

Utah Mountain Lion Status Report

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Mountain lions (*Puma concolor*), or cougars, were persecuted as vermin in Utah from the time of European settlement (in 1847) until 1966. In 1967 the Utah State Legislature changed the status of cougars to protected wildlife and since then they have been considered a game species with established hunting regulations. The Utah Division of Wildlife Resources (UDWR) developed the Utah Cougar Management Plan in 1999 (UDWR 1999b) with the assistance of a Cougar Discussion Group composed of representatives of various public interest groups. This plan will guide cougar management in Utah through 2009. Its goal is to maintain a healthy cougar population within existing occupied habitat while considering human safety, economic concerns and other wildlife species. Management objectives include: 1) Maintaining current (1999) cougar distribution, with a reasonable proportion of older age animals and breeding females, balancing population numbers with other wildlife species; 2) Minimizing the loss in quality and quantity of existing critical and high priority cougar habitat; 3) Reducing the risk of loss of human life and reducing chances of injury by cougar; 4) Maintaining a downward trend in the number of livestock killed by cougar; and 5) Maintaining quality recreational opportunity for a minimum of 800 persons per year through 2009.

Utah's cougar harvests are controlled on specific geographic areas, or management units (Fig. 1), using three harvest strategies: harvest objective, limited entry, and a split-strategy. Under the **harvest objective strategy**, managers prescribe a quota, or number of cougars to be harvested on the unit. An unlimited number of licensed hunters are allowed to hunt during a season that is variable in length, as the hunting season closes as soon as the quota is filled or when the season end date is reached. Under the **limited-entry strategy**, harvests are managed by limiting the number of hunters on a unit. The number of hunters is determined based upon an expectation of hunting success and the desired harvest size. Individuals are usually selected for hunting on the unit through a random drawing process. Under the **split strategy**, units start the season as limited entry, and then transition to a harvest objective strategy after approximately 8 weeks using the number of limited-entry permits that remain unfilled at the time of the transition as the quota for the remaining weeks of the season.

In 1996 the Utah Wildlife Board approved a Predator Management Policy (UDWR 1996) that allows UDWR to increase cougar harvests on management units where big game populations are depressed, or where big game has recently been released to establish new populations. Most predator management plans directed at cougars have been designed to benefit mule deer (*Odocoileus hemionus*) and bighorn sheep (*Ovis canadensis*). Cougar harvests have been liberalized where big game populations are far below objective (<50% of target densities) under the assumption that large harvests will reduce cougar numbers and hence predation rates on big game, and therefore encourage growth of big game populations by improving survival. Because drought, habitat alteration and loss and predation have substantially reduced mule deer populations over significant portions of Utah in recent years, predator management plans remain

