COUGAR--HUMAN ENCOUNTERS:

A SEARCH FOR THE FACTS

by

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ABSTRACT

Washington State is the home of North America's largest feline carnivore, the cougar, *Felis concolor*. This species is difficult to study because of its secretive, solitary and nocturnal nature which gives it an air of mystery and fosters fear. The cougar was thrust into the public limelight two years ago when Initiative 655 was passed by Washington voters. The Initiative banned the use of hounds for hunting cougar and several other species.

Populations have increased since the bounty days before cougars were given game status and management protection. Increases in mountain lion sightings and encounters have raised the question whether the increase is due solely to the two year old ban on hound hunting.

The topic of cougar-human encounters is complex and varied. The issues include human population growth, habitat destruction and fragmentation, social and political views on carnivores, intolerance, and people's fear due to misinformation regarding cougars and their behavior.

Cougar biology, population dynamics and cougar management in twelve states and two Canadian provinces (British Columbia and Alberta) were analyzed for this report. This review found that increases in cougar sightings and encounters are greatest in areas of rapid human population growth where intrusion into cougar habitat occurs. The analysis further determined that cougar attacks are rare and with proper safeguards and knowledge of cougar behavior people can learn to co-exist with cougars.

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INTRODUCTION

In November 1996, Washington voters passed Initiative 655 which stated in part:

> (2) Notwithstanding RCW 77.12.240 or any other provisions of law, it is unlawful to hunt or pursue black bear, cougar, bobcat or lynx with the aid of a dog or dogs (emphasis added).

With the passage of this initiative, Washington became the third state to ban the use of hounds to hunt black bears, cougars, bobcats and lynx, following California in 1971 and Oregon in 1994. Conservation and animal protection groups in other states in the West are also looking at putting similar initiatives before voters.

One of the most controversial and challenging conservation issues is carnivore conservation. Large carnivores (e.g. wolves, *Canis lupus,* grizzly bear, *Ursus arctos horribilis*, and the cougar, *Felis concolor*), have been among the most persecuted of all North American animals (Clark et al. 1996). However, with increased public awareness and education, many people are taking a closer look at the importance of carnivores in a healthy ecosystem. This change in attitude from treating carnivores as vermin to be extirpated, to important and necessary components in a healthy ecological system, is showing up in the form of laws to protect and ensure their existence.

The passage of this initiative has thrust Washington State's top wild large feline predator, the cougar, *F. concolor*, also known as the mountain lion, puma, panther and catamount, into the public limelight where it has become a controversial political animal. It is important to note that Initiative 655 did not ban the hunting of cougars; it only banned a particular method used to hunt cougars: the use of hounds to track and tree these animals.

Although this change in the law has been in effect for only two years, reports of cougar populations exploding and increased cougar sightings have heightened the public's fear for its safety. This paper will look at cougar biology, management history, and interactions with humans in order to answer the question: Is the increase in human-cougar encounters a direct result of the ban on using hounds to hunt cougars? It is hoped this research will assist the public in understanding cougar history, population dynamics and methods for living with this species.

METHODS

I examined over 200 articles and books in the published literature and conducted interviews with wildlife biologists in order to evaluate cougar history, population dynamics, management practices and public education programs in twelve states and two Canadian provinces.

HISTORY

Ancestral cougars, *Felis inexpectata*, occurred in North America from the Blancan to the Irvingtonian period during the Pleistocene epoch, three to one million years ago, with modern cougars appearing about 100,000 years ago (Kitchener 1991). During the Pleistocene epoch, there were a number of cougar species, but only *F. concolor* survives today (Busch 1996).

TAXONOMY

One of the first classifications of the family *Felidae* was done by Carolus Linneaus, the father of taxonomy. It was Linneaus who first named the cougar, placing it in the genus *Felis*. There have been disagreements between scientists over how to classify the 37 species of cats that exist today. The main controversy involves the division of the family *Felidae* into genera and subgenera (Nowak 1991). Each taxonomist had his/her own criteria for classifying the cats (Nowak 1991). Many scientists today divide the cat family into four genera: *Panthera*, the large roaring cats; *Felis*, the smaller purring cats; *Neofelis*, the Clouded Leopard; and *Acinonyx*, the Cheetah (Table 1).

TABLE 1: The Family of Cats:

Panthera ----------	Tiger (*Panthera tigris)*
	Lion (*Panthera leo*)
	Leopard (*Panthera pardus*)
	Jaguar (*Panthera onca*)
	Snow Leopard (*Panthera uncia*)
Felis ----------	Cougar (*Felis concolor*)
	Ocelot (*Felis pardalis*)
	Caracal (*Felis caracal*)
	and 27 other species of *Felis*
Neofelis ----------	Clouded leopard (*Neofelis nebulosa*)
Acinonyx ----------	Cheetah (*Acinonyx jubatus*)

(Hansen 1992).

F. concolor is the most widely used scientific name for the cougar. However, a recent reclassification occurred in 1993 in W. Christopher Wozencraft's, "Classification of the Felidae" (Appendix 1). Under Wozencraft's classification, the cougar is known as *Puma concolor.* This classification is also widely used and has been adopted by the Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES) and the World

Conservation Monitoring Centre (WCMC). This paper will use the classification by Carolus Linneaus, *F. concolor*.

DISTRIBUTION

Cougars once ranged from British Columbia to the Straits of Magellan in South America, and coast to coast from the northern United States and southern Canada southward (Russell 1978). This extensive distribution indicates a plasticity for living in many habitat types and for utilizing a variety of prey species (Hopkins 1984).

The cougar is widely distributed throughout its current range across North and South America (Figure 1). They have been extirpated from most of eastern North America and population figures for South America are incomplete. It is estimated that there are 27-30 subspecies scattered across North and South America, depending on which taxonomic list is used (Table 2).

HISTORICAL RANGE

CURRENT RANGE

FIGURE 1: HISTORICAL AND CURRENT RANGE OF THE COUGAR IN THE WESTERN HEMISPHERE. (Status of Cougar in Mexico, Central and South America is unknown) (Hansen 1992)

TABLE 2: Cougar Subspecies in North and South America:

Cougar (*Felis concolor*) Subspecies	
North America	
F. c. couguar--Eastern cougar	*F. c. browni*--Yuma puma
F. c. schogeri--Wisconsin cougar	*F. c. improcera*--Baja California cougar
F. c. missoulensis--Missoula cougar	*F. c. azteca*--Mexican cougar
F. c. hippolestes--Colorado cougar	*F. c. stanleyana*--Texas cougar
F. c. oregonensis--Oregon cougar	*F. c. coryi*--Florida panther
F. c. vancouverensis--Vancouver Island cougar	*F. c. mayensis*--Mayan cougar
F. c. californica--California cougar	*F. c. costaricensis*--Costa Rican puma
F. c. kaibabensis--Kaibab cougar	
South America	
F. c. concolor--Brazilian cougar	*F. c. acrocodia*--Mato Grosso cougar
F. c. bangsi--Colombian cougar	*F. c. puma*--Chilean puma
F. c. soderstromi--Ecuador cougar	*F. c. cabrerae*--Argentine puma
F. c. discolor--Amazon cougar	*F. c. pearsoni*--Pearson's puma
F. c. incarum--Incan cougar	*F. c. patagonica*--Patagonia puma
F. c. osgoodi--Bolivian cougar	*F. c. araucanus*--Andes puma

(Busch 1996).

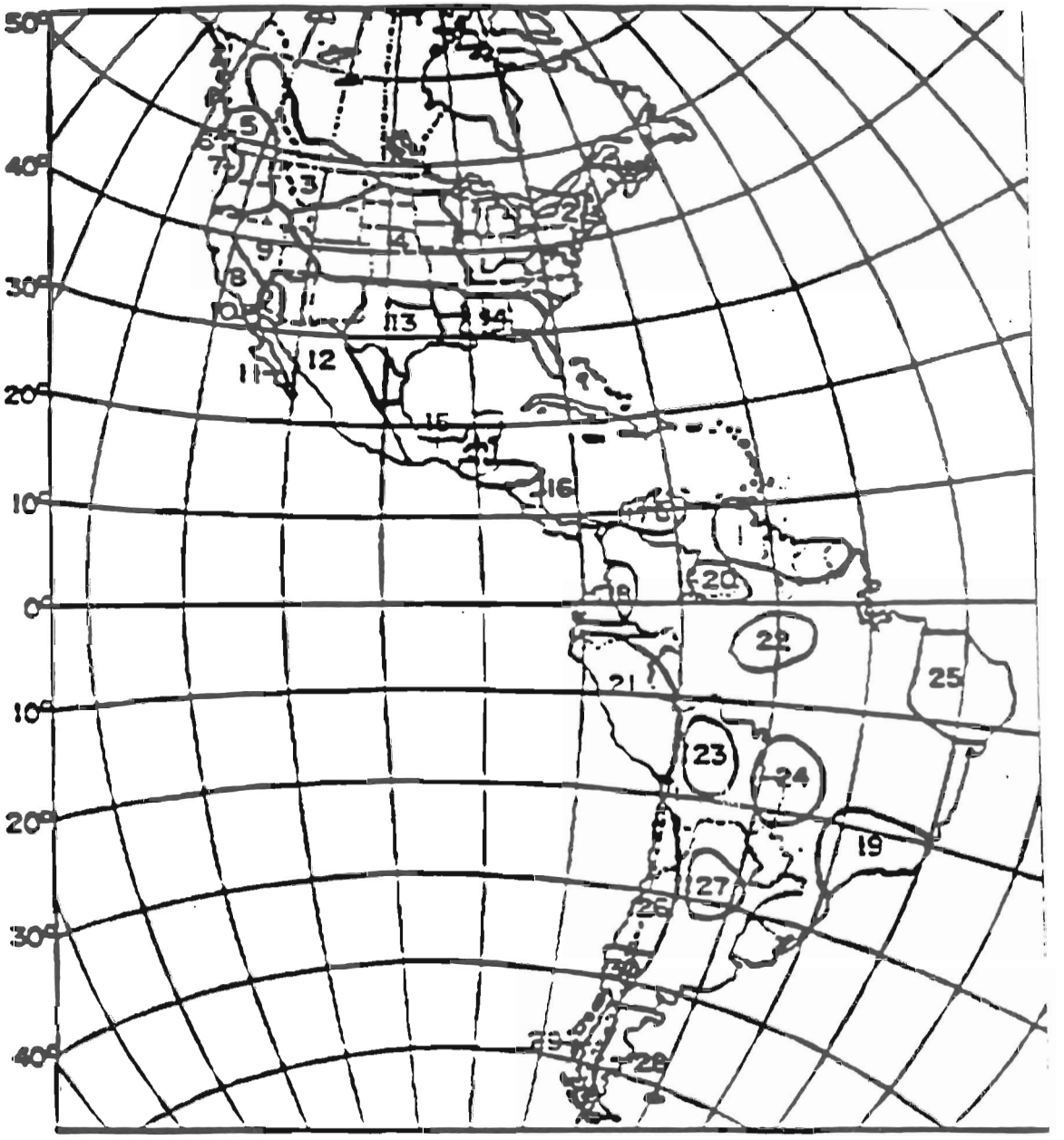
In a review of the literature, Washington's cougar population would be *Felis concolor oregonensis*. However, E. A. Goldman (1946), in his

"Classification of the Races of the Puma, Part 2," lists two subspecies found in Washington: *F. c. oregonensis* and *F. c. olympus*, a subspecies found on the Olympic Peninsula (Figure 2).

HABITAT

The cougar has one of the greatest natural distributions of any mammal in the Western Hemisphere (Nowak 1991). It can thrive in montane coniferous and lowland tropical forests, swamps, grassland, dry brush country or any other area which provides adequate food and cover. In studies conducted in the remote wilderness area in the Idaho Primitive Area, (now known as the Frank Church River of No Return Wilderness Area), researchers found that cougars preferred steep, rocky areas covered with dense stands of Douglas fir and ponderosa pine, with sagebrush and grasslands mixed among the bluffs and talus slopes (Hornocker 1970; Seidensticker et al. 1973). In the Bighorn Mountains of northern Wyoming, researchers found similar results. Cougars frequented canyonland habitats with steep, rugged slopes (greater than 45 degrees) containing a mix of conifer and brushy mountain mahogany cover. Grasslands and sagebrush areas with gentle slopes (less than 20 degrees) were generally avoided (Hansen 1992). Cougars normally avoid large open spaces where there is insufficient cover. Suitable cougar habitat is a combination of vegetation, topography, prey numbers and prey vulnerability (which depends on both stalking and escape cover).

