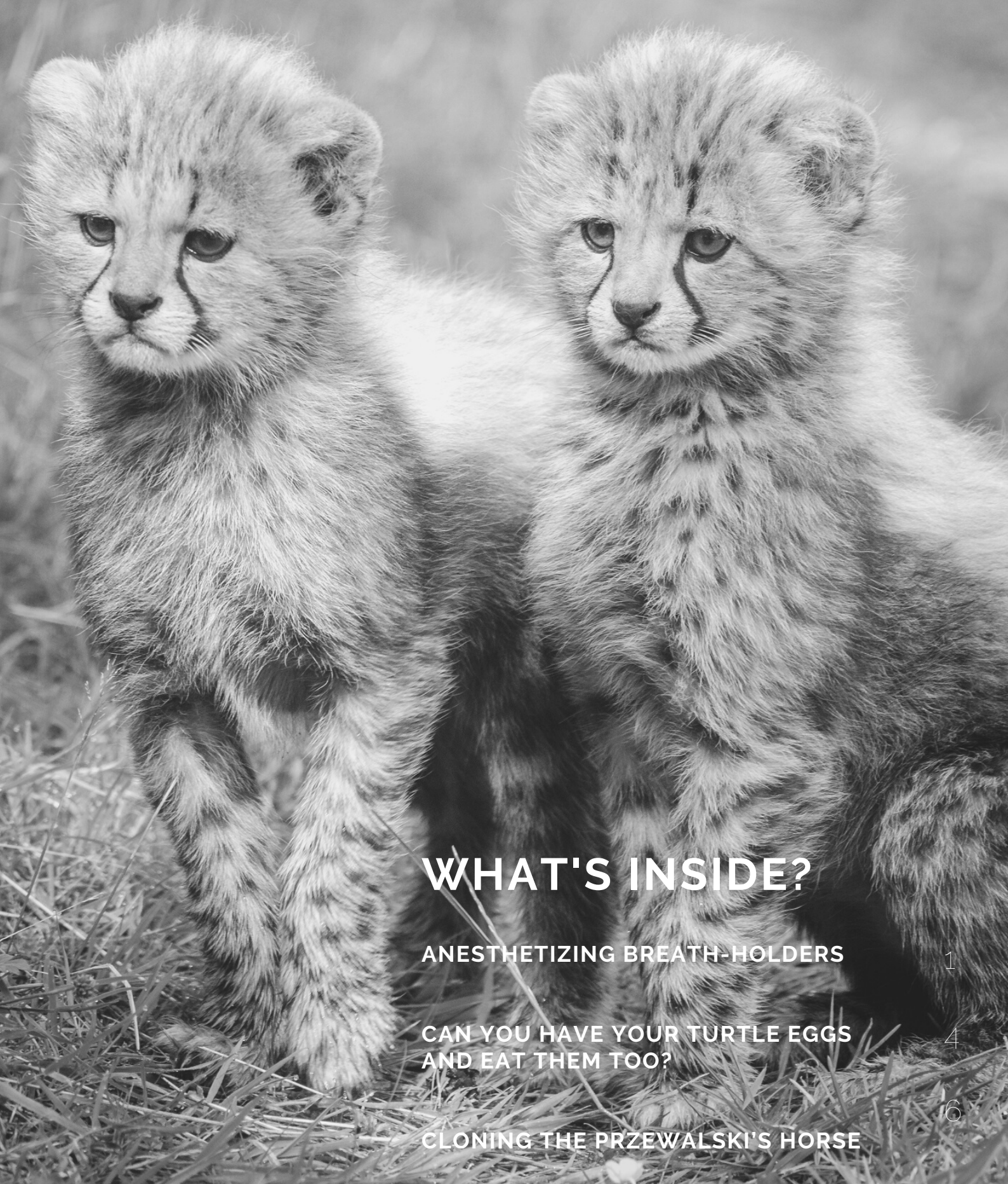


# NTS NEWSLETTER

PUBLISHED BY THE NON-TRADITIONAL SPECIES CLUB AT THE UNIVERSITY OF ILLINOIS



## WHAT'S INSIDE?

ANESTHETIZING BREATH-HOLDERS

1

CAN YOU HAVE YOUR TURTLE EGGS  
AND EAT THEM TOO?

4

CLONING THE PRZEWALSKI'S HORSE

6

# ANESTHETIZING BREATH-HOLDERS

BY ALEC COLOSI

Anesthesia is one of the most important tools we use in veterinary medicine. We use it on almost every species for countless procedures, from special imaging, to physical exam, to surgery. Pinnipeds (seals, sea lions, and walruses) aren't an exception! But anesthesia can be a bit complicated when it comes to animals that hold their breath for extreme lengths of time on a regular basis. How do we make sure we have a safe and effective anesthetic event when our patient can hold its breath for over an hour?

