# Aging the African Lion

## A Training on Aging Lions

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## Citation

## Photo credits

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# Background and Applications

## Lions in Africa

As the dominant predator in Africa, the African lion (*Panthera leo*) is highly valued for its ecological role and importance for the tourism industry. However, lions have declined by an estimated 42% over the past 21 years (3 generations) to approximately 20,000 individuals (Bauer et al. 2015). Robust tools for assessing and managing lion population dynamics are critical for survival of the species.

## Why Age Lions?

Age is a common metric used throughout the world to guide the management, research and sustainable harvest of many types of wildlife, including large carnivores, ungulates and fish. Knowing an animal's age is critical for accurately estimating key elements of wildlife behavior and life history, such as reproduction, survival, movement and population size. Our ability to successfully conserve and manage wildlife depends on how well we understand each animal's social and biological role, which is closely tied to age.

## Implications for Management and Research

Managers use population models based on the age structure of a population to help predict how different management scenarios or environmental stressors might affect the future of a species. Population models project a species' population size based on information about a species' life history, including conception rate, birth rate, survival of young, age at puberty, territoriality and other behavioural characteristics. The age or life stage of an animal is closely tied to its reproduction, survival, behavior, and other aspects of its ecology that can affect population stability. Thus, an animal's age in the context of its population can provide valuable information about the future of a single population and, for threatened species like the African lion, even the species as a whole.

For this reason, age is an important metrics collected by lion researchers. For example, researchers that collar individual lions must be able to accurately age the lions they study in order to understand lion behaviour in a broader context. Ensuring that lions have the natural resources and the protection that they require at different phases of their lives is critical for ensuring their conservation.

## Importance for Sustainable Hunting

Lions are the only social big cats in the world. Each pride consists of 4-5 adult lionesses, their dependent cubs, and a temporary coalition of pride males. Pride males play a key role in defending their pride against invading males by forming coalitions of 2-3 males to defend the pride territory through roaring, patrolling, scent marking and aggressively approaching invading males. When new males enter a pride, they often kill cubs (a behavior termed "infanticide") in order to bring lionesses into estrus more quickly so they can produce offspring. Infanticide

ensures that the new male will pass on his genes to boost his reproductive fitness, while reducing the fitness of previous pride males.

The social nature of lions and common use of infanticide means that lion populations are greatly impacted by the loss of males. For example, when 72% of the adult males studied in Hwange National Park, Zimbabwe were harvested by hunters, these pride males were replaced by invading males that caused high rates of infanticide and disrupted population stability (Loveridge et al. 2007). Many of the harvested males were sub-adults less than 4 years old and had few opportunities to reproduce, making their loss especially impactful on the long-term stability of the population.

Because of this, trophy hunting must be managed in a way that reduces infanticide to achieve sustainable lion populations and long-term harvests. Simulation models suggest that sustainable trophy hunting can be accomplished by harvesting only adult males that have raised cubs to independence. (Note that females should never be harvested because their removal consistently leads to population decline). The age of physical and sexual maturation in male lion differs slightly between geographic areas of Africa, with males in East Africa maturing by around 4 years (Whitman et al. 2004) and males in southern Africa maturing by 6-7 years (Loveridge et al. 2007). Reproducing and raising cubs to independence typically requires an additional 1-2 years.

Studies have found that to be sustainable (achieve stable lion populations and maximum harvests), trophy hunting should harvest lions in East Africa (Tanzania) older than 6 years (Whitman et al. 2004, 2007) and lions in southern Africa older than 8 years. As a general rule, harvesting males older than 8 years maximizes both the quantity and the quality of the long-term harvest. The science of aging lions in part grew out of the need for more reliable indicators of age to make trophy hunting sustainable.

# Resources

## Resources for Learning to Age Lions

The ability to accurately age lions takes time and practice to develop, but is the sign of a dedicated and accomplished expert who understands lion biology. We encourage you to take advantage of the other resources that were developed alongside this training by visiting http://AgingTheAfricanLion.org, including:

- Test – Measure your lion aging accuracy
- Photo gallery – Images of known-age lions
- Pocket guides – Quick tips for aging

## Before You Begin: Test Yourself!

To see your improvement after taking this training, we encourage you to test your lion aging score online at http://AgingTheAfricanLion/TestYourself.org. When you finish the training, test yourself again!