Persecution, habitat loss and reduction in prey species have brought both the Eastern cougar, *F. concolor couguar*, and the Florida panther, *F. concolor*



1. *F. c. concolor*
2. *F. c. couguar*
3. *F. c. missoulensis*
4. *F. c. hippolestes*
5. *F. c. oregonensis*
6. *F. c. vancouverensis*
7. *F.c. olympus*
8. *F. c. californica*
9. *F. c. kaibabensis*
10. *F. c. browni*
11. *F. c. improcera*
12. *F. c. azteca*
13. *F. c. stanleyana*
14. *F. c. coryi*
15. *F. c. mayensis*
16. *F. c. costaricensis*
17. *F. c. bangsi*
18. *F. c. soderstromi*
19. *F. c. capricornensis*
20. *F. c. anthonyi*
21. *F. c. incarum*
22. *F. c. borbensis*
23. *F. c. osgoodi*
24. *F. c. acrocodia*
25. *F. c. greeni*
26. *F. c. puma*
27. *F. c. cabrerae*
28. *F. c. pearsoni*
29. *F. c. patagonica*
30. *F. c. araucanus*

FIGURE 2: DISTRIBUTION OF MOUNTAIN LION SUBSPECIES IN AMERICA (Goldman 1946)

coryi, near extinction. Both are listed as endangered. There are less than 50 Florida panthers remaining. The Eastern cougar was thought to be extinct, but recent cougar sightings in northeastern Canada and the United States have scientists hopeful there is still a small, remnant population which may have survived.

REPRODUCTION

Cougars can reproduce on a year-round basis (Sweanor 1992; Ross et al. 1992), although most births are reported to occur in the warmer months of April-September in their northern range (Robinette et al. 1961; Eaton and Verland 1977; Ashman et al. 1983; Lindzey 1987). Both sexes are sexually mature at 24 months, with females sometimes becoming sexually mature at 20 months (Lindzey 1987). The time of first breeding probably depends on when a female is able to establish her territory (Hornocker 1970; Seidensticker et al. 1973). Logan et al. (1986) found that females entered the breeding population at age 3-4 years in their hunted study population in Wyoming.

Females in stable populations rarely breed with more than one male during estrus (Hemker et al. 1984). Estrus is approximately eight days and the estrus cycle of female cougars is 23 days (Hansen 1992) with a gestation period of 91.9 $\pm$ 4 days. Litter size varies from one to six, but the average is 2.2-2.7 (Anderson 1983; Ross et al. 1992). Lindzey (1987) reported that first litters may contain only one kitten, which enables a new mother to develop her parenting skills.

Newborn cougars, called kittens or cubs, are born weighing slightly more

than a pound and are buff brown in color (Anderson 1983). Their eyes and ear canals are closed, their coats are covered with blackish brown spots and their tails are dark ringed. This color pattern provides excellent protective camouflage. Kittens begin nursing within minutes after birth and gain weight rapidly. At two weeks of age the kittens' eyes and ears are open and they are able to walk. Within 20 to 30 days the kittens may weigh over two pounds (Hansen 1992).

While suckling her young, the mother must occasionally leave the den to hunt. This is the time of her most restricted movements, but she must hunt to sustain herself and replenish her milk. The kittens are weaned at two to three months but are dependent on their mother for food until they disperse.

The interbirth interval, which ends when the last litter disperses, can be one year (Robinette et al. 1961) but more generally is 18-24 months (Lindzey 1987).

DISPERSAL

The departure of young cats from their mother's home range is called *dispersal*. Dispersal is normally initiated by the mother leaving the cubs 0-3 kilometers (km) from an edge of her home range while she moves to or just beyond the opposite edge of her home range, remaining there for 2-3 weeks (Beier 1995). The age of dispersal in Beier's (1995) study ranged from 13.5 months to 22 months, with an average of 18 months. Dispersal typically occurred in the spring months of April, May and June in Alberta, Canada (Jalkotzy et al. 1992), but year around in California (Beier 1995).

Dispersal is a time when the young cougars are especially vulnerable. They expose themselves to the dangers of finding and taking prey, and no longer have available the alternative food source provided by their mother. Since their hunting skills are limited, they risk injury while catching prey, and are vulnerable as well to injury or death from cougars and other predators, including humans. Since they are looking to establish their own territory, these young cougars often end up, even for a short period of time, in marginal habitats, including urban, rural areas, greenbelts and parks. They often face lethal removal by control agencies or landowners, even if the cougar has not injured a person. However, due to the close proximity to people and/or children, the potential for harm is still there.

Even in a non-hunted population, mortality is high for dispersing cougars. Beier (1995) conducted a study on the dispersal of nine juvenile cougars in fragmented habitat in the Santa Ana Mountains in Southern California. Cougar dispersal is important for recruitment into adjacent local populations. As Table 3 sets out, only two of the nine cougars survived to recruit into other populations.

TABLE 3: Dispersal Age, Month of Dispersal, Fate and Distance Traveled for Nine Juvenile Cougars, 1990-92:

Sex	Dispersal age (Month)	Dispersal Month	Fate	Dispersal Distance (km)
F	20	September	Died (natural cause)	48
M	18	January	Died (disease)	19
M	19	August	Died (vehicle)	69
M	19.5	August	Recruited	75
M	19.5	April	Recruited	56
M	18.5	December	Died (vehicle)	77
M	22	March	Died (vehicle)	66
M	17	January	Died (shot)	69
M	13.5	September	Died (natural cause)	75

(Beier 1995).

In an Alberta, Canada study, the fates of eight of 11 cougars that dispersed from their maternal home ranges were recorded. Five of the eight were shot within 25 km and 150 km from their maternal home ranges: two, a male and female, were shot as subadults, while three were shot at 2 years 8 months, 3 years five months, and 5 years 6 months of age, respectively. Of the remaining three cougars, two females died of natural causes as subadults, and only one cougar subsequently established a home range (Jalkotzy et al. 1992).

HOME RANGE

While cougars are not territorial in the classic sense, i.e., they do not defend an exclusive area against all cougars, they are attached to their homes. Within cougar habitat, adult cougars space themselves out and confine their movement to individual fixed areas. These areas are known as *home ranges*. These areas include hunting areas, water sources, resting areas, lookout positions and denning sites where young can be safely reared. Cougars without a home range generally do not breed.

Male cougars will usually overlap several females' home ranges. In most cases, male home ranges will not overlap, but female home ranges do. It is not unusual for female cubs to establish home ranges contiguous with their maternal home ranges (Jalkotzy et al. 1992).

There is a feline social hierarchy consisting of three classes of animals: resident adult males and females, transient males and females, and dependent offspring of resident females (Hansen 1992). Resident adults maintain established home ranges and do most of the breeding in a population. Transients constantly move through homes ranges of residents in search of a vacant home range of their own. Transients are approximately 18 to 24 months old and have left their mother's home range, but have not established their own home range. They are

also known as emigrants and dispersers.

The size of an animal's home range is a function of the abundance, distribution and vulnerability of the prey, topography, climate and a variety of other factors, including body size. Male cougars are 1.5-2 times larger than females and have larger home ranges.

Sex differences in home range size, however, may be related to factors other than body size. The size of a female's home range must be large enough to provide for the nutritional needs of herself and her offspring. While she is likely to have metabolic requirements similar to the large males due to the cost of reproduction and parental care, the female will also have a reduced foraging radius because she must frequently return to her cubs. These constraints may explain her smaller, but more intensive use of a home range (Hopkins et al. 1986). Table 4 summarizes home ranges found in studies conducted in seven states and two Canadian provinces and shows the difference in the size of home ranges between male and female cougars.

TABLE 4: Average Home Ranges From Various Cougar Studies:

HOME RANGE

Mean home ranges (square kilometers) of both male and female cougars from seven states and two provinces of Canada from radio telemetry and mark-recapture studies.

State/ Providence	Year	Season	Male	Female
Alberta[1]	1981-89	Winter	204	97
		Summer	314	87
		Annual	334	140
Arizona[2]	1972-73	Winter	189	67
British Columbia[3]			151	55
California[4]	1978-82	All Year	82	71
			88	62
			105	70
			355	
			301	
Idaho[5]	1970-71		453	268
		Winter		8
				32
				20
Nevada[6]	1972-73	All year	211	
	1975-78	All year	480	142
	1978-79	Varied by cougar	222	79
New Mexico[7]	1975-77	All year	182	
	1976-78			122
Utah[8]	1979-81	Nonwinter	573	232-556 ($\bar{x}$ 347
		Winter	503	100-421 ($\bar{x}$ 236)
				190
Wyoming[9]	1981-83	All Year	370	54
			269	67
				91
				57

Sources: [1]Spreadbury, 1988; [2]Shaw 1973; [3]Ross et al. 1992; [4]Sitton et al. 1976; [5]Seidensticker et al. 1973, Hornocker 1969; [6]Ashman 1976, 1983; [7]Bavin 1976; [8]Hemker 1984; [9]Logan, 1985, 1986.

DENSITY

Cougar social structure ensures that they seldom overpopulate an area. Home range size and the degree of overlap between home ranges influences the density of a cougar population. In unhunted or very lightly hunted populations, social interactions (Hornocker 1969; Seidensticker et al. 1973) or prey densities (Hemker et al. 1984) may be more important in controlling populations. As Table 5 sets out, different studies in different areas have varying cougar densities. Beier (1993) stated regarding cougar density estimates:

> Because many study sites were selected because of expected high cougar density, some reported densities are atypically high. Also, not all studies report how many of these animals were nonbreeding transients. Cougar carrying capacity must be estimated by numbers of breeding adult males and females, excluding the pool of nonbreeding male and female transients that characterize most populations (Seidensticker et al. 1973). Categorizing all individuals over 1 year of age as adult breeders would lead to overly optimistic predictions.

Therefore, it is important to look at specific cougar populations, habitat, and prey availability in order to adequately assess whether cougars are "overpopulated." It is also important to remember that cougars are recovering from depressed numbers and,

not merely increasing. They are reestablishing populations in many areas since the elimination of bounties and the change in game status.

TABLE 5: Cougar Population Densities Reported in Intensive Studies in North America:

Location	Estimated density[a] (Cougar/100 km2)		Source
	Annual	Winter	
Alberta	2.7 - 4.7 1.5 - 5.9		Jalkotzy et al. (1992) Management Plan for Cougar In Alberta
Utah	0.3 - 0.5 0.37	0.6	Hemker et al. (1984) Lindzey et al. (1994)
Idaho		2.1 - 7.4 2.9	Seidensticker et al. (1973) Hornocker (1970)
California	3.5 - 4.4 1.2 - 2.3[b]		Sitton et al. (1976, 1977)
Colorado		1.7 - 3.3	Currier et al. (1977)
Arizona	3.2 - 3.5		Shaw (1973, 1979)
Nevada	1.4 - 1.6		Ashman (1976); Ashman et al. (1983)
Washington	Unknown		
Oregon	3.0		Oregon Dept. Of Fish and Wildlife (1993)
British Columbia	3.5- 3.7		Spreadbury (1988)

[a]Calculated by dividing the size of the study area by the total number of cougars (including dependent kittens and juveniles) present.
[b]Adults only.

DIET AND ENERGETICS

The known prey of cougars throughout their range includes insects, birds, mice, up to porcupine, capybara, pronghorn antelope, elk, deer, bighorn sheep and moose. Large ungulates, particularly deer, are the cougars' principal prey in North America. Studies on food habitats for cougars in southern Chile found that ungulates made up 68% of the average diet (Iriarte et al. 1991). Mule deer, *Odocoileus hemionus,* are the primary prey in Oregon, Alberta and Utah, while in Florida white-tailed deer, *O. virginianus*, and wild hogs, *Sus scrofa*, are the preferred prey. Hornocker (1970) found that cougars in the Idaho Primitive Area fed primarily on mule deer and elk, *Cervus canadensis*. In Nevada, the adaptable cougar occasionally augments its diet with wild horses, *Equus caballus,* and desert bighorn sheep, *Ovis canadensis* (Hansen 1992). Moose, *Alces alces*, also are taken by cougar in British Columbia and Alberta.

Cougars are opportunistic predators and also feed on a variety of smaller prey, especially in times of seasonal abundance. Columbian ground squirrels, *Citelius columbianus,* are frequently the cougars' main course during the warmer summer months in Idaho, while peak years of snowshoe hare, *Lepus americanus,* abundance in British Columbia can comprise over one-quarter of the cougars' diet (Seidensticker et al. 1973; Spalding et al. 1971).

In the southern parts of cougar range, and particularly in the tropics, small to medium-sized prey appear to be more important. Studies by Iriarte et al. (1991) suggested cougars' smaller body size in the tropics, and their low rate of predation on larger prey, such as tapirs, *Tapirus* sp., may be linked to interspecific competition with the jaguar, *Panthera onca*.

In Washington, the major prey species include mule deer, white-tailed deer and elk east of the Cascades, and Washington hare, *Lepus washingtonii*, black-tailed deer and elk west of the Cascades (Brittell and Pierce *in* Washington Department of Fish and Wildlife (WDFW) 1997). Other important food sources include the snowshoe hare, *L. americanus*, black-tailed hare, *L. californicus*, white-tailed hare, *L. townsendii*, and porcupine, *Erethizon dorsatum*. Table 6 shows the wide variety of food sources which cougars utilize.

