

**WORKS ON THE VARANIDAE, TRANSLATED FROM VARIOUS
LANGUAGES INTO ENGLISH: PART II.**

This is the second in the series of translations of notable works about monitor lizards. Like the previous compilation, it has relied entirely on the generosity of the translators, who gave their time and effort for no reward. Although I have tried to minimise the errors induced by translation, some may remain, and I would be grateful to be made aware of them. This collection is to facilitate scientific research. It makes no claim on the copyright of any translated works and should not be used for any purpose other than private study. The translations are designed to be read along with the original, and give no figures or references.

This second set of translations is dedicated to the memory of Salah-ah-Din Yusuf, 1138-1193.

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FROM: BOHME, HORN & ZEIGLER, CONT.

p129. 4.1 Problems of taxonomy.

The example of *Varanus karlschmidti* shows how risky it can be to establish new names in an area of a variable complex of types without first evaluating the available synonyms, including the underlying defining characteristics (Bohme1991). Taking everything into consideration the point is to examine whether the names referring to Pacific monitors are 1) available and 2) relevant to the type described here. We shall go through them in chronological order and discuss them individually.

Monitor douarrha. Lesson 1830. Located at Port Praslin, New Holland (=Praslinhaven, New Hebrides, Bismarck Archipelago). According to Brygoo (1987) the holotype of this name is not supported (by implication "only one example of this kind") which makes certain interpretation of this identification impossible. So we have to class it as an unproved and dubious name and useless for the purposes of typology, particularly since the possible location of this type is home to more than one kind and therefore no certainty can be achieved.

Varanus kalabeck Lesson 1830. Location: kalabeck in the native language of the island of Waigeu. According to Brygoo (1987) the paratypes (series of types) cited by Peters and Doria (1878) and among others by Mertens 1942, 1963) falsely as *Monitor kalabeck* Lesson 1830 are lost. As with *Monitor douarrha* the original description provides too little for a definite identification of that name. The diagnostic characteristics quoted later do not tally with the type-evidence nor with Lesson's name. Our research in RMNH indicate an indicus type. Even supposing that three very similar types lived together on Waigeu

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Monitor chlorostigma, Gray 1831. Locality Rawack Island, north of Weigeu. Even if this name were not identifiable in his two and a half lines of original description, it is possible that the holotype existed in Paris with the number MHNP 2202 (1536) (Brygoo 1987). It is a young specimen, 261mm in total, and from the distribution of its scales (especially the S character), the colour of its tongue and the markings on its belly, it is clearly identifiable as a real *V.indicus* - shown in plate 7. So the name *chlorostigma* is useable as a synonym for *V.indicus*.

-*Monitor doreanus*. A.B. Meyer 1874. Locality: New Guinea (dore) (= Doreh, Bonen* Peninsular, NW New Guinea).

Although the holotype of this name was destroyed in the Second World War in Dresden (not in Berlin as Cogger et al 1983 believed) (Good et al 1993), its old number Ns. MTKD Realkatalog no.26 (Obst 1977) A.B. Meyer's very complete and precise description permits a clean taxonomic classification. Meyer identifies the new kind with *Monitor chlorostigma* D.B. which he assigns to New Guinea, Naffpr*, Mysore, and Jobi, and also recognises as widely distributed. *M.doreanus* is distinguished by having much smaller scales are progressively more in number (175 rows over the back); having 3-9 yellow scales standing together in large spots,

altogether forming bands; having a clearly striped tail and a very brightly marbled underside, and moreover, the rows of bigger scales over the orbit are enclosed by more rows of small scales; there are five rows of scales above the lips, and above all, the pattern of the head, where the high part at the back has only small markings (Meyer, p130).

The differences recognised here in scalation and pattern between *M.chlorostigma* and the typical *V.indicus* taken together, correspond with those which we related as a result of this work, to the white tongued Pacific monitor with a raised scale count (G, S, XY & M) and speckled throat (*Varanus*, see under *indicus*, Bohme 1991). Meyer's remark about a "very strongly marbled underside" excludes equally *V.jobiensis* and the population of New Britain, *, in that both differ from.... in New Guinea colloquially called the blue tailed monitor is different from *V.indicus* and *V.jobiensis* as well, but still it cannot be renamed. the criteria mentioned above, adduced by Meyer for his monitor *doreanus* (strongly marbled underside and high scale count) support the view that the Dresden Museum's holotype, destroyed in WW2 was identical with the twin type that we have described. We strongly propose a neotype for Meyer's variety and expand his original assessment. In addition, from the characteristic consistent undifferentiated white throat (variant?) of this monitor we recognise it as a new sub variety. In table 2 we present again the whole complicated story of the taxonomy and nomenclature of this group.

p.134.

Varanus doreanus A B Meyer)

Diagnosis, a twin type of *V.indicus*, differing from it as follows: a clearly higher scale count at the base of the tail (Q), in the middle of the body (S), along the sides of the body (XY) and on the throat (m). Consistent differences are the strongly marbled throat, a whitish or yellowish tongue and on the hemipenes 8-10 paraphyma bands* (against five at most (two in most cases) and 5 (instead of 3) pointed hemibacula. Neotype

Slender build. Total length 624 (240+384mm), back leg 113mm Nostrils much closer to snout than eye. canthus rostralis rounded, sharp-edged only in the pre-orbital area. nasal region raised, with a concave median ridge in the middle of the snout. Supraocular region with a differentiated row of 5 (left) and 6 (right) enlarged scales, but scarcely bigger than those on the frontal region. The transparent scale over the pineal organ is surrounded by a rim of smaller scales. Dorsal scales on the neck are smooth, elongated into ovals, and gradually into sturdier ovals, even changing into flat dorsal scales. Throat and belly scales flat, the throat 6 scales roundish oval, the belly scales stretched-out rectangles. the extremities are covered above and below with smooth scales, showing a slight ridge only on the forward and upper tibia of the hind leg. the scales of the tail are ridged, above and below; a ventral transverse row corresponds, as on the body, with a double row of lateral scales, to form the characteristic double ridged row on the dorsal edge of the compressed tail. particularly visible against the light coloured scales of the trunk, above and below and the extremities of the tail, there

is, instead of scales, a clearly visible conical * dimple not only on the head and foot surface. Individual scale counts of the neotype (for a resume of the details see the section "materials and methods").

Varanus (Odatria) prasinus beccarii (Doria, 1874), Pflege und Zucht.

Varanus (Odatria) prasinus beccarii; Care and Breeding.

Bernd Eidenmuller & Rudolf Wicker

Salamandra 28 (3/4):171-178.

Translated by M.J. Bennett.

General Remarks.

The distribution of *Varanus prasinus* and its subspecies (*bogerti*, *beccarii*, *kordensis* and *prasinus*) is confined to the IndoAustralian region (DeJong 1927, Mertens 1942, 1950, 1959, 1963, 1971a, Loveridge 1948, Keast 1959, Cogger 1964, Room 1974, Czechura 1980, Covachevich et al 1982, Greene 1986). *V.p.beccarii* is only known from the Aru Islands, southwest of New Guinea (Mertens 1942, 1959, 1963, Loveridge 1948). It has a black colouration in contrast to the light green varieties in New Guinea. *V.p.bogerti* is also black; it comes from Trobriand and the islands of the Entrecasteux Archipelago, south-east of New Guinea (Mertens 1950, 1959, 1963) Czechura (1980) also describes a *V.prasinus* with black colouration on the northern fringe of the Australian continent. Sprackland (1991) describes these as a new species *V.teriae*. He also re-classified the other members of the *V.prasinus* group, describing a second new variety, *V.telenestes* from Russell Island. This variety, like those of New Guinea, have a green ground colour.