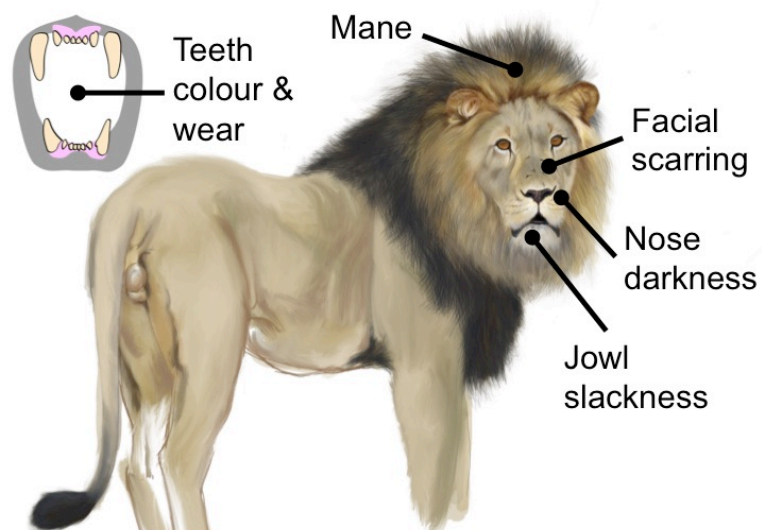# Training

## How to Age a Lion

Scientific research on lions across Africa shows that a male lion's appearance changes with five main physical characteristics that can be distinguished into four age classes (Miller et al. 2016):

Aging Characteristics
- Teeth color and wear
- Facial scarring
- Nose darkness
- Mane
- Slack jowl

Age classes
1-2 years
3-4 years
5-6 years
≥7 years



Minor variation in each physical characteristic between lions of the same age means that a single trait should never be used alone to determine age: always reference 3-4 characteristics to reliably narrow down a lion's age. This will ensure the greatest accuracy possible.

# Aging Characteristics

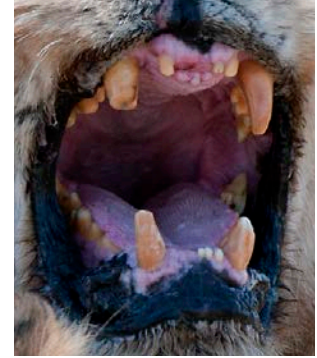## 1. Teeth Color and Wear
Teeth become more yellow and worn with age.



**1-2 years**
White, sharp

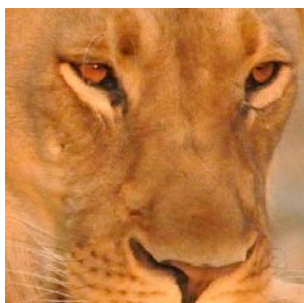**3-4 years**
Light yellow,
sharp or lightly worn

**5-6 years**
Light yellow,
lightly or heavily worn

**≥7 years**
Dark yellow, lightly
or heavily worn

## 2. Facial Scarring
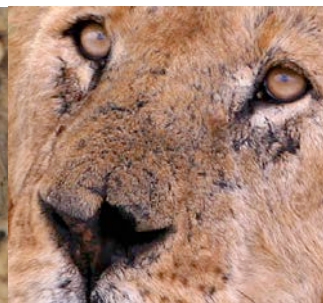Lions acquire scarring and pocketing on their faces due to fighting.



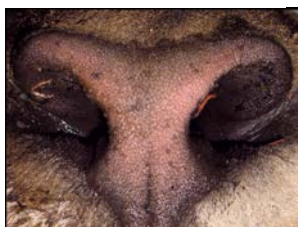**1-2 years**
No scarring

**3-4 years**
No or light scarring

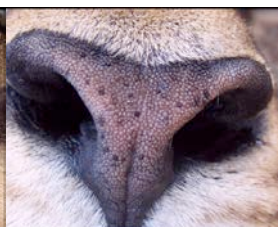**5-6 years**
Light scarring

**≥7 years**
Heavy scarring

## 3. Nose Darkness
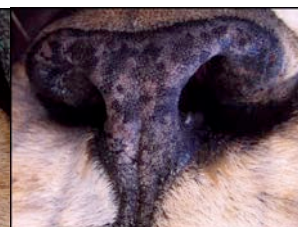Lion noses darken from pink to black with age.



**1-2 years**
Mostly pink
0-30% black

**3-4 years**
Slightly black
20-60% black

**5-6 years**
Mostly black
40-70% black

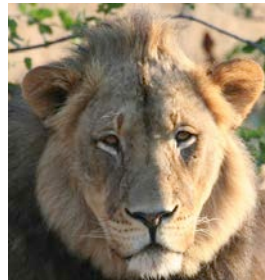**≥7 years**
Nearly all black
40-100% black

