



## THE BEARDED DRAGON

### Name and Origin

- Bearded Dragons (*Pogona* sp.) are a group/genus of lizard species that belong to the family Agamidae (Old World Iguanids or Agamid Lizards), and more specifically the subfamily Amphibolurinae. The environmental conditions of their natural habitats will vary slightly depending on the locality of the species, but for the most part they are found in semi-arid/arid deserts, dry forests and plains of Australia. Their natural environment is similar to the southwestern regions of the United States and Northern Mexico.
- The following are recognized species with the genus *Pogona*<sup>12</sup>.
  - *Pogona barbata* – Eastern Bearded Dragon
  - *Pogona henylawsoni* – Black-soil Bearded Dragon; Dwarf Bearded Dragon; Synonymous with Rankin's Dragon
  - *Pogona microlepidota* – Kimberley Bearded Dragon
  - *Pogona minor* – Western Bearded Dragon
    - *Pogona minor mitchelli* (formally *P. mitchelli*) and *Pogona minor minima* (formerly *P. minima*) are both currently considered subspecies of *P. minor*
  - *Pogona nullarbor* – Nullarbor Bearded Dragon
  - *Pogona vitticeps* – Central or Inland Bearded Dragon
- The most common bearded dragon in the pet trade is the central or inland Bearded Dragons (*P. vitticeps*).
  - Australia officially banned the sale and exportation of wild bearded dragons in the 1960's. Despite that ban, illegal exportation continued until the 1990's. Since then, all wildlife animal exportation is prohibited and extensively regulated.
  - All the Central or Inland bearded dragons in circulation today are from those original populations that were exported. There are several large-scale captive breeding facilities



<sup>1</sup> Retrieved [01/10/2023] from the Integrated Taxonomic Information System (ITIS) on-line database, [www.itis.gov](http://www.itis.gov), [https://www.itis.gov/servlet/SingleRpt/SingleRpt?search\\_topic=TSN&search\\_value=1055443#null](https://www.itis.gov/servlet/SingleRpt/SingleRpt?search_topic=TSN&search_value=1055443#null)

<sup>2</sup> Retrieved [01/10/2023] from The Reptile Database on-line database, [reptile-database.org](http://reptile-database.org), [https://reptile-database.reptarium.cz/advanced\\_search?genus=pogona&exact%5B0%5D=genus&submit=Search](https://reptile-database.reptarium.cz/advanced_search?genus=pogona&exact%5B0%5D=genus&submit=Search)



throughout the world in addition to numerous domestic breeders that supply bearded dragons for the pet trade.

### Anatomy and Physiology

- Animals belonging to the *Pogona* genus have broad bodies with large and muscular characteristically triangular heads. The most notable feature of all bearded dragons is the pronounced guttural (throat/beard) pouch that will expand and darken in response to a variety of situations including but not limited to stress, displays of aggression, and mating. The ability to darken their beard is not exclusively limited to this region. As with many other reptiles they have an ability to modify the pigmentation of their scales to modify their appearance. Among the many behavioral reasons for this ability (e.g., threat or mate attraction), thermoregulation is among the most functional for bearded dragons. They can darken various body segments to better absorb ultraviolet radiation depending on the climatic condition<sup>3</sup>. One of the more interesting features of this ability is that some of the changes are only visible by other animals. This feature is not exclusively limited to reptiles and is actually very common in many species. For more information on this please review: <https://www.petsmart.com/learning-center/bird-care/lighting-for-pet-birds/A0364.html?fdid=bird>
- Bearded dragons primarily have acrodont dentition (lacking roots and fused at the base of the jawbone rather than sitting in a socket). Acrodont teeth are permanent and do not regenerate throughout the animal's life, but rather new ones are added to the back of the jaw as it grows. The jaw continues to develop and teeth will erupt from the gingiva (gums) at the back of the mouth until the lizard reaches adulthood (~8-12 months in *P.vitticeps*)<sup>45</sup>.
  - There are various kinds of teeth that do not sit within a socket (fused to the jaw in different ways with and without roots). When describing reptiles there are multiple dental models (e.g., acrodont, pleurodont, monophyodont, and polyphyodont).
  - The bearded dragon (*P.vitticeps*) actually has both pleurodont and acrodont teeth<sup>67</sup>. The pleurodont teeth are located towards the front of the jaw on both top and bottom (maxilla and mandible)<sup>8</sup>.

