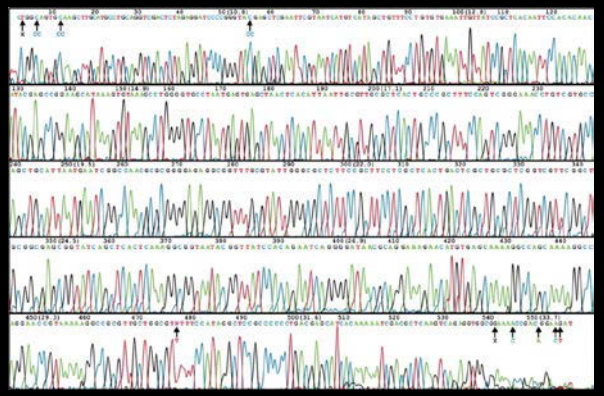
Florida Panther Taxonomy



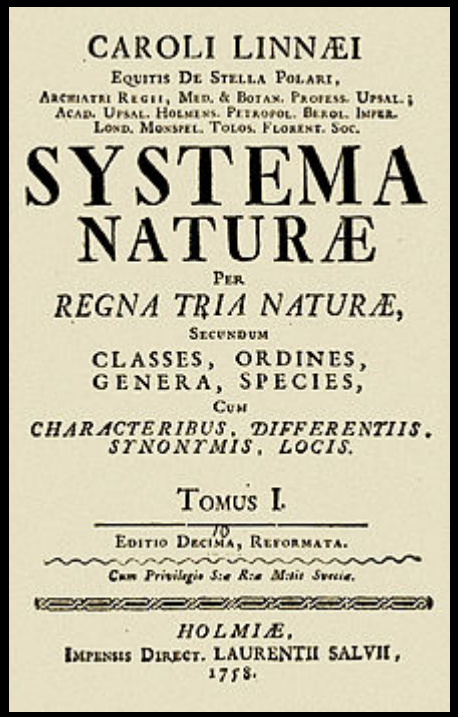
Dave Onorato

Fish and Wildlife Research Institute

Florida Fish and Wildlife Conservation Commission

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***


CAROLI LINNÆI
EQUITIS DE STELLA POLARI,
ARCHIATRI REGII, MED. & BOTAN. PROFESS. UPSAL.;
ACAD. UPSAL. HOLMENS. PETROPOL. BEROL. IMPER.
LOND. MONSPEL. TOLOS. FLORENT. SOC.

SYSTEMA NATURÆ

PER
REGNA TRIA NATURÆ,
SECUNDUM
CLASSES, ORDINES,
GENERA, SPECIES,
CUM
CHARACTERIBUS, DIFFERENTIIS,
SYNONYMIS, LOCIS.

TOMUS I.

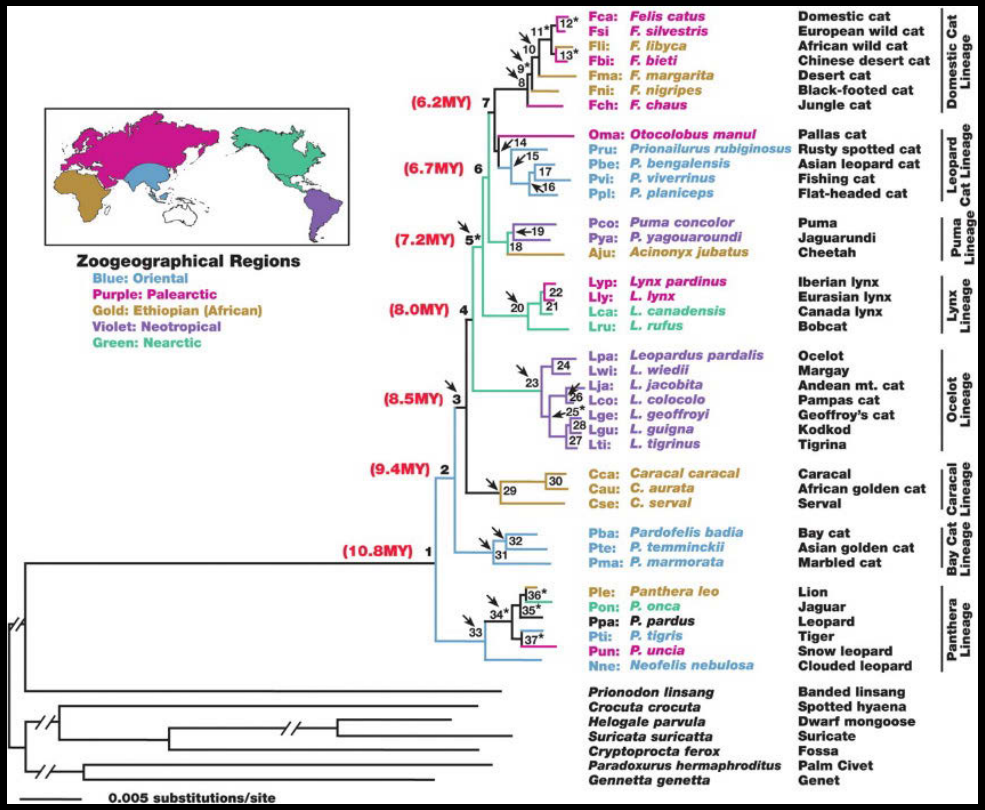
EDITIO DECIMA, REFORMATA.