Previously, little has been published about breeding of this group. Horn & Visser (1989) cite in their work a mating of *V.p.kordensis* at the Dallas Zoo in Texas. Carlzen (1982) describes another mating of this variety. The data from that report are discussed below. Wanner (1991) describes the first successful breeding in captivity of *V.p.beccarii* at Fort Worth Zoo, Texas. So far we know of no matings in Germany. Danzer & Dedlemer (both in personal correspondence) have several times had eggs laid, but no young hatched.

Accommodation of Parent Lizards.

In the wild *V.prasinus* is exclusively a tree dweller, as is simply demonstrated by reference to its truly prehensile tail (Mertens 1942, Czechura 1980, Greene 1986), with which it can keep a firm grip whilst climbing. We often observed this in our specimens. For our *V.p.beccarii* we built a terrarium 150 X 60 X 110cm. The enclosure was divided by a partition wall into two parts 75cm wide. To give the lizards access to both areas two holes were made in the partition, 15 X 15cm in size, one at the top back, the other in the middle at the front. These could be closed to separate the lizards if they annoyed each other.

The inside of the terrarium was lined with 2cm thick cork which we secured to the back and sides with ordinary silicone rubber from a hardware shop. This form of walling is remarkably robust and was ideal as the lizards could climb on it and make more use of the available space. The partition was lined from the bottom with a strip of cork 2mm thick, again using silicon glue. A number of fruit tree branches gave the

lizards further opportunities to climb. Half of the enclosure was lit with just on Phillips HPL 50W mercury vapour lamp. So that the lizards could warm themselves we put in each compartment a 12v 50W halogen radiant bulb about 20cm away from a branch where the lizards could warm themselves. On the floor we put bark mulch, regularly kept damp. To keep up the temperature and humidity by promoting evaporation, a further 5W heating cable was installed underneath the terrarium. Since the temperature in the room where the lizards are kept goes down to 18°C at night the warm cable was kept on continuously, which keeps the basic temperature at night at 23°C. Humidity was not measured regularly but varied between 60 and 85%. The periods when the light and heat lamps were kept on was not varied, because in the natural habitat of *V.prasinus* day length does not differ significantly.

The rest of the furnishings consisted of just one nest box, in a natural log, in each half of the terrarium (height about 45cm, diameter about 25cm, entrance 5cm) standing on the floor and half filled with bark mulch. Also one hollow cork tree branch and one rubber tree (*Ficus benjamini*). The terrarium was sprayed with a plant spray three or four times a week.

Behaviour of Adults.

To begin with the lizards were extremely timid and remained so for several months. Indeed, they seem from our experience to be very touchy about each other; occasionally they do not feed but when separated from each other they took food within a few hours. In the wild they are probably solitary and only come together for mating. These conditions were simulated by keeping the partition closed. At the same time it gave some control over their intake of food. Their diet consisted of dead mice, always reinforced with Tricrescovit vitamins. cockroaches (*Blaptica dubia*) and crickets (*Gryllus bimaculatus*). The insects were always treated with Korvimin ZVT. Food animals were proffered on tweezers. In the summer the lizards occasionally got freshly caught grasshoppers and leaf-grasshoppers given free in the enclosure, to provide some hunting. . Greene (1986) has shown by investigating the stomach contents of *V.prasinus* that in the wild they eat mainly orthopterans. Mertens (1971b) mentions that his emerald monitor ate bananas. Ours were occasionally offered vegetable food but they did not eat it.

Mating & Egglaying.

Moehn (1980) gives a very adequate description of mating in *V.timorensis*. Foreplay and actual mating are very similar in *V.p.beccarii*. For several hours the male pursued the female round both parts of the enclosure, sometimes so roughly that we considered separating them. After some time the male's display became less ardent, perhaps because of the female's behaviour, in that she tolerated his approaches. A little while later we were able to see copulation take place, with the lizards hanging on the cork wall. The male's backside was under the female's. The lizards stayed in that position with their eyes shut for about 90 minutes. Then they ran off and took no further notice of each other. Similar behaviour occurred several times between 19.12.90 to 6.1.91. After that no more mating was observed. Afterwards the lizards showed indifference to each other. When we found the female's girth increasing we separated them by closing the hatches. In the following days the female more often took refuge in the nest hole described above, but always emerged after a short while (fig 1). On 2.3.91 she resorted

to the hole again and stayed there until midday the following day. From outside it was not possible to see whether she had laid any eggs; her girth was not noticeably reduced. But on closer examination of the nest hole we found that eggs had been laid. Where the floor of the chamber had become damp because of the moistness of the bark mulch, the lizard had excavated a hollow of about 2cm and laid five eggs about 4.5cm long and 1.5cm in diameter, on the glass floor of the terrarium. We bedded them down in a previously prepared incubator. We put two eggs in perlite and the rest in vermiculite. With an incubation temperature of 27-30°C the eggs developed normally, the increase in (embryo) size and blood circulation was clearly seen by x-rays. The female took no food between the matings we observed and the laying her eggs. Also, after laying her eggs she showed no aggressive behaviour either towards her keeper or to the male (as Garrett & Peterson (1991) have observed), who now had the run of the terrarium.

Hatching and Problems of Rearing the Young.

Earlier experiences of rearing monitor lizards (Eidenmuller & Horn 1985, Eidenmuller 1986, 1989, 1990, Eidenmuller & Wicker 1991) and data from a variety of sources (Carlzen 1982, Horn & Visser 1989, Wanner 1991) lead us to infer an incubation period of 160-180 days. We have disregarded Carlzen's statement; he gives a temperature of 26.7 - 33.3°C. At that temperature the period of incubation was said to be between 57 and 70 days. In our view that can only be attributed to a mistake in the incubation period. According to Horn (1978) and our own experiences the incubation period of monitor lizards varies with body size of the parent animals (Eidenmuller 1989, 1990, Eidenmuller & Wicker 1991). Alteration of the temperature, in our view, cannot reduce the incubation period by 40% .

After 172 days, on 25.7.91 one of the eggs bedded in perlite was found to be open. A baby lizard was poking its head out (fig 2). It immediately drew back when the camera flash startled it. This lizard left its eggs on 27.7.91. To our surprise, the little lizard had a patterned marking. This is amazing, because as they grow up they are uniformly black. On its back it showed golden-green spots, on the sides 10 or 12 light sloping, stripes, running diagonally over the body across two or three lines of scales. Only the head was completely black (fig 3). The second baby opened its egg on 3.8.91. Here also the substrate was perlite. On 25.8.91 the next two eggs, in vermiculite, opened. Now the incubation period was 203 days. Data on the hatchlings and weights are given in Table 1 below. After being measured once the babies were excused from further examination on the grounds of their susceptibility to stress. They were first put into a shared terrarium 100 X 40 X 40cm furnished with several branches and a tube of cork. Here we also put bark mulch on the floor, which holds moisture well. Lighting was by an 18W striplight and for a source of heat an 60W * point radiator (Osram concentra) set at a distance of 20cm from a stone. We fed the youngsters on freshly caught grasshoppers and crickets (both laced with Korvimin ZVT) and chopped up baby mice. They first took food after ten days. We cannot determine the reason for different incubation lengths in different substrates. Our previous experience was that lizards whose eggs were incubated in vermiculite clearly hatched earlier than those in perlite (Eidenmuller 1989, 1990).

Unfortunately a problem presented itself a little while after hatching. On 7.9.91 three of the babies lay almost completely motionless and collapsed in their enclosure - perhaps

dehydrated. We treated them at once with 0.5ml Amynin (IFFA Merieux) intramuscularly. But their condition did not change. We re-accommodated them in other containers, with one 30W floor heater and only lined with damp cellulose, to raise humidity, but it brought no improvement. Each day the lizards were given an intra-muscular injection (0.5ml) of a mixture of Amynin and Aquifusal (ASID Bonz u. Sohn GmbH). Up to 10.9.91 there was no sign of change in their health, so they were handed to Dr B. Schildger at Frankfurt Zoo for examination. His diagnosis was that they were infected with salmonella. In spite of treatment with Binotal (Beyer, dosage 100mg/kg intramuscular) two of the lizards died. The other gradually recovered.

