

BIOL3110: Evolutionary and Conservation and genetics

Lecture 1:

Introduction to unit format/schedule/assessments & staff, foundation concepts in conservation genetics

Unit staffing

Convener:

A/Prof. Adam Stow

Email (best): adam.stow@mq.edu.au

Office: 6 Science Rd-275,

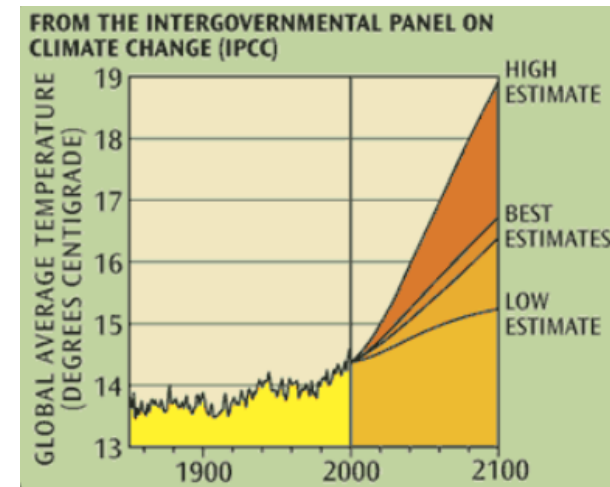
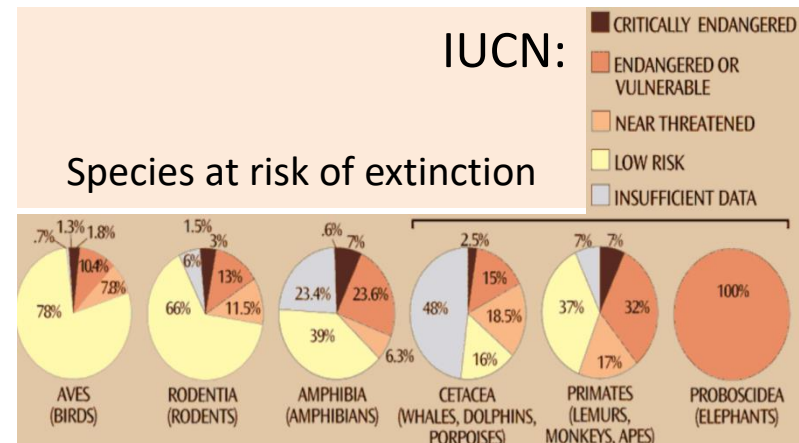
Ph: (02) 9850 8135

Tutor: Jessica O'Hare

Unit OVERVIEW

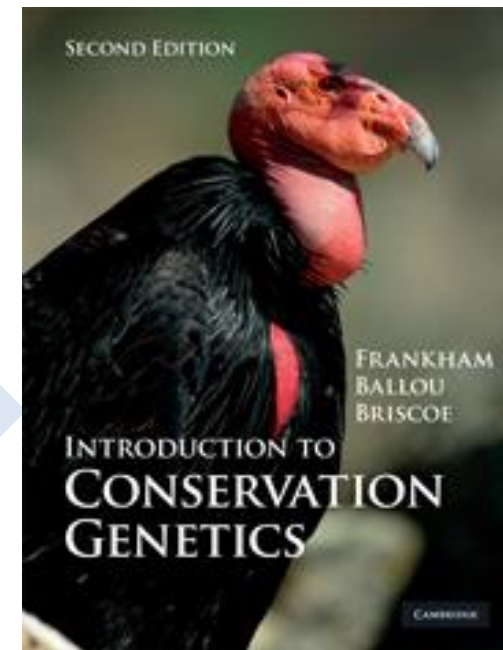
Major themes:

- **Genetic diversity** (variation);
- Determinants of genetic diversity;
- Considerations for conservation in wild & captive populations;
- Quantitative genetics, molecular genetics & genomics as tools
- Evolutionary & Ecological genetics
 - **Applied Macquarie research**

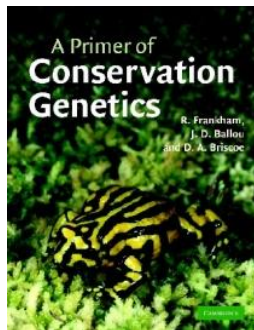


Unit TEXT(s)

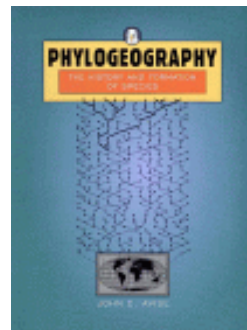
- Frankham et al. 2009
- Required & necessary
- Conceived for and strongly linked to course content
- Contains weekly problems



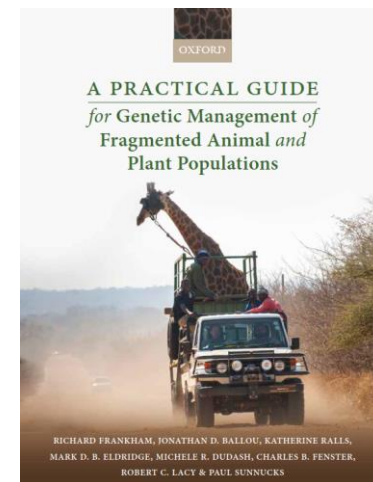
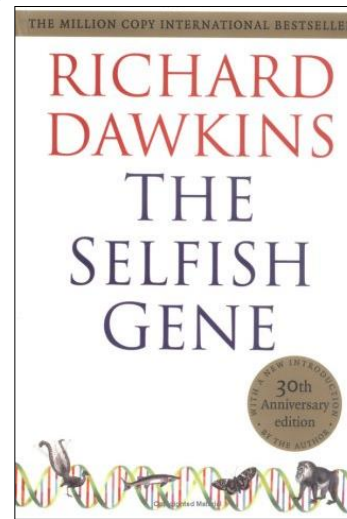
...Others:



