Biology Curators Group Newsletter

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1b soil cannot be kept clean, so frequent changes are necessary

1c peat, like soil, cannot be kept clean, and it is likely to harbour parasites and disease;

1d leaf litter also cannot be kept clean, but it is a good medium for nervous ground dwelling species, so long as it is changed frequently;

1e gravel is by far the best substrate, because it is easily removed and washed and is available in a variety of colours and grades. The smallest grade I would advise for use is 7mm; anything smaller could be consumed by the animal. For larger snakes, such as the pythons and boas, large pebbles are best.

2 Furnishing - the loose fixtures that are placed in the cage to create a more natural look, such as branches, logs, pieces of bark and rocks. These need re-newing or cleaning from time to time to keep the cage hygenic. The choice is purely a personal one, as one branch may be a good shape to one keeper but not to another. All loose furnishings should be positioned so as not to hinder the keeper when servicing the cage and to offer the animal a feeling of security.

The use of live plants in a display should only be attempted if natural daylight is available, although this point is much argued amongst herpetologists. Plastic plants are a good substitute, they add colour and provide the viewer with a more natural looking scene, and they can also be removed for cleaning.

3 Heating is the most important factor if healthy and lively stock are to be maintained. There are numerous ways of heating a cage:

3a Heat pipes running along the front or rear of the cage; these can be electric, oil or steam. At the Cotswold Wildlife Park we use oil pipes along the front of the cages controlled by a thermostat at source.

3b Cables can be positioned below a substrate or above the animals in the cage. These have a disadvantage in that they can be exposed and the chances of accidental damage to the animal are increased.

3c Spotlamps can be used to heat a small cage from above, or as additional heat to create hotspots. If they are the only source of heat and light they cannot be used to the full effect because thermostatic control of temperature will leave the cage dark for periods of the day.

3d Heatpads can be used under a substrate or can be fixed on to a wall out of view in small cages.

It is best to have all heat elements well covered so that animals cannot come into contact with them and they cannot be seen.

4 Lighting is an important aspect of creating a cage environment. Fluorescent tubes are probably the best as they come in various lengths and sizes; they are best positioned out of public view.

Blacklight is used by some herpetologists for some species but is the subject of considerable debate.

Snakes do not require the use of blacklight at all, it is only various species of lizard that thrive from its use. A tube we use at the Park is the Philips Blacklight 09, this peaks between 290nm and 310nm which is the desired range for the species we exhibit.

Ultra-violet lights should never be used as these can be harmful to the animals. All lighting should be set on a cycle so as to create a photoperiod for the animals; the photoperiodic timing varies according to the species.

Correct timing of heat and light cycles can induce breeding in the captive animals.

Finally when displaying animals for the public some form on interpretation is necessary. At the Park we use formica labels giving the family name, where the animal comes from, the common name, the Latin name, its distribution range and its diet. We keep the information simple to create an interest in the animal on the part of the viewer. Further information can be obtained by asking a member of staff or using a reference library. We find that labels containing too much information have an off-putting effect and are not read or not fully understood by our visitors.

5

Sexing and Breeding Reptiles and Amphibians

Adam Wright, Herbert Art Gallery and Museum, Jordan Well, Coventry.

One of the more neglected areas of research in relation to live animal displays in museums is probably that of inducing captive livestock to breed. I believe that this should be a primary objective for the keepers of museum vivaria and many techniques are now available for inducing a mating response in display animals.

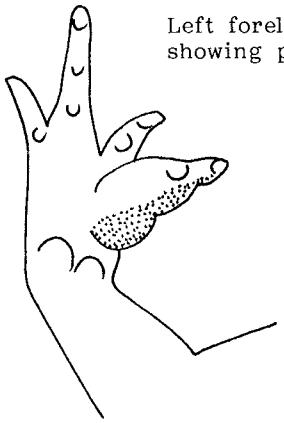
However, if breeding is to be encouraged both sexes must be present and, perhaps surprisingly, this can present problems for the keeper dealing with amphibians and reptiles. Whilst it is true that the males and females of some species are very difficult to distinguish, the majority of species can be sexed with a little care. This paper discusses the more commonly practised methods of sexing for these groups.