TABLE 6: Prey Items Reported Taken by Cougars:

Large Wild Animals

Mule deer, *Odocoileus hemionus*	Bear, *Ursus* sp.
White-tailed deer, *O. virginianus*	Bobcat, *Lynx rufus*
Elk, *Cervus canadensis*	Cougar, *F. concolor*
Bighorn sheep, *Ovis canadensis*	Coyote, *Canis latrans*
Pampas deer , *Ozotoceros* sp.	Moose, *Alces alces*
Pronghorn, *Antilocapra americana*	Caribou, *Rangifer caribou*
Mountain goat, *Oreamnos americanus*	Huemul, *Hippocamelus* sp.
Peccary, *Pecari angulatus*	Wild boar, *Sus scrofa*
Porcupine, *E. dorsatum*	Beaver, *Castor canadensis*
Badger, *Taxidea taxus*	Armadillo, *Dasypus novemcinctus*
Guanaco, *Lama guanicoe*	

Small Wild Animals

Jackrabbits and Hares, *Lepus* sp.	Meadow vole, *Microtus pennsylvanicus*
Turkey, *Meleagris* sp.	
White-footed vole, *Phenacomys albipes*	Raccoon, *Procyon lotor*
Other rabbits, *Sylvilagus* sp.	Pika, *Ochotona princeps*
Marmot, *Marmota* sp.	Fox, *Vulpes* sp.
Skunk, *Mephitis* sp.	Coati, *Nasua narica*
Ground squirrels, *Citellus, Otospermophilus* sp.	
Squirrels, *Tamiasciurus, Eutamias, Tamias, Sciurus* sp.	
Flying squirrel, *Glaucomys* sp.	Opossum, *Didelphis marsupialis*
Pocket gopher, *Thomomys* sp.	Agouti, *Dasyprocta* sp.
Mountain beaver, *Aplodontia rufa*	Woodrat, *Neotoma* sp.
Ruffed grouse, *Bonasa umbellus*	Cotton rat, *Sigmodon* sp.

Domestic Animals		**Other Items**
Sheep, *Ovis* sp.	Dog, *Canis familiaris*	Grass Berries
Pig, *Sus* sp.	Cattle, *Bos* sp.	Fish Insects
Horse, *Equus caballus*	Goat, *Capra* sp.	Domestic Fowl
Peafowl, *Francolinus* sp.	Rhea, *Rhea* sp.	
Burro, *Equus asinus*	Cat, *Felis catus*	

(Hansen 1992)

When the abundance of their primary prey declines, cougars have been known

to switch their diet. In 1980-81, when the mule deer population crashed in Big Bend National Park in western Texas, cougars were forced to switch to peccaries and lagomorphs, the next largest prey (Hansen 1992).

The diet of a cougar also varies according to its sex and age. Solitary cats seem to consume more small prey than do females with young, while transients focus on smaller prey until they have developed their skills to stalk and kill larger prey.

The frequency of prey kills depends upon several factors:

- Sex and reproductive status
- Size of the dependent young
- Social status
- Abundance of alternate prey
- Rate of spoilage of kill
- Time of year

Many of the studies on food habits of cougars have concentrated on deer and elk since those species are managed for human use and cougars are seen as competitors for the resource. A study in southern Utah (Ackerman et al. 1984) estimated the following kill rates of deer for resident females:

---	Solitary resident female	1 deer per 16 days
---	Resident female with three 3-month old kittens	1 deer per 9 days
---	Resident female with three 15-month-old kittens	1 deer per 3 days

These kill rates are similar to other studies conducted to determine daily consumption rates and annual prey kills of cougars (Table 7).

TABLE 7: Comparison of Annual Kill by Cougars, Derived From Estimated Daily Consumption and From Frequency of Kills:

Source and Area	Estimated Consumption (Kg/day)	Computed* prey biomass killed (kg/yr)	Computed** animals killed (#/yr)	Estimated kill rate (1 animal/ # of days)
Ackerman et al. (1984) southern Utah				Resident female: 1 deer/16 days Female w/three, 3-month old cubs: 1 deer/9 days Female w/three, 15-month old cubs: 1 deer/3 days
Young & Goldman (1946) throughout West				Single adult: 1 deer/ 7 days Female w/cubs: 1 deer/3+ days
Connolly (1949) central Utah				Single adult: 1 deer/9.7 days & 1 porcupine/7.2 days
Robinette et al. (1959) Utah and Nevada	2.3-5.5			Single adult: 1 deer/ 4-10 days
Hornocker (1970) central Idaho	1.8-2.7	860-1300	14-20 deer (@ 64 kg) or 5-7 elk (@175 kg)	Single adult: 1 deer/ 10-14 days
Shaw (1977) central Arizona	1.8-2.7	860-1300	17-25 deer (@ 51 kg)	Single female: 1 deer/10.4 days Female w/cubs: 1 deer/6.8 days

*Daily consumption x 1.3 to include carcass wastage.
**Prey biomass killed divided average prey weight.

In a study conducted by Anderson (1983), 26.7% of 619 cougar stomachs examined in six studies were empty. Cougars exhibit a gorge-and-fast type of feeding behavior and will shift prey selection in response to prey availability. Therefore, cougars may go without eating for days at a time.

There are other variables which dictate the number of prey taken. Spoilage of carcasses in summer may lead to an increase in the number of animals killed. On the other hand, scavenging of winter-killed deer and elk (Ackerman et al. 1984) could reduce the predicted impact of cougars on ungulate populations, as could increased use of unusually abundant small prey such as snowshoe hares (Spalding et al. 1971).

Changes in structure of the cougar population, e.g. caused by intensive harvest, would alter the population's energetic needs, and thus alter the cougar population's impact on prey species. Smuts (1978) showed that harvesting of African lions caused an increase in the number of juveniles, presumably with an attendant increase in energetic demand by the population (Ackerman et al. 1986). Shaw (1982) suggested when stable social systems are disrupted with the removal of resident cougars out of a population, the removal can cause an increase in the population through immigration and establishment of territories by transient cougars.

Female cougars are clearly in an unusual ecological role. Cubs are dependent on the female for longer periods than juveniles of most vertebrate species. With the exception of other large felids, juveniles of most species are able

to obtain a portion of their food within a few months (Ackerman et al. 1986). Although it is rare, cougar cubs may be capable of surviving on their own after 6-9 months; however, they ordinarily rely heavily on the female for their food until 16-19 months of age (Ackerman et al. 1986). Females may hunt as far as 16 km from their kittens and be gone for several days (Hemker et al. 1984).

Needs of a single adult could be met by 1-2 black-tailed jackrabbits, but it would take 7-8 jackrabbits a day to feed a family group with three, 15-month old cubs. Ackerman's (1986) study suggests that, while individual cougars can probably live and support themselves in many areas, an adult female with cubs may be so dependent on large prey that viable, breeding cougar populations cannot exist in the absence of deer-sized ungulates.

Cougars also cache excess food. This enables them to return to the food source for several days, thus expending less energy. In a study conducted by Thompson et al. (1994) in Montana, a cougar was observed feeding on an adult female elk for 27 days. The study estimated the elk to weigh 236 kg. Assuming the unconsumed remains of the elk constituted 30% of its live weight (Hornocker 1970), the cougar consumed approximately 165 kg in 27 days, or an average of 6.1 kg per day. It is unusual for a cougar to consume a kill so slowly, but Thompson et al. (1994) theorized the long period may have been due to low densities of potential competitors for the meat.

MANAGEMENT: BOUNTIES AND HUNTING:

It has taken a long time for the cougar to be viewed as more than vermin. When the Europeans arrived in the New World, they brought an attitude of intolerance for animals which competed with them for land and game.

The first bounty on cougars was established by Jesuit priests in California in the 1500s when they offered natives a bull for each cougar killed (Busch 1996). In 1694, Connecticut offered a bounty of twenty shillings for each dead "catamount." South Carolina's "Act for Destroying Beasts of Prey," enacted in 1695, forced Native American hunters to submit a predator's hide annually or be whipped in punishment. Massachusetts enacted a bounty payment of forty shillings per cougar in 1742 (Busch 1996).

A new perspective on predators began in the 1960s and a limited degree of protection for the cougar began as state and provincial legislatures and wildlife managers in most of the West, shifted cougars' official status from injurious predator to game animal. Alberta, Canada, removed the bounty on cougars in 1964. In the United States, Nevada reclassified the cougar as a game animal in 1965, Washington in 1966, Utah in 1967, California in 1969 and Arizona was the last state to have a cougar bounty and did not remove it until 1970. Table 8 sets out the legal status, hunting and trapping status of cougars in the United States and Canada.

TABLE 8: Legal Status of the Cougar in the United States and Canada:

State/ Province	Legal status	Hunting Season		Trapping Season	
		Yes	No	Yes	No
Alabama	Game		X		X
Alberta	Game	X			X
British Columbia	Game	X			X
California	Specially Protected Mammal		X		X
Colorado	Game	X			X
Florida	Endangered		X		X
Idaho	Game	X			X
Louisiana	Protected		X		X
Manitoba	Protected		X		X
Mississippi	Endangered		X		X
Montana	Game	X			X
Nebraska	Unprotected		X		X
Nevada	Game	X			X
New Mexico	Game	X			X
N. Carolina	Endangered		X		X
N. Dakota	Unprotected	No closed season			

TABLE 8 (continued): Legal Status of the Cougar in the United States and Canada:

State/ Province	Legal status	Hunting Season		Trapping Season	
		Yes	No	Yes	No
Oklahoma	Protected		X		X
Oregon	Game	X			X
Saskatchewan	Protected		X		X
S. Dakota	Threatened		X		X
Texas	Unprotected				
Utah	Game	X			X
Virginia	Endangered		X		X
Washington	Game	X			X
Wyoming	Game	X			X

(Green 1991)

In addition to hunting, cougars are killed under the United States' Federal Animal Damage Control Program (ADC) which was established in 1915. The program was given sweeping powers for "the destruction of mountain lions, wolves, coyotes, . . . and other animals injurious to agriculture, horticulture, forestry, husbandry, game or domestic animals, or that carried disease". Between 1937 and

1977, U. S. federal authorities officially killed over ten thousand cougars, although some claim the actual toll was much higher (Busch 1996). In addition to the federal removal, over two hundred thousand cougars were killed by bounty hunters between 1900 and 1970 (Busch 1996).

Little was known about predator management prior to the 1960s, and the result of large-scale removal of predators was often catastrophic. In the early 1900s, Arizona officials decided to kill off the cougars, coyotes, and bobcats from the Kaibab Plateau in order to "improve the hunting for humans" (Busch 1996). Without the limiting effect of natural predation, the deer population exploded from 3,000 in 1910 to over 100,000 by 1924. The area was soon overgrazed and deer died by the thousands. The cougar did not return for almost fifty years.

COUGAR HABITAT IN WASHINGTON STATE

Cougars occur throughout Washington State except in areas of the Columbia Basin which are devoid of either shrub steppe or forests. The cougar is associated with coniferous forests with a mixture of vegetative types and seral stages providing both abundant cover and abundant prey. In Washington, the greatest concentrations of cougars are located in the Cascade Mountains, Blue Mountains, Okanogan Highlands, the northeastern quarter of the state and the Olympic Mountains (WDFW 1997a).

Population and harvest data for game species in Washington State are analyzed by different geographical areas. WDFW recently developed new

management areas specifically for cougar. These management areas are called *cougar management units* (CMUs). CMUs are based on game management units and ecoregions which were identified using a program developed by the University of Washington (WDFW 1997a). This program determines the location of gaps in the biodiversity of wildlife species and their geographical range and is known as GAP. Nine CMUs were designated by WDFW and Table 10 outlines the units and their boundaries:

TABLE 9: Geographic Description of Cougar Management Units (CMUs) :

UNIT	DESCRIPTION
Coastal	The western boundary is the Pacific Ocean, the northern boundary is the Strait of Juan de Fuca, the eastern boundary is the Hood Canal and Capitol State Forest, and the southern boundary is the Columbia River. All or portions of the Chehalis, Elwha S'Klallam (Port Angeles), Hoh, Jamestown S'Klallam, Makah, Ozette, Quileute, Quinault, Shoalwater, and Skokomish Indian reservations lie within this CMU. The Olympic National Park and the Willapa Wildlife Reserve are also within this CMU.
Puget Sound	The western boundary is the Hood Canal, the northern boundary is the Canadian border, the eastern boundary is the western foothills of the Cascade Range, and the southern boundary is approximately the Cowlitz River. All or portions of the Lower Elwah, Lummi, Muckleshoot, Nisqually, Nooksack, Port Gamble, Puyallup, Skokomish, Squaxin Island, Stillaguamish, Sauk-Suiattle, Suquamish, Swinomish, Tulalip, and Upper Skagit Indian reservations lie within this CMU.
North Cascades	The western boundary is Highway 9 and Highway 203; the northern boundary is the Canadian border; the eastern boundary is the Mt. Baker National Forest, and the Skagit, Snohomish, and King county lines to Snoqualimie Pass; and the southern boundary is approximately the I-90 corridor. The North Cascades National Park lies within this CMU.

