes attain sexual maturity at 3-1/2 to 4-1/2 years, although there are many exceptions. Some females mature as early as 2-1/2 years while others are 6-1/2 years old at first breeding. Males are usually sexually mature by 4-1/2 years of age.

The breeding season extends from May through mid-July and the eight to ten ounce hairless cubs are born in the den in late January or February following a gestation period of 194-278 days (usually 245 days). The gestation period includes a relatively long period of delayed implantation, when the blastocyst lies nearly dormant. Implantation occurs in October or November.

Litters average 2.2 cubs with one to three common and four not unusual. Most young nurse for one or two summers and a few for three summers. Generally, family "break up" occurs in the spring of the third year, when the female is again in estrus.

Maximum life span in the wild is unknown, though captives have lived to be 30 years old. Age determinations of wild bears using tooth cementum aging techniques suggest that some bears reach their late 20's.

Cub and yearling litters observed in summer average slightly in excess of two, suggesting a high survival rate for cubs from conception to family breakup. However, it is possible that natural mortality affecting litters may most often involve the entire litter rather than individual cubs, thereby masking the true extent of mortality.

In accessible and inhabited areas, human activities are doubtless the most significant mortality sources. Sport hunting is presently the most important human-related mortality factor, but there is also a high mortality of nuisance bears near inhabited areas. Often situations attractive to bears, such as garbage dumps and free-ranging livestock, are responsible for conflicts ending in the bear's death. Factors limiting remote and unexploited populations are largely unknown.

Timing and duration of the winter denning period varies according to location, physical condition and sexes and ages of bears. In Interior Alaska and northern Canada, the animals spend almost half of their total lives in winter dens. Here denning generally begins in late October and extends through April or into May.

Den sites chosen by brown-grizzly bears are most often on hillsides or high on mountain slopes. On the Alaska Peninsula and Kodiak, dens are usually located in the alder, willow and grass zone, and are often lined with grass and leaves. Females and young apparently den earlier in the fall and emerge later in the spring than do old males.

Tagging studies have shown that bear movements are confined to limited areas and movements in excess of 30 miles are unusual. A few displaced bears have demonstrated remarkable homing behavior.

A particularly interesting feature of brown bear behavior is the fact that sows will adopt cubs. Mixed-age litters of yearlings and cubs-of-the-year have also been reported. Such observations are unusual but they do suggest a tolerance uncommon in lower animals.

Although there are no precise data on the abundance of brown-grizzly bears in the state, there is general understanding of the species' status. Numerous attempts to determine the abundance of brown-grizzly bears in various portions of the state have met with little success except to yield minimum estimates and to provide information on their relative abundance.

Brown bears are probably as abundant in the state as during earlier times, except where they have been displaced

by man. Definite reductions in bear numbers have occurred near human population centers. A marked reduction has occurred on the Chiniak portion of Kodiak Island, where conflicts between livestock interests and brown bears are common.

The large size attained in several months' growth by coastal brown bear cubs compared to Interior cubs suggests the differences are largely caused by environment rather than by genetics. A richer food supply, particularly protein-rich salmon, is generally available to coastal bears. The foraging period of coastal bears is also several months longer than that of Interior bears, which spend more time denning.

The precise habitat requirements of brown-grizzly bears are unknown, but they are seemingly most at home in open tundra and grassland areas. Even where they occur in forested areas, as in Southeastern Alaska, substantial mountain meadows, muskegs, sedge flats, and other grassland areas are present. Perhaps the best indication of habitat requirements is the fact that the densest populations occur in lush grassland communities, as on Kodiak Island and the Alaska Peninsula. Grassland types appear especially critical for bears during the spring, when other high quality bear foods are scarce.

The grizzly bear's diet includes a wide range of animal and plant foods and is highly variable between areas and at different seasons. In the spring, grass and other early herbaceous plants make up the bulk of the diet. During summer and fall these foods are supplemented by a variety of fruit and berry-producing plants and shrubs. When bears feed on these, they consume leaves, plant stems and berries alike. In Alaska, blueberries, elderberries, lowbush and highbush cranberries, and crowberries are eaten in large quantities.

As a rule, animal matter constitutes a minor but important portion of the grizzly bear's diet, except in coastal areas where abundant salmon comprise a major segment of the summer and early fall diet. Other animal foods include small rodents, insect larvae, carrion and ungulates.

Of all Alaska's wildlife, brown-grizzly bears are probably least compatible with human activities. Without special consideration, their numbers will be markedly reduced wherever substantial and sustained human occupation and confrontation occur. Even with protection, a certain amount of conflict and consequent attrition of bears can be expected. The whole history of the species on this continent since the advent of the explorers has followed this pattern, and today grizzly bears have disappeared from most of their former range in the contiguous United States and Central America.

Their numbers have been markedly reduced over much of Canada and in small portions of Alaska. The brown bear in Europe has suffered a similar fate.

The eventual survival of the brown-grizzly bear may not depend entirely on the designation of vast tracts of unspoiled "wilderness", as shown by conflicts occurring in large national parks. Instead, the future of the bear lies in the reassessment of human values to include reasonable coexistence with it. Bears are not constant competitors and the major conflicts usually have resulted from improper land planning and classification, marginal economic pursuits, and basic misunderstanding of bears and their behavior.

## **POLAR BEAR**

The largest living carnivores, polar bears occur in association with Arctic sea ice and ringed seals or bearded seals, their principal foods. Young are born and develop for several months in winter snow dens, and the bears therefore require areas where snow accumulates and winter temperatures remain below freezing. Polar bears, except for females with young, are solitary most of the year. During the breeding season in late March, April and May, however, males actively seek out females by following their tracks on the sea ice. Males remain with each female a relatively short time and then seek other mates. Delayed implantation is thought to occur, as it does in several other bear species. In October, pregnant females begin to seek out denning areas. Normally, only

pregnant females go into winter dens for extended periods. Known denning concentration areas occur on Russian and Canadian islands and on Spitsbergen. Bears den along sections of the Greenland coast and to a limited extent on the northern Alaska coast. Some denning also occurs in heavy pack ice north of Alaska. Bears most commonly den under banks along the coast or on rivers and on slopes where snow drifts. In most cases, a denning female forms a depression in the snow, enlarging the denning chamber as snow drifts over her.

Young are generally born in December. A litter size of two cubs is the most common, one is fairly common, and three is rare. Cubs weigh about a pound at birth, and the female and cubs remain in the den until late March or early April, when cubs weigh about 15 pounds.

After breaking out of the den, bears remain in the area for several days, making short trips to and from the den as cubs become acclimated to outside temperatures. If the den is on land, the female and cubs then travel to the ocean ice.

Cubs remain with the mother for two more years, or until about 28 months of age, in most sections of the Arctic. In the Spitsbergen area, however, family breakup occurs a year earlier, when the cubs are about 16 months old. Perhaps milder weather and better feeding conditions allow them to develop faster there than in other areas.

Females breed again at the time they separate from their young, so most produce litters every third year.

Map numbers M-154A and M-155A illustrate polar bear distribution off the coast of Alaska. Bears are common throughout much of the drifting ice zone. In winter, this includes the Beaufort Sea beyond the narrow zone of shore fast ice, and the Chukchi Sea from Bering Strait northward, excluding Kotzebue Sound. Bears are more abundant within about 200 miles of the Alaska coast than further north where ice is heavier and less broken and where seals are less abundant or harder to obtain.

Polar bears occasionally visit shorefast ice and beaches in winter, apparently attracted by whale, walrus, and seal carcasses on the beach. The zone of shore ice varies from approximately three to perhaps 30 miles in width. Some bears drift south of Bering Strait in winter, occasionally reaching St. Lawrence Island and even St. Matthew Island. Such movements are associated with winds moving heavy ice south in autumn.

Bears move north prior to ice breakup in the spring. In the Bering Strait area there is a pronounced northward movement in March. North of Alaska, bears move east past Point Barrow and the Colville Delta in late April and May, from an area where ice is breaking up to an area of more solid ice. North of Alaska there is also a general northward movement of bears prior to breakup. It is assumed that bears concentrate in summer along the southern edge of the drifting ice. Depending on winds, this edge varies from the latitude of Point Barrow to about 100 miles north.

Alaskan polar bears den most commonly on offshore islands and associated heavy, stable ice from the mouth of the Colville River east for about 115 miles to Brownlow Point. They do not concentrate to den here as they do in "core" denning areas in Canada and Russia, but a few litters are produced each year. Bears den occasionally on shorefast ice and river bottoms from the Kuparuk River west and south along the Alaska coast for approximately 550 miles to the Point Hope area. Most dens are within 25 miles of the coast. Some denning also occurs on heavy pack ice north of Alaska, but how much is not yet known. Bears concentrate to den on Wrangell Island, which is under Russian jurisdiction, and perhaps many of the bears found west of Alaska are born there.

Alaskan polar bears were harvested until about 1950 largely by Eskimos hunting with dog teams to obtain meat for food and skins for personal use, barter, and sale. Trophy hunting with use of aircraft started in the late 1940's. By the 1960's, 85 to 90 percent of the harvest involved the use of aircraft. The most important hunting areas were the Chukchi Sea (hunted from Teller, Kotzebue, and Point Hope) and the area north of Point Barrow. To upgrade



the quality of hunting, Alaska in 1972 prohibited the use of aircraft for hunting polar bears and lengthened the open season to encourage recreational hunting from the ground. Shortly thereafter the federal Marine Mammals Protection Act of 1972 prohibited all sport hunting of the bears.

Recoveries of tagged bears indicate there are two geographically isolated groups of bears off the coast of Alaska, one to the west and one to the north of the state. Relative abundance and population composition figures are the best available indicators of trends in population. These figures have been collected since 1956, and although they are not precise, they do not indicate a decline in the number of bears. Population composition figures show a high percentage of females with young, indicating good reproduction. Selective hunting for mature males has altered the sex ratio of mature animals, and in the area north of Alaska, depressed the mean age of males harvested in 1970 and 1971. The mean age in 1972, however, was significantly higher. Hunting only from the ground would have caused future harvests to be significantly below reproductive rates.

Additional studies needed relating to polar bear habitat is a more precise delineation of areas used for denning and a determination of productivity of denning areas. Effects of native hunting and development along the Arctic coast on polar bear denning should be considered and necessary protective measures taken. For instance, human activity associated with oil exploration or extraction on islands east of the Colville Delta could keep bears away from areas where they might normally den.

## **WOLF**

Most of the wolves in the United States today are within the State of Alaska. Once distributed throughout North America, wolves have been almost eliminated in the contiguous States; only in northern Minnesota is there a substantial population. This elimination came about through the loss of habitat and, more importantly, as a result of predator control carried out because wolves began killing domestic stock after man severely reduced the populations of their wild ungulate prey.

In Alaska, conflicts between wolves and man over the use of domestic stock have been minimal except where domestic reindeer are raised on the mainland. Temporary suppression of wolves has been imposed in other areas on the premise that in certain situations they have an adverse effect upon stocks of ungulate big game sought by man. The results and merits of such programs have never been adequately evaluated.

In the past, wolves have been subjected to bounties, (and still are in three Southeastern game management units), unrestricted hunting and trapping, and poison. Fortunately, they have somehow survived this treatment and have even become reestablished in some areas. In the past ten years, they have repopulated the Kenai Peninsula, probably because ungulate prey species remained abundant and wolf populations in adjoining areas increased dramatically because of progressive management by the state. The state has not only scorned predator control efforts and eliminated the bounty, but has also instituted regulations classifying wolves as big game and furbearers and providing seasons and bag limits appropriate to existing wolf population levels.

Wolves are sexually mature at 22 months. Females produce their first litter at two years of age, generally in May or early June following a gestation period of about 63 days. Primiparous females produce an average of 5.5 pups per litter, and multiparous females average 6.5 pups. In Alaska a high proportion of all adult (two years and older) females breed every year. Such high productivity is counterbalanced by correspondingly high mortality, and few wolves in the wild live for ten years.

Wolves have a highly-developed social structure, and sometimes travel in extended family groups, or packs. Packs vary in size from two to 30 or more animals, but wolves also often travel singly. Food consumption is rather prodigious, probably averaging 4.0 to 7.7 pounds of meat per wolf per day. All ungulates are prey as are many smaller mammals, birds and fish. In Alaska, depending upon the part of the state under consideration, moose, caribou and deer are the most important food items. Snowshoe hares, beavers, salmon, waterfowl, Dall sheep and mountain goats are important secondary prey species.

Wolves are adaptable, being capable of existing in a wide variety of climates and terrains. In Alaska they inhabit the entire state from the rain forests of the Southeastern panhandle to the Arctic tundra adjoining the Beaufort Sea. They tolerate a variety of plant communities, precipitation levels, temperatures and human uses of the earth's surface. Their success seems related to the complex social structure of individual packs and their interpack relationships. The success of individual packs is dependent upon a degree of cooperation uncommon in all other mammals except man and certain primates.

Although wolves, afforded some protection, tolerate the activities of civilization, there may be an upper limit of disturbances acceptable if wolves are to maintain their wild character and not become nuisances. This undefined level of human activity apparently has not yet been reached in Alaska, for wolves still den in close proximity to the large metropolitan areas.

## **WOLVERINE**

Wolverines have a circumpolar distribution, largely within the Arctic and boreal zones. In North America they occur in Canada, a few of the northwestern United States and Alaska. In Alaska they occur throughout the mainland and on some of the islands in the Southeastern panhandle.

Wolverines are the largest land-based North American weasel, belonging to the same large and successful family that includes mink, land and sea otter, marten, ermine and the smallest carnivore, the least weasel.

Wolverines are relatively long lived animals, with some reaching 13 years of age in the wild. They mature rapidly and all skeletal long bones are fused within nine months. About half of all female wolverines are sexually mature at one year of age. They breed in May, June and July and give birth to an average of 3.5 kits in January, February or March. Natal dens usually are located on the surface of the ground under snow. Hollow stumps, rock cairns, abandoned beaver houses and hollow trees are also used. The kits emerge in early summer and apparently remain with the female until fall when they disperse. Food apparently consists of any animal they can capture plus carrion and fruit.

In Asia and Europe reindeer herders consider wolverines as undesirable predators on their herds. In North America there is no evidence that predation by wolverines adversely affects game populations or causes excessive economic loss. Wolverine fur is prized for parka ruffs and trim and tourists purchase skins mounted as rugs.

Wolverines are found from the sea coast to the tops of mountains. Individuals range over great distances, seemingly always at a lope. Brush, snow, water, glaciers and rain forests are all negotiated with apparent ease. They are often considered a "wilderness" species, unable to adapt to human use of their habitat. Recent studies, however, suggest that wolverines are not adversely affected by moderate use of land by man. Instead, the major threat to continued existence of wolverines stems from man's proclivity for killing carnivores and for severely altering habitats. If protected, even moderately, wolverines will continue to use habitat adjacent to and within metropolitan areas.

The specifics of wolverine habitat requirements are unknown, but ample food sources apparently are the key requirement. Almost any item from fruit to the largest ungulate constitutes food. Wolverines will eat blueberries or moose. Carrion appears very important, and sea mammals that have washed ashore and winter-killed animals are relished. Wolverines repeatedly return to large carcasses, and food caches often are found near den sites.

Some individuals and agencies have considered the wolverine a rare or endangered species. While such a designation may be appropriate in some parts of the world it is not in Alaska. The animal is never truly abundant as compared to some of its prey, such as ground squirrels or snowshoe hares, but this is not unusual for a predator.

The wolverine's well-being in Alaska is assured if man accords protection to the land and maintains stocks of native wildlife at existing levels.

Because wolverines eat carrion, predator control using poison often results in killing many wolverines. The use of poison in animal control activities should be eliminated. Improperly maintained garbage dumps attract wolverines and lead to their destruction by humans. Industries, municipalities and governments are urged to minimize such losses through proper disposal of refuse.

## UNGULATES

### BARREN GROUND CARIBOU

Caribou have been aptly described as the "nomads of the north". They travel incessantly and seemingly without purpose. Such is not really the case, however, for their periodic movements, though unpredictable, are needed to satisfy life requirements which include calving grounds, summer range, breeding/fall range and winter range. Caribou are social creatures and most often occur in groups. The aggregations vary in size from a few animals to tens of thousands, depending upon the season, location and herd size. Although their distribution is circum-polar, primarily within the boreal forest and Arctic tundra zones, they have not fared well in Europe and Asia. A strong emphasis on agriculture led to the domestication of caribou {reindeer} hundreds of years ago and subsequent usurpation of the wild form's range. Today most of the world's wild caribou are in Alaska and Canada.

Caribou in Alaska played a vital role in the settlement of the land by native peoples and provided sustenance for many early fur traders, trappers and miners. Because of their importance, they have received considerable attention from government agencies responsible for wildlife programs.

The caribou is a medium-large member of the deer family, distinguished from all other North American deer by the fact that both males and females grow antlers. Caribou are polygamous. Females are sexually mature at 28 months of age, though a few breed at 18 months and some not until 40 months. Calves are born in late May and early June, with the Arctic herds giving birth a week to ten days later than the more southerly herds. Calves weigh from 8 to 12 pounds and grow rapidly, achieving most of their growth during the first three years. Some growth continues for at least six years. Males are sexually mature at 16 to 28 months and are considerably larger than females, possessing spectacular antlers as adults. They are extremely strong swimmers and excellent climbers, crossing steep-sloped mountains with apparent ease. Their oversize crescent shaped hooves and spindly legs function superbly in combination. Running caribou appear to float across incredibly difficult sedge tussocks.

Mortality is inflicted by large predators, mainly wolves, and some calves and adults are eaten by bears. Wolverines, golden eagles and ravens take a few calves. Caribou calves may also be decimated by severe weather at calving time. Malnutrition or starvation has seldom been documented as a direct mortality factor, perhaps because techniques for evaluating this condition have not been applied. The tendency for caribou to move away from unfavorable feeding areas also obscures range-animal relationships. Disease may be a limiting factor, as brucellosis is present in several herds. Its impact, if any, is unknown.

Although movements of caribou herds appear erratic and are difficult to predict, especially as the herds grow larger, all herds do have a strong tendency to return annually to traditional calving areas. The topography of calving areas used by various herds differs somewhat, but all share common attributes. They are invariably above timberline in gently rolling hills, or foothills. Precipitation is usually low and the frequently windswept areas are snow free by mid-May to early June. Heaths, sedges and forbs are the dominant vegetation, and favored spring foods are abundant. The calving ground is the focal point or "center of distribution" of a caribou herd, with a "herd" being defined as a group of caribou using a common calving ground not shared with adjoining herds.

Following calving, caribou cows and calves clump into ever larger aggregations and are often joined by some bulls and yearlings. These groups, when in mountainous terrain, seek higher elevations, feeding upon the nutritious new growth of vegetation emerging as the snowline recedes. Summer ranges may take caribou high into the mountains where they share sedge meadows with Dall sheep. The higher elevations also afford relief from multitudes of biting insects. Post-calving herds in some coastal areas derive similar benefits from coastal vegetation, ocean winds and cold water.

With the first September snows, caribou begin to seek lower elevations. Bands become sexually integrated and males begin shedding antler velvet, signaling the onset of the breeding cycle. Breeding activity peaks in mid-October as the herd continues to move toward winter range. Usually the herd is established on winter range by January.

Characterization of winter range for all of Alaska's caribou herds is difficult because they use such a variety of range types. Most winter range consists of climax vegetation, but satisfactory range may consist of a windswept, heath-dry sedge slope or a 150 year-old stand of white spruce in a valley. Lichens often are a major component of winter range and a number of investigators have considered lichens a "key" indicator of the quality of caribou winter range. However, sedges predominate on some winter ranges without apparent ill effects on the caribou. Nevertheless, caribou seem to prefer the lichen ranges and may seek them within their orbit of annual movement. Caribou clearly are creatures of the climax vegetation of the boreal forests and Arctic tundra.

In Alaska a considerable portion of these zones is mountainous and underlain entirely or partially with permafrost. The soils often are thin, growing season is short, plant growth is slow and successional changes are slow. Thus, the loss of climax range through natural fire or man-caused disturbance is, for practical purposes, nonreversible and permanent.

Since caribou require relatively undisturbed tundra and boreal forest, habitat loss through natural and man-caused disruptions of land invariably leads to lowered numbers of caribou. Calving range, the focal point of a herd's range, is critical to herds' existence.

Migration routes between seasonal ranges are equally important. Major rivers and mountains seldom are effective barriers and man-made devices such as roads and railroads do not permanently defer migrations. It is possible, however, that even slight alterations of caribou movements can produce long-term decreases in productivity by altering natural range use patterns. Further, such alterations may raise management problems by concentrating hunting and tourist pressures that may temporarily disrupt caribou movements.

The effects of structures of unusual design such as elevated pipelines or hydroelectric impoundments have not been satisfactorily evaluated in Alaska, but they could become limiting factors to caribou populations if design criteria do not provide for unimpeded passage of migrating animals.

## **BISON**

Bison were introduced into Alaska in 1928. No definitive study of this exotic has been completed in Alaska, but most of the available data have come from the Delta bison herd near Delta Junction. Comprehensive studies have been completed on bison in Wood Buffalo National Park in Canada and in various parks and wildlife preserves in the United States. These studies, modified and supplemented by the available information on bison in Alaska, are the basis of the following discussion.

Most bison exhibit periodic movements, and the general timing and destination of each herd's movements are predictable, although there are temporary deviations from the pattern. Apparently, the primary objective of seasonal movements is to seek different pasturages. Superimposed on these movements are seasonal movements

to a traditional calving area, seasonal aggregations during the rut, periodic movements to mineral licks or salt deposits, periodic movements to avoid high winds, and daily movements to water. The influence of insects on bison movements is not clear.

Bison are predominantly grazing animals, although they do eat some shrubs. Summer range is generally at a higher altitude than winter range, with summer pastures usually located on upland dry meadows, in open aspen or balsam poplar forests, around the margins of wet areas within forests, and on well-drained alluvial soils. Upland dry meadows and openings in aspen forests intergrade, and the ground cover of forbs and grasses is similar in both situations. Preferred forage of bison is chiefly grasses and legumes on well-drained alluvium; grasses, forbs, and willow twigs on dry meadows; and primarily sedges in wet areas. Bison avoid extensive areas of boggy ground during the summer. In Alaska bison summer ranges are created by fire, silt deposition and changes of stream channels, and are lost through successional changes of vegetation. Dense forests are used by bison during periods of high wind and blowing dust but are probably not a requirement of summer range. A source of water within several hours walk of summer pastures is probably a habitat requirement. Areas of natural salt deposition or artificial salt blocks are often visited by bison during the summer and fall. It is not known whether mineral licks are a habitat requirement.

Bison winter ranges in northern latitudes are usually poorly drained during the summer, being frequently located on bogs, stream banks, and the margins of sloughs and ponds. These areas are characterized by a lush climax growth of sedges and grasses. Bison generally do not move onto their poorly drained winter ranges until the topsoil is solidly frozen, usually in October. Since succession alters this vegetation only very slowly, and it is protected from overgrazing by its boggy substrate during the summer, the winter pasturages of bison are generally stable under natural conditions. Dry meadows with willow shrubs and dense, tall grasses are also utilized by bison from early fall through the winter.

Bison can apparently tolerate three feet or more of loose snow in areas where forage is abundant and relatively tall; however, several instances of large-scale winter starvation have been recorded. Factors that contributed to these mortalities were snow depths of four feet or more, crusting, exceptional cold, and sparse forage. The severity of a winter's effects on bison may be predictable by the number and magnitude of these factors that are present. The snow depth in subalpine, windswept areas used by bison seldom exceeds two and one-half feet. Snow in these windswept areas drifts and consolidates relatively rapidly, however, and bison stay in timbered areas during very cold and windy days. This may be why windswept, subalpine meadows are not utilized by bison in the Delta herd until late winter when the coldest days have passed.

Some bison females are sexually mature at 18 months, but most cows give birth to their first calf when three or four years of age. Incidence of pregnancy in adult cows varies between 57 and 86 percent. Maximum reproductive vigor occurs in 3 to 12 year old cows, and incidence of pregnancy gradually declines in 13 to 24 year old cows and markedly declines in 25 to 35 year old cows.

The peak of bison calving occurs during May and June, although there are reports of calves born throughout the year. Twin births are rare. Calves have a light reddish-brown pelage until the latter part of July when the coat starts to darken. The moult to a dark brown coat is largely complete by the first of September in calves born in May and June. Calves are weaned when seven to eight months of age. Calf proportion in the herds increases through June, when calving is still occurring, and reaches a maximum of 20 to 30 percent in July, declining in subsequent months. This decline is due both to calf mortality and to bulls joining the herd during the rut. At other times of the year, the bulls are segregated into bull groups and mixed groups. Mortality of yearlings and older sub adults is low during years with mild winters, so most calves surviving their first winter live to enter the breeding population. During its first ten years in Alaska, the Delta herd had an annual recruitment rate of nearly 20 percent. The herd was then young, and the range was lush. Since that time, recruitment has dropped to about ten percent with a natural mortality of seven percent annually.

Breeding occurs from mid-June through September with the peak of breeding in August. Most breeding is done by 6 to 14 year old bulls. Bulls are sexually mature at two to three years of age, but young bulls are prevented from breeding by older bulls. Cows are apparently bred by only one bull, although one bull may breed many cows. The gestation period is 9 to 9-1/2 months.

### **SITKA BLACK-TAILED DEER**

The Sitka black-tailed deer is a subspecies of the group which includes the Columbian blacktail and mule deer of western North America. The Sitka black-tail was once confined to the heavily forested regions of north coastal British Columbia and Southeast Alaska, but its range has been expanded in Alaska by successful transplants to Kodiak and Afognak Islands, Prince William Sound and the Yakutat area. This deer is a relatively recent species in geologic time, and was not present in Southeast Alaska until after the Pleistocene ice receded. Although smaller and stockier, it is similar to the Columbian blacktail. The slight differences between the two races have probably resulted from isolation and the more rigorous climate occupied by the Sitka subspecies.

Transplants in Alaska have shown that the Sitka black-tail can survive in a variety of habitats. As with most ungulate species at the northern extremities of their range, winter weather conditions are the major factors limiting abundance and range expansion.

The Sitka deer is the most abundant big game species throughout its range in Alaska. In the past it provided the majority of meat for settlers of Southeast Alaska, and even today deer meat is a staple item for many residents. During the early 1900's, market hunting for meat and hides was a common practice. This is no longer legal and hunting is now controlled by seasons and bag limits. Seasons and limits are generally liberal, designed to meet the requirements of both the sport hunter and the subsistence hunter on a sustained yield basis. Hunting pressure is relatively light in most areas. Only about 6,000 individuals usually hunt in about 25,000 square miles of deer range in Southeast Alaska, and many areas receive little or no hunting pressure.

Deer populations fluctuate greatly in Alaska depending upon the severity of winters. Weather patterns are often cyclic with several mild or severe winters occurring in a series. A series of mild winters results in high deer populations and severe winters in declining populations.

The wolf is the only serious predator on deer although black and brown bears also kill some deer. Deer populations recover more slowly after lows in areas which have wolves; however, most areas produce sufficient deer to provide for the needs of both human hunters and wild predators.

Alaskan deer have a low incidence of parasites and disease. External parasites are extremely rare and there is no known instance where parasites or disease has influenced populations. None of the known internal parasites of deer are transmittable to humans.

Deer range in Alaska is characterized by steep, mountainous terrain. Mountains usually rise directly from sea level to about 3,500 ft. on islands and to over 7,000 ft. on the mainland. The mainland is flanked by many island groups ranging from a few acres to over 2,000 square miles in size. Shorelines throughout Southeast Alaska are irregular, with many bays, fiords and coastal glaciers.

The climate is maritime: moderate, cool and wet. Temperatures rarely drop below -10° F in winter or exceed 70° F in summer. Most areas average from 80 to 120 inches of rain per year. Dense forests of Sitka spruce and western hemlock are present from sea level to about 2,500 ft. Forests are interspersed with muskegs on poorly drained sites, providing "edge effects". These edge areas produce the best winter food source for deer. Because of the heavy winter snowfall, cover is extremely important to deer survival. Even though open areas normally

produce more and higher quality food, it often is not available because of snow, and deer must depend on what is present under the closed timber canopy.

Deer feed upon different plant species during the various seasons of the year. Vertical migrations are stimulated by new vegetation in the spring and by snow cover in the fall. A few plant species are common to fall, winter and spring ranges under forest cover. Summer range is unique in that it is above timberline and plant species are different from those found under timber cover.

In spring, most deer concentrate at low elevations immediately adjacent to tidewater, because snow still covers the higher ranges. The tidewater zone includes the beach and the fringe timber which is usually a mixture of spruce and scrub hemlock. New vegetative growth generally begins in May. The first species available to deer are beach rye, goose tongue, sedges and skunk cabbage. As spring progresses, deer also use the new growth of blueberry and salmonberry. During June and July most deer move up the mountains, utilizing new growth which becomes available as the snow melts. They enter a densely forested area interspersed with muskeg openings. The predominant timber type remains spruce hemlock with transitions to hemlock-yellow cedar adjacent to muskegs. Food is most abundant along muskeg fringes where additional light stimulates plant growth. Skunk cabbage and marsh marigold are the most important food items; however, ground dogwood, trailing bramble, goldthread and new growth of blueberry are also used.

The alpine terrain, usually between 2,000 and 3,500 ft. elevation, is the most important deer summer range in Alaska. Deer usually reach this area sometime in July although a few, primarily yearlings and does with fawns, remain at lower levels throughout the summer. High quality food species are abundant in the alpine areas and deer gain weight rapidly. Above timberline, mountain hemlock is the most prevalent tree species. Slide areas are common and are usually covered with dense growths of salmonberry, dwarf alder and black currant. Deer remain along the forest edge during the day, and move into the open alpine during the evening and night, returning to cover in morning.

Alpine range is spectacular. On the mainland, mountain goats and deer share the same habitat. During this season, bucks form social groups and it is not uncommon to see ten or more feeding together in the evening or early morning. The most important food species on summer range is deer cabbage, a succulent forb of high quality that contains between 15 and 25 percent protein. It covers the ground almost completely in the lower alpine zone.

The first fall frosts come in September and the high country changes from green to a wide range of yellows and reds. The succulent forbs, which have been so abundant, are gone almost overnight, forecasting the beginning of the lean season for deer. Deer remain at timberline for a few weeks, and their diet changes to salmonberry and black currant, and marsh marigold which have escaped the frost under timber cover. Other plants such as deerberry, ground dogwood and ferns augment their diet.

The first snows usually blanket the high country in October. This is also the beginning of the rut and deer become restless, moving over wide areas between sea level and the snow line. During late fall and early winter deer feed primarily on ground forbs. Ground dogwood, trailing bramble and goldthread are used extensively, along with many minor species including ferns. The first three species are perennials of high quality and, because they remain green, are used to some extent throughout the year. When these plants are available, deer remain in good condition.

December is the beginning of real winter in Southeast Alaska. During mild winters little or no snow is present under timber cover below 500 ft. and deer have no difficulty obtaining food. Colder winters bring tough times to deer. High quality foods are covered by snow and deer must rely on low quality browse species, of which blueberry is the most important. Not only is food difficult to obtain, but more energy is required to move in deep

snow and to maintain body temperature. During very severe winters, snow depths at sea level may exceed three feet. Deer movements are restricted and almost any available plant is used, regardless of quality. Hemlock and spruce twigs, rusty menziesia, salmonberry, yellow cedar and other foods are used in addition to blueberry. Deer lose weight and starvation ensues unless the snow melts and higher quality plants become available.

During extreme conditions snow covers almost all plants on the forest floor. Deer move out to open beaches and utilize dead beach grass, sedges and kelp. The kelp has almost no food value. Conditions are compounded when temperatures drop below zero, for ice forms on the beaches making movement difficult and covering what little food is still present. Deer begin to die; first the fawns, then the older bucks and then the older does until finally only the fittest survive. Surprisingly, even after a series of hard winters, enough deer always survive to become the nucleus of a new population.

Sitka black-tail fawns are usually born in June. They weigh five to eight pounds at birth and gain weight rapidly during their first few weeks of life. They are reddish-brown with a line of white spots along each side of the back and scattered white spots on both sides which begin to disappear in late August or September. The forehead is dark and the inner ears white. They use some vegetation almost immediately after birth and can survive without milk by September.

Adult does weigh about 100 pounds and bucks 150 to 175 pounds, with the largest bucks reaching about 250 pounds. Summer pelage of both does and bucks is reddish-brown, replaced by grayish-brown in all. The tail is jet black on top with contrasting pure white beneath. Both sexes have dark foreheads which shade to light gray around the noses of older animals. Antlers are reddish-brown with typical black-tail branching, but are usually small. The average life span is relatively short, with only about 10 percent of the population living longer than five years. Some, however, do live to be ten years old. The breeding season begins about mid-October and peaks in mid-November, and bucks lose most of their excess body fat during the rut. Does, however, remain in good condition. The Sitka deer spends most of its life in a single drainage. It does move up and down the mountains with changing seasons, but rarely travels far from the locality where it was born.

## **DALL SHEEP**

The Dall sheep is the northernmost species of wild sheep in North America and the only white wild sheep in the world. It occurs only in North America although a similar but brown-colored species, the snow sheep, is found in Siberia.

Dall sheep inhabit parts of all major mountain ranges in Alaska, including the Kenai, Chugach, Wrangell, Talk-eetna, Alaska and Brooks Ranges as well as the White Mountains and Tanana Hills. Their range in Alaska extends from about 60 degrees north latitude in the southern Kenai Mountains to almost 70 degrees in the Sadlerochit Mountains north of the Brooks Range, and from the DeLong Mountains in the western Brooks Range to the Canadian border. They are also found in the Yukon and Northwest Territories of Canada.

Mature rams weigh 150 to 160 pounds, with some individuals exceeding 200 pounds. Ewes average about 110 pounds and occasionally reach 130 pounds. Rams are about 35 inches tall at the shoulder and ewes about 30 inches.

Both sexes have horns. Those of the male are heavy and curled, occasionally exceeding 40 inches in contour length. Ewe horns are thinner and straighter, averaging 10-11 inches long. Until they are about three years old, young rams are difficult to distinguish from mature ewes because of similarities in horn and body size.

The most striking physical characteristic of the Dall sheep is its white coat. In Alaska, a few sheep have dark tails or a sprinkling of dark hairs on other parts of their bodies, but most are entirely white. The white coat may vary



in appearance from snow-white through yellowish to brown, depending upon dirt and staining. The hairs are brittle and hollow and the coat may be thicker than three inches during winter, forming an excellent insulating barrier against the cold.

Dall sheep breed from late November through mid-December. Rams do not gather harems but circulate freely between groups of females, seeking ewes in estrus. Most fighting between rams takes place prior to the rut and appears to help equal-sized rams determine social dominance. Dominance between unequal rams is generally established by horn display rather than by fighting. Ritualized horn clashing is not, as many believe, over the possession of ewes during the breeding season, although some clashing and shoving does occur during chases of estrus females.

Lambing occurs from mid-May through mid-June, after a gestation period of about 175-180 days. Lambs weigh five to six pounds at birth and reach 60 to 70 pounds by their first winter.

Some females are sexually mature at 18 months but most mature at 30 months and breed annually thereafter. Even very old ewes, 13 to 15 years old, continue to breed.

The survival of lambs is variable but generally low. Between 29 and 45 lambs per 100 ewes survived to yearlings in herds studied in the Kenai Mountains. Although twins have been reported, single births are the rule.

Bunchgrass is the most important plant food in some areas, but other grasses as well as sedges are also important. Numerous species of forbs, browse (including willow) and dryas are eaten in small amounts when available, as are lichens. The specific food habits of Dall sheep in most of Alaska are little known.

Dall sheep are not migratory although some fairly extensive movements do occur between winter and summer ranges. Throughout much of their range, sheep merely expand their movements to include suitable habitat during the summer months, and become restricted in late winter to snow-free parts of their range.

Rams segregate themselves from the ewes and lambs during late spring and summer, although both sexes may be using the same slopes. Ram groups often seek higher and more rugged terrain as the summer progresses-possibly to escape insects or to seek newly emergent vegetation-and so may be found several miles from ewe-lamb groups.

By October, both sexes begin to congregate on winter range. This may be a rugged slope where a particularly good southern exposure assures snow-free conditions, or a series of high, exposed ridges where winter winds remove snow.

As winter progresses, deep or wind-crusting snow restricts movements and feeding to small portions of the normal range. Thus, winter range may be merely a series of high ridge tops only a few yards in width by a few hundred yards in length, with the remaining forage covered by concrete-hard, wind-packed snow and ice. In extreme winters it may consist of perhaps only the one slope in the herd's entire range which receives adequate winter sun and wind to keep forage exposed.

As spring arrives and the snow begins to melt at lower elevations, the sheep move down-slope to make use of the earliest growing vegetation. With retreating snow, sheep feed back up the slopes, following the emergent vegetation. At this time, rams begin to leave winter and spring ranges and move away from the ewe herds toward their summering grounds. After lambing the ewe-lamb herds also move out, to the same or different summer ranges. It is at this season that use of natural mineral licks seems most important to the sheep, although it is not yet understood exactly what part they play or how important they are to the animals' welfare.

Dall sheep are subject to predation by wolves, coyotes, wolverines, black and brown bears, golden eagles and lynx. However, wolves are the only predators that may have a significant effect on adult sheep. Accidents from falls and avalanches take their toll of sheep. Diseases and parasites, such as lump-jaw and lung worm, occur in Dall sheep in Alaska, but their effects on herd dynamics are not yet understood.

The primary mortality factor affecting sheep in Alaska is winter climate. In fact, the only documented large-scale reductions in sheep numbers appear to have been caused directly by severe winter weather. Bad winters may also cause severe debilitation of pregnant ewes and greatly reduce lambing success. Dall sheep are almost exclusively limited to the alpine zone, although they may range into the lower brush and timber zones locally or seasonally. Since the alpine is a relatively stable climax vegetational zone, sheep distribution is also relatively stable.

Within the general alpine zone, sheep have specific requirements for suitable escape terrain adequately dispersed throughout feeding areas. Cliffs and rugged rock outcrops are necessary sanctuaries from predators, and sheep are rarely found in otherwise suitable habitat where such terrain cannot be easily reached.

The most important habitat requirement seems to be acceptable winter climate. Sheep depend upon cold temperatures, wind and moderate snowfall in order to survive the winter. Continued cold keeps the snow light and powdery, while high winds remove it from alpine ridges, exposing the low winter forage. Warm, wet snows do not blow away, and so prevent sheep from reaching winter feed. Winter climate must also be consistent within tolerable bounds. If only one winter out of ten, for example, produces sufficiently heavy, wet snow to cover all forage for more than a short time, this could prevent the establishment and survival of a sheep herd in an otherwise suitable area. Thus, Dall sheep may occur on one alpine range while not occupying an adjacent and apparently similar range with subtle differences in winter climate, terrain, or forage composition.

Natural mineral licks are present on many Dall sheep ranges. Use of licks is presently under study but not well enough understood to determine if they are essential. Large licks are obvious and well used for long periods by sheep in some areas, but in other areas are absent or small and used only periodically.

Because sheep habitat is rugged and inhospitable, there has been little conflict with man in Alaska to date. Sheep have tolerated man's activities in close proximity to their ranges in some parts of Alaska, but intensive use of actual sheep habitat could prove extremely detrimental to sheep populations. Because sheep are relatively inflexible in their habitat requirements, any use interfering with or preventing their use of specific areas at critical times could result in the elimination of resident herds.

Because of the spectacular horns carried by rams, their snow-white color and the fact that they inhabit only the remote mountain ranges of the far north, Dall sheep are one of the most desired sport hunting trophies in North America. The recreational value of hunting and photographing sheep is beyond measure, and commercial values are also high. At least one community in Alaska derives a good part of its income from tourists attracted by an adjacent and easily viewed herd.

## **ROOSEVELT ELK**

In 1928 the Alaska Territorial Game Commission transplanted eight Roosevelt elk calves from Washington State to Kodiak Island. The calves, three males and five females, were held at Kalsin Bay in a semi-domestic state throughout their first winter before being released the following spring on Afognak Island. By the early 1940's a population of more than 140 animals made it evident that the elk were well established on Afognak Island and that the introduction was successful. The population peaked at an estimated 1,500 elk in 1965, and probably does not exceed 500 in 1972.

The biology of introduced Alaskan elk is essentially the same as that of naturally-occurring populations. The

polishing of antlers by the bulls signals the start of the annual breeding cycle. During the fall, elk of both sexes band together into large rutting herds. At the peak of the rut, which usually occurs between September 25 and October 1 on Afognak, bulls are scattered throughout the herds. Yearling bulls, physically capable of breeding, frequently take an active part in the rut. This has been especially true of the Malina herd on Afognak where yearling bulls breed a significant proportion of cows each year. Cows usually do not breed until 28 months of age.

Most calves are born in the last week of May, after a gestation period of approximately 244 days. Calving occurs from approximately May 20 to June 12. Elk calves weigh 30-40 pounds at birth and by mid-June reach 80-90 pounds. By this time, calves are still nursing, but are also feeding on succulent vegetation.

In other areas Roosevelt elk are considered browsers, but on Afognak they use a broad variety of grasses, sedges, forbs and shrubs. Fireweed, lupine, burnet, cow parsnip, sea lovage, false hellebore and water chickweed are favored foods in summer. In fall, consumption of grasses and forbs decreases as the use of browse, notably elderberry and highbush cranberry, increases.

During the winter months Afognak elk feed almost exclusively on browse, with elderberry and willow the most important species. By late winter they graze heavily on the cured tops of hairgrass, which occurs in scattered stands in a few of the lowland valleys. During snow-free winters elk often feed on trailing bramble, which is found under the forest canopy. Blueberry and salmonberry, important to Washington elk are seldom used on Afognak ranges.

In spring, as new growth becomes available, elk consume chiefly grasses, sedges and perennial forbs. Sedges, horsetail, angelica, bluejoint and cow parsnip are heavily utilized as are the buds and roots of ferns and the terminal buds of devil's club.

The spruce climax community is also important to Afognak elk. All major winter ranges on Afognak are characterized by dense stands of Sitka spruce interspersed with extensive shrublands of alder, elderberry and willow. These shrublands produce the bulk of winter forage, and the spruce forest provides protection from severe winter weather. Throughout periods of inclement weather elk stay within the forest canopy, venturing into the shrubland to feed for short periods only.

The willow and alder/elderberry associations on Afognak are successional and relatively short lived. Plant succession and excessive use of several key elderberry stands in the Litnik Lake watershed have nearly eliminated this species. Interspecific relationships between plants of the alder/elderberry association are not fully understood, although it appears that alder is asserting dominance as the overstory species by forming a closed canopy, while elderberry, a shade intolerant species, suffers from poor vigor and may eventually be eliminated.

## MOOSE

The moose is the largest living deer, and the Alaskan subspecies is the largest of the genus. It is a particularly successful species, with circumpolar distribution concentrated in the boreal forest zone. In North America, moose range from the Arctic Ocean to the Rocky Mountains of Colorado and Wyoming and across the northern tier of the conterminous states. Moose have adapted well to man's incursions upon their original habitat, and given protection from excessive exploitation, moose and man have coexisted in close, though not always harmonious, association.

Adult female moose are somewhat smaller than males, weighing 800-1,200 pounds. Mature males weigh 1,000-1,600 pounds, although larger animals are occasionally taken. Males are in their prime and grow the largest antlers from 6 to 12 years of age. For such a large and long-lived animal (moose may live to be more than 20 years old), the moose has a high potential rate of productivity. On the best ranges, both sexes are sexually mature

at 16 months. Breeding activities begin in late August when the larger bulls shed the velvet from their antlers and begin pre-rut behavior, including antler polishing, a cessation of feeding activities, jousting with similar sized males, calling and seeking receptive females. During the rut, males exhaust the entire reserve of fat accumulated during the summer months. This may include 20 to 25 percent of their total weight, and they enter the winter season exhausted. Cows vocalize as estrus approaches and search for bulls. Most breeding takes place from September 15 to October 10, with most females conceiving during the first estrus cycle. Calves are born in late May and early June (most are born from May 24 to June 6) following a gestation period of approximately 240 days.

About 90 percent of all females over two years old breed every year. Yearlings, 13 - 24 months old, are sexually mature at 16 to 18 months on the best ranges but only about 15-25 percent breed in most of Alaska. Cows generally produce a single calf the first time they breed, but thereafter up to 60 percent produce twins, depending upon the quality and quantity of available food. On some ranges in Sweden where moose are intensely managed, reportedly all females produce twins. Triplets occur rarely, perhaps once every 1,000-2,000 births.

At birth, the reddish-brown calves weigh 25-35 pounds. Thereafter they grow at a fantastic rate, reaching 300-400 pounds four months later. A little milk plus vast quantities of willow leaves, sedges, pond weeds and a sampling of most everything green except spruce trees produces animal tissue at a prodigious rate.

In the spring, newborn calves may represent 40 to 50 percent of a moose population, but mortality is great and by November their number often has been reduced by half. Many calves die during the six weeks following birth. Mortality factors include predators, malnutrition, accidental drowning, falls, entanglement in underbrush and abandonment. Perhaps malnutrition and predators account for most calf deaths.

Females on poor range often barely survive the severe Alaskan winters, and are at a physical low when they give birth. Such individuals may have stillborn, weak or undersized calves. Some females suffering from extreme malnutrition fail to produce milk, with fatal consequences to their offspring.

The role of predation in the survival of moose calves is difficult to assess because dead or dying calves scavenged by bears or wolves cannot be distinguished from healthy calves actually killed. Denning wolves do use a considerable number of calf moose in late May and June, however, and locally they may be important depressants on moose populations. Since there is total overlap between the distribution of wolves and moose, wolves must be considered major users of the moose resource.

Black bears and brown bears both eat moose calves but their impact upon populations has never been satisfactorily evaluated. Cow moose often defend their young when attacked by black bears or wolves. Sometimes they are successful. In contrast, a rapid retreat is their best defense against brown bears. Unusual climatic conditions, especially prolonged periods of deep snow, may eliminate a large proportion of calves-of-the-year. Even mild winters cause some mortality to this age class.

Since so many calves are produced, net productivity, measured when calves have survived for one year, often equals 15 to 25 percent of the herd despite high calf mortality. Under ideal conditions of low calf mortality, net productivity may approach 33 percent. Moose populations can, therefore, withstand rather intense hunting. Unlike species dependent upon pristine wilderness or climax vegetation, moose are adaptable to many situations. They thrive on transitional vegetation, such as that which follows forest fires, clear-cut logging operations, land clearing for agricultural purposes, highway right-of-way clearing, receding glaciers, braided river beds and man-disturbed areas. Their annual habitat requirements are extremely broad but include the following: breeding grounds, winter feeding areas, calving grounds and summer feeding areas. Specific characterization of each habitat type is impossible because moose have such a wide tolerance to weather, food and terrain. Nevertheless, some generalizations can be made.

In much of Alaska, large groups of moose concentrate at timberline from late August through November. During the rut, groups of 10 to 60 moose are not uncommon and several hundred moose may concentrate in a few square miles. Rutting concentrations also occur in nonalpine areas, river bottoms, flat lands, and swamps, and apparently the same locations are used every year. Even where moose populations are spread thinly the sexes manage to get together through vocalization and scent.

The winter period is crucial not only to the survival of adults and young-of-the-year but also to the survival of the succeeding year's calves; cows in a weakened condition produce inferior offspring. Winter ranges consist of two basic types: seral (successional) and climax. In Alaska, fire—both natural and man-caused—has created a large portion of the available moose winter range. The “life” of a seral winter range is highly variable, and depends upon intensity of the fires, soil type, aspect, moisture, burn size, seed source and the number of moose using the range. Some fire-created ranges produce browse for more than 30 years, while others pass out of production in 15-20 years. Man-made clearings are somewhat more predictable and generally persist for longer periods of time, perhaps because they are often small areas, intensively used by moose each year.

The streambeds of Alaska's great glacial rivers are constantly building and changing and periodic scouring during annual “break-up” of the winter accumulation of ice aids in reformation and relocation of alluvium. Ice jams and subsequent flooding, often followed by violent release of water and ice may denude islands and river banks of accumulated vegetation, thereby renewing the successional process. Since the river bars are built of organically rich material, plant growth is rapid and its nutrient quality is high. The stands of willow on alluvial bars of major rivers support thousands of wintering moose. Similar deposits in the Arctic have enabled moose to expand to the Arctic coast along the Colville, Sagavanirktok and other rivers.

Glacial recessions during the recent past have provided additional important winter feed areas. Vegetation establishing on the newly exposed areas frequently includes aspen, willow and birch. Strong winds associated with glaciers also influence vegetation growth form and species composition.

Climax willow stands occurring at 2,500-4,000 ft. elevations are also very important components of moose winter range—especially during early winter and in areas with high winds or low snowfall. Willow is often quite abundant in thin stands of white spruce occurring at higher elevations.

Willow and dwarf birch occur together in other alpine situations. Naturally occurring ecotones or edges are the lifeblood of moose populations in these stable or slowly changing vegetation complexes.

Moose are adapted to cold climates characterized by a prolonged ground cover of snow of moderate to extreme depth. They successfully inhabit areas subjected to extremely deep wet accumulations of snow (Cordova and Yakutat, for example). Snow quality is important to the welfare of moose. In areas with dense high quality browse, soft snow up to 36 inches may not cause great hardship, but a wet, crusted snow of the same depth might lead to severe problems. In other areas, moderately soft snow in excess of 24 inches may lead to major losses of calves and yearlings from dense populations dependent upon ground cover for a part of their sustenance.

Spring-summer concentration areas often coincide with calving areas, although both sexes and all age cohorts use these favored feeding areas. These concentrations may be very spectacular but few people see them because most are located in remote and extremely wet muskeg areas.

Diversity of early emergent vegetation is most important to calving, spring and summer habitat. Parturient females seek meadows interspersed with islands of black spruce, alder, willow, sedges, and shallow lakes and ponds with associated emergent and aquatic vegetation. These areas combine a high quality diet with suitable escape cover. Even so, some scattered calving activity does take place from timberline to the edge of salt water. Moose do not migrate in the classic sense but periodic movements of considerable distance are associated with sea-

sonal activities and climatic phenomena. These movements are traditional and plans for construction of roads, pipelines, canals, impoundments and other structures must evaluate the impact that disruption will have upon moose populations. The most obvious migrations take place between mountains and adjoining lowlands. Moose movements from highlands to lower wintering areas normally commence in about November, but early snowfall may accelerate movements.

Because moose are widely distributed within the state and are also a highly visible species, they have become a symbol of populated Alaska. They contribute to our economy and culture in many ways. Guiding and hunting for moose is a multimillion dollar business, outlying peoples depend upon them for meat, tourists and residents derive pleasure from observing and photographing them, and they are an integral part of the resident fauna that should be protected for future generations.

## **MOUNTAIN GOAT**

The range of the mountain goat in North America extends from Idaho and Oregon northward through the Rocky and coastal mountains of Alberta and British Columbia to Southcentral Alaska. In Alaska, goats occur from the southernmost tip of Southeast Alaska, north along the entire coast to Cook Inlet. With the exceptions of Bainbridge Island and possibly Culross Island in Prince William Sound, goats do not occur naturally on any of the coastal islands. The northern limit of their range extends into the Talkeetna Mountains nearly to McKinley Park and into the southern drainages of the Wrangell Mountains. Goats have been transplanted to Kodiak, Chichagof, and Baranof Islands where they have established breeding populations. The breeding season of the mountain goat in Alaska extends from late November through December. Mountain goats are polygamous and males frequently travel considerable distances between receptive females. Yearling females breed, but it is doubtful that yearling males do. The one or two kids are born in late May and early June after a gestation period of approximately 180 days. Nannies seek isolation just prior to giving birth, but shortly thereafter join other nannies with kids. Kids usually remain with their mothers until the following spring when the nanny again seeks seclusion.

Mountain goats occur in small groups during most of the year. Males are usually seen singly or in groups of two or three during the spring and summer. During the rut, they join females with yearlings and kids and it is during this period and the following winter that groups reach their largest size. Yearlings are rarely seen alone.

Mountain goats have long, dense hair, particularly in winter, which makes the animals appear more massive than they actually are. The average weights of adult Alaskan goats are about 135 pounds for nannies and 175 pounds for billies, but occasionally a billy reaches 250 to 300 pounds at maturity.

Both sexes have horns; however, they differ somewhat in appearance. The horns of females are slender with a gradual taper and curve while those of males have a larger base, more rapid taper and a more abrupt curve in the central portion.

Accidents, especially snowslides and falls, are probably the greatest cause of natural mortality in mountain goats. Predation by wolves and eagles occurs but is not considered a serious mortality factor.

Mountain goat habitat is generally restricted to the alpine zone of mountain ranges. Goats are often found in very rugged and broken terrain containing cliffs, ledges, projecting pinnacles and talus slopes. In the summer months, goats frequent high alpine meadows where they graze on grasses, sedges and low shrubs. In winter they migrate to lower elevations and spend a considerable amount of time at or below timberline. On clear, mild days goats move up to snow-free slopes to feed, returning again to timberline late in the day. Goat and sheep ranges overlap in a number of areas, and on occasion both species can be observed feeding in the same alpine meadow.

Because goats inhabit the more inaccessible mountain areas, man's exploitation of the land through mining and timber harvest has had insignificant effect on goat populations to date.

## MUSKOX

Muskoxen are short, stocky ungulates whose bulky appearance is exaggerated by a heavy coat of extremely long, coarse outer hair. Except for the head and lower legs, the muskox's shape is hidden by its skirt-length coat. During spring and summer the muskox sheds its fine underhair in great trailing strands and sheets which produces an even shaggier appearance. The outer pelage is dark brown, except for a light tan "saddle" and legs. The underfur is light brown.

The amber colored horns descend and rise to the sides in a graceful sweep. Males have longer, heavier horns than females. Adult bulls may weigh 500 to 900 pounds, and cows weigh 250 to 500 pounds. Calves weigh 25 to 35 pounds at birth and reach 100 to 170 pounds by one year of age.

Muskoxen were once distributed from Greenland west throughout the Canadian Arctic Archipelago and along the Arctic Slope of Alaska. They became extinct in Alaska between 1850 and 1860. Their demise is generally blamed on increased hunting by natives and introduction of firearms associated with the advent of Arctic whaling.

At the request of Alaska's Territorial Legislature, Congress (1930) appropriated \$40,000 to obtain muskoxen from Greenland to restock Alaskan muskox range. Nunivak Island was designated a National Wildlife Refuge, and the interim home of Alaska's new herd. Thirty-four animals were captured and moved to the University of Alaska in 1930, where they were held until released on Nunivak in 1935 and 1936. Eighteen males and 13 females comprised the original Nunivak herd.

The Nunivak population numbered between 50 and 60 animals by 1947, but after that date grew at a regular and substantial rate. In 1968 the population estimate was 750, based on 714 animals seen and other information. Because winter range is limited to about 0.6 percent of the island (6,500 of 1.1 million acres) in normal winters, and because optimum population size is considered to be no more than 500 animals, there was much concern for the Nunivak herd's welfare, and more concern for effects of such a large herd on the limited winter range. Because of an unusually large proportion of males born a few years earlier and because mostly females were removed for transplants, about 200 bulls in excess of breeding needs were present. A plan to remove many of these bulls by carefully regulated sport hunting was approved by the Alaska Board of Fish and Game, but cancelled by the Governor for political reasons. Later, as Secretary of Interior, he continued to block reduction of the herd by hunting. The herd has since declined to about 500 animals, largely due to winter losses. Effects of the high population on winter range have not been determined.

Muskoxen on Nunivak Island breed during late July and August. Cows may mature when two years old and bear a calf at three, provided good nutrition, but during the high population levels on Nunivak apparently few cows younger than four years old bred. Occasionally cows are sexually mature as yearlings, and bear a calf at two years of age. Bulls probably are reproductively mature at four to six years old. Younger bulls may be physiologically capable of breeding but socially incapable of competing for cows. When well fed, cows can produce a calf each year, but on poor range a calf every other year may be maximum. Calves are born in late April and early May on Nunivak.

Muskoxen are polygamous. One bull may control two to four cows during the breeding season. Bulls unable to compete socially do not breed. Nonbreeding bulls on Nunivak probably numbered about 200 in 1968 as a result of a very high proportion of bulls to cows.

The chief mortality factors on Nunivak Island seem to be insufficient food, old age, and wandering off the island in winter and being unable to return due to shifting or melting ice, or a combination of the three. No large predators exist on Nunivak. One ear-tagged cow found after it died in 1953 was 23 years old, but average life expectancy is unknown.

Transplants from Nunivak Island to the mainland began in 1967 when the Alaska Department of Fish and Game moved eight short yearlings (11 months old) to nearby Nelson Island. In 1968, sixteen additional animals were moved to Nelson Island. Both operations were experiments in capturing and handling muskoxen. Muskoxen were reintroduced on the Arctic Slope in 1969, when 52 were released at Barter Island. In 1970, 36 muskoxen were released near Nome, 36 at Cape Thompson, and 13 on the Arctic Slope at Kavik River. All transplants were made with the cooperation and assistance of the Bureau of Sport Fisheries and Wildlife. No transplants were made in 1971 or 1972. Sightings of various segments of the transplanted groups have since occurred in all areas.

The Nelson Island herd has grown to about 33 animals and appears well established. Those released on the Arctic Slope have formed several small groups, and are reproducing. How well they survive remains to be seen. Both the Nome and Cape Thompson groups have dispersed widely, but have reproduced. Again, sometime must pass before their success can be determined.

## **MARINE MAMMALS**

### **BEARDED SEAL**

The bearded seal is the most widely distributed pinniped throughout most of the Bering and Chukchi Seas. These seals show little tendency to form herds, although sometimes they do congregate in favorable areas. In late winter and early spring, they are most abundant north of the ice edge and south of Bering Strait. They are common in areas where walruses are found, although not usually in the immediate vicinity of large concentrations of walruses.

The time of birth and the development of bearded seal pups are intermediate between that of walruses and the other northern phocids. Most bearded seal pups are born between April 15 and April 25, a few as early as April 5, and some as late as May 3.

At birth pups have a coat of soft, gray (silver-bluish to brownish) hair, the white lanugo having been shed before birth. Pups born during the normal season begin to shed the gray hair soon after birth. In pups born as late as May, molt is nearly complete at birth. Pups enter the water within a few days after birth, still closely attended by their mothers.

Pups are extremely thin at birth, when they are about 52 inches long and weigh only about 70-80 pounds, or approximately 14 percent of their mother's weight. They gain weight rapidly, mostly from an increase in blubber. Within a few days they weigh about 100 pounds and increase to about 190 pounds by the time they are weaned. Their dense hair is important for thermo-regulation during the first few days of life, until the rapidly increasing blubber layer provides sufficient insulation. Nursing ceases after only 12 - 18 days.

Bearded seals may live as long as 20 to 23 years. Females achieve sexual maturity at age five or six and bear one pup at a time, about 85 percent of adult females being pregnant each year. Males achieve sexual maturity at age six or seven.

Bearded seals eat a wide variety of invertebrate epibenthos (animals living on rather than in the sea floor) including shrimps, crabs, hermit crabs, bottom fishes, cephalopods, annelids, mollusks, and tunicates. These and other foods occur over a very wide area, and bearded seals are found anywhere sea ice conditions are favorable and the



water is shallow enough for them to feed on the bottom. The very extensive and shallow Bering-Chukchi platform and good ice conditions thus combine to support large numbers of bearded seals.

## **HARBOR OR SPOTTED SEAL**

The harbor or spotted seal ranges in the Pacific Ocean from southern California and China northward to the Chukchi Sea. In Alaska, it is a very common resident in virtually all coastal waters south of the Arctic ice field, and is frequently seen in rivers and lakes far from sea. A great deal of confusion has surrounded the natural history of this seal because of its wide distribution and great variations in birth and mating periods and condition of the pups at birth. It is clear today that both ice-breeding and land-breeding populations of spotted seals occur in the Bering Sea. Land-breeding seals occur primarily along the north coast of the Alaska Peninsula and the Aleutian Islands, and enter sea ice only when extreme conditions cause the ice to advance into their normal range. Ice-breeding harbor seals follow the ice edge in the winter and spring and are widely distributed along the northern Bering Sea coast in summer and fall. Because the two groups differ in their habitat requirements and life history they will be discussed separately.

### **Land Breeding Harbor Seal**

From Southeastern Alaska to the Aleutian Islands, harbor seals give birth between late May and mid-July, with most pups being born during the first three weeks of June. Birth occurs on sandy beaches or remote reefs and rocks or on glacial ice pans. Usually only one pup is born but twinning does occur. Newborn pups are about 35 inches long and weigh about 28 pounds. The pups are able to swim almost immediately after birth and often take to the water before the next high tide covers their birth place. Abandonment is relatively common, particularly when seals are disturbed by man. Pups are usually weaned after 3 to 4 weeks.

Female harbor seals attain sexual maturity when three or four years old. Mating usually occurs in July, shortly after the females have stopped nursing their pups. These seals are relatively long-lived, and some survive longer than 30 years in the wild.

Harbor seals south of the sea ice are most commonly found near shore in water less than 30 fathoms deep. They thrive equally well in areas with rocky or muddy ocean bottoms. Unlike sea lions and sea otters, which prefer relatively clear water, harbor seals occupy both clear and turbid waters. They are able to catch fish in silt-laden glacial streams and at the bases of glaciers extending to the sea.

Harbor seals commonly haul out on offshore rocks and sand bars temporarily exposed during low tide. They also use flat beach areas, large rock outcrops worn smooth by the surf and glacial ice. Haul-out areas must have gentle slopes, for seals are poor climbers and move with considerable difficulty on land. Most of these areas seldom have more than 100 seals hauled out at one time; however, in a few places several thousand haul out at each low tide during the pupping season. When ashore, they are almost always close to the water, usually within a yard or two. These hauling out areas are especially important for pupping. Frequent disturbance during this period increases the rate of abandonment of pups.

River mouths are favorite haunts of harbor seals, particularly during summer when salmon are migrating up the streams. Areas where glaciers push into the sea are also favored. Chunks of ice breaking off the glaciers provide good platforms for the seals to haul out and rest on.

The most common foods eaten by harbor seals in Alaska are crustaceans and fish, including herring, flounders, eulachon, salmon, rockfish, cod, sculpin, octopus, squid and small crabs.

Seals tolerate moderate boat traffic through their marine habitat and some disturbance of their hauling-out areas. Pupping areas probably are the most critical and least able to withstand disturbance. Although seals may be able to tolerate low levels of pollution, large amounts of oil or other toxic substances in the water would be detrimental.

tal by harming seals and their food supply.

Harbor seals in most areas require certain traditional beaches and offshore rocks for resting areas and places where they can give birth to their young. Land areas where pups are born are particularly important to seals and disturbance of these areas should be avoided especially during the first three weeks in June.

#### Ice Breeding Spotted (Harbor) Seal

Ice breeding harbor seal pups are born on drifting ice during early April. Like ribbon and ringed seal pups, they are covered by a dense, white coat of lanugo which is shed by or shortly after weaning, or about four weeks after birth. Pups average only 22 pounds in weight and 33 inches in length at birth but may weigh over 65 pounds at four weeks of age. The first-year coat of pups (after the lanugo is shed) resembles adult pelage. The back is blue-gray, the sides and belly straw yellow, and irregular black spots cover the body.

Spotted seals pair in March, prior to the birth and breeding seasons. Pairs remain together until early May, by which time the pups are weaned and the adults have mated. Females achieve sexual maturity at three to four years of age, males at about four to five and breeding occurs annually. Maximum life span is about 35 years.

Ice breeding harbor seals, like ribbon seals, are only seasonally dependent upon sea ice. They occur along the southern edge of sea ice during late winter and spring, and are widely distributed along the coast, usually away from the ice, during summer and fall.

These seals are primarily fish eaters during summer and fall, and take advantage of spawning concentrations of salmon, herring, capelin, smelt and whitefish which occur along the coast and in the numerous bays and river mouths.

In winter, when harbor seals are at sea among the ice floes, they continue to utilize fishes where they are available. However, they also feed on shrimp, small crabs and cephalopods.

### **NORTHERN FUR SEAL**

The world's northern fur seal population was greatly reduced by commercial fur hunting on the rookeries in the late 18th, 19th and early 20th Centuries and on the high seas in the late 19th and early 20th Centuries. In 1911 the species became protected by international treaty. The herd has recovered and is now under intensive management, producing an annual supply of pelts taken from the rookeries.

During the summer, the majority of all northern fur seals are concentrated on rookeries in the Pribilof Islands of Alaska and the Commander Islands and Robben Island in the U.S.S.R.

In early May, adult male fur seals, many of which have remained in the Bering Sea all winter, begin to arrive at the rookeries and establish territories. A month later, adult females which have wintered as far south as California begin to arrive and form harems within these territories. The harem within a male's territory may number up to 100 females but averages about 45. Younger animals between the ages of 2 and 6 begin to arrive in June and haul out in large groups separate from the harem areas. Yearlings do not arrive until fall and many remain at sea. Occasional fur seals seen near or on shore throughout southern Alaska are from this latter group.

Females bear a single pup in the harems in late June or July, and breed again within about a week after giving birth. They then alternately nurse the pup and feed offshore for two to three months. The pups are abandoned when the southward migration begins in October and November. By the end of December, the rookeries are empty.

Fur seal rookeries, which in Alaska include only certain beaches in the Pribilof Islands, are essential to the maintenance of the species. Abundant supplies of food, primarily squid and smaller school fish such as herring, saury and lantern fish, must be available within a 150 mile radius of the rookeries for lactating females and younger animals. With well over a million seals in the area, the demand for food is tremendous. After the seals have left the rookeries in fall, they feed and migrate throughout the southern Bering Sea, passes in the Aleutian Islands, and the entire Pacific continental shelf of the United States and Canada. Water quality requirements for fur seals in these areas are probably similar to those for sea lions and harbor seals.

## **RIBBON SEAL**

The ecology of ribbon seals is similar to that of harbor seals in many respects. Ribbon seal pups are born on drifting ice in early April, as are harbor seals. They are covered with white lanugo and do not become active swimmers until this hair begins to shed about three to four weeks after birth. At birth, ribbon seal pups weigh only about 22 pounds and are about 32 inches long, but by the time they are weaned many pups have doubled or even tripled in weight. Ribbon seals do not acquire their distinctive color pattern of a dark background with white ribbons around the neck, foreflippers and lower abdomen until their second year. Some female ribbon seals achieve sexual maturity at age two, and essentially all are mature by age four. Males attain sexual maturity at 3 - 5 year-olds. Some ribbon seals live to be 23 - 25 years old.

Ribbon seals have long been regarded as rare, but they are common within some regions of the Bering Sea. Adult seals are always associated with sea ice from March through June, when birth, lactation, mating and molt occur. Their distribution within the pack ice is confined to the edge zone near the southern terminus of the pack. The edge zone is characterized by small floes, usually less than 20 yards wide, separated by water or slush ice and subject to rapid dispersal and compaction by winds and currents. The edge zone varies from 40 to more than 90 miles wide, depending on local conditions. Ribbon seals are most numerous along the inner (northern) edge of the zone and are gradually outnumbered by spotted seals toward the southern edge.

During ice free periods ribbon seals are pelagic, and remain mostly in the Bering Sea. Little information is available concerning summer food habits of ribbon seals. During the period when they are associated with sea ice and occupy areas underlain by the shallow Bering platform, they feed on a variety of fishes, shrimps, crabs, mysids and cephalopods, with fishes and cephalopods comprising the major part of their diet.

## **RINGED SEAL**

Ringed seals are the smallest of the northern seals. They range widely throughout the areas of both seasonal and permanent pack ice and have been reported from all Arctic areas men have visited,

including the North Pole. Greatest numbers, though, occur near shore. They are the seal most capable of living under (and in) a solid cover of stable, thick, snow-covered ice, such as that formed along our northern coast and anchored to land or the shallow sea floor. Ringed seals maintain breathing holes and are not dependent upon the movement of drifting ice for holes or leads to provide access to air.

During late winter and early spring, adult ringed seals occupy the regions covered by extensive and-fast ice. Their range is thus restricted to the vicinity of the mainland coasts of Alaska and Siberia and the larger offshore islands. Pups are born in lairs excavated under thick snow or in natural cavities in rough shore ice. Ringed seal pups are born as "whitecoats", mainly during April. They are the smallest pups of any ice-inhabiting seals, weighing only about nine pounds and measuring about 23 inches long at birth. Pups apparently remain out of water longer than the pups of other ice inhabiting seals. They stay on the ice until they are weaned and have developed the sleek coat of hair they will possess to the end of their first year. They nurse for 5 - 7 weeks and are left unattended in the lair while the mother is away feeding.

Some ringed seals are born in drifting pack ice far from land, especially in the northern Chukchi Sea and the Arctic Ocean. Whitecoats are also occasionally taken from the pack ice near Nome, St. Lawrence Island, King Island, and Little Diomed Island. Perhaps more pups are born on the drifting pack in years when suitable land-fast ice is scarce. Evidence indicates that females bearing young for the first time often deliver in marginal areas.

Predators are common in areas of land-fast ice to which most adults and pups are restricted during the pupping season. These include ravens, red foxes, arctic foxes, wolves, dogs, wolverines, polar bears and men.

Some ringed seals live to be more than 40 years old. Most females achieve sexual maturity when 6 - 7 years old; males when about 7 - 8 years of age.

In relatively shallow areas, ringed seals feed on many bottom dwelling invertebrates such as shrimp, amphipods, decapods, and crabs. However, the major food items are fishes, including sculpins, Arctic cod and saffron cod. During fall and winter months, fish usually make up more than 90 percent of the seals' diet. During spring, invertebrates are the major food items. Little is known about the summer feeding habits of ringed seals.

Ringed seals also occur in areas of the Arctic Ocean where water depth is much too great for feeding on the bottom. In these areas they eat primarily invertebrates from the upper water layers, including euphausiids, amphipods and larval forms of other groups. This type of feeding is partly accomplished by straining water through their extensively serrated teeth.

## **PACIFIC WALRUS**

Pacific walrus are highly gregarious and form herds of a few to several hundred individuals. The largest herds are nursery herds of females with newborn calves. Although walrus are widely distributed throughout the pack ice, nursery herds are closely grouped south and west of St. Lawrence Island during the late winter and early spring (February through mid-April). Main concentrations of bulls and cows without large fetuses or newborn calves occur at about the same latitudes, but east of the nursery herds, and sometimes south of Nunivak Island. In effect, nursery herds and other groups are segregated. This is not surprising because parturient females do not breed again until at least a year after parturition.

Calving occurs mainly between April 20 and May 10, and walrus give birth on the ice rather than in the water. Newborn calves do not have the dense white coat of lanugo found on ringed, ribbon and spotted seal pups. Brooding of the calf by the mother is important to thermoregulation, and warmth derived from maternal presence is essential to the calf's survival.

Average length of newborn calves is 42 inches and average weight about 90 pounds. Calves are able to swim from birth, but are never left unattended by their mothers, whether in or out of water. By two years of age, most walrus weigh about 750 pounds, and they may live for more than 35 years.

Walrus are specialized feeders, eating primarily mollusks. The extensive clam beds necessary to support large numbers of walrus are more restricted in distribution than are the food sources used by spotted seals, ribbon seals, ringed seals and bearded seals.

Walrus concentrate in the same areas each spring as long as any ice is present, in order to be near the mollusk beds. The most favorable feeding areas for walrus are well within the region covered by seasonal pack ice. By comparison, spotted seals, ribbon seals, ringed seals and bearded seals feed on organisms generally available over a much wider area, and these four species show a much greater preference for specific and unpredictable ice conditions. Thus walrus distribution is much less variable than distribution of the seals.

## SEA OTTER

Sea otters once occupied the coastal waters of the North Pacific Rim from the vicinity of Moro Hermoso on the Pacific side of Baja California northward to Prince William Sound, Alaska then westward through the Aleutian, Pribilof and Commander Islands and southward along the southern Kamchatka Peninsula and the Kurile Islands to the north side of Hokaido Island, Japan. Between 1742 and 1911 commercial fur hunters reduced sea otters to an extremely low population level. Perhaps fewer than 2,000 remained in the world by 1911. The present populations grew out of small nuclei remaining in California, Prince William Sound, Afognak Island, the Alaska Peninsula, Sanak Island, Sandman Reefs, Bristol Bay, the Andreanof Islands, Rat Islands, Medney Island and the Kurile Islands.

Because excessive exploitation was the sole cause of the elimination of sea otters from most areas and because there has been little alteration of their marine habitat, virtually all areas of former habitat in Alaska should eventually support sea otter populations again.

Sea otters reproduce slowly, with each female normally producing one pup every two years after she is four years old. However, survival of pups is very high when food is abundant, so sea otter populations may increase rapidly. The main factor regulating the size of sea otter populations appears to be food availability. Predation is usually low, although bald eagles may kill significant numbers of newborn pups in some areas. Once a population reaches a density at which food becomes limiting, (often over 100 otters per square mile of feeding habitat) large numbers of subadults, 9 to 12 months old, begin to die from malnutrition, particularly in late winter. Adult survival usually remains high and many otters attain ages of 15 to 20 years.

Sea otters may breed and pup at any time of year. In Aleutian populations, breeding reaches a peak in September, October and November and pupping peaks in April, May and June. There are reports that California sea otters pup later and that the peak is more pronounced. Populations along the Alaska mainland have not been studied intensively but the timing of pupping appears similar to that found in the Aleutians.

In the Aleutians, sexes tend to segregate. "Male areas" are usually on exposed points where shallow water extends farther offshore than in adjacent areas. These areas are usually no more than a few hundred yards wide and may be separated by 10 to 20 miles of "female areas". All animals in male areas, except occasional transients, are males. Female areas are less distinct and the sex and age composition of animals using these areas fluctuates throughout the year. Males enter female areas to breed in numbers proportional to the number of females in estrous at a particular time. At the peak of breeding in fall, approximately 25 percent of otters in female areas are males and in early spring, when breeding activity is at a minimum, only 5 to 10 percent are males. Very few subadult males are found in female areas, and in some female areas no males between the ages of two and six are found. Sex and age segregation is somewhat different in at least some populations outside of the Aleutians, but is not fully understood. For example, the composition in certain areas of Prince William Sound in July appears similar to that found in female areas in the Aleutians in September and October. Because of these differences, the effects of any factor influencing sea otters or sea otter habitat will vary according to the location and time of year.

Sea otter habitat is shallow coastal waters, no more than 40 fathoms deep. Rocky shores exposed to the open ocean with offshore rocks and extensive kelp beds are most typical; but substantial numbers of otters occur in some areas such as Bristol Bay where there are no exposed rocks or kelp. In these areas, otters may range 30 miles or more from shore where water is still shallow enough for them to obtain food. Relatively few otters ever occupied inland waters such as those of Southeast Alaska, nor do significant populations persist in areas where substantial amounts of sea ice regularly form. The primary habitat requirement seems to be abundant populations of the marine invertebrates or bottom fish necessary for food.

