

# HS California Condor Literature Dive Lesson Plan

## At a Glance

Students practice reading scientific articles to better understand the current scientific research related to the California condor.

## 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 California condor.
- 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:** Sieg et al. (2009). Voluntary lead reduction efforts within the northern Arizona range of the California Condor. Ingestion of lead from spent ammunition: implications for wildlife and humans.<sup>2</sup>

### KEY POINTS:

- This article focuses on different approaches used to reduce the amount of lead in the northern Arizona range where condors are flying free since lead poisoning continues to be the primary cause of mortality in the condor recovery program.. The targeted area is the Kaibab Plateau (north rim of Grand Canyon) where annual hunts take place.
- In the early years of the campaign, the AGFD began by educating hunters about the issues with lead poisoning and conducted over 200 surveys to identify the level of understanding about these issues. Results: 23% of hunters were aware that lead poisoning was a problem faced by condors. 9% were aware of any educational efforts to reduce condor deaths from lead poisoning. 83-97% of hunters would be somewhat to very willing, depending on requested action, to take some action to help save condors.
- In 2005, focus groups revealed that hunters and ranchers were not convinced that spent lead played a big role in condor deaths and requested more credible data to link this information. To help connect this link, The Peregrine Fund (TPF) funded and conducted research to relate this issue. They compiled a lot of data and information and also were able to make a direct connection to the lead poisonings that coincided with the Kaibab Plateau hunts. In 2006, the literature sent out received negative responses stating too much information was provided and most hunters did not read it.
- In addition to increasing the amount of education and communication to the hunters and ranchers, AGFD also implemented voluntary and free non-lead program giving hunters that drew permits for deer, pronghorn, sheep or bison a coupon to exchange for 2 free boxes of lead free ammunition.
- 60% rated the non-lead ammunition accuracy as excellent or above average, 70.5% stated it performed as well as lead, 22.6% stated it performed better than lead.
- Most would use it again if provided for free, 55.8% would use it again even if not for free, 72% said they would recommend it to others.
- 81% used it on their hunt with 41.6% on deer.
- When asked why they participated, majority stated because AGFD asked them to, followed by it helped condors, then because it was free/ they heard or read that non-lead ammunition had good ballistics.
- The primary reason for not using: the non-lead was not available in their caliber, not available on their preferred weight, and it takes too long to sight new ammunition. The next most important reasons were the coupon was too complicated to redeem or too much

hassle, followed by they were not convinced there is a link to condor lead poisoning- they think this was an effort by anti-hunters to ban the use of lead.

- To continue to increase participation in non-lead ammunition, the team wanted to increase outreach efforts by publishing articles in hunter magazines, general media stories, and they simplified their message to “use non-lead ammunition.” They also utilized Nolan Ryan as a host to develop an 11-minute DVD titled “How to be successful in your upcoming deer hunt.”

### **Vocabulary:**

- Chelation therapy - a therapy for mercury or lead poisoning that binds the toxins in the bloodstream by circulating a chelating solution<sup>3</sup>
- Carrion - the decaying flesh of dead animals<sup>3</sup>
- Augmented - having been made greater in size or value.<sup>3</sup>
- Unprecedented - never done or known before<sup>3</sup>
- Coalition - an alliance for combined action<sup>3</sup>

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

1. The reintroduced condors are provided carcasses because:
  - A. The condors don't know how to find their own food
  - B. Their is not enough food sources in the location where they were released
  - C. The carcasses are lead-free**
  - D. All of the above
  - E. I don't know
2. The findings from the 2003 survey were:
  - A. Over 50% of hunters were aware of the lead poisoning condors faced
  - B. Very few hunters were willing to take action to help condors
  - C. Less than 25% of hunters were aware of the lead poisoning condors faced**
  - D. None of the above
  - E. I don't know

3. Chelation therapy is used to:

- A. Reduce dangerously high lead levels
- B. Increase absorption of calcium
- C. Calm stressed condors
- D. All of the above
- E. I don't know

4. What was one of the concerns of the ranchers and hunters about the lead-poisoning condor topic?

**Answer:** Focus groups also revealed that hunters and ranchers were not yet convinced that lead from spent ammunition was a problem for condors and requested credible data linking lead from spent ammunition and condor lead poisoning (D. J. Case, 2005).

5. What did you think was the least successful part of the campaign? How would you change that piece to make it more successful?

**Answer:** There could be several options, including the cost of the bullet, access to purchasing lead free ammo, not presenting the data in a clear and concise manner, making the coupon exchange too challenging, etc.