There are several considerations to take into account when anesthetizing a breath-holding mammal. The most obvious is the dive response. This is a physiological state that is activated when the animal goes underwater, resulting in bradycardia, decreased cardiac output, and peripheral vasoconstriction. There is sufficient evidence, however, that pinnipeds can activate this response in stressful situations other than diving. To counteract this, it is important to sufficiently premedicate these animals to reduce stress. It is particularly important to monitor seals for the dive response, as they are most likely to become apneic (stop breathing), or to hypoventilate during a procedure. To be prepared for this, reversal agents should always be ready for an emergency.



Another consideration is the thick blubber layer that most pinnipeds, particularly walruses, have to keep them warm. This makes monitoring difficult, particularly auscultation, as the blubber muffles chest sounds. It can also make it difficult to find peripheral veins for administering IV medications. For these species, it is important to observe chest movement and use equipment like ECG to monitor heart rate when anesthetizing a walrus. Anesthetic agents also build up in fatty tissue, so decreasing the anesthesia rate before the procedure is over can help with recovery.

Specific anatomy and physiology are other important considerations when anesthetizing any animal. Sea lions have much shorter tracheas than seals or walruses, so it is important to use short endotracheal tubes when intubating them. Similarly, while most animals have a risk for hypothermia during anesthetic events, sea lions are at risk of hyperthermia, so keeping them cool is a necessity. Positioning is also important, as sea lions and walruses should be in sternal recumbency (on their belly), while seals should be in lateral recumbency (on their side).

In any case, anesthesia is never to be taken lightly, especially for pinnipeds who have such special physiological considerations. In cases where anesthesia is necessary, reducing stress and monitoring is of the utmost importance, and it is imperative to know the specific needs of animals in each family to avoid complications. With all this in consideration, the best action that can be taken is to avoid reasons to anesthetize these animals. This means having exceptional husbandry and care guidelines for animals under human management and training animals for husbandry behaviors.

# MIDWEST AVIAN TAXONOMY

BY KAYLA LADEZ

Test your taxonomy skills with Midwest wildlife.  
Can you match each bird with the correct order and family?

A: Order: Pelecaniformes, Family: Pelecanidae

B: Order: Caprimulgiformes, Family: Trochilidae

C: Order: Anseriformes, Family: Anatidae

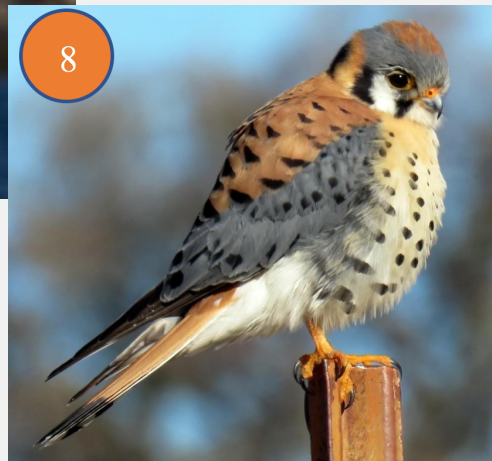
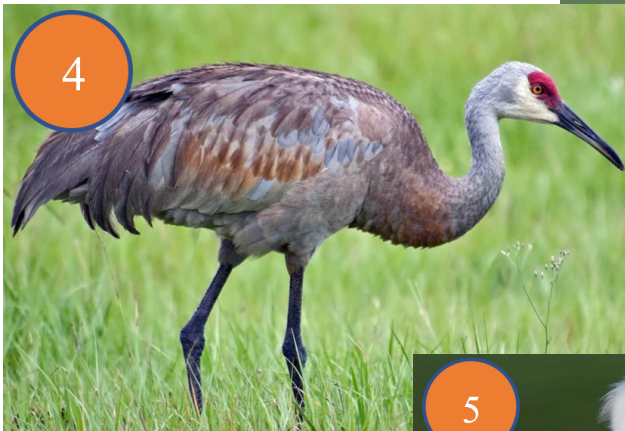
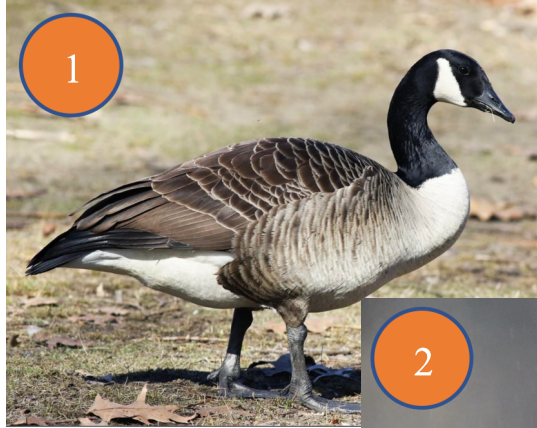
D: Order: Pelecaniformes, Family: Ardeidae