Anura - Frogs and Toads

One of the most easily discernible features of certain frog groups is the possession of inflatable vocal sacs which the males use to attract females - usually at night. When calling, the vocal sacs are filled with air and easy to see. On male specimens not in voice, the presence of a vocal sac can be determined by a folded wrinkly appearance to

the skin in the region of the sac. Females lack a vocal sac. Although not all male amphibians have vocal sacs, many Ranids, Rhacoporids, Bufonids and Hylids can be sexed in this manner.

During the breeding season the males of many Anuran species develop nuptial pads - the hardened growths on the forelimbs which are used by the male to grasp females during amplexus. Whilst these provide an easy means of sexing frogs in breeding condition, the nuptial pads are absent outside the breeding period. It is perhaps worth mentioning that Spadefoot toads (Pelobatidae) have horny growths on their hind feet to aid digging at all times of the year and in both sexes. These have no significance in terms of breeding function and in fact true Spadefoots (genus Pelobates) do not develop nuptial pads at all.



Left forelimb of male Anuran, showing position of nuptial pad.

The females of many frog and toad species grow significantly larger than males and generally appear more robust. This can, of course, be hard to quantify! Certain Anuran families can be sexed by means peculiar to that family, for example the Discoglossids (which include the commonly kept Bombina orientalis) can readily be sexed by forelimb shape. Male Discoglossids have much thicker front limbs than females.

Caudata - Newts and Salamanders

Doubtless we are all familiar with the sexual differences in breeding dress of our native newts - where the males become brightly coloured and develop body and/or tail crests. Such crests are also developed by many non-British species of newt but give little help in sexing specimens outside the breeding season; many species do not develop fancy display garb at all.

The most reliable method for sexing adult Caudata is to look at cloacal shape. In males the cloaca appears considerably swollen in comparison to that of a female.

Chelonia - Tortoises, Turtles and Terrapins

For most species of Chelonian, plastron shape gives a good guide to the sex of the individual. The plastron of males is normally concave, whilst that of females is flat or even convex. Unfortunately, this character is not readily seen in juveniles - nor, of course, is the fact that for many species females grow considerably larger than males (although this can be helpful in adults).

The tail of a male chelonian is normally longer than that of a similarly sized female of the same species, but the degree of difference varies greatly from one species to another. This fact provides an extremely easy method of sexing Testudo hermanni, Hermann's tortoise.

There is also a considerable difference in the tail length between the sexes in the Red-eared terrapin Pseudemys scripta elegans. However, these can be sexed even more easily by looking at the front claws on adult specimens. Males develop absurdly long claws which they use in courtship dance prior to mating.

Squamata: Lacertilia - Lizards

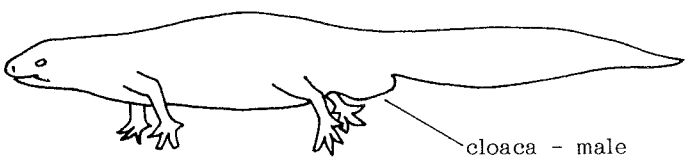
A large number of lizard species show quite marked sexual dimorphism. This may be in terms of colour (eg Sand lizards, Lacerta agilis), or physical adornment (eg the 'sails' on Basiliscus spp in males, or the bright throat-pouches in Anolis spp).

Needless to say many species are less cooperative and do not have sexually dimorphic colour patterns or specially adapted structures. Worse still, some lizards, particularly Agamids and Cordyliids, can cause further confusion through their ability to change colour. Thus the dominant male in a colony will display breeding male colouration, but other males in the group will adopt female colouration to show their submissiveness! Obviously care is needed in selecting 'pairs' on colour alone.

Reliable, constant characteristics are, however, exhibited by many species.