<sup>33</sup> Smith, et. al (2016). Colour change on different body regions provides thermal and signaling advantages in bearded dragon lizards. *Proc. R. Soc. B.* 2832016062620160626. <http://doi.org/10.1098/rspb.2016.0626>

<sup>4</sup> Mott, et. al (2020). Prevalence and risk factors for dental disease in captive Central bearded dragons (*Pogona vitticeps*) in the United Kingdom. *Journal of Exotic Pet Medicine*, Vol. 36, pg.1-7. <https://doi.org/10.1053/j.jepm.2020.09.002>

<sup>5</sup> LeBlanc, A. et al. (2020) Tooth attachment and pleurodont implantation in lizards: Histology, development, and evolution. *Journal of Anatomy*, Vol. 238, Issue 5. Pg 1156-1178. <https://doi.org/10.1111/joa.13371>

<sup>6</sup> Salomies, L. et. al (2019) The alternative regenerative strategy of bearded dragon unveils the key processes underlying vertebrate tooth renewal. *eLife* 8: e47702. <https://doi.org/10.7554/eLife.47702>

<sup>7</sup> Salomies, L. et. al (2021) The developmental origins of heterodonty and acrodonty as revealed by reptile dentitions. *Science Advances*, Vol. 7, No. 51. <https://doi.org/10.1126/sciadv.abj7912>



- Acrodont teeth – no roots. Facilitate chewing and mastication of tough materials as they allow for a stronger bite
- Pleurodont teeth – minimal roots with no periodontal ligament, but still strong attachment. Attaches to the jaw only on one side to facilitate replacement throughout the animal's life. These teeth are most beneficial for grabbing and tearing at food items. They are typically sharper for this reason and therefore the reason why they are routinely replaced as they wear.
- The reason behind their dentition in part can be traced back to the dietary model. They are considered omnivorous lizards. As juveniles they are almost exclusively insectivorous gradually transitioning to primarily herbivorous as adults. Most herbivorous reptiles have a combination of strong jaws and teeth to facilitate in the chewing and consumption of tough vegetation. The stronger the bite, typically, the tougher the vegetation you can likely find in their natural environment.<sup>9</sup>

## Natural Behavior

- In general, bearded dragons are considered poikilothermic or ectotherms (these terms are synonymous). This means their body temperature is dependent on external factors and not produced internally. There are various ways ectotherms will thermoregulate (heliothermy, thigmothermy, and stenothermy) and produce energy for their body. In many ectotherms, their circulatory system (blood circulation) cannot function properly until the core body reaches a certain temperature. This is primarily why cold reptiles are not very active.
  - Heliothermy – direct absorption of solar radiation to produce energy. Especially heat. This method can be observed most easily in sun basking species.
  - Thigmothermy – obtaining heat from an object in the environment. This method of thermoregulation is not very common as a primary method. Often this will be combined with other sources. This has been documented a primary method for thermoregulation in high-altitude agamids – The Andean Mountain agamid (*Liolaemus tacnae*)<sup>10</sup> and Toad-headed lizards (*Phrynocephalus vlangalii* and *P. erythrurus*) found in the mountains of Central Asia, Northern China, Tibet, and Mongolia. In the late morning and afternoon,

<sup>8</sup> Berkovitz, B. and Shellis, P. (2017). Chapter 6 - Reptiles 1: Tuatara and Lizards. Editor(s): Barry Berkovitz, Peter Shellis, *The Teeth of Non-Mammalian Vertebrates*. Academic Press, pgs. 152-200. <https://doi.org/10.1016/B978-0-12-802850-6.00006-0>

<sup>9</sup> Jenkins KM, Shaw JO. (2020). Bite force data suggests relationship between acrodont tooth implantation and strong bite force. *PeerJ Life and Environment*, 30(8): e9468. doi: 10.7717/peerj.9468. PMID: 32656000; PMCID: PMC7333653.

<sup>10</sup> Garrick, D. (2008). Body surface temperature and length in relation to the thermal biology of lizards. *Bioscience Horizons: The International Journal of Student Research* 1(2), pg. 136-242. <https://doi.org/10.1093/biohorizons/hzn014>



they can be found on dark rocks absorbing the heat they retained from the earlier exposure to the sun<sup>11</sup>.