## 4. Mane

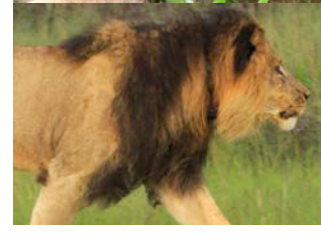A male's mane develops from a Mohawk to a full, thick mane covering his forehead and shoulders.



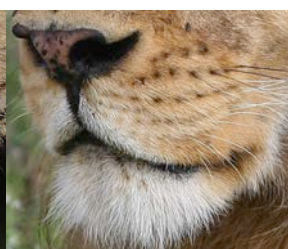| 1-2 years | 3-4 years | 5-6 years | ≥7 years |
|---|---|---|---|
| No hair or very short Mohawk on head. No or very sparse mane around face, chest and neck. No shoulder mane. | Long Mohawk on head, bare patches between Mohawk and ears. Short mane around face, chest and neck. No shoulder mane. | No Mohawk. Full, long mane with forehead and shoulders filled in. | Full, long mane, frayed or frizzy hair.<br><br>Note: Other traits (facial scarring, teeth wear) will be more indicative of this age. |

Note: Some regional differences occur in mane appearance. Lions in southern and high-lying Africa (e.g. Hwange in Zambia and Serengeti in Tanzania) show larger, thicker manes whereas lions in west-central and eastern low-lying Africa (e.g. Niassa in Mozambique and Seleous in Tanzania) show thinner, sparser manes.

## 5. Slack Jowl

A lion's back lip hangs in about half of individuals older than 7 years.



| 1-2 years | 3-4 years | 5-6 years | ≥7 years |
|---|---|---|---|
| No slack jowl | No slack jowl | No slack jowl | Slack jowl in 50% of lions in this age group |

# Next Steps

## Photo Galleries & Pocket Guides
After finishing this training, check out the other resources available at http://AgingTheAfricanLion.org:
- Test – Measure your lion aging accuracy
- Photo gallery – Images of known-age lions
- Pocket guides – Quick tips for aging

## After You Finish: Re-Test Yourself
To see your improvement after reviewing this training and the online photos and pocket guides, re-test your lion aging accuracy online at http://AgingTheAfricanLion/TestYourself.org.

## Pocket Guides
Pocket guides to use for quick reference in the field are available on the last pages of this course packet and online at http://AgingTheAfricanLion.org/Resources.html

# Additional Reading

Links to many of these articles are freely available at
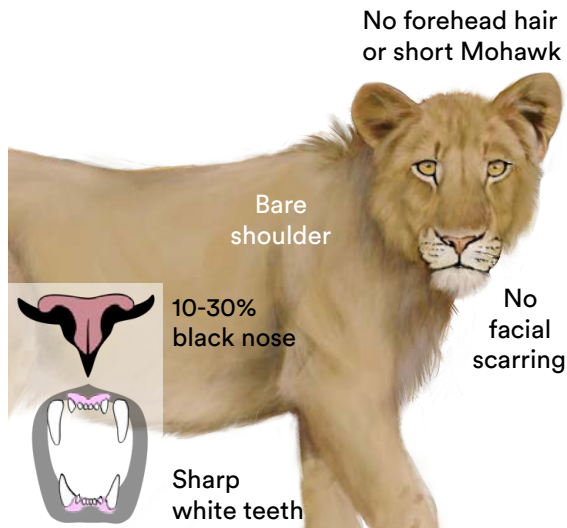http://AgingTheAfricanLion.org.