The colouration of the baby lizards described above did not persist for long. Three or four months after hatching the rows of gold-green spots had given way to the familiar glossy black of the adult lizards.

Thanks to Dr Schildger for his diagnosis and treatment of the sick lizards, to R.Stein for the successful production of this paper and to R.Danzer and A. Dedlemer who have provided us with previously unpublished data.

Erfolgreiche Nachzucht von Beccar's Smaragdwaran *Varanus prasinus beccarii*.

BIEBL, H. 1994. Monitor (Frankfurt) 3(1):37-40.

Successful Breeding of Beccari's monitor lizards *Varanus prasinus beccarii*

Translated by Florian Werner

General

Breeding of this monitor has occurred in several cases. Detailed information can be found in the works of Eidenmüller & Wicker. The conditions under which I have successfully bred them are as follows

My breeding group consists of 4.2 specimens in 200 X 80 X 220 highcm terrarium, including two baths, one for water and another for the dry part. Day temperature is 42°C in upper part of terrarium and 24.5°C close to the ground. At night the temperature sinks to 24-28°C throughout depending on room temperature and external climatic factors. The terrarium is furnished with real plants which have grown into a real jungle. In addition there are several branches with Bromeliads. Half of the ground is covered with water to 25cm depth fed by a waterfall. The water is kept in motion with an 850lph filter. It then flows through a ultra-violet steriliser and is heated to 26°C before being pumped into the waterfall. The ground part consists of "hydro-culture granulate which can be kept clean with a hose. Underneath the plants there is a drain for this water. The back wall is made of cork and pieces of hollow branches serve as hiding places to stop the animals damaging the plants. Within the dry part is a heat plate which can be switched on if needed. The sun inside the light box presses the air that has been heated there and slips into the terrarium and pushes to cooler air behind the terrarium. On the back wall there is a humidifier which maintains a humidity of 90% or more. It is rare that the water part is used by the lizards like to drink from the leaves when they have been sprayed with water. My green tree monitors, maintained under the same conditions, use the water extensively and can often be seen swimming and diving

Breeding

On 27 October 1993 one of my females laid three eggs on the ground of the terrarium. I was not able to observe the laying. They were collected and incubated as described previously (Biebl 1993).

Incubation

The eggs were incubated at 27.5-28.5°C with humidity of 80-90%. Their incubation time varies between 228 and 230 days and was remarkably above the time registered by Eidenmüller & Wicker and Eidenmüller 1992 of 172-205 days, even though the incubation temperature only differed by +/- 0.5°C.

Hatching

All three eggs hatched but the one from egg no 3, which was very small, died. It hatched after 230 days but lasted only a few days.

Comments

When comparing the two young animals it can be seen that they have very different markings. No. 1 was black and had a pale stomach. No 2 was equally dark it had a series of spots ranging from light to dark green over the back which disappeared after about 6 weeks. These animals can easily be identified as females

Thanks to Prof H.G. Horn for perpetual advice.

Catching and Exploitation of the Nile Monitor Lizard (*Varanus n. niloticus*) in the region of Lake Chad.

Vivian de Buffrenil. Bull Herp.Soc.Fr. (1992) 62:47-56.

Translated by Simon Marshall

The uses, methods of catching and traditional uses of monitor lizards are very rarely described and little known. It is very much part of the economic life of the villages of the area. They use them primarily for food although the meat is not generally appreciated and for several decades interest in monitor lizards has become more commercial. Thousands are caught for processing in tanneries in Europe. In 1988, for example, more than 700,000 skins left Africa legally. This is the official figure and gives an indication of how useful this animal is to man. For every skin on the international market two or three lizards have to die. Their skins meant for the international market from time to time are used by local craftsmen or find their way to foreign buyers who work on the black market. In this final case the lizards do not appear in international statistics. The biggest producers are in central and western Africa between the equator and the 15 parallel; Cameroon, Mali, Chad and Sudan.

In the course of a study conducted in Chad, to investigate the intensive exploitation of the monitors. The findings of which are discussed below.

2. Principle Sites of capture

In Chad catching monitors is a traditional activity, practised mainly in the southern half of the country between 8 and 14° latitude. It is rare to find someone in a village who has never in their life caught a monitor. Without a doubt Lake Chad provides an ideal biotope and a good reservoir for lizards and it is in this area that collecting is most evident. The Lake itself is very large, covering 27,000 km², divided between four countries: Chad, Niger, Nigeria and Cameroon. Amongst the best skins on the market at Djamena 60-70% come from Lake Chad and the skins are of exceptional size and quality, two characteristics which reflect the richness of the habitat available to the animals and the competence of the local "fishermen". Typical biotopes frequented by the monitors on the Lake are in the flooded woodlands, where the water is shallow, 1.5-0.5m deep and filled with a wide range of organic debris. Vegetation is very dense in general, and insects, fish, amphibians, little reptiles and mammals and a wide range of tortoise birds eggs etc. are available. In fact all the normal foods that monitor lizards eat. Most of their habitats are close to firm earth or between numerous little islands which make up the Chad banks of the Lake. The lizards are never found in open water or in deep water any distance from the shore. They are particularly active, fast and disappear quickly at the slightest sign of danger and is difficult to find. Its back is an olive brown with ornate markings, 6 or 7 regularly spaced transverse bars with yellow ocellations, typical pigmentation of the subspecies *V.n.niloticus*. It is well camouflaged against the mousse that covers the surface of the still waters in the area. It is common to see them plunge into the water from a distance of 20-30 metres.

3. Organisation, carrying out and efficiency of capture.

For most part the fishing of monitors for regular collections of skins is largely restricted to the south half of the lake in the region split in four by the villages

Kouloudia, Kodjirom, Banangore and Kanggalom. This territory represents only about 25% of the whole flooded area and this accounts for the Chad portion of the lake. Out of this zone in the territory north of Bol organised fishing has been discontinued since the mid 1970s even though the area is as abundant with lizards as elsewhere, but occasional captures are still made for food by the villagers. It is difficult to say how many fishermen are operating with any accuracy but it can be admitted that at least a dozen groups of 12-15 men practise fishing full-time for five or six months of the year. Most of the fishermen are Kenembous people, the great majority of Chad nationality and a small proportion of Nigerians and Cameroonians who have worked in Chad for many years. The teams of fishermen are mainly men but include a few young boys are being trained by their parents. In the bivouac the fishermen are generally from the same village and are often distantly related. They work under a chief fisherman who can be recognised by having several bivouacs. These fishermen who fish for lizards don't fish much for fish and in the same way fishermen of fish don't usually catch lizards.

These bivouacs are very bare and built on islands near where the lizards are found in clearings or in holes. They don't have much except a mosquito net hung during the night between four pegs, a cover and, if they are really lucky an electric lamp as well as their fishing equipment. The equipment comprises of a sagaie which is used to "neutralise" the numerous snakes, cobras, vipers etc, that infest the region, or to capture the occasional ... they carry a machete, several knives and lots of fish hooks, 2-3cm in diameter, made of metal with a barbed point. With the exception of the machetes, made in Cameroon or Nigeria, everything is made in the village from recycled metal taken from car chassis and old blades. They also use lots of amulets and trinkets to protect them from many dangers they find in the bush. They have a very animist view of nature, which is Islamised. The rest of their material, kitchen utensils, little instruments, dug out canoes and iron instruments is all divided out amongst the members of the bivouac. The dug-outs are of Nigerian origin and are very light and fragile (1cm thick), 4-5 m long and can be pulled out of the water and are very manoeuvrable. The canoes can carry five passengers and about 150kg of baggage. Along the coast of the lake in the shallow regions navigational accidents are very rare the biggest peril that confronts the crews are hippopotami which are very territorial but becoming more and more rare and are quick to destroy canoes and frighten men away. It is principally in the period when waters are rising, September to March, that fishing is at its most intense. Out of this period the men return to their villages and farm. Fishing is done from the canoe in 0.5-1.5m deep water. Some men do not have canoes go in on foot and push their equipment in front of them in metal bowls. It requires a certain courage to fish in this manner because the mud at the bottom of the lake is very thick and slippery and there are many dangers. There are only two or three canoes per encampment so two or three groups can operate in the water at one time. The hooks are normally baited with monitor meat but sometimes fish is used. The hooks are put down between 0930 and 1130 in an area of 4-5km around the bivouac, up to an hour's ride away by canoe. Each hook has a wire line which is 50-60cm long attached to a submerged tree trunk or bit of vegetation. One team of two men will put down 60-70 hooks in a morning. The lizards are picked up in the afternoon, between 1500 and 1700 hrs. 40% of hooks are not touched, and another 40% have bait removed without capture. 20% have caught animals. This can either be a monitor lizard, or more rarely a cobra. The cobras are killed without emotion with a couple of whacks from the

