**WORKS ON THE VARANIDAE, TRANSLATED FROM VARIOUS LANGUAGES INTO ENGLISH**

This is a collection of papers concerning the monitor lizards of the family Varanidae, translated from European and Asian languages into English. It is the result of an ongoing four year project and has relied very heavily on donations of time from many people. Additional papers will be prepared from time to time. Very few of the translators were paid for their work, those that were paid often had to wait many months for their reward. Some are still waiting. My apologies to them and heartfelt thanks to everyone concerned. These translations are designed to be read alongside the originals, thus figures, table etc are missing.

Three thousand years ago Alexander the Great of Macedonia, sick and tired of prejudices and misunderstandings between the different nationalities of his army, made 30,000 of his officers marry Persian women. The object of the exercise was a first step towards uniting the races and thus do away with the notion of "foreigners". Perhaps if he had lived for longer than 33 years he would have been successful, conquered the rest of the world and thus made this project unnecessary. Thus this humble work is dedicated to the memory of that great and farsighted man.

Daniel Bennett.
118 Sheffield Road
Glossop.
SK13 8QU.
England.

01457-861069.

CONTENTS.

ANON.Varanus exanthematicus albigularis in the Iguana Reptile Zoo, Vlissingen, Netherlands.Translated by Mary and Harry of Sassenheim.....6

ANDRES,A. Bl. Aqu. Terra. Kunde. 1904 15: 269. News of a monitor lizard. Translated by M.J. Bennett.....8

BANNIKOV,N.G. Priroda (Nature) No 9:97. The Monitor needs Protection. Translated by Edwina Fenwick.....9

BOHME,W. SALAMANDRA 1988. 24 (2/3):87-101. The Argus Monitor (Varanus panoptes, Storr 1980) of New Guinea: V. panoptes horni ssp.n. Translated by John Hackworth.....10

BOHME,W., FRITZ,J.P, & SCUTTE,F. 1987 Herpetofauna 46 (February): 13-20. The Discovery of a Giant Monitor (Sauria: Varanus) from the Arabian Republic of Yemen. Translated by Naomi Cowgill & Daniel Bennett.....17

CISSE,M. Bulletin de L'insitute Fondamental d'Afrique Noire. 1972 34 (2): 503-515. The diet of Varanids in Senegal. Translated by Daniel Bennett.....21

CISSE,M.Bulletin de l'Insitute Fondamental Afrique Noire. Ser. A 38(1):188-205. Le cycle genital des Varans du Senegal (Reptiles Lacertiliens). Translated by Daniel Bennett.....26

CREBS,U. Salamandra 1979 15(3):146-157. Varanus dumerilii - A Specialised Crab Eater? Translated by Gerald Gardiner and Daniel Bennett.....29

EIDENMULLER,B. Salamandra 1986 22 (2/3):157-161. Observations on the care and a recent breeding of Varanus (Odatria) timorensis timorensis (Gray 1831). Translated by Naomi Cowgill and Daniel Bennett.....33

EIDENMULLER,B. Salamandra 1989 25 (2/3):265-271. Observations on keeping and rearing Varanus tristis orientalis. Translated by M.J. Bennett.....

EIDENMULLER,B. Observations on keeping and breeding of Varanus (Varanus) mertensi. Translated by M.J. Bennett.....

EIDENMULLER,B. & HORN,H.G.1985. Salamandra 21 (1):55-61. Some examples of breeding and the present state of knowledge about breeding in Varanus (Odatria) storri MERTENS 1966. Translated by M. J. Bennett.....35

HECK,L. Aqua-Terra-Z. 1955. VIII 7:190-191. The Cape Monitor Varanus exanthematicus albigularis.Translated by M.J. Bennett..39

HORN,H.G. Salamandra 1977 13 2: 78-88.Notes on the Systematics, Places of Discovery and Keeping of Varanus karlschmidti. Translated by Little Miss Muffet and Daniel Bennett.....39

HORN,H.G. 1980 Salamandra 16(1):1-18. Previously undiscovered Details about Varanus varius based on observations in the field and in the terrarium. Translated by Naomi Cowgill and Daniel Bennett.....45

HORN,H.G. Salamandra 1985 21 2/3: 169-179. Comments on the Behaviour of Monitors: The Ritual Fights of V. komodoensis and V. semiremex, also the Threat Display phases of the Ritual Fights of V. timorensis timorensis and V. timorensis similis. Translated by Naomi Cowgill and Daniel Bennett.....52

HORN,H.G. & PETTERS,G. Salamandra 1982 18 1/2:29-40 Some notes on Varanus rudicollis. Translated by Heather Truelove and Daniel Bennett.....55

HORN,H.G. & SCHULZ,B. Das Aquarium 1977 91 (11):37-38. Varanus dumerilli, as few know it. Translated by Frank Schofield.....58

HORN,H.G. & SCHURER,U. Salamandra 1978 14 (3):105-116. Some notes concerning Varanus glebopalma (MITCHELL 1955). Translated by Elizabeth Stodge and Daniel Bennett.....60

HORN,H.G. & VISSER,G.J. Salamandra 1988. 24 (2/3): 102-118. On Varanus giganteus. Translated by Naomi Cowgill and Daniel Bennett.....66

IGOLKIN,V.A. Priroda (Nature) No 9: 95-96. The Propogation of Reptiles in Captivity: The Grey Monitor Varanus griseus. Translated by Edwina Fenwick.....72

KLEE,O. Aqua-Terra, 6:61-63 (1969). From other publication; Peters,U. Observations on a mangrove monitor Varanus (Odatria) semiremex Peters 1869. Translated by M.J.Bennett.....75

KRATZER,H. 1973. Salamandra 9(1):27-33.Observations on the incubation time of a clutch of eggs of Varanus salvator. Translated by John Hackworth.....76

KRATZER,H. AquaTerra 10(1) 1973:12. Summary of a review of Aquaterra 9 (10). 1972:98-102. Translated by Steven Plunkett...80

MAKAROV,A.N. Voprosy Gerpetologii. Abstracts of the papers presented at the VI All - Union Herpetological Conference. Leningrad. "Nauka" 1985: 130. A Case of Cannibalism in a Desert Monitor (Varanus griseus). Translated by Marina and Anatoli Makarov.....80

MAKAYEV,B.M. Naochnie Osnovi I Patsionalnhogo Ispolzovaniya Zhivotnoho Mira. Moscow 1982:36-42.Present Condition and Problems of Conservation of the Desert Monitor Lizard (Varanus griseus). Translated by Maria Shimanskaya and Daniel Bennett.....81

MERTENS,R. Senckenbergiana 1941. 23 (4/6): 266-272. From: Zwei neue Warane des Australischen Faunengebeties.Varanus indicus spinulosus, new subspecies. Translated by M.J. Bennett.....85

MERTENS,R. Senck. Biol. 36 5/6:353-357, 1954. The races of Varanus griseus. Translated by Naomi Cowgill & Daniel Bennett..87

MERTENS,R. Kosmos. 1960 56:547-549. A Rare Guest at the Zoo: Salvadori's Monitor. Translated by Naomi Cowgill and Daniel Bennett.....91

MUNSCH,W. Das Aquarium. 1987. 214: 206-210. Monitors Encountered in Sri Lanka. Translated by M. J. Bennett.....93

NUTPHAND,W. The Monitor Lizards of Thailand. Mitphadung Publishing Office, Bangkok, 33p. No date. Translated by J. Nabhitabhata.....97

PETERS,U. 1967. Aquar. Terrar. 20:120-121. Observations on Varanus varius (Shaw) in the wild.Translated by M. J. Bennett.102

PETERS,U. 1971. Aquaterra8:75-77.Remarks on Mitchell's Water Monitor. Translated by John Hackworth.....104

PETERS,U.. Das Aquarium 1973 53:462-463. A Note on the Ecology of Varanus (Odatria) storri. Translated by M.J. Bennett.....105

PETERS,U. Das Aquarium, 205, Juni 1986. The Successful Rearing of Varanus spenceri.Translated by Naomi Cowgill & Daniel Bennett.107

POLLECK,R. Aquar. Terrar. Z. 1979. 32:285-286. The Pacific Monitor in the Terrarium. Translated by Naomi Cowgill and Daniel Bennett.....108

RUEGG,R. Das Aquarium 1974. 62 August: 360-363. The Breeding of Varanus timorensis similis.Translated by Jens Labohm and Daniel Bennett.....110

RJUMIN,V. Herpetology of Middle Asia. Academy of Sciences, Uzbek SSR. Tashkent 1968. pgs 28-31. The Ecology of the Desert Monitor (Varanus griseus) in southern Turkmenistan. Translated by Maria Shimanskaya and Daniel Bennett.....111

SAUTEREAU,L. & DE BITTER,P. Bull. Soc. Herp. Fr. 1980 15:4-9. Breeding Varanus timorensis. Translated by Daniel Bennett.....113

SCHMIDA,G.E..1971. Aquar. Terrar.Z. 24:168-170.The Australian Spotted Tree monitor, Varanus timorensis similis. Translated by M.J. Bennett.....116

SCHMIDA,,G.E. Aqua. Terra. (Z). 1974 27 (11):390-394. The Short Tailed Monitor (Varanus brevicauda). Translated by Frank Schofield and Daniel Bennett.....119

SCHURER,U. & HORN,H.G. Salamandra 1976 12 (4):176-188. Observations of Wild and Captive Australian Water Monitors: V.mertensi. Translated by Naomi Cowgill and Daniel Bennett....125

SCHMUTZ,E. & HORN,H.G. Salamandra 1986 22(2/3):147-156. The Habitat of Varanus timorensis timorensis. Translated by M. J. Bennett.....133

SHAMMAKOV,S. 1981. The Reptiles of Turkmenistan. Acad. Nauk. Turkmen. SSR., Ashkabad. pp 312 . p.144-150: Varanus griseus caspius (Eichwald 1831). Translated by Maria Shimanskaya and Daniel Bennett.....136

SOPIEV,O., MAKAYEV,V.M, KRUDRJSTEV,S. & MAKAROV,A.N. Turkmenistan Academy of Science 1987. 598 112:615. A Case of Intoxification from the Bite of Varanus griseus. Translated by Marina.....139

STIRNBERG,E. & HORN,H.G. Salamandra 1981 17 1/2:55-62. An Unexpected New Generation in a Terrarium: Varanus (Odatria) storri.Translated by Jens Labohme and Daniel Bennett.....140

VAN DUINEN,J. Lacerta 1983 42 (1):12-14. Breeding Varanus exanthematicus albigularis. Translated by Claudia Van Dam and Daniel Bennett.....142

VERNET,R. Bull.Soc.Herp.Fr. 1982 22:33-34. Study of the Ecology of Varanus griseus in the northwestern Sahara.Translated by Daniel Bennett.....144

VISSER,G.J. Salamandra 1985 21 2/3: 161-168. Notes on the Reproductive Biology of Varanus (Empagusia) flavescens (Hardwicke and Gray 1827) in the Rotterdam Zoo. Translated by Jens Labohm and Daniel Bennett.....145

WERNER,F. 1900. Zool.Jahr (syst) 13:479-508. FROM: Reptilien und Batrachier aus Sumatra, gesammelt Herrn. Gustav Schneider jr., im Jahre 1897-1898. Translated by M. J. Bennett.....149

YADGAROV,T.Y. Herpetology of Middle Asia. Academy of Sciences, Uzbek SSR. Tashkent 1968: 24-28. Materials on the Ecology of the Desert Monitor (Varanus griseus) in the River Surhandarja Basin. Translated by Maria Shimanskaya and Daniel Bennett.....149

Varanus exanthematicus microstictus in the Iguana Reptile Zoo, Vlissingen, Netherlands.

Anonymus. Zoo report. Undated.

Translated by Mary and Harry of Sassenheim.

Varanus exanthematicus exanthematicus lives in the prairie belt (flat region) north of the rainforest between Senegal and Kordofan. There are three subspecies known; V.e.angolensis, which is found in Angola, V.e.microstictus from east Africa and V.e.albigularis from southern Africa.

The enclosure in the Iguana Zoo is 4.7 metres long, 3.2m wide and 1.7m high. Novilon is used as the substrate. A waterbath is sunk into the floor and has a volume of 1m2 and is 20cm deep.

Furthermore, the furnishings consist of large stones and several thick tree trunks. For heat and light 3 "pressglass" lamps (very strong glass which gives off high energy) with wattages between 60 and 80 are used together with 2 100w lamps which provide a temperature of between 36 and 40oC in the warmest spot, and an overall temperature of 30oC. Nightime temperature varies between 21-24oC, depending on the season.

The animals get water every other day, and food twice weekly: this consists of mice, hamsters, rats, eggs chicken peices (unseasoned drumsticks), whiting and chicken. Only lime (chalk) and a vitamin supplement is added to the last three foods mentioned.

In March 1983 we bought five very young monitors, which were eating the same day. The smallest was 26cm, largest 28cm. The same year, on August 21 we lost an animal because the others regarded it as food. Despite this there were no visible external wounds, but he still died. At the end of November one of the others had an intestinal prolapse, in which there was much broken intestine in the faeces. The intestine was cleaned, lubricated with panologzalf and massaged back inside. An hour later the intestine was again protruding. The treatment was repeated with no result, and the animal was dead the next day. The remaining animals grew succesfully.

In May 1985 we put the monitors onto a 24hr light cycle because of the cold, and gave them water only twice a week, on the days that they were fed. On June 5 we saw Michael (male)mating with Flipje (female). The following day he was observed trying to mate with Roosje (smallest female). Ten days later he mated with her again. After the matings the females ate less. On the 24 June we made a nest in the lizards' enclosure by making a hole in the corner, which was filled with an equal mixture of sand and peat to a depth of about 20cm. A lamp was positioned overhead to warm the soil. Early in the morning of July 8 Flipje laid 26 eggs in front of the lights, three of which were broken. She was very tired and drank a great deal. Later that day she ate a rat, but only with great difficulty. The eggs were removed immediately, but the monitor remained in the nest for three days.

On August 14 Roosje laid 13 eggs, all laid at approximately the same time. Afterwards she could barely walk, and drank a great deal. She also guarded the nest for several days. A month later Michael mated with Roosje again, and on October 19 she produced 21 more eggs. She had scarely eaten during the 71 days in between ovipositions. Two days after this Michael mated with Flipje, who laid 39 eggs on November 19, 134 days after her first laying. The weight of the eggs averaged 55g, after oviposition (eggs weighed 2000g total) she weighed 3800g.

The eggs were incubated at various temperatures between 28 and 34oC, and at various levels of humidity from dry to soaking. Several eggs settled with their undersides in the water.

The eggs from the first batch were all fertile. On November 3 we made a window in an egg; it contained a fully formed monitor. We enlarged the hole to 3 X 1.5cm and pulled out the head and dried it. After returning the egg to the incubator the neonate died a few hours later. The

monitor still had a large yolk and an umbilical cord. It had a total length of 22cm, and when almost dry, a weight of 22.5g. The shell and yolk with the remaining moisture weighed 31g.

On November 25 a crack appeared in another egg. We opened it, and when the head was freed the animal became very lively and stuck his tongue out. On better advice we returned it to its incubator. The monitor slept practically all the time, breathing regularly, once every four minutes. Two days later it crawled out of its egg, and because it still had a large egg yolk we bandaged them. The following day the yolk was two-thirds of its original width. the animal found it very difficult to walk, being still attatched to the yolk. Because there were some dirty bits of shell near the blood vessels we separated the lizard from the yolk. The lizard became very lively, and reacted to the slightest disturbance (it reacted by opening its mouth). As soon as a baby mouse was offered it was eaten.

