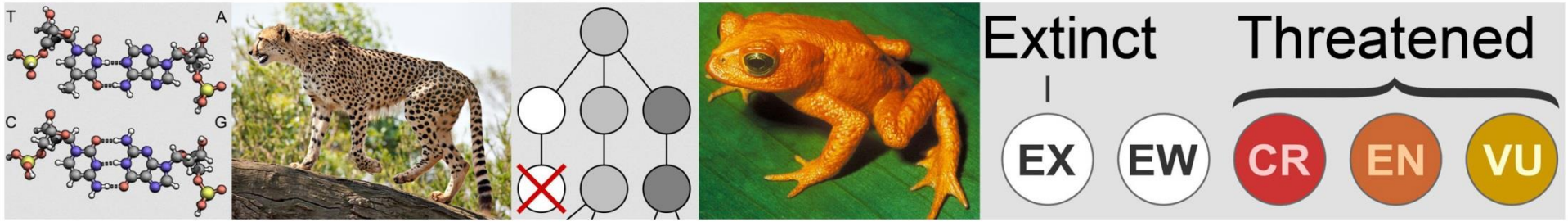



# **BIOL3110**: Evolutionary and Conservation and genetics

## Lecture 1:

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

MACQUARIE UNIVERSITY

# Unit staffing

Convener:

**A/Prof. Adam Stow**

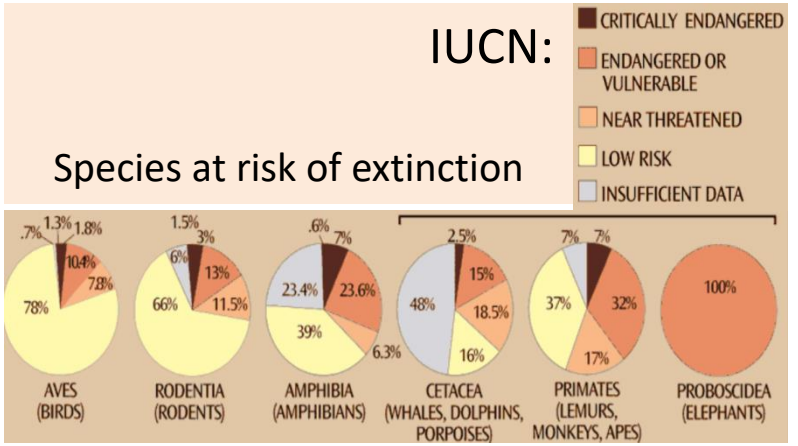
Email (best): adam.stow@mq.edu,au

Office: 6 Science Rd-275,

Ph: (02) 9850 8135

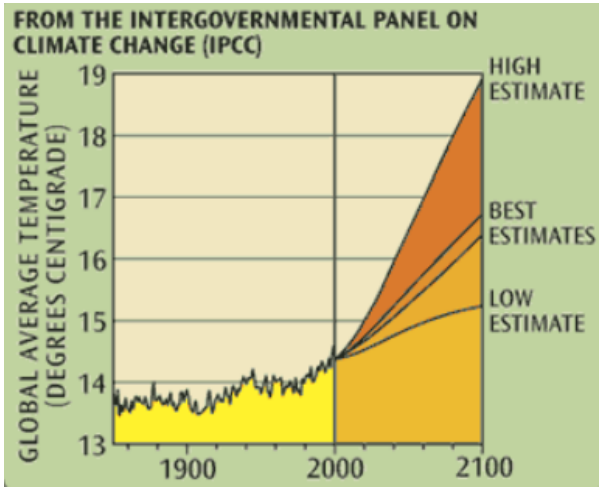
Tutor: Jessica O'Hare

# Unit OVERVIEW



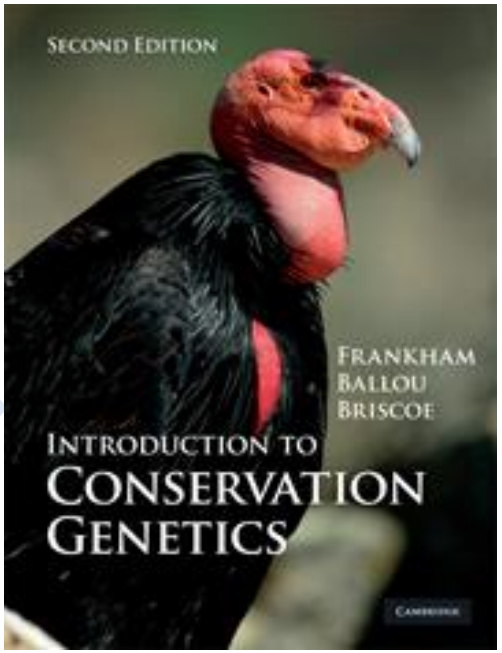

## Major themes:

- **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**

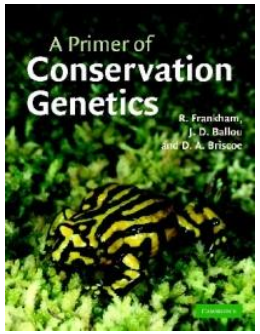



# Unit TEXT(s)

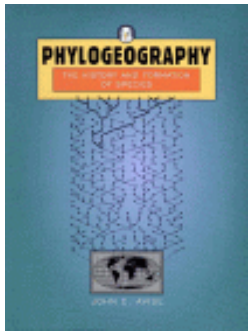
- Frankham et al. 2009
- Required & necessary
- Conceived for and strongly linked to course content
- Contains weekly problems



