WAZA Husbandry guidelines for

Sardinian Brook Salamander: *Euproctus platycephalus*

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Section 1. Biology and field data

1.1 Taxonomy

ORDER: URODELA (Duméril, 1806)
FAMILY: SALAMANDRIDAE (Goldfuss, 1820)
GENUS: EUPROCTUS (Gené, 1838)
SPECIES: Euproctus platycephalus (Gravenhorst, 1829)
COMMON NAMES: Sardinian Brook Salamander/ Sardinian Mountain Newt

1.2 Morphology

1.2.1 Weight: Adults weigh between 3.0 – 8.5g. (“Zirichiltaggi personal communication”).

1.2.2 Length: Adults reach a maximum of 140mm but are usually smaller at 100 - 120mm
Length of adults from snout to vent is approximately 75mm (Bovero et al, 2003).

1.2.3 Colouration: Colouration varies between individuals and at different ages. The dorsal
colouring in adults and juveniles is a dark olive or brown with yellow, black or green spots.
Colouration tends to darken with age, especially in males. Some juveniles or medium age
individuals have an orange/yellow vertebral stripe that fades with age and eventually
disappears. The ventral surface is a cream colour on the sides becoming yellow in the middle.
Numerous black spots are present on the ventral parts; distribution of spots is greatly reduced
in females. With age, the black spots tend to enlarge with some of the oldest individuals
having completely dark ventral areas. Larvae, at about 2 weeks old, are greyish in colour with
black eyes and distinguishable pink gills (French Urodela Group, 2005).

1.2.4 Description: E. platycephalus is sexually dimorphic (Fig. 1 and 2). The head of this
species is very depressed with a wide snout. Males have proportionally larger and wider
heads compared to females (Bovero et al, 2003). The upper jaw is larger than the lower jaw.
Ventral and dorsal skin is relatively smooth, fine tubercules are present on the dorsal surface.
The tail is oval in cross-section and is broad at the base and compressed laterally with small
upper and lower crests. The males are longer and heavier than the females (Bovero et al,
2003). The females are more stream-lined with a finer and longer tail than the males. Males
have longer and wider hind legs than females and especially visible protruding spurs present
on the rear of the hind leg just above the foot (French Urodela Group 2005). These spurs
appear at 12 to 14 months of age and are present throughout life.
The female cloaca opens distally and is cone shaped (Fig. 3). The hook shaped cloaca of the male (Fig. 4) is directed posteriorly and opens dorsally. A large pseudopenis is evaginated during mating (Bovero et al, 2003).
At 3 to 4 months of age the head is visibly flattened and the top jaw is more prominent. Male spurs become evident and the tail thickens at the base. Gills are present throughout the larval stage. The gills regress just before metamorphosis and eventually disappear; some young adults however have a strong affinity for partial neoteny (French Urodela Group 2005).

1.3 Longevity:

The longevity of *E. platycephalus* in its natural environment is difficult to evaluate due to lack of research. The average age in the wild ranges between 6.4 -8.5 years (Bovero *et al*, 2003; Angelini *et al*, 2008) however a life span of 17 years has been observed in the wild (Bovero *et al*, 2003), for males and 9 years for females. The maximum recorded life span for this species in captivity is 9 years (French Urodela Group, 2005) however they usually live for about 5 - 7 years in captivity, and, so far, are only able to breed for 3 or 4 years.

Field data

1.4 Zoogeography, ecology and conservation

1.4.1 Distribution: *E. platycephalus* is endemic to the island of Sardinia, Italy (Fig. 5), and survives in three isolated regions of the island; The Limbara Mountains in the north east, the mountains of Gerrei and Sarrabus in the region of Sette Fratelli to the south east and the Gennargentu Mountains in the center of Sardinia. All three regions range in altitude from 50m to 1,800m however they are most abundant between 500 to 600m above sea level (French Urodela Group, 2005). With few exceptions, there are no records of the species on the west side of the island (IUCN *et al*, 2008).
1.4.2 Habitat: During the aquatic phase, *E. platycephalus* inhabits streams, pools and small lakes on the main mountain systems of Sardinia (Arnold & Ovenden, 2002). On land they are found among roots and under stones and logs (Arnold & Ovenden, 2002) that are sometimes close to its aquatic habitats (Arnold & Ovenden, 2002; “Zirichiltaggi” personal communication). Studies have shown that *E. platycephalus* are more likely to be found in areas with colder water temperature (Roberta & Norris, 2004) ranging from 12°C – 16°C (“Zirichiltaggi” personal communication), a marginal absence of fish and less riparian vegetation (Roberta & Norris, 2004). Recent studies confirm that *E. platycephalus* can occur in areas with consistent with riparian vegetation and tree covering (“Zirichiltaggi” personal communication). The species can also be found in hypogean streams (“Zirichiltaggi” personal communication). *E. platycephalus* show a preference for relatively calm sections of rivers and streams (Arnold & Ovenden, 2002). Streams inhabited by this species have good water quality and are well oxygenated (French Urodela Group, 2005).