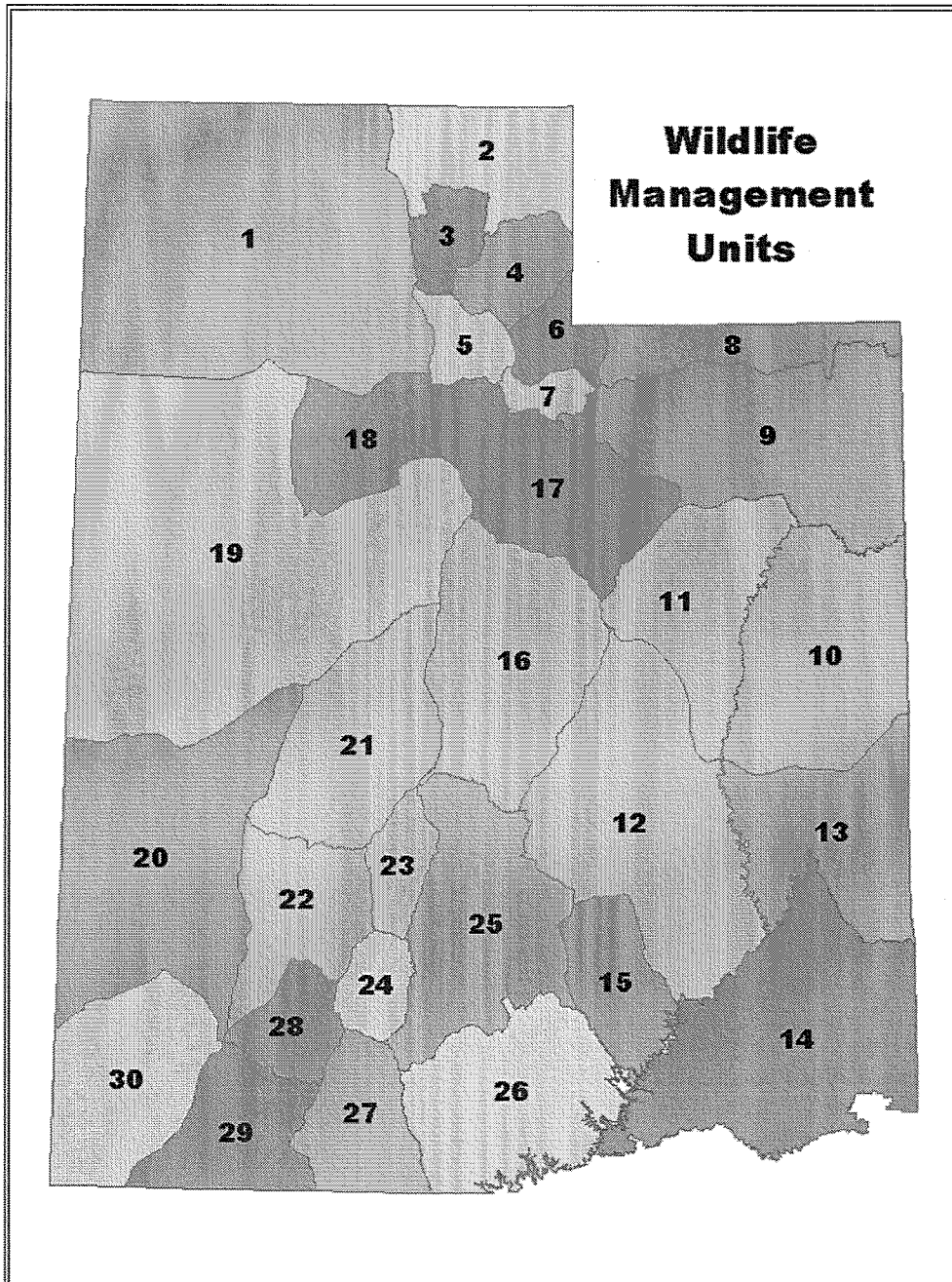


Figure 1. Wildlife Management Units used by Utah Division of Wildlife Resources to manage cougar harvests. Some of the units have been subdivided for additional control of harvests.

in effect on much of the State's cougar range. Currently predator management plans are in place on 26 of 48 cougar management units or subunits open to harvest.

In 1999, UDWR implemented a Nuisance Cougar Complaints policy (UDWR 1999a) to provide guidance for reducing damage to private property and reducing public safety concerns, and to provide direction to UDWR personnel responding to cougar depredation, nuisance, and human safety situations. Any cougar that preys upon livestock or pets or that poses a threat to human safety is euthanized, as are sick or injured adult cougars and kittens that are unable to care for themselves in the wild. The Division does not rehabilitate these animals. The only cougars that are captured and translocated are adults and subadults that wander into urban or suburban "no tolerance zones" in situations where they have not been aggressive toward humans, pets, or livestock.

Distribution and Abundance

Utah's cougar habitat encompasses about 92,696 km² (35,790 mi²; Fig. 2). Cougars are distributed throughout all available habitats within the state. Residential and commercial development is incrementally reducing cougar distribution through habitat alteration and destruction, particularly along the western border of the Wasatch Mountains in northern and central Utah.

The last statewide cougar population estimates were developed in conjunction with the Utah Cougar Management Plan in 1999 (UDWR 1999b). These estimates used extrapolations of cougar densities from published studies in the southwestern United States to: 1) the total area within all management units that comprise cougar range, and 2) the total amount of occupied cougar habitat within Utah. The habitat quality within each management unit was classified as either high, medium or low based on vegetative characteristics, terrain ruggedness (following Riley 1998) and prey density. Cougar densities derived from research within Utah, California and New Mexico were associated with each habitat quality level (UDWR 1999b). High quality habitat was assigned a density range of 2.5-3.9 cougars/100 km², medium quality habitat was assigned a density of 1.7-2.5 cougars/100 km² and a density of 0.26-0.52 cougar/100 km² was assigned to low quality habitat.