machete. On average there is about one cobra for every 20 lizards caught. In great abundance the snakes represent quite a menace to the fishermen, especially on foot and they also visit villages and cause several deaths per year. The lizards are removed from the water by the tail by one of the fishermen, put into the canoe and a real professional carefully releases any lizards that are too small for skin trade (below 20cm in width). Like most animals the Nile monitor will escape danger when given the opportunity rather than stand and fight. But when escape routes are blocked it fights for its life and is a redoubtable adversary, worse than a crocodile of the same size. A monitor larger than 2m has muscle power in its back, tail, jaws and feet and the fisherman on his knees in a canoe has a fair old time trying to get the better of the lizard. If the lizard is actually hooked it rips its throats which limits its movements. The animal's scariest weapons are its teeth, which are strong and pointed and can bite deeply and painfully. Also its claws, which are even worse than its teeth. They are long and solid and cut like a knife. If seized by the neck it will attempt to cut you up with its claws so the way it is held is of paramount importance. One hand must be used to firmly grab the nape of the neck and the other to hold the base of the tail. The fishermen carry many scars from the battles they have with the lizards. Nile monitors use their tails like whips and use it most effectively on land when it can fix on a point, but this doesn't generally bother the fishermen because the whole body is immobilised. In the region of Lake Chad the sagaie (spear?) is rarely used to kill the lizards because it makes holes in the skin. The lizards are much too powerful just to be tied up on the canoe so they are killed immediately with a cut behind the head. Smaller ones are kept alive until next morning and are pegged out around the encampment. Sometimes they are eaten by little carnivores during the night. In the first days of setting up camp 25-30 lizards can be caught, numbers decrease gradually until after 10-15 days it falls to less than ten. The fishermen set up another bivouac. On average 200-250 individuals are caught at any given site in one year (six months of collecting). Minimum quantity of 30,000 lizards can be taken in one region of the Lake by all the fishing teams. The way that they capture the monitors is not selective which means that they catch monitors of both sexes and of all sizes, although they usually do not take specimens of less than 70cm TL, because the mouth is not large enough to take the hooks. In the Lake Chad region the monitors can grow to a large size, doubtless a good sign that the animals in this area have a long life. The males found average between 150-180cm TL, weighing 7-10kg, but animals of over 200cm are not rare. The biggest specimen the writer saw measured 214cm and weighed 14.5kg, the heaviest was 17kg, 213cm TL. Nor are these world record holders. The skin of a specimen 214cm had a width of 56.5cm. In the warehouses of exporters there are skins from Lake Chad of over 65cm wide, representing animals of around 240cm. In very favourable ecological conditions, as found along Lake Chad, the monitors grow very quickly and we could believe that the oldest males would be as long as 250cm and weigh 20kg. Crocodiles have disappeared from the lake after intense hunting, so the lizards have no enemies other than man. However the young monitors are eaten by herons, eagles, catfish, fishermen and snakes. The females are considerably smaller than males, rarely growing over 180cm, and usually 140-160cm. They start to reproduce early in life after reaching a length of about 120cm long. They initially only produce about ten eggs per year but as they grow bigger they produce eggs in greater abundance and with more regularity, laying up to about 60 per year. They are the size of chicken eggs and in the region of Lake Chad they breed after the waters have risen, from mid December to the start of January and

the young hatch at the beginning of the next rain season (in June) just as the insects start to emerge.

4. Use of Monitors

The lizards caught are cut up on site early in the morning (0630-0900) the day after capture. Once killed a deep circular cut is made at the base of the hands and feet and also in the middle of the tail, the skin is then split the length of the belly and along the underside of the limbs and is then carefully removed with a very sharp knife. The young children often perform this operation and the skins are dried in the sun after being stretched on the ground with spikes made of metal and wood. They take only 4 or 5 hours to dry. This is the only process used to preserve the skins. The carcasses which is trunk and tail, are hung on low branches of trees to dry out in the air for 2-3 days and then cut up and dried in the sun. The dehydrated meat placed in large bags (usually 50kg) and is sold locally at the markets. The corpse gives 20-30% of its weight in dried meat and is ready to be sold. The skin and meat are the only commercial uses. Lizards are a base food for the fisherman themselves. They boil the eggs, mash them, make pate or eaten whole. The lizard meat appear in all of their meals, boiled, grilled, fried in lizard fat or even smoked and is eaten together with maize flour cooked together.

Skin collectors who are registered by the administrative authorities split up regions of the lake and go from bivouac to bivouac meeting the fisherman or at the big markets at Banagore, Kangelom, Boulfetimi or Kouloudia. Often the fisherman of an encampment work for one collector who stays faithful to them, but this is business relationship is not an absolute rule. Some fishermen go for the collector who offers the most. In this case they have to through

They are despatched in lorries to the capital where people check their condition and send them on to Europe by air. Without doubt a large proportion of the trade is illicit and are smuggled out of the country to avoid high taxes. Most goes to Cameroon, Nigeria and Sudan, agents of the state customs officers, forest inspectors have a hard job surveying all of the lake. The farmers make most of their money during the hunting season and farm for subsistence. Sale of meat and skin of lizards earns them 100,00-125,000FCFA, between 2,000-2,500 French francs for each man, which represents a lot of cash for the village. Chad is one of the poorest countries in Africa and from the time it is captured to when it is sold in Paris or Rome it becomes 18 times more valuable.

Does hunting endanger monitor populations?

The Nile monitor is classed in CITES appendix II. Trade is permitted if the authorisation of exporting and importing country are obtained. Classification in appendix II implies that it is not in danger of extinction. In the case of Lake Chad the monitors are very common, even after several decades of commercial exploitation. It is true that since the disappearance of the crocodile there are hardly any natural predators. Existence of large individuals indicates that because of the fewer predators they get to grow to a larger size. The capture of these animals is limited to the area around the Lake and is still done traditionally, and is apparently not destructive to the

environment. One danger is the village habit of burning vegetation in the dry season, when the lizards are in tree hollows, termite mounds or burrows are therefore killed in the fire and die in great numbers, burned or asphyxiated. We were also able to find individuals whose feet and tail had been badly burned with scars or signs of burns.

The abundance of troops of bovids that go through the low waters of the lake also endangers the natural habitat of the lizards. In comparison the effects that hunting has is more limited and much better controlled. The fishermen are quite conscientious in general and are aware that they must not kill the chicken that lays the golden egg. Their techniques are conserved so that they are still effective but are not too effective. Over exploitation of natural stocks of monitors is not to be worried about....

Bemerkungen zur Haltung und Zucht von *Varanus acanthurus*, *V.storri* und *V.gilleni*.

EIDENMULLER,B. 1994. Herpetofauna 16 (88):6-12.#

Translated by Florian Werner

Small Odatrian monitors appear exclusively in Australia with the exception of *V.timorensis*. Only *V.teriae* occurs in Cape York, north Queensland.