Frankham et al. (2004) *A Primer of Conservation Genetics*, Cambridge



Avise (2000) *Phylogeography: The History and Formation of Species*, Harvard



Unit delivery

Read relevant textbook chapter & other readings (on iLearn)

- Work through problems for upcoming tutorial (weeks 2-4 & 8-10)
- Prepare assignments & seminar, study for tests & final exam

Timetable:

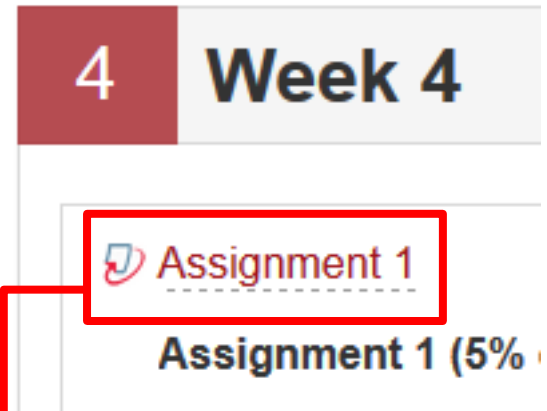
Lecture 1	Monday	12:00-1.00	ONLINE
Lecture 2	Tuesday	12:00-1.00	ONLINE
Tutorial [class 1]	Wednesday	10:00-12:00	14 Eastern Road 120 Science Lab
Tutorial [class 2]	Wednesday	2:00-4.00	14 Eastern Road 120 Science Lab
Tutorial [class 3]	Wednesday	4.30-6.30	ONLINE
Residential session (for infrequent attendance students)	6 - 8th of April (inclusive)		14 Eastern Rd, 160 Science Lab

Online delivery

www.iLearn.mq.edu.au

Access for:

- Announcements
- Detailed unit guide (latest **updates**)
- Assignment information & **submission**
- Grades
- Lecture materials (overheads/Echo360)
- Discussion board
- Other resources (e.g. example papers)



General Assessment Information

Due dates, extensions, penalties and disruption to study

Overdue assignments will attract a penalty at the rate of **5 % of the total mark allocated for the assignment per day past the due date.** This penalty will be capped at 75 %, which means that once your submission is more than 15-days overdue you can earn up to a maximum of 25 %.

The date and time of your submission will be taken as registered by TURNITIN.

General Assessment Information

Disruption to study

Deadlines for assessments are **not negotiable** except under circumstances when you have experienced a serious and unavoidable disruption. In such instances, you should formally lodge a **disruption to studies notification via ASK@MQ**.

1. To be eligible for special consideration, you must notify the University of a *serious and unavoidable* disruption **within five (5) working days** of the commencement of the disruption;
2. Such requests must be lodged for the **specific assessment task** for which you experienced disruption. Special consideration cannot be granted retrospectively (i.e., beyond the 5-day window of each assessment due-date);

UNIT GUIDE

See it for:

- Unit completion requirements
- Detail on upcoming assessments (including submission guidelines)
- **Due dates/penalties/special consideration**
- Plagiarism policy
- Other general policies
- Statements of:
 - Unit objectives
 - Learning outcomes
 - Graduate capabilities

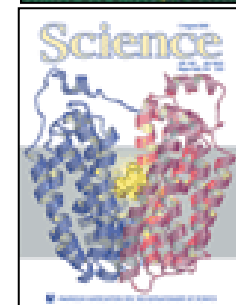
Assessment at a glance

Task:	Worth	Learning Outcomes	Graduate Capabilities	Description
Assignment 1 EARLY assessment task	5%	1-3	1-9	Commentary article
Problem test 1	15%	1-4,6	1-9	Multiple choice & problems
Problem test 2	15%	1-4,6	1-9	Multiple choice & problems
Seminar	15%	1-3,5,7	1-9	Oral lab presentation
Assignment 2	20%	1-6,8	1-9	Scientific lab report
Final exam	30%	1-6	1-9	Test of all unit content (problem based) – error in unit guide

Assignment 1

Commentary article (5%)

- Commentary-style article on genetic diversity & conservation (**500-600 words**)
- Identify a paper from leading journals....examples in **iLearn** folder located in Week 3
- Read paper and its methodologies and write a commentary in the tone of those appearing in the 'Perspectives' section of the journal *Science*.
- Assessment weighted for participation, presentation and genuine effort.
- **iLearn** link for TURNITIN submission in Week 4



Assignment 1

Commentary article (5%) – see **ilearn week 3 or Unit outline**

Original article

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. Hostettler,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-

