HS African Elephant Literature Dive Lesson Plan

At a Glance

Students practice reading scientific articles to better understand the current scientific research related to the African elephant.

Advance Preparation

- Decide how you want students to view articles (on a computer/tablet or printed out).
- Follow the link below to an infographic on how to read a scientific paper. Decide whether you will have your students read the infographic individually or go through it as a class.
  https://www.elsevier.com/connect/infographic-how-to-read-a-scientific-paper

Objectives

- Learn the process of reading a scientific article
- Learn how to pull out relevant information from scientific articles to share with others

Materials

- PDF's of articles for each student to read
- "Check for Understanding" questions for each student (online or print-out)

Lesson

• Introduce your students to the process of reading a scientific paper utilizing the infographic provided or any other documents that you find helpful.

• Provide your students with the two articles related to the African elephant, starting with the Pre-Lesson Article.

•There are vocabulary words provided in the Teacher Summary section. You can introduce them before or after students read the articles, whenever you feel it fits best in the lesson for your students.

• Provide each student with the "Check for Understanding" questions. These questions could be done while reading the article (worksheet style) or after students are done reading the articles (quiz style). We suggest going through the "Check for Understanding" questions as a class after students have completed individually to see if there are any concepts in the questions that need more clarification.

Teacher Summary

Pre-Lesson Article: Bates et al. (2008). African elephants have expectations about the locations of out-of-sight family members.[1]

ABSTRACT: Monitoring the location of conspecifics may be important to social mammals. Here, we use an expectancy-violation paradigm to test the ability of African elephants (*Loxodonta africana*) to keep track of their social companions from olfactory cues. We presented elephants with samples of earth mixed with urine from female conspecifics that were either kin or unrelated to them, and either unexpected or highly predict- able at that location. From behavioral measurements of the elephants' reactions, we show that African elephants can recognize up to 17 females and possibly up to 30 family members from cues present in the urine–earth mix, and that they keep track of the location of these individuals in relation to themselves.

KEY POINTS:

- elephants can distinguish ~100 individuals as familiar via long-distance vocalizations
- females showed increased interest in urine from individuals walking behind her or from her absent family, but not to non-kin or family walking ahead of her
- expectancy-violation' paradigms, children's longer looking times towards unexpected or impossible situations are taken to indicate surprise when an expectation has been violated- can be used with elephants too!

Vocabulary:

- Olfaction - the action or capacity of smelling; the sense of smell[3]
- Expectancy-violation paradigm - a communication theory which tries to explain the unexpected behaviors of human beings while interacting.[4]
- Fission-fusion - In ethology, a fission–fusion society is one in which the size and composition of the social group change as time passes and animals move throughout the environment; animals merge into a group (fusion)—e.g. sleeping in one place—or split (fission)—e.g. foraging in small groups during the day.[5]
- Flehmen response - A behavioral response found in many male mammals when they detect particular smells from females, characterized by a curling of the upper lip and a raising of the head[3]
- Urine - a watery, typically yellowish fluid stored in the bladder and discharged through the urethra. It is one of the body's chief means of eliminating excess water and salt.[3]

Check for Understanding Questions: (Answers are bolded for teacher reference)

1. The authors' results suggest that Amboseli elephants can:

    A. distinguish between family member and non-family member urine

    B. recognize individual family member urine

    C. remember where a family member is in relation to itself

    D. all of the above

    E. I don't know

2. Interest in a urine sample was characterized by increased:

    A. trunk reaching

    B. trumpeting

    C. ear flapping

    D. earth kicking

    E. I don't know

3. Elephant herds are:

    A. matriarchal and eusocial

    B. patriarchal and eusocial

    C. matriarchal and fission-fusion

    D. patriarchal and fission-fusion

    E. I don't know

4. Why did the authors only analyze the reaction of the first female to pass over a urine sample?

    Answer: Because elephants are highly social, they are drawn to each others reactions. Every female elephant after the first would have an amplified response to the urine sample, simply because the first female responded to it at all.

5. Illustrate the fission-fusion social structure of elephant herds with examples from the text:

    Answer: Female matrilineal relatives and dependent offspring form family units that usually travel, forage and socialize together, but these family units can split up into smaller groups with irregular composition and can also join with members of other families to form larger groups.

