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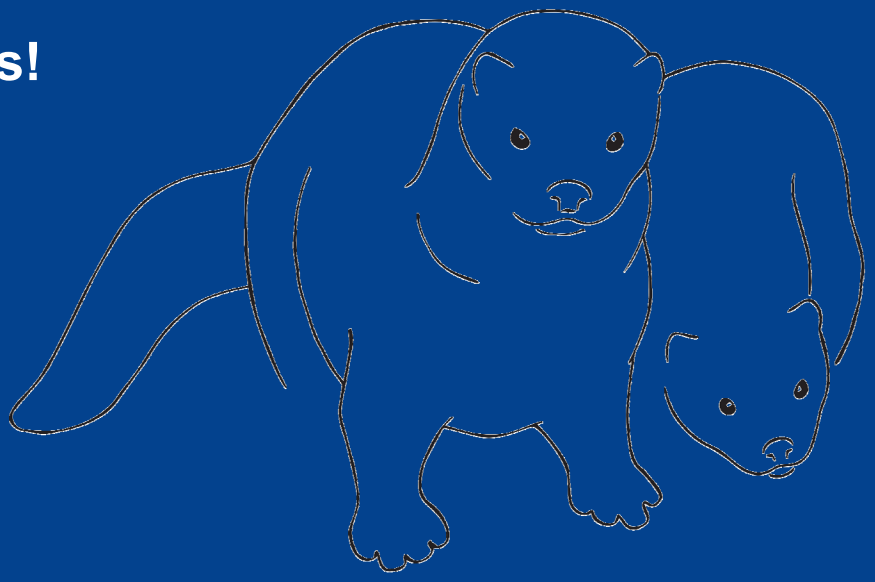
Early weaning and separation to group housing can reduce bite marks in mink

Group selection against bite marks works!

So does environmental factors!
Are they

- **Age at separation?**
- **Age at weaning?**
- **Other factors?**



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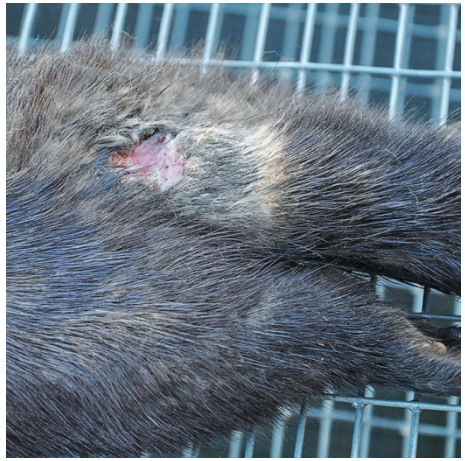
What is a mink?

- The mink (Neovison vison) is a fur animal from North America
  - Farmed in Europe for about 100 years
    - 7200 farms in Europe (30,000,000 pelts)
    - 1500 farms in Denmark, 3.3 million dams (16,000,000 pelts)
- The mink is a solitary, territorial carnivore
  - Male territories often overlap that of females
  - Defend territory by aggression – if needed

Group housing

- European regulation allows for group housing
  - I.e. more than two mink in a cage
  - Despite the risk of aggression
  - This may result in bite marks
  - Sometimes even in wounds!

- Bite marks are an excellent indicator of aggression during the autumn!
  - Additive record of the 6-8 weeks period of the winter fur development



Bite-marks and how they are scored

Scores used for grading of bite marks on the skin side of mink pelts after fleshing.

Score	0	1	2	3	4	5	6	7	8	9
Bite marks	0	1-5	6-10	11-15	16-20	21-25	26-30	31-35	36-45	>45

