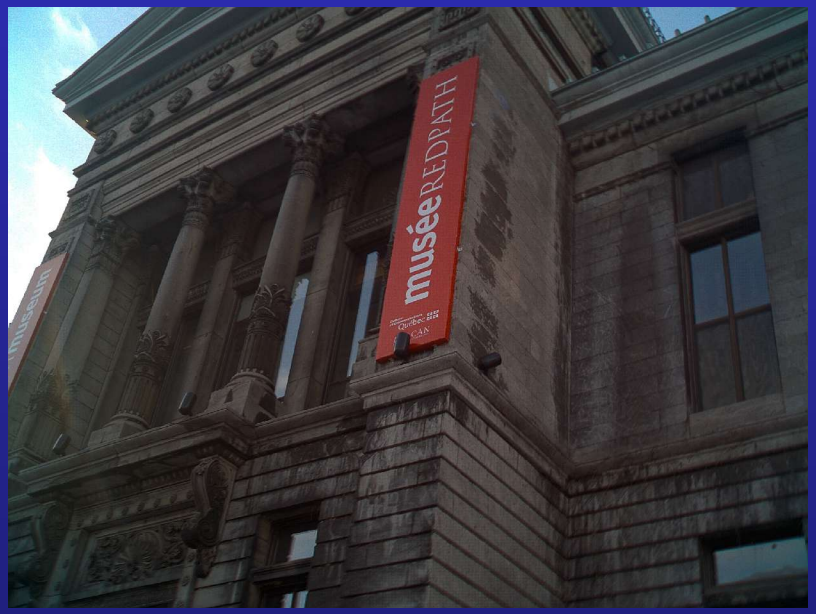
Interactions between gene flow and adaptation in populations of guppies (*Poecilia reticulata*):

an individual based modelling approach.