- Stenothermy (thermal heterogeneity/uniformity) – capable of surviving within a specific and narrow temperature range. Depend on constant ambient temperatures ranges. Tropical forest or subcanopy dwelling amphibians and reptiles fall within this category.
- Bearded dragons are primarily heliothermic lizards that utilize the sun to absorb energy. They will spend a large part of their day basking on elevated points absorbing solar radiation. Like many other lizards, a bearded dragon's metabolism not only depends on sun basking for heat. It is also their primary method to properly metabolize the calcium that is obtained dietarily. This behavior also aids in the proper absorption of vitamin A and D.

## Enrichment

- In nature, many lizards roam their territory throughout the majority of the day looking for food items, potential mates, invaders, threats, alternate burrows or shelters. Essentially actively working to survive. In captivity it is important to try and replicate as much natural behavior as possible. When everything they “need” is already provided (e.g., food, water, shelter) there is not much for them to do. In captivity, it is essential to stimulate their minds and bodies.
- Enrichment is not limited to environmental stimulation. It should also include new, interesting, and safe food. These two can even be combined and you may hide novel food or treats throughout the environment. There are several manufacturers that produce foraging toys, but they can also easily be made at home with a safe products and creativity.
- The following should be supplied in their habitats to support total health:
  - Different textures to climb and explore, replaced routinely.
  - Safe and appropriate substrates for digging or burrowing if you are not using carpet
  - Rotating novel safe species appropriate food items routinely.
    - Note: The more varied and closer to the items found in their natural environment the better to prevent secondary medical issues.

## Diet

- The natural diet of central bearded dragons will vary greatly depending on season, climatic conditions, and size or age. In general, bearded dragons are opportunistic omnivores. As juveniles they have a higher protein and fat demand and prioritize insect/arthropod intake. As adults, which typically occurs between 6-12 months after hatching or approximately <300 grams, they begin a heavier dependence on plant material. Studies of free roaming

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<sup>11</sup> Tang, X. et. al (2013). Metabolic Characteristics and Response to High Altitude in *Phrynocephalus erythrurus* (Lacertilia: Agamidae), a Lizard Dwell at Altitudes Higher Than Any Other Living Lizards in the World. *PLOS ONE* 8(8): e71976. <https://doi.org/10.1371/journal.pone.0071976>



central/inland bearded dragons in New South Wales (NSW) identified the primarily consumed protein consisted of Isoptera – termites (i.e., *Drepanotermes* sp.), Orthoptera – locust, crickets, katydid (e.g., *Chortoicetes terminifera* – Australian plague locust), Hymenoptera – bees, wasps, ants. The period of study coincided with the end of the dry season and beginning of the wet season. That season in the NSW is characteristic for an overabundance of harvest termites in their winged phase. Therefore, the study authors suggest there was likely a higher quantity of opportunistic insect/arthropod content than suggested in previous studies for adult bearded dragons. Despite the high volume of animal protein, the stomach contents of all bearded dragons studied contained over 50% plant material. The plant material evaluated contained high levels of n3 fatty acids (omega 3)<sup>12</sup>.

- In captivity the diet is limited to the availability of food items.
- **Juveniles** – 50% animal protein, 50% plant matter/vegetation.
- **Adults** – 10% animal protein, 90% plant matter/vegetation.
  - **Insects:** Feed gut-loaded insects (crickets or dubia roaches) 1x daily. Mealworms, superworms and waxworms should be offered in only small amounts. Dust food with a calcium/Vitamin D3 powder: 4-5x a week (juveniles); 2-3x a week (adults). Dust food with a multivitamin 1x a week (juveniles); 2x a month (adults), or as directed by your veterinarian.
  - **Plant material/vegetation:** Fresh dark leafy greens rich in omega 3 fatty acids (e.g., kale, collards, romaine), carrots (high in beta carotene), squash and peas can be offered daily.
  - **Fruits:** Fruits like melons, berries (rich in omega 3 fatty acids) and citrus may be offered 1x a week.
  - **Prepared diets:** Bearded dragon pelleted food or omnivorous/insectivorous lizard diets (e.g., Repashy - Grub pie) can be offered daily.
- **Dietary enrichment**
  - It is important to rotate and alternate the variety of foods provided. This will help diversify the dietary nutrient profiles and expose the lizard to different textures and consistencies. Just make sure it is species appropriate. For a more detailed description of commonly available feeder insects you can offer, please reference: [Feeder Insect Nutritional Information](#)
- Fresh water from multiple sources should be made available within the habitat