1.4.3 Population: This generally rare species can be locally common in suitable habitat. One of the largest populations of the species occurs in the Gola di Gorroppu in the Gennargentu region. In one well-studied population the sex ratio is male dominated. The number of subpopulations is declining. Between 1999 and 2001 it was found in 14 sites, whereas around 1991 it was present in 30 sites (and even in 1991 it was absent from nine other sites where it had been previously observed) (IUCN et al, 2008). Recent studies (“Zirichiltaggi” personal communication) on species distribution commencing from 2004 and are still ongoing, report

Figure 5: The distribution of *E. platycephalus*.
the species is actually present in more than 35 sites across the species range and may be present in more.

1.4.4 Conservation status: The species is listed as Endangered by the Global Amphibian Assessment because its area of occupancy is less than 500 km², its distribution is severely fragmented, and there is a continuing decline in the extent and quality of its habitat, and in the number of subpopulations (IUCN et al., 2008). The numbers of *E. platycephalus* have reduced drastically in recent years due to a number of reasons. In the past, Sardinia was covered in forests providing a good hydraulic system to the area which resulted in frequent precipitations. The area was covered in vegetation supporting the species and they could inhabit most areas of Sardinia, particularly the eastern side. In more recent years, anthropogenic influences such as forest fires, removal of trees to support development of railways and tourist sites and increasing agricultural development, has resulted in deforestation creating desertification zones (Fig. 6).

![Desertification in Sardinia](image)

**Figure 6:** Desertification in Sardinia (Map adapted from Costantini *et al.*, 2005)

Gradually, as the ground has become less able to support vegetation, temperatures have increased, precipitations have reduced and streams and lakes have dried up resulting in localised disappearances of *E. platycephalus*. The three remaining populations are most likely isolated with no gene flow between the populations. Global warming has also increased water temperatures (French Urodela Group, 2005).
In the region of Gennargentu, tourism and farming have played an important role in the drying up of mountain streams. Farm animals such as goats are now found in the area resulting in the pollution of the remaining streams from faeces and erosion. In low altitude areas pollution from agricultural processes such as fertilizers and pesticides are an ever increasing problem (French Urodela Group, 2005). The treatment of water bodies with DichloroDiphenylTrichloroethane (DDT) in the 1950's in the battle against malaria may also have contributed to the decline of the species (Boehme et al, 1999).

Although *E. platycephalus* may have evolved sympatrically with native trout populations (*Salmo trutta macrostigma*) and reached an ecological equilibrium, the mass introduction of alien fish (*Salmo t. trutta* and *Oncorhyncus mykiss*) conducted in Sardinia over the past century may have altered the balance in stream species communities (Roberta & Lecis, 2004). These introduced fish feed on the eggs and larvae of *E. platycephalus* and compete for food (Lecis and Norris, 2004). These factors may have partially led to the decline of the species.

Studies (Bovero et al, 2008) have shown that chytridiomycosis caused by the *Batrachochytrium dendrobatidis* fungus is affecting the populations in the wild. Adult individuals in the Sette Fratelli Mountains show the symptoms of the disease and further testing has proven its existence. Chytridiomycosis has been the cause for massive amphibian declines in recent decades resulting in population declines and extirpations of amphibian species locally and globally. For effective conservation, it is imperative to determine the distribution of *B. dendrobatidis* among populations of *E. platycephalus*, as well as among other amphibians which may be affected or involved in the epidemiology of this disease (Bovero et al, 2008).