E: Order: Falconiformes, Family: Falconidae

F: Order: Columbiformes, Family: Columbidae

G: Order: Accipitriformes, Family: Accipitridae

H: Order: Gruiformes, Family: Gruidae



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Canada Goose

C: Order: Anseriformes, Family: Anatidae



Mourning Dove

F: Order: Columbiformes, Family: Columbidae



Red-throated Hummingbird

B: Order: Caprimulgiformes, Family: Trochilidae



Sandhill Crane

H: Order: Gruiformes, Family: Gruidae



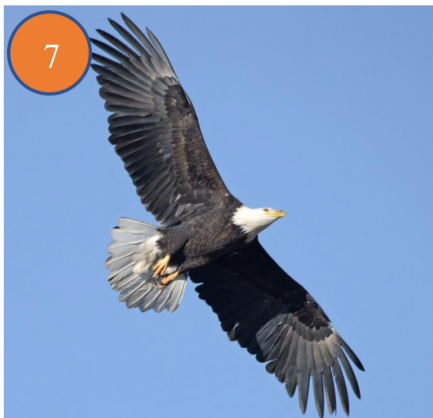
American White Pelican

A: Order: Pelecaniformes, Family: Pelecanidae



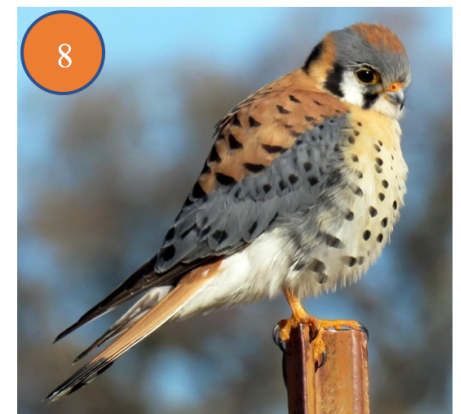
Great Blue Heron

D: Order: Pelecaniformes, Family: Ardeidae



Bald Eagle

G: Order: Accipitriformes, Family: Accipitridae



American Kestrel

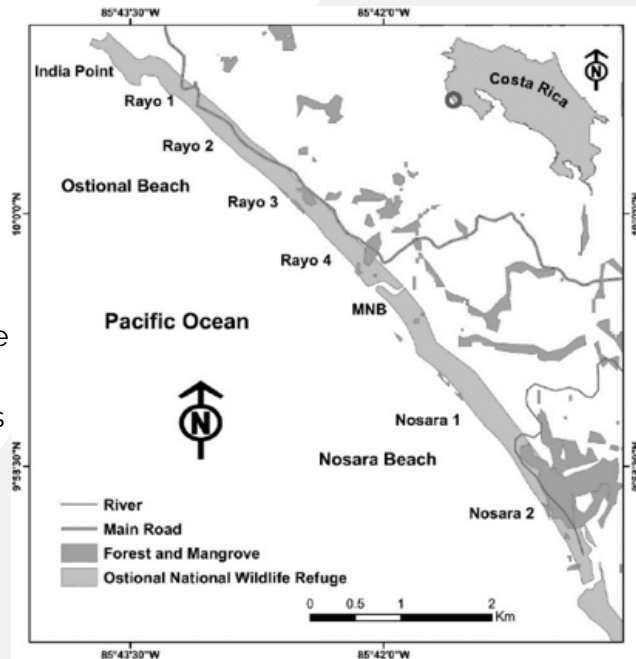
E: Order: Falconiformes, Family: Falconidae

# CAN YOU HAVE YOUR TURTLE EGGS AND EAT THEM TOO?

BY SHEVON MEADOWS

On the Nicoya peninsula on the Pacific side of Costa Rica, in the province of Guanacaste, there is a small Village named Ostional with a beach that is part of a wildlife refuge. One of the features of Ostional is that it's the site of event called Arribadas for Olive Ridley Sea Turtles. An Arribada, meaning "the arrival", is a mass emergence of these sea turtles in order to nest. The event typically lasts around 5 days and occurs 1-2 times monthly between August and December, though they nest year-round (1). What makes Ostional even more unique is that it is the only beach in the world where turtle egg harvesting is legal.