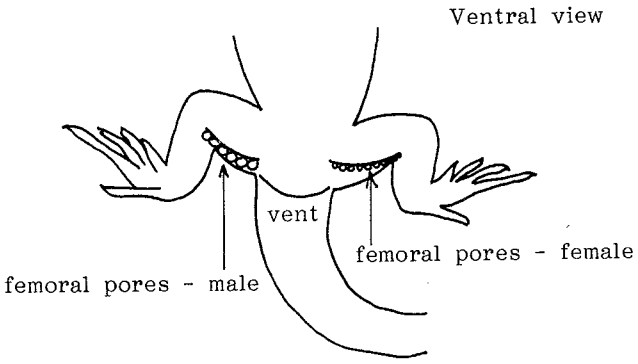
Secondary sexual characteristics such as the degree of enlargement of femoral pores can provide an easy means of sex determination in many Iguanids and others, including families such as Gerrhosauridae where sexing would otherwise be difficult. The femoral pores are much larger in males than females.

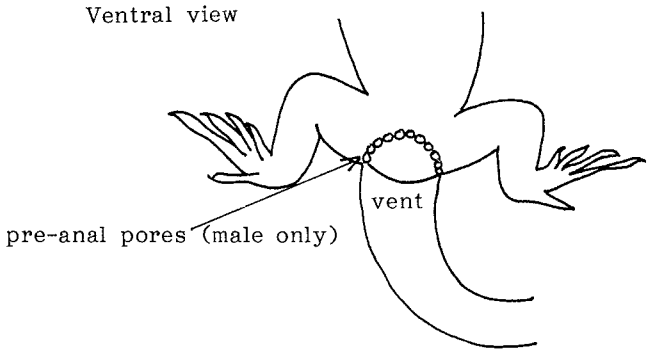
Another secondary sexual characteristic akin to femoral pore development is that of pre-anal pore development exhibited, for example, in Eublepharine Geckoes. Here the row of pre-anal pores is pronounced in males, but scarcely developed in females.



Because these pores are secondary sexual characters, the differences are unfortunately not discernable in juveniles.

Male lizards have a swelling at the base of the tail which is absent in females, but this is not always easy to see.





Squamata: Ophidia - Snakes

Perhaps because so few snakes show any sexually dimorphic colouration - the Adder, Vipera berus, is a notable exception - and lack (obviously!) femoral pores, they seem to cause most problems when it comes to sexing.

I have frequently heard claims that Boids can be sexed according to the length of their claws - the external remnants of their hind legs - but do not feel this method is at all reliable even though these claws are undoubtedly used only by males during the courtship rituals.

In virtually all species of snake the male has a tail of proportionately greater length than the female. In some species such as the Puff Adder Bitis arietans this makes snake sexing easy whilst in other species such as Blood Pythons Python curtus the method is useless.

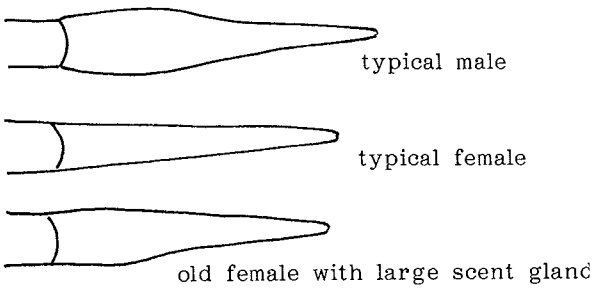
Happily, most Colubrids fall between these two extremes, and sexing by relative tail length is often possible. It is most easily accomplished by performing a subcaudal scale count. For any species, the number of subcaudal scales, although variable, will cover a set range. If, for example, this range is 50 - 80 subcaudals, then most snakes with a count of 50 - 60 subcaudals will be female, and those with a count of 70 - 80 are likely to be male. A subcaudal count in the middle of the range gives no real clue as to the sex of the specimen. Unfortunately, 'rogue' specimens with unusually short or long tails for their sex also occur, although fairly infrequently. Wright (1987) lists many known subcaudal ranges. If one is faced with a number of snakes for which one does not know the subcaudal count range, choosing the snakes with the highest and lowest subcaudal counts will normally produce a 'true pair'.