On November 29 the first animal hatched independantly, and without a yolk. It weighed 42 grammes. The second hatched on December 1, and after that they others followed in quick succession. As a result we had to extensively increase the number of mice. The youngsters were kept in trios in enclosures measuring 50 X 50 X 50cm, with novilon as substrate, several branches and a water bowl, together with a 40w light. When cleaning there was an art to avoiding the open mouths and striking tails. One of the eggs laid in the water was about twice as big as normal, and had begun to go mouldy. This egg was incubated at 33oC for 117 days before we decided to open it. When we pierced the shell moisture spurted out. The animal was alive, but very small (12.5g), and was attatched to a large (25g) rotten egg yolk. This was removed, but the monitor died shortly afterwards. All the other eggs hatched without complications, and only three failed to hatch.

What really gave us problems were the second batch of eggs from Roosje. The young were born with a calcium deficiency, because she had not eaten enough between laying the two clutches. From the 21 eggs laid, 20 hatched, 13 had died before their third month. Altogether we had 78 young. The young from the eggs hatched at high temperatures were female, those hatched at low temperatures male. The last egg hatched on May 10, at 28oC, after 172 days incubation. We kept two animals from each batch, a total of four males and four females.

The four biggest monitors are given ample space in the enclosure shared by their parents. Many are now bigger than their parents, weighing 9kg, with a length of more than 1.5m

Intelligenz eine Wustwarens.

News of a monitor lizard.

Adolf Andres. Bl. Aqu. Terra. Kunde. 1904 15: 269.

Translated by M.J. Bennett.

Some years ago I had a V.griseus about a metre long free in my garden which is surrounded by a fairly high wall. The animal had dug itself a deep hole in which it stayed at night and during the cooler hours of the day. At midday it did not fail to go in search of food in our dining-room. The lizard made its way there over the terrace, raised up just a few steps. Here it waited like a dog for the bits of meat and bones we threw at it, which it greedily devoured in fairly large chunks. Once it eat some four or five day old puppies, the offspring of a dog about the size of a fox terrier. This lizard could distinguish between its "foster parents" and the next door neighbours and strangers: the first it would let approach, but never touch, whereas it always got out of the way of the latter, and if it happened to be in its favourite spot, outside the mouth of its burrow it would disappear inside. Unfortunately the lizard was killed by some unsuspecting people in the garden next door. It had dug a hole so deep that it had made a second exit on the other side of the wall.

The Monitor needs Protection.

A.G.Bannikov. Priroda (Nature) No 9:97.

Translated by Edwina Fenwick.

The desert monitor (Varanus griseus caspius) needs every possible protection. It is extremely important to learn how to breed them in captivity or at least to prolong their lifespan in zoos. In this respect V.A.Igolkina's article is very interesting. She has managed to do a great deal to create relatively good conditions for maintaining these rare animals in Leningrad Zoo.

The Varanidae are the largest contemporary lizards. Some 30 species of this family are found in Australia, southern Asia and Africa. Most grow to a length of 1-2m, but the giant monitors from the island of Komodo, Flores, Pintjar and Padar grow to 3m and weigh 150kg. They often feed on large prey: rodents, lizards and frogs. Many raid birds' nests eating both eggs and chicks, or dig up the eggs of reptiles. The majority of monitors swim well and, when the opportunity arises, eat fish, molluscs and crabs. The giant monitor usually feeds on carrion.

The eggs, covered in a casing which looks like parchment, are laid in the ground by females, some monitors use hollow trees.

Many monitors were commmon, and even numerous reptiles in their appropriate environments. But their numbers have been sharply reduced as a result of intensive hunting for their valuble skin, which is used to make fancy goods, and for their tasty meat. In a series of countries the monitors have come under the protection of the law, and the giant monitor and the most northerly species, the grey monitor, have been listed in the international Red data Book.

The grey monitor of which V.A.Igolkina writes, is found in our counrty in the deserts of central Asia and south Kazakhstan, and also in north Africa and south west Asia as far east as Pakistan and northwest India. This average sized monitor reaches a length of 160cm, including tail, and weighs 2.5kg. Greyish/reddish/brownish on top/from the top with brown transverse stripes, in transverse view it differs from other monitors with its round tail that lacks lateral compressions.

It runs fairly quickly, with the body lifted high on its strong legs, easily climbing bushes and small trees. When confronted by a person it greatly inflates its body, sticks out its long forked tongue and opens the mouth widely. It also defends itself with the tail, which it sweeps to the left and right. Its bite causes illness, and its large teeth make deep wounds.

Monitors live in burrows made by a large peschanik (a member of the squirrel family) or thinfingered suslik (another squirrel), which the lizards make broader and deeper. Sometimes they dig their own burrows, which can be up to 4m long. When searching for food they cover hundreds of metres from the burrow, investigating squirrel colonies and birds nests. Its prey consists of small wild animals up to the size of a young hare, but more often squirrels, lizards, snakes, small tortoises insects and (rarely) birds are eaten. They hunt only during the day, and remain in their burrows at night.

The monitors avoid cultivated areas, and so they disappear when man takes over the desert. Hence this species has pratically disappeared from the Fergan Valley, and has become rare in south west Turkestan and many other places. Unfortunately it is often caught or killed for no reason at all.

Yet the reproductive capacities of the monitors are not great. The females do not lay eggs before they are three years old, usually in clutches of 12-15 eggs (rarely from 6-23), burying them in sand. A large quantity of eggs and youngsters perish.

Der Arguswaran (Varanus panoptes STORR, 1980) auf Neuguinea: Varanus panoptes horni ssp.n.

The Argus Monitor (Varanus panoptes, Storr 1980) of New Guinea: V. panoptes horni ssp.n.

Wolfgang Bohme. 1988. Salamandra 24 (2/3):87-101.

Translated by John Hackworth.

In 1987, Prof. Dr Horn had already made me aware that the Gould's monitor which lives in New Guinea (PETERS 1876, PETERS & DORIA 1878, Monitor gouldi; BOULENGER 1885, LUCAS & FROST 1896, DE ROOIJ 1915, DE JONG 1927, MERTENS 1942, Varanus gouldii; MERTENS 1963, 1971: Varanus (Varanus) gouldii gouldii) was considerably different from the Australian representatives of this species. This is because in the semi-adult and adult stages the latter third or quarter of the tail is always a uniform yellow colour, whilst New Guinea specimens have transverse bands throughout their lives. The verification of this was a specimen imported to the Federal Republic of Germany from Merauke in the southeast of Western Irian i.e. the Indonesian part of the large island which lies off the coast (fig.1). However, there only remained six half grown and juvenile animals which were preserved as museum specimens (2FMK 14778-782, 19290). A further larger specimen kept in private hands is shown as a portrait photograph by WISCHNIEWSKI & WISCHNIEWSKI (1976:182). Its whereabouts since then are unknown.

A further revision of this interesting pointer was however postponed until we could obtain an adult museum specimen so that we could exclude an ontogenetical variable characteristic in the distal bandings of the tail. The adult specimen ZMB 8898 (Maclure Bay, New Guinea) mentioned by Mertens (1942:282) has not been found in Berlin to date (GUNTHER pers. comm.). This is also the case in the Senckenberg Museum in Frankfurt, where it was loaned by Prof. Mertens during the 2nd World War (KLEMMER, pers.comm.).

A short time ago a still unpublished examination work (BRANDENBERG 1983) revised the New Guinea Varanus species in the museums of Leiden and Amsterdam. Under V.gouldii he lists 4 specimens (tbl.1) which were all juvenile to very young adults with snout-vent lengths of 145-220mm. However the investigation resulted in the conclusion - compared to the 5 specimens of V.gouldii from Australia - that "the New Guinea specimens have finer scales across the head between the corners of the mouth, fewer rows of ventrals and fewer ventral scales from the mental to the gular fold. They also have distinctly fewer supralabials than Australian specimens. Nevertheless the severe shortage of basic materials prevented taxonomic consequences to be drawn from these findings".

In the meantime STORR (1980) discovered that the form rosenbergi from southern Australia which was described by MERTENS (1957:18) as a subspecies of gouldii does not live and interbreed with the typical V.gouldii, and is a separate species. Furthermore, and to his suprise, he also found that in the northwest and Western Australia there also occurs a further species which could almost be a twin to V.gouldii. This he described as V.panoptes (STORR 1980:273) and is distinguished from the former by its patterning of alternating transverse bands of large, dark and small and light scales. The name panoptes refers to the numerous light-coloured eyespots on the base of the tail and the rear extremeties and is a nickname for the hundred-

eyed Argus of Greek mythology. For this reason I suggest that the common name for this large lizard should be Argus monitor.

When he first described V.panoptes, STORR divided his new species into two subspecies; V.p.panoptes and V.p.rubidus. The latter subspecies, which is concentrated in the Pilbara region of Western Australia is distinguished from the nominate form by a reddish (as opposed to brownish) ground colour and a "gouldii-like" yellowish unbanded tip to the tail, compared to the continously banded tail of the nominate form, as is also characteristic of V.rosenbergi and the New Guinea populations. If one now compares the diagnostic characteristics of V.panoptes as opposed to the New Guinea populations of V.gouldii it can be seen that according to the dorsal patterning (see above) and because the ventral spots are arranged in transverse rows which correspond with the dorsal rows of transverse spots, this species must be unambigously classed as V.panoptes. Even the continously banded tail tip is found as in the nominate form.

Although the nominate race, as opposed to V.p.rubidus is the nearest neighbour to New Guinea there are however several important differences in the philidosis and the ontogenetic dorsal markings which transcend the degree of difference between V.p.panoptes and V.p.rubidus. I cannot, therefore, classify the New Guinea populations of the Argus monitor with either of the Australia subspecies. Because of this variance I thus describe and establish them as a third subspecies:

VARANUS PANOPTES HORNI (ssp. nov.)

Diagnosis: Proven by the alternating transverse rows of dark and light spots and the corresponding rows of ventral spots as a member of V.panoptes but distinguished from V.p.panoptes by lower dorsal values (170-205 vs. 192-242) with significantly different average values (X = 188.27 vs. 221.3) and a dorsal pattern which begins to disperse at the subadult stage. It is also set apart from V.p.rubidus by the permanently banded tail tip and the lower number of lamellae below the fourth toes (24-26 X = 24.95 vs. 27-31, X = 28.7).

Derivation nominis: The new form is dedicated to Prof. Dr. Hans-Georg Horn, who was not only the first to recognise its independance but who also contributed numerous important works and impulses for the investigation of this fascinating large lizard.

Holotype: ZFMK 19290, subadult male, New Guinea: West Irian (Indonesia): Merauke; by B. SCHULZ. III, 1977, Figs. 2a, b & 3.

Total length 655mm, build slim (figs. 2a,b), tail 1.51 times as long as the head and body. Rear legs conatined 2.36 times in the snout-vent length. Nostrils nearer to the snout tip than to the eyes. Canthus rostralis very sharp. Supraoculars small, however larger in the centre of the lamina superciliaria than at the edges. Head scales in the interocular area are the largest but become smaller towards the back of the head. An enlarged transparent scale over the pineal organ . Neck scales small and sharply keeled gradually changing into the also keeled dorsalia.

Throat and ventral scales smooth and enlarged as are the scales on the underside of the extremeties as opposed to the scales covering the upper sides of the extremities. For philidosis values and measurements see table 1. Claws elongated but only very slightly curved. On their upper surface is a large cap-like scale.

Ground colour dark brown, in the head region blackish-brown. Sides of the head in the frenal area are speckled with yellow. Eyelids whitish-yellow; a lightly coloured supracilliar stripe from the upper lid to the back of the head; a second as a continuation of the lower lid to the upper edge of the ear drum, which is bordered at the front and below by a lighter colour. Below the ear drum there is a further narrow stripe running to the joint of the front legs, limited ventrally by a row of blackish-brown spots which form the transition to throat spots (fig.3). The back is covered with transverse bands of light, dark bordered spots, between which there are partially dispersed transverse rows of dark spots. The upper side of the double keeled tail is densely covered in transverse bands. Over the last quarter the distances between the transverse bands become much greater. The underside of the tail has no markings. The ventral surface is covered with dark transverse bands some 1-2 scale rows wide. these join up with the transverse bands on the flanks (fig 2). The upper sides of the extremities are covered with light spots which sometimes run into transverse bands on the arms and lower thighs.

The incompletely exposed hemipenes of the subadult male show two symmetrical, smooth edged hemibacula (fig 4). Paryphasms are already significantly differentiated (for terminology see BOHME 1988).

Paratypes: ZFMK 14778 - 782, subadult and juvenile, same data as holotype but imported in XI 1974, male subadult, Papua New Guinea, Port Moresby Savanne. T SCULTZE-WESTRUM, 5.XI.1959 (figs 5 & 6 left).

The five animals from Merauke are completely identical to the holotype in both colouring and markings. Even after 14 years of alcohol conservation the contrasting colours are remarkably well preserved. It is especially prominent in the head regions of these specimens, which were imported by WISCHNIEWSKY & WISCHNIEWSKY (1976:182). The male from Port Moresby which is comparable in size to the holotype has strongly reduced colouring and markings to the series of specimens from Merauke. They do however have the typical elements i.e. dorsal and ventral spots as well as the banded tail tip which can still be recognised. The variability in philidosis is summarised in Table 1.

Distribution: V.panoptes horni ssp.n. is known from the following New Guinea habitats: (Ciphers refer to Fig.1.).

1. Maclure Bay - Maclure Bay, today Teluk Berau (PETERS 1876, DE ROOIJ 1915, MERTENS 1942).

2. Kampong Gelib, today Gelib (DE JONG 1927).

3. Merauke (BRANDENBERG 1983: ZFMK documents).

4. Koerik (BRANDENBERG 1983)

5. Bensbach (Photographic documents A.ALLISON, his work).

6. Yale Island = Yule Island (PETERS & DORIA 1878, DE ROOIJ 1915)

7. Port Moresby (MERTENS 1971).

8. Aroma (DE ROOIJ 1915).

Two further habitats Hula and Gerekanumu (DE ROOIJ) could not be verified on the available map material. Thursday Island and further islands of the Torres Straits are not considered in Fig.1 because the identity of the monitors there still need to be clarified. The conclusions that can be drawn are that V.panoptes horni inhabits the the entire southern coast of New Guinea insofar as suitable biotopes (open landscapes with a savannah-like character) are present.

Further materials: The specimens RMNH 14027, 21056 (Keorik) and 21057 (Merauke) and ZMA 10206 (south New Guinea) are only evaluated and contained in table 1 on the basis of the philidosis.

Relationships: On the basis of the description of Varanus panoptes (STORR 1980, STORR ET AL 1983, COGGER 1983;261f). there are available figures for the philidosis with average values only for the scales around the middle of the body and the lamellae under the fourth toe. The latter fall within the variation width of V.gouldii and therefore are of no taxonomic importance here. the inclusion of the values for the transverse rows of scales around the body (fig.7) shows that V.panoptes, especially in its nominate form, has smaller scales than V.gouldii. This is also stated by STORR (1980:273) although he uses only Western Australian V.gouldii for comparison.