**Lion Biology**
- Funston, P. J., M. G. L. Mills, P. R. K. Richardson, and A. S. van Jaarsveld. 2003. Reduced dispersal and opportunistic territory acquisition in male lions (Panthera leo). Journal of Zoology 259:131–42. **Free!**
- Mosser, A., and C. Packer. 2009. Group territoriality and the benefits of sociality in the African lion, *Panthera leo*. Animal Behaviour 78:359–370.
- Packer, C., D. Scheel, and A. E. Pusey. 1990. Why lions form groups: food is not enough. American Naturalist 136:1–19. **Free!**
- Pusey, A. E., and C. Packer. 1994. Non-offspring nursing in social carnivores: minimizing the costs. Behavioral Ecology 5:362-374.
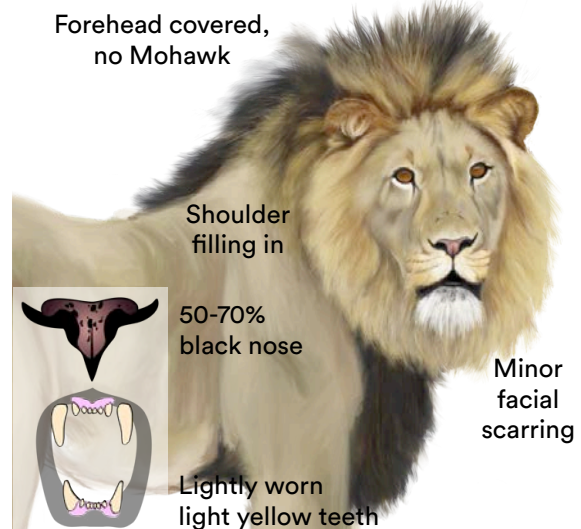
**Aging Lions and Sustainable Trophy Hunting**
- Creel, S., M'soka, J., Droge, E., Rosenblatt, E.G., Becker, M. S., Matandiko, W., Simpamba, T. 2016. Assessing the sustainability of African lion trophy hunting, with recommendations for policy. Ecological Applications, doi: 10.1002/eap.1377.
- Loveridge, A. J., A. W. Searle, F. Murindagomo, and D. W. Macdonald. 2007. The impact of sport-hunting on the population dynamics of an African lion population in a protected area. Biological Conservation 134:548–558.
- Miller, J., Funston, P. J., Balme, G., Lindsey, P. A., Loveridge, A. J., Becker, M. S. Begg, C., Brink, H., Cotterill, A., Dolrenry, S., Hunt, J. E., Jansson, I., MacDonald, D. W., Mandisodza-Chikerema, R., Packer, C., Rosengren, D., Stratford, K., Trinkel, M., White, P., Winterbach, C., Winterbach, H. E. K. 2016. Aging traits and sustainable trophy hunting of African lions. Biological Conservation 201:160-168. Free!
- Rosenblatt, E., Becker, M. S., Creel, S., Droge, E., Mweetwa, T., Schuette, P. A., Watson, F., Merkle, J., Mwape, H. 2014. Detecting declines of apex carnivores and evaluating their causes: An example with Zambian lions. Biological Conservation 180:176–186. **Free!**
- White, P. A. , Belant, J. L. 2016. Individual variation in dental characteristics for estimating age of African lions. Wildlife Biology 22: 71–77. **Free!**
- White, P. A., Ikanda, D. , Ferrante, L., Chardonnet, P., Mesochina, P., Cameriere, R. 2016. Age estimation of African lions Panthera leo by ratio of tooth areas. PLoS ONE. Doi: 10.6084/m9.figshare.3159430. **Free!**
- Whitman, K. L., Starfield, A. M., Quadling, H. S., and C. Packer. 2004. Sustainable trophy hunting of African lions. Nature 428:175–178. **Free!**
- Whitman, K. L., Starfield, A. M., Quadling, H., Packer, C. 2007. Modeling the effects of trophy selection and environmental disturbance on a simulated population of African lions. Conservation Biology 21:591–601. **Free!**