Ostional has a population of around 700 people and is very susceptible to being isolated at times due to seasonal flooding. Historically, turtle egg harvesting for the people of Ostional was a means of survival during times of isolation, and income as the eggs were sold. The harvesting had been outlawed, but in 1987 after 10 years of research and push back by the local community, the harvesting was legalized again. Research had showed that due to the heavily nested nature of the beach, the eggs laid at the beginning of an Arribada were mostly destroyed by nesting turtles coming later (1). To paint the picture, up to 10 million eggs are laid over a 15km x 200m stretch of beach in just 5 days, once or twice a month during the rainy season (1, 2). Due to these findings and the community's desire to continue the practice, the harvesting was legalized again in 1987 and continues to this day, with stipulations.



The people of Ostional are employed by the Ostional Integral Development Association (ADIO) and are the only ones allowed to harvest the eggs. They are only allowed to harvest for the first 3 hours after sunset for the first 3 days of each Arribada. This amounts to roughly 4.5 million eggs yearly, less the 1% of the total eggs laid for the year (1). These ADIO individuals are also charged with upholding the restrictions and guarding the beach nightly to accost and prevent illegal poachers. The eggs are used by the locals for food, or sold to bring income. In the last 7 years the program has brought in 6 million dollars to the community (2). ADIO is also able to hire locals as beach cleaners who regularly walk the beach and remove rubbish and debris in order to accommodate nesting. Other benefits the program allows for are retirement programs for workers, maternity leave, and community development, such as funds for the school and medical services. Every year the Costa Rican Coast Guard, University of Costa Rica, and the Park Rangers with the Environment Ministry meet to address any issues or changes that need to be made to the program (2).

The people of Ostional are dependent on the prosperity of these turtles in their way of life, and because government, science, and community were able to come to a consensus, the community thrives and ensures the protection of these turtle and their nesting. Although this is an example of community and environment living harmonically, it holds very unique circumstances and comes with its own set of drawbacks.



It can be very difficult to determine if turtle eggs being sold are those that have been legally obtained, and poached eggs can be integrated into the market, making it difficult for consumers to be able to determine if eggs for sale are from the ADIO program. While the biologist in residence, Rodrigo Morera, claims that the survival rate of Olive Ridley sea turtles has increased since the program began, particularly due to community education and dependence, there hasn't been substantial recent research to validate the effect (2). Peer-reviewed research for this region in regards to population in relation to egg harvesting is scarce. In fact, one of the more recent articles, though it is now 8 years old, indicates the egg hatching may be on a decline, though this could be due to a variety of factors such as El Nino and La Nina, and does not extrapolate the catalyst as being due to harvesting (3).

While the program is remarkable as it creates a symbiotic relationship between the ecosystem and community, it is lacking updated research to justify its continuation and accommodate adjustment. On a personal note, my experiences in Ostional are near and dear to my heart and it is a hope of mine to be a part of the necessary future research.

(1) <https://nicoyapeninsula.com/ostional/>

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# Test Your Trivia Knowledge!

BY: RYAN PATTERSON

**1. This large organ in sharks is responsible for buoyancy.**

- a. Swim Bladder
- b. Liver
- c. Lungs
- d. Spleen

**2. What is the smallest mammal species in the world?**

- a. Mouse Lemur
- b. Etruscan Shrew
- c. Bumblebee Bat
- d. Pygmy Possum

**3. Which is the largest species of flying bird (by wingspan)?**

- a. California Condor
- b. Himalayan Vulture
- c. Wandering Albatross
- d. Great White Pelican

**4. Which animal has fingerprints so similar to humans that they can be mistaken as human at a crime scene?**

- a. Chimpanzee
- b. Koala
- c. Gorilla
- d. Bonobo

**5. Which species of sea turtle does not have a carapace made up of scutes?**

- a. Flatback
- b. Leatherback
- c. Hawksbill
- d. Olive Ridley

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## CLONING THE PRZEWALSKI'S HORSE

BY RACHEL ANGLES

On August 6th, 2020, a colt was born. Not just any colt – the world’s first successfully cloned Przewalski’s horse, the clone of a male whose DNA was cryopreserved 40 years ago at the San Diego Zoo Global Frozen Zoo®. The colt’s birth revives genetic diversity that had been lost to the world, as all remaining members of this species are descendants from the same 12 horses. Lack of genetic diversity has led to in-breeding which can cause a wide variety of health issues, thus maintaining genetic variation will be vital to ensuring the survival of this species in the future. This is the first time a member of this species has been cloned, and it represents an important model for future conservation efforts.