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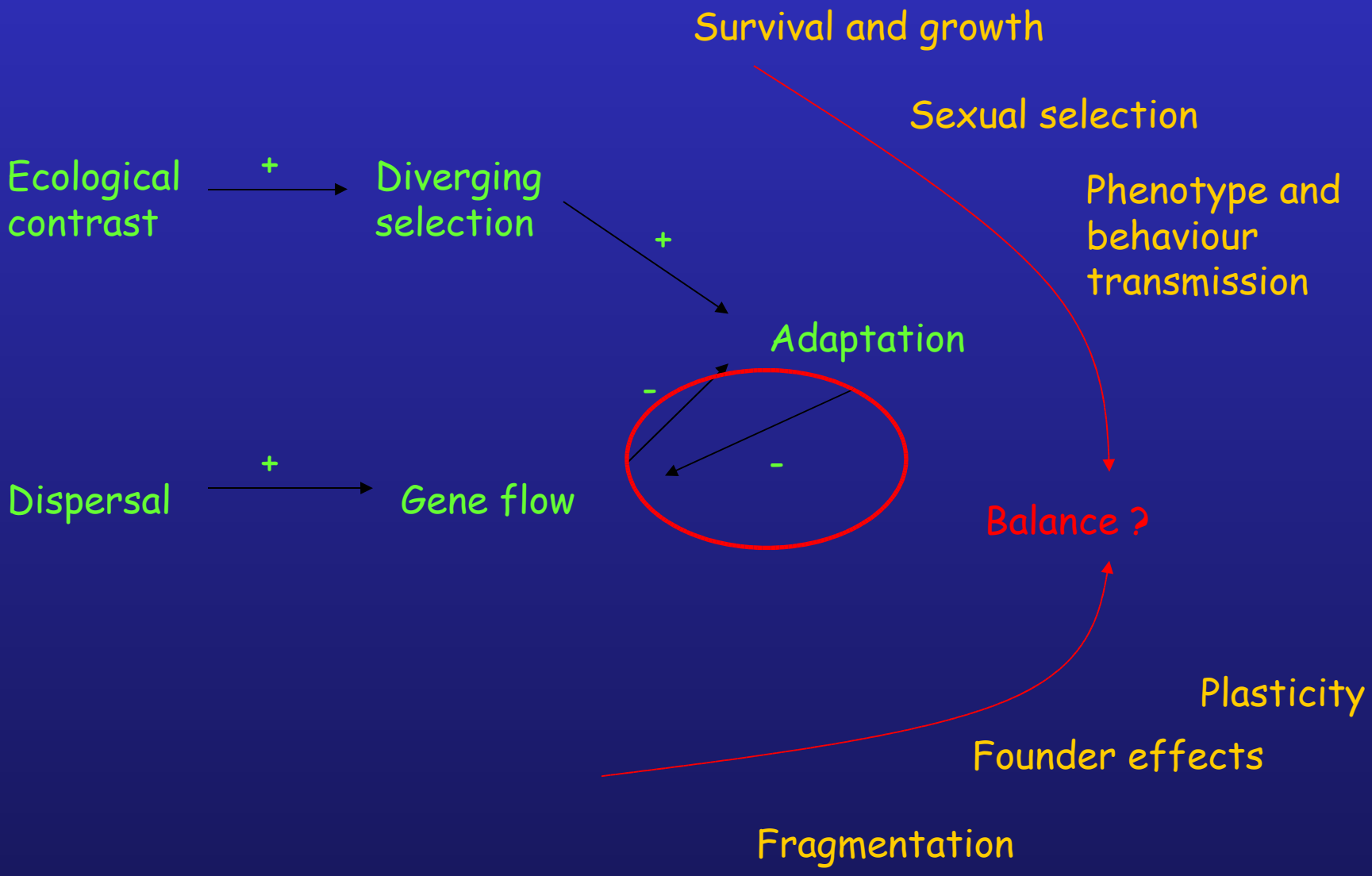
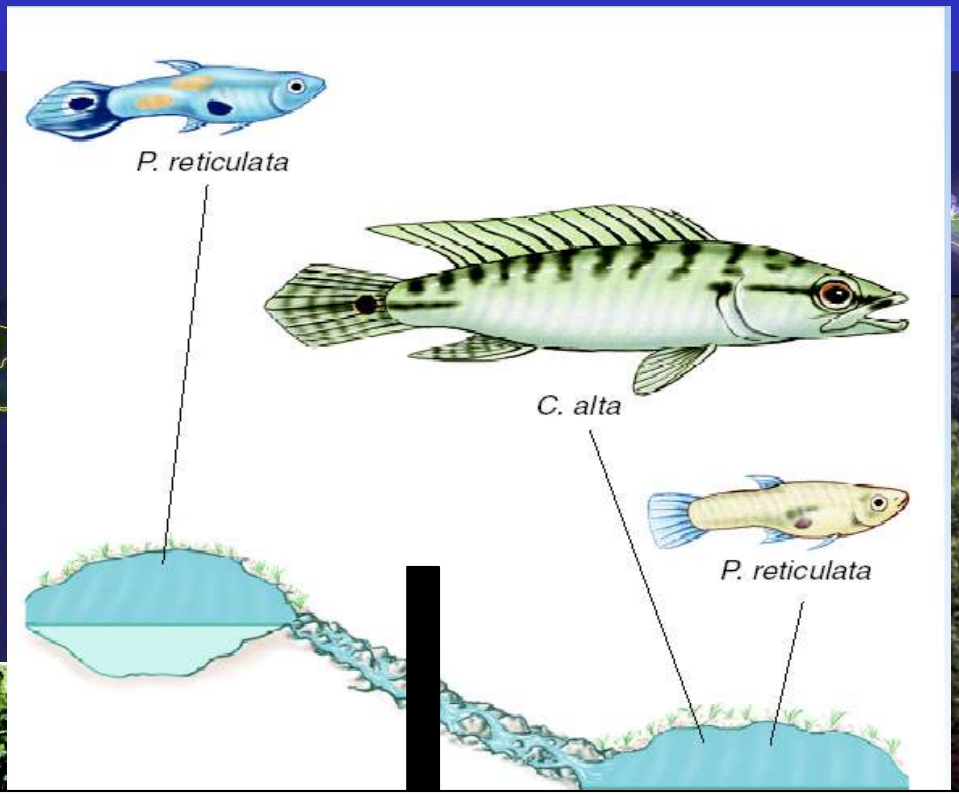
Under Natural Selection, the Theory of Evolution predicts that speciation can occur.

