Taxonomic Process

• Taxonomy: *The theory and practice of describing, naming and classifying organisms.*

• Taxonomic Hierarchy:
  - Kingdom: Animalia
  - Phylum: Chordata
  - Class: Mammalia
  - Order: Carnivora
  - Family: Felidae
  - Genus: *Puma*
  - Species: *concolor*
  - Subspecies: *coryi*
Taxonomic Process - *Puma concolor*

- **Felis concolor** (Linnaeus, 1771)
- **Puma concolor** (Ewer, 1973)
Taxonomic Process- *Puma concolor ssp.*

Subspecies

"Members of a subspecies share a unique geographic range..., a group of phylogenetically concordant phenotypic characters, and a unique natural history relative to other subdivisions of the species....different subspecies are reproductively compatible“ (O’Brien and Mayr, 1991)

Figure 1. Distribution of subspecies of *Felis concolor* in North and Middle America

1. *F. c. concolor* cougar
2. *F. c. misouriensis*
3. *F. c. hippocrepis*
4. *F. c. oregonaensis*
5. *F. c. vancouverensis*  
6. *F. c. olympus*
7. *F. c. californica*
8. *F. c. kaibabensis*
9. *F. c. brownii*
10. *F. c. improcera*
11. *F. c. asteca*
12. *F. c. stanleyana*
13. *F. c. coryi*
14. *F. c. mayensis*
15. *F. c. costaricensis*

Young and Goldman (1946)
Taxonomic Process- *Puma concolor coryi*

- First described by Charles B. Cory in 1896
  - *Felis concolor floridana*
- Nelson and Goldman (1929)
  - *Felis concolor coryi*
  - Type specimen collected in Sebastian, FL
- Young and Goldman (1946)
  - Mention morphological distinctions of *F. c. coryi*
    - Fur coloration
    - Skull morphology
    - Differences with pumas from TX and eastern US.
Taxonomic Process - *Puma concolor coryi*

Arched Nasals
Puma concolor coryi

- Arrival of colonists
- Unregulated hunting
- Habitat loss
- Range contraction
Florida Panther Taxonomy

- **1950**: Attains game animal status
- **1958**: Listed as endangered by FL
- **1967**: Listed as endangered by U.S.
- **1973**: Afforded protection under ESA
Florida Panther Taxonomy

• The ESA defines an “endangered species” as “any species which is in danger of extinction throughout all or a significant portion of its range.”

• Under the definition of “species” in the ESA, the U.S. Fish and Wildlife Service (FWS) can apply the protections of the ESA to any species or subspecies of fish, wildlife, or plants, or any distinct population segment of any species of vertebrate fish or wildlife that meets the definition of endangered or threatened.
Florida Panther Genetic Restoration

- Panthers captured appeared to be suffering from inbreeding depression
Florida Panther Genetic Restoration

- Release of 8 wild female Texas pumas in 1995
- 5 of 8 produced a minimum of 20 kittens
- Offspring successfully reproduced
- All female Texas pumas removed from wild by 2003
Florida Panther Taxonomy- Recent Research
Wilkins et al. (1997)

• Sampled skulls and skins of 79 *P. concolor* from SE US

• Also compared with puma from western NA and SA.

• Assessed
  • Pelage color
  • Cranial profiles and proportions
  • Other morphological traits

• Results
  • Specimens recovered in SW Florida between 1977-1997 continued to display classic *P. c. coryi* morphological features.
  • Did not include any post-genetic restoration panthers in their sample.
Florida Panther Taxonomy - Recent Research
Culver et al. (2000)

6 major geographic subdivisions of *Puma* per Culver et al. (2000)

*Puma concolor cougar*
Genetic Restoration of the Florida Panther


The rediscovery of remnant Florida panthers (Puma concolor coryi) in southern Florida swamplands prompted a program to protect and stabilize the population. In 1995, conservation managers translocated eight female pumas (P. c. stanleyana) from Texas to increase depleted genetic diversity, improve population numbers, and reverse indications of inbreeding depression. We have assessed the demographic, population-genetic, and biomedical consequences of this restoration experiment and show that panther numbers increased threefold, genetic heterozygosity doubled, survival and fitness measures improved, and inbreeding correlates declined significantly. Although these results are encouraging, continued habitat loss, persistent inbreeding, infectious agents, and possible habitat saturation pose new dilemmas. This intensive management program illustrates the challenges of maintaining populations of large predators worldwide.

Pumas (also called cougars, mountain lions, or panthers) are currently distributed throughout western North America and much of Central and South America (1). The endangered Florida panther (listed in 1967, table S1), the last surviving puma subspecies in eastern North Ameri-
Florida Panther Taxonomy - Recent Research
Florida Panther Taxonomy- Recent Research
Finn et al. 2013

The impact of genetic restoration on cranial morphology of Florida panthers (Puma concolor coryi)

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• Results:
  • Admixed and canonical cranial morphology did not differ
  • Cranial morphology continues to discriminate FL panthers and TX pumas.
Florida Panther Taxonomy- Recent Research

- Conservation project using Whole Genome Sequencing
- Fine-scale assessment of genetic restoration
- Identify potential local adaptations
- Define criteria for implementing subsequent genetic restoration programs
Current Distribution
100-180 adult and subadult panthers
Perspectives on Taxonomic Process: Subspecies

- **O’Brien and Mayr** *(Science 1991, 251:1187-1188)* The Florida panther would receive continued protection since it clearly qualifies as a subspecies. In fact, the present population may be better off as a result of acquisition of new genes because of the multiple congenital difficulties that apparently emerged as a result of inbreeding in the ancestral Florida panther.

- **Cronin** *(WSB 2006, 34:237-241)* *Subspecies* has been a loosely applied concept with little objective rigor. However, the concept has utility in recognizing potentially important geographic variation and may be applied with proper application of taxonomic principles.

- **Haig et al.** *(Con. Bio. 2006, 20:1584-1594)* Despite all the criticisms, recent studies in which researchers used multiple criteria...have confirmed that many *subspecies* are evolutionarily definable entities...although subspecies may have been too liberally applied by early taxonomists, this does not invalidate the concept of subspecies as meaningful biological entities. **Factors other than genetics need to be considered in understanding relationships below the species level.**
Perspectives on Taxonomic Process

• **Belden (FWS) Inquiry 2007:** Should the subspecific status of Florida panthers be reassessed?

• **Results:**
  
  • Ranged from retain subspecies status, to manage as DPS.
  
  • Included comments that “morphological comparisons are uninformative” to “morphological research is important”.
  
  • “Genetics is only part of the story”
Current Genetic Research

• Samples collected from all panthers handled
• Historic tissue archives in FL and Smithsonian
• Samples processed in USFS Genetics Lab in MT
• Microsatellite panel
  • Changes in genetic variation
  • Historic comparisons
  • Paternity, Pedigree
  • Landscape Genetics
• Population modeling
• Comparisons with other puma populations
Questions?