If one includes the total Australian variability of this species (COGGER 1983:529) the difference is less striking (sse fig 7). Nevertheless it is obvious from the illustration that V.p.horni overlaps with V.p.panoptes and V.p.rubidus, but that its average values are below the minimum values of both Australian subspecies, or conversely that the average values of both these subspecies exceed the maximum values of V.p.horni. A V.p.rubidus with extremely few body scales originates from Dolphin Island and is thus correctly classified by STORR as an aberrant.

In the literature from before 1980 it is extremely difficult to evaluate numerical values, since with all details of V.gouldii one must also reckon with unknown panoptes material as well as west and northwest Australian material being included. Unfortunately STORR 91980) and STORR ET AL (1983) do not give any details of longitudinal and lateral rows of ventrals, the gularia or at least the scales on top of the head. Regarding the last characteristic, STORR

(1980:273) states only that V.panoptes is distinguished from V.gouldii by smaller, i.e. more numerous interorbital scales. The results of the figures of the BRANDENBURGS (1983) and myself (hoc loco) result in the discovery that V.p.horni has larger, i.e. less numerous (!) scales on the top of the head than has V.gouldii (for values see table 1). The conclusion is therefore that V.p.horni must have significantly lower values than V.p.panoptes or V.p.rubidus, although in this case no concrete figures could be determined. This is therefore one further characteristic to distinguish New Guinea specimens from those of Australia.

V.p.horni has its permanently banded distal tail section in common with the north and northwestern Australian V.p.panoptes but also with V.rosenbergi, which is limited to the southern perimeters of the gouldii areas. That this is really the case is proven by (as well as our subadult material) a photograph of a large V.p.horni male from the Bensbach area of southwest New Guinea (fig 8) which serves to document the adult colouring. Unfortunately there are no available measurements for this specimen photographed by A. Allison, but it is nevertheless obvious that V.p.horni is at least as large as its Australian relatives (up to 1.4m) or could even reach the length of Gould's monitor (1.6m).

The banded distal tail section as opposed to the unicoloured light whip of V.gouldii is certainly in the original condition and occurs interestingly among the peripheral forms. This thus gives the impression that on the periphery of the widely distributed and ecologically flexible Gould's monitor several more original or related forms have survived, whereby the lack of symmetry has only been proven for V.p.horni. On the basis of its unmixed occurence with V.gouldii in a narrow strip of south and southwest Australia, V.rosenbergi is classed as a separate species (STORR 1980:282) which in the meantime has also been verified by a comparison of the structures of the hemipenes (BOHME 1988). Above all, because of the V.panoptes-like dorsal markings in young animals (fig.5 left) V.p.horni illustrates that it is less pleisomorphic in comparison to Australian animals. A corresponding dissolution of the markings occurs , according to STORR (1980) and STORR ET AL (1983), only in very old V.p.panoptes specimens. The stronger setting of horni results from the reduced scale count.
Zoo-geographically it is not suprising to discover northern Australia species in New Guinea. However it is also plausible that identical taxa cannot be found here. Because the chorological relationship does not stretch over northern Queensland and Cape York to New Guinea, the Australian populations of the Argus monitor have intra-specific differences in characteristics as is also the case in the south for V.rosenbergi (fig.9). The taxonomic placement of V.p.horni on New Guinea is therefore zoologically feasible. It is characteristic that this is a case of an animal which inhabits arid regions and which during the pleistocene age with its changing climates and sea levels, was able to make full use of any existing land bridges, as was the case for inhabitants of rainforests ( see the literature survey of Cavacevitch (1986:21). That the Argus monitor colonised New Guinea from Australia and not the reverse is obvious when one considers not only the V.gouldii complex in question here, but also all the members of the V.gouldii group i.e. V.giganteus, V.spenceri and V.mertensi. Together with V.gouldii, V.rosenbergi and V.panoptes they form a chorological (KING & KING 1975), biochemical (HOLMES ET AL 1975) and genital morphological (BOHME 1988) homogeneously related group which is so far removed from other large monitors of the Indo-Australian region that

they should certainly be assigned the status of a separate sub-genus. the old name Pantherosaurus (FITZINGER 1943) ‹species typica V.gouldii› is available.

Conclusion.
Naturally the present work leaves many questions open. To the variability of characteristics should also be added that face that the already mentioned lamellae beneath the fourth toes are of no use to distinguish V.p.horni from the Australian subspecies. However the figures of STORR (1980) and STORR ET AL (1983) show that between V.p.panoptes and V.p.rubidus there is practically no overlapping, a characteristic which can also be used to seperate the two Australian subspecies from one another. Nevertheless STORR does not mention this in the text and diagnoses each exclusively by the characteristics of colouring and marking.

To the zoo-geography should also be added that hitherto all "original" Gould's monitors living in New Guinea were regarded as V.p.horni. One should not ignore the fact that in a later immigration phase V.gouldii could actually have reached New Guinea via Cape York. The evidence from islands of the Torres Straits (e.g. Thursday Island) could also bring us to the conclusion that the Argus monitor colonised in exactly the same way.

HOUSTON (1978:49) directs our attention to a new scalation characteristic which serves to distinguish V.gouldii from other monitors (V.varius, V.giganteus) in his identification key, and that is the formation of the scales above and around the claws. In the last named species these take the form of a cap which is not however the case with V.gouldii. Our V.panoptes horni also has these claw caps, but our specimens of V.g.flavirufus (ZFMK 19209, 29329 and 29983) also have them. Thus it follows that in his work, HOUSTON has only considered southern Australian material (see the title of his book) of V.gouldii. Nevertheless it would be interesting to know if this was also the case with Australian Argus monitors. Only then would a purposeful evaluation of the presence of these caps in V.panoptes be possible.

One would thus think that it would be relatively simple to prove this with relevant material. However at this point we should establish the following: Astonishingly the Varanidae, which are the largest-growing lizards in the world, still present a fascinating number of discoveries, not only with regard to new species still to be found (see BOHME 1987 and unpublished) and especially regarding new experiments into their biology, ethology and the history of their evolution (BOHME 1988, GAULKE 1988 and other specialist literature quoted there). In addition to these fruitful perspectives of future research we have had to cope with the legislative situation which has prevailed since 1976 which deals with the irresponsible commercial treatment of these animals. There are a number of beurocratic hurdles to be cleared before research material can be obtained. These have prevented research by a number of well known zoologists. The balance resulting from a survey carried out by the German Zoological Company (D.Z.G.) amongst its members. As the chairman of this commission remarked (NAUMANN 1985) this could not be in the sole interests of the German Federal Republic. We hope that our research into the wealth of new challenges offered by the Varanus family of large monitors will be able to be effectively resumed as soon as possible.

# The Discovery of a Giant Monitor Lizard (Sauria: Varanus) from the Arabian Republic of Yemen.

Wolfgang Bohme, Johannes Peter Fritz and Felix Schutte. 1987 Herpetofauna 46 (February): 13-20.

Translated by Naomi Cowgill & Daniel Bennett.

In 1950, when KRUMBIEGEL wrote his short volume of New and Undiscovered Animal Species, he listed. among the 21 newly discovered species in the first half of the century, a reptile, namely the Komodo monitor (Varanus komodoensis). It has been proved that this species of over 3 metres in length, which was first discovered in 1912 was not the last known representative of the giant monitors on Earth. As well as a whole line of newly discovered and described dwarf monitors, the Indo-Australian sphere in 1951 produced V.karlschmidti and V.mertensi, and in 1957 V.rosenbergi (see MERTENS 1963).

The Dragon par excellence from the highlands of New Guinea, mentioned in 1981 by Probst in his report on newly discovered animals is certainly no new discovery of the last few years: the genuine Papuan monitor of over 4 metres in length (V.salvadorii) has been known since 1878 (MERTENS 1963). Nevertheless, the new description from New Guinea of the population of giant monitors stands as previously unknown taxonomy. Prof. Hans-Georg Horn In Sprockhovel first drew attention to it shortly before BOHME & BRANDENBERG (in preparation). Whereas the existence of this giant monitor has long been apparent in New Guinea, its taxonomic individuality had previously gone unnoticed. Even today there are still large monitors which remain unseen by any herpetologists. One such new discovery, which came about in the most strange fashion, was reported recently in the Arabian Peninsula, and will be discussed in the following pages.

A three month herpetological research trip to the Arabian Republic by two of the authors (Peter Fritz and Felix Schutte) was supposed to supply the basis of two dissertations under the charge of the Museum - Koenig in Bonn, concerning the reptiles of the Republic of Yemen (Fritz 1985) and the amphibian fauna (SCHUTTE 1986). During the course of publication we were able to make contact with the German film producer Dr Wieland Lippoldmuller, who in 1984 had made a nature film about the north Yemen, and had unwittingly filmed a scene with a monitor. The film had already been shown by the German television company Z.D.F. (channel 2). The news of this encounter with a monitor made us sit up and listen, as according to the literature, no monitors had previously been detected in north Yemen. It was certainly expected that the desert monitor (V. griseus), which is widely distributed around the Yemen borders in southern Arabia, would be present in north Yemen, particularly as documentation had been provided from nearby Aden (Peoples Rebublic of Yemen, or South Yemen) (MERTENS 1942: 342) However, proof of V.griseus in North Yemen would have been expected primarily in the Arabian desert going over into Rub-al-Khali., i.e. east of the high mountain ridges which run in

a north-south direction. Dr Lippoldmuller's film scene was filmed west of these mountains in an area where the coastal desert of the Red Sea, or Tihama crosses over into the so-called Gebirstihama. The animal was caught off guard in a wadi (dry river bed) aaprox 10km north of the village of As Sokhna (see drawings 2 & 3), just as it was about to climb a little tree. The area that it was found in, and the fact that it was climbing a tree, made it unlikely to be V.griseus, so we asked for some visual aids in order to evaluate the evidence and our own opinions. A liberally afforded copy of the film (picture 1) immediately made clear that we were not dealing with the desert monitor. Rather, we were dealing with an animal that was very similar to the African steppe monitor V.exanthematicus, or at least resembled it. This electrifying fact naturally led to making the search for the animal the main point of the January to April research trip, with the goal of taking one or several specimens to Bonn, without which the sensational new discovery was unexplainable. In spite of our great exertions and many visits to the area of As Sokha, which is fairly inaccesible, we were unsucessful, and did not even catch sight of one. Even in areas inhabited by natives or Europeans very little of any great use was contributed. Thus we had to bury our hopes of finding a type specimen and saw our chances of finding one in the future with great pessimism. Even three months after the search there had been no success, but this secretive monitor continued to occupy our thoughts incessantly. Dr Walter Auffenberg, the famous American monitor expert, was shown the film we had whilst on a working visit to the Museum Koenig in Bonn, after which he assessed the monitor as a new, still unascribed form. He remembered his rediscovery of the Philippino monitor V.grayi (= olivaceus), which had been lost without trace for more than a hundred years, and proposed involving the IUCN and WWF in the research and necessary protection of the Yemen monitor.

In late Autumn, a leading expert on the reptiles of Arabia, Dr Edwin Nicholas Arnold from the British Museum in London, saw our film during a symposium on the Zoology of the near East in Maine, and remembered that his own museum possessed two steppe monitors from Al Khobar in South Yemen, whose collector had also been collecting in Somalia in the 19th century. It had been presumed that they were mislabelled and had come from Africa. Later Dr Arnold wrote to say that our pictures showed that one of the two V.exanthematicus from Al Khobar seemed to be a completely different variety (30.1.1986). He agreed with our idea that it would be sensible to publish the photographs, even without a type specimen. With such a publication we could make as many travelling research biologists as possible in Yemen aware of the new discoveries. However, before things developed so far, a new chance arose to track the monitor down, due to the plan of our colleague Beat Schatti to make a journey which was primarily devoted to the snakes. B. Schatti (of the Zoological Museum, Zurich) appeared interested, and prepared to search the As Sokha area for us. In case of success, and as a precaution, an import permit had already been applied for in Switzerland, with the help of Mr Rene Honneger, curator of the Aquarium in Zurich.

During October 1986, at As Sokhna, B. Schatti did indeed succeed in catching not one, but eight, monitors, and importing them into Switzerland. This success may well have had a lot to do with the season, for the rains prevail in October, but from January to March is the main dry season, when many reptiles, and probably he monitors, are in hibernation. At present six of

these animals are under the care of Mr Honneger, where they are supposed to form a breeding group. The remaining two, an adult and a young animal without a tail reached the Museum Koenig in Bonn, which with its own animal house and a public vivarium, is particularly well equipped as a museum, to keep reptiles.

A report in the daily press (Bonn Generalanzeiger of 10.12.1986) about this sensational discovery lead to a further unexpected peice of information: Herr. Prof. Dr. Horst Kopp from Freiburg, a law expert and the president of the German-Yemen Society, wrote in a letter of 31-12-1986, that he too had sighted a monitor in North Yemen, namely 20km east of Bajil (see drawing 1 -3). His unsuccesful photographs, one of which is reproduced here (picture 4) show that it is the same as those in As Sokhna.

On 8.1.1987. Prof. Kopp wrote the following about their habitat: "The location of their discovery in As Sokhna may well belong to the same ecological system as mine, the edge of the mountains at approx. 300metres above sea level, with light bramble, or degraded dry forest, fairly warm throughout the year and maybe 300mm of rainfall, concentrated in late summer. Substratum sandy to gravelly with a moderate proportion of poor clay".

The discovery described here, opened, after a suprisingly short time, the possibility of a thorough examination of the identity of the Yemen monitor. Particularly advantageous is the presence of living specimens, for even museums have reflected back on the literal meaning of the word bio-logy (i.e. science and life) and have recognised that the living animal, with all its manifestations of life and achievements even in the case of relative research is much more meaningful than that by no means superflous preparation in alcohol.

To clear the identity of the monitor, many possibilities come into consideration, which are briefly outlined here:

1.It is more or less closely related to the previously elusive African monitor V.exanthematicus. As a comparison of sections 3/4 and 5 shows, some differences exist between these and the nominate form (V.e.exanthematicus) such as the position of the nostrils and the shape of the scales, (particularly on the head and neck) and the colour of the tip of the tail. Reliable conclusions can only be drawn when the east African subspecies (from Ethiopia to Tanzania) V.e.microstictus are included in the comparison. There is hardly any material of this subspecies in the West German museums, so examples will have to be brought from elsewhere.

2. Zoogeographically this is possible,, one only needs to think of the Arabian frog Rana cyanophlyctis, a relationship of this monitor to the yellow monitor (V.flavescens) is possible since Mertens (1942) place it with the steppe monitor in the subgenus Empagusia.....

Although a close relationship of the Yemen monitor to the yellow monitor is less probable, this species should also be included in the comparisons. The same applies to the planned blood examinations. In order to take out some microlitres of blood painlessly and without damage from the tail vein, all these species and subspecies must be made available, for which requests

will be made to both public and private terrariums. There is probably a closer relationship with the African monitor, since comparisons and parallels show that the fauna elements of the coastal {tihama} are mostly identical with their relatives from the African Red Sea. From herpetology, the dwarf geckos Pristurus flavipunctatus and P.crucifer, the Turkish gecko Hemidactylus yerburri (see FRITZ 1985), or the puff adder (Bitis arietans somalica) are offered as examples. Opposed to this the fauna elements of the {Gebirgstihama} and the mountains often used to be regarded as being of the same species as their east African relatives (e.g. Agama cyanogaster - Klausewitz 1954, Bufo pentoni - Balletto & Cherchi 1973) were later recognised as individual varieties: A.yemenensis (Arnold 1980) and A.adramitaria (Peters 1982), Bufo tihamicus (Balleto et al 1985). With regard to the identity of the Yemen monitor and its zoogeographical relations one can establish worthwhile hypotheses prior to this verification and transformation into facts, and to the eventual allocation of a new scientific name. Many thorough examinations are necessary. Yet, in any case, be the Yemen monitor a new population of an already known African monitor, a new subspecies or a completely new variety, we nevertheless have a new spectacular large lizard from Arabia before us. It should, therefore, be the object of a lengthy project as soon as possible, in oder to aquire the necessary biological and ecological scientific basis for an effective form of protection.