emag.org **SCIENCE** VOL 329 24 SEPTEMBER 2010

Science Perspectives (commentary) article

GENETICS

A Bit of Texas in Florida

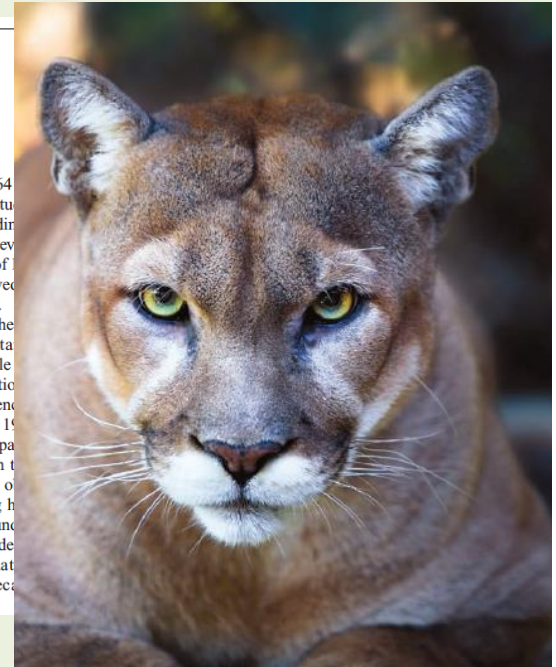
Craig Packer

Harassed, hunted, and restricted to ever smaller areas, most populations of large carnivores are fragmented into archipelagoes of parks and reserves. Biologists have long warned of the negative genetic consequences of inbreeding in such small populations. To restore genetic health, they have prescribed “active management,” including moving, or translocating, individuals into inbred populations. In a time of budget cuts and inadequate funding for effective conservation, however, is translocation worth the costs? Moving a lion from Namibia to South Africa is not a trivial exercise, nor is the translocation of cougars from one part of the United States to another. But it may be worth the trouble, Johnson *et al.* (1)

Department of Ecology, Evolution, and Behavior, University of Minnesota, St. Paul, MN 55108, USA. E-mail: packer@umn.edu

report on page 164 comprehensive study of effects of inbreeding find convincing evidence of a population of successfully improved others from Texas.

Florida panther pumas, or mountain lions, provided an exception to genetic consequences. By the early 1990s, of 20 to 25 adult panthers, genetic variation was low. Biologists of the problems—including low quality, poor fecundity, and with one or no deer to predictions that the population would be extinct within decades.



Research Themes: A/Prof Stow

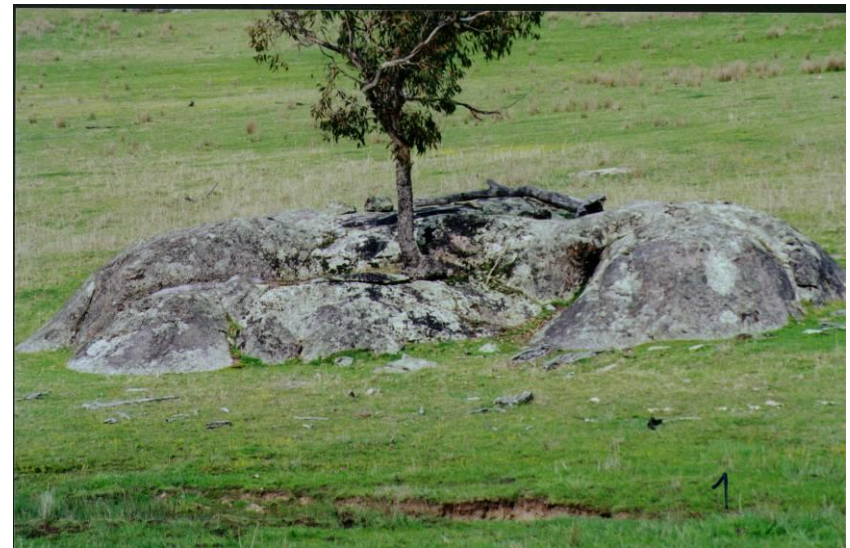
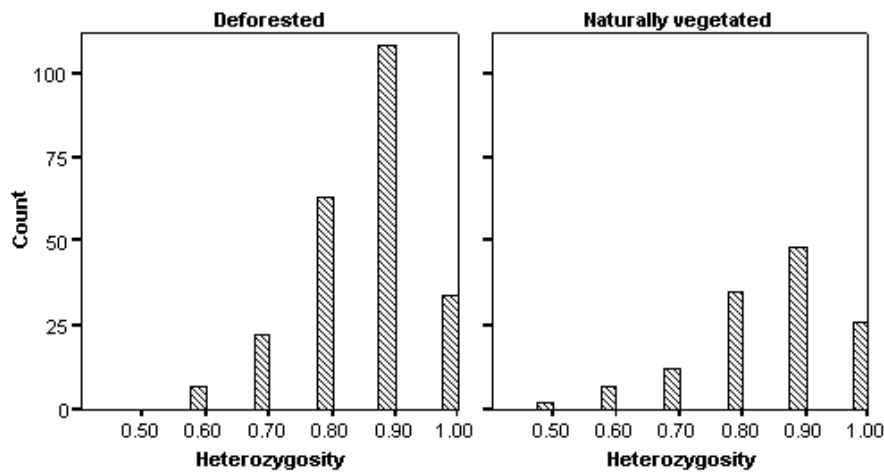
A large shark, possibly a tiger shark, is swimming horizontally across the frame. It is positioned in the center, slightly lower. The background shows a sandy ocean floor with some coral and other marine life. The water is clear, and the lighting is bright, suggesting a shallow depth. The shark's body is dark with lighter stripes, and its fins are clearly visible.