The three areas now inhabited by the species are considered as biogenetic reserves (IUCN et al, 2008) as they are especially valuable for nature conservation in Europe. This species is listed on Appendix II of the Berne Convention and on Annex IV of the EU Natural Habitats Directive; it is also protected by regional legislation (Regional Law n. 23/1998 (art. 5, c. 3). The Gola di Gorroppuu has been designated as a Site of Community Importance under the Habitats Directive (IUCN et al, 2008). Monte Limbara in Limbarda and Sette Fratelli are now regional parks with Gennargentu under the process of being declared a National park. Programmes to remove trout from the species' habitat would assist in the recovery of populations (IUCN et al, 2008) however it is unknown whether there are any plans to do so. There is a captive breeding program to ensure this species persistence at least in captivity. Returning the species back into the wild at present is not a viable option as the threats to the habitat and the species are still present. The species is currently under the Regional Collection Plans (RCP) for speciose *taxa* category 2: research (b) (Furrer & Gibson, 2008) under which the species is undergoing general research; the species has been recommended for a clearly defined pure or applied research that includes knowledge of natural history, population biology, taxonomy, husbandry or disease and health management (Koldwey et al, 2008).

1.5 Diet and feeding behaviour

1.5.1 Food preference: The only study on the diet of *E. platycephalus* performed in the wild (Sotgiu et al, 2008) reports that is a carnivorous species that feeds on small invertebrates. Males prey on more varied *taxa* than females (“Zirichittaggi” personal communication) due
to the sexual dimorphic nature the species; there is a tendency for larger individuals to take larger prey in addition to the smaller prey (Wells, 2007) females may be limited to. The diet of *E. platycephalus* varies seasonally according to activity levels and nutritional needs. *E. platycephalus* larvae feed on mosquito larvae, blood worms (Chironomids and *Glycera sp.*), sludge worms (*Tubifex tubifex*), very small aquatic crustaceans and tadpoles (*Hyla sarda* and *Discoglossus sardus*). Oophagy can also occur in some cases (Sotgiu et al, 2008).

1.5.2 Feeding: Sight is the dominant sense in prey detection. Movement of the prey is the stimulus that triggers the feeding response. Olfaction is also used to find prey but is secondary to sight and is used in dim or dark conditions (Stebbins et al, 1995). Water vibration sensed by the lateral line is also used to detect prey. Once prey is found the mouth is opened very rapidly and the prey is sucked into the mouth.

1.6 Reproduction

1.6.1 Developmental stages to sexual maturity: Once hatched the young are between 4 - 5mm in length, at 6 months they are 20 - 30mm, 60 - 70 mm at 1 year and 80 - 90 mm at 2 years. Metamorphosis occurs at 7 months (French Urodela Group, 2005) however, in some cases can occur between 14 - 15 months of age (Alcher, 1980; “Zirichiltaggi” personal communication).

1.6.2 Age of sexual maturity: *E. platycephalus* reaches sub-adulthood at about 17 to 18 months old. At 18 months, both males and females are sexually mature. First mating can occur from the age of eighteen months onwards (personal observation).

1.6.3 Seasonality of cycling: Mating occurs all year round (French Urodela Group, 2005) and observations have shown that reproduction peaks in the summer months in the centre of Sardinia. The conical shape of the female cloaca supports fertilization in flowing water during the rainy season as it assures penetration of the males’ spermatophore.

1.6.4 Clutch size: The number of eggs laid varies from between 50 - 230 (Boehmer et al, 1999). Eggs are 3mm in diameter. With the gelatinous envelope they are 4 to 5mm in diameter (Boehme et al, 1999).

1.6.5 Birth details and seasons: Eggs are laid over a long period from 3 - 5.6 months (IUCN et al, 2009). Deposition sites are usually swept by light oxygenating currents that are thought to prevent mildew formation.

1.7 Behaviour

1.7.1 Activity: *E. platycephalus* are diurnal (Andreone & Luiselli, 2000) and are possibly the most aquatic member of the genus. They can be found in water throughout the year. *E. platycephalus* usually hibernate and aestivate on land apparently in the vicinity of water during the autumn months of September through to November (Boehme et al, 1999).

1.7.2 Locomotion: In water, *E. platycephalus* either walks along the bottom or swims in the water. On land, *E. platycephalus* can walk, trot or run (O’Reilly et al, 2002).
1.7.3 Predation: *E. platycephalus* is able to prey on the tadpoles of other amphibian species such as *Disclogossus sardus*. *Natrix maura* has been observed preying on *E. platycephalus* (“Zirichiltaggi” personal communication).