Thanks first and foremost to Dr Wieland Lippoldmuller, Munich, who set the wheels in motion with his film, and is therefore, the cause of this discovery. For construcive conversation and attitional information about the monitor we thank Dr E.N. Arnold, London, Dr Walter Auffenberg, Gainesville, W. Bischoff, Bonn, Prof.Dr.H-G Horn, Sprockhovel, Dr U Joger, Darmstadt, D.Rappenhohner, Leverkusen. Last but not least we thank Beat Schatti, Zurich, who, with help from Rene Honneger, Zurich, succeeded in bringing the monitor to Europe.

L'Alimentaire des Varanides du Senegal

The Diet of Varanids in Senegal.

Mamadou Cisse. Bulletin de L'insitute Fondamental d'Afrique Noire. 1972 34 (2): 503-515.

Translated by Daniel Bennett.

Introduction.

Several authors have given information on the diet of monitor lizards. ROUX (1936) states that "The monitors are carnivores, but not exclusively so. They eat mice, small rats, lizards, fish, frogs and also ripe banana and honey diluted in a little water. They take dead prey readily". We

do not know which species of monitor he is referring to. Moreover he is citing an example of captive animals.

FITZSIMMONS (1943) speaks of the food of Varanus albigularis and V. nilocticus.

GAUTHIER (1967) deals with the diet of V. griseus and GUIBE of the monitors in general.

Because of these accounts and many others which we have not cited, it seems superfluous to say more about the diet of monitor lizards. Nevertheless it is known that the greater part of these studies have been done in the different regions of the "Sahelo- Sudanese" savannah, so the use of an analysis of the food in this area can been seen. Besides, the diet of V. exanthematicus exanthematicus has not been the object of many publications, and to our knowledge there is not another comparative study of its dietary regime, nor of that of V. nilocticus. This is to be the object of these notes. We have attempted an analysis of the diets of these two species in order to establish the similarities and differences. The work has nothing original, but we hope that this contribution will, in some measure, give more specific information on the diets of Varanids.

Materials and Methods.

We conducted our research in Senegal, a tropical "sahelo Sudanese" area characterised by alternate wet and dry seasons. V.e. exanthematicus Bosc and V. nilocticus Linne are the only monitors which live there. The first is terrestrial, the second primarily amphibious. The seasonal activity of these animals is strictly bound by climatic conditions.

During the winter season they are very active and fed themselves to satiety. During the dry season they observe a more or less complete fast, according to the species (CISSE 1971). We studied them over two seasons and have analysed their stomach contents by identifying, weighing and counting the ingested prey.

The two monitors are diurnal. They emerge from their retreats at about 0900 and return at about 1730. We took their stomach contents between 1300 and 1900. For this we have returned once or twice a month to an area where both species are relatively abundant; the sector of Fissel - Diaganiao in the region of Thies. There we recruited some villagers who were well experienced in the capture of animals. Each monitor was immediately weighed, killed and the stomach contents removed and weighed separately. Next the stomach was labelled and put into a glass jar containing formalin. Afterwards they were transferred to the I.F.A.N. for identification by the department of Zoology of Invertebrates.

Results.

I. Research of nourishment and prey.

A. Varanus exanthematicus exanthematicus.

The animal finds its prey by active searches in which the eyes play an essential role. The chase begins when the animal has left its retreat around 0900, although the animal suspends its activity between 1400 and 1500. The prey are found in the branches of trees, amongst the bases of plants (in the flowers of Ipomea in particular) and in organic material in a state of decompostion (especially in ruminant dung). V. exanthematicus is voracious. It swallows its prey whole and can ingest up to 10% of its own body weight. A specimen weighing 600g had stomach contents that weighed 61g, another weighing 1kg contained 115g of ingested prey. The taking of prey is greatest from July to October. It begins to diminish in November, at the end of the dry season. Thus all individuals taken from July to August have completely full stomachs, those captured from 20 November had either meagre stomach contents or were empty. Towards the end of December the monitors rarely has any foods in their stomachs. Of 8 specimens collected on December 22 only one contained an item of prey. In January all monitors had empty stomachs.

In total we analysed the stomach contents of 28 animals. The results are presented by monitor and by month in table I. The identified prey was made up exclusively of invertebrates except for the eggs of Agama agama and V. exanthematicus. The following were found;

1. Insects.

a. Coleopera:
- Carabids: Ctenosta senegalense, Megacephala megacephela, Scarites sp.
- Curculionids: Episus sp.
- Dytiscids: Cybister sp.
- Meloids: Psalydolytta fusca.
- Scaribids: Adoretus sp. Anomala sp. Oryctes sp. Schizonycha africana.
- Tenebrionids: Pimelia senegalensis, Phrynocolus dentatus, Vieta senegalensis.

b. Dictyoptera: Mantes: Epitenodera gambiensis
c. Hymenoptera: Aphids: Xylocopa sp.

d. Lepidotera: chiefly Chenilles and Sphingids.

e. Orthoptera:
- Acridids: Acanthacris ruficornis citrina, Anacridium sp., Kraussaria angulifera, Cataloipus sp., Oedaleus nigeriensis, Humbe tenuicornis.
- Gryllids: Gryllus bimaculatus
- Pyrgomorphids: Zonocerus variegatus
- Tettigonids: Homorocoryphus nitidulus vicinus.

2. Arachnids: a scorpion of the family Buthidae.

3. Myriapods: Diplopodes (Iules) and Chilipods (Scolopendra).

4. Molluscs: Gasteropods pulmones Helicarionines.

5. The eggs of Varanus exanthematicus and Agama agama.

In order of number, prey was distributed as follows;

Myriapods 48.32%
Insects 45.49% of which 21.22% were Coleopterids, 15.21% Lepidoterans (Chenilles) and 8.84% Orthopterans.
Eggs of Agama and V. exanthematicus 3.75%.
Gasteropod molluscs 2.35%.
Arachnid scorpions 0.11%.

These results interpret the respective percentages of prey items, but they do not give information on their distribution in the predators. This we have indicated by the degrees of prescence (LESCURE). The number of animals containing each prey is given. In other words, it shows the percentage of animals containing each prey.

Table II shows the different prey with their percentages and frequency of prescence. The prey most frequently consumed by V. exanthematicus in the area where our research was based was the Coleopterids (64.28%), the Myriapods (53.57%), larvae of Lepidopterans (46.42%) and the Orthopterans (35.71%).

If we consider this diet by month we need to establish whether it reflects the availability of the large invertebrates of that period. In fact, the Coleopterans, larvae of Sphingides and the Myriopods, which are abundant during the first half of the winter constitute the main items of prey during this season, whilst they are absent from the intestines towards the end of the season, replaced at that time by the Orthopterans which become more numerous. Otherwise, except for the reptile eggs (Agama and Varanus) we did not find any trace of vertebrates in the diet of V.exanthematicus. This species feeds exclusively on invertebrates and eggs (including those of its own species). Towards the end of December all feeding ceases until favourable conditions return.

Is this diet different from that of Varanus nilocticus? This is what we are going to find by examining the stomach contents of the second species.

B. The Diet of Varanus nilocticus.

Like V.exanthematicus, V.nilocticus makes an active search for its prey. Leaving the burrow around 0900 it warms itself up before it begins to hunt. One day we observed an individual which took its morning sunbathe close to the Sea of Ndiokoda, not far from Diaganiao. The animal was in a tree (Celtis intigrifolia) which contained its retreat, laid against the trunk with its back turned towards the sun. It rested in that position for more than half an hour. This species is very ubiquitous during the winter. It can be found in all the microbiotopes of the

region, in ordinary fields, on the edge of water, in the water and in areas of human habitation. Sometimes one has the impresssion that it sets traps for its prey. In fact, in the fields the animal often digs shallow burrows which differ from its normal retreats. This would probably be to unearth prey at some earlier time. But later on these holes must have served as traps, as the lizards dig them, systematically outside its daily exits in order to take its prey. We once suprised a male who was in the process of exploring a burrow in a field of groundnuts in Bafaye, close to Fissel. After capturing it we excavated the hole and found a toad. In addition another V. nilocticus was stalking (nearby). We have seen them in Acacia bushes in the act of waiting for the little birds that nest there. The animal will eat dead prey readily. It is possible to catch one on a hook and line with dead bait (frog, lizard, rat etc.). This operation is never successful with V.exanthematicus, which appears to eat only live prey.

We have analysed the stomach contents of 32 V. nilocticus. The prey are listed in table III. We have ascertained that this species eats invertebrates like V. exanthematicus. But in addition it takes vertebrate prey. Among the prey ingested, we have identified;

Fish - Protopterus annectens.
Bachtrians - frogs and toads
A turtle - Pelusios subniger.
Lizards - Agama agama, Mabuya and V. exanthematicus.
A bird of the genus Ploceus.
Murides.

V.nilocticus takes its prey from all classes of terrestrial and freshwater vertebrates. The case of the turtle is particularly striking, and we have photographed the stomach with its contents. The specimen was a juvenile whose carapace measured 5.5cm in length and 4.3cm in width. A countryman of ours affirms that he has found a snake it the stomach of V. nilocticus, and we believe him. Thus this species is a complete carnivore. It will attack any animal that it is able to swallow. Its diet is more varied than that of V.exanthematicus, whose young it does not spare.

Its different prey are listed in table IV with percentages and frequency of prescence.

Fig.1. The stomach of a V.nilocticus containing a turtle (Pelusios subniger). Nematodes are frequently encountered in the intestines of monitor lizards.

Here we are concerned with the species diet according to season. In our previous publication we have shown that these animals feed themselves in water within their range, but that they fast and are inactive during the dry season when their environment shows a deficency of water.

Comparisons of the diets of the two monitor lizards.

After our results we can ascertain;
1. That the two species feed on the same invertebrates including all the available species of a large enough size.

2. That Varanus exanthematicus feeds exclusively on invertebrates and eggs, whereas V. nilocticus also eats any vertebrates it is able to swallow.
3. That V.exanthematicus young invariably endure all the dry season when V.nilocticus does not, and aestivates whilst its water is absent.

Discussion and Conclusion.

Our analysis of the diet of monitor lizards relies on the list of identifiable prey in the stomach contents. A simple summary of the limits of such a method; it does not make allowance for prey that are digested very quickly. In order to be exhaustive it would be worth while making a study of the animals' excrement. But this is very difficult to do in the field. And, as for food that disappears quickly in the stomach we do not feel that they are numerous. The greater part of ingested prey is more or less sclerotic if it is not of vertebrate origin, and is therefore resistant to rapid digestion. The identifiable prey in the stomach contents represents the major part of ther diet. Also, we think that our work, despite its shortcomings, is not devoid of interest. It allows us an idea of the actual food of V.exanthematicus and V.nilocticus in the savannah "sehelo soudanienne". This diet is made up exclusively of invertebrates in the case of V.exanthematicus and of all available prey in the case of V. nilocticus.

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FROM: Le Cycle Genital des Varans au Senegal.

FROM The Genital Cycle of Varanids in Senegal.

Marmadou Cisse. Bulletin de l'Institute Fondamental Afrique Noire. Ser. A 38(1):188-205.

Translated by Daniel Bennett.

In a previous study concerning the variations in gonad mass and fat deposits of Varanus nilocticus in Senegal (CISSE 1973), it was noted that the sexual cycle of this animal consists of two phases: a period of glandular development from June to October (wet season) and a period of regression and rest from November to May (dry season). Furthermore, the appearance of growth in the testes in February was noted. But as the results simply recorded an increase in weight it gave no precise information about the nature of the growth. Was it an artefact or evidence of a actual abortive activity? The present study aims to clear this ambiguity. It concerns both V. nilocticus and V. exanthematicus, the only Varanids living in Senegal. The

analysis considers the gonads and is followed by a histological study. [N.B. The greater part of the histological studies have been omitted in this translation because my French wasn't up to the job - D.B.]

Materials and Method.

The study animals were caught in the wild and sacrificed towards the middle of each month after being weighed. The gonads were likewise weighed separately from the body and were fixed in "Bouin-Hollande", 5 microns were cut from each and dyed with "Trichrome de Masson". The weight of the gonads was expressed as a percentage of body weight. The monthly average measurements were calculated and the limits of their reliability determined to the level of probability where P = 95%. The severed tissues were examined by "photonique" microscope and the characteristic stages of the gametes photographed.

Results.

1.Sexual cycle of males.

A) Changes in testes weight.

The monthly average measurements are given in table 1, the curve of variation in figure 1.

In V.nilocticus the graph shows little variation from January - May, except a slight transistory rise in February. In contrast, a progressive rise took place between June and September, followed by a decrease from October to January.

In V.exanthematicus the curve behaved the same way as above, except that growth appeared a little earlier, in May instead of June.

These preliminary observations suggest that the reproductive cycle is similar in males of both species. After resting from January until April the testes develop until September and shrink from October to December. However the period of rest allows a transitory growth in February

B. Histological Study.

Microscopical examination of testes tissue show that spermatogenesis is synchronized alike in both these Varanids. In January the germinal epithelium does not allow a category of cell germination. Spermatagonia are primitive (figure 2). The external limits of seminiferous tubules are festooned and the spaces between tubules are large. The tissue of the intervening spaces is formed of small cells loaded with granulations.....etc.

Thus, the histological examination reveals two principle phases in the annual testicular cycle; a phase of spermatogensis from April to October, followed by a period of regression and rest from November to March with some abortive activity in February, complying with the recorded increase in weight.

Elsewhere, one notices that sexual awakening occurs in the full dry season; at this time the Varanids eat little or nothing at all. This leads one to think that the initial energy needed for "unlatching the door" of spermogenesis is of endogenous origin.

2. Sexual cycle of females.

A. Study of ovaries

i) Changes in weight.

Monthly averages are shown in table 1 and their representative curves in figure 9. In V.nilocticus the graph does not show any notable changes between January and May. They begin to grow in June, culminate in October and decrease in November and December.

In V.exanthematicus no great change is seen from January to March. Growth begins timidly in April, to become explosive in September. It is followed by rapid descent from October to December.

Histological Study.
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The females show a genital cycle parallel with that of the males. The ovaries develop from April until September/October and afterwards regress and put themselves to sleep from November until March.

2. The Eggs.

From the end of December until mid September no eggs were found in the oviducts. However in most of the female sacrificed between mid September and the beginning of September were gestating. In the same(?) species the number of eggs seemed to vary with the size of the individuals. In effect, in V.exanthematicus one female weighing 500g contained seven eggs, the larger females up to 40. The number of eggs found was equally dependant on species, so that in V.nilocticus there were never more than 30, whereas V.exanthematicus yielded as many as 41. The eggs were slightly larger in the former species (5-4cm) than the latter (4-3cm).