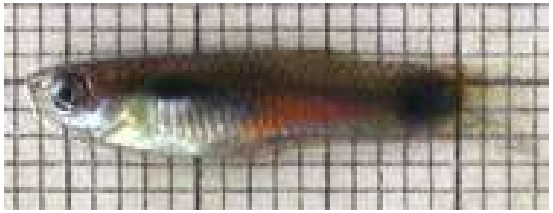
(« Ecological Speciation » Schluter D. 2000, Kirkpatrick & Ravigné 2003).



Guppies populations in Trinidad



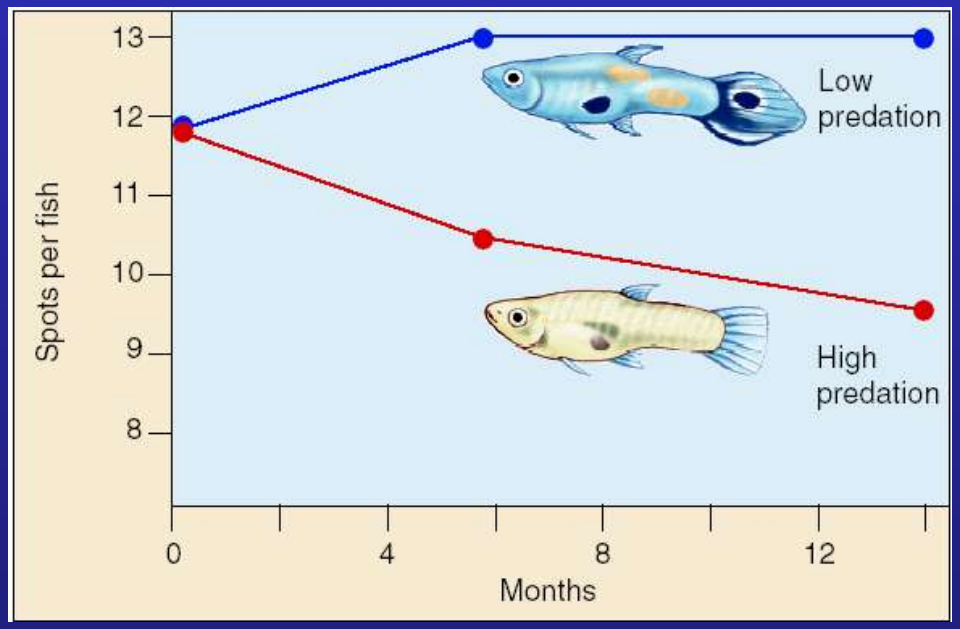
High predation (HP)



Low predation (LP)

Seminal works from J. Endler, H. Rodd et D. Reznick

- Transplant experiments showed rapid evolution of phenotype depending on predation