The first statewide population estimate of 2,528-3,936 cougars resulted from summing unit population estimates. The number of cougars on each unit was estimated by first multiplying the total area contained within the unit by the highest density of the range assigned to it, and then by the lowest density of the range assigned to it.

For comparison, a second estimate of 2,927 cougars statewide was generated based upon mean cougar densities and total occupied cougar habitat within the state. Each management unit's cougar population was estimated by extrapolating the mean cougar density assigned to the unit (based on the respective range indicated above) to the amount of occupied cougar habitat within the unit, and unit estimates were summed to obtain the statewide figure. The two methods produced population estimates that show considerable agreement, but they should be only viewed as general approximations of the statewide cougar population.

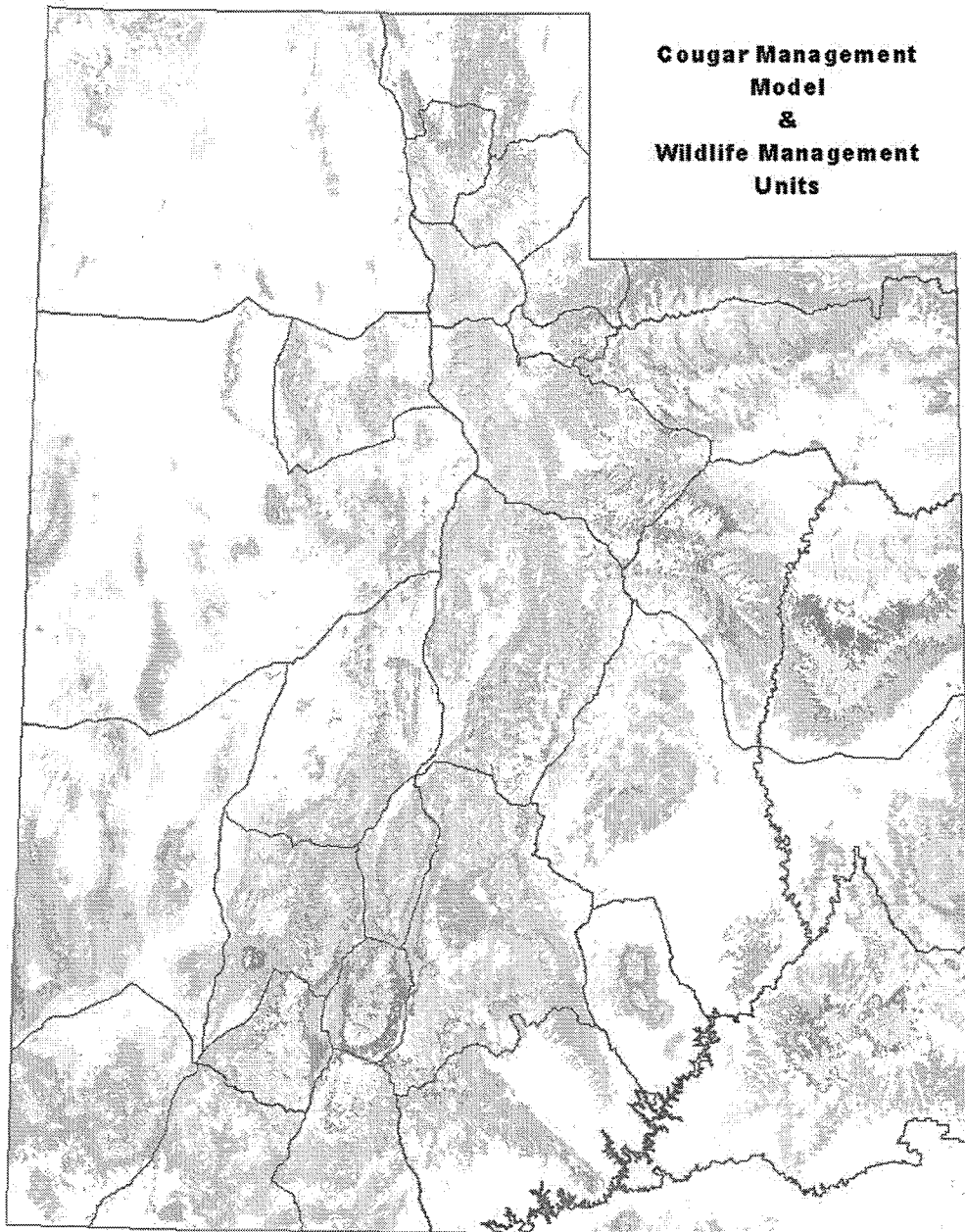


Figure 2. Cougar habitat in Utah. All colored areas represent occupied cougar habitat.