Endangered Species Management

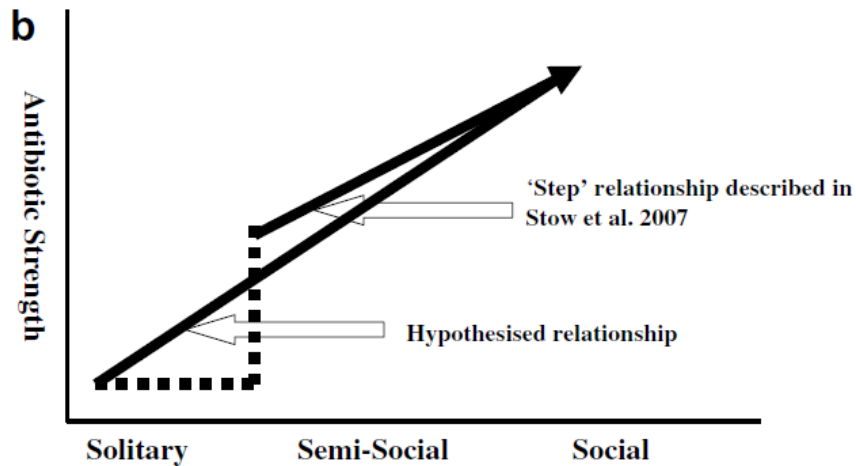
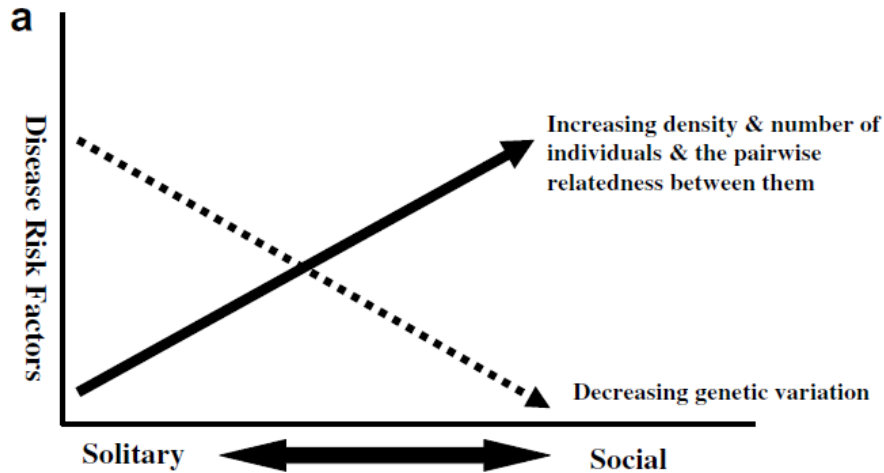
Climate change Impacts



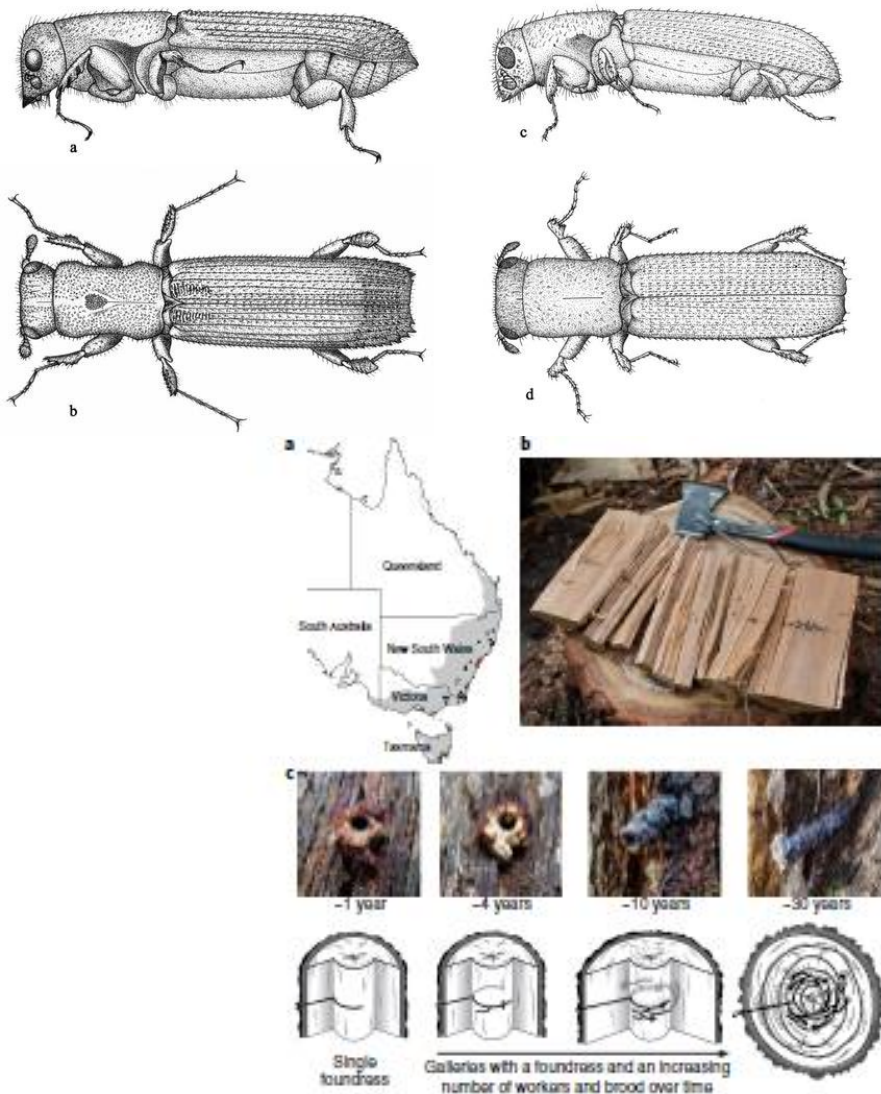
Habitat Fragmentation



Disease and evolution of sociality



Evolution of Sociality



The 'sixth extinction'

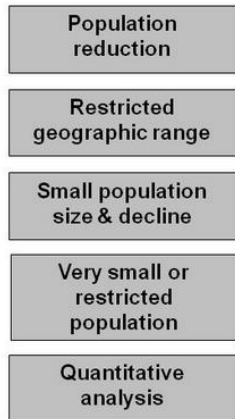


Categories formulated by IUCN - International Union for the Conservation of Nature (www.iucn.org)



