

# A questão

Ilhas como modelo/windows para

- > evolução em populações pequenas
- > relação entre ecologia/área e tamanho efetivo
- > menor taxa de evolução adaptativa
- > menor eficácia da seleção (eficácia/efetividade: o quanto a seleção consegue mudar a composição da população)
- > eficácia na remoção de deletérias OU "populações pequenas acumulam mais mutações deletérias"?

# Bases teóricas: a teoria quase neutra

## Teoria Neutra

- > vantajosas *rara ↓*
- > deletérias *comum +*
- > neutras muito comum

↓  
deriva

$$H = \frac{4N\mu}{4N\mu + 1}$$

## Teoria quase neutra

- > vantajosas
- > deletérias
- > neutras
- > fracamente deletérias / selecionadas *comuns*

↓



deriva predominante

- > mutações deletérias não são eficientemente eliminadas
- > mutações vantajosas não são eficientemente fixadas

↑ N

↓  
seleção predominante

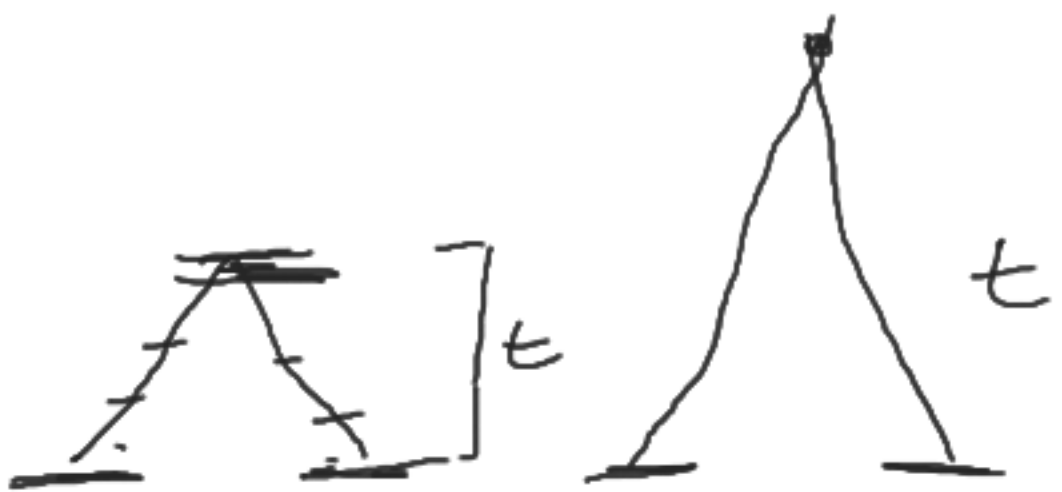
- > mutações deletérias são eficientemente eliminadas
- > mutações vantajosas são eficientemente fixadas