Sea otters in western Alaska regularly come ashore to rest, particularly at night and during storms. They usually

stay within a few feet of the water, but occasionally move as far as 100 yards inland. Sea otters in more eastern populations rarely haul out except in one or two small areas.

Sea otters rely on air trapped in their dense fur for buoyancy and warmth. They lack the layer of blubber that most other marine mammals have, and so their fur must be kept clean to prevent water from penetrating to the skin. Most of the rubbing, scratching and rolling activity that characterizes sea otter behavior serves to clean their fur. Anything that soils the full allows water to penetrate to the skin, causing the animal to chill and die. For this reason oil spills are particularly disastrous to sea otters.

The primary foods of sea otters are clams, mussels, snails and abalone, sea urchins, crabs, octopus, and (in areas where invertebrate populations have been reduced), slow moving bottom fish. A sea otter eats 20 to 25 percent of its weight in solid food, excluding shells, viscera, etc., each day. For adults, this amounts to 8 to 15 pounds of fresh food per otter per day, or over 180 tons of food per square mile containing 100 sea otters each year. The abundance of food is the primary factor limiting most sea otter populations. Anything influencing this abundance will affect sea otter numbers.

Predation by sea otters influences certain invertebrate populations, and thus the ecology of areas now unoccupied by sea otters will be altered substantially when sea otters become abundant there. Such changes have not been studied in great detail, but one major effect is a reduction of the age structure of sea urchin populations. This in turn reduces grazing by urchins on kelp and allows greater formation of kelp beds.

## STELLER SEA LION

Steller sea lions are found along the coast of the North Pacific from the Channel Islands of California to Alaska and west to the islands of Japan. They also occur in the Bering Sea along the edge of the sea ice in winter and at the Pribilof Islands during the summer months.

In Alaska, sea lion pups are most commonly born during late May and June, with the majority of upping occurring during the first two weeks in June. Usually only one pup is produced, but twinning occurs rarely. The average weight at birth is 44 pounds. Females eventually weigh 600 to 800 pounds, and males may grow as large as 2,400 pounds.

Breeding activity begins in late May when mature bulls begin defending territories on the coastal rookeries. Females may move about the territories, but all intruding males are challenged. On large rookeries, males generally have 14 – 17 females within their defended areas. Most females breed within a week or ten days after giving birth, with the peak of breeding activity occurring in mid-June.

Not all sea lions go to rookery areas during the breeding season. Large numbers of mature bulls occupy male hauling grounds, generally located adjacent to rookeries. Also, males and females without pups may gather on hauling grounds where males also defend territories and engage in breeding activities. Territorial behavior by males begins to decrease around the first of July and by mid-July most breeding activity has ended.

Pups are capable of swimming within hours after birth but most do not venture into the water until they are at least a month old. In July, females swim near the rookery with their pups, which by this time are learning to swim. By late July, rookery populations begin to decline as some territorial bulls and females without pups leave the area. Hauling grounds that contained few or no sea lions during the summer gradually begin to attract more animals, but the number using each hauling ground varies from day to day and month to month.

As many as 25 percent of adult females fail to produce a pup each year. In addition, more than half the new pups die in their first year. Drowning, abandonment, malnutrition and predation are the major causes of death. Killer

whales, sharks and men prey on adults as well as pups.

Sea lions are generally shy animals and rush to the water when approached by man, except during the June breeding season. During that month, sea lions on rookeries show great reluctance to leave the land. Although most females will finally flee when a man approaches too closely, some become very protective of their pups and refuse to leave their sides. Similarly, many males continue to defend their territories against all intruders, including men.

During winter, sea lions move into the more protected waters of bays and inland passages to live. They use hauling grounds that were unoccupied in summer and often follow predictable feeding patterns, such as moving into herring spawning areas in spring.

Although sea lions live in the marine environment, they occasionally ascend freshwater rivers for short periods of time. They seem to thrive best in remote island areas with extensive shallow water and rocky bottoms highly productive of fish life.

Offshore rock piles exposed through all stages of the tide are important as resting areas. Sea lions are excellent swimmers and range widely in search of food, but most of their feeding activity is confined to waters less than 50 fathoms deep. They are uncommon in glacial areas where the water is turbid, and prefer relatively clear waters.

Sea lions eat a wide variety of foods including rockfish, sculpin, greenling, sand lance, smelt, salmon, halibut, flounder, octopus, shrimp and crab.

Although most sea lions are found in association with land masses, some occur along the southern edge of Bering Sea ice during the winter months. They move in and about the broken ice, occasionally hauling out on large floes to rest.

## **WATERFOWL AND SEABIRDS**

No other state or province in North America boasts such varied extremes in topography and climate as does Alaska. The state's large and diverse avifauna reflects these unique factors. This inventory deals with waterfowl, seabirds and their close relatives in relation to the many habitats they occupy. Table 1 lists 120 of these birds which are known to occur in Alaska.

Alaska contains over 110,000 square miles of waterfowl breeding habitat, plus several thousand square miles of habitat used mainly as feeding, resting and staging areas (Figure 1). Perhaps half a million square miles of open seas are used by seabirds during most of the year. Except for a few short summer months when these birds concentrate on rocky cliffs to nest, they remain always at sea.

Each year over 1 million geese, 12 million ducks, 70,000 swans and 50,000 cranes utilize Alaskan habitat. For the past fifteen years the Bureau of Sport Fisheries and Wildlife has conducted aerial surveys in major waterfowl areas in Alaska. Results of these surveys, with modifications of our own, are presented in Tables 2 and 3. Because the surveys do not cover or inadequately cover breeding areas of geese, swans, harlequin ducks, and eiders, population estimates for these birds must be based on a variety of other reports and surveys. We believe most estimates are conservative and that actual populations of most species are probably higher than indicated. More specific population enumerations are presented in game management unit discussions.

Waterfowl from Alaska are found in every state, most provinces of Canada, and in many other countries. Figure 2 presents data on recoveries, by area, of birds banded in Alaska. Also shown are major fall migration routes traveled by waterfowl to and from Alaska.

To facilitate the presentation of information concerning habitat and pertinent life history information of migratory birds, the state has been divided into six regions of waterfowl habitat: Southeastern, Gulf Coast, Aleutian Islands, Western Tundra, Interior, and Arctic North Slope. Habitats within each region have many things in common and are generally unlike habitats in other regions. Consequently, birds in each region generally exhibit characteristics different from those of other regions. Figure 1 illustrates these regions.

**TABLE 1**  
**Waterfowl, Seabirds and Other Related**  
**Birds present or recorded in Alaska**

**Dabbling Ducks**

Mallard - *Anas platyrhynchos*  
 Gadwall - *Anas strepera*  
 Pintail - *Anas acuta*  
 Green-Winged Teal - *Anas crecca carolinensis*  
 Blue-Winged Teal - *Anas discors*  
 Aleutian Common Teal - *Anas crecca nimia*  
 Baikal Teal\* - *Anas formosa*  
 Falcated Teal \* - *Anas falcata*  
 Cinnamon Teal \* - *Anas cyanoptera*  
 Garganey\* - *Anas querquedula*  
 European Common Teal \* - *Anas crecca crecca*  
 Chinese Spot Bill\* - *Anas poecilorhyncha zonorhyncha*  
 American Widgeon - *Mareca americana*  
 European Widgeon \* - *Mareca penelope*  
 Shoveler - *Spatula clypeata*  
 Wood Duck \* - *Aix sponsa*

**Diving Ducks**

Lesser Scaup - *Aythya affinis*  
 Greater Scaup - *Aythya marila*  
 Canvasback - *Aythya valisineria*  
 Redhead\* - *Aythya americana*  
 Ringneck\* - *Aythya collaris*  
 Common Pochard\* - *Aythya ferina*  
 Tufted Duck\* - *Aythya fuligula*  
 Barrow's Goldeneye - *Bucephala islandica*  
 American Goldeneye - *Bucephala clangula americana*  
 Bufflehead - *Bucephala albeola*  
 Ruddy Duck \* - *Oxyura jamaicensis*  
 Sea Ducks and Mergansers  
 Old Squaw - *Clangula hyematis*  
 Harlequin - *Histrionicus histrionicus*  
 American Common Merganser - *Mergus Inerganser*  
 Red-Breasted Merganser - *Mergus serrator*  
 Smew\* - *Mergus albellus*  
 Hooded Merganser\* - *Lophodytes cucullatus*  
 Pacific Common Eider - *Somateria molissima*  
 King Eider - *Somateria spectabilis*

Spectacled Eider - *Lampronetta fischeri*  
 Steller's Eider - *Polysticta stelleri*  
 Western White-Winged Scoter - *Malanitta deglandi*  
 Surf Scoter - *Melanitta perspicillata*  
 American Common Scoter - *Oidemia nigra*

**Geese**

Canada  
 Lesser - *Branta canadensis parvipes*; *B. c. teverneri*  
 Cackling - *Branta canadensis minima*  
 Vancouver - *Branta canadensis fulva*  
 Dusky - *Branta canadensis occidentalis*  
 Aleutian - *Branta canadensis leucopareia*  
 Emperor - *Philacte canagica*  
 White-Fronted - *Anser albifrons*  
 Bear\* - *Anser fabatis*  
 Lesser Snow - *Chen hyperborea*  
 Ross\* - *Chen rossii*  
 Black Brant - *Branta nigricans*  
 American Brant\* - *Branta bernicla*

**Swans**

Trumpeter - *Olor buccinator*  
 Whistling - *Olor columbianus*  
 Whooper\* - *Cygnus olor*

**Cranes, Loons, Grebes, Rails and Coots**

Lesser Sandhill Crane - *Grus canadensis*  
 Gray (Common) Crane\* - *Grus grus*  
 Common Loon - *Gavia immer*  
 Arctic Loon - *Gavia arctica*  
 Red-Throated Loon - *Gavia stellata*  
 Yellow-Billed Loon\* - *Gavia adamsii*  
 Red-Necked Grebe - *Podiceps grisegena*  
 Horned Grebe - *Podiceps auritus*  
 Western Grebe\* - *Aechmophorus occidentalis*  
 Pied-Billed Grebe\* - *Podilymbus podiceps*  
 Sora Rail\* - *Porzana carolina*



American Coot\* - *Futica Americana*

### **Pelagic and Seabirds**

Black-Footed Albatross - *Diomedea nigripes*  
Short-Tailed Albatross\* - *Diomedea albatrus*  
Laysan Albatross\* - *Diomedea immutabilis*  
Slender-Billed Shearwater - *Puffinus tenuirostris*  
Sooty Shearwater - *Puffinus griscus*  
Pink-Footed Shearwater\* - *Puffinus creatopus*  
Fork-Tailed Petrel - *Oceanodroma lurcata*  
Leach's Petrel - *Oceanodroma leucorhoa*  
Scaled Petrel \* - *Pterodroma inexpectata*  
Cook's Petrel \* - *Pterodroma cookii*  
Pacific Fulmar - *Fulmarus glacialis*  
Double-Crested Cormorant - *Phalacrocorax auritus*  
Pelagic Cormorant - *Phalacrocorax pelagicus*  
Red-Faced Cormorant - *Phalacrocorax urile*  
Brandt's Cormorant\* - *Phalacrocorax penicillatus*  
Pomarine Jaeger - *Stercorarius pomarinus*  
Parasitic Jaeger - *Stercorarius parasiticus*  
Long-Tailed Jaeger - *Stercorarius longicaudus*  
Glaucous Gull - *Larus hyperboreus*  
Glaucous-Winged Gull - *Larus glaucescens*  
Iceland Gull \* - *Larus glaucooides*  
Slaty-Backed Gull \* - *Larus schistisagus*  
Herring gull - *Larus argentatus*  
California Gull\* - *Larus californicus*  
Short-Billed (Mew) Gull - *Larus canus*

Bonaparte's Gull - *Larus philadelphia*  
Black-Headed Gull \* - *Larus ridibundus*  
Ivory Gull \* - *Pagophila eburnea*  
Sabine's Gull - *Xema sabinii*  
Ross's Gull - *Rhodostethia*  
Pacific Kittiwake - *Rissa tridactyla*  
Red-Legged Kittiwake - *Rissa brevirostris*  
Arctic Tern - *Sterna paradisaea*  
Aleutian Tern - *Sterna aleutica*  
American Black Tern\* - *Chlidonias niger*  
Common Murre - *Uria aalge*  
Thick-Billed Murre - *Uria lomvia*  
Common Dovekie\* - *Plautus aile*  
Marbled Murrelet - *Brachyramphus marmoratum*  
Kittlitz's Murrelet - *Brachyramphus brevirostre*  
Ancient Murrelet - *Synthliboramphus antiquum*  
Cassin's Auklet - *Ptychoramphus aleutica*  
Parakeet Auklet - *Cyclorhynchus psittacula*  
Crested Auklet - *Aethia cristatella*  
Least Auklet - *Aethia pusilla*  
Whiskered Auklet\* - *Aethia pygmaea*  
Rhinoceros Auklet - *Cerorhinca monocerata*  
Horned Puffin - *Fratercula corniculata*  
Tufted Puffin - *Lunda cirrhata*  
Mant's Black Guillemot\* - *Cepphus grylle*  
Pigeon Guillemot\* - *Cepphus columba*  
\* Denotes uncommon to very rare in Alaska. Others listed as common may be common only locally.

**TABLE 2**  
**Estimated Average Fall Flights of Ducks**  
**from Alaska**

Interior	4,671,000
Western Tundra	4,671,000
North Slope	4,310,000
Gulf Coast	750,000
Aleutian Chain	268,000
Southeastern	100,000
	125,000
	10,225,000
Estimated Migrant Population (from Russia and Canada)	2,000,000
Total Ducks Utilizing Alaskan Habitats	12,224,000

**TABLE 3**  
**Estimated Average Fall Flights of Geese,**  
**Swans and Cranes From Alaska**  
**Geese**

Aleutian Canada Goose	300
Dusky Canada Goose	35,000
Vancouver Canada Goose	60,000
Lesser Canada Goose	175,000
Cackling Canada Goose	150,000
Black Brant	150,000
Emperor Goose	150,000
Lesser Snow Goose	500
Pacific White-Fronted Goose	150,000
(Yukon-Kuskokwim Valley & Innoko River Valley)	
Mid-Continent White-Fronted Goose	250,000
(Yukon-Tanana R. drainages-1 0,0001 Koyukuk R. drainage-15,0001 Innoko R. drainage-20,0001 Selawik and Kobuk R. drainages-25,0001 Upper Kuskokwim R. drainage-5,0001 North Slope-175,000)	
	1,120,800

**Geese Migrant Through Alaska**

Lesser Snow Goose (from Russia & Canada)	100,000
Black Brant (from Russia & Canada)	50,000
Total Geese Utilizing Alaskan Habitats	1,270,800

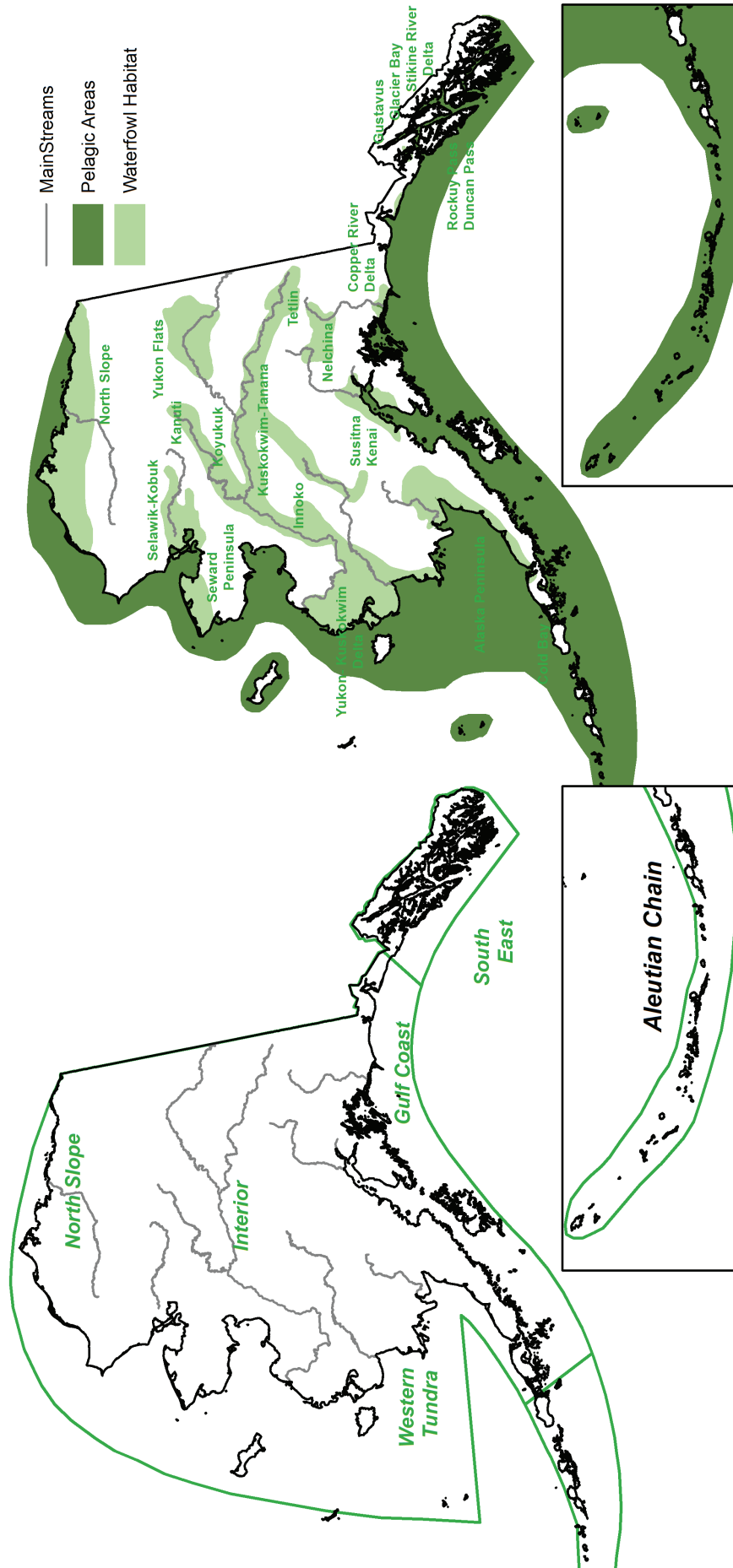
**Swans**

Whooper (mostly migrant from Asia)	100
Trumpeter	3,500
Whistling	70,000

**Cranes**

Lesser Sandhill (includes 5,000 migrant from Russia)	50,000
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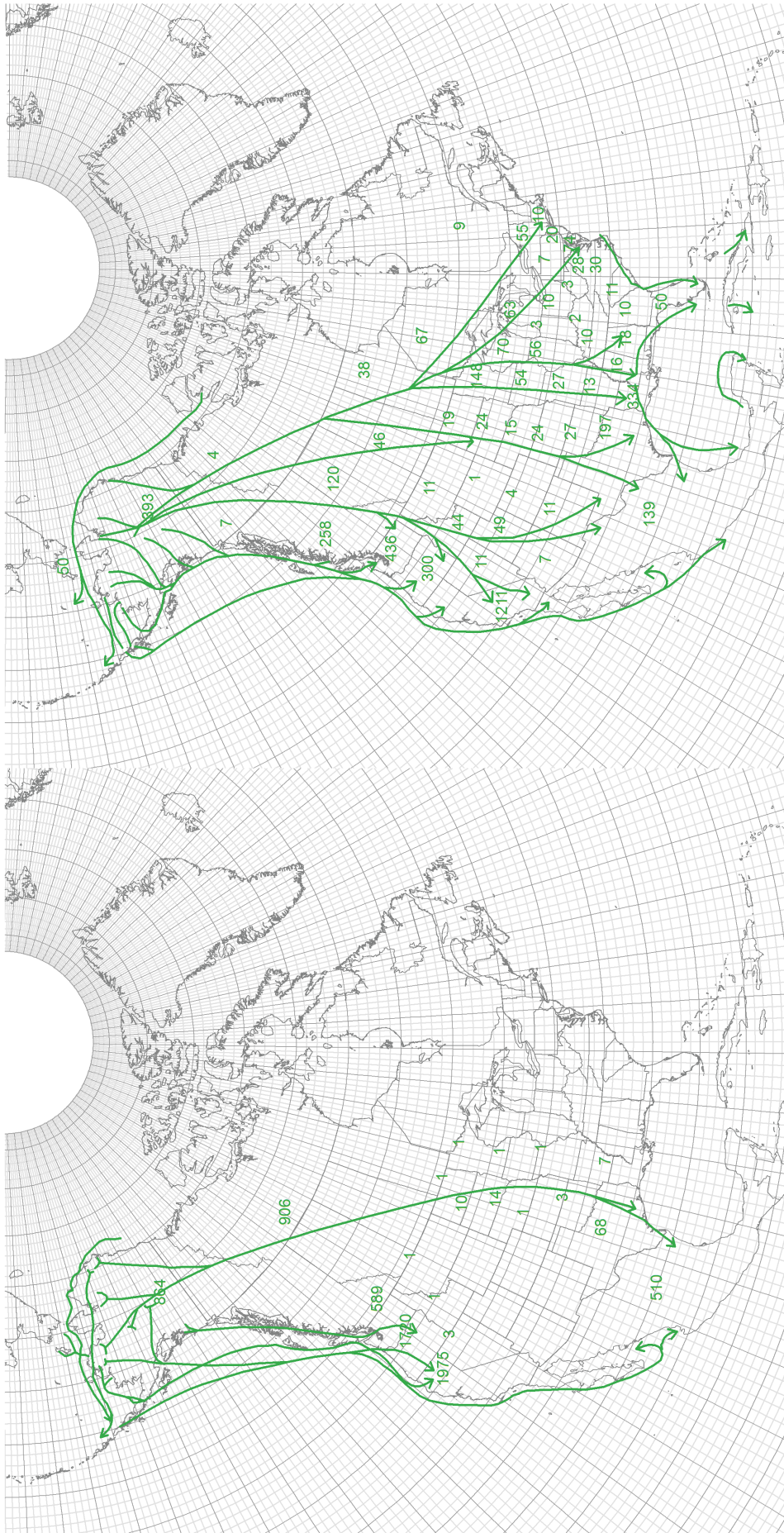
Figure 1. WATERFOWL AND SEABIRD HABITAT REGIONS AND FORAGING AREAS



Primary Waterfowl Habitat in Alaska and Pelagic Foraging Areas Essential for Sea Ducks and Seabirds

Waterfowl and Seabird Habitat Regions

Figure 2. WATERFOWL MIGRATION ROUTES AND BAND RECOVERIES



Major Goose Migration Routes from Alaska  
Number of Recoveries from Alaskan Banded Geese

Major Duck Migration Routes from Alaska  
Number of Recoveries from Alaskan Banded Ducks

**SOUTHEAST WATERFOWL HABITAT REGION**  
**(Game Management Units 1, 2, 3, 4)**

Southeast Alaska is a mountainous area of spruce-hemlock rain forest, alpine tundra beginning at 3,000 ft. elevation, thousands of streams and rivers, and numerous bays, fiords, river and stream deltas. Waterfowl are associated primarily with intertidal zones, deltas, some streams and rivers, and generally those ponds found below 1,500 ft. Seabirds and most sea ducks are dependent upon the plentiful animal and plant life found in ocean waters. Small herring, needle fish and fish eggs are three preferred and abundant foods.

In herring spawning areas and on salmon spawning streams, concentrations of seabirds, sea and diving ducks and even dabblers and Canada geese occur during late spring and through the summer.

Because most salt water, except in small protected bays, remains ice-free during winter months, waterfowl use is year-round. Even when tide flats and river deltas become ice covered, dabbling ducks (mostly mallards) and Vancouver Canada geese remain to forage on plant and animal life at tide line near small stream mouths which remain open. Sedge and grass roots, mussels, snails and other organic matter are eaten. Depending upon the severity of the winter, numbers of wintering dabbling ducks and trumpeter swans vary from year to year.

Although numbers of breeding waterfowl have never been determined, nesting does occur in this region. Larger river valleys and deltas, mountain ponds, streams and beach fringes all support production of various species. Most of the numerous glaciers (in the northern two-thirds of the region) are retreating each year, thereby creating new waterfowl habitat.

Important plants and animals associated with waterfowl habitats in the Southeast are similar to those in the Gulf Coast Region. Additions to those listed in that region are presented below.

Common & Scientific Name	Major Uses	
	Food Source	Cover and/or Nest Material
Blueberry-Cranberry - <i>Vaccinium</i> spp	X	X
Crab-apple - <i>Malus</i> sp.	X	X
Gooseberry-Currant - <i>Ribes</i> spp.	X	X
Goose tongue - <i>Plantago maritima</i>	X	
Sitka spruce - <i>Picea sitchensis</i>		X
Hemlock - <i>Tsuga</i> sp.		X

**Selected Life History Information**

**Migration**

Waterfowl banding in the Southeast Region has been accomplished on only two groups of birds: Vancouver Canada geese and some wintering ducks. Thus, migration patterns of birds utilizing southeast habitats are not completely known.

Vancouver geese are probably permanent residents of the region. Several thousand molting birds have been banded during early July in inlets of Glacier Bay. About 10 per cent of the recoveries have been in Oregon, the rest from Southeast Alaska. We believe the Oregon recoveries may well have been subadult dusky geese banded as they spent the summer in Southeastern Alaska. This behavior has been documented for several subspecies of Canada geese. Vancouvers thus appear to migrate only intra-regionally. Paired birds with broods and flocks of non-breeders gather in the fall, to winter in relatively small flocks in the numerous bays.

During fall migration, comparatively few waterfowl (mostly dabblers, divers and lesser Canadas) utilize Southeast habitats. Most birds that are migrating to southern Pacific Flyway areas stop only briefly or pass through on the outer coast. Many divers, some mallards and trumpeter swans, and a few pintails remain in the Southeast to over-winter.

During spring migration most birds traveling from western Pacific Flyway wintering areas to Alaskan breeding grounds use Southeast areas for more extended periods. Many species uncommon in the fall are seen in the spring.

Adult common, white-winged and surf scoters migrate from the Southeast to northern breeding areas in the spring. Male birds leave the breeding areas generally by mid-July and return to the Southeast to molt. Subadults usually remain in the Southeast Region throughout the year.

Peak concentrations of migrating waterfowl occur in the Southeast as follows: northern half of region, October 7-22 and April 10-May 1; southern half of region, October 10 - November 1, and April 5 - 25.

### **Aspects of Reproduction**

No intensive nesting studies have been conducted in the Southeast Region. Only scant information is available and this does not cover all breeding species. Dabbling duck nesting occurs on river deltas, wider stream valleys, glacial plains and at the heads of some bays. It is unknown whether breeding occurs in mountain ponds. Peak of hatching probably occurs by July 1.

Large numbers of mergansers and harlequin ducks are produced, mostly on fish-run streams. Mergansers bring their broods to tide-flat areas soon after hatching.

The Southeast Region is best voted as a breeding area for Vancouver geese, but only general knowledge is available. Nesting activities begin in early April, often with deep snow still present. One nest with eight eggs found near Juneau on April 29 was located under a small spruce tree surrounded by hip-deep snow and attended by an incubating female. After the eggs hatch, adults usually walk their young from the beach area to mountain ponds, sometimes 1,000 to 2,000 feet above the place of hatching. This behavior is peculiar to the Vancouver subspecies.

Although nesting has not been observed on mountain ponds, some nesting could occur there, especially in southern parts of the region where ponds are open several weeks earlier than in the north.

### **Mortality**

Predators on waterfowl in the Southeast include brown and black bears, wolves, gulls, and bald eagles. (There are no wolves in Unit 4.) Predation is probably a minor mortality factor throughout the region, except during winter months when eagles may well become a significant factor. Incidence of parasites, disease and lead shot poisoning is probably low.

Over-wintering waterfowl, especially dabblers and Canada geese, may suffer substantial natural mortality because of subsistence-level food supplies. Birds handled in winter in Southeast Alaska are very thin and easily weakened in comparison to birds handled farther south.

About 20 percent of the state's duck harvest and just over 10 percent of the goose harvest occurs in the Southeast. This kill is very small compared to the harvest farther south of birds that have passed through the region. Only a small proportion of the resident Vancouver goose population is shot each year in the region.

## ALEUTIAN ISLANDS WATERFOWL HABITAT REGION (Game Management Unit 10)

The Aleutian Islands consist of over 70 named and other lesser islands extending in a great arc early 1,100 miles from the Alaska Peninsula. These mountainous and isolated islands are breeding and wintering areas for waterfowl, sea ducks and seabirds. Bordered on both the north and south sides by deep oceanic troughs and touched by several major ocean currents, the islands have a rich supply of marine life. Volcanic cones and rugged coastlines provide nesting sites for millions of seabirds which feed both winter and summer on the abundant sea life. Estuarine habitat is most important to wintering birds since most saltwater bays remain ice-free all year. Aleutian nesting habitat is of special importance because it supports populations of Aleutian Canada geese, common teal, Aleutian terns and several other species not found in other regions of Alaska.

Marine and terrestrial habitat types which are important to bird populations in the Aleutians can be broadly defined as follows:

**Marine Littoral Waters** - These are waters bordering the shore and extending outward to merge with pelagic waters. Seabirds and sea ducks, brant, emperor geese and others use these waters for feeding and resting.

**Pelagic Waters** - This habitat includes marine waters extending approximately two miles seaward from land, providing feeding and resting areas for seabirds and other pelagic species.

**Lacustrine Waters** - This type includes bodies of standing water and emergent plant and aquatic animal life found within the upland basins. It provides resting and feeding habitat for loons, grebes, dabbling ducks, diving ducks and some sea ducks.

**Riparian Meadows** - This habitat includes vegetation bordering streams which serves as nesting cover and food for dabbling ducks, diving ducks and sea ducks.

**Beach Ridges** - These are vegetated shorelines predominantly covered with beach rye, sandwort and goundsel and are used as nesting and feeding cover.

**Coastal Reefs** - This type contains exposed lichen splattered rocky reefs and headlands, largely devoid of vegetation and typically covered with marine algae.

**Sea Beaches** - These are sparsely vegetated, rugged beaches, usually at the bases of sea cliffs, often littered with driftwood, kelp and the remains of marine invertebrates.

**Sea Cliffs** - These areas are steep rocky cliffs and pinnacles facing seaward and used by seabirds. They are sparsely, but often richly, vegetated due to constant fertilization by nesting birds.

Important food items which constitute a significant portion of many nesting and wintering birds' diets include: sedges, beach rye, buttercup, sea lettuce, kelp, eelgrass, horsetail, crowberry, mare's tail, algae, sea urchins, periwinkles, clams and other invertebrates and tomcods, blennies, sculpins and small cod.

The relationship of seabirds, especially murre, to the overall ecology of arctic seas is an important one. Seabirds provide a vital link in the ecology of the species which are their food.

The birds' excrement, rich in potash, is important to growth and abundance of small marine organisms. In turn,

these organisms provide food for small fish which are eaten by adult fish, which in turn become seabird food. It is said that seabird colonies are the fertilizing factories of the northern seas.

### **Selected Life History Information**

#### **Emperor Goose**

The emperor goose, though not a year-round resident of the Aleutians, over-winters in large numbers throughout the region. Early migrants arrive in the Aleutian Islands by mid-August, but the majority of the wintering population passes along the Aleutians in late September and October. Spring migration eastward starts in late April or early May.

Emperor geese most often feed along beaches during the winter on beach rye shoots and roots, horsetail rhizomes and sea lettuce. They also eat mollusks, crabs, crustaceans, small fish and other animal life.

Emperor geese are subject to a number of mortality factors including predation and possible winter starvation due to freezing of feeding areas. Hunting on the Aleutian Chain is of little consequence to emperor populations.

#### **Aleutian Canada Goose**

The Aleutian Canada goose was once common on many of the islands of the Aleutian group. Agattu and Semichi Islands were the chief breeding grounds of thousands of these geese in the late 1800's. Foxes introduced for fur farming caused rapid disappearance of the birds. Thought extinct for many years, a small flock of Aleutian Canada geese survived on Buldir Island. Efforts are now being made by the Bureau of Sport Fisheries and Wildlife to reintroduce these geese to other areas.

#### **Common Teal**

This bird is fairly abundant in the Aleutians from Akutan to Adak. The population on Amchitka Island was estimated at 1,000 birds in 1959, and recent studies suggest about 500 common teal are year-round residents on this island.

Pair formation begins in March and by early May breeding pairs have selected territories. Nesting is prolonged, with both newly hatched broods and fresh nests present in early June. Nests are placed near stream edges and in grass clumps, often some distance from water. Clutch size varies from 6 to 9 eggs. By August most common teal are again in flocks and spend most of their time near lake shores. During October, flock sizes tend to diminish and the birds feed on beaches and ponds near saltwater in winter.

Mortality due to blue foxes has practically ceased in recent years because of fox control programs. However, rat populations may still create a serious predation problem. Raptors often harass teal but are inefficient in capturing them.

#### **Whooper Swan**

Whooper swans winter in the Aleutians and have been seen regularly on Amchitka and St. Paul Islands on their way to and from Siberian breeding areas.

#### **Pelagic Cormorant**

This bird is one of the most numerous resident marine birds in the Aleutians. Nesting activity reaches a peak about mid-May when from 1 to 4 eggs are incubated. Nesting is irregular; leathery, half-grown young can be found in the same colony with freshly laid eggs. The young require many weeks to mature



and do not leave the nest site until well developed and feathered. The birds are apparently restricted to a fish diet.

### **Red-Faced Cormorant**

The only North American records of this bird is in Alaska. Known breeding colonies exist throughout the Aleutians with concentrations in the Shumagin Islands and the Pribilof Islands. Although often found nesting with pelagic cormorants, they also nest among dense concentrations of murre. Egg laying dates are similar to those of pelagic cormorants. Most authorities agree that the red-faced cormorant is the more abundant of the two species in the Aleutians, with large colonies also present on Walrus, Amak and Adak Islands. Cormorants remain in Aleutian waters throughout the year.

### **Common Murre**

The common murre is found in numerous colonies from Attu to Unimak Island. Usually it occurs in association with colonies of thick-billed murre. The largest colonies are located on Bogoslof, Kagamil, Chagulak, Amukta, Kasatochi and Koniuji Islands.

A single pear-shaped egg is laid on bare rock on a steep cliff in late May or June. Young are born in July and early August after a 32 to 34 day incubation period. The young remain on the cliffs for 18 to 25 days, and then leave the colonies by a spectacular leap or a walk into the sea.

Adult mortality is low, the major factors being storms, oil pollution and commercial fishing nets. Egg picking and predation by gulls result in egg and chick losses.

Aleutian murre spend winter close to the islands; however, some may winter near Kodiak, the Gulf Coast and Southeastern Alaska.

### **Tufted Puffin**

Tufted puffins are probably the most abundant birds in the Aleutian Islands. The Pribilofs also support large populations of nesting puffins.

Breeding occurs between May and August, with eggs appearing from late June to early August. Nests are usually in burrows dug in the grassy tops of cliffs and islands, but are also placed in natural crevices among rocks or in cliffs. A single egg is laid, little nest material is used other than a few coarse plant stems, and both parents incubate.

Alaskan puffins are reported to be dependent on sand lances for winter food, although food habitats are not well known.

Mortality factors affecting puffin populations are thought to be storms, oil pollution, entanglement in fish nets and starvation due to abnormal movements of their food supply.

### **Least Auklet**

The least auklet occurs in such dense colonies in some areas that it is nearly impossible to estimate their numbers. The Pribilof Islands host huge numbers of these birds, especially on St. George Island, but the majority of these auklets occupy the central Aleutian Islands, from Koniuji to Buldir. Kasatochi, Gareloi, Semisopchnoi, Segula, Koniuji, Buldir and Kiska Islands are the main nesting locations.

Least auklets lay a single white egg between boulders, in crevices, or on talus slopes or lava beds. As with many alcids, no nest materials are used and both parents incubate the eggs. Eggs are laid from late May through early July. The least auklet's major food source is small crustaceans. Causes of mortality are foxes,

raptors, storms, egg picking and harvest of adults, destruction of eggs by rodents and predation by sea mammals and large fish.

**GULF COAST WATERFOWL HABITAT REGION  
(Game Management Units 5, 6, 7, 8, 9, 14, 15, 16)**

Of the six waterfowl regions, the Gulf Coast has the most varied waterfowl habitat. It contains the Alaska Peninsula, Kodiak-Afognak Islands, Cook Inlet, the Gulf of Alaska and Prince William Sound, and the Matanuska-Susitna Valleys.

The Alaska Peninsula is essentially treeless with a heath-type vegetation of sedges, grasses and shrubs predominating. In many respects, it more closely resembles western tundra areas than "typical" Gulf Coast habitat farther east. Waterfowl are associated primarily with estuarine areas and tidal flats, except for upland lakes where nesting occurs. Dabbling and diving ducks, sea ducks, all species of geese, and whistling swans are dependent primarily upon the abundant plant and animal life in bays, river deltas, intertidal zones and the other estuarine areas the Peninsula affords. Some use of sedges, grasses and various berries on upland areas also occur. Seabirds utilize pelagic areas for foraging on small herring, needle fish and other animal and plant life.

The Kodiak-Afognak Island group is a transitional area between habitat more typical of the Southeast Region and western tundra. Although these islands have some subalpine lakes and numerous mountain streams, waterfowl depend primarily upon estuarine and tidal flat areas of the numerous bays and fjords, where they feed on various grasses, sedges, snails, crustaceans, bivalves, small fish and fish eggs.

The northern coast of the Gulf of Alaska extends in an arc from Cape Fairweather on the east to the Alaska Peninsula on the west. Waterfowl habitat is mostly in glacial outwash plains, marshlands in river valleys and deltas, upland ponds (especially in the Kenai Peninsula-Susitna River area), and estuarine-tidal flat areas in numerous bays.

The 1964 Good Friday earthquake caused dramatic changes in waterfowl habitat in the northern coastal area. Some coastal intertidal areas rose several feet, thereby changing from brackish to fresh water environments. Other areas sank several feet, changing from fresh water to saline conditions. In both instances, changes in plant and animal life occurred. The best-documented effect on waterfowl use is a decrease in duck numbers and production on the Copper River Delta, where the land rose about six feet.

Much of the eastern part of the region is bounded by glaciers to the north. Many of these are retreating each year and creating new waterfowl habitat as they do. Trumpeter swans especially benefit from this new habitat.

In summary, most waterfowl and all seabirds in the Gulf Coast Region are closely tied to pelagic areas, estuarine and intertidal zones. Waterfowl reproduction occurs mainly in conjunction with upland ponds of the Alaska Peninsula and Kenai-Susitna areas, and along the eastern coast in river deltas and glacial plains.

**Important Plants and Animal Groups Associated with Waterfowl Habitats.  
Gulf Coast Waterfowl Habitat Region.**

Plants	Food Source	Cover and/or Nest Material
Mosses - Sphagnaceae spp.		X
Mannagrass - <i>Glyceria</i> spp.	X	X
Reed-grass - <i>Calamagrostis</i> spp.		X

Bent-grass - <i>Agrostis</i> spp.	X	X
Foxtail - <i>Alopecurus</i> spp.		X
Sioughgrass - <i>Beckmannia</i> spp.	X	X
Beach rye - <i>Elymus</i> spp.		X
Reed canary grass - <i>Phalaris</i> spp.	X	X
Sedge - <i>Carex</i> spp.	X	
Horsetail - <i>Equisetum</i> spp.	X	
Bur-reed - <i>Sparganium</i> spp.	X	
Pond weed - <i>Potamogeton</i> spp.	X	
Widgeon grass - <i>Ruppia</i> spp.	X	
Eel grass - <i>Zostera marina</i>	X	
Spike rush - <i>Eleocharis</i> spp.	X	X
Cotton grass - <i>Eriophorum</i> spp.	X	X
Rush - <i>Juncus</i> spp.	X	X
Duck weed - <i>Lemna</i> spp.	X	
Dock - <i>Rumex</i> spp.	X	
Mares-tail - <i>Hippuris</i> spp.	X	
Water milfoil - <i>Myriophyllum</i> spp.	X	
Snakeweed-Smartweed - <i>Polygonum</i> spp.	X	
Coontail - <i>Ceratophyllum</i> spp.	X	
Arrowgrass - <i>Triglochin</i> spp.		X
Saltgrass - <i>Distichlis</i> spp.	X	
Cloudberry - <i>Rubus</i> spp.	X	
Crowberry - <i>Empetrum</i> spp.	X	
Willow - <i>Salix</i> spp.		X
Sweetgale - <i>Myrica</i> spp.		X
Alder - <i>Alnus</i> spp.		X
Animals		
Gastropods	X	
Pelecypods	X	
Crustaceans	X	
Insects	X	
Small fish and fish eggs	X	

### **Selected Life History Information**

#### **Migration**

Ducks, geese, cranes and swans begin arriving on the Alaska Peninsula in late August. A general picture of the chronology of migration, major areas of use, and wintering area by species is presented below. Except for a few wintering emperor geese and sea ducks, most birds have left the Peninsula by November 1. By far the greatest waterfowl use occurs on the north side of the Peninsula.

Species or Groups	Dates of Peak Concentration	Area on Peninsula	Wintering Areas
Dabblers & divers	October 5-15	All	Pacific Flyway
Sea Ducks	October 20-November 5	All estuarine areas	From Aleutian Islands through California

Black Brant	October 10-20	Cold Bay	Oregon Coast through Mexico
Emperor Goose	October 20-November 1	Egegik west	Cold Bay through the Aleutians & Russia
Snow Goose	October 5-10	Egegik through Port Heiden	California
Cackling Goose	October 5-10	Pilot Point-Port Heiden	California
Lesser Canada Goose	October 10-20	Pilot Point, west	California, Oregon, Washington
White-Fronted Goose	Early October	Port Heiden, east	California
Whistling Swan	Early October	Port Heiden, east	Pacific Flyway
Sandhill Crane	Early October	Port Heiden, east	Pacific Flyway, Mexico

There is little use of the Peninsula by white-fronted geese in the fall, for they appear to stage on their breeding grounds on the Yukon-Kuskokwim Delta, using the Peninsula only for short stops. They do extensively use the coastline from Egegik east around Bristol Bay in the spring.

One interesting migration pattern is exhibited by Steller's eiders, some of which were banded as molting birds in early September at Cold Bay. Most band recoveries were along the north coast of Russia, as far east as Lena River, 1270 East longitude. One recovery also occurred at Point Barrow in June.

Probably the most spectacular fall migration is exhibited by black brant. These birds concentrate on Izembeck Lagoon and leave in mass for their over-water flight of some 2,000 miles to the British Columbia coast.

Migration of pelagic seabirds is apparently restricted to movements from the open sea to their many nesting colonies during the summer months, although wintering areas do differ somewhat from fall-spring use areas.

Little is known about migration patterns of waterfowl through the Kodiak Islands, except that this area is outside of major migration routes. Birds do not begin arriving in numbers until mid-October.

Dabblers, divers, swans and geese utilizing the Cook Inlet area begin arriving in late August and peak in numbers about October 1. White-fronted geese usually peak by the first of September. Migration continues southeasterly along the coast with numbers of dabblers and divers peaking on the Copper River Delta about October 15. Cranes move through the region at a more rapid rate while swans linger into mid-November and some even over-winter during mild winters. Dabblers, divers and geese have normally left the Yakutat area by November 10, except for a few birds which will over-winter. Almost all birds utilizing the Gulf Coast as a migration route winter in Pacific Flyway regions, especially Oregon, Washington and California.

The dusky Canada goose, which nests on the Copper River Delta, generally departs before the main fall migration about September 10. Most birds have left the Gulf Coast Region by October 1, and arrive at their wintering area in the Willamette Valley in Oregon by November 1. In the spring, duskys generally arrive on the Copper River Delta by mid-April.

The spring migration occurs more rapidly than the fall migration through all Gulf Coast regions. Large concentrations of birds in early to mid-May persist for only short periods.

## Aspects of Reproduction

No intensive studies of waterfowl or seabird reproduction have been conducted either on the Alaska Peninsula or the Kodiak Island complex. Because these areas, especially the Peninsula, are similar to western tundra habitat, an overview of aspects of reproduction can be obtained by referring to the discussion of that region. In addition, some inference of whistling swan production in the Lake Iliamna area can be made from the following observations made during mid-July 1971: paired swans - 62; paired swans with cygnets - 28 (55 young); flocked adults and subadults - 54; average brood size 3.9 or .38 young per observed adult.

Ice goes out of ponds on the Alaska Peninsula and snow is generally melted by early May, about a week to 10 days earlier than in western tundra areas on the north side of Bristol Bay. Break-up occurs from a week to ten days earlier on the southern Peninsula than it does in the King Salmon area. Accordingly, nesting and molting chronology is earlier there than in areas to the north.

Like the Alaska Peninsula - Kodiak area, the north Gulf Coast and Kenai-Susitna areas have had no intensive reproduction studies conducted. One interesting and significant observation of production, considering that Lake Hood in Anchorage is the world's busiest sea plane base, was made during mid-August 1971 on that lake. Forty-four broods (185 young) and 126 adults were observed. Species represented were: Canada goose, mallard, widgeon, green-winged teal, pintail, greater scaup, common loon and horned grebe. Average brood size for ducks was 5.9.

In the absence of specific data, we can only speculate that most facets of reproduction in the Cook Inlet area are similar to those in Interior areas such as the Nelchina Basin and/or the Copper River Delta area in the Gulf Coast Region. Although the Gulf Coast is south of Interior areas, nesting-molting chronology is approximately the same as in the Nelchina Basin and even the Tanana Valley.

In 1959, 38 trumpeter swan clutches were studied in the Copper River Delta area. Of 179 total eggs laid, 55 percent hatched, 13 percent were destroyed, 8 percent were abandoned, and 11 percent remained unhatched in the nest. The fate of the other 13 percent was unknown. Studies on the Kenai Peninsula from 1965 through 1967 indicated 79 percent of all clutches hatched (100 total nests) and 82 percent of all eggs hatched (450 total eggs). Facets of duck reproduction for areas south of the Cooper River Delta are unknown. Information concerning seabird reproduction is not available.

## Mortality

Predators on waterfowl in the Gulf Coast Region include red foxes, coyotes, wolves, brown and black bears, wolverines, eagles, jaegers and gulls. Predation on seabirds is probably limited to eagles, gulls and jaegers. Most loss is limited to eggs and young birds, although some loss of adults does occur, mostly during molt when birds are flightless.

Botulism causes the greatest loss to waterfowl in the lower Pacific Flyway, but has not been recorded in this region. Botulism seems to occur after periods of drought and resulting low water levels in ponds, and this phenomenon is rare in the Gulf Coast Region. No losses of birds have been recorded from other diseases or parasites. Although Sarcocystis has been observed in striated muscle tissue of ducks, it causes death only in unusually severe cases.

Lead shot poisoning, especially of dabbling ducks and geese, is another common cause of death throughout the lower United States and Canada, but this has not been recorded in this region. Some probable explanations for this lack of mortality include: few areas are heavily hunted, and those that are (mainly in the Cook Inlet area)

have relatively little bird use except for short periods in the fall and spring; many heavily hunted areas are intertidal and water action and tidal debris probably cover many shot pellets.

The major cause of mortality for waterfowl utilizing Gulf Coast habitat is sport hunting. Nearly 50 percent of the state's legal duck harvest and a little over 50 percent of the goose harvest occurs here. Although some areas of the Alaska Peninsula, Cook Inlet and the Copper River Delta receive the heaviest hunting pressure in Alaska, most mortality on game ducks occurs after they leave Alaska, in Pacific Flyway areas to the south. Spring and summer hunting is of little consequence in the region.

Whistling swans frequenting the Alaska Peninsula probably do not migrate through the swan hunting states of Montana, Utah, Nevada and Oregon. Thus, hunting is of little consequence to this population. There are no open swan seasons in areas which trumpeter swans utilize. Few sandhill cranes are shot in this region.

### **WESTERN TUNDRA WATERFOWL HABITAT REGION (Game Management Units 17, 18, 22 and 23)**

The Western Tundra Region is an area of sub-arctic tundra extending from Cape Lisburne to Bristol Bay. The tundra along the coastal portions of this area is barely above sea level, especially in the delta of the Yukon and Kuskokwim Rivers, and waterfowl habitats on this great delta are greatly influenced by tidal erosion and alluvial deposition. Inland, the tundra is dotted by many thaw lakes formed by surface melting, sloughing, alluvial deposition and by wind erosion of the permanently frozen ground. Fragments of boreal forest habitat types form a discontinuous ecotone between the tundra and Interior regions. Examples of this blending are found on the upper Selawik River, Norton Sound, and south of Cape Newenham.

Winters are cold and often windy along the coast, but temperatures rarely reach the extreme lows encountered in the Interior. Summers are cool, with onshore winds, fog, or overcast skies causing even lower temperatures much of the season. Daily maximum temperatures are usually below 70° F. and often below 60° F. Annual precipitation rarely exceeds 15 inches, but because of permanent ice and the flatness of the tundra, runoff is slow. Open water occurs from "breakup" in early June to "freezeup" in early October.

Aquatic habitats of the western tundra are generally less fertile than those of the more productive Interior. Annual aquatic heat budgets are lower, resulting in generally lower productivity. Lower fertility and productivity are somewhat offset by a greater number of lakes per square mile in the western tundra areas. Shallow and partially drained lake basins appear to be the most productive habitats on the tundra. Narrow coastal fringes of tideland on the Yukon-Kuskokwim Delta and in a few other western tundra areas are perhaps some of the world's most productive waterfowl habitats.

Goose and swan populations of the Western Tundra Region exceed those of any other region in Alaska. Tidal habitat on the Clarence Rhode Refuge supports densities of over 200 black brant and geese per square mile. All the whistling swans, nearly all the emperor geese and cackling geese and most of the white-fronted geese migrating to the Pacific Flyway, as well as a large segment of the continental black brant are produced on this delta. Other common western tundra species are greater scaup, pintail, old squaw, American widgeon, green-winged teal, common scoter, and common, spectacled and Steller's eiders.

#### **Selected Life History Information**

Waterfowl biologists have studied goose populations on the western tundra nesting grounds for many years. Intensive research into population dynamics, productivity, and breeding population enumeration is still in progress. Whistling swan populations and productivity are now much better known than just a few years ago. Inves-

tigations of ducks and seabirds have been conducted intermittently in the past and these need further attention. The following species were selected for discussion because they are indigenous nesters or typical tundra species of the western tundra.

### **Black Brant**

Black brant nest abundantly on the Yukon-Kuskokwim Delta from Igiak Bay to Hazen Bay. Most of this nesting habitat is a narrow strip of tidal flats barely above mean high tide level, extending from a few hundred yards to a mile from the sea. These flats are bounded inland by the tundra and seaward by a storm tide drift line.

Nesting begins as soon as the tidal flats are free of snow and ice, usually from mid-May to early June. Nests are built in sedge or occasionally beach rye, on small islands, points and among scattered small ponds and sloughs. Three to six eggs (average 3.6) are laid in a down-filled bowl-shaped depression and incubated just over 21 days. Average brood size at hatching is between 3.0 and 3.5 young. Very important food plants for adults and young are *Carex rariflora* and eelgrass.

Mew gulls, parasitic jaegers, and probably long-tailed and pomarine jaegers are the most common nest predators. However, nest predation is often very slight during incubation, possibly because of the brant's proclivity for colonial nesting. Glaucous gulls constantly annoy and occasionally capture downy young, especially if the young are disturbed or separated from brood flocks.

Brant depart the Yukon-Kuskokwim Delta in late August or early September and fly to Izembek Bay. They gather in this staging area for many weeks before departing in late October for wintering areas in southern California and Mexico. Mortality occurs through hunting, predation by gulls, egg picking, storms and sometimes starvation.

### **Cackling Goose**

The small cackling goose nests along the coast between the Yukon and Kuskokwim Rivers. Nesting populations readily mix with black brant but cackler nests are more abundant outside the outer tidal flats and a short distance inland. Early records seem to suggest a more extensive distribution than exists at present along the western coastal tundra.

Nests are usually placed in mixed cover of sedge and beach rye and five to eight eggs are laid in late May or early June. Broods range from three to four young. Cacklers feed on sedge roots, seeds and leaves, beach rye, and berries.

Migration from the Yukon-Kuskokwim nesting grounds begins in late August with a leisurely movement down the coast to the Bristol Bay tundra. Here the geese feed and rest until early October when they move across the Alaska Peninsula and over the Pacific Ocean, reaching the mouth of the Columbia River a few days later. The final leg of the fall migration is across the Cascade Mountains to the Klamath Basin and California.

Mortality factors include hunting, nest destruction by mammals, losses of young to gulls, disease, and storm tides.

### **Spectacled Eider**

The spectacled eider is a common nester in coastal habitats. Spring migrants reach the Yukon Delta in

early May and are normally in the Seward Peninsula area by late May. Nests are placed among tussocks of dry beach rye, sedge, or dry grass on small islands or near ponds. Clutch size varies from five to nine eggs, but is usually five or six eggs. Broods are small and range from two to five young, with peak of hatch occurring in early July.

Animal foods constitute over 75 percent of the spectacled eider's diet, of which mollusks, insects, and crustaceans are most important. Pondweeds, mare's tail, sedges and crowberries are the chief plant components of its diet.

By mid-July a general southern movement of nonbreeders and males occurs. These flocks are joined later in August and September by the adult females and young. Spectacled eiders winter in open areas and leads of Bristol Bay, the Aleutians, the Alaska Peninsula and the Kodiak Island group.

Egg picking, loss of young to avian predators and hunting are probably the major mortality factors.  
Pintail

Pintails are one of the most abundant and characteristic waterfowl of the Western Tundra Region. They nest in a wide variety of habitats. Nests have been found on bare sand, gravel, and tundra, but more commonly in grass, sedge, mixed grass and brush, and among drift logs. In addition to breeding birds, tremendous numbers summer in large and small flocks along tidal lakes and lagoons near the coast.

Clutch sizes vary from 6 to 12 eggs and average about 7 or 8. The eggs are incubated for slightly more than 3 weeks. Males desert soon after the clutch is completed and spend June and July in molting flocks. Adult male pintails also migrate south sooner than adult females with young, usually leaving the region by early September.

Broods of four to eight young are seen in mid-June or a little later. Young pintails achieve flight within seven weeks.

Important foods include pondweeds, seeds, sedges, smartweed, bur-reed, and aquatic insects (especially mosquito larvae). Hunting along the Pacific Flyway contributes heavily to annual mortality. Losses of eggs, young and adult females to other mammalian and avian predators are lesser causes of mortality.

### **Greater Scaup**

Greater scaup are the most abundant breeding ducks of the western tundra, and pairs occupy nearly every suitable pond and lake in the region. They arrive on the breeding grounds in the southwest coastal tundra by mid-May and in the vicinity of Kotzebue by early June.

Band recoveries suggest nearly equal contribution of birds to Pacific and Atlantic coast wintering areas. Lesser scaup compose about 10 percent of the western tundra scaup population.

Scaup nest near water in sedge, fivefinger, grass, or buckbean cover. A clutch of 7 to 11 eggs is laid in a down and grass lined nest which is often barely above the water level. The peak of nesting occurs in about mid-June. Most eggs are hatched by late July or early August. Late-hatched young are often frozen in ice by early freezes. An average brood consists of six to eight young. Larger broods are not uncommon but are often the result of combined broods.

Scaup are highly dependent on animal food and eat a variety of mollusks, crustaceans, and aquatic insects. Pondweeds, manna grass, water milfoil, sedges, grasses, seeds and other plant materials are also used heavily.



Mortality factors include hunting, predation by other mammals and birds, and storms.

### **Common Scoter**

Although the common scoter is the least common of the three scoters in Alaska, it is abundant in the Western Tundra Region. Nests are placed along steep grassy or sedge-covered lake banks near water. Many nests also occur in grassy areas formed over long abandoned village sites or middens. A clutch of 6 to 10 eggs is laid in a weed-lined nest.

Nesting begins later than it does for many other ducks. Early arrival and first nesting dates are mid-May and mid-June, respectively. Broods are commonly seen in late July and August.

Scoters' diets include mollusks, crustaceans, insects, fish, echinoderms and other animal matter. Plant foods such as pondweeds, eelgrass and widgeon grass, are also eaten by common scoters. Fall migration to the Aleutians, the Alaska Peninsula, Kodiak Island and Southeastern Alaska begins in October, and most birds are in their wintering areas by November.

Common scoters are subject to little hunting mortality in Alaska, although formerly many were taken during the summers by coastal natives.

### **Little Brown (Sandhill) Crane**

The densest crane nesting populations in Alaska occur in coastal tundra areas, especially on the Yukon-Kuskokwim delta. Nests usually are depressions in the tundra lined with grass and plant material and a few colored feathers. However, some nests are built in wetter habitat, and resemble small hay mounds about 18 inches high. One to two eggs (usually two) are laid in June and the red-downy young appear during July. Cranes arrive in early May and depart the region by mid-September.

Cranes are hunted in many areas of the state and are prized as trophies by most hunters. Accidents may contribute further to crane mortality, although little is known about mortality other than from hunting.

### **Black-Legged Kittiwake**

This small oceanic bird is common on much of the western tundra coastline and adjacent islands. Some of the largest colonies in Alaska occur on the rugged cliffs of this region.

Nests are placed on ledges of steep cliffs where two eggs are laid in a nest of soft grass and bits of sod, which are securely fastened to rocks. Kittiwakes are late nesters and young usually are not seen until late July. Kittiwakes feed upon schools of small fish.

The glaucous gull causes much damage to kittiwake eggs and young. Humans rarely disturb their nests due to the inaccessibility of the colonies. Kittiwakes winter at sea from the Aleutians south.

### **Glaucous Gull**

The glaucous gull is the largest Alaskan gull and is a consistent predator and scavenger. During the nesting season these birds destroy many seabird and waterfowl eggs. Murres, kittiwakes, fulmars and other colonial nesting species are most affected. In turn, human egg pickers and jaegers show preference for this gull's large and quite edible eggs.

Glaucous gulls arrive on the western tundra about mid-May. When nesting on rocky cliffs or shores, they line a single depression sparsely with fine grass. On beaches and tide flats, they nest in masses of sod, seaweed, and tufts of moss. Two or three eggs are laid in late May or early June and most young are hatched by late June.

Glaucous gulls leave the western tundra areas in late fall and spend the winter along the Pacific coast southward to California.

### **Crested Auklet**

Crested auklets arrive on breeding islands in late May and early June. A single egg is laid under piles of loose rocks or boulders or in crevices or cliffs. No nest is constructed. Both adults take turns incubating the egg, and egg losses to gulls are not nearly so severe as those of the murre and kittiwake because the nests are well concealed.

Auklets do suffer some predation from falcons, fish and mammals. Many are taken for food by Eskimos using nets and guns. Some die from starvation during storms at sea and others are caught in fishnets.

Movement to wintering areas near the Pribilof, the Aleutian Islands and the Kodiak Island group begins in late August and early September.

### **Horned Puffin**

The horned puffin is one of the most abundant seabirds in Alaska, and is found in some large colonies in the Western Tundra Region.

Breeding adults arrive on the Bering Sea nesting islands in early June. They make nesting burrows in the earth at the tops of banks and cliffs on islands, laying a single egg on the bare ground or in some scattered grass. The young hatch late in July and are able to fly by early fall.

Horned puffins are expert underwater swimmers, catching most of their fish meals by this means. These birds are one of the most pelagic of the alcids.

Puffins' winter only as far south as the sea ice forces them to retreat. Major wintering areas are the Aleutian and Kodiak Island groups.

## **INTERIOR WATERFOWL HABITAT REGION (Game Management Units 11, 12, 13, 19, 20, 21, 24 and 25)**

The broad flood plains of the Yukon, Kuskokwim and Tanana Rivers in the Interior are the most productive of all Alaska waterfowl habitats. Over the centuries these great, meandering rivers carved wide valleys among the mountain systems, leaving fertile flood plains dotted with oxbows, sloughs and lakes. These highly productive waters also owe much to the long, sunlit continental summer day's characteristic of the area. The region is generally mountainous and is situated between the Brooks Range on the north and the Alaska Range on the south. Eastern and western boundaries are the Canadian boundary and the Coastal Tundra Region.

Climatically, the area is dry, with little more than 15 inches of precipitation annually. However, a low mean annual temperature causes permanent ground frost which acts as a barrier to ground water percolation. Wet and marshy habitat is therefore common over much of the region. Extremes in temperature from 100° F in the summer to -60° F in the winter are common. Interior river valleys become "sunbowls" or "solar basins" in the sum-

mer and “cold sinks” in the winter. Rivers and lakes are free of ice by late May and frozen again by mid-October.

Mixed forests of coniferous and deciduous trees (white and black spruce, larch, birch, cottonwood and aspen) are common to an elevation of 3,000 ft., where they intergrade into alpine vegetation and eventually to bare rock and snow in the higher mountains. This cover of trees and shrubs is collectively known as “boreal forest” or “taiga” and extends westward until it forms a narrow ecotone with the coastal tundra.

Among aquatic habitats important to waterfowl, certain plant communities deserve special mention. Floating vegetation mats, formed by buckbean, fivefinger and sedge gradually cover and eventually fill lake, slough, and pond basins. Early stages of succession provide nesting cover for many waterfowl--in fact, vegetational mats are often the only available nesting substrate, and the few ground-nesting waterfowl whose eggs survive severe floods are those choosing this nesting substrate. Shallow ponds, often vegetated with stands of horsetail and emergent grasses, are popular feeding areas for adults and young. Natural drawdown, expedited by evaporation and intricate drainage systems, stimulates the growth of lush stands of spike rush, fleabane, smartweeds, bur-reeds and grasses on many Interior lakes. These areas serve as summer “resort” areas for millions of non-breeders, sub-adults, molting adults and young.

Nearly 35,000 square miles of Interior habitat produce a fall flight of approximately six million ducks and 250,000 geese. This is a significant contribution to Canada, most of the other states, and Mexico. Virtually none of the waterfowl habitat in this region is presently protected by state and federal refuges. Among these highly critical habitat areas are the Yukon Flats, Kanuti Flats, and Innoko and Tanana Rivers.

### **Selected Life History Information**

The following life histories include those of a number of species which nest principally in boreal forest areas. Other species of breeding ducks, geese and seabirds of the Interior that are not mentioned in the life history sketches include lesser Canada goose, white-fronted goose, pintail, Barrow's goldeneye, white-winged scoter, surf scoter, harlequin duck, herring gull, mew gull and Arctic tern.

### **Trumpeter Swan**

The trumpeter swan was long thought nearly extinct until surveys in Alaska revealed a population in excess of 3,000 birds. Alaska now supports over half the world's breeding population of trumpeter swans. About one-third of these large swans are found in the Interior during the nesting season.

Trumpeter swans begin nesting by mid-May and lay from 3 to 7 eggs in a large mound-shaped nest. Most nests are placed in shallow water among stands of emergent vegetation. Both adults work to build the nest. Incubation lasts 33-35 days, and the larger clutches may require more than 24 hours for all eggs to hatch.

The young (cygnets) are brooded for only a day or less, leaving the nest soon after hatching. Aquatic insects form an important part of the cygnets' early diet; however, green plants are also eaten within a week after hatching. Growth of the cygnets is rapid and most are flying by late September or early October. By this time, they may weigh 16-20 pounds.

Migration from the Interior begins in early October, and probably proceeds to the coastal areas of Alaska, British Columbia and Washington. Only four bands have been recovered, so migration routes are poorly known.

A few trumpeter swans are illegally shot by accident or poached. Starvation during severe winters and predation on young by otters, wolverines, coyotes, wolves and bears are other mortality factors.

## **Mallard**

The mallard is one of the most abundant dabbling ducks found in the Interior. Breeding pairs are found along lakes, sloughs, beaver ponds, rivers and headwater streams throughout the region. Some mallards remain the entire winter in warm spring-fed streams.

Nesting begins in early May in various types of cover. Most frequently nests are concealed in grass or sedge near shrubs or forested areas, often some distance from water. Eight to 12 eggs are laid in the down-filled nest bowl, and incubation takes from 23-26 days.

The downy young are led from the nest as soon as they are dry. The hen assumes all parental care since the drake departs at the beginning of incubation. The young are able to fly in 61-64 days.

Mallards are shallow-water feeders, eating rhizomes, stems and leaves of emergent and submerged plants by “tipping-up” and scouring the bottom with their bills. Insects form a large part of the diet of young mallards as well as of adults. Mallards also eat salmon eggs and decayed salmon. Mallards tend to be one of the last waterfowl species to depart the marshes of the Interior, moving to the swifter streams when freezing threatens. Most depart by mid-October, but mallards have remained on some streams until early November.

Several migration routes are used by south-bound mallards. Some travel to coastal routes while others follow inland flyways to the interior of Canada and the lower states.

Mallards are favorite game for waterfowl hunters. Accidents and predation are other mortality factors. Mallards are susceptible to botulism and many of the other common diseases of waterfowl.

## **Green-winged Teal**

The green-winged teal is a very common breeder in the Interior boreal forest. An early migrant along with the mallard and pintail, the diminutive but hardy teal usually begins nesting in early May. The nest is placed under stumps or large trees in brushy or timbered areas. However, nests have occasionally been found in open, grassy areas in coastal habitat. A clutch of 6 to 12 eggs is laid in the well-lined nest depression to which much down is added as incubation progresses.

Incubation lasts about three weeks and, as with most puddle ducks, is left to the female. The downy young develop rapidly and can fly in about seven weeks.

Most teal migrating from Alaska are bound for the Pacific Flyway, although many use the Central Flyway, and a few travel via the Mississippi Flyway. Most Alaskan teal winter in Texas, Mexico, California, and Central America.

Green-winged teal are not as popular with hunters as the larger dabblers, but are a most delectable table bird. Accidents, hunting, and predation by birds and mammals take a heavy toll of teal annually.

## **American Widgeon**

The widgeon (baldpate) is one of the most common summer ducks in Alaska, exceeded in numbers only by scaup and pintail. The widgeon is most frequently found in Interior marshes, especially in wooded and brushy cover. Spring migrants arrive in mid- or late May, somewhat later than most other dabblers.

Nesting pairs usually select sites in shrub-grass stands, often some distance from water. Egg laying begins in late May or early June, with clutches varying from 6 to 12 eggs. Widgeon hens are attentive mothers, herding their young with such great zeal that broods often include stray ducklings from other broods. The distress call of a hen with a brood frequently attracts widgeon and scaup hens from surrounding areas.

Widgeons tend to favor open-water areas far more than do other dabblers. Stands of spike rush; newly sprouted grass and other succulents are rapidly grazed by hungry widgeons. Like other dabblers, widgeons feed by “tipping up” in shallow water.

Band recoveries suggest that nearly all Alaskan widgeons fly to West Coast states in the Pacific Flyway. Widgeons are early fall migrants, leaving the breeding grounds in late August and early September. Stragglers are seldom seen after October in the Interior.

Widgeons decoy readily, providing hunters with excellent sport. Hunters do not hold widgeons in high esteem as table birds when they frequent salt or brackish water areas. However, on the breeding grounds they become fat earlier than many of the other dabblers. Mortality factors are assumed to be similar to those of other dabbling ducks.

### **Shoveler**

Shovelers are found more commonly in the typical Interior marshes than elsewhere in Alaska. A savannah-like association of shrubs and grasses, occurring in fragments in many areas, appears attractive to this typically prairie-nesting species. Observations of this species suggest considerable extension of range in Alaska over the past 20 years.

Shovelers arrive at the breeding grounds about the same time as mallards and pintails. They nest slightly later than pintails and mallards, but earlier than widgeons. Shovelers tend to lay large clutches of 10 to 12 eggs. Nests are placed in open, grassy areas near shrubs or drift logs. Large broods of downy shovelers are commonly seen in late June feeding along pond surfaces.

Few shovelers have been banded in Alaska, but recoveries from 900 bandings suggest most utilize the Pacific Flyway. Fall migration begins in late August and early September and is essentially complete by late September. California appears to be the main wintering area for shovelers in the “lower” 48 states.

### **Canvasback**

Normally thought of as prairie-nesting ducks, canvasbacks are more abundant in Alaska than one would suspect. They are especially abundant in several of the Interior marshes. Waterfowl biologists have found nests at Minto Lakes, Tetlin Lakes, and Fort Yukon. Although canvasbacks are generally considered inland fresh-water nesters, biologists found many nesting on the Copper River Delta prior to the 1964 earthquake. Breeding pairs and nests have also been observed on the Yukon Delta and other western tundra areas.

Canvasbacks are early migrants into the Interior, and many arrive with the mallards and pintails. They build nests in emergent stands of sedge or grass, close to the shoreline. Several nests have been found on small islands in a sparse cover of dry manna grass. As a rule, canvasbacks lay a clutch of 6 to 9 eggs. Larger clutches are not unusual, but may be a result of “dumping” practices by other hens.

Canvasback young develop slowly and are at least 9 to 10 weeks old before they can fly. The larger lakes with dense stands of pondweed and other submerged aquatics attract many canvasback broods as the young begin to fledge.

A few hunters in Alaska specialize in “can” hunting, but most of the harvested birds are found in mixed bags with other species. Alaska at present is the only state with an open season on canvasbacks.

Alaska-banded canvasbacks have been recovered along all four flyways, with the greatest number being taken on the Pacific Flyway. Fall migration begins in mid-September and migrating canvasbacks are common passing through the coastal salt marshes by mid-October.

Canvasback populations seem to be decreasing annually and severe measures have been taken to reduce the harvest; however, bag reductions and closures apparently have not halted the steady decline of this species. Several studies have been initiated to investigate all aspects of canvasback ecology in hopes of solving this perplexing problem.

### **Lesser Scaup**

Approximately 90 percent of the scaup nesting in the Interior are lesser scaup. Lesser scaup far outnumber other game ducks in the Interior Region and are commonly seen on all suitable lakes and open-water areas of this region. The first spring migrants arrive as soon as the larger lakes have open water, usually in late May or early June.

Nests may be constructed in a variety of cover, but are always close to water. The most frequently used plants for nesting cover are buckbean, sedge, fivefinger, horsetail, manna grass, and bluejoint grass.

Clutches vary from 5 to 12 eggs with an average clutch size of about eight eggs. The eggs are incubated for about 28 days and the first broods usually hatch in late June or early July. Young scaup require 7-8 weeks before they can fly.

Band recoveries suggest that nearly half the Interior-raised lesser scaup migrate through the Mississippi Flyway and winter principally in the Gulf of Mexico. The Pacific Flyway receives about one-fourth of the migrants, and the Central and Atlantic Flyways receive the remainder.

Fall migration from the Interior takes place in September, but many scaup remain on the larger lakes until just before “freeze-up”. The harvest of lesser scaup in Alaska is light, and most are taken by non-selective hunters.

### **American Goldeneye**

The American (common) goldeneye is a common breeding species of the boreal forest area of Alaska, being restricted by a need for tree cavities for nest sites. Goldeneyes are one of the earliest species of divers to arrive in the Interior and the latest to depart. Some individuals remain around open-water areas in the Tanana Valley until extremely low temperatures force them to move to the coast.

A clutch of 8 to 12 eggs is laid in large, natural cavities in cottonwood or sometimes birch trees. Incubation requires about three weeks and shortly after hatching the downy young “bailout” of the nest cavity, fluttering to the ground like tiny balls of down.

Very few common goldeneyes have been banded in Alaska; but the few returns show that most winter in Alaskan coastal areas where food and open water are available. Harvest of this species is negligible. The few harvested are killed largely by hunters who are not selective in shooting waterfowl.

### **Bufflehead**

The little bufflehead or “butterball” is a common duck in the wooded ponds, lakes and streams of the

Interior Region. River travelers often repeatedly flush the same flocks of these small speedsters in front of their river boats. Generally buffleheads are not considered the best table fare in saltwater areas; however, those taken in the Interior are considerably better in flavor and edibility.

Early migrants reach the Interior in early May, but nesting does not begin until early June. Nest site requirements are the same as for goldeneyes, although buffleheads may more often appropriate enlarged woodpecker nest cavities. Some may nest in bank cavities, but this type of nest site has not been recorded in Alaska. A large clutch of 10 or 12 eggs is not unusual; however, small broods of 6 to 8 young are the general rule.

Band recoveries of bufflehead suggest these beautiful little ducks are cosmopolitan in their migrational travels. Some have been recovered in Siberia, although many winter in coastal waters from Alaska to Washington. Harvest of bufflehead in Alaska is largely confined to coastal waters, but a few birds are taken for subsistence use in the Interior when they are molting.

### **Bonaparte's Gull**

Of all the seabirds nesting in the Interior Region the Bonaparte's gull is most truly a forest-nesting species. This small, beautiful and graceful bird is attracted to wooded bog areas of central Alaska. Pairs are commonly seen alighting on beaver houses and floating bog islands covered with stunted black spruce and ericaceous shrubs.

The first migrants arrive in mid- or late May and begin nesting by early June. The nest is a simple pile of twigs, similar to a dove nest, and placed on the branches of spruce trees a few feet from the ground. Two to four eggs complete the normal clutch. The

Bonaparte's gull is an avid insectivore, and actively pursues surface hatches of caddis and May flies. Often these gulls swim along the shores of lakes picking out dead and live insects from the windrows of lake debris.

Bonaparte's gulls winter in Alaskan coastal waters, especially in Southeastern Alaska.

## **ARCTIC NORTH SLOPE WATERFOWL HABITAT REGION (Game Management Unit 26)**

The Arctic Slope of Alaska covers a vast area of 82,000 square miles north of the Continental Divide of the Brooks Range. About 26,000 square miles of the slope is waterfowl habitat. Geologists recognize three physiographic provinces within this area: the Arctic Coastal Plain, the Arctic Foothills, and the Arctic Mountains. These provinces coincide well with major plant and animal habitats on the Arctic Slope.

The Arctic Coastal Plain rises slowly from the Arctic Ocean to a maximum altitude of 600 ft. Much of this plain is poorly drained and covered by elongated thaw lakes oriented to the prevailing summer winds. These lakes range from a few feet to nine miles long and are 2 to 20 feet deep. The Arctic Ocean shoreline varies from one to ten feet above tidal waters. Offshore is a series of barrier islands, largely composed of gravel and sand (although some are vegetated) which several species of birds use extensively. Natural destruction of lake basins on the coastal plain occurs through surface or subsurface drainage. Many stages of actively draining and drained lake basins are evident on the Coastal Plains. Thaw lakes which are partially drained and contain good stands of emergent plants receive heavy use from waterfowl. Dry lake basins or undrained lake and pond basins are used sparingly by nesting waterfowl.

River valleys and lakes of the Arctic Foothills Province constitute nearly all the remaining waterfowl habitat on

the Arctic Slope. These foothills are rolling plateaus and low linear mountains rising in elevation from 600 to 3,500 ft. Most streams crossing the foothills are swift and braided, meandering across broad gravel beds. In the winter these streams freeze to the bottom and are covered with sheets of overflow ice, causing wide flooding of the gravel flats during spring high water. Waterfowl habitat is confined primarily to the river valleys in this province.