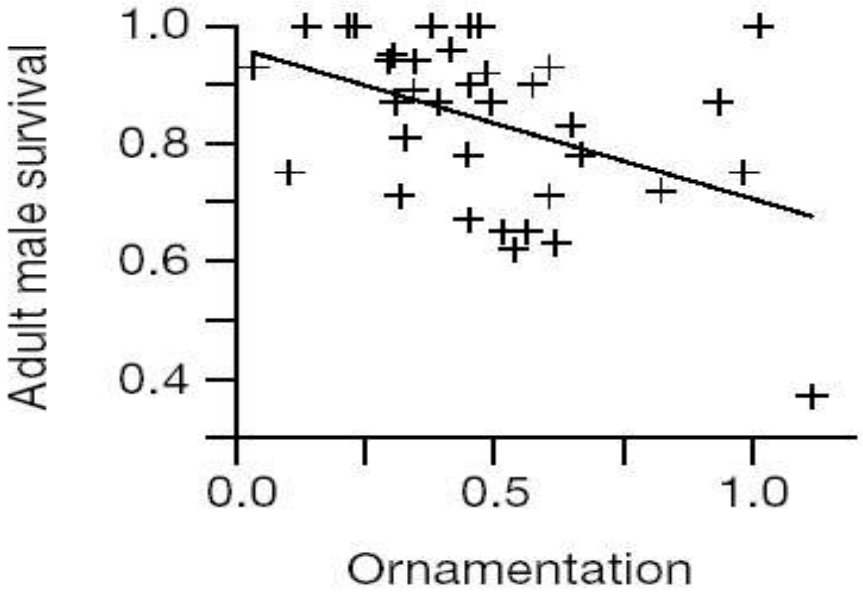


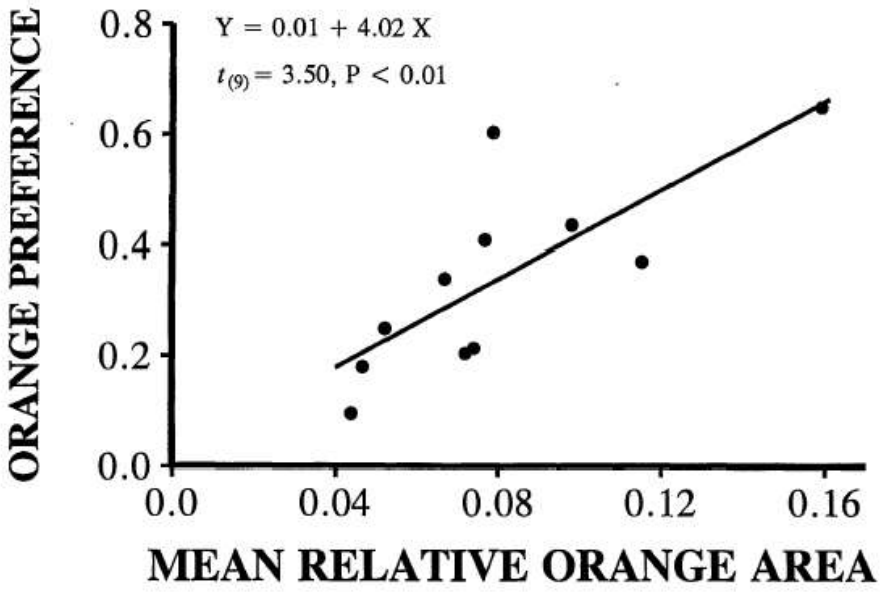
- Colour evolves as a trade-off between sexual selection and natural selection, and thus create adaptive divergence.

What are the selection pressures acting on male's colour ?

- Natural selection : predation

Brooks R., 2002.





- Sexual selection :

females preference

Endler J.A., Houde A.E. 1995

Can this diverging selection lead to reproductive isolation ?

Does gene flow influence adaptation efficiently ?

Can adaptation reduce gene flow ?

- Field investigations by Crispo et al. (2006)

  - No effect of predation on genetic distance between populations

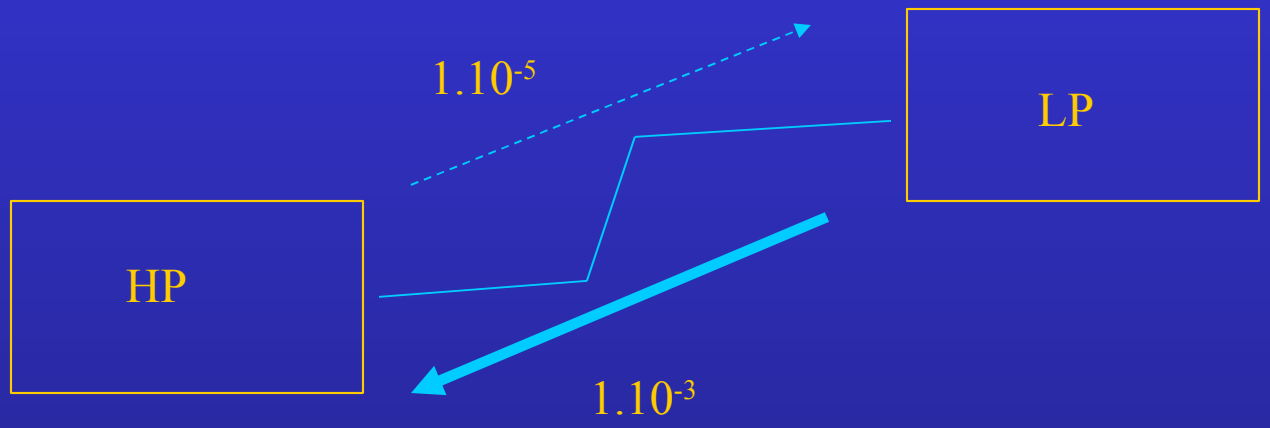
- Analysis *via* modelling

  Different environments under different predation regimes

  Individual behaviour (female preference) and phenotype (male colour)