TABLE 9 (continued): Geographic Description of Cougar Management Units (CMUs) :

UNIT	DESCRIPTION
South Cascades	The western boundary is Interstate 5, Highway 508, Highway 7 and the Burlington-Northern railroad lines; the northern boundary is the I-90 corridor; the eastern boundary is the Skamania, Lewis, Pierce, and King county lines; and the southern boundary is the Columbia River at the Oregon border. The Mount Rainier National Park and part of the Yakama Indian Reservation lie within this CMU.
East Cascades North	The western boundary is the Mt. Baker National Forest, and the Skagit, Snohomish, King, and Pierce county lines to the Mt. Rainier National park; the southern boundary is the Umtaneum Creek, south fork Manastash Creek, and American River; the eastern boundary is the Methow River to the Columbia River, Colockum Pass, and North Branch Canal; and the northern boundary is the Canadian border.
East Cascades South	The western boundary is the Skamania, Lewis, and Pierce county lines; the southern boundary is the Columbia River at the Oregon border; the eastern boundary is the Yakima River and the Yakama Indian Reservation; and the northern boundary is the Umtanum Creek, South Fork Manastash Creek, and the American River. Most of the Yakama Indian Reservation lies within this CMU.
Columbia Basin	The western boundary is the Methow River to the Columbia River; the southern boundary is Oregon border; the eastern boundary follows the Columbia River north to Trinidad, along the Douglas county line, up the Columbia River and then the Okanogan River; and the northern boundary is the Canadian border.
North-eastern	The western boundary is the Okanogan River; the northern boundary is the Canadian border; the eastern boundary is the Idaho border; and the southern boundary is Highway 174, Highway 2, and Highway 231 east to the Spokane County line. All or portions of the Colville, Kalispell, and Spokane Indian reservations lie within this CMU.

TABLE 9 (continued): Geographic Description of Cougar Management Units (CMUs) :

UNIT	DESCRIPTION
Blue Mountains	This unit encompasses the entire Blue Mountain range in Washington from the Snake River on the north, to the Idaho border on the east, the Oregon border on the south, and the Columbia River to Burbank on the west.

(WDFW 1997a)

The GAP analysis provided WDFW with a habitat inventory which estimated current available cougar habitat in each CMU in the state (Table 10). All forested land was considered cougar habitat, including deciduous forest, coniferous forest, and deciduous/coniferous mixed forest. Forested lands which were devoid of trees due to fire, timber harvest, or some other event, were also considered cougar habitat. Typically these non-forested sites still had an understory of shrubs, grasses and forbs which provide foraging and travel cover, and serve as year-round habitat once the trees grow.

TABLE 10: Cougar Habitat (hectares) by Cougar Management Unit (CMU) in Washington, 1997 (WDFW 1997a):

CMU	Current Habitat[a]	Additional Habitat[b]	Total Habitat[c]	Total as a percent of statewide
E. Cascades North	1,648,221	11,654	1,659,875	19
Coastal	1,433,780	33,126	1,466,906	17
Northeastern	1,499,619	16,850	1,516,469	17
S. Cascades	1,143,562	66,386	1,209,948	14
Puget Sound	991,467	60,943	1,052,410	12
N. Cascades	900,694	26,770	927,464	10
E. Cascades South	568,011	15,451	583,462	7
Columbia Basin	274,306	133	274,439	3
Blue Mountains	158,371	324	158,695	2
TOTALS	**8,618,032**	**231,637**	**8,849,668**	**101**

a Currently forested refers to land currently covered with deciduous, coniferous, or deciduous/coniferous mixed forest in any age or size class and any canopy coverage.
b Additional habitat refers to land normally covered with deciduous, coniferous, or deciduous/coniferous mixed forest that has recently had trees removed through fire, timber harvest, or some other event. These areas are managed as forest land; trees are not permanently removed.
c Percentages may not add up to 100% because of rounding.

COUGAR HUNTING IN WASHINGTON

Washington reclassified the cougar from predator to game animal in 1966 which required hunters to possess a hunting license to take cougar. The cougar season was year-round in western Washington and 244 days in eastern Washington. One cougar was allowed to be taken in most counties, with no limit in four counties (Clallam, Jefferson, Grays Harbor and Mason). In 1973, the harvest limit was set at

one cougar per hunter per year for the state. In 1987, the Washington State Legislature passed a bill requiring hunters to have a cougar tag in their possession before hunting for or killing a cougar. Only those hunters who applied and were drawn for a permit were authorized to hunt that season (WDFW 1997a). Table 11 summarizes the cougar permits in Washington from 1987-1996. Permits available to hunt cougar gradually increased from 170 in 1987 until 1994 when it jumped to 730 and 892 in 1995. Even though the number of permits were increased five-fold, the number of cougars removed during the ten year period did not jump significantly, even with the use of hounds. Hunting seasons are set to maximize hunting opportunities without negatively affecting the cougar population (WDFW 1997a). However, in order to set the number of "harvestable" cougars, it is essential to know what the cougar population is. There is no indication that the cougar population in Washington significantly increased to justify a five-fold increase in the number of cougar permits available in 1994, 1995 and 1996.

TABLE 11: Cougar Permits Issued in Washington From 1987 to 1997:

Year	Permits Available	Permit Applications	Permits Issued	Total permit Harvest
1987	170	803	170	60
1988	210	1,082	210	89
1989	210	1,588	210	85
1990	225	1,790	225	107
1991	235	2,188	235	135
1992	262	2,773	262	156
1993	307	3,230	307	121
1994	730	3,855	365	177
1995	892	5,073	446	283
1996	506	3,970	506	112
1997				132

(WDFW 1997a)

In 1970, WDFW began a mandatory reporting of cougar kills and in 1977 required the inspection and sealing of cougar pelts. This mandatory reporting and inspection allowed WDFW to monitor the number, sex and location of cougars killed. From 1987 to 1996, all permit hunters were required to complete a Cougar Hunting Report. Beginning in the 1998-99 general season, both successful and unsuccessful cougar hunters will be required to submit a game harvest report card to the WDFW (WDFW 1997a).

WDFW uses hunter success rates, hunter effort, hunter efficiency, cougar sex composition and median age, and nuisance cougar complaints to assess cougar populations (WDFW 1997a). However, management of cougars based only on submission of harvest reports by hunters and nuisance complaints does not give an accurate assessment of cougar numbers statewide. Population estimates are only as good as the data which is collected and analyzed. Between 1987 and 1996, return rates of harvest information from cougar hunters ranged from a high of 98% in 1988 to a low of 57% in 1996. Additionally, the number of cougars lethally removed by WDFW personnel and/or landowners due to depredation or public safety, is not consistently documented and submitted for inclusion for statewide mortality figures. Tribal members, who can still use hounds to hunt cougar, are not required to have cougar pelts sealed, and submission of accurate harvest level data by tribal members regarding cougar is minimal. Cougar mortality from natural causes, disease, intraspecific conflicts, kitten mortality, road kills and poaching also need to be included to more accurately assess cougar populations.

In 1994, the hunting season for eastern Washington and western Washington was January 1- 31, in all 1993 permit areas; October 15 to November 22 with hounds not allowed; and November 23 to December 31. Hunters were required to obtain a cougar tag prior to the cougar season . The cougar season did not overlap the general deer and elk season.

When the ban on hound hunting went into effect, WDFW significantly changed and lengthened the hunting season for cougar. In 1997, the cougar permit

season was eliminated and the general season extended from August 1 to March 15, except for closure in three game management units. The general season now overlaps the deer and elk seasons, increasing the opportunity of encountering a cougar. Even without the use of hounds, 132 cougars were killed during the 1997 hunting season (Table 12).

TABLE 12: Cougar Harvest Statistics for 1997 Hunting Season:

CMU	**FEMALE** Hunting Harvest	**MALE** Hunting Harvest	**TOTAL**
Coastal	5	6	11
Puget Sound	7	3	10
North Cascades	7	4	11
South Cascades	8	4	12
East Cascades N.	14	10	24
Columbia Basin	2	4	6
East Cascades S.	3	0	3
Northeastern	22	20	42
Blue Mountains	9	4	13
Total	**77**	**55**	**132**

(WDFW 1997b)

ADDITIONAL MORTALITY

Survival rates are commonly used in management programs, but are difficult to estimate for long-lived, secretive mammals occurring at low densities (Lindzey et al. 1988). In addition to sport hunting, trapping and predator control, injuries and death occur within populations from intraspecific killings, injuries suffered during attempts to capture prey, starvation and road mortality.

Problem Cougars: Washington State does not normally utilize the U. S. Department of Agriculture's Animal Damage Control (ADC) program for lethal removal of cougars. Removal of cougars for public safety or depredation is done by the WDFW and/or the reporting party. Under Title 77 RCW, Chapter 36, the owner, the owner's immediate family member, the owner's documented employee, or a tenant of real property may trap or kill on that property any cougar damaging private property. In 1995, WDFW and private landowners lethally removed 10 cougars; in 1996, 43 cougars were lethally removed; and in 1997, 47 were lethally removed. Although the number of cougars lethally removed appears to have drastically jumped between 1995 and 1997, the figures are misleading. What has changed is the number of cougars relocated versus cougars lethally removed. In 1995, 14 cougars were relocated, in 1996 eleven were relocated and only 2 were relocated in 1997. The increase in lethal removal numbers shows a change in the method for dealing with problem cougars away from relocation and toward lethal removal.

Illegal Harvest: Poaching also removes cougars from the population, but the

actual number of cougars poached is unknown. Estimates can be made based on game violations; however, accurate numbers of cougars poached cannot be accurately assessed (WDFW 1997a). Not knowing the number of cougars illegally taken from a population can skew population figures toward higher cougar numbers. Different populations may have different poaching pressures, e.g. roaded areas afford poachers with an easier opportunity to find cougars (Neal et al. 1987).

Native American Harvest: Tribal harvest of cougars is not well-documented. The state ban on hound hunting does not affect tribal members. WDFW is continually working with tribes to obtain accurate harvest information but some tribes' data is incomplete and/or are not even submitted to WDFW. Non-tribal hunters can still hunt cougar on reservations with a tribal member using his/her hounds as a guide (Pozzanghera 1998). Cougar populations cannot be properly managed without accurate harvest data from tribal hunters.

Motor Vehicle Mortality: Deaths from motor vehicles are increasing nationwide as more roads are built in and around cougar habitat. From 1979 to 1991, almost 50% of documented mortality of Florida panthers was due to collisions with cars. In California, 22 cougars were killed by collisions between 1971 and 1976. Cougars seemingly do not avoid roaded areas. Hemker et al. (1984), and Barnhurst et al. (1989) suggested that the vulnerability of cougars to hunters increases with increasing road density. As Washington's population increases and road density increases, mortality of cougars due to collisions will also increase.

Natural Causes: Intraspecific mortality, cougars killing other cougars, can

also have a significant impact on a population. Cougars killing cougars have been documented in studies conducted by Sitton et al. (1976), Robinette et al. (1961) and Hornocker (1970). In a study conducted in Sheep River, Alberta, intraspecific killings accounted for 14% of the cougar mortality from 1981-1988 (Jalkotzy et al. 1992). In addition, cougar mortality can be caused by disease, accidental death and unknown natural causes (non-human related mortality). In Washington, the majority of all natural deaths of radio-collared cougars were due to intraspecific killings and injuries sustained while capturing prey (WDFW 1997a).

Cub survival: Although it is illegal to kill a female with cubs in Washington State, the reproductive status of a female may not be obvious. Females may hunt as far as 16 km (Hemker et al. 1984) from their cubs and may be gone for several days. Cougar kittens seldom survive if orphaned before six months of age and are still dependent on their mother until the age of dispersal, which is approximately 1.5 to 2 years of age. Regulations that prohibit killing female cougars with kittens have limited effectiveness: hunters cannot easily recognize these females since young kittens (up to 6 months of age) rarely accompany their mother. Juvenile cougars accompany their mother to kills more often than cubs, however, they are also rarely seen but are still dependent. In a study on detecting female cougars with kittens, conducted in the Boulder, Escalante, and Canaan Mountains in southern Utah, Barnhurst et al. (1989) found kittens age 0-6 months were found with their mother only 19% of the time and juveniles, 7-12 months of age, were found with their mother only 43% of the time. With the new expanded cougar season in Washington State,

August through March, it will be very difficult to determine the mortality rate for cougar kittens. Kittens born in the spring and summer will still be dependent upon their mother for survival during most of the season. If they are orphaned prior to dispersal age, survival of the cubs will be greatly reduced. In a study conducted on female reproductive biology in New Mexico, Sweanor et al. (1997) stated: "Sport-hunting may adversely affect a cougar population by killing the most productive females and/or orphaning cubs."