**Post-Lesson Article:** Jensen et al (2003). Conditions for rapid sex determination in 47 avian species by PCR of genomic DNA from blood, shell-membrane blood vessels, and feathers.<sup>1</sup>

**ABSTRACT:** The ability to rapidly and reliably determine the sex of birds is very important for successful captive-bird breeding programs, as well as for field research. Visual inspection of adult birds is sufficient for sexually dimorphic species, but nestlings and monomorphic species are difficult, if not impossible, to sex by sight only. A method for rapid extraction of gDNA from blood, shell-membrane blood vessels, and fully grown feathers, using Chelex, and the PCR conditions for determination of sex-specific bands in 47 species (39 genera, 21 families, and 10 orders) are described. The PCR primers used amplify a length of DNA spanning an intron in the CHD-1 gene, which is present on both the W and Z chromosomes. The intron differs in size between the two sex chromosomes, resulting in PCR products that separate into two bands for females and a single band for males in most avian species (except ratites). Because this simple technique uses Chelex, a rapid gDNA isolation protocol, and sets of PCR primers independent of restriction enzyme digestion, birds can be accurately sexed within 5 hr of sample collection.

**KEY POINTS:**

- Fast and reliable method for sex determination of monomorphic bird species (within 5 hours of sample collection).
- Monomorphic species comprise an estimated of 50% of all birds.
- Even dimorphic species (ie. mallard ducks, peacocks, etc.) are monomorphic as chicks since they display no sexually mature characteristics.
- Using DNA sexing techniques, minimizes handling induced stress for the birds and chicks.
- Birds can be identified where females are heterogametic (ZW) and males are homogametic (ZZ).
- Genomic DNA (gDNA) can be isolated from bird feathers, blood, shell-membrane blood vessels and is suitable for both sexing and paternity testing.
- As an option, you could also have students read the Walsh, et al., 1991 paper as mentioned in this journal article. Dr. Tom Jensen mentioned to me that this article shows how cross-disciplines come together in science. The paper is a forensics case study.

**Vocabulary:**

- Heterogametic - denoting the sex which has sex chromosomes that differ in morphology, resulting in two different kinds of gamete, e.g. (in mammals) the male and (in birds) the female (the opposite of homogametic)<sup>3</sup>
- Alleles - each of two or more alternative forms of a gene that arise by mutation and are found at the same place on a chromosome<sup>3</sup>
- Morphometrics - the process of measuring the external shape and dimensions of landforms, living organisms, or other objects<sup>3</sup>
- Monomorphic - (of an animal species) having sexes that are similar in size and appearance<sup>3</sup>
- Primers - a molecule that serves as a starting material for a polymerization process<sup>3</sup>

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

1. Samples obtained for sex determination in birds includes:
  - A. Egg shell membrane
  - B. Feathers
  - C. Blood
  - D. All of the above**
  - E. I don't know
2. Choose the correct statement below in relation to all bird species (including condors, parakeets, chickens, etc):
  - A. Males are heterogametic
  - B. Females are homogametic
  - C. Females are heterogametic**
  - D. Male sex chromosomes are ZW
  - E. I don't know
3. Most sexually monomorphic species:
  - A. Are physically identical
  - B. Lack obvious behavioral differences
  - C. Often pair-bond for life
  - D. All of the above**
  - E. I don't know
4. What is the benefit of using samples other than blood or why should we care to optimize testing for feathers and egg shell membrane?

**Answer:** The use of shell-membrane blood vessels allows newly hatched chicks to be sexed without being handled. Likewise, feather sexing of adults minimizes handling compared to what is required in collecting blood. Minimal handling of birds in a breeding situation decreases stress and thus increases the chances of successful breeding.

5. Why do we need to use molecular sexing techniques?

**Answer:** Since monomorphic birds are physically identical and have no obvious behavioral attributes, determining the sex of monomorphic birds (which comprise an estimated 50% of all birds) and young chicks is necessary in successful breeding

programs, as well as in investigations of population-sex ratios in nestling and adult free-ranging populations.

### References

1. Jensen, T., Pernasetti, F. M., & Durrant, B. (2003). Conditions for rapid sex determination in 47 avian species by PCR of genomic DNA from blood, shell-membrane blood vessels, and feathers. *Zoo Biology: Published in affiliation with the American Zoo and Aquarium Association*, 22(6), 561-571.
2. Sieg, R., Sullivan, K. A., & Parish, C. N. (2009). Voluntary lead reduction efforts within the northern Arizona range of the California Condor. *Ingestion of lead from spent ammunition: implications for wildlife and humans. The Peregrine Fund, Boise, Idaho, USA. DOI, 10.*
3. <https://en.oxforddictionaries.com/>