# Quick Guide to Southern and High-Lying Africa
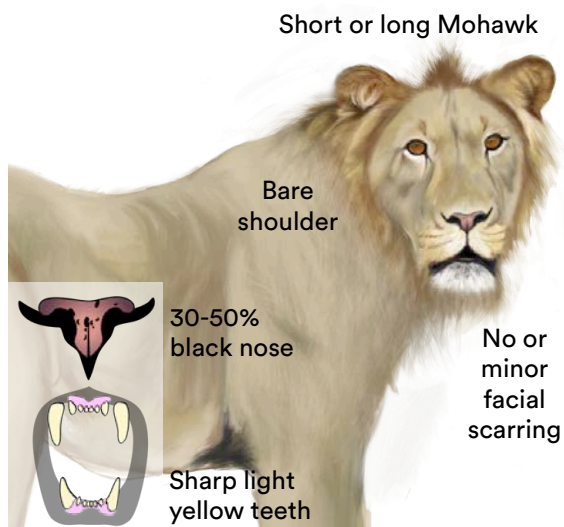## (e.g. Hwange in Zimbabwe, Serengeti in Tanzania)
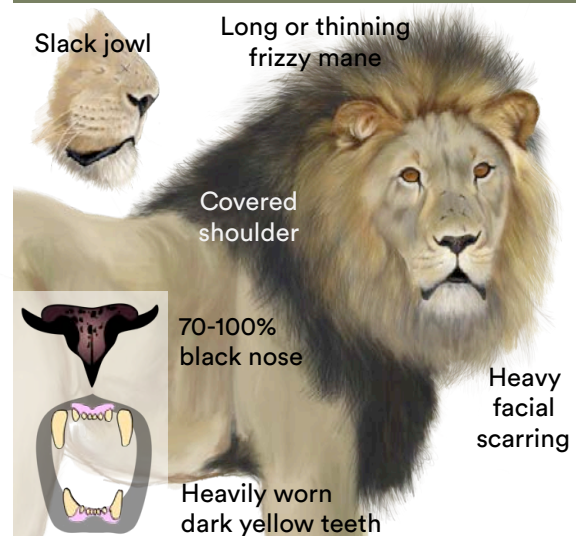
### MATURE CUBS: 1-2 years

No forehead hair or short Mohawk

Bare shoulder

10-30% black nose

No facial scarring

Sharp white teeth

### PRIME ADULTS: 5-6 years

Forehead covered, no Mohawk

Shoulder filling in

50-70% black nose

Minor facial scarring

Lightly worn light yellow teeth

### SUB-ADULTS: 3-4 years

Short or long Mohawk

Bare shoulder

30-50% black nose

No or minor facial scarring

Sharp light yellow teeth

### OLDER ADULTS: 7 years & older

Slack jowl

Long or thinning frizzy mane

Covered shoulder

70-100% black nose

Heavy facial scarring

Heavily worn dark yellow teeth

Available as complete pocket guide at http://AgingTheAfricanLion/Resources.org.
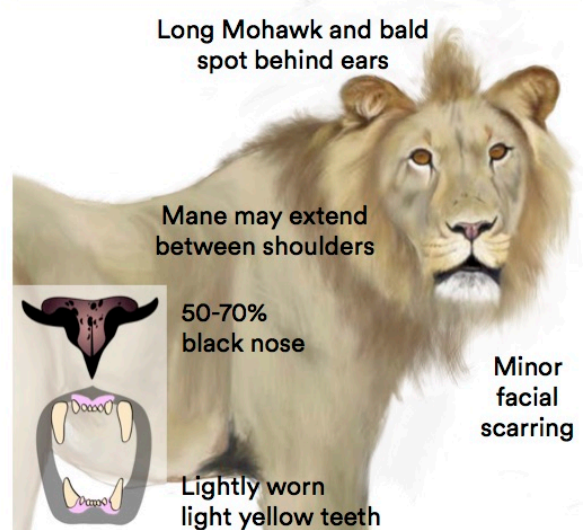
# Quick Guide to West-Central and Eastern Low-Lying Africa
## (e.g. Niassa in Mozambique, Seleous in Tanzania)



**MATURE CUBS: 1-2 years**
- No forehead hair or short Mohawk
- Bare shoulder
- 10-30% black nose
- No facial scarring
- Sharp white teeth

**PRIME ADULTS: 5-6 years**
- Long Mohawk and bald spot behind ears
- Mane may extend between shoulders
- 50-70% black nose
- Minor facial scarring
- Lightly worn light yellow teeth

**SUB-ADULTS: 3-4 years**
- Short Mohawk and bald spot behind ears
- Bare shoulder
- 30-50% black nose
- No or minor facial scarring
- Sharp light yellow teeth

**OLDER ADULTS: 7 years & older**
- Slack jowl
- Mohawk may still be present, mane filled in behind ears
- Covered shoulder
- Full mane ring around face
- 70-100% black nose
- Heavy facial scarring
- Heavily worn dark yellow teeth

Available as complete pocket guide at http://AgingTheAfricanLion/Resources.org.