# Resultados

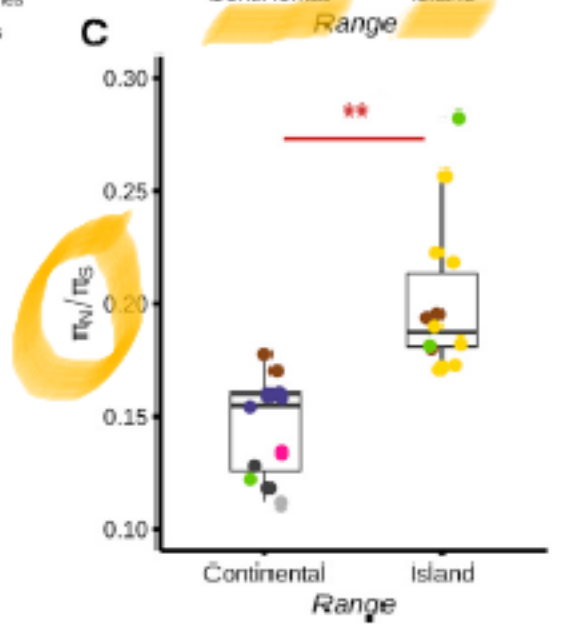
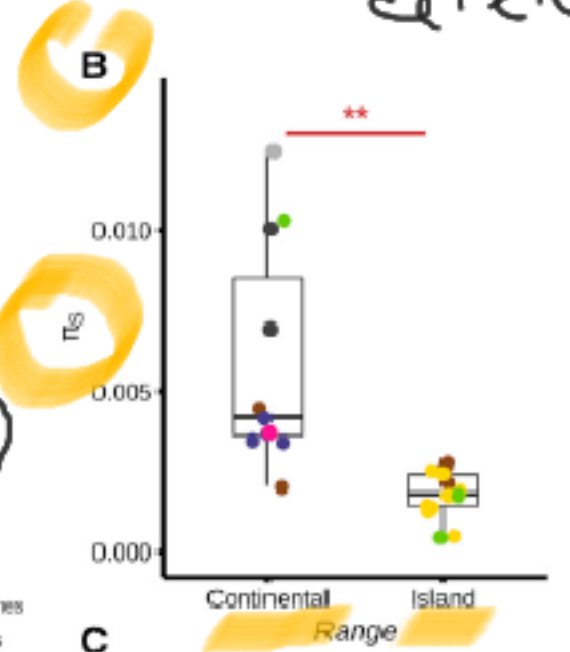
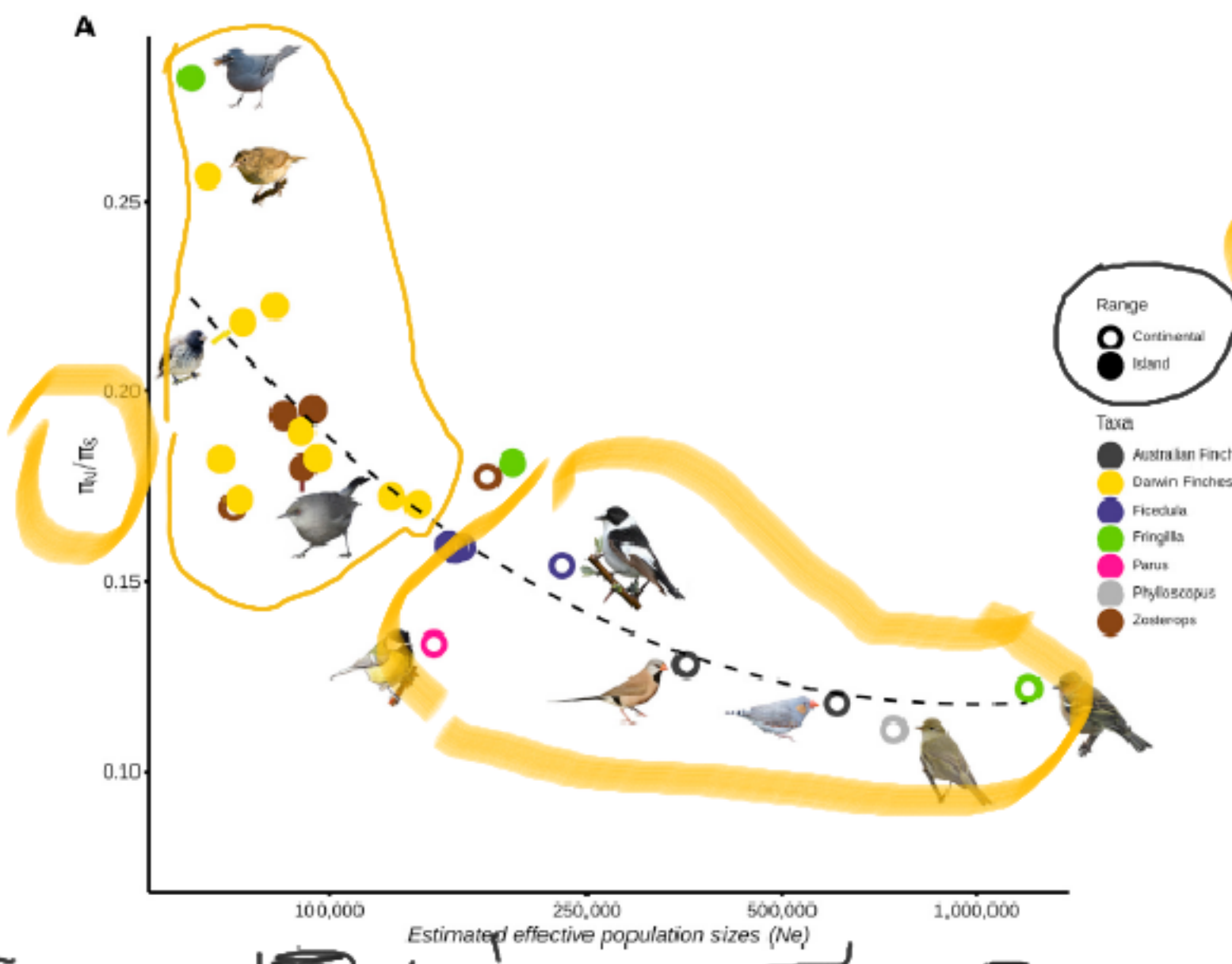
$\frac{\pi_N}{\pi_S}$   $\nearrow$  maior  $\rightarrow$  mais mutações deletérias  
 $\searrow$  menor  $\rightarrow$  menos deletéria