The Arctic Mountains Province contains little waterfowl habitat, except for river valleys and several large rock-basin lakes occurring at the mouths of some glaciated valleys. Several major passes leading through these mountains, such as Anaktuvuk, Howard, and Survey Passes are important migration routes to the Alaskan Arctic Slope and the eastern Canadian Arctic.

The mere presence of a great abundance of water on the Coastal Plain does not mean this habitat supports dense populations of waterfowl. Although the long period of continuous summer sunlight contributes immensely to the basic productivity of these waters, their habitat potential is lower than similar west coast tundra habitat or the Interior basins. Even the highly productive estuarine habitat is limited along the Arctic Ocean, primarily because mean tides of six inches are insufficient to create wide productive intertidal flats.

Within the broad coastal plain and foothill provinces many different plant associations are used by waterfowl during the short summer season. Several different habitat types are present, varying by the life-forms of the vegetation:

**Sedge-Grass Marsh** - Dominant species in this community are sedge and mixed grasses growing in usually low, wet and poorly drained terrain around ponds and lakes on the Arctic Coastal Plain. This type is used for nesting, foraging, and resting by Canada geese, pintails, green-winged teal, greater scaup and old squaws.

**Tussock-Heath Tundra** - This is the dominant habitat of the Arctic Foothills, and also occurs on the pingos and elevated portions of the Arctic Coastal Plain. Tussocks are usually formed by a sedge, *Eriophorum vaginatum*, combined with luxuriant and varied vegetation of many secondary species. Waterfowl use of this type is most common along the edges adjacent to lacustrine waters and sedge-grass marsh. Pintails, common scoters and old squaws often nest in this habitat.

**Dwarf Shrub** - This is most common plant community along the Arctic Foothills streams. It is characterized by dwarf birch, low willows, alders and ericaceous plants and is used mainly for nesting cover by dabblers and divers.

**Tundra-Lacustrine Water Edge** - Composed of either sedge-grass or tussock-heath at the water's edge, this habitat is an important nesting area for yellow-billed loons, Arctic loons, red-throated loons, whistling swans, Canada geese, white-fronted geese, pintails, greenwinged teal, greater scaup and old squaws. It is also used for resting and feeding.

**Bluffs, Slides and Outcrops** - This topographic type occurs along river courses from the foothills to near the sea coast and is used mainly by Canada geese for nesting.

**Fluviatile Waters** - Generally this habitat is used for feeding, nesting, courtship activities and escape purposes. Most of the waterfowl present on the Arctic Slope are found in this habitat at one time or another. It is especially important to red-breasted mergansers, Canada geese, greater scaup, harlequin ducks, and all species of loons, green-winged teal and American widgeons.

**Lacustrine Waters** - These waters include lakes, ponds, oxbows, and all fresh and brackish water basins.



These are both temporary and relatively permanent bodies of captive water and are used by nearly all dabbling ducks, diving ducks, sea ducks, whistling swans, geese, loons, gulls and other wetland species for all activities except nesting (an exception is the red-necked grebe which builds floating nests).

**Alluvial Deposits and Barrier Islands** - Alluvial deposits consist of gravel bars, silt bars and islands (freshwater formed), and estuarine deltas. Barrier islands are gravel deposits formed by wave action off the coast line. These deposits may be vegetated or bare, depending upon whether or not they are inundated regularly by tides. They are very important nesting, feeding and resting habitat for all species of eider, glaucous gulls, black brant, white-fronted geese, whistling swans, old squaws and many others.

**Coastal Lagoons, Bays and Intertidal Waters** - Open salt waters of the Arctic Ocean are used by millions of migrating eiders, loons, old squaws, seabirds and many other waterfowl for molting, feeding, resting and travel.

In summary, Arctic Slope habitat supports many summer resident waterfowl, although large numbers of these birds are apparently nonproductive. Nonbreeders seem to be disproportionately more numerous on the Arctic Slope than in the other waterfowl breeding centers of Alaska. However, this should not influence one's judgment as to the overall value of the Arctic Slope habitat, which serves as a refugium and feeding area for millions of unsuccessful breeding adults, nonbreeding adults, subadults and migrants.

### **Selected Life History Information**

Life history information is very sketchy for Arctic Slope birds, but some species are so abundant and characteristic of the area that a brief review is in order. Red-Throated Loon and Arctic Loon

Red-throated and Arctic loons are among the most numerous and conspicuous birds on the Arctic Slope, with red-throated loons apparently the most abundant of the two species.

Although both nest in approximately the same areas, redthroated loons tend to nest nearer the coast than do Arctic loons. Both species arrive in the Point Barrow area between May 15 and June 1 and nesting occurs from mid-June through July. Two eggs are laid in an open, wet nest next to the water's edge. Departures to wintering areas in the Aleutians, Kodiak and Southcentral Alaska occur between September 15 and early October. Illegal hunting is a mortality factor of undetermined importance.

### **Canada Goose**

Canada geese arrive on the river valleys of the Arctic Coastal Plain and Arctic Foothills in early June and most are nesting by mid-June. Many Canada geese nest on bluffs and talus slopes along the Colville River. Downy young are present from early July to mid-July. Adult molt occurs from early July through early August, mainly along the coast and inland several miles. Birds leave the vicinity of Point Barrow from late August through September. Migrants are thought to use both inland and coastal flyways. One Canada goose banded on the Colville Delta was recovered in Alberta, Canada the following year, but the majority has been recovered in California. Chief mortality factors are hunting, avian and mammalian predation and accidents.

### **Black Brant**

Black brant occupy suitable habitat on the Arctic Slope in varying densities and fluctuating total numbers. Recent aerial surveys provided estimates of 35,000 brant, of which 5,000 were goslings, along the Arctic coast, largely in the Cape Halkett vicinity north of Teshekpuk Lake. Black brant arrive in the Point Barrow area in late May (early record May 20) and begin nesting in early to mid-June. Downy young have been seen as early as June 25. Some spring migrants are thought to reach the Arctic coast via Brooks Range mountain passes. Fall migrants follow the coast to the west, starting in mid-August and continu-

ing through September. Hunting, avian predation on young and eggs, and accidents (such as “sanding” of nests by surf) are mortality factors.

### **White-Fronted Goose**

White-fronted geese arrive on the Arctic Slope in mid-or late May. Nesting begins in early June and first broods usually hatch between July 10 and 20 near the coast. Because the Arctic Foothills phenology is somewhat advanced over that of Coastal Plain habitat, the timing of hatch on the inland areas may be earlier by one week or more. Fall migration starts early as flocks (largely adults) gather in early August. Most white-fronts, including young-of-the-year, have departed from the Arctic Slope by the first week in September. White-fronted geese appear to be the most abundant geese in passage up the Colville River, and therefore an inland spring migration is suspected. Recoveries of white-fronts banded in Saskatchewan and Alaska indicate that Arctic Slope whitefronts winter on the Texas coast and in Mexico. Hunting and losses of young and eggs to predation are thought to be major mortality factors.

### **Snow Goose**

Snow geese are well known as migrants over much of Alaska, but little is known about their nesting and summering status in the state. The Arctic Coastal Plain is apparently the only area in Alaska used by any number of molting snow geese and young. Westward movements of snow geese in the early summer indicate that molting populations are associated with MacKenzie River Delta populations, or possibly those from Perry River in Canada. Spring migrants arrive near Point Barrow as early as mid-May and nesting begins by mid-June. Broods are evident during July. Hunting, predation by birds and mammals, and disease are possible causes of mortality in snow geese.

### **Old Squaw**

Old squaws are common throughout the Arctic Slope. Impressive numbers of molting birds are found inside the barrier islands. Old squaws reach Point Barrow about mid-May or whenever suitable leads open in the pack ice. Nesting commences in late June and downy young may be found on the Arctic Slope from mid-July through mid-August. Nests are most often found in close association with lacustrine waters in stands of sedges or grassy heath cover. Islands are favorite nest locations. The fall migration of old squaws begins in late August and early September, but some birds may remain along the Arctic Coast as late as the first week in October. The birds winter in the Aleutians, Kodiak Island, Southeastern Alaska and along the coast of British Columbia, Washington, Oregon and California. Hunting, nest and brood predation, and starvation are some mortality factors.

### **Common Eider**

Common eiders are characteristic nesters on the offshore barrier islands. Nesting birds are found in tight colonies, often near old shelters or periodically occupied dwellings. Nearly 100 common eider nests were located on Cross Island in 1970. Fifty of these nests were within a 50-yard radius of an old shelter cabin and seven nests were inside the cabin. Colonial nesting by common eiders is of special interest, since they are solitary nesters in other areas.

Common eiders arrive near Point Barrow in early May by following open leads near the shore-fast ice. Nesting does not begin until late June and downy young are commonly seen the last week in July and in early August. Nests are usually placed in sparse beach rye or sedge clumps, but may be simple down-lined depressions in gravel or sand. Common eiders and other coastal nesting species often take advantage of drift debris, building nests near sticks, logs or within the inner debris.

The fall migration of adult male common eiders begins in July with a general westward movement along the coast. Females and young begin to move in mid-August, but young common eiders often do not

reach flight stage until late September. Most migrants gather in large flocks to move west during September.

Common eiders have been recorded on the Arctic coast until late October, and one was collected near Point Barrow on November 18. Common eiders winter chiefly in the Bering Sea south to and including the Aleutian Islands. A few occur around Kodiak Island and the southeast Pacific coastal shores of Game Management Unit 9.

Hunting, predation, starvation and disease are possible mortality factors affecting common eiders. An estimated 100,000 eiders (mostly males) were lost in the Alaskan and Canadian Arctic in the spring of 1964, apparently due to unseasonably cold weather.

### **Whistling Swan**

Banding and neck marking of whistling swans in the Arctic Coastal Plain suggests that these birds are part of the east coast wintering population. Further discussion of whistling swan life history is presented in the section covering the Western Tundra Region.

### **King Eider**

King eiders nest along the entire Arctic coast and are possibly as numerous as common eiders. King eiders nest in colonies on sandspits and islands, and are widely dispersed near freshwater ponds along the coast. Bristol Bay is a major wintering area for these eiders.

### **Seabirds**

Glaucous gulls, Sabine's gulls, Arctic terns and parasitic, pomarine, and long-tailed jaegers are common along the Arctic coast and occasionally into the Arctic Foothills. Mew gulls occupy the Arctic Foothills. Colonies of black-legged kittiwakes, common and thick-billed murres, horned and tufted puffins, and other seabirds nest along the sea-cliffs.

## **PART III: WILDLIFE DISTRIBUTION MAPS**

### **SPECIES MAPPING CATEGORIES**

The mapping categories used show species distribution and known essential habitats. The mapping designations reflect the current state of knowledge of the various species. Because the knowledge is incomplete or fragmentary in many instances, the category "species present" includes species distribution and essential habitat components that can be identified only with additional field work.

### **BLACK BEAR**

#### **Intensive Use - Spring**

This category is used to show those areas known to be important during the critical spring period. Early herbaceous growth is the obvious attraction during these months, and the availability of carrion and young big game animals often coincides with new plant growth. In many areas of the state, black bears concentrate to a lesser degree on the sunny south slopes of the larger mountain ranges. Although this

mapping category could be applied to many of these subalpine areas, no attempt was made to include them all. Only those spring areas of the highest quality and subject to the most intense use by bears were included.

### **Concentration on Fish Streams**

This category is applied only to those streams where concentrations and fishing are known to occur.

### **Present**

Throughout the quadrangles the distribution of black bears is illustrated by encircling the appropriate range. Areas excluded may have unreported bear populations.

## **BROWN-GRIZZLY BEAR**

### **Intensive Use - Spring**

This category presents those areas known to be extremely important to bears during the critical spring period. These relatively small areas are usually characterized by small alluvial plains, steep mountains, grass flats, saltwater bays or sedge meadows, where bears are consistently found during the early spring months.

### **Intensive Use - Spring through Fall**

These are areas which consistently support large numbers (relative to normal bear densities in that type of habitat) of bears through most of the nondenning period. Most of these areas occur along the coast near concentrated denning areas, and are attractive because of lush spring herbaceous growths, adequate cover (including alder and willow zones), better-than-average fish runs of several species, and alpine and subalpine berry crops.

### **Concentrations on Fish Streams**

These concentrations are known to occur consistently and are relative to bear densities in the area and habitat type. This category is assigned only where fishing by bears is known to occur.

### **Known Denning**

Denning was actually observed in these areas.

### **Suspected Denning**

Dens were not actually found in these areas but evidence was available (such as observations of snow beds, numerous tracks or bears in the early spring) to indicate probable denning activity. Areas not marked may be important denning sites unknown at the present time.

### **Present**

The known distribution of brown-grizzly bears is illustrated by encircling the appropriate range. Areas excluded may have unreported bear populations.

## **POLAR BEAR**

### **Winter Distribution**

#### **Low Density**

This category includes much of the shorefast ice and the area in Bering Strait and south of St. Lawrence Island. Bears which get as far south as St. Lawrence Island are probably associated with occasional movement of heavy sea ice south in the fall.

## **Common**

This category includes much of the drifting ice zone off the coast of Alaska.

## **Summer Distribution**

Relative summer densities of polar bears are not well known but the available information suggests bears are concentrated along the southern edge of the drifting ice. The usual width of the concentration is poorly known.

## **Denning**

### **Moderate Use**

The offshore islands and associated stable heavy ice from the mouth of the Colville River to Brown-low Point are denning areas. Bears do not concentrate to den here as they do in "core" denning areas in Canada and Russia.

### **Limited Use**

This category includes shorefast ice and river bottoms approximately 25 miles inland, from Kugaruk River to the Canadian border.

### **Rare Use**

A few bears den in shorefast ice and river bottoms approximately 25 miles inland, from Kugaruk River to Point Hope.

## **WOLF**

### **Present**

This is the only category used because wolves have such broad distribution in different habitat types. Relative densities are poorly known and are subject to dramatic fluctuations. The available population information is presented in the specific Game Management Unit Accounts.

## **WOLVERINE**

### **Present**

This is the only category used. Wolverines are widely distributed over the entire state but they do not concentrate seasonally nor do they have known specific habitat requirements. Information concerning relative abundance is reported in unit accounts.

## **BARREN GROUND CARIBOU**

"Winter range," "summer range" and traditional "calving" areas are illustrated for individual caribou herds where known. An individual herd may not winter or summer in the indicated area in a given year, but has done so at some time in recent years. Calving areas are used annually.

### **Migration Routes**

Known traditional migration routes are shown with arrows.

### **Present**

A thick line surrounds those areas where caribou are present even if they occur only sporadically.

## BISON

Bison, an introduced species, have become established in a few braided river valleys and on one island. Where distribution within these habitats is well known, the mapping categories represent three critical habitats. The categories are “winter range,” “summer range” and “calving” areas.

## SITKA BLACK-TAILED DEER

### Present

This category illustrates the general distribution of the species within Alaska. Because deer are so widely distributed within Southeast Alaska, no attempt was made to delineate general range more specifically. Summer range includes almost all areas above 2,000 ft. elevation within the “species present” category.

### High Density Winter Range

This designation illustrates those areas that have supported high densities of wintering deer over a period of years. It does not include areas that might support high densities only during extreme winters or during population peaks. During population peaks almost all beach fringe is critical high density winter range.

### Low Density Winter Range

Low density winter ranges are those areas that have supported lower densities of wintering deer over a period of years. The designation is relative and subjective.

## DALL SHEEP

### Range

The only mapping category used is “Range”. Too little is known of specific populations in most of the state to attempt to delineate lambing areas, winter ranges, etc.

Dall sheep are known or have been reported to be present in all shaded areas. It is possible sheep are found in unmarked areas where surveys have not been conducted or where reliable reports of their presence were unobtainable. Some areas shown as sheep habitat may not contain sheep at all seasons or even in all years.

Mineral licks are illustrated by a square symbol on some maps. Many others exist but are not so noted.

## ROOSEVELT ELK

The mapping categories used to delineate known habitats for this exotic include the following: “elk present”, “winter range” and “summer range.”

## MOOSE

The categories chosen for illustrating the distribution and concentrations of moose in Alaska were deliberately limited to simplify use of the maps. When there was conflicting information on moose concentrations, the most conservative interpretation was applied.

### Concentration Areas

This category refers to specific areas where surveys, censuses or rarely interviews show that moose from a more general area group together for some essential activity. Densities of moose in these areas vary

considerably between different parts of the state. “Concentration” is used only relative to more general densities in the same area.

### **Spring-Summer Concentrations (1)**

This designation indicates areas where parturient cows, yearlings and some bulls concentrate on favored feeding areas. Often the locations are wet. Salt marshes, bogs, permafrost slumps, flooded areas, and eutrophic lake beds are examples. These areas support large quantities of plants that emerge early in spring and are favored by moose. Some of the areas also have complex interspersions of plant communities including thickets or islands of dense spruce, alder or willow where moose give birth. Some individual calving sites have been used for many years and networks of trails converge on the sites. Not all moose concentrate on these areas and calving also occurs in a variety of other habitats.

### **Fall Concentrations (2)**

These concentrations represent rutting (breeding ground) and post-rutting distribution. Often the areas are at timberline, but similar congregations take place over extensive lowland areas.

### **Winter Concentrations (3)**

This designation illustrates areas where moose concentrate during the winter months.

### **Distribution**

Moose are present in all shaded areas. Their presence may not be year-round, they may be rare, or they may be very abundant. The category makes no distinction.

## **MOUNTAIN GOAT**

### **Goat Range or Goat Present**

This category is used to illustrate areas in the state that are known to contain goats. Some survey information is presented in the Game Management Unit Accounts.

### **Winter Range**

Areas where goats concentrate in winter in Southeast Alaska are designated “winter range.”

## **MUSKOX**

Muskox distribution in the Nunivak Island-Nelson Island area is indicated as “winter range”, “summer range” and “distribution.” The latter category illustrates areas where muskoxen have been sighted but where established winter and summer ranges have not been documented. In other parts of the state “winter range”, “summer range” and “introduction sites” are illustrated.

## **HARBOR SEAL**

### **Ice Breeding Harbor Seals**

#### **Coinciding Ribbon and Harbor Seal Distribution**

Both ribbon and harbor seals concentrate along the edge zone of the seasonal ice pack in the Bering Sea. The maps show the average location in the seasonal sea ice edges. The actual location of the edge and hence the distribution of these species changes with weather conditions throughout each winter and spring and these seasonal changes may vary from year to year. As long as the ice pack remains in the Bering Sea, the relative distribution of both species tends to remain the same regardless of their actual geographic location.

### **Harbor Seal Concentrations**

Within the relatively broad ice edge zone, harbor seals tend to be more abundant at the outer or southern edge of the ice, and this category shows this.

## **Land Breeding Harbor Seals**

### **Harbor Seal Density**

#### **High**

This category is used to designate areas where seals haul out or are abundant. Locations covered by this category may contain ten or more seals hauled out on offshore rocks or thousands of seals utilizing a large beach for breeding, pupping or resting purposes.

#### **Present**

This category is used for most of the areas where seals occur. Seals are commonly seen in most coastal areas of the state but relative densities are poorly known.

### **Marine Mammal Habitat**

This category is represented by a blue line drawn along the 50 fathom curve and applies to sea otters and sea lions as well as to harbor seals.

## **BEARDED SEAL**

### **Bearded Seal Distribution**

#### **Low Density**

Low densities of bearded seals are found where ice conditions are less than ideal, most notably along shore and in the ice edge zone. As the ice pack advances and retreats throughout the year and from year to year the actual location of low densities varies.

#### **High Density**

High densities of bearded seals may occur in almost any area north of the ice edge zone where ice conditions are suitable. The actual location of these areas changes as ice conditions fluctuate. In map M155C, shaded areas illustrate only general summer distribution with no reference to densities.

### **Bearded Seal Spring Migration (reversed in fall)**

Arrows indicate spring migration routes followed by animals moving north with the ice. The size of each arrow indicates the relative magnitude of the movement of seals along the route. In fall and early winter, southward migrations follow the same routes.

## **RIBBON SEAL**

### **Coinciding Ribbon and Harbor Seal Distribution**

Both ribbon and harbor seals concentrate along the edge zone of the seasonal ice pack in the Bering Sea. The maps show the average location of the edge. Distribution of these species changes with weather conditions throughout each winter and spring and these seasonal changes may vary from year to year. As long as the ice pack remains in the Bering Sea, the relative distribution of both species tends to remain the same regardless of their actual geographic location.

### **Ribbon Seal Concentrations**

Within the relatively broad ice edge zone, ribbon seals tend to be more abundant in the inner or northern portion, and this category shows this.

## **RINGED SEAL**



## **Ringed Seal Distribution**

### **Low Density**

Low densities of ringed seals may occur throughout the seasonal ice pack away from shore fast ice. Most of these seals are subadults. The actual extent of this area varies as ice conditions change.

### **High Density**

High density ringed seal areas tend to be in the solid, stable shore-fast ice in winter and spring, where most adults are found and where pupping occurs. The extent of high density areas varies with the extent of suitable ice. In map M155C, shaded areas illustrate only general summer distribution, with no reference to densities.

## **Ringed Seal Spring Migration** (reversed in the fall)

Arrows indicate the direction and location of the northward migration of ringed seals in spring as the ice retreats. The size of each arrow indicates the relative magnitude of the movement of seals along the route. The migration is reversed in fall and early winter.

## **WALRUS**

### **Walrus Distribution**

#### **Low Density**

Low density walrus areas are areas where walrus may occur in small groups when seasonal ice is present. The extent of these areas changes as ice conditions change. Small numbers of walrus may occur outside the area indicated, particularly along the Alaska Peninsula, even when ice is not present.

#### **High Density**

High density indicates locations of extensive clam beds. High concentrations of walrus, including nursery herds, use these areas in spring as long as ice of any type remains over the clam beds.

### **Major Hauling Grounds During Ice Free Periods**

This category includes portions of islands where walrus regularly come onto land after the retreat of seasonal ice. Some of these areas may be used for only a short time each year; whereas, others may be used throughout the ice free period. The hauling grounds are indicated by numbers, which correspond to numbers in the Game Management Unit Accounts, and by a heavy red line pointing to the hauling area. The extent of the hauling area is indicated by a solid red area.

### **Walrus Spring Migration** (reversed in the fall)

Arrows indicate the northward migration of walrus in spring. The size of each arrow indicates the relative magnitude of movement along each route. The migration is reversed in fall.

## **SEA OTTER**

### **Sea Otter Density**

#### **High**

High density describes areas where there is good otter habitat and where populations are at or near the carrying capacity of the habitat.

#### **Low**

Low density describes areas where at least a few sea otters have been sighted but where the population is believed to be well below the carrying capacity of good habitat. Some areas such as inland waters and areas with frequent sea ice may never support high densities; however, most low density areas contain

expanding populations and should eventually become high density areas.

### **Marine Mammal Habitat**

This category is represented by a blue line drawn along the 50 fathom curve and applies to harbor seals and sea lions as well as to sea otters. Sea otters rarely occur in waters more than 40 fathoms deep and most remain in water less than 30 fathoms deep. The area within the 50 fathom curve does tend to indicate the relative amounts of shallow water in different areas, however, and thus usually indicates whether sea otter habitat is extensive or limited in an area.

### **Male Areas**

On map M 19A there are four sea otter symbols indicating male areas near Amchitka Island. Although segregation by sexes is the normal situation in all areas, these are the only male areas whose locations are specifically known, and so they are the only ones illustrated.

## **STELLER SEA LION**

### **Sea Lion Concentrations, Rookeries and Hauling Grounds**

This category designates specific land areas which are known to be regularly used by sealions. A numbered symbol of a sea lion and a line pointing to the location of the rookery is used to designate these areas. Refer to the Game Management Unit Accounts section and the sea lion part of each discussion for additional information about each numbered rookery or hauling ground. The list of rookeries and hauling grounds is not complete. Many areas of Alaska, particularly in the Aleutian Islands, are infrequently visited by man and the opportunities for sighting animals on land are few. It is felt, however, that few if any major rookeries and hauling grounds have been missed.

### **Marine Mammal Habitat**

This category applies to seals and sea otters as well as to sea lions. It is illustrated with a blue line drawn along the 50 fathom curve. Most of a sea lion's life is spent within this area.

## **WATERFOWL AND SEABIRDS**

### **Wintering Areas**

These areas are known to be used by one or more species of waterfowl and/or seabirds during the winter months (December through March).

### **Nesting, Molting**

These areas are known to be used by one or more species of waterfowl for the purposes of reproduction and/or molting during the summer or early fall months.

### **Present**

These areas are known to be used by one or more species of waterfowl and/or seabirds. This category may include resting, feeding or staging areas.

### **Major Migration Routes**

These routes are known to be used by many species and great numbers of waterfowl during periods of migration. Direction of arrows depicts spring and/or fall migration. Seabird migration routes are not included, although they may coincide with waterfowl routes in some instances.

### **Minor Migration Routes**

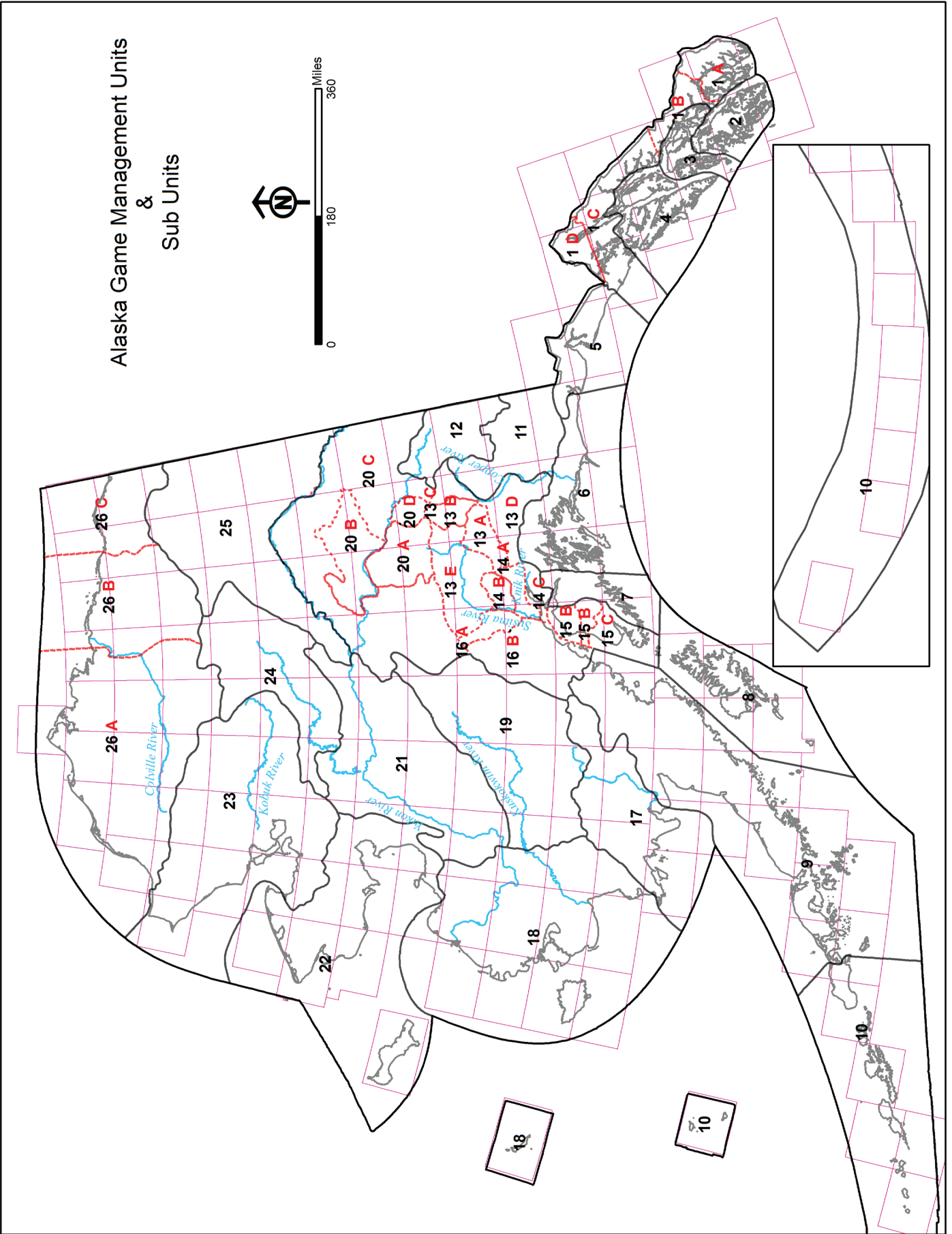
These routes are known to be used by a lesser number of species and/or numbers of waterfowl during periods of migration. Direction of arrows depicts spring and/or fall migration. Seabird migration routes are not included, although they may coincide with waterfowl routes in some instances.

### **Seabird Colonies**

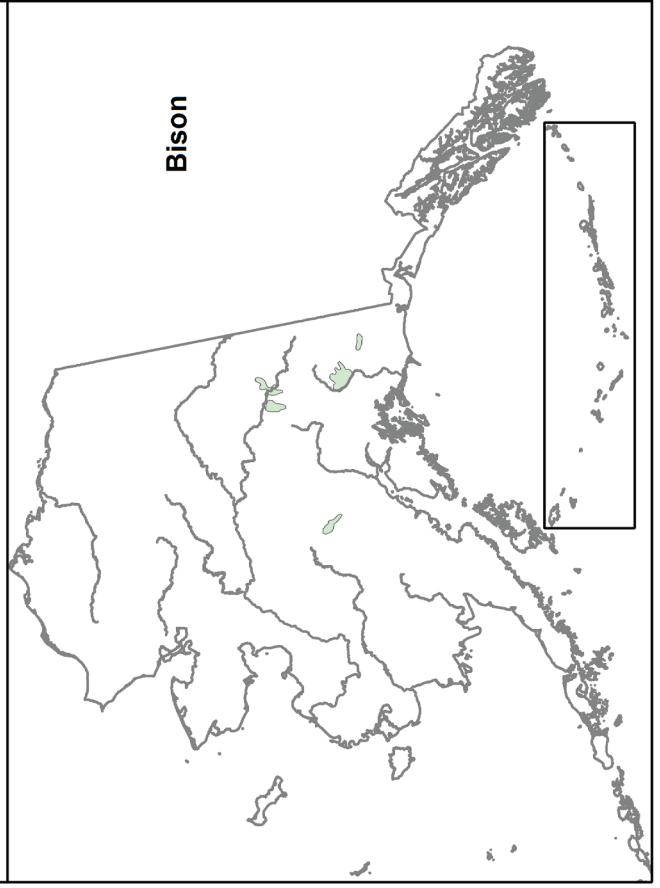
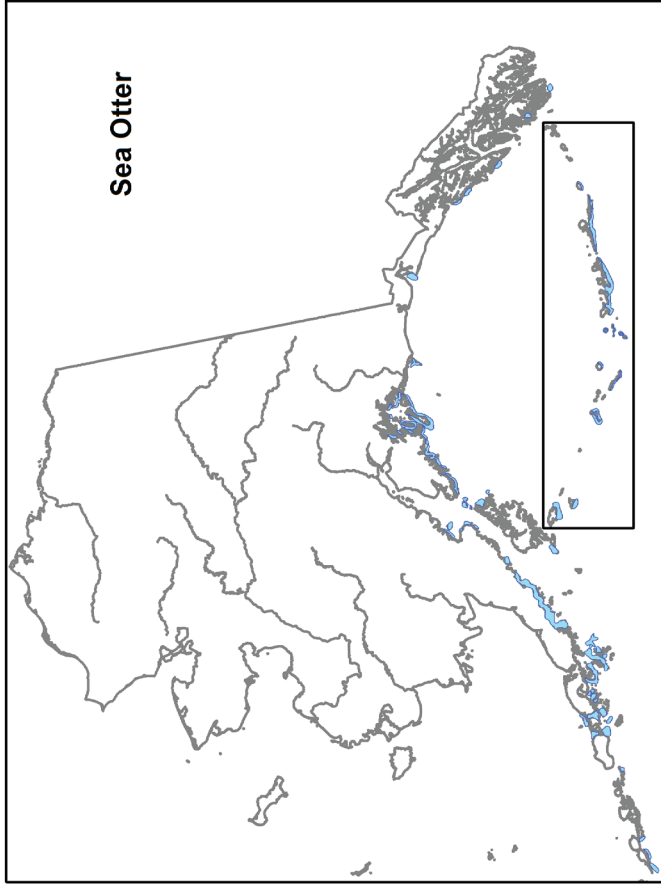
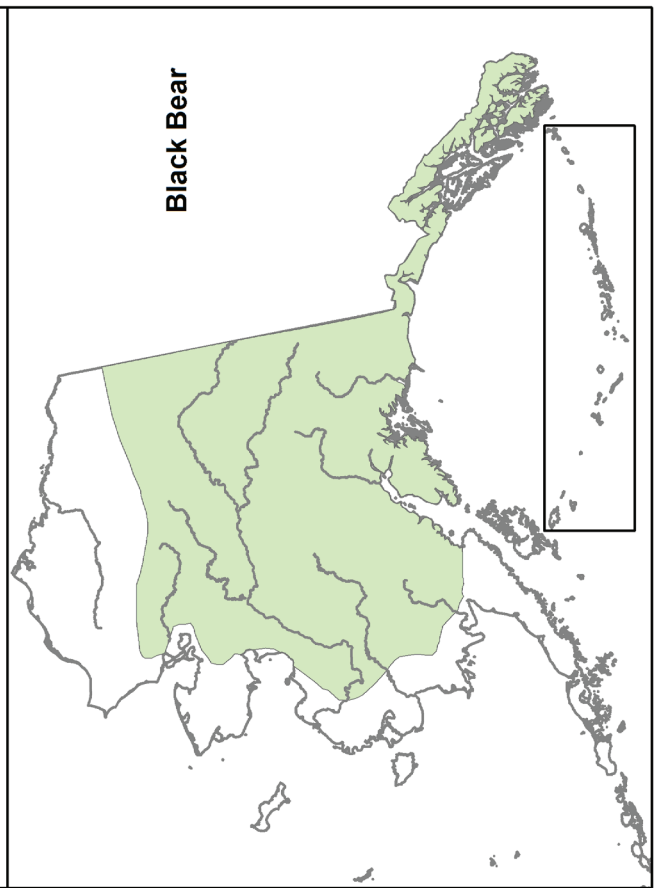
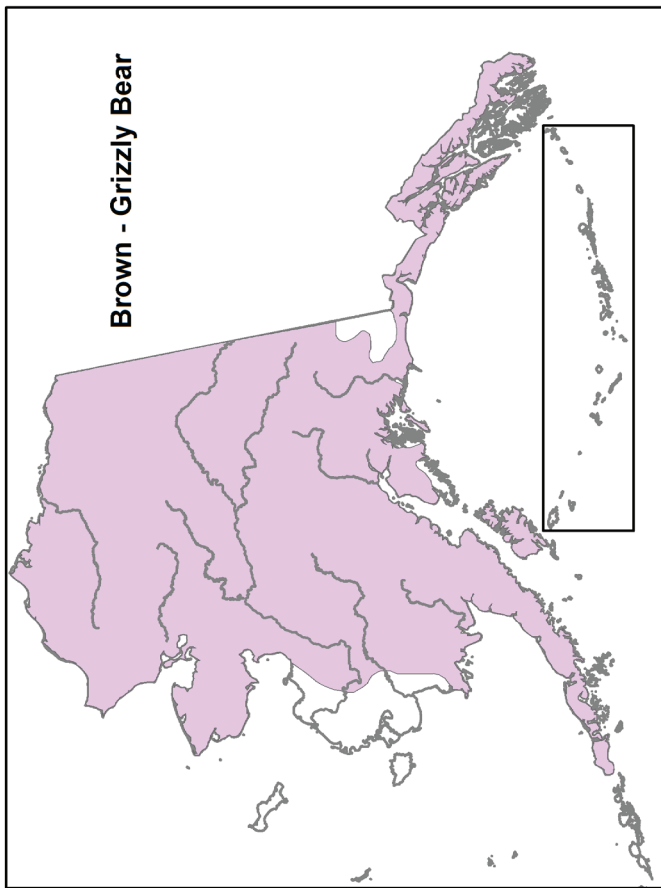
Areas so designated are known to be places where one or more species of seabirds congregate for breeding. The seabird colony number corresponds to listed numbers in each Game Management Unit Account.

0 Numbers of birds known to be more than 100,000 and less than 500,000  
00 Numbers of birds known to be more than 500,000 and less than 1,000,000  
000 Numbers of birds known to be more than 1,000,000  
No symbol - Colony present, numbers unknown.

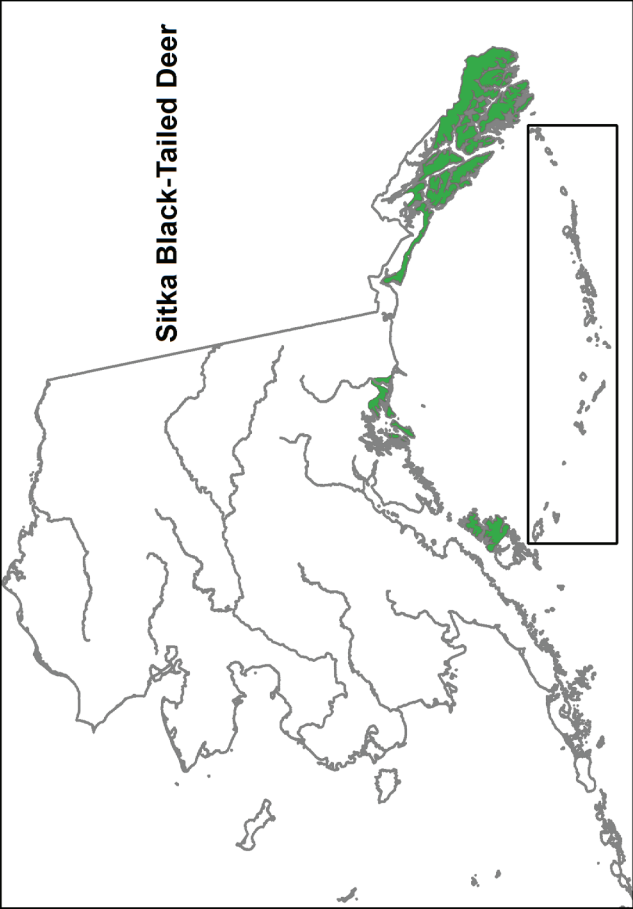
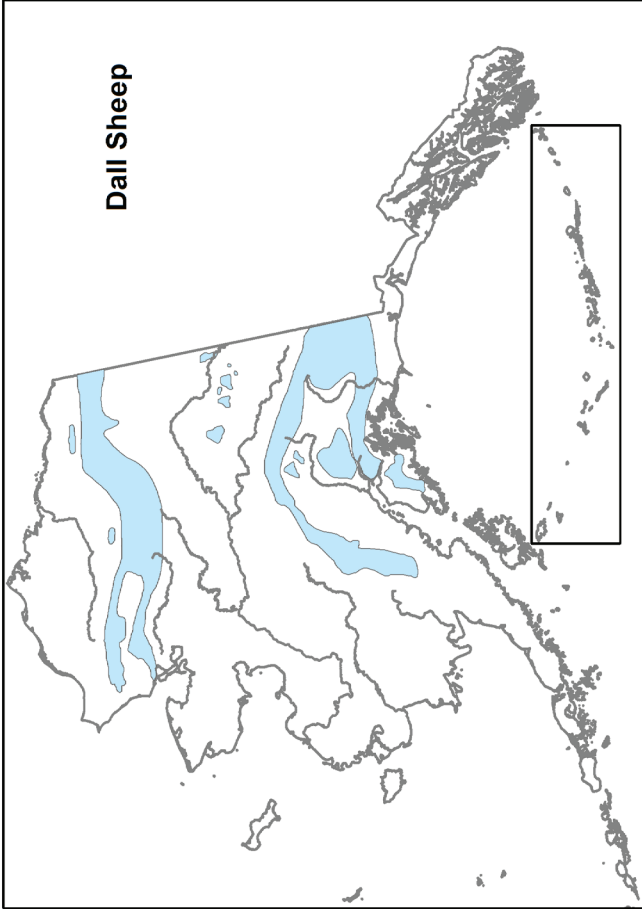
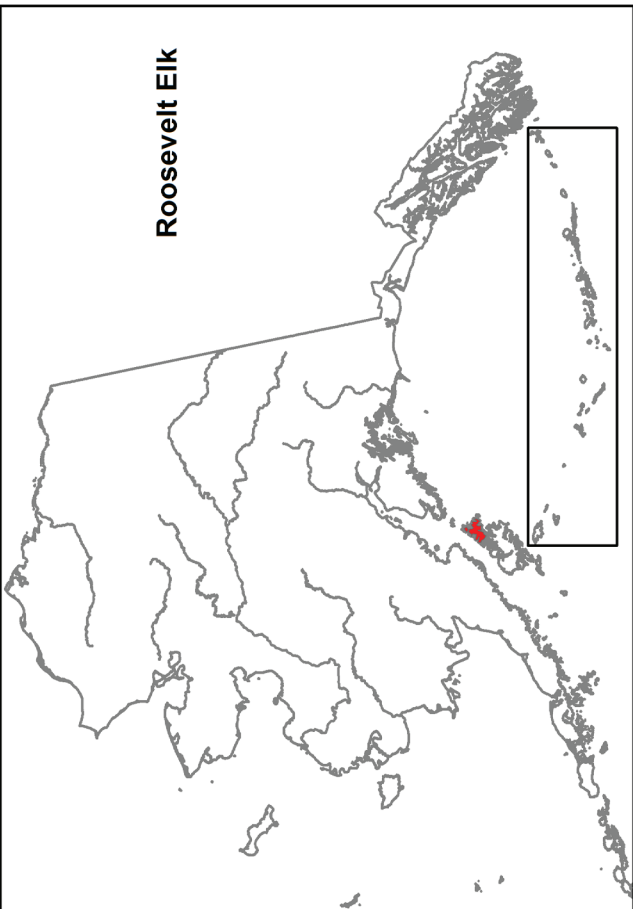
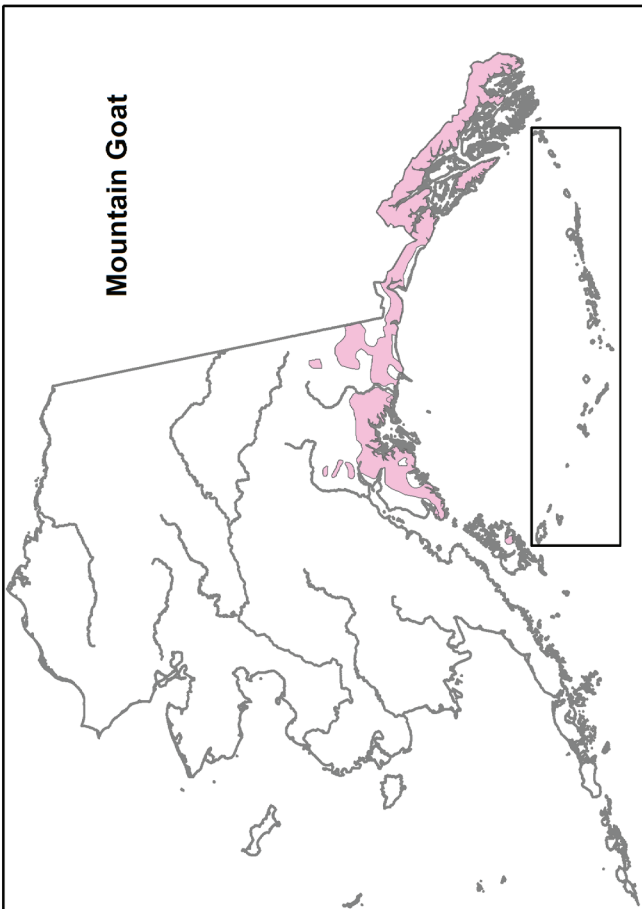
# Alaska Game Management Units & Sub Units



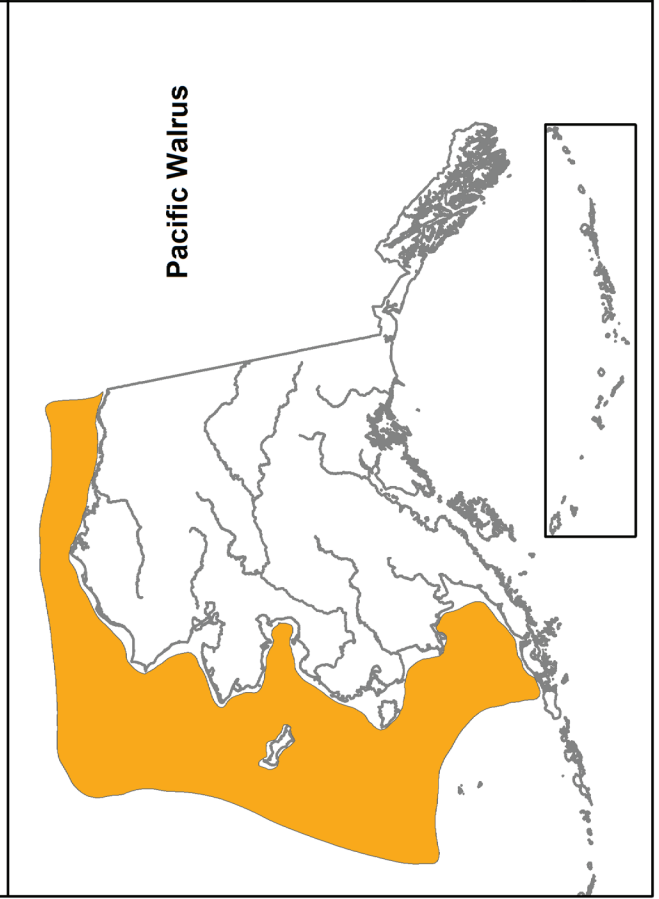
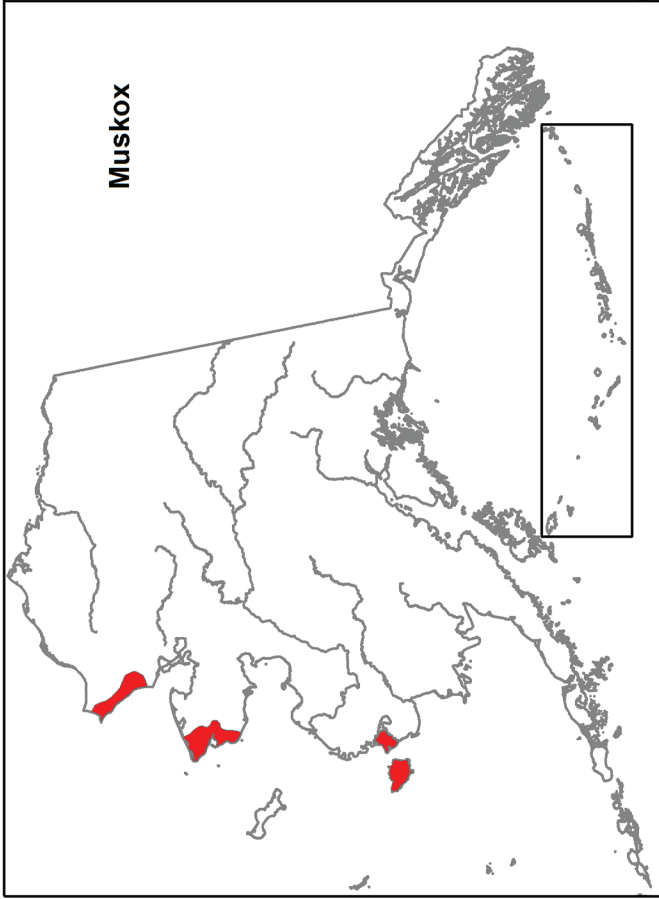
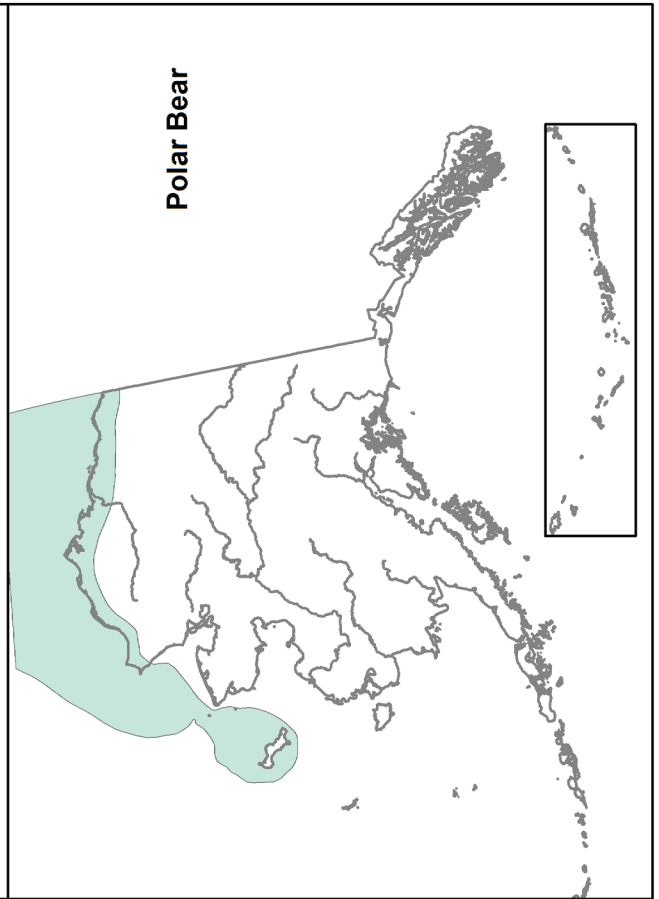
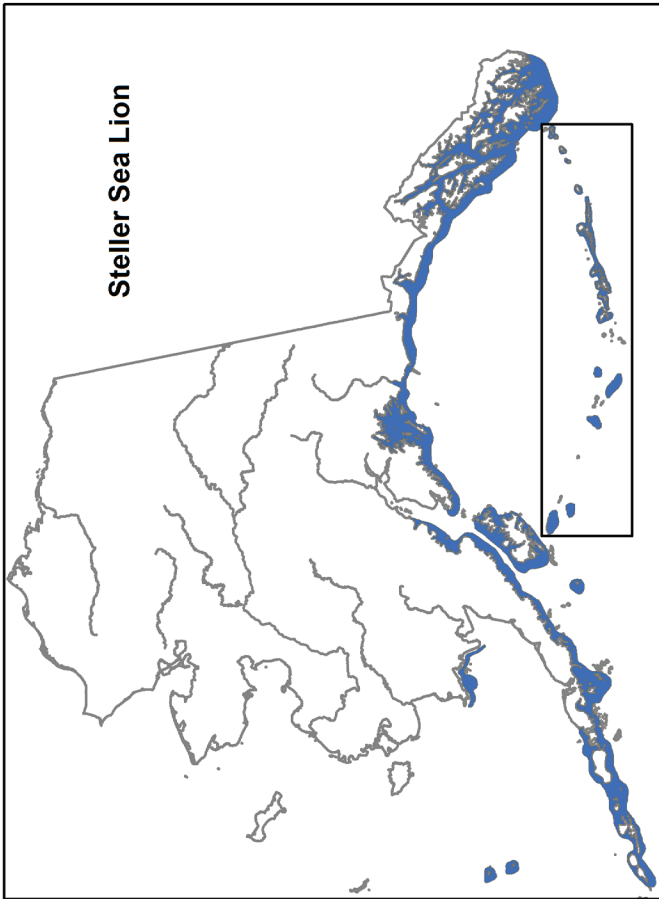
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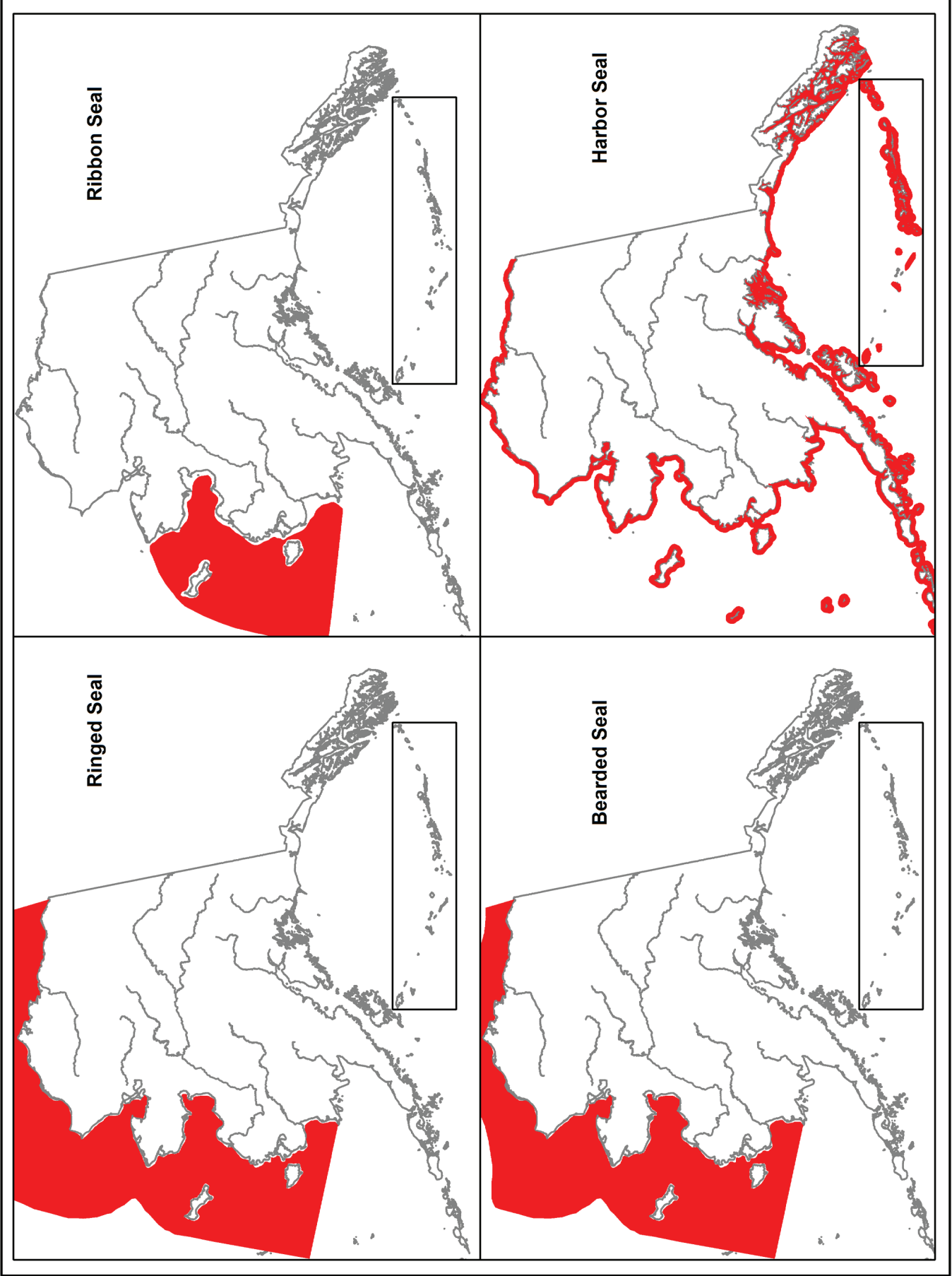
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SPECIES DISTRIBUTION MAPS



SPECIES DISTRIBUTION MAPS





## Part IV: GAME MANAGEMENT UNIT ACCOUNTS

### GAME MANAGEMENT UNIT 1

Game Management Unit 1 includes the entire mainland in Southeast Alaska from Cape Fairweather to Dixon Entrance, as well as Douglas, Revillagigedo and a few smaller islands. The unit extends about 375 miles in a northwesterly direction and is divided into four subunits. Ketchikan and Juneau, the two largest towns in Southeast Alaska, are located in Unit 1.

Unit 1 includes the extremely rugged Alaska Coast Range. The peaks which rise from sea level to over 10,000 ft. have a perpetual snow cover and many glaciers flowing to the sea. The Coast Range is bisected by several major river systems originating in British Columbia. These drainages have provided access from the interior to coastal areas for game species (primarily moose) not found in Units 2 - 4. Although game is not as abundant in Unit 1 as in Units 2 - 4, Unit 1 does contain a wider variety of big game species. It is the only unit in Southeast Alaska where mountain goats, Sitka black-tailed deer, moose, black bears, brown bears, wolves and wolverines co-exist. There is even a record of a mule deer from the Stikine River.

The climate in Unit 1 is generally cooler than on adjacent islands and habitat conditions are progressively more severe from south to north. Deer are usually relatively abundant in the southern portion of the unit and rare in the northern sector.

Vegetation in Unit 1 is similar to that in Units 2 - 4 but ground cover is usually denser and deer use lighter. The forest type is primarily spruce-hemlock, with a higher proportion of spruce than in other units in Southeast. Yellow cedar is present on poorer sites. Western red cedar and salal are found in the southern portion of Unit 1, but not north of the Stikine River.

#### **BLACK BEAR**

(Southeast Alaska: Units 1, 2, 3 and 5)

Black bears are found in Units 1, 2, 3 and 5, but not in Unit 4. Black bear habitat is almost identical to that described below for brown bear. Grass flats in the spring and salmon drainages in the fall are critical components. Black bears do not; however, appear to be quite as dependent on these types as brown bears, for black bear populations remain fairly high even in areas where these types are not present. Berries are more important to black bears, which commonly concentrate in alpine berry patches in fall.

Very little quantitative information is available on black bears in these units. They are common to abundant but the average annual kill is estimated at only 100 animals. Black bears in these units are primarily hunted for trophies, and the meat is seldom used. Most nonresident hunters on brown bear hunts also take one or more black bears. Black bears have an affinity for garbage dumps and soon lose their fear of man. Refuse attracts black bears and many are killed each year near dwellings. Proper disposal of garbage and refuse would eliminate much of this conflict.

Of special interest in Unit 5 is a population containing black bears of the blue color phase, commonly termed the "glacier bear". They are most common in the vicinity of Russel Fiord and Disenchantment Bay near Yakutat. They have also been taken, but only rarely, along the mainland of Unit 1. The glacier bear is a highly valued trophy and this isolated population may require additional protection in the future. Very few are now taken by hunters.

Hunting throughout Units 1-5 has never had an impact on black bear populations. However, in many areas they appear to have become abundant only in recent years.

## **BROWN BEAR**

(Southeast Alaska: Units 1, 4 and 5)

Brown bears are present in Units 1, 4 and 5 of Southeast Alaska, but are not found in Units 2 and 3. Habitat is similar in all five units and the absence of brown bears from Units 2 and 3 cannot be readily explained. Their absence may be related to distribution and movements in the post-glacial period or to inter-specific competition. Both black bears and wolves are present in Units 2 and 3, but are absent from Unit 4, which supports the highest populations of brown bears in Southeast Alaska. The competition theory must be questioned, however, for all three species co-exist in Units 1 and 5 and throughout most of the rest of Alaska.

Brown bear habitat includes several vegetative types from sea level to above timberline. Bears are omnivorous and utilize a wide variety of foods. In spring, skunk cabbage is probably the most important food immediately after bears emerge from their dens. This is augmented by carrion from deer, moose and mountain goats which have succumbed during the winter. In May and June, brown bears concentrate primarily on grass flats in estuarine areas. A wide variety of plant species is used, but most important are sedges, beach rye, sea lorage and beach pea. Bears continue to use skunk cabbage when available.

In late summer and fall, salmon are used extensively by brown bears. Almost every salmon stream in bear habitat has a well-used bear trail along its banks. Berries are also ripening at this season and bears feed on almost every variety available. In Southeast Alaska, salmonberry and blueberry are most common. Some bears spend considerable time above timberline where blueberry is abundant. The estuarine grass flats and salmon drainages appear to be essential for bear populations, for in areas where these habitat types are absent, bears are also absent or scarce.

Brown bears are widely distributed in Unit along major river systems, and are also occasionally found elsewhere throughout the unit. Since 1961, the annual sport harvest has ranged from a low of seven to a high of 27 bears. About 15 bears are taken each year. Most brown bears killed in Unit 1 are taken incidentally to hunting other game species.

## **WOLF**

(Southeast Alaska: Units 1, 2, 3 and 5)

Wolves are common in the southern portion of Unit 1 and in Units 2 and 3. Some wolves are present in the northern portion of Unit 1 and in Unit 5. No wolves have been reported in unit 4. Wolves have successfully adapted to a wide variety of habitats, and characterization of specific habitat is difficult. Wolves in Southeast Alaska appear to have established hunting areas and normally travel the same routes between these locations. This has resulted in well-defined trails which sometimes can be followed for many miles. These travel routes normally follow drainages along the route of least resistance.

Denning and rearing sites probably require the most definitive habitat type used by wolves. In Southeast Alaska these are almost always at the forest edge adjacent to the grass flats of an estuarine area. Even during the winter when dens are not being used family groups of wolves return occasionally to these den sites.

The primary food species for wolves throughout Southeast Alaska are deer, mountain goat, moose, beaver and fish, depending on availability. In times of short food supply, wolves become scavengers and eat almost any edible object. The wolf's use of big game species that are also hunted by man has made him a controversial subject since man first came to Alaska. This is particularly true in Units 1,2 and 3, where wolves use significant numbers of deer. The conflict is particularly intense during periods of low deer abundance when it is difficult for the human hunter to obtain deer. Research in Southeast Alaska has demonstrated that wolves do not eliminate deer populations, but that they are sometimes a significant limiting factor, particularly in combination with severe

winter conditions.

There has been a bounty on wolves in Units 1 - 3 since 1915, but there is no evidence that the incentive of bounty payments has resulted in reduced wolf populations. Only approximately 200 wolves are killed each year by men in Southeast Alaska, so natural factors appear to control wolf numbers. Food availability is probably the most important limiting factor. In recent years, more and more people have recognized the wolf as an integral and desirable part of Southeast Alaska's fauna. Seeing or hearing a wolf is an experience not soon forgotten. Nevertheless, complete protection of wolves is unnecessary and is poor management. They can be utilized and managed as are deer, moose and bears. Reasonable use of wolves and continued attention to collecting management related information about them probably provides the best assurance of their survival in the future.

## **WOLVERINE**

(Southeast Alaska: Units 1, 3 and 5)

Wolverines are rare in Units 1, 3 and 5 and have not been reported in Units 2 and 4. They are rarely seen and only a few are killed each year. Most of these are taken incidentally by wolf trappers. Very little small game is present in Units 1 and 3 and the wolverines here survive mainly by scavenging. There are a few known instances where wolverines have killed deer, but these have occurred only when the deer was already in a weakened condition.

## **SITKA BLACK-TAILED DEER**

Deer in Unit 1 fluctuate in numbers depending upon winter severity, as is the case throughout Southeast Alaska. They are usually relatively abundant in the southern portion of the unit and rare in the northern sector. North of Ernest Sound, winter conditions are usually very severe, but a stable low population of especially large deer is always present. Most deer killed by hunters are taken in the Ketchikan area, with many fewer being harvested around Juneau. When winter survival is fair or good, harvests are often around 2,000 with only 10-15 percent being taken from the northern part of the unit. There is a record of a mule deer taken from the Stikine River valley in Unit 1.

## **MOOSE**

Five distinct moose populations are present in Unit 1; at Haines, Berner's Bay, Taku River, Thomas Bay and Stikine River. A few moose are found in other areas of Unit 1, but populations are very low. The Berner's Bay population stems from an introduction, but all others are indigenous. Moose throughout Unit 1 are of more recent origin than those in other areas of Alaska, having moved into the coastal area through river drainages which have their sources in Canada. Moose habitat in Unit 1, with the exception of Thomas Bay, is a combination of coastal and interior types. Hillsides support dense stands of Sitka spruce and valley floors have a mixture of cottonwood, alder and willows. Moose utilize a wide variety of vegetation, the most important being willow, red osier dogwood, highbush cranberry and blueberry. Although moose populations in Southeast are small compared to other areas of Alaska, they do provide much hunting recreation for local residents.

### **Haines Population**

This is the largest moose population in Unit 1. Prior to 1960, hunting was primarily by local residents who took about 50 bulls a year. The marine transportation system then made the area accessible to other communities of Southeast Alaska and hunting pressure has increased in recent years. In 1964, the first cow season was allowed. Since that time almost equal numbers of cows and bulls have been taken each year and the kill has averaged 100 animals. The population remains productive and is a good example of how an allowable harvest can be increased by allowing either-sex hunting.

## **Berner's Bay Population**

Moose in the Berner's Bay area originate from transplants of 21 calves in 1958 and 1960. The potential moose habitat in this area was limited but range analysis indicated the area would support a small moose population. The population increased rapidly and bull hunting was first allowed in 1963. By 1969, it was apparent that unless more moose were taken, the population would soon exceed the carrying capacity of its limited range, so in 1971 either-sex hunting was allowed by permit. Three bulls and 20 cows were taken from 40 permits issued. If this herd is to remain productive it should be maintained at about its present level, for there is little area available for herd expansion.

## **Taku River and Stikine River Populations**

These populations are similar in many respects and will be discussed together. Both drainages originate in Canada, and there is interchange of some moose between Canada and Alaska. Access is primarily by boat and hunting pressure is high. Only bulls have been legally hunted for many years. Populations are static and the kill ranges between 20 and 30 bulls each year. Most animals taken are less than three years old. Bull-cow and calf-cow ratios are both fairly low. As in other areas of Unit 1, the primary values of moose in the Stikine and Taku River drainages are hunting recreation and meat. Very few sightseers ever enter the area. Bulls rarely attain trophy size antlers. Either-sex hunting would permit more animals to be taken, balance sex ratios, and probably result in increased productivity. Thirty permits to take cows were issued for the Stikine River area for 1972 and either-sex hunting will be recommended for the Taku River in 1973. Vegetation is very dense in both areas. Hunting is unique in that most moose are taken from tree stands.

### **Thomas Bay Population**

This is a very small population of recent origin. Thomas Bay is the only area in Southeast Alaska where a moose population is solely dependent on successional vegetation from logging cuts. The herd is rather temporary and will probably decline when the forest again becomes tall enough to shade out low growing plant species. Hunters take 10 to 15 moose each year from the Thomas Bay area.

### **Chickamin River Introduction**

In 1963 and 1964, 14 moose calves were released at the mouth of the Chickamin River in southern Unit 1. An occasional moose has been observed in the drainage since the transplant but the population does not appear to be increasing.

## **MOUNTAIN GOAT**

(Southeast Alaska: Units 1-5)

The Southeast Alaska coastal mainland (Unit 1) supports some of the largest mountain goat populations in North America. Two habitat types are most used by mountain goats in Unit 1-5: summer and winter range. The vegetative types are almost identical to those described for deer in Units 1-5. Summer range extends from timberline to about 5,000 ft. elevation. Contrary to popular belief, goats in these units are not normally abundant in the high rocky country; for most remain lower, where food is more abundant. They do move up into the higher snow fields on warm days to rest on snow patches, but move down again in evening to feed in the lush alpine meadows. Deer cabbage is the most important summer food, as it is for deer. Winter range for mountain goats is more extensive than for deer, extending from sea level to timberline. Plant species used are identical to those described for deer; however, goats are able to survive on a lower quality diet than are deer. Almost all woody plant species are used to some extent in winter, but blueberry is probably most important. In addition, goats also use salmonberry, elderberry, high bush cranberry, alder, hemlock and many other species. Deer normally browse the current annual growth of woody plant species, but goats utilize much of the older portions of the plants as well.

Goats, in contrast to sheep, appear to thrive in the wet coastal climate. Populations are similar in most areas and appear stable. Surveys since 1960 have shown little change in total numbers. Highest counts have been made in the vicinities of Tracy Arm and the Peabody Mountains south of Ketchikan.

About 300 goats are taken annually by hunters in Unit 1. A few high lakes are available for float plane access into goat country, but for most hunters it is a long hike from the beach up to 3,000 ft. or higher. Hunting pressure is highest adjacent to the larger towns of Juneau and Ketchikan, but in most other areas hunting is biologically insignificant. Winter losses and predation by wolves are probably the most important limiting factors on goat populations.

## **ELEPHANT SEAL**

(Southeast Alaska: Units 1-5)

Elephant seals have been sighted occasionally in Southeast Alaska, but no permanent populations reside in the state.

## **HARBOR SEAL (Units 1-4)**

Harbor seals have long been common residents along Alaska's coast, south of the Arctic. They have been hunted intensively, first by coastal natives for subsistence purposes and, in more recent years, by commercial and sport hunters. They remain abundant throughout their range.

### **Populations**

Harbor seals commonly occur throughout Game Management Units 1-4, but there is no estimate of the total population. The greatest concentrations of seals occur in Glacier Bay National Monument, in a few island areas along the outer coast of Chichagof Island, and in a few glacier-fed bays along the mainland coast. The sport and commercial harvest of seals since 1960 has exceeded 1,000 seals annually and has been as high as 10,000 (1965). Heavy harvests in the mid-1960's depressed seal numbers in many areas; however, the populations appear to have since returned to their former numbers.

**NORTHERN FUR SEAL**-See Unit 10.

## **SEA OTTER**

Sea otters were never abundant in the inland waters of Southeast Alaska. It is unlikely that large numbers existed anywhere in this unit except along the outside coast between Cape Spencer and Cape Fairweather (including the shallow Fairweather Grounds 35 miles offshore) and the area south of Ketchikan. All sea otters in this area were exterminated by commercial fur hunters in the 19th and early 20th Centuries. In 1968, 25 sea otters were transplanted to Cape Spencer. The status of the Cape Spencer transplant is unknown although a well-established population exists nearby (see Unit 4). Occasional stray animals have been sighted throughout the unit. Numbers should increase until otters are scattered throughout the inland waters, with larger concentrations near Cape Spencer and Duke Island.

### **Population**

Probably fewer than 50 sea otters inhabit the unit at the present time.

## **STELLER SEA LION**

(Southeast Alaska: Units 1-5)

Sea lions were intensively harvested for subsistence purposes by natives prior to 1900. As a result, population levels were considerably reduced throughout most of the state. Since the turn of the century, harvest of this species has been very low and populations have recovered to the point where they now appear to be near maximum size.

### Populations

Sea lions have been observed in many locations in Game Management Units 1-5 and a number of surveys have been conducted during the summer months. Of all the locations, only Lowrie Island, Sea Lion Rocks and Cape Horn Rocks are known to be rookeries. The following table lists locations and numbers of sea lions seen at each location.

#### SEA LION ROOKERIES AND HAULING GROUNDS Game Management Units 1, 2, 3, 4 & 5

<u>Quadrangle</u>	<u>Reference No.</u>	<u>Location</u>	<u>Population</u>
Yakutat	390	Sitkagi Bluffs	1,000
Mt. Fairweather	395	Cape Bingham	100
Juneau	400	Benjamin Island	400
	401	The Sisters	50
Sitka	410	White Sisters	300
	411	Pinta Rocks	50
Sundum	415	Stephens Passage (below Point League)	30
	416	Sunset Island	100
	417	West Brother Island (rock on south end)	50
	418	Round Rock	50
Port Alexander	427	Cape Ommaney	100
	426	Yasha Island	50
Craig	430	Hazy Islands	2,500
	431	Timbered Island	200
	432	Cape Addington	600
	433	Approach Point	50
	434	Coronation Island (rocks of north side)	30
Dixon Entrance	440	Lowrie Island	1,000
	441	Cape Horn Rocks & Sea Lion Rocks	3,000

### **WHALES**

(Southeast Alaska: Units 1-5)

Dall porpoises and harbor porpoises are commonly seen in Southeastern Alaska waters. Humpback and finback whales are frequently sighted in the inside passages, particularly in Frederick Sound and Stephens Passage. Killer whales are commonly seen in late spring in Bucareli Bay and the Gulf of Esquibel. Gray whales pass through Southeast Alaska on their annual migrations.

### **WATERFOWL AND SEABIRDS**

## Populations

Although few waterfowl surveys have been conducted in this unit, waterfowl use occurs throughout the year in virtually every bay, and in every river and creek that has fish. Perhaps one-fourth of the breeding ducks and Vancouver geese in Southeast Alaska are located here.

In 1970, a Fish and Wildlife Service census estimated that between 43,600 and 59,000 mallards wintered in Southeast Alaska and that 40 percent of these were in Unit 1. Average populations are probably at least twice this number and perhaps 35,000 mallards actually winter in the unit. Total winter populations of scoters, mergansers, harlequins, old squaws, American goldeneyes and buffleheads are many times greater than of mallards. The Stikine River Delta is a major spring and fall resting/feeding area. The average estimate of geese and ducks on the Delta during three days in October, 1971 was: dabblers - 6,875; snow geese - 1,000; Canada geese - 165. Whistling swans and little brown cranes also use the Delta in both summer and spring.

Glacier Bay National Monument has nesting dabblers, divers and Canada geese scattered throughout the area. Adams Inlet annually accommodates about 3,000 molting Canada geese, and Geike, Hugh Miller, and Carpenter Inlets contain about an additional 2,000 birds.

About 200 molting geese have been observed in Shakey's Slough above the Stikine River Delta. Other small flocks of molting geese are scattered throughout the unit in places such as Swan Lake and Hobart Bay. Unknown numbers of trumpeter swans winter in the southern part of the unit. Following is a list of known seasonal use areas for trumpeters in Unit 1 (F = Fall, W = Winter, S = Spring):

Bakewell Lake · S, F	Manzanita Bay · S, F
Berner's Bay · S, F	Manzanita Lake · S, F
Big Goat Lake · S, F	Patching Lake · S, F
Burrough's Bay · S, F, W	Portage Cover · S, F
Chamberlain Lake · S, F	Punchbowl Lake · S, F
Ella Lake · S, F	Roosevelt Lagoon · S, F
Emma Lake · S, F	Swan Lake · S, F
Heckman Lake · S, F	Thorne Arm · S
January Lake · S, F	Traitor's Cove · S, F
Jordan Lake · S, F	Upper Checats Lake · brood
Lake Grace · S, F	Observed in summer
Little Goat Lake · S, F	Wilson Lake · S, F
Loring Lake · S, F	Winstone Lake · S, F
Lower Harriet Lake · S, F	
Lower Wolf Lake · S, F	

Species of waterfowl breeding in Unit 1 are the same as those breeding in Unit 6, except for dusky Canada geese which do not breed here.

### **Description of Seabird Colony Illustrated on Maps Game Management Unit 1**

<u>Map No.</u>	<u>Location</u>	<u>Colony No.</u>	<u>Species Present</u>
M 12	Glacier Bay Island	111	Glaucous-winged gull, mew gull, black-legged kittiwake, pigeon guillemot, Kittlitz's and ancient murrelets, horned and tufted puffins.