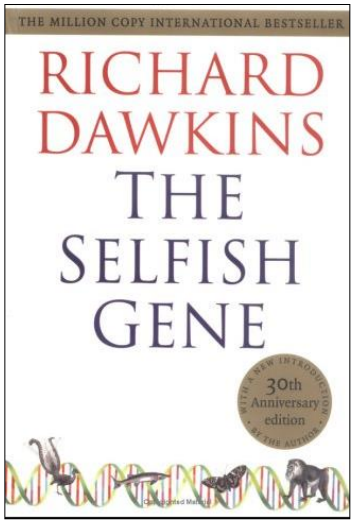

## …Others:

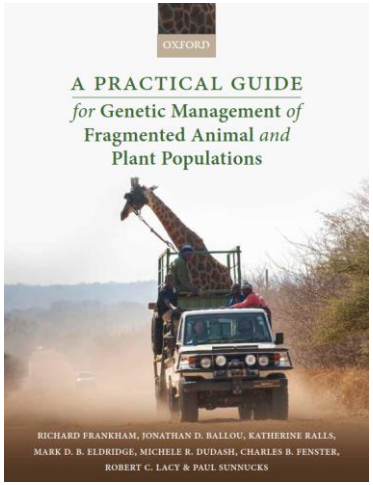



Frankham *et al.* (2004) *A Primer of Conservation Genetics*, Cambridge




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** |

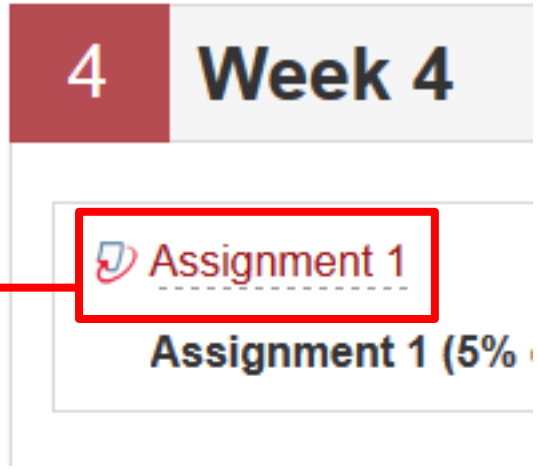
| | | |
|---|---|---|
| **Residential session (for infrequent attendance students)** | **6 - 8th of April (inclusive)** | **14 Eastern Rd, 160 Science Lab** |

# 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:

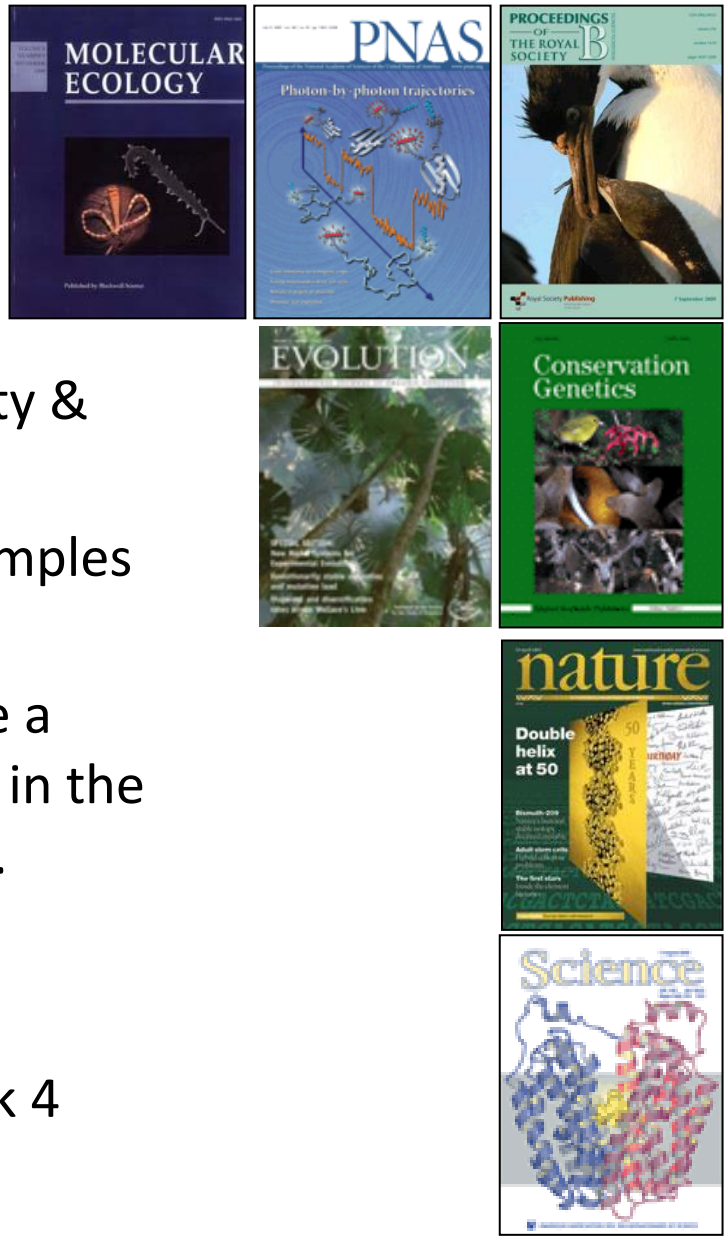
- Unit completion requirements
- Detail on upcoming assessments (including submission guidelines)
- **Due dates/penalties/special consideration**
- Plagiarism policy
- Other general policies
- Statements of:
  - Unit objectives
  - Learning outcomes
  - Graduate capabilities