Cum Privilegio Sæ Reæ Mtis Sveciæ.

HOLMIÆ,
IMPENSIS DIRECT. LAURENTII SALVII,
1758.

Taxonomic Process- *Puma concolor*

- ***Felis concolor*** **(Linnaeus, 1771)**
- ***Puma concolor*** **(Ewer, 1973)**



Taxonomic Process- *Puma concolor ssp.*

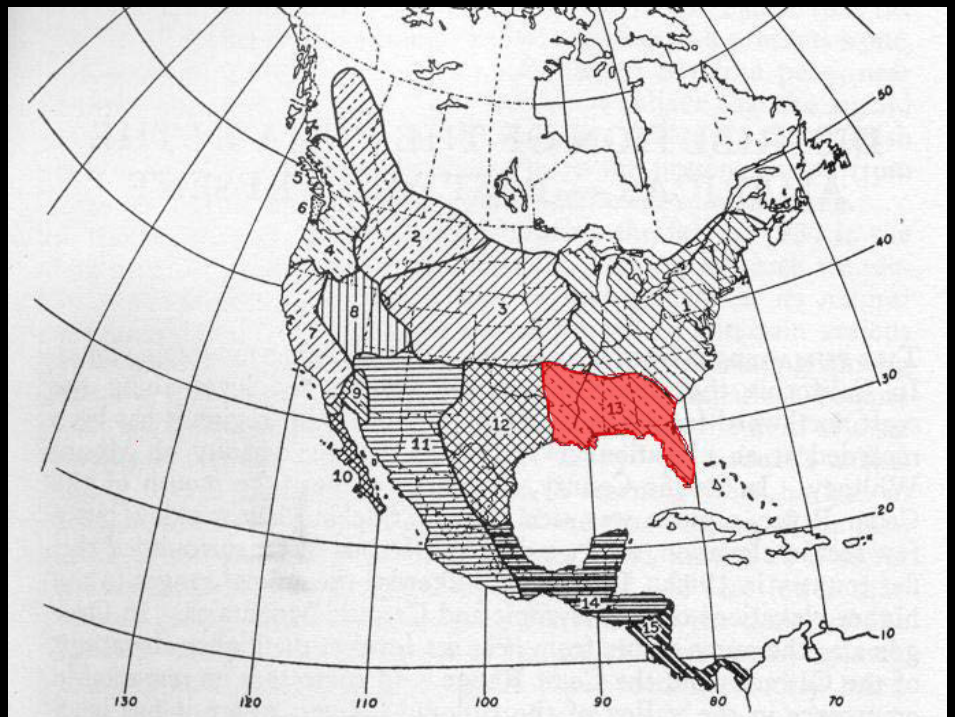


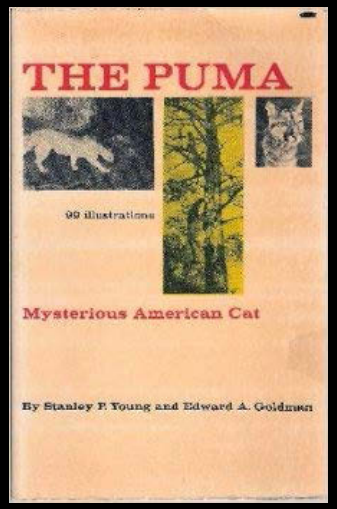
Figure 1. Distribution of subspecies of *Felis concolor* in North and Middle America

1. *Felis concolor couguar*
2. *F. c. missoulensis*
3. *F. c. hippolestes*
4. *F. c. oregonensis*
5. *F. c. vancouverensis*
6. *F. c. olympus*
7. *F. c. californica*
8. *F. c. kaibabensis*
9. *F. c. browni*
10. *F. c. improcera*
11. *F. c. azteca*
12. *F. c. stanleyana*
13. *F. c. coryi*
14. *F. c. mayensis*
15. *F. c. costaricensis*

Young and Goldman (1946)