UNDERSTANDING MYTH AND LEGEND

Rather than concentrating on myth, legend and unsupported data, the public needs to be educated about cougars, their importance in an ecosystem, and how to live with these large carnivores. For the most part, human attitudes have changed regarding predators; mass persecution has ended, and real efforts to manage and preserve these splendid animals have been initiated. The grizzly bear and wolf are protected in the 48 contiguous states and reintroduction of wolves to their former range has begun. The change in attitude toward wolves and grizzly bears has been the result of increased research, and intensive educational programs directed at understanding these animals while dispelling myths. This same education needs to be conducted for cougars, as well as other predators.

COUGAR ATTACKS ON HUMANS IN THE UNITED STATES

One of the biggest myths perpetrated on the cougar is that of indiscriminate killer of livestock and humans. Paul Beier, a scientist dealing with cougars, did an in-depth examination of historical and present records and documented all attacks over a

101-year period, from January 1, 1890 through December 31, 1990 (Beier 1991). The work was updated in 1992 (Beier 1992). Beier searched both scientific and popular literature, including hunters' magazines and newspapers, for reports of unprovoked attacks by wild cougars. An "attack" was defined as an incident in which the cougar bit, clawed, or knocked down a human. Maulings by captive cougars and cases in which a person deliberately approached or harassed a wild cougar were not included.

The following table is a summary of both fatal and non-fatal attacks on humans from 1890 through 1997.

TABLE 13: Cougar and Human Interactions Both Fatal and Non-Fatal from 1890 to 1997:

Fatal Attacks								
			Victim		Cougar			
Month	Year	State	Sex	Age	Sex	Age	Shot	Condition
June	1890	CA	M	7	FC		Y	6
July	1909	CA	M/F	10/Adult			Y	
Dec.	1924	WA	M	13	M	3	Y	1
June	1949	VI	M	7			Y	3
January	1971	BC	M	12	M	12	Y	5
January	1974	NM	M	8	F	3	Y	4
July	1976	VI	F	7	M	2	Y	1
May	1988	VI	M	9	M	4	Y	1
September	1989	MT	M	5	F	1.5	Y	2
January	1991	CO	M	18	M	2-3	Y	
April	1994	CA*	F	Adult	FC	2-3	Y	
Dec.	1994	CA*	F	Adult	M	Adult	Y	
July	1997	CO*	M	10				

VI=Vancouver Island, BC; ALB=Alberta, Canada; FC=female with cubs; Condition: 1=good health and normal body mass; 2 = mass (measure) was normal for age; 3 = mass (estimated) was normal for age; 4 = mass (measure) was below normal for age; 5 = mass (estimated) was below normal for age; 6 = rabid; 7 = cataracts.

* = national park, state park, remote areas or undeveloped recreational area; ** = current information from WDFW DEIS 1997--no other information on cougar listed.

TABLE 13 (continued): Cougar and Human Interactions Both Fatal and Non-Fatal from 1890 to 1997:

Non-Fatal Attacks								
			Victim		Cougar			
Month	Year	State	Sex	Age	Sex	Age	Shot	Condition
Sept.	1916	BC	M	8		2.5	Y	7
			F	11				
May	1934	VI	M	Adult			Y	
May	1935	VI	M	Adult			Y	
January	1951	VI	M	63	F	1.5	Y	4
July	1951	BC	M	29	FC		Y	5
March	1953	VI	M	43		2	Y	2
April	1953	TX*	M	Adult			Y	
June	1953	VI	F	24	F		Y	5
March	1962	ALB	M	6		1.5	Y	5
June	1963	BC	M	6	M	Adult	Y	5
March	1965	BC	M	15	F	Adult	Y	5
October	1966	BC	M	Adult	M	Adult	Y	5
Sept.	1969	VI	M	13			Y	
June	1970	CO	M	2	M	Adult	Y	2

VI=Vancouver Island, BC; ALB=Alberta, Canada; FC=female with cubs; Condition: 1=good health and normal body mass; 2 = mass (measure) was normal for age; 3 = mass (estimated) was normal for age; 4 = mass (measure) was below normal for age; 5 = mass (estimated) was below normal for age; 6 = rabid; 7 = cataracts.

* = national park, state park, remote areas or undeveloped recreational area; ** = current information from WDFW DEIS 1997--no other information on cougar listed.

TABLE 13 (continued): Cougar and Human Interactions Both Fatal and Non-Fatal from 1890 to 1997:

Non-Fatal Attacks								
			Victim		Cougar			
Month	Year	State	Sex	Age	Sex	Age	Shot	Condition
June	1970	BC*	F	50	M	Adult	Y	2
December	1970	BC	M	29	F	2	Y	3
July	1971	NV	M	Adult	F	Adult	Y	3
June	1972	VI*		1			N	
June	1972	VI*	M	25			N	
July	1972	VI	M	8			N	
June	1975	BC	M	8	M	2	Y	1
December	1976	CO	M	14	F	1.5	Y	
June	1977	WA	F	28	M	1.7	Y	4
			F	4				
November	1978	TX*		Child			N	
February	1979	BC	F	9	F	5	Y	4
August	1979	VI	F	4	F		Y	5
May	1981	ALB	M	Child	FC		N	
	1981	VI	M	Adult	F	1.5	Y	

VI=Vancouver Island, BC; ALB=Alberta, Canada; FC=female with cubs; Condition: 1=good health and normal body mass; 2 = mass (measure) was normal for age; 3 = mass (estimated) was normal for age; 4 = mass (measure) was below normal for age; 5 = mass (estimated) was below normal for age; 6 = rabid; 7 = cataracts.

* = national park, state park, remote areas or undeveloped recreational area; ** = current information from WDFW DEIS 1997--no other information on cougar listed.

TABLE 13 (continued): Cougar and Human Interactions Both Fatal and Non-Fatal from 1890 to 1997:

Nonfatal Attacks								
			Victim		Cougar			
Month	Year	State	Sex	Age	Sex	Age	Shot	Condition
August	1982	ALB*	M	9	M	0.5	Y	2
	1983	VI	M	Adult			Y	
April	1983	VI	M	10			Y	
			M	11				
	1983	VI	M	16	M	3	Y	
April	1984	TX*	F	Adult		1	N	
August	1984	TX*	M	9	M	1.8	Y	4
May	1985	VI*	M	12			N	
August	1985	VI	F	10	M	1.5	Y	2
March	1986	CA*	F	5	M	2	Y	1
October	1986	CA*	M	6			N	
April	1987	TX*	F	31	M	1.2	Y	4
May	1988	AZ	F	6	F	1.5	Y	4
January	1989	VI	M	28	F	2	Y	4
April	1989	AZ	M	5			N	

VI=Vancouver Island, BC; ALB=Alberta, Canada; FC=female with cubs; Condition: 1=good health and normal body mass; 2 = mass (measure) was normal for age; 3 = mass (estimated) was normal for age; 4 = mass (measure) was below normal for age; 5 = mass (estimated) was below normal for age; 6 = rabid; 7 = cataracts.

* = national park, state park, remote areas or undeveloped recreational area; ** = current information from WDFW DEIS 1997--no other information on cougar listed.

TABLE 13 (continued: Cougar and Human Interactions Both Fatal and Non-Fatal from 1890 to 1997:

Nonfatal Attacks								
			Victim		Cougar			
Month	Year	State	Sex	Age	Sex	Age	Shot	Condition
June	1990	CO	F	28	FC		N	
July	1990	MT*	M	9	M	1.3	N	4
July	1991	BC	M	2			N	
			F	1.5				
March	1992	CA*	M	12	M	Adult	N	
	1992	WA**	F	5				
	1992	WA**		Child				
Sept.	1993	CA*	F	10	F	1-2		
August	1994	CA*	M	50's	F	2		
August	1994	WA*	M	5	F	1.5	Y	
March	1995	CA*	M	28	F	Adult		
	1996	WA**	M	Adult				

VI=Vancouver Island, BC; ALB=Alberta, Canada; FC=female with cubs; Condition: 1=good health and normal body mass; 2 = mass (measure) was normal for age; 3 = mass (estimated) was normal for age; 4 = mass (measure) was below normal for age; 5 = mass (estimated) was below normal for age; 6 = rabid; 7 = cataracts.

* = national park, state park, remote areas or undeveloped recreational area; ** = current information from WDFW DEIS 1997--no other information on cougar listed.

(Beier 1991, 1992; Torres et al. 1996; Busch 1996; WDFW 1997a)

The table clearly shows that cougar attacks are rare. There have been only 14 fatal attacks and 57 non-fatal attacks over the past 107 years (Table 13). The number of deaths attributed to cougars over the past century is far less than the annual total of people killed by lightning strikes, rattlesnake bites, or bee-stings (Beier 1991). Attacks are especially rare when one considers that cougars forego thousands of opportunities to attack humans. In most cases, cougars were merely seen, or an attack was prevented by the action of the human.

Table 13 also shows that 74.6% of cougar attacks occurred during the spring and summer months by young, inexperienced juvenile cats. This time period coincides with the time when many young cougars leave their mother's home range and set out on their own. Beier (1991) in studying cougar attacks on humans stated: "The data suggest that yearlings and underweight cougars were most likely to attack humans." Juvenile cougars (0-24 months of age) may have difficulty capturing wild prey. The low body mass of most juvenile attackers may be an important factor in attacks on humans (Beier 1991).

Over 63% of cougar attacks are on children. The smaller size of children is similar to that of the cougar's natural prey. Cats are stimulated to attack by smaller objects moving rapidly across or away from their line of travel (Fitzhugh and Fjelline 1997). Children have quicker, more erratic movements compared with adults which make them vulnerable. The vulnerability of children to attacks can be minimized by keeping them within sight of an adult who may not prevent, but can repulse an attack (Beier 1991).

Many attacks have occurred in Canada. Fifty-one percent of the attacks on children have occurred in British Columbia, including Vancouver Island, and Alberta, Canada, where cougars are heavily hunted using hounds. Knut Atkinson (1996), a carnivore biologist with the British Columbia Wildlife Branch stated:

> Many of our attacks, and all of the fatalities, have taken place on the west coast of the island. This is the area where our deer populations are the lowest, due to a combination of poorer habitat, logging, and wolf predation, and where people and their houses are right against the bush. There is no buffer zone . . . Occasionally a child is in the wrong place at the wrong time and we have an attack (83).

Like Vancouver Island, human population growth, destruction of habitat, fragmentation, and increased recreational access to isolated areas are the main reasons for more cougar encounters. Complaints from the public to WDFW also have steadily increased as the human population has increased, and they have not been limited to complaints regarding cougars. Complaints regarding wildlife in general, have increased, especially for deer and elk damage, opossums, raccoons, and bear. In 1995 WDFW received 247 cougar complaints, 495 in 1996 and 563 in 1997. Table 14 shows the number of cougar complaints received in 1996 by the WDFW (final data on 1997 complaints were not available at the time this thesis was completed). The majority of complaints in 1996 (n=313) were sightings or a chance encounter with a cougar (WDFW 1997a).

TABLE 14: Cougar Complaints Reported by WDFW Enforcement Program and the Activity Cougar Were Engaging in for 1996:

County	Confirmed complaints	Encounter Type(a)			Complaint Type (b)			Service Provided (c)		
		S/C	I	A	H	L/P	O	T	L	O
Asotin	6	2	4	0	4	1	1	0	0	3
Benton	4	0	4	0	0	0	4	0	0	0
Chelan	25	18	7	0	19	5	1	0	3	1
Clallam	14	9	5	0	9	3	2	0	1	1
Clark	8	7	1	0	5	2	1	0	0	0
Columbia	4	1	3	0	1	3	0	0	1	2
Cowlitz	9	9	0	0	9	0	0	0	0	3
Douglas	4	4	0	0	3	0	1	0	0	0
Ferry	21	13	8	0	15	3	3	1	4	2
Garfield	2	1	1	0	1	1	0	0	0	0
Grant	1	1	0	0	1	0	0	0	0	0

(a) Encounter type involves three categories: a sighting or chance encounter with a cougar (S/C), an incident involving direct confrontation between a human and a cougar (I), and a cougar attacking a human (A).
(b) Complaint type involves three categories: a human encounter with a cougar (H); a livestock or pet depredation (L/P); or other including cougar entering a crop/orchard, a nuisance cougar, or an injured cougar (O).
(c) Three categories of service were provided by the WDFW for dealing with problem cougar in 1996: the offending cougar was trapped and relocated or an attempt was made to relocate (T); the cougar was lethally removed or an attempted removal was made either by a Department official or through the issuance of a removal permit (L); or other, including using repellents, noise makers, hazing, fencing, referring to a hunter, issuing a preference permit to a landowner, placing cameras for observation, or the cougar was found sick or dead.