The laying of eggs takes place from late October until early November. But in V.nilocticus the females lay eggs as late as December. One gravid specimen of this species was caught on December 31 by a terrier. It was probably about to bury its eggs, which indicates that these animals oviposit in the ground and cover their eggs with earth. This opinion is confirmed by the fact that gestating females kept in terraria would deposit their eggs in the terriers' diggings and recover them with earth.

Hatching takes place with the first rains of July. The remains of two very young V.exanthematicus were recovered from the stomach of a V.nilocticus caught in July. Furthermore, the very young monitors in the collection of the I.F.A.N. were caught in July.

Discussion and Conclusions.

The sexual cycle of varanids in Senegal is divided into two distinct phases; a phase of activity which essentially displays itself it the wet season, and a period of rest in the dry season. It is a seasonal cycle leading to annual egg deposition. Activity begins in April, maturation of the gonads and copulation occur in September and October, months in which (lesquels) free spermatozoa are visible in the seminiferous tubules and the {epididymis}. Ovulating females are numerous from mid September until the end of October. The eggs, which are laid from the end of October to the beginning of November and December, do not hatch until July, after the first rains. Incubation therefore takes place throughout the dry season (six months).

The genital cycle presents two peculiarities, the `unmooring' of gemetogenesis in the dry season (a period of fasting) and the abortive growth of testes in February. To deal with the first question, it causes one to think that the primordial metabolic energy necessary for sexual awakening is of endogenous origin. It is thought, according to the opinion of different authors, that it is furnished by the fat reserves of the animals (DUGAY 1963; ZAIN & ZAIN 1967; GAFFNEY & FITZPATRICK 1973).

As for the abortive activity of the testes in February, could it be a vestige of another reproductive season which once existed in a primitive time of the monitors' history?

Der Dumeril-Waran (Varanus dumerilii), ein spezialisierter Krabbenfresser?

Varanus dumerilii - A Specialised Crab Eater?

Uwe Crebs. Salamandra 1979 15(3):146-157.

Translated by Gerald Gardiner and Daniel Bennett.

Little is known about this species. It shares the biotope of Varanus rudicollis and is similarly described as a tree dwelling insect eater (Mertens 1942a, Rotter 1963).

Stomach contents have shown that V.rudicollis eats ants, but no similar evidence is held for V.dumerilii. In appearance, particularly the skull, they differ markedly. Whilst in V.rudicollis it is long slender and delicate, in V.dumerilii it is short, broad and heavy. This might mean that

they specialise in different insects, in which case no monitor species would take advantage of the crabs which are usually abundant in these areas. V.salvator, a more primitive species, is known to eat crabs (for example in Sri Lanka), but only as a part of a varied diet over its wider range. This there would only be limited competition between V.salvator and a specialised crab eater.

Systematic Classification.
Robert Mertens perceptively allocated a special position to V.dumerilii (which here includes both V.d.dumerilii and V.d.heteropholis). He described the species (1942c:364) as isolated on account of its unusually heavy, flat, short broad skull, with the highest index for the parietal plate of any Varanid. Skull development ontogenetically shows quite young specimens are developed in this way (1942b:199).

Compared with other Varanus species the head is small in relation to the body. Is the species phylogenetically young or old? Mertens classic work on Varanus considers this point and comments; "The skull differs considerably from all other Varanus species....The slit shaped nostril, positioned well back, shows that this is far from being a primitive species"(1942a:65). He comments that both V.rudicollis and V.dumerilii are highly developed forms, though in no way closely related.

Ecology.
Little is known of the ecology of V.dumerilii, except that it distinctly prefers trees, including mangroves in the Mergui Archipelago, and if disturbed, readily takes to the sea to escape. On diet Mertens says (1942a:44) "there are imposing species which are insectivorous, particularly the Indo-Malayan tree dwellers V.dumerilii and V.rudicollis.... Barbour (1921:43) says that V.d.heterophois eats ants, but Mitsch (1936:597) and Lodiges (1939:245) say that V.dumerilii also eats mice, eggs and chicken offal in captivity

Ethological Observations.
Observation of some of the peculiarities of V.dumerilii's way of taking food may throw some light on its status. For six months a tame male of about 100cm total length was offered a variety of food - mealworms, snails, frogs, fresh herring, filleted (sea)fish, freshwater fish, eggs, starlings, mice, shore crabs (Carcinus maenas) and another crab (Eriocheir sinensis). All were eaten except the mealworms, snails and frogs, but with varying degrees of enthusiasm. V.dumerilii gives the appearance of being ill-adapted to take other vertebrates, something which other keepers of the species have confirmed. To be more precise the taking of a mouse is described;

Whether live or dead, the mouse is seized by the middle, not the head, and is then struck against some hard surface with violent head movements. Swallowing is difficult because the mouse lies across the mouth. It is partly pushed further in by pressing with the head against, for example, the wall, and partly lined up by forward and backward jerking movements with the head. If anything, these jerking movements throw the mouse away from, rather than into,

the mouth. Sometimes the head is bent sideways so that the floor can be used to lever the mouse into he mouth.

The claws of one foot often make wiping movements backwards and forwards along the snout. The effect is often to tear the mouse apart so that part of it is lost. The claws also seem counter productive in moving the prey out of, rather than towards the mouth. Both head and jaw movements appear to be instinctive and stereotyped.

Assuming such movements are efficent and purposeful in natural conditions, what are they intended for? Substitue a crab for the mouse, an object perhaps three times the size, and the picture changes. A central grip holds the crab well; distinguishing head and tail is irrelevant. Pressing the head against a fixed object removes the crabs legs and claws with which it often grips the monitor's snout - the movements with the claws achieve the same. The whole crab is then swiftly gulped down. Crabs are hammered against a fixed object, but often survive this because of their shells, and escape temporarily.

Freshly caught crabs of various sizes were offered. Despite threatening pincers they were usually taken from the front and gripped in the monitor's lower jaw. Larger crabs were then dropped and siezed again by a pincer, which is broken off by violent levering with the back arched, and dropped. Very large crabs always had both pincers and all legs removed before the shell was swallowed, pressed into the mouth against a convenient hard surface. The lower jaw can stretch to an equilateral triangle, nearly twice as large as the upper jaw (pictures 4&5).
All crabs are completely digested. During transportation one monitor regirgitated four crabs, all with small holes in the shell from the small, needle - sharp teeth, well suited to make punctures in this way. The relatively few teeth are quite sufficent to hold a hard crab shell.

Interpretation of some features.
Length exceeds width in virtually all prey of Varanus species, except crabs which are almost square. The broad skull of V.dumerilii is therefore well adapted to crab eating. The fact that this shape is also found in juveniles supports this, as does the abundance of crabs of all sizes in the mangrove habitat. Even newly hatched specimens could find suitable crab prey, whereas other juvenile Varanus species may not find suitably sized insect prey, for example. Mertens found a specific skull shape only in the juveniles of V.dumerilii.

The relatively flat skull can also be seen as adapted to crab eating. The flat prey hide in narrow crevices where a low head can easily follow them, especially since, overall, the head is small compared to other Varanids. At 125cm, a fully grown V.dumerilii can no doubt master most crabs. Crab specialisation could be seen as logical if the species occurs predominantly in the mangrove forest and its intertidal zones.

Some crab species are soley land and tree dwelling, but most crabs live in the mangrove forests, whose base, depending on tides and river flows, is generally submerged. Here, and only in this biotope, crabs are so numerous that finding a specialised niche seems ecologically very sensible.

V.dumerilii shows morphological features pointing to its suitability for mangrove swamp life.

1. This is an evolutionary young species, but has the laterally compressed tail associated with older kinds. Compare the Papuan monitor (V.salvadorii), an older species in evolutionary terms, but already showing a rounded tail which Mertens says is a more recent feature. Asssuming that V.dumerilii is partly aquatic, the retention of the compressed tail makes sense.

2. Not only does this monitor have slit like nostrils, positioned closer to the eyes than the ears, a sign of a "young" species, but it can also seal them. This is done by pushing forward the front side of the relatively elastic scales to fully close up the nostril opening (pictures 6 & 7). The remaining sides of the nostrils have scales fused together with those of the surrounding snout. On the living animal the nostrils cannot be opened with tweezers without injury. The existence of such a nostril has apparently been overlooked in the past, and is interesting because of the importance of nostril shape and position in classifying Varanus species.

The ability to close the nostril is probably lost at death, and so the specimen examined by Mertens would not reveal this feature - neither he nor Taylor (1963) nor Rotter (1963) refer to it. Presumably a muscle operates the opening and closing mechanism.

The nostrils are closed when the animal lies under water for a long time (asleep?). With great regularity - every 90-120 seconds
- the head is raised to the surface, the nostrils open, and audible breath in and out is taken, and the head is submerged again with the nostrils closed. The eyes remain closed. The nostrils are also closed while the animal basks with its eyes open- it is as if the nostrils only open when necessary, such as when seeking food or when disturbed.

3. My specimens much preferred to be in warm (30oC) water, and often remained there for long periods, even when passing faeces and urinating.

4. The length and curvature of the toes and claws suggest an arboreal life and resemble those of V.rudicollis and V.salvadorii.

5. Movement on the ground is with a high stepping, rather stiff leg action, much less agile than, for example, the ground dwelling V.exanthematicus. Movement in the water is very different, and threee sorts of movement are seen.
i) In very shallow water the land-type movement is retained.
ii) In rather deeper water, where the bottom can be touched, the rump is lowered, the legs stick out sideways, almost horizontally and the animal moves swiftly with paddling movements of the legs along the bottom, a rapid and economical use of the specific gravity of the water.
iii) Where the bottom is out of reach, the legs are stretched back beside the body and the animal swims with snake-like movements of the body and tail. Unlike other Varanus species,

the whole head does not emerge from the water, only the tip of the snout and the upper surface of the head. The swimming resembles that of crocodiles.

6. Climbing, even of slippery stems such as telegraph poles, as in mangrove conditions, is very skillful. My specimen was often allowed outside in good weather, allowing study of movement.

To summarise, V.dumerilii shows features indicating that it combines adaptations to both amphibious and arboreal lifestyles in a marked way. Consideration of the mangrove forest habitat shows precisely how such adaptations would be advantageous.

Additional Experiments.
Over a period, a number of zoos tested their V.dumerilii on crabs. The Wilhelma Zoo in Stuttgart, Berlin Aquarium and Munster Zoo specimens had never had crabs whilst in captivity (averaging 4-6 years). Despite initial scepticism the experiment was tried, and in every case the crab was taken, overpowered, and eaten as described. Those in Stuttgart had some difficulty which, in my opinion, was due to the disturbance of the animals and their smooth surfaced terrarium. As a "control", a living crab was offered to a V.varius belonging to Dr Horn of Bochum. The monitor followed the crab, but failed to hold it and the crab escaped each time. It was like an inexperienced puppy trying to catch a hedgehog.

Discusssion,
The cranial, morphological, ethological and ecological features seeem to confirm that;
1. V.dumerilii should be distinguished from true tree dwelling species, and might be better described as amphibian-arboreal.
2.It might more properly be called crab-eating than insectivorous
3. Consideration of the significance of the sealing nostril is needed from a viewpoint of classification. Could this be a more highly developed and specialised species that was previously thought?

Observations on the care and a recent breeding of Varanus (Odatria) timorensis timorensis (Gray 1831).

Bernd Eidenmuller. Salamandra 1986 22 (2/3):157-161.

Translated by Naomi Cowgill and Daniel Bennett.

Introduction.
V. t. timorensis, the Timor monitor, is found on the islands of Timor, Sava and Roti, where they inhabit bright savannah forests to a height of 800 metres. They do not avoid proximity with human settlements (SCHMUTZ & HORN 1986).

Only a few reports on the breeding of this delightful little lizard exist in literature. For example in 1981 BEHRMANN succeeded in hatching two eggs, after an incubation period of 93-100 days at 30-34oC. The overall length of the hatchlings was between 14 and 15 cm. At the same time reports of a late breeding were received by the Albuqueque Zoo in New Mexico, U.S.A. There the gestation period of the eggs (hatched in vermaculite and water, weight ratio 2:1, was exceptionally long, namely 182-186 days. Temperature was 27.2-28.9oC. The first hatchling measured 14 cm and weighed 4.05 grammes. The length of the others was between 14 and 15.2 cm.(ANONYMUS 1981).

In view of the fact that only two reports on the rearing of these little lizards exist, it seems appropriate to report briefly on personal experiences of the care and rearing of this monitor.

Accomodation/Habitat of the Parent Animals.
Two V. t. timorensis obtained in 1976 turned out to be a couple. They were housed in a terrarium measuring 100X50X50 (length X breadth X height), which as one observes from the numerous successful layings of fertilised eggs, is sufficent space for an adult animal. Cat straw was used as the substrate, and a water bowl (30X20X5) serves as a drinking vessel and is occasionally used as a bath tub. A 50W heating cable was used to warm the floor of the terrarium, together with an electric heater (100W, Osram Concentra) which heats the air and provides areas for the lizards to bask. Branches for climbing, and hollow tubes for hiding, were provided. At first the animals were very shy, and retreated into the tubes at the slightest disturbance. The parents were fed once or twice a week with housecrickets, crickets and newborn mice. Insects were sprayed with Osspulvit.

Breeding Observations.
During the first year (1976) five eggs were laid. I did not observe copulation. They were incubated in sphagnum moss, and after a short time two infertile eggs collapsed. The remaining three eggs developed well, as could be seen by their increasing size. At a temperature of 28oC incubation period for monitors of this size is from 110-140 days. After 120 days no sign of hatching was apparent so I decided to open one of them. It contained a fully developed monitor without a yolk sac, which perished. Dead embryos were found in the two remaining eggs that were not as well developed.

In the following years (1977 and 1978), no eggs were laid. Between the end of December 1978 and January 1979 several copulations were observed, and 6 weeks later, towards the end of February, 11 eggs were laid, 9 of which were perfect, 2 so called "wax eggs". These eggs were incubated in peat at a temperature of 28oC, but shrivelled and rotted within a short space of time. In the following years, also in February, more eggs were produced; 1980 (7 eggs), 1981 (14 eggs (3 wax eggs)) and 1982 (9 (4 wax eggs)). They were incubated in various substrates, but all these eggs were infertile, and shrivelled and rotted in a short space of time.
Between the end of 1982 and the beginning of 1983 (26.12.82 - 6.1.83) I was able to observe copulations almost uninterruptedly. On 12.2.83 10 eggs were laid unburied. The next day another egg was produced. Due to the fact that they were incubated in Vermiculite temperature was 28+/-oC. After a short time 7 eggs went bad and were removed. The

remaining four eggs clearly increased in size, but were not measured to avoid damaging the embryos.
On 10.6.83 a hatchling broke its shell and poked its head out (Photo 1). He did not leave the egg until the next day. Due to my absence the exact time of hatching is unknown. The other eggs hatched on 14.6, 16.6 and 17.6. They also stayed in the eggs for a day after hatching. Measurements and weights of the hatchlings can be found in table 1, details of their further development are in table 2.
On leaving the egg, only the final hatchling brought a small section of umbilical cord with it. Three days after hatching all lizards began to eat. They received insects, including little crickets dusted witha mineral/vitamin supplement (Osspulavit) and freshly caught grasshoppers.