# 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. 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-



### 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*)

report on page 164

comprehensive stu
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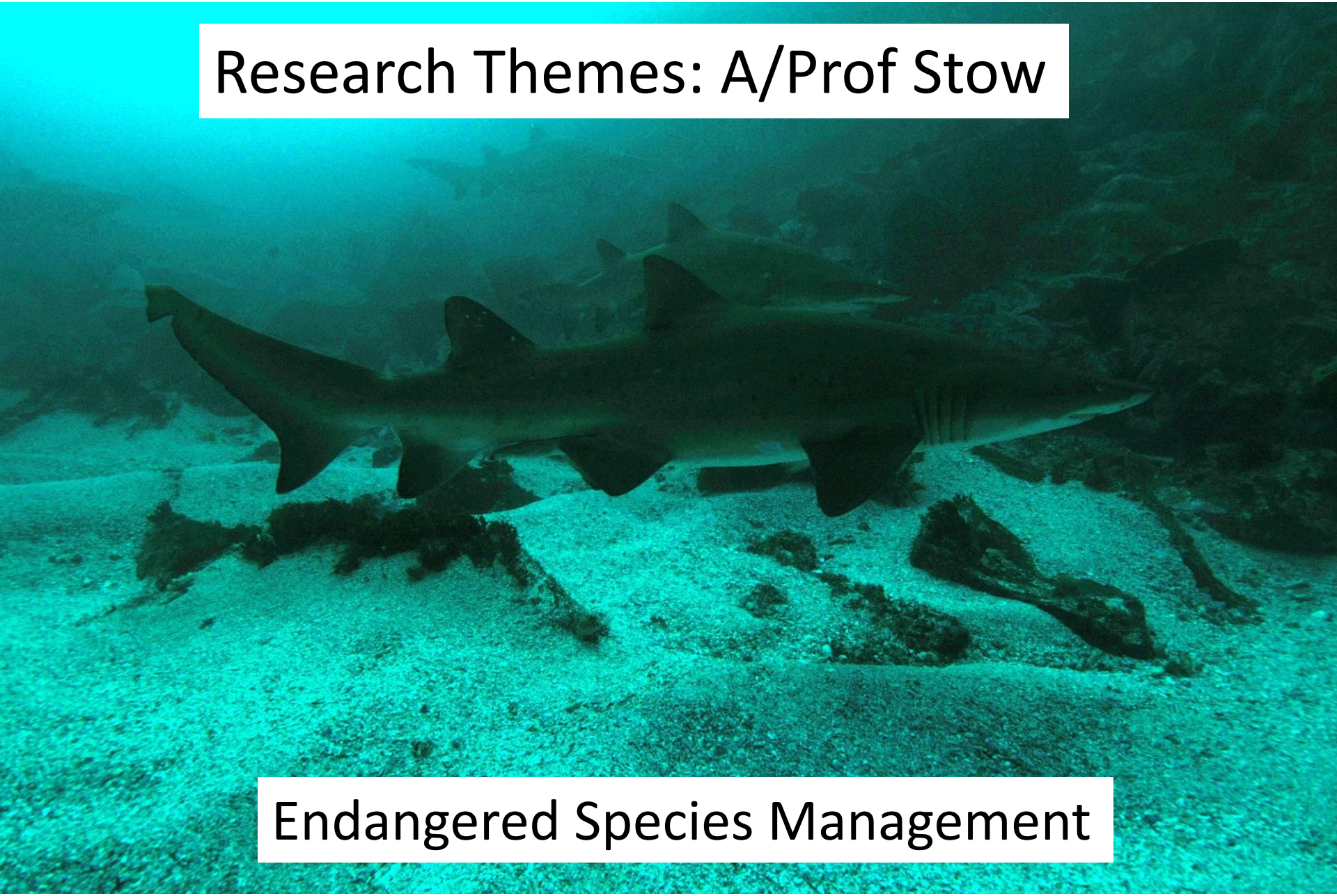
to predictions that
extinct within dec