Subspecies

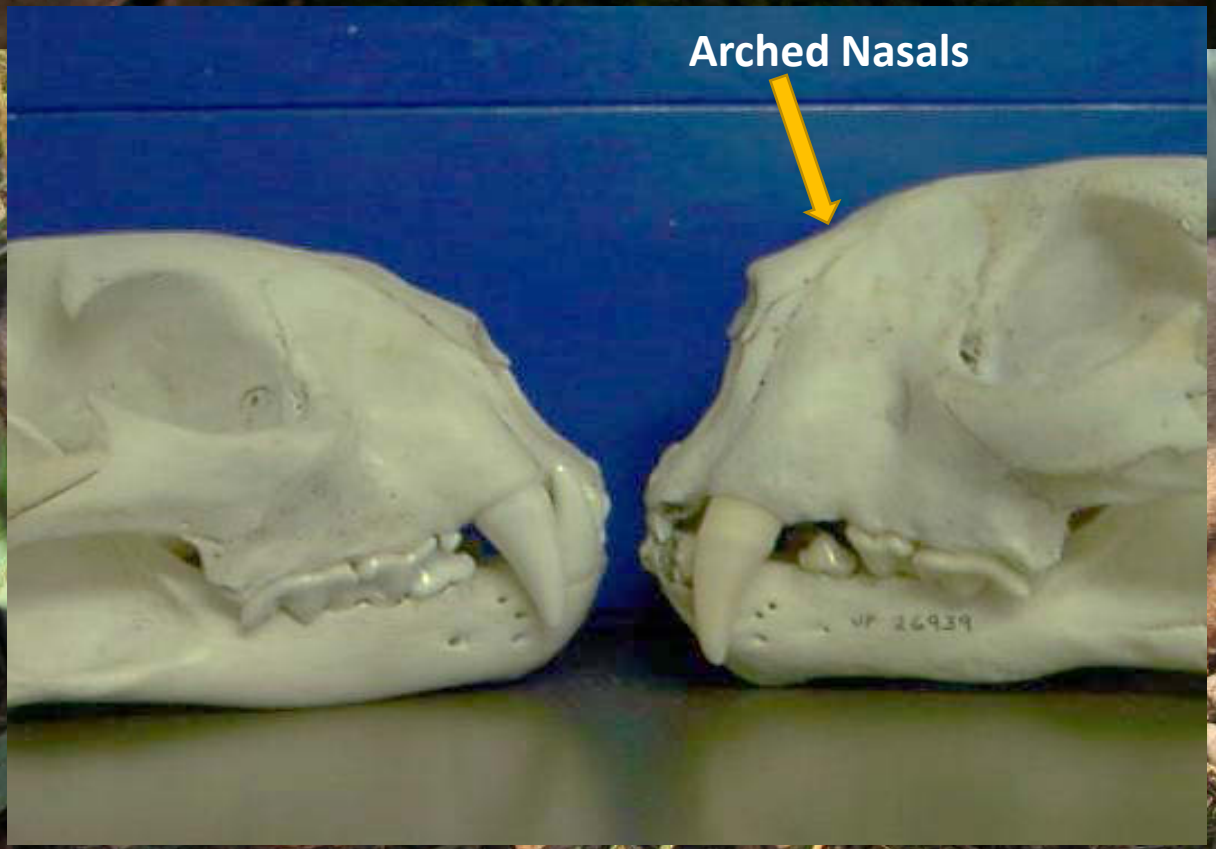
"Members of a subspecies share a unique geographic range…, a group of phylogenetically concordant phenotypic characters, and a unique natural history relative to other subdivisions of the species….different subspecies are reproductively compatible" (O'Brien and Mayr, 1991)



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.**

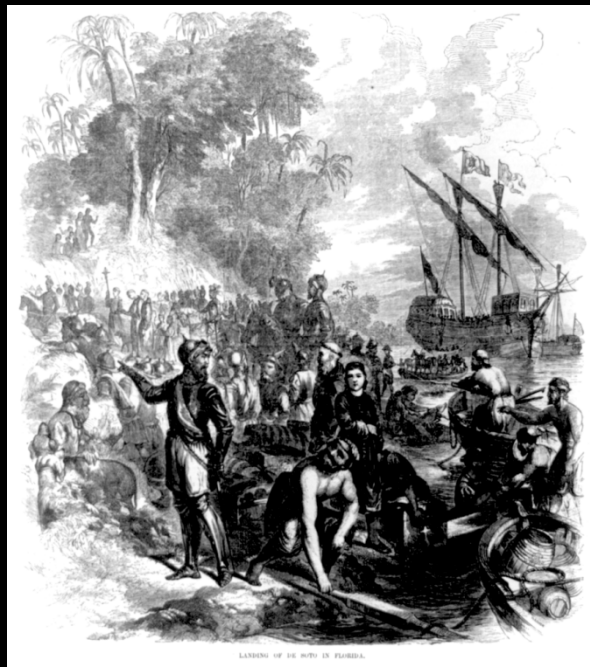
Taxonomic Process- *Puma concolor coryi*




Missouri
Kentucky
Virginia
Oklahoma
Tennessee
North Carolina
Arkansas
South Carolina
Mississippi
Alabama
Georgia
Texas
Louisiana
Florida
Historical Distribution
N
0 95 190 380 Km

Puma concolor coryi

- Arrival of colonists
- Unregulated hunting
- Habitat loss
- Range contraction



DEPARTMENT OF THE INTERIOR

Fish and Wildlife Service

HURON ISLANDS AND SENEY UNITS

Notice of Public Hearing Regarding Wilderness Study

Notice is hereby given in accordance with provisions of the Wilderness Act of September 3, 1964 (P.L. 88-577; 78 Stat. 890, 892; 16 U.S.C. 1131, 1132), that a public hearing will be held beginning at 9 a.m. on May 10, 1967, at the Northern Michigan University Center, Marquette, Mich., on studies leading to recommendations to be made to the President of the United States by the Secretary of the Interior regarding the desirability of including the Huron Islands and Seney Wilderness Study Areas in the National Wilderness Preservation System. The Units consist of approximately 147 acres and 20,000 acres within the Huron Islands and Seney National Wildlife Refuges located in Marquette and Schoolcraft Counties, Mich., respectively.