Bite-marks and how they are scored

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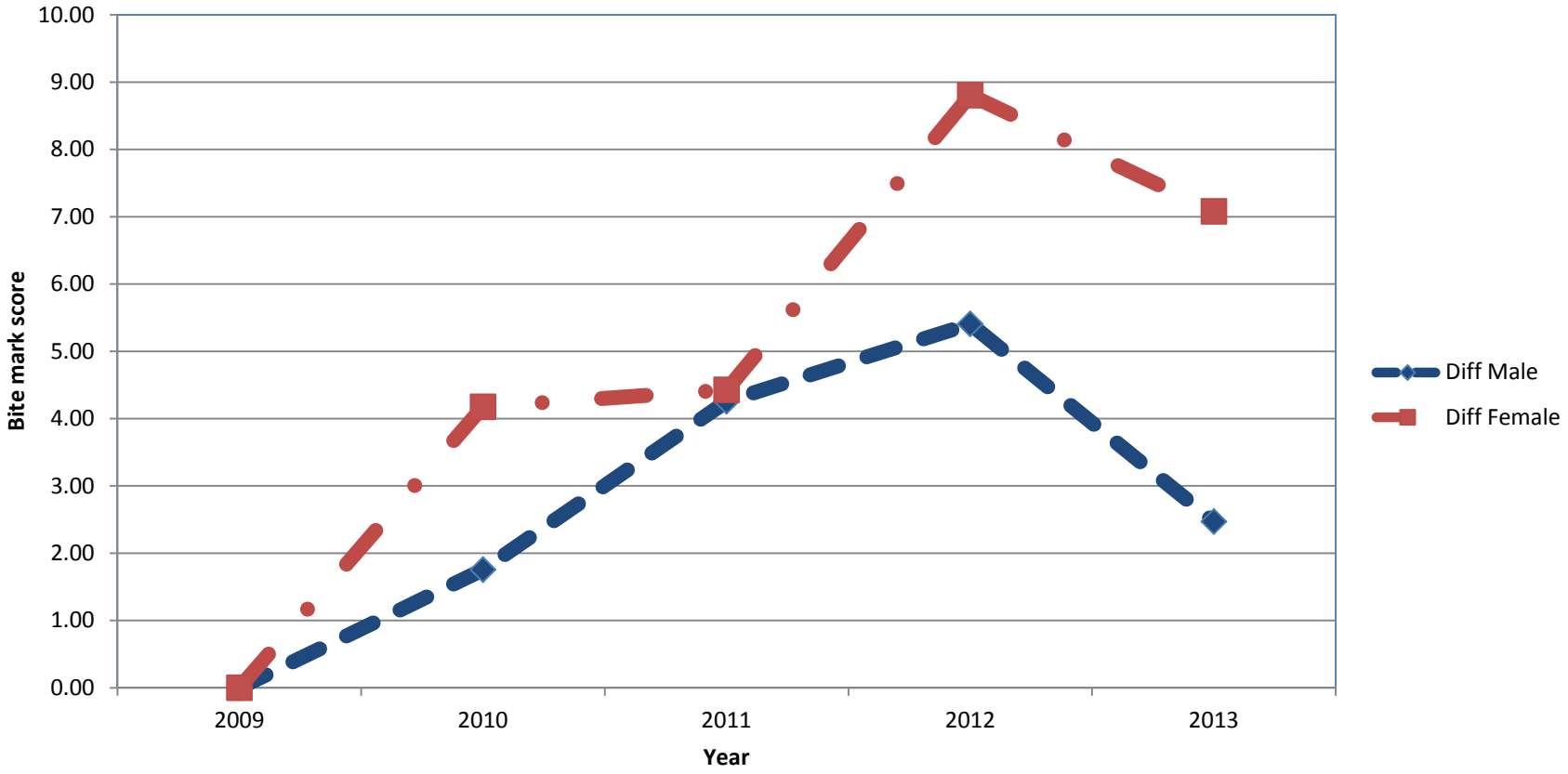
Why group selection against bite marks?

- Large genetic variation in bite-mark score in group housed mink
  - Direct genetic variation, $h^2 = 0.25$
    - 'Normal heritability' effect of genotype on own phenotype
  - Direct and Indirect genetic variation, $h^2 = 0.61$
    - 'Normal $h^2 = 0.10$ + Social interaction heritability $h^2 = 0.51$ '
- Bite marks are not only the result of a minks tendency to bite or get bitten
  - Interactions between all mink in a group are more important
  - Indirect genetic effects for bite marks are most important
- Group selection is most efficient
  - To minimise aggression in group housing
- With $h^2 = 0.61$ selection should be very efficient!