“This birth expands the opportunity for genetic rescue of endangered wild species,” said Ryan Phelan, executive director of Revive & Restore, a wildlife conservation organization which has pioneered the incorporation of biotechnologies into conservation practice. “Advanced reproductive technologies, including cloning, can save species by allowing us to restore genetic diversity that would have otherwise been lost to time.”

The San Diego Institute for Conservation Research boasts that the “Frozen Zoo® contains over 10,000 living cell cultures, oocytes, sperm, and embryos representing nearly 1,000 taxa, including one extinct species, the po’ouli.” Cells stored in the Frozen Zoo® have the potential to produce offspring through a process of several steps, including in vitro oocyte maturation and fertilization, artificial insemination, and embryo transfer. Aspects of this process has been successful in the past for other species besides Przewalski’s horse. Previous achievements include the production of pheasant chicks, the maturation and fertilization of frozen cat oocytes in vitro to advanced stage embryos, and the fertilization of an in vitro matured cheetah oocyte with thawed sperm from the Frozen Zoo®. Additionally, using intracytoplasmic sperm injection, southern white rhino oocytes were fertilized with sperm that had frozen for 20 years.

Because it can often be difficult to collect eggs and sperm, due to both the risk that it poses for the endangered animal and viability issues with the cells themselves, the Regenerative Bioscience Center at the University of Georgia has been taking it one step further. Their research has shown success in turning a skin cell into a stem cell and turning pluripotent stem cells into sperm. Future research could result in differentiation of these stem cells into oocytes as well.

The Institute for Conservation Research has been able to successfully clone a guar (Indian bison) and a banteng using frozen skin samples and cloning technology. The guar died of an infection after two days, but the banteng survived for seven years. Further improvements in these biotechnologies will be a crucial resource for reversing losses of genetic diversity and sustaining populations of many different types of endangered species in the future. As one example, the Scripps Research Institute has been working on the conversion of cells preserved from 12 individual northern white rhinos in the Frozen Zoo® to stem cells that could develop into sperm and eggs.

These reproductive technologies hold much promise for future conservation efforts. However, it is important that we do not lose sight of the things we can do now. We should aim for preservation of natural environments to ensure that other animals and species do not go extinct in the meantime. These efforts, combined with these new technologies, will facilitate advances in population sustainability that will directly aid conservation efforts worldwide.



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## REPTILE DENTITION

BY KENNYMAC DURANTE

Welcome back to another episode of “Kennymac Writes about Something that he Finds Incredibly Cool.” The subject for this month’s newsletter is all about reptile dentition! Reptile dentition is quite fascinating because there are a handful of varieties between orders of reptiles.

There are 3 main types of dentition for reptile species. First there is the acrodont type. This type of tooth formation is common in lizards such as chameleons, uromastyses, water dragons, frilled dragons, bearded dragons and most snakes. Acrodont teeth are the weakest kind of teeth as they are superficially attached to the biting edges of the mandible and the maxilla and lack a firm attachment within these bones. Things get a bit dicey with acrodont teeth as tooth replacement for this dentition formation is either partially suppressed (for our agamid species) or completely suppressed (for our chameleon species). What this ultimately means is that unlike most reptiles, species with acrodont teeth typically do NOT have their teeth be replaced if they are broken off or lost. Paradoxically, snakes replace their teeth continuously.



The second type of dentition is called pleurodont. This type of dentition is common in many lizard species such as iguanids, monitors, and geckos. Pleurodont teeth are superficially attached and fused to the inner surfaces of the mandible and maxilla which make them a bit stronger than acrodont teeth. What also makes this type of dentition more versatile is that pleurodont teeth can be continuously replaced throughout an animal's life. Interestingly, there are further variations of pleurodont teeth when it comes to replacing them. Take the iguanid method for example, in which the replacement tooth is initiated at the base of its predecessor on the inner (lingual or palatal) aspect. On the other hand, there is also the varanid method of tooth replacement where the replacing teeth develop behind their predecessors and move forward.

The third type of dentition in reptiles is called thecodont. This dentition type is found in all living crocodilians. Thecodont dentition is most similar to mammalian dentition as they are morphologically arranged where the base of the tooth is completely enclosed in a deep socket of bone. This kind of dentition is incredibly strong and durable but in the event that a tooth falls out, they can still be continuously replaced throughout a crocodilian's life. What makes this dentition type even more impressive is that it also has a periodontal ligament which acts as a medium of force transfer when a crocodilian is securing its prey.