A brochure containing a map and information about the Huron Islands and Seney Wilderness Units may be obtained from the Refuge Manager of Seney National Wildlife Refuge, Seney, Mich. 49883, or the Regional Director, Bureau of Sport Fisheries and Wildlife, 1006 West Lake Street, Minneapolis, Minn. 55408.

Individuals or organizations may express their oral or written views by appearing at this hearing, or they may submit written comments for inclusion in the official record of the hearing to the Regional Director at the above address by May 10, 1967.

JOHN S. GOTTSCHALK,
Director, Bureau of Sport Fisheries and Wildlife.

MARCH 8, 1967.

[F.R. Doc. 67-2721; Filed, Mar. 10, 1967; 8:48 a.m.]

Office of the Secretary

NATIVE FISH AND WILDLIFE

Endangered Species

In accordance with section 1(c) of the Endangered Species Preservation Act of October 15, 1966 (80 Stat. 926; 16 U.S.C. 668aa(c)) I find after consulting the States, interested organizations, and individual scientists, that the following listed native fish and wildlife are threatened with extinction.

Mammals:

Indiana Bat—*Myotis sodalis.*
Delmarva Peninsula Fox Squirrel—*Sciurus niger cinereus.*
Timber Wolf—*Canis lupus lycaon.*
Red Wolf—*Canis niger.*
San Joaquin Kit Fox—*Vulpes macrotis mutica.*
Grizzly Bear—*Ursus horribilis.*
Black-Footed Ferret—*Mustela nigripes.*
Florida Panther—*Felis concolor coryi.*
Caribbean Monk Seal—*Monachus tropicalis.*
Guadalupe Fur Seal—*Arctocephalus philippi townsendi.*
Florida Manatee or Florida Sea Cow—*Trichechus manatus latirostris.*
Key Deer—*Odocoileus virginianus clavium.*
Columbian White-Tailed Deer—*Odocoileus virginianus leucurus.*
Sonoran Pronghorn—*Antilocapra americana sonoriensis.*

Birds:

Hawaiian Dark-Rumped Petrel—*Pterodroma phaeopygia sandwichensis.*
Hawaiian Goose (Nene)—*Branta sandvicensis.*
Aleutian Canada Goose—*Branta canadensis leucopareia.*
Tule White-Fronted Goose—*Anser albifrons gambelli.*
Laysan Duck—*Anas laysanensis.*
Hawaiian Duck (or Koloa)—*Anas wyvilliana.*
Mexican Duck—*Anas diazi.*
California Condor—*Gymnogyps californianus.*
Florida Everglade Kite (Florida Snail Kite)—*Rostrhamus sociabilis plumbeus.*
Hawaiian Hawk (or Ii)—*Buteo solitarius.*
Southern Bald Eagle—*Haliaeetus l. leucocephalus.*
Attwater's Greater Prairie Chicken—*Tympanuchus cupido attwateri.*
Masked Bobwhite—*Colinus virginianus ridgwayi.*
Whooping Crane—*Grus americana.*
Yuma Clapper Rail—*Rallus longirostris yumanensis.*
Hawaiian Common Gallinule—*Gallinula Chloropus sandvicensis.*
Eskimo Curlew—*Numenius borealis.*
Puerto Rican Parrot—*Amazona vittata.*
American Ivory-Billed Woodpecker—*Campephilus p. principalis.*
Hawaiian Crow (or Alala)—*Corvus tropicus.*
Small Kauai Thrush (Puaiohi)—*Phaeornis palmeri.*
Nihoa Millerbird—*Acrocephalus kingi.*
Kauai Oo (or Oo Aa)—*Moho braccatus.*
Crested Honeycreeper (or Akohekohe)—*Palmeria dolei.*
Akiapolaau—*Hemignathus wilsoni.*
Kauai Akialoa—*Hemignathus procerus.*
Kauai Nukupuu—*Hemignathus lucidus hanapepe.*
Laysan Finchbill (Laysan Finch)—*Psittirostra c. cantans.*
Nihoa Finchbill (Nihoa Finch)—*Psittirostra cantans ultima.*
Ou—*Psittirostra psittacea.*
Palila—*Psittirostra bailleui.*
Maui Parrotbill—*Pseudonestor xanthophrys.*
Bachman's Warbler—*Vermivora bachmanii.*
Kirtland's Warbler—*Dendroica Kirtlandii.*
Dusky Seaside Sparrow—*Ammospiza nigrescens.*
Cape Sable Sparrow—*Ammospiza mirabilis.*

Reptiles and Amphibians:

American Alligator—*Alligator mississippiensis.*

Blunt-No... *wiliz...*
San Fran... *sirtalis*
Santa Cr... *bystom...*
Texas ... *rathbu...*
Black To...

