



Snow Leopard (*Panthera uncia*)

Supplementary material for *Panthera uncia* Red List assessment

Table 1. Snow Leopard population estimates reported in the country status chapters of the book 'Snow Leopards' (McCarthy and Mallon 2016).

Country	Population Estimate
Afghanistan	50-200
Bhutan	No estimate included
China	4,500
India	516-524
Kazakhstan	100-120
Kyrgyz Republic	300-350; 350-400
Mongolia	1,000
Nepal	301-400
Pakistan	250
Russia	70-90
Tajikistan	250-280
Uzbekistan	30-50; 80-120
Totals	7,367-7,884

Appendix 1.

Model inputs and outputs for 9 Snow Leopard population scenarios. Each model is scaled with adult survival ranging from 0.6 to 0.9 in increments of 0.01, and other survival rates are scaled linearly to adult survival. It is also stochastic, using the same Beta distributions for survival and Gamma distribution for litter size as Chapron (2015). Ten thousand iterations at each of the scaled adult survival rates were run, resulting in 310,000 stable stage population matrices. We report the mean of matrices which had a $\lambda \geq 1.0$, and their standard deviation. Plus or minus two standard deviations would thus represent 95% of the estimated population structures from the model.

Scenario 1

Actual breeding by age	2 yr=0%	3 yr=25%	4 yr+=100%
% Mature by age	2 yr=25%	3 yr=50%	4 yr+=100%
Population includes:	50% of 1 yr olds plus all 2+ yr olds		
Results	Mean % MI (SD) = 67.75 (2.07)		Mean # MI (SD) =2,709.8 (83.0)

Age class	Mean % (SD)	# in population estimate (SD)	# MI (SD)
Yearling (12-24 mo.)	21.4 (1.40)	479.62 (35.24)	0
2 yr old	15.67 (1.08)	701.96 (51.79)	175.49 (12.95)
3 yr old	12.68 (1.03)	568.17 (47.54)	284.09 (23.77)
4 yr old	10.39 (0.53)	465.66 (24.13)	465.66 (24.13)
5 yr old	8.53 (0.23)	382.06 (9.21)	382.06 (9.21)
6 yr old	7.01 (0.22)	313.8 (7.77)	313.8 (7.77)
7 yr old	5.76 (0.33)	258.01 (13.45)	258.01 (13.45)
8 yr old	4.74 (0.42)	212.36 (17.58)	212.36 (17.58)
9 yr old	3.91 (0.46)	174.97 (19.94)	174.97 (19.94)
10 yr old	3.22 (0.48)	144.31 (20.97)	144.31 (20.97)
11 yr old	2.66 (0.48)	119.15 (21.05)	119.15 (21.05)
12 yr old	2.2 (0.47)	98.47 (20.49)	98.47 (20.49)
13 yr old	1.82 (0.44)	81.46 (19.52)	81.46 (19.52)
Totals		4,000	2,709.82 (82.99)

Scenario 2

Actual breeding by age 2 yr=10% 3 yr=50% 4 yr+=100%
% Mature by age 2 yr=50% 3 yr=75% 4 yr+=100%
Population includes: 50% of 1 yr olds plus all 2+ yr olds
Results Mean % MI (SD) = 74.6 (1.69) Mean # MI (SD) =2,984.8 (67.7)

Age class	Mean % (SD)	# in population estimate (SD)	# MI (SD)
Yearling (12-24 mo.)	22.39 (1.5)	504.49 (38.13)	0
2 yr old	16.19 (1.15)	729.59 (55.69)	364.8 (27.85)
3 yr old	12.95 (1.08)	583.63 (50.19)	437.72 (37.64)
4 yr old	10.46 (0.52)	471.19 (24.21)	471.19 (24.21)
5 yr old	8.46 (0.23)	380.9 (8.74)	380.9 (8.74)
6 yr old	6.85 (0.26)	308.3 (9.42)	308.3 (9.42)
7 yr old	5.55 (0.38)	249.85 (15.34)	249.85 (15.34)
8 yr old	4.5 (0.45)	202.73 (19.2)	202.73 (19.2)
9 yr old	3.66 (0.49)	164.7 (21.14)	164.7 (21.14)
10 yr old	2.98 (0.5)	133.97 (21.72)	133.97 (21.72)
11 yr old	2.42 (0.49)	109.1 (21.37)	109.1 (21.37)
12 yr old	1.98 (0.46)	88.95 (20.43)	88.95 (20.43)
13 yr old	1.61 (0.43)	72.61 (19.13)	72.61 (19.13)
Totals		4,000	2,984.81 (67.74)