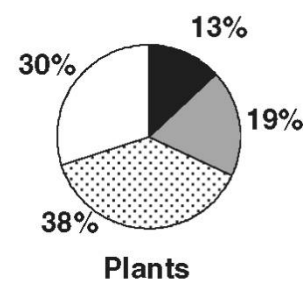
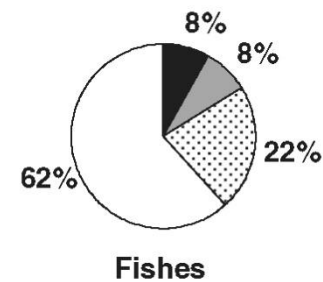
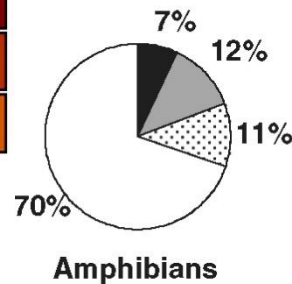
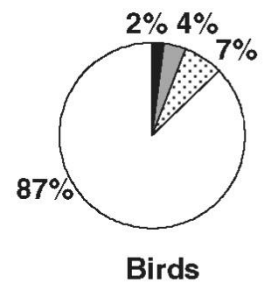
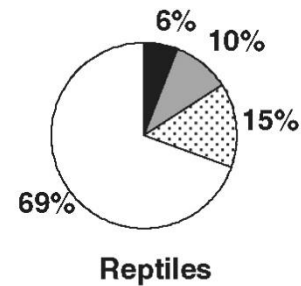
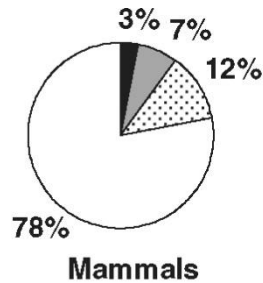
cd: conservation-dependent
nt: near threatened
lc: least concern

CRITERIA



Quantitative thresholds

THREATENED CATEGORIES



Cr. endangered Endangered Vulnerable Low risk, etc.



The 'sixth extinction' – www.iucn.org



Categories formulated by IUCN - International Union for the Conservation of Nature (www.iucn.org)



The IUCN Red List of Threatened Species™ 2013.1

Navigation links: ::About ::Initiatives ::News ::Photos ::Partners ::Sponsors ::Resources

Search bar: Enter Red List search term(s) [GO] [OTHER SEARCH OPTIONS] [Discover more]

Donation button: DONATE NOW!

Red List categories (from left to right):

- LEAST CONCERN (LC)
- NEAR THREATENED (NT)
- VULNERABLE (VU)
- <ENDANGERED> (EN)**
- CRITICALLY ENDANGERED (CR)
- EXTINCT IN THE WILD (EW)
- EXTINCT (EX)



QUYET'S TREEFROG
Gracixalus quyeti

© Ralf Hendrix



A users' guide to The IUCN Red List web site

03 April 2009 - In October 2008, the IUCN Red List web site was given a brand new look. The new site has more functionality than ever before. This also means that the site has more detailed search pages that... [more](#)



Threatened freshwater fish fall through net of mismanaged aquarium pet trade

26 July 2013 - The global trade in freshwater fish is a large and diverse industry, estimated to be worth around US \$15–30 billion a year. Supplied by captive-bred and wild-caught specimens, the... [more](#)



The most traded wild mammal - the Pangolin - is being eaten to

The 'sixth extinction' – www.iucn.org

The screenshot displays the IUCN Red List of Threatened Species website. At the top, the header includes the IUCN Red List logo, the title "The IUCN Red List of Threatened Species™", the version "2013.1", and navigation links for Login, FAQ, Contact, Terms of use, and IUCN.org. Below the header, a navigation bar lists various sections: About, Initiatives, News, Photos, Partners, Sponsors, and Resources. A search bar is prominently featured with the placeholder text "Enter Red List search term(s)" and a "GO" button. To the right of the search bar is a "DONATE NOW!" button. A large black arrow points from the search bar area to a detailed view of the search interface. This interface includes a "Search the IUCN Red List" section with tabs for Keywords, Taxonomy, Location, Systems, Habitat, Threats, Assessment, and Life History. The Taxonomy tab is selected, showing a list of taxonomic groups: ANIMALIA, FUNGI, PLANTAE, and PROTISTA. Below this, there is a "Taxa to show:" section with checkboxes for Species (checked), Subspecies and varieties, and Stocks and subpopulations. To the right of the search criteria is a "Your Search Criteria" section with instructions on how to use the search interface. At the bottom right, there is a "Run search" button and a close button (X).

The IUCN Red List of Threatened Species™ 2013.1

Login | FAQ | Contact | Terms of use | IUCN.org

::About ::Initiatives ::News ::Photos ::Partners ::Sponsors ::Resources

Enter Red List search term(s) GO OTHER SEARCH OPTIONS Discover more

DONATE NOW!

Search the IUCN Red List

Clear all criteria

Keywords

Taxonomy

☐ ANIMALIA

☐ FUNGI

☐ PLANTAE

☐ PROTISTA

Taxa to show:

☒ Species

☐ Subspecies and varieties

☐ Stocks and subpopulations

Your Search Criteria

No criteria selected

Select a tab on the left and enter text or select options.

Then, press the arrow button to build your search criteria here.

You may select options from multiple tabs.

Your selections must appear in this area to be used in your final search.

Click the "Run Search" button below to run your search using the criteria displayed above.

