

## DRAFT MODIFIED PANTHER RECOVERY CRITERIA

- Word smith these criteria post-meeting through electronic contacts and meetings
- Handle SMART later or in some cases, not at all.

### **Demographics: (Presented by Mike Runge)**

*Team: Mike, Jeff, Madan*

Presenting several optional, alternative sets of recovery criteria:

- Step down proxy of probability of persistence
- Written at the population level
- Tradeoffs between these sets
- **Continue to work further on Set 1 and Set 3:**

#### **Set 1:**

- Prime adult female survival > Threshold 1 [number or a range; would need to explain a the range (i.e., not hit the minimum for all)]
  - Not difficult to measure, good estimates
- Kitten survival at low density > Threshold 2 (when population size is small)
  - At low density confers resilience, high resilience = high probability of persistence
  - Challenge: PIT tag but not able to get them back reliably, extrapolating what kitten survival is at low density, changes in heterozygosity over time
- Carrying Capacity > Threshold 3
  - Buffering
  - Challenge: carrying capacity is hard to measure
- [Plus additional assumptions: at least 1 adult male, breeding rate of the females is at a healthy rate, sub-adult survival rates are satisfactory = understanding of life history and research, these are not areas of concern. The concern is female survival, kitten survival, enough habitat and space for there to be enough animals to buffer against extinction]
- $N > \text{Threshold 4}$  (minimum population size)
- Challenges: difficult to estimate 3 out of the 4 variables, would have to specify what constituted an appropriate PVA (density dependence, take into account different life history strategies, uncertainty in the parameters, etc.)

Different targets for each of the 3 populations?

#### **Set 2: Logistic Growth Curve**

- Represent dynamics with logistic [reference graphs on flip chart]
- Growth rate at low density > Threshold 5 (resilience)
- Carrying Capacity > Threshold 3 (buffering)
- [not an ideal option, a more general option – option 1]

#### **Set 3: Focus on instantaneous growth rate** (how fast is the population growing right now?)

- Instantaneous growth rate now > 1 [reference graph on flip chart]
  - Easiest to get measurements for (avoid density dependence, don't have to measure K)
  - **Example draft Criterion: Instantaneous growth > 1.05 with 90% confidence for > or = 15 years**

- Transient measure: use during the phase of active movement away from a depleted state
  - Would you need a next measure to get to probability of persistence measure?
  - Doesn't answer if we are far enough out of "trouble," can't say we are recovered but that we are recovering, great status measurement for progress but not a good criterion of recovery
  - Could be a reintroduction criterion
  - Set 1 and 2 are capturing short and long-term picture
- Objective, data-based, not influenced by individual ideas about what needs to be included in, for example, the PVA (see additional assumptions identified in Set 1) – everyone would calculate the same or very similar number for instantaneous growth rate
- Field work/Achievability: Marking kittens, marking adults, does not require minimum population #
  - Could include information from camera traps if developed
- Lower bound of confidence interval needs to be above 1 (similar to manatee criteria)

### **Genetics:**

*Team: Dave, David*

**\*\*\*Exchange of individuals and gene flow among populations can either be natural or through management for both reclassification and delisting.**

*Discussion of above:*

- Sub-Team proposes change regarding the current criteria calling for natural movement only for delisting (example of FL population and Arkansas population – unlikely that natural movement will occur)
- One recovery unit/recovery zone, south Florida is the only population right now, can be sub-populations within?
- Default approach of USFWS: prefer to not intentionally design recovery plan to be conservation reliant, design recovery in a way that it can achieve its goals naturally but if that fails, assisted migration can be used as a fallback – insert language "as needed" (examples: wolves, prairie dogs)
- Criteria are overlapping
- Expression of inbreeding – immediate threat. Not focused to date on preparing the species for long-term future with a changing planet.
- Is an isolated FL panther population biologically sustainable? Are there metrics for when human assistance is needed again?
- **Reference page 91 in Recovery Plan, first sentence, first paragraph**
- Criterion or a trigger? Goal is heterozygosity, so are the metrics triggers?
- **NEXT STEPS** post-meeting by Genetics Sub-Team:
  - Decide whether these are criteria that we want to move forward with and develop specific metrics.
    - Genetics should be monitored but conduct an evaluation to filter
  - Filtering Answer the following 3 questions (Mike R.):
    - From the statutory standpoint and associated guidance, is the goal for genetic diversity to prevent inbreeding depression or also to ensure long-term adaptive capacity? (policy question)

- If addressing preventing inbreeding depression, will also be addressing long-term. There is overlap here.
- What are the fundamental standards to consider in setting the desired future condition for genetic diversity? (policy question)
  - How much genetic diversity is “enough?”
- What is the relationship between these three criteria? Is there a best one? Do we need all three? (scientific question)

**Genetic Criterion 1: Maintain an effective population size of X in each population for Y years.**

- Microsatellite data already being collected, can get this number using this data source
- Fill in x and y once more information is gathered

**Metrics**

- $N_e$  – Effective population size [multiple studies on large carnivore species]

**Genetic Criterion 2: A viable population must maintain 90% of their heterozygosity projected over X panther generations (representation).**

- This criterion can be used to get at criterion 1
- Means of monitoring genetic health of the population over time

**Possible Metrics to Consider** (all metrics are currently measurable/calculated with data we have right now)

- $H_e$  – Expected Heterozygosity [issues when compared study to study, used often in the literature]
- IR – Internal Relatedness
- HL – Homozygosity by loci
- A- Allelic Richness
- $F_{\text{Temporal}}$  – Assess temporal changes in allelic diversity