Scenario 3

Actual breeding by age 2 yr=25% 3 yr=75% 4 yr+=100%
% Mature by age 2 yr=50% 3 yr=75% 4 yr+=100%
Population includes: 50% of 1 yr olds plus all 2+ yr olds
Results Mean % MI (SD) = 85.4 (1.19) Mean # MI (SD) =2,933.6 (75.4)

Age class	Mean % (SD)	# in population estimate (SD)	# MI (SD)
Yearling (12-24 mo.)	23.58 (1.64)	535.04 (42.07)	0
2 yr old	16.8 (1.23)	762.34 (60.23)	381.17 (30.12)
3 yr old	13.24 (1.11)	600.72 (52.54)	450.54 (39.4)
4 yr old	10.5 (0.51)	476.4 (23.73)	476.4 (23.73)
5 yr old	8.35 (0.23)	378.39 (8.33)	378.39 (8.33)
6 yr old	6.64 (0.31)	301 (11.62)	301 (11.62)
7 yr old	5.29 (0.42)	239.79 (17.58)	239.79 (17.58)
8 yr old	4.22 (0.49)	191.32 (21)	191.32 (21)

9 yr old	3.37 (0.52)	152.86 (22.39)	152.86 (22.39)
10 yr old	2.7 (0.51)	122.31 (22.4)	122.31 (22.4)
11 yr old	2.16 (0.49)	98.01 (21.55)	98.01 (21.55)
12 yr old	1.74 (0.46)	78.64 (20.18)	78.64 (20.18)
13 yr old	1.4 (0.42)	63.19 (18.54)	63.19 (18.54)
Totals		4,000	2,933.61 (74.54)

Scenario 4

Actual breeding by age

2 yr=0%

3 yr=25%

4 yr+=100%

% Mature by age

2 yr=25%

3 yr=50%

4 yr+=100%

Population includes:

25% of 1 yr olds plus all 2+ yr olds

Results

Mean % MI (SD) = 72.06 (1.94)

Mean # MI (SD)
=2,882.4 (77.7)

Age class	Mean % (SD)	# in population estimate (SD)	# MI (SD)
Yearling (12-24 mo.)	21.4 (1.4)	255.2 (19.95)	0
2 yr old	15.67 (1.08)	746.9 (57.32)	186.73 (14.33)
3 yr old	12.68 (1.03)	604.5 (51.62)	302.25 (25.81)
4 yr old	10.39 (0.53)	495.4 (26.29)	495.4 (26.29)
5 yr old	8.53 (0.23)	406.42 (9.62)	406.42 (9.62)
6 yr old	7.01 (0.22)	333.78 (7)	333.78 (7)
7 yr old	5.76 (0.33)	274.42 (13.43)	274.42 (13.43)
8 yr old	4.74 (0.42)	225.85 (18.04)	225.85 (18.04)
9 yr old	3.91 (0.46)	186.07 (20.69)	186.07 (20.69)
10 yr old	3.22 (0.48)	153.46 (21.88)	153.46 (21.88)
11 yr old	2.66 (0.48)	126.69 (22.04)	126.69 (22.04)
12 yr old	2.2 (0.47)	104.7 (21.51)	104.7 (21.51)
13 yr old	1.82 (0.44)	86.61 (20.52)	86.61 (20.52)
Totals		4,000	2,882.37 (77.74)

Scenario 5

Actual breeding by age

2 yr=10%

3 yr=50%

4 yr+=100%

% Mature by age

2 yr=50%

3 yr=75%

4 yr+=100%

Population includes:

25% of 1 yr olds plus all 2+ yr olds

Results

Mean % MI (SD) = 79.6 (1.46)

Mean # MI (SD)
=3,185.5 (58.3)

Age class	Mean % (SD)	# in population estimate (SD)	# MI (SD)
Yearling (12-24 mo.)	22.39 (1.5)	269.33 (21.73)	0
2 yr old	16.19 (1.15)	778.91 (62.04)	389.46 (31.02)