TABLE 14 (continued): Cougar Complaints Reported by WDFW Enforcement Program and the Activity Cougar Were Engaging in for 1996:

County	Confirmed complaints	Encounter Type(a)			Complaint Type (b)			Service Provided (c)		
		S/C	I	A	H	L/P	O	T	L	O
Grays Harbor	8	6	2	0	5	2	1	1	0	0
Island	7	7	0	0	3	0	4	2	0	0
Jefferson	17	13	4	0	11	4	2	1	0	0
King	56	33	23	0	31	21	4	12	3	1
Kitsap	2	2	0	0	1	0	1	0	0	0
Kittitas	12	7	5	0	7	3	2	0	2	2
Klickitat	2	0	2	0	0	2	0	1	0	0
Lewis	12	6	6	0	10	2	0	1	1	0
Lincoln	1	1	0	0	1	0	0	0	0	0
Mason	5	5	0	0	4	0	1	0	0	0
Okanogan	26	9	17	0	7	18	1	0	13	3

(a) Encounter type involves three categories: a sighting or chance encounter with a cougar (S/C), an incident involving direct confrontation between a human and a cougar (I), and a cougar attacking a human (A).
(b) Complaint type involves three categories: a human encounter with a cougar (H); a livestock or pet depredation (L/P); or other including cougar entering a crop/orchard, a nuisance cougar, or an injured cougar (O).
(c) Three categories of service were provided by the WDFW for dealing with problem cougar in 1996: the offending cougar was trapped and relocated or an attempt was made to relocate (T); the cougar was lethally removed or an attempted removal was made either by a Department official or through the issuance of a removal permit (L); or other, including using repellents, noise makers, hazing, fencing, referring to a hunter, issuing a preference permit to a landowner, placing cameras for observation, or the cougar was found sick or dead.

TABLE 14 (continued): Cougar Complaints Reported by WDFW Enforcement Program and the Activity Cougar Were Engaging in for 1996:

County	Confirmed complaints	Encounter Type(a)			Complaint Type (b)			Service Provided (c)		
		S/C	I	A	H	L/P	O	T	L	O
Pacific	3	3	0	0	1	0	2	1	1	0
Pend Oreille	31	13	18	0	16	12	3	2	4	0
Pierce	38	23	15	0	16	14	8	5	7	0
Skagit	16	8	8	0	10	6	0	0	0	1
Snohomish	42	31	11	0	21	11	10	4	2	0
Spokane	33	29	4	0	29	4	0	2	0	0
Stevens	32	22	10	0	16	9	7	1	8	0
Thurston	17	9	8	0	11	5	1	2	0	0
Wahkiakum	3	2	1	0	2	1	0	0	0	0
Walla Walla	4	2	2	0	3	0	1	0	2	1

(a) Encounter type involves three categories: a sighting or chance encounter with a cougar (S/C), an incident involving direct confrontation between a human and a cougar (I), and a cougar attacking a human (A).
(b) Complaint type involves three categories: a human encounter with a cougar (H); a livestock or pet depredation (L/P); or other including cougar entering a crop/orchard, a nuisance cougar, or an injured cougar (O).
(c) Three categories of service were provided by the WDFW for dealing with problem cougar in 1996: the offending cougar was trapped and relocated or an attempt was made to relocate (T); the cougar was lethally removed or an attempted removal was made either by a Department official or through the issuance of a removal permit (L); or other, including using repellents, noise makers, hazing, fencing, referring to a hunter, issuing a preference permit to a landowner, placing cameras for observation, or the cougar was found sick or dead.

TABLE 14 (continued): Cougar Complaints Reported by WDFW Enforcement Program and the Activity Cougar Were Engaging in for 1996:

County	Confirmed complaints	Encounter Type(a)			Complaint Type (b)			Service Provided (c)		
		S/C	I	A	H	L/P	O	T	L	O
Whatcom	19	11	8	0	11	4	4	2	1	0
Whitman	2	2	0	0	2	0	0	0	0	0
Yakima	3	1	2	0	1	1	1	0	0	0
Oly Nat'l Park	1	0	0	1	0	0	1	0	0	1
Unknown	1	1	0	0	0	0	0	0	0	0
TOTAL	**495**	**313**	**181**	**1**	**290**	**100**	**68**	**38**	**54**	**20**

(a) Encounter type involves three categories: a sighting or chance encounter with a cougar (S/C), an incident involving direct confrontation between a human and a cougar (I), and a cougar attacking a human (A).
(b) Complaint type involves three categories: a human encounter with a cougar (H); a livestock or pet depredation (L/P); or other including cougar entering a crop/orchard, a nuisance cougar, or an injured cougar (O).
(c) Three categories of service were provided by the WDFW for dealing with problem cougar in 1996: the offending cougar was trapped and relocated or an attempt was made to relocate (T); the cougar was lethally removed or an attempted removal was made either by a Department official or through the issuance of a removal permit (L); or other, including using repellents, noise makers, hazing, fencing, referring to a hunter, issuing a preference permit to a landowner, placing cameras for observation, or the cougar was found sick or dead.
(WDFW 1997a)

Over 62% of the complaints received in 1996 were "sightings or chance encounter" with a cougar. Reports of cougar sightings have been heavily criticized as indices of cougar population trends (Beier et al. 1996; Van Dyke et al. 1986). As

Van Dyke et al. (1987) wrote:

> Indiscreet solicitation of lion sightings by management agencies is an inefficient, inappropriate, and unreliable method of determining lion status . . . sightings alone should never be used for describing cougar distribution and abundance . . . [sightings] should never serve as a basis for describing the distribution or abundance of mountain lions.

Cougar reports by the public are notoriously unreliable. California investigations have found that bobcats, large house cats, coyotes, deer, raccoons, and domestic dogs, especially yellow Labrador retrievers, are often reported as cougar sightings (PDI 1997). In addition, field studies have shown that experienced campers and hunters cannot reliably identify cougar tracks. Only 19% of western deer hunters and 20% of campers, with an average of 21 years of experience, could distinguish a drawing of a cougar track (Appendices 3 and 4) from among other types of tracks (PDI 1997). Finally, auditory reports ascribed to cougars have been found to be noises made by bobcats, domestic cats, and several species of owl (Young and Goldman 1946).

HUMAN POPULATION TRENDS

Starting in the early 1990s, there has been a surge in rural population growth in Washington due to people's desire to have a simpler lifestyle and less stress from urban crime and congestion. This urban flight fueled a demand for more houses to be built in previously undeveloped areas. Due to the continued conversion of wildlife

habitat into housing developments, lands which had supported numerous wildlife species are no longer available.

Table 15 identifies the ten Washington counties with the highest number of cougar complaints. A review of the growth in population and where that growth is occurring in these ten counties shows each has experienced rapid population growth over the past seven years.

TABLE 15: Counties with Highest Number of Cougar Complaints and Population Change:

COUNTY	CONFIRMED COMPLAINTS	POPULATION % CHANGE 1990-1997	NUMBER INCREASE	% POPULATION INCREASE IN UNINCORPORATED AREAS
Pend Oreille	31	25.63	2,285	87.6
Whatcom	19	22.24	28,420	46.5
Stevens	32	20.85	6,452	82.5
Chelan	25	19.04	9,950	52.1
Snohomish	42	18.38	85,572	18.7
Ferry	21	15.97	1,005	90.0
Okanogan	26	15.14	5,050	71.6
Pierce	38	15.03	88,097	**
Spokane	33	13.44	48,567	69.2
King	56	9.21	138,895	**

**Population increase was only in incorporated areas because of annexations and incorporations of cities and towns. (Office of Financial Management--1997 Population Trends)

Total population numbers in the counties in eastern Washington, except Spokane County, first appear to be relatively small. However, the percent of population change shows these counties are also experiencing rapid growth. What is also significant, is the population growth in the eastern Washington counties of Pend Oreille, Stevens, Okanogan, Chelan, and Ferry was in unincorporated areas (Table 15).

In the western Washington counties, Whatcom County had 46.5% of their growth in unincorporated areas. Figures from Pierce and King Counties show a reduction in population in the unincorporated areas and Snohomish County's unincorporated growth appears low at 18.7%. However, from 1990 to 1997, those counties increased the incorporated areas (cities and towns) through an increase in annexations and incorporations. Their population increases are still significant.

Counties with good opportunities for recreation and retirement living are the fastest growing counties (OFM 1997). With an increase in Washington's population, also comes an increase in recreational use of state and federal wildlands where development is limited. With increased access to historic cougar habitat, there is going to be an increase in cougar-human interactions. All of the top ten counties with the highest cougar encounters have large tracts of undeveloped land designated as state or federal forests, wilderness areas and parks used for recreation. The statistics on cougar encounters do not designate whether the cougar encounter was in a residential area or a wilderness area. This

information is important to obtain in order to properly evaluate the number of cougars which are entering residential areas and creating a public safety issue.

EXPLORING CALIFORNIA'S COUGAR HISTORY

When looking at the impacts associated with the ban on hound hunting and cougar-human interactions, a review of California's cougar management is useful since they have had a complete hunting ban on cougars for over 25 years.

In California, cougars were bountied from 1907 to 1963 and state records indicated that 12,461 were killed during that 57-year period (Torres et al. 1996). During 1963-1968, cougars were managed as a non-game and non-protected mammal; take was not regulated and no state records were kept. In 1972, Californians passed a moratorium on cougar hunting. In 1986, cougars were again classified as game mammals. The California Department of Fish and Game recommended regulated cougar hunts, but were challenged in court. In 1990, another ballot initiative, Proposition 117, designated the cougar as a "specially protected mammal". Cougar hunting has not occurred in California since 1972.

California has continued to experience increased human population, habitat destruction, and fragmentation, as well as an increase in cougar populations. As Beier stated: "Five years after shooting every cougar seen, of course there's been an increase in numbers" (qtd. in Lyons 1996). Over the past 24 years, up to 1996, the human population in California has increased to 32 million people and records indicate annual housing development reached a high of 163,000 new, single-unit homes in 1989 (Torres et al. 1996). Population centers have expanded, and

people now live in many previously undeveloped areas. This has caused an increase in encroachment into wildlife habitat. Torres' study concluded that observed conflicts between cougars and humans vary regionally for different reasons. Regional differences include diversity of cougar habitat, prey availability and human impacts. Management goals for cougars in California include: (1) maintaining viable populations of cougars; (2) minimizing conflicts related to public safety, property damage, and other wildlife; (3) protecting important habitats; (4) recognizing their ecological role and value; (5) monitoring populations and conducting research; and (6) improving public awareness (Torres et al. 1996).

California still removes cougars under their cougar depredation policy. Between 1990 and 1996, they removed on average 88 cougars per year for livestock depredation or public safety. Even with a total hunting ban on cougars, the California cougar population, estimated between 4,000 to 6,000, is considered stable and there is no detectable change in population over the last five years (Torres 1997).

WASHINGTON'S NEW COUGAR SEASON

Shortly after Initiative 655 (page 1) was passed, media reports on cougar sightings or encounters stressed the fact that the increase was due to the ban on the use of hounds to hunt cougars. Media reports placed the blame for the increase in cougar encounters squarely on the shoulders of the public for banning the use of hounds. The public was told that without the use of hounds, hunting

cougar would be almost impossible, causing overpopulation of cougars. In an article in the Yakima Herald Republic, on Oregon's debate on whether to reinstate hound hunting, it stated:

> . . . unless hunters are given more of a sporting chance, the state [Oregon] is headed for a deadly confrontation like the one in which a California jogger was killed by a cougar in 1994 (Hall 1997).

On August 22, 1998, The News Tribune in Tacoma, Washington, gave this quote from the Thurston County Sheriff, Gary Edwards: "If you spot a cougar on or near your property, shoot it. I'm not going to wait until they eat some kid to shoot them." Sheriff Edwards went on to state he believed the passage of Initiative 655, passed in 1996, had an effect on the cougar population because of the lack of hunting pressure. Even though the indiscriminate killing of cougars is illegal, the sheriff still advocated this "shoot on sight" policy (Hucks 1998). This type of media hype fuels the public's fear and puts forth inaccurate information. It is clear from a review of California's management history, cougar biology and research on hunted and non-hunted cougar populations, that the information being disseminated is inaccurate.

With Washington's new liberal hunting season, it is very doubtful the ban on hound hunting will be a significant factor in cougar-human interactions. Rather, the real problems are increasing population, encroachment into cougar habitat, habitat loss and fragmentation, and people's intolerance of wildlife. These are the areas which need to be addressed in order to decrease cougar-human interactions.

One common belief concerning cougar-human interactions is that, in order to prevent or eliminate these interactions, you must hunt the cougars "to keep their numbers down". Hunting does not necessarily reduce cougar-human interactions. British Columbia accounts for 48%, of all recorded attacks from 1890 to 1997 (Table 13). The hot spot has been on Vancouver Island where cougars have accounted for 30% of all recorded attacks by animals despite having been hunted relentlessly.

