

Outline

Wildlife aging :


- Importance of aging
- Various aging techniques

Non-invasive genetic sampling

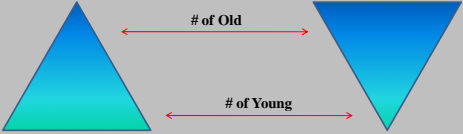
Telomeres:

- Form
- Function
- Methods of measuring
- Telomeres in wildlife aging

Aging Wildlife




Population Age Structure

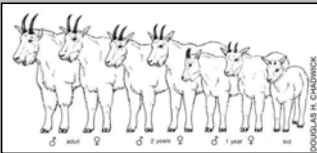


Aging Techniques

Known-age individuals




Longitudinal studies




Non-invasive Aging Techniques


Remote Observation




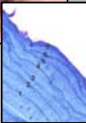
Invasive Aging Techniques

Capture and handling

Molt patterns 


Pelage characteristics 


Tooth extraction 


Cementum annuli 

Super-invasive Aging Techniques

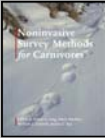
Destructive Sampling

Otolith removal 

Tooth wear 


Otolith 


Non-invasive Genetic Sampling



- Identify species
- Identify individuals
- Identify sex of individuals

What about age?

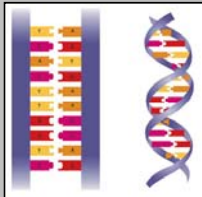




Telomere

Form:

- Short repeated sequences of DNA
- Found at the ends of linear eukaryotic chromosomes
- Non-coding DNA
- Many base pairs in length




Typical pattern of vertebrate telomeres

```
5' .....TTAGGG TTAGGG TTAGGG TTAGGG TTAGGG TTAGGG...3'  
3' .....AATCCC AATCCC AATCCC AATCCC AATCCC AATCCC...5'
```

Telomere

Function:

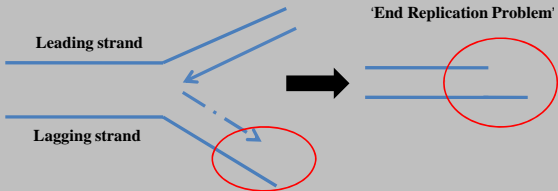
- Chromosome 'end-cap'
- Prevent 'end-to-end' fusion and subsequent genomic instability



Telomere

Function:





- Prevent gene loss during replication



Telomere

Function:

- Cellular clock'
- Trigger cellular senescence







tick tock tick tock

Telomere

Medical research:

- Aging process
- Cancer (telomerase)
- Cloning



"Old age ain't no place for sissies." - H.L.Mencken


Q and A

Questions:

Can telomere length be used as an indicator of age for wildlife species?

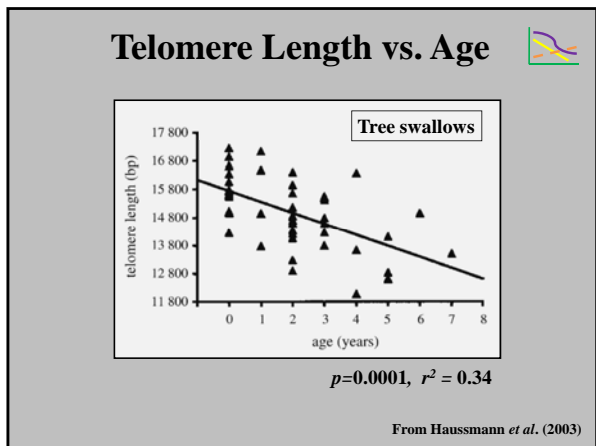
Can telomere rate of change (TROC) be used as an indicator of aging for wildlife species?

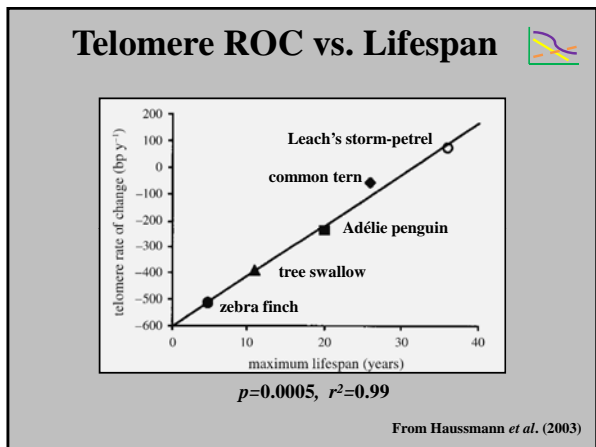
Can telomere work be done with non-invasively collected samples such as hair?

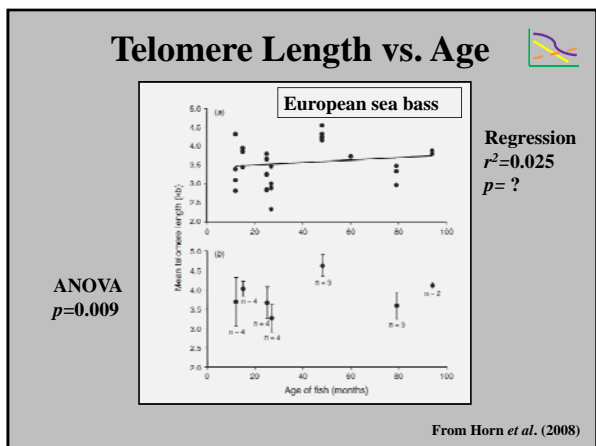


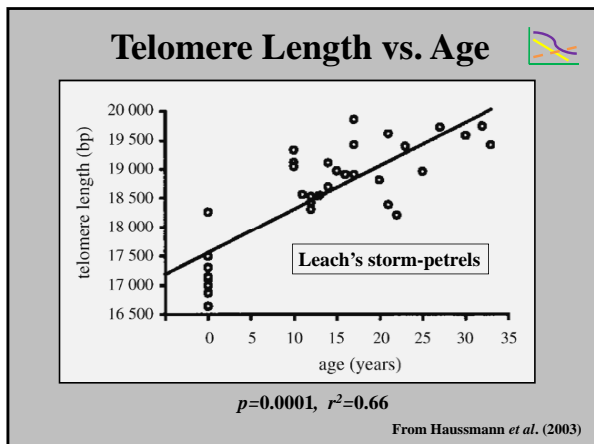
Answer:

Yes, No, Maybe!










Telomere Measurement




Many methods:

Method	No. of cells required	Example amounts
TRF analysis	Large	5000–10,000 ng of DNA
Q-PCR	Small	
Q-FISH	Intermediate	
Flow-FISH	Intermediate	
STELA	Small	50–100 ng of DNA
T-OLA	Large	

Adapted from table in Nakagawa *et al.* 2004

Telomere Measurement




Q-PCR:



- Small amounts of DNA required
- Same extraction process as microsatellite work
- Relatively inexpensive (3 to 4 \$/ sample)

from interview with J. Pauli

Telomere Measurement




Q-PCR:
Telomeric contamination a big issue




from interview with J. Pauli

Telomere Measurement




Q-PCR:

- Interstitial telomeric sequences can be problematic
- Run Q-PCR in concert with TRF



from Nakagawa *et al.* 2004

Closing Thoughts



- The use of telomeres is relatively new to wildlife research
- Not a 'cure-all' aging technique but has potential
- Many complexities to consider
- Due to the telomere's significance in human health research further developments are likely