3 yr old	12.95 (1.08)	623.03 (54.82)	467.27 (41.12)
4 yr old	10.46 (0.52)	502.94 (26.56)	502.94 (26.56)
5 yr old	8.46 (0.23)	406.53 (8.93)	406.53 (8.93)
6 yr old	6.85 (0.26)	329.01 (8.71)	329.01 (8.71)
7 yr old	5.55 (0.38)	266.61 (15.43)	266.61 (15.43)
8 yr old	4.5 (0.45)	216.31 (19.78)	216.31 (19.78)
9 yr old	3.66 (0.49)	175.72 (22)	175.72 (22)
10 yr old	2.98 (0.5)	142.92 (22.73)	142.92 (22.73)
11 yr old	2.42 (0.49)	116.37 (22.44)	116.37 (22.44)
12 yr old	1.98 (0.46)	94.87 (21.5)	94.87 (21.5)
13 yr old	1.61 (0.43)	77.43 (20.17)	77.43 (20.17)
Totals		4,000	3,185.46 (58.32)

Scenario 6

Actual breeding by age

2 yr=25%

3 yr=75%

4 yr+=100%

% Mature by age

2 yr=50%

3 yr=75%

4 yr+=100%

Population includes:

25% of 1 yr olds plus all 2+ yr olds

Results

Mean % MI (SD) = 78.6 (1.61)

Mean # MI (SD)
=3,143.6 (64.3)

Age class	Mean % (SD)	# in population estimate (SD)	# MI (SD)
Yearling (12-24 mo.)	23.58 (1.64)	286.83 (24.17)	0
2 yr old	16.8 (1.23)	817.25 (67.7)	408.62 (33.85)
3 yr old	13.24 (1.11)	643.93 (57.9)	482.95 (43.43)
4 yr old	10.5 (0.51)	510.6 (26.32)	510.6 (26.32)
5 yr old	8.35 (0.23)	405.5 (8.16)	405.5 (8.16)
6 yr old	6.64 (0.31)	322.52 (11)	322.52 (11)
7 yr old	5.29 (0.42)	256.91 (17.81)	256.91 (17.81)
8 yr old	4.22 (0.49)	204.95 (21.72)	204.95 (21.72)
9 yr old	3.37 (0.52)	163.73 (23.38)	163.73 (23.38)
10 yr old	2.7 (0.51)	130.99 (23.52)	130.99 (23.52)
11 yr old	2.16 (0.49)	104.95 (22.7)	104.95 (22.7)
12 yr old	1.74 (0.46)	84.2 (21.31)	84.2 (21.31)
13 yr old	1.4 (0.42)	67.65 (19.61)	67.65 (19.61)
Totals		4,000	3,143.57 (64.33)

Scenario 7**Actual breeding by age**

2 yr=0%

3 yr=25%

4 yr+=100%

% Mature by age

2 yr=25%

3 yr=50%

4 yr+=100%

Population includes:

0% of 1 yr olds plus all 2+ yr olds

Results

Mean % MI (SD) = 77.0 (1.79)

Mean # MI (SD)
=3,078.6 (71.6)

Age class	Mean % (SD)	# in population estimate (SD)	# MI (SD)
Yearling (12-24 mo.)	21.4 (1.4)	0	0
2 yr old	15.67 (1.08)	798.04 (64.09)	199.51 (16.02)
3 yr old	12.68 (1.03)	645.83 (56.57)	322.91 (28.29)
4 yr old	10.39 (0.53)	529.22 (29.09)	529.22 (29.09)
5 yr old	8.53 (0.23)	434.13 (10.53)	434.13 (10.53)
6 yr old	7.01 (0.22)	356.51 (6.13)	356.51 (6.13)
7 yr old	5.76 (0.33)	293.08 (13.36)	293.08 (13.36)
8 yr old	4.74 (0.42)	241.19 (18.51)	241.19 (18.51)
9 yr old	3.91 (0.46)	198.69 (21.49)	198.69 (21.49)
10 yr old	3.22 (0.48)	163.85 (22.88)	163.85 (22.88)
11 yr old	2.66 (0.48)	135.26 (23.14)	135.26 (23.14)
12 yr old	2.2 (0.47)	111.77 (22.64)	111.77 (22.64)
13 yr old	1.82 (0.44)	92.45 (21.64)	92.45 (21.64)
Totals		4,000	3,078.56 (71.64)

Scenario 8**Actual breeding by age**

2 yr=10%

3 yr=50%

4 yr+=100%

% Mature by age

2 yr=50%

3 yr=75%

4 yr+=100%

Population includes:

0% of 1 yr olds plus all 2+ yr olds

Results

Mean % MI (SD) = 85.4 (1.19)

Mean # MI (SD)
=3,415.2 (47.4)