Because the export of reptiles from Australia is generally forbidden keepers make every possible effort to breed them. Unfortunately the stock of animals in Germany is very limited and many are too old. Nevertheless breeding communities should be established to maintain these animals. In the lastt years several successful breedings of *Vacanthurus* have been described (refs). ** has been breeding these animals for several years and has reached the F3 generation. I have also heard of other amateur herpetiologists who have also successfully bred this species, so we need not worry about its preservation in Germany. Since however all breedings, to my knowledge, stem from only a few parents it would be advisable to occasionally swap animals to prevenmnt inbreeding. Unfortunately this is only possible for *V.acanthurus*. Recently several breedings of small monitor lizards have been reported for *V.storri*, *V.t.timorensis* *V.t.similis*, *V.gilleni*, *V.prasinus becarri* and *v.tristis orientalis*.

A nearly complete list of breedings of both small and large monitors was published by Horn & Visser 1990.

I would like to talk about my experinces with breeding several monitor that are very different to each other in habit and share tips and observations with other keepers.

V.acanthurs

Since the individual demands and behaviours can be very different this should be taken into account when designing the terrarium. *V.acanthurus* and its subspecies is a mid sized varanid with a total length of about 70cm. It lives on the ground and occurs in the dry areas of north and central Australia (refs) . It is advisable to keep this species in a terrarium with floor dimensions larger than height, my specimens (1male 2 females) live in 150x60x60cm terrarium. For lighting I have install a Phillips HPL 80W in use for ** hours during the winter and 14 hours during the summer. For basking I use a spot light Osram cobcentra 60W pointed at a rock ledge. In the case of the spotlights duration also depends on season. In the summer and winter it varies between 5 and 11 hours, but I sometimes leave the spotlight off for several days. I keep all my animals on southern hemisphere seasons. At the back and sides of the terrarium I have build ledges made of styrofoam and epoxy resin so that the animals can use the spaces and recesses created there (refs). The ground is covered with 5cm deep sand and put a couple of roots and peices of cork bark into the terrarium as well as a hiding place of 40 X 20 X 20cm filled with moist sand.

V.storri

Lives in the northern parts of Australia (refs). The nominate form occurs in NE Queensland close to Charters Towers. *V.s. ocreatus* inhabits an area of the NE of

Western Australia. Thus they inhabit the same biotope as *V.acanthurus*. The terrarium should be equipped in the same way. Since this monitor with a total length of 35cm the terrarium can be smaller. In contrast with *V.acanthurus storri* are very aggressive with each other and I prefer to keep them separate during most of the year, introducing them only during the mating season (during the Australian spring and early summer) and always under supervision in 150x60x60cm enclosure. The equipment is similar to that provided for *V.acanthurus*. If the animals fight and bite each other I separate them immediately and try again a few days later. If they get on well I leave them together for several days. Out of the mating season I keep them in 60x30x25cm. with a sand substrate and just a piece of cork bark, a rock and a bowl of water. The spotlight (25W Osram Concentra) acts as a source of light and warmth. Depending on the season it runs 10-13 hours per day.

V.gilleni

Up to 35cm, it requires a different terrarium. They live on trees and come from the dry central parts of Australia (refs). Because of this the terrarium measures 50x50x75(high) cm. Sand is substrate and 3mm cork cover the walls in some place I glued larger pieces which can be used to climb on without wearing down their claws. This technique has also been found successful when keeping *V.p.becarri*. The terrarium is equipped with branches, a nesting box 30x20x20, a cork pipe and a water bowl. Lighting is a Phillips HPL 50W. Heating is via a Osram Concentra 60W, with similar durations as for *V.acanthurus*. Even though the animals get along well with each other it is recommended to separate them every now and then.

Über zwei Nachzucht des Steppenwarans (*Varanus exanthematicus*).

Axel Roder & Hans-Georg Horn, Salamandra 1993 30(2):97-108.

Translated by Bernd Rottcher

1. General and systematic remarks.

Strimple recently gave a report (unfortunately in a not easily accessible publication) covering all aspects of the biology of this monitor lizard. Bayless (1994) gave a careful description of the behaviour of this monitor lizard, whereby he particularly looks at reproductive behaviour and gives advice for the prerequisites required. He assessed the advantages of keeping the animals in groups and temporary separation of the sexes. *V.ex* is a widespread inhabitant of the African continent and the systematic treatment in the literature splits the species into several subspecies. After the discovery of *yemenensis* the unavoidable conclusion was reached that several subspecies had to be reclassified. Bohme et al 1989 pointed out that *V.e.albigularis* constituted a new species. *V.e.microstictus* and *V.e.angolensis* that occurred along a broad stripe of the eastern and Southwest African coast constituted subspecies of *V.albigularis*. According to Bohme *V.exanthematicus* is considered to be a sub-Saharan species that lives in a close zone south of the Sahara from the Atlantic to the Red Sea in a more or less xeric niche. It could be that within *V.exanthematicus* there is a race distinguished by very small nuchal scales. Two species are in the collection of the A.Koenig museum in Bonn but unfortunately the place of collection is unknown and it would be interesting if any reader knew about this. Examples are shown in figures 1-9 so that it should be easy to distinguish the races. Examples of captive breeding of this form is given in Horn & Visser and more recently in Bayless. Because the original home of these lizards isn't mentioned in either article no exact determination of the species can be made. *V.a.angolensis* and *V.a.microstictus* are rarely documented in Museums with precise locations so it can be surmised that most exported animals belong to *V.exanthematicus* or *V.a.albigularis*. according to the accepted systematics.

2. Results and discussion

2.1 Keeping and care of parent animals.

In December 1991 a juvenile pair with a total length of 35-40cm were acquired. The male animal had a thicker tail as well as a broader and more strongly developed neck together with a more pointed appearing skull. The characteristics were clearly less recognisable in the female. According to the idea that *V.ex* is an inhabitant of arid areas for at least long periods of the year the terrarium was 150X100 x 150 (high). Substrate of 15cm depth of sand. The furnishings were simple of consisted of several small stones piled on top of each other and a few fine "grits". The animals used them as hiding place and a receptacle 30 X 50x15cm was filled with water to a depth of 10cm and was used regularly by drinking and basking by both animals. The heating coils were arranged so that they could not be dug up. Air temperature reached 30-35°C one electric heater with 100w spotlight was used to create a warmer basking area and

heaters with 75W neutral white bulbs were used for lighting and heat. At night temperature fell by around 15oC , to 20oC. One UV spotlight was switched on daily for 30 minutes. All heating and lighting was placed out of the reach of the animals. During the winter they were kept in a noticeably dry environment and with onset of spring the humidity of the air was raised considerably by frequent spraying. A frequent supply on insects (crickets, roaches and locusts seemed to have its advantages. Additionally they were provided with juvenile mice, day old chickens, egg and heart enriched with minerals. James et al 1992 pointed out that frequent feeding with insects is probably correct...

2.2.

Several difficulties occurred when putting the second breeding pair together. Two animals with total length of about 60cm were acquired in 1987 were both males. A bit later two additional animals were obtained, said to come from Ghana, as before. Those animals luckily a pair, were emaciated and weakened due to ectoparasites, ticks and mites and cestodes. Due to this they were kept apart for four months. After removing the ectoparasites with Paral and cestodes with Citarin and feeding at intervals of two days the condition of both animals improved. The male became used to the keeper but the female remained shy and had to be moved to a smaller terrarium because it was unable to compete with the male for food. After a further four weeks both animals had recovered sufficient to be put together in a terrarium 400x80x50(high) together with the two other specimens. The ground has a thin covering of wood chippings and a big tree trunk of 2m as hiding places in case the animals should chase each other during antagonistic behaviour. . A small bowl with the dimensions 37x48x12cm was filled with water 8-10cm deep was supplied. Sometimes one specimen would spend the whole day in the water. Three 80W fluorescent tubes were used to light the enclosure and a 50W heating mat was used for local heating. Surface temperature of about 35oC was attained. The animals liked to use the mat for warming up. Air temperature was 25-26oC so that the animals were kept relatively cool, but at night the temperature only fell slightly. UV light was switched on daily for 20 minutes. After putting the animals together they were fed at intervals of 8 days alternately with small mice, day old chicks and cooked eggs in the shell. Furthermore mixes of beef and raw eggs were prepared, mixed dog food and minerals. No change in their behaviour could be observed in any of the animals but one female remained shy. Because of this the males grew quicker and put more weight on. After a year they had reached about 75cm. At the beginning of 1990 another specimen with a total length of 50cm was acquired and introduced after three months quarantine. This specimen was noticeably more active than the others. After warming up for several hours it began very agile and examined the terrarium with its tongue.