Maurice Hornocker, the founder of the Hornocker Wildlife Institute and, for the past three decades, the dean of cougar research states: "Hunting could solve the problem by annihilating lions completely. We need instead to educate people on how to live with lions." He points to human population growth as the real numbers problem: "All you need to do is fly to Los Angeles and see all the new subdivisions on the finger ridges. Those ridges are wildlife corridors, critical grounds for juvenile cougars to establish themselves and try new behaviors when they leave their mothers. And this is where humans and cougars will most frequently encounter each other" (qtd. in Lyons 1996). Beier puts it more succinctly: "You must accept some risk by living in these shared areas. I accept that risk. I'm irritated that people who move in want to sanitize the West" (qtd. in Lyons 1996).

COUGAR BEHAVIOR DURING ENCOUNTERS WITH HUMANS AND APPROPRIATE HUMAN RESPONSES

The possibility of being attacked by a cougar is still very rare, and definitely

not a "major public safety concern" if numbers are an appropriate measure (Fitzhugh and Fjelline 1997). Even so, the small chance of being eaten by a large carnivore causes fear and anxiety in many people.

To help allay these concerns, it is useful to know that cats, including cougars, are intimidated by anything unusual that is larger, especially taller, than them, and by things that approach rapidly. Positions above a cat are positions of dominance, and those below are positions of subordinance.

Some basic principles of cougar behavior and attacks are: (1) most cougar attacks on humans seem to have been predatory in nature; (2) cats in general are threatened and intimidated by large, strange, objects approaching rapidly and from above; (3) cats are stimulated to attack by smaller objects moving rapidly across or away from their line of travel (Fitzhugh and Fjelline 1997). Fitzhugh and Fjelline (1997) developed the following summary (Table 16) from the works of Leyhausen (1979), Beier (1991), Bogue and Ferrari (1974), Bogue (n.d.), and Fromhold (n.d.), and from discussions with experienced cougar biologists. The table summarizes cougar behavior and recommends appropriate human responses.

TABLE 16: A Summary of Cougar Predatory Behavior and Suggested Associated Human Responses:

Cougar activity	Meaning	Human Risk	Appropriate Response
Cougar far away and moving away	Secretive and avoidance	Insignificant	Keep children where they can be observed.
Cougar > 100 yards away various positions and movements, attention directed away from people.	Indifference	Slight, provided human response is appropriate	Avoid rapid movements, running, loud, excited talk. Stay in groups; keep children with adults. Observe cougar. For agencies, this may indicate future problems if repeated.
Cougar > 50 yards away; various body positions; ears up; may be changing positions; intent attention toward people; following behavior	Curiosity	Slight for adults given proper response. Serious for unaccompanied children	Hold small children; keep older children close to an adult. Do not turn back on cougar; assume standing position on ground, rocks, or large equipment that are above the cougar if possible. Look for sticks, rocks or other weapons and pick them up, using an aggressive posture while doing so. Watch cougar at all times. However, if cougar sits, looks away, and grooms itself, this is not a predatory situation, and you should imitate the cougar, but keep it in peripheral vision. For agencies, consider warning visitors and limiting hiking to groups.

TABLE 16 (continued): A Summary of Cougar Predatory Behavior and Suggested Associated Human Responses:

Cougar activity	Meaning	Human Risk	Appropriate Response
Cougar < 50 yards away; intense staring at humans; hiding	Assessing success of attack	Substantial	All of above steps, plus Place older children behind adults. If a safer location or one above the cougar is available, go there. Do not run. Raise hands and other objects such as jackets above head so as to present image of bulk as high as possible. Prepare to defend yourself.
Intense staring and hiding coupled with crouching and/or creeping towards humans	Moving to attack position	Serious if within 200 yards	Take all the above actions. If possible, move slowly to place large objects such as trees, boulders between yourself and the cougar, but do not lose sight of the cougar. Smile! (Show your teeth). Make menacing sounds; throw things if cougar is close enough to hit.
Crouching; tail twitching; intense staring at humans; ears erect; body low to ground; head may be up	Pre-attack; awaiting opportunity	Grave	Do all of the above and use whatever weapons you have. If you have lethal weapons take careful aim and use them now. Pepper spray may be effective if cougar is close enough and downwind. If you have rocks or other items that can be thrown, do so.

TABLE 16 (continued): A Summary of Cougar Predatory Behavior and Suggested Associated Human Responses:

Cougar activity	Meaning	Human Risk	Appropriate Response
Ears turned so the "fur" side is forward; Tail twitching; body and head low to ground; rear legs may be "pumping" or "treading" gently up and down.	Imminent	Extreme attack; cougar ready to leap	Prepare to defend yourself in close combat. Fight back. Make menacing noises. The attack may happen within seconds. If you have any chance of averting it, it is by acting aggressively toward the cougar. If the distance is too great to use a stick, run rapidly toward the cougar until you can put the stick in its face and eyes. If you lack a stick, run toward the cougar with arms high, making loud noises. Stop before you are within striking distance of its paws. Rapid movements towards the cougar, especially from above it, may still deter an attack. Avoid positions below the cougar; do not turn your back on it.

(Fitzhugh and Fjelline 1997).

CONCLUSIONS AND RECOMMENDATIONS

Humans all over the world have lived in the presence of large, dangerous animals since our time began. We, too, must learn to live with cougars. Cougars have always lived closer to humans than many humans realize. Because of their solitary, secretive, crepuscular and nocturnal nature, they are rarely seen, but are still present.

Cougars represent a link between wildland values and civilization and should be considered a treasured natural and national heritage. Living with the cougar should be considered an honor and a privilege, but one must understand the risks and accept the anxieties that living among large predators generate (Benson 1991).

RESEARCH AND MANAGEMENT: Cougar hunting will continue and hunters can be successful without the use of hounds. However, it is imperative that additional research be conducted on the population status of cougars in Washington State. Cougar populations need to be evaluated on a regional population basis, their management should be biologically motivated and directed to ensure their survival and viability, while minimizing conflicts with humans. Therefore, WDFW should adopt a regional approach toward wildlife conservation that considers the differing status of each cougar population and the feasibility of potential management activities.

It is also mandatory that accurate and corroborated data be collected on cougar and human interactions. As we have seen from previous published literature, public reports on cougar sightings and encounters are notoriously inaccurate. Inflated numbers of phone calls to an agency about cougar sightings or encounters, without verification, only leads to an atmosphere of fear and uncertainty. Additionally, accurate information needs to be compiled dealing with the age, sex and physical conditions of the offending cougar. An effort should be made to collar and relocate cougars, if they have not attacked people. This is

particularly important since many of the cougars that find their way into fringe areas are newly dispersed juveniles who are exploring new areas and looking for suitable habitat to establish their territories. Important data can be gained by monitoring these relocated cougars. How successful is relocating these cougars. When do they establish their own territory. Do they return to fringe and human development areas. A dead cougar reveals very little data.

This author is concerned about the liberalization of the hunting season for cougars without adequate data to justify a hunting season from August 1 through March 15. There is a high probability of mortality of cubs that are not yet able to survive on their own when a female is killed. Those kittens born in spring, summer and fall would probably not survive on their own if orphaned within 9 months of birth. In addition to liberalizing the season, the cost of a cougar tag is now only $5, a very good incentive for deer and elk hunters to obtain a cougar permit. Rather than lowering the fee, the fee should be increased and the money put into cougar research. When asked about the lengthening of the cougar season and the potential impacts on cougar populations, Steve Pozzanghera, WDFW, indicated it was a compromise with the legislature. "WDFW is being pressured from legislators to make the cougar season year round" (Pozzanghera 1998). This would be like going back to the old bounty days and it would be very difficult to monitor and protect cougar populations. Protection and management of wiidlife, especially cougars, should be based on facts and accurate data, not political whim.

Because it is up to WDFW to provide the best scientific data available on

cougar populations, the agency must have sufficient funding to conduct adequate research on cougars on a regional basis to ensure that populations are not adversely affected by the liberalization of the hunting season. It may take several years to determine the impact on a population if a significant number of breeding females and litters are lost. Additionally, accurate data on tribal harvest must be provided to WDFW to adequately evaluate and manage the population. A cooperative management agreement between tribes and the WDFW should be secured to ensure data is gathered, compiled and submitted in a timely manner.

Funding and manpower must be increased to more comprehensively research the cougars' complex biology. These studies need to be for periods of at least five years in duration to gain adequate data. Research needs to address habitat issues, prey availability, age, sex and condition of depredating cougars, and population dynamics.

As mentioned above, reports by the public on cougar sightings, encounters, lost pets, or tracks are poor methods for evaluating cougar populations (Van Dyke et al. 1987). Additionally, other states indicate that field staff inconsistently and incompletely fill out report forms used to document problem activities. Trends in problem activities from the 1980s to 1997, which are based on the old WDFW Form 57, are not accurate (WDFW 1997a). Although it appears there are more cougar encounters, without adequate and corroborated data, the speculation that the cougar population is increasing and cougar-human interactions are increasing due to the ban on hound hunting, is erroneous and deceptive. It is a much more

complex and varied issue and the public needs all the information in order to learn to live with cougars. WDFW needs to accurately record and evaluate the data to ensure that unsubstantiated complaints do not cloud the real issues of habitat loss, human encroachment and expanding human population. A standard reporting policy is needed. This should not necessarily include all reported sightings, but certainly should include field-verified accounts of interactions between humans and cougars. Field case and laboratory necropsy reports should also be included in each incident report (Aune 1991).

HABITAT PROTECTION: Since degradation of their habitat is one of the biggest threats to the cougar, their ecological needs must be factored into any proposed developments in formerly wild back country, and rural areas. This is especially true for residential developments, such as subdivisions and town expansions, recreational development such as golf courses and tourist lodges, and road building intended to provide access for residential, recreational and industrial activities (Hummel et al. 1991). Attention must be placed on direct impacts on cougars themselves, as well as the primary prey species of cougars, deer and elk. As Hummel et al. (1991), states: "When will we finally understand that the status of top predators, such as cougars, indicates how well we are doing in protecting the entire wildlife system. . . ."

Habitat acquisition, enhancement, restoration and protection are fundamental to cougar survival, as well as to their prey base. The following is An Action Plan for Cougar Management and Preservation developed by the Cougar

Foundation and Kevin Hansen (1992) and addresses very important factors. These tenets would be applicable for cougar management in Washington State:

1. Protect large, contiguous tracts of cougar habitat as wildlife preserves. These must be large enough to support healthy cougar populations.
2. Provide funding to acquire habitat and to enhance and restore habitat, including special appropriations, federal funds, and bond acts.
3. Prevent construction of barriers--roads, canals, reservoirs, croplands, or residential developments--that separate cougar populations from portions of their habitat. In those areas where cougar habitat is more fragmented, place land acquisition emphasis on habitat corridors.
4. In areas where there is a decreasing prey base, promote the increase of ungulate numbers as part of an overall biodiversity protection program.
5. Develop incentives to protect private land from development, including acquisitions, and swaps, transfer of development rights, agreements, and easements. Establishing conservation easements and cooperative wildlife protection projects on private wildlands saves tax dollars and can be innovative state/private cooperative ventures. There are many creative programs that provide incentives to land managers for voluntary habitat protection efforts.
6. Restore degraded habitats, and, where appropriate, create new habitat. For example, many eastern states now have large tracts of land no longer suitable for farming that may be able to support cougar

populations.

7. Wildlife corridors, connecting habitat is essential. Linda Sweanor, a cougar researcher in New Mexico states: "It is apparent that fragmented habitat may only support lions on a long-term basis if individuals are allowed to successfully immigrate, hence requiring dispersal from other local populations. To conserve populations of cougars over the long term, adequate habitats must be maintained in an effective patchwork composed of relatively large blocks of wildland reserves interconnected by dispersal corridors." (76).

These recommendations will also help numerous other species of wildlife since habitat destruction and degradation affects all wildlife.

EDUCATION: One of the most important first steps is public education, particularly among the younger generation, in order to preserve cougars for future generations. It is essential that people understand carnivores and how they are an indispensable component of a healthy environment. Coexistence with cougars is possible, but it requires changing our attitude toward the wild animals that share our landscape.

Living in cougar country poses some risk, but it is a manageable one. Part of Florida's success in bringing the alligator back from the brink of extinction was an aggressive public education campaign about the importance of making room for wildlife that some considered dangerous (Hansen 1992).