Whereas it appears plausible that both the animals that were bred by BEHRMANN (1981) were hatched after 93-100 days as a consequence of the considerably higher incubation temperatures 30-34oC, the report from the Rio Grande Zoo, Albuqueque remains a mystery. An explanation of this abnormally lengthy period (182-186 days, 28+/-oC) could be a falsely read incubation temperature
or the possibility that the measuring point was too near to the heating element, not however at the possibly cooler moment of breeding of the eggs.
A further breeding of a Timor monitor (1973) took 140 days to hatch at an incubation temperature of 28-31oC. The systematic classification, which was uncertain to begin with, due to the absence of scientific names was cleared by RUEGG in 1974, the animal in question was V. timorensis similis.

Summary.
The report is concerned with the care and latest breeding of Varanus t. timorensis. From 11 eggs 7 failed to develop and the remaining 4 hatched after 119-126 days at a temperature of 28+/-1oC. Their total lengths were between 16.3- 17.4 cm. On the third day they accepted food.

Terms from the tables.

Schlupfdatum = Date of hatching.

Zeitigungsdauer = Incubation period.

Gewicht = Weight.

Schwanzlange = Length of tail.

Kopf & Rumpf = Head and body.

Durchschnittswerte = Average value.

Datum = Date.

Eigene Nachzucht und der gegenwartige Stand der Nachzucht von Varanus storri.

Some examples of breeding and the present state of knowledge about breeding in Varanus (Odatria) storri MERTENS 1966.

Bernd Eidenmuller and Hans-Georg Horn. 1985. Salamandra 21 (1):55-61.

Translated by M.J. Bennett.

Introduction.
Varanus storri belongs to the smallest kind of Varanus. It was recognised and described as a new type in MERTENS 1966. Since then STORR (1980 and in STORR ET AL 1983) was able to describe a population of this species of Varanus in Western Australia as a new subspecies. Oddly, the place where this subspecies was first observed is today no longer accessible, submerged beneath the waters of an artificial lake (Lake Argyle). The greatest length of this lizard is 35cm (STORR 1980). Its distribution is given as the most northerly part of Western Australia. In eastern Australia in the area of Charters Towers specimens of the nominate race were found mostly 32-34cm, but some as big as 44cm (PETERS 1969, 1973).

These handsome but aggressive little lizards are reported to lay their eggs in the months of February, March. April, June, July, September and December (MUDRACK 1969, STIRNBERG & HORN 1981, BARTLETT 1982). The eggs laid in this description were laid in February and May.

Breeding was first reported by STIRNBERG & HORN in 1981, with these breeding animals and another breeding in 1983. Bartlett (1982) managed to breed them in open air conditions in southwestern Florida, which has a climate similar to that of SE Queensland, the home of the nominate race.

A further mating took place successfully in different conditions a year later. The young hatched after 72 days and died a few days later (RESE 1984). In 1983 we were blessed with two more matings, which are described below. So after V. salvator, V. storri is the species of monitor most frequently bred in captivity.

Preparations and Observations before Egg laying.
To begin with 2.2 Varanus storri were kept together in a single terrarium. Unfortunately among these animals was the same kind of animosity that other keepers have described and so one of the males died in 1982. The females were also quite hostile towards one another, so it seemed best to separate them. The remaining pair lived in a terrarium 90 X 40 X 30cm high. Cat litter served as substrate, which the animals obviously found not unnatural. The floor

covering had several advantages; the lizards dropping combined with it quickly and without smell and when eggs are to be laid a small area of the terrarium can be kept damp without the whole floor becoming wet. A slate 20 X 10cm was warmed with a floor heater. About 20cm above this slate was a 40W reflector heater which in addition ensures a high temperature (35 C) on the surface of the slate. The terrarium was also furnished with several pieces of cork to provide hiding places.

Over several years the lizards mated repeatedly. But not a single egg was produced. After one of the females was removed, in February 1982 we were able to observe repeated copulation. Before copulation the male moved jerkily, darting his tongue in and out in his search round the tank for the female. At first the female tried to escape, but after several days they got round to mating (plate 1).

Egglaying and Hatching.
After the copulation just described it was surprising to find two (spindly??) eggs about 2.5 X 1.0cm, uncovered in the terrarium. These eggs were incubated in an incubator at 28 +\-1 C and 100& humidity in vermiculite. After a few days it could be seen that these eggs were not going to develop.

Not until a year later, on 3 February 1983, after copulation similar to that described above and the animals had been separated, the female laid two eggs with weak shells. The eggs were not measured. They were kept in an incubator at 28 +/-1 C, 100% humidity on vermiculite.

According to a table (in HORN 1978) of the gestation periods of different kinds of monitors, the gestation period of V. gilleni, which reaches a size similar to that of V. storri, was about 100 days. In fact the first egg hatched after 105 days, the second after 107 days. ‹The first animal took three hours to leave its egg after slitting the shell, the second needed a similar time›.

After the eggs were laid the parents were again put together and copulated at once. On 24 May 1983 the size of the female indicated that she was about to lay eggs again, the adults were apart at the time. The same day the female laid three eggs which hatched on 9 September 1983. Incubation period was 109 days in similar conditions to those described above. A further breeding took place at the Tierpark at Bochum. The specimen bred in the terrarium (STIRNBERG & HORN 1981) laid two eggs on 30 May 1983 (sizes: 3.2 X 1.9cm, 2.9 X 1.9cm) which were incubated in conditions as described by HORN (1978) hatched after 102 and 103 days (nos. 6 & & in Table 1). In captivity V.storri reaches sexual maturity somewhere between 1.5 - 2 years. In photograph 3 can be seen one young newly hatched animal and one hatching. Their colouration is clearly brighter than their parents.

In captivity Varanus storri can reproduce twice per year. The extremely short incubation time reported by RESE (1984) can only be explained by an excessively high temperature. Those young perished after a few days, another indication that the temperature was too high. In fact it is known from another species of lizard, Anolis lineatopus, that an excessively high

temperature causes eggs to develop quickly but that the young often die or are weak (E. Curio, personal communication).

About two days after hatching the young V. storri started to feed on crickets, maggots, moths and freshly caught grasshoppers. After a short time the animals hatched in may had to be kept apart so that the first hatched, who was stronger, would not bully the other. In the following table 1 are some data on hatching as described in this report. In the two different set-ups the eggs were incubated at a similar temperature (Monitors nos.. 1-5 at 28+/-1 C, 6&7 at 29+/-.5 C) with an average incubation period of 107 days in the conditions described for Varanus storri.

Development, Weight and Length.

Not a lot is known about the development of monitors in weight and length. A long time ago Lederer (1942) published some data on the Komodo monitor, but his information is only partly usable; his published weight for V. komodoensis on Komodo was not attained; 60kg was the heaviest monitor Auffenberg (1978) was able to find. This means that in captivity these monitors were consistently overfed. Until now the most detailed information is that in HORN & PETTERS (1982) for V. rudicollis, covering the period from hatching to 4.5 months

Not all the examples produced in table 1 correspond with further measurements at our disposal, partly because after breeding the animals were handed on to others. In table 2 are data of growth in weight and length under the headings of corresponding data in table 1, collected over the period of about a year. It is still only the average of all the animals measured. Contrary to other practises, the length is taken not from the cloaca but from the distal margin of the back leg. This method is easier with live animals and less stressful than when the animal has to be measured on its back! In the data for weight and growth it should be taken into consideration that at the time of weighing the animal may have just eaten. Measuring the length of small animals can be difficult because they can contract their length, especially at the tail end. So we either have to measure them several times or measure again when the lizard is relaxed in the terrarium.

From the data in table 2 it can be seen that V. storri is born with a proportionately long tail. But afterwards it seems that the head and body catch up more quickly, as a subtraction of the proportion of tail to head and body seems to show. At measurement on 20 November 1983 all the lizards were in their first slough.

Thanks.

To Herr. E. Stirnberg, director of the Tierpark at Bochum for his kindness in providing data on live breeding specimens from the tierpark for this article.

Summary.

The article sets out the present state of knowledge about breeding in Storr's dwarf monitor lizard. Observations are presented from three instances of breeding. Copulation and hatching are recorded photographically. Data are provided in tabular form of the development in length and weight of this species of monitor.

Headings in the Tables.
Datum = date. schlupfdatum = date of hatching. Zeitigungsdauer = length of incubation (in days).
Gewicht = weight (in grammes).
Kopf + Rumpf = head and body. * bis Ansatz Hinterschenkel to the insertion of hind leg.
Schwanzlange = tail length.
E = total length.

Der Kap-Waaran (Varanus albigularis Daud.).

The Cape Monitor Varanus exanthematicus albigularis.

Lutz Heck Jr. Aqua-Terra-Z. 1955. VIII 7:190-191.

Translated by M.J. Bennett.

In the Wilhelmstal district of S.W. Africa in August 1954 I caught a Cape monitor. It was an early morning when I came across the monitor sunning itself on a termite mound. The capture, which I had imagined much more dificult, turned out to be quite simple. I approached the termite mound carefully and grabbed the monitor quickly by the neck. Of course he resisted with all his might. His tail, thrashing to and fro, caught me once on my bare forearm and left a broad weal there. He must not have reached his fully active state after the cool of the night, for (if he had) it would certainly have taken a lot more effort to get him into a bag. My father caught a Cape monitor on a scorching hot day with a snare, and it fought back so much it took a great deal of trouble to master it. The lizard I caught refused food altogether for the first day. On the journey home, by sea, he took finely cut up peices of donkey and goat meat. The peace and quiet of the ship, and the overwhelming heat both day and night near the Equator, probably appealed to him. In the Hellabrunn Zoo (Munich) he was put into the enclosure of the first animal imported. The daytime temperature reached about 28oC. Both animal are doing well on their food. They get finely cut up horseflesh and frequently raw eggs. Chicks, a few days old, are given as a special treat. One lizard alone gets through 20 chicks in 20 minutes. The weight of the first lizard imported is 7.5lbs., and its length is 117cm. The second lizard weighs 9.75lbs., and is 109cm long. He lost 3cm of tail through trashing about. Although both animals were caught in the same part of South west Africa their colouring is different. The first lizard is slate grey, while the second is red-brown. All the probabilities indicate that they are both females. When taken out of their enclosure they hiss fiercely, and the constant spurting

of stinking faeces is very unpleasant. Incidentally, millet seed can be observed in their faeces, from the chicks eaten earlier.

Notizen zu systematik Fundortang aben und Haltung von Varanus (Varanus) karlschmidti.

Notes on the Systematics, Places of Discovery and Keeping of Varanus karlschmidti.

Hans-George Horn. Salamandra 1977 13 2: 78-88.

Translated by Little Miss Muffet and Daniel Bennett.

As far as I know, V. karlschmidti has never been kept in captivity, or at least there are no written reports of this.

There are only six examples of this probably not very rare lizard, namely at the Chicago Natural History Museum (Mertens 1951), the Senckenberg Museum, Frankfurt am Main, the natural history museum, at Sasel (Mertens 1959), and the Zoological State Collection in Munich (Mertens 1971). There was only one, not especially informative photographic portrait (Schultze-Westrum 1972). Good reasons for reporting on the appearance of this rarely imported Varanid in order to expand our knowledge of the species.

Systematic Description.
The following description concerns four specimens (WG,WM,WK,WK1). Total lengths: 118.5, 81.0, 67.5, 63.5 cm. As these specimens (especially WM, WK and WK1) are clearly very different to the ones described by Mertens (1959), an up to date description follows.

Common denominators (WG, WM, WK, WK1): skull appears bony, nostrils oval; above the nostrils the snout is a little raised. Nostril is closer to the tip of the snout than the eye. Eye opening appears large, in WG very large. Back legs in WK and WK1 cross over the front legs; large curved claws in WK reminding one of V. prasinus. Tail with a double keel, laterally compressed. Mertens (1951,1959 & 1971) compares V. karlschmidti with V.indicus . His specimens look more like V. salvator. If one studies living animals of this type, one is much more likely to be reminded of V. salvator, especially by the skull, in which V.indicus appears to be less skeletal and bony, but more massive and "round". In V. karlschmidti the neck is slimmer, and more clearly differentiated from the head, whereas V. indicus has a relatively flat neck. In this V. karlschmidti resembles V.salvator more than V. indicus.

Colouration.
To show this better, two colour photographs are included. They are of WG (the largest) and WM (middle sized), taken when they were alive. They show how different the colouration was. The description that follows is of the living animal: basic colour of body and tail in WG (picture 1 - compare with p.3) dark to black, with numerous white - yellow dots ; tail with

unclear dark yellow stripes and soft blue - green sheen; Nuchal region (base of neck) shows clear tendancy to yellow; Top of head grey - blue; throat, lower jaw-eye region fleshy red, ranging from pale pink to reddish yellow on the neck; Ventral and subcaudal regions a dirty cream colour. Eyes dark; Tip of tongue white, otherwise bright red.

In his description of lizards from eastern New Guinea Mertens (1971) says that V. karlschmidti from this region has a reddish tongue with two small black points, whereas V. indicus has a yellow tongue. Of the animals described here, only WK could be siad to have black points to the tongue (which are indistinct), but many V. indicus I was able to study closely have a tongue which is two-thirds black from the tip. The rest is flesh coloured, whereas the imported V. indicus ~kalabeck', an exceptionally beautifully coloured monitor, always shows a uniformly yellow-white tongue.

With the colouring of WG described here, the animal reminds one of the colouring of the type and paratype specimens. The basically black specimens (WM (picture 2), WK, WK1) show a very different colouring. An exact description of these colours in WK follows; Basic colouration is black to blackish grey, dotted with yellow-green (each dot extending over 1-3 scales); Four black stripes across the front part of the rump, followed by 2-3 undistinguishable dark stripes; Nuchal region dark brown to black with white single scales, while orange-yellow scales are barely visible; Folds at the side of the neck lilac with grey spots; Neck region red-purple (in WK base of neck is at first red-orange, but at the throat yellow-orange); Anterior side of the snout blue grey; Top of head grey-black; Feet black to grey-white with white dots which at the toes are blue-green; The last two-thirds of the tail are a gorgeous striped black-blue; Ventral region whitish and striped grey-white. Tips of tongue black, otherwise bright red; Eye very dark brown.
The clear differences in colouring of the examples described in the literature up to now, and WG on the one side, and WM, WK & WK1 on the other, allows us to suppose that V. karlschmidti forms a geographical race, something that occured to Mertens (1971).

Measurements.
V. karlschmidti probably does not growe larger than 120cm (compare this with Mertens 1951). Thus WG is a fully grown (female) example, of which, we are sorry to say, only a few measurements could be assertained (see table 1). For measurements of WM (male), WK (female) and WK1 (female?) also see table 1. For comparison the relative data of the type specimen are also given. These values agree with those published by Mertens (1951, 1959) only in part, in that the relation of snout-vent and tail length of the two paratypes differs greatly to the data presented in table 1, while the corresponding values of the type and so-called Basle example agree very well. We suspect that the tails of the paratypes as well as the specimens from east and south New Guinea (Mertens 1971) are incomplete.

Scalation.
The established numbers of scales are shown in table 1. The minor differences in the number of scales from those of the type can be seen as idiosyncratic. In WK the interparietal is not clearly recognisable as there is an error (deviation?) in the scales. Scales in the temporal region very

small; Nuchalia very fine, slightly raised; Scales over the flanks smaller; Abdominal scales markedly larger than back scales; On the upper part of the body more oval, in the centre of the abdominal square; Scales on the thigh somewhat rougher than dorsalia, slightly raised; Tail scales slightly raised at the proximally, flat distally; Preanal pores not recognisable.

