

# ARMADILLO RESCUE AND REHABILITATION

## The Basics

First and foremost it is important to understand the general biology, habits and needs of armadillos as a species. Depending on your regional location, you are most likely to be rehabilitating the Nine-banded armadillo. There are more than 20 different species of armadillo. For the purpose of this guide, unless otherwise noted, our focus will be on the Nine-banded armadillo.

Nine-banded armadillos are found in North, Central and South America. They are primarily solitary, nocturnal and found in an extremely wide range of habitats from rainforests to grassland to dry scrub. Both extremely cold or extremely dry environments are a challenge for armadillos to survive, as they are susceptible to heat and water loss.

## Aging Armadillos

Adult armadillos typically weigh between 3 and 7 kgs (7-15 lbs). Total body length of adults including the tail is 25 – 42 inches and they typically stand between 6 and 10 inches tall. Aging armadillos is particularly difficult given the highly varied rates of growth, the lack of deciduous teeth and relatively consistent body morphology, regardless of age. Typically, armadillos weigh 85 grams at birth. Basic age categories can be determined below.

Juveniles - Less 2kg

Yearlings - 2-3 kgs

Adults - Over 3 kgs

## Migration Patterns

While it might seem absurd to address migration patterns in a guide for rehabilitation, it may significantly impact your rehabilitation and release options. Nine-banded armadillos have enjoyed a significant expanse of their “natural” territory, having both migrated and been introduced to areas by humans as well. This means they may be considered an invasive species in your state. This could mean either rehabilitation isn’t supported, or it is, but you will be prohibited from releasing rehabilitated animals legally. Make sure that you understand the laws in your area before you commit to rehabilitating armadillos, and make sure that you carry the appropriate class of license or sub license in your state if possible.

## Natural Enemies

Armadillos do not have a significant number of predators once they are adults. Part of the reason for their proliferation across the U.S. is due to the significantly reduced number of apex predators in general. Natural predators of adult armadillos include: black bears, pumas, wolves, coyotes, jaguars, alligators and bobcats. Juvenile armadillos must contend with additional predators including raccoons and birds of prey. The number one killer of armadillos, regardless of age, are humans. Armadillos are

both hunted for meat and shells, and killed in significant numbers by vehicles. This means upon release, the most significant obstacle to survival is proximity to roads or hunters.

### Reproduction in Armadillos

Like everything in Armadillos, their reproductive cycle is highly unusual. Female armadillos go through a single breeding cycle per year. In Northern regions that period will be July – August, and in more Southern areas it typically takes place between November and January however the egg is not usually implanted for 3-4 months to ensure young the maximum likelihood of survival. In times of extreme duress or stress, armadillos have deferred implantation of the egg for up to three years. The gestation period for nine-banded armadillos is 4.5 months. Armadillos always have 4 identical quadruplets. They are nursed for 1-2 months and forage alongside their siblings, while sharing a den with their mother for an additional 3-6 months. Sexual maturity for males (production of sperm) occurs at approximately 300 days old. Sexual maturity in female nine banded armadillos is typically at 17-20 months of age. The typical lifespan is 12-15 years. When sexing an armadillo, you will note that males have a clearly visible penis, however testicles are not outwardly visible due to the colder body temperature of armadillos.

Average weight at birth is 85 grams. In the wild, at emergence from their den (50 days old) they typically weigh 600 grams.

### Adult Armadillo Diet

Armadillos are considered insectivore generalists but will stray into omnivore territory when the opportunity presents itself. Generally, any ground-dwelling insects are fair game including grubs, beetles, ants, termites, worms, crickets amphibians and very small reptiles. If accessible they will eat bird eggs and even extremely small mammals. They are sometimes seen eating carrion, although it is likely they are feeding on maggots from the spoiled meat as well as carrion itself. On occasion armadillos will consume seeds, fungi or fruits, this is generally less than 10% of their diet. For rehabbers of Nine-banded armadillos a meat-centered diet is recommended by experts.