Age class	Mean % (SD)	# in population estimate (SD)	# MI (SD)
Yearling (12-24 mo.)	22.39 (1.5)	0	0
2 yr old	16.19 (1.15)	835.43 (69.9)	417.72 (34.95)
3 yr old	12.95 (1.08)	668.17 (60.52)	501.13 (45.39)
4 yr old	10.46 (0.52)	539.33 (29.65)	539.33 (29.65)
5 yr old	8.46 (0.23)	435.89 (9.71)	435.89 (9.71)
6 yr old	6.85 (0.26)	352.74 (7.88)	352.74 (7.88)

7 yr old	5.55 (0.38)	285.81 (15.48)	285.81 (15.48)
8 yr old	4.5 (0.45)	231.86 (20.39)	231.86 (20.39)
9 yr old	3.66 (0.49)	188.33 (22.94)	188.33 (22.94)
10 yr old	2.98 (0.5)	153.15 (23.84)	153.15 (23.84)
11 yr old	2.42 (0.49)	124.7 (23.63)	124.7 (23.63)
12 yr old	1.98 (0.46)	101.65 (22.7)	101.65 (22.7)
13 yr old	1.61 (0.43)	82.96 (21.33)	82.96 (21.33)
Totals		4,000	3,415.24 (47.42)

Scenario 9

Actual breeding by age

2 yr=25%

3 yr=75%

4 yr+=100%

% Mature by age

2 yr=50%

3 yr=75%

4 yr+=100%

Population includes:

0% of 1 yr olds plus all 2+ yr olds

Results

Mean % MI (SD) = 84.7 (1.30)

Mean # MI (SD)
=3,386.2 (52.0)

Age class	Mean % (SD)	# in population estimate (SD)	# MI (SD)
Yearling (12-24 mo.)	23.58 (1.64)	0	0
2 yr old	16.8 (1.23)	880.74 (77.08)	440.37 (38.54)
3 yr old	13.24 (1.11)	693.89 (64.61)	520.41 (48.46)
4 yr old	10.5 (0.51)	550.13 (29.81)	550.13 (29.81)
5 yr old	8.35 (0.23)	436.83 (8.64)	436.83 (8.64)
6 yr old	6.64 (0.31)	347.39 (10.21)	347.39 (10.21)
7 yr old	5.29 (0.42)	276.68 (17.98)	276.68 (17.98)
8 yr old	4.22 (0.49)	220.69 (22.48)	220.69 (22.48)
9 yr old	3.37 (0.52)	176.28 (24.46)	176.28 (24.46)
10 yr old	2.7 (0.51)	141.01 (24.76)	141.01 (24.76)
11 yr old	2.16 (0.49)	112.96 (23.98)	112.96 (23.98)
12 yr old	1.74 (0.46)	90.62 (22.57)	90.62 (22.57)
13 yr old	1.4 (0.42)	72.79 (20.81)	72.79 (20.81)
Totals		4,000	3,386.16 (52.01)

Appendix 2.

Modeling the number of mature individuals in the global Snow Leopard population: implications for IUCN Red List status

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Background

Snow Leopards have previously been listed as Endangered (EN) on the IUCN Red List under Criteria C1. To qualify as EN under C1 there must be <2,500 mature individuals (MI) and an observed, estimated or projected population decline of 20% over 2 generations. In the 2008 Snow Leopard population assessment, effective population size (N_e) was used in place of the number of mature individuals (MI). Following Nowell *et al.* (2007) N_e was calculated as 50% of the global estimate of 4,080 wild adult Snow Leopards, yielding an N_e of 2,040. The use of N_e as a surrogate for MI was later determined to be inappropriate. Hence, an alternate method of calculating MI is required for the 2014 assessment.

Chapron (2015) developed a female-only age-classified Leslie matrix-model to examine the age-structure and population dynamics of the Snow Leopard where the population was defined as cubs (<12 months), juveniles (12-24 months), sub-adult (24-36 months) and adult (>36 months) with a maximum age of 13 years. The pre-breeding census model assumes the population is at its asymptotic stage, implying that the matrix was constant (i.e., has reached a stable age distribution) and the population was well below its carrying capacity, hence density-dependent effects are negligible compared to other factors affecting mortality and reproduction. Stochasticity is built into the model to account for uncertainty in the least understood parameters, such as age-specific survival rates and litter size.

