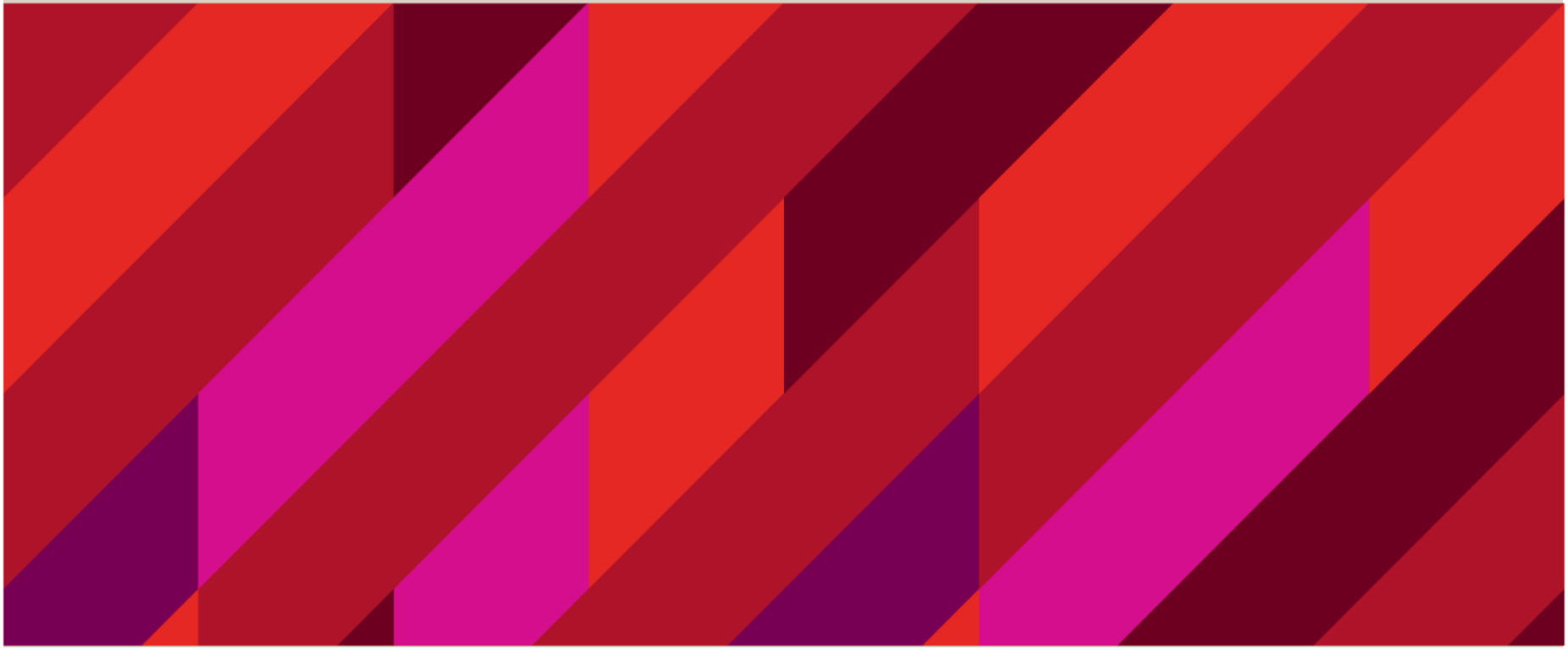
MACQUARIE University

BIOL334 Conservation & Ecological Genetics