## **Habitat and Land Use Considerations and Recommendations**

The Stikine Delta is jointly managed by the U.S. Forest Service and the Department of Fish and Game. In recent years efforts have been made to improve the area for waterfowl and for hunters by creating potholes on upland sites. This technique may well be useful on many deltas in the unit.

Although pollution of habitat by oil is possible, there appears to be no immediate major threat.

Logging is a major industry in this unit, and the short and long-term effects of logging activities on waterfowl habitat are relatively unknown. A cause for concern is the apparent change in anim. and plant life on bottoms of bays due to bark decomposition in log storage areas. In some cases this change has made bays unattractive to waterfowl. Another unknown is the long-term effect on productivity of streams after watersheds are logged. Effects of logging on Vancouver geese, which breed mainly in mature timber, are unknown.

Waterfowl losses have occurred from pulp mill effluence at Ketchikan.

Growth of Cities, construction of airports and other economic developments will result in some local habitat destruction. For example, expansion of Juneau could virtually eliminate one of the better feeding/resting and hunting areas in the unit.

### **Key Waterfowl Habitat Areas - Game Management Unit 1**

Adams Inlet	Geikie Inlet
Behm Canal	Glacier Bay
Berner's Bay	Gustavus Tidelands
Brown's Cove	Hugh Miller Inlet
Carpentier Inlet	Martin River Flats
Chickamin River Flats	St. James Bay
Chilkat River from Kellsall	Sandborn Canal
River to Haines	Traitor's Cove
Dry Bay	Unuk River Flats
Farragut Bay	Walker's Cove
Gastineau Channel & Mendenhall Flats	Wilson River Flats

Maintenance of habitat in these areas is of state and national concern. Improperly planned alteration of habitat could result in high bird losses and state-owned tide lands in the above listed areas should be designated as critical wildlife habitat.

### **GAME MANAGEMENT UNIT 2**

Unit 2 is located in the southwestern portion of Southeast Alaska. It includes Prince of Wales Island, which is over 2,000 square miles in size, and numerous smaller islands adjacent to the Pacific Ocean. Climate on the west coast is influenced by the ocean and is milder than that of the inner islands and mainland. No large human populations are located in Unit 2, but there are many small villages and logging camps scattered throughout the unit. Many people depend primarily on deer for their meat supply.

Most of Unit 2 has a limestone base. Soils tend to be well drained and, although there are some mountain peaks over 3,000 ft. in elevation, much of the area consists of limestone knobs and relatively low terrain. The major



vegetative difference from other units in Southeast Alaska is the presence of considerable amounts of western red cedar and salal.

**BLACK BEAR** - See Unit 1.

**WOLF** - See Unit 1.

### **SITKA BLACK-TAILED DEER**

The influence of the Pacific Ocean results in a milder climate than in other units. Deer populations tend to be more stable and in some cases appear to be static. Deer are normally plentiful, especially on the outer islands. Constant use of the range by deer on the smaller islands has resulted in a reduction of higher quality food species. Although severe winter losses are uncommon, under similar winter conditions losses in Unit 2 are generally higher than in other units where better quality food is available.

The average deer size on the outer islands is considerably smaller than in other areas of Southeast. This is probably related to both poor quality winter range and less high quality alpine summer range within the unit. Analyses have shown a lower protein content in rumen samples from deer which inhabit the outside coastal islands than those from those closer to the mainland. Even within Unit 2, areas which have plentiful high summer range produce larger deer than those with little high country.

Wolves and black bears, but no brown bears, are present throughout the unit. Predation by wolves is a significant factor in maintaining deer in reasonable balance with their food supply in an area where winter losses are consistently low.

**MOUNTAIN GOAT** - See Unit 1.

**ELEPHANT SEAL** - See Unit 1.

**HARBOR SEAL** - See Unit 1.

**NORTHERN FUR SEAL** - See Unit 10.

### **SEA OTTER**

Sea otters were once abundant along the outside coast of Prince of Wales Island and adjacent islands. All were exterminated by commercial fur hunters in the 19th Century. In 1968, 55 sea otters were transplanted to the Barrier Islands in Cordova Bay and 51 to the Maurelle Islands south of Heceta Island.

Neither of the transplant release sites has been surveyed; however, sea otters have since been sighted in the vicinity of the Heceta Island release site. Eventually sea otters will again be abundant along the outside coast and smaller numbers will be found in other parts of the unit.

### **Populations**

The present population of the unit is probably less than 150 otters.

**STELLER SEA LION** - See Unit 1.

**WHALES** - See Unit 1.

### **WATERFOWL AND SEABIRDS**

### **Populations**

As in other southeast game management units, few formal waterfowl surveys have been conducted in this unit. Waterfowl use occurs throughout the year in virtually every bay, and in every river and creek that has fish. Perhaps one-fourth of the breeding ducks and less than one-fifth of the Vancouver geese in Southeast Alaska are

located here.

The 1970 winter inventory showed that 13,000 mallards were present in Unit 2. This figure can perhaps be doubled to arrive at a realistic estimate of the total population. Total wintering populations of scoters, mergansers, harlequins, old squaws, goldeneyes and buffleheads are many times greater than those of mallards. In the outer islands, scoters probably outnumber all other species combined. As in other units, most bird use occurs within one-half mile of shore, and little use occurs in mid-channel of the large sounds and canals.

The Fish Egg Island area is a large herring spawning grounds, and large numbers of sea ducks concentrate in the area during spawning in April and May. Smeaton Bay, Walker Cove and the McFarland Island area have similar concentrations of birds, which probably feed on herring spawn.

It is very unusual for brant to winter in Alaska, but during the winter of 1970-71, about 20 black brant wintered in Crab Bay near Craig.

Unknown numbers of trumpeter swans winter throughout the unit. Probably Unit 2 has more of these wintering birds than any other game management unit in Southeast Alaska. A list of known seasonal use areas for trumpeters in Unit 2 follows (F = Fall, W = Winter, S = Spring) :

Barnes Lake - F,S	Salmon Lake - F,S
Lake St. Nicholas - F,S	Sarkar Lake System - F ,W,S
Old Frank's Lake - F,S	Sweetbriar Lake - F,S
Red Bay Lake - F ,W,S,	Thorne River - F,S
Salmon Bay - F,W,S,	

Up to 200 swans have been observed during mild winters. Trumpeters no doubt use other areas as well.

Species of waterfowl breeding in the unit are the same as those found in Unit 1.

The following list presents data on known seabird colonies in the unit. Although not so marked on the range maps, Kassin and outer Coronation Islands have scattered colonies of seabirds and/or cormorants. Undoubtedly more colonies exist than are recorded here. Murrelets and guillemots are included, although they are not considered colonial nesters.

#### **Description of Seabird Colonies Indicated on Maps Game Management Unit 2**

<u>Map No.</u>	<u>Location</u>	<u>Colony No.</u>	<u>Species Present</u>
M 3	Timbered Island	114	glaucous-winged gull, common murre
M 3	St. Nicholas Point	115	glaucous-winged gull
M 3	Noyes Island	115A	pelagic cormorant, common murre, glaucous-winged gull
M 2 & 3	Forrester Islands	116	common murre, pigeon guillemot, complex and Wolf Rock glaucous-winged gull, ancient murrelet, Cassin's and rhinoceros auklets, horned and tufted puffins, fork-tailed and Leach's petrels, pelagic cormorant

#### **Habitat and Land Use Considerations and Recommendations**

Effects of logging and economic development, as described in the discussion of Unit 1, constitute relatively unknown threats to waterfowl habitat in Game Management Unit 2.

As in other Southeast Alaska areas, uncontaminated estuarine areas are essential to waterfowl populations in Unit 2. Outer coastal areas are especially susceptible to alteration by oil spills that occur at sea. Action similar to that recommended in the discussion of Unit 6 is required to prevent future oil pollution of waterfowl habitats.

### **Key Waterfowl Habitat Areas - Game Management Unit 2**

Big Salt Lake	Red Bay
Calder Bay	Salmon Bay
Exchange Cove	Sarkar Lakes
Fish Egg Island area	Sea Otter Sound
Forrester Island	Shinaku Inlet
McFarland Island area	Smeaton Bay
Mud Bay	Stanley Creek
Portage Bay	Suemez Island area
Port Estrella	Sweetbriar Lake
Portillo Channel	Trocadero Bay
Port Red Mari na	Walker Cove
Port Refugio	

Wolf Rock Refuge Maintenance of habitat in these areas is of state and national concern. Improperly planned alteration of habitat could result in high bird losses and state-owned tide lands in the above-listed areas should be designated as critical wildlife habitats.

### **GAME MANAGEMENT UNIT 3**

Unit 3 is located centrally in Southeast Alaska. It includes several major islands, the largest being Kupreanof, which is slightly over 1,000 square miles in size. Topography is generally rugged, with many peaks exceeding 3,000 ft., but no mountains have continuous snow cover. Many muskegs are present on the more poorly drained sites, and these produce openings in the forest with much edge area.

The climate in Unit 3 can be quite severe. The area normally has more snowfall than any other unit in Southeast Alaska. There is also more variation in average winter temperature from year to year than in other units.

Two small towns, Petersburg and Wrangell, are located within the unit. Both have economies based on fishing and lumbering and both have a high percentage of residents who are avid deer hunters. Deer meat has historically been an important food item.

**BLACK BEAR** - See Unit 1.

**BROWN BEAR**

No established brown bear populations occur in Unit 3. There are a few reports of brown bears in Unit 3 on islands adjacent to the mainland (Unit 1).

**WOLF** - See Unit 1.

**WOLVERINE** - See Unit 1.

**SITKA BLACK-TAILED DEER**

Unit 3 contains some of the best deer habitat in Southeast Alaska. It is also subject to some of the greatest deer population fluctuations. Populations vary from extremely high during series of mild winters to very low during years of heavy snowfall. When deer populations are high, the carrying capacity of the range is often exceeded.

Winter range deteriorates and when a hard winter comes, losses are high. Much good quality summer range is present and deer average larger than in any Alaska area except the mainland.

Hunter success in Unit 3 varies from poor to extremely good depending on deer status. The kill ranges from about 700 in poor years to over 2,500 in good years.

Unit 3 is similar to Unit 2 in that it supports wolf and black bear populations, but virtually no brown bear. Wolves have more impact on deer populations in Unit 3 than in other areas of Southeast. When deer are increasing or at a peak, the wolf is a balancing factor; however, wolf cycles tend to lag behind those of prey species and when deer numbers are reduced after a series of cold winters, predation by wolves slows or retards the potential rate of increase.

**MOUNTAIN GOAT** - See Unit 1.

**ELEPHANT SEAL** - See Unit 1.

**HARBOR SEAL** - See Unit 1.

**NORTHERN FUR SEAL** - See Unit 1.

**SEA OTTER**

It is unlikely that large numbers of sea otters ever lived in this unit except around Kuiu and Coronation Islands. All were exterminated by fur hunters during the 19th Century.

Occasional stray animals, probably from transplants to adjacent units, are seen in this unit. Eventually the area should support numbers equal to the small aboriginal population.

**STELLER SEA LION** - See Unit 1.

**WHALES** - See Unit 1.

**WATERFOWL AND SEABIRDS**

### Populations

Few waterfowl surveys have been conducted in Unit 3, but perhaps one-fourth of the breeding ducks and one-third of the breeding Vancouver geese in Southeastern Alaska are found here. Security and Saginaw Bays may have the highest densities of breeding geese in the Southeast, and Duncan Canal, Rocky Pass and Tebenkof Bay all have good numbers of breeding geese and ducks. About 21,000 mallards probably winter in Unit 1. Wintering populations of scoters, mergansers, harlequin, old squaw, goldeneye, and bufflehead are many times greater. Unknown numbers of trumpeter swans winter scattered throughout the unit. A list of known seasonal use areas for trumpeters in Unit 3 follows (F = Fall, W = Winter, S = Spring):

Blind Slough - F, W, S

(20-25 each winter)

Harvey Lake - F, W, S

Petersburg Lake - F, W, S

Thayer Lake - F, S

Trumpeters no doubt use additional areas during other times of the year.

Sandhill cranes consistently stop at Blind Slough in both spring and fall. Cranes also stop in other scattered areas for short time periods.

Species of waterfowl breeding in the unit are the same as those breeding in Unit 1.

The following list presents data on known seabird colonies in the unit. Undoubtedly more colonies and species exist than are recorded here. Description of Seabird Colony Indicated on Map

### **Game Management Unit 3**

<u>Map No.</u>	<u>Location</u>	<u>Colony No.</u>	
M 3	Hazy Islands	117	common murre, glaucouswinged gull, mew gull

### **Habitat and Land Use Considerations and Recommendations**

Effects of logging and economic development, as described in Unit 1, constitute relatively unknown threats to waterfowl habitat in Unit 3.

Uncontaminated estuarine areas are essential to preservation of the waterfowl populations in Unit 3. Outer coastal areas of the unit are especially susceptible to oil spills occurring at sea. Action as recommended in Unit 6 is required to prevent future oil pollution of waterfowl habitats.

#### **Key Waterfowl Habitat Areas -Game Management Unit 3**

Bay of Pillars	Rowan Bay
Blind Slough	Saginaw Bay
Colorado Creek	St. John Harbor
Duncan Canal	Security Bay
Hazy Islands	Tebenkof Bay
Kadake Bay	Threemile Arm
Petersburg Creek	Totem Bay
Port Camden	Wrangell Narrows
Rocky Pass & Big John Bay	Zimovia Strait

Maintenance of habitat in these areas is of state and national importance. Improperly planned alteration of habitat could result in losses of many birds, so state-owned tide lands in the above-listed areas should be designated as critical wildlife habitat.

### **GAME MANAGEMENT UNIT 4**

Game Management Unit 4 includes the three large northern islands (Admiralty, Baranof and Chichagof) of Southeast Alaska as well as many smaller islands. Admiralty and Baranof Islands are each about 1,600 square miles in size and Chichagof is somewhat over 2,000 square miles. The western portions of both Baranof and Chichagof Islands are exposed to the Pacific Ocean. Vegetation is similar to that in other Southeast Alaska units, but timberline is somewhat lower than in the southern portion of Southeast Alaska. All three large islands contain much alpine habitat. One major town, Sitka, is situated on Baranof Island and four small villages are also in the unit.

### **BROWN BEAR**

Unit 4 supports the highest brown bear densities in Southeast Alaska. Admiralty, Baranof and Chichagof islands make up the majority of Unit 4, and bears are common to Abundant on all of these islands. Since 1961, the brown bear harvest in Unit 4 has ranged from a low of 27 in 1963 to a high of 77 in 1971. There has been a gradual increase in the number of bears taken each year; however, there is no evidence that hunting is adversely affecting populations. The average age of 65 bears taken in Unit 4 in 1971 was 8.0 years. About 50 percent of the

annual kill is usually taken on Admiralty Island. Pybus, Gambier and Chaik Bays have historically produced more bears for hunters than other areas in Unit 4. Average skull and hide sizes are about the same as in other Southeastern units, but exceptionally large bears are rare. Hunting is confined almost exclusively to grass flats at stream estuaries in the spring and along salmon streams in the fall.

Extensive logging has taken place on Baranof and Chichagof Islands in areas which support good bear populations. There is no present evidence that cutting timber is detrimental to bear populations; however, it does influence the aesthetic quality of hunting. Since brown bear-people contacts usually result in conflict, increased human activity in any area will probably influence brown bears more than any other factor.

### **SITKA BLACK-TAILED DEER**

Deer are generally abundant in Unit 4 and populations fluctuate less here than they do in Unit 3. Deer ranges in most areas show heavy use; winter losses are normally quite high except on the outside coast. This may be related to the fact that no wolves or black bears occur in Unit 4; however, the unit does support the major brown bear population in Southeast Alaska.

### **MOUNTAIN GOAT**

Baranof Island in Unit 4 has a thriving goat population which stems from a transplant of 18 animals in 1923. Hunting was first allowed in 1950. Population increase and range expansion has been slow. The herd now exceeds 200 and is capable of supporting the hunting pressure by local residents of Sitka. About 30 goats are taken from this herd annually. The extremely rough terrain and lack of high lakes make goat hunting on Baranof Island the sport of only a few rugged individuals.

An additional transplant of 33 goats was made to Chichagof Island between 1954 and 1957. There have been occasional reports of goats being sighted in recent years; however, despite several intensive surveys, none of these reports have been confirmed.

**ELEPHANT SEAL** - See Unit 1.

**HARBOR SEAL** - See Unit 1.

**NORTHERN FUR SEAL** - See Unit 10.

### **SEA OTTER**

The outside coasts of Baranof, Chichagof, Kruzof and Yakobi Islands once supported large populations of sea otters, and lesser numbers were scattered throughout the remainder of the unit. All were exterminated by commercial fur hunters in the 19th Century. Between 1965 and 1969 a total of 272 sea otters were transplanted into the unit. Forty-eight of these were released near the Necker Islands, 30 at the south end of Lisianski Strait and the remainder in Khaz Bay. Well-established populations of sea otters currently inhabit Khaz Bay and Yakobi Island. Smaller numbers are regularly seen along the entire outside coast from Necker Bay to Cross Sound. Otters also are seen occasionally in the inside waters of the unit. These populations should continue to expand to their aboriginal levels.

### **Populations**

The present population probably numbers fewer than 350 animals.

**STELLER SEA LION** - See Unit 1.

**WHALES** - See Unit 1.

### **WATERFOWL AND SEABIRDS**

## Populations

Few waterfowl surveys have been conducted in Unit 4, but one-fourth of the breeding ducks and one third of the breeding Vancouver geese in Southeast Alaska probably occur in this unit. The Seymour Canal is one of the best goose production areas in Southeast Alaska, supporting an estimated pair of breeding Canadas per linear mile of beach. Pybus Bay, Gambier Bay, Hood Bay, Mitchell Bay and Tenakee Inlet are other important goose breeding areas. The 1970 winter inventory counted 10,200 mallards in Unit 4, but actual populations could well be over 20,000. Wintering populations of scoters, mergansers, harlequin, old squaw, American goldeneye and bufflehead are many times larger. Although waterfowl winter throughout the unit, waters in inlets on the east side and southern end of Baranof Island generally freeze, so relatively few birds are found there. Fish Bay and Nakwisina Sound on the northern end of the island are especially good wintering areas for scoters and divers. Sandhill cranes do not concentrate in large numbers during spring or fall, and apparently stop only briefly on suitable tide flat areas. Unknown numbers of trumpeter swans winter in the southern part of the unit. Trumpeter use of other areas occurs during other times of the year. A list of known seasonal use areas by trumpeter swans in Unit 4 follows (F = Fall, W = Winter, S = Spring):

Alecks Lake - S, W, F	Lake Alexander - S, F
Beaver Lake - S, F	Lake Guerin - S, F
Davidson Lake - S, F,	McKinney Lake - S, F
Distin Lake - S, F	Mitchell Bay - S, W, F
Hasselborg Lake - S, F	

Species of waterfowl breeding in Unit 4 are the same as those listed for Unit I. The following list presents data on known seabird colonies in the unit. Undoubtedly more colonies and species exist than are recorded here.

### **Description of Seabird Colonies Indicated on Maps Game Management Unit 4**

Map No.	Location	Colony No.	Species Present
M7	St. Lazaria Island	112	common murre, rhinoceros auklet, tufted puffins, fork-tailed and Leach's petrels, glaucous-winged gull, black-legged kittiwake, mew gull .
M7	Necker Islands	113 common	murre, glaucous-winged gull, black-legged kittiwake, mew gull .

## Land Use Considerations and Recommendations

Logging and economic development in the unit threaten possible damage to waterfowl habitat in Unit 4. Waterfowl losses have already resulted from pulp mill effluence at Sitka.

Uncontaminated estuarine areas are essential for maintenance of present numbers of waterfowl and seabirds. The outside coasts of Unit 4 are especially susceptible to oil spills, and action similar to that described in the Unit 6 discussion is recommended to prevent such spills. Federal protection of St. Lazaria Island should insure the future existence of the large seabird colonies on the island.

### **Key Waterfowl Habitat Areas - Game Management Unit 4**

Baranof Island (southwest side) *	
Chaik Bay	Gambier Bay
Favorite Bay	Hoonah Sound
Fish Bay	Kadashan Bay

\*Major pelagic feeding areas.  
Kruzof I sland (west side) \*  
Mitchell Bay  
Neka Sound

Pybus Bay  
St. Lazaria Islands  
Seymour Canal  
Young's Bay

Maintenance of habitat in these areas is of state and national concern. Improperly planned alteration of habitat could result in high bird losses, and state-owned tide lands in the above-listed areas should be designated as critical wildlife habitat.

## GAME MANAGEMENT UNIT 5

Unit 5 includes the Yakutat area along the coastal mainland between Icy Cape and Cape Fairweather. This region is exposed to the Gulf of Alaska. The climate is cooler than that of Southeast Alaska and it is a region of heavy snowfall. Much of the Yakutat area is only a few feet above sea level.

**BLACK BEAR** - See Unit 1.

**BROWN BEAR** (Also see Unit 1)

Little information is available on brown bear populations in Unit 5. Between 15 and 20 bears are taken by hunters annually, mostly incidental to moose hunting. Bears are reasonably abundant in the unit, as attested by the fact that the entrails from almost every hunter-killed moose are appropriated by a bear. Up to the present time, few brown bears have been taken in Unit 5 by nonresident hunters. With increased restrictions in other areas, more pressure can be expected in this unit from guided hunts.

**WOLF** - See Unit 1.

**WOLVERINE** - See Unit 1.

**SITKA BLACK-TAILED DEER**

Deer are not native to Yakutat, but stem from a transplant of 12 animals in 1934. This is a marginal area for deer. They have done quite well on the small islands in Yakutat Bay but are rarely seen on the mainland.

The small islands which deer occupy are low with a dense canopy of scrub spruce and hemlock. Plant species used by deer are mainly the same as those in Southeast Alaska; however, deer use beach vegetation during the summer much more than in Southeast. Deer inhabiting the Yakutat Islands are much smaller than the average deer in Southeast Alaska, probably because of the absence of high quality summer range.

Deer hunting at Yakutat is primarily by local residents. The total kill is small, probably less than 100 per year, but is important to the few local people. In spite of the abundance of moose in the Yakutat area, many residents prefer deer because they are easy to handle and provide high quality meat.

### **Land Use Considerations and Recommendations**

With the exception of Kodiak and adjacent small islands, all major deer habitat in Alaska is within the Tongass or Chugach National Forests. Until recently man has had little impact on this region. There have also been few natural disturbances. Fires rarely occur in this wet, cool climate. Human populations are sparse and access is generally by airplane or boat. Much of the area has undergone little change in the last several hundred years.

Early settlers included miners, fishermen, loggers and furfarmers. Today, fishing, lumbering and tourism provide the economic base throughout most of southcoastal Alaska. Of these, lumbering has had the most significant im-



impact on deer habitat. Until as recently as the early 1950's, most logging operations were small. During the past 20 years two large pulp mills have been established and timber harvesting has increased many-fold. Very large cuts were allowed, some exceeding 2,000 acres. As in most other black-tail areas, timber removal stimulates growth of plant species which are normally under forest cover. The problem in Alaska is that snow usually covers these open areas in winter, making them unavailable to deer and reducing the amount of winter range at the time it is most needed. The edge areas of these clear-cuts do provide both food and cover, and in most cases are beneficial to deer. The ideal solution is to reduce the cut size, making smaller forest openings than the present cuts afford. This is especially important where timber removal includes areas of critical deer winter range. With the exception of timber removal, other foreseeable land use practices will have very little impact on deer populations in Alaska.

## **MOOSE**

A few moose are present throughout Unit 5, but the major concentration is located along the coastal area near Yakutat. Moose began populating this area in the early 1900's, moving down the river drainages which bisect the coast range. They are now abundant and liberal either-sex seasons have been allowed since 1961. Approximately 2,500 moose were recently counted on a total count census effort. Total count censuses of moose tend to underestimate the true population by a large factor and a population estimate of 4,000 to 5,000 moose appears reasonable.

Examination of gravid female moose from the Yakutat area shows they have the highest initial productivity reported for any North American moose population. Approximately 70 percent of the yearlings ovulate and 60 percent of the multiparous females contain twin fetuses. The annual kill averages about 300 animals, usually fairly equally divided between cows and bulls. Hunter success is good, averaging about 50 percent.

The Yakutat area is excellent moose habitat. Spruce forests provide winter cover and willow and other shrubs are readily available for food. Yakutat has no road link with other areas of Alaska and access is almost entirely by commercial airlines. Hunting is confined to the rather small portion of moose habitat adjacent to bush airstrips and along the limited local road system.

Extensive logging is planned near Yakutat in the future. Logging roads will provide access to many areas not previously available to hunters. This is a region of heavy snowfall and it is important some timbered areas be left for winter cover.

## **MOUNTAIN GOAT**

Mountain goats are common throughout the coastal mountains of Unit 5. Most areas are rarely hunted; however, a few goats are taken each year near Yakutat. Populations appear stable and hunting is biologically insignificant at this time.

## **HARBOR SEAL**

Harbor seals are very abundant in areas of Yakutat Bay and Icy Bay. Population estimates are not available, but the area produced an annual harvest of 4,000 to 6,000 seals (mostly pups) for a number of years during the 1960's when seal prices were high.

**NORTHERN FUR SEAL** - See Unit 10.

**STELLER SEA LION** - See Unit 1.

**SEA OTTER**

Yakutat Bay and the outside coast once supported large numbers of sea otters. All were exterminated by commercial fur hunters in the 19th Century. In 1966, ten were transplanted to Yakutat Bay, and there is some evidence that other otters may have immigrated from the west (see Unit 6). Small numbers of sea otters have been sighted throughout the unit. Total numbers are unknown.

**WHALES** - See Unit 1.

**WATERFOWL AND SEABIRDS**

**Populations**

There have been no waterfowl surveys conducted in this unit, even though thousands of migrating birds use the immediate tidal zone habitat in spring and fall. Most waterfowl use occurs from tide line to about 400 ft. elevation.

Casual observations during the fall in the Yakutat area suggest peak Canada goose populations are over 10,000, snow geese number 10,000, swans 3,000 plus (both species), sandhill cranes several thousand, ducks thousands and shore birds in the millions. Spring population estimates are unavailable, but waterfowl numbers are large.

Pairs of Canada geese have been sighted on small wooded streams in May and June, and young geese have been observed during mid-summer, so we suspect an unknown but probably small number of geese (probably the Vancouver subspecies) breed in the area from Yakutat south.

Wintering mallards, Canada geese, some divers and sea ducks occur in unknown numbers where open water with suitable food is present. Swans (probably trumpeters) have also been observed during the winter.

Species of waterfowl breeding in Unit 5 are the same as those listed for Unit 6, except dusky Canada geese probably do not breed here.

The following list presents information on the seabird colony shown on the maps. Undoubtedly more colonies exist and more species breed in the unit. Guillemots are included, although they are not generally considered colonial nesters.

**Description of Seabird Colony Indicated on Map  
Game Management Unit 5**

<u>Map No.</u>	<u>Location</u>	<u>Colony No.</u>	<u>Species Present</u>
M 15	Yakutat Bay Islands	110	glaucous-winged gull, pigeon guillemot, black-legged kittiwake.

**Habitat and Land Use Considerations and Recommendations**

Primary waterfowl habitat in the unit is associated with intertidal and estuarine areas, and is therefore susceptible to oil pollution. Precautions such as recommended for Unit 6 are necessary in the future.

Upland oil exploration in the unit is imminent. Although upland spills do not constitute the potential damage that offshore oil spills do, pollution of localized habitat is possible without proper planning and surveillance of the drilling. Forest Service ownership of most upland areas should foster proper supervision of oil exploration activities.

## Key Waterfowl Habitat Areas - Game Management Unit 5

Akwe River Drainage  
Dangerous River Drainage

Dry Bay  
Situk River Drainage

Maintenance of habitat in these areas is of state and national concern, for improperly planned alteration of habitat could result in high bird losses. State-owned tide lands in the above-listed areas should be designated critical wildlife habitats.

## GAME MANAGEMENT UNIT 6

The spectacular fiords, glaciers and islands of Prince William Sound characterize Game Management Unit 6. The unit includes the islands and coastal fringe of mainland that extend in an arc from Icy Cape on the southeast to Cape Fairfield on the southwest.

The mainland largely consists of sheer mountains with glacier covered tops and valleys. Most drainage is short, glacial and steep. In contrast, the islands have relatively little rugged terrain, with few peaks exceeding 3,000 ft. in elevation.

The Copper River Delta is an exception to the otherwise rugged coastline. The delta is broad and flat with many ponds, lakes, and silt-laden streams. The 1964 earthquake uplifted much of the delta, and triggered continuing changes in the area's vegetation and in its ability to support game populations.

Unit 6 is exposed to the Gulf of Alaska and has a cool, wet climate and heavy snowfall-as much as 40 feet a year in some coastal areas. Timberline is rather low, often around 1,500 ft., but sometimes as low as shoreline. Spruce-hemlock forest is the dominant vegetation type. Alder is dense and wide-spread and willow is abundant in the Copper River flats and along other drainages.

The coastal waters are rich in marine mammals and commercial fishing is the life blood of the area's economy. Few people live in the unit, and most of them depend upon renewable resources for their livelihood.

### **BLACK BEAR**

Black bears occur throughout most of the mainland portion of Unit 6, but on very few of the islands. Glacier bears (the blue color phase of the black bear) are found in the same general area, especially east of the Suckling Hills. As in other areas of the state, the black bears here prefer forested habitat. Seasonal uses of tidal flats, alpine and subalpine zones, and open meadows are also common.

Black bear hunting has become increasingly popular in the unit since the early 1960's. Although specific harvest data are not available for most of the area, there is some indication that hunting pressures in the Valdez Arm, Port Wells and from Port Gravina to Cordova were sufficient to reduce black bear numbers. Spring hunting from boats is very efficient when bears are clearly visible on open slopes and tidal flats.

### **Population**

Black bear densities are only roughly known, although estimates of 8 to 10 bear per square mile of prime habitat have been made for relatively small portions of upper Prince William Sound. Prime habitat in these areas occurs in narrow strips running from alpine areas to the tidal line.

### **Specific Habitat Considerations**

A few critical areas of spring concentrations are shown on the maps because of their size and traditional use by bears. In addition, many other south facing slopes are important early spring use areas due to early emerging grasses, sedges, horsetails, false hellebore, and herbs. Horsetails and foliage of salmonberry, cranberry and blueberry are used extensively in some areas. During summer and fall, bears switch to diets of mostly salmon and berries.

Black bear population levels in this area fluctuate a great deal year-to-year. This is probably because severe winters or late springs have serious effects on denning success, cub survival, and post-denning adult survival in areas where good habitat is limited.

The overlap of critical habitat for both brown and black bears in the unit demonstrates the two species do tolerate each other in some instances.

More than likely, denning periods are similar to those of brown bears in the same areas. Denning usually begins by late October and lasts through April. Males and single bears seem to den later and emerge earlier than do sows with cubs.

### **Recommendations**

Protection of habitat in spring concentration areas, maintenance of salmon stocks and preservation of alpine and subalpine zones are necessary to proper black bear management. When logging occurs, small clearings are more beneficial to black bears than are larger ones. The release of berry-producing plants by the selective removal of mature timber should be considered when timber cuts are designed.

### **BROWN BEAR**

Brown bears occur on some of the major islands and much of the mainland in Unit 6. The major island populations are on Hinchinbrook, Montague and Kayak Islands. A few bears also inhabit Hawkins Island. On the mainland, bears are most numerous from Port Fidalgo eastward to Icy Bay. Brown bears do not normally inhabit any of the western portions of Prince William Sound, although individual bears have probably wandered into some of these areas.

From 1961 to 1971, 361 brown bears were reported killed in the unit. The highest recorded annual harvest was 63 in 1968.

### **Populations**

No estimates of brown bear populations have been made for this unit. Population densities appear lower than on Kodiak Island and the Alaska Peninsula.

### **Specific Habitat Considerations**

The terrain in Unit 6 is rugged with limited good bear habitat. What habitat does exist is sometimes further restricted by unfavorable weather conditions, particularly deep snow. As is typical of these coastal areas, spring habitat is critical because it is limited and because the immediate post-emergent period is especially stressful for bears.

Bears emerging from dens in early spring often find travel difficult as they are forced to the tidal flats and snow-free south slopes. Grasses, particularly beach rye and bluejoint, sedges, horsetails, red poque, cow parsnip, and other early green plants make up the major portion of their spring diet. Scavenging is common at this time of year and bears will eat practically anything that is readily available, including waterfowl, eggs, moose calves, winter-killed game, carrion and garbage.

During August and September, bears concentrate along streams to feed on spawning salmon. Other than in the Copper River, Eyak Lake, Martin Lake and certain other smaller systems where red salmon are abundant, the primary salmon species are pink, chum and silver salmon. Silver salmon are often available as late as October or November.

Blueberries ripen early in August and attract bears away from the streams somewhat, although movements from the alpine and subalpine zones to salmon streams do continue until fish are no longer available. Salmonberries, elderberries, and highbush and lowbush cranberries are also utilized extensively when available.

Concentrations of brown bears from Ikalee Spit to Cape Yakataga during the late spring and summer seem to be associated with green grasses, forbs and particularly wild strawberries and spawning salmon.

Very little is known of denning activities in this unit, although the basic slope and vegetative zone requirements are similar to those discussed for Units 8 and 9. Bears appear to den later in the Prince William Sound area than they do farther north, probably because of the coastal climate. Timing of denning compares with that found on Kodiak Island and in most areas of the Alaska Peninsula. There is some indication, however, that the bears in Unit 6 emerge later in the spring. During extremely mild winters lone bears travel about all year long.

### **Land Use Considerations and Recommendations**

If care is taken to protect the critical high use areas, protect water quality and the salmon resource, and guard against extensive damage to the alpine and subalpine zones, and if direct human conflicts are kept to a minimum, little or no permanent damage to brown bear populations will occur. Given a minimum of protection, brown bears can coexist with human activities under most circumstances.

Future logging activities in the more heavily forested areas should be conducted in such a manner as to alternate clear cuttings. Leave strips along streams and heads of major bays are essential to protection of bear habitat.

### **WOLF**

Wolves have never been common in Unit 6, although they do occur in most of the area. As moose populations increase in the unit in the future, a consequent ingress of wolves from the north might occur.

### **WOLVERINE**

Wolverines have been present in Unit 6 for a considerable time. They use all habitat types and may appear in any portion of the unit.

There are no estimates of wolverine numbers in Unit 6. Harvest records show an average of about 14 reported annually.

### **SITKA BLACK-TAILED DEER**

Deer habitat in Unit 6 is confined primarily to the islands of Prince William Sound; however, a few deer also oc-

cur on the mainland. Unit 6 is exposed to the Gulf of Alaska and has a cool, wet climate and heavy snowfall. The mainland is extremely rugged, mountainous terrain with many glacial valleys. The islands, in contrast, have relatively little rugged terrain and most peaks are less than 3,000 ft. in elevation. Timber line is usually lower than 1,500 ft., and even though mountains are not high, much good quality summer alpine deer range is available. The south slopes of the islands are usual timbered, but a large proportion of north slopes is muskeg. In some localities, muskegs are continuous from sea level to alpine habitat, but in most areas they are interspersed with small patches of timber. Spruce-hemlock is the major timber type and deer food species are largely the same as those in Southeast Alaska.

Deer populations in Prince William Sound stem from transplants of 22 animals between 1916 and 1923. Hunting was first permitted in 1935.

On most islands of Prince William Sound, deer winter range is confined to a narrow strip along the beach. Winters are more severe than in Southeast Alaska and deer are forced to beaches earlier and become accustomed to low quality diets earlier in the season. This early, more gradual shift to poor winter range seems to be easier on deer than the abrupt shifts they endure in Southeast Alaska. In spite of severe winters, deer are usually fairly abundant in Unit 6. Hunting is mostly by local residents, who take between 700 and 1,200 deer per year. In many areas, deer are considered an essential meat source by most residents. Although body size is comparable to that of deer from the better ranges of Southeast Alaska, antler development is poor, and very few bucks attain the typical five point black-tail antler. Most mature bucks develop only an eye guard and a single fork.

**DALL SHEEP** (Chugach Mountains: see Unit 13)

## **MOOSE**

Moose were first introduced into Unit 6 in 1948 and introductions continued sporadically through 1958. The thriving herds present today are probably descendants of these transplants, although moose in the Yakutat area may be the result of natural immigration from the Yakutat-Icy Bay populations.

Moose have populated most of the suitable habitat within the unit. Populations are substantial and now support annual sport harvests. In some portions of the unit, moose may have exceeded the carrying capacity of their range.

### **Populations**

No population estimate is available for the unit. Aerial sex and age composition surveys conducted in fall and early winter in 1970-71 revealed 436 moose. Sport hunters killed 93 moose in 1972.

### **Specific Habitat Considerations**

Moose are dependent upon willow stands associated with alluvial bars of the outwash plains of the many glacial rivers within the unit, and upon the transitional vegetation below receding glaciers.

### **Land Use Considerations and Recommendations**

Most moose habitat in Unit 6 is within the Chugach National Forest and there is thus some assurance that surface values will be protected. This assurance is further buttressed by a cooperative agreement between the Alaska Department of Natural Resources, the Alaska Department of Fish and Game and the U.S. Forest Service.

Proposed timber harvest operations should consider the importance to moose of “stringers” of mature timber that occasionally project into lowlands. These areas provide shelter and food for moose during extreme accumulations of snow and should not be cut over.

## **MOUNTAIN GOAT**

(Chugach Mountains: Units 6, 7, 11, 13 and 14)

Mountain goats have been present on the south side of the Chugach Mountains for many years. Only recently have they become established on the north side, where numbers are still low and groups widely scattered.

### **Populations**

Large concentrations of goats are found on the south slope of the Chugach Mountains from Prince William Sound to Icy Bay. There are no sheep in the area and most of the available habitat for goats appears to be occupied. Hunting pressure is exceedingly light and has no effect on population levels. In 1952, the goat population in the area was estimated as 3,500, and the present population probably exceeds this estimate.

Goats are scattered throughout the north slope of the Chugach Mountains. In a number of locations, they occupy the same general ranges as Dall sheep. The highest densities of goats occur in areas adjacent to glaciers where annual precipitation and snow depths are great. Good goat populations presently exist along the west side of upper and lower Lake George and near Colony and Gannett Glaciers.

In the mountain area north of Knik Glacier from Lazy Mountain to Tazlina Glacier, goat numbers are low and the populations scattered. Small populations of goats exist on both sides of the Copper River and along the Chitina River and Chitina Glacier. Goat and sheep ranges overlap in these areas.

## **HARBOR SEAL**

There are no harbor seal population estimates for the unit but high concentrations of seals are known to exist in several areas. Thousands of seals are commonly seen hauled out on sand bars at the mouths of the Copper and Bering Rivers. Seals also travel up these rivers during summer and remain there for extended periods. Concentrations also occur in College Fiord and Harriman Fiord within Prince William Sound. During summer several thousand seals also inhabit the outside coast around Johnston Bay in the western part of the unit. All these areas contain concentrations of more than 1,000 seals. Smaller concentrations occur throughout the unit.

**NORTHERN FUR SEAL** - See Unit 10.

## **SEA OTTER**

The outer islands of Prince William Sound, including Knight, Montague and Hinchinbrook, and the area around Kayak Island once supported large sea otter populations. Lesser numbers occurred throughout the northern bays of the sound. Commercial fur hunters greatly reduced the population in the 19th Century, but a few animals survived, probably around Montague and Kayak Islands. These remnant populations grew rapidly in the 1950's and 1960's, and by 1965, Montague and Hinchinbrook were almost completely repopulated. Since that time, otters have spread northward along both shores of Prince William Sound and westward along the Kenai Peninsula (see Unit 7). At the same time, sea otter numbers around Kayak Island dropped, possibly because of emigration toward Yakutat (see Unit 5).

Population expansion is continuing. Montague, Hinchinbrook, Knight, Latouche, Bainbridge and Elrington Islands have populations approaching the capacity of the habitat. Small groups and individual otters occur throughout the northern parts of Prince William Sound.

## Populations

The present sea otter population of Unit 6 is about 5,000 animals and is increasing.

## **STELLER SEA LION**

Sea lions were intensively harvested for subsistence purposes by coastal natives prior to 1900. As a result, population levels were considerably reduced throughout most of the state. Since the turn of the Century, sea lion harvest has been very low and the populations have recovered to near maximum level.

## Populations

Fourteen sea lion areas in Unit 6 are listed below. The two most important rookeries are Pinnacle Rock (no. 336) and Lewis Island (no. 351). Lewis Island alone produces several hundred pups annually.

### **Sea Lion Rookeries and Hauling Grounds, Game Management Unit 6**

<u>Quadrangle</u>	<u>Reference No.</u>	<u>Location</u>	<u>Population</u>
Middleton Island	335	Fountain Rock	300
	336	Pinnacle Rock	1340
Blying Sound	346	Cape Junken	20
	347	Cape Puget	20
	348	Point Elrington	550
	349	Danger Island	300
	350	Latouche Island (south end)	75
Seward	351	Lewis Island	3760
	370	The Needle	200
	371	Perry Island	50
Cordova	380	Seal Rocks	300
	381	Porpoise Rocks	50
	382	Knowles Head	200
	383	Fox Point	20

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## **WHALES**

Dall porpoises and harbor porpoises are common in Prince William Sound. Killer whales and Minke whales are common singly and in groups, and large groups of Pacific blackfish also occur.

Sei whales, finback whales and humpback whales occur in the outer portions of Prince William Sound and many use Knight Island Passage and Montague Strait during July. Gray whales pass outside of Prince William Sound on their annual migrations, and stray animals sometimes enter the Sound.

## **WATERFOWL AND SEABIRDS**

## Populations



The Fish and Wildlife Service estimates that 85.8 ducks per square mile breed on the Copper River Delta. Because their estimate is based on aerial surveys performed prior to the 1964 earthquake, we believe the estimate is now excessive. An estimate of 12.5 ducks per square mile or a total breeding population of 5,000 birds seems more realistic for the delta, and is also probably a good estimate of breeding densities throughout Game Management Unit 6.

From 15,000 to 27,000 dusky Canada geese breed in the Copper River Delta each spring. Fall flights have ranged from 20,000 - 42,000 birds. Fish and Wildlife Service estimates of birds using Prince William Sound during the summer are as follows: gulls - 100,000; kittiwakes - 58,000; alcids - 48,000; arctic terns - 22,000; scoters - 20,000; petrels - 16,000; cormorants - 10,000; shearwaters (outer coast only) - 7,000; mergansers - 2,500; Canada geese - 2,500; loons - 1,600; mallards - 1,000; grebes - 700; miscellaneous - 27,700; total - 317,000. These figures are only approximate and do not include corrections for visibility rate differences between birds. Actual populations are perhaps up to four times greater, especially in the cases of alcids and grebes. Winter populations of most species are several times greater than these summer populations. Canada geese nesting in Prince William Sound have been identified morphologically as both dusky and Vancouver subspecies. However, their nesting, brood rearing and wintering habitats most closely resemble those of Vancouver geese. Perhaps one-half of the world's trumpeter swans (about 1500 birds) breed in the Copper River drainage.

**Description of Seabird Colonies Indicated on Maps  
Game Management Unit 6**

Map No.	Colony No.	Name	Species Present
53	36	Bainbridge Island	the following birds are known to occur in Unit 6; any or all could be found in colonies listed: Glaucous-winged gull, black-legged kittiwake, common murre, tufted puffin, horned puffin, parakeet auklet, mew gull, ancient, Kittlitz's and marbled murrelets, pigeon guillemot.
50	37	Wooded Island	
53	38	Channel Island	
49	39	Middleton Island	
54	40	Porpoise Rocks	
54	41	Port Etches	
54	42	Boswell Rocks	
54	43	Mummy Island	
49	44	Kayak Island	
57	45	Shoup Glacier	
53	46	Glacier Island	
58	47	Yale Glacier	
58	48	Harriman Fiord	
53	49	Blackstone Bay	

The Copper River Delta attracts large numbers of geese, ducks, and swans, and some cranes in the fall. No estimates of numbers have been made except for snow geese, which generally peak at about 10,000.

Wintering waterfowl are found throughout the unit where suitable habitat exists. There are no present estimates of numbers and species composition of these birds.

**The following waterfowl species commonly breed in Game Management Unit 6:**

mallard	shoveler
American widgeon	gadwall
green-winged teal	greater scaup
pintail	bufflehead

canvasback  
harlequin  
red-breasted merganser  
du sky Canada goose

goldeneye (Barrow's & American)  
Vancouver Canada goose  
trumpeter swan

### **Habitat and Land Use Considerations and Recommendations**

Valdez would be the southern terminus of the proposed Trans-Alaska oil pipeline. Heavy tanker traffic and resulting oil spills are therefore probable in the unit. To minimize pelagic and intertidal habitat damage, close state-federal monitoring of oil spills and strict enforcement of regulations is necessary.

Upland areas of the Copper Delta are managed jointly under U. S. Forest Service ownership by the Forest Service and the Alaska Department of Fish and Game. This agreement is desirable and should continue. Close surveillance of the ecological changes on the delta resulting from the 1964 Earthquake should be continued. Due to encroachment of woody plants into former sedge-forb communities, loss of nesting habitat for dusky Canada geese is possible.

Since the 1964 earthquake there has been a decrease in duck use of the Copper River Delta by both breeding and migrating birds. Factors causing this decrease should be further investigated.

### **Key Waterfowl Habitat Areas - Game Management Unit 6**

Copper River Delta  
Prince William Sound  
Bering River Drainage  
Copper River Drainage

Maintenance of habitat within these areas is of state and national importance. Improperly planned alteration of habitat could result in high bird losses. State-owned tide lands in the above-listed areas should be designated as critical waterfowl habitats.

### **GAME MANAGEMENT UNIT 7**

Game Management Unit 7 comprises the southeast portion of the Kenai Peninsula except for that portion bordering Prince William Sound, which is a part of Unit 6. This odd shaped unit is mostly high mountains, often with ice fields, narrow deep-gorged valleys, and short swift streams. The diversity created by this "on end" topography provides niches for a variety of wildlife. The coastal waters support commercial fisheries and the deeply indented coastline is home for a variety of marine mammals.

Conifers are the dominant vegetation with white spruce, hemlock and Sitka spruce prominent. Timberline is low, graduating into shrubs and alpine vegetation with increased elevation.

The area has a moderate population of permanent human residents and also serves as recreation headquarters for Anchorage area residents. It is therefore subjected to intense seasonal use.

The land area of Unit 7 is largely within the Chugach National Forest. The climate is typically brutal along the exposed coast--wet, windy, cool and with deep wet snows. Inland areas are subjected to a moderate version of the coastal climate. Often the inland areas are considerably drier and colder in winter and warmer in summer.

## **BLACK BEAR**

Black bears are one of the most widely distributed and abundant large mammals in Unit 7. Their affinity for timbered and brushy areas provides them with more than adequate protection, despite intensive hunting pressures. Populations appear to fluctuate annually depending primarily on winter and spring weather conditions.

Harvest data are lacking for black bears, although it is known that they do receive considerable attention in the spring when they are the only legally hunted big game species. They are also taken incidentally to other recreational activities.

### **Specific Habitat Considerations**

Spring concentration areas in the unit are generally associated with valley floors, small alluvial plains, lake shores and tidal areas. As in Unit 6, this critical habitat is limited and following particularly harsh winters it may be a limiting factor. Preferred spring foods are generally grasses, sedges, horsetails and carrion. Recreational facilities and human population centers in both Units 7 and 15 are often “invaded” by black bears during this period.

The lower alpine zone near the alder line is important habitat for black bears on the Kenai Peninsula. Bears move back and forth from the lowlands to this zone during July and August, with extremely heavy bear concentrations noted at the higher elevations. As the snowline recedes, black bears move farther up the open south-facing slopes which are showing new green vegetation. Rarely do they venture very far from adequate timber or alder cover, however.

Red, pink and silver salmon appear in the major streams in late July and August and are sought by black bears. Highbush and lowbush cranberries, blueberries, elderberries, bearberries and crowberries make up a large part of bears’ diets by mid-August.

### **Land Use Considerations and Recommendations**

As long as human population levels remain low or only seasonally high, the present public land ownership patterns in Unit 7 should sustain high black bear populations. Recreational sites and waste disposal facilities should be designed to minimize bear-human conflicts.

## **BROWN BEAR**

Brown bears are sparsely distributed throughout most of this unit. Bear densities in this and the adjacent Game Management Unit 15 are probably much lower than the Kenai Peninsula supported during the 19th and early 20th Centuries. Continued pressures and conflicts with early settlers, both Russian and American, and possibly market hunting, reduced the populations to very low levels. It is possible that neither of these units ever supported the densities of bears found in Units 8 and 9 or even Unit 6 to the east. Salmon, although present in fairly good numbers, are not as abundant nor as readily available as in Units 6, 8 and 9, and this lack may have limited brown bear numbers. Numbers of bears have increased over the past 20 - 30 years, but little brown bear hunting occurs in Unit 7.

The largest reported sport harvest for one year was two bears. The few bears shot are taken incidentally to other recreational activities.

### **Specific Habitat Considerations**

High spring use areas are those areas which, because of topography and exposure, are the first to show green vegetation. Primary brown bear foods are grasses, sedges, red paque, horsetails, wild celery, and cow parsnip. A broad habitat area which overlaps both the alpine and subalpine zones is used fairly intensively by brown bears, especially beginning in late spring or early summer. This area extends broadly into both zones, and use by bears varies seasonally to quite an extent. A more detailed account of these movements is presented under the discussion of Unit 8.

Berries become edible by early August and bears use lowbush and highbush cranberries, elderberries, blueberries, bearberries and crowberries. Salmon are not readily available in great numbers in this unit although red, silver and pink salmon occur in a few streams.

Very little is known about brown bear denning in this unit. It is believed that those basic requirements mentioned in Units 8 and 9 discussions generally apply to Unit 7, for the vegetation zones are very similar. Denning periods appear to be a little longer in Unit 7, however.

### **Land Use Considerations and Recommendations**

Although bear numbers appear to be increasing on the Kenai Peninsula, intensive recreational uses of the entire area will continue to create direct conflicts with humans. Commercial grazing and other developmental land uses also present potential conflicts. Some of these problems can be solved by simply reducing the attractiveness of human development to bears by proper methods of waste disposal. Others can be minimized by educating people to better understand bear behavior. On the other hand, it must be clearly understood that commercial livestock grazing and bears are not compatible and that one resource use must eventually give way to the other.

### **WOLF**

Wolves are rare visitors to this unit (see discussion under Unit 15 - Wolves).

### **WOLVERINE**

Wolverines are widely distributed in this unit. Harvests averaged 12 animals annually over the past 10 reporting periods.

**BARREN GROUND CARIBOU** (Kenai Herd: See Unit 15)

### **SITKA BLACK-TAILED DEER**

Deer and deer tracks have been reported for several years from the coastal areas of Unit 7, but no reports have been confirmed. It is unlikely the area could support very large sustained populations of deer even if they were someday to become permanent residents of the unit.

**DALL SHEEP** (Kenai Mountains: Units 7 and 15)

Dall sheep inhabit the Kenai Mountains west and north of the Harding Ice Field from the head of Kachemak Bay to Turnagain Arm. The greatest concentrations occur in the arc from Kenai Lake through Skilak Lake to Tustumena Lake. Sheep were hunted as a source of meat in the early days of mining, but are presently utilized by man only for recreational hunting under 3/4 curl ram-only hunting management. About 70 rams are harvested annually from the Kenai Mountains. Sheep are also of great importance as a tourist attraction in the Cooper Landing closed area where they occur near the highway and are viewed and photographed each year by thousands of visitors.

## **Populations**

Sheep populations on the Kenai were reported as high by early residents, but apparently suffered a drastic decline in the 1930's or 1940's due to a series of severe winters. They were reported low in the late 1940's and early 1950's by the U. S. Fish and Wildlife Service who made initial aerial and ground surveys in parts of the range. Since that time, periodic aerial surveys have indicated a steady increase to the present time. An aerial inventory covering all sheep ranges in the Kenai Mountains showed a minimum population of 2195 in 1968. Populations seem to be reaching their maximum sustainable level in at least some parts of the area. The Surprise Mountain herd, which had been increasing rapidly, was reduced by some 40 percent by starvation during 1969-70 because of a severe winter and possible overcrowding. These Kenai herds include the southern limit of Dall sheep range in this part of the state - a limit which is probably established by coastal winter climate. Consequently, these populations are probably subject to more fluctuations due to climatic extremes and variability than are sheep in the interior mountain ranges.

## **Land Use Considerations and Recommendations**

Nearly all sheep habitat in Unit 7 is within the Chugach National Forest and in Unit 15 within the Kenai National Moose Range. A small part of the southern sheep habitat falls within Kachemak State Park. With this type of land tenure, there is little likelihood of loss or damage to sheep range by development.

One possible conflict between man and sheep in the area which should be considered by land-use planners is harassment by snowmachines during critical winter periods. Areas of critical winter habitat should be zoned against snowmachine use, particularly during late winter.

## **MOOSE**

Moose generally are distributed throughout this unit, except where physical barriers have prevented their expansion into some river valleys draining into Prince William Sound. They provide food to large carnivores, but recreation and sustenance for humans are presently their most important uses.

## **Populations**

Aerial sex and age composition counts in selected portions of the unit conducted in late fall and early winter provide information for management decisions, but no estimate of total population is available. Harvests have been restricted in recent years due to the lack of public acceptance of "any sex" harvests. In 1972, hunters killed 169 moose. At the present time, a considerable portion of the existing winter range is over-mature, resulting in reduced populations of moose in some areas. Rehabilitation of some ranges has been attempted or is contemplated by the U. S. Forest Service, the principal land owner.

Moose habitat in this unit is limited to the narrow river valleys and some south facing mountain slopes where moose congregate during winter. Snow accumulations are often deep and crusted, leading to mortality of substantial numbers of moose in some years.

## **Land Use Considerations and Recommendations**

Most of the important moose habitat is within the Chugach National Forest, but there is little likelihood that the value of timber production on moose habitat will exceed the recreational values derived from the moose resource.

The area's mountainous terrain directs highway planners toward river valleys. Highways through moose winter

ranges invariably lead to problems for both moose and motorists.

## **MOUNTAIN GOAT** (Kenai Mountains: Units 7 and 15)

(See also Unit 6)

Although goats are now present in Game Management Units 7 and 15, permanent populations apparently did not exist west of the Anchorage-Seward railroad prior to 1920. Goats now occur throughout the Kenai Peninsula, with highest densities present on outer coastal areas.

### **Populations**

Goats are present in most of the mountainous areas of Game Management Units 7 and 15. Heaviest concentrations are along the coast of the Gulf of Alaska from Day Harbor to Port Dick. Goats are also found on the north side of the Harding Glacier, but only in scattered groups and low numbers. The Cooper Mountain-Crescent Mountain area has high densities of sheep and very low densities of goats.

The group of mountains north and west of the Sterling Highway from Sunrise to Cooper Landing presently has very low densities of goats, with the highest numbers found in the areas just east and west of Hope.

## **HARBOR SEAL**

No harbor seal population estimates are available for the unit but concentrations of several hundred seals occur in Aialik Bay, Harris Bay and Day Harbor.

**NORTHERN FUR SEAL** - See Unit 10.

## **SEA OTTER**

Sea otters were once abundant along the south side of the Kenai Peninsula although habitat is limited by a lack of shallow water in some areas. All sea otters were exterminated from this unit by commercial hunters in the 19th Century. By 1960, only occasional stray animals had returned to the area. During the late 1960's larger numbers began to appear. Most of these probably came from the expanding Prince William Sound population (see Unit 6), but some, particularly those in Nuka Bay, may have come from the west (see Unit 15).

Relatively small numbers are now found along the entire coast. The largest concentrations are in Whidbey Bay, Aialik Bay, Harris Bay and Nuka Bay.

### **Populations**

At present, Unit 7 contains about 1,000 sea otters and the number is increasing. The population should reach aboriginal levels in the near future, but limited habitat will prevent it from attaining the high numbers found in many other areas.

## **STELLER SEA LION**

Sea lions were intensively harvested for subsistence purposes by natives prior to 1900. As a result, population levels were considerably reduced throughout most of the state. Since the turn of the Century, harvest of this species has been very low and populations have recovered to near maximum levels.

### **Populations**

There are eight known locations in Unit 7 used by sea lions. Rookery number 366, Otter Island, is known to produce pups.

**Sea Lion Rookeries and Hauling Grounds  
Game Management Unit 7**

<u>Quadrangle</u>	<u>Reference No.</u>	<u>Location</u>	<u>Population</u>
Blying Sound	340	Seal Rocks	500
	341	Chiswell Island	4715
	342	Aialik Cape	50
	343	Rugged Island	50
	344	Hive Island	100
Seldovia	345	Barwell Island	100
	365	Nuka Point	160
	366	Otter Island	6000

**WHALES** - See Unit 8.

**WATERFOWL AND SEABIRDS**

**Populations**

US Fish and Wildlife Service estimates densities of 12 breeding ducks per square mile of habitat in Game Management Unit 7. Waterfowl commonly breeding in the unit are the same as those found in Unit 14, with the exception of sandhill cranes, which are not common. Trumpeter swans are more common in Unit 7 than 14. Total numbers of breeding waterfowl are relatively small, for suitable habitat is limited. Waterfowl are present year-round, and greatest use is by seabirds and sea ducks in coastal bays during the winter. Unit 7 contains few areas where large numbers of birds concentrate during migration periods.

Following is a list of known seabird colonies in the unit. Undoubtedly more colonies exist than are recorded here.

**Description of Seabird Colonies Indicated on Maps -  
Game Management Unit 7**

<u>Map No.</u>	<u>Colony No.</u>	<u>Name</u>	<u>Species Present</u>	
51	27B	Gore Point	Any or all birds listed as present in Game Management Unit 6 could be found on these colonies.	
51	28	Nuka Island		
51	29A	McArthur Pass		
51	29B	Black Bay		
51	29C	Two Arm Bay		
50	290	Harris Bay	glaucous-winged gull, common murre, ancient murrelet, tufted puffin, parakeet auk let.	
50	30	Granite Island		
50	31	Granite Cape		
50	32	Aialik Peninsula		
50	33	Chiswell Island		
50 & 53	34	Resurrection Bay		glaucous-winged gull, common murre, horned puffin, tufted puffin.

50	35	Rugged Island	black-legged kittiwake,
	35A	Cape Resurrection	glaucous-winged gull, common murre.

### **Land Use Considerations and Recommendations**

The major threat to waterfowl habitat in Unit 7 is oil pollution. Because so little is known about waterfowl in this unit, surveys of breeding and wintering birds are recommended. Action similar to that recommended for Unit 6 is also recommended to minimize future habitat and bird losses.

#### **Key Waterfowl Habitat Areas - Game Management Unit 7**

Placer River Valley  
Turnagain Arm (Head)

Portage Creek  
Twentymile River Valley

Undoubtedly more key areas exist than are recorded here. As future surveys are conducted these areas will be so designated. Maintenance of habitat in these areas is of state and national concern. Improperly planned alteration of habitat could result in bird losses, so state-owned lands in the above-listed areas should be designated as critical waterfowl habitat.

### **GAME MANAGEMENT UNIT 8**

Kodiak, Afognak, Chirikof, and Semidi Islands, and all their smaller adjacent offshore islands form Game Management Unit 8. These storm-swept islands supported restricted mammalian fauna until man intervened to use the area as a dumping ground for exotics. Never the less the best known mammal now present is an indigenous species, the "Kodiak" brown bear.

The habitat on these islands varies from rolling, windswept, treeless tundra to solid stands of mature Sitka spruce. The mountains reach over 4,000 ft. on Kodiak Island and are extremely difficult to traverse because the lower slopes are a tangle of alder. The weather is severe maritime: windy, cool and wet. Snow accumulations are variable and seldom reach the depths common to Prince William Sound areas. The short clear streams characteristic of the area are extremely productive and seafood harvesting is the area's primary industry.

Agriculture in the forms of cattle and reindeer growing has been attempted. The former is marginally successful but at a terrible cost to the indigenous brown bear. Reindeer herding was never successful and the herd remaining is now feral.

Marine mammals are abundant along the extensive coastline and significant seal and sea lion harvests have occurred on some of the islands.

The human population is increasing rather rapidly in a cluster pattern, with the town of Kodiak the population center.

### **BROWN BEAR**

Brown bears inhabit all of the major islands in the Kodiak group and apparently their distribution differs little, if any, from that existing prior to the appearance of the Russian settlers.



Although conflicts have always occurred between the bears and man, full-scale confrontations did not occur until fishing and farming became important industries. Commercial fisheries greatly expanded during the early 1900's and conflicts increased rapidly. The bears' dependence on spawning salmon, especially when coupled with man's fear of the beasts, was cause enough for early fishermen to attempt their extermination.

Cattle grazing by Russians began on Kodiak Island in 1794, and bears and man began to compete for habitat. The northern part of the island, where most of the cattle grazing has occurred, is prime brown bear habitat. Studies have shown that bears definitely kill cattle, but that the problems have never been solved by simply eliminating problem bears.

Bear-cattle conflicts fluctuate in severity depending on factors such as weather, availability of other foods, efficiency of specific predator control programs (both governmental and private) and chance. Although other solutions (e.g. fencing), have been examined, the costs of such alternatives have been prohibitive.

The Kodiak brown bear has long been noted for its size and ferocity. Sportsmen from all over the world have hunted here, especially prior to the late 1960's, for a chance at a big bear. Hunting pressures increased rather steadily to 1966, when a record 199 bears were reported as sport harvest for the entire game management unit. Since then the harvest has fluctuated with a low reported kill of 91 animals in 1969. The lower harvest was due primarily to restrictive regulations designed to reduce and redistribute the kill. It was felt that the higher harvests during the mid-sixties were probably excessive. It now appears that, allowing for some yearly fluctuations and no drastic land use changes, the annual increment of bears in Unit 8 is probably about 150 bears.

### **Populations**

Most recent estimates of bear populations on the Kodiak National Wildlife Refuge show a population of approximately 2,000 bears. Projecting these densities to the rest of the unit, 2,500 - 3,000 bears are probably present. Greatest numbers occur on Kodiak Island although Afognak Island also supports a good bear population.

### **Specific Habitat Considerations**

As in other areas of the state, brown bears on Kodiak and Afognak Islands are primarily dependent in spring on early green plants. Cow parsnip, red poque, sedges, horsetails, lupine, false hellebore and grasses are probably the more important spring food items. Particularly harsh winters with heavy spring accumulations of snow are believed to be extremely hard on early spring emerging bears. Critically narrow beach fingers with winter-killed deer and elk plus some early herbaceous growth are especially important at this time.

In Unit 8, the greatest densities of bears occur in the Karluk system, Sturgeon River, Ayakulik River, Red lake, Frazer lake-Dog Salmon River system, the Akalura system, Upper Deadman Bay, Upper Uyak Bay, Upper Zachar Bay, Upper Spiridon Bay, the Uganik system, the Terror system, Upper Viekoda Bay, the Ugak Bay-Shearwater Peninsula-Hidden Basin area, the Gretchen-laura-Pauls lakes system, the Portage lake-Creek system, Upper Kazakof Bay, and the Afognak lake-River system.

Red salmon begin arriving in some streams in mid-June and continue through July. Some reds do not reach the spawning streams until early August. Major red salmon producing stream systems such as the Karluk, Uganik, Terror, Spiridon, Red, Akalura, Frazer and Dog Salmon, Malina, Afognak, Portage and the Pauls-laura-Gretchen should be considered critical bear habitat. Pink salmon are most abundant in July and August. Most of the major systems mentioned above are high pink salmon producers, as are Viekoda Creek, Brown's lagoon, Upper Ugak Bay, Kizhuyak Creek, Upper Zachar Bay, Grant's lagoon, Halibut Bay, Sturgeon River, Upper Station lakes, Horse Marine lagoon, Upper Sulua Bay, Kiavak Bay, Barling Bay, Rolling Bay, Paramanof Bay, Waterfall Bay, Tonki Bay,

Upper Kazakof Bay and Marka Creek.

Dog salmon and silver salmon usually follow the pinks in September and October. Silvers are often available into November on many of the streams and this salmon species may be more important to late denning bears than previously believed.

Early summer finds many bears near the edge of the alpine-subalpine zone. Considerable movement occurs between this zone and the valley floors where early fish runs appear. Bear food habits during this period are not well known but this alpine-subalpine area is probably extremely important.

Although there are daily movements between zones, some bears begin to feed on ripening berries by early August. The most important berry foods are lowbush cranberries, highbush cranberries, elderberries, blueberries and salmonberries.

Radio-tracking studies by the Fish and Wildlife Service indicate that activity areas (the units of habitat used to fulfill normal living requirements) average 5.5 square miles and range from 1.0 to 13.9 square miles per bear. Overland movements seem largely responsive to salmon runs in the surrounding drainages. Seventy-four bear dens discovered to date by Richard Hensel of the Fish and Wildlife Service were found from 100 to 3,300 ft. above sea level, with most occurring at elevations of around 1,800 ft. Most bears denned along the lower limits of subalpine habitat (at 1,500 to 2,000 ft.), probably because of the cover provided by alder or willow thickets. In addition to providing concealment, shrubs tend to bind the soil, thus limiting the probability of den collapse during spring thaws. Further, the drifting snow that accumulates within thickets may be important as an insulating layer over dens.

North-facing slopes are most often chosen as denning sites, perhaps as a result of the northwesterly orientation of major valley systems. Bears evidently prefer to den on well-drained sites where water seepage into dens is minimized and excavated material is more easily deposited downhill. New dens are excavated each year because thawing, seepage, and erosion destroy dens soon after abandonment. According to Hensel, the most important features of denning habitat are (1) steep to gentle sloping ground, (2) semi-open areas associated with willow or alder shrubs and (3) a relatively stable soil substrate.

From the foregoing descriptions of some ecological elements in brown bear habitat, a chronological list of habitat use on Kodiak has been compiled:

Brown bears on Kodiak occupy distinct habitat zones extending from alpine slopes to valley bottoms.

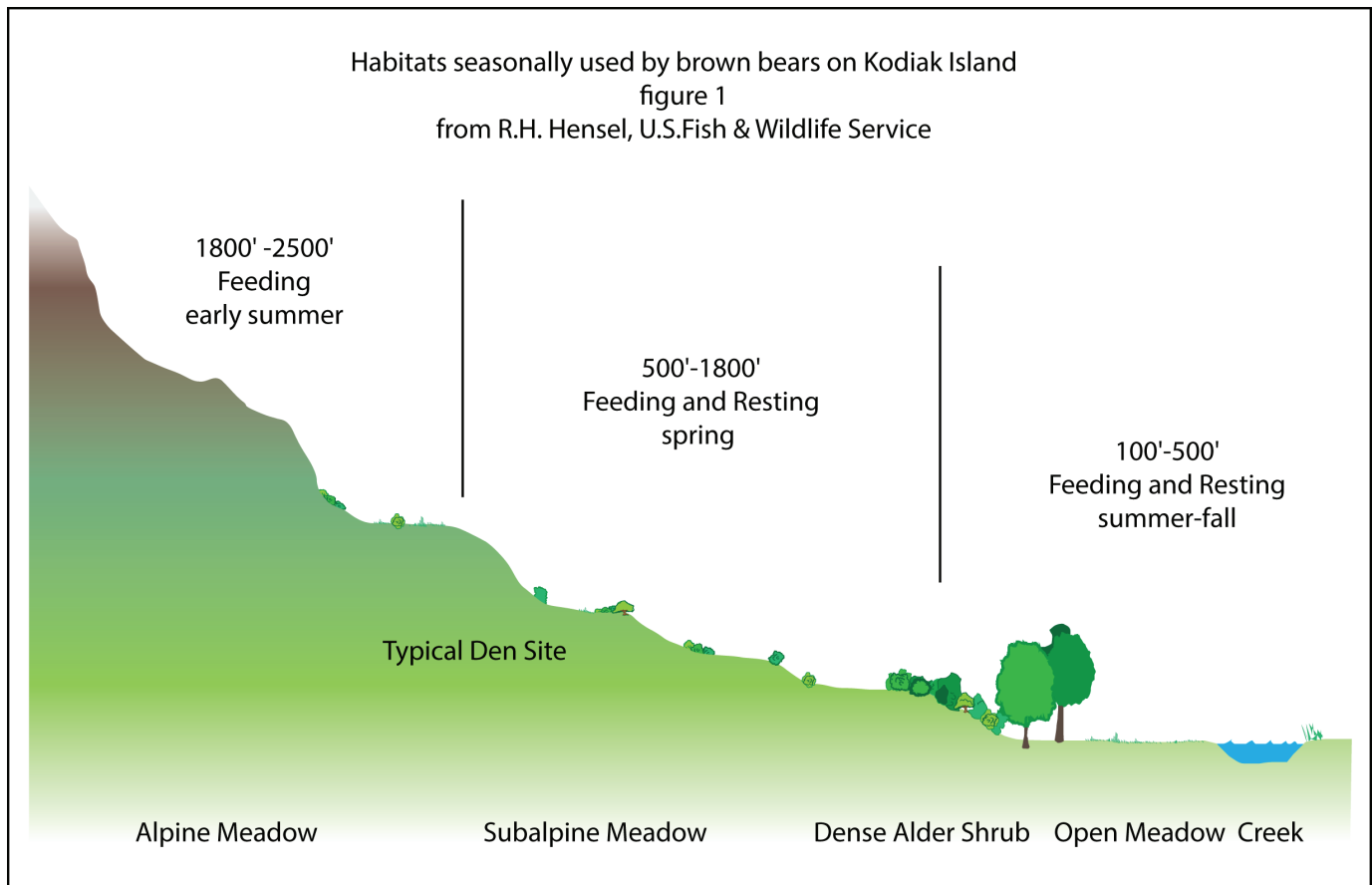
May-June Alpine and subalpine zones used for feeding, resting, and mating.

July-August Valley bottom zone used for feeding and resting.

September-October Valley bottom and foothill zones used for feeding and resting.

November-April Alpine and subalpine zones used for winter denning.

Perhaps the most efficient method of illustrating these relationships is to diagram a "cross section" through typical localities utilized by bears (Figure I).



### **Land Use Considerations and Recommendations**

Future resource planning for this area must consider several critical habitat requirements for brown bear. One of the most important is the maintenance of a good fisheries resource. The dependence of bears on fish, although not completely understood, is probably critical. Precautions should be taken to alleviate bear-livestock problems before the industry expands in this area. If timber removal is considered, adequate leave strips along major streams and at the heads of bays with important grass flats should be maintained to protect bear escape cover.

Garbage pits and other waste disposal systems should be designed and maintained so they do not attract bears. Access should be controlled and restricted primarily to peripheral areas; human developments should be centralized as much as possible. These considerations will minimize bear-human conflicts.

Denning areas and high concentration areas should be given some land use classification whereby minimal disturbances occur. Care should be exercised to avoid harassment during peak concentrating periods.

The tenuous and potentially explosive situation existing with the Kodiak bear-cattle problem should be considered when similar land use decisions are made in the future. Alternatives must be sought, especially those that would permanently separate the two catalysts--bears and cattle. If economic subsidies in the form of loss mitigation, fencing subsidies or bear control are to be considered, then decisions should be made on the basis of cost-benefit ratios, long-term objectives and sources of funds; the true values of bears to tourists, photographers and hunters alike should be considered. Application of progressive time and area zoning concepts will allow for more compatible consumptive and nonconsumptive uses of the valuable bear resource.

### **SITKA BLACK-TAILED DEER**

Unit 8 deer populations all originate from transplants of 25 animals from Southeast Alaska between 1923 and 1934. The climate in the unit is mild, cool and wet, and both terrain and vegetation are different from most other areas inhabited by deer in Alaska. This area emerged from ice much later than regions farther south and is presently at a stage similar to Southeast Alaska several hundred years ago. In addition, the Kodiak area was covered with a thick layer of ash (over 12 inches deep in some localities) during the 1912 Katmai volcano eruption.

Mountains rise steeply from tidewater on northern Kodiak and Afognak Islands but grade to rolling tundra on southern Kodiak Island. Mountain crests are usually rounded and range from about 2,000 to 4,500 ft. elevation.

Conifer cover is Sitka spruce, and western hemlock and cedar are absent. Spruce forests are young and still encroaching on Kodiak Island; the southern portion of the island as yet has no conifer species. Most mountains are covered with dense growths of alder, salmonberry and elderberry. Willow is abundant on the more poorly drained sites, and cottonwood is common along the lower drainages. Openings on mountain slopes are covered with a complex of grasses, fireweed, lupine, geranium, wild rose and salmonberry. On alpine ridges vegetation is primarily bearberry, crow berry, blueberry and other low-growing plants.

Deer utilize many plants in Unit 8 not generally considered important in other units. Summer range may extend from tidewater to the alpine zone. Fireweed is probably the most important summer food but deer also use grasses, wild rose, elderberry and salmonberry. Some blueberry is present under spruce cover, but rarely occurs in the abundance normal to Prince William Sound and Southeast Alaska. Other plant species used less extensively on summer range include high bush cranberry, bearberry, crowberry and cow parsnip. Some ground dogwood is present, but it is not as important to deer here as in other areas of Alaska. Deer in Unit 8 have less seasonal change in diet than elsewhere in Alaska. In winter, willow, wild rose, elderberry, cow parsnip and highbush cranberry are primary foods. When snow cover is absent, crowberry and bearberry are also important. Ground dogwood and blueberry are used when available. Unit 8 is the only area in Alaska where spruce tips are browsed extensively in winter.

Deer seem to thrive in this environment. There are no significant predators and food is usually abundant and available during both summer and winter. Snow is sometimes a limiting factor, often compounded by the lack of conifer cover. Winter losses are high during severe winters but the population nevertheless is still increasing. Deer are now quite abundant on northern Kodiak Island, with lower populations on Afognak Island. Competition with elk for winter range probably influences deer numbers on Afognak. During recent years, the elk population on Afognak Island has declined and there has been a corresponding increase in deer numbers.

Most deer hunting in Unit 8 occurs on Kodiak Island. Hunting was first allowed in 1935, when 38 bucks were taken. The kill has progressively increased and in recent years has sometimes exceeded 2,000 animals annually. Access is by road on the northeast portion of the island and by boat and aircraft to other areas. Inclement weather often makes boat travel difficult and the harvest is influenced by weather conditions. In areas where conifer cover is sparse or absent, deer become vulnerable after leaves fall and snow covers the ground. This is especially true along the road system of northeastern Kodiak Island, which is one of the few areas in Alaska where hunting has a significant impact on deer populations.

Kodiak Island is also the only area in Alaska where cattle compete with deer for winter food. Competition is greatest on the Chiniak Peninsula where more snow accumulates than on other cattle areas of the island.