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

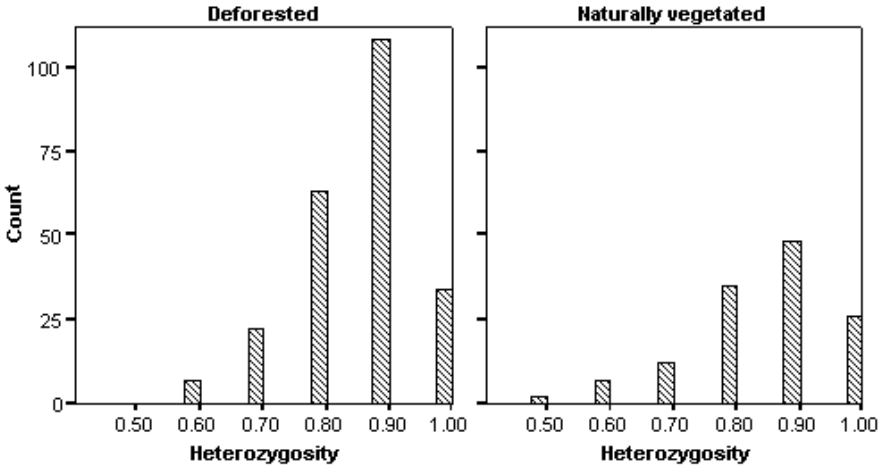
# Research Themes: A/Prof Stow



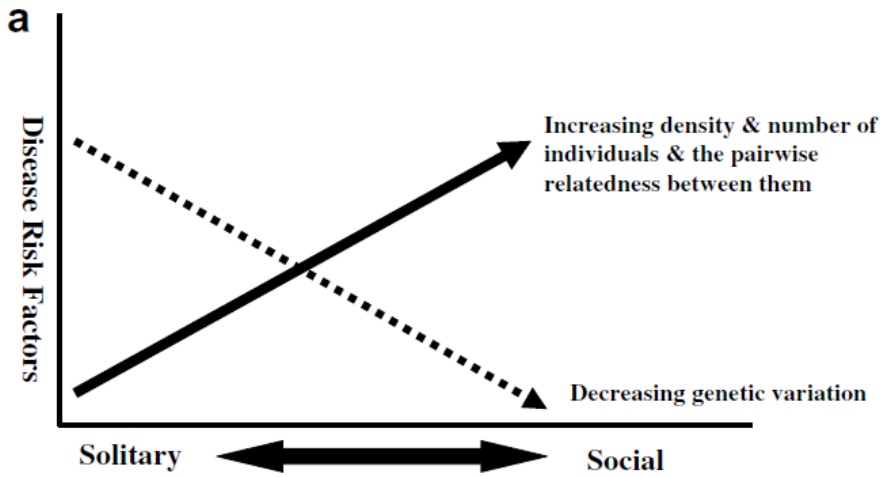
Endangered Species Management

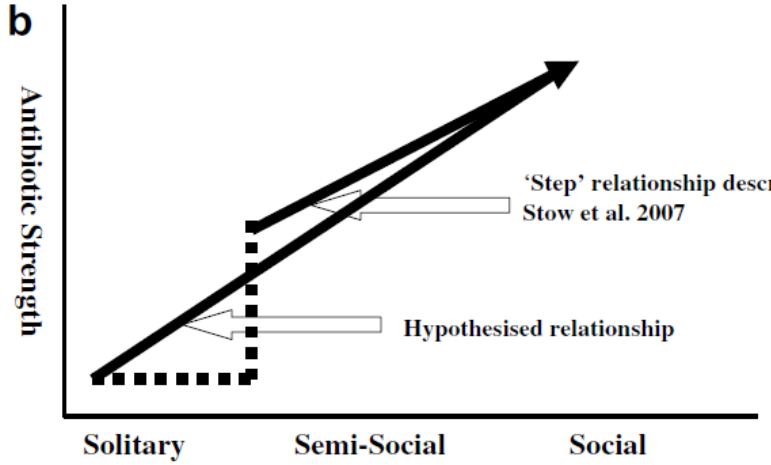
# Climate change Impacts

# Habitat Fragmentation

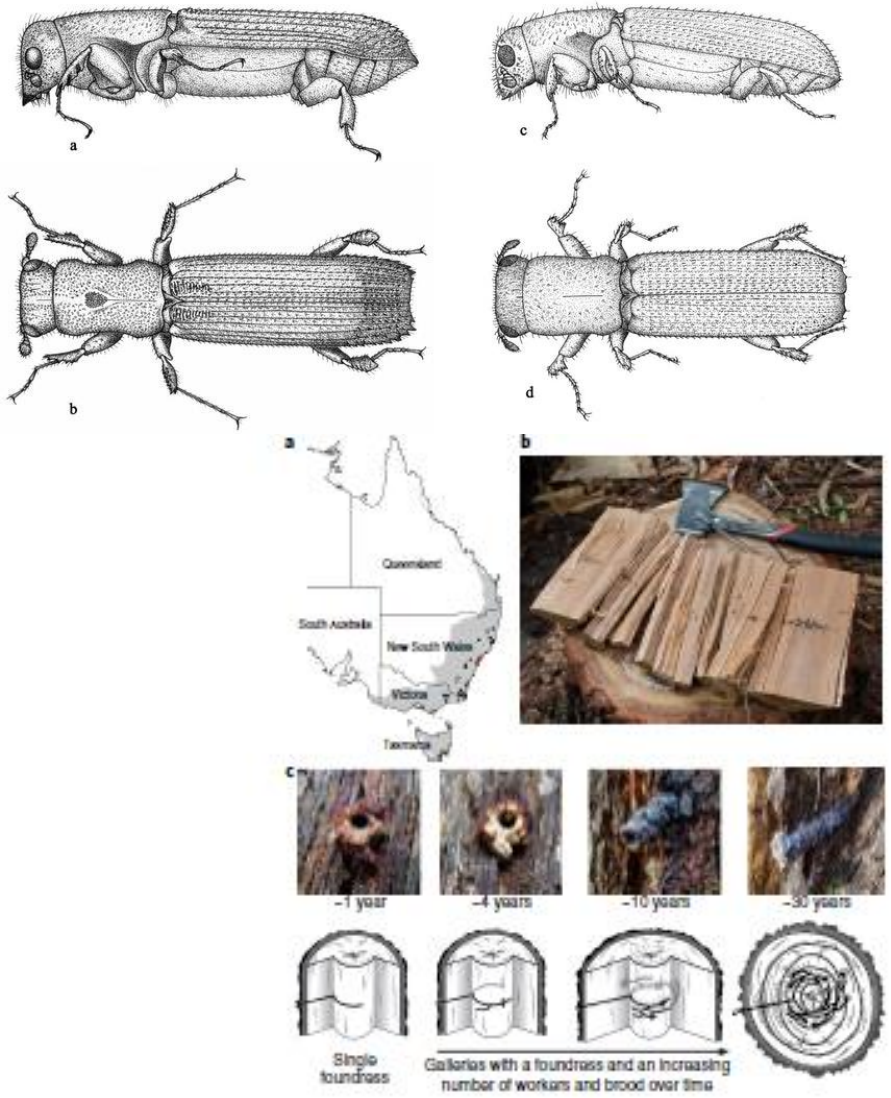