Fishes:

Shortnos... *strum.*
Longjaw ...
Piute Cu... *leniris.*
Greenbac... *stomias*
Montana ... *Salmo ...*
Gila Trou...
Arizona (...
Desert D...
Humpbac...
Little C... *vittata*
Moapa D...
Colorado ... *lucius.*
Cui-ui—C...
Devils Ho...
Commans... *elegans*
Owens ... *osus.*
Pahrump...
Big Bend ...
Clear Cre... *chir.*
Gila Topm...
Maryland ...
Blue Pike...

FEBRUAR...

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PRAIRIEL... RIC...

Order

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Florida Panther Taxonomy

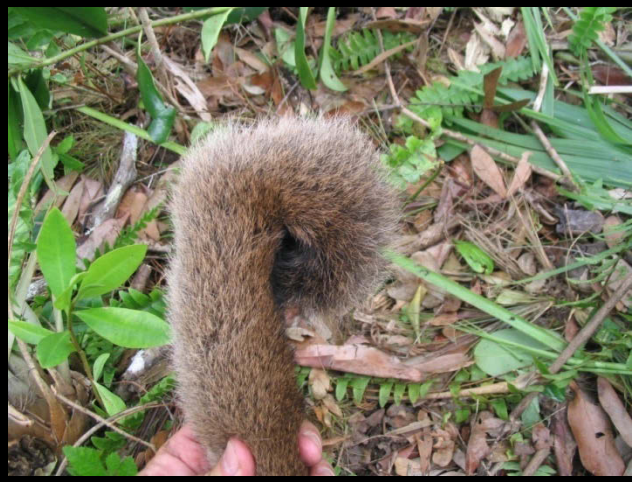
- 1950: Attains game animal status
- 1958: Listed as endangered by FL
- 1967: Listed as endangered by U.S.
- 1973: Afforded protection under ESA