PROBLEM SET #5



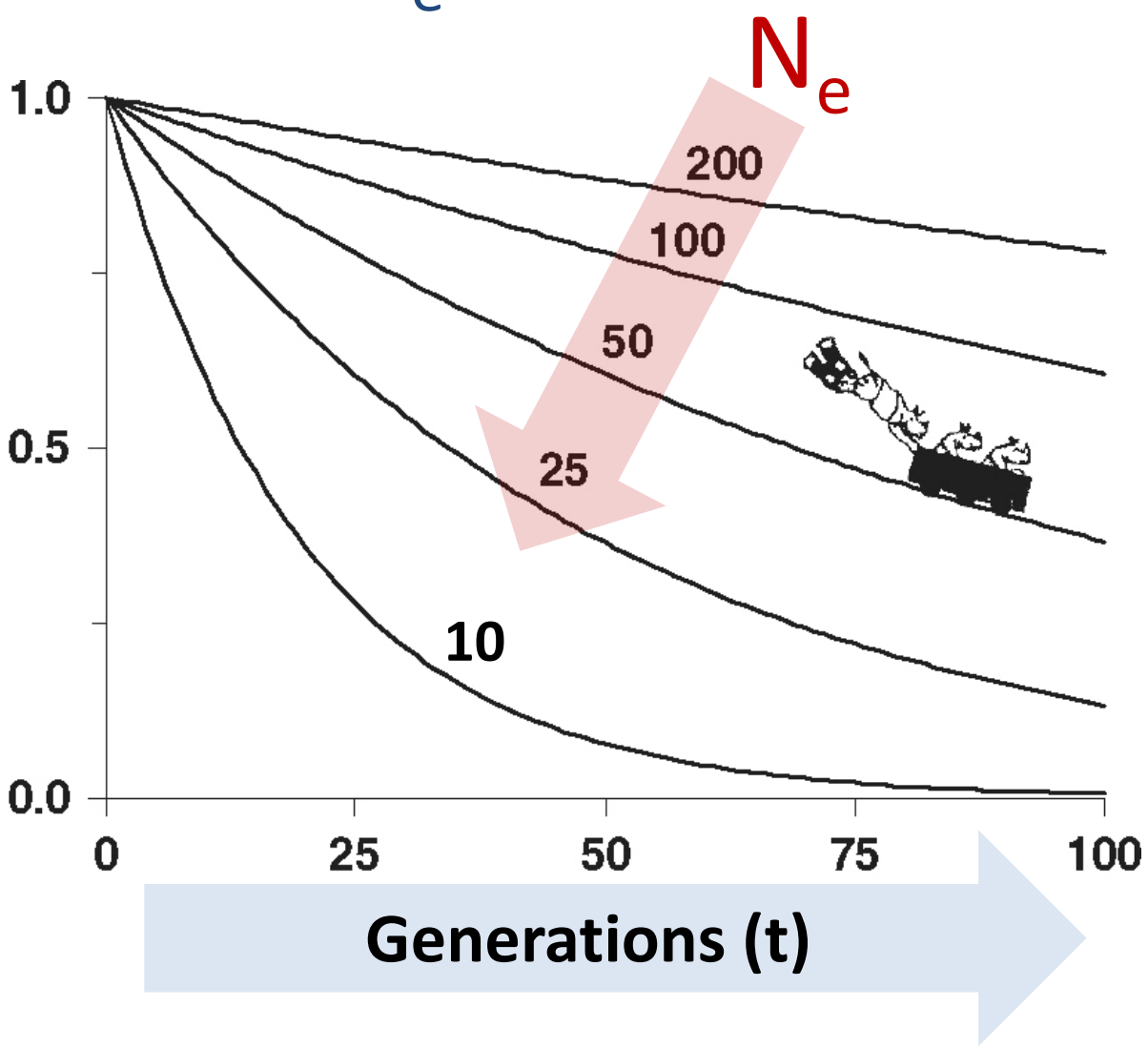
Problem Set #5

OVERVIEW:

1. N_e and Heterozygosity (H)
2. N_e, H and Inbreeding (F)
3. Example of intervention

Heterzoygosity (*H*) decays over time as the inverse of N_e:

$$\frac{H_t}{H_0}$$



N_e and Heterozygosity

1. Larger (effective) populations retain more genetic diversity…
2. H decays as the inverse of N_e

$$\frac{H_t}{H_0} = \left(1 - \frac{1}{2N_e}\right)^t$$

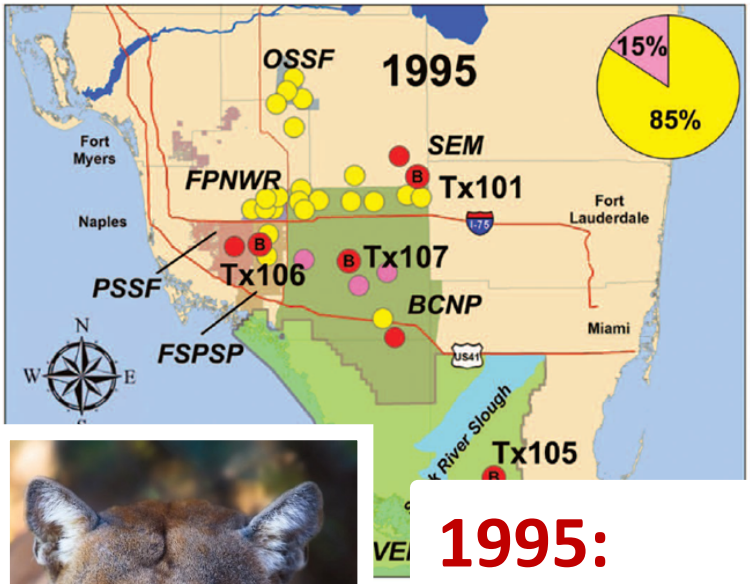
Where: t = number of generations

Question 5.1

Predicting loss of *H:*

For the population of Florida panthers that existed in 1995, estimate *H* in 2007 if they hadn't introduced TX individuals

(12 years ~6 Generations)



1995:

$H = 0.184$

$N_e = 16.4$

H: 1995 – 2007

(without introduction)

$$\frac{H_t}{H_0} = \left(1 - \frac{1}{2N_e}\right)^t$$

1995

$H_0 = 0.184$

$N_e = 16.4$

$t \sim 6$

What is *H* in 2007?

H: 1995 – 2007

(without introduction)

$$\frac{H_t}{H_0} = \left(1 - \frac{1}{2N_e}\right)^t$$

1995

$H_0 = 0.184$

$N_e = 16.4$

$t \sim 6$

$$\frac{H_{t=6}}{0.184} = \left(1 - \frac{1}{2(16.4)}\right)^6$$

$$\frac{H_{t=6}}{0.184} = 0.830$$

$$H_{t=6} = 0.830 \; x \; 0.184$$

$$= \mathbf{0.153}$$

Predicting loss of *H*:

In 2007, if they hadn't introduced tx panthers

(12 years ~6 gens)

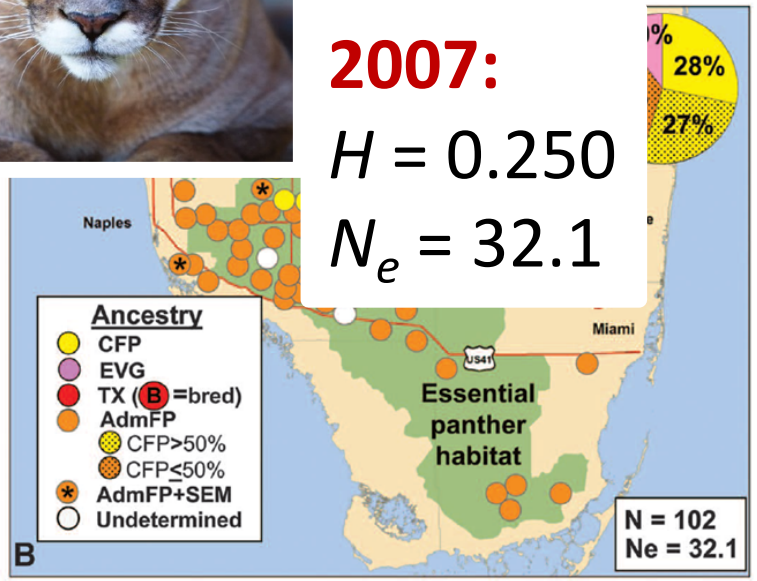
H_{est} **~ 0.153**

[Incidentally, after 24 years ~12 gen, H_{est} = 0.127]