Published literature and zoo records indicate sexual maturity in Snow Leopards occurs at 2 to 3 years old, with the earliest documented breeding at 20-21 months (Jay Tetzloff, Snow Leopard Species Survival Plan Coordinator, personal communication). Field observations are consistent with breeding at 2 or 3 years of age. Of two known age females in a long-term radio-telemetry study of Snow Leopards in Mongolia, one gave birth at the age of 3 and the other at 3 or 4 years of age (Johansson, personal communication and Panthera/Snow Leopard Trust unpublished data). This means that one female definitely bred at age 2 years and the second bred at either 2-3 years. Two other females of estimated age likely gave birth at 3-4 years, again indicating successful breeding at 2-3 years old.

Sexual maturity and breeding at 2-3 years old appears to be consistent across a range of large wild felids. Balme *et al.* (2012) used an extensive data set to establish baseline reproductive parameters for female leopards *Panthera pardus* and found that mean age at first parturition was older than earliest age of breeding in captivity ($n = 26$, mean \pm standard error = 46 ± 2 months). However, female leopards are known to reach sexual maturity in other populations at 24-28 months (Hunter *et al.* 2013) and individuals in this population began displaying signs of oestrus as early as 18 months old, first mated as early as 24 months old and were able to conceive at 33 months old (Balme *et al.* 2012). Hunter (1998) reported conception in three lionesses in a South African study area at 32-33 months of age. Miller and Funston (2014) reported the average age of first reproduction for lionesses in 10 South African reserves was 39.6 months ($n = 61$, range = 26 - 76 months, s.d. = 9.4) and that 25 (42%) of the females gave birth before the age of 36 months. Robinson *et al.* (2014) reported that 14 known age female mountain lions gave birth to their first litter at a mean age of 31.4 months (range 23-37 months). Cheetahs in Namibia produce their first litter at about 36 months of age (Berry *et al.* 1997), and at 30 months in the Serengeti (Kelly *et al.* 1998). Jaguars are also known to breed by three years of age in the wild (Miller 2013). Tigers seem to be the exception and generally breed first at 3-4 years of age (Kerley *et al.* 2003, Chapron *et al.* 2008). Although we have not performed an exhaustive review, the reported age at sexual maturity and breeding for large felids in zoos does not seem to differ substantially from what has been observed in the wild. Therefore, there is no reason to suspect that the case is different for Snow Leopards that are well documented to be mature at 2-3 years of age.

The IUCN Red List guidelines define 'mature individuals' as individuals known, estimated or inferred to be capable of reproduction. The guidelines go on to state that age of first reproduction in the wild may be later than the age at which an individual is biologically capable of breeding (emphasis added). Therefore, mature individuals in the Red List context are those capable of breeding, not just those actually breeding in any given year. We contend that for Snow Leopards, as with many large cats, individuals are capable of breeding beginning at 2 years of age and thus meet the IUCN definition of mature individuals (IUCN Standards and Petitions Subcommittee 2014), even if they do not actually breed.

With few exceptions, such as the census of Asiatic lions conducted by the government of India, or total counts of Amur tigers using snow tracking (D. Miquelle, WCS, Personal Communication), nearly all published felid population estimates do not include dependent cubs. Indeed, cubs are specifically excluded from population estimates and the voluminous literature on felid density estimates derived from camera-trapping is the most obvious example where this applies. The global population estimate of 4,080-6,590 Snow Leopards (McCarthy and Chapron, 2003) only includes mature individuals. Moreover, the 2008 Red List Snow Leopard assessment clearly states that the population estimate is for adults only and the authors calculate effective population size (2,040) as 50% of the estimated total number of adults (4,080), citing Nowell *et al.* (2007). Hence, for the purposes of modeling the percent of mature individuals, published Snow Leopard population estimates should be considered to be comprised of adults only.

Methods:

We used the model developed by Chapron, with 10,000 iterations at each of the stochastic, scaled adult survival rates (0.6-0.9, in increments of 0.01), resulting in 310,000 stable stage population matrices. We report the mean number of mature individuals for matrices which had a $\lambda \geq 1.0$. We disregard outputs where $\lambda < 1$ as per Chapron's recommendations, since these indicate a declining population.

We used three different sets of input values to describe the percentage of each age class that actually bred. These values are used in the first phase of the model that drives the population matrix (i.e., population growth and the stable age distribution). The output from this phase is described as the percentage of the population in each age class from yearling to 13 years old when the asymptotic stage is attained. The three sets of input values were:

1. 0% of 2 year olds breed, 25% of 3 year olds breed, all 4+ year olds breed.
2. 10% of 2 year olds breed, 50% of 3 year olds breed, all 4+ year olds breed.
3. 25% of 2 year olds breed, 75% of 3 year olds breed, all 4+ year olds breed.