# Disease and evolution of sociality



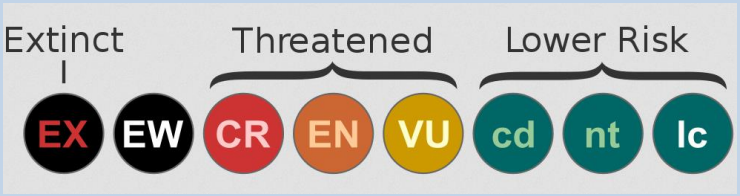




# Evolution of Sociality




Smith et al. 2018 Nature Ecology & Evolution

# 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

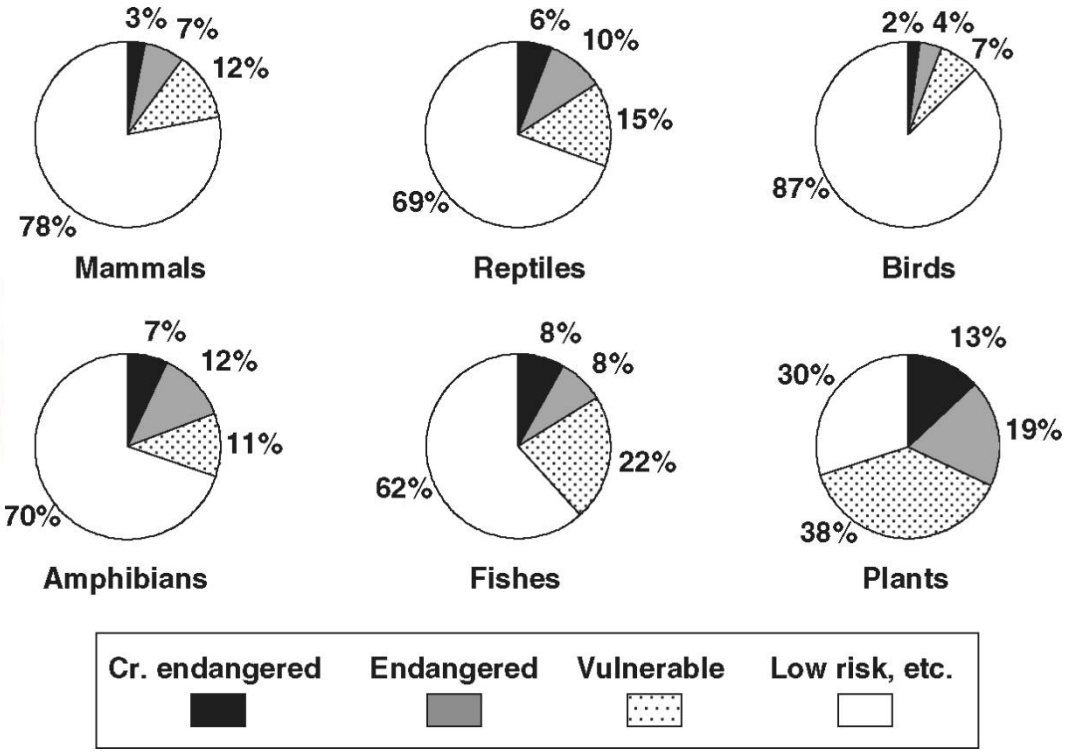
**CRITERIA**

- Population reduction
- Restricted geographic range
- Small population size & decline
- Very small or restricted population
- Quantitative analysis