## **DALL SHEEP**

Sixteen Dall sheep were transplanted onto Kodiak Island between 1964 and 1967 in the Uganik Bay (Mink Point) and Three Saints' Bay areas. At least half of the animals died within a week after arriving on the island. One new

lamb was observed in Barling Bay in 1966, but the last authenticated report of sheep on Kodiak was made in 1968. Since then intermittent reports of sheep sightings have been made, but never confirmed. It is unlikely that sheep have become established on the island.

## ROOSEVELT ELK

Elk are restricted to Afognak and Raspberry Islands in Unit 8. Afognak Island lies in the Gulf of Alaska some 50 miles below the southern tip of the Kenai Peninsula and three miles northeast of Kodiak Island. Nearly 40 miles long and averaging 25 miles wide, with an area of 780 square miles, it is the second largest island in the Kodiak Archipelago. Several smaller islands, including Raspberry Island, belong to the Afognak group. Afognak is the western-most portion of the Chugach National Forest.

Most of Afognak is undulating or mountainous with elevations ranging to over 2,500 ft. at the summit of Crown Mountain in the southwestern corner of the Island. The coastline is irregular, with many steep-walled bays. The principal streams are generally less than six miles long, flowing through fairly narrow, well-drained valleys bordered by rolling hills. Many of these valleys have been deeply glaciated and are separated by steep ridges or peaks.

The vegetation of Afognak Island is similar to that on the Kenai Peninsula to the north, and also contains elements common to Southeast Alaska. Two distinct plant communities occur on the island: a spruce shrubland area in the northern, central and southeastern regions, and a grassland-forb- shrub community on the western side. The Sitka spruce climax community which dominates the former is interspersed with extensive shrublands of alder and elderberry. Understory vegetation here contains many species indigenous to Southeast Alaska, principally devil's club, blueberry, salmonberry, trailing bramble, nagoon berry, and highbush cranberry. Extensive forestation by Sitka spruce (a recent arrival to Afognak) is occurring throughout the island and it is only a matter of time before this species will occupy the entire Afognak group.

The vegetation that typifies western Afognak becomes evident northwest of Litnik Lake where a vast grassland-forb- shrub complex dominates the landscape. The formation consists of extensive shrublands of alder, willow and salmonberry interspersed with a matrix of grasses and forbs, which include bluejoint, hairgrass, fireweed, geranium, lupine, burnet, cow parsnip, and angelica. Sedge meadows occupy poorly drained sites, and a riparian shrubland of alder and willows is found along most water courses. At about 1,800 ft. elevation, the grassland-forb-shrub formation is replaced by an alpine vegetation dominated by extensive heath mats of crowberry, alpine azalea, diapensia, Kamchatka rhododendron, purple heather, Alaska heather, alpine bearberry, lowbush cranberry, bog blueberry, and dwarf willow. In this western portion of the island, spruce is found only in isolated stands in the lowlands.

Elk harvests have varied from a low of 26 in 1955 to a high of 142 in 1965. Since 1965 the harvest has declined to a low of 27 in 1971. This does not necessarily reflect a drastic decline in the population. Many of the remaining elk herds are in the more inaccessible portions of the island. The more accessible and traditional hunting areas have experienced serious reductions in hunting seasons and bag limits as elk numbers declined. Populations The Afognak elk population was estimated at 147 animals in 1946. At that time the main herd summered in the Litnik Lake-Raspberry Strait region of southwestern Afognak and in late fall migrated northeastward to Blue Fox and Perenosa Bays, where it remained throughout the winter, to return southward in the spring.

By 1947 a few elk were sighted in the vicinity of Danger Bay and the following summer several elk were reported on Raspberry Island. As early as 1946, reports were received of elk tracks on the northeast shore of Kodiak Island and in June of the same year a single elk carcass was located on Kodiak, indicating that at least one animal had left Afognak.

The first comprehensive census of Afognak elk was conducted in 1948: 116 animals were counted and the total population was estimated at 212. Observations of tracks indicated that few elk strayed from the southwestern part of the island.

It was concluded from these surveys that most of the elk were sedentary and spent the greater part of the year in the southwest quarter of Afognak, on Raspberry Island, and to a lesser extent, at the head of Izhut Bay.

From 1951 to 1958 elk spread over much of Afognak and the herd increased from 264 in 1951 to a population estimated at 800 in 1958. In 1960, approximately 160 elk were reported on Tonki Cape in the northeastern sector of the island and 640 along Raspberry Strait and on Raspberry Island. Since then, the highest total counts of elk were 926 in 1965, 907 in 1966 and 887 in 1970.

### **Specific Habitat Considerations**

The sequence of events surrounding the expansion of elk on Afognak is typical of island introductions. The herds that have become established on the island have generally increased and declined rapidly, although new herds, such as in the interior of Afognak, have expanded their ranges and subsequently increased in numbers. Today, the Raspberry Island and Malina herds are practically nonexistent. Eventually, the elk and their ranges will probably stabilize at a level much lower than that reached in the past. There are several unpredictable influences on future elk populations, two of which are competition from deer and possible habitat changes. Manipulation to improve elk winter ranges could be helpful in maintaining a balanced population at a higher level. In this island situation, regardless of the future changes in land status or habitat alterations, it will be necessary to control elk in one way or another to prevent drastic fluctuations and sub-optimum production.

The protection of key winter ranges is probably the most important habitat consideration on Afognak Island. If in the future elk spread to Kodiak Island, the picture would become more complex, for elk and cattle compete for space and food practically throughout the year.

### **Land Use Considerations and Recommendations**

The potential problem of elk-cattle strife should be dealt with hypothetically before it becomes a real problem. Should elk become established on Kodiak, the combined effect of deer, elk and cattle in the grazing leases could seriously reduce commercial grazing value. Probably, elk should never be allowed to become established on Kodiak Island.

The effects of logging on elk populations have been the subject of several studies in other states. Most studies have been conducted in Rocky Mountain elk range and the results of these studies should be applied only with caution when considering the effects of logging on Roosevelt elk in Alaska. A few general facts have emerged in all studies and are probably applicable to Alaskan conditions as well. These facts are: (1) on most sites, logging improves the food supply for elk for a period of time; (2) elk rarely use food on clear cuts more than 400 yards from cover; (3) elk are dependent upon fairly large stands of native timber for cover. A separate but related consideration which is unimportant in other states has emerged in deer/logging studies in Southeast Alaska and seems applicable to elk on Afognak. This consideration is the strong dependence of Alaskan ungulates on native timber stands on lowland areas near the beach fringes.

With these considerations as guidelines, the following stipulations are recommended for logging on Afognak Island areas of elk range:

- (1) Clear cut areas should provide as much fringe area as possible. If the cut is essentially square or round, the cut size should be limited to 160 acres or less.
- (2) Cut areas should be bordered on all sides by similar size unlogged areas.

- (3) The bordering unlogged areas should remain uncut until the clear cut areas have revegetated in spruce suitable for providing elk cover. At present this is estimated to be spruce of 24 inches d.b.h. and approximately 50 ft. in height. Cutting should be scheduled to provide vegetation in various stages of regrowth.
- (4) Slash disposal should be conducted in a manner that will not hinder wildlife movements.
- (5) Areas critical to elk winter habitat should be designated and protected.

## **MOUNTAIN GOAT**

Eighteen mountain goats were introduced to Hidden Basin on Kodiak Island in 1952-1953. Since that time a goat population has become established in the area of introduction, and the most recent survey in 1972 showed a minimum of 91 goats present, including 27 kids. Hunting was first allowed in 1968, when 10 permits were issued. Through 1971, four annual permit hunts have resulted in a total harvest of 21 goats. The presently-thriving goat population on Kodiak currently extends from Komag Peak to Kizhuyak Bay and from Mt. Glottof to Saltery Creek. Additional unconfirmed sightings have been made between Terror and Uganik Bays. It seems certain that goats are now a permanent part of Kodiak Island's fauna.

## **HARBOR SEAL**

No harbor seal population estimate for the unit is available. Seals are common throughout the unit near land masses and concentrations of seals in excess of 1,000 animals occur near Sud Island in the Barren Islands. Ugak Island supports over 2,000 seals, Tugidak Island has a population in excess of 8,000 and is a major pupping area, and Sitkinak Island is the pupping ground for several thousand seals in June. Other areas with somewhat smaller concentrations of seals are Olga Bay, Geese Island, Ugak Bay and the north sides of Afognak Island and Shuyak Island.

Seals have been harvested on Tugidak Island for many years. Between 1965 and 1971, a total of at least 12,000 seals (primarily pups) were harvested from the island, stabilizing the population. Intensive harvesting also has occurred at Ugak Island and Afognak Island.

**NORTHERN FUR SEAL** - See Unit 10.

## **SEA OTTER**

Suitable sea otter habitat is limited on both sides of Kodiak Island and it is unlikely that large numbers ever occurred there. However, the areas north of Afognak Island, around the Barren Islands and around the Trinity Islands south of Kodiak Island contain much excellent habitat. The Russian capital was located at Kodiak as a result of the quest for sea otter furs from these areas in the late 18th Century.

Commercial hunting continued into the early 20th Century, but a remnant population survived north of Afognak Island. This was one of the first areas in Southcentral Alaska where sea otters again became abundant; however, there has been relatively little expansion since the 1950's. Larger numbers have appeared near the Trinity Islands, and in 1967 approximately 400 sea otters suddenly appeared on the tip of the Kenai Peninsula (see Unit 15). These may have emigrated from the Afognak area. During the early 1970's, there has been an increase in the number of sightings in Chiniak Bay, indicating that some expansion is now occurring.

Sea otter numbers north of Afognak Island and around the Barren Islands are probably near their maximum level. Numbers should increase along both sides of Kodiak Island, but will always be small in these areas because of a lack of habitat. An unknown number of otters is scattered in the shallow waters between Kodiak and Chirikof Island. This population should increase considerably.

## Populations

The present population of Unit 8 is probably over 4,000 and increasing.

## STELLER SEA LION

Sea lions were intensively harvested for subsistence purposes by natives prior to 1900. As a result, population levels were considerably reduced throughout most of the state. Since the turn of the Century, the level of harvest of this species has been very low and the populations have recovered to near maximum levels.

## Populations

Because there have been few surveys made of sea lions in the unit the data presented in the following table are only approximate. The population estimate given for each location is the highest number of sea lions that a biologist has seen at a location at one time. It is not an absolute figure for that location but only an indicator of the degree of use by sea lions.

### Sea Lion Rookeries and Hauling Grounds Game Management Unit 8

<u>Quadrangle</u>	<u>Reference No.</u>	<u>Location</u>	<u>Population</u>
Sutwick Island	241	Chowiet Island	5,000
Trinity Island	245	Chirikof Island	500
	246	Sundstrom Island	100
Kaguyak	250	Sitkinak Island (Cape Sitkinak)	470
	251	Twoheaded Island	3,600
	252	Cape Hepburn	
	253	Bert Point	
<u>Quadrangle</u>	<u>Reference No.</u>	<u>Location</u>	<u>Population</u>
Kodiak	255	Cape Barnabas	1000
	256	Ugak Island	440
	257	Chiniak Island	600
	258	Long Island (Vera Bay Rocks)	50
Karluk	259	Cape Ugat	50
	266	Outer Seal Rocks	50
	267	Tombstone Rocks	50
Afognak	268	Middle Cape	25
	320	Marmot Island	10,000
	321	Afognak Island (Tonki Cape)	100
	322	Afognak Island (Cape Paramonof)	50
	323	Latax Rocks	3,300
	325	Sugarloaf Island	10,000
	326	West Amatuli (Southeast end)	1,600
	327	Sea lion Rocks	500



328	Ushagak Island	100
329	West Amatuli (Rocks on west end)	100

## WHALES

Dall porpoises are commonly seen in the waters surrounding Kodiak Island. Kupreanof Strait and Marmot Bay are extensively used by large whales (reported to be sei whales, humpback whales and fin-back whales) during the months of April to August. Killer whales are also commonly seen in the same area, in Ugak Bay in April and October, and in Uganik Bay and Viekoda Bay in March and April. Gray whales are frequently sighted off Cape Chiniak during May.

## WATERFOWL AND SEABIRDS

There have been no surveys of breeding waterfowl and seabirds in Game Management Unit 8, and only a few superficial estimates of winter waterfowl populations have been made. Waterfowl commonly breeding in the unit are probably the same species found in Unit 9 with the exception of whistling swans, cranes, and geese, which do not breed in Unit 8. Breeding birds probably average fewer than 10 per square mile of suitable habitat.

Waterfowl use occurs year-round, and winter populations are many times greater than summer populations. Common, surf and white-winged scoters, common and spectacled eiders, old squaws and harlequins are much more abundant than other waterfowl in the winter. Many millions of seabirds breed and winter in the unit.

The following list presents data on known seabird colonies in the unit. Undoubtedly more colonies and species exist than are recorded here. Also included are non-colonial nesters such as murrelets and guillemots.

### Description of Seabird Colonies Indicated on Maps Game Management Unit 8

Map No.	Colony No.	Name	Species Present
47	15	Sea Otter Island	glaucous-winged gull, Pacific fulmar
47-47	23A-23B	East Amatuli- Nord Island	glaucous-winged gull, pelagic cormorant
38	53	Ugak Bay	glaucous-winged gull, horned puffin, double-crested cormorant
38	82	Whale Island	glaucous-winged gull, black-legged kittiwake
36	108	Chirikof Island	glaucous-winged gull, black-legged kittiwake, parakeet auklet
38	50	Uganik Passage	
38-38	51A-51B	Chief Point -Ditto Island	
39	52	Ayakulik Island	
38-39	54	Deadman Bay	
37	55	Flat Island	
37	56	Cape Kiavak (not illustrated)	
38	57	Sitkalidak Strait	
38	58	Aunulu Creek	
38	59	John Island	
38	60	Cathedral Island	

38	61	Midway Bay
38	62	Ghost Rocks
38	63	Ladder Island
38	64	Boulder Bay
38	65	Gull Point
38	66	Svitlak Island
38	67	Utesistoi Island
38	68	Middle Bay
38	69	Viesoki Island
38	70	Inter Rock
38	71	Zaimka Island
38	72	Cliff Island
38	73	Puffin Island
38	74	Chiniak Island
47	75	Parrot Island
38	76	Taliudek Island
47	77	Foul Bay
47	78	Peril Cape
47	79	Izhut Bay
47	80	Edge Mountain
47	81	Big Waterfall Bay
38	83	Anton Larsen Bay
38	84	Sharatin Bay
38	85	Kekur Point
38	86	Bare Islan

The following birds are known to occur in Unit 8; any or all may be found on all colonies listed : glaucous winged gull, black-legged kittiwake, Aleutian and Arctic terns, horned and tufted puffins, common murre, Cassin's, parakeet, crested and least auklets, Pacific fulmar, double-crested, pelagic and red-faced cormorants, marbled and ancient murrelets, pigeon guillemot, mew gull.

#### **Land Use Considerations and Recommendations**

The major threat to waterfowl and seabird habitat in Unit 8 is offshore oil spills. Actions suggested in the discussion of Unit 6 are recommended in Unit 8 to prevent future habitat and bird losses due to oil pollution.

The Kodiak Island National Wildlife Refuge will preserve and protect much of the upland waterfowl habitat in the unit. Creation of new federal and/or state sanctuaries for some of the larger seabird colonies should be considered. At this writing, knowledge about key habitat areas is not sufficient to specifically designate them. Winter inventories should be conducted to assess bird populations and delineate areas of key habitat.

### **GAME MANAGEMENT UNIT 9**

The Alaska Peninsula is designated Game Management Unit 9. This is a land of superlatives: the biggest, most spectacular, most violent and most productive piece of wild land in Alaska. It contains prime habitat for land mammals, waterfowl, marine mammals, fish and shellfish but fortunately is not especially hospitable to modern man. Aboriginal peoples, however, lived throughout the coastal areas.

The area has a large number of active volcanoes whose periodic eruptions have laid waste to vast stretches of the Peninsula inundating them with thick layers of volcanic ash and locally with lava flows. The typical cone-shaped

mountains, visible on rare clear days, extend from the western tip of the Aleutians to the Peninsula's base some 1,150 miles to the northeast. The Aleutian Mountain Range rather neatly divides the Pacific Ocean exposure from that of the Bering Sea. The Pacific side consists of steep, alder and willow covered mountains with relatively short rivers. In contrast, the Bering Sea side consists of (I broad gently rolling flatland between the coast and the mountains.

The area is rich in wildlife. The world's largest red salmon fishery feeds numerous brown bears and other species and the river estuaries rest and nurture millions of migrating waterfowl. The successional vegetation, reclaiming the volcanic ash wastes, provides forage for thousands of the world's largest moose, and the extensive sedge meadows support a rapidly increasing caribou population. Offshore migrations of whales are an annual event and sea otters, seals, and sea lions seem innumerable. Clouds of seabirds inhabit the numerous rocky cliffs. Summers on the peninsula are cool and wet, with frequent storms moving through the area from both the Bering Sea and the Pacific Ocean. Winters are long but mild compared to those of Interior Alaska. Snow cover is relatively light, but severe icing conditions occur periodically. Annual temperature extremes range between 80 F and -35 F, and annual precipitation averages about 30 inches a year.

The rugged Aleutian Range, 1,000 to 4,000 ft. in elevation, parallels the Pacific Coast for the entire length of the peninsula, surmounted at intervals by volcanoes rising to peaks of 4,500 to 8,500 ft. Most volcanoes have glaciers on all sides and some have summit ice fields. The western portion of the peninsula slopes gradually toward the Bering Sea. The northeast half contains many lakes, and land adjacent to the Bering Sea is relatively flat and poorly drained; the southwest half is better drained and has fewer lakes. Passes through the mountains are common along the entire length of the Aleutian Range. On the Pacific side, these mountains end rather abruptly at the sea, leaving a rugged coastline.

Extensive volcanic cinder beds radiate in irregular lines on slopes surrounding Aniakhak Crater, Mt. Katmai, Mt. Veniaminof and others. Bare rock is common above 2,000 ft. elevation. The vegetation is primarily wind-swept tundra, with willow and alders along streams and on protected hillsides. Near the base of the peninsula, white and black spruce forests, with some birch, predominate. These forests thin to the southwest and aspen and cottonwood become prominent. Even these disappear just south of Port Moller.

The climate is fierce--wet, windy, cool to cold. Snowfall is not particularly heavy and the wind further compacts it. Generally snow depths are not limiting to ungulates, although there are exceptional years when snows accumulate. Humans are clustered in fishing villages and military installations. Much of the population is transitory, coming to fish during the summer and departing in the fall.

## **BLACK BEAR**

Most of Unit 9 is not suitable habitat for black bears, which are rare below the sparse spruce forests near Iliamna Lake. Throughout the upper portion of Unit 9, black bears are associated with the denser timber stands. Sightings in the open tundra are rare although considerably more common near dense alder and willow stands devoid of mature timber.

Black bears are seldom hunted in this unit although a few are taken on guided hunts. Most are taken incidentally to hunting of other big game or even to fishing. Apparently, local residents take a few bears for food when they are readily available. This use was probably more important in the past than it is today.

Food requirements for black bears in Unit 9 are probably the same as for black bears in Unit 16. Red salmon are important to bears in the area although few streams are major bear concentration areas.

Due to the present sparse distribution of humans in the unit, very few black bear-human conflicts have arisen.

As man's activities increase, direct conflicts will arise. Black bears are generally more tolerant of habitat changes than are most species; however, changes which adversely affect fish runs could seriously decrease black bear populations.

## **BROWN BEAR**

Brown bears have been and remain abundant in Game Management Unit 9--probably in densities comparable to those found on Kodiak Island. Although historical information is practically nonexistent, it appears that the distribution of brown bears on the Alaska Peninsula has changed very little in recent times.

Apparently, natives took some brown bears for food and hides. There is very little information available on their historic uses but hides could have been traded to early Russians.

Although estimates have been made of the early sport harvests, it was not until 1961 that a mandatory bear hide sealing program was initiated and harvest enumeration became fairly precise. Since 1961, the Alaska Peninsula has contributed over 25 percent of the statewide harvest of brown-grizzly bears. The lowest and highest reported harvests were 91 in 1969 and 230 in 1966. Much of the area's popularity with some hunters is because the terrain and cover favor the use of small aircraft for transportation and illegal spotting. This practice has, however, been subjected to stringent controls, with transportation between hunting camps the only legal aircraft use.

Due to topography and vegetation much of the peninsula is not ideally suited for viewing and photographing bears. Many areas do traditionally attract bears during salmon runs, however, and these are well-suited for this purpose. The McNeil River Game Sanctuary, located on McNeil River in Kamishak Bay, is probably the most popular bear viewing area in the world because of its accessibility and large numbers of bears. Many such concentration areas are available, however, if one searches diligently along the major salmon spawning tributaries on the peninsula.

Access for observation and hunting of bears on the Alaska Peninsula is peripheral, being limited to boats, float planes, and a few airports. Access must be a prime consideration in all future management plans.

### **Populations**

Generally speaking, the greatest bear densities occur between Port Moller and Katmai National Monument, although there are local and seasonal population concentrations below and above these locations.

Despite the fact that intensive bear studies have been accomplished on the peninsula, it is difficult to estimate the total population with any accuracy. However, an analysis of available data suggests a conservative estimate of 2,000 bears below the Naknek River and Katmai National Monument. Considering the size of the area, the densities on Kodiak and similar areas of the Alaska Peninsula, and recent tagging data, it is very likely that this estimate is low.

Spring bear tagging operations conducted in less than 1,000 square miles in the Black-Chignik area for the past three years (1970-72) marked about 100 animals yearly, of which only about 30 percent were recaptures each of the last two years. This indicates that bear densities are indeed high on the peninsula.

### **Specific Habitat Considerations**

The Alaska Peninsula contains two distinctly different types of bear habitat, which must be considered separately. The Pacific Ocean side of the Aleutian Range is consistently more rugged and critical habitat areas more compact than on the Bristol Bay side. In the spring, bears quickly move from denning areas, primarily on steeper slopes of

the Range, to lower subalpine zones and coastal areas. On the Pacific side, these high spring use areas are considered extremely critical, depending on the severity of the winter, the condition of the bears, and spring weather. Available spring forage is limited during the few critical months.

On the Bristol Bay side, the spring habitat zone is so wide that it is doubtful that the spring food supply is ever very limited. Scavenging winter kills of moose and caribou and carcasses of marine mammals washed ashore provides valuable dietary supplements to bears on the Bristol Bay side.

As on Kodiak Island, important early spring foods are sedges, grasses, horsetails, red poque and other early herbaceous species. Carrion, small rodents and readily available big game (particularly caribou and moose calves) are also important spring items.

The abundance and availability of salmon on the Alaska Peninsula is undoubtedly the most important dietary consideration for brown bears. The availability of this high protein diet from July through September, and in some streams through November, must account for the bears' large individual size and for the high population densities in the area.

Except for areas like the Chignik River and the Aniakchak River system, both of which produce good runs of red salmon, the salmon runs on the Pacific side are dominated by pink, chum and silver salmon. Pink salmon appear in some streams in late July and continue through August. Chum and silver salmon appear generally in August and September with silvers sometimes being available as late as November or December depending on weather conditions. This availability of salmon late in the fall may be critical to late denning bears, most of which are boars.

The longer stream-lake systems in the Bristol Bay drainage are dominated by larger and more dramatically variable runs of red salmon. Literally millions of red salmon spawn throughout the Iliamna, Kukaklek, Nonvianuk, Naknek, Becharof, Ugashik, and Bear Lakes systems, and other similar but smaller systems. Red salmon arrive in mid-July in some streams, and peak periods of spawning occur from early to late August. Considerable variances occur between systems and September spawners are not uncommon. Pink, chum, silver and king salmon usually arrive from late July through early September, with silvers and kings being available even later in many streams. Late spawning red salmon may be available on spawning areas in a few major systems such as the Savonoski River as late as November or until freeze-up occurs.

Summer berry crops are also important to brown bears on the Alaska Peninsula. Movements to alpine and subalpine areas begin in early August, as the lowbush cranberries, highbush cranberries, elderberries, and blueberries ripen. More than likely, constant movement between zones occurs on the peninsula much as on Kodiak Island. Predictable concentrations of bears on salmon streams and in berry areas during late summer and fall attest to this fact. The alpine and subalpine area is fairly extensive and although it is not specifically plotted on the maps it is important bear habitat. The reason for not including this category is the size of the area, the difficulty of plotting it correctly, the variability in bear use of specific areas and the lack of specific data available.

Denning on the Alaska Peninsula occurs primarily in the alder-willow zone, with differences in elevations of dens relating to the elevation of this habitat type. Dens examined on the peninsula showed a preference for east facing slopes and well-drained sites. Steep slopes apparently are preferred for ease in excavating.

Females and young bears usually den in late October or November and emerge beginning in May. Males and single bears tend to den later and emerge earlier, with some bears denning for only a very short time. Because of the size of this unit and the variability in weather and food availability, there is considerable variability in denning.

## **Land Use Considerations and Recommendations**

Bear-man conflicts in land use on the Alaska Peninsula will most likely not arise unless intensive commercial livestock grazing is attempted. Many areas on the peninsula support extensive growth of sedges, willows and grasses which can be considered commercially valuable. Although carrying capacities for livestock are relatively low by most standards, interest in these areas has been expressed in the past. A brief review of bear-livestock relations shows that the two are completely incompatible. For this reason, open commercial grazing of any type is not recommended. Fencing and controlled herding may be possible in some areas.

Future human encroachment on the land will undoubtedly have some impact on bear numbers and distribution. Although brown bears usually tolerate man, man seldom tolerates bears. Concentrating human development, establishing and enforcing rigid waste disposal requirements, and educating the public concerning bear behavior would at least alleviate the majority of the direct conflicts between bears and man.

The Alaska Peninsula is one of the most productive fish and wildlife areas in the state and for all practical purposes it can be considered a complete ecological unit. For these reasons, it is recommended that future resource management decisions concerning the peninsula be made in favor of wildlife, and that interactions between wild species (e.g., bears and salmon) be prominently considered.

### **WOLF**

Wolves occur throughout Unit 9 but they have not been particularly abundant for some time. Their relative scarcity is surprising because ungulate prey, beaver and waterfowl are so abundant. In addition, wolves on the peninsula commonly feed on spawning salmon, which are also very abundant.

### **WOLVERINE**

Wolverines occur throughout this unit and, while never truly abundant in any part of their range, are commonly seen along the Bering Sea beaches. On average of 36 wolverines were harvested annually during the past ten years.

### **BARREN GROUND CARIBOU** (Alaska Peninsula Herd: see also Unit 10)

The Alaska Peninsula caribou herd presently ranges over an area of about 30,000 square miles extending from Naknek Lake southwest to and including Unimak Island (Unit 10). The herd has increased in numbers from a recent low of about 2,500 animals in the late 1940's to a present population of approximately 15,000. This herd consists of three segments: one north of Port Moller; one south of Port Moller; and one ephemeral population on Unimak Island (see Game Management Unit 10).

In the mid-1800's caribou were abundant on coastal areas near Bristol Bay and along both sides of the Alaska Peninsula. Trading posts at Fort Alexander (at the mouth of the Nushagak River) and at Ugashik did a brisk business in caribou skins. At that time caribou moved seasonally on and off the peninsula. By the turn of the Century, however, large migrations across the Kvichak River had stopped and caribou moved only as far north as Becharof Lake. In the early 1900's caribou numbers on Unimak Island reached full carrying capacity and most of the herd remained on the southwestern portion of the Alaska Peninsula. Later the animals shifted to the northeast, a move that may have been precipitated by the heavy volcanic activity occurring between 1929 and 1931 near Port Moller. Domestic reindeer were introduced to the Alaska Peninsula in 1932, but the reindeer industry lasted only a few years.

Overgrazing in the late 1920's combined with extreme icing conditions and deep snow in the winter of 1938-39 to precipitate heavy losses of both reindeer and caribou. Caribou and reindeer numbers reached a low level dur-

ing the 1940's and the few remaining reindeer herds were abandoned at this time.

### **Populations**

No censuses of this caribou herd have been made in recent years. Casual observations suggest good productivity and an increasing population. Neither hunting pressure nor predation is intense. Hunters kill 400-600 animals each year. The population, exclusive of Unimak Island in Unit 10, is between 12,000 and 15,000 animals.

### **Winter Distribution**

Preferred winter ranges are on the lowlands between the Ugashik and Naknek Rivers. Sedges are numerous on these poorly-drained coastal plains and provide the most abundant winter food. However, in the region north of Becharof Lake, lichens offer attractive winter forage where they are an understory in the spruce forests of the drier uplands. Winter movements may extend as far north as King Salmon, but caribou rarely cross the Naknek River. Scattered bands are present from Port Moller to Pilot Point throughout the winter.

Snow accumulations are usually light on the peninsula and normally do not restrict caribou movements. However, coastal storms can result in severe icing conditions during some winters and may inhibit feeding activities over large areas.

Caribou south of Port Moller presently winter on the marshy Caribou River lowlands and westward along the foothills north of Pavlof Volcano. On Unimak Island caribou frequent the lowland areas in winter.

### **Spring Migration**

Instead of the rapid and direct migration to the calving grounds that is typical of most other Alaskan caribou herds, the Alaska Peninsula herd begins a leisurely drift to the southwest in February or March. This spring drift spans a broad front, at times covering much of the coastal plain, but most cows follow a straight line paralleling the coast between the mouths of the Ugashik and Meshik Rivers, and reach the calving grounds by mid-May.

### **Calving**

The segment of the Alaska Peninsula herd north of Port Moller calves on the coastal plains between Bear River and Port Heiden Bay. Occasionally some calving occurs between Port Heiden and Cinder River.

South of Port Moller, the calving area is located on the slopes of Trader Mountain at the head of Caribou River. No regular calving area has been identified on Unimak Island. The calving period lasts from May 20 to June 15 and peaks about June 1.

### **Summer Distribution**

Most cows and calves remain near calving areas from May through July, but bulls and yearlings scatter widely and may be found throughout the Aleutian Range and from coast to coast.

### **Fall Migration**

In late August caribou on the peninsula shift to the northeast. Cows and calves are the first to move and movements proceed along the same coastal routes used in the spring. As cows move northward they are joined by ever increasing numbers of bulls and yearlings. Bands of adult bulls often lag far behind the cows and calves.

By mid-September some caribou have reached the area near Becharof Lake but many still remain between Port Moller and Port Heiden. In October the bulls join the cows for the rut. By mid-December most animals occupy a common winter range between the Ugashik and Naknek Rivers.

#### **Specific Habitat Considerations**

The Alaska Peninsula herd occupies an area with poor stands of lichens. These caribou over-winter largely on sedges. The range is not subject to burning because of the cool maritime climate, and except for volcanic action is reasonably secure from natural alteration. Man's activities, especially on the calving grounds, should be carefully regulated. Even here, however, the impact of disturbance is minimal when compared to damage that can be done to soils underlain with permafrost. Erosion from surface water runoff and wind can be a major problem and removal of the protective vegetative mat should be avoided.

## **BISON**

Bison were transplanted to Popof Island sometime between 1954 and 1958 in an apparent attempt to establish them for commercial purposes. The bison were privately owned and are free ranging over the entire island. Current reports indicate that there are about 7 to 10 animals remaining. No specific bison habitat information is available for the island.

## **MOOSE**

Although moose are generally considered relative newcomers to the Alaska Peninsula, early reports show they were present as far west as Bear Lake near Port Moller in the late 1800's. Probably they were eliminated periodically from major portions of the peninsula by cataclysmic volcanic eruptions. As conditions stabilized and vegetation became reestablished, moose reappeared, giving rise to a theory of westward movement in recent years.

The populations between Iliamna and Mother Goose Lakes apparently built up rapidly from the late 1940's through the mid-1950's. The population increase below Mother Goose Lake continued into the early 1960's.

Human uses of moose include trophy hunting, largely by guides and nonresidents, and recreational meat hunting by residents. The area produces what may be the world's largest representatives of the species, but few weights and measurements are available at this time. Some of the largest recorded moose antlers have come from Unit 9, however.

### **Populations**

The greatest densities of moose occur along rivers and their headwaters from King Salmon River to and including the Meshik River. Sex and age composition counts of selected areas have included over 2,000 animals in some years and a reasonable estimate places the total population at over 7,500 moose. Harvests are relatively low; in 1972 hunters reported 440 moose killed.

### **Specific Habitat Considerations**

Moose are a hardy species that need relatively little protection from man's tendency to destroy habitat. The most devastating impact could come from the introduction of domestic animals such as cattle or sheep. These exotics would cause conflicts with indigenous carnivores as well, and we strongly recommend against such actions.

## **HARBOR SEAL (Land Breeding)**

The total number of harbor seals in this unit is unknown. Port Heiden has produced a harvest of 1,500 to 3,000



seal pups annually since 1965. Port Moller supports a similar number of adult seals, and the pup harvest has been about 1,500 annually. Izembek Lagoon supports several thousand seals, but none are harvested.

Seals concentrate in the Shumagin and Sanak Islands, on the south side of the Alaska Peninsula, and are common throughout the remainder of the unit. Lake Iliamna contains the only known resident population of harbor seals in fresh water in Alaska. The population remains in the lake throughout the year and numbers 50 to 150 animals.

**NORTHERN FUR SEAL** · See Unit 10.

**BEARDED SEAL, ICE BREEDING HARBOR SEAL, RIB-**

**BON SEAL, RINGED SEAL, WALRUS** · See Unit 22.

**SEA OTTER**

Unit 9 contains vast areas of excellent sea otter habitat. Few otters ever inhabited Cook Inlet north of Tuxedni Bay. Portions of the Pacific coast of the Alaska Peninsula contain only a narrow band of shallow water suitable for sea otters, but large populations once occurred where extensive habitat was available such as near Augustine Island, Sutwick Island, the Shumagin Islands, Sanak Island and the Sandman Reefs. Another large population existed in the extensive shallow waters north of Unimak Island (Unit 10) and the Alaska Peninsula. Sea ice limited the distribution of this population. Small numbers occasionally strayed past Port Heiden, but ice periodically eliminated sea otters east of Port Moller.

Intensive market hunting of sea otters in this unit began in the 18th Century. Perhaps because hunting was difficult in large offshore areas, a number of populations managed to persist. When the hunting ended around 1900, a small number may have survived near Augustine Island, south of Sanak Island, in the Sandman Reefs and north of Unimak Island. All of these populations have grown steadily and have expanded their ranges since 1960. Sea otters from Augustine Island have spread southwestward to Katmai Bay. The Sutwick Island population has spread to Puale Bay to the northeast and Castle Cape to the southwest. Sea otters from Simeon of have repopulated the northern Shumagin Islands and a few have reached the adjacent mainland coast. The Sanak Island and Sandman Reef populations have increased to near maximum levels and are expanding into the Pavlof Islands and adjacent mainland coast and Unimak Island. The population north of Unimak Island has expanded northeastward along the Alaska Peninsula. By 1965, otters were common as far as Port Moller. By 1970, significant numbers had reached Port Heiden and stray animals were seen as far north as Ugashik Bay.

Extreme sea ice conditions in the springs of 1971 and 1972 caused considerable mortality and restricted distribution to the area west of Moffet Point except for a few survivors at Port Moller. During the period of maximum sea ice in 1972, several hundred otters moved to the Pacific Ocean by drifting through False Pass or by crossing land into Cold Bay and possibly Morzhovoi Bay.

Sea otters are currently abundant near Augustine Island. Scattered animals occur between Cape Douglas and Puale Bay with a small concentration near the Shakun Islands northeast of Hallo Bay. Numbers should continue to increase in this area for many years. Greater numbers are found between Puale Bay and Amber Bay but these populations are still well below the capacity of the habitat and are increasing rapidly. There is a very dense concentration of otters between Amber Bay and Chignik Bay, particularly in Kujulik Bay, where numbers may exceed the long-term carrying capacity of the habitat. This area will continue to be an important source of animals repopulating adjacent areas.

Between Castle Cape and Stepovak Bay there are only scattered individuals. Much of this area has only a limited amount of shallow water suitable for sea otters, however. Over the next few years there should be a substantial influx of sea otters into this area from the large populations on either side.

Sea otter populations in the southern Shumagin Islands are probably near their maximum potential size. Unga, Popof and Korovin Islands have populations below potential, but growing rapidly. Numbers along the adjacent mainland coast, which now supports a few small groups, should also increase rapidly.

In the shallow, rocky waters south of Sanak Island there is a large group of sea otters whose numbers probably stabilized by the early 1960's. The Sandman Reefs northeast of Sanak also contain a large number of sea otters. This population should continue to expand to the mainland shore and the south side of Unimak Island. Eventually, animals from this population may contribute to the repopulation of the Krenitzin and Fox Islands (see Unit 10).

The population north of Unimak Island and the Alaska Peninsula is currently restricted to waters west of Port Moller. Its range should again expand to the Port Heiden area but it may be periodically curtailed by severe winters. Within this range, sea otters live over 30 miles from shore in completely unprotected waters. They seldom come ashore and occasionally are seen resting in pods as large as 1,000 animals. The present population is very large and it is not known if it will continue to grow. Otters from this area may also contribute to the repopulation of the Krenitzin and Fox Islands (see Unit 10).

### **Populations**

The following population estimates are based on otters actually seen in aerial surveys, expanded on the basis of comparisons of this type of survey with known minimum numbers in other areas.

Augustine Island · Puale Bay	1,000 +	increasing
Puale Bay - Stepovak Bay	8,000 to 10,000	increasing
Shumagin Islands	8,000 to 10,000	increasing
Sanak Island - Sandman Reefs and the adjacent mainland	6,000 to 10,000	increasing
North Unimak - Alaska Peninsula	8,000 to 10,000	increasing
Total, Unit 9	31,000 to 40,000	increasing

### **STELLER SEA LION**

Sea lions were intensively harvested by coastal natives prior to the 1900's. As a result, population levels were considerably reduced throughout most of the state. Since the turn of the Century, the level of harvest of this species has been very low and populations have recovered to near maximum levels.

### **Populations**

Because there have been few surveys made of sea lions in this unit, the data presented in the following table are only approximate. The population estimate given for each location is the highest number of sea lions that a biologist has seen at a location at one time. It is not an absolute figure for that location but only an indicator of the degree of use by sea lions.

**Sea Lion Rookeries and Hauling Grounds  
Game Management Unit 9**

<u>Quadrangle</u>	<u>Ref. No.</u>	<u>Location</u>	<u>Population</u>
False Pass	178	Bird Island	260
	179	Sanak Island (South Rock)	3200
	180	Cherni Island	380
	181	Clubbing Rocks	5600
	182	Pinnacle Rock	980
Simeonof Island	190	Nagai Island	15
	191	Twins	10
	192	Chernabura Island	2000
	193	Simeonof Island	150
Cold Bay	200	Amak Island	2000
	201	Sea Lion Rocks	350
Port Moller	205	Wosnesenski Island	300
	206	Jude Island	3000 (Pups)
	207	Shumagin Islands (Sea Lion rocks)	400
	208	Unga Island (Unga Cape)	30
	209	The Whaleback	600
	210	The Haystacks	100
Stepovak Bay	215	Atkins Island	3100
	216	Castle Rocks	400
	217	Kupreanof Pen. (Kupreanof point)	35
	218	Spitz Island	700
	219	Mitrofanina Island	216
Sutwik Island	220	Seal Cape	10
	235	Kak Island	100
	236	Atkulik Island	10
	237	Sutwik Island (West end)	738
	238	Sutwik Island (Foggy Cape)	Unknown
Karluk	239	Cape Kumlik	10
	240	Ugaiushak Island	600
Katmai	265	Puale Bay (Rocks at entrance)	2800
	315	Cape Gull	100
Afognak	316	Cape Ugyak	100
	317	Takli Island (Rocks west of Island)	Unknown
	324	Cape Nukshak	500
Iliamna	410	Augustine Rocks	500

Relatively few sea lions utilize the north side of the Alaska Peninsula; major concentrations are in the area of Amak Island (Rookeries No. 200 and No. 201). Some sea lions also concentrate in and around False Pass during summer when salmon are migrating. Most of the rookeries and hauling grounds in the unit are along the south side of the Alaska Peninsula near Cold Bay and in the Shumagin Islands. In 1965, sea lion hunters harvested 259 pups on Atkins Island (Rookery No. 215) and 72 on Jude Island (Rookery No. 206). The total sea lion population in the unit probably exceeds 50,000 animals.

## WHALES

Cook Inlet - See Unit 16.

Pacific Side of the Alaska Peninsula - See Unit 8.

Bristol Bay

Gray whales commonly occur along the north shore of the Alaska Peninsula from Izembek Bay to Pilot Point. They are frequently sighted within a mile of shore although they do occur farther out. Beluga whales are very abundant in Bristol Bay during ice-free periods. They occur most frequently in Kvichak Bay and Nushagak Bay. In spring when the Naknek River becomes ice free, belugas ascend the river to feed, sometimes going as far as King Salmon and even beyond. Belugas also ascend the Kvichak and Nushagak Rivers, frequently passing be-

yond the village of Levelock on the Kvichak. They are most abundant in the river during the month of May and the first two weeks of June.

## **WATERFOWL AND SEABIRDS**

### **Populations**

The Fish and Wildlife Service estimates there are 32 breeding ducks per square mile of suitable habitat in Game Management Unit 9. Waterfowl species commonly breeding in Unit 9 are: scaup (about 90 percent greater scaup and 10 percent lesser scaup), mallard, pintail, green-winged teal, shoveler, widgeon, gadwall, Barrow's goldeneye, harlequin, bufflehead, old squaw, Pacific eider, common scoter, common merganser, whistling swan and sandhill crane. Canada geese breed in the northwestern part of the unit. Trumpeter swans breed in the Tuxedni Bay area, and possibly in the area southwest of Lake Iliamna.

A post-production survey of 100 square miles conducted during the summer of 1971 south of Lake Iliamna showed 2.0 whistling swans per square mile. Comparable concentrations are found as far down the Alaska Peninsula as Egegik, and lower densities to Pilot Point. Few swans are found south of Pilot Point.

Unit 9 is extremely important as a spring and fall waterfowl staging and migration area. All or nearly all of North America's black brant, emperor geese, cackling Canada geese and Aleutian Canada geese use habitats in Unit 9. In addition, many hundreds of thousands of snow geese, white-fronted geese, lesser Canada geese, sandhill cranes, dabblers, divers and sea ducks are present during spring and fall months.

Nearly all of the large spring and fall concentrations of birds occur in intertidal, estuarine and river delta areas. Many waterfowl surveys have been conducted in Unit 9. For specific information, refer to Alaska Department of Fish and Game 1970 and 1971 Survey and Inventory Reports.

The following list presents data on known seabird colonies in Game Management Unit 9. Undoubtedly more colonies exist than are recorded here. Also listed are non-colonial species such as murrelets and guillemots.

## Description of Seabird Colonies Indicated on Maps Game Management Unit 9

<u>Map No.</u>	<u>Colony No.</u>	<u>Name</u>	<u>Species Present</u>
29	1	Amagat Island	glaucous-winged gull, horned puffin, tufted puffin, Arctic tern, marbled murrelet.
29	2	Sanak Island	tufted and horned puffins, ancient murrelet.
30	Not shown	Simeonof Island	glaucous-winged gull, blacklegged kittiwake, red-faced cormorant, parakeet and crested auklets.
31	14	Amak Island	pelagic and red-faced cormorants, glaucous and glaucous-winged gulls, black-legged kittiwake, common\thick-billed murre, horned and tufted puffins.
32	6B	The Haystacks	pelagic and red-faced cormorants, glaucous-winged gull, mew gull, black-legged kittiwake, pigeon guillemot, common murre, thick-billed murre, Cassin's auk let, parakeet auklet, least auklet, horned and tufted puffins, Pacific fulmar.
30-33	6C-6D	Bird-Big Koniuji Islands	
33-32	6E-6F	Castle Rock-Karpa Island	
32	6A	Unga Cape	black-legged kittiwake, glaucous winged
33	7	Stepovak Bay	gull. tufted puffin, glaucous-winged gull, black-legged kittiwake.
33	8	Mitrofanina Island	
35-35	9A-9B	Aghiyuk-Chowiet Islands	pelagic and red-faced cormorants, glaucous-winged gull, Pacific fulmar, black-legged kittiwake, common murre, tufted and horned puffins, parakeet auklet.
35-35	9C-9D	Aliksemit-Suklik Islands	
35-35	9E-9F	Kiliktagik-Anowik Islands	
35-35	9G-9H	Keteekuk-Aghik Islands	pelagic cormorant, glaucous winged gull.
39	16	Kashvik Bay	common murre, pelagic cormorant, black-legged kittiwake, glaucous winged gull.
46	17	Kukak Bay	
46-46	17A-17B	Kukak Point-Yugnat	
52	20	Chisik Island	black-legged kittiwake, glaucous winged gull, common murre, pigeon guillemot, tufted puffin, double crested and pelagic cormorants.
52	22	Tuxedni Bay	glaucous winged gull, double-crested cormorant.
68	109	Iliamna Lake	double-crested cormorant, glaucous and glaucous winged gulls, Arctic tern, marbled murrelet.
32	3	Bay Point(Unga Island)	The following birds are known to breed in Unit 9; any or all may be found in all colonies listed: glaucous winged gull, blacklegged kittiwake, Arctic tern, pelagic, red-faced and double crested cormorants, horned and tufted puffins, common and thick billed murre, Pacific fulmar, Cassin's, least, parakeet, and crested auklets, mew gull, marbled, ancient and Kittlitz's murrelets, pigeo-guillemot.
32	4	Pavlof Bay	
32	5	Zachary Bay	
35	10	Atkulik Island	
35	11	Cape Kuyuykak	
46	12	Amalik Island	
39	13	Puale Bay	
47	18	Shakun Rocks	
68	19	Augustine Island	
52	21	Duck Island	
51	24	Gull Island	
68	25	Glacier Spit	

## **Habitat and land Use Considerations and Recommendations**

The major threat to waterfowl habitat in Unit 9 is possible offshore oil spills in Bristol Bay. Millions of seabirds would also be affected. Oil spills in the Gulf of Alaska constitute less danger to waterfowl but tremendous danger to seabirds and sea ducks. Additional onshore drilling could constitute threats of a more local nature. Actions suggested in the discussion of Unit 6 are recommended in Unit 9 to prevent habitat and bird losses due to oil pollution.

Grazing leases have been considered for parts of Unit 9, and constitute a possible threat of unknown magnitude to nesting birds and habitat.

Any human activities in Unit 9 which would alter the present estuarine ecosystems would be undesirable in terms of waterfowl. The concentrations of birds in Unit 9, which are among the largest and most diversified concentrations in the world, depend upon the unpolluted condition of the habitat. A bill passed by the Alaska State legislature (1972) provided for official designation of key wildlife habitats as critical habitat, thereby affording special consideration and protection to the areas. Areas in Unit 9 which have been so designated to date include upland, tidal and submerged lands in Izembek lagoon, Port Moller, Port Heiden, Cinder River, Pilot Point and Egegik.

## **GAME MANAGEMENT UNIT 10**

The Aleutian Islands, extending in a 900-mile arc from Unimak Island to Attu Island, comprise Game Management Unit 10. Most of the islands are mountainous and all are treeless except for a few exotic specimens planted by man. The coasts are generally irregular with many off-lying rocks and reefs. The beaches tend to be rocky and narrow and the water usually is deep fairly close to shore. No other area in the world has consistently worse weather than the Aleutian Islands. Skies are persistently overcast, and high winds and violent storms are common. The average winter temperature is above freezing, a result of the warm Japanese current which flows along the islands. The area is rich in bird life and marine mammals but has few large land mammals. Caribou and foxes have been introduced on a few of the islands, and Unimak Island has several species of mammals from the adjacent Alaska Peninsula. Except for six of the large islands in the Fox Island group, all of Unit 10 is within the Aleutian Islands National Wildlife Refuge. The area is sparsely populated, containing only a few military installations and several small settlements. Access is primarily by air and, to a lesser extent, by boat.

### **BROWN BEAR**

Brown bears are found only on Unimak Island in this unit. There is no reason to believe that their numbers differ much today from those present prior to Russian settlement. Very little is known concerning actual bear numbers on the island, but densities probably compare with those on the lower portion of the Alaska Peninsula. Hunting has been limited, with the highest recorded sport harvest being 15 in 1964. Refer to the Unit 9 narrative for basic habitat requirements and specific habitat considerations.

### **WOLF**

Wolves have occurred on Unimak Island from time to time, but their status at the present time is unknown. Caribou are abundant and the island could support a population of wolves.

### **WOLVERINE**

Wolverines occur on Unimak Island but their status is not known.

## **BARREN GROUND CARIBOU**

(Alaska Peninsula Herd - See also Unit 9)

(Adak Herd)

### **Alaska Peninsula Herd**

Caribou occur on Unimak and Adak Islands in Game Management Unit 10. The animals present on Unimak Island are considered to be a part of the Alaska Peninsula herd. Apparently there is some exchange of animals between Unimak and the mainland across Isanotski Strait, a distance of one-half mile. Movements back and forth across the strait have been documented since the late 1800's.

The seasonal dynamics of caribou on Unimak Island are not well known. They probably calve in the vicinity of Urilia Bay. At present there is very little use of these caribou by humans. Natural predators include brown bears, wolves, wolverines and eagles. A recent partial count of the herd showed a minimum of 3,000 animals present. It seems probable that if the population build-up continues the Unimak Island caribou will immigrate to the mainland or, as has been the case with other island populations, will destroy the vegetation and starve. The island is within the Aleutian Islands National Refuge and most of it has been included in proposed wilderness classification. Management opportunities are extremely limited by these classifications and by the lack of nearby human populations of appreciable size.

### **Adak Herd**

Twenty-three caribou calves placed on Adak Island in 1958 and 1959 formed the nucleus of the present Adak herd. By 1967 the population numbered 189. Presently, 50 animals are shot annually to maintain the herd at a summer level of 200.

Adak caribou, which now range over the island's entire 290 square miles, are the largest caribou in North America. The total lack of biting insects, low caribou population, abundant forage, and absence of obstructions to movement allow them to reach tremendous size. One adult male, shot in September 1968, weighed 700 pounds.

## **HARBOR SEAL (Land Breeding)**

Harbor seals are present throughout the Aleutian Islands. No large concentrations are known, but the animals are abundant throughout the unit. A few seals are harvested annually in the area of Dutch Harbor and also on Atka Island.

## **NORTHERN FUR SEAL**

Unit 10 contains the Pribilof Islands National Reserve, the breeding grounds of the northern fur seal. Management of the population, which presently exceeds 1.25 million animals, is the responsibility of the U.S. government. Seals are harvested annually for their hides, and by-products are used for animal food. For more information concerning this program, contact:

U.S. Department of Commerce  
National Oceanic and Atmospheric Administration  
National Marine Fisheries Service  
Marine Mammals Biological Laboratory  
Seattle, Washington

## **BEARDED SEAL, ICE BREEDING HARBOR SEAL, RIBBON SEAL, RINGED SEAL, WALRUS** - See Unit 22.

### **SEA OTTER**

All of the Aleutian Islands are surrounded by excellent sea otter habitat. Shallow water is limited around a few of the smaller islands, such as the Islands of Four Mountains, but good habitat extends from 1 to 6 miles offshore of most of the larger islands. This entire habitat presumably supported dense aboriginal populations of sea otters. The Pribilof Islands are near the southern limit of sea ice but substantial numbers of sea otters were killed there in the 18th Century, indicating a relatively high aboriginal population.

Commercial hunters greatly reduced the numbers of sea otters in all populations and completely exterminated many populations during the 18th and 19th Centuries. The following is a description of population changes in each island group since market hunting stopped in 1911.

#### **Past Distribution**

**Pribilof Islands** - All sea otters were exterminated from these islands. An experimental transplant of 19 otters was made to Otter Island in 1955, but none are known to have survived. Another transplant of 57 otters was made to St. George Island in 1968, and has been successful. There is some evidence that a few otters may have emigrated from the Alaska Peninsula, either on retreating sea ice or across the shallow water of northern Bristol Bay.

**Unimak Island** - See Unit 9.

**Krenitzin and Fox Islands** - Almost all of the sea otters were exterminated from these islands. Two very small groups, one at Tigalda Island and the other at Samalga Island, have grown from nuclei of survivors. These groups grew slowly during the 1960's, and scattered animals are now present throughout the island group.

**Islands of the Four Mountains** - All sea otters were exterminated from this island group. Several otters were reported there in 1969, but subsequent searches have not relocated them.

**Andreanof Islands** - Sea otters were almost completely eliminated from this area. Very small residual populations probably remained on Atka, Amlia, Seguam and possibly Tanaga Islands. The Atka and Amlia populations have grown slowly and each now numbers several hundred in localized areas on the Pacific side of the islands. Repopulation of the Andreanof Islands has been primarily from the west, however, with others coming either from the Delarof Islands, Tanaga Island or both. Otters have typically built up to a high population level in one area before abruptly moving to the next island. In this stepwise manner, Tanaga Island was repopulated in the 1940's, Kanaga Island in the early 1950's, Adak Island in the late 1950's and the islands between Adak and Atka Island in the 1960's.

**Delarof Islands** - Although sea otter numbers in the Delarof Islands were greatly reduced by commercial hunters, small numbers probably survived in the rough, shallow waters of the area. The population grew, reached a peak by 1950, and now is fluctuating at a lower level.

**Rat Islands** - Sea otter numbers were greatly reduced in the Rat Islands, but relatively large numbers survived. As a result, the islands of this group, most notably Amchitka, have become repopulated. The populations of most of the islands reached peaks during the 1940's and then declined to levels approaching the long-term carrying capacity of the habitat. Semisopchnoi and Buldir Islands were exceptions. Sea otters apparently immigrated to Semisopchnoi in the 1940's and Buldir in the late 1950's from the nearby overpopulated islands.



Near Islands - Sea otters were completely exterminated from the Near Islands by fur hunters. In the late 1950's, small numbers of otters reappeared there, probably emigrating from the Rat Islands.

**Present Distribution**

Pribilof Islands - Scattered sea otters occur around St. George Island and occasional strays visit St. Paul Island. This population should increase slowly.

Unimak Island - See Unit 9.

Krenitzin and Fox Islands - Small concentrations of sea otters inhabit the water northeast of Tigalda Island and near Samalga Island. Smaller numbers occur throughout the island group, particularly near Beaver Inlet and Konets Head on Unalaska Island and near Vsevidof Island. Numbers are increasing steadily and there is the potential for an influx of large numbers of otters from Unimak Island. Much suitable habitat remains vacant or underpopulated in this group, and the population should continue to grow for many years.

Islands of the Four Mountains - At present, there are few if any sea otters in the Islands of the Four Mountains. A limited amount of suitable habitat exists in the area. Sea otters may eventually cross the deep passes from either Seguam Island or, more likely, Samalga Island, but significant movements may not occur until the Fox Islands are completely repopulated.

Andreanof Islands - Tanaga and Kanaga Islands support populations at the carrying capacity of the habitat. The populations between Atka Island and Atka Pass may exceed carrying capacity. Numbers in this area should decline as animals migrate eastward to Atka Island and as natural mortality increases. A front of population expansion is moving along the western end of Atka Island and several hundred animals inhabit the central portions of the Pacific shores of both Atka and Amlia. The northern shores of both islands have very few sea otters. As large numbers immigrate from the west, both islands should be rapidly repopulated, first on the Pacific sides then on the Bering Sea sides. Sea otters inhabit all waters of Seguam Island in small but increasing numbers. This population may reach its potential before Amlia Island is completely repopulated.

Rat Islands - Sea otter numbers are presently at or approaching carrying capacity throughout the Rat Islands.

Near Islands - Scattered sea otters occur throughout the Near Islands. Numbers should continue to increase and eventually this island group will support relatively large populations.

**Populations**

The following table presents our best current estimates of sea otter populations in Unit 10. Where only aerial survey results are available, estimates have been expanded to make them comparable to estimates based on shore and boat surveys. Because some local errors may occur, estimates are combined by island group.

<u>Island Group</u>	<u>Estimated Population</u>	<u>Status</u>
Pribilof Islands	50	Increasing?
Unimak Island	(See Unit 9)	
Fox & Krenitzin Islands	300	Increasing
Islands of Four Mountains	0	?
Andreanof Islands	36,000-38,000	Increasing east of Atka Pass, Stable west of Atka Pass
Delarof & Rat Islands	23,000-32,000	Stable
Near Islands	100	Increasing
Total in Unit 10 except Unimak Island:	59,000-70,000	

## STELLER SEA LION

Sea lions were intensively harvested by natives prior to the 1900's and as a result, population levels were considerably reduced throughout most of the state. Since the turn of the Century, harvest of this species has been low and populations have recovered to the point where they now appear to be near maximum.

Unit 10 presently contains more sea lions than any other game management unit. Because there have been few surveys made of sea lions in this unit, the data presented in the following table are only approximate. The population estimate given for each location is the highest number of sea lions that a biologist has seen at a location at a particular time. It is not an absolute figure for that location but only an indicator of the degree of use by sea lions.

### Sea lion Rookeries and Hauling Grounds Game Management Unit 10

<u>Quadrangle</u>	<u>Ref. No.</u>	<u>Location</u>	<u>Population</u>
Attu	1	Attu Island (Cape Wrangell)	9,000
	2	Attu Island (Chirikof Point)	10
	3	Agattu Island (Gillon Point)	3,000
	4	Agattu Island (Dtkriti Bay)	100
	5	Agattu Island (Cape Sabak)	3,300
	6	Alaid Island (west end)	1,500
	7	Shemya Island (rocks off north shore)	2,500
Kiska	17	Buldir Island (south shore)	2,500
	18	Kiska (Cape St. Stephen)	1,000
	19	Kiska (Vega Point)	400
	20	Tanadak Island	50
Rat Islands	25	Rat Island (eastern point)	750
	26	Amchitka Island (Bird Rock)	50
	27	Amchitka Island (islet off Chitka Point)	50
	28	Amchitka Island (Ivakin Point)	300
	29	Amchitka Island (East Cape)	200
	30	Amchitka Island (St. Makarius Islet)	50
	31	Amchitka Island (SW islets & rocks)	600
	32	Semisopchnoi Island (rocks off SW shore)	500
	33	Semisopchnoi Island (Pochnoi Point)	2,000
	Gareloi Island	43	Amatignak Island (Nitrof Point)
44		Amatignak Island (Knob Point)	50
45		Ulak Island (Hasgox Point)	1,500
46		Unalga Island (Dinkum Rocks)	350
47		Gareloi Island (south shore)	2,500
48		Skagol Island (rocks off south point)	500
49		Tag Island	400
50		Ugidak Island	400
51		Gramp Rock	700
52		Tanaga Island (north side of Cape Sajaka)	200
Adak	62	Tanaga Island (Cape Sasmik)	75
	63	Adak Island (Argonne Point)	1,000
	64	Adak Island (Hook Point)	1,500
	64	Adak Island (Cape Yakak)	800
	66	Adak Island (rocks off Cape Moffett)	50
	67	Little Tanaga Island (Tana Point)	450
	68	Great Sitkin Island (Swallow Head)	650
Atka	78	Anagaksik Island	700
	79	Igitkin Island (southwest point)	700

Atka	80	Kasatochi Island (north point)	200
	81	Ikiginak Island	500
	82	Atka Island (North Cape)	550
	83	Atka Island (Cape Korovin)	100
	84	Salt Island	100
	85	Sagchudak Island	1,200
	86	Amtagis Island	800
Seguam	96	Amlia Island (Cape Misty)	750
	97	Amlia Island (rocks in Sviechnikof Harbor)	700
	99	Sagigik Island	100
	100	Tanadak Island	20
	101	Agligadak Island	250
	102	Seguam Island (southwest point)	150
	103	Seguam Island (Lava Point)	150
	104	Seguam Island (north shore)	4,000
105	Seguam Island (Wharf Point)	100	
Amukta	115	Amukta Island (High rock & adjacent rocks)	600
	116	Amukta Island (Amukta Point)	150
	117	Chagulak Island (Chagulak Point)	100
	118	Yunaska Island (East Cove)	800
	119	Carlisle Island (northwest point)	100
Samalga Island	124	Chuginadak Island (Concord Point)	700
	125	Adugak Island	1,275
	126	Ogchul Island	2,966
Umnak	131	Ullaga Island (northwest shore)	500
	132	Kagamil Island (north point)	75
	133	Umnak Island (Cape Aslik)	450
	134	Bogoslof Island	3,707
	135	Fire Island	100
Unalaska	140	Umnak Island (Cape Idak)	600
	141	Unalaska Island (Cape Izigan)	150
	142	Unalaska Island (Spray Cape)	200
	143	Unalaska Island (Cape Starichkof)	100
	144	Unalaska Island (Point Tebenkoff)	200
	145	Unalaska Island (Cape Kalekta)	10
	146	Unalaska (Whalebone Cape)	1,000
	147	Egg Island	329
148	Akutan Island (Lava Point to Cape Morgan)	15,700	
Unimak	158	Akutan Island (North Head)	714
	159	Akun Island (Akun Head)	2,000
	160	Akun Island (Billings Head)	100
	161	Tanginak Island	600
	162	Tigalda Island (rock off west end)	10
	163	Tigalda Island (rock off northeast end)	750
	164	Aiktak Island	600
	165	Ugamak Island	13,400
	166	Round Island	6,000
167	Unimak Island (Cape Sarichef)	200	
168	Unimak Island (Oksenof Point)	4,000	
Pribilof Island	285	St. George Island (Dalnoi Point)	2,500-3,000
	286	St. George Island (Red Bluff)	500
	287	St. George Island (Toistoi Point)	100
	288	Otter Island	100
	289	St. Paul Island (Sea Lion Rock)	30
	290	St. Paul Island (Northeast Point)	50
291	Walrus Island	5,000	

Sea lion populations in Game Management Unit 10 are at or very close to carrying capacity. The total population within the area probably exceeds 140,000 animals.

Two of the largest known sea lion rookeries are in the unit: Akutan Island (No. 148) and Ugamak Island (No. 165). Both normally contain more than 15,000 animals during June. The Pribilof Islands contain the most northern sea lion rookery in the Bering Sea.

## WHALES

Harbor porpoises, Dall porpoises, killer whales, Pacific pilot whales, Baird's beaked whales and Cuvier's beaked whales are the smaller toothed whales normally found in the Aleutian Islands. The first three species are very common in the coastal areas, as they are in many other parts of southern Alaska. The last species is relatively uncommon. Male sperm whales may migrate to the vicinity of this unit. Baleen whales occurring in Unit 10 are the finback whale, humpback whale, and Minke whale. Blue whales and sei whales remain south of the Aleutian Islands, the former being very rare. Another rare species that may occur in the unit is the North Pacific right whale. Bowhead whales are found in the vicinity of Unit 10 in winter and gray whales pass through the eastern Aleutians on their migrations to and from the Bering Sea.

## WATERFOWL AND SEABIRDS

### Populations

Bird populations in the Aleutian Islands have experienced many drastic changes in distribution, numbers and species composition since man first visited the islands. Many changes have resulted from natural events such as volcanic action, storms and tidal waves. In addition, man has wrought much havoc. Introduction of blue foxes to many of the islands virtually eliminated several breeding species. Rats, dogs and cats were introduced by the military during World War II on several of the Rat and Near Islands. Predator eradication programs were initiated in 1951 and succeeded in eliminating dogs and cats, but only temporarily reduced foxes and rats. From 1953 to 1959 an intensive predator poisoning campaign was carried out on Amchitka Island, and succeeded in eliminating most foxes by 1959. Rats are still abundant on many of the islands. The overall effects of rat predation on island-nesting species of birds is not known, but at least two species of small song birds have been exterminated from Amchitka Island by rats.

Federal biologists are now making intensive investigations into bird populations, distribution and numbers in the Aleutian Chain. They have discovered that more than 100,000 emperor geese winter in the islands, each year. The following is a list of known seabird colonies in the unit. Undoubtedly more colonies exist than are recorded here. Murrelets, guillemots and other seabirds which are not normally colonial nesters are also included.

**Description of Seabird Colonies Indicated on Maps  
Game Management Unit 10**

<u>Map</u>	<u>Colony No.</u>	<u>Name</u>	<u>Species Present</u>
26	87	Bogoslof Island	thick billed and common murres, pigeon guillemot, tufted puffin, red-faced cormorant.
42	92A	St. Paul Island	thick billed and common murres, parakeet auk let and least auklet (millions present), red legged kittiwake.
42	92B	St. George Island	common and thick billed murres, least and parakeet auklets, red legged kittiwake.
42	92C	Otter Island	parakeet auklet.
42	92D	Walrus Island	red-faced cormorant, parakeet auklet.
28	118	Kaligagan Island	Cassin's auklet, parakeet auklet.
20	119	Ogiluga-Skagul Islands	Arctic tern, ancient murrelet, parakeet auklet.
17	120	Agattu Island	red-faced cormorant, fork tailed petrel, blacklegged kittiwake, common and thick billed murres, Kittlitz's and ancient murrelets, parakeet and crested auklets, horned puffin.
17	121	Attu Island	pelagic and red-faced cormorants, fork-tailed petrel, black-legged kittiwake, common and thick-billed murres, crested auklet, Kittlitz's and ancient murrelets.
17	122	Semichi Islands (Alaid, Nizki, Shemya Islands)	red-faced cormorant, black-legged kittiwake, common and thick-billed murres, ancient murrelet, crested and parakeet auklets.
27 & 28	123	Akutan Island	tufted puffin.
28	124	Unimak Island	double-crested cormorant, black-legged kittiwake, Aleutian tern.
25 & 27	125	Umnak Island	double-crested cormorant, ancient murrelet, parakeet auklet.
27	127	Unalaska Island	pelagic cormorant, marbled murrelet, red-faced cormorant, black-legged kittiwake, parakeet auklet.
27	127	Unalga Island	
24 & 25	128	Carlisle Island	double-crested and red-faced cormorants, parakeet and whiskered auklets, ancient murrelet.
25 (26)	129 (124)	Kagamil Island	Ancient murrelet, fork-tailed petrel, red-faced and double crested cormorants, common and thick-billed murres, parakeet and whiskered auklets.
24	130	Chagulak Island	Pacific fulmar, fork tailed petrel, red-faced cormorant, black-legged kittiwake, common and thick billed murres, crested and whiskered auklets.
24	131	Amutka Island	Pacific fulmar, red-faced cormorant, blacklegged kittiwake, common and thick billed murres, ancient murrelet, fork tailed petrel, red-faced and double crested cormorants, parakeet auklet, ancient murrelet.
24	132	Herbert Island	red-faced cormorant, common and thick billed murres, parakeet, crested and whiskered auklets.
23	133	Seguam Island	fork tailed petrel, Cassin's and crested auklet
23	134	Atka Island (Cape Shaw & Tadluk)	fork tailed petrel, red-faced cormorant, parakeet and whiskered auklets.
20	135	Ulak	fork tailed petrel, red-faced cormorant, common and thick billed murres, ancient murrelet, Cassin's, crested least, whiskered and parakeet auklets.
22	136	Kasatochi Island	
22	137	Koniuji Island	blacklegged kittiwake, common murre, parakeet, crested and whiskered auklets.
21	138	Tanaga Island	fork tailed petrel, Arctic tern, whiskered auklet.
21	139	Kanaga Island	Arctic tern.

20	140	Gareloi Island	Pacific fulmar, fork tailed petrel, ancient murrelet, red-faced cormorant, Arctic tern, parakeet, crested and least auklets, horned and tufted puffins
20	141	Ilak Island	Cassin's and parakeet auklets.
19	142	Semisopchnoi Island	fork tailed petrel, red-faced cormorant, Arctic tern, common and thick billed murre, parakeet, crested and least auklets.
19	143	Little Sitkin Island	fork tailed petrel, red-faced cormorant, parakeet auklet, horned and tufted puffins.
19	144	Amchitka Island	glaucous winged gull, pelagic cormorant, ancient murrelet, pigeon guillemot,
18	145	Buldir Island	Arctic tern, parakeet, crested and least auklets, fork tailed petrel, blacklegged kittiwake, parakeet crested and least auklets. Crested and least auklets, ancient murrelet.
18	146	Kiska Island	fork tailed petrel, red-faced cormorant, Arctic tern, ancient murrelet, glaucous gull, parakeet, least, crested and whiskered auklets.
			least auklet.
19	147	Segula Island	Cassin's auklet.
22	148	Tagalak-Ikiginak Islands	Cassin's auklet.
22	149	Amtagis Islands (not shown)	
23	150	Cape Idalug	Cassin's auklet.
23	151	Amlia Island	fork tailed petrel, Cassin's and whiskered auklets.

The following birds are known to breed in Unit 10; any or all may be found in all colonies listed: glaucous winged and glaucous gulls, Arctic and Aleutian terns, fork tailed petrel, common and thick billed murre, red-faced, double-crested and pelagic cormorants, Pacific fulmar, Cassin's, crested, whiskered, least and parakeet auklets, red- and blacklegged kittiwakes, horned and tufted puffins, marbled, ancient and Kittlitz's murrelets, pigeon guillemot.

### **Specific Habitat and Land Use Considerations and Recommendations**

There are about 50 islands in the Aleutian Islands National Wildlife Refuge which contain sizeable seabird colonies. Bogoslof Island is itself a separate refuge. The Pribilof Islands Reservation (Saint George Island, Saint Paul Island and Walrus Island) was established primarily for fur seal management, but it also protects the myriad of seabirds breeding in the Pribilofs. These land-use designations should adequately protect Aleutian birds and their habitats.

Reestablishment of formerly indigenous bird species in the Aleutians is a noteworthy land use and resource goal. Studies of seabird distribution and abundance in offshore and pelagic waters are encouraged as are more intensive investigations of seabird breeding colonies. Conflicts between purposely introduced mammals and nesting birds, such as those created by fox, reindeer and caribou introductions, should be prevented in the future. Introductions of sheep and other domestic grazing species on the islands should be thoroughly investigated before they are allowed.

## GAME MANAGEMENT UNIT 11

The Wrangell Mountains, forming the eastern drainages of the Copper River, have been designated Game Management Unit 11. This superb mountain wildlife habitat also is blessed with outstanding scenic qualities. It contains some of North America's highest mountains - Mt. Blackburn, Mt. Bona, Mt.

Sanford, all over 16,000 ft. - and nearly one-third of the area is under glaciers. The valley of the silt-laden Copper River is heavily forested with white spruce, birch, cottonwood and aspen, and the braided streambeds contain extensive stands of willow and wind-resistant shrubs.

The climate is wet in the mountains facing the Gulf of Alaska, which receive moderately heavy snowfall. The northwest slopes of Mt. Drum and Mt. Sanford have a typically interior climate, however, and are cold and dry with warm summers.

The Kennicott and McCarthy districts were the scene of a large copper mining industry during the early part of this Century. At that time a railroad extended from Cordova to the mining district and human use of wildlife was intense. Today few people live in the unit and recreational hunting is the major use of most of the land. The unit is accessible by aircraft and by a new road crossing the Copper River at Chitina.

### **BLACK BEAR**

Very little is known about black bears in this unit, except that they do occur throughout the forested zones and in parts of the subalpine "alder" zones. Population sizes are unknown but are believed to be typical of other Interior locations. See Unit 13 for further information.

### **BROWN BEAR**

Brown bears inhabit most of this unit and their distribution and abundance probably are much like they were prior to human settlement. Access to this area is limited and direct bear confrontations with humans are infrequent. In fact, earlier mining operations in the lower portion of the unit probably created more direct conflicts than exist today.

Hunting pressure has been low in this unit due to limited access. The highest reported annual sport kill was 11 bears in 1964.

### **Populations**

No specific population information is available although the densities of brown bears are much lower than those found along the coast.

### **Specific Habitat Considerations**

The alpine and subalpine zones are probably the habitats most frequently used by brown bears, although the more heavily timbered areas are seasonally important. Some denning does take place in these lower areas and heavy use of lowlands occurs when fish are present and during the early spring when bears first emerge from dens in search of food.

Denning begins in October and all bears are in dens by mid-November. Bears usually reappear during May, depending on weather conditions. Important spring foods probably are grasses, sedges, horsetails, other herbaceous plants, and carrion when it is available. On occasion, moose and caribou calves are taken. Red salmon from the Copper River system are the only important fish food source and are available from early August to

September in some areas. Berries such as lowbush and highbush cranberries, blueberries, and bearberries provide major summer food supplements.

### **Land Use Considerations and Recommendations Special consideration**

should be given to the effects of fires on mature forests and subalpine areas. Although fires and possibly future logging may temporarily destroy habitat, resulting herbaceous and particularly berry-producing plants may prove to be advantageous to bears.

The prime consideration for brown bears will be the minimizing of direct conflicts between man and bears. Centralizing human development and control of wastes, educating man to better understand bear behavior and maintaining strong policies to keep commercial livestock and bears apart are the most obvious solutions.

### **WOLF**

Wolves are abundant throughout this exceptionally diverse area. Wolves use moose, caribou and sheep as their primary diet. These are supplemented with snowshoe hares, beavers, ground squirrels, waterfowl, ptarmigan, marmots, bison and goats. Population estimates for this area have generally been combined with adjoining Unit 13. Annual reported harvests by trappers and hunters during the past decade have ranged from 8 to 117.

### **WOLVERINE**

Wolverines are abundant, for the species, in much of Unit 11. They appear to benefit from the rather stable salmon migrations and use that food source to a considerable extent. Harvests average about 25 wolverines annually.

### **BARREN GROUND CARIBOU**

Mentasta Herd : Units 11 and 12

This small and poorly delineated herd is believed to be a remnant of the Fortymile herd that, at its most recent population peak, ranged into the Mentasta Mountains for several years before 1932. These animals range over an area extending from the Mentasta Mountains at the east end of the Alaska Range southward onto the western slopes of the Wrangell Mountains.

The Mentasta Mountains consist of a single ridge broken at intervals by low passes. Their northern slopes drain into the Tanana River and their southern slopes into the Copper River. The Wrangell Mountains are an oval group of glacier capped volcanoes more than 12,000 ft. in elevation. Between the Mentasta and Wrangell Mountains the Copper River lowlands form a relatively smooth, forested plain, 1,000 to 2,000 ft. high.

In winter, caribou range over alpine areas and sparsely covered spruce flats from the west slopes of the Wrangell Mountains north to the Gerstle River. Calving usually occurs on west slopes of Mount Sanford, between Boulder Creek and the Sanford River, but some calving activity occurs on the Macomb Plateau east of the Johnson River. The peak of calving occurs during the last week of May. Since relatively few caribou surveys have been made in the Mentasta-Wrangell Mountains area, it is possible that several small relict herds are present there also. The distribution picture is further complicated by the shift of the Nelchina herd into the Wrangell Mountains each winter since 1965.

This mixing has continued until the status of the Mentasta herd is not clear. In the winter of 1972 the Nelchina herd again wintered throughout the range of the Mentasta herd and apparently the following spring only a few caribou calved in the Mentasta herd's traditional calving area. More detailed studies must be carried out to re-



confirm this herd's status.