Utah's cougar population is monitored through mandatory reporting of all hunter-harvested cougars, cougars that are killed on highways or in accidents and those taken by animal damage control programs (Table 1). Location of kill, sex and age (through a premolar for age estimation) are recorded for every cougar killed, and provide the data used to assess management performance in relation to established target values that serve as indicators of population status. "Rules of thumb", expressed as threshold values of: 1) A minimum percentage of older aged animals in the harvest, 2) A maximum percentage of females in the harvest, and 3) Minimum adult survival were set to ensure that cougar densities are maintained within all management units, except where predator management plans are in place. Threshold values of the harvest criteria were obtained from the literature and from past evaluations of cougar population dynamics in Utah. This approach is likely conservative, but it is justified based upon our limited knowledge of the abundance of deer and alternate prey in Utah (UDWR 1999b). Ongoing research on 2 study sites, under the direction of Dr. Michael Wolfe (Utah State University, See papers by Choate et al. 2006, Stoner et al. 2006, 2007), is supplying comparative data on the dynamics of cougars subjected to varying levels of hunting harvest. This information should help the Division refine management criteria in the near future. The Division also monitors trends in numbers of cougar incident reports, which have fluctuated in recent years (Table 2). Attempts to reduce the number of cougar management units that are subject to predator management plans have met with little success, mostly due to continued drought and deteriorating range conditions.

Harvest Information

Cougar hunting in Utah is regulated on a management-unit basis to address differences in cougar densities, hunter access and management objectives. Annually, the composition of each unit's harvest is compared to performance targets that were selected to maintain cougar densities: 1) maintain an average of 15% or greater of the harvest in older age classes (≥ 6 years of age); 2) maintain total adult survival at or above 65%; 3) restrict the female component to $< 40\%$ of the harvest. In addition, an average treeing rate (rate of successful treeing/cornering a cougar) of 0.38 cougar/hunter/day is used as a reasonable expectation of success given viable cougar densities. Harvest prescriptions are elevated and the above criteria do not apply on any management unit that has a predator management plan in effect. In these units, the management objective is to reduce cougar numbers.

The harvest-objective strategy is often used on units where managers want to ensure a substantial harvest. This strategy can result in hunter crowding and less hunter selectivity toward males, as many hunters take the first cougar they encounter. Consequently, the harvest may be weighted toward young animals and females.

Conversely, limited-entry hunts allow managers to spread hunting effort over a longer time-period and shift harvesting pressure toward adult males. This strategy is commonly used on management units that are readily accessible to hunters to minimize crowding and promote hunter selectivity for adult males.

Since 2001, a few units have been harvested under a hybrid strategy, where both harvest-objective and limited-entry hunts are held. This approach attempts to produce a large harvest

Table 1. Utah cougar harvests, 1989-90 through 2006-07.