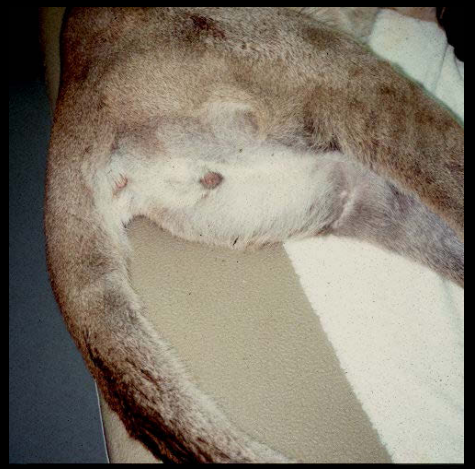
Florida Panther Taxonomy

- ***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.***

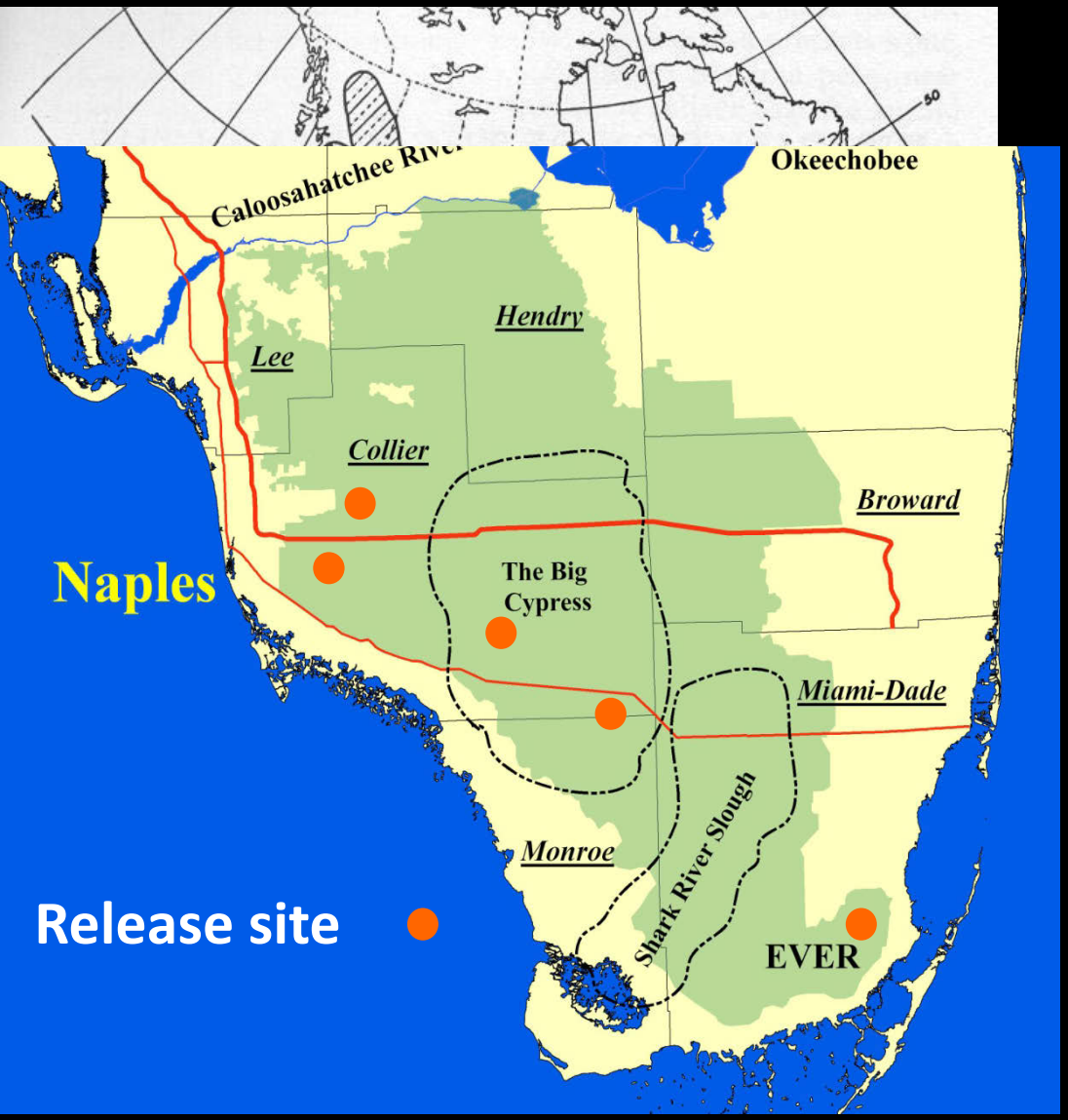
Florida Panther Genetic Restoration

- **Panthers captured appeared to be suffering from inbreeding depression**

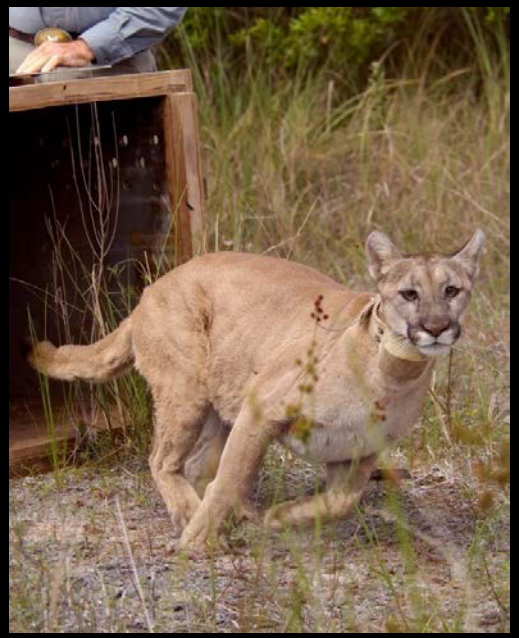




Florida Panther Genetic Restoration

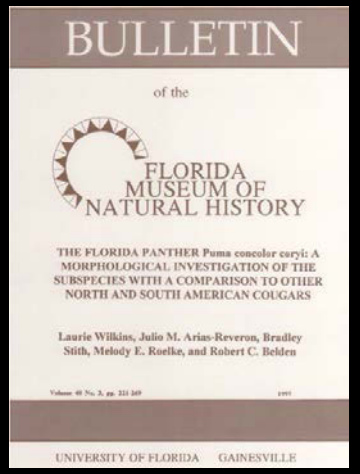


- Release of 8 wild female Texas pumas in 1995
- 5 of 8 produced a minimum of 20 kittens
- Offspring successfully reproduced
- All female Texas pumas removed from wild by 2003



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 couguar

Florida Panther Taxonomy- Recent Research Johnson et al. (2010)

texture evolution is modeled crystal plasticity theory apent (*31*). It is assumed that random orientation distribu-
D″ about 290 km above the results, we assume dominant)[010] slip. We chose a geo-ecords strain and temperature, to the CMB and attains large ntation develops rapidly and he strong alignment of (001) inclined to the CMB (Fig. e orientation distribution and properties (*34*), we calculated erties and seismic wave prop- polarization directions of the wave velocities, high shear- km/s in the flow direction; olarized parallel to the CMB is consistent with seismic circum-Pacific regions (*2*, *4*),