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<sup>12</sup> Oonincx et al. (2015). The Diet of Free-Roaming Australian Central Bearded Dragons (*Pogona vitticeps*). *Zoo Biology*, 9999: 1-7.  
<https://doi.org/10.1002/zoo.21209>





### Housing a Pet Bearded Dragon

- Reptile carpet or tile is easiest and appropriate for pet bearded dragons. Remove droppings as needed. Clean at least every other week.
  - A natural substrate with a diverse and appropriate soil profile can be used by the more experienced reptile keeper and typically only recommended for adult bearded dragons. This should be discussed with a reptile savvy veterinarian prior to introducing.
- Bearded dragon terrariums require a temperature gradient (a cool side and a warm side). Add thermometer(s) and a hygrometer to monitor temperature and humidity. Mist the environment as needed with a warm water to maintain humidity. Providing humidity hides and soaking in shallow warm water can also help maintain a healthy hydrated animal.
- Reptiles require a 12-hour day/night cycle. A UVA/UVB bulb is necessary to help your bearded dragon metabolize the calcium and vitamin A obtained from the feeder insects, supplemental powders, and vegetation.
- Add driftwood or rock to climb a little closer to heat source. Add a few branches for hiding and climbing.

## HEALTH AND PREVENTATIVE MEDICINE

### Finding An Amphibian and Reptile Savvy Veterinarian

It is important to locate a veterinary office before welcoming an amphibian or reptile to the household.

- Board certified veterinarians specializing in exotic animals can be found by visiting the American Board of Veterinary Practitioners' webpage (<https://abvp.com/animal-owners/find-an-abvp-specialist/>)
- Veterinarians who have a particular interest in Amphibians and Reptiles can be found by visiting the Association of Amphibian and Reptilian Veterinarians' webpage (<https://arav.org/>).

### Examinations

It is recommended that all newly acquired amphibians and reptiles receive a complete physical examination. Thereafter, you should have your pet examined by a veterinarian every 6-12 months and as soon as any signs of illness/disease are noted.

### Changes in appetite or urination/defecation

Any change in appetite, activity level, or urination/defecation should be reported to your veterinarian. As prey species, they tend to hide outward signs of pain or illness so often the monitoring of appetite, activity level, and urination/defecation is the first sign of a concern. It is a best practice to regularly



monitor/document these three areas daily to identify normal behavior patterns for your particular animal(s).

### **Amphibian and Reptile Waste**

Like other vertebrates, amphibians and reptiles produce waste. There are three components their waste. composed of nitrogenous elements (ammonia, urea, and uric acid) and feces.

Nitrogenous elements are byproducts of protein oxidation processed by kidneys and excreted in the form of liquid or viscous paste. This resembles the avian excretory system but differs from mammals that only excrete a liquid form of nitrogenous waste. Regardless of the system, the kidneys still function in a similar manner. All vertebrates produce ammonia, urea, and uric acid as byproducts. However, mammals do not excrete uric acid in a concentrated manner, but rather it dissolves in the blood, further processed by the kidneys, and whatever remains is excreted in the form of urea or urine. Reptiles excrete liquid urea/ammonia and viscous (semi-solid) uric acid. Depending on their status of hydration the coloration will vary. Color can be clear, white, orange, yellow, and shades of green. The darker the urea and urates the less hydrated at the time of deposit just like in other animals. On occasion, these animals will pass nitrogenous waste without a fecal component. However, this should not be a normal occurrence as they tend to pass both together. If you are failing to see fecal material every few deposits, it is an indicator the pet is not consuming food properly. With exception of snakes, these animals should pass waste material at least once weekly when eating regularly.

Fecal material is primarily the undigestible components (e.g., fibers, hair/fur, exoskeleton), bacteria, fats, etc. Like most vertebrates, this material will be various hues of brown and have a strong foul odor.

Understanding and evaluating an amphibian and reptiles waste is a good practice to properly evaluate their overall health. Urea/urates can help you determine hydration status. While one or two discolored episodes are not that concerning, chronic discoloration should be addressed and discussed with your veterinarian.