Season Year	Hunters afield	Limited entry permits	Harvest objective permits	Sport Harvest males	Sport Harvest females	Total sport harvest	Mean age	Percent permits filled	Percent quota filled	Percent females	Percent USDA APHIS/WS harvest	Other mortality	Total mortality	Adult survival rate	Percent > 6 yrs old	Treed per pursuit day
1989-90	478	527	146	71	217	217		41.2%		32.7%	48	10	275			0.41
1990-91	480	525	184	81	265	265		50.5%		30.6%	38	22	325			0.49
1991-92	485	525	160	81	241	241		45.9%		33.6%	34	22	297			0.45
1992-93	538	591	260	112	372	372		62.9%		30.1%	53	42	467			0.49
1993-94	575	659	216	136	352	352		53.4%		38.6%	53	10	415			0.57
1994-95	656	791	262	169	431	431		54.5%		39.2%	54	24	509			
1995-96	787	872	269	183	452	452	3.5	51.8%		40.5%	33	39	524	67%	16.7%	0.48
1996-97	1,376	595	297	279	576	576	3.8	56.0%	88.3%	48.4%	40	50	666	67%	20.0%	0.33
1997-98	1,109	509	270	261	492	492	3.2	54.4%	79.6%	47.0%	27	23	542	63%	14.5%	0.36
1998-99	939	446	230	206	373	373	3.1	49.0%	64.0%	44.8%	13	1	387	62%	10.1%	0.30
1999-00	817	343	304	258	177	435	2.9	60.0%	81.0%	40.7%	25	9	469	60%	9.7%	0.28
2000-01	1,341	272	371	242	207	449	3.3	52.0%	35.4%	46.1%	27	20	496	63%	12.8%	0.30
2001-02	1,353	266	339	222	184	406	3.1	57.9%	74.3%	45.3%	45	17	468	61%	11.5%	0.21
2002-03	1,231	374	297	251	175	427	3.6	58.3%	77.1%	41.0%	53	30	510	63%	13.3%	0.29
2003-04	936	266	492	219	229	448	3.4	55.2%	66.3%	51.1%	47	28	523	61%	13.8%	0.23
2004-05	1,309	276	527	190	131	321	2.5	45.3%	36.2%	40.8%	38	21	380	54%	6.5%	0.17
2005-06	1,016	406	227	202	137	339	3.2	58.6%	44.5%	40.4%	35	15	389	62%	8.9%	0.19
2006-07	1,126	366	185	173	117	291	2.9	58.5%	41.6%	40.2%	9	25	325	63%	10.5%	0.22
Total	16,552	8,609	3,517	4,018	2,867	6,887					672	408	7,967			
Mean	920	478	320	223	159	383	3.2	53.6%	62.6%	41.6%	37	23	443	62%	12.4%	0.34

Performance targets:

40.0% 65% 15.0% 0.38

Table 2. Confirmed livestock losses due to cougar depredation in Utah, FY1993 (1992-93) to FY2007 (2006-07).

Fiscal Year	Number of Incidents	Confirmed Losses:						Total		Cougar taken by USDA/APHIS
		Ewes	Lambs	Bucks	Calf	Goat	Other	Confirmed Losses	Value Losses	
1993	114	263	722	1	2	0	0	988	\$94,644.00	53
1994	115	258	646	5	6	0	0	915	\$120,615.00	53
1995	152	335	760	24	12	0	0	1,130	\$111,495.00	54
1996	112	257	621	2	6	0	0	878	\$79,277.00	33
1997	110	375	531	20	11	0	0	937	\$106,210.00	46
1998	114	253	506	19	13	0	0	805	\$97,703.00	27
1999	69	244	406	18	4	0	0	730	\$92,945.00	11
2000	82	160	371	2	15	0	0	548	\$60,750.00	22
2001	74	136	361	12	3	1	0	587	\$61,395.00	18
2002	95	167	453	18	11	2	1	652	\$70,351.34	74
2003	108	204	778	8	4	22	3	1,127	\$81,067.00	33
2004	89	222	533	7	9	5	0	776	\$108,917.25	38
2005	69	99	362	2	1	19	0	483	\$64,911.61	27
2006	50	56	228	0	32	26	0	342	\$77,415.00	13
2007	42	46	265	0	0	7	0	318	\$43,082.50	18
Total	1,395	3,075	7,543	138	129	82	4	11,216	\$1,270,778.70	520

while encouraging some hunter selectivity. Under the hybrid strategy, a limited-entry hunt is opened early, followed by a harvest-objective hunt that is delayed until mid-winter. In the past, managers have used female sub-quotas in conjunction with harvest-objective strategies to protect females in the face of increased harvest pressure. This strategy has been discontinued because it biased the harvest sex composition toward females (through early closure when the sub-quota was attained) and prevented meaningful evaluations of harvest sex composition under criterion 3 above.

Each year, regional wildlife managers review the size and composition of harvests from individual units in relation to management rules of thumb and then make recommendations for the forthcoming season. Often, their evaluations result in changes in the number of permits allocated the size of quotas and/or changes in harvest strategy. These regulation changes often result in year-to-year fluctuation in harvest strategy and hence harvest pressure. As a result, variances in harvest size and composition are difficult to interpret. Total harvest has varied between 325 and 542 since the 1997-1998 season, with no definite trend (Table 1).