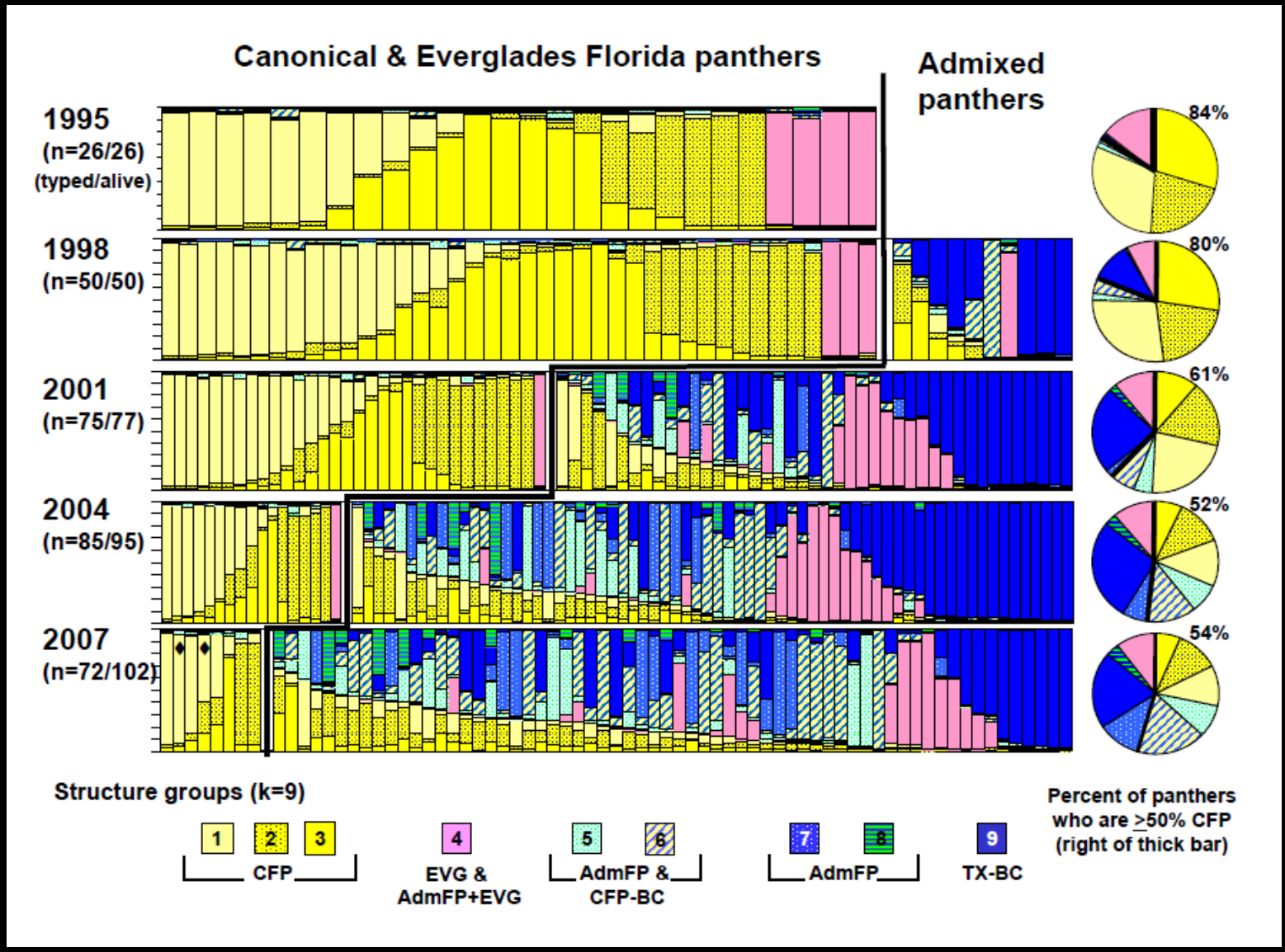
Genetic Restoration of the Florida Panther

Warren E. Johnson,[1]*† David P. Onorato,[2]*† Melody E. Roelke,[3]* E. Darrell Land,[2]* Mark Cunningham,[2] Robert C. Belden,[4] Roy McBride,[5] Deborah Jansen,[6] Mark Lotz,[2] David Shindle,[2] JoGayle Howard,[8] David E. Wildt,[8] Linda M. Penfold,[9] Jeffrey A. Hostetler,[10] Madan K. Oli,[10] Stephen J. O'Brien[1]†

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 Amer-

Florida Panther Taxonomy- Recent Research



Florida Panther Taxonomy- Recent Research
Finn et al. 2013

Journal of Mammalogy, 94(5):1037–1047, 2013

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

KYLE T. FINN, MARC A. CRIFFIELD, DAVE P. ONORATO, AND DAVID L. REED*

Florida Museum of Natural History, University of Florida, P.O. Box 117800, Gainesville, FL 32611, USA (KTF, DLR)
Fish and Wildlife Research Institute, Florida Fish and Wildlife Conservation Commission, 298 Sabal Palm Road, Naples, FL 34114, USA (MAC, DPO)

** Correspondent: dlreed@ufl.edu*

- Results:
  - Admixed and canonical cranial morphology did not differ
  - Cranial morphology continues to discriminate FL panthers and TX pumas.