**Genetic Criterion 3: Maintain an acceptable level of genetic structure (gene flow) among populations.**

**Metrics**

- $F_{st}$  (shows genetic differentiation between populations, keep this less than a threshold)
- Number of effective migrants
- Adapt to health and disease issues

**Threats-based:**

*Team: Kipp (prey), Randy (habitat), Seth (Factor D – regulatory), Roxanna (human-caused mortality)*

**HABITAT Criterion**– distribution, security and reproduction

**80% or X of y management units annually occupied by females with kittens on secure habitat blocks of 100 square miles [see existing recovery plan, 2-5 panthers/100 square acres] of relatively contiguous habitat, totaling Z acres [see recovery plan].**

- Management units determined by implementation team
- Applies to a single population (i.e., multiple management units within the South Florida population)? Or does this apply across multiple populations (e.g., South Florida)?
- Alternative index for degradation of panther habitat units (PHUs) (Randy)
- See habitat-based criteria in current plan
  - Dependent on the 240 but this number to be discussed

- Improve on this? Increase measurable?
- Describes “sufficient” in the explanation text below the criterion (~4800 square miles)
- Need to identify minimum number of units (current plan identifies 3) as well as persistence
- What is a management unit and does it interact with the other aerial factors

*Discussion for Habitat Criterion:*

- 80 or some other high percentage
- Denning habitat – important, some portion of contiguous habitat must include habitat for denning.
- X number of relatively contiguous acres of (bright red to yellow)...
- X number of acres to be occupied = suitable
- Occupied, breeding, distribution, reproduction
- Habitat = security, distribution and reproduction as a surrogate for habitat quality
  - 200 square mile area, 10% in flatwoods, x number of females can breed
  - Focus on structure rather than habitat type (allow to adapt to whatever area the panther may den in)
- Security – purchase it or have an easement
- (1) amount of habitat (2) animals in the habitat and for recovery we need both

**ROADS Criterion – Roxanna**

**Total number of road-related panther mortalities does not reduce the probability of persistence below 95% for 100 years.** [a minimum standard]

**OR**

**The rate of road-related mortality is less than 1 - T<sub>1</sub> – other sources of mortality** (see demographic criteria – Set 1, allowable mortality rate of adult females)

- *Note female component:* sub-adult males primarily what is being measured by road mortality.

*Discussion for Road Criterion:*

- Data from *radio-tracked* sub-adults and adults and cause specific mortality rates – estimated for males 5% annual mortality from vehicles and approximately 3% of females die/year from vehicles across age classes (paper, Jeff)
  - Many of these individuals are not spending a lot of time crossing roads
- NOTE: Check on mortality in other puma populations; develop thresholds bounds related to these populations → this can be addressed with the PVA, actually. Recruitment rates may be different for other populations.
- Use concept of sustainable tack to indicate how much mortality can be tolerated in each of the age classes? “What is the sustainable **tack** of panthers (roads, other causes, etc.)?” [One Question]
- Why did sub-team focus on roads? It’s a technical fix type of problem (not perfect but there are actions), well-monitored, can count them
- “What is the adult female prime survival rate that is needed?” question in Demographics, so for this criterion it is “What is the total mortality that can ‘be allowed.’” [Second Question]
- What is the threshold rate for mortality from vehicles?
- All new and modified roads are looked at...this is an action

- Discussion topic of sub-team: Road mortality doesn't impact the PVA?
- Standalone metric looking at transportation? measurable, important to identify independently
- Majority of human-related panther deaths are road related, use language similar to Seth's
- Transportation very high in the threats analysis
- The yellow text reiterates the demographic criterion

#### PREY Criterion – Kipp

**Panther prey bases are adequate to support a stable or growing panther population, and important prey species such as white-tailed deer are monitored and managed for long-term sustainability.**

- Deer management plan takes panthers into consideration?
  - o Deer essential to panthers
- Deer management units and population targets – measurable, quantifiable
- Add numbers later
- If this doesn't happen, seen in demographics
- Polar Bear plan – sea ice criterion related to prey availability, bigger issue was the platform used to hunt rather than the prey availability, likely to lose platform before primary prey item
  - o Unsure if there is a substitute for panther prey, though
  - o Can/can't assume habitat suitability = adequate prey
- If increase prey, are we increasing resiliency or increasing buffer?
- Medium ranked threat in Threat Assessment – could be a high or very high if assessment run today with current events
  - o Deer have crashed in some areas, cattle depredation increased
  - o **Is the loss of prey a significant threat to panthers today?**
    - A yes vibe so continue working on it
- Prey is included in habitat criterion...
- **NOTE:** Check other recovery plans for large carnivores about a prey criterion

#### FACTOR D (Delisting Criterion for Remnant Threats) – Seth

**Develop with partners a Conservation Strategy to outline remnant threats (those threats that are likely to persist after delisting) and how they will be managed in the absence of Federal ESA protections (i.e., after delisting). These commitments (those articulated in the Conservation Strategy) should be incorporated into regulation as possible.**

**In cooperation with partners, develop a post delisting monitoring period considering the biology of the species (6 year life cycle of the species) as well as the likely duration / period of concern for remnant threats. Employ this methodology for several generations leading up to delisting, if possible, to prove its effectiveness.**

#### Discussion for Factor D Criterion:

- Post-listing Management Plan typically the route taken. A remnant threat criterion like this is rarely addressed in the Recovery Plan.
- Would/Could down listing trigger this effort?