Nearly all cougars harvested in Utah are taken with the aid of dogs. An individual hunter is restricted to holding either a limited-entry permit or a harvest-objective permit per season, and must wait 3 years to reapply once he/she acquires a permit. The bag limit is 1 cougar per season and kittens and females accompanied by young are protected from harvest. Currently the cougar-hunting season runs from 21 November, 2007 through 1 June, 2008 on both limited-entry and harvest-objective units. However, some units are open year-round and some have earlier or later opening dates. Because harvest-objective units close as soon as the objective (quota) is reached, hunters must call a toll-free number daily to ensure that the season in their hunt unit is still open.

Pursuit (chase or no-kill) seasons provide additional recreational opportunities over most of the State. The pursuit season generally runs 21 November, 2007 through 1 June, 2008, but specific units have year-round pursuit and a few units are closed to pursuit hunting. In recent years, the Division has sold about 700-800 cougar pursuit permits annually (Table 3).

The Division began managing cougar harvests through statewide limited-entry hunting in 1990 and increased numbers of permits through 1995-1996 (Table 3). In 1996-1997, additional harvest pressure was added by switching some management units to the harvest-objective (quota) system and a record high of 1,376 hunters was afield (Table 1).

Units with predator management plans designed to reduce cougar densities produce harvests of similar composition to areas where the management objective is to sustain higher population densities (Table 4). Throughout the State, the proportion of harvest comprised of females has usually been above the prescribed threshold for maintaining cougar densities, the percent of older aged cougars in the harvest has remained below the desired threshold level, adult survival is below the desired level, and the cougar treeing rate is below the value ascribed as an indicator of secure population abundance. Given the relative abundance of *de facto* refugia for cougars in Utah (National Parks, wilderness and inaccessible tracts) and the species' propensity to disperse long distances, current harvest prescriptions may not prove effective for attaining either of the

Table 3. Number of cougar pursuit permits sold in Utah, 1989-90 through 2006-07.

Year	Limited-Entry Permits			Harvest-Objective Permits			Total Permits	Pursuit Permits
	Resident	Nonresident	Conservation	Total	Resident	Nonresident		
1989-90	385	142		527			527	355
1990-91	383	142		525			525	364
1991-92	383	142		525			525	524
1992-93	431	160		591			591	570
1993-94	479	180		659			659	552
1994-95	559	232		791			791	505
1995-96	611	261		872			872	627
1996-97	425	170		595	n/a	n/a	901	638
1997-98	381	128		509	472	199	671	1,180
1998-99	337	109		446	386	189	575	1,021
1999-00	259	84		343	374	170	544	887
2000-01	206	66		272	880	290	1,170	1,442
2001-02	228	30	8	266	897	300	1,197	1,463
2002-03	326	36	12	374	685	266	951	1,325
2003-04	215	29	20	264	533	209	742	1,006
2004-05	233	30	10	273	841	290	1,131	1,404
2005-06	356	38	12	406	464	222	686	1,092
2006-07	313	35	18	366	600	245	845	1,211
Total	6,510	2,014	80	8,604	6,132	2,380	9,413	18,017
Mean	362	112	13	478	613	238	856	1,001

Table 4. Comparison of harvest characteristics for Utah management units that have predator management plans (designed to reduce cougar numbers) and units that are managed to sustain cougar populations.

Criteria (threshold for sustaining population)	Predator Management Plan in Place			No Predator Management Plan		
	1999-00	2000-01	2001-02	1999-00	2000-01	2001-02
% Females (<40)	45	45	41	38	46	47
% > 6 years (>15)	9.7	9.8	10	7.6	12.3	9
Adult Survival (>0.65)	0.60	0.61	0.52	0.59	0.61	0.62
Cougar treed/day (0.38)	0.24		0.16	0.30		0.24

State's management objectives (maintenance of population density, or substantial reduction in population density).

Evaluation of harvest information

The harvest-based criteria used in Utah's cougar management system are based upon published research, and represent the expectation of harvest statistics that are associated with sustained population densities. However, managers have not been able to fully meet all threshold values since the Cougar Management Plan was adopted in 1999. There may be several explanations for this difficulty, including the geographic scale of management actions and differences in the vital rates of cougar populations within Utah.

The proportion of mature (≥ 6 years of age) cougars in the harvest is used as an index of the presence of mature cougars in the underlying population. If this proportion declines below 15%, the management plan assumes that the harvest rate is unsustainable. However, scarcity of older-aged cougars in harvests could also result from light (sustainable) harvesting of a productive cougar population by nonselective hunters, where relatively few cougars are taken and the harvest is composed of mostly subadults and younger-aged adults.