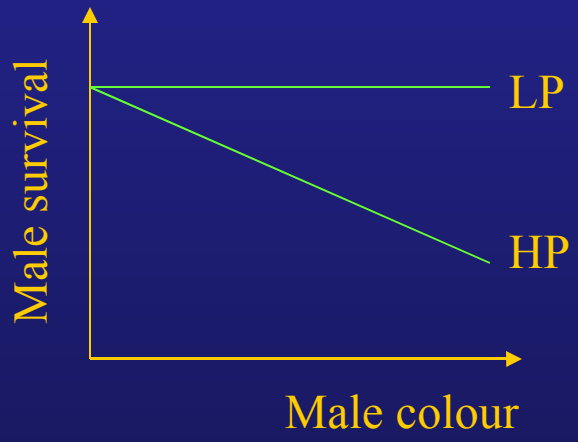
  Explicit genetic transmission of phenotype

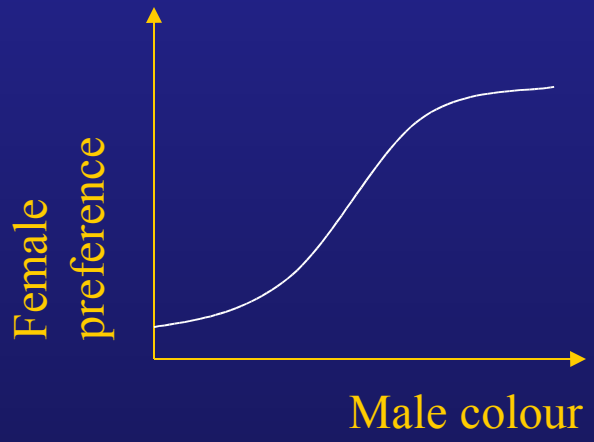
- Different environments under different predation regimes



- Initial population 10 000 individuals not yet colonized

- Natural and sexual selection





- Male Phenotype and its transmission

Male colour

Neutral loci

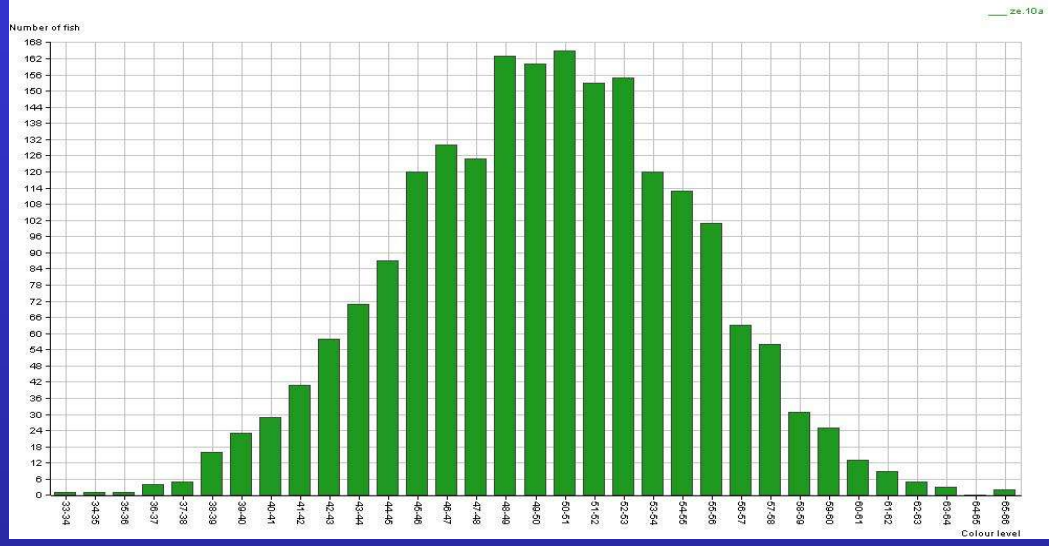
(7 loci, 10 allèles each)

Classical nuclear loci

(5 loci, 4 allèles each)