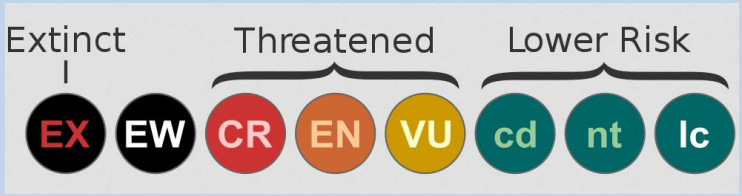
Quantitative thresholds

**THREATENED CATEGORIES**

- Critically Endangered (CR)
- Endangered (EN)
- Vulnerable (VU)



# The ‘sixth extinction’ – www.iucn.org

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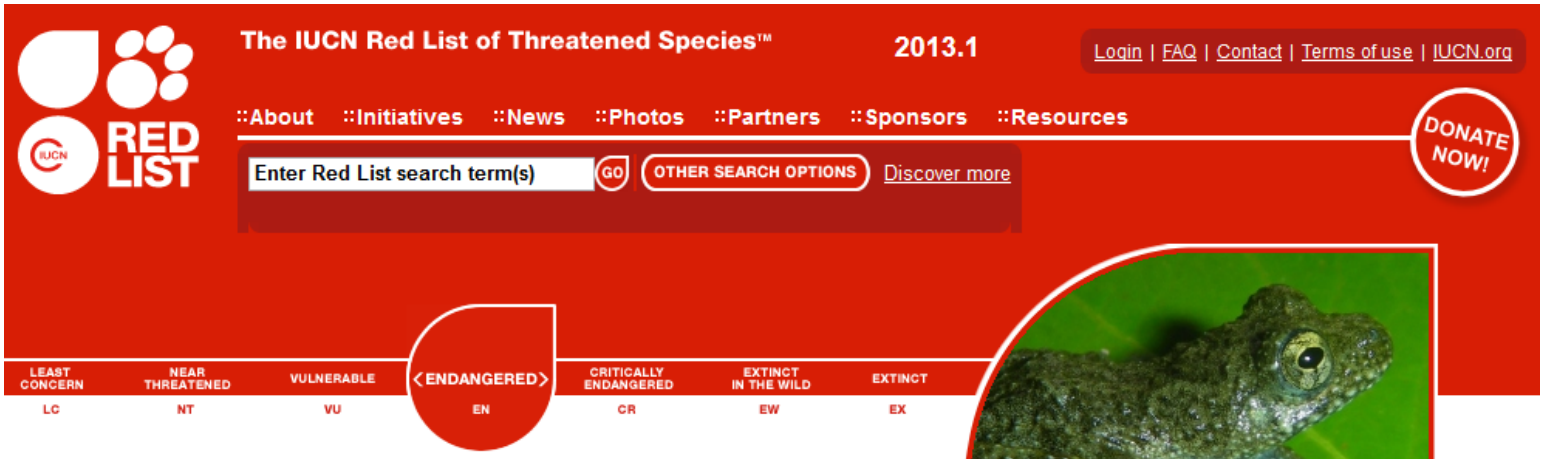
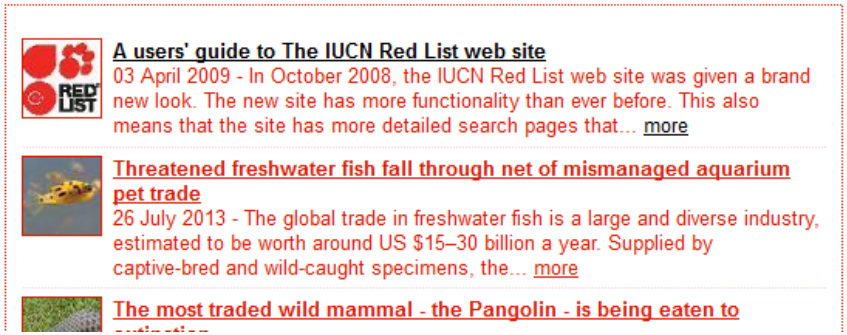
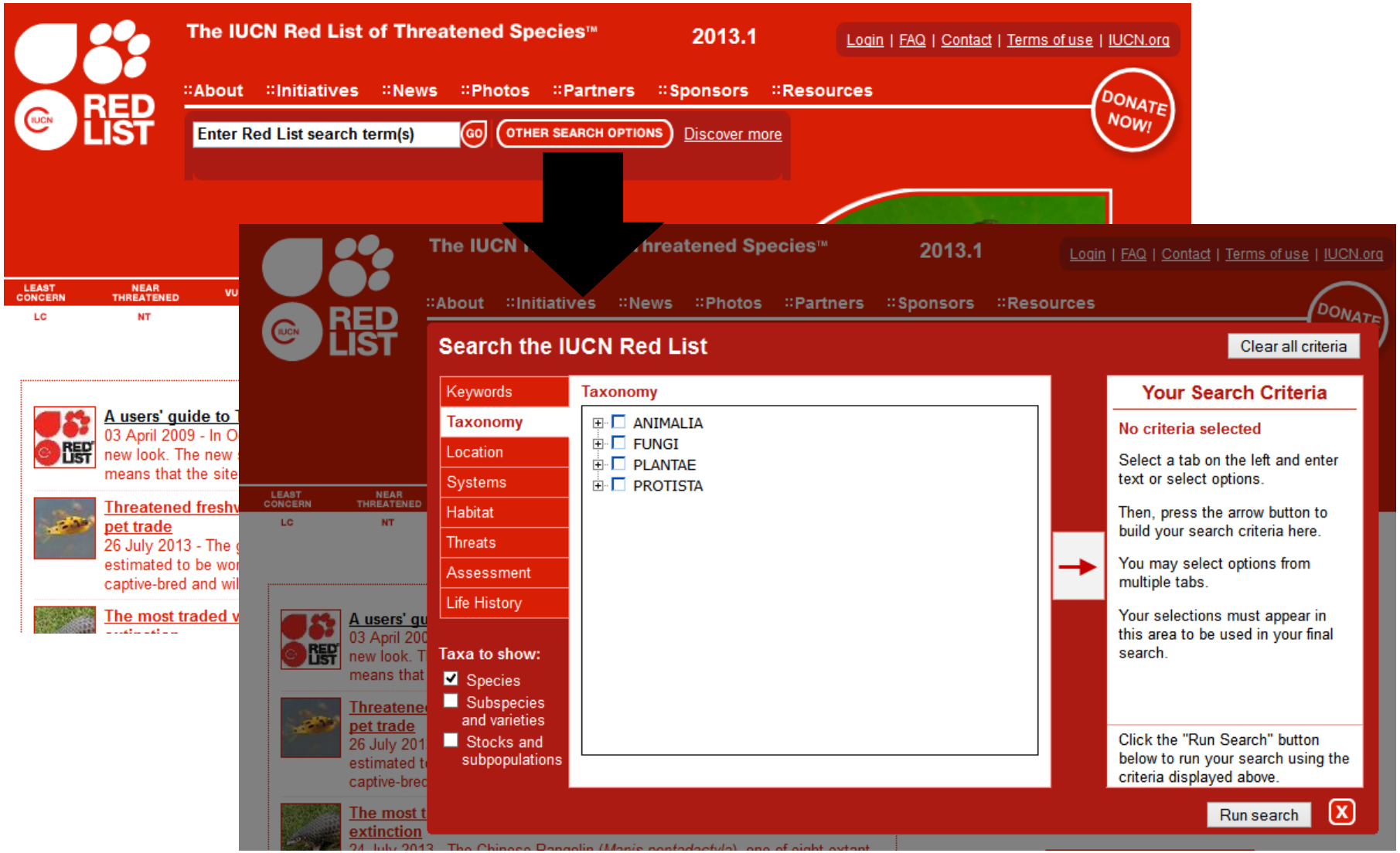