## **BISON**

There are two distinct bison herds in Unit 11. The Copper River herd remains east of the Copper River between the Dadina and Kotsina Rivers. The Chitina herd is resident in the Chitina River valley from the Tana River to the base of Barnard Glacier.

### **Chitina Herd**

The Chitina herd originated either as a result of egress from the Copper River herd or from the 1962 transplant of 35 (29 cows and 6 bulls) animals from Delta to May Creek. There is some question of the success of the latter transplant, for unconfirmed reports indicated that there was 100 percent mortality of the transplanted animals. This herd now has a relatively static population of about 16 animals and shows consistently low calf production.

### **Specific Habitat Considerations**

The Chitina herd has a limited range consisting primarily of the Chitina River valley. Apparently, high winds keep the river bars relatively free of snow so that the preferred grass and pea-vine are available.

### **Copper River Herd**

This herd originated from a transplant of 12 cows and 5 bulls from the Delta herd. They were released on the Nabesna Road about 6 miles southeast of Slana in 1950 and were next recorded along the Copper River near Copper Center in 1960.

Aerial surveys revealed a high population of 119 bison in 1970. Limited hunting was begun in 1964 with a harvest of 14. Harvests in 1965, 1968, 1969 and 1970 were 11, 13, 16 and 13, respectively. No hunts were allowed in 1966, 1967, 1971 and 1972 due to poor calf crops and apparent winter losses.

During the summer and early fall, bison utilize the benches, river bars, and open grass-sedge meadows along the tributaries of the Copper River, particularly along the Dadina and Chetaslina Rivers.

By October, most of the animals have taken up residence along the bluffs of the Copper River which, along with the river bars, make up the major portion of their winter range. Grasses and sedges in park-like openings and along small lakes and wet meadows above the bluffs are utilized extensively along with quantities of Artemisia. Pea-vine appears to be the desired species on the river bars.

### **Land Use Considerations and Recommendations**

The Copper River and Chitina bison herds have extremely limited range and for all practical purposes have reached the carrying capacity of this range. The apparent inability of the range to support large herds makes the future of these bison somewhat tenuous and their management difficult.

The most pressing problem will be the potential of overlapping of grazing leases, primarily for horses, with bison ranges. Grasses, sedges and pea-vine are all utilized by horses and during extremely bad winters competition could prove disastrous for both horses and bison.

## **DALL SHEEP**

Wrangell-Nutzotin Mountains: Units 11 and 12

Sheep inhabit both the north and south slopes of the entire Wrangell Mountain Range. They are also common in the Nutzotin Mountains which are adjacent to the north slope of the Wrangells. These mountain ranges appear to contain some of the best sheep habitat in Alaska and populations are relatively dense in all suitable areas. The Wrangell Mountains at Kennicott and McCarthy were heavily mined in the past, and miners undoubtedly took many sheep for food. Present take of Dall sheep is limited to sport hunting for rams with 3/4 curl or larger horns. As elsewhere, this type of hunting seems to have little effect on overall population numbers. The area supports some of the heaviest sheep hunting pressure in the state due to its popularity with hunters and accessibility by light aircraft. Some 300 rams are taken during an average hunting season.

### **Populations**

Almost no information is available regarding sheep populations in the Wrangell Mountains prior to 1949. In 1949, the population was estimated at about 700 sheep in the entire mountain range. In 1967, 1,119 sheep were counted on the south slope only. Counts conducted in 1968 and 1970 of that portion of the south slope from McCarthy to the Canadian border (a little over half of the area covered in 1967) showed at least 1,625 sheep were present. These aerial surveys do indicate an increasing sheep herd, but probably indicate improved counting accuracy as well.

Although specific information is not available, local residents felt that a die-off of part of the herd occurred sometime prior to 1967. This appeared to affect the older age classes of animals and possibly the very young as well, and was thought to be disease-related. Herd numbers in general remained high but old rams suddenly became scarce. From the little data available, the herd seems to be recovering at present.

Despite relatively heavy hunting pressure, large rams are still available throughout the range. Hunting has had small effect on ram abundance except locally and has had almost no effect on herd dynamics. The major controlling factor remains winter climate, which periodically cause population "crashes" and is thereby responsible for long-term population fluctuations.

### **Land Use Considerations and Recommendations**

Most sheep habitat in the Wrangell-Nutzotin Mountains lies within unclassified public domain. A very small part in the McCarthy vicinity has been patented by the state, and there are very small areas under private ownership through homesteads and mining claims. Parts of the western Wrangells are open to native land selection. Most of the public domain has been withdrawn by the federal government and is under consideration for federal selection as a National Park, National Forest or National Wildlife Refuge.

Most sheep habitat is presently well-protected by remoteness, but this will not be true for long. When developments such as scenic highways, hotels, airstrips, ski areas, etc., are proposed within sheep habitat, wintering areas and natural licks and their access trails should be located and avoided. Sheep should be protected from harassment by human activity as much as possible throughout the year and especially during critical seasons.

Since much of the area is under consideration as a National Park, the great loss of this renewable resource to the hunting public could be balanced with the dubious value of complete and unmanaged protection. Complete protection would not only prevent the recreational hunting of surplus sheep by the people, but could also become responsible for severe population fluctuations due to overpopulation and resulting food shortages.

### **MOOSE**

Moose have roamed the alpine willow draws and meadows on the flanks of the Wrangell Mountains for a consid-

erable time. They were an important component of aboriginal diets, even though numbers apparently fluctuated widely in response to successional vegetative changes and to the vagaries of climate. They have been relatively abundant in the unit for at least the past 30 years.

### **Populations**

There are no census figures for moose in this unit. The densest populations occur along the slopes of Mt. Drum and Mt. Sanford. Extensive stands of willow at timberline and along the drainages appear to be the key factor to their abundance. Recent fires at lower elevations have created additional winter foods and the riparian vegetation along the braided Copper River provides still more food, especially during winters when deep snow forces moose to lower elevations.

Aerial sex and age counts have enumerated up to 450 moose and the total population probably exceeds 5,000 animals. The kill by hunters in 1972 was 181. The unit has extremely limited access; there are no roads into the areas supporting the densest moose populations.

In recent years production of calves, measured in November and December, has been poor, and the population has probably declined.

### **Land Use Considerations and Recommendations**

The best way to ensure high future moose densities in Unit I is to allow selected natural wild fires to burn, thereby creating additional moose range.

## **MOUNTAIN GOAT**

Scattered populations of goats have historically been present in Unit 11 in the Wrangell Mountains; however, the animals have never been very numerous. They are present only on the south slopes of the mountains and in most areas occupy the same general range as Dall sheep.

### **Populations**

No population estimates for the area are available. Aerial surveys of alpine areas indicate that the western limit for goats in the Wrangell Mountains is a small population that ranges along the northwest side of the Kuskulana River. Small populations also exist on Fireweed Mountain, along McCarthy Creek, around Nizina Glacier and along Chitistone River. Goats are also present in very low numbers on MacColi Ridge and on the south facing slopes along the Chitina River to the Chitina Glacier.

## **WATERFOWL**

### **Populations**

Annual breeding pair surveys are not conducted in this unit. It is assumed that favorable habitats in this area support numbers of waterfowl comparable to the densities found in Unit 13. Trumpeter swans are found throughout the lower Copper River and Chitina River drainages. Other nesting species include widgeon, green-winged teal, American and Barrow's goldeneyes, lesser and greater scaup, pintail, mallard, and Canada geese.

### **Habitat and Land Use Considerations**

Several drainages in Unit 11 are important for conservation of trumpeter swan breeding habitat. Among these

are the Bremner River, Peninsula Lake, Tasnuna River, Tiekel River, Chitina River and lakes and oxbows along the Copper River above Chitina. These areas are critical and should be protected from the threat of dam construction on the Copper River and Bremner River.

## GAME MANAGEMENT UNIT 12

Unit 12 encompasses the upper Tanana River and its tributaries. Compared to much of Interior Alaska, the general valley elevation within Unit 12 is quite high. The Nutzotin Mountains and the Tanana Hills converge to produce a narrow valley and a large proportion of alpine and subalpine communities, especially in the eastern portion of Unit 12. The climate is strongly continental with little precipitation, very cold winters, and warm summers. Snow is characteristically dry and light, and accumulation is usually slight, although accumulations of 3 feet to 4 feet do occur in some years.

The Tetlin area traditionally was an Athabascan Indian population center in the upper Tanana valley. Like most Interior people, they depended upon a variety of game, and moose were the most basic necessity for food and domestic materials.

Because early travel routes to gold fields lay mainly east or west, miners had limited contact with the upper Tanana valley until the completion of the Alaska Highway in 1942.

Much of Unit 12 is still relatively inaccessible, although there are a few major roads, many airstrips and many lakes suitable for float planes.

**BLACK BEAR** (Interior Alaska: Units 12, 18, 19,20,21,22, 23,24 and 25)

Throughout much of Interior Alaska, habitat and life styles of black bears vary little. Because they have been in limited demand as food or trophies, little effort has been spent to acquire more than a general knowledge of life history and human use. As a result, there is little information for specific management units; therefore, black bears will be discussed for the Interior region in general.

Black bears have been present in Interior Alaska at least since post-glacial times. Their present distribution roughly coincides with forest distribution although they also use subalpine and alpine areas seasonally. They occur only rarely north of the Brooks Range and on the Yukon-Kuskokwim Delta.

Being highly mobile and omnivorous, black bears live wherever foods such as grass, horsetail, sedges, berries, carrion and fish are available. Although mobile, they are not migratory in the usual sense. In contrast to southcoastal Alaska, concentrations of fish are rarely available to black bears of the Interior. Other food sources are also less lush in the Interior, but there is a broader range of habitat types and larger suitable area available to black bears.

Annual activities of Interior black bears are strongly affected by climate and food supply. Long, cold winters result in a six to seven month's denning period, somewhat longer than in southcoastal Alaska.

Bears usually leave their dens in early May. Carrion, such as winter-killed moose, and berries that persist over winter probably are important foods at this time. Bears are attracted to wet lowland areas where the first green growth of the season begins in wet sedge meadows and ponds in early May. From its first appearance in May through mid-July, horsetail is the major food item for Interior black bears. A few grasses, sedges and forbs also are eaten, and carrion is eaten at every opportunity. Wet lowland areas containing abundant green vegetation are also preferred spring calving and feeding grounds for moose, and often coincide with moose wintering areas.

Therefore, some carrion is usually available; especially when a severe winter has caused high moose mortality, and occasionally a newborn moose calf may be captured or scavenged.

In late July, black bears apparently move from lowland areas to higher areas in response to ripening of various species of berries, including blueberry, lowbush cranberry, highbush cranberry, crowberry and bearberry. As the season progresses, more use is made of berries, almost to the exclusion of other plant foods. Blueberries are most favored, especially before heavy frosts begin, but lowbush cranberries and highbush cranberries are also important. Currants may be very abundant in old burns and clearings and may constitute a major food supply. There is some evidence that black bears return to lower elevations in late fall to take advantage of previously unused berries that persist after frosts, such as lowbush and highbush cranberries. Some bears, however, probably never leave the lowlands. Denning follows shortly, in early October.

### **Populations**

Black bear population levels are poorly known. Levels do seem to fluctuate greatly over a period of years from relative scarcity to abundance. Specific causes for these fluctuations are unknown. A poor berry crop, a very late spring, or disease could reduce survival. Hunting pressure has never been sufficient to affect population levels in the Interior. Black bears den in a variety of locations ranging from hollows under tree roots to caves, and at various elevations. It is unlikely that numbers of available den sites affect population levels.

Most recreational use of black bears is incidental to other hunting activities, hiking or sight-seeing. Harvest by hunters is not known, but is low in most areas. In recent years black bear hunting has gained in popularity.

### **Specific Habitat Considerations**

Black bears use a wide range of habitat types, from river valleys and wet sedge meadows through mixed spruce deciduous forests to alpine-subalpine shrub communities. Their needs are closely tied to many other species because of their omnivorous, adaptable habits. Perhaps their most critical habitat needs are adequate early spring feeding areas that support quantities of horsetails and other emergent aquatics and semi-aquatics, and a reliable source of late summer food sufficient to allow them to accumulate fat for the extended denning period. Berries, especially blueberries, have traditionally filled this latter role, even though their abundance does fluctuate. Processes that maintain or create openings in densely vegetated areas, such as fire and clearing, serve to promote communities with a large proportion of berry-producing shrubs.

## **BROWN BEAR**

Brown-grizzly bears occur throughout Unit 12, but they favor alpine and subalpine country and occur only sporadically in forested valley bottoms. In recent times, brown bears probably have never been as abundant as black bears although they are more generally distributed in Unit 12 because of widespread alpine-subalpine habitat.

### **Populations**

Population estimates are not available, but, in general terms, grizzlies range in abundance from low to moderate densities in various areas. Hunter harvest in Unit 12 has ranged from 12 to 21 bears per year since 1961, with a high in 1963.

### **Specific Habitat Considerations**

Throughout much of Interior Alaska, brown bears live mainly in alpine and subalpine habitat. With some exceptions, salmon are not abundantly available as they are in coastal areas. Interior bears are more dependent on

semi-aquatic plants, berries, terrestrial carrion, and small and large mammals. They also are prone to frequenting garbage dumps within their range. Because they are at the top of the mammalian food chain and occur in relatively low densities over large areas, a primary habitat need appears to be large areas of preferred habitat.

## **WOLF**

Wolves are found throughout Unit 12 wherever suitable prey is available. Their distribution has probably been essentially the same since the modern faunal complement became established.

### **Populations**

As in other parts of Alaska, wolf population levels fluctuate in response to variations in natural mortality and harvest. Reported harvests have ranged from 1 to 94 with the high occurring in 1971-72. In Unit 12, harvest by man is too small to affect populations except in local areas.

### **Specific Habitat Considerations**

Because wolves are adaptable to a wide variety of habitat, they will survive if prey, minimal cover and den sites are available.

## **WOLVERINE**

Wolverines occur throughout Unit 12. Their distribution has probably remained unchanged since the modern faunal complement became established. Wolverine populations are characteristically sparse compared to populations of most other species. Relative levels are not known for Unit 12, but since harvests have been moderate (9 to 33 per year) since 1962, the population is assumed to be at a natural level.

## **BARREN GROUND CARIBOU**

Mentasta, Chisana and Fortymile Herds  
(See also Game Management Units 11 and 20C)

Caribou have been present throughout much of Unit 12 at one time or another in the past 100 years. Elements of three presently recognized herds; Mentasta, Chisana, and Fortymile, are found in Unit 12.

Mentasta Herd (See also Unit 11) The Mentasta herd, thought to be an early offshoot of the Fortymile herd, ranges from the Mentasta Mountains south into the Wrangell Mountains and into the Gerstle River-Macomb Plateau area (Units 11 and 20C) of the Alaska Range. The Mentasta herd usually calves on the west slopes of Mount Sanford, but calving has also been reported on Macomb Plateau, east of the Johnson River (Unit 20C). In recent years, distribution of the Mentasta herd has overlapped with that of the larger Nelchina herd in the Wrangell Mountains, especially in the winter. The relationship of these two herds may well be changing from relative distinctness to some sort of amalgamation. The Mentasta herd is discussed in more detail under Game Management Unit 11.

### **Chisana Herd**

The Chisana herd is thought to have developed between 1920 and the early 1930's from another offshoot of the Fortymile herd. Presently, this herd ranges through the Nutzotin Mountains along tributaries of the Chisana and White Rivers. Because the herd does not seem to migrate to another area for calving or wintering, rumors have spread that these are "woodland" caribou such as are found in parts of Canada; but that is not the case. The herd was estimated to contain 3,000 caribou in 1963. Harvest is generally low; in 1971 it was 44.

Calving has been reported from the north side of Mt. Sulzer near Sheep Creek north to the hills between Chisana

and Horsfeld.

### **Fortymile Herd** (See also Unit 20)

Portions of the Fortymile herd presently range into Unit 12, but to a lesser extent than in earlier times. This herd is discussed in detail under Game Management Unit 20C.

### **DALL SHEEP**

Alaska Range: Game Management Units 9, 12, 16, 17,  
19 and 20

Nutzotin Mountains: See Unit 11

The Alaska Range is the most extensive expanse of Dall sheep habitat within the state and stretches from near the Canadian border on the east, west to Mt. McKinley National Park and southwest to the Aleutian Range near Lake Clark.

Specific information is sparse concerning the historic abundance of Dall sheep in these mountains. Athabascan residents of the region traditionally hunted sheep at certain times for subsistence. Late in the 1800's and early in the 1900's, miners made limited use of sheep for food while prospecting. In certain local areas the miners may have significantly reduced sheep populations. Market hunting also occurred during this period, and sheep populations in local areas were reduced significantly. Tales of these market hunters are many, but unfortunately confirmed facts are few. Presently, subsistence hunting is extremely limited and market hunting is illegal.

In recent times sport hunting, photography and enjoyment of Dall sheep in their natural habitat by mountain hikers have increased and now constitute the major uses of this resource.

All available information indicates that the number of sheep hunters in the Alaska Range slowly increased from the 1940's to the early 1960's. Since 1967, harvest ticket reports show that the number of hunters afield has more than doubled. In 1967, 407 hunters took 185 rams and in 1971, 868 hunters took 301 rams. Throughout this period it has been legal to kill only 3/4 curl rams. The only obvious population change due to hunting has been a lowered percentage of large rams in the hunted populations.

### **Populations**

Surveys have shown that sheep are generally limited to the north slope of the Alaska Range. Throughout most of the North Slope, sheep are abundant, although densities do vary considerably. High concentrations occur in areas of extensive foothill development north of the main crest of the range, such as the Granite Mountains, the Wood River drainage, the eastern portion of Mt. McKinley National Park and the Tonzona River-Windy Fork country west of Mt. McKinley.

In most of this range, sheep populations have recovered from a reported low level during the 1920's but it is not known whether most populations are still, increasing, stable or decreasing. In the Twin Lakes, Lake Clark and Iliamna Lake area, reputable sources indicated a winter die-off occurred during 1969. Since this area represents the limit of sheep habitat in the southwestern Alaska Range, such die-offs are not surprising and probably occur with greater frequency than in the more central portions of sheep range.

The table below is a listing of numbers of sheep observed during surveys within the Alaska Range from the Mentasta Mountains west to Mt. McKinley, and southwest to Iliamna Lake. The numbers of sheep given are not total counts for the areas indicated, because some proportion of sheep present are invariably overlooked.

**General Abundance and Distribution Surveys  
Dall sheep - Alaska Range.**

<u>Date</u>	<u>Area</u>	Game Management <u>Units</u>	Sheep <u>observed</u>
July 24, 1971	Mentasta Mountains	12.13	780
July 30, 1971	Tok River, Robertson River	12,20C	697
August 5, 1971	Johnson River, Gerstle River	20C, 20D	1437
August 11, 1969	Granite Mountains, Jarvis Creek, Black Rapids Glacier, McGinnis Creek Trident Glacier, East Fork of little Delta, Buchanan Creek, West Fork of Little Delta	20A	395
August 27, 1970	West side of West Fork of Little Delta, Dry Creek, east side of Wood River	29A	1347
June 1-3, 1967	Totatlanika River, Jumbo Dome, Healy River, Mystic Mountain, west side of Wood River	20A	494
June 30-July 1, 1972	Eastern end of Mt. McKinley Park east of Thorofare River	20C	954
June 18-19, 1972	Thorofare River to western boundary of Mt. McKinley Park	20C	55
June 18-19, 1972	Tonzona River	19	214
June 18-19, 1972	South Fork Kuskokwim, Post River, Terra Cotta Mountains, Big River, Trimokish Hills, Stony River (west side only)	19	857
June 22-28, 1967	Lake Clark drainages, Twin Lakes area	19, 17, 9	258

**Specific Habitat Considerations**

Research in the Alaska Range has shown that sheep spend a major portion of early summer utilizing natural mineral licks. Mineral licks occur throughout sheep habitat in this mountain range. The ecological functions of mineral licks have not been fully explained, but preliminary analysis of lick use indicates these areas are of considerable social and physiological importance to Dall sheep. Traditionally used trails converge on licks from large areas of range. Sheep summer and winter ranges are often separated by several miles, and specific routes are traditionally used by sheep moving between the ranges.

**Land Use Considerations and Recommendations**

At present, there is one special sheep management area within the Alaska Range -- the Delta Management Area. The object of establishing this management area was to provide a high quality area for those desiring a "walk-in" hunting area accessible from a road system. This area has been well received by the public. The role of special management areas in public resource planning should be considered. Traditional access to licks and seasonal ranges should also be protected in developmental plans.



At several places throughout the Alaska Range, sheep habitat and sheep are visible from the highway. Most photography of sheep and hiking into sheep habitat takes place in these areas and they should be protected in future land use decisions.

## **MOOSE**

Few historic records exist regarding early abundance or distribution of moose in what is now Game Management Unit 12. Considering the physiography and vegetation of the area, moose likely are residents of long standing. The traditional use of the area by Athabascan residents who depended heavily on moose supports this idea. It may well be that the extensive braided stream beds and other active geologic processes in foothills and mountains of Unit 12 were important in maintaining populations of moose by providing a continued supply of browse during long periods with few wild fires in forested parts of the unit.

Moose presently occur throughout the unit except in high alpine portions of mountains. As in most of Interior Alaska, moose have benefited from side effects of development that have created new range by removing mature vegetation, thus allowing browse species to flourish. Because much of this developmental activity was related to road systems, people have benefited from the proximity of moose for recreational uses.

### **Populations**

No estimates of moose numbers are available. General population levels range from moderate to high in western and northern parts of Unit 12, and from low to moderate in the eastern portion. Harvests have ranged from 150 to 190 annually over the last eight years.

### **Specific Habitat Considerations**

Unit 12 probably has a fairly stable carrying capacity for moose in most of the accessible areas due to riparian and alpine willow communities. The extent of these range types is limited, however, and they could be subject to overuse if high moose populations were to persist. Creation of additional range through natural or man-made clearings would make possible larger sustainable populations. More remote portions of the unit will probably remain unaffected by man's activity for some time.

## **WATERFOWL**

### **Populations**

Waterfowl breeding habitat in this unit is among the best in Alaska; however, this prime habitat is restricted to a small area along the south side of the Alaska Highway between Tok and Northway. Breeding duck densities and production are approximately the same as described for Unit 20. Species composition is similar to that found in Units 20 and 25. Widgeon, lesser scaup, pintail, green-winged teal, mallard, canvasback, bufflehead and American and Barrow's goldeneyes are common nesting species in this locality. Subsistence hunting is minimal under present welfare and food stamp programs.

Favorite hunting locations are in the Tetlin-Northway area, with Moose Creek and Fish Camp (Fish Lodge) providing points of access. Yarger and Deadman Lakes between Northway and the Canadian border offer some duck hunting, as does Moon Lake near Tok.

### **Habitat and Land Use Considerations**

Hunter access to the better areas may present some problems in the future due to land allocated to native claims,

allotments and private holdings. Preservation or development of public access to hunting areas is therefore of prime importance in land use planning.

### GAME MANAGEMENT UNIT 13

The main portion of Unit 13 encompasses the headwaters of the Copper River to the northeast, the Nenana River and the Susitna River drainages to the north and west and the Talkeetna River and Chickaloon Rivers to the south. The terrain varies from spruce covered lowlands and basins with numerous lakes and streams, to long gentle brush-covered slopes of scattered hills and foothills, to alpine sedge meadows and tundra, to steep rugged mountains. The complex drainage system produces an especially complex physiography with wide variations in elevation, slope and exposure.

Human access to the area is moderately good from the Glenn, Richardson, Denali and Anchorage-Fairbanks highways. In addition much of the highlands has been traversed by "off-road" vehicles and by aircraft landing on the many lakes, streams, glaciers and ridges.

Permanent human settlements are few and lie only along the periphery of the unit coincident to highway development. The settlements are mostly service-oriented businesses and state and federal offices. Tourism is the major business, and the unit contains most of the southern part of Mt. McKinley National Park.

The climate is largely continental. The winters are long and extremely cold, and snowfall is generally slight. Periodic excessive snowfalls do occur.

#### **BLACK BEAR**

Game Management Unit 13 supports fair black bear densities--at least by Interior standards. The larger populations are in semi-open forested areas with readily accessible alpine-subalpine berry crops.

#### **Specific Habitat Considerations**

River bottoms, lake shores, and marshy lowlands (lowlands occur at 2,000 ft. elevation in this unit) are favorite spring black bear haunts. Grasses, sedges, horsetails, forbs, carrion and year-old berries are common spring foods. Human habitations and garbage dumps also attract bears during springtime.

Except for a few locations, black bears in Unit 13 do not concentrate along salmon streams. By late July and early August the bears move to alpine-subalpine areas in search of ripening blueberries, highbush and lowbush cranberries, bearberries, elderberries and crowberries. Little is known about black bear denning in this area. Better drained sites near subalpine and forested areas are preferred for den construction. Denning begins about mid-October and ends in late April or early May. Natural fires in the area benefit black bears, especially when they burn dense mature spruce stands. Most other foreseeable land uses should not seriously affect bear numbers in this unit.

#### **BROWN BEAR**

Brown-grizzly bears occur throughout the unit. Densities are high by Interior Alaska standards but are still significantly below those in most coastal areas.

Many recreational activities in this area are enhanced by the relative abundance of bears, and consumptive and nonconsumptive uses have remained relatively compatible. Despite the fact that 440 bears have been harvested

by sportsmen in the past 11 years, brown-grizzly bears appear to be as numerous and widely distributed throughout the unit today as in the past.

Hunting for brown bears in this unit often occurs incidentally to other hunting. Sheep, moose and caribou hunters, as well as other recreationists, do take bears if the opportunity arises during the relatively short fall open season. The annual harvest has fluctuated from 17 in 1969 to 69 in 1971.

### **Specific Habitat Considerations**

Early spring foods are generally the same as those discussed in the Unit 11 narrative. However, some bears in the Talkeetna Mountains appear to be attracted to traditional caribou calving areas. There is no doubt that bears take some caribou calves during this period. Bears concentrate on streams such as the Gulkana River, Fish Creek, Tonsina River, St. Anne Creek, and Klutina River during the August and early September peaks of salmon runs. Late summer and fall foods consist primarily of berries and grasses.

Very little information is available on bear denning in the unit. Denning periods are essentially the same as discussed for Unit 11.

### **WOLF**

Wolves have been an integral part of this unit's fauna throughout historic time. Since 1948 the unit has been the scene of extensive and intensive studies of wolf-ungulate relationships. The studies included formal wolf control from 1948 through 1957 for the purpose of benefitting populations of ungulates. This was followed by a complete closure on the killing of wolves until 1968 (some trapping and sport hunting was allowed, but very few wolves were taken). The study terminated in 1968 when the Board of Fish and Game demanded that 300 wolves be removed from the unit. At the time, 300 were probably equal to or greater than the total population. Approximately 120 wolves were killed.

The study concluded that wolf use of ungulates from 1957-1967 did not adversely affect ungulate populations, nor did it reduce hunting success for sportsmen. Absolute conclusions were uncertain, however, for moose and caribou populations may have reached recent population highs during this period and hunting pressure was increasing dramatically in terms of hunter numbers and efficiency. The study did prove that wolves and man can coexist when competing for ungulates but that man must accept the fact that wolves might sometimes reduce the number of animals available for his use.

### **Populations**

Wolf numbers have been estimated for this unit since 1943 when the Fish and Wildlife Service reported that only 13 wolves remained after their predator control efforts. Wolf numbers increased and by 1965, an estimated 400-450 wolf were present in Unit 13 and the Mount Drum and Mount Sanford portion of Unit 11. Increased use of wolves by humans has tended to stabilize the population since then, and the current population is estimated at 300 wolves. Wolf populations are capable of rapid fluctuations and thus all estimates must be viewed with extreme caution.

### **Land Use Considerations and Recommendations**

The requirements for maintaining wolves here are the same as in all other areas--maintain ungulate prey and the wolves will do very well indeed.

### **WOLVERINE**

Unit 13 has consistently produced more wolverines than any other area of comparable size in Alaska. Visitors see them regularly in all parts of the unit and it is not unusual for a hunter returning to a kill site to find a wolverine feeding on his moose or caribou. Wolverines have withstood human encroachments and trapping (harvest averages about 75 annually) without noticeable diminution in number or range. Their future is assured if management of ungulates and small game is at all successful.

## **BARREN GROUND CARIBOU**

Nelchina Herd: Game Management Units 11, 12, 13, 14, 16 and 20

Caribou have probably ranged in the Nelchina Basin for at least 5,000 years, ever since the recession of the Pleistocene glaciers. There are historic records documenting their presence for the past 100 years. The entire area of potential use by the Nelchina caribou encompasses about 75,000 square miles, but only about 40,000 square miles are considered acceptable caribou habitat and only 20,000 square miles are used at present.

The Nelchina herd's range is a diversified area of rugged, glacier-capped mountains, rolling uplands and broad forested plains. Four mountain ranges form the herd boundaries: the Alaska Range on the north, the Chugach Mountains on the south, and the Talkeetna Mountains on the west and the Wrangell Mountains on the east. Rolling alpine foothills surround the broad Copper River lowlands. The eastern part of the lowlands is a relatively smooth, forested plain, 1,000 to 2,000 ft. in elevation, trenched by the valleys of the Copper River and its tributaries. The Lake Louise Plateau to the west is a lake-dotted upland, 2,200 to 3,500 ft. in elevation.

The Nelchina herd has remained mostly within the boundaries of its present range since at least the mid-1930's. In recent years major shifts have occurred and more of the range is presently occupied than was in the 1930's and 1940's. However, herd structure has remained intact, and each year the cows have returned to the traditional calving area.

This herd is not always isolated from neighboring caribou populations. At times it has shared winter ranges with portions of the Delta, McKinley, Mentasta and (possibly) Fortymile herds.

The range of the Nelchina herd is only partially limited by physical barriers. Natural barriers to caribou movement are relatively few. Animals have been observed in every part of the range, and occasionally large numbers have extended into areas beyond what is considered the main range. The ice caps and rugged slopes of the Chugach Mountains do present an effective barrier to southward emigrations. Although caribou could travel around the west end of the Chugach Range onto the Kenai Peninsula or south along the Copper River, such movements have not occurred in recent times. The Alaska Range in part presents a similar barrier on the north, but a number of passes provide easy access to the north slopes. On the far north and far east the broad spruce-covered valleys of the Tanana River serve to inhibit caribou movement in those directions, but historical records indicate that this "barrier" has been crossed on occasion. In recent years Nelchina caribou have crossed the Copper River Valley and reached the edge of the Tanana Valley. Although similar terrain exists along the lower Susitna River, there are no records indicating a direct westward or eastward movement across the Susitna Valley. The main routes for dispersal by Nelchina caribou are 1) to the northwest via Broad and Windy passes and then west or east along the north slopes of the Alaska Range, or north across the Yukon River; 2) to the northeast via Isabel Pass, and then east or west along the Alaska Range, or northward across the Tanana Valley; and 3) to the east via Mentasta Pass, and then north or south along the Alaska Range, or east across the upper Tanana River.

It is impossible to predict when or where shifts in distribution will occur in the future. In the past, major shifts and egress have occurred during peaks in caribou populations. It is possible that some animals left the herd in 1965 when several thousand moved into the headwaters of the Tanana

River and onto the Tetlin-Northway Flats, an area occasionally utilized by the Fortymile herd.

Most sport hunters consider the Nelchina herd the state's most important caribou population. Thousands of hunters from Anchorage and Fairbanks participate in the annual hunts. In addition, the herd provides sustenance to large predators; principally wolves, brown bears, wolverines, lynx and golden eagles.

Additional thousands of nonhunting recreationists view the migrations of caribou as they cross the major highways.

### **Winter Distribution**

In late September, as the first snows of winter begin to fill high mountain valleys, caribou of both sexes and all age classes begin to form integrated bands in preparation for the rut and the move to lower elevations. The bulk of the rut lasts only two weeks, and by mid-October this herd is on the move again. From late October through November, the animals generally make a clockwise swing across the Lake Louise Flat. Here they feed on sedges common along margins of the abundant ponds and lakes. During only four of the last 22 years did these caribou fail to traverse the Flat. The animals usually disperse from the Lake Louise Flat during late November and early December, and move to their respective wintering grounds. Usually they are established on their winter ranges by mid-January.

Prior to 1955, primary winter ranges were located in the area bounded by the Denali Highway on the north, the Glenn Highway on the south, the Richardson Highway on the east and the foothills of the Talkeetna Mountains on the west. From 1955 to 1960, however, this herd shifted to the northwest and west, utilizing winter ranges along tributaries of the Nenana and Susitna Rivers and the upper Talkeetna River. The herd grew rapidly during this period. Irregular movements were recorded in the winter of 1956-57, when approximately 15,000 caribou moved north from the Paxson area through Isabel Pass to Black Rapids Glacier in early December. By the end of December most had returned, but in January another round trip through the pass was observed. It is unknown whether any of these animals remained north of the Alaska Range, but periodic aerial surveys failed to reveal any permanent shift.

By 1957 the previously favored wintering grounds on the Lake Louise-Ewan Lake Flats had become almost deserted, with only a few thousand caribou remaining. Most of the herd was then using the Deadman Lake-Butte Lake area. In addition, stragglers and stray bands occurred throughout the range at all times of year.

In the winter of 1958-59 caribou moved into the Broad Pass area where some emigration from the main herd may have occurred. That winter part of the herd moved into the range of the Delta herd on Yanert Fork, but they returned to their traditional calving area in the spring.

From 1960 to 1965 the herd shifted to the east. Skoog (1964) reported the first evidence of this eastward shift in the winter of 1961-62 when some animals moved as far east as Mentasta Pass in the Alaska Range and Tanada Lake in the Wrangell Mountains. However, a major portion of the herd used winter ranges near Cantwell until 1964. In the winter of 1964-65 a large group of caribou moved east through Mentasta Pass and was last seen along the upper Tok River. It is not known whether any of these animals returned to the Nelchina area because severe weather precluded further aerial surveys. From 1965 to present, most of the herd has wintered on the north slopes of the Wrangell Mountains and the south slopes of the Alaska Range east of the Richardson Highway.

In summary, the Nelchina herd shifted winter ranges from the Lake Louise-Ewan Lake Flats to an area approximately 90 miles northwest of Monahan Flats, and then later shifted 180 miles east to the Wrangell and Mentasta Mountains. This almost constant changing of winter ranges by the Nelchina herd during the last 22 years repre-

sents a phenomenon that has undoubtedly characterized Alaska's caribou populations for centuries. Nevertheless, these distributional shifts of the Nelchina caribou are difficult to explain. In particular, one might wonder why the animals would cross some 50 miles of spruce-covered flats to reach the Mentasta Mountains. Probably none of the animals participating in the first move (1962-65) had visited the area previously.

### **Spring Migration**

As the calving period approaches, scattered bands of females begin to congregate and move cross-country in long lines, single file, on deeply worn parallel trails. Timing of this pre-calving movement is variable, but in most years the migration begins in early April. The onset of spring migration may be triggered by the appearance of new plant growth on snow-free areas. This movement involves mostly the cow-calf segment of the herd, plus some young bulls. Adult bulls seem content to linger near the wintering grounds.

The main movement proceeds by the most direct route to the calving grounds. Animals moving westward from the Wrangell Mountains cross the Copper River just south of Chistochina and proceed across the Richardson Highway, crossing the Gulkana River between Sourdough and Paxson Lake. This movement continues through the Alphabet Hills and the Lake Louise Flats to the foothills of the Talkeetna Mountains. Animals from the north usually cross the Susitna River between Deadman Creek and Jay Creek. Caribou wintering along tributaries of the Talkeetna River move north over the mountains to the upper Kosina River.

Late spring thaws may delay movement to the calving grounds. In 1964, for example, exceptionally deep snow and a late thaw resulted in most calves being born en-route between the upper Nenana River and the traditional calving area.

As parturition approaches, large migratory groups break into smaller ones and spread out over the calving area.

### **Calving**

For more than two decades pregnant cows have returned from wintering areas to calve in a region of about 1,000 square miles, extending from Kosina Creek southeastward to the Little Nelchina River. This area is generally above timberline, rising from 3,000 to 4,000 ft. above sea level. Grasses, sedges and forbs are abundant on the mountain meadows and willows and dwarf birch dominate the stream valleys, particularly at lower elevations. Timing of the arrival of caribou onto the calving grounds is closely tied to emergence of the first green shoots on scattered snow-free areas. Most calves are born from May 11 to June 10, with the peak occurring around May 25. Noncalving groups occur in every portion of the range during the calving period.

### **Summer Distribution**

Shortly after calving, the caribou aggregate into ever-larger groups. At first these groups are composed of cows and newborn calves, which are gradually joined by peripheral groups of noncalving animals. Usually the post-calving concentration reaches maximum aggregation by the third week of June. Throughout this period the animals move gradually to higher elevations, taking advantage of fresh green forage exposed by the receding snow.

In July these caribou normally separate into somewhat smaller groups. Most of them remain on windswept ridges of the Talkeetna Mountains, but one segment of the herd usually moves north across the upper Susitna River to the benchlands of the Chulitna Mountains. Each of these areas contains scattered patches of snow and ice and windy places where caribou can find relief from the summer hordes of biting insects. Whenever the wind stops the animals begin to mill around, often running in a confused mass. Meanwhile bulls and many yearlings' frequent areas closer to the wintering grounds--the headwaters of the Nenana River, the upper reaches of the

Chulitna Mountains, and south through the Talkeetna Mountains to the headwaters of Caribou Creek and the Chickaloon River. These animals are often observed on mountain summits and glaciers above the summer pastures of Dall sheep.

### **Populations**

The Nelchina herd grew from approximately 20,000 animals in 1948 to a peak of 70,000 in 1962. A census in 1967 suggested 60,000 plus, and a count in 1972 suggested that fewer than 20,000 animals remained. The exact factors causing the decline are unknown but range studies show advanced deterioration of plant communities important to caribou. The survival of calves during their first year has been poor. Inclement weather at or before calving, range deterioration and predation by wolves are considered prime mortality factors to calves.

Increased use of the population by hunters concurrent with poor survival of young has accelerated the range-initiated decline. In addition, emigration to other ranges may have occurred, though with the exception of 1965 no major egress has been recorded.

### **Specific Habitat Considerations Caribou**

are creatures dependent upon climax range, especially for winter forage. For this reason, activities or events that alter the vegetation may have a detrimental impact upon caribou distribution and numbers. In addition, the proposed Alaska oil pipeline would bisect the Nelchina herd's range. It is of utmost importance to this population that construction of the line allows unimpeded passage to caribou.

### **DALL SHEEP**

Chugach Mountains: Game Management Units 6, 11, 13 and 14

Talkeetna Mountains: Game Management Units 13 and 14

### **Chugach Mountains**

Sheep inhabit most of the north slope of the Chugach Range from Turnagain Arm to the Canadian border. Populations are not continuous, however, and some areas within this range contain no sheep while others have large herds. As elsewhere in Alaska, sheep were hunted for their meat by miners, settlers and market hunters in early settlement days. In areas now being managed for recreational hunting, only rams with 3/4 curl or larger horns may be taken. Such hunting, even in the few areas where pressure is high, appears to have little effect on herd dynamics. The average annual kill in the Chugach Mountains in recent years have been about 117 rams.

### **Populations**

Although little specific information is available, sheep numbers appear to have "crashed" at some time before censuses began. This probably occurred during the 1930's or 1940's when other herds in the state also suffered large winter losses. Initial surveys reported comparatively low sheep densities in the areas surveyed, but recent surveys indicate steady increases to date. For example, in the area now contained in Chugach State Park (established in 1970), 450 sheep were counted during aerial surveys in 1951. In 1968, 868 were counted in the same area, and in 1972, 1,050 were counted. The Chugach Mountains were surveyed in 1968 and 1969 from Turnagain Arm to the Copper River. A total of 2,380 sheep were tallied. The range from the Copper River to the Canadian border has not yet been surveyed and populations are unknown. Under present ram-only hunting management, and particularly with the light hunting pressure over most of this area, Dall sheep numbers in the Chugach Mountains are almost entirely controlled by natural influences.

## **Land Use Considerations and Recommendations**

Sheep habitat in the Chugach Mountains is largely within unclassified public land subject to various withdrawals by the state, natives and federal government. Part is included in Chugach State Park. Very little is in private holdings at present. Because of the remote and rugged nature of this alpine habitat, conflict with development activities will probably remain slight regardless of land ownership. In any land-use planning which does involve sheep range, special considerations should be given to the protection of specific habitat needs such as traditional mineral licks and their access routes, identifiable lambing areas and critical wintering habitat. Since sheep appear relatively inflexible in their habitat requirements, disturbance of important segments, even though small in size, could be dangerous to population survival. In addition, sheep should be protected from harassment by vehicles, such as snowmachines and helicopters, especially during late winter, lambing season or other critical periods in their annual life cycle. Any construction within sheep habitat (which might include ski-lifts or lodges, scenic highways, scenic viewpoints, park buildings, airstrips, etc.) or zoning for special uses (recreational snow-vehicle trails, for example) should be planned to avoid such critical periods or areas.

### **Talkeetna Mountains Sheep**

Sheep inhabit the Talkeetna Mountains from the Glenn Highway on the south almost to the Denali Highway on the north. Greatest concentrations are found in the southern portion of the range with herds becoming scattered to the north, and parts of the mountains are uninhabited by sheep.

Sheep also occur in the Watana Hills, just to the north and east of the main range, and these are considered along with the Talkeetna Mountains populations.

Past use of Dall sheep included market hunting and use as food by early settlers and prospectors. Sheep have also always furnished some of the diet of wolves and other carnivores in the area. Present consumptive use by man is restricted to sport hunting for 3/4 curl or larger rams.

Hunting pressure for rams is fairly heavy due to relatively good access from the highways, by air and by all-terrain vehicle. Approximately 100 rams are taken annually in the Talkeetna Mountains. Nevertheless, as is true elsewhere in the state, ram-only hunting seems to have little effect on overall numbers. Populations are almost entirely controlled by natural factors.

### **Populations**

The first sheep population estimate for the Talkeetna Mountains was 300 sheep in 1949. It is probable that this herd was, like others in the state, severely reduced in size by exceptional winters in the 1930's or 1940's. In 1967, an intensive aerial survey showed a minimum of 1,280 sheep in the Matanuska River drainages from Granite Creek to Caribou Creek. Although this probably includes the west sheep range in the Talkeetnas, it represents less than a quarter of the total range. In the Watana Hills, 220 sheep were observed in 1967; but, after a severe winter, only 180 could be found in 1968.

Because of the relatively gentle nature of much of the Talkeetna Mountains and Watana Hills, it is possible that predation has more effect on sheep numbers here than in more rugged habitats.

## **Land Use Considerations and Recommendations**

Most of the Talkeetna Mountains are public domain subject to state, federal and native selection. An insignificant portion of sheep habitat falls within private homestead holdings or mining claims. It is doubtful that there will be any significant conflict between development and sheep use in the near future except in very localized areas.



One such conflict may occur within the Sheep Mountain Closed Area, which lies along the Glenn Highway at the southeastern end of this mountain range. In this case, extensive open-pit mining is being considered for a portion of the mountain within sheep habitat. Information on the status of this development is unavailable to us at present, but sheep would surely suffer from any such disturbance.

Another possible source of conflict is in the use of natural mineral licks for mining purposes. Known licks should be designated as critical habitat at the earliest opportunity and, with their access trails, should be protected from disturbance.

Any development planned within sheep habitat should take into consideration critical areas needed by sheep for lambing and wintering. Because such areas might be relatively small but irreplaceable to the sheep, particularly at certain seasons, they should be protected from disturbance. Prior to any construction or use-zoning, such areas should be delineated and considered.

A large portion of the Talkeetna Mountains is under study by the federal government for possible withdrawal. A possible use is the establishment of a National Park. When studying such a proposal, land use planners should recognize the loss it would cause to the sheep hunting public without giving sheep populations any worthwhile additional protection beyond that presently offered by ram-only hunting and remoteness.

## **MOOSE**

Much of Unit 13 is at or above timberline (2,600 to 3,200 ft.) and these results in a large amount of "edge" at timberline which produces considerable quantities of willow that is excellent winter forage for moose. The many lakes and an abundance of big game animals, excellent sport fishing and splendid scenery combine to make Unit 13 one of Alaska's most important recreation areas. Moose contribute to this image as trophies in the eyes of the hunter and as an irreplaceable part of the fauna to all interested observers, tourists and photographers. The moose of this area have been of considerable importance for many years and a reasonable amount of knowledge about their welfare has been accumulated.

Moose, like a number of other large mammals, were apparently rather scarce in the 1930's and 1940's, but spectacular increases occurred in the late 1940's and 1950's. The precise reasons for the eruption of moose numbers are not known but may have been related to intense wolf control efforts by the Fish and Wildlife Service, abundance of food caused by successional changes following fire, and the cessation of market hunting.

From the mid-1950's to the present the unit has been one of the most important moose hunting areas for hunters from Anchorage and Fairbanks as well as for local residents.

### **Populations**

In the mid-1960's the moose population in Unit 13 was estimated at 25,000 to 30,000 moose. Subsequent calf survival has been poor, wolf predation has increased and hunting has distorted the male: female ratio. All of these indices suggest the population has decreased. Casual examinations of some alpine willow ranges show a high percentage of the stems are dead--killed by excessive browsing and by super-abundant snowshoe hares. Hare population peaks occurred in 1963-64 and again in some areas in 1971 and 1972.

Moose hunting has continued at a moderately high level, but disproportionately few female moose have been taken due to adverse reactions to such seasons by the public. Over the past ten seasons the annual harvest of males has ranged from 1,126 to 1,385 while antlerless harvest has been 0 to 614 annually.

The area has reasonably good road access from the Glenn, Richardson, Anchorage-Fairbanks and Denali highways. In addition, much of the terrain is traversed by off-road vehicles and the many lakes provide easy access for float-equipped aircraft.

### **Land Use Considerations**

Recreational hunting, fishing and wildlife observation appear to be the highest uses of most of Unit 13. Most moose habitat requires periodic disturbance to maintain it in maximum productivity. The alpine willow ranges in this unit are an exception and these should be protected from disturbances. In contrast, burning would improve the moose carrying capacity of lowland timbered areas, for the fires that created important moose winter range occurred some 40 to 75 years ago and the ranges are now debilitated. Restoration of ranges must be carefully considered because caribou use the same areas and their requirements are radically different. Careful evaluation of the requirements of both species should precede any decision regarding manipulation of habitat.

### **WATERFOWL**

The most important waterfowl habitat in Unit 13 is the Nelchina Basin. Fish and Wildlife Service estimates of breeding ducks in the Nelchina Basin are 24.1 ducks per square mile. This is the lowest density in all the Interior units. The Nelchina Basin is located in an intermountain basin which is liberally dotted with lake and stream systems. Much of this wetland habitat is close to or above timberline and is less fertile than are lower-lying drainages.

Lesser scaup, white-winged scoter, bufflehead, American widgeon, mallard and American and Barrow's goldeneyes are the most abundant duck species. Canada geese nest along most of the upper river systems (e.g., McClaren River, West Fork Susitna, Gulkana River, Copper River and Susitna River). A fall flight of 188,000 ducks is estimated on the basis of 1.0 duckling per adult. Trumpeter swans nest throughout the basin, and a 1968 aerial survey of trumpeter swans in this area counted a total of 300 adults and 190 cygnets.

Recreational use of this area is the most intensive in the state, with pressure largely from Anchorage and Fairbanks. Subsistence use of the waterfowl resource is negligible, although past subsistence harvests were no doubt much greater.

### **Land Use Considerations and Recommendations**

Good waterfowl hunting areas are scarce in the Nelchina and upper Copper River basins. Some of the more popular areas include the Mentasta Lakes, Paxson Lake, Tangle Lakes, Fiftymile Lake, Mud Lake, potholes and streams in the Glennallen area, and several of the major streams and lake outlets. Acquisition of lake areas and purchase of access right-of-ways are currently being undertaken by the State of Alaska.

## **GAME MANAGEMENT UNIT 14**

Unit 14 includes the mouths of three major rivers: the Susitna, Matanuska and Knik Rivers. The foothills and portions of the main ranges of the Talkeetna and Chugach Mountains and the silt-choked Knik and Turnagain Arms of Cook Inlet are also significant features of the unit. In addition, it includes nearly half of Alaska's human population. An extensive network of roads, most of Alaska's dairy farms, major truck gardens, a multitude of lakes most important for recreation and a currently debilitated commercial and sport salmon fishery are also within the boundaries of Unit 14.

The topography is highly variable, ranging from salt marshes along the coast to black spruce bogs, thence to roll-

ing hills covered with white spruce and birch and finally to the high, steep mountains of the Chugach and Talkeetna Ranges. The river valleys are braided, and the many islands and cut-offs are covered with willow, cottonwood and occasionally white spruce. The diversity of habitat provides home for a variety of ungulates, carnivores and birds.

The climate is essentially northern maritime. Cool cloudy summers, wet autumns, variable but cold winters and relatively cool, dry springs are characteristic. Winter is the key to ungulate survival and the winters in Unit 14 periodically stress moose and sheep populations to the breaking point with deep, often wet, snows.

## **BLACK BEAR**

Despite intensive development and irregular land use patterns, Unit 14 possesses some of the densest black bear populations in the state. It is doubtful that black bear populations in this unit were ever much higher than they are at present, except in what is now metropolitan Anchorage. Even here, the suburban areas support good numbers of bears, as attested by numerous public complaints in the spring.

Black bear hunting, particularly in the spring, has long been a favorite sport. South facing slopes along the Seward Highway from Girdwood to Anchorage are particularly popular. Similarly, other areas in the Chugach and Talkeetna Mountains attract spring hunters. Fall hunting in conjunction with other hunts is also important in this unit.

Residents probably spend as much recreational time hunting in this unit for black bears as in any other unit in the state. This level of pressure does not appear to have affected bear numbers to any significant degree. Hunting in the area east of Anchorage has probably been a beneficial damper on annual fluctuations of bear numbers. Extremely high bear populations could create havoc in Anchorage during the spring.

### **Land Use Considerations and Recommendations**

Confrontations with humans remain the most important problem with black bears. Habitat changes occurring through fires, logging and partial clearing may be beneficial in some cases. The primary requirements for habitat that will sustain bears are proper waste disposal and production of key berry, grass and sedge crops, and the maintenance of salmon stocks. As livestock grazing increases, problems with black bears can be expected to increase.

## **BROWN BEAR**

Most of Unit 14 still maintains relatively high brown-grizzly bear densities. It is safe to assume, however, that the expansion of the metropolitan Anchorage area and the continued intensive development of the Matanuska Valley will continue to usurp good bear habitat.

Direct conflicts with early settlers probably affected bear numbers but high bear densities (relatively speaking) are still found in the Chugach Mountains east of Anchorage and in the upper drainages of the Big Susitna River tributaries in the Talkeetna Mountains. Probably these areas were always the best bear habitat within the unit.

Most bears harvested in the unit are taken incidentally to other hunts or other recreational activities. The largest recorded annual sport harvest was 19 in 1971.

### **Specific Habitat Considerations**

The food habits of brown-grizzly bears in this area are similar to those described in Units 11 and 13. It is possible

that the high availability of moose and caribou calves in Unit 14 creates a more intense predator-prey relationship than is found in many other areas. Some salmon are available to bears in the late summer and early fall, especially in the Talkeetna Mountain foothills.

Most denning activity probably occurs in the Chugach and Talkeetna Mountains. Denning requirements discussed for Units 8 and 9 are probably equally true for bears in Unit 14.

### **Land Use Considerations and Recommendations**

Brown-grizzly bears located in the new (1970) Chugach State Park will have tremendous aesthetic value for people using the park. However, the chances of seeing them are no greater within the park than they are in other similar areas. Limited seasons will always yield a small sustained harvest of this renewable resource, and this use is compatible with nonconsumptive uses. In Unit 14, late hunting seasons generally allow for maximum sporting value while minimizing conflicts with viewers.

The Talkeetna Mountains lend themselves to lucrative multiple-species guided hunts. Combined moose, sheep, caribou and black and brown bear hunts are popular and important economically. Although hunter success in brown grizzly hunts in the unit is lower than in Units 8 and 9, the possibility of such a prize does attract many sportsmen into the area.

Commercial grazing has been and will continue to be a problem in the Matanuska Valley, especially near the foothills. Early spring and late fall grazing of livestock encourages conflicts with brown bears and should be discouraged.

## **WOLF**

Unit 14 includes Anchorage, Palmer and the associated accouterments of a human population center. Intensive use of the area has taken a toll of wolves, which were abundant in the area before settlement and into the 1940's. Control efforts by the Fish and Wildlife Service reduced wolf numbers and by the mid-1950's they were absent or rare in major portions of the unit. The cessation of control and additional protection in the form of seasons and bag limits has led to increasing wolf populations, which have not yet fully recovered.

Wolves now den in the Matanuska and Little Susitna River Valleys and in the Chugach Mountains immediately behind Anchorage.

### **Populations**

There is no current estimate of total population. Annual harvests in this unit have ranged from 8 to 30 wolves.

### **Land Use Considerations and Recommendations**

If human use of the land expands, wolves will probably disappear from significant portions of this unit, principally in the Wasilla-Palmer area and in metropolitan Anchorage. The newly-designated Chugach State Park and Nancy Lake State Recreational Area are strategically located and will definitely assist in maintaining wolf populations by preventing land development.

## **WOLVERINE**

Wolverines have persisted in this unit in spite of urban sprawl, agricultural endeavors, recreational subdivision and military installations. There are no population estimates and harvests are low, averaging about 12 animals

annually.

## **BARREN GROUND CARIBOU**

Nelchina Herd: See Unit 13

## **DALL SHEEP**

Talkeetna Mountains: See Unit 13

Chugach Mountains: See Unit 13

## **MOOSE**

Moose are and have been an integral part of this rapidly developing area. Moose populations were benefited considerably by the openings created in mature forests during the first half of the Century during construction of the Alaska Railroad, gold mining and colonization of the Matanuska Valley. The openings were created not only by construction activities but by fires started attendant to these activities. Early accounts indicate a scarcity of moose in the lower Susitna and Matanuska Valleys prior to the early 1940's.

In the Matanuska Valley, large numbers of moose first appeared in the mid-1940's. Large areas burned about 1924 and reburned about 1940, and smaller fires occurred in between. Great quantities of birch, willow and aspen browse appeared where little was present before. Triggered by the sudden abundance of food, the high reproductive capability of moose resulted in a rapid increase in the herd. Moose populations in much of Game Management Unit 14 reached historic highs of abundance in the early 1950's. The following gradual reduction of winter range then combined with several unusually severe winters to cause some reductions in moose numbers in specific areas. Nevertheless, moose populations in some of the more accessible portions of the unit are presently as abundant on a "per unit of area" basis as any reported moose populations in the world. With the advent of statehood in 1959 and the assumption of game management responsibilities by the state in January of 1960, management programs allowing for the harvest of all ages and sexes were instituted. At that time, it became necessary to further delineate the moose populations within Game Management Unit 14, and three subunits were delineated. For the purposes of this discussion, the subunits will be referred to as they appear in the Game Management Unit Map (14A, 14B and 14C).

### **Game Management Unit 14A - Matanuska Valley**

This subunit is Alaska's most consistently productive area for moose when considered on a square-mile basis. Since 1960, more than 10,000 moose have been harvested by hunters and thousands more have been killed by motorists and Alaska Railroad trains. Moose in the Matanuska Valley have generally prospered under intensive hunting and approximately 6,000 to 7,500 moose are present today. In 1972, moose populations on winter ranges appeared to be at or above long-term carrying capacity. Moose numbers have been maintained in part because there has been a continual effort to develop farmland and recreational sites, and a limited amount of logging. These activities have created many additional miles of roads with edges lined with favored browse plants. Many fields cleared to satisfy the provisions of homestead laws were allowed to revert to natural plant succession and some fields cleared for agricultural purposes have been abandoned because of uneconomic operations. All of these disturbances have combined with game management efforts to prolong the abundant populations of moose in the Matanuska Valley.

### **Specific Habitat Considerations**

Increased human activity, especially vehicular traffic, has resulted in increased mortality rates to moose. Future problems in maintaining high moose densities include increased accidental mortality and the loss of key habitat such as calving areas and summer ranges to development. The state has anticipated the latter problems to a lim-

ited degree and has entered into cooperative agreements with the Alaska Department of Natural Resources and the Matanuska-Susitna Borough to protect some key moose ranges such as the Palmer Hay Flats. Agreements covering additional areas are needed.

### **Land Use Considerations and Recommendations**

The complex pattern of land ownership that exists within Subunit 14A promises great difficulty to long-term moose management planning. More land will pass into private hands as state and local governments sell or lease choice agricultural, industrial and recreational lands. The human population will also increase and portions of the Matanuska Valley will become suburbs of Anchorage within the next two decades as better highways are built. This will be especially detrimental to moose populations because these highways are invariably in the valleys, and run at right angles to the annual migrations of moose.

Moose are extremely valuable recreational animals in Subunit 14A. In all probability, their worth will increase as the human population in Southcentral Alaska increases. If we desire to continue to benefit from this natural asset, certain lands now held by the state and borough governments must be set aside and managed as moose winter range. Proper selection of such ranges will also aid in minimizing human moose conflicts that increase annually on the highways, in residential and agricultural areas.

### **Subunit 14B**

This subunit contains a number of relatively discrete moose populations that annually migrate between the mountains and the lowlands, generally following the major drainages. The historic winter ranges, particularly those created by fire 30 or more years ago, are now largely over-mature. Settlement in the Willow and Montana Creek areas has created a few new openings as has road construction. Nevertheless, the resident or "lowland" moose are not as abundant today as they were 15 to 20 years ago. The important winter ranges now are the alluvial bars of the Susitna River, residual winter range created by the old burns, a few small burns that occurred during the 1950's, man-made clearings, and some climax winter range on steep slopes at or near timberline.

Because access has never been created, except through the former winter ranges in the lowland areas, these moose populations have been harvested rather lightly in spite of liberal seasons. In 1972, 312 moose were taken by hunters. The total moose population within the area probably exceeds 5,000 animals.

### **Specific Habitat Considerations**

Additional winter range is required in order to maintain the moose population at its present size. Logging is not economically feasible at present and advancing forest age rules out large scale harvesting of timber in the foreseeable future. Therefore, manipulation of vegetative cover by fire or mechanical crushing seems appropriate both to maintaining highest forest values for future harvest and to obtaining maximum use of the renewable moose resource at the present time.

### **Land Use Considerations and Recommendations**

Development in this subunit will probably be localized along the existing Fairbanks-Anchorage Highway and the Alaska Railroad. These travel routes bisect most of the formerly important moose winter range in the subunit and are the direct cause of considerable moose mortality. Some lateral highways for access to timberline areas would be compatible with long-term management objectives for moose. The important winter range is largely in state or borough ownership, but an increasing portion is passing into private ownership.

### **Subunit 14C**

This subunit incorporates metropolitan Anchorage, Fort Richardson Army Base, Elmendorf Air Force Base, Chugach State Park, the State Refuge at Potter Marsh, and the northern portion of the Chugach National Forest. All the area is used by moose except the highest peaks and ice fields.

Inevitably, moose and people clash over the use of roads, airfields, ornamental shrubs, golf courses, school yards and playgrounds. While moose can tolerate intensive development, man seems unable to tolerate moose in some situations. Furthermore, as the intensity of human land use increases and the asphalt and concrete cover becomes greater, moose are limited by the scarcity of food and the lack of areas providing life's necessities. We have reached these stages in much of the City of Anchorage. Moose are now excluded or eliminated from the commercial and military airports. Limited access highways are fenced and an ever increasing portion of the area is under concrete or asphalt. Moose have persisted in surprisingly high numbers in the remaining areas, but not without creating controversy. If Anchorage and its suburbs continue to grow at the present rate, moose habitat will shrink dramatically within the next decade. The reduction will be all the more noticeable because moose invasions in the city will cease, as man-made physical barriers exclude them and as asphalt continues to eliminate necessary habitat. Moose populations within Chugach State Park also will decline, for they are dependent upon wintering grounds outside the park, primarily those within the Fort Richardson- Elmendorf complex. This dismal forecast would be reversed if significant areas now under military jurisdiction were dedicated for rehabilitation of winter range and if man could tolerate the occasional disruptions and damages inflicted by moose. In 1971, hunters killed 93 moose in Subunit 14C, and accidental deaths probably exceeded 100. There are perhaps 2,500-3,500 moose within the subunit.

## **MOUNTAIN GOAT**

Talkeetna Mountains A few scattered populations of goats have existed in the Talkeetna Mountains for many years, but in very limited numbers. The area represents the northern limit of established goat populations in Alaska.

### **Populations**

A few goats are present in the Little Susitna River drainage and at the head of Kings Creek. The north side of Sheep River also supports a small number of goats and a few are reported to exist on Wells Mountain. The total population in the Talkeetna Mountains is probably fewer than 200 goats.

**BELUGA WHALES** - See Unit 16.

## **WATERFOWL AND SEABIRDS**

### **Populations**

The Fish and Wildlife Service estimates that breeding densities are about 12 ducks per square mile of waterfowl habitat. Waterfowl species commonly breeding in Unit 14 are: lesser scaup, mallard, pintail, green-winged teal, American widgeon, shoveler, American and Barrow's goldeneyes, bufflehead, surf and white-winged scoters and harlequin. Small numbers of white-fronted and Canada geese, sandhill cranes and trumpeter swans also breed within the unit.

Waterfowl use occurs mainly from April through November. Peak concentrations of waterfowl usually occur during May and from late September to early October. Perhaps 1,000,000 Canada, white-fronted and snow geese and several times that many ducks utilize the Matanuska Valley and Upper Cook Inlet during spring. Although fall concentrations are not generally as spectacular, large numbers of ducks using tideline areas and smaller num-

bers of geese are present. Nearly all tidal flats, river and stream deltas and coastal marshes have birds present.

Whistling swans are present in relatively large numbers, primarily on the Susitna and Palmer Hay Flats during the fall and spring. Sandhill cranes are common on coastal marshes during the spring and fall but large concentrations do not occur.

Many waterfowl surveys have been conducted in this unit. For more specific information, refer to 1970 and 1971 Alaska Department of Fish and Game Survey and Inventory Reports. Although no seabird colonies are known in Unit 14, some undoubtedly occur, especially small colonies of gulls.

### **Habitat and Land Use Considerations and Recommendations**

The two major threats to waterfowl habitat in Unit 14 are oil pollution (especially spills in Cook Inlet) and habitat destruction through the physical and industrial growth of the Anchorage area.

Oil spills in Cook Inlet have been common for several years, but usually have been small. Little or no habitat has been lost yet due to pollution, but kills of several thousand birds have been recorded.

Additional state lands have been leased recently for oil extraction, and actions similar to those recommended in the discussion of Unit 6 are necessary to prevent future oil pollution.

The Potter Marsh near Anchorage has been legislatively declared a game refuge to be managed by the Department of Fish and Game. This small but heavily used area is thus protected for future waterfowl and public recreational use. The Alaska Department of Fish and Game, Alaska Department of Natural Resources and the Matanuska-Susitna Borough have jointly agreed to designate the Susitna Flats as a resource management area with wildlife the major consideration. This area and the Palmer Hay Flats are perhaps the most heavily used hunting areas in the state, as well as being important fall and spring waterfowl staging areas.

Public access to waterfowl habitats on the Palmer Hay Flats is now limited to only a few trails and therefore hunters are concentrated more than is desirable. Access problems in this and other areas should be studied and actions taken to insure adequate future public access.

#### **Key Waterfowl Habitat Areas - Game Management Unit 14**

Upper Cook Inlet (Potter, Rabbit Creek,  
Campbell, Airport Flats)  
Eagle River Flats  
Goose Bay  
Palmer Hay Flats  
Susitna Flats

Maintenance of habitat in these areas is of state and national concern. Improperly planned alteration of habitat could result in high bird losses, and state-owned lands in the above-listed areas should be designated as critical waterfowl habitat.

#### **GAME MANAGEMENT UNIT 15**

The portion of the Kenai Peninsula draining into Cook Inlet has been designated Game Management Unit 15. The unit has two major topographic features: the broad, flat to rolling plain extending from Cook Inlet to the Kenai Mountains and the Kenai Mountains themselves.



The flatlands are heavily timbered with white spruce, birch and aspen with interspersions of willow and cottonwood. Forest openings have been created by fire and glacial lakes and man-made clearings are numerous. Timberline is relatively low and a broad band of subalpine vegetation sustains abundant populations of moose, black and brown bears.

The coastal area is diverse. The northern shoreline is not particularly productive, suffering from the glacial siltation of Upper Cook Inlet, but the southern shores are fertile habitat for shellfish, bird colonies and marine mammals.

The area was the home of aboriginal and early migrant people. Most initially came to exploit the abundant fur and fishery resources. The latter is still an important industry although petroleum exploration, extraction and refining now command a major interest. The unit has a restricted road system and most potential recreation areas are undeveloped. Land ownership is largely vested in federal refuges and state parks.

The climate, from south to north, ranges from wet maritime to alpine. The northern flatlands are relatively dry, cold and cloudy with variable snowfall, which is moderate in most years, seldom reaching 24-36 inches accumulation. To the south, near Kachemak Bay, Seldovia and Portlock, snowfall and total precipitation are much greater, being essentially similar to that found in the coastal Units 6 and 7.

Much of the unit is contained in the Kenai National Moose Range and Kachemak Bay State Park, and thus public control of land-use patterns is relatively well assured.

## **BLACK BEAR**

Black bears are exceptionally abundant in much of Unit 15. Although population figures are not available, seasonal concentrations here may equal or exceed densities found anywhere else in the world.

### Specific Habitat Considerations

Most of the discussion of black bear habitat in Unit 7 also applies to Unit 15. In this unit, however, the correlation of high spring use with high density moose calving areas is more evident. Black bears kill moose calves in the spring and probably also eat many that have died from other causes. Bears are also attracted to moose wintering areas in the spring to feed on winter-killed animals.

Food requirements vary little, if at all, from those discussed in reference to Unit 7, although the topography of Unit 15 makes some difference in habitat uses by individual bears. Some bears probably never leave the lowlands. In addition, spring habitat is probably not as critically limited in Unit 15 as it is in Unit 7.

Black bear densities in the 1947 burn on the Kenai National Moose Range indicate that fires in Alaska may be beneficial to bears in some cases. It may be argued whether the benefits are due to the increased production of flora or of fauna. More than likely it is a combination of both.

Other than direct confrontations with man, very few black bear conflicts arising from man's land use are foreseen. There may be potential conflicts with commercial grazing enterprises. Commercial fishing interests have at times expressed concern over the effects of bear predation on commercial fish stocks, but actual effects are probably minimal. Habitat manipulations which remove the mature forest cover can be considered beneficial to bears if revegetation is allowed to occur and the manipulated areas are not exceptionally large.

## **BROWN BEAR**

(See also Game Management Unit 7)

Brown bears are low to moderate in abundance in Unit 15. High spring concentrations of bears on the upper Moose River flats coincide with moose calving activities in the same area. There is little doubt that bears are attracted to these areas during the May-June calving period. The area not only produces several thousand moose calves each year, but also produces a large quantity of the more preferred spring plant foods such as sedges, grasses and horsetails.

Much of the alpine-subalpine zone is important bear habitat during summer and fall. Because of the extent of the area and elevational fluctuations of the zone, no attempt was made to plot it on the maps. Certain salmon spawning streams in the Kenai, Kasilof, Deep Creek, Anchor River, Fox River and Chickaloon drainages attract concentrations of bears in July-September.

### **Land Use Considerations and Recommendations**

Intensive recreational developments have created the recreationist- bear problems usually associated with quarrels over garbage or fish. However, since most of the bear habitat in the unit is in wildlife-oriented land use classification, bear populations on the Kenai are probably quite secure.

### **WOLF**

Wolves disappeared from the Kenai Peninsula shortly after 1900. They reappeared in the mid-1960's and several packs are now distributed over the peninsula, including parts of Unit 7. The reasons for both their disappearance and subsequent reappearance are obscure. Wolves disappeared about the time caribou were eliminated; they may have been the victim of excessive predator poisoning and/or prey shortages. Their return coincided with generally increased wolf populations in Units 13, 14 and '16, which followed a cessation of federal predator control activities and institution of more conservative hunting regulations by the state. It is currently illegal to kill wolves on the Kenai Peninsula.

### **Populations**

There are probably 20-50 wolves present in the unit, comprising at least two packs.

### **Land Use Considerations and Recommendations**

Most of unit 15 is in the Kenai National Moose Range, Chugach National Forest and Kachemak State Park. A small portion of the unit near Homer is state land. Because so much of the land is already classified for public retention there is little possibility that development will endanger wolves. However, recovery of wolves to maximum numbers has been retarded by illegal individual efforts at predator control during the past several years. The persistent archaic belief that wolves endanger moose and Dall sheep populations and domestic livestock remains the greatest obstacle to a completely restored wolf population.

### **WOLVERINE**

Wolverines occur throughout Unit 15 but in relatively low numbers. Humans trap wolverines rather intensively but the rugged mountains and extensive public lands assure a measure of protection to the species. There are no population estimates for Unit 15 wolverines. About 10 are harvested annually.

### **BARREN GROUND CARIBOU**

Kenai Herd: Game Management Units 7 and 15 Caribou occurred on the Kenai Peninsula until the early 1900's. apparently loss of habitat to extensive fires and intensive hunting around the turn of the century caused

the herd to decline rapidly. Caribou became extinct on the Kenai Peninsula about 1913.

In the early 1950's the Fish and Wildlife Service conducted feasibility studies to determine if historic caribou ranges on the Kenai Peninsula could again support caribou. Suitable range was found in the Chickaloon River-Mystery Creek area, the Skilak-Tustumena Lake area and the Caribou Hills north of Homer. These areas were reappraised in 1964 by the Alaska Department of Fish and Game, which released 15 caribou near the Chickaloon River in May, 1965. In April, 1966, 29 more were released at Watson Lake near Sterling. These transplants were highly successful and since 1966 caribou have been observed at scattered points over the entire western half of the Kenai Peninsula.

At the present time the largest group (about 200 animals) is resident in the northern Kenai Mountains south of Hope, between the headwaters of Resurrection Creek and the Chickaloon River. A smaller band of 20-30 caribou winters on the Moose River Flats, and calves and summers on the lowlands just north of the Kenai Airport. A few animals have also been observed near Indian Creek and east of Tustumena Lake.

## **DALL SHEEP**

Kenai Mountains: See Unit 7

## **MOOSE**

The Kenai Peninsula, location of the Kenai National Moose Range, is almost synonymous with moose. Although moose are long-time residents of the peninsula, population levels have fluctuated over the years with changes in vegetation and the age of the tree canopy. Since the 1920's, fires (largely caused by man) have had a most beneficial effect upon the numbers of moose in the unit. The most significant event benefiting current moose populations was the 350,000 acre fire that occurred in 1947. The fire was capricious, skipping some areas entirely while burning to the mineral layer in others, and leaving a patchwork of vegetation over nearly 450,000 acres. Plant succession since has been equally variable and the complex of vegetation types and successional stages has provided unparalleled moose habitat that is now at or just past its zenith. Fires have continued to bless the area, with approximately 5,000 acres burned on Kenai Lake in 1959, 90,000 acres burned in the Swanson River area in 1969 and 450 acres burned in the Russian River area in 1969. The more recent fires should insure a continued supply of winter moose forage as the vegetation from the 1947 fire advances into nonavailability.

The Fish and Wildlife Service has played an active role in modification of winter ranges as a part of long-term management goals on the Kenai National Moose Range. Several thousands of acres have been mechanically reverted from moderate-aged white spruce to willow and birch in the Slikok Lake area and a considerable portion of the 1969 burn has been "rolled" for aesthetic and browse production purposes.

Moose habitat off the Kenai National Moose Range has not fared so well. In the Homer area, where natural and man-caused fires are rare because of the moist climate, the ranges are in poor condition. The older fire-created communities are becoming mature and no new range has been created. Some climax willow communities in river bottoms and at timberline continue to support sizeable populations of moose, but much of the range shows the effects of overuse. At the eastern edge of Unit 15 where the land is managed by the Chugach National Forest, moose habitat is restricted to steep mountain slopes and river valleys, and the range is also in poor condition. In 1972, 1,419 moose were harvested in Unit 15. The population of moose in the unit is estimated to be between 15,000 and 17,000 animals with some extensive areas supporting 10 to 15 moose per square mile. This is the highest reported moose population per unit of area in the world.

## **Land Use Considerations and Recommendations**

Most of Game Management Unit 15 is owned by the federal government and is in the Kenai National Moose

Range or the Chugach National Forest. The State of Alaska and the Kenai Peninsula Borough own the southern portion of Unit 15. This area includes two state parks, neither of which have much importance to moose. A portion of the state and borough lands will eventually be in private hands and native corporations may select some refuge land under the Native Claims Settlement Act. Generally, however, there is stable land tenure on the most important moose habitat.

Here, as elsewhere, roads tend to intersect annual moose migration routes. The Sterling Highway passes through prime winter range and annually several hundred moose-vehicle collisions occur. Several thousand moose migrate twice annually between the Kenai Mountains and the Moose River lowlands, and a proposed north-south highway, especially if fenced, would affect perhaps 30 percent of the moose in Unit 15.

**MOUNTAIN GOAT**

Kenai Mountains: See Unit 7

**HARBOR SEAL**

Heavy concentrations of seals exist in Nuka Bay, Nuka Passage and Port Dick. A concentration of seals also occurs in the Chugach Islands. No population estimates are available for the unit.

**SEA OTTER**

Sea otters were once abundant along the south side of the Kenai Peninsula and in lower Cook Inlet, perhaps as far north as Anchor Point. Large numbers were never present in upper Cook Inlet. All sea otters were exterminated from this area by fur hunters in the 19th Century. By 1960, only occasional stray animals had appeared in the area. In the mid-1960's, several hundred suddenly appeared between Port Graham and Port Chatham, perhaps after immigrating from either the Barren Islands (see Unit 8) or Augustine Island (see Unit 9) . These animals have since spread eastward to the Port Dick area and some otters may have immigrated from the east (see Unit 7). Sea otters are common in Port Dick, Chugach Bay and Port Chatham. Only occasional stray animals are found north of English Bay. As numbers increase, the population should expand into Kachemak Bay and repopulate all of its former range.

**Populations**

There are approximately 500 sea otters in the unit and the population is increasing.

**SEA LION**

Sea lions were intensively harvested by natives prior to the 1900's. As a result, population levels were considerably reduced throughout most of the state. Since the turn of the Century, harvest of this species has been very low and populations have recovered to near maximum levels. Populations

**Sea Lion Rookeries and Hauling Grounds  
Game Management Unit 15**

<u>Quadrangle</u>	<u>Ref. No.</u>	<u>Location</u>	<u>Population</u>
Seldovia	360	Flat Island	300
	361	Cape Elizabeth	30
	362	Nagahut Rocks	50
	363	East Chugach Island	20
	364	Gore Point	220

## WHALES

Outside Coast - Similar to Unit 8.