Y-linked loci

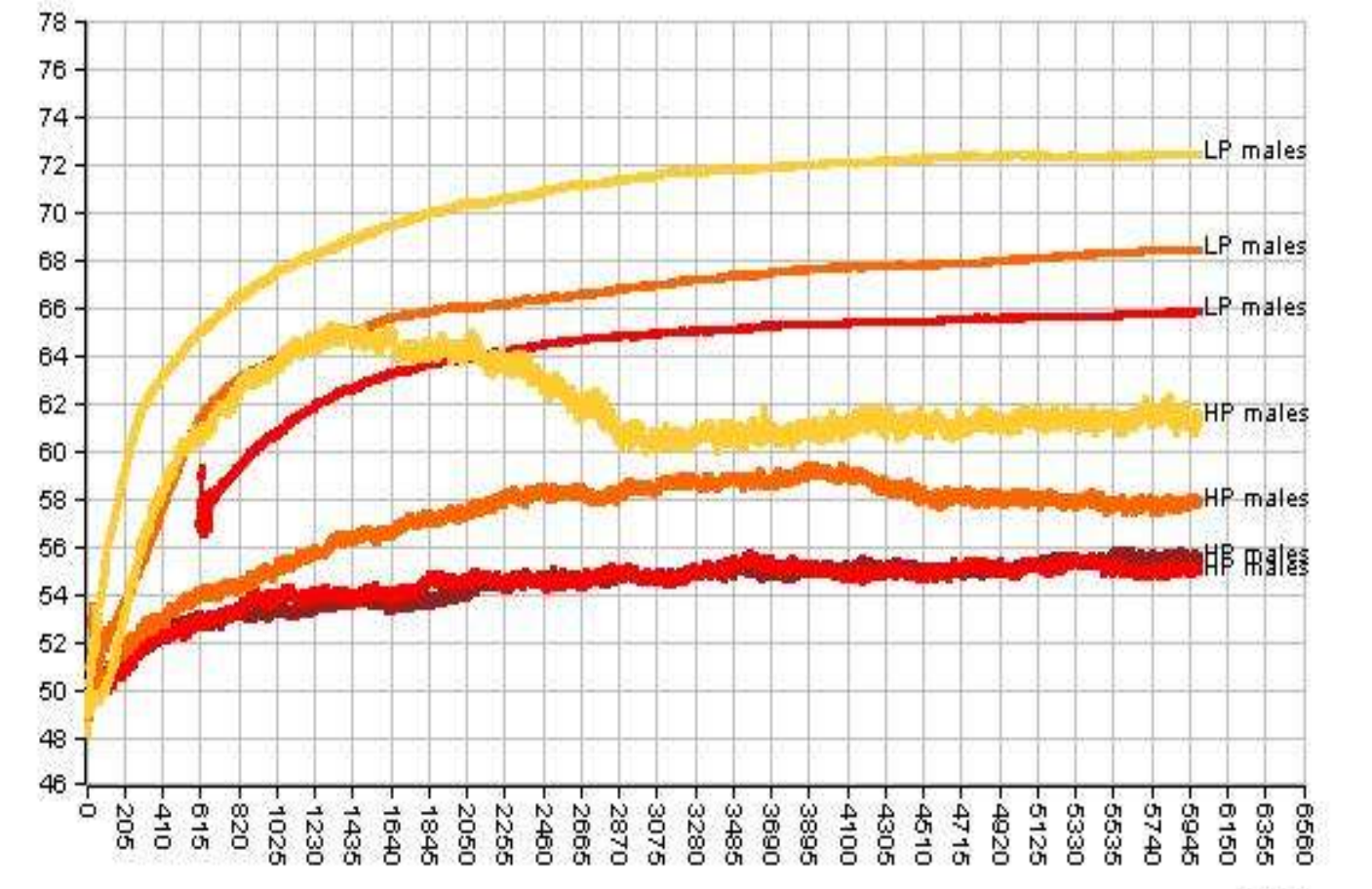
(10 loci, 4 allèles each)



- Measure of adaptation and divergence
  - Mean colour in a site
  - Relative difference of colour between sites
- Measure of gene flow
  - Theta distance *(Weir and Cockerham 1983)*
- 6000 time steps trajectory (200 years, 1000 to 2000 generations)

Measure of adaptation

Male mean colour



No dispersal (HP only)