Florida Panther Taxonomy- Recent Research

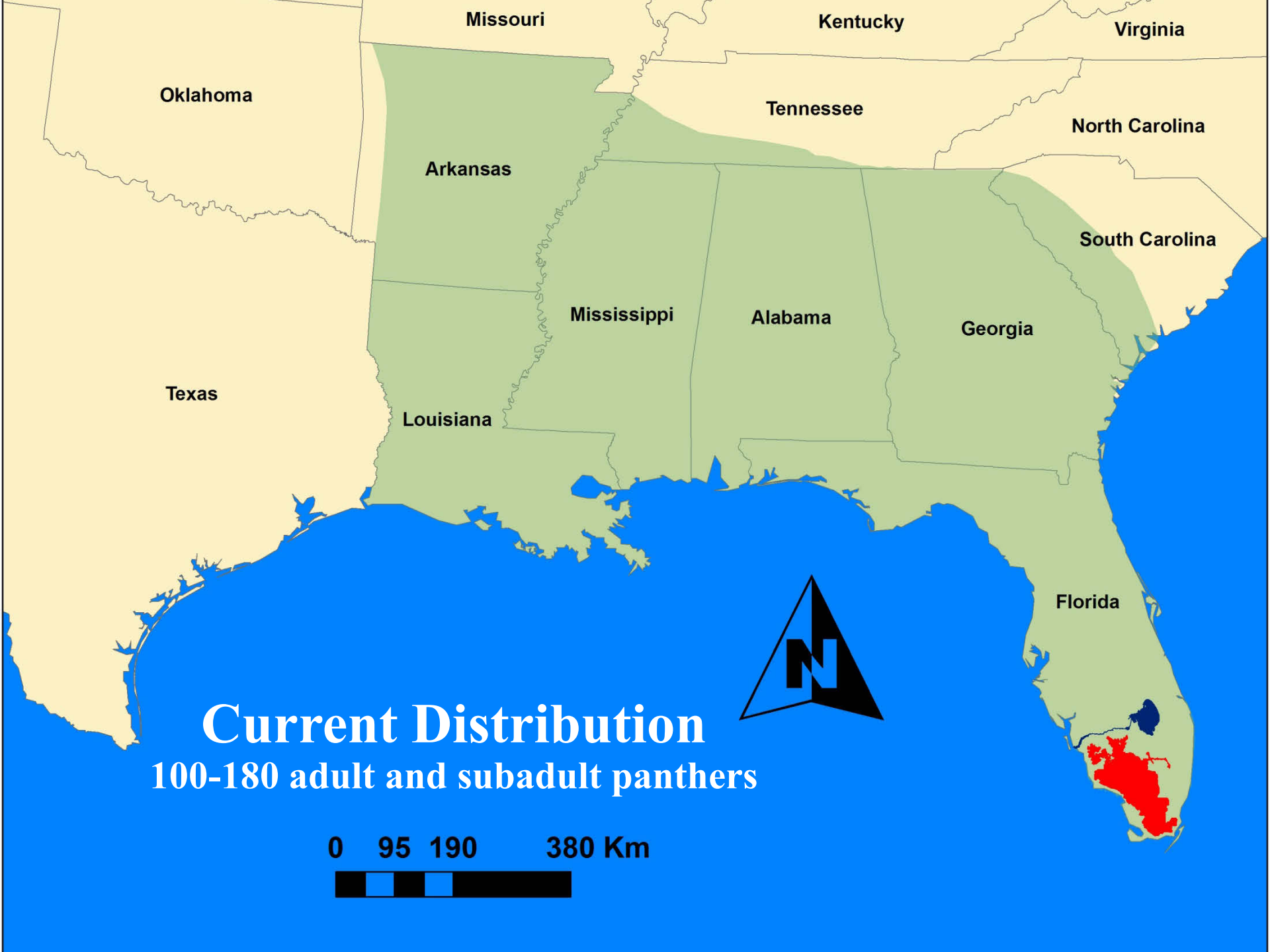
THE UNIVERSITY OF ARIZONA

Functional Genomics and Conservation of the Endangered Florida Panther

Alexander Ochoa,* Dave Onorato,§ Robert Fitak,† and Melanie Culver*

**School of Natural Resources and the Environment, The University of Arizona; §Fish and Wildlife Research Institute, Florida Fish and Wildlife Conservation Commission; †Institut für Populationsgenetik Veterinärmedizinische, Universität Wien*

- Conservation project using Whole Genome Sequencing
- Fine-scale assessment of genetic restoration
- Identify potential local adaptations
- Define criteria for implementing subsequent genetic restoration programs


Missouri
Kentucky
Virginia
Oklahoma
Tennessee
North Carolina
Arkansas
South Carolina
Mississippi
Alabama
Georgia
Texas
Louisiana
Florida
N
Current Distribution
100-180 adult and subadult panthers
0 95 190 380 Km

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?