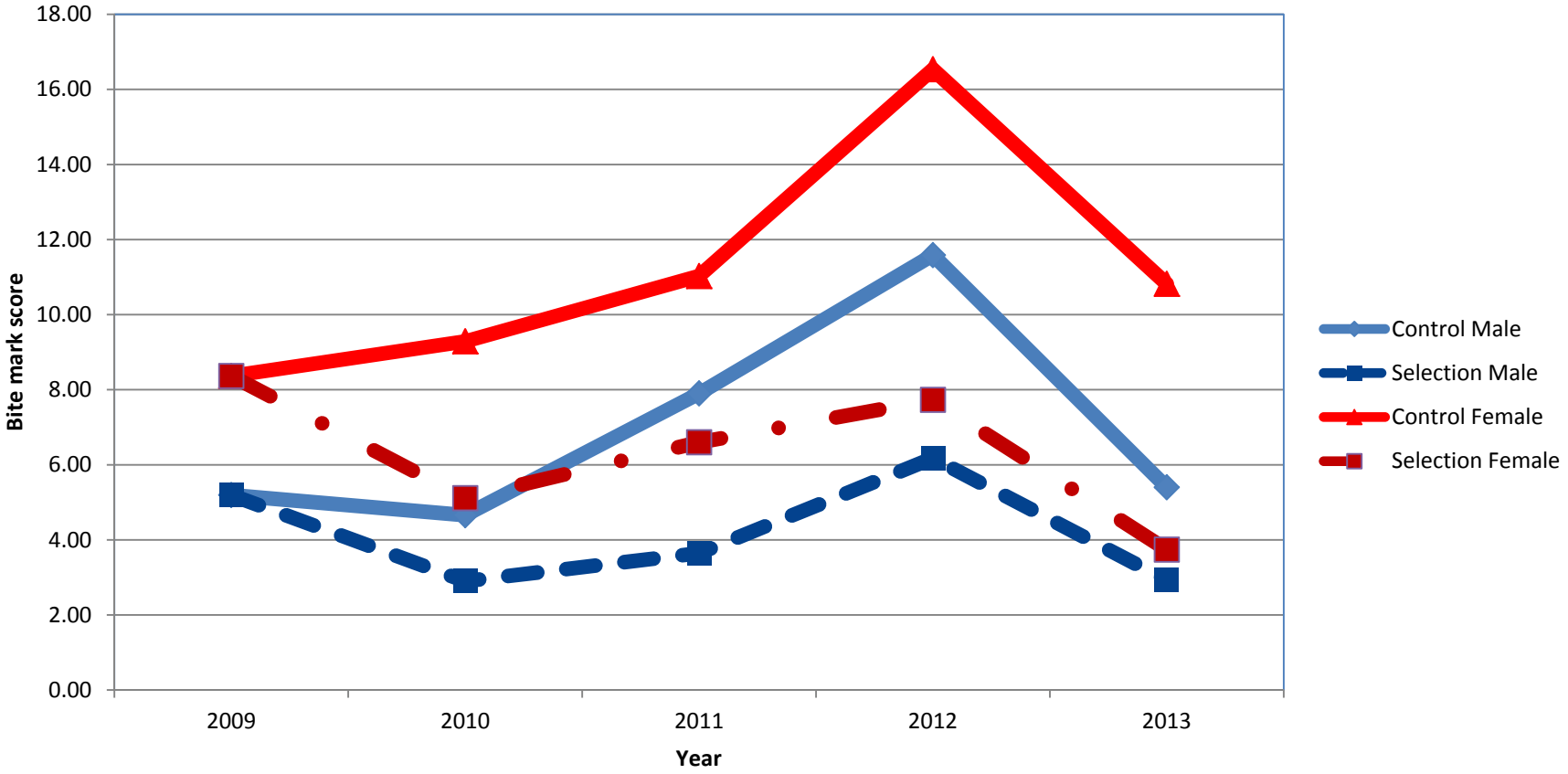
Figure 1. Difference between sum of bite-mark score in the control and selection lines in group housing for males and females.



Why is group selection not enough?

- With $h^2 = 0.61$ bite marks should be history in few generations!
- Unfortunately, the heritability is not all
  - The bite mark score increased in the control line!
  - Decreased very little in the selection line!
- Other environmental factors must be in effect
  - What are these factors?
    - Can we find them?
    - Can we control them?
  - If they are management factors
    - We can control them
    - Selection in the best environment will reduce the number of bite marks

Figure 2. Sum of bite-mark score of males and females from the control and selection lines in group housing 2009-2013.



Which environmental factors?

- Known management factors:
  - Group size end sex combinations!
  - Number of feeding places!
  - (Feeding level?)

- Possible management factors
  - Date of separation to group housing?
    - Indicated by farm experiment in 2011
    - By farmers and consultants
  - Age at weaning?
  - Cage design?
  - Farm activity?