Low dispersal

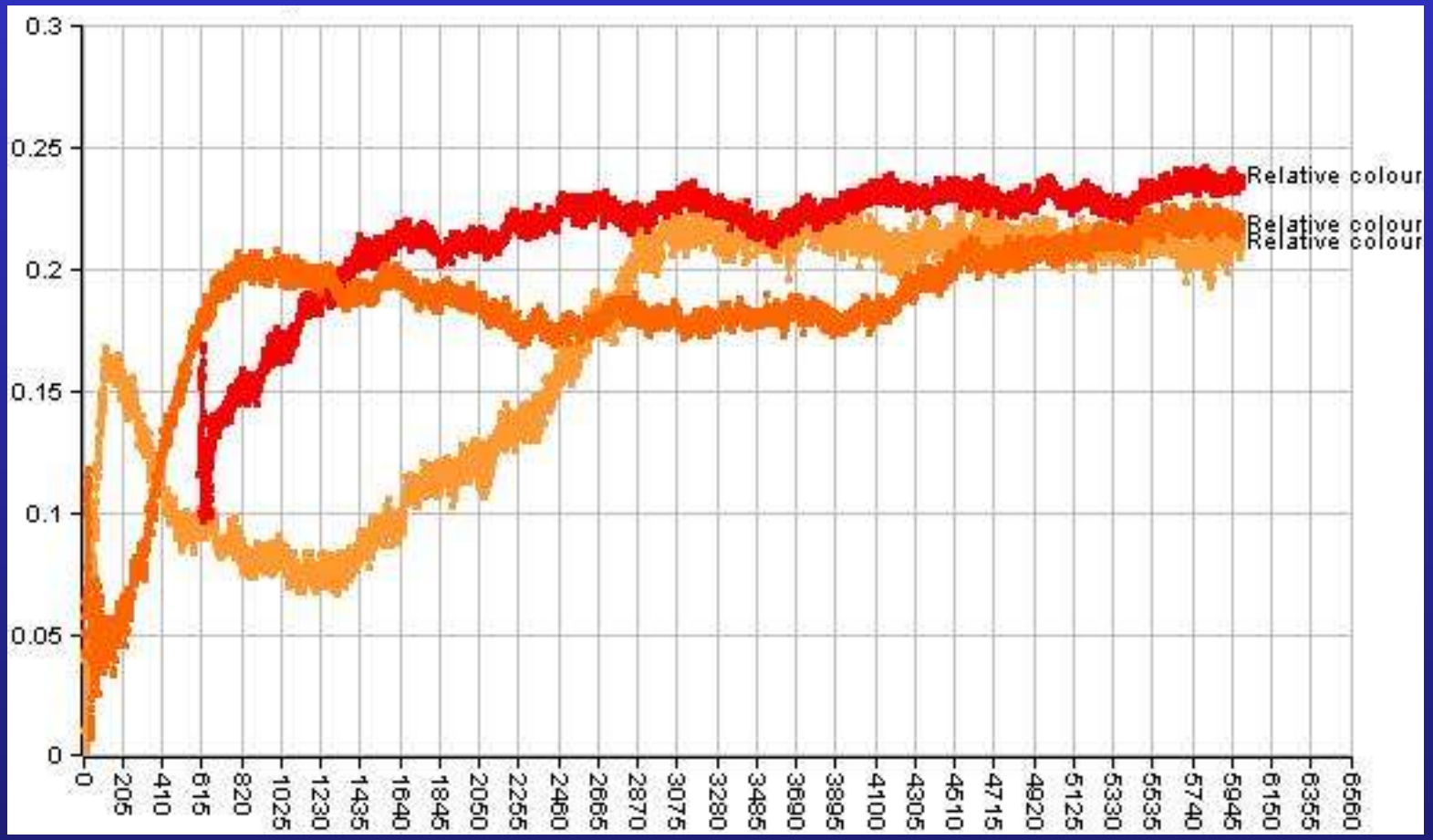
Medium dispersal

High dispersal

Time

Measure of divergence

Relative colour difference



Time

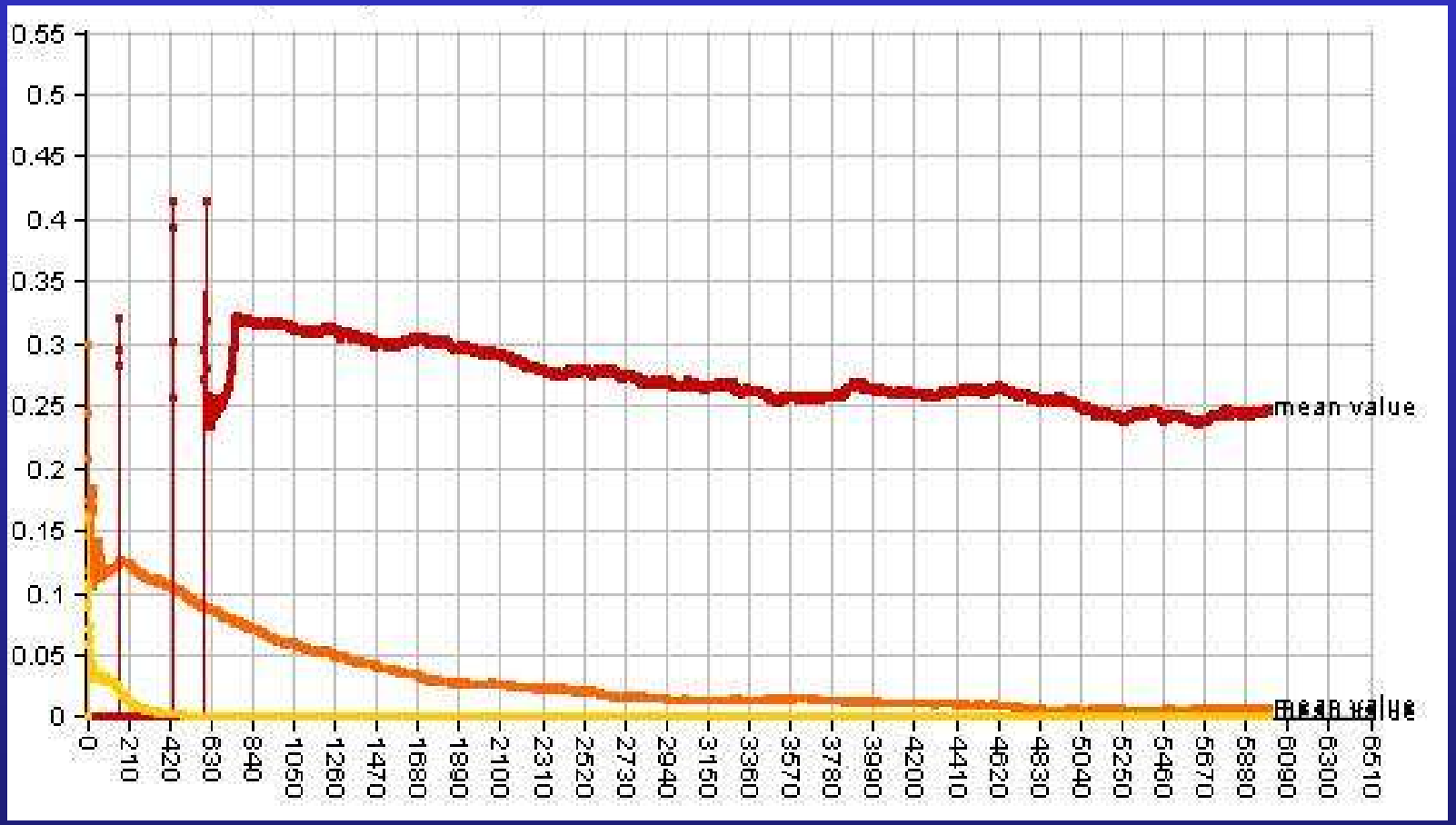
Low dispersal

Medium dispersal

High dispersal

Measure of gene flow

θ genetic distance between HP and LP populations



Time

Low dispersal

Medium dispersal

High dispersal

Discussion : results

- Gene flow influence adaptation, mainly by changing the mean value of phenotype, for intermediate and high dispersal

- But gene flow does not efficiently reduce phenotypic divergence between populations

- When adaptation occurs, it doesn't seem to reduce gene flow (i.e., increase genetic distance) between populations

- We add support to Crispo et al. findings.

Discussion : what's wrong with ecological speciation?

- The model is very optimistic for the diverging selection, still it does not add support to the ecological speciation hypothesis

- Stochastic + individual based model = obstacle to rapid convergence

- Is ecological speciation a major mechanism for speciation ?

Discussion : what is next ?

- Complete Monte Carlo analysis of the model

- Life histories may vary between environments (faster growth and earlier maturation in HP environment)

- Female preference can differ between environments too (Schwarz & Hendry 2006)

- Female preference evolution : a joint problem ?

Thanks for your attention !

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