1.7.4 Sexual behavior: Mating can take place in April and May, after hibernation, or after aestivation in the autumn. Mating takes place in the water. Females produce pheromones at a higher level during the breeding season. Males actively search for females. If a female is encountered the male grips her in the trunk with his jaws. This is a form of mate guarding (Wells, 2007) as well as supporting mating in running water. Unready females will struggle and bite until they are freed (Salthe, 1967). The male then proceeds to find a suitable place for mating, carrying the passive female in his jaws. This searching behaviour can last for several hours. The male then curves his body so that his tail lies over the tail base of the female, and his hook-like extended cloaca lies under her tail in the cloacal region. The male then strokes the female’s cloaca with his hind limbs (Salthe, 1967) for a period of time before transferring his spermatophore. Spermatophore transfer can take place directly or with the aid of the spurs on the hind legs of the male (Boehme *et al*, 1999). The female shows no observable responses during courtship, being held captive throughout (Salthe, 1967). There is a tendency for females to select larger males for mating. In a species with such a forced mating technique, selection for larger males is stronger (Bovero *et al*, 2002).

SECTION 2. Captive management

2.1 Enclosure

2.1.2 Substrate: Coarse gravel laid out flat at the bottom of the aquarium with a high number of pebbles in the middle. A terrestrial part is not essential as *E. platycephalus* can remain aquatic through out the year in captivity.

2.1.3 Furnishings and maintenance: Maintenance differs between adults and larva. For adults, an internal pump is necessary with a medium debit and quick cleaning set up. The pump, depending on its size, must be cleaned regularly to maintain good filtration and a maximum debit. If this is not done bacterial deposits in the filter can build up causing diseases such as pathogenic mildew which affects the extremity of the tail. *E. platycephalus* is particularly susceptible to this. 20-30% water changes occur at regular intervals, larger water changes can stimulate mating and egg- laying which corresponds with the beginning of the spring rains in its natural habitat. Water temperature should be kept between 10.0°C to 15.0°C during the winter months of December through to February, 15.0°C to 20.0°C in the spring months of April through to June and peak at a maximum of 24.0°C during the summer months of July through to September. Hibernation during the winter months at low temperatures is the key to the successful breeding of this species. Avoid keeping this species, particularly individuals coming form the region of Sette Frattelli, in temperatures below 10.0°C.

Larvae require shallow water (approximately 3.5cm deep) with small pebbles as a substrate. Plants such as *Vesicularia dubyana* can be placed in the tank to improve oxygenation of the water, provide shelter and can also be used as a support for eggs. Spot cleaning should be carried out three times a week (especially after day feeding) using a turkey baster or net to remove detritus. During water changes, water conditioners for aquariums (e.g. aqua plus and
aqua safe) should be used remove any hazardous chemicals from the water. An air diffuser can be used in the tank to keep the water well oxygenated.

For eggs of this species, a large flat tank should be used. Water depth should be at around 3 to 4 cm, renewed at least twice a week and be kept between 18°C to 20°C. A membrane pump with a weak debit can be provided until hatching occurs however this is not absolutely necessary (French Urodela group, 2005).

2.1.4 Environment: Aquaria should not be exposed to direct sunlight as they may over heat. Good luminosity with some exposure to sun light during the afternoon hours supports egg-laying. Natural photoperiods should be used to expose the species to its natural daylight hours; 9 - 10 hours of light mid winter and 14 - 15 hours of light mid summer.

The eggs of this species should be housed in a tank in a dark area to prevent the formation of algae (French Urodela group, 2005).

2.1.5 Dimensions: 30 x 60 cm aquariums can be used as a minimum to house three adult individuals. For larva, tanks of 40 x 25 cm can be used to house a maximum of 5 individuals of the same size (French Urodela group, 2005).

2.2 Feeding

2.2.1 Basic diet: Food variety is fundamental for successful keeping and breeding. Diet differs between young larva and adult individuals. Newly hatched larva can be fed tiny Daphnia pulex that are clean and free of Cyclops (Cyclops can consume larva) or small Tubifex tubifex cut into pieces. Mosquito larvae may also be used; benefits associated with mosquito larva include oxygenation of the water and they do not pollute the water. Blood worms (Chironomus sp), and C. plumosus, and their larvae, can also be fed in moderation to newly metamorphosed larva as well as small earth worms of about 2 to 3 mm in diameter cut into 10mm long pieces. Adult individuals should be fed a variety of food such as C. plumosus and small earth worms of 6cm in length. Trichopterid and Plecopterid larvae along with gammarus are favourably accepted by the adults (French Urodela Group, 2005).