The last type of dentition (or really lack thereof...) is well... no dentition! This is the case for our chelonian species. Chelonians lack dentition all together, however this lack of teeth doesn't mean that they are at an disadvantage. Some turtles- like green sea turtles- have serrated ridges along the inside of their beaks that simulate the function of teeth. Additionally, alligator snapping turtles have sharp and pointed jaws that allow them to clamp down with incredible force ensuring that they capture their prey without fail. One last really cool "tooth" adaptation in turtles is the egg tooth. This small and sharp protrusion extends from the front of their beaks and is used to create an opening through the shell during the hatching process. The egg tooth eventually falls off a couple days after the turtle has hatched.



# FISH ANESTHESIA BASICS

BY COLLEEN ELZINGA



## When and What to Use

Like other animals, fish display neuroendocrine and physiologic stress responses to noxious stimuli. Thus, anesthetic drugs can be utilized to reduce stress, decrease handling trauma, and minimize movement and physiologic changes in response to nociceptive stimuli. The most common method of drug administration in fish is through immersion, which is analogous to inhalant anesthesia in terrestrial animals. The most common product used is MS-222 (tricaine methanesulfonate), an FDA approved powder that can be weighed out and dissolved in a certain volume of water. When using this drug, the water can become acidic so sodium bicarbonate should be added to maintain a neutral pH.

## Preparation and Equipment Considerations

As with other species, fish are often fasted about 12-24 hours before anesthesia to reduce the risk of regurgitation as well as fecal contamination of water. When possible, water should be taken from the original fish holding tank for the anesthesia tank to ensure appropriate water quality parameters (chlorine, temperature, pH, ammonia, etc.) Otherwise, those parameters should be duplicated as closely as possible in the new water. During the procedure, it is important to ensure adequate oxygenation necessary for maintenance of normal physiologic homeostasis. Supplemental oxygen can be supplied via an air stone placed in to water. Personal protective gear should also be utilized during preparation and procedural operations. For instance, a respiratory mask would be appropriate when measuring powdered anesthetics, while wearing gloves limits systemic drug absorption and reduces the potential for transmission of zoonotic disease.

## Process

Once the fish is emerged in anesthetic water, induction occurs in about 5-10 minutes. This process is observed as decreased caudal fin strokes, loss of equilibrium, decreased respiratory rate, and reduced reaction to stimuli. Some species actually go through a short excitement phase during immersion induction, so they should be closely monitored to avoid risk of trauma. At surgical anesthesia there is total loss of muscle tone and a further decrease in respiratory rate. To determine response to stimuli, people often give a firm squeeze at the base of the tail fin to determine if general anesthesia has taken effect. Respiratory rate should be monitored throughout the procedure and can be evaluated by observing movement of the operculum. If respirations become extremely slow or stop, the fish may be placed in anesthetic-free recovery water to resolve this issue. Gill color should also be checked when possible, ideally displayed as dark pink to light red.

# SNAKE RACKS VS TANKS?

BY EMILY GRZEDA

When people buy a reptile, they typically keep it in a tank. Makes sense, right? You can see the animal clearly through the glass and they come in various sizes that can fit most size reptiles. Breeders, particularly snake breeders, are known to use a system called a “snake rack” instead of tanks. These are essentially shelving units with pullout drawers to keep your snakes in. Those drawers do come in various sizes, but by design cannot be as tall of an enclosure. Is the design humane? Should animals really be kept in drawers? There’s heavy debate and it can be quite controversial, so I’ll break down the pros and cons.

## **Pros:**

- Drawers are much easier to clean. They are lightweight and don’t have lids because the drawers are designed to match with the top of the rack’s shelf, so there aren’t as many parts. This means you’re less likely to put it off.
- You save a lot of space if you have many reptiles. Tanks take up a lot of room!
- Racks typically come with either belly or back-heated heat tape that you can adjust with your thermostat (a thermostat is required for any heat mat regardless of whether you have a snake rack or not!), so the temperature gradient remains fairly even. The heating element in the back must be measured to make sure that the hot spot is not too hot, and then the tub gets gradually cooler towards the front of the tub.
- There are varying sizes available – a hatchling ball python obviously needs a smaller size than a full-grown boa constrictor, or some species may need a wider temperature gradient. Some species, such as ball pythons, like being in dark compressed spaces all the time, so for them, this is a setup that can make them feel very secure.