Cook Inlet - See Unit 16.

## WATERFOWL AND SEABIRDS

### Populations

The Fish and Wildlife Service estimates there are 12 breeding ducks per square mile of suitable habitat in Game Management Unit 15. Waterfowl species commonly breeding in the unit are the same as those found in Unit 14. Breeding trumpeter swans are relatively abundant on upland ponds.

Waterfowl use suitable areas in this unit throughout the year. Winter use is restricted to coastal bays and other estuarine areas. Kachemak Bay is a major wintering area, supporting substantial numbers of mallards, sea ducks and seabirds. Large concentrations of birds are common on Fox River Flats and Chickaloon Flats during spring and fall migrations.

A few trumpeter swans winter in the unit during mild winters. A number of waterfowl surveys have been conducted in Unit 15. For more specific information, refer to 1970 and 1971 Alaska Department of Fish and Game Survey and Inventory Reports.

The following is a list: of known seabird colonies in the unit. Undoubtedly more colonies exist than are recorded here.

### **Description of Seabird Colonies Indicated on Map Game Management Unit 15**

<u>Map No.</u>	<u>Colony No.</u>	<u>Name</u>	<u>Species Present</u>
51	26	Elizabeth Island	Any or all species
51	26A	Perl Island	listed as present in
51	26B	East Chugach Island	Unit 6 as well as the
51	27	Windy Rocky Bays	double-crested
51	27A	Port Dick	cormorant could be found on these colonies.

### **Habitat and Land Use Considerations and Recommendations**

The major threat to waterfowl habitat in Unit 15 is from offshore oil spills. Local habitat contamination from oil on upland sites is a possibility, for some oil fields are presently in production, exploration is occurring and future expansion of drilling activities is probable. Action as described in the discussion of Unit 6 is recommended to prevent future habitat loss from oil pollution. Oil spills and resulting bird losses in Cook Inlet have occurred in about the same magnitude as described in the discussion of Unit 14. Habitat loss through community expansion and other economic developments will probably be negligible because most waterfowl habitat is protected by inclusion in the Kenai National Moose Range or Kachemak Bay State Park. The Fox River Flats has recently been designated legislatively as critical wildlife habitat (see Unit 9). This designation should provide some measure of protection.

### **Key Habitat Areas - Game Management U, 15**

Chickaloon Flats

Fox River Flats  
Kenai River Flats  
Kachemak Bay  
Kasilof Flats

Maintenance of habitat in these areas is of state and national concern. All but the Kenai River Flats and Kasilof Flats are currently protected from unplanned alteration. State-owned lands in the Kenai and Kasilof Flats should be designated critical habitat.

## GAME MANAGEMENT UNIT 16

Unit 16 is formed from the west drainages of the Susitna River below the Chulitna River and including the west drainage of Cook Inlet from the Susitna River to and including Redoubt Creek. It includes Kalgin Island. The broad heavily timbered Susitna River Valley dominates the unit. This largely inaccessible valley includes some of the finest recreational areas in Southcentral Alaska. Much of the white spruce - birch timber is mature to over-mature and manipulation to an earlier successional stage would be beneficial both to the lumber industry and to populations of large carnivores and ungulates.

South of the Susitna River lie the Beluga coal and gas fields, with coastal flatlands narrowing to the south. The massive Alaska Range dominates the scenery. The tidal flats and river estuaries are extremely important waterfowl spring and fall resting areas.

The area is sparsely settled, with Tyonek the only town of any size. Most visitors are associated with the petroleum industry, seeking recreation, or prospecting for minerals. Gold mining was a prominent activity in the Petersville-Cache Creek district prior to World War II, but has little impact today.

The climate ranges from maritime along the coast to continental near the mountains. Snowfall is often heavy and deep and on occasion causes severe losses of moose.

### **BLACK BEAR**

Black bears are widely distributed throughout the unit, which supports densities nearly equal to those found in Units 6 and 15. As in the other units, black bears are primarily associated with timber and dense alder growths. Considerable overlap with brown-grizzly bears occurs here, even on stream concentrations and high spring use areas. With good populations of both species it is understandable that important overlaps will occur, especially in the spring when diets of the two species are almost identical.

Hunters often pursue black bears incidentally to other hunting. Guides in the unit often offer black bear hunts as a bonus to more popular moose, sheep and caribou excursions. This "back-seat" role is not surprising considering that black bears are present throughout much of the contiguous United States. It is anticipated, however, that hunting for bears will become increasingly more popular as access from the metropolitan centers improves.

### **Specific Habitat Considerations**

Spring bear habitat is not critically limited in most of the unit. However, in areas such as Tuxedni and Redoubt Bays, where steep mountains crowd the shoreline, there may be some areas of extremely critical spring habitat. Spring foods consist of grasses, sedges, horsetails, carrion, and, for a short period, moose calves. Fish, particularly silver and red salmon, are very important to black bears in Unit 16 from July through September. By early August some attention is turned to blueberries, elderberries, lowbush and high bush cranberries, bearberries and crowberries.

## **Land Use Considerations and Recommendations**

Future habitat changes may affect bear populations. Intensive development and human encroachment will utilize some prime habitat areas. Black bears generally seem to adjust very well to most of this type of intrusion, however. Manipulation of mature timber stands probably will prove to be beneficial to bears. The biggest problem will still be the black bear's inquisitive nature and continued attraction to "civilization", and man's intolerance of his presence.

Where high spring use areas are limited, special consideration should be given in future land decisions to protecting these areas, especially during that time of year when they are used by bears.

### **BROWN BEAR**

Brown bears are found throughout Unit 16, and occur in moderate to high densities. They fall somewhere between the giant coastal bears and Interior bears in both size and population density.

#### **Specific Habitat Considerations**

Very little is known about the food habits of bears in the unit but because of vegetative similarities, it is expected that they are similar to those of bears in Units 8 and 9. Early spring food is relatively abundant, with broad expanses of sedge meadows, grass flats and potholes providing an abundance of early green plants. Carrion left from hunter and winter kills further supplements brown bear diets. Moose calves and rodents are probably also important. Salmon are important to brown bears in Unit 16. Red salmon appear in July and August and bears frequent Coal Creek, Lewis River, Talachulitna Creek, Fish Lake Creek, Alexander Creek and Coal Creek. King salmon arrive in July and August in many of the streams and are often available later into the fall on the spawning grounds. Silver salmon and a few pink salmon also spawn in the unit, and the later run silvers may provide a major food supplement in the fall.

Although denning activities have not been studied in this unit, habitat requirements are probably similar to those on the Alaska Peninsula (Unit 9). Bears in Unit 16 appear to den earlier and emerge a little later than those on the peninsula, however.

As in other units, the alpine-Subalpine zone is extremely important for summer and fall use as well as for denning. Land Use Considerations and Recommendations The few direct conflicts with humans that have occurred here have been with recreationists, homesteaders, and prospectors. Access and human habitation have been limited primarily to the lowlands and to date commercial grazing does not appear to be feasible. It is foreseeable that livestock will appear when better access and grazing lands are available. Bear habitat requirements and distribution should be prominently considered when evaluating proposals for grazing leases. Recreational uses of this area will undoubtedly increase rapidly in the next few years. Intense public relations programs will be needed to educate the public and thereby reduce conflicts with bears.

### **WOLF**

Wolves have often been quite abundant in this unit, even though they received intense pressure from aerial hunters from Anchorage through the winter of 1971 -72. The reported annual harvest ranged from 5 to 84 animals during the past decade. At present wolves are abundant in the headwaters of the Yentna and Skwentna Rivers and reduced along the lower Susitna River. Moose constitute the major food item for wolves.

### **WOLVERINE**

Wolverines are relatively abundant in this unit. The salmon, carrion, and big game and small game populations all seem to be ideal for this giant weasel. There are no population estimates. About 50 are harvested each year.

## **BARREN GROUND CARIBOU**

McKinley Herd: Game Management Units 16, 19 and 20 This herd presently occupies an area of over 6,000 square miles extending westward from the eastern boundary of Mt. McKinley National Park to the north fork of the Kuskokwim River, northward to Chitsia Mountain and southward as far as Rainy Pass. The region north of the Alaska Range is noted for cold winters and moderate snowfall. South of the range, winter temperatures are warmer but snowfall is heavy. Within the range of the McKinley herd temperature extremes range between 90° F and -45° F. Annual precipitation averages about 14 inches.

The central part of the Alaska Range consists of rugged glaciated ridges, 6,000 to 9,000 ft. high, surmounted by groups of extremely rugged glacier and snow-capped mountains more than 9,500 ft. in elevation. Mt. McKinley, rising to a summit of 20,320 ft. is the highest mountain in North America. Here the north and west parts of the range drain into the Tanana and Kuskokwim Rivers, while the south flank drains into the Susitna River.

The broad Tanana-Kuskokwim lowlands lie between the Alaska Range and the Kuskokwim Mountains. They are laced with braided glacial streams and dotted with ponds and lakes.

The Kuskokwim Mountains are a monotonous succession of northeast-trending ridges with rounded or flat summits, 1,500 to 2,000 ft. in elevation, and broad, gentle slopes. These mountains are drained by tributaries of the Yukon and Kuskokwim Rivers. Spruce and birch forests cover most areas below 2,500 ft. elevation.

### **Winter Distribution**

Records of the winter distribution and movements of the McKinley herd are sketchy at best, but a pattern is evident. Prior to 1931, when the herd was estimated at over 30,000 animals, several widely separated winter ranges were utilized. Part of the McKinley herd wintered in the Broad Pass area south of the Alaska Range, while the remainder utilized the hills and lowlands near Lake Minchumina and the northern Kuskokwim Mountains. From 1931 to 1961 winter movements were mostly north and west of the Alaska Range, centering in the Lake Minchumina area. In recent years caribou have wintered in the foothills between the Nenana and Kantishna Rivers and the foothills between the Little Tonzona River and Slippery Creek. Apparently the latter area supports the greatest number of caribou today.

### **Spring Migration**

In spring the animals move toward Mt. McKinley National Park. Caribou that wintered to the southwest move northeast along the foothills, while animals that wintered north of the park move south along stream and river courses between the Toklat and Sanctuary Rivers.

### **Calving**

Calving has been observed as far west as the McKinley River, but cows usually calve on the open rolling tundra between the upper Savage and Teklanika Rivers. Calving has been observed from June 12 to June 22.

Shortly after calving, cows and their new calves cross the Alaska Range between the Teklanika and Savage Rivers, to the area between upper Cantwell Creek and the west fork of the Holitna River.

### **Summer Distribution**



In late June or early July, the herd crosses the Alaska Range and then swings west, parallel to the park road. This is a leisurely drift that tends toward the western boundary of the park. Some animals turn north in the vicinity of Muldrow Glacier while others continue west along the foothills. In August and September only a few animals remain in the park. The herd spends a major portion of the year in Mt. McKinley National Park and is not subjected to hunting or the effects of development while in the park. Hunters kill a few animals along the north boundary of the park, particularly during the winter months.

### **Population**

The herd population levels have fluctuated during the past 50 years and appear to be decreasing at present. In 1964 the herd was estimated at 14,000 animals but scattered recent observations suggest fewer than 10,000 present. The factors causing the decrease are not known, but are probably related to range condition.

### **DALLSHEEP**

Alaska Range: See Unit 12

### **MOOSE**

The lower Susitna River and its tributaries, the Yentna and Skwentna Rivers, have long been outstanding moose habitat. This area encompasses most of the primary habitat types including seral willow on the alluvial bars, successional willow and aspen below receding glaciers, climax willow stands at timberline and seral birch, willow and aspen in fire-created ranges. Use of this outstanding resource has not been commensurate with its potential because until the late 1960's access to the area was restricted to aircraft and boats. In 1969 the Sunshine Bridge was opened across the Susitna River as part of the Anchorage-Fairbanks Highway. This opened a small corner of the unit containing high quality moose habitat and human use of the area increased dramatically.

### **Populations**

There is no estimate of the total number of moose within the unit. The harvest in 1972 was 836.

### **Land Use Considerations and Recommendations**

Most of Unit 16, including all of the high quality lose range, is now owned by the State of Alaska, the Matanuska-Susitna Borough and private individuals. Development in the area will probably be closely tied to the construction of the proposed Knik Causeway which would link Anchorage to the lower Susitna Basin. If this causeway is built, development in Unit 16 will be rapid. Planners should incorporate maintenance of the key moose ranges identified in this study into long-term planning.

Recently, moose have suffered several severe winters in Game Management Unit 16 and winter habitat was not adequate to sustain the populations. Hundreds died in 1971 and many more in 1972. Creation of additional range through mechanical manipulation or controlled fires is possible if human demands for moose warrant the expense.

### **HARBOR SEAL**

No harbor seal population estimates are available for the unit. Seals are present along the west shore of Cook Inlet and a concentration occurs at the mouth of the Susitna River.

## SEA OTTER

Unit 16 has never supported permanent sea otter populations and probably will not in the future. Occasionally animals stray there from Unit 9, however.

## WHALES

About 100-300 beluga whales inhabit Cook Inlet. They are most common near the Susitna River, although they occasionally move into Turnagain Arm. It is believed that the population does not intermingle with the belugas of the Bering Sea.

## WATERFOWL AND SEABIRDS

### Populations

The Fish and Wildlife Service estimates there are 32 breeding ducks per square mile of habitat in Game Management Unit 16. Waterfowl species commonly breeding in Unit 16 are the same as those listed as present in Unit 14. The few swans breeding in Unit 16 are probably trumpeters. Most waterfowl use occurs from April through November. Few if any waterfowl overwinter because streams and tidal flat areas are frozen and the waters of Cook Inlet are apparently unsuitable. A few gulls and other seabirds are present during winter months large numbers of ducks and geese utilize Unit 16 habitats (see Unit 14) during spring and fall migration periods. Whistling swans and cranes are generally less common than in Unit 14, but gadwalls are more common here in the fall than they are in the rest of Cook Inlet.

A number of formal waterfowl surveys were conducted in the unit from 1969 through 1972. For more specific information, refer to 1970 and 1971 Alaska Department of Fish and Game Survey and Inventory Reports.

Although not so designated on the maps, Kalgin Island has small colonies of nesting glaucous-winged gulls. Undoubtedly more colonies of gulls and other seabirds exist in Unit 16, but locations are unknown at this time.

### Habitat and land Use Considerations and Recommendations

The major threat to waterfowl habitat in Unit 16 is contamination of estuarine and perhaps upland habitats by oil pollution. Oil spills in Cook Inlet affect Unit 16 as well as Units 14 and 15. Action as described in the discussion of Unit 6 is recommended to prevent future habitat loss by oil pollution.

Agreements between interested agencies for natural resource management on key areas as described in the Unit 14 discussion are possible and desirable in this unit. It is recommended that key habitat areas be studied for possible inclusion in such agreements.

Grazing leases on Kalgin Island State Game Refuge have been proposed. Grazing constitutes a threat of unknown magnitude to waterfowl habitat. Parts of the island have been legislatively designated as critical habitat, as described in Unit 9.

### **Key Waterfowl Habitat Areas - Game Management Unit 16**

Kalgin Island  
Redoubt Bay  
Trading Bay

Maintenance of habitat in these areas is of state and national concern, for improperly planned alteration of habitat could result in high bird losses. State-owned lands in the abovelisted areas should be designated as critical waterfowl habitats.

## GAME MANAGEMENT UNIT 17

Most major drainages of Unit 17, including the Wood, Nushagak and Togiak Rivers, originate among flat-topped ridges rising to 2,500 ft. The Mulchatna River drains the North Slope of the rugged Alaska Range with peaks reaching to 6,000 ft. The vegetation in the headwaters of all major drainages is strikingly different from the sedge meadows and bogs of the coastal plains adjacent to Bristol and Togiak Bays where the rivers empty. Spruce with lichen understory is common in river valleys and dry, rocky hilltops are carpeted with dryas fell-field and lichens.

The unit is remote and sparsely populated. There are no roads linking the unit to the rest of the state. Commercial fisheries and tourism form the area's economic base.

The climate is northern maritime graduating to continental in the upper portions of the drainages. High winds, fog and blowing snow are the most noticeable weather characteristics.

### BLACK BEAR

Black bears are sparsely distributed in much of the central and eastern portions of Unit 17. Bears are seldom hunted and in most cases are considered nuisances by local people.

The food requirements for bears in Unit 17 are basically the same as in Unit 9 and 16. Red salmon are the most important fish although king, chum, and silver salmon are taken when available.

Black bear concentration areas per se are practically nonexistent in the unit.

### BROWN BEAR

Brown bears are relatively common in Unit 17, and tend to be slightly smaller than those in Unit 9.

The size and remoteness of Unit 17 have made it difficult to assess bear numbers. Generally, it can be stated that bear densities are less than in bordering Units 9 and 16; however, they do appear to be more abundant than in most Interior Alaska units.

### Specific Habitat Considerations

The terrain and vegetation in Unit 17 are typical of Bristol Bay drainages and there is an adequate supply of bear food from spring through fall. The diets of bears in this unit are probably about the same as those of bears found on the Alaska Peninsula. Red salmon are by far the most abundant and available fish in the unit and are found primarily in the Nushagak River drainages during August and September.

Chum, king, and silver salmon are also abundant in many of the streams, and some fish are available until freeze-up.

Except in the eastern portion of the unit, denning is probably not as confined to high slopes as on the Alaska Peninsula. The more gradual slopes, open tundra, and scattered small mountains probably encourage scattered denning throughout the foothills and limited steeper slopes. When possible, however, bears do probably seek the

steeper well-drained sites. The denning period is believed to be slightly longer than on the Alaska Peninsula.

## **WOLF**

Wolves occur in moderate densities throughout Unit 17.

## **WOLVERINE**

This fish and game rich unit supports a substantial population of wolverines. There are no population estimates. Harvests average about 30 annually.

## **BARREN GROUND CARIBOU**

Mulchatna Herd: Game Management Units 17 and 19 The Mulchatna caribou herd presently occupies an area of about 20,000 square miles of western Alaska in Units 17 and 19. Within the range of the Mulchatna herd, temperature extremes range between 80 F and -30 F. Annual precipitation averages 22 inches.

### **Winter Distribution**

From 1967 to 1970 the major wintering area of the Mulchatna herd extended from the Lime Hills along the Stony River to the Bonanza Hills at the head of the Mulchatna River. Smaller numbers of caribou wintered along the lower reaches of the South and Windy Forks of the Kuskokwim River, the marshy lowlands near the mouth of Swift River, Nushagak Bay near Clark's Point and along the Kvichak River just west of Igiugig. The latter observations were particularly interesting because until 1968 caribou had not crossed the Kvichak River since the turn of the Century.

### **Calving**

In March and April the cows begin to move toward the calving area. Animals wintering far to the north move up the south fork of the Kuskokwim and through the mountains to the head of Stony River then due south to their calving grounds. There are no barriers to movement for animals wintering to the west and south of the calving area and they move by the most direct routes to the calving grounds.

Calves are born in the Bonanza Hills and on the mountain slopes between Telaquana Lake and Twin Lakes. This area is above timberline and consists of rolling alpine tundra. Calving occurs throughout the month of May, peaking from May 16-19.

### **Summer Distribution**

After calving, the caribou shift to the north, south and west. By mid-summer scattered bands occur along the west slopes of the Alaska Range from Iliamna Lake to the Swift River, and west through the Nushagak-Big River Hills to the Aniak-Nishlik Lakes area.

### **Fall Migration**

No definite fall migration pattern has been recorded, except for a tendency for animals to drift toward the slopes of the Alaska Range during the breeding period.

### **Population**

There has been no census of the Mulchatna herd but partial counts of calving and breeding groups suggest the herd is increasing and that it contains a minimum of 5,000 animals.

## MOOSE

This remote unit has received very little management attention and the history and present status of moose within the unit are poorly known. It seems probable that some drainages support substantial moose populations but information on their relative abundance is not available at this time. In 1971, there was a reported harvest of 37 moose, but local unreported use of the resource probably far exceeded the reported kill.

## DALL SHEEP

Alaska Range: See Unit 12

## HARBOR SEAL

No estimates of harbor seal populations are available for the unit. Seals are present but in relatively low numbers.

## BEARDED SEAL, ICE BREEDING HARBOR SEAL, RIBBON SEAL, RINGED SEAL, WALRUS - See Unit 22

## SEA OTTER

Unit 17 has never supported permanent sea otter populations and will not in the future; however, stray animals are seen there occasionally during ice-free periods.

## STELLER SEA LION

Sea lions were intensively harvested for subsistence purposes by natives prior to 1900. As a result, population levels were considerably reduced throughout most of the state. Since the turn of the Century, the level of harvest of this species has been very light and the populations have recovered to near maximum levels. There are five locations in Unit 17 which are used by sea lions. This unit appears to be a rather marginal habitat for this species.

### Sea Lion Rookeries and Hauling Grounds Game Management Unit 17

<u>Quadrangle</u>	<u>Ref. No.</u>	<u>Ref No.</u>	<u>Location</u>	<u>Population</u>
Hagemeister Island	295		Hagemeister Island (Calm point)	150
	296		High Island (South End)	50
	297		Crooked Island (South End)	50
	298		The Twins	100
Nushagak Bay	305		Round Island (South End)	100

**WHALES** - See Units 9 and 22

## WATERFOWL AND SEABIRDS

### Populations

Waterfowl breeding pair surveys indicate there are approximately 32 breeding ducks per square mile of suitable habitat in Unit 17. Old squaw, common scoter, greater scaup and pintail are by far the most common species. Other ducks breeding in Unit 17 include: mallard, American widgeon, green-winged teal, shoveler, gadwall, can-

vasback, American goldeneye, bufflehead, common merganser and common, Steller's and spectacled eiders.

Canada geese are not abundant as nesters everywhere but are fairly numerous on the upper drainages of the Nushagak and Mulchatna Rivers. A few white-fronted geese also breed in these and other drainages.

During short periods in May and September, large numbers of migrating ducks and geese use tide flat areas and lagoons, favoring those that contain eelgrass beds. . Subsistence hunting has probably affected local breeding waterfowl populations as described in the discussion of Unit 18. Waterfowl killing probably increases and decreases with poor and good fish runs.

### **Description of Seabird Colonies Indicated on Maps**

#### **Game Management Unit 17**

<u>Map No.</u>	<u>Colony</u>	<u>Name</u>	<u>Species Present</u>
43-44	89	Walrus Islands	black-legged kittiwake, horned and tufted puffins, pelagic cormorant.
43	90	Cape Newenham	horned and tufted puffins, glaucous-winged gull, black-legged kittiwake, common and thick-billed
	99	Hagemeister Island	murre, pelagic and redfaced cormorant.

### **Habitat and Land Use Considerations and Recommendations**

The Wood River-Tikchik drainage supports valuable commercial and sport fisheries and is a resting-feeding area for numerous waterfowl. The state has selected this area for a park.

Part of the Cape Newenham Wildlife Refuge and the Walrus Islands State Refuge are in Un it 17. Hagemeister Island, land adjacent to Kulukak Bay, and Etohin Point have all been tentatively selected for possible federal refuges or public interest lands.

Estuarine, littoral and pelagic waters of Bristol Bay are some of the richest waters in the world and support millions of birds throughout the year. The potential for oil development and resultant threats to waterfowl and seabirds is high. Intensive surveys should be conducted in this unit as well as throughout Bristol Bay to assess bird numbers and species composition. Actions as described in the discussion of Unit 6 are recommended to prevent future habitat and bird losses by oil pollution, should petroleum development occur.

Bays and lagoons in Hagemeister Strait, Hagemeister Island, Walrus Islands and the waters of Bristol Bay are all key habitats of state and national concern.

### **GAME MANAGEMENT UNIT 18**

The vast Yukon-Kuskokwim Delta comprises most of Unit 18. North, the unit extends into the hills ordering the Yukon River, while to the south the Kilbuck Mountains form the boundary. The edge of boreal forest coincides roughly with the eastern boundary; the unit extends westward beyond the coast to include Nunivak and St. Matthew Islands and smaller coastal islands.

Most of Unit 18 is coastal tundra, seemingly with as much water as land. The tremendous array of lakes, streams, tidal flats and bars interspersed with tundra and sedge flats make this area one of North America's outstanding waterfowl, shorebird and furbearer areas.

Although the delta is a rich habitat for aquatic and semiaquatic birds and mammals, it is a “hungry country” for most large terrestrial mammals, primarily because it lacks year-round food or shelter. Trees are absent over most of the delta. Willows and alders are the only large woody plants, and they gradually become scarce and virtually disappear toward the coast, leaving only diminutive alpine willows, sedges and other tundra vegetation. In summer the delta teems with life. In winter its surface is a cold and quiet place.

Along the inland border of Unit 18 the land rises to bench lands, hills and low mountains. Here, physiography and climate are perceptibly different than on the coast and subtle changes in plant and animal communities are apparent. Willows and shrubs are larger, some tree species are present in local areas, and large mammals such as moose and brown bears are present all year, rather than seasonally or never as on the delta. Tundra persists into the higher hills and mountains, however.

In spite of these variations, the unit as a whole is typically coastal tundra country dominated by a northern maritime climate, and the distribution and abundance of its fauna reflect this fact.

The entire area has long been occupied by Eskimos, who successfully made their living hunting, fishing and gathering, even though many had no access to large mammals such as moose and caribou.

**BLACK BEAR** - See Unit 12.

## **BROWN BEAR**

Brown bears are distributed throughout the hills and mountains of Unit 18, but seldom roam onto the Yukon Kuskokwim delta. Concentrations of bears are known to occur on streams with major salmon runs in late summer and fall. In spring, bears or their tracks are often observed in the higher country of the unit. Denning areas have not been determined, although denning is suspected in several areas. Few reconnaissance surveys have been made in Unit 18.

### **Populations**

Population levels are moderate, with high densities in some local areas. Additional survey work is needed to determine if observed local high populations are truly that, or if they are merely seasonal concentrations. The reported annual harvest in Unit 18, has varied from 0 to 6 bears since 1961. Some unreported kills occur, but the actual harvest probably does not exceed 15 per year.

## **POLAR BEAR**

Polar bears are rarely seen in Unit 18, but in years of very extensive winter sea ice they occasionally are found as far south as St. Matthew and Nunivak Islands. There is evidence that about 100 years ago polar bears regularly inhabited St. Matthew Island. The reasons for their disappearance and failure to reinhabit the island are unknown. Variations in seasonal sea ice, with associated variations in seal abundance, probably preclude the possibility of polar bears ever becoming abundant in Unit 18.

## **WOLF**

Wolves are scarce throughout Unit 18. They are rarely found on the Yukon-Kuskokwim Delta, but do occur in very low densities around the landward rim of the unit. On rare occasions in the past, wolves have been seen on Nunivak Island. Wolves have probably not been common on the Yukon-Kuskokwim Delta since the last great movements of caribou occurred there in the late 1800's.

## **Populations**

Wolf population levels in Unit 18 are low compared to levels in other parts of the wolf's range in Alaska. The reported harvest has ranged from 0 to 4 since 1959, including the years when a \$50 bounty was paid.

## **Specific Habitat Considerations**

The chief factor limiting abundance and distribution of wolves in Unit 18 is lack of large ungulate prey. Should caribou again move into the unit, wolves would likely become more abundant.

## **WOLVERINE**

Wolverines occur in very low numbers in most of Unit 18. They are most numerous in portions of the Kilbuck Mountains but even there populations are lower than throughout the rest of their range in Alaska. Apparently they have never been numerous in this area.

## **Populations**

Population levels are low. The harvest has ranged from 1 to 7 since 1961.

## **Specific Habitat Considerations**

Because wolverines seem to depend heavily on carrion for winter food, the lack of large mammals in Unit 18 probably affects them much as it does wolf populations. Should caribou again become numerous, wolverines would probably increase.

## **BARREN GROUND CARIBOU**

Caribou were present in large numbers throughout Unit 18 in the mid-1800's and apparently began to decline during the 1870's. At its peak size the herd probably ranged from the Alaska Peninsula to the Seward Peninsula along the Bering Sea, and may have ranged east to the Alaska Range (Units 7 and 19). Large migrations crossed the Yukon and Kuskokwim Rivers, spread over the delta and even reached Nunivak Island, where they became established. A heavy trade in hides and meat flourished along the Yukon during this time. By the late 1870's the herd had apparently shifted to new ranges, and the tremendous movements across the Yukon and Kuskokwim had ceased. Caribou had also been virtually eliminated from Nunivak Island by commercial hunting.

Caribou essentially disappeared from much of Unit 18 except the Kilbuck Mountains by 1895. Increased populations eastward in the Kuskokwim Mountains (Units 19 and 21) and the Alaska Range (Units 19 and 20) were noted about this time, suggesting a shift of range by these caribou.

Caribou have not returned to Unit 18 in numbers since that time, although small numbers lingered in the Kilbuck Mountains for several years. By 1935 large reindeer herds were becoming established all along the coastal areas and on Nunivak Island. After several years, the mainland reindeer herds in Unit 18 grew too large and "crashed".

In recent years a herd of wild reindeer/caribou has apparently been increasing in the hills between the Yukon River and Norton Sound (Units 21 and 22). Some portion of this herd wintered near Marshall on the Yukon in 1971-72.



A few caribou still occur in the Kilbuck Mountains in summer. Apparently these are from the Mulchatna herd (Unit 17).

### **Populations**

Accurate population estimates are not available for early years. Caribou now using portions of Unit 18 are considered parts of other herds, primarily the Mulchatna herd, discussed under Unit 17. The herd occupying hills between the Yukon River and Norton Sound has been estimated at 5,000, but this initial estimate needs to be checked by additional surveys.

### **MOOSE**

Moose occur in low numbers on the Yukon-Kuskokwim Delta and other tundra areas of Unit 18. Greatest numbers are present in summer, when abundant aquatic plants and other foods are available. Few moose normally winter on the Delta and in years of deep or hard snow they are extremely rare.

Some observers have suggested that moose have extended their range into tundra areas during the last 30 to 50 years. However, several early sources indicate that moose have been present on the Delta and other coastal areas since at least the late 1800's. Population fluctuations have probably caused contradictory reports about presence of moose here as they have elsewhere in Alaska.

Moose regularly occur along the Yukon River west to Mountain Village, and have reached high densities east of Russian Mission. Along the Kuskokwim River, moose become scarce below Tuluksak, but they are found along the foothills and drainages of the Kilbuck Mountains.

### **Populations**

General observations indicate low population levels throughout most of Unit 18, with moderate populations in areas of better habitat, such as along the Yukon River and some drainage of the Kilbuck Mountains. The reported harvest has ranged from 12 to 78 annually. The actual harvest is estimated at 200 to 300 moose per year.

### **Specific Habitat Considerations**

Moose depend upon browse for the long fall-winter period and prefer, if not require, some cover. Therefore it is unlikely that Unit 18 will ever support more moose than present populations.

### **MUSKOX**

The status of muskoxen on Nunivak Island and Nelson Island is reviewed under the general species account of muskoxen earlier in this volume. Please refer to that section.

### **BEARDED SEAL, HARBOR SEAL, RIBBON SEAL, RINGED SEAL, WALRUS, WHALES - See Unit 22. WATERFOWL AND SEABIRDS**

### **Populations**

The Yukon-Kuskokwim Delta is the largest and most productive of the western tundra waterfowl habitats. Some of the richest waterfowl habitat and the highest breeding goose densities in the world are found on the outer

fringes of the delta. Unit 18 has an estimated average 1.5 million breeding ducks, which provide a fall flight of about 3.0 million ducks. Most of the black brant and emperor geese plus nearly all of the cackling and Pacific white-fronted geese in North America breed in the unit. Most Pacific Flyway oriented whistling swans also use Unit 18 habitats, as do many other species.

The Yukon-Kuskokwim Delta has the densest Eskimo population in the world. Until recently, illegal spring and summer waterfowl hunting and egg picking were confined to local areas around small villages. A centralization of people into larger villages like Bethel has recently occurred, and economic changes have enabled many Eskimos to purchase snow travelers and river boats. This greater mobility has resulted in subsistence hunting occurring over a much wider area than previously. Although an increased cash economy has lessened most people's dependence on wildlife for their existence, considerable spring and summer hunting is still undertaken for recreation.

### **Description of Seabird Colonies Indicated on Maps Game Management Unit 18**

<u>Map No.</u>	<u>Colony No.</u>	<u>Name</u>	<u>Species Present</u>
72-73	91	Nunivak Island	glaucous-winged gull, common and thick-billed murre, parakeet auklet, horned and tufted puffins, black-legged kittiwake.
92	93A	St. Matthew Island(north side)	glaucous gull, common and thick-billed murre, horned and tufted puffins, Pacific
92	938	Hall Island	fulmar.
92	93C	Pinnacle Island	

### **Habitat and Land Use Considerations and Recommendations**

The high potential for petroleum development in the Bering Sea and in some upland areas poses a threat to waterfowl and seabirds in Unit 18. Pollution by oil spills could contaminate habitats used by millions of birds. Much of the better waterfowl and seabird habitat is protected by federal refuges and additions to the refuge system are under consideration. The critical state-owned intertidal lands adjoining upland areas are as yet unprotected. State-owned areas of critical importance should be protected by state laws, by federal controls under a lease agreement, or by other suitable means.

### **GAME MANAGEMENT UNIT 19**

All the drainages of the Kuskokwim River from its North Fork west to Unit 18 are part of Unit 19. Much of the unit is a broad valley lying between the low, rolling Kuskokwim Mountains on the northwest and the rugged Alaska Range to the east. To the south, low rolling hills separate the Kuskokwim drainage (Unit 19) from the Bristol Bay drainages (Unit 17).

Weather patterns and plant communities in western Unit 19 reflect a modified coastal influence. Temperatures are more moderate and precipitation is greater than farther east. Subalpine areas are found at elevations of 500 to 1,000 ft. and in some cases even lower. Farther east greater extremes of temperature prevail, precipitation is less and subalpine and alpine areas occur at 1,200 to 1,500. ft. Snow depths, however, may reach 3 to 5 feet.

Throughout much of Unit 19, white spruce and paper birch forests occur on all well-drained sites. Black spruce

bogs and wet sedge meadows occupy expanses of poorly drained flats throughout the valley system. Meandering streams contribute to an already complex vegetation pattern. Gently sloping hills between the Alaska Range and river valleys support broad expanses of thinly wooded black spruce stands and subalpine shrub communities. The Alaska Range rises abruptly from these benchlands. The Kuskokwim Mountains rise directly from the valleys, with little intervening bench land.

While the coastal climate exerts some influence over much of Unit 19, the unit is best characterized as basically interior in weather, vegetation and fauna.

The Kuskokwim drainage once supported substantial numbers of people, both Athabascans and Eskimos, who lived all along the river and used a surprisingly large portion of the surrounding country for hunting and food gathering. Relatively rich and varied fish resources probably contributed substantially to their success.

Most of Unit 19 remains inaccessible today, although light aircraft, snow machines and boats provide considerably more extensive and rapid access than was available in the past.

**BLACK BEAR** - See Unit 12.

Little information on past distribution ( brown-grizzly bears in Unit 19 is available. Bears are commonly found throughout most of Unit 19, although their presence on major river flats is sporadic. The foothills and valleys of the Alaska Range, the Selatna Mountains, White Mountains, Chuilnuk Mountains, and Kuskokwim Mountains are favored grizzly bear habitat. Within these areas some concentrations on salmon streams are known; others remain to be determined.

### **Populations**

Population data have not been gathered. General observations and limited aerial surveys suggest moderate to high populations relative to other parts of Interior Alaska's grizzly range. Reported harvests since 1961 have ranged from 11 to 28, with the high in 1971. Some unreported harvest occurs in outlying areas, but it probably does not exceed 10 bears per year. Some unreported kills are used for food or fur, or are the result of bear-man conflicts. Some are made by sport hunters or guides. Most of the reported kill is made by guided hunters. The latter segment of the harvest is expected to increase.

### **WOLF**

Wolves range throughout Unit 19. In virtually all of the unit either moose, sheep or caribou are sufficiently abundant to support substantial wolf populations. Historic wolf distribution was probably similar to present distribution, although major shifts in caribou numbers may have affected wolf populations. Increased moose numbers along the Kuskokwim River over the last 50 years have provided a more stable, abundant food supply in that area.

### **Populations**

Wolf population levels are poorly known except in relative terms. The population has fluctuated over many years, in response to variations in production, natural mortality and hunting. In 1965-66 and 1966-67, 110 and 147 wolves were taken, largely by aircraft-equipped hunters. The population appeared to be reduced as a result, but began showing signs of increasing again by 1970. Harvests have ranged from 12 to 147 since 1961-62. In 1971, 95 wolves were taken, again largely by aircraft- equipped hunters. General observations by biologists in fall, 1972 suggest the population is still rising.

### **Specific Habitat Considerations**

Varied cover and prey species in Unit 19 insure the wolf's continued success as part of the natural fauna of the area.

### **WOLVERINE**

Wolverines are present throughout Unit 19, and probably have been since the modern faunal complement became established.

### **Populations**

Population levels are known only in relative terms. Compared to other parts of Interior Alaska, wolverine populations appear moderate to high. High wolverine populations are still sparsely distributed compared to most species, however.

### **Specific Habitat Considerations**

Existing habitat and food sources are probably optimal for wolverines under Interior Alaska conditions.

### **BARREN GROUND CARIBOU**

McKinley Herd: See also Units 16 and 20

Beaver Herd

Mulchatna Herd: See also Unit 17

Fewer early records of caribou abundance and distribution are available for Unit 19 than for Unit 18, because fewer Russians and Americans visited this area. Early Russian explorers (1834-1844) noted that caribou were hunted by residents of the upper Kuskokwim (probably in the McGrath- Nikolai area) and of the Innoko River (Unit 21), but found no caribou along the middle Kuskokwim and lower Stony Rivers.

Fluctuations described for the Kilbuck Mountains in Unit 18 apply equally to Unit 19, because these mountains extend into both units. Heavy trails found in the Taylor Mountains in 1890 indicated previous use by caribou although none were present at that time. Apparently a major shift in distribution from Unit 18 to Unit 19 occurred in the period 1875 to 1895, because evidence of large herds was found in the Kuskokwim Mountains, Sischu Mountains and Alaska Range by biologists and geologists in the early 1900's. Some caribou were present at that time, but not enough to account for the heavy signs of use observed. Large numbers of these caribou may have moved north of the Yukon River in 1907-1908.

Caribou numbers in the Rainy Pass - Mt. McKinley area apparently increased rapidly in the early 1900's. Various reports from 1915 to 1930 indicate a large population that wintered both east in Units 20 and 13, and west in the Kuskokwim drainage. Substantial numbers apparently moved north to the Arctic and west to the Innoko River country late in the period. These caribou are now considered the McKinley herd. Their numbers have declined in recent years and their wanderings into Unit 19 appear reduced. A more detailed account of their history is given under Units 16 and 20. Presently, three recognized herds range into Unit 19: Beaver herd, Mulchatna herd, and McKinley herd. The Beaver herd calves in the Beaver Mountains group of the Kuskokwim Mountains and winters mainly on the Innoko Flats (Unit 21).

The Mulchatna herd calves in the Bonanza Hills (Unit 17) and ranges north and east to the Kuskokwim River, South Fork Kuskokwim River and Rainy Pass. The McKinley herd calves in McKinley Park and now winters partly in adjacent Unit 19 and partly in Unit 20C. Even the limited historical information available for the gen-

eral area of Unit 18, 19 and 21 dramatically demonstrates the tremendous variations in numbers and distribution of caribou that have occurred, and suggests that such changes may occur again.

### **Populations**

Current population estimates for the three presently recognized herds are: Beaver herd - 3,000 (1963); Mulchatna herd - 5,000 to 10,000 (1963, 1972); McKinley herd - 5,000 to 10,000 (1972). The McKinley herd apparently reached a high of 30,000 animals in 1941.

### **BISON (Farewell Herd)**

Bison in Unit 19 are the result of two transplants from the Delta herd. In 1965, 18 bison and in 1967, 20 bison were released at the Farewell airstrip. The first group stayed in the Farewell area until after the later group was released. Shortly thereafter, most of the new herd moved east to the South Fork of the Kuskokwim River. Since that time the "Farewell herd", as this herd became known, has not left the South Fork for any significant period of time, although a single bison and single bison tracks have been seen in the Windy Fork of the Kuskokwim River.

The Farewell herd now ranges from the vicinity of Wolverine Creek to about 12 miles downstream from the Dilling River, a distance of about 50 river-miles. They usually are on or within 1 to 2 miles of the river.

They may rarely range as far as 4 to 6 miles from the South Fork. In summer the herd spends much of its time on the bars, islands and adjacent sloughs near the main stream. In winter they frequent the bench lands adjacent to the South Fork where they feed on sedges growing around ponds, and on sedges and grasses found on wind-swept hills. They spend very little time on the river bars in winter.

### **Populations**

The Farewell herd contains about 75 bison. The number has been stable over the past two years, probably because heavy snow has created difficult feeding conditions in both years.

### **Specific Habitat Considerations**

The Farewell bison herd presently occupies a very small range. Little of the surrounding area is suitable range due to topography and habitat. A recent study suggests the present range could support 100 to 150 bison. A small population of bison will probably be able to subsist in the area under any foreseeable circumstances. A recent wildfire near Farewell Lake (1972) may enhance their chances to expand, by promoting revegetation by grass.

### **DALL SHEEP**

Alaska Range: See Unit 13

### **MOOSE**

A few records from the mid-1800's indicate moose were present, and in some areas abundant, in the western half of Unit 19. In the upper Kuskokwim to the east, a resident and relatively distinct group of Athabascans traditionally depended upon moose for food and domestic needs. Thus it appears moose have been present throughout much of Unit 19 for at least 150 years and probably longer. Older residents note that moose became much more abundant along the Kuskokwim River about 1915 to 1920, following a series of large fires that resulted from both natural causes and an influx of miners. Extensive stands of paper birch attest to the extent of fires during that era, as well as later periods. Fire has probably been instrumental in maintaining substantial moose populations in Unit 19. Today moose are present throughout the unit.

Seasonal concentrations occur on wet flats in spring and summer, in foothills and along portions of rivers in fall, and in burns or riparian willow stands in winter. Large concentrations along rivers seem to occur only in years of unusually deep snow.

### **Populations**

Limited aerial surveys and field observations indicate moderate to high moose populations in much of the unit. Two successive winters of deep snow (1970-71 and 1971 -72) have recently caused extensive winter mortality, however, and a few years will be required before the populations again reach maximum numbers. Reported annual harvests since 1963 have ranged from 111 to 189. Actual harvest is approximately 500 to 700.

### **Specific Habitat Considerations**

Alpine-subalpine willow communities, fire-caused seral communities and riparian willow and birch communities are all very important to moose in Unit 19. Riparian willows provide a "margin of safety" in food supply that enables moose to survive difficult winters in higher numbers than in areas where few or no riparian stands occur.

### **WATERFOWL**

(See also Unit 20)

Survey data pertinent to Unit 19 are presented in the Unit 20 section. Productive habitat in this unit is confined to the Kuskokwim River flood plain and tributary streams. Subsistence hunting is considered negligible today and hunting has assumed a more recreational aspect in the past 10 years. Favorite hunting areas are Wilson's Slough (35 miles below McGrath), Takotna River Flats, Nixon Fork, North Fork of the Kuskokwim, Big River, sloughs of the Kuskokwim and many other lakes and sloughs.

### **Habitat and Land Use Considerations**

This unit is one of the least populated of the Interior region. Consequently there is little competition for hunting areas. Chances of habitat loss seem remote, although parts of the area are highly mineralized. Placer mining in the past seems to have created better waterfowl and furbearer habitat than was previously present. Wild fire is common over much of the Kuskokwim drainage, and fire control policies consistent with game management and forest use should be developed between agencies.

## **GAME MANAGEMENT UNIT 20**

Unit 20 typifies the usual conception of Alaska's Interior. The climate is strongly continental, with very low precipitation and extreme temperature ranges. A large proportion of Unit 20 consists of broad river valleys, outwash flats and low hills supporting forests of white spruce, paper birch and aspen, or black spruce and shrub birch. Drainage patterns in combination with other physiographic considerations produce very complex vegetation patterns.

The ancient, highly dissected Tanana Hills form a long series of alpine and subalpine ridges in northeastern Unit 20 (Subunit 20C). Boreal forest extends well into these hills along various drainages. The streams on the north and east side of the Tanana Hills drain into the Yukon River, which forms the northern boundary of the unit. Along the Yukon and its tributaries, boreal forests primarily of spruce again predominate.

The Alaska Range divide forms the southern boundary for Unit 20. Outwash plains and long slopes extend north

from the range, creating expanses of subalpine habitat adjacent to the foothills. Alpine areas begin at 2,500 to 3,000 ft. in the Alaska Range and Tanana hills.

Athabascans of various groups lived and hunted throughout much of the unit in early times. The major rivers provided much of their support because of the summer fishing and winter moose hunting found there. At times these people traveled extensively.

Extensive settlement did not occur until the early 1900's when gold was discovered near Fairbanks. During the expansive mining period, market hunting for various species of big game was common, but it gradually diminished with declining demand and increasing concern for game populations. A period of restrictive territory-wide game regulations ensued and lasted from the early 1930's through the advent of statehood.

Human population and demands for outdoor recreation in Unit 20, as in other developed areas of the state, are today increasing rapidly.

**BLACK BEAR** - See unit 12.

### **BROWN BEAR**

Brown-grizzly bears occur throughout alpine and subalpine areas, and sporadically in lowland areas, throughout Unit 20. Distribution and relative abundance do not appear to have changed within historic times. The Alaska Range, Tanana Hills, and the extreme eastern end of the Kuskokwim Mountains constitute most of the grizzly habitat. Bears have been observed in virtually all drainages at one time or another, including those immediately adjacent to Fairbanks. Their primary foods are sedges, grasses, berries, small mammals, and carrion. Fish are of minor importance, especially compared to coastal areas.

#### **Populations**

Population data are not available. General observations, limited surveys, and harvest data indicate low to moderate grizzly population levels relative to other parts of Interior Alaska. Annual harvests in Unit 20 since 1961 range from 15 to 58, with the high in 1965.

#### **Specific Habitat Considerations**

Specific habitat requirements for grizzlies in Unit 20 are not known. The general requirement of large areas of preferred habitat does apply, however.

### **WOLF**

Wolves range throughout Unit 20, even to the outskirts of Fairbanks. Aside from the immediate Fairbanks area, their distribution is probably unchanged from that of prehistoric times. Dens, tracks, and sightings of wolves are reported each year from Goldstream Valley, Tanana River, Fox and other areas adjacent to the state's second-largest city. In outlying areas wolves attend to their business much as they always have. Substantial moose populations in most of Unit 20 and sheep and caribou in various areas provide the major food supplies for wolves.

#### **Populations**

Wolf populations in Unit 20 have fluctuated dramatically in response to natural factors and hunting. Because of the proximity of a human population center, wolf harvests in Unit 20 have been higher than anywhere else in Alaska. The reported harvest has ranged from 90 to 336 since 1961-62. The highest harvests may be due in part

to falsified reports of wolves actually taken in nearby Unit 13, which was closed to wolf hunting through the mid-60's. Observations in 1971-72 and fall, 1972 indicate wolves are generally abundant throughout Unit 20.

### **Specific Habitat Considerations**

Aside from continued expansion of the Fairbanks urban/suburban complex and a few other localized human population centers, wolf and prey habitat is largely intact and healthy throughout the unit.

### **WOLVERINE**

Wolverines occur in moderate abundance throughout Unit 20. They depend to a large extent upon carrion from the abundant moose and caribou populations in the unit. Harvests by trappers and hunters average about 75 annually.

### **BARREN GROUND CARIBOU**

Delta Herd: Subunit 20A

Fortymile Herd: Subunits 20B and 20C

McKinley Herd: Subunit 20C - See also Units 17, 18, 19 and 21

Caribou habitat from spring through fall in Subunit 20A consists of alpine and subalpine areas on the north slope of the Alaska Range between Totatlanika River and Delta River, and the upper half of the Yanert River, east of McKinley Park. Winter range includes considerable portions of the same area, plus a broad band of low foothills and flats immediately north of the range. Similar habitats extend west into Subunit 20C and east into Subunit 20D and beyond along the Alaska Range.

### **Delta Herd**

(Subunit 20A)

The Delta caribou herd ranges throughout much of Subunit 20A, and may wander into adjacent areas as well. Historical data on this herd are limited. The herd most likely originated from the Fortymile herd between 1918 and 1930, when the latter herd was extremely large and widely distributed. The McKinley and Nelchina herds may also have contributed to the Delta herd. Contact between all of these various herds has occurred from time to time.

Although the Delta herd presently stays largely within Subunit 20A, continuity of habitat west to the Nenana river and presence of caribou in that general area at various seasons is strong evidence that the Delta herd does extend at least that far. Known spring and fall movements across the Nenana River suggest some interchange, at least in range use if not of animals, between the Delta and McKinley herds.

Movement across the Delta River to the east has not been observed, yet with suitable habitat available a short distance from present known ranges such movements seem a certainty. Caribou are found east of the Delta River but their herd identity is not known.

The Delta herd calves in alpine-subalpine habitat drained by Delta Creek and Little Delta River. In fa they are widely scattered throughout the foothills to the west. As winter progresses they concentrate in wintering areas on lower Delta Creek and Little Delta River.

Patterns of early human use in this area are poorly known. If caribou ranged throughout this area, Athabascan residents surely hunted them seasonally, as they did in other parts of Interior Alaska. In recent years, recreational



hunting of this herd has been increasing.

## **Population**

The population of the Delta herd was estimated at 5,000 (excluding calves) in 1964. Recent census attempts have been unsuccessful, but other surveys and observations suggest the population remains in the 4,000 to 6,000 range. Recent harvests have ranged from 50 to 700 annually.

## **Fortymile Herd**

(Subunit 20C)

Most of northern and eastern Unit 20C was at some time within the range of the Fortymile herd, one of the major caribou herds in Alaska. The Fortymile herd has been called the most unpredictable herd in Alaska because of frequent major changes in numbers and in calving, wintering and migratory patterns over the last 20 to 30 years. From sometime before 1900 to the 1930's, the herd ranged from the Yukon Flats to Whitehorse and from the Dawson and Ogilvie Mountains in Yukon Territory southwest to the Copper River basin.

The Fortymile herd reportedly numbered over 500,000 in the early 1920's, but has since decreased in size. Much of the decrease may have been due to egress of substantial portions of the herd to other areas. For example, in 1956-57, about 30,000 Fortymile caribou wintering in Canada went north with the Porcupine herd in spring instead of returning to their White Mountains calving area north of the Steese Highway. A similar emigration of about 20,000 animals apparently occurred in 1964.

The result of such erratic patterns has been that the Fortymile herd dropped drastically from its population high in the 1920's to a low by 1940, rose to about 50,000 in the early 1950's, and is considerably smaller at present.

Range of the herd has also been reduced since the 1950's. Since 1965 it has not crossed the Steese Highway to calve, but has remained in the vicinity of Mt. Black and Mt. Harper at the heads of the Goodpaster and Fortymile Rivers. During summer the herd is scattered over the Tanana Hills, primarily in the alpine and subalpine hills and mountains at the upper reaches of the Chena, Salcha, Charley, Goodpaster and Fortymile Rivers. In September a gradual drift southeastward toward wintering grounds begins. Movements are largely confined to a major movement into the Ladue and Sixtymile River drainages in Canada, with usually lesser movements into Canada north of the Sixtymile River almost to Dawson, and occasionally across the Yukon River north and west of Dawson. Some segment of the herd usually winters in the Ogilvie Mountains, north of the Yukon River in Canada. This segment usually crosses the Yukon River between Eagle and Circle in late October or in November, and returns by a similar route in March and April. Some of this group does not leave Alaska, but winters between Circle and Eagle, south of the Yukon River. A variable proportion of the remainder of the herd winters along the upper Salcha and Goodpaster Rivers. In recent years, a few reports have been received of caribou as far west as the Sawtooth Mountains west of Livengood, part of the herd's former range. Other reports have indicated that cows with calves are present in the Ogilvie Mountains of the Yukon Territory throughout the year, and may not move to Alaska at all.

Review of the history of the Fortymile herd as well as other herds in Alaska demonstrates that caribou populations in Alaska are likely to change dramatically in numbers, distribution and identity over a period of several decades. The phenomenon is still not well understood, but we should recognize that such changes will continue to occur.

## **Population**

The Fortymile herd is estimated at about 15,000. An adequate survey has not been accomplished recently, how-

ever, and this figure is tentative.

Because the Fortymile herd is accessible by road at certain times, it is an important source of many forms of recreation for residents of Interior Alaska. Measures of most recreational pursuits have not been devised, but hunting alone is a major use. The reported harvest in 1971 was 1,994 animals, and estimated harvest was 2,500. In 1972, about 1,200 animals were killed by hunters.

### **McKinley Herd**

(Subunit 20C - Also see Units 18, 19 and 21)

The McKinley herd is presently the major caribou herd in western Subunit 20C although variations in movements and numbers of caribou in Units 17, 18, 19 and 21 have apparently occurred historically.

Little is known of distribution and abundance in the McKinley area during the mid-1800's. As discussed under Unit 18 and 19, there appeared to be a shift of caribou concentrations east from the lower Yukon-Kuskokwim area in the late 1800's. This shift either contributed strongly to, or constituted, the McKinley herd. This herd increased steadily; its size was variously estimated at 25,000 to over 30,000 between 1919 and 1922. Caribou were observed from Nenana to the Alaska Range, and west to foothills between Rainy Pass and McGrath. During the period 1925 to 1930, the herd apparently split to winter, with some traveling east as far as the Maclaren River (Unit 13), and others traveling west and north around Lake Minchumina and the Kuskokwim River (Unit 19). A large group also moved north to the Arctic and did not return. Movements to the east ceased after 1931, and winter range has been mainly to the west of McKinley Park since. Through further shifts and emigrations the McKinley herd has become still smaller, and its distribution more restricted.

The main calving ground has remained in McKinley Park, between the Savage and Toklat Rivers. Present wintering areas are north and west of the Park on the foothills and flats extending toward Lake Minchumina, and the North and South Forks of the Kuskokwim River.

### **Population**

The McKinley herd was estimated at 20,000 through the late 1920's and up to 1941. In 1963 it was estimated at 12,000. Since that time the herd appears to have decreased further. An accurate estimate is not available, but the herd probably numbers fewer than 10,000.

### **Specific Habitat and Land Use Considerations**

General habitat requirements of caribou discussed earlier apply to caribou throughout the state. The need for large areas of climax range and unrestricted movement is basic to sustaining these herds as well as others in the state. The passing of previously public land into smaller parcels of private land will surely restrict the habitat available for these caribou, and resulting development will likely restrict their movements.

### **BISON**

Delta Herd

Healy Lake Herd

### **Delta Herd**

The seasonal land use pattern by bison in the Delta herd has varied little since 1933. The herd usually begins leaving its early winter range during February. The onset of this movement is gradual, with bison leaving in small

groups. Most bison have left their early winter range by the end of March. They generally move south, through Fort Greely and Delta Junction, to subalpine, windswept meadows. The major portion of their late winter-spring range is bounded by Donnelly Dome on the south, the Old Richardson Trail to the east, Bolio Lake to the north, and the Delta River to the west. Bison have also been reported during early spring on windswept portions of upper Jarvis Creek.

Most bison cross the Delta River to their summer range during May, and most calving occurs shortly afterward. The alluvial river bars that have served as summer range extend along the west side of the Delta River from west of Donnelly Dome to just north of Black Rapids Glacier.

The bison generally leave their summer range on the Delta River bars during late July and August. Most rutting activity apparently occurs during this period. The late summer-fall range consists of small alluvial bars on the lower Delta River and Jarvis Creek, natural dry meadows, large bulldozed clearings, and open balsam poplar forests. The bison herd gradually moves through its late summer-fall range to reach its early winter range during mid-August to November. From 1933 to 1952, the early winter range of the Delta bison herd consisted mainly of (1) a seven mile long dry creek channel of Jarvis Creek, the "99 mile dry bar", and (2) tall grass and sedge meadows adjacent to and south of Clearwater Creek. The Clearwater Burn of 1952 burned a large part of the bison's early winter range. Following the Granite Mountain Burn of 1954, which overlapped some of the Clearwater Burn, homesteads began to appear on the bison's winter range. Now, most of the area formerly used by bison for their traditional winter range consists of cultivated farmland. Bison have continued to use their early winter range, substituting harvested and unharvested barley, oats, brome, and vegetable crops for their former diet of native grasses and sedges. Portions of their former winter range, such as the grass and sedge meadows around Clearwater Creek and "99 mile dry bar", are now less frequently used because bison have tended to concentrate on the forage remaining in cultivated fields.

### **Population**

A nucleus of 23 young bison were introduced into Alaska at Delta in 1928. These bison increased at a rate that averaged 20 percent annually for 10 years. The herd size continued to increase until 1944 - 1947 when a peak population of over 500 bison was reached. Bison numbers at this time apparently exceeded the carrying capacity of the range. By 1949, there were roughly half as many bison as during the time of peak population. Ninety-nine bison were transplanted or harvested in 1950 - 1952 in an effort to lower numbers to the range capacity. By 1955, the herd contained an estimated 265 bison. A large winter-kill during 1955-56 further reduced the population. By 1960, however, numbers had increased to an estimated 350, and it was decided to again reduce the population and stabilize it at a lower level by periodic hunting and transplanting. The bison population has subsequently ranged between estimated population levels of 200 and 300 animals.

### **Specific Habitat Considerations**

Several factors have been changing bison range in recent years. Summer range on the Delta River alluvial bar has been substantially reduced by succession and by overgrazing. Late summer-fall range in upland areas east of the Delta River has been significantly increased by land clearing and seeding, and this has partially offset the loss of dry meadows to successional changes. Much of the land cleared by the military has been seeded to grasses to improve its potential as bison range, and this seeding program is continuing. The windswept, subalpine meadows used by bison for late winter-spring range have not changed appreciably since the bison were introduced. These areas have a climax vegetation and have not been useful for cultivation. Range used by bison from late winter through early fall probably does not limit bison numbers at this time.

The early winter range of the Delta bison herd continues to be the source of conflicts with agricultural interests. Changes in bison distribution over the past two decades indicate that forage on cultivated fields is preferred over

native grasses and sedges. In addition, those areas where native winter forage still exists are continually being encroached upon by human developments. Examples of this encroachment are the expansion of Delta Junction residences into the "99 mile dry bar" and the expansion of farmland into areas that are actual or potential grasslands. The "99 mile dry bar" is also undergoing succession from a dry meadow to an open woodland. The present use of farmland by bison for their early winter range is probably not a stable arrangement. The termination of agriculture is not probable, and the extermination of bison is a poor alternative. Continued fencing of farmland or the enclosing of bison in a preserve appears to be a probable future necessity if substantial crop damage continues to occur or if livestock raising becomes important. If the Delta bison herd is to be preserved over a long period of time at a population level close to its present size, definite plans for the development and preservation of early winter range are needed.

### **Land Use Considerations and Recommendations**

Bison late summer-fall range and late winter-spring range will not become critical in the foreseeable future. Bison summer range is changing from grassland to forest. The area is heavily stocked during the summers (152 adult and subadult bison on an area totaling 4.2 square miles during 1972) and appears to be overgrazed. A habitat improvement program designed to maintain the Delta River alluvial bar as grassland could probably be achieved by annual prescribed burns. Because the alluvial bar borders the broad Delta River, an inexpensive technique for prescribed burns probably could be developed.

The most critical factor to the long-term existence of the Delta bison herd is an early winter range. We assume that the gradual fencing of farmlands or the enclosing of bison in a preserve will eventually exclude bison from current early winter range. A habitat improvement program could probably be developed to provide early winter range that would sustain bison during severe winters. To prevent subsequent human development, the area must first be acquired and designate as bison winter range. Long-term benefits of having the Delta bison herd must be weighed against the long-term costs of acquiring, developing, and maintaining an adequate early winter range.

### **Healy Lake Herd**

Whether or not this herd exists as a separate entity from the Delta herd is a controversial issue. The first reference to bison inhabiting the range presently occupied by the Healy Lake herd dates back to 1935. Two cows and one bull from the original bison transplant in 1928 were retained at College. These animals were subsequently released at Delta in 1930. A note from a biologist in 1935 stated that these three bison stayed apart from the Delta herd and remained along the Gerstle River. The next reference to this herd is a 1949 report by a hunting party describing 40 bison near the Volkmar river. Nine adults and two calves were seen near Healy Lake in 1955. Approximately 150 bison were reported at Healy Lake in 1961. Most sightings since 1961 have been of 25 to 65 bison.

No observations of this "herd" have ever been reported from July through October, except for one bison seen at Healy Lake in September. Several Delta Junction residents believe that this herd moves toward Delta Junction to join the Delta herd in the summer and subsequently returns to the Healy Lake area each fall.

The Healy Lake herd has usually been observed while the bison were on their winter range. The herd is usually south of the Tanana River in November, and reaches Healy Lake by December; Most observations in February have located the herd on the Healy River, on the Volkmar River and adjacent sloughs, and on Healy Lake. Bison begin moving south in February and March. They apparently return to Healy Lake during March and April, then continue moving south to reach the Tanana River by May and June. Calving usually occurs between Healy Lake and the Tanana River or on the Tanana River alluvial bars. Most reports in June locate the herd on the lower portion of the Gerstle River. Two bulls were seen during two separate years just below the glacier on the Gerstle River, once in June and once in November. The summer and fall movements of the Healy Lake herd are unknown.

Forage consumed by this herd on their winter range consists primarily of the sedges and grasses that border bogs, sloughs, and streams. Small groups have also been reported on windswept hillsides. Forage utilized by this herd during early summer, while they are on the Tanana River alluvial bars, probably consists of grasses and legumes.

**Specific Habitat Considerations**

The winter range of the Healy Lake herd consists primarily of climax vegetation. This area is probably not subject to agricultural development. Additional information on this herd is needed before specific habitat recommendations can be made.

**DALL SHEEP**

Alaska Range: See Unit 12

Tanana Hills - White Mountains

The Alaska Range and the Tanana Hills-White Mountains area constitute two disjunct areas of Dall sheep range in Unit 20. The Alaska Range is discussed under Unit 12. Discussion of sheep in the Tanana Hills follows.

**Tanana Hills-White Mountains**

The Tanana Hills-White Mountains complex falls within Subunit 20C and reaches from the Canadian Border north of Tok west across the Steese Highway into the White Mountains near Beaver Creek. Little specific information is available concerning historic use and abundance of Dall sheep in this mountain complex. Miners in the late 1800's and early 1900's probably used sheep for food and may have significantly affected sheep populations in local areas, such as Glacier Mountain, but as far as is known sheep were not eliminated from any of the available habitat.

More recently, sport hunting has been the major use of this resource, with very limited numbers of people photographing sheep or hiking into sheep habitat.

**Populations**

Aerial surveys were conducted throughout sheep habitat in this mountain complex in 1970. Sheep are generally limited to only the highest, most rugged peaks. One exception occurs on the Charley River where sheep are often found on the cliffs just above the river. Sheep observed during the 1970 survey are listed below. Numbers are actual numbers of sheep seen and are, of course, not total population figures.

**Dall Sheep General Abundance and Distribution Surveys  
Tanana Hills-White Mountains**

<u>Date</u>	<u>Area</u>	<u>Sheep Observed</u>
August 18, 1970	Canadian Border west, Charley River, Twin Mountain, Mount Sorenson, Glacier Mountain, Big Windy	286
August 28, 1970	Mount Victoria, Schwatka Mountain, White Mountains proper	285
Total		571

During the past five sheep hunting seasons, harvest reports indicated an average of 34 hunters took 11 rams each season. No trends in the harvest are obvious at this time. Access is mainly limited to airplanes or cross country vehicles with only two small areas, Glacier Mountain and Mount Prindle, being accessible from the road.

### **Land Use Considerations**

Research in the Alaska Range has shown that sheep spend a major portion of the early summer utilizing natural mineral licks. Mineral licks have been located throughout the Tanana Hills-White Mountains complex. The specific functions of these licks are still unknown but it is likely that they are important in the ecology of Dall sheep. Future land use decisions should consider the importance of licks and trails leading to and from them.

Sheep summer and winter ranges are often separated by several miles. Specific routes are traditionally used by sheep moving between ranges. In the Tanana Hills-White Mountains, movements may occur over longer distances and with less regularity than in more central sheep ranges. Sheep movement routes should be considered before making future land use decisions.

One area in the Tanana Hills, Glacier Mountain, has been set aside as a walk-in hunting area. The objective of this management area was to establish a high quality hunting area for those willing to expend the effort necessary to reach sheep habitat without aid of vehicular transport. This area has been well received by the public and future land use decisions should preserve this area for this use.

The Charley River is another area that should receive special consideration in land use planning. It is one of the few, if not the only, river in Alaska that supports a population of Dall sheep just above its banks during the summer months. River boaters and canoeists utilize the area for recreation and sport hunters take several sheep from this area annually.

### **MOOSE**

The wide distribution of Athabaskan residents throughout Unit 20, with major villages on main rivers, attests to the presence of moose throughout the unit for a considerable period before the arrival of white men. Paleoecological investigations in the Fairbanks area show that moose have long been present, although distribution and abundance have varied considerably over the centuries. Moose are presently found throughout Unit 20 wherever suitable habitat is available.

Fires, construction, logging, and dredging that occurred with the advent of gold mining led to a tremendous increase in moose winter range in much of central and eastern Unit 20. In some cases this winter range is still usable, but vegetation on many of the earlier disturbances is now too old to provide browse. Clearing and construction in addition to lightning fires and other natural processes continue to provide more limited new sites for eventual growth of browse species. Seasonal concentrations of moose occur in various portions of Unit 20. Broad, swampy river flats near the Tanana and Yukon Rivers provide spring and summer calving and feeding areas for thousands of moose. Alpine-subalpine areas in the Alaska Range and Tanana Hills receive influxes of moose during the rut, many of which remain into early winter. In mid- to late winter, moose tend to congregate on river flats, islands and bars, particularly in years of deep snows. These basic movements are repeated annually in various parts of the unit, but with many variations, depending on moose population densities, weather and snow depth.

### **Populations**

Moose population numbers fluctuate dramatically in Interior Alaska, primarily in response to winter conditions.

Although complete censuses have not proved practical, general population levels, productivity and survival have been watched closely in Subunit 20A. From 1957 to 1965 moose numbers rose steadily, with productivity leveling off from 1963 to 1965.

The winter of 1965-1966 was one of record snowfall and persistently deep snow accumulation. Winter moose mortality was extensive, possibly equaling 50 percent of the herd.

Moose probably numbered 6,000 to 8,000 in Subunit 20A prior to the severe winter; with 3,000 to 4,000 remaining after winter mortality had taken its toll. Within two years the population was again growing at a rapid rate. In adjacent Subunit 20B, a similar chain of events had occurred. Population levels are less well known there, but appear lower than in Subunit 20A due to habitat differences. Moose numbers probably did not exceed 4,000 to 5,000 at the peak period in 20B, and may have fallen to 2,000 to 3,000 as a result of the severe winter of 1965-66. Similar fluctuations in moose numbers have been observed in Subunits 20C and 20D, but populations have not been followed as closely in these areas.

Harvests have varied in all these subunits in response to availability of moose, variations in access due to flooding or drought, economic conditions, and hunting regulation changes. In Unit 20 as a whole, harvests have ranged from 856 to 1,457, with the highest annual harvests preceding the 1965-66 winter loss, and the lowest years immediately following it. In 1971, the harvests in subunits were: 20A - 347; 20B - 184; 20C - 496; 20D - 23; total 1,072 (accumulated total for subunits does not equal unit total because subunits are not always reported).

### **Specific Habitat Considerations**

Alpine-subalpine, upland seral, and riparian willow and birch communities, as well as calving areas such as the Tanana Flats, are all extremely important to moose in Unit 20. The relatively stable quantities of food produced by alpine-subalpine and riparian communities will probably determine the numbers of moose that can be sustained over severe winters, while seral successional ranges will determine ultimate population size during normal years.

## **WATERFOWL**

(Units 12, 19 and 20)

### **Populations**

The average duck breeding density in Units 12, 19 and 20 is 67.0 ducks per square mile. Annual production from an estimated total population of 621,000 ducks is 1,244,000 birds. Lesser scaup, pintails, widgeons, mallards, green-winged teal, white-winged scoters, buffleheads, American goldeneyes, canvasbacks and shovlers commonly nest in the unit, Redheads, ring-necked ducks, blue-winged teal, and gadwalls are common breeders but are present in small numbers.

Fairly substantial populations of Canada geese and white-fronted geese can be found in most of these units. Trumpeter swans are common nesters on the Tanana Flats, Minto Lakes, Kantishna River and the upper Kuskokwim River. Little brown cranes nest throughout the unit in wet muskeg habitats.

Subsistence hunting is of small consequences today; past use was much more intensive, especially in the vicinity of outlying villages. Much of this hunting was conducted in conjunction with the spring muskrat harvest. This way of life has not been consistently practiced since the early 1950's.

### **Habitat and Land Use Considerations**

Area of major concern in relation to breeding habitat is Minto Lakes, Kantishna River, Tanana Flats, Shaw Creek

Flats, Dot Lake and Lake Minchumina. Considerations should be given the lower drainages of the Chatanika River, Chena River, Salcha River, Charley River, Birch Creek Flats (part of Yukon Flats), Beaver Creek, and sloughs and lakes adjacent to the Tanana River. These segments of quality habitat serve primarily as breeding areas and also as important migrant resting and feeding areas.

Units 20, 19 and 12 are within one of the more fertile waterfowl areas of the state. Fire has played an important role in recycling nutrients into aquatic habitats in these areas. Habitat manipulation by use of levees, water control gates and reclamation projects are considered possible and suggested for future management. Implementation of habitat management programs would aid in stabilizing annual production, which at present fluctuates considerably on the major marshes with uncontrolled water levels.

Access to hunting areas is by boat, aircraft and motor vehicle. Favorite areas are Minto Flats, Salachaket Slough, Linder Lake, Fish Lake, Healy Lake, Clearwater Lake, Shaw Creek Flats, Pile Driver Slough and many other local streams, sloughs and lakes which are accessible.

A potential problem in management of local breeding stocks may arise with increased hunting pressure. Most waterfowl taken in early September on local marshes are adult females and young of the year. Continual heavy harvest of these stocks could theoretically eliminate some breeding populations. Monitoring of harvest and hunter distribution is important in Units 12 and 20.

## GAME MANAGEMENT UNIT 21

Unit 21 includes the "mid-section" of the Yukon River and its drainages, from Paimiut upstream almost to Tanana. The Innoka River drainage is entirely included, as well as the lower Koyukuk River.

Almost the entire unit consists of river valleys, black spruce flats, and low hills. The unit extends into the Ray Mountains north of the Yukon River, however, and the Kuskokwim Mountains form the boundary between Unit 21 and Unit 19 on the south. Much of the unit supports coniferous or mixed forests. In the few mountains, considerable areas of alpine tundra and subalpine associations occur. Much of the Innoka River flats consist of wet, nearly treeless bog, with timber primarily restricted to streamsides, and small "islands" of black spruce scattered over much of the boggy area. Drainage patterns and other physiographic features create complex vegetation patterns such as occur in other parts of the Interior. Wildfire, both lightning- and man-caused, has had an important influence on vegetation in this unit and throughout the Interior.

Athabaskan residents of the middle Yukon River ranged over much of the area, although here as elsewhere major settlements were on the main rivers. Russian traders and explorers entered the area early in the 1800's via the Yukon River. American occupancy later followed much the same pattern, but was further stimulated by the search for gold.

Western Unit 21 is strongly affected by coastal weather patterns, but a continental climate prevails elsewhere.

Access is limited to air, water or winter cross-country travel.

**BLACK BEAR** - See Unit 12.

**BROWN BEAR**

Brown-grizzly bear distribution in Unit 21 is related to occurrence of alpine and subalpine habitat. Highest population levels appear to be in the central Kuskokwim Mountains, but other preferred habitat includes the rest of the Kuskokwim Mountains, Kaiyuh Mountains, Ray Mountains, and hills west of the Yukon River. Grizzlies



also occur sporadically on lowlands. Distribution has apparently changed little in historic times.

### **Populations**

Population levels in most of Unit 21 are low to moderate compared to those found in most of Interior Alaska. Relative population levels appear high in the central Kuskokwim Mountains. General observations, limited surveys, and harvest data are the only present sources of information.

Reported harvests have ranged from 1-5 annually since 1961 . Unreported kills for subsistence or as a result of bear-man conflicts probably exceed the reported harvest, but total harvest of bears probably does not exceed 15 per year.

### **WOLF**

Wolves range throughout Unit 21 . Their chief prey species is moose, but in earlier times when moose were less numerous and caribou inhabited the area in numbers, the latter species probably was most important as prey. Wolf distribution and abundance may have differed then somewhat from the present.

### **Populations**

Wolf population levels are known only in general terms. Relative abundance has varied from low to very high in response to production, natural mortality, and hunting. High populations with resultant high annual harvests {187, 189, 105 wolves} occurred from 1965-66 through 1967-68. Population levels showed signs of rising by 1970 and hunters killed 93 wolves in 1971 -72. Most hunting was done with the aid of aircraft. Field observations suggest a continued high population in faU, 1972.

Specific Habitat Considerations Varied cover and prey species assure the continued success of wolves as part of the natural fauna of the area.

### **WOLVERINE**

Wolverines occur throughout Unit 21. This distribution likely has not changed significantly in the last several hundred years, although minor shifts may have occurred in response to shifts in distribution of moose and caribou.

### **Populations**

Population levels are known only in relative terms, and appear moderate to high compared with other parts of Interior Alaska. Harvests have ranged from 12 to 45 since 1961 -62, with the high in 1965-66.

### **Specific Habitat Considerations**

Existing food and habitat are probably near-optimal for wolverines in Interior Alaska.

### **BARREN GROUND CARIBOU**

Beaver Herd: See also Unit 19.

Arctic Herd: See also Unit 26.

Caribou distribution and abundance in Unit 21 have changed in concert with changes in Units 17,18,19 and western Unit 20 and with changes in the Arctic herd.

The large population ranging along coastal areas in the mid-1800's probably "spilled over" into the Kuskokwim Mountains which largely lie in Unit 21. Changes in migratory patterns and range shifts are believed to have produced an expanding Kuskokwim Mountain population in the late 1800's. By 1912 to 1915, most of these caribou apparently had moved elsewhere. Very deeply worn trails were found then, but relatively few caribou. Large migrations north across the Yukon River a few years earlier probably accounted for the loss.

By 1930, only small scattered herds remained in the Kuskokwim Mountains, and this situation persists to the present time. The Beaver herd, about 3,000 animals, is the major group of caribou found here. This herd calves on the northwest slopes of the Beaver Mountains, and winters largely on the Iditarod-Innoko River flats. Small groups winter throughout the middle Kuskokwim Mountains.