1995:

H = 0.184

N_e = 16.4



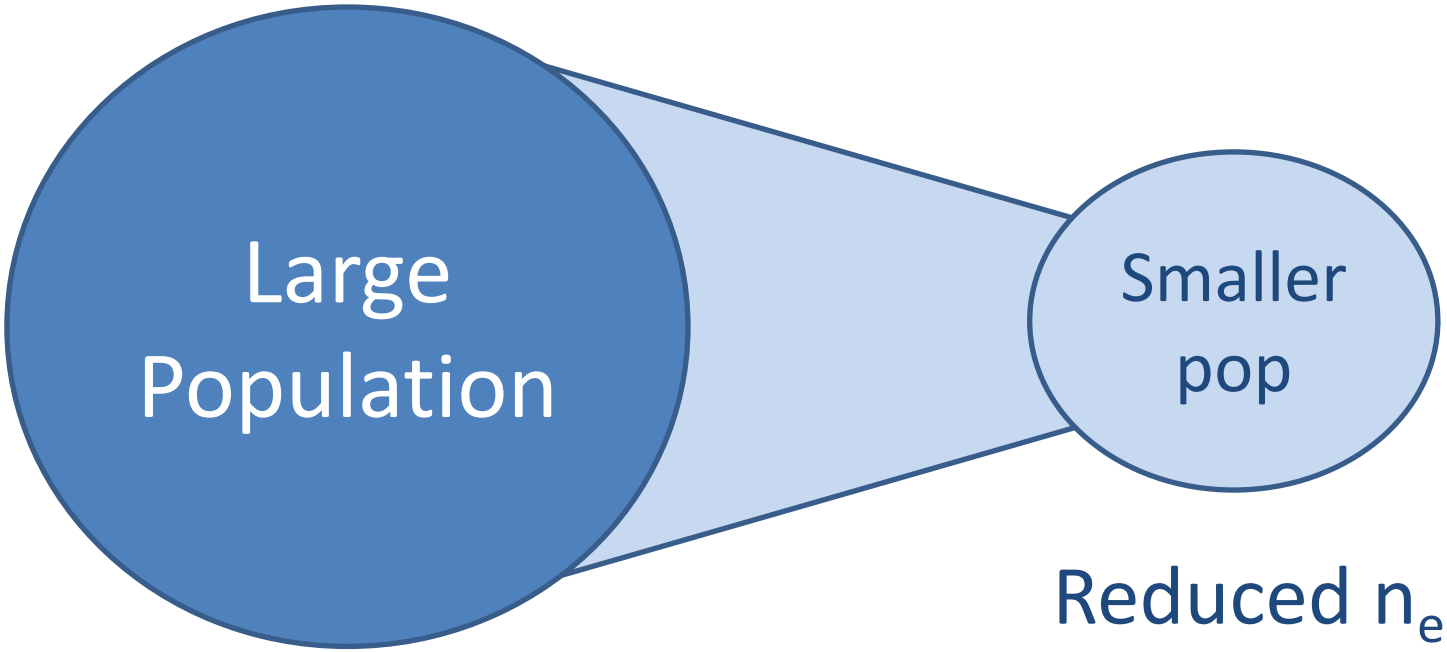
2007:

H = 0.250

N_e = 32.1

N_e and H_t/H_0 and inbreeding (F)

They're all related, aren't they?