## **Cons:**

- They are typically expensive. You probably can’t just take a pre-existing shelf and turn it into a rack because the shelf has to fit the top of the tub almost exactly so that the animal cannot escape.
- If you have multiple species that have varying temperature requirements, this system will not work well – all tubs are heated to the same temperature.
- There is no way to incorporate lights easily, so they do not work for species that require UVA/UVB.
- By nature, the tubs are short, so arboreal species have no place to climb. This setup is better suited for ground species such as ball pythons or ground boas. You cannot see your pets well (or at all, depending on the rack) without opening their drawer.

In summary, there is both a lot of good and bad to keeping animals in snake racks – it just depends on the situation. They are a great way to keep many species, but they should not be used if your primary reason is to just save space and time cleaning – make sure that the species you keep will actually thrive in the enclosure you provide. They are certainly not inhumane, as long as you continue to provide your pet with proper husbandry and take all of its needs into account.

# CREATURE FEATURE: CHINCHILLA

BY KYLIE AYERS

Chinchillas make great pets! They are social creatures with big personalities, but, like all animals, they have unique qualities that anyone who wants to own a chinchilla or see one in a veterinary setting should know. The chinchilla is native to the Andes Mountains of South America. There are two species of chinchillas that exist in the wild today: *Chinchilla brevicaudata* (Short-tailed chinchilla, aka Bolivian or Peruvian chinchilla) and *Chinchilla lanigera* (long-tailed chinchilla, aka Chilean or common chinchilla). Domestic chinchillas are thought to have descended from *C. lanigera* and are roughly twice as large as their wild relatives.



**Husbandry:** Chinchillas are very active animals, so they need a lot of space in their enclosure to run, jump, and climb. Chinchillas can jump up to 6 feet in the air! They should also be offered a wide variety of enrichment items to keep them busy and active during the day. Because of their active nature and relatively delicate bones, chinchillas are prone to orthopedic injuries. In order to maintain and clean their fine fur coats, chinchillas require daily dust baths. The dust bath should be removed after use to avoid irritation and conjunctivitis. Commercial chinchilla dust should be used. Check out this video of a chinchilla taking a dust bath: <https://www.youtube.com/watch?v=NYIdmpp69MY> Like other herbivorous hind-gut fermenters, the basis of a chinchilla's diet should be free-choice grass hay. High fiber chinchilla pellets and fresh vegetables should also be offered in smaller quantities.

**Longevity:** Chinchillas can live up to 20 years in a well managed captive environment, making them one of the longest lived rodents! In the wild, they frequently live between 8-10 years.

**Fur coat:** The chinchilla has the densest fur of any land mammal, with up to 60 hairs per follicle! This thick coat is adapted to living in the frozen temperatures of the Andes mountains. As a result of their ultra-dense fur and lack of sweat and sebaceous glands, they are very susceptible to heat stress and sensitive to increased humidity. The ideal temperature for a chinchilla is between 59 and 70°F and humidity should not exceed 55%.

**Fur slip:** In addition to other defense mechanisms (speed, hiding, and urine spraying), chinchillas possess the ability to release tufts of hair in order to escape predators. While this is helpful from escaping predators in the wild, it is important to be aware of when handling a chinchilla in a veterinary setting. Be sure not to scruff or roughly handle a chinchilla during restraint. Remember: they are prey species and can become stressed easily!



**Reproduction:** Chinchillas become sexually mature at 4-9 months, with females generally becoming sexually mature before males. Domestic chinchillas have average gestation periods of 111 days, which is one of the longest gestation period of any rodent. Chinchillas produce precocial young, meaning newborns are born fully furred with open eyes. Newborn chinchillas are called kits, and mothers can give birth to 1-6 at a time. Sexing chinchillas can be difficult as males lack a true scrotum and both sexes have two pairs of lateral thoracic mammary glands and one pair of inguinal mammary glands. However, females are typically larger than males and the anogenital distance (distance between the urogenital region and anus) is much longer in males than females.

**Conservation:** Unfortunately, both species have faced extensive hunting for their fur, leaving both species listed as “endangered” on the IUCN Red List. *C. chinchilla* is facing extinction, while *C. lanigera* can still be found in the wild in the mountains of northern Chile. Both species were close to extinction in the 1900s, but were prevented from total destruction as a result of legislation put in place. Chinchillas in the wild are still facing habitat loss and illegal hunting, so their populations are still in decline.