QUYET'S TREEFROG
*Gracixalus quyeti*
© Ralf Hendrix

# The ‘sixth extinction’ – www.iucn.org



# 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

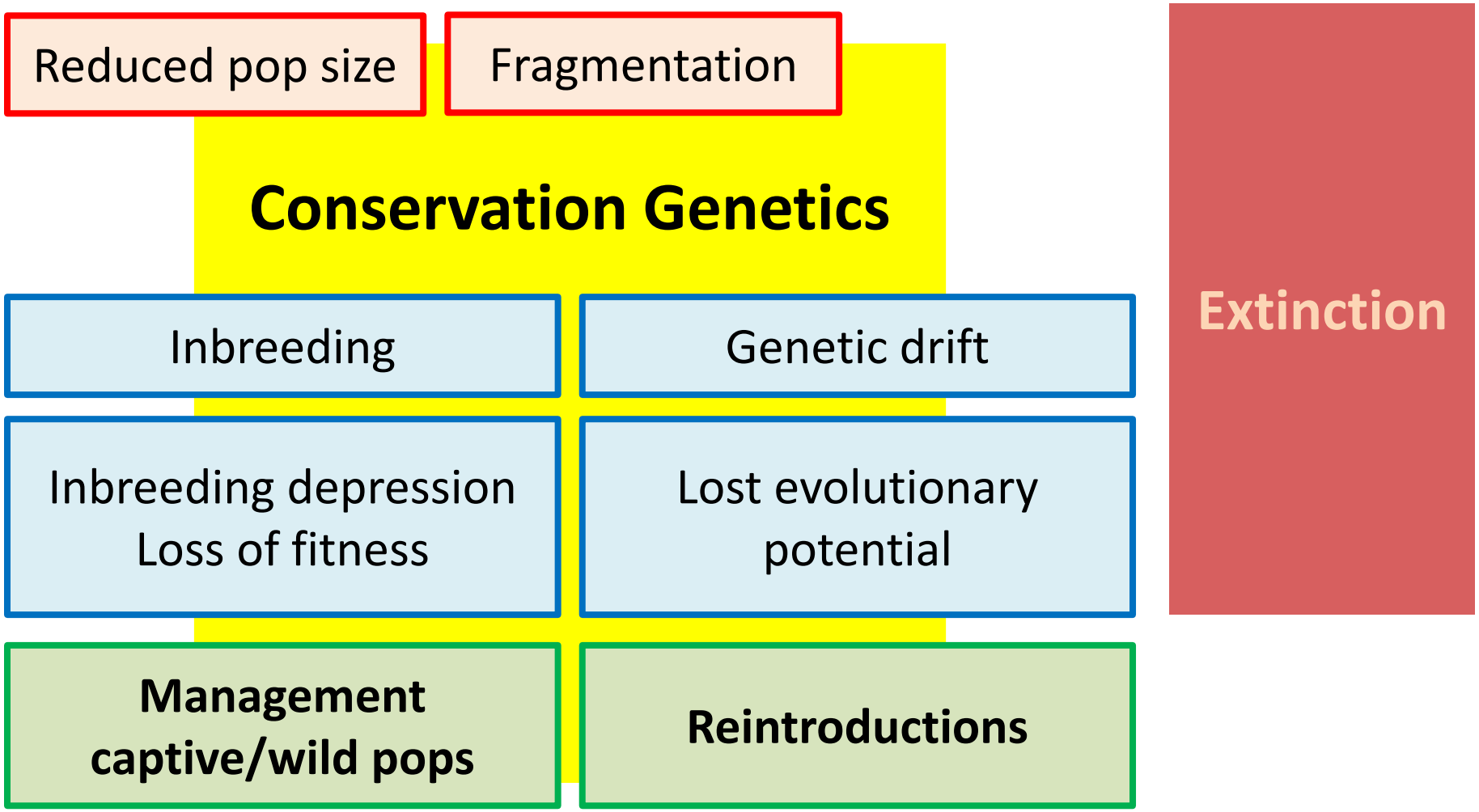
# The ‘sixth’ extinction & genetics

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



# 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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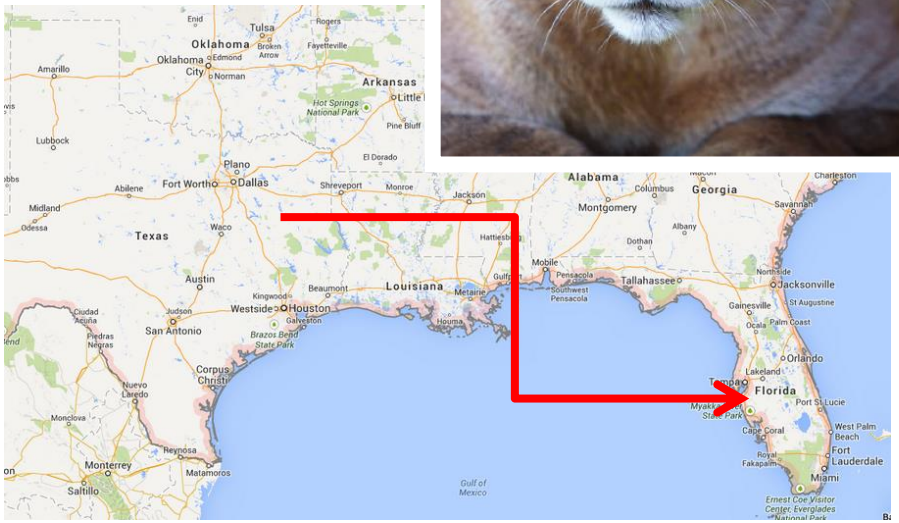
emag.org SCIENCE VOL 329 24 SEPTEMBER 2010

# Example: Florida panther

(Cougar, puma, mountain lion)

- Early 1990s, FLA pop **N = 20-25**
  (including two subgroups – CFP & EVG)
- Low molecular $\mathbf{V_G}$
- 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

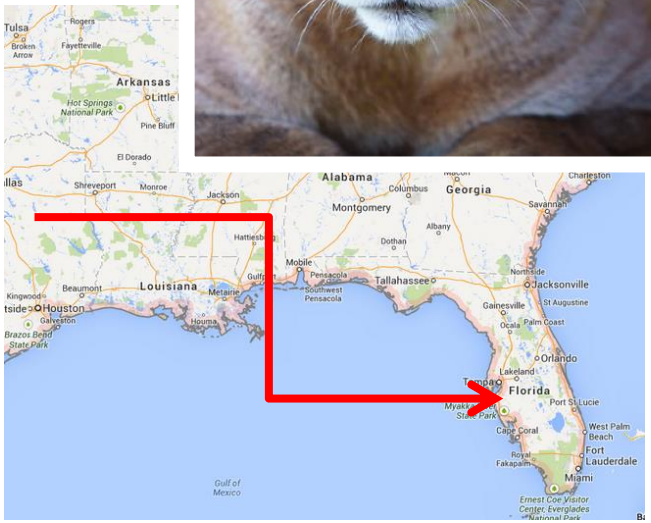


# Example: Florida panther

(Cougar, puma, mountain lion)

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

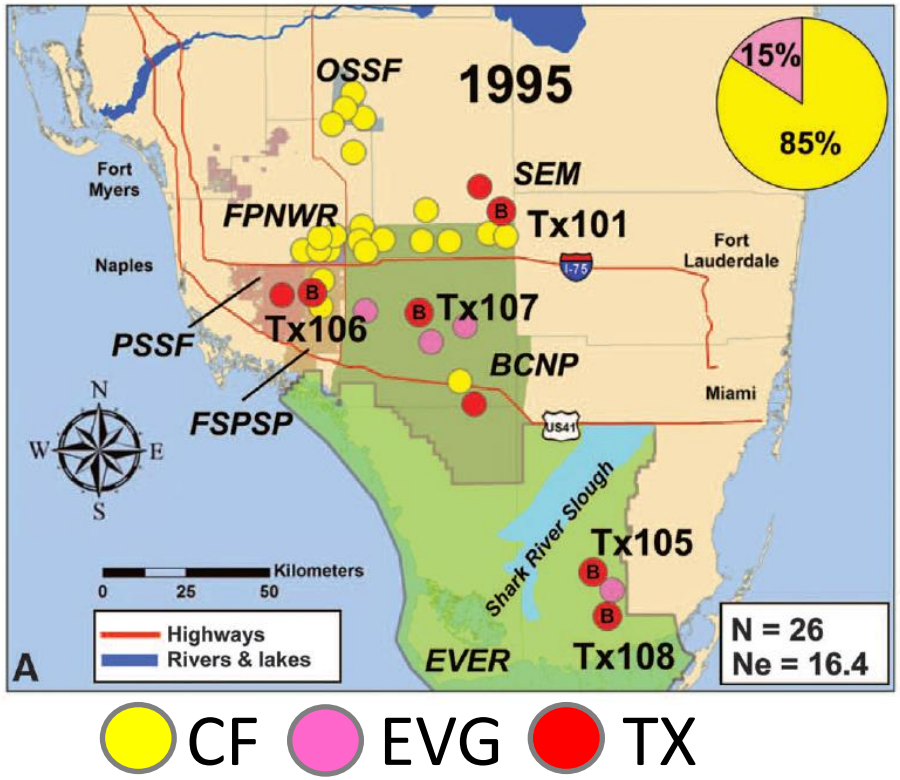
- **8 TX females** introduced in 1995




- Molecular techniques (Microsatellites [short tandem repeats]) used to track:
  - Gene flow & dispersal
  - Establishment & mating success
  - Fitness effects of outbreeding

# 1995

## Introduction




**N = 26 :** Adults (breeding age)

**Ne = 16.4:** Effective population size

Pie chart:

Genetic pedigree

CF = Central Florida

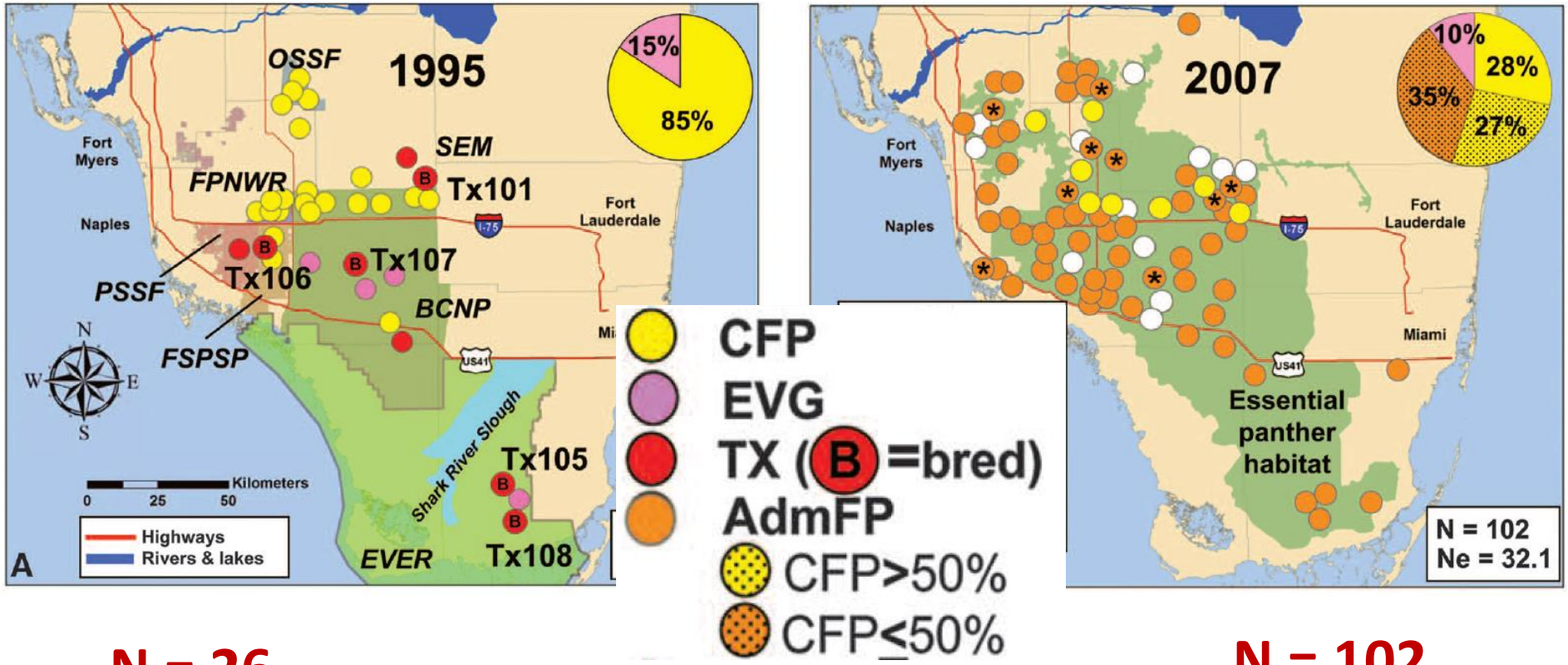
EVG = Everglades

TX = Texas

# 1995 versus 2007

Introduction

post-introduction




**N = 26**

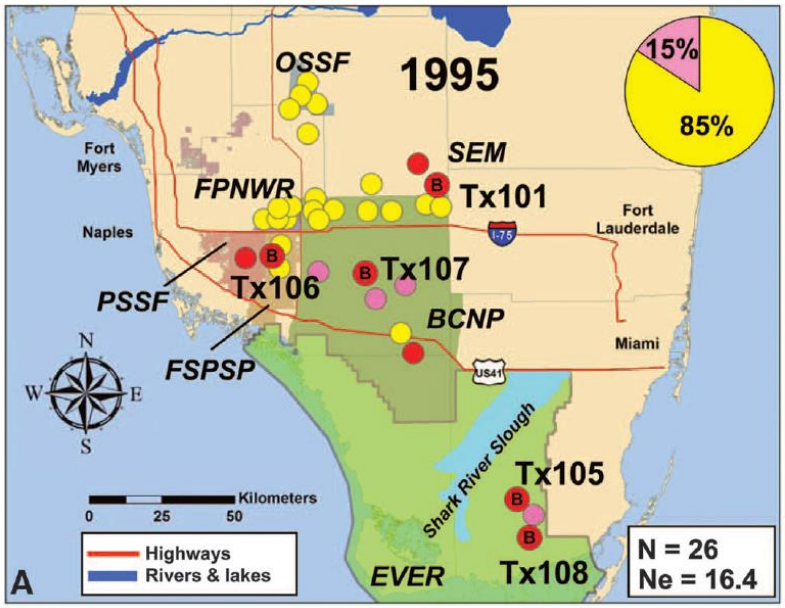
**Ne = 16.4**

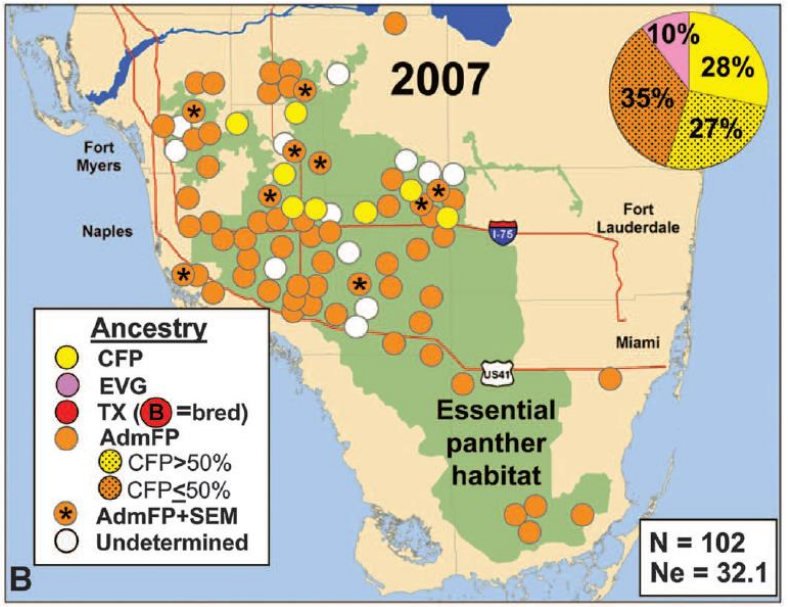
**N = 102**

**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