2.3. Copulatory behaviour.

When the first parents animals had reached total length of 50cm and appeared incapable of reproduction the male animals unexpectedly began to court the female by jerking movements of the head and sticking its tongue in and out. The courting behaviour described in detail by Bayless could not be observed and no observations of copulation were made. The courting behaviour of the second pair was totally different. The recently acquired and most active animal despite being the smallest it was ready

for courtship. It tried to copulate with the larger males whilst jerking its head left and right and while aggressively sticking its tongue in and out (compare with Horn 1985). The smaller and shyer female was ignored and the courtship behaviour was only aimed at the larger males (compare with Bayless). The female was only noticed after the other three animals were removed, when it was courted with jerking head movement, flicking tongue, scratching of the female's pelvic region. Copulatory attempts were also observed but the female remained passive, if it did not reject the mating attempts. The female would hide from the male and he would try to pull her out of her hiding place by scratching and biting into its tail. Finally on 15 December 1990 copulation occurred after courtship behaviour as described by Bayless. Whereby the female also received bite to her front legs. Shortly and beforehand the female tried to escape and remained still for early three hours without changing its position. This is extremely important in the context of a just published paper by Bohme and Sieving of three snake species. That the species with the most strongly forked hemipenes (*Epicrates*) copulated less often and changed sides less often than the two species with hardly forked or unforked organs. Arbitrary separation of the sexes of these species during copulation relate to the use of only one organ in multiple copula, resulting in a drop in number of fertilised eggs by about 50%. The authors also discussed this phenomenon with *V. varius* where the hemipenes are slightly forked and have been observed in multiple copulations (Carter 1990). *V. exanthematicus* does not show pronounced forking, as can be seen from picture in Bohme 1988, Bohme et al 1989. This would mean that copulation in this species should be multiple, assuming that no other influencing mechanisms exist. However three hour long copulation on a single side contradicts this.

2.4. Egg laying incubation and hatching.

Mother of pair 1 hid the first egg under a flat stone. a day later three eggs were found and next day 14 eggs were found in a similar hiding place. Compare with table 1). The entire clutch of 18 eggs was transferred to an improvised incubator, air kept at 29°C constantly with 95% humidity. A peat/sand mixture was used as substrate. The size of the clutch was significantly higher than expected, if number of eggs as a function of total body length was used as a guide (King 1991). Eggs were 18-20g, average about 2.5x4cm. Regular examination by candling showed that they were all fertile but after 4 weeks fungi were found on 6 eggs and all embryos died. The reason for this was probably that the sand/peat mixture was too damp, so the medium was abandoned and instead sand sterilised by boiling was used. No more eggs died thereafter. Incubation period was expected to be about 160 days (Horn 1978, King 1991). First hatched after 169 days, two more after 170, five after 172 and four after 173 days (table 1). All hatchlings were in good condition and had completely absorbed the yolk sac. Total lengths and weights were as expected (table 1). The first accepted food after 6 hours (crickets) the last after 24 hours.

Four weeks after copulation the female of the second pair began to lay her eggs. First female laid eggs 4-6 weeks after copulation. Compare with period by Horn & Visser (1989). The female was restless two days before and was obviously looking for somewhere to lay her eggs but she did not attempt to dig in the substrate. First laid 12 January 1991. 17 others laid a day later. They were similar in size to those of *Testudo hermanni* but no measurements were taken. Through incubation the eggs appeared white and only at the end did they begin to lose some of their stability. They were

presumed to have had hatching difficulties when small dents appeared on the eggs whilst pressing them slightly between the fingers.....

We can only try to guess why the eggs were unable to hatch. White (1991) came to the conclusion that the amino acid composition of the proteins within the egg and the quality of the eggs, and therefore the development of the embryos depends very much on the nutritional state of the mother. Birkhahn 1991 came to a similar conclusion for *Dendrobatids*. The female of the second pair was in very poor condition when acquired and many difficulties arose in her feeding. Probably the animal was in a suboptimal state prior to breeding. Horn (1991) reached similar conclusions.

The freshly hatched animals from the 2nd parents first accepted crickets and were extremely greedy eaters, trying to get everything that moved, including the feet and tails of their brothers and sisters. It took them a while to realise that these appendages were not food and to release them. Several hours after hatching the first food was consumed

2.5. Development of the Young

Hatchlings of the first clutch developed satisfactorily, as can be seen by the increases in length and weight observed over 4 months (table 2). The animals had relatively short tails. After four months they were kept in a 120x50x60cm, with the same furnishings as pair 2. They had reached an average length of 13cm, SVL 11.5cm tails. Now they were fed young, chopped mice and day old chicks, and crickets. Picture 10 shows that the juveniles differed far more among themselves than did the parent animals. In this picture they were 5 weeks old. They still differed after another six months, but only 12 had survived, three dying shortly after each other at the age of six months, but the cause of death was not determined. The 14 juveniles from clutch 2 also developed without major problems. After one year some animals (perhaps males) reached a total length of 40-50cm whilst the others were 23-30cm. After 20 months the "males" weighed 500g, more than twice as much as the less developed ones which were about 230g (table 2). Juvenile mice can be consumed after about six weeks.

**CONSTRUCTION OF NESTING BURROWS AND PROTECTION OF THE CLUTCH BY FEMALE GREY MONITORS (*VARANUS GRISEUS*)
Tsellarius & Menshikov**

Translated by Maria Bennett

Materials and methods

We carried out the studies of grey monitor biology in sandy desert Kizil-Kum in 1990-1993. Our station was located in latitude 40°40' North and longitude 62°08' East. The landscape in the area of study is typical for this part of Kizil-Kum - ridged sands with dominant vegetation consisting of *Haloxylon persicum*, *Carex physodes*. In 1980 we devised the method of marking the monitors, which allowed us to recognise the marked animals by their tracks (Tsellarius, Cherlin, 1991). We had an opportunity to observe some of the marked specimens continuously during the whole breeding season and, daily, by tracking, to collect the information about the movements of an animal, its actions and its location. Generally, animals which were observed continuously, were called by names, and the ones which were observed periodically - numbers. Six females (Mamasha, Dozent (=senior lecturer), Katrin, Tatyana, K-2, K-8) laid eggs in 1991-1992 (Table 1), after which these females were controlled with particular care. Apart from tracking we, from time to time, carried out visual observations near the nesting burrows, from the hide (most often - a pit camouflaged by branches), situated 30-40m away from the burrow. Two burrows (one in 1991 and another one in 1992) were dug out in summer, prior to hatching, and three burrows - in spring of 1993, after hatching. Methods and the natural conditions of the area were described by us previously (Tsellarius et al, 1991).

Authors are very grateful to colleagues who helped in organising the work and collection of material, V.A.Cherlin, S.A. Shepilov,....

Table 1.