The tail also differs in shape between the sexes. This is because the male's hemipenes, when not is use, lie inverted in the base of the tail, facing the tail tip, causing a swelling immediately behind the vent. This swelling will be present in sub-adult and adult specimens, and provides an easy method of sexing for many species. Females lack this swelling in most instances. This difference is most obvious when looking at the underside of a snake, but a difference between males and females can also be noted in side view. The rapidity of tapering from vent to tail tip is much greater in female snakes than males, so a female's tail rapidly becomes thin behind the vent.

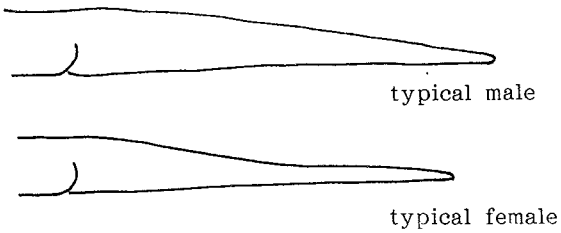
However, in certain genera, perhaps most infamously Lampropeltis, older females possess massive scent glands at the base of the tail, resulting in large swellings similar to those caused by male hemipenes. These also make interpretation of side view tapering difficult.

In such cases it is necessary to revert to subcaudal counts, or if available, probing.

Ventral view



Side view



Snake probing is an extremely effective method of sexing snakes, but should only be undertaken by someone with considerable experience. By inserting a narrow, blunt rod at the vent, in the direction of tail tip, it is posible to determine the sex of the snake from the distance the probe can be inserted. In snakes of roughtly equal size the probe can be inserted considerably further in males than in females, since it travels down inside the inverted hemipenes.

Probing is not recommended for beginners, and the possibility of causing irreparable damage to small or hatchling snakes is considerable.

For sexing hatchling snakes (where probing is inadvisable), the subcaudal count method is useful. Bear in mind that this method can easily be performed on a cast skin, thus avoiding the possibility of stress to the hatchling.

Another method of sexing hatchling snakes relies on their nervousness, and is known as 'popping'. It is a certain, and apparently safe method, of snake sexing. Baby snakes can easily be encouraged to evert their cloacas, and in the case of male snakes this causes the paired hemipenes to 'pop' out. These are readily seen as a pair of dark red protruberances at each side of the vent. Many Lampropeltis and Elaphe hatchlings will evert their cloacas on handling; others can be encouraged to do so:

> Hold the snake ventral side uppermost; gently run your thumb along the base of the spine towards the tail tip. When you pass the cloaca and touch the base of the tail, gentle pressure combined with a reverse of direction is usually enough to get a snake to 'pop'. If the snake does not wish to comply, do not force the issue.

Eliciting a mating response

Reptiles and amphibians in the wild usually have set breeding seasons which are controlled by external climatic factors. These factors also trigger off mating responses in captive specimens. Thus by manipulating light/dark cycles in the vivarium to comply with those the animal experiences in the wild, together with appropriate changes in temperature throughout the seasons, one may induce a mating response. Certainly for many temperate species a cool winter resting period is a prerequisite for subsequent successful breeding. It is also advisable to separate the sexes at the time, reintroducing them in 'spring'.

Some amphibians from temperate areas can conveniently be placed in the fridge for a few weeks - this has been successful for Green Tree Frogs Hyla cinerea.

In the wild, Axolotls spawn in the coolest part of the year, and the addition of ice-cubes to the water in January or February will often induce spawning.

Mating responses in species from tropical areas, where day length is constant throughout the year, are triggered by other factors. For example Royal Pythons, Python regius, and Common Boas, Boa constrictor, both mate in December, a dry part of the year in their area of origin. Other species, however, appear to be stimulated by spraying lightly with water.