Run search X

The 'sixth' extinction & genetics

Threats to extinction:

- Habitat loss
- Over-exploitation
- Alien introductions
- Pollution
- Climate change



The 'sixth' extinction & genetics

Threats to extinction:

- Habitat loss
- Habitat fragmentation
- Over-exploitation
- Invasive species
- Pollution
- Climate change



The 'sixth' extinction & genetics

Threats to extinction:

- Habitat loss
 - Over-exploitation
 - Alien introductions
 - Pollution
 - Climate change
- Small population sizes **amplify the importance of genetic factors** for extinction
 - Small population sizes typify **captive populations**



The 'sixth' extinction & genetics

Reduced pop size

Fragmentation

Conservation Genetics

Inbreeding

Genetic drift

Inbreeding depression
Loss of fitness

Lost evolutionary
potential

Management
captive/wild pops

Reintroductions

Extinction

Eg: Florida panther

(Cougar, puma, mountain lion)



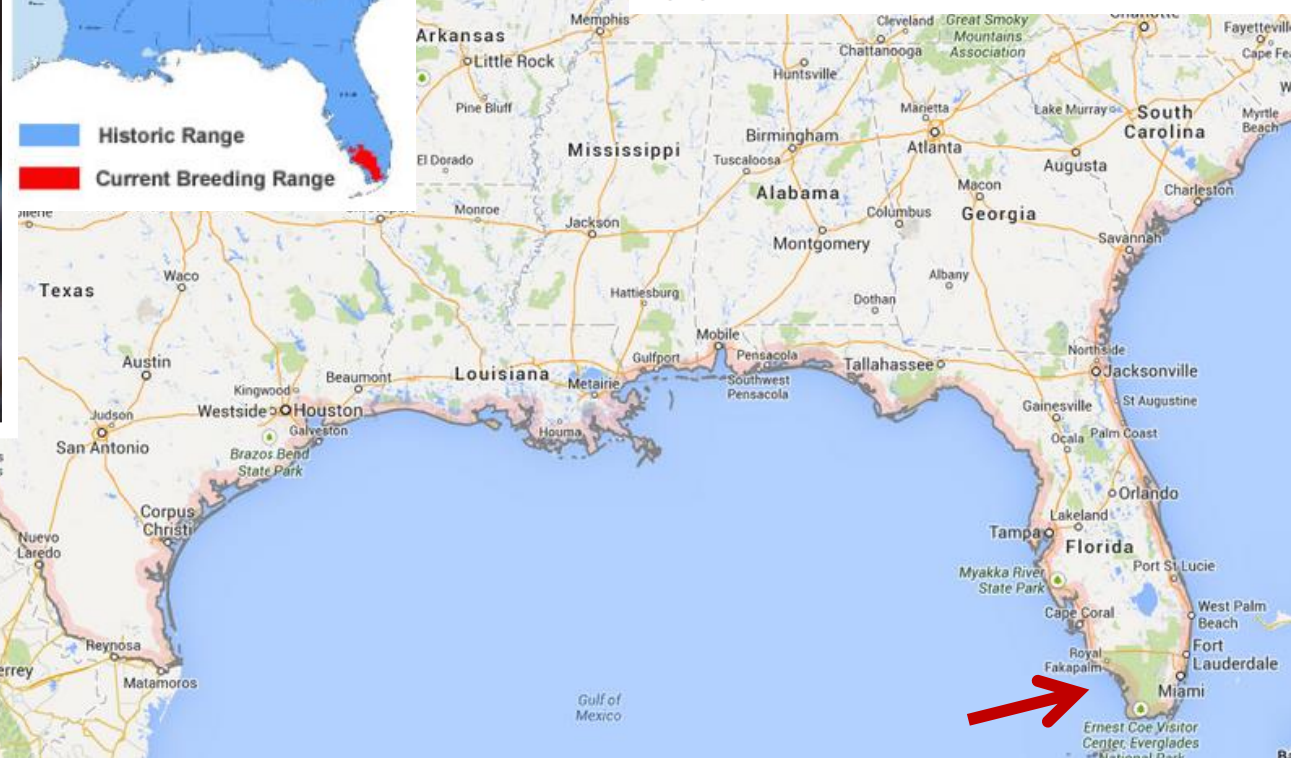
Genetic Restoration of the Florida Panther

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,†}

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Example: Florida panther

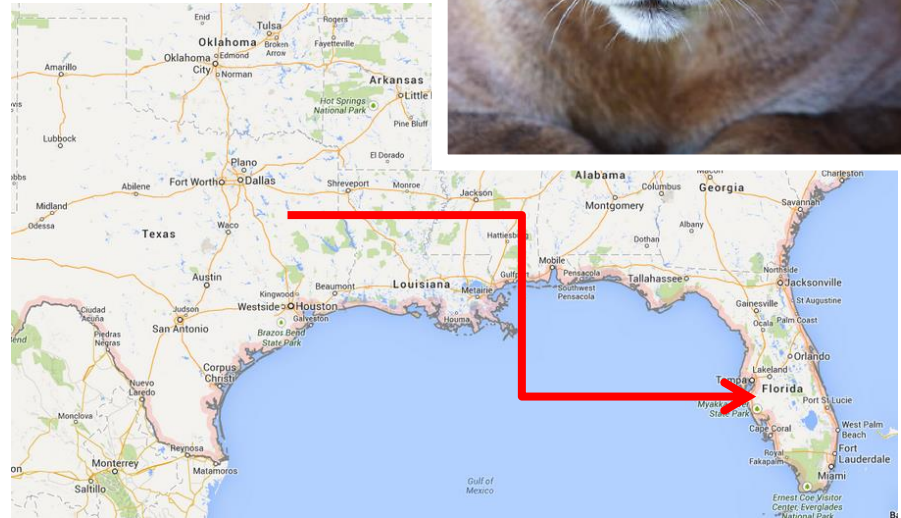
(Cougar, puma, mountain lion)