While we contend that Snow Leopard reproductive biology and the IUCN definitions would indicate that all individuals ≥ 2 years of age be considered mature individuals, we took a much more precautionary approach. In the second phase of the model where MI is calculated, we used two different sets of input values to describe the age at which Snow Leopards become capable of reproduction (mature). These were:

1. 25% of 2 year olds mature, 50% of 3 year olds mature, all 4+ year olds mature.
2. 50% of 2 year olds mature, 75% of 3 year olds mature, all 4+ year olds mature.

Lastly, we varied the input values that define the population from which percent MI was calculated. Recall our contention that dependent yearlings would not be included in the population estimate, hence should not be considered when calculating MI. Here again we took a precautionary approach where some proportion of yearlings are included in the population estimate. We used three sets of input values as follows:

1. Population estimate includes 50% of yearlings, plus all 2+ year olds.
2. Population estimate includes 25% of yearlings, plus all 2+ year olds.
3. Population estimate includes 0% of yearlings, plus all 2+ year olds.

Results

We ran nine different scenarios using various combinations of vital rates and percent of yearlings in the population estimate (Table 1). Full model input and output parameters for each scenario are provided in Appendix 1. We used the lower range of the global population estimate (~4,000-6,500 individuals) as a conservative value for the total population. As expected, the lowest percentage of MI was obtained when 2 year old maturity rates were lowest (25%) and the proportion of cubs in the population estimate was highest (50%). Yet even in that most precautionary scenario, we obtained a mean MI of 67.7% (s.d. = 2.07), which coupled with the most conservative global population estimate of 4,000 individuals, yielded 2,710 (s.d. = 83) mature individuals, which would exceed the 2,500 threshold for an Endangered classification.

Table 1. Input and output parameters used in the revised model. Input vital rates and resultant mean % MI and total MI are shown for nine scenarios for Snow Leopard populations in the wild. Red-shaded outputs are from the least likely scenario where 50% of yearlings are included in the population estimate and yellow-shaded outputs included 25% of the yearlings. Green-shaded outputs are from what we contend is the most plausible scenario in which the population estimate only includes independent animals ≥ 2 years of age.

Scenario	% Actually Breeding at age:			% Physiologically Mature at age:			% yearlings in population estimate	Mean % MI (SD)	Mean MI in 4,000 population (SD)
	2	3	4	2	3	4			
1	0	25	100	25	50	100	50%	67.75 (2.07)	2,709.8 (83.0)
2	10	50	100	50	75	100	50%	74.6 (1.69)	2,984.8 (67.7)
3	25	75	100	50	75	100	50%	85.4 (1.19)	2,933.6 (75.4)
4	0	25	100	25	50	100	25%	72.06 (1.94)	2,882.4 (77.7)
5	10	50	100	50	75	100	25%	79.6 (1.46)	3,185.5 (58.3)
6	25	75	100	50	75	100	25%	78.6 (1.61)	3,143.6 (64.3)
7	0	25	100	25	50	100	0%	77.0 (1.79)	3,078.6 (71.6)
8	10	50	100	50	75	100	0%	85.4 (1.19)	3,415.2 (47.4)
9	25	75	100	50	75	100	0%	84.7 (1.30)	3,386.2 (52.0)

Discussion

There are substantial data deficiencies in the known demographic parameters of wild Snow Leopards, yet where our knowledge is sound, such as for the pattern of sexual maturity, that information should be used to build the most realistic model possible. Further, the IUCN Red List definition of mature individuals seems unambiguous and should be used to interpret model outputs. In this case, where the Red List status of a species was potentially resting on the results, we did neither. Rather, we used an abundance of caution and developed scenarios where only 25% of the population becomes physiologically mature (and qualify as MI) at age two and an equal percentage was not mature until age four.

Taking this precautionary approach a step further, we applied the resultant MI percentages to a population estimate which hypothetically included up to 50% of the existing dependent yearling cubs, even though published population estimates for wild felids rarely include that age class.

To summarize, despite 1) using maturity ages later than what is recognized for the species, 2) taking an alternative approach to that prescribed by IUCN Red List Guidelines and allowing various percentages of an age class to be classified as Mature, 3) including dependent young in the population estimate contrary to convention, and 4) applying the resultant MI % to the lowest commonly accepted global population estimate, we still found that it is highly unlikely that there are less than 2,500 mature individuals in the wild Snow Leopard population.

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