Método usado:  
 Ne PSMC <https://onlinelibrary.wiley.com/doi/full/10.1002/ece3.5888>

Dados em escala genômica



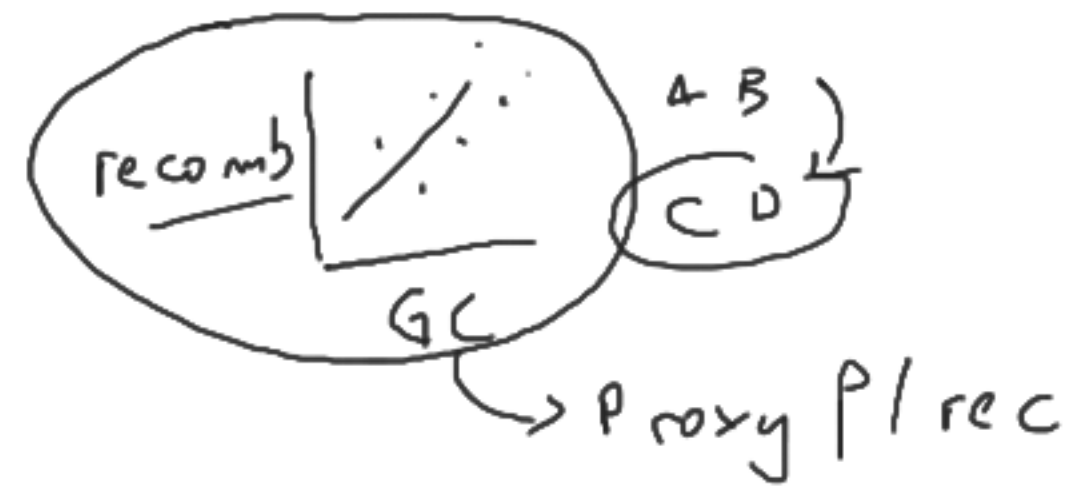
"island species exhibit a significantly lower mean Ne than continental species over the last one million years"



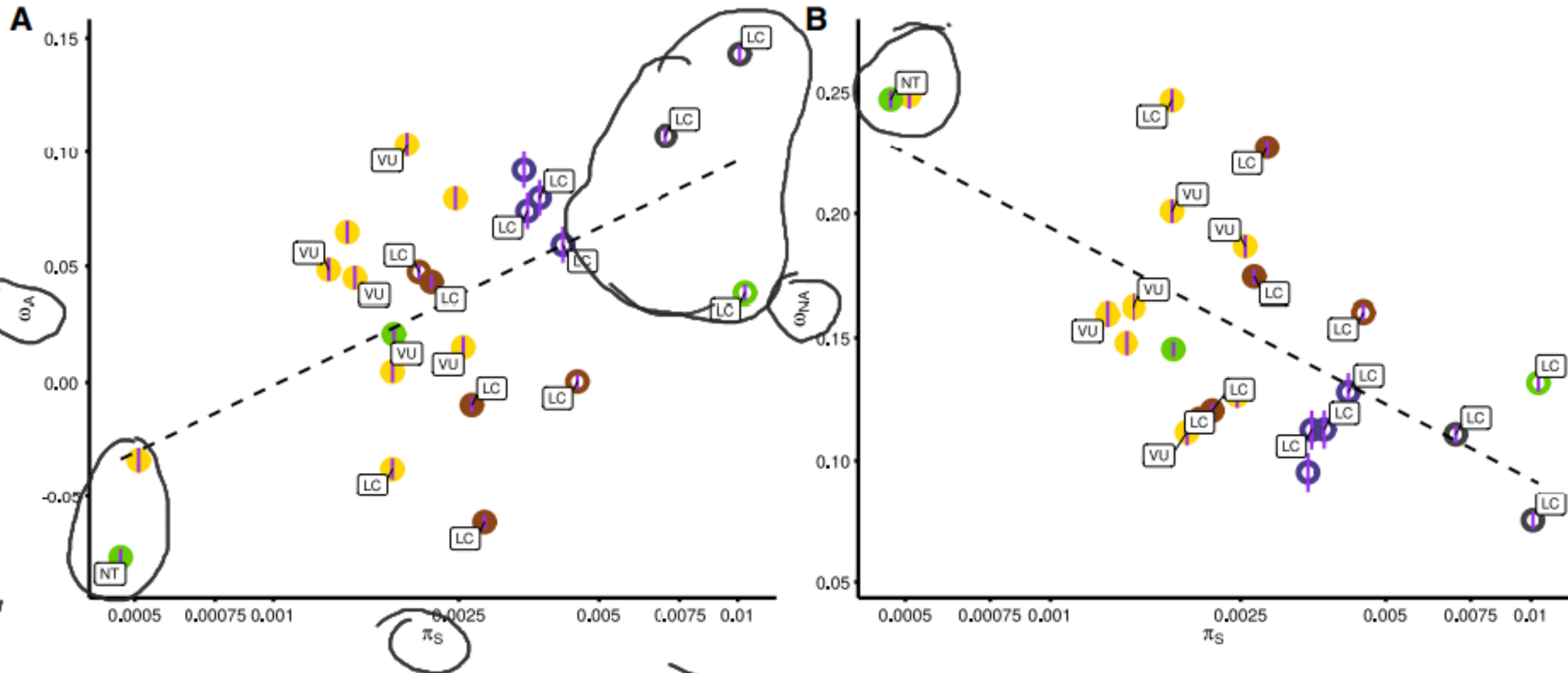
$\hookrightarrow$  usa diversidade  
 $\downarrow$   
 estimativa Ne