- Early 1990s, FLA pop **N = 20-25**
(including two subgroups – CFP & EVG)

- Low molecular **V_G**

- Signature of **inbreeding**:

- Poor sperm quality
- Low male testosterone levels
- Low fecundity (and recruitment)
- Spinal defects & kinked tails
- High pathogen and parasite load
- **95% Probability of extinction in next 2 decades**



Example: Florida panther

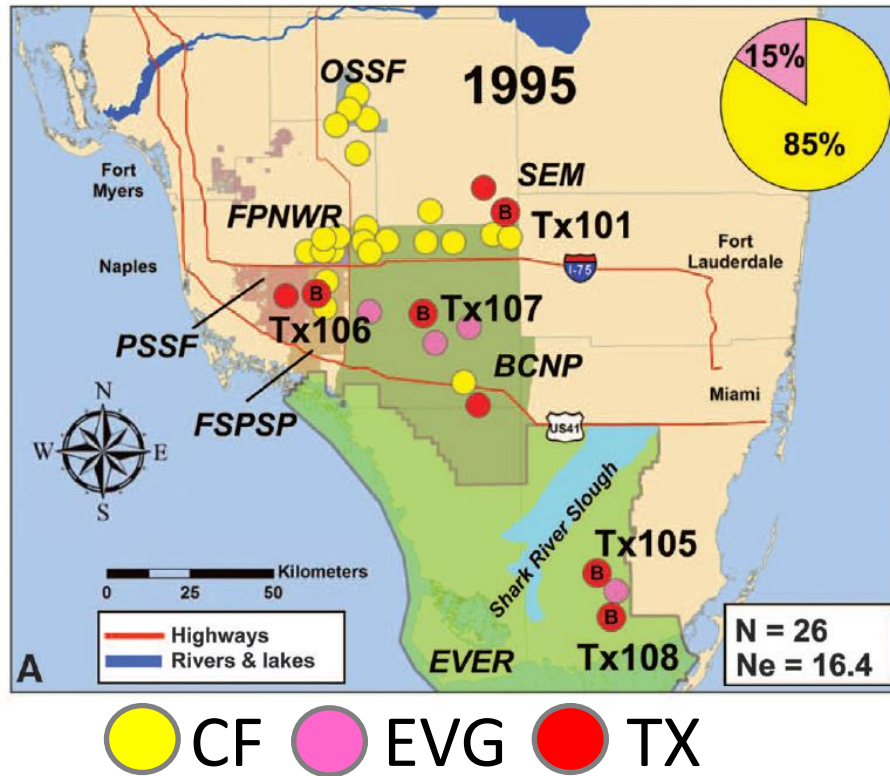
(Cougar, puma, mountain lion)

- Early 1990s, FLA pop **N = 20-25**
(including two subgroups – CFP & EVG)
- **8 TX females** introduced in 1995
- Molecular techniques
(Microsatellites [short tandem repeats]) used to track:
 - Gene flow & dispersal
 - Establishment & mating success
 - Fitness effects of outbreeding