The proportion of adult females in the harvest is assumed to increase with increasing harvest pressure, and the threshold level chosen for sustainability in Utah ($>40\%$) is based upon research from several western states. However, managers are evaluating small management units, some containing $<1,000 \text{ km}^2$ of cougar habitat. Populations on 8 of these units are estimated at <50 cougars and they produce harvests of only a few animals. Consequently, individual animals comprise a large proportion of the unit's harvest (i.e., 1 cougar comprises 25% of a 4-cougar harvest). The addition or subtraction of 1 female can shift harvest percentages considerably, with consequent changes in management recommendations that may or may not be biologically significant.

The threshold adult survival value (0.65 survival overall) used by the cougar management plan is the only management criterion in use that relies on a direct measure of a vital rate. This information is based upon cementum age estimates, and is evaluated at a regional scale (groups of management units) or at the statewide level, where sample sizes are sufficiently large enough to remove individual-animal bias. The 0.65 survival threshold also assumes average reproduction and recruitment of cougars in Utah, as reported in the literature. Unfortunately, there is no current data on cougar productivity being collected within the State.

Utah's cougar management program suffers from the lack of current estimates of reproduction and juvenile survival. These vital rates may vary considerably in response to changing prey abundance and as social structure is impacted by harvesting. Reproduction and juvenile survival could substantially influence a cougar population's ability to sustain harvest. Consequently, the Division should develop a means to monitor both reproduction and juvenile survival.

Future needs

The Division needs greater understanding of the underlying assumptions of the management criteria adopted by the Cougar Management Plan and of cougar population dynamics within

Utah. We also need to determine the appropriate geographic scale for managing cougars and to resist the temptation to adjust harvest regulations annually. Currently, management is operating on an individual-unit scale, where interpretation of harvest data is hampered by small sample sizes. Attempts to evaluate harvests on larger geographic scales or multi-year time frames are confounded by the continual change in regulations and harvest effort on individual management units.

In the future, research and management should focus on obtaining and applying reliable indicators of cougar productivity and survival, and ultimately population growth. Specifically, our harvest management efforts should improve with understanding of cougar movements and dispersal, particularly between lightly hunted and heavily harvested cougar populations. In addition, we need greater confidence in our ability to evaluate a population's ability to sustain harvesting, and better measures of population growth.

Depredations and Human Interactions/Conflicts

Under Division policy, cougars that prey upon livestock or pets or cause public safety concerns are lethally controlled (UDWR 1999a). The number of cougars killed due to these conflicts has fluctuated markedly in the past 5 years, from a high of 53 in 2002-2003 to a low of 9 cougars in 2006-2007 (Table 1). USDA APHIS, Wildlife Services handles most livestock depredation complaints under a memorandum of understanding with UDWR. Their reports are compiled on a fiscal year basis (and therefore numbers/year differ from those reported in Table 1), and confirm livestock losses ranging from \$43,000 to \$109,000 per year since 1998 (Table 2). Cougars were implicated in 42-114 separate depredation incidents per year during this period, killing 318-1,127 sheep, cattle and goats annually (Table 2).

Research and Publications

UDWR is funding research conducted through the Utah State University, under the direction of Dr. Michael Wolfe. This research has been ongoing on two study sites since 1995, and is directed at determining means of quantifying cougar populations and evaluating the effects of harvesting on them. Field research is currently underway by David Stoner, PhD candidate.

Recent publications

- Bernales, H. H., K. R. Hersey, and K. Bunnell. 2008. Utah cougar annual report 2006 and 2007. Annual performance report, Fed. Aid Project No. W-65-M-54 and 55. Publication Number 08-35, Utah Div. Wildlife Res., Salt Lake City. USA, 75 pp.
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- Hill, H. and K. Bunnell. 2005. Utah cougar harvest report 2001-2002 to 2004-2005. Annual performance report, Fed. Aid Project No. W-65-M-50, 51, 52 and 53. Publication Number 05-39, Utah Div. Wildlife Res., Salt Lake City. USA, 65 pp.
- Stoner, D. C., M.L. Wolfe and D.M. Choate. 2006. Cougar exploitation levels in Utah: Implications for demographic structure, population recovery, and metapopulation dynamics. *Journal of Wildlife Management* 70(6): 1588-1600

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