Some information on the observed nesting burrows of the grey monitor

Burrow owner	Number of passages in the burrow	L of the passage leading to the nesting chamber	Location of n.chamber below the ground (depth)	Date of egg-laying	
No or name	body length				
	mm				
Mamasha*	495	3	?	?	22.6.91
Dozent**	470	2	185	83	25.6.91
K-2	450	3	195	100	5.7.92
K-8	430	2	80	76	2.7.92

Katrin	435	2	135	114	6.7.92
Tatyana	430	2	330	95	3.7.92

* Died in 1991, the burrow had not been dug out

** Did not breed in 1992

Fig.1. Nesting burrow of a female called Mamasha. 26.6.91

Results

Structure of nesting burrows

In the area of study, in spring and summer monitors use as a shelter the burrows of rodents, mainly *Rhombomys opimus*. Females dig special burrows only for egg-laying, which was already mentioned by Gorelov (1983). However, the abandoned rodent's burrow can serve as a basis for the structure. All six nesting burrows known to us were situated on turved sections of a slope or at its foot, mainly of southern aspect. In three cases the burrows were situated under the bush of *Calligonum* sp., once - at the base of 15cm depression ?, the other two - in the open. None of the burrows found by us were situated in the place of the old nesting burrow made in previous years. Large, flat area of excavated sand near the recently made burrow (fig 1) helped to easily distinguish it from rodents' burrows. Later, when the winds dispersed and smoothed the sand, it became difficult to distinguish the nesting burrow from the others.

Nesting burrow has 2 or 3 relatively straight, rarely winding, passages branching off from the main "vestibule" (Table 1; fig.2). Often the roof of the "vestibule" collapses because of careless movements of the female, and the passages acquire independent

exits to the surface. The passage leading to the chamber with eggs is tightly packed with sand by the female, who uses the rest of the passages as a shelter. The nesting chamber is not packed with sand, and the eggs lie on its floor openly, in one layer. In both burrows

dug out in the year of egg-laying before the beginning of winter (burrows of Dozent and K-8, Table 1), the nesting chamber was situated in the layer of slightly damp sand, while the sand of the higher-lying horizons has completely dried up during summer. Among three burrows which were dug out in spring of the year following egg-laying, the nesting chambers in the burrows of K-2 and Tatyana were situated in the layer of very damp sand, wetted by winter rains, and in the burrow of Katrin (the deepest one - Table 1) the nesting chamber was situated below this layer, in only slightly moist sand. In the first two burrows the babies have died in October-November, at the hatching stage or slightly

later, and in the third one they hatched successfully and came out the next spring. Temperature of the sand at the depth of nesting chambers was about 30-32°C in July, 25-27°C in October, 17-20°C in early May of the following year.

Fig.2. The diagram of Dozent's (1) and K-8's (2) nesting burrows: A - nesting chamber, B - passage filled with sand; C - passage used by the female as a shelter; D - entrance into the burrow.

Burrow construction and egg-laying.

Monitors' courting and mating season in the area of study takes place in the first half of June and lasts about 10 days. In 1991 the first case of breeding behaviour was recorded on 3d of June, the last one - on 11th of June; in 1992 - 10th and 18th of June respectively. The differences in timing are probably connected with the weather. Only once we observed an attempt of mating, on 16th June 1992. Egg-laying in 1991 took place in the end of June, in 1992 - beginning of July (Table 1).

12 to 10 days before egg-laying females become noticeably less mobile, the length of their walk in 24 hours shortens to a few hundred meters, while the males and barren females cover more than 1km over the same period of time.

7 to 2 days before egg-laying females start searching for the burrow site: lizards excavate burrows in various places or clear out the empty rodents' burrows. The depth of these trial burrows is from 20-30cm to 1m, and the monitors periodically return to some of them. The distance between trial burrows was from 5-10m to 200-300m, the search for some females was concentrated in central parts of their foraging area, for others - on its periphery (the foraging area was from 65 to 100 ha). 2 to 1 days before egg-laying the females began to excavate one of the trial burrows, which became a nesting burrow, first of all digging the passage at the end of which the nesting chamber was made. The burrow chosen for egg-laying was not necessarily one of the last trial burrows. Dozent, K-2 and K-8 chose one of the burrows which they started to excavate right at the beginning of their search. By this time, females stop changing the sites where they spend

the night, in contrast to other periods of their life, and settled in a burrow in the nearest colony of *Rhombomys opimus*, which we will call a 'base burrow' below. Base burrow was situated at the most 35m away from the nesting one, and was of importance during the whole period of guarding the eggs (see below).

1 or 2 days after the beginning of work on the nesting burrow the female suddenly stopped digging and stays in the burrow for about 24 hours, without showing any sign of life. The next day the lizard starts to excavate another passage, at an angle to the first one, and fills the first one with sand. The final work on the burrow takes another 3-5 days. During the whole period of burrow construction, apart from the day of egg-laying, the female spends the night in the base burrow, and sometimes goes into it during the day for up to 1.5 hours. On the whole the construction of nesting burrow takes 5-6 days. After that no excavating activities connected with the nesting burrow were observed.

During the period of burrow construction and egg-laying the females get very thin, which can be seen very well through binoculars; a deep hollow appears along the tail, the spine and ribs stick out prominently. Extraordinarily sudden and significant loss of weight in females of grey monitor during egg-laying period was also recorded in captivity (V.B.Vasilyev - personal communication).

Fig.3. Frequency of visits of nesting burrow and base burrow by females of grey monitor in 1992 after egg-laying: 1 - K-2; 2 - Katrin; 3 - Tatyana; 4 - K-8;
A - visits to nesting burrow, B - visits to base burrow, C - egg-laying, D - start of hunting, E - visits of the nesting burrow by strange monitors, F - visits of females to the area of the nesting burrow without entering it.

Behaviour of females after egg-laying

K-8 began to prey on invertebrates and small lizards near the nesting burrow immediately after egg-laying, all the other females - after the final construction of the burrow or even later (Fig.3). First few days lizards usually did not go further than 200m away from the nesting burrow and visited it several times a day, interrupting their foraging. For a night females always returned to the base burrow, or, rarely, nesting burrow, and in one of these burrows they spent the hot time during the middle of the day. Such attachment to the nesting burrow was observed in different specimens for 15 to 32 days after egg-laying (Fig.3). After that the frequency of visits began to decrease, lizards went away for longer periods of time, although sometimes they spent several days on the run in a burrow again.

In August and early September the females which had laid the eggs were visiting the area of nesting burrow more or less regularly, at the same time foraging actively an over a large territory, while the males and barren females beginning from mid-August stayed underground for several days on the run, and their route during 24 hours has shortened to a few hundred metres. By mid-September the activity of majority of adult monitors has almost ceased, while our females continued to forage the whole September and early October.

Visits to the burrows by some females continued till early October (fig.3), i.e. virtually until the start of hibernation. Females hibernated neither in the base burrow, nor in the nesting burrow, but chose the site nearby, not further away than 200-300m. In spring of the following year, after hibernation, females visited neither....

Relationships with various animals near the nesting burrow

In the area of the nesting burrow the females are very cautious and watch the surroundings intently. While observing Mamasha (on the 4th day after egg-laying) the researcher had carelessly moved in his hide. Lizard was looking in his direction for about 15 minutes, after which, although the observer stayed completely still, disappeared in the nesting burrow. Approximately in an hour after the man had left, Mamasha came out of the burrow and studied the nearest surroundings, and examined the hide particularly thoroughly. We had to change the site, because after this incident the lizard paid the hide a heightened attention.

When a man approaches, the lizards escape into the nesting or base burrow and, as a rule, do not show any signs of life. Base burrow is clearly preferred. In the majority of cases the female, unless she is right at the entrance of the nesting burrow, tries to escape into the base burrow, even if during the appearance of danger she happens to be not far from the nesting burrow. The lizards react the same way to the ungulates (domestic horse), to a crawling man covered with camouflage net, to the rucksack pulled towards the hide on a piece of string. A predator near the nesting burrow was

observed by us only once: jackal (*Canis aureus*) walked pass the burrow of K-8, slowed down, sniffed without showing much interest and went on. The female which was staying in the burrow has not appeared on the surface. There is an impression that the female does not protect the burrow frpm the animals which could pose a considerable danger to her. It is possible that this is the reason for a female to spend the night in the base burrow and to tend to escape into it during the day if the danger appears, because in a colony of *Rhombomys opimus* she feels more secure than in a simple, relatively shallow nesting burrow with a wide, conspicuous entrance.