1995

Introduction



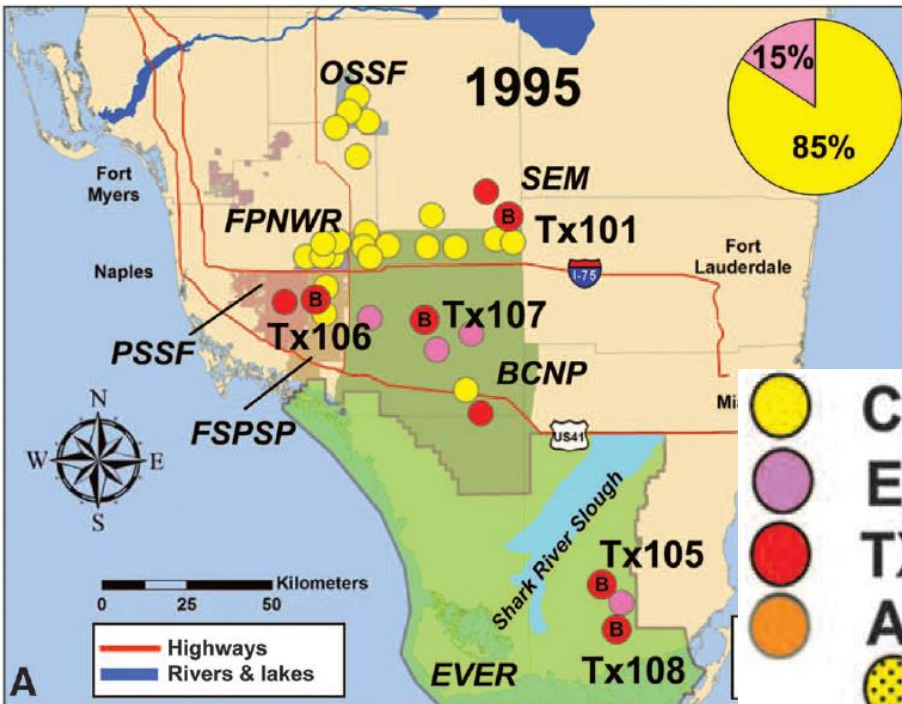
1995

versus

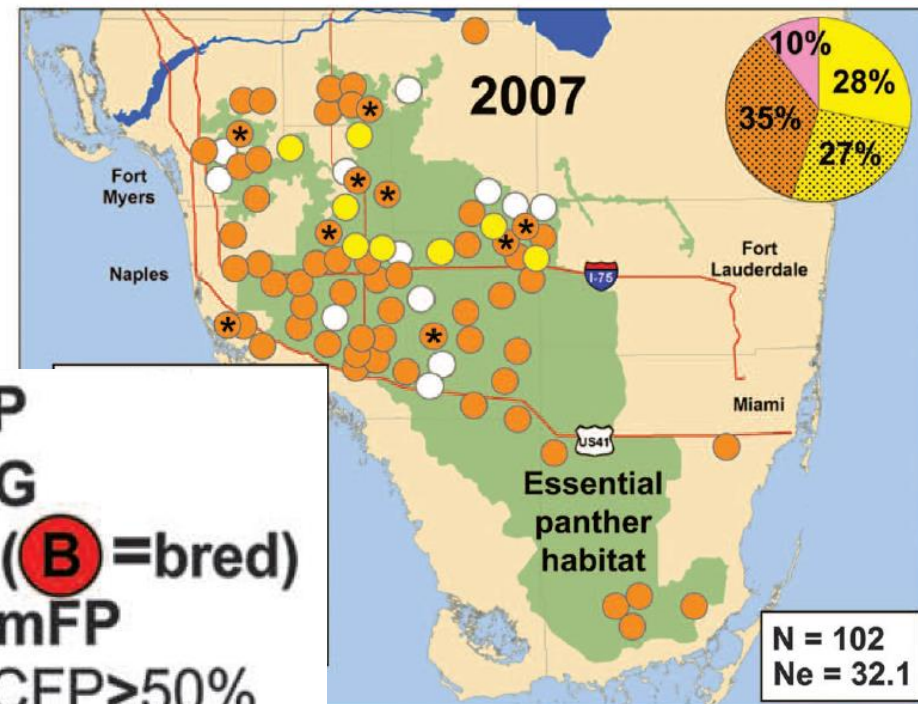
2007

Introduction

post-introduction



N = 26
Ne = 16.4



N = 102
Ne = 32.1

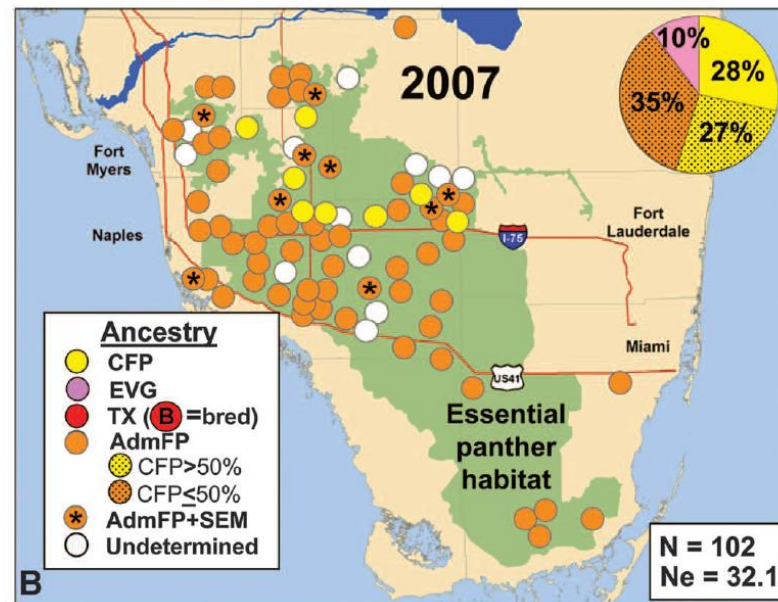
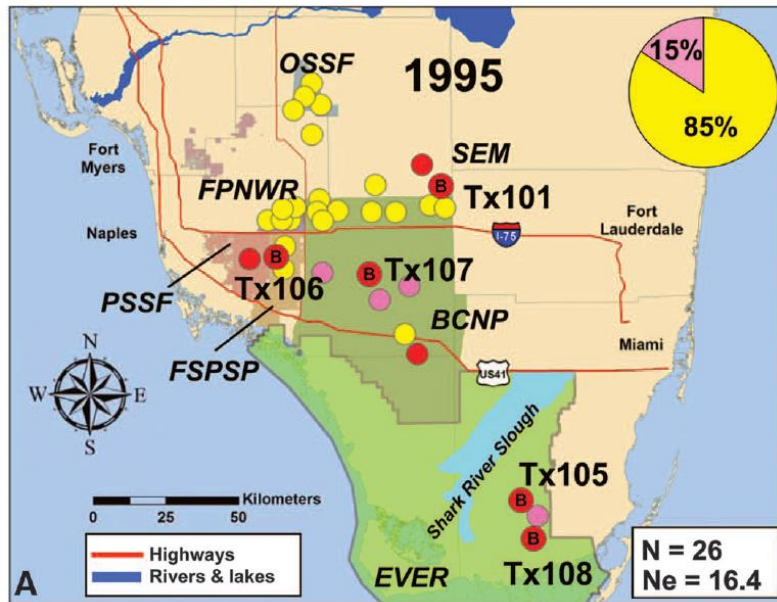
1995

versus

2007

Intro

post-intro



● CF ● EVG ● TX

Population:

- Increased 14% per year
- Average **heterozygosity** 18 to 25%
- Average age decreased (6.6 to 4.2yrs)

● **Adm (hybrids)** associated with:

- Dispersal and colonisation of new areas
- Increased offspring survival
- Increased competitiveness

- **Individual survival increased with heterozygosity**

Next lecture...

Genetics and extinction