### **Dental Health**

Dental disease in Bearded Dragons has not yet been identified in wild free roaming animals. Therefore, this is a disease currently only observed in captivity. The direct cause is unknown, but some have theorized it can be attributed to a difference in diets (e.g., fruits, less course vegetation, arthropod availability, etc.) and subsequent eating behaviors that cannot be replicated outside of their natural range. Regardless of the nature of the onset, the damage occurs where the gingiva (gums) meets the base of the teeth. The fact that bearded dragons have acrodont dentition (no roots and fused directly to the jawbone) complicates the condition. Unlike a mammal, where the infection would eat away at the



tooth and subsequently locally infect and damage the root system, the infection and damage occur directly on the bone. As the infection spreads, the lack of blood flow causes the surrounding jawbone to die. Once there is infiltration into the bone, there is a risk for spread into the rest of circulatory system prompting the development of septicemia (widespread systemic infection). The only alternative is surgical removal of the infected segment, which subsequently weakens the jaw strength or impedes ability to eat properly<sup>13</sup>.

To prevent onset of clinical dental disease, it is recommended to have your bearded dragon evaluated at least yearly by a reptile savvy veterinarian. Just like other pets, it is possible to perform sedated/anesthetized dental cleanings when areas of concern and decay are noted.

### **Adenovirus**

In bearded dragons, atadenovirus (agamid adenovirus or AgAdv-1) is considered to be a commonly carried organism (as in the majority of bearded dragons are asymptomatic carriers). Molecular PCR testing for atadenovirus in healthy bearded dragons has a high likelihood to return a positive. This does not mean it cannot cause problems or manifest symptoms. It just means that it is commonly found within these animals and the theory is that the immune system does a good job managing it and keeping it subdued. Molecular testing typically only identifies the presence of the DNA of the organism. It does not tell you how the body or immune system is responding to that organism. The reason you start seeing outward atadenovirus symptoms (neurological – ataxia, head tilt, disorientation) is because the immune system is being compromised for one reason or another (underlying illness). The most common are intestinal parasites or bacterial organisms. All the organisms mentioned are considered opportunistic (whereas they take advantage of a weakened immune system and start reproducing and causing problems). Stress is the number one cause of immune systems going down. The stress of transport, relocation, new environment, etc. shocks the immune system and all of these organisms flare. While the door is open (so to speak) the atadenovirus gets out of control and starts attacking the body, primarily the gastrointestinal track and central nervous system. In most cases if you can identify and/or address the underlying cause (i.e., parasites or bacteria) that is contributing to the immune system going down you can bring the animals back. and subdue the atadenoviral flare up/symptoms. Sometimes the damage the atadenovirus does cannot be reversed and will be permanent, this is primarily true for the central nervous system. However, it can be placed in remission and no longer continue causing degeneration.

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<sup>13</sup> Mott et al. (2021). Prevalence and risk factors for dental disease in captive Central bearded dragons (*Pogona vitticeps*) in the United Kingdom. *Journal of Exotic Pet Medicine*, 36: 1-7. <https://doi.org/10.1053/j.jepm.2020.09.002>





The recommendation with "ill" bearded dragons, is to make sure we look for underlying causes (parasites, bacteria) and/or just treat preventatively. Along with providing supportive care (e.g., syringe feeding and soaking). If they do not respond to treatment or decline, it is preferable to humanely euthanize and submit for necropsy/histopathology so that detailed information can be obtained as to what exactly was the cause death and/or just how much the adenovirus contributed to the cause of death.

### **Spaying and Neutering**

In amphibians and reptiles this is typically only done when it is medically necessary. The physiological and behavioral changes this practice prevents in cats, dogs and other small mammals is not observed in these species. Therefore, there is no common preventative or prophylactic need to pursue spaying and neutering.

### **Grooming**

Not necessary if providing appropriate humidity parameters, structures, textures, and environmental enrichment within the habitat

## **CONSIDERATIONS:**

- Life expectancy: approximately 10 years on average. With proper care can live 15 years.
- Bearded dragons can grow up to 24" (61 cm).
- Like avian species, oviparous (egg-laying) amphibians and reptiles can produce and lay infertile eggs even if alone.
- Head bobbing, beard darkening, and puffing up are signs of aggression and should be considered a threatening posture. Hand waving is most typically attributed to submissiveness and mate signaling but is also understood as a fear reaction.