Places of Origin and Habitat.
The place of origin of WG could not be assertained, from it's appearance the animal seems to come from Papua New Guinea. The three remaining examples are most likely to have come from West Irian. I'm sorry to say that the person who delivered these animals to the author at first said they had come from the Sepik River in north east New Guinea, but later claimed that they came from Lake Puley in central West Irian. This lake could not be found in world atlases, nor on a large American military map.

Thus all examples of the "Rothalswaren" stem from Papua New Guinea, while the strongly melanistic specimens are probably from West Irian. As the origin of the latter is in doubt, the following speculations only concern the New Guinea specimens. Places of discovery are listed on table 3.

If one looks at a map of the vegetation of Papua New Guinea (Shultze-Westrum 1972) it is clear that all the places that V. karlschmidti has been found in, up to now, lie in the zone of tropical rainforest, which covers the low lying land up to an altitude of 1000 metres. Rainfall is up to 1.5 metres in mid year. although the amount can vary from region to region. the climatic details given in table 4 for Kikori and Madang give indications on how to maintain V. karlschmidti in the terrarium. Kikori is situated on the southern coast of New Guinea, and lies only 130 km from the type location, Mt. Bosavi. Here there is an annual rainfall of 5.92 metres and the humidity of the air is 80% at all times. We can expect to find similar conditions on Mt. Bosavi. Similar findings also apply to the climatic situation of Bulolo and Lae (where V. karlschmidti has also been found) which lies approximately 170 km southeast of Madang. In Madang the annual rainfall is `only' 3.49 metres, but the relative humidity of the air is still very high - 74-86%. So far V. karlschmidti has only been caught near lakes (see table 3); this leads us (if we consider the extraordinarily large eyes) to the assumption that the animal lives in the gloom of the thickly overgrown rain or swamp forest. The animals on which the original descriptions were based were, according to K. P. Schmidt, indeed caught in such a habitat, but one which also included grassland (Mertens 1951). Their favourite food, frogs, are also an indication of the preferred habitat of these monitors. The strong, laterally compressed tail points to a nearly aquatic species, a view supported by Swanson (pers. comm.). Compare the behaviour of the animals in the terrarium, described in the next chapter.

Behaviour.
All four monitors proved to be nervous and shy, but if left undisturbed they were quiet. This behaviour was unchanged, even after prolonged stay in the terrarium. The largest specimen WG, in certain situations, always demonstrated the same behaviour. If one looked through the side panes of the terrarium, the animal at once suspended all movement in order to observe the disturber. At that time the neck would be slightly inflated, and the tongue would protrude

about 1 cm from the slightly open mouth, but without moving the head from side to side. If the terrarium were opened the monitor would inflate its neck a little more, and make a hissing sound. The neck was never blown up in the same way that other, even smaller monitors do, although one would expect a certain signalling effect because of the glowing colours on the neck (yellow-orange-bright red, depending on the individual). If disturbed even further the lizard would raise itself off the floor and flatten its body in the vertical direction. The head, bent slightly downwards, with its now half open mouth and with the neck inflated even more was turned towards the disturber, then the animal occasionally lashed out with its tail. Mostly the monitor tried to flee, panicking in anxiety. Picture 3 shows the described threatening behaviour of a V. karlschmidti, captured by a native on Brown River, near Port Moresby. The animal was released near a small river, where this photograph was taken (Swanson Pers. Comm.). The semiadult WM showed signs of similar behaviour, while the juvenile animals at once tried to flee.
While WG never warmed itself directly under the spotlight (see section on care), the smaller animals did so frequently. Common to all four monitors was digging in the moist leaves and earth. Beacuse of this the water baisin resembled a mudbath in a very short time, and the walls and glass panes of the terrarium were covered in mud. The animals obviously relished the mud, WG and WM sleeping there all night, diving into the mudbath until it came to the tip of their noses. They only sufaced late in the morning in order to dry themselves on a branch or peice of wood and to warm up. Fresh water was almost always contaminated in this way, and was very rarely used directly for sleeping. By digging in the soil, and instantly muddifying their water, these Varanids are comparable to V. indicus. However I have never seen a V. indicus sleep in the water. The larger animals only slept occasionally, more or less curled up beneath the proffered hiding places, whilst the smaller animals liked to squash themselves together in the hollow branch of a tree stump. On animal (WK1) tried to bite when given a vitamin injection, another after severe disturbance.

Care of V. karlschmidti in Captivity.
Because of the relative differences in the sizes of WK in comparison to the others they were kept in different terrariums. WG was given an enclosure 140X180X100cm, with a 150 Watt spotlight and a 60 cm Vitalite tube. Further light enters the terrarium through a window. Beneath the floor is a 60W heating cable, mainly under the water bowl. The floor covering consists of a 15cm depth of leaves and earth which is moistened daily. Several strong climbing branches and a large partially rotting tree stump as a hiding place complete the terrarium. A litre of lukewarm water is sprayed round the enclosure at least daily. The improvised containers for the other monitors are smaller, but no different in their arrangement. The air temperature reaches 28-32oC during the day, falling to 26-28oC at night. Depending on the height of the branches beneath the spotlight the temperature can reach 26-38oC.

Feeding.
V. karlschmidti seems to differ very little from other Varanids in its choice of food. The smallest (WK WK1) would only eat crickets (6-12 per feed) which the larger animals ignored. After repeated offerings WK1 accepted cut up chicks. the two larger monitors took mice (living ones) which they seized witha quick bite and then crushed aginst the floor or branches

until they could no longer feel them moving. Dead chicks with vitamin supplement were also accepted, while sparrows shot with scrapnel were ignored. Animals for food were only offered every 5-8 days, so as not to overfeed them, while crickets were fed every 2-3 days, depending on their nutritional value.
The two larger monitors were especially lively if frogs (Rana temporalia) were offered to them. WG could swallow 6 fully grown frogs very greedily and with great speed. WM was given live goldfish several times, which it swallowed head first.

Disease.
V. karlschmidti can be said to be affected by the parasites affecting most types of Varanids. Thus WG and WK died of amoebiasis after prolonged nursing. At first no parasites of any kind could be found in WG's faeces. After the animal died an autopsy by W. Frank Hohenheim showed an extra intestinal amoebiasis, in which, as the term denotes, not the large intestine but the liver was almost completely destroyed. Because of this detection of the amoebae in the living animal was virtually impossible. The presence of Salmonella arizonae in WG was also demonstrated, but this was unlikely to have been the cause of death.

The smaller animal WK aws treated soon after reception prophylactically with Humatin (Parkes-Davis) against amoebae and Telmin (Janssen) against worms. This arrested the amoebae, but the destruction of the large intestine had probably progressed to far for a cure to be effective. In spite of it's severe illness the minitor was lively until shortly before it's death, but feeding decreased.

The large monitor showed a deficency in minerals and vitamins, caused by the importer who had kept it for a long time.

As happened recently with a V. salvator nuchalis and a V. indicus (Horn 1976), a collection of fluid from the tissues caused swellings beneath the skin, which then burst, releasing a colourless fluid, within 8-10 days of delivery. Thick scabs formed over the greater part of the back, and, in consequence food intake ceased. Through infusion of a mixture of water, raw egg yolk, raw scraped beef and 1 gramme vitamin supplement every four days a visible improvement was achieved within four weeks. But as its damaged liver was taxed even more by this diet, its health deteriorated - after it had eaten for six weeks it stopped and died. WM and WK1 (which was aquired later) are in very good health, after repeated treatment with Humatin and Telmin.

Bisher unbekannte Details zur Kenntnis von Varanus varius auf Grund von feldherpetologischen und terraristischen Beobachtungen.

Previously undiscovered Details about Varanus varius based on observations in the field and in the terrarium.

Hans-Georg Horn. 1980 Salamandra 16(1):1-18.

Translated by Naomi Cowgill and Daniel Bennett.

In German Varanus varius is often called Buntwaran (lace monitor) because of its varying colour. It was first mentioned by Shaw as early as 1790 (MERTENS 1942:273). Thus science has been aware of its existence for much longer than, for example, V.gouldii or V.exanthematicus. Although many interesting examinations into body temperature (BARTHOLEMEW & TUCKER 1964) and a study of thermal regulatory activity have already been carried out, many questions remain concerning the classification, the ecology and the reproduction of this powerful animal. The author would like to present the following observations which widen the description of these impressive lizards, and, in addition, collect and critically review. the in part contradictory statements about the reproductive habits of this monitor, which are widely scattered in the literature.

On the systematic position of V. varius "belli".
Locations of these monitors, known as "Bandevarius" in German and "banded colour phase" in English can be found in diagram 1 and table 1. From this illustration, in which the location of museum exhibits plus the locations of some observed are plotted, emerges the fact that V.varius bellii appears in part of the same area of distribution as V.v. varius, i.e. they are sympatric. The question arises of how to classify them sytematically. Whilst Mertens (1942) was composing his well known 3 part monitor treatise, two lace monitors, distinctively different in colour, were very common.
With the more common varieties, whose basic colour is a deep dark brown, entire upper surface is more or less regularly coloured with yellow to white dots, and this colouring passes over the head and neck in a stripe mixed with blue, on the tail broad cream to weak red colours and black bands, alternate with each other. The other colour variation (picture 2) has colouring consisting of narrower, predominant, mostly yellow crossbars on a black/brown basis. This is the so-called "bellii" phase as depicted by LOVERIDGE (1934). The systematic position of this animal, which is een by WORREL (1963) and DALE (1973) as a domestic form, is still inexplicable.

MERTENS (1942:275) commented on this; "Varius is most noticable in its so called "bellii" form. It is so different from the typical form that one can assume, as did LOVERIDGE (1934) that it is a special breed. Whereas LOVERIDGE considered them as a breed of varius, I consider it to be a pure individual variation, perhaps to be viewed as a mutation, or for the juvenile pattern, which is sometimes kept into old age". This view will be strengthened in later work.

To conclude, from the joint occurence of both colour forms, there cannot be two distinct taxa, so the subspecies V.varius bellii does not exist. The question remains, however, as to what the banded phase signifies.

Some time ago I had the opportunity to observe both colour variations of Varanus varius next to one another in the open. In doing so I formed the opinion that the much rarer "bellii" phase consists entirely of males (south of Moomie I saw 18 speciemns in total, 2 of which were banded phase. This theory requires much more material for examination. Fortunately the sex of the living animal was ascertainable with the support of some museums.....

In all cases only males of the banded phase have been found. As long as no monitor of the "bellii" phase is found to be female, this form of V.varius can be regarded as a gender bound mutation. For this reason the name Varanus varius bellii must be dropped.

On the Behaviour of the Coloured Monitor.
Varanus varius lives in the tropical rain forests, bright Eucalyptus dry forests but also in the more strongly cultivated moor, meadow and forest areas of north Queensland to Victoria in the south and some parts of New South wales (COGGER 1975). The area of distribution of this monitor lies, therefore, in areas with a moderate to low annual rainfall (HOUSTON 1978). Both of the following descriptions of the clour pattern and markings provide excellent camouflage in light and shadow, especially on the trees, but also to some extent on the ground whilst in search of food.

Studies in the field.
The primary task here is to report on the behaviour of this large lizard, on the basis of bibliographical references and personal observations. The field herpetology took place south of the town of Goodiwindi in New South Wales (BUSTARD 1968, 1970) and also by the author north of this place in Queensland 1977. Neither of us were able to detect young monitors, probably due to the fact that lace monitors when young have an exceptional amount of enemies, e.g. the kookaburra (Dacelo gigas) and other birds of prey, and as a consequence are very shy, a characteristic which decreases with size and age (BUSTARD 1968).

In 1968 and 1970 Bustard observed this monitor in the Merriwindi State Forest, in an area populated with Callitris huegelii, Eucalyptus racemosa and Casuarina luehmanni (Pilliga scrub). They are much less shy, and a peaceful inhabitant of the forest (compare with PETERS 1970), that searches for food at midday and takes an afternoon nap. Even in the presence of an approaching observer the lizard remains undisturbed. If one steps nearer however, they take on a threatening stance which consists of inflating the throat, accompanied by violent hissing and occasional boastful like behaviour, as VOGEL (1979) described for V.salvator.

The area north of Goodiwindi belongs to the so called Brigalow region, in which numerable Eucalyptus and varieties of Accacia form dry forest. Pictures 3 and 4 give an impression of this habitat. In this area another monitor, the mainly terrestrial V.gouldii, is also found. The first monitor which I detected in this biotype was sunning itself at a height of about 3-4 metres on

a tree. We approached cautiously and the animal (who was about 1m long) adopted the position shown in picture 5, whilst pressing itself firmly against the trunk. As this behaviour was also observed in two other cases it seems that they react to a disturbance in a specific manner, which can be observed particularly in young and half grown specimens when they hope to be overlooked. Only in fully grown monitors is this behaviour no longer apparent. With their increasing size they obviously have less enemies to fear and their behaviour changes, as already ascertained by BUSTARD (1968). Therefore the question must remain as to whether or not the banded monitors behave in the same way. If one approaches the animals too closely they try to slide over to the shadowed side of the tree away from the observer. If one tries to follow it round to the other side of the tree it moves in a spiral further up the trunk towards the top of the tree.

When these observations were made the habitat depicted in picture 4 was distinguishable because the river bed was dry, and large puddles were present, which were used to drink from by cattle. Occasionally whilst drinking they come across muddy areas,are unable to free themselves and starve. If the carcass is not quickly surrounded by dingos or the descendants of wild domestic pigs, the monitors will be attracted from some distance by the smell. I saw a cow in the riverbed that had just been finished off and obviously a large number of lace monitors had been attracted to the water. In the mornings, shortly after 8 o'clock I was able to observe the first V.varius sunning themselves high in the trees with their backs facing the sun. Towards 11 o'clock I saw the first monitor on its search for food. It was a large specimen of about 1.8 metres total length. It moved regularly and leisurely with its tongue incessantly shooting out from its half closed mouth, making to and fro movements with the head as it examined tree trunks and bushes in its search for food. If one approached the monitor more closely it would only look up for a second before it continued to examine the tree trunks, darting its tongue in and out.

A distinctively smaller monitor was much more afraid. As I approached it quickly fled onto a nearby tree. As it reached a height of about 2 metres it was threatened by an even smaller monitor, who hissed and distended the throat making the bright neck colours light up, this monitor was already some 3.5 metres up the tree, and had half turned itself towards the fleeing monitor. Although this lizard was distictly stronger it believed itself to be in danger, it shot down to the ground again and ran up the next tree. It seems, therefore, as if the trees are occupied by one monitor at atime. If a second animal tries to climb the tree a dispute arises, in which the "owner" of the tree is usually the victor.
Only on one occasion and elsewhere (east of Goodiwindi) was I able to observe two monitors in the same tree. This was a couple in a mating situation, where the female was about 1 metre from the male, and slowly heading for the top of the tree. They were sexed by means of a probe, after which they were released. Also, eggs were clearly visible beneath the skin of the female.

Although it is already known, from observations in captivity, another reaction of the lace monitor must be mentioned here. If one can seize the animal by its tail as it runs up a tree the hemipenes are everted (a fear reaction) If one lets it go again the hemipenes retract and the animal continues to climb as quickly as possible. This reaction was observed in 16 out of 18

normal and banded monitors. This observation raises questions as to the sexual behaviour of V.varius. If one assumes that the animals that showed no hemipenes were female then the male/female ratio would be 8:1. Whether this reaction is a coincidence, whether the females lead a more concealed lifestyle and why this reaction exists are unknown.