Care of eggs

In most amphibians, where fertilisation is external, the spawn can be collected, incubated and hatched in a short space of time. Pregnancy in reptiles, of course, follows a different pattern, and several weeks or even months will pass between copulation and egg deposition or birth of young.

As pregnancy progresses the shape of the reptile changes considerably as weight becomes distributed towards the posterior end of the animal. Many gravid snakes cease feeding.

For snakes it is possible to predict accurately the time of egg laying from the pre-laying slough. In the North American Columbrids, such as Elaphe or Lampropeltis, eggs are laid 10-12 days after shedding.

If a 5 litre ice-cream tub of moist sphagnum moss is offered to the snake about a week before laying, this will do much to reduce its nervous activity. Otherwise the snake will often rub its nose whilst hunting for a suitable egg-laying site. The container should be sealed, but have a hole cut in the side for access and egress. Failure to provide such a laying area can result in the eggs being laid in the water bowl and thus lost.

Although some snakes, eg Pythons, incubate their own eggs, I feel it is safer to remove eggs for artificial incubation.

I incubate all eggs in 'micafil' loft insulation material (vermiculite) and vary the humidity according to egg type. For 'soft' shelled eggs eg snakes, most lizards and aquatic chelonia, I recommend equal weights of water and micafil. For 'hard' shelled eggs such as land tortoises or some geckoes a lower humidity is required. I use a sealed container, and remove the lid each day in order to let fresh air circulate. It has been suggested that kyphosis is caused by oxygen deficiency, therefore if it is impractical to remove the lid regularly a container with air-holes in the lid should be used (although moisture-levels must then be checked regularly).

Ideally each egg should be separated from all others so that if one egg perishes and becomes mouldy it will not automatically infect the remaining eggs. However, snake eggs are covered in an adherent fluid when laid, and although I prefer to separate the eggs if possible, if a clutch is securely stuck together they can be successfully incubated 'en masse' although the risk of fungal spread increases.

Incubation temperature can fluctuate within the adult temperature tolerance range, although a constant temperature results in a more rapid hatching. Aim for a constant 28°C for most species - I would advise against temperatures over 30°C. Bear in mind that in some reptiles at least temperature dictates sex (particularly late in incubation period), therefore too high or too low a temperature may yield an imbalanced sex ratio in hatchlings.

After breaking the shell, the reptile remains in the egg whilst it absorbs the remains of the yolk sac. This period varies, but is normally longer in Chelonia than Squamata, and may be two or three days in the former.

Recommended reading

General works

Mattison, C. THE CARE OF REPTILES AND AMPHIBIANS IN CAPTIVITY. 1987 (1982). Blandford Press, Poole, Dorset.
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Welch, K R G. HANDBOOK ON THE MAINTENANCE OF REPTILES IN CAPTIVITY. 1987. R E Kreiger Pub Co, Malabar, Florida
Zimmerman, E. BREEDING TERRARIUM ANIMALS'. 1986 (1983). T F H Publications, Ascot, Berks.

Specific aspects

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Thatcher, T (1987). Lizards in Confinement and their husbandry, parts 1 and 2. Monographs A S R A, 2 No 1 pp36-53.
Wright, A (1986) Notes on the captive breeding of the Florida Kingsnake, Lampropeltis getulus floridana, Blanchard, with observations on incubation of eggs and on the newly hatched young. J A S R A, 3 No 1 pp39-45
Wright, A (1987) Sexing snakes. Monographs A S R A, 2 No 1 pp2-10

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Remember: Beetle down is a two year campaign and 'Beetle-down to your local museum' is not a slogan which will become redundant, as long as natural history is found in museums ...

Paul Richards
Sheffield City Museum
0742 768588

Subscription rates are £6.00 for individual membership and £10.00 for institutional membership. Contact Adam Wright, Herbert Museum, Jordan Well, Coventry, for application forms.

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