Females remain indifferent to small lizards and rodents, even if they enter the burrow, or show purely gastronomic interest.

Relationships with the members of the same species near the nesting burrow

During the period of observation (over 400 days) we recorded 18 visits of the area of nesting burrows by eight specimens of grey monitor, 16 out of them were the visits to the burrow itself (Table 2). An appearance of her kin close to the nesting burrow often causes agression of the female. As a rule, the stranger retreats as soon as the mistress of the burrow expresses her displeasure. Only one monitor was amazingly persistent. This large lizard (body length at least 480mm) repeatedly during 9, 10, 11 and 12 of July 1992 visited the burrow of K-2 and, although each time it was driven away by the furious female, returned back, sometimes within an hour. The same monitor (identified by the characteristic element of pattern) came to the burrow again on 23 of July and again was driven away by K-2. When the monitor came to the burrow while the female was absent, in the short period before her appearance it hesitatingly dug the sand at the entrance of the nesting burrow (it brought down the ceiling of the "vestibule" and excavated in its place an irregularly shaped pit about 70cm in diameter and about 20cm deep during several visits) and widened the entrance into a trial burrow situated 25m away. Its actions did not bear any resemblance to the purposefull actions of a monitor digging out the food. During all years of work we have never encountered such a persistent, over a period of many days, striving to obtain such not easily accessible source of food, similar to that monitor who visited the burrow of K-2. Unfortunately we did not manage to catch and sex the animal.

Table 2

Visits to nesting burrows by strange adult monitors

Burrow owner	Visitor	Female's reaction	Visitor's behaviour	Day of visit (from egg-laying)
Visits in female's presence				
K-2	Unmarked *	A	P	4
"	"	A	P	4
"	"	A	P	5

"	"	A	P	6
"	"	A	P	6
"	"	A	P	7
"	"	A	P	7
"	"	A	P	18
Tatyana	K-9, female	A	M	62
"	Unmarked	A	M	71
"	K-9, female	D	O	72
Dozent	Mafiosi, male	D	O	6

Visits in female's absence

Dozent	Zhenya, female		O	2
Mamasha	Edik, male		O	3
Katrin	Mafiosi, male		M	17
K-8	Unmarked		O	9

Key: A - aggression; D - no aggression; P - visitor tries to enter the burrow, excavates the "vestibule"; O - examines the excavated sand and the entrance into the burrow, sometimes sticks its head into the burrow, then goes away; M - passes by the burrow, without paying much attention to it. * Recognised by a characteristic pattern element.

Part of the visits to the burrow went without conflicts (Table 2). Visits of a base burrow in female's presence were observed by us twice: males C-7 and Mafiosi visited Dozent's burrow on the 2d and 3d day after egg-laying. In both cases it ended peacefully, and Mafiosi even spent one night in Dozent's base burrow together with the female. It is not unknown for monitors to spend the night together (Tsellarius et al, 1991), but we did not expect such a situation near the nesting burrow.

Thus, not all monitors cause the female's aggression, even if they explore the entrance to the nesting burrow (Table 2). Most visitors do not make any attempts to enter the burrow even when the female is absent or in the first days after egg-laying (Table 2)

The female K-9, which caused Tatyana's aggression, did not have a compact individual foraging area, moved very widely and, probably, before meeting Tatyana near the nesting burrow, had not had any contacts with her, or had very few or them (during the second visit K-9 has not caused aggression - Table 2). Mafiosi and C-7's foraging areas were overlaying? the whole of Dozent's area, and met her repeatedly during the years of observation (there were no sexual contacts, including courting, between Dozent and these males).

There is an impression that the reaction of a female towards a visitor depends largely on visitor's behaviour, and aggression is probably certain to be caused by the attempt to enter the nesting burrow. However, it appears that the fact of personal acquaintance and experience of previous contacts with the visitor, including those outwith the breeding period, have a great significance. Lizards with whom the female had 'peaceful' relationships over years, were allowed to approach the burrow, and even peep into the "vestibule". On the other hand, after the first attempt of the visitor to enter the burrow, K-2 attacked him without warning on all other occasions, even 40-50m away from the nesting burrow.

Discussion

The behaviour of a female indicates that her main task is to protect the eggs, and not from predators, but from the members of its own species. Effectiveness of protection is increased due to special structure of nesting burrow. Presence of several passages branching from one "vestibule" allows the female to control the burrow entrance comfortably, and also probably disorients a visitor in her absence. It is possible that the "clusters" of nesting burrows in *Varanus bengalensis* noted by Auffenberg (1983) are excavated by one female, and not several as the author thought (it is also confirmed by direct observation - Deraniyagala, 1958), and have analogous significance.

However, although the fact and the aim of clutch protection can be considered as determined, the whole situation remains unclear, as the meaning of the encroachment of monitors on burrows of females belonging to the same species is unknown. Monitor's gastronomic interest in eggs is quite possible, but in the cases observed by us, the behaviour of monitors near nesting burrows did not have anything in common with ordinary foraging behaviour.

B.Green and D.King (1993) suppose that *V.rosenbergi* protects its clutch from the attempts of other females to lay the eggs in the same burrow. In our case this hypothesis is supported by the apparent absence of interest towards the nesting burrow in most specimens, and clearly non-foraging behaviour of those which are interested. However this explanation does not correlate well with the prolonged protection of the clutch (fig.3), which would have made sense only if the breeding period of this species was extended. However in each particular area this period is rather short and does not exceed one month (Yadgarov, 1968; our observations). Thus the female of grey

monitor protects the clutch and expresses aggression towards her kin for a long time after any possibility of other females' laying eggs expires (Table 2, fig.3). It is appropriate to consider that in a sandy desert there is no deficiency in sites for nesting burrows and there are no obvious benefits for a female or its offspring which would result from laying eggs into other female's burrow. It seems to us that the assumed striving of females to lay eggs in other females' burrows needs extra evidence.

Behaviour of a female protecting the burrow is equivalent to protection of individual territory (Carpenter, Ferguson, 1977) and is, strictly speaking, territorial behaviour. This type of territorial behaviour, when particular sites (shelter, basking sites, observation posts) are protected from their kin, is quite common in lizards (Stamps, 1977). Thus, widespread opinion that recent? varanids are not territorial (Auffenberg, 1981; Gaulke, 1989; Greer, 1989; Tsellarius et.al, 1991), based mainly on scanty observations of males and barren females, often outwith breeding period, is incorrect. In reality there is an obvious though considerably reduced territorial behaviour, at least in the species of monitors which protect the clutch.

Conclusions

1. Females of grey monitor protect the nesting burrow for a long period after egg-laying. Data based on observations shows that the main aim of this behaviour is the protection of the nesting burrow from specimens of the same species. Structure of nesting burrow is, probably, intended to meet the aims of clutch protection.
2. The meaning of encroachment of grey monitors on nesting burrows of their own species remains unidentified. Most specimens do not express any noticeable interest in nesting burrow. Behaviour of those animals which try to enter the burrow is not foraging behaviour, and food is clearly not the motive. Assumed striving of some females for laying eggs in other females' burrows causes certain doubts in case of the grey monitor, and cannot be accepted without extra evidence.
3. Attitude of females towards the specimens of their own species near the nesting burrow is evidently differential. Reaction of a female to a visitor before it shows its intentions is seemingly based on the experience of previous contacts with this animal, and not on innate mechanisms of reaction.
4. It seems probable that the protection of clutch in some varanid species is a result of reduction of developed territorial behaviour, which was inherent to the common ancestor of all modern monitors. This has to be considered when analysing social relationships in modern monitors.