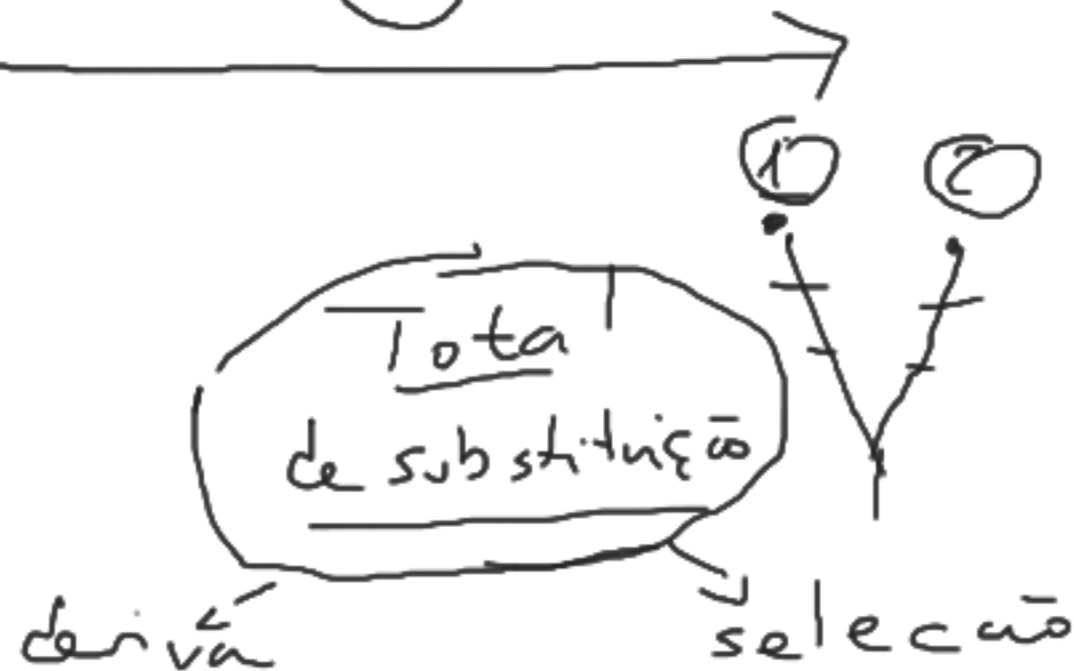
# Resultados - 3



$\omega \rightarrow \frac{dN}{dS}$   
 diferença entre espécies  
 $\Pi \rightarrow$  diversidade dentro de espécies