2.2.3: Method of feeding: Feeding should occur during the day. Food should be dropped into the aquarium close to the individuals.

2.2.4 Water: Regular 20-30% water changes should occur to ensure the maintenance of good water quality. Larger water changes may dramatically alter water parameters and this may be highly stressful.

2.3 Social structure

2.3.1 Basic social structure: In captivity a 1.2 sex ratio should be maintained as repetitive mating with the females can cause stress and eventually lead to death of the female. Larva should be allocated according to size with each tank holding three individuals of approximately the same size. Tanks holding eggs should contain only six to eight. Individuals that have originated from the same sites should be housed together (French Urodela Group, 2005) as individuals from different sites may have evolved in a different way and may expose
individuals to diseases never encountered before. This may have negative implications for possible future reintroductions.

2.3.2 Changing group structure: Group structure for larvae should be changed according to their size. Only individuals of the same size should be housed together.

2.3.3 Sharing enclosure with other species: This should be avoided as *E. platycephalus* is a predatory species. There is also a risk of spreading diseases between the species which may have a detrimental impact on both species.

2.4 Breeding (fig. 8)

2.4.1 Mating: This occurs in water and can last up to several hours. Multiple shelters need to be available for adult females to provide an escape from repetitive mating with the males. As a female approaches a male before mating his tail ripples slightly before holding the body of the female in the pelvic area with his tail in such a manner so as to immobilize the female (fig. 7). The male then places his cloaca against the opened cloaca of the female before transferring a single spermatophore, sometimes with the help of the hind legs. The female makes half a turn, while biting the male, to try and release his grip. Once in amplexus the male relaxes his hold, but does not separate himself, when there is no resistance from the female (French Urodela Group, 2005). Behavioural changes associated with sexual activity for both the male and female require further research.

Fig. 7 shows a breeding pair in amplexus. The pair often bites each other during mating. Bite marks can usually be seen on females due to the well developed jaws of the males (French Urodela Group).

2.4.2 Pregnancy/ egg laying and incubation: Females lay their eggs over a period of 3 to 5 ½ months (Boehme *et al.*, 1999). They deposit and attach their eggs to the underside of stones and at the base of plants, lodged between the twigs roots and pebbles (Arnold & Ovenden, 2002, Alcher, 1975, 1980, 1981) by extending their conical cloaca into a tube. Females will also lay eggs on artificial woolen spawn mops (Personal observation). The eggs firmly adhere to the substratum of plants. The eggs are translucent and the whitish embryo is visible inside (French Urodela Group, 2005).
2.4.3 Hatching: The larvae hatch after about 4-5 weeks depending on the temperature. Embryonic development takes approximately 37.5 days at 15 °C and 12.5 at 24.5 °C (Boehme et al., 1999). 17.0 °C – 20.0 °C is the optimum temperature for embryonic development. Only about 50% of the eggs in captivity are viable. The other 50% may not survive as they are not fertile or go mouldy (French Urodela Group 2005). Mouldy or infertile eggs should be removed to prevent the spread of mould to the developing eggs. The hatched embryo is between 10 to 13mm and can be discerned by their black eyes and lack of balancers on the body (French Urodela Group, 2005).

2.4.4 Development and care of young: Larval development is temperature dependent. At 15.0 °C development takes from 376 - 453 days, at 20.0 °C development takes 184 to 260 days (Boehme et al., 1999). The larvae are very sensitive to pollution at this stage. It is not necessary to feed the larva during the first 10 days after hatching as they sustain themselves on their yolk reserves. Water must be well oxygenated and renewed frequently as larva are very sensitive to mildew. The larvae begin to eat after 10 - 15 days (French Urodela Group, 2005).

Fig 8: Breeding, reproductive and larval stages of *E. platycephalus* (French Urodela Group).
2.5 Handling

2.5.1 Individual identification and sexing: Photographing individuals can be used as an identification method (Ferner, 2007). *E. platycephalus* has its own naturally occurring variation in markings. Photographs of the ventral areas of each individual will provide individual recognition techniques from the variation of black dot patterns that are present on the males and females. Photographs should be sharp and shadow free, with good colour rendition (Heyer et al, 1994). Further research is required for marking individuals however, for potential marking techniques please refer to Ferner, 2007.