Early records of caribou are few in the Yukon River area. Migrations both to the north and south occurred in the Tanana-Ruby area in the early 1900's, and about the same time people from Nulato to Rampart hunted caribou extensively north of the Yukon. Apparently portions of the Arctic herd (see Unit 26) have moved into northern Unit 21 intermittently over the last 100 years; this pattern prevails to the present time, although no caribou have wintered along the Yukon since the 1930's.

In addition to the Beaver and Arctic herds, the nameless herd of reindeer/caribou presently ranging through the hills of Units 18 and 22 north of the Yukon River and east of Norton Sound also ranges into western Unit 21. Little is presently known of the origin or size of this herd, but it probably numbers about 5,000 animals.

### **Populations**

The Beaver herd is estimated at about 3,000 animals. The Arctic herd, which ranges into northern Unit 21, was estimated by photographic census in 1970 at 242,000 animals.

Estimated harvest for the Beaver herd including the various small groups scattered in the Kuskokwim Mountains is less than 100 per year.

Harvest of Arctic herd caribou was estimated at 25,000 in 1963-64, but has since declined, largely due to disuse of dog teams and the resulting decreased need for caribou meat as dog food.

### **MOOSE**

Unit 21 has long been inhabited by moose. Athabaskan people were and are distributed along major waterways, where they have traditionally hunted moose. Early Russian traders and explorers noted the presence of moose along the Yukon, lower Koyukuk, and Innoko Rivers. Few observations of moose distribution and abundance in outlying areas of Unit 21 have been recorded, however, even to this day, although the animals do occur throughout the unit.

### **Populations**

In the Innoko drainage, large numbers of moose have been reported from time to time over the last thirty years; the most recent high in population was recorded in 1970-71. Severe winters and high wolf populations have probably stabilized or lowered the population levels there.

Moose numbers and survival along the Yukon River and the lower Koyukuk River have been monitored by aerial surveys for the last 14 years. Surveys are made in March or early April when moose are concentrated in riparian willow stands. Population peaks were observed in 1958 and 1969, with a low in 1959-1960 followed by fairly steady growth. Spring flooding and deep snow both affect moose abundance in this area. Highest concentrations

have consistently been observed between Galena and Koyukuk and between Kaltag and Holy Cross on the Yukon River, and all along the Koyukuk River within Unit 21.

Between Kaltag and Koyukuk few moose have been seen. For example, in March 1969, 1,004 moose were counted between Holy Cross and Koyukuk in four hours of aerial survey, but only 12 were seen between Kaltag and Koyukuk. Limited winter food apparently is the reason few moose winter in that area.

Moose populations appear to expand rapidly only to “crash” during winters of deep snow throughout this unit. The relative influence of flooding on calf survival is not known, but it is probably important, especially in the Galena-Koyukuk area where extensive flooding occasionally occurs in the spring when calves are very young.

Reported harvests in Unit 21 range from 128 to 247. Actual harvest probably averages 600 to 800 per year.

### **Specific Habitat Considerations**

Riparian willow stands are clearly of prime importance in sustaining moose populations in Unit 21. Little else is known of habitat needs in this area.

## **WATERFOWL**

### **Populations**

Three major river drainages are contained in Unit 21: the Yukon, the lower Koyukuk and the Innoko. Extensive waterfowl habitat is associated with all three rivers and their numerous tributaries. Breeding duck surveys indicate about 53 ducks per square mile in the Innoko drainage and about 40 per square mile in the lower Koyukuk River area. A fall duck flight of nearly 400,000 birds annually comes from Unit 21 assuming the production of one young for every adult in the breeding population.

Primary species of ducks include lesser scaup, pintail, American widgeon, mallard, green-winged teal and white-winged scoter. Other breeding birds include shoveler, goldeneye bufflehead, canvasback, redhead, old squaw, redbreasted merganser, harlequin, sandhill crane, loons, grebes, Canada geese and white-fronted goose. Trumpeter swans are relatively scarce on the Koyukuk drainage, although habitat appears to be suitable. Elimination of local populations by natives is one possible explanation for their scarcity. Both Canada and white-fronted geese are abundant.

The Innoko drainage is now only sparsely populated by humans and population movement has been to villages on the Yukon. Subsistence hunting, fishing, and trapping have declined on the Innoko and Iditarod Rivers. Some “fly in” hunting of moose and waterfowl takes place from Bethel and some low Kuskokwim villages. “Sno-go” travel from distant villages into this area for hunting is becoming common, but is highly unpopular with local residents.

Portions of the unit are used extensively by large flocks of migrant and molting geese and ducks.

### **Habitat and Land Use Considerations and Recommendations**

Nearly all of the lower Yukon River and adjacent stream valleys, and the Innoko River Valley in particular, are subject to periodic and severe spring flooding. Effects of flooding in Unit 21 are similar to those described in Unit 25.

Fires are common in the unit; effects and recommendations for future fire suppression are also the same as those

described for Unit 25.

Both the Yukon and Koyukuk Rivers would be subject to oil pollution should a break occur in the proposed oil pipeline from Prudhoe Bay to Valdez.

Mining was once common in the unit, but only minor activity continues. Should the price of gold rise sufficiently to cause expanded mining operations, minor local contamination of some waterfowl habitat is possible.

The Fish and Wildlife Service is currently considering parts of the Innoko drainage for a wildlife refuge. We recommend the Department of Fish and Game support this designation.

## GAME MANAGEMENT UNIT 22

A large portion of the Seward Peninsula and the drainage into Norton Sound, plus St. Lawrence Island and Little Diomedede Island, comprise Unit 22. The Seward Peninsula is largely Arctic coastal tundra with some mountainous outcrops. Forest cover extends west only to the peninsula's base, and seldom persists about 100 ft. elevation.

The Norton Sound area is primarily coastal tundra, but mixed forests closely approach the sea along major drainages. The hills separating Norton Sound from the Yukon drainage are mostly treeless, with subalpine and tundra plant communities predominant. Forest cover extends well into the hills along major streams in central Unit 22. To the south, coastal tundra again predominates.

A subarctic maritime climate prevails throughout the unit, but is less severe in eastern Norton Sound than on the exposed Seward Peninsula and southern Norton Sound. Seasonal sea ice is present from late October through early June.

Eskimo residents have traditionally relied heavily on marine mammals and fish, although caribou hunting was important at times. Within the past 75 years, introduced domestic reindeer have contributed to these people's livelihood in varying amounts.

Russian explorers and traders preceded the 1904 rush of American gold seekers to this area by about a hundred years. St. Michael was one of the earliest Russian outposts, from which trading was pursued along the coast and up the Yukon River. Most of the unit today is still accessible only by air, water or cross-country winter travel, but roads now connect Nome with Teller, Taylor and Council.

**BLACK BEAR** - See Unit 12.

### **BROWN BEAR**

Little information exists regarding historic distribution and abundance of brown-grizzly bears in Unit 22, but they were probably similar to present distribution and abundance, since little change in habitat has occurred. Grizzly bears presently occur throughout the unit. Concentrations occur where salmon or berries are seasonally abundant.

### **Populations**

Population data are not available. General observations and limited survey work indicate low to moderate population levels. Reported harvest has varied from two to five since 1961. Grizzlies are not taken for food in Unit 22, and few sport hunters seek them. A few are taken in defense of property, especially reindeer.

### **Specific Habitat Considerations**

Specific habitat needs for grizzlies in Unit 22 are poorly known. Access to important food sources such as salmon and berries, in addition to the general requirement of large areas of preferred habitat are the known requirements at this time.

### **POLAR BEAR**

Polar bears occur regularly in northern and western marine portions of Unit 22, primarily in association with seasonal sea ice. They rarely travel into Norton Sound or Kotzebue Sound. Some polar bears are found around St. Lawrence Island each year, but numbers are low except in years when a strong southward movement of Arctic ice occurs. The bears move north again in spring prior to breakup, generally in March.

### **Populations**

Polar bear population levels are known only in relative terms. Most bears in Unit 22 are a part of the western population discussed in the polar bear species account. Indirect evidence in relation to individual size, age, production and sightings suggest that the population is stable in numbers.

### **Specific Habitat Considerations**

Polar bears are adapted to a unique set of circumstances depending upon distribution of their chief prey, ringed and bearded seals. The food chain producing these prey species must remain intact and healthy for polar bears to thrive.

### **WOLF**

Wolves range throughout Unit 22. Before 1900 their distribution was probably most strongly influenced by distribution and abundance of caribou, the major prey species then available. By the late 1800's caribou no longer occurred in large numbers in most of Unit 22, and very few moose occurred there. During the 1900's two factors probably contributed to the wolves' welfare: (1) the introduction (in 1897-98) and increase of reindeer and (2) the gradual increase in numbers and apparently in distribution of moose.

Moose numbers are still increasing slowly, but reindeer numbers have fluctuated considerably since their introduction. In addition, intensive wolf control was done on reindeer ranges by reindeer herders and by the U.S. Fish and Wildlife Service under the auspices of the Bureau of Indian Affairs until 1971.

### **Populations**

The wolf population level in Unit 22 is low relative to other parts of northern Alaska. Variations in prey abundance and control activities have contributed to low populations. Harvest by sport and native hunters has varied from 6 to 28 since 1962-63, with the high in 1967-68.

### **Specific Habitat Considerations**

Prey abundance and availability seems the major limiting factor of wolves in Unit 22. Moose are unlikely to ever become abundant and reindeer will probably continue to have some form of protection from wolves. Numbers of caribou wintering in eastern and southern Unit 22 appear to be increasing and may provide the means of support for a larger wolf population in the future.

## **WOLVERINE**

Wolverines are found throughout Unit 22. Even though they are more scavenger than predator, their abundance was probably most dependent upon caribou population levels prior to 1900. The introduction of reindeer in 1897-98, their later increase, and the gradual increase of moose have contributed to the wolverine's welfare since 1900. However, predator control by reindeer herders and later by federal government agencies has been sufficiently intense to keep wolverine numbers depressed throughout much of the period 1900 to 1970.

The wolverine population is currently low, but appears to be growing slowly. Wolverine furs are in high demand for use in parka ruffs and for sale. The annual reported take has ranged from 4 to 31 since 1961-62, with the high in 1966-67 and 1967-68.

Availability of carrion, prey and berries constitute the major needs of wolverines, which seem to have a remarkable ability to survive in relatively barren areas.

## **BARREN GROUND CARIBOU**

Arctic Herd: See Unit 26.

## **MOOSE**

Moose have been present in eastern Unit 22 for some time, but appear to have become common on the Seward Peninsula only within the last 20 to 30 years. The first moose recorded from Cape Prince of Wales was shot there in 1948. Presently moose seem to be expanding their range and slowly increasing in numbers on the Seward Peninsula.

### **Populations**

Minimum population figures for major drainages on the Seward Peninsula (from 1971 aerial counts) are: Kuzitrin River - 180; Pilgrim River - 36; Serpentine River - 60; Koyuk River - 109; Niukluk River - 31. Annual reported harvests have ranged from 35 to 72. Actual harvests probably exceed these figures only slightly.

### **Specific Habitat Considerations**

Moose habitat on the western Seward Peninsula is limited to willow stands on major rivers and hillsides. These stands are usually disjunct in distribution, but cover a considerable portion of the area. Moose population levels are low compared to those in Interior Alaska, but are quite important locally. Existing willow stands are of greatest importance in maintaining what moose there are. On the eastern part of the peninsula moose habitat resembles that of Interior Alaska, but timberline seldom exceeds 1,000 ft. elevation.

## **MUSKOX**

In 1970, 36 muskoxen were transplanted from Nunivak Island to the Feather River near Nome. They subsequently split into smaller groups and moved to various locations on the western Seward Peninsula.

Three groups totaling 24 animals are presently accounted for. Eleven have been in the area north of Lost River during summer and fall 1972. A group of 10 including a cow with a calf is periodically seen north of Brevig Mission. Three muskoxen spend most of their time around the Bluestone River, and south and east of Teller.

The present lack of calves is not encouraging, but to judge the transplant's success at this time is premature.

## **MARINE MAMMALS - General**

(Units 9, 10, 17,18,22,23 and 26)

Five species of pinnipeds are commonly associated with sea ice in the northern Bering and Chukchi seas: ringed seal, bearded seal, ice-breeding spotted or harbor seal, ribbon seal, and walrus. Two additional species, the northern fur seal and Steller sea lion, also are present during all or part of the year, but are not dependent upon sea ice during the birth and mating seasons. The distribution and abundance of the five ice-inhabiting species are closely tied to ice conditions which vary throughout the year and from year to year. In order to present a complete picture of the distribution and movements of these five species, game management unit boundaries are ignored throughout most of the following discussion. Various parts of the discussion may apply to waters adjacent to Units 9, 10, 17,18,22,23 and 26.

The general term “sea ice” is vague and each of these seal species occurs in greatest abundance in a specific and special ice zone. Ice varies greatly within the various regions in size and thickness of the floes, in surface area of the sea covered by ice, in degree of attachment of ice to the shore, and in the thickness of accumulated snow cover. Seasonal sea ice comprises the majority of ice occurring in the Bering and Chukchi Seas. It is, by definition, ice which does not persist for more than one year. It is formed with the onset of cold weather in the fall and disintegrates during the following spring and summer.

In addition to requiring favorable ice, each species requires suitable water depth and/or bottom-type for feeding. Each species is adapted to exploit a different ecological niche, although all may on occasion occur in the same place at the same time. Our present knowledge of the marine environment and of the habitat requirements of each species is meager, and the effects of population changes in one species on another are unknown.

The distributions of all seal species in the Bering Sea (particularly of sexually immature individuals) overlap to some degree. Additionally, individuals of all five species pass through some of the same areas during seasonal migrations or movements. Many occurrences far from normal ranges have been recorded, perhaps due to the lack of major barriers to dispersal.

Sea ice conditions and the resulting distributions of marine mammals during any given year depend upon a variety of factors, including weather, winds and water currents. In some years, the seasonal pack ice extends much further south than in others, thus shifting the locations where concentrations of marine mammals may occur. However, the general distribution of one species in relation to the others remains the same. The accompanying distribution maps indicate ice conditions prevailing during “average” years.

## **BEARDED SEAL**

Bearded seals, like walruses and ringed seals, are mainly associated with sea ice throughout the year. However, they are more like walruses in that they occur primarily in those regions of drifting sea ice where currents and surface winds continually produce openings between ice floes.

During late winter and early spring, most of Alaska’s bearded seals are in the Bering Sea. They occupy all regions where suitable drifting sea ice occurs. They are distributed over a wider area than are walruses and extend decreasing abundance into the northern Chukchi Sea. The winter and early spring distribution of bearded seals includes the offshore regions of Game Management Units, 17, 18, 22, 23 and 26. Greatest abundance occurs in Units 18 and 22.

The spring migration of bearded seals is associated with the seasonal deterioration and northward retreat of sea ice. Because of their extensive distribution, passage of these seals north through Bering Strait occurs without the

dramatic “peak” migrations which are common with walruses. Their transit through the strait also occurs over a longer period of time.

Some bearded seals, especially immature animals, remain in the Bering Sea during the ice free period, seldom hauling out on land. This group represents only a small fraction of the population.

The northward retreat of seasonal sea ice continues during the summer and the animals associated with it continue to move north through the Chukchi Sea. As a result, seals wintering along the southern ice edge in the Bering Sea migrate much farther than those wintering in the Chukchi Sea. These migrations involve both active swimming and passive movement with the ice.

By late August, when almost all seasonal sea ice is gone, bearded seals are distributed along the margin of polar pack ice over areas of water of suitable feeding depth.

The reverse fall migration begins with the formation of new seasonal sea ice, usually in early October.

### **HARBOR OR SPOTTED SEAL**

The harbor or spotted seal, like the ribbon sei is associated with sea ice only during the late fall and spring months. During March and April, these seals are concentrated along the southern margin of the seasonal sea ice where they bear their pups, breed and begin the annual molt. At this time of the year, they are essentially unavailable to coastal residents.

As with all of the ice-inhabiting seals, the seasonal deterioration and northward movement of sea ice results in a major movement of spotted seals. Migration in the strict sense of the word, however, does not occur in its species. As the sea ice recedes northward, spotted seals disperse along the coast, occupying the mouths of rivers, bays and isolated beaches, where they remain during the ice-free months. Some spotted seals occupy the near-shore areas close to their wintering grounds, such as the Yukon-Kuskokwim Delta and St. Matthew Island. Others remain with the retreating sea ice long enough to move north through Bering Strait and occupy near-shore areas all along the northern coast as far east as Prudhoe Bay and Demarcation Point. They frequently ascend the major rivers for considerable distances, mostly in association with spawning fish. During the summer and early fall, spotted seals are likely to be encountered hauled up on the beaches, basking in the sun. Sizes of these groups vary from individual animals to pods of 1,000 animals or more. Their distribution is essentially the entire coastal area of Game Management Units 17, 18, 22, 23 and 26.

With the onset of cold weather in the fall and the formation of new sea ice, the northernmost spotted seals begin to move south, being joined by other spotted seals as sea ice forms and advances. By late winter, the major concentration of these seals is again along the southern perimeter of seasonal sea ice.

### **RIBBON SEAL**

Most of Alaska's ribbon seals remain in the Bering Sea throughout the year. They are infrequently seen near coastal hunting villages and relatively few migrate north through Bering Strait. These seals, particularly the adults, are distributed throughout the edge zone of the seasonal pack ice during late winter and early spring, with greatest concentrations occurring along the northern edge of this zone. As the sea ice melts and recedes north during the spring, ribbon seals remain in the open sea. A few ribbon seals have been reported from the Chukchi Sea during the summer months. They have not been reported along the edge of the polar ice during August and September.

### **RINGED SEAL**



Ringed seals move in patterns similar to those of walruses and bearded seals. Definite migration of this species is evident and is dependent upon the seasonal advance and retreat of sea ice. However, as with bearded seals and walruses, migration does not involve the entire population, for a small number of immature ringed seals remain in ice-free areas. Also, those seals which wintered in the far northern areas do not have to move far in order to remain with the sea ice.

During the late fall, winter and spring, ringed seals occur in the Bering and Chukchi Seas to the southern limit of ice distribution. However, they are relatively uncommon in the edge zone of the seasonal ice and, in the Bering Sea, in those areas far from land. Most adult ringed seals occupy the narrow fringes of land-fast ice. Immature ringed seals are numerous just off the edge of the land-fast ice. This distribution, in combination with the great abundance and availability of ringed seals, makes them the most important marine mammal to the coastal residents of northern Alaska.

During winter and early spring, ringed seals are common in the coastal areas of Game Management Units 18, 22, 23 and 26.

The spring migration of ringed seals is associated with the seasonal deterioration and northward movement of the sea ice. Unlike walruses and bearded seals, most ringed seals move north close to the shore, at least in the Bering Sea.

Ringed seals continue their northward movement through the Chukchi Sea as summer progresses. By August, they are distributed along the entire edge of the polar pack ice regardless of the depth of the water over which it occurs. These seals also penetrate far into the polar ice, but little information is available concerning ringed seal densities in these far northern regions.

A reverse fall migration begins with the formation of new seasonal sea ice, usually in early October.

## **WALRUS**

During late winter and early spring, essentially the entire population of Alaska's Pacific walruses is in the Bering Sea, including the offshore areas of Game Management Units 10 (near the Pribilof Islands during years of extensive ice), 17, 18 and 22. Walruses may occur in any area where the right combination of ice conditions and water depth occurs. However, the greatest concentrations of walruses seem to occur in the same general areas year after year.

Beginning usually in mid-April, the seasonal sea ice starts to melt and recede northward, and the majority of walruses move with the ice. This spring migration reaches a peak in the Bering Strait during the last week of May and the first two weeks of June, and the Bering Sea is usually free of ice by the end of June.

A few walruses remain in the Bering Sea during the period when it is free of ice. These animals are essentially all males which frequent several traditional hauling grounds on isolated islands, as described below.

The northward retreat of seasonal sea ice continues during the summer months and the ice and animals associated with it continue to move north through the Chukchi Sea. Walruses moving north within several miles of the coast reach the vicinity of Point Hope (Unit 23) during early July and Wainwright and Barrow (Unit 26) by early August.

By late August, seasonal sea ice has all but disappeared, and walruses are distributed primarily along the edge of the polar ice pack. Some occur along the ice east of Point Barrow, but most animals are farther west, as far as the

East Siberian Sea. The reverse fall migration begins with the formation of seasonal sea ice, usually in early October.

## Hauling Grounds

As stated previously, a small segment of the walrus population remains in or returns to the Bering Sea during the ice-free period. During this time, they frequent several traditional hauling grounds on isolated islands:

Number 1. Amak Island, Game Management Unit 9, southeastern Bristol Bay, approximately 17 miles from the town of Cold Bay. This island is occasionally used by walruses.

Number 2. Walrus Islands, Game Management Unit 17, northern Bristol Bay, approximately 25 miles from the town of Togiak. This group of islands (including Round Island, Crooked Island, Hi!tllsland, Summit Island, The Twins, Black Rock and adjacent state waters) comprises the Walrus Islands State Game Sanctuary. Walruses frequent these islands every year, with Round Island containing the most commonly utilized hauling grounds. This sanctuary is closed to the taking of walruses.

Number 3. Hagemeister Island, Game Management Unit 17, northern Bristol Bay, approximately 20 miles from Togiak. Walruses occasionally use beaches on the southeast end of this island.

Numbers 4 and 5. Cape Mendenhall on the southeast side and Cape Mohican on the west side of Nunivak Island, Game Management Unit 18. The beaches around these capes are occasionally used by walruses.

Number 6. Hall Island, Game Management Unit 1B, off the western tip of St. Matthew Island. Walruses frequent this island, especially during late fall and early winter prior to the formation of sea ice. St. Matthew Island also contains several suspected hauling grounds.

Number 7. Penuk Islands, Game Management Unit 22, approximately five miles south of the eastern tip of St. Lawrence Island. Walruses occur on these small islands, especially on the easternmost island, almost every fall. They usually use the beaches from late October until sea ice forms in December.

Number 8. Besboro Island, Game Management Unit 22, approximately 21 miles northwest of the town of Unalakleet. This island has been used intermittently by walruses during June, July and August, especially during those years when heavy sea ice remains in Norton Sound during June.

Number 9. Sledge Island, Game Management Unit 22, approximately 22 miles west of Nome. Like Besboro Island, Sledge Island has been intermittently used by walruses during summers when extensive sea ice persists in Norton Sound until well into the summer.

Number 10. Big Diomedes Island (Soviet Territory). Big Diomedes Island is 2.7 miles west of Little Diomedes Island (the latter in Game Management Unit 22); both are situated in the center of Bering Strait. Big Diomedes Island was formerly the location of two Eskimo settlements, but is presently unoccupied except for a small military and scientific outpost. The east side of Big Diomedes is clearly visible to Eskimo residents of the smaller island. Starting in 1965, walruses began hauling out on the beaches of Big Diomedes, usually during late November and December, and then abandoning the beaches when the sea ice arrived. Each year since then, the walruses have frequented Big Diomedes in greater numbers and beginning earlier in the fall. In 1971 walruses were first observed in late August. By November of that year, more than 4,000 animals occupied most of the suitable beaches visible from Little Diomedes. It is unknown whether other suitable beaches around the island are similarly utilized by walruses. Big Diomedes

Island may presently be the major hauling ground in the Bering Sea area.

Number 11. King Island, Game Management Unit 22, approximately 34 miles west of Cape Douglas, western Seward Peninsula. King Island is situated near the southeastern approach to Bering Strait. Like Big Diomed Island, it was formerly occupied by Eskimo residents. Since 1965 it has been unoccupied except for brief periods during June of each year, when the King Island people return to hunt walrus. Walrus have been reported to haul out on King Island during November. It is reasonable to expect that since there are neither hunters nor dogs on the island during most of the year (particularly in the fall), this island will also become an important hauling ground.

The use of hauling grounds by walrus has been related to overall size of the Pacific walrus population--the larger the population the higher the incidence of animals occurring away from the major animal concentrations which are associated with sea ice. In fact, the use of hauling grounds in the American sector of Bering Sea has been increasing during the last decade, along with a steady increase in the walrus population, which now numbers around 130,000 animals. Use of some hauling grounds, particularly those in Norton Sound, is also related to the vagaries of weather and its influence on sea ice. Little information is available to us concerning hauling grounds in the Soviet sector of the Bering and Chukchi Seas.

### SUMMARY - MARINE MAMMALS AND SEA ICE

From the foregoing discussions, it is obvious that sea ice and the seasonal changes affecting sea ice directly influence the seasonal abundance, distribution and movements of seals and walrus. The major segments of the walrus, bearded seal and ringed seal populations are found in association with sea ice and therefore undertake marked and generally predictable seasonal movements or migrations. Ribbon seals and spotted sea ls are only seasonally associated with sea ice, during the winter and spring months. Ice provides a suitable floating platform upon which these seals give birth and nurture their pups. However, as the sea ice disintegrates and recedes northward during late spring and summer, the ribbon seal becomes pelagic, remaining mostly in the Bering Sea, and the spotted seal disperses along the coast.

An important result of these differences among species is that the total number of pinnipeds associated with the ice is substantially reduced at the time when sea ice is most restricted. This reduces competition for both food and suitable sea ice conditions. There is also a seasonal change in the species occurring in the near-coastal areas--from the ringed seal during the months of ice cover, to the spotted seal during the ice free months.

### WHALES

(Units 9, 10, 17,18,22,23 and 26)

Sixteen species of whales have been recorded in the Bering Sea, bordering Game Management Units 9, 10, 17, 18 and 22. Many of these seasonally pass north through Bering Strait, entering the Chukchi Sea and impinging upon Game Management Units 23 and 26.

The whales are in two major groups: the suborder Odontoceti or toothed whales, and the suborder Mysticeti, or baleen whales. The following whales occur in the Bering Sea:

#### **Toothed Whales**

Beluga whale  
Killer whale  
Harbor porpoise  
Bottle-nosed whale  
Stejneger's beaked whale  
Goose-beaked whale

Sperm whale  
Dall porpoise  
Narwhal

#### **Baleen Whales**

Grey whale  
Sei whale  
Minke whale  
Fin whale  
Humpback whale  
Blue whale

The following discussion is based primarily on the works of F.H. Fay. Fay has pointed out that that most whales of the Bering Sea occur primarily in ice-free waters. As a result, their movements often coincide with the seasonal advance and retreat of ice. The killer whale, harbor porpoise, fin, minke, humpback and gray whales migrate into the northern Bering Sea; some animals do so even before the region is completely ice-free. Additionally, these species enter the Chukchi Sea during summer. These whales move southward in the fall, usually before the first ice is formed.

Three species of whales are commonly found in association with drifting seasonal sea ice. These are the bowhead, beluga and narwhal. Sightings of narwhals are very infrequent and they are probably uncommon in northwest Alaska. Bowhead whales are common inhabitants of our northern seas. According to Fay and Tomilin, they frequent the ice front of the central and southwestern Bering Sea and, from March to May, seasonally penetrate nearly 2,000 miles into the ice.

Distribution and movements of bowheads at this time of the year appear to be greatly influenced by naturally caused and relatively predictable systems of flaws and leads which occur in the ice along the coast. Whale hunting frequently occurs simultaneously at locations on western St. Lawrence Island and Cape Prince of Wales (Unit 22), Kivalina and Point Hope (Unit 23) and Wainwright and Point Barrow (Unit 24), indicating that the south to north distribution of bowhead whales at this time of the year exceeds 550 miles.

Historical records, mainly from American whalers, indicate that many bowheads summer in the eastern Beaufort Sea and the adjacent Arctic Ocean. Fall whale hunting at Point Barrow indicates that a major southward movement of these whales occurs from mid-September through mid-October.

Bowhead whales are not strictly dependent on natural openings in the ice for breathing holes, for they can break through ice up to nine inches thick. This ability is probably facilitated by location of the nostrils near the top of a high, toughened knob on their dorsal side.

Belugas are the most commonly observed whales along the northern coast. They winter in and along the edge of the seasonal sea ice and are probably most numerous in the Bristol Bay area (Units 9 and 10). In spring these whales move inshore and northward, some frequenting the same areas as bowheads. Based on belugas obtained by hunters during April, most of the early migrants are adult males. Mixed pods of beluga whales frequent such locations as Bristol Bay and Kuskokwim Bay (Unit 18), Norton Sound (Unit 17) and Kotzebue Sound (Unit 13) throughout the ice-free summer period. Eschscholtz Bay, in southeastern Kotzebue Sound, is a favored area for belugas during June. Reportedly, many calves are born in this area, especially during years when the ice breaks up early.

As pointed out by Fay, belugas return to the Bering Sea in the fall somewhat earlier than do bowheads. This is prior to the formation of winter ice. This is probably necessitated by the beluga's inability to make breathing holes in any but the thinnest ice. Several instances have been reported in which pods of belugas were trapped by the formation of extensive sea ice around them. These whales remained at localized breathing holes until they eventually starved.

## **WATERFOWL AND SEABIRDS**

### **Populations**

The best of several small waterfowl breeding areas in Game Management Unit 22 is the Imuruk Basin on the Seward Peninsula. The north side of the peninsula (Lapp Lagoon) also produces some birds, but is best noted as a molting area for pintails.

Aerial surveys indicate an average population of 60 ducks per square mile of suitable habitat. The average population of about 231,000 annually contributes a fall flight of 416,000 ducks, assuming 0.8 young produced per adult breeder. Greater scaup and pintails are the most common ducks.

Small populations of emperor geese, white-fronted geese and black brant are present. Hunting by Eskimos is believed to have caused a depletion of goose numbers in Unit 22, especially in Lapp Lagoon and the Serpentine River Delta.

The following is a list of known seabird colonies in the unit.

**Description of Seabird Colonies Indicated on Maps  
Game Management Unit 22**

Map No.	Colony No.	Name
103	94	King Island
103	95	Little Diomede Island
103	96	Fairway Rock
102	101	Sledge Island
100	103	Besboro Island
100	104	Cape Denbigh
101	106	Cape Darby-Rocky Point
93	107	St. Lawrence Island

Species Present - 1/ Black-legged kittiwake, thick-billed murre, common murre, glaucous gull, crested auklet, least auklet, parakeet auklet, tufted puffin, horned puffin, pelagic cormorant, red-faced cormorant, pomarine jaeger, parasitic jaeger, long-tailed jaeger, Arctic tern, pigeon guillemot, Kittlitz's murrelet.

2/ Pacific fulmar, herring gull, Sabine's gull, slender-billed shearwater, dovekie.

1/ Known nesters on some or all colonies.

2/ Present in colonies but not observed nesting.

**Habitat and Land Use Considerations and Recommendations**

Development of a proposed electrical power site on Tuksuk Channel near Teller would destroy much of the waterfowl habitat in the Imuruk Basin.

The potential for oil discovery in the Imuruk Basin and other areas in Unit 22 is high and constitutes a potential threat to waterfowl and seabirds in the unit.

A number of coastal lagoons contain fine stands of eelgrass and support large numbers of transient and molting birds. None of these lagoons nor any of the seabird colonies in Norton Sound and the Bering Strait is presently under state or federal protection.

State-owned tidal lands and upland marshes in the following areas should be considered for special protection: Serpentine River Valley, Imuruk Basin, Safety Lagoon, Lapp Lagoon, Golovnin Bay, and portions of the Koyuk Flats, and all of the larger seabird colonies. Another consideration affecting the future of seabird colonies is disturbance by airplanes and helicopters, which can cause considerable egg and chick loss when they fly near the colonies.

## GAME MANAGEMENT UNIT 23

Contrasts between ecological communities within Unit 23 are striking. From Cape Lisburne south to Goodhope River on the Seward Peninsula's north coast, Arctic coastal tundra and an Arctic marine climate prevail. Seasonal sea ice persists from October through June. Cool, moist summers and cold, dry winters typify the climate. In contrast, the inland drainages of the Noatak and Kobuk Rivers strongly resemble rivers of Interior Alaska. Temperature ranges are more extreme than in coastal areas, and the vegetation is similar to that of Interior Alaska, though more restricted in distribution. Tree species are particularly restricted in distribution on the Noatak River, which begins and ends in treeless tundra.

The Delong, Baird, Schwatka, and Waring Mountains, western extensions of the Brooks Range, separate major drainages and increase the diversity of ecological communities within the unit. The Great Kobuk Sand Dunes south of the Kobuk River add an incongruous note that emphasizes the tenuous grip of vegetation on the land. Eskimo residents have long inhabited both coastal and inland areas, and have adapted their hunting techniques to successfully meet their subsistence needs. In doing so they once traveled extensively to hunt, especially in inland areas where food sources were less abundant than on the coast. Early Russian explorers and later American whalers were the forerunners of white occupancy which has fluctuated considerably and is at a low level today. Much of the unit is still remote, although light aircraft have provided considerably increased access between settlements and into outlying areas.

**BLACK BEAR**· See Unit 12.

### **BROWN BEAR**

Brown-grizzly bears are found throughout Unit 23. Concentration areas on some salmon streams and portions of spring-summer or fall range have been documented and are shown on the maps. Field observations show that grizzlies use a variety of habitats, rather than being limited to a certain habitat type. Historic distribution is poorly known, but was probably similar to present distribution since habitat has changed little. Grizzly bears are hunted for food in Unit 23, in contrast to adjacent Unit 22 and most other parts of the Interior.

#### **Populations**

General observations, limited surveys, and reports of residents indicate that grizzly population levels are moderate to high in Unit 23 relative to much of the Interior.

### **POLAR BEAR**

Polar bears occur regularly in northern and western marine portions of Unit 23, primarily in association with Arctic seasonal sea ice. They rarely travel into Kotzebue Sound, where ice forms earlier and remains largely intact during winter. Exposed points and headlands such as Point Hope and Cape Lisburne, where Arctic Ice moves close to shore, have long been favored areas for native bear hunters. Timing of bear movements is related to development of seasonal sea ice; generally it is November before a substantial amount of ice and a large number of bears are found in Unit 23.

#### **Populations**

Most polar bears found in Unit 23 probably belong to the Western population discussed under Unit 22 and in the species account. Evidence suggests a stable population.

### **Specific Habitat Considerations**

Factors affecting polar bear welfare discussed under Unit 22 and earlier in the polar bear species account apply equally to Unit 23.

### **WOLF**

Wolves range throughout Unit 23. Their distribution seems to be strongly affected by caribou movements in or through the area, especially during the fall-winter-spring period. Both moose and sheep are available in addition to caribou, and in portions of the unit these species constitute important food sources. Little information is available concerning historic and prehistoric distribution and numbers, but wolves have surely long been a normal part of the fauna. Wolves are actively hunted by local residents and by guided hunters.

### **Populations**

Population numbers are not known. Wolf numbers are at a moderate level compared to other parts of the Interior and Arctic. Wolf harvests have ranged from 71 to 177 since 1961-62, with the high in 1967-68.

### **Specific Habitat Considerations**

Food supply is the most important variable affecting wolf abundance. A major change in distribution or size of the Arctic caribou herd would produce secondary effects among wolves. The same is true to a much more limited extent with respect to moose and sheep; however, the varied topography, vegetation and prey species assure wolf populations will remain healthy in the foreseeable future.

### **WOLVERINE**

Wolverines range throughout Unit 23. Like wolves, their distribution is strongly affected by the distribution of large ungulates, which provide a substantial proportion of the carrion they rely upon.

Wolverines occupy both forested and tundra areas, provided food is available. Wolverines are found in moderate numbers relative to their densities in other portions of Interior and Arctic Alaska. Their fur is highly prized for use in parka ruffs and for sale, and they are actively hunted and trapped in winter. Harvests have ranged from 2 through 51 since 1961-62, with the high in 1963-64.

Because their welfare is closely linked to that of large ungulates, wolverines will fare quite well as long as caribou, moose and sheep are in good supply. Therefore, the status of these prey species is of prime importance to wolverines.

**BARREN GROUND CARIBOU** Arctic Herd: See Unit 26.

**DALL SHEEP** - See Unit 25

### **MOOSE**

Moose apparently were scarce or absent in Unit 23 until 50 to 75 years ago. Presently they are found throughout the unit, with concentrations on major streams. They have reached the northwestern section of the unit only within the last five years. Moose appear to be both expanding their range and increasing in numbers. They have become an important source of meat in early fall, when they are most often taken in conjunction with other activities.

### **Populations**

No data are available. Limited aerial surveys and field observations suggest low populations in most of the unit, with some areas of moderate abundance. The reported harvest has ranged from 45 to 77. Actual harvest is probably 100 to 150 moose per year.

**Specific Habitat Considerations**

Moose are dispersed throughout timbered regions. In treeless areas they concentrate in winter on major rivers where riparian willow stands provide food.

**MUSKOX**

Thirty-six muskoxen were transplanted in 1970 from Nunivak Island to near Cape Thompson, south and east of Point Hope.

Animals from this group seem to have moved much more randomly than have those from other transplants. Lone muskoxen have been seen several miles out on sea ice near Point Hope and along the coast as far east as the Noatak River. Deaths of four by accidents and one by gunshot have been documented. Reports of single animals occur sporadically, but the only group known to exist at this time consists of eleven adults that are usually near the Kukpuk River, not far from the release site.

The success of this transplant will remain in doubt for several years.

**BEARDED SEAL, HARBOR OR SPOTTED SEAL, RIBBON SEAL, RINGED SEAL, WALRUS, WHALES - See Unit 22.  
WATERFOWL AND SEABIRDS**

**Populations**

This unit encompasses some of the most productive waterfowl habitat in the state. Prime areas are the Noatak River Valley, Buckland River Valley, Kobuk River Delta and the Selawik Flats. Breeding pair counts suggest an average of 44 ducks per square mile of suitable habitat. Average annual production by the 234,000 breeding ducks is estimated at 187,000 young, assuming 0.8 young per adult. Pintail, greater and lesser scaup and widgeon comprise about two-thirds of the breeding population. Concentrations of Canada and white-fronted geese are found in the Selawik area. Waterfowl populations--geese especially--probably have been depleted in local areas due to illegal spring shooting and summer bird "drives". The Buckland River Valley is one area where this depletion is most evident. The following is a list of the larger known seabird colonies in the unit.

**Description of Seabird Colonies Indicated on Maps  
Game Management Unit 23**

<u>Map No.</u>	<u>Colony</u>	<u>Name</u>	<u>Species Present</u>
118	<u>98</u>	Chamisso Island	black-legged kittiwake, glaucous gull, horned
119	<u>102</u>	Cape Deceit Toawlevic Point	puffin, tufted puffin, thick-billed murre, common murre.
119	<u>102A</u>	Sullivan Bluffs	
137	<u>97</u>	Cape Thompson	black-legged kittiwake, glaucous gull, horned puffin,
137	<u>105A</u>	Cape Lisburne	tufted puffin, thick-billed murre, common murre, pelagic cormorant, black guillemot, pigeon guillemot.



The following species have been seen in the colonies, but have not been found nesting: Pacific fulmar, slender-billed shearwater, pomarine jaeger, parasitic jaeger, long-tailed jaeger, glaucous-winged gull, herring gull, mew gull, ivory gull, Ross' gull, Sabine's gull, Arctic tern, Kittlitz's murrelet, crested auklet, least auklet.

### **Habitat and Land Use Considerations and Recommendations**

Much of the best waterfowl breeding habitat in the unit is located on sedimentary basins, where the chance of oil discoveries is very good. Such discoveries would constitute a threat to this habitat.

Several dam sites have been proposed. Dams built at any of these sites would result in substantial waterfowl habitat losses.

Except for the Chamisso Island refuge, there are no lands presently protected for wildlife. Some form of protection should be afforded to seabird colonies and other prime habitats, especially in the Selawik area, the Kobuk River Valley, and the Buckland and Noatak River Valleys.

## **GAME MANAGEMENT UNIT 24**

The Koyukuk River drainage from Dulbi River to the Koyukuk's headwaters, has been designated Unit 24. Much of the land area is part of the broad Koyukuk Valley and associated tributary valleys and flats. On the west, rolling hills and low mountains separate the Koyukuk from coastal drainages. Farther north, waters of the Koyukuk are separated from the Kobuk and Noatak Rivers by narrow divides in the Schwatka and Endicott Mountains, and from Arctic Slope drainages by the summits of the Brooks Range. The Ray Mountains and Zane Hills pinch the Koyukuk Valley near Hughes, but upstream it widens again in a broad flat extending to Bettles. Numerous streams converge from the Brooks Range to form the Koyukuk's headwaters.

Typical interior forests and black spruce flats cover most lowlands. Alpine and subalpine communities predominate above 2,000 ft. in the numerous hills and mountains surrounding and forming the boundaries of Unit 24.

Weather is continental, with low precipitation and wide extremes in temperature. Athabascan residents traditionally travel over much of this unit for hunting and food gathering. As in much of the Interior, major settlements are all along main rivers. Although early explorers traversed parts of this area, no major immigration occurred until the gold rush.

Much of the unit remains remote, with access limited to air, water and one winter haul road. Development of the Trans-Alaska Pipeline would result in one new major road and several airstrips within the unit. Other developmental projects are also being considered.

**BLACK BEAR** - See Unit 12.

### **BROWN BEAR**

General observations and some accounts of long-time residents indicate that brown-grizzly bear distribution and abundance in Unit 24 has changed little in historic times. Grizzlies are regularly found throughout all alpine and subalpine habitats, and occur sporadically in forested lowlands.

In northern portions of the unit, grizzlies spend most of their active season in valleys or on low hillsides where food is most abundant. Denning habitat requirements are poorly known at this time. Known den sites include

natural caves or hollows, holes and overhanging banks.

Grizzlies are a valued food item for hunters in northern Unit 24.

### **Populations**

Data from one specific study and general observations suggest moderate population levels relative to other areas of Interior Alaska. A very rough estimate of one grizzly per 100 square miles was made for adjacent areas of Unit 26 when habitat and general populations appeared similar to those in northern Unit 24. Estimates have not been made for southern Unit 24.

Reported harvests have ranged from 3 through 27 since 1961, with the high in 1966-1967. Most of the reported harvest is by sport hunters. Some unreported harvest does occur.

### **Specific Habitat Considerations**

Specific habitat needs of grizzlies are poorly known. Beyond the general requirement for large areas of preferred habitat, a potentially important consideration is protection of valleys and low hillsides in northern Unit 24, where these areas are preferred habitat and are limited in quantity.

## **WOLF**

Wolves occur throughout Unit 24, which is well known for periodically abundant wolf populations. Moose populations in Unit 24 are known to fluctuate dramatically between very high populations and low to moderate numbers in response to winter conditions and variations in wolf numbers may well be a response to large changes in numbers of moose.

Little is known of summer wolf distribution. In winter, a substantial proportion of the wolves spend considerable time on main rivers, where moose congregate.

### **Populations**

In relative terms, wolf numbers in Unit 24 have varied from low to very high. Presently the population is high.

Wolves have long been trapped and hunted from the ground. In addition, aerial hunting has taken large numbers of wolves from Unit 24 periodically for the last 20 years. The harvest has ranged from 12 to 276 since 1961-62, with the high in 1967-68.

### **Specific Habitat Considerations**

Because of their dependence upon large ungulates for food, wolves will remain at substantial population levels only if suitable habitat is maintained for major prey species, including moose, caribou and sheep.

## **WOLVERINE**

Wolverines range throughout Unit 24, where they are sparsely distributed as in other parts of Interior-Arctic Alaska. Their distribution and abundance have probably been essentially the same for several thousand years. Wolverines are actively hunted and trapped in Unit 24 as they are elsewhere in northern Alaska. Relative to populations in other parts of Interior-Arctic Alaska, wolverine populations are moderate to high in Unit 24.

Because wolverines depend heavily on carrion and some predation, their welfare is closely linked to that of large

ungulates and smaller game. Adequate habitat for food species will provide adequate habitat for wolverines.

## **BARREN GROUND CARIBOU**

Arctic Herd: See Unit 26.

Porcupine Herd: See Unit 26.

**DALL SHEEP** - See Unit 25.

## **MOOSE**

Moose are present throughout Unit 24 wherever there is suitable habitat. Although few early records are available, this seems to have been the case for some time. In northern Unit 24, moose are restricted during much of the year to valleys supporting willows. In some cases these valleys support surprisingly high densities of moose.

### **Populations**

General observations indicate moderate moose numbers throughout most of the unit, with higher concentrations along the Koyukuk River in winter. Many of the northern tributaries of the Koyukuk support substantial numbers of moose, and constitute highly important local wintering areas.

Reported harvests have ranged from 44 to 102. Actual harvests probably average 200 to 250 annually.

### **Specific Habitat Considerations**

Throughout northern Unit 24, riparian and alpine-subalpine willow communities are of great importance in sustaining moose populations. Further south, fire-caused successional communities assume more importance, but riparian willow is still of major importance.

## **WATERFOWL**

### **Populations**

The Koyukuk River drainage supports an average of 32.0 ducks per square mile of waterfowl habitat. The Koyukuk and Kanuti Flats, with areas of 2,700 and 1,400 square miles respectively, are similar to the Yukon Flats. An annual fall flight of about 266,000 ducks normally leaves this area. The most abundant nesting species are American widgeon, lesser scaup, pintail, green-winged teal, mallard and American goldeneye. Canada geese and white-fronted geese are very abundant. A large breeding and molting population of over 3,000 white-fronted geese was recently found on the upper Kanuti River. Little brown cranes are present, but not abundant. A few whistling swans also nest in this unit.

Less than 1,000 people live in this unit. Subsistence hunting is common, but not intensive at present. Many ducks and geese are harvested during the fall months from boats, usually in conjunction with moose and bear hunting.

### **Land Use Practices and Recommendations**

Placer gold mining is still conducted in the more mountainous areas, but is of little consequence to the adjacent waterfowl habitat. Wild fire is continually a problem in the Koyukuk. Fire suppression has become ever more intensive and more successful in recent years. A more comprehensive policy regarding fire control on certain habitats in this unit is needed.

A dam site on the Kanuti River has been suggested by the Corps of Engineers. The impoundment area of this dam could inundate and destroy the best waterfowl habitat in the drainage. Proposed oil pipeline crossings occur over several of the headwater streams of the Koyukuk and Kanuti Rivers. An uncontained break during the spring or fall high water stages of these rivers could cause loss of waterfowl and damage to habitat along the lower watercourses.

## GAME MANAGEMENT UNIT 25

Unit 25 lies between the Brooks Range on the north and the Yukon River on the south, abuts Canada to the east and is bounded by the Koyukuk-Yukon divide on the west.

The southern half of Unit 25 encompasses a large part of the Yukon Flats, and uplands adjacent to the Yukon and Porcupine Rivers. North of these flats and uplands the terrain rises gradually to foothills and mountains of the Brooks Range. The unit essentially encompasses all of one huge drainage basin of the Yukon. Several major rivers drain the southern Brooks Range and the Yukon-Porcupine uplands.

Weather is strongly continental with some of the highest and lowest temperatures in the state being recorded at Ft. Yukon. Lowlands support typical boreal forests of spruce, birch and aspen, expanses of black spruce bog and numerous lakes and swamps. Fire is an important ecological factor here as elsewhere in Interior Alaska. As elevation increases north toward the Brooks Range, timber rapidly thins and disappears except in major river valleys.

Subalpine vegetation occupies the foothills and lower mountain slopes. Arctic alpine tundra begins at about 2,000 ft. elevation. Upper mountain slopes are relatively rugged and barren.

Most Athabascan population centers were in lower major river valleys, although some occurred well into the foothills region, as at Arctic Village. All groups ranged widely in hunting and gathering foods at various seasons.

Fur traders from Hudson Bay Company penetrated this area in the mid-1800's, but numbers of whites did not come into the country until gold rush days. Access in the area is primarily by air and water, although the Steese Highway reaches the edge of Unit 25 at Circle, and a new road now reaches the Yukon north of Livengood.

**BLACK BEAR** - See Unit 12.

### **BROWN BEAR**

Limited data indicate brown-grizzly bear distribution has remained essentially unchanged in historic times. Grizzlies are regularly found throughout subalpine and alpine areas and occur sporadically, in forested lowlands. As in most of Interior Alaska, salmon seem relatively unimportant as food, although further observations may show some exceptions to this generalization.

Most observations of grizzlies have been made in northern Unit 25. In that area, grizzlies spend most of the active season in river valleys and on low hillsides where food is most abundant. Denning habitat requirements are poorly known. Most known den sites have been natural caves, with abundant grass or sedge adjacent to the entrance.

### **Populations**

General observations and reconnaissance surveys indicate moderate population levels in northern Unit 25. Population levels in other parts of the unit are unknown. Reported harvests have ranged from 3 to 27. Some

unreported harvest also occurs.

### **Specific Habitat Considerations**

As in Unit 24, river valleys seem to be the most important habitat for grizzlies in northern Unit 25. Observations suggest that areas with suitable substrates for den sites are limited and this could prove to be a critical habitat factor. In the southern part of the unit, specific habitat requirements are not known.

### **WOLF**

Wolves inhabit all of Unit 25. Their numbers have varied historically as a result of variations in production, natural mortality, and hunting. Throughout much of the unit their major prey species are moose and caribou, but sheep are also important in the Brooks Range. Moose probably are the most important prey species in the unit as a whole.

### **Populations**

Absolute numbers of wolves in Unit 25 are not known. In relative terms, the population is moderate to high at this time, but in the past it has varied from low to high. The recorded kill of wolves has ranged from 25 to 145 since 1961-62, with the high in 1967-68.

### **Specific Habitat Considerations**

Primary needs for wolves in Unit 25 are similar to those in other parts of the state, and include adequate prey populations and cover. Welfare of prey dictates welfare of wolves.

### **WOLVERINE**

Wolverines are found throughout Unit 25. Their distribution probably has not changed substantially for hundreds, perhaps thousands, of years.

Moose, caribou and sheep remains constitute the primary diet of wolverines. Moose are probably most important throughout most of the unit.

Population levels are poorly known. In relative terms, wolverine populations vary from low to moderate in Unit 25.

Maintenance of suitable habitat for support of food species is the prime need for wolverines.

### **BARREN GROUND CARIBOU**

Porcupine Herd: See Unit 26.

### **DALL SHEEP**

Brooks Range: Game Management Units 23, 24, 25 and 26

This discussion relates to sheep throughout the Brooks Range, which includes parts of Game Management Units 23, 24, 25 and 26.

Little specific information is available concerning the historic use and abundance of Dall sheep in these mountains. Eskimos of Kaktovik, Pt. Barrow, Pt. Hope, Kivalina, Noatak, Kobuk and Anaktuvuk Pass and Indians

from Allakaket, Arctic Village, and Venetie utilized sheep at times throughout the range for subsistence. Present utilization of sheep for subsistence purposes is limited to a very few areas. Anaktuvuk Pass and Kaktovik residents occasionally take sheep, and while it is not likely that they have any significant effect on sheep populations over a large area, localized reductions may occur. Historic use of sheep for food by miners certainly did occur but presently is nonexistent or very limited. In the Brooks Range, market hunting is not known to have occurred in the past and does not occur at present. Sport hunting by both residents and nonresidents has increased since the 1940's. Presently, approximately 200 hunters harvest 120 sheep each year. The trend in number of hunters and sheep harvest will probably continue upward. Because of 3/4 curl rams have been legal game, the only obvious population change due to hunting has been lower percentages of legal rams in the herd. Photography and hiking in the Brooks Range are becoming more popular each year, with Da sheep one of the attractants for this type of use.

### **Populations**

Little specific information is available concerning distribution and abundance of sheep in this mountain range. Logistic problems have prevented the Department of Fish and Game from conducting thorough surveys comparable to those in the Alaska Range. One survey done in May, 1970 in the Atigun and Dietrich River drainages counted approximately 2,200 sheep: 1,375 on the south slope and 825 on the north slope. Many reputable sources report sheep as being abundant throughout the range. More survey and inventory work is needed in this area.

### **Land Use Considerations**

Research in the Alaska Range has shown that sheep spend a major portion of the early summer utilizing natural mineral licks. Some mineral licks have been located in the Brooks Range and it is likely that they occur throughout the range. The specific functions of these licks are uncertain but they are probably important in the ecology of Dall sheep. Future land use decisions should consider the importance of these licks and the trails leading to them. Sheep summer and winter ranges are often separated by several miles, and specific routes are traditionally used by sheep moving between the ranges. These movement routes should be determined and considered in any future land use decisions.

Winter ranges of sheep throughout the range are critical and limited, and should be considered in any future land use decisions.

## **MOOSE**

Moose are long-time residents of Unit 25. Athabascan residents have long lived in the area in considerable numbers, and have traditionally depended heavily upon moose for food and domestic materials. The earliest accounts of explorers and traders noted the importance of moose for food and clothing. While fire and other natural factors have affected moose distribution locally from time to time, overall distribution today is probably little changed from prehistoric times.

Moose are present throughout the unit. Concentrations occur seasonally in preferred habitat, such as riparian willow stands, old burns, alpine-subalpine areas and wet flats in spring. In foothills and mountains of northern Unit 25, valleys supporting willows become increasingly important as other suitable habitat becomes less available.

### **Populations**

Moose populations in Unit 25 range from low to high, depending upon the area. The number of moose inhabiting the Yukon Flats was estimated at 3,000 to 6,000 in 1961 by the U.S. Fish and Wildlife Service during studies of

the proposed Rampart Dam impoundment area.

Extreme snow depths can materially affect moose survival here as elsewhere in Interior Alaska. Reported harvests range from 53 to 108. Actual harvests are on the order of 700 to 800 moose annually.

### **Specific Habitat Considerations**

The habitat types of major importance to moose throughout Alaska are equally important in Unit 25. As in portions of other Interior units, scattered willow and birch in black and white spruce stands sustain low density moose populations over large areas.

During the 1962 Rampart Dam studies, 500 square miles were classified high density moose areas, 3,500 square miles were medium density, and 6,000 square miles supported low moose densities. These proportions reflect the relative scarcity of high quality moose winter range.

## **WATERFOWL**

### **Populations**

Breeding duck surveys indicate over 100 ducks per square mile on the approximately 10,800 square miles of Yukon Flats habitat. The flats are one of North America's best known waterfowl production areas and perhaps the most productive single segment of Arctic habitat on the continent.

The most recent Fish & Wildlife Service estimate puts the fall flight at over 3.5 million ducks. Other breeding habitat in the unit, located in streams, valleys and rolling hills, also produces ducks, white-fronted and Canada geese. Duck production is assumed to be 1.0 young produced per adult in the unit.

Primary species of ducks include lesser scaup, American widgeon, mallard, pintail, white-winged scoter, green-winged teal, shoveler and canvasback. Over 20 percent of the fall flight of canvasbacks in North America is estimated to come from the Yukon Flats. Other breeding birds include gadwall, American goldeneye, redhead, bufflehead, surf scoter, old squaw, harlequin, red-breasted merganser, blue-winged teal, trumpeter swan, Canada geese, sandhill crane (10,000 estimated population), loons and grebes. White-fronted geese and harlequin ducks breed mainly on small brushy streams above the flats while Canada geese use river bars and islands. Snow geese are common spring migrants.

Many of the larger lakes such as Ohtig and Canvasback Lakes support large flocks of molting adult ducks and serve as pre-migration fall staging areas. For example, one midsummer banding operation on Ohtig Lake resulted in over 10,000 ducks captured in a single drive.

### **Land Use Considerations and Recommendations**

In the mid-1960's, the Yukon Flats gained national attention because of the proposed Rampart Canyon Dam which would have inundated the entire flats. Although dam construction has been indefinitely postponed, the entire flats is under a federal power withdrawal. The Bureau of Sport Fisheries and Wildlife is currently trying to acquire the flats for a refuge, which would adequately protect this important waterfowl area.

Fires are common on the Yukon Flats, and lakes and ponds in burn areas are generally more productive than those in climax forest. The Bureau of Land Management is becoming more efficient in fire suppression, but their efficiency could well mean a gradual decline in waterfowl produced. It is recommended that research be conducted to assess fire-waterfowl production relationships. It is also recommended that the state confer with the Bureau of Land Management in an attempt to temper present fire control policies.

Periodic flooding of lakes and ponds on the Yukon Flats appears to be essential to maintaining fertility and productivity of the waters. Dams constructed upstream on the major rivers would probably be detrimental to waterfowl. However, construction of dikes and channels on the flats for positive water level control would increase duck production substantially.

## GAME MANAGEMENT UNIT 26

The north slope of the Brooks Range, the Arctic foothills and the Arctic coastal plain are all included in Unit 26, the largest game management unit in Alaska.

Vegetation composition and distribution are strongly affected by the severe Arctic coastal climate, although this influence is diminished with increasing distance from the coast and increasing elevation. Only a few scattered clumps of trees (primarily cottonwood) are found in the entire unit. Larger species of brushy willows do occur along most drainages. Their distribution is spotty in the foothills and plains, but more consistent in the mountain valleys.

Wet tundra and sedge stands are most common on the coastal plain, where there is little slope and continuous permafrost. Lakes and ponds are exceedingly numerous. The foothill vegetation is generally characterized by vast stands of cotton-grass. Subalpine conditions prevail in the mountain valleys, and alpine tundra persists to about 2,500 ft. elevation.

Eskimos traditionally hunted or gathered food over extensive portions of Unit 26. Most major settlements were along the coast (as they are now), but some groups did occupy the foothills and mountains for long periods. Until the recent development of oil resources began, few white men stayed on the North Slope for any length of time since whaling days.

### **BLACK BEAR**

Black bears are rare occasional visitors to Unit 26.

### **BROWN BEAR**

Brown-grizzly bears historically have been distributed throughout Unit 26 essentially as they are today. Although they range throughout the unit, they spend most of their active season in river valleys where food is most abundant.

General observations and movement studies suggest that highest population levels are in the foothills. Some movement occurs between foothills and coastal plains, but not to the extent previously supposed. Primary foods are grasses and sedges, berries, and carrion, with some predation on moose and caribou.

Denning habitat requirements are poorly known. In the foothills and mountains, observed den sites have been holes and caves, similar to sites used in northern Units 24 and 25. Denning habits of bears on the coastal plain are unknown.

### **Populations**

A study of bear movements in the Umiat-Anaktuvuk River area resulted in a very rough estimate of one bear per 100 square miles. Although this figure is approximate, it illustrates the sparse distribution of grizzlies. Limited data suggest lower reproductive rates among Arctic Slope bears than in Alaska Peninsula brown bears. Relative



population levels appear low to moderate compared with Interior Alaska bear population levels.

Reported harvests since 1961 have ranged from 6 to 23 with the high in 1968-69. Most of these bears are taken by sport hunters. Some unreported kills may occur of “nuisance” bears, bears taken for subsistence use, and some illegal sport hunting kills.

### **Specific Habitat Considerations**

River valleys are clearly important habitat during the active season. Supply of denning areas may be a limiting habitat factor, but this is not yet an established fact.

## **POLAR BEAR**

Polar bears range along the entire coast of Unit 26, but generally remain beyond the solid shorefast ice. Occasionally they may visit carcasses of other marine mammals found in shorefast ice or on the beach.

The only known denning in Alaska occurs on offshore islands and associated shorefast ice from the Colville River east to Brownlow Point, and to a lesser extent from the Kuparuk River to the Point Hope area.

Polar bears move near the Alaska coast in fall as Arctic ice develops, and move north and east again in spring as breakup proceeds. They follow the distribution of ringed and bearded seals and favorable ice conditions for finding and catching these prey.

### **Populations**

Bears found in and near Unit 26 belong primarily to the group, or population, centered north of Alaska, and has minimum interchange with those to the west. Although hunting has depressed the mean age of male bears taken north of Alaska, the population is probably stable.

### **Specific Habitat Considerations**

As in other parts of the polar bear’s range, the integrity of the Arctic marine food chain is of foremost importance.

Developments that alter the bear’s ability to cope with the environment, be they excessive human traffic or accidents of development, would affect bears negatively.

## **WOLF**

Wolves range throughout Unit 26, where their general distribution is probably unchanged from historic and prehistoric times. However, seasonal distribution and distribution during various periods have surely changed in response to seasonal movements and abundance of caribou and changes in distribution and abundance of moose, sheep, and possibly other prey as well. At present caribou are the most widespread and numerous prey available, yet they are absent from many areas for months. Wolves may hunt moose or sheep extensively under such circumstances. Wolves are actively hunted within reach of various communities. Aerial hunting of wolves was permitted until November, 1969, when Unit 26 was closed to aerial hunting by emergency regulation to avoid over-hunting. The unit has not been reopened to aerial hunting.

### **Population**

Wolf numbers in Unit 26 have fluctuated dramatically as a result of natural factors and in some years in response to federal control programs in territorial days and intensive aerial sport hunting since statehood. In the late 1950's and early 1960's, and again in the late 1960's, wolf populations declined. Today wolf populations are again rising in Unit 26. The reported take of wolves has ranged from 45 to 162 since 1961-62, with the high in 1966-67.

### **Specific Habitat Considerations**

Marked growth of wolf populations in Unit 26 from time to time has demonstrated that, given an adequate food supply, wolves are capable of maintaining their numbers. Because much of the unit has little escape cover, wolves are more vulnerable to aerial hunting than they are in most other areas of the state. The potential for growth of both moose and sheep populations in Unit 26 is limited; therefore, the welfare of wolves will continue to be closely related to the welfare of caribou populations.

### **WOLVERINE**

Wolverines range throughout Unit 26. Except in local areas where numbers are reduced seasonally by hunting and trapping, their distribution is probably unchanged from that of prehistoric times. Details of their habits are poorly known, but they are known to be scavengers and sometime-predators just as they are in other parts of the state. Because their fur is highly prized for parka ruffs and for sale, they are actively hunted and trapped near human habitation.

Population levels are poorly known. In relative terms their numbers are moderate throughout much of Unit 26.

Wolverines inhabit and apparently thrive in seemingly the bleakest habitat in Alaska. Their major need is an adequate food supply. In winter they are vulnerable to illegal pursuit by aircraft and snowmachines.

### **BARREN GROUND CARIBOU**

Arctic Herd : Game Management Units 22, 23,24 and 26

Porcupine Herd: Game Management Units 24, 25 and 26

#### **Arctic Herd**

Historic accounts suggest that the Arctic herd, which now occupies much of northwestern Alaska (Units 22, 23, 24 and 26), at one time may have been the large herd traversing the coast south of the Seward Peninsula discussed under Unit 18, or that the Arctic herd was derived from it. The exact relationship is unclear, but caribou were apparently abundant in coastal areas, including the Seward Peninsula north and east of the Colville River, in the early 1800's. Early records from inland areas of northwest Alaska are scarce, but caribou abundance is known to have waxed and waned in various areas, and Eskimo people moved accordingly. Later (in the 1800's), caribou became scarce along the northwest coast, although they were numerous along the upper Colville, Noatak and Kobuk Rivers. That situation soon changed, however, and few caribou were found except on the north coast by the early 1880's. Various shifts occurred during the intervening years, with one area, then another, being deserted or reoccupied. Immigrations by caribou from the east and south complicated distribution patterns, but by the late 1930's a distinct northwestern calving areas along the upper Utukok and Colville Rivers was apparent, and caribou numbers were increasing. The identity of this herd has persisted to the present, based on use of the same calving area over the years.

In most years the Arctic herd winters south of the Brooks Range, often as far as the base of the Seward Peninsula, the middle Koyukuk, and the Ray Mountains, and as far east as the Wiseman area where overlap sometimes occurs with the Porcupine herd. Some also winter on the North Slope in coastal areas. Return to the calving area usually begins in March and follows river valleys and passes through the Brooks Range. Variations in weather

and snow depth cause variation in the progress of spring migration, and calving may occur before the calving ground is reached, as happened in 1962 and again in 1972.

### **Population**

An estimate of 300,000 caribou was made in 1964. In 1970 an aerial photographic census gave a minimum population estimate of 242,000.

### **Specific Habitat Considerations**

Wintering areas, calving grounds and major migration routes are critical habitat areas for all caribou herds. The Arctic herd uses the south slope of the Brooks Range and associated flats from Point Hope to Wiseman for wintering, the upper Colville, Utukok, Ketik and Meade Rivers for calving, and the Noatak, Killik, Alatna, Chandler, John, Anaktuvuk, Koyukuk and Sagavanirktok Rivers for major migration routes. These areas are all important to the Arctic herd.

### **Land Use Considerations and Recommendations**

The critical habitat areas important to the Arctic herd have thus far been protected primarily by their remoteness. Development of oil and other resources throughout the herd's range could change this very soon, however. The proposed Alaska oil pipeline would pass through the eastern portion of the herd's present range. Any restriction the line or associated development might place on caribou movement would prevent the herd from using the easternmost parts of its current summer and winter ranges, and preclude any expansion to the east. The pipeline must be designed to allow free movement of caribou.

Development of oil production facilities at Prudhoe Bay has already restricted summer movements of a small band of Arctic herd caribou using that area. Future more permanent developments must be designed to minimize conflicts with caribou, and must at the very least allow a coastal corridor for east-west caribou migrations along traditional coastal routes.

The calving area in the foothills of the Colville, Ketik, Meade and Utukok Rivers is critical wildlife habitat and should be designated as such. Developmental activities in this area should be restricted to times of the year when caribou are not present, and should not disturb the tussock-type vegetation.

The entire Arctic coastal plain is presently summer range for the Arctic and Porcupine caribou herds, and also has high potential for oil production. Any exploration or development in this area must be achieved in a manner compatible with caribou and their habitat.

### **Porcupine Herd**

The Porcupine herd presently ranges over the eastern half of Unit 26, northern and eastern Unit 25, and the eastern edge of Unit 24. Its range extends nearly to the Mackenzie River in Canada.

Early accounts suggest a large caribou population in northeastern Alaska and adjacent parts of Canada prior to 1900. Considerable shifting occurred in the early 1900's, with a major shift west to the central Brooks Range. During the 1920's and 1930's, two fairly distinct groups persisted, one ranging primarily in Canada and eastern Alaska, and the other ranging the central Brooks Range. The central Brooks Range group may have shifted to the west, because substantial decline in numbers occurred between the late 1930's and early 1950's. Thereafter, caribou numbers in the northeast expanded rather rapidly, perhaps aided by substantial immigrations from the Fortymile herd. It was established in the 1950's that only one calving area existed in northeastern Alaska, and therefore that caribou wintering in northeast Alaska and adjacent Canada comprised one herd, the Porcupine herd.

Calving and wintering areas have been relatively consistent for the last several years. A small portion of the herd has wintered west to the Chandalar Lake-Wiseman area where Porcupine and Arctic caribou may mingle. Most of the Porcupine caribou herd winters in Canada well into the Richardson Mountains, and southward into the Ogilvie Mountains, where contact with Fortymile caribou may occur. Calving usually occurs on the north slope of the Brooks Range south of Barter Island, but considerable variation in time and place occurs year-to-year.

### **Population**

The Porcupine caribou herd's population was estimated at 117,000 to 140,000 in the early 1960's. An aerial photographic census completed in late 1972 suggests the population is now about 120,000.

### **Specific Habitat Considerations**

Wintering areas, calving grounds and major migration routes are critical habitat areas for all caribou herds. The Porcupine herd's calving ground is on the Arctic foothills between the Blow River (in Canada) on the east and the Canning River on the west. Exact location of calving is dictated by snow cover and weather in any given year. Thus the entire foothills region must be protected if the herd's calving grounds are to be maintained. The most important wintering areas and migration routes of the Porcupine herd are in Canada; however, the valleys of the Kongakut, Canning, Sheenjek, Jago, Aichilik, Sadlerochit, and East Fork Chandalar Rivers are important routes through the Brooks

Range for the herd. The Big Lake-Chandalar region and the drainages near Arctic Village are remnant wintering areas today, and once wintered thousands of animals. All these areas must be considered critical areas for present and future animals of the Porcupine caribou herd. The coastal fringe and tidal flats between the Sagavanirktok River and Demarcation Bay are critical post-calving and summer range for caribou harassed by insects. These habitats replace the snow patches and windy ridges used by most other herds for insect-escape habitat, and caribou must have access to them during summer months.

### **Land Use Considerations and Recommendations**

As is true in the range of the Arctic herd, the critical habitats of the Porcupine herd, until now protected by remoteness, are being more and more threatened by northern development. The proposed Alaska oil pipeline impinges upon the western part of the herd's present range, and unimpeded passage of animals must be maintained.

Even more important threats to the Porcupine herd's habitat are the proposed Prudhoe Bay-Mackenzie River gas pipeline and the Dempster highway, currently being constructed between Dawson and Inuvik, in Canada. Both of these structures cross the path of nearly the entire Porcupine herd in its migration between summer and winter ranges, and if either was to prove a barrier, the herd could not survive in its present size or distribution. If constructed, both must be built in such a way as to provide unimpeded passage of caribou. The coastal alternative of the proposed gas line could prove especially harmful if it prevented summering caribou from making full use of the important coastal habitat.

The majority of spring and summer range in Alaska is protected to a great extent by the Arctic National Wildlife Range. Important wintering, calving and migration areas in Canada, however, remain unprotected and are presently the scene of large scale oil and gas exploration activities. Development in these areas must be conducted so that critical habitat areas are undisturbed and caribou movements are unaltered, if this important international resource is to be maintained.

### **DALL SHEEP**

Brooks Range - See Unit 25.

## **MOOSE**

Somewhat conflicting reports exist of early moose distribution in Unit 26. Various observers have stated that moose have recently extended their range onto the North Slope, yet accounts of resident Eskimos indicate they have hunted moose along the Colville River for several generations. Whether or not an actual range extension is involved, moose numbers do seem to be increasing, and more of the available habitat is being used.

Moose are presently found throughout the unit, along drainages supporting willows from the mountains to near the coast. Although moose wander throughout all but the most rugged portions of the unit, they spend most of their time throughout the year in river bottoms with willows.

### **Population**

Limited aerial surveys and field observations indicate the highest moose population densities on the North Slope are in the Colville River-Canning River area. Although willows are available and moose occur in both eastern and western Unit 26, moose are less abundant there than in the central portion of the slope. Reported harvests range from 1 to 38. Actual harvests probably range from 50 to 100 annually.

### **Specific Habitat Considerations**

The most important habitat, and virtually the sole habitat, for moose in Unit 26, is the riparian willow community found in various drainages.

## **MUSKOX**

Muskoxen were reintroduced on the Arctic Slope in 1969, when 52 were released at Barter Island. In 1970, 13 additional animals were released at Kavik airstrip on the Kavik River.

These muskoxen groups have scattered and recombined into several smaller groups. At least six animals wandered into Canada, as far as the Mackenzie River delta, and several were shot there. Another crossed the Brooks Range, and was killed 30 miles above Arctic Village.

Numerous sightings of muskoxen were made by Renewable Resources Consulting Services, Ltd., Alaska Department of Fish and Game, and U. S. Fish and Wildlife Service personnel during spring, summer and fall, 1972.

There appear to be three major groups of muskoxen in Unit 26 at this time. A group of eight adults and two calves has been seen repeatedly in the Kavik River-Canning River, Tamayariak River area; a group of seven adults and three calves, plus a group of five, probably bulls, have been seen repeatedly in the Sadlerochit drainage, mainly in the Sadlerochit Springs area; and a group of nine adults and one calf, variously seen together or split into a group of six adults and a group of three adults plus a calf, have been seen in the Aichilik River area. Apparently a total of 29 adults and six calves are present at this time.

Because the groups seem to be maintaining their integrity and because a number of calves have been born, there is some promise that this transplant will be successful.

## **BEARDED SEAL, HARBOR OR SPOTTED SEAL, RIBBON**

**SEAL, RINGED SEAL, WALRUS, WHALES - See Unit 22.**  
**WATERFOWL AND SEABIRDS**

**Populations**

Waterfowl populations in Game Management Unit 26 have changed in species composition and relative numbers in recent and historic times. For example, snow geese were once a common nesting species near Point Barrow, but were nearly annihilated by reindeer and reindeer herders. In 1967, however, several hundred molting snow geese and 19 broods were counted between Barrow and the Colville River. Such population fluctuations are not uncommon in high Arctic habitats where many species are at the northern limit of their breeding ranges. Except for species with long life spans, local populations disappear and require pioneering from other populations to be maintained if productivity is as low as it appears. In other words, several “bust” years could reduce or nearly eliminate breeding populations from local or even wide areas of Arctic habitat, perhaps for many years in the case of species with short life expectancies. Therefore, the harsh Arctic climate is indeed a primary factor determining waterfowl distribution and density, as well as survival and productivity, in Unit 26.

Recent estimates derived from surveys by helicopter and fixed-wing aircraft on randomly selected plots indicate much higher waterfowl densities than were previously estimated. These counts in conjunction with ground counts have provided data on visibility error. Data suggest average densities of 16 “breeding” ducks per square mile. Expanded fall flight estimates of white-fronted geese from the unit are between 175,000 and 200,000 birds. Whistling swan populations are estimated at 10,000, with concentrations on the Colville River Delta and Teshekpuk Lake area.

Possibly two-thirds of the bird fauna of the Canadian Arctic islands follow the Alaska Arctic coast during fall migration. These species include black brant, old squaw, gulls, eiders and shorebirds. The westbound migration flight near Barrow from mid-July to early September was estimated in 1953 to be nearly 800,000 waterfowl, largely king and common eiders. Another study estimated that 1,108,000 eiders used the Beaufort Sea migration route. This latter estimate included the juvenile portion of the flight, which takes place largely in September and was not included in the other estimate. Because black brant and old squaw migrations along the Arctic coast occur in September, estimates of their numbers are rather crude. One count showed 1,545 old squaws from August 31 through September 7, a figure which extrapolates to nearly 21,000 total old squaws. The following list presents data on known seabird colonies in the unit. Undoubtedly more colonies exist than are recorded here.

**Description of Seabird Colony**  
**Game Management Unit 26**

<u>Map No.</u>	<u>Colony No.</u>	<u>Name</u>	<u>Species Present</u>
138	(not shown)	Cape Beaufort	See Unit 23 species

**Land Use Considerations and Recommendations**

Oil pollution is a continuing threat to the wildfowl and seabird resource of the Arctic Slope. Effects of crude oil upon seabirds are well documented and no further discussion is needed here. Continued vigilance of land use practices is recommended not only for the prevention of oil spills, but also for the control of waste disposal and road construction. Birds nesting along the narrow Arctic coastal fringe have demanding ecological requirements in a delicate habitat and require consideration in the planning and development of roads and pipelines near these areas.

A damsite proposed by the U.S. Army Corps of Engineers and the Bureau of Reclamation on the Colville River near Umiat could eliminate hundreds of square miles of waterfowl habitat.

The state should establish a special waterfowl management area from Teshepuk Lake north to the coast and between Smith and Harrison Bays and south along the coast from Cape Halkett down to and including the Colville River Delta. This would protect a large waterfowl breeding and molting area.

The entire estuarine coastal habitat, including the barrier islands, is susceptible to gravel removal operations, oil exploration and other activities, and protection of waterfowl habitat should be prominently considered in any plans to exploit these nonrenewable resources.

The seabird colonies of Cape Lisburne (see unit 23) and Cape Beaufort deserve special protection.

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