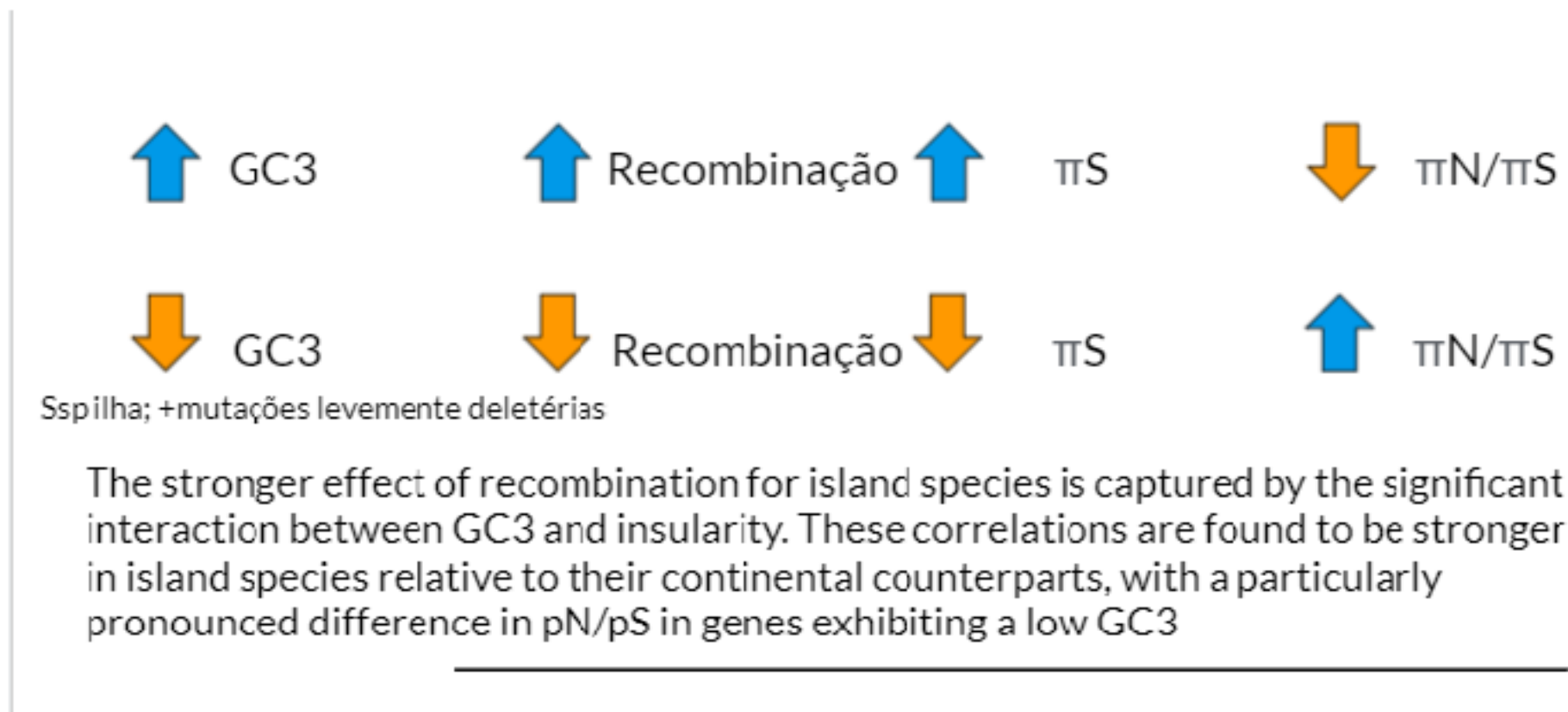


$\omega_A$   
 $\omega_{NA}$



"Overall, our analysis suggests that a lower  $N_e$  doubly affects island species relative to continental species, because (1) relatively fewer adaptive mutations can reach fixation, and (2) the lower efficiency of natural selection allows a greater proportion of weakly deleterious variants to reach fixation in insular species."

# Recombinação e diversidade



The stronger effect of recombination for island species is captured by the significant interaction between GC3 and insularity. These correlations are found to be stronger in island species relative to their continental counterparts, with a particularly pronounced difference in  $\pi N/\pi S$  in genes exhibiting a low GC3

Recombination limits genetic interactions between selected mutations and can therefore improve the efficiency of selection. These results suggest that the intensity of the differences between island and continental species in the effectiveness of purifying selection relies heavily on the local genomic context

# Conclusões e implicações

"Overall, our analysis suggests that a lower  $N_e$  doubly affects island species relative to continental species, because (1) relatively fewer adaptive mutations can reach fixation, and (2) the lower efficiency of natural selection allows a greater proportion of weakly deleterious variants to reach fixation in insular species."

Implicação para  
conervação

Rogers and Slatkin<sup>25</sup> propose that, after a tipping point, this mutational meltdown might contribute to the ultimate steps in the road to extinction. Endemic island species therefore represent taxa of high interest in the evaluation of the long-term consequences of evolution under low effective population sizes