Post -Lesson Article: Hollister-Smith et al. (2007). Age, musth and paternity success in wild male African elephants, *Loxodonta africana*.[2]

ABSTRACT: Male African elephants experience intense intrasexual selection in gaining access to oestrous females, who represent a very scarce and highly mobile resource. An unusual combination of behavioral and physiological traits in males probably reflects this intense selection pressure. Males show prolonged growth, growing throughout much or perhaps all of their long life span (ca. 60-65 years), and they show musth, a physiological and behavioral condition exclusive to elephants, which is manifested by bouts of elevated testosterone and aggression and heightened sexual activity. Most observed matings are by males over 35 years of age and in musth, suggesting that age and musth are both important factors contributing to male reproductive success. Here we report the results of a genetic paternity analysis of a well-studied population of wild African elephants. Patterns of paternity for 119 calves born over a 22-year period showed significant effects of both age and musth on paternity success. Among males in musth, paternity success increased significantly with age until the very oldest age classes, when it modestly declined. When not in musth, males experienced relatively constant, low levels of paternity success at all ages. Thus, despite the importance of both musth and age in determining male paternity success, adult males both in and out of musth, and of all ages, produced calves. In general, however, older males had markedly elevated paternity success compared with younger males, suggesting the possibility of sexual selection for longevity in this species.

KEY POINTS:

- male elephants show prolonged and indeterminate growth; stature, body mass and tusk weight grow throughout life; males gain in dominance rank as they age due to dominant rank being size dependent
- musth begins at average of 29 yo, as he ages, musth episode duration increases; it is an energetically costly state to maintain, body condition deteriorates due to decreased foraging, increased distance travelled, altered homeostasis
- most observed matings are by musth males over 35 yo
- Results: paternity success was highest between 45-53 yo, but continued into late 50s for study; 74% of calves fathered by males known to be in musth, only 12.7% of males were in musth during conception opportunities; males not in musth experienced low, constant levels of paternity success at all ages; however, age AND musth did predict increased paternity success; male survival to 50yo is estimated at <10%; males >35yo sired 29% of calves in study
- male elephants differ from many other described mammals in their mating and paternity success late in life, they do not show the typical decline after reaching peak body weight, as they continue to grow throughout life
- *great graphs, would be good for data interpretation practice!*

Vocabulary:

- Oestrous (or estrous) - a recurring period of sexual receptivity and fertility in many female mammals; heat[3]
- Musth (or must) - A condition of heightened aggression and unpredictable behavior occurring annually in certain male animals in association with a surge in testosterone level[3]
- Paternity success - increased offspring sired by a particular male[3]
- Homeostasis - the tendency towards a relatively stable equilibrium between interdependent elements, especially as maintained by physiological processes[3]
- Faecal (or fecal) sample - a specimen of waste matter [3]

Check for Understanding Questions: (Answers are bolded for teacher reference)

1. If a male elephant lived to be 55 years old, when is he most likely to experience highest paternity success?

   A. 15-25 years old

   B. 25-35 years old

   C. 35-45 years old

   D. 45-55 years old

   E. I don't know

2. Musth in male elephants is characterized by:

   A. elevated testosterone

   B. increased sexual activity

   C. highly aggressive behavior

   D. all of the above

   E. I don't know

3. Unlike other mammals, male elephants:

   A. continue to grow throughout their life

   B. are more dominant if they have longer tusks

   C. have a short lifespan

   D. none of the above

   E. I don't know

4. How do the factors that contribute to male elephant paternity success differ from other well-described male mammal paternity success?

   Answer: Male elephants repeatedly rotate in and out high dominance as they enter musth throughout their adult lifespan, unlike other mammalian systems. They also continue to grow as they age, not showing the typical drop in body condition most mammals display as they age. This allows them to sustain musth for longer periods of time as they age, increasing their dominance and chances for paternity success.

5. Explain the authors statement that "each adult female is sexually receptive only for 3-6 days every 3-9 years" in relationship to the 3-4 month estrus cycle we learned about at the SDZG ICR.

   Answer: Although female elephants cycle all-year round and have a 3-4 month ovulatory cycle, in the wild they would rarely actually experience several cycles in a row. This is because they would likely be impregnated by a male early in their reproductive years, be pregnant for 22 months, and nurse their infant for 1-7 years, depending on resources and potential mates available. As soon as an infant/subadult is weaned, she would likely go into her first cycle and be impregnated almost immediately by the male, thus explaining the large gap between her sexual receptivity.

References

1. Bates, L. A., Sayialel, K. N., Njiraini, N. W., Poole, J. H., Moss, C. J., & Byrne, R. W. (2008). African elephants have expectations about the locations of out-of-sight family members. Biology Letters, 4(1), 34-36.

2. Hollister-Smith, J. A., Poole, J. H., Archie, E. A., Vance, E. A., Georgiadis, N. J., Moss, C. J., & Alberts, S. C. (2007). Age, musth and paternity success in wild male African elephants, Loxodonta africana. Animal Behaviour, 74(2), 287-296.

3. https://en.oxforddictionaries.com/

4. https://www.communicationtheory.org/expectancy-violation-theory/

5. https://ipfs.io/ipfs/QmXoypizjW3WknFiJnKLwHCnL72vedxjQkDDP1mXWo6uco/wiki/Fission-fusion_society.html