2.5.2 General handling: This species should be handled very carefully. Gloves that are talc free (talc may irritate the skin of the individual) should be used during handling as they protect the skin from abrasion, contamination between the species and the handler and the spread of infection (CCAC, 2003). Gloves also reduce the transmission of heat from the handler to the specimen. Contact with the tail should be particularly avoided if possible as it will easily break off; this may influence future growth and reproduction as it will deprive the individual of fat stores (Derickson, 1976; Bellairs & Bryant, 1985). When handled out of water 5 to 10ml of water should be poured over the specimen to prevent it from drying out (Heyer et al, 1994). When moving eggs from their initial tanks to separate them, their primary support should always be used. When carrying out individual recognition techniques on larva or neotenic adults it is important to avoid contact with the gills as they are easily damaged. If any surgical procedures need to be carried out all equipment must be thoroughly sterilized before and after. Handling the species for measurement should be done so carefully. It is important not to pull on the animal if measuring length as the vertebral column is quite flexible and doing so will stretch the animal and causes it harm (Heyer et al, 1994). The individual may become thermally stressed due to heat transfer from the hand of the handler so it is important to handle the individual quickly and efficiently (CCAC, 2003).

2.5.3: Catching / restraining: The need to restrain individuals in captivity is quite rare. If restraint is necessary an open flat hand should be used to apply even pressure over the individual’s entire body (CCAC, 2003). Anesthesia can be used during certain techniques involving surgery. A solution of 30% ethyl alcohol can be used in water as an anesthetic agent. The individual should be carefully placed in the solution. Once the specimen is completely flaccid or does not move when nudged with a blunt probe it is completely anesthetized. Other anesthetic agents include a solution of equal parts of saturated benzocaine solution and water; MS 222, or tricane methanosulphonate in water solution ranging from 0.03% to 0.05%. The anesthetic solution should be at pH 7.0 to prevent damage to the skin especially with MS 222 (Heyer et al, 1994).

2.5.4 Transportation: Transportation of *E. platycephalus* should occur in a darkened condition. Plastic bags make ideal transportation containers. Glass or plastic containers should not be used during transportation as the animals can rub against it resulting in injury. The animal should be able to hide so shallow water with small natural plants floating in it should be provided (Indiviglio, 1997). The transportation container should be packed within a Styrofoam cooler to prevent sudden changes in temperature and to provide a buffer against temperature extremes (CCAC, 2003). If water temperature needs to be increased for any reason a hot water bottle with cool water can be used. To cool the Styrofoam container one can use freezer icepacks. Take temperature readings before the trip to determine how much of the cooling or heating element to use and for how long it retains its effectiveness (Indiviglio, 1997). The transportation container should be kept out of direct sunlight. The packing
containers should be placed in a rigid outer shipping container. To prevent jarring during transport, crushed newspaper or foam packing chips can be used to support the packing containers within the outer shipping container. It is advisable to avoid shipping if weather forecasts predict very hot or very cold temperatures (CCAC, 2003).

2.5.5 Safety: As with all amphibians, disposable powder free gloves should always be worn to prevent toxins coming in contact with the skin and to avoid the spread of harmful microorganisms such as salmonella being transmitted to the handler.

2.6 Specific problems: considerations for health and welfare
This species is very sensitive to mildew and pathogenic fungus that attack the eggs and larva. Good water quality and well oxygenated aquariums are essential to help prevent this. Adult species are very sensitive to *Saprolegnia*, a fungus infecting the extremity of the tail. A 3% methylene blue solution can be used to treat this (French Urodela Group, 2005); soak the individual in the solution for one hour. Regular cleaning and good filtration of the aquarium help prevent this. The jaws of adult individuals sometimes succumb to an infection which is characterized by the removal of the skin on the infected area. The individual is not able to eat and eventually dies; further research is required to determine how to treat this. The accumulation of water in the body of an individual is a common yet significant problem. A simple shot with a needle through the skin of the animal stimulates the withdrawal of the accumulated water (French Urodela Group, 2005). The diagnosis of specific diseases in individuals is not easy as sick animals usually show similar symptoms with a variety of causal agents. Daily observation and visual examination is usually the best way to determine variations from the norm (CCAC, 2003).

2.7 Recommended research
The use of UVB in the environment, if necessary, is an area that requires further research to determine the exposure lengths and strengths that may be needed to successfully keep the species; however, using natural light is generally thought to be the better option.

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SECTION 3. References


French Urodeles Group, 2005, *Euproctus platycephalus: Keeping and Breeding*.