Reduced n_e
Reduced H
Increased F

N_e and H_t/H_0 and inbreeding

They're all related:

$$\frac{H_t}{H_0} = \left(1 - \frac{1}{2N_e}\right)^t = 1 - F$$

Re-arranged:

$$F = 1 - \frac{H_t}{H_0}$$

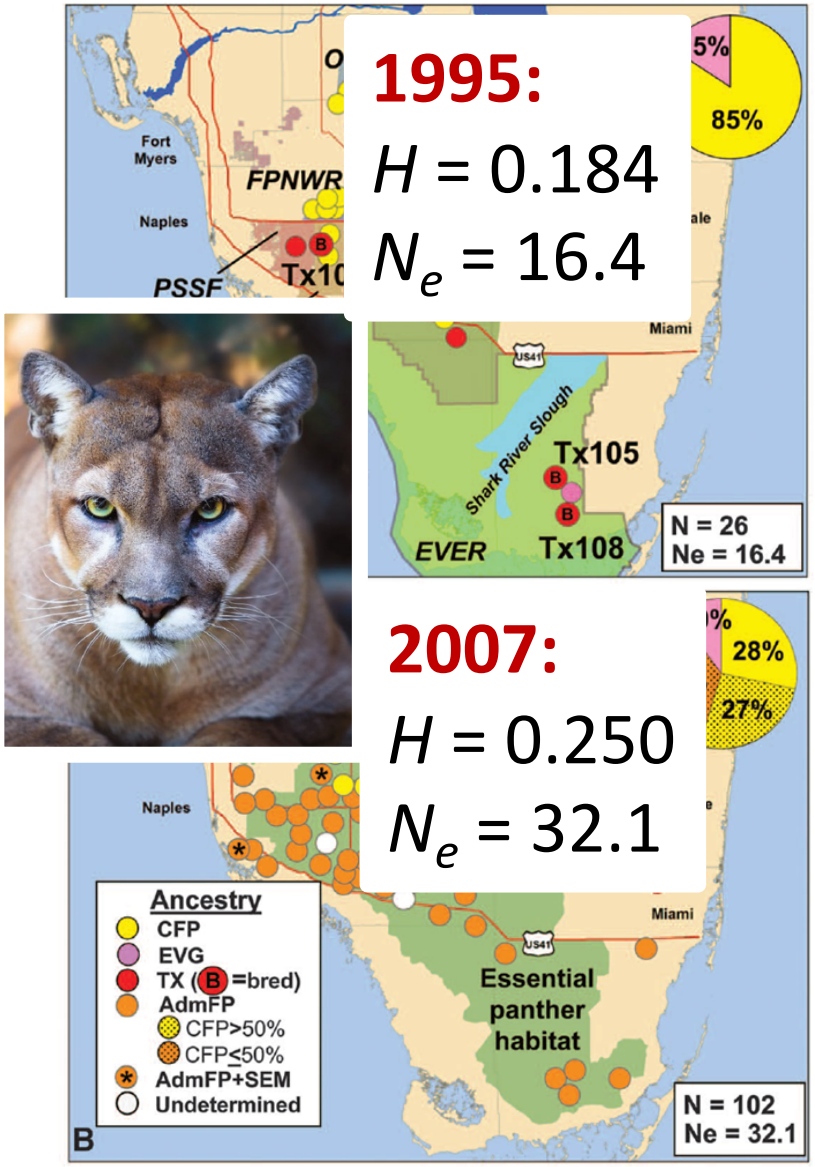
Question 5.2 Inbreeding without-versus-with intervention:

Estimate *F* in 2007:

(a) If they hadn't introduced TX panthers…

(b) Given that they were introduced…

Interpret & discuss these values



Inbreeding without intervention:

From 1995 to 2007:

H_0 = **0.184**, H_6 = **0.153**

$$F = 1 - \frac{H_t}{H_0}$$

$$F = ?$$

Inbreeding without intervention:

From 1995 to 2007:

H_0 = **0.184**, H_6 = **0.153**

$$F = 1 - \frac{H_t}{H_0}$$

$$F = 1 - \frac{0.153}{0.184}$$

$$F = 1 - 0.831$$

$$F = \mathbf{0.168}$$

Inbreeding with intervention:

From 1995 to 2007:

H_0 = **0.184**, H_6 = **0.250**

$$F = 1 - \frac{H_t}{H_0}$$

$$F = 1 - \frac{0.250}{0.184}$$

$$F = 1 - 1.359$$

$$F = -0.359$$???