### Special Considerations – Zoonosis

Depending on your location, your risk for contracting leprosy from armadillo contact could be significant. They are the only known species to naturally harbor Hansen’s Disease (leprosy) and you should both understand the risks, as well as exercise basic prevention protocols in order to ensure the

disease is not transmitted to you or your family (if you rehabilitate at your home). According to UC Davis the following are basic precautions against the transmission of leprosy from armadillos to humans:

- **Wash your hands.** The single most effective preventative measure that can be taken is thorough, regular hand washing. Wash hands and arms after handling armadillos, ant-eaters, and sloths. Never smoke, drink or eat after handling an animal without washing your hands.
- **Wear gloves.** You should protect your hands by wearing sturdy, impervious gloves.
- **Seek Medical Attention Promptly.** If you are injured on the job, promptly report the accident to your supervisor, even if it seems relatively minor. Minor cuts and abrasions should be immediately cleansed with antibacterial soap and then protected from exposure. For more serious injuries, or if there are any questions, employees should report to Occupational Health Services.
- **Tell your physician you work with this animal family.** Whenever you are ill, even if you're not certain that the illness is work-related, always mention to your physician that you work with armadillos, anteaters or sloths. Many zoonotic diseases have flu-like symptoms and would not normally be suspected. Your physician needs this information to make an accurate diagnosis. Questions regarding personal human health should be answered by your physician.

The full reference page from UC Davis can be found in the **References -Zoonosis** section of this guide.

### **Rehabilitating Orphaned Armadillos**

Armadillos, like possums, must be tube fed when they are very young as lapping will cause aspiration. Generally, if the baby weighs over 250 grams they can lap formula as detailed in the protocols below. If they are under that weight, you will need to tube feed or, if inexperienced, find a rehabber that can tube feed babies until they are over the designated weight.

### **Dehydration Determination**

Typically when determining the adequate hydration of orphaned wildlife, a turgor test would be performed. Given the armored shell present in armadillo, that test is not possible. So, determining hydration (or dehydration) is as much of an art as it is science. Below are tips based on those with extensive experience with the species.

- Pale mucous membranes with a capillary refill time of longer than 2 seconds. (in layman's terms -pale gums that fail to "re-pink" within 2 seconds or less after applying manual pressure)
- Sunken eyeballs presenting with dried mucous membranes
- Skin that appears wrinkly, with a peeling appearance
- Upon opening the mouth it should be moist, not tacky
- Presence of saliva strings hanging as you open the mouth

### **Rehydration of Armadillos – Quick Tips**

- Rehydration could take up to 12 hours, and should be continued until diarrhea subsides and symptoms or indications of dehydration subside. Even if that requires hydration between feedings.

- Use Oralyte or Pedialyte not exceeding 30-40ml/kg every two hours

## **Tube Feeding**

Tube feeding, if not done properly, can lead to the death of the animal being tubed, so it should not be undertaken lightly, or without proper hands-on training unless there is absolutely no hope of assistance available. To locate a rehabber, you can go to [www.ahnow.com](http://www.ahnow.com) or a simple online search for licensed and experienced rehabbers in your area. Often exotic vets will work with wildlife rehabbers, so they too will sometimes be able to refer you to someone qualified and experienced. If you have no options available, below are the basic steps to follow as well as a tutorial video. I would greatly encourage you to have assistance available holding and restraining the baby, from someone experienced with animal handling.

**You can see a video on how to tube feed here:**

<https://www.youtube.com/watch?v=MPSPYkAEtJQ>

- If you are experienced, a no. 8 French feeding tube can be used for babies weighing at least 100grams (Fowler and Miller 1986).
- The tube can be lubricated with petroleum jelly and inserted into the armadillo's mouth, hopefully inducing it to swallow.
- The tube must be measured and marked prior to insertion. The appropriate measurement would be between the sixth and eighth intercostal space (6<sup>th</sup> – 8<sup>th</sup> rib space)
- Following the introduction of the tube, it is important to ensure proper placement before infusing any liquid. We recommend introducing the outside tip of the feeding tube into a beaker with water so that, if bubbles are observed, it means that the internal end is in the respiratory tract and could cause an aspiration pneumonia; it should be reinserted.
- The infusion rate of fluids through the tube must be slow enough to not cause the patient's stomach to dilate and result in reflux of contents into the esophagus proposed a rate by experienced rehabbers is approximately 1 ml/30–40 seconds).
- After completing the infusion volume at each administration, it is necessary to inject air into the tube to completely empty its contents into the stomach, because this will decrease the risk of aspiration pneumonia while extracting the tube from the animal.