WORRELL (1963) states that male lace monitors are continually fighting during the Australian spring (August-October) chiefly using the claws. Occasionally wounds arise from additional bites. From these brief statements one can conclude that these are ritual fights rather than "fights for injuries". Such a scene was depicted pictorally by BREEDEN AND BREEDEN (1972) and also photographically by WORREL in 1963 (see pictures 6&7)

Observations in Captivity.
It can be said of lace monitors that females are shyer and more anxious than the males, and also more difficult to feed. This makes it possible to guess at the gender of the monitors by their behaviour with careful observation.
A reaction that has been demonstrated by many mammals in captivity is begging, which has not yet been described for monitors. In an unclear form, I was able to observe this reaction, which probably has a lot do do with an reaction in a large lace monitor when he was obviously very hungry. This behaviour, however, was much more distinct in the case of a medium sized female when it was thirsty. As I approached the enclosure it jumped upwards several times with its mouth closed, towards the front of the cage; if, however, one held a water filled vessel before her, she would sip the water without biting the bearer.

MERTENS (1946) in particular understood the threatening pose to be a signal of external attraction, and then subdivided it into a warning (against foreign individuals) and a threat (against the same species). This subdivision was not justifiable here (see section on field studies) because the behaviour was directed towards other lace monitors and to humans. By "threat" we mean both warning and threatening poses.
The threatening behaviour of a female 1.2 m in length is shown in picture 8. The animal raised its head and front of its body and spat at the annoyer with its neck inflated (audible reaction), but the rest of its body was kept lowered, and the tail in an "S" shaped coil, ready to strike. A large male lace monitor (1.8m) in contrast, coils the tail and carries it in this position. A lace monitor of equal size also showed a distinctively different type of threatening posture from that just described (when the animal was acquired it had already been in captivity for some time). If one approached its makeshift container, the neck was not as inflated as in picture 8, but the neck muscles were arched powerfully and the hissing noise almost became a roar - an exceptionally impressive warning. Occasionally short thrusts with the head are made at the person approaching the cage, followed by whipping strokes with the tail. This type of threatening behaviour is shown in picture 9.

Male lace monitors display different ways of darting the tongue in and out. At least two different forms can be recognised, one for orientation and one for aggression. Where the environment is analysed with moderate frequency of tongue movements, such as when tracking prey or examining other monitors. In aggressive use the tongue is moved with much

greater frequency, occasionally followed by quick, jerky movements of the head to and fro. The aggressive tonguing can indicate or introduce aggressive action against a fellow cage inhabitant; this hint is often sufficent to make the other monitor try to escape. The same behaviour takes place prior to mating.

The author was able to observe this particularly impressively in the following situation (1973): a female V.salvator nuchalis of about 1.4m was put next to a male lace monitor of about 1.6m. The lace monitor made aggressive tonguing motions to the V.salvator, tried to raise himself up and whilst nodding its head to and fro very quickly, placed himself diagonally in front of the female, tapped with a closed mouth on her neck and finally laid its head on the base of her tail for a few seconds. The female remained passive throughout, possibly because she was in new surroundings. Although the behaviour of a lace monitor towards a foreign female is described here, the same applies to their behaviour towards females of the same species, as observed by the author.

Reception of Food.
V.varius drinks by putting the head underwater past the nostrils and protruding the tongue from the half closed mouth about 2cm. After it has slurped water for about half a minute the monitor raises its head diagonally upwards, and lets the water run into its stomach, after which the breath, which has been retained, is released.

Lace monitors try to devour everything that they can overpower. In the wild I observed (1230hrs) a monitor devouring the remains of a cow's carcass, but it could not find anything edible. In contrast another monitor (1300) devoured a rabbit skin with the front and back paws attached after half an hours struggle (picture 10). If the prey animal is too big, e.g. in the case of a fully grown male rat, it is seized and after violent hurling to and fro, is pressed against the floor or a tree trunk. When the prey stops moving the lizard tries, mainly with the front right hand, to tear the prey apart. In contrast, small animals such as mice or chicks are seized and swallowed without any particular rituals. The act of swallowing consists of the neck being pushed together in an "S" form, and the prey is pushed down into the stomach. One gains the impression that the lace monitor can estimate the danger involved in eating a rat rather than a mouse, since it will always kill a rat before swallowing it. After it has eaten, the monitor rubs the sides of the jaws on stones or tree trunks, especially after intensive tearing up of frogs. In the most simple cases the jaws are cleaned by licking.

A V.varius showed a remarkable reaction when a large rat was put before him, posssibly he had never encountered one before. In a manner typical for monitors, the rat was seized in the middle of the back. The rat gave the lizard a mild bite on the neck, causing the lizard to release the rodent, and back away hissing. He did not attack it agin. Later the monitor overpowered, with increasing success rate, rats of every size. If they were seized in an unfavourable manner they were set free and recaptured immediately in a better position. One has the impression that to overpower unknown animals the lizard has to learn suitable methods of seizing and killing it.

It is well known that lace monitors are great robbers of nests and that they love eating eggs. Furthermore, time and time again it is impressive to see how a lace monitor can swallow a hen's egg of approx 6cm in length without breaking it. Five phases are definable here; the monitor tries (A) to grab the egg normally across its width from above (B) it raises it up by manipulating it against an edge (C)in a transverse presentation (D)it turns the egg until one end is positioned correctly and (E) swallows it unbroken. In picture 11 phase (D) is observed, where the monitor has manipulated the egg into the correct position. Other monitors of the same size such as V.salvator and V.rudicollis are much less skillful, and always broke their eggs.

The Reproduction of Varanus varius.

There are many different opinions about the size of the clutches of eggs: WAITE (1929 according to BUSTARD 1970) says there are 12 parchment shelled eggs, which WORRELL agreed with in 1963. FLEAY (1950) said that between 6-9 eggs were laid, IRVINE (1957 according to BUSTARD 1970) reported that an animal approx. 122cm in length from New South wales laid 9 eggs, whereas FRAUCA (1973) reports of an expedition, during which he found 2 batches of 10 eggs. SWANSON (1976) quotes batches of 6 eggs; this amount was also reported to the author by an Australian fellow enthusiast (mid 1977), in which an animal of 1-1.2m laid 5 eggs at the beginning of December. On the other hand COGGER (1967), later DAVEY (1970), DALE (1973) and MCPHEE (1979) report that the batch size can be as great as 20. The differences in numbers are no mistake of observation, buit can be explained by differences in the size of the female. According to WAITE (1929) (in BUSTARD 1970) the eggs have an average length of 65mm, which is also stated by FRAUCA (1973). COGGER (1967) gave a somewhat smaller size of 51mm.

According to BUSTARD (1970) eggs are laid in hollow tree trunks, in holes dug in the earth which are afterwards covered up, in foliage or in rotten wood, as also stated by FRAUCA and DALE (both 1973). The monitor often digs holes in termite nests in order to lay its eggs FLEAY 1950, COGGER 1967, DAVEY 1970, DALE 1973, SWANSON 1976, MCPHEE 1979 and WORRELL 1973). As termites repair their nests after the monitors have oviposited, the eggs are protected more from enemies, and kept at constant rates of temperature and humidity.

COGGER (1967), DALE (1973) and FLEAY (1950) maintain that the termite nest used is abandoned. This observation leaves many difficult questions: How can the newly hatched monitors leave the rock hard nest? WORREL and COGGER and others share the opinion that they dig their way out of the nest into the open. Considering the toughness of the nests this would be a great achievement. COGGER (1967) makes another observation; sometimes fully grown lace monitors have been disturbed at the nests at the time the young are emerging. Afterwards the female monitor should be help the young on their arrival in the open. Although similar assistance is known in the case of crocodiles, who arrive when they hear the croaking of their young in the hole, it is difficult to imagine monitors doing the same, since as far as we know the large monitors can only hiss. Even more difficult to imagine would be if the mother remembered the location of the nest and the correct time of hatching (COGGER 1967). If this

were to prove a reality it would be one of the most unusual achievements and memories not only in the reptile, but of the whole animal world.

The length of the brightly coloured hatchlings is, according to FRAUCA and MCPHEE about 25cm, according to SWANSON about 28cm.

As COGGER (1967) maintains, monitors in the southern parts of Australia lay eggs between September and December, which agrees with the assertations of my fellow enthusiasts who cited December as egg laying time. The hatching of the young animals should take place between December and March. Occasionally, however, young animals are discovered in the spring (August - September), so that one must assume that egg laying took place in the previous Autumn (COGGER 1967). In my opinion there are many signs that point to the fact that fertilisation takes place 4-6 weeks before oviposition.

Opinions about the incubation period vary. FLEAY (1950) found an unburied batch of eggs and buried it under a finely stitched wire net in order to acsertain the period of gestation. After 42 days the first young monitor appeared. COGGER (1967) quotes a gestation period of 48-70 days. These times are unbelievable short if one compares them to the authenticated gestation periods of, for example, KRATZER (1973) whose V.salvator eggs hatched between 222-317 days, BROTZLER (1965) for V.mertensi - 182-217 days, and PETERS (1969) 123-130 days for V.spenceri. Thus one should, providing no other factors are present, expect a gestation period of at least 200 days for the lace monitor.

Beitrage zum Verhalten von Waranen: Die Ritualkampfe von Varanus komodoensis OUWENS 1912 und V.semiremex PETERS 1869 sowie die Imponierphasen der Ritualkampfe von V.timorensis timorensis (GRAY 1831) und V.t.similis MERTENS 1958.

Comments on the Behaviour of Monitors: The Ritual Fights of V. komodoensis and V. semiremex, also the Threat Display phases of the Ritual Fights of V. timorensis timorensis and V. timorensis similis.

Hans-Georg Horn. Salamandra 1985 21 2/3: 169-179.

Translated by Naomi Cowgill and Daniel Bennett.

Introduction.

Many types of lizards reach the climax of their conflicts during the mating season, which in certain types is expressed in so-called ritual and ritualized fights. These rituals have developed with evolution, with the aim of reducing the wounds caused by biting and scratching, but still favour the stronger individual. In this way, for example, young males can be protected from serious injury or death, which is more favourable for the species' population.

Another, more recent view is that the individuals are primarily concerned with the propogation and preservation of their own type. By investigating the possibilities that have occured over the course of evolution for each types of fighters - the"injured fighter" (where severe wounds can often result) and the "ritualised" fighter (where such wounds are rare) it has been established that none of the pure "fighter" types is evolutionary stable. This means that every individual should be capable of utilising the various strategies whilst fighting (Immelmann 1982: 137, 64, 45. Lamprecht 1979: 43, 80 onwards). For further details see Smith 1982, Wickler and Seibt 1981: 114, 54 ).

Ritualised Fights Between Large Monitors.

Hitherto little has been known about the ritualised fights of all but a few lizards, and these, with one exception, concern the large species. Understandable since the larger animals are easier to watch.

Waite (1929) published the oldest photographic document of a ritualised fight between two lizards. It does not show V.giganteus, as assumed, but V. spenceri (Horn 1981). The season in which the photograph was taken in not known, but it can be supposed that it was some time in the Australian spring months of September or October.

A similar photograph of V. varius was published by Worrel (1963). It depicts the final clinch phase of a fight, in which the defeated lizard is almost lying on its back, with the victor half on top of it. A sketch of the ritualised fight of two lace monitors is also known. According to Worrel (1963) they often engage in ritualised fights during the spring, and now and again wounds appear, caused by claws and additional bites.

Ali (1944) presumably gave the first description of the ritual fight of V. bengalensis, verified by photographs. This fight was observed during August in Kutsch in the middle of north western India. This scene was mistakenly interpreted by Ali as courtship.

Deraniyagala (1958) also photographed V. bengalensis engaging in combat in Sri Lanka at the end of April. Two males, of a good metre in length pounced on each other in the Ruhunu Game Sanctuary, and at the moment of contact they straightened up embrace the opponent, and try to push him over. When the stronger animal suceeds, the same scene is seen as illustrated in Worrel (1963). Deraniyagala stresses that the animals often try to bite one another (seen clearly in one of the photographs), but at most only minor injuries result. Auffenberg (1981a) maintains that according to his observations no bites appear in V. bengalensis fights. He therefore reguards Deraniyagala's interpretation as false. Ali's report and photograph speak against this. Other photographers have captured the clinch phase of such a fight.

Ritual fighting in V. salvator is mentioned in Auffenberg (1981a). The first person to give a brief hint of this was Deraniyagala (1958), who saw it in a different part of Sri Lanka in August. Vogel (1979) observed the ritual fights of V. salvator in the nature reserve of Udjong Kulon, west Java. They lasted from 6-120 seconds. The two monitors (about the same size - at least

150 cm) approached each other close enough to embrace. then both opponents clasp one another with the front legs and lift themselves up (the clinch phase). If the victor succeeds in pushing his opponent onto the ground he will lie over the looser, who attempts to escape. An interesting point is that almost all of this can take place in captivity, as reported by Hediger (1962) and Honneger and Heusser (1969). These authors also mention that the loser was squashed against the wall of the terrarium, and that the fight did not result in a lasting hierarchy between the two males, probably because body size was very similar.

Finally, another clinch phase, this time involving V. nilocticus
and also falsely believed to be courtship was seen at the Umfolozi game reserve in eastern South Africa in October, during which both lizards roll intertwined on the floor and scratch each other with their powerful claws, keeping their mouths closed (Clements 1968).

Although countless reports of V. komodoensis have appeared since 1912, it appears that a ritual fight of this type has never been observed and photographed, and even in the previously mention study of fighting in bengal monitors (Auffenberg 1981a) no mention of such a fight can be found.
I was all the more pleased therefore, when E. Wolff put a series of 27 photographs at my disposal which show Komodo dragons fighting in March 1972 at Basel Zoo. In the reptile house at the zoo, visitors can see a large water bowl in the left of the enclosure, sunken in the concrete floor. To the right the rock floor climbs in a terrace-like fashion, and there are plants on the uppermost level.

One of the animals shows a wound on the front right leg. The other has several on the gullet and thorax area and one on the back leg. However the bites are not visable on the photographs but one can see the open mouth of one lizard on the neck of the other.
One of the pictures shows both opponents meeting in an embrace with tails on the floor, ready to fight. They do not continue however, and one animal stands diagonally to the other and strokes the other's chest. Another shows an animal stretched up on it's front legs, but the abdomen still touches the floor, while the other lizard touches the stomach of the first with it's closed mouth in an apparent thrusting movement from between the others legs. From what is known of ritualised fights in large lizards, this would result in the clinch phase. The action of the victor lying across the loser as seen by Worrel (1963) in V.varius was not observed here, although this does not mean that it does not occur. Instead one animal broke free and ran away, and was chased by the other, which it hit with it's tail and splayed it's throat.
Finally the animal which seemed stronger (to the observer), which also shows several wounds on the neck, has prostrated itself on the floor and has been mounted by the other in an attempt to copulate. The mouth of the upper lizard is wide open. In the final picture both opponents seem to meet at the edge of the water bowl to renew the fight. The length of the fight in total was not ascertained.
When one considers that the fights of three diffferent subgenera are described (Varanus, Indovaranus and Polydaedalus) it is noticeable that apart from a few noticeable behavioural elements, they are all very similar.

Ritualised Fights of Little Lizards.
Until