Education programs do work. Colorado also is experiencing increased

population and cougar-human interactions, especially in the Front Range where human population is intruding into historic cougar habitat (Seidel 1998). The State of Colorado Division of Wildlife conducted a number of public information/education programs, developed a brochure entitled "Living with Wildlife in Lion County" and developed a standardized reporting system. Colorado saw a 30% reduction in cougar-human encounters after the first year of its education campaign (Hornocker 1996). The brochure points out that "with a better understanding of cougars and their habitat, we can coexist with these magnificent animals." The brochure gives a brief overview of cougars: physical appearance, tracks, habitat, hunting and feeding habits, mating and breeding, birth to maturity and recommendations for living in cougar country. Brochures on living with cougars have also been developed for Montana, "Living With Montana Mountain Lions; The Predator Defense Institute developed "Living with Cougars" for Oregon and the Olympic National Park puts out an informational sheet on traveling in cougar country. WDFW has just completed their first informational brochure dealing with cougars which is now available. It is hoped this will be the start of an aggressive education program in Washington. This brochure should be provided to cities, counties, parks, realtors, recreationists, natural resource agencies and any others who may have the privilege of coexisting with our largest feline predator.

It does not have to be an "either them or us" mentality. There will always be cougar and human encounters, and some cougars will need to be removed from

areas where they have caused problems. Many of the cougars that wander into urban areas are young, transient cougars or old cougars who are looking for easy prey. If there is no food for them to eat, they will normally leave the area. Pets are easy prey and, even when not in cougar habitat, they should be under control at all times. The public needs to be aware that pets which roam are also prey for coyotes, eagles and great horned owls; poisoning and motor vehicles collisions also take a toll. Not all pet disappearances are due to cougars.

It is hoped that this thesis will be a catalyst for accepting and embracing cougars as the majestic feline predator which personifies strength, movement, grace, stealth, independence, and the wilderness spirit. The cougar is resilient--but it is vulnerable, e.g. the Florida panther, the Eastern panther, Yuma cougar, Costa Rican cougar. The public needs accurate and non-biased information on cougars in order to coexist with these magnificent creatures.

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Classification of the Felidae

by W. Christopher Wozencraft (1993)

Family Felidae G. Fischer, 1817

Subfamily Acinonychinae Pocock, 1917

Acinonyx Brookes, 1828	
jubatus Schreber, 1776	Cheetah

Subfamily Felinae Fischer, 1817

Caracal	
caracal (Schreber, 1776)	Caracal
Catopuma Severtzov, 1858	
badia (Gray, 1874)	Bornean bay cat
temminckii (Vigors and Horsfield, 1827)	Asiatic golden cat
Felis	
bieti Milne-Edwards, 1892	Chinese mountain (desert) cat
chaus Schreber, 1777	Jungle cat
margarita Loche, 1858	Sand cat
nigripes Burchell, 1824	Black-footed cat
silvestris Schreber, 1775	Wildcat of Africa and Eurasia
Herpailurus	
yaguaroundi Lacepede, 1809	Jaguarundi
Leopardus Gray, 1842	
pardalis (Linnaeus, 1758)	Ocelot
tigrinus (Schreber, 1775)	Oncilla, Little tiger cat
wiedii (Schinz, 1821)	Margay
Leptailurus Severtzov, 1858	
serval (Schreber, 1776)	Serval
Lynx Kerr, 1792	
canadensis Kerr, 1792	Canada lynx
lynx (Linnaeus, 1758)	Eurasian lynx
pardinus (Temminck, 1824)	Iberian lynx
rufus (Schreber, 1776)	Bobcat
Oncifelis Severtzov, 1858	
colocolo (Molina, 1782)	Pampas cat
geoffroyi (d'Orbigny and Gervais, 1844)	Geoffroy's cat
guigna (Molina, 1782)	Kodkod
Oreailurus Cabrera, 1940	
jacobitus (Cornalia, 1865)	Andean mountain cat
Otocolobus Brandt, 1842	
manul (Pallas, 1776)	Pallas's cat
Prionailurus Severtzov, 1858	
bengalensis (Kerr, 1792)	Leopard cat
planiceps (Vigors and Horsfield, 1827)	Flat-headed cat
rubiginosus (I. Geoffroy Saint-Hilaire, 1831)	Rusty-spotted cat
viverrinus (Bennett, 1833)	Fishing cat

Profelis Severtzov 1858.	
aurata (Temminck, 1827)	African golden cat
Puma Jardine, 1834.	
concolor (Linnaeus 1771)	Puma, Cougar, or Mountain lion
Subfamily Pantherinae Pocock 1917	
Neofelis Gray, 1867	
nebulosa (Griffith, 1821)	Clouded leopard
Panthera Oken, 1816.	
leo (Linnaeus, 1758)	Lion
onca (Linnaeus, 1758)	Jaguar
pardus (Linnaeus, 1758)	Leopard
tigris (Linnaeus, 1758)	Tiger
Pardofelis Severtzov, 1858	
marmorata Martin, 1837	Marbled cat
Uncia Gray 1854	
uncia (Schreber, 1758)	Snow leopard

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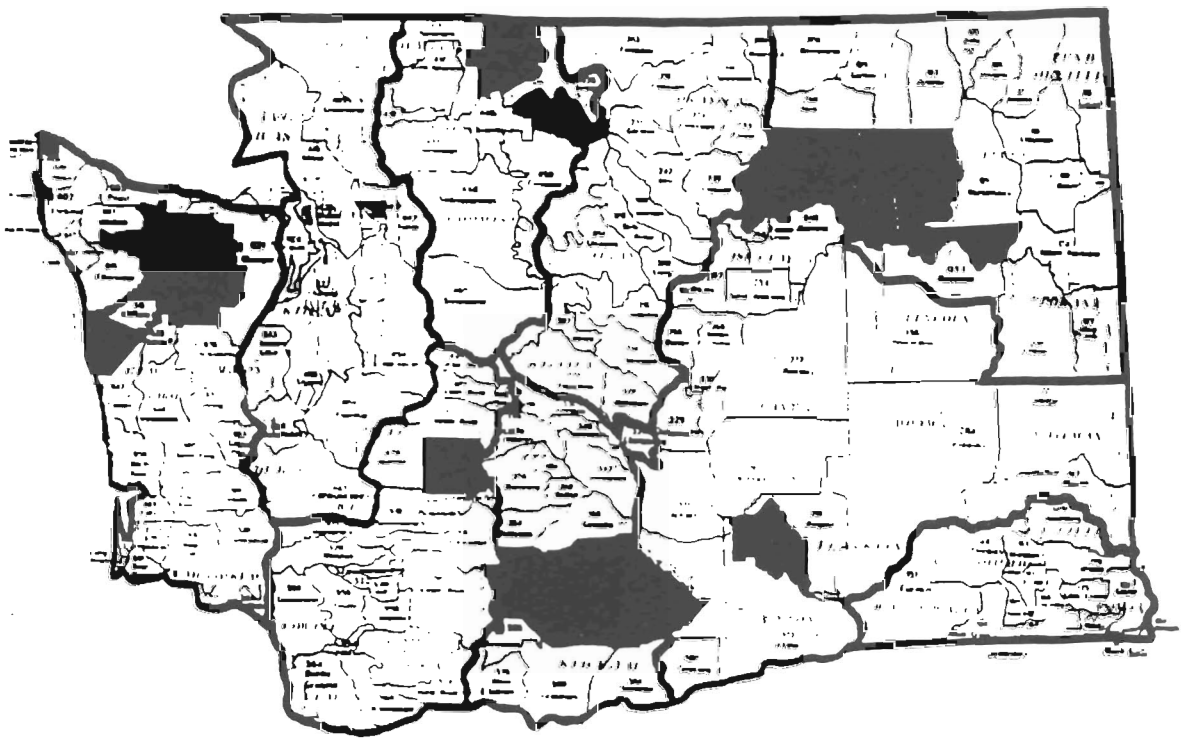
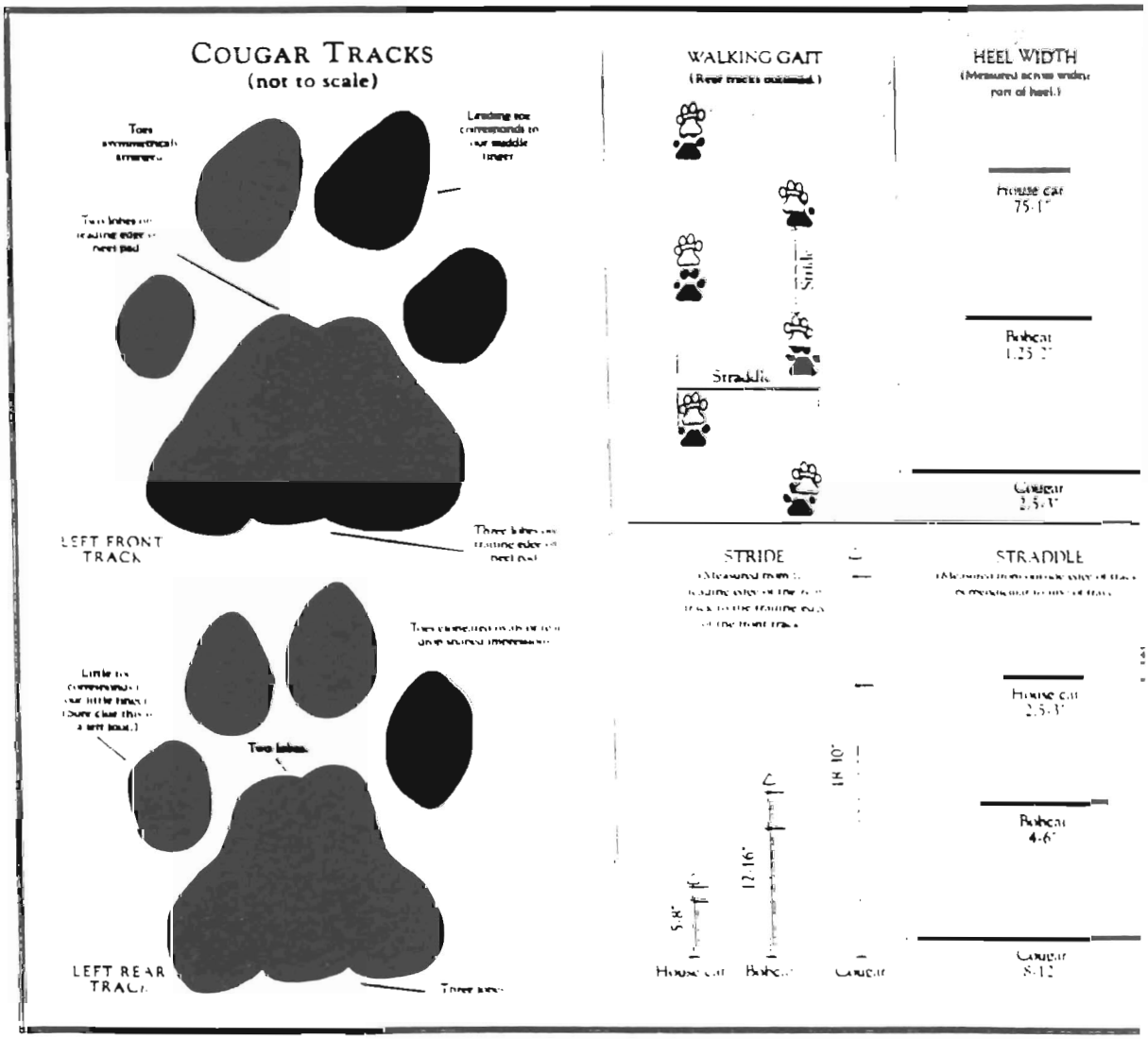
[1] *jacobita*, *wiedii*, and *temminckii* in Wozencraft (1993) amended to *iacobitus*, *wiedi*, and *temminckii* in accordance with the 1985 International Code of Zoological Nomenclature Article 31a mandating that patronymic species names follow the rules of Latin grammar.

Note: Brackets round the name of the authority indicate that the genus has been changed since first publication by that authority.

APPENDIX 2: COUGAR MANAGEMENT UNITS (CMUs) IN WASHINGTON. CMUs ARE BASED ON ECOREGIONS DEVELOPED BY THE GAP PROGRAM AND GROUPINGS OF WASHINGTON DEPARTMENT OF FISH AND WILDLIFE GAME MANAGEMENT UNITS (GMUs). (WDFW 1997a)



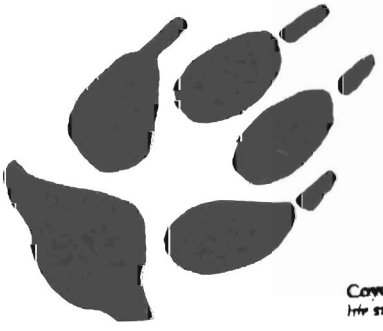
APPENDIX 3: COUGAR TRACKS
(Hansen 1992)



APPENDIX 4: TRACKS OF COUGAR, BOBCAT, DOMESTIC DOG AND COYOTE (Pandell 1992; Murie 1974)

Mountain Lion
life size in mud

Bobcat
life size in mud



Coyote
life size in mud

CANIDAE