\*\* Recommended subcutaneous hydration formulation: For dehydrated infants, it is recommended to use a mixture of dextrose 0.9% and NaCl 2.5% (Hoskins 1996)

\*\*Using the subcutaneous route, the sites of puncture should be the lateral zones of the individual, with particular attention to the volume to be injected. It is strongly recommended that multiple points of infusion be used.

## **Formulas and Foods**

There are very few expert rehabbers in the U.S. when it comes to armadillos, and as seen often in rehabilitation, it is an art as much as it is science. Rather than present you with a “one size fits all” approach, we are choosing to present to you a range and option of best practices from experienced rehabbers, all of which successfully rehabilitate these amazing creatures. So, if one formula or diet does not work for your baby, slowly switch to the next option, transitioning over several days to avoid stomach upset. Regardless of the method you choose, your armadillo’s will need additional supplements as well including:

**Vitamin K (2-3 times per week) ¼ teaspoon per batch of formula**

**Calcium Carbonate (daily) ½ teaspoon per batch of formula**

By 5 weeks of age a variety of live meals need to be offered including:

- Wax worms
- Meal worms or super worms
- Earthworms

While initially offering these items in a or in an empty tub will work, eventually they should be encouraged to dig for their foods and will find it great fun as well as enrichment to work for their meal.

When transitioning from tube feeding to lapping, great care must be taken to prevent aspiration of formula.

Once old enough, intermediate steps need to be taken to prevent aspiration as babies learn to successfully lap. Below you will see a recommended method for preventing aspiration. Cleaned and sanitized river rocks, placed in a shallow bowl will help to stop aspiration. Because armadillos have long tongues, this setup will not prevent them from consuming formula. Care should be taken to ensure formula is available as appropriate to age. The addition of river rocks will reduce the amount of formula in the bowl, and may slightly inhibit all of the formula being accessed so weighing daily is critical.



### **Basic Feeding Protocol 1:**

#### Initial Feedings:

- 1st feed: pedialyte
- 2nd feed: 1 part Esbilac / 4 parts water
- 3rd feed: 1 part Esbilac / 4 parts water
- 4th feed: 1 part Esbilac / 3 parts water
- 5th feed: 1 part Esbilac / 3 parts water

#### 2<sup>nd</sup> Step Diet:

Hill's Science Diet AD + Esbilac

#### 3<sup>rd</sup> Step Diet:

Esbilac + Mazuri Insectivore Chow

#### 4<sup>th</sup> Step Diet

Mazuri Insectivore Chow + AD

#### Final Diet Pre Release

Insectivore Chow with live gut-loaded mealworms, wax worms and earth worms

**Basic Feeding Protocol 2: \*\*** Please note that the recommended dilution for armadillos is 3-parts water to 1-part Esbilac, however here the protocol is adjusted to 2:1 based on the addition of the additional ingredients and the fact they act to dilute the formula to the 3:1 ratio when added.

Initial Feedings:

- 1st feed: pedialyte
- 2nd feed: 1 part Esbilac / 4 parts water
- 3rd feed: 1 part Esbilac / 4 parts water
- 4th feed: 1 part Esbilac / 3 parts water
- 5th feed: 1 part Esbilac / 3 parts water
- 6th feed: 1 part Esbilac / 1 parts water

2<sup>nd</sup> Step Diet: (in food processor till smooth)

- 1 part Esbilac / 2 parts water
- ¼ banana
- 1-2 tbs baby food
- ¼ Petite Eats Puppy
- ¼ leaf of black kale

3<sup>rd</sup> Step Diet: (in food processor till smooth)

- 1 part Esbilac / 2 parts water
- ¼ banana
- 1-2 tbs baby food
- 1/2 Nutro Petite Eats Puppy
- 1/2 leaf of black kale

4<sup>th</sup> Step Diet: (In food processor till smooth)

- 1 part Esbilac / 2 parts water
- ¼ banana
- 1-2 tbs baby food
- 1/2 Petite Eats Puppy
- 1 leaf of black kale

5<sup>th</sup> Step Diet: (In food processor till smooth)

- 1 part Esbilac / 2 parts water
- ¼ banana
- 1-2 tbs baby food
- 3/4 Petite Eats Puppy
- 1-2 leaves of black kale

6<sup>th</sup> Step Diet: (In food processor till smooth)