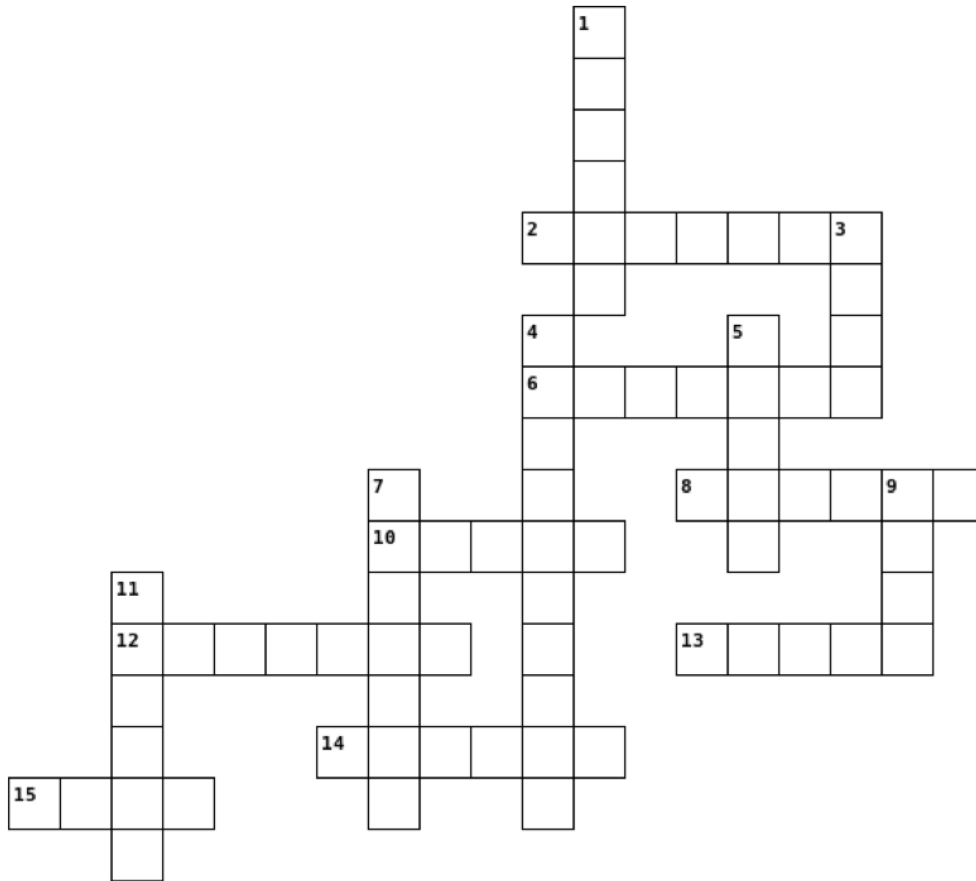


**Fun Fact!**

An American miner named Mathias Chapman got permission from the Chilean government in the 1920s to import 11 wild chinchillas in the United States. It's thought that most domestic chinchillas in the US today are descendants of the 11 animals Chapman imported.



# WILD CAT CROSSWORD



## Across

2. African cat with tufted ears that can leap up to ten feet in the air
6. The endangered variety of lynx
8. African species that has the relatively largest ears amongst cats
10. Bone that determines whether cats are able to purr or roar
12. This variety of leopard can open its jaws wider than any other cat and has the largest canine teeth-to-body ratio of any cat, earning it the nickname of "the modern saber-tooth"
13. Largest extant feline species
14. Species of New World cat that kills its smaller prey by using its powerful jaw to crush skulls
15. Asian leopard variety with wide furry paws that act like natural snowshoes

## Down

1. Feline species often confused for an ocelot that spends most of its life in trees
3. Species of roaring cat is generally regarded as the most social
4. Feline species known for its love of water and are named accordingly
5. The hybrid offspring of a male lion and a female tiger
7. Large cat native to Africa and central Iran that has a stride of 22 feet when sprinting
9. Most endangered variety of leopard
11. New World cat that can rotate ankles 180 degrees to climb down trees head-first

Crossword Answer Key:

- 1) MARGAY
- 2) CARACAL
- 3) LION
- 4) FISHINGCAT
- 5) LIGER
- 6) IBERIAN
- 7) CHEETAH
- 8) SERVAL
- 9) AMUR
- 10) HYOID
- 11) OCELOT
- 12) CLOUDED
- 13) TIGER
- 14) JAGUAR
- 15) SNOW

## Test Your Trivia Knowledge Answers!

1. This large organ in sharks is responsible for buoyancy.

- a. Swim Bladder
- b. **Liver**
- c. Lungs
- d. Spleen

2. What is the smallest mammal species in the world?

- a. Mouse Lemur
- b. Etruscan Shrew
- c. **Bumblebee Bat**
- d. Pygmy Possum

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- b. Himalayan Vulture
- c. **Wandering Albatross**
- d. Great White Pelican

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