- We tested age at separation to group housing in 2012
- Early weaning included in 2013

Experimental design

- Continuation of group selection experiment
  - 2 male siblings + 2 female siblings!
  - Brown colour type
- Weaning and separation
  - Early: weaning and separation at 7 weeks
  - Late,:weaning at 8, separation at 11 weeks
- The management factor was also tested at a private farm
  - In group housed juveniles 2 males + 2 females
- In total 714 pelts were inspected
  - Early separation: 360 pelts
  - Late separation: 354 pelts

Figure 3. Bite-mark score of males and females from early and late separation to group housing at AU-Foulum in 2012 and 2013.

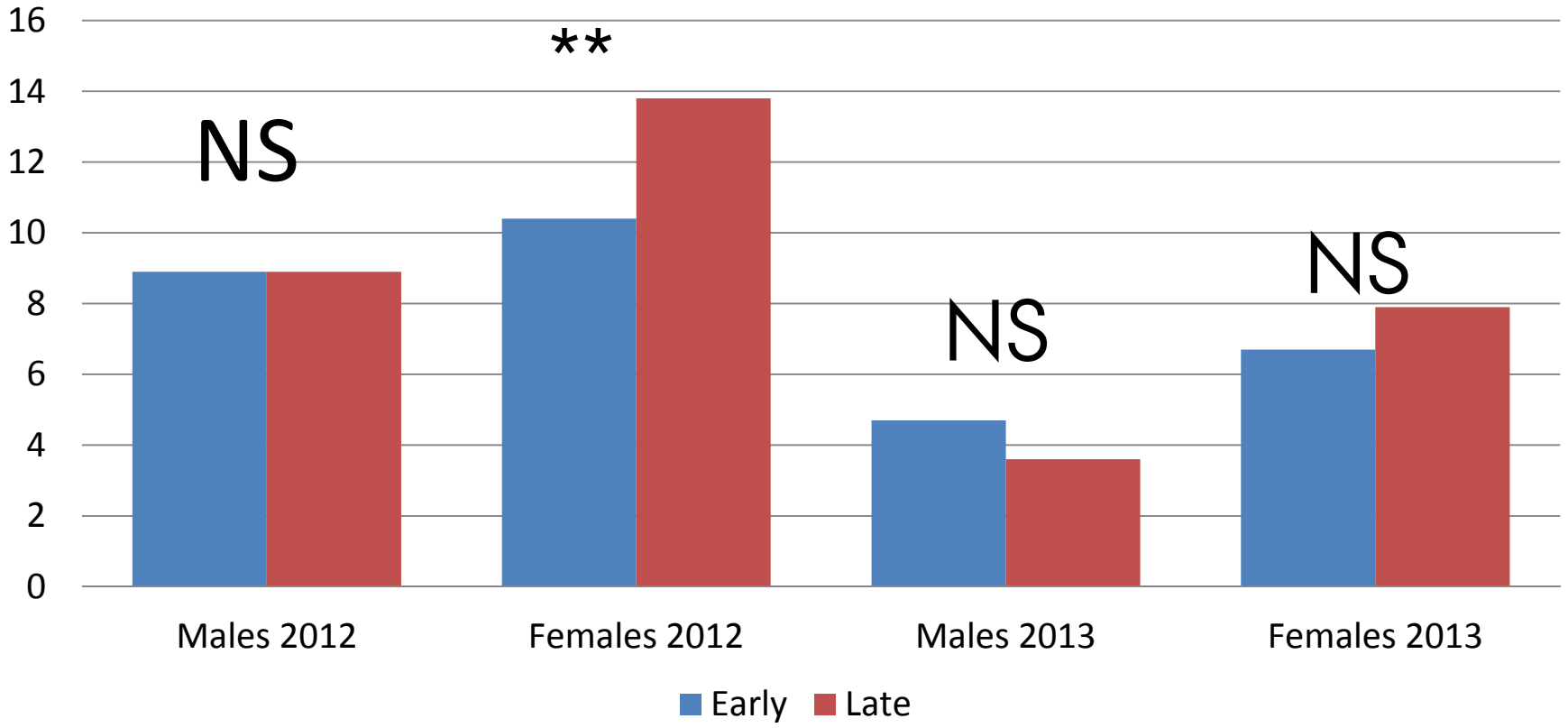
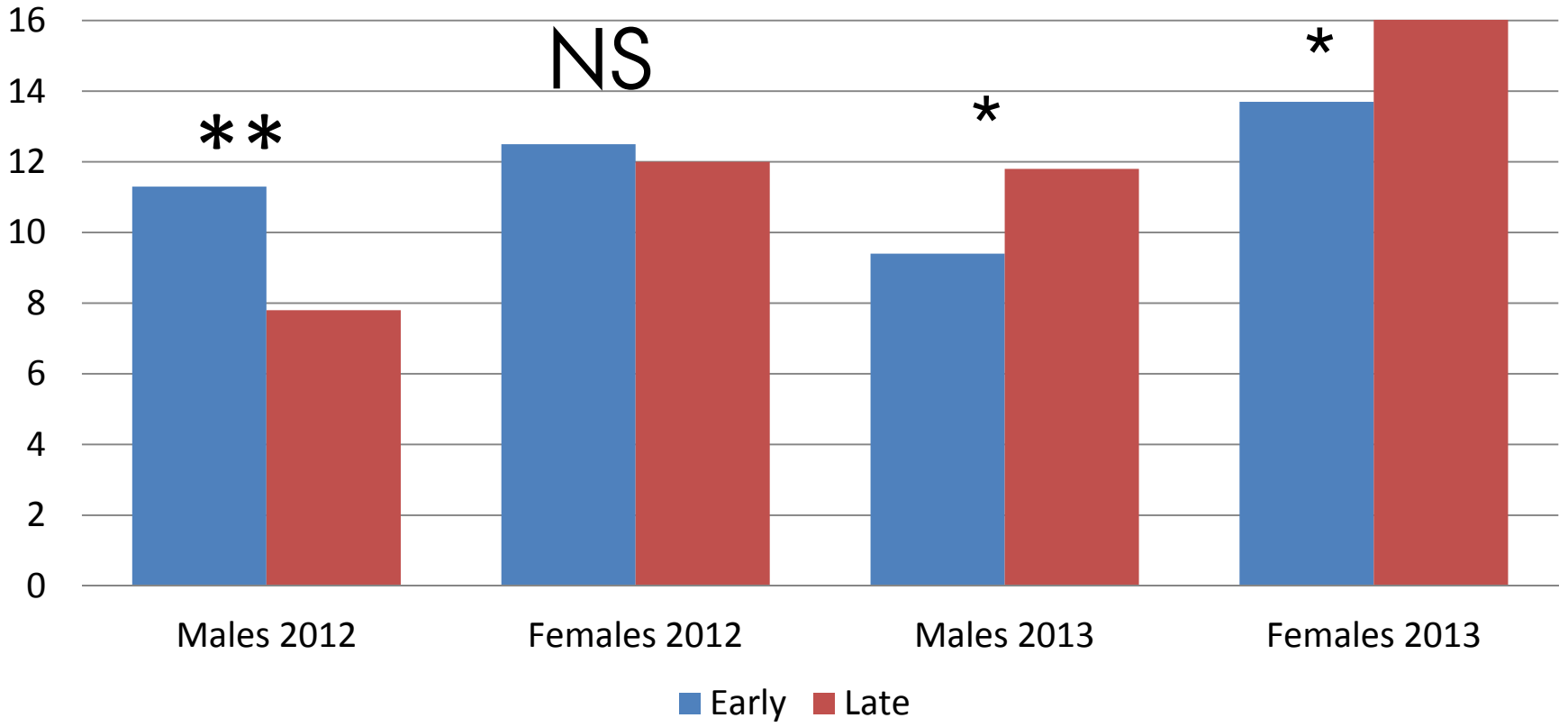


Figure 4. Bite-mark score of males and females from early and late separation to group housing at the private farm in 2012 and 2013.



Discussion

- The high heritability for group selection against bite marks works
  - Large difference between lines
- However, the bite mark score did not decrease as expected
  - Due to environmental factors
- Early weaning and separation at 7 weeks can be a factor!
  - No consistent effect across farms
  - Weaning at 7 weeks is against current European regulations!
- Both early and late groups varied in bite marks from the year before
  - Other factors involved

Discussion

- What other factors?
  - The experimental procedures were not changed
  - Why the significant decrease in 2013
- All group-housing cages were in the same shed
  - Increasing number of investigations since 2009
    - Observations, enrichments, videos, feeding sites, temperament tests
    - Increasing level of activity?
- The mink might have experienced more disturbances?
  - Activity level is included in 2014 studies

Conclusions

- Group selection works, so we accept the hypothesis that:
- Group selection can reduce bite marks
  - But environmental factors disguise the effect

- Weaning and separation at 7 weeks has some effect
  - Is not the primary environmental factor

- The environmental factors should be found in order to minimize the higher level of bite marks in group housing compared to pair-wise housing