- 1 part Esbilac / 2 parts water
- ¼ banana
- 1-2 tbs baby food
- 1 container Petite Eats Puppy
- 1-2 leaves of black kale

7<sup>th</sup> Step Diet: (In food processor till smooth)

1 part Esbilac / 2 parts water

¼ banana

1-2 tbs baby food

1 container Petite Eats Puppy

1-2 leaves of black kale

\*after processing add ½ container Petite Eats Puppy

8<sup>th</sup> Step Diet: (In food processor till smooth)

1 part Esbilac / 2 parts water

¼ banana

1-2 tbs baby food

1-2 leaves of black kale

1 container Petite Eats Puppy

\*after processing add 1 container Petite Eats Puppy

9<sup>th</sup> Step Diet: (In food processor till smooth)

1 part Esbilac / 2 parts water

¼ banana

1-2 tbs baby food

1-2 leaves of black kale

\*after processing add 2 container Petite Eats Puppy

For final steps with Protocol 2, you should start substituting (slowly) the Petite Eats Puppy with a high quality grain-free cat or kitten food that has been softened by soaking in formula or water in advance. Over time the “wet” portions of this are slowly replaced by soaked and softened cat food. You can also alternate or mix dog and cat food or insectivore, dog and cat food however all dry foods must be softened through soaking.

The above protocol assumes 3-4 armadillos being fed. 7 scoops Esbilac per batch should last close to the 24 hour period that formula would need to be discarded.

**Basic Protocol 3:**

Initial Feedings:

1st feed: pedialyte

2nd feed: 1 part Esbilac /4 parts water

3rd feed: 1 part Esbilac /4 parts water

4th feed: 1 part Esbilac / 3 parts water

5th feed: 1 part Esbilac / 3 parts water

6th feed: 1 part Esbilac/ 3 parts water

**Step 2:**

Slowly add in solid ingredients, as listed below until the exact composition below is met. You will need to play with the consistency and bring them along slowly from all formula, to a mix, and then finally to the ending formulation.

In a large container place

- 1 ½ cup dry cat food (no grains, corn, soy or wheat)
- 3 cups hot distilled water & allow to soak
- 2 jars (142 g) baby pumpkin
- 2 jars (142 g) baby carrot or sweet potato
- 2 jars (142 g) baby green beans
- 2 jars or ¼ of a banana

Add extra water as needed for a thin pudding consistency, allow to cool to < 102 C  
2 tsp calcium carbonate powder

Formula citations: (Wampler 1969; Storrs and Grier 1973; Meritt 1976, 1985; Fowler and Cubas 1996; Fowler and Miller 2003; Rosa *et al.* 2009), but it is difficult to find literature that proposes adequate formulas for baby armadillos. Among the minimal guidance in the literature, we recommend Esbilac® milk diluted in water in a proportion of one part milk to three parts water (1:3; Fowler and Miller 1986. CROW 2018 protocols, Florida Wildlife Care protocols & The First 48 Hours and Beyond.

It is interesting to note the need to add vitamin K to the food of armadillos, a species that is more susceptible to possible diseases when lacking this vitamin (Wampler 1969; Storrs and Grier 1973; Meritt 1976, 1985; Fowler and Cubas 1996; Fowler and Miller 2003).

### **Reference pages - General**

<http://www.nsrl.ttu.edu/tmot1/dasynove.htm>

[https://www.jstor.org/stable/2426822?origin=crossref&seq=1#page\\_scan\\_tab\\_contents](https://www.jstor.org/stable/2426822?origin=crossref&seq=1#page_scan_tab_contents)

<http://scienceblogs.com/tetrapodzoology/2007/06/13/five-things-you-didnt-know-abo/>

### **Reference pages - Zoonosis**

<https://www.cdc.gov/leprosy/transmission/index.html>

<https://www.ncbi.nlm.nih.gov/pmc/articles/PMC5537442/>

[https://wwwnc.cdc.gov/eid/article/21/12/15-0501\\_article](https://wwwnc.cdc.gov/eid/article/21/12/15-0501_article)

### **Reference pages – Calcium Needs**

<https://academic.oup.com/jmammal/article-abstract/99/2/498/4868575>

<http://www.humanesociety.org/news/magazines/2017/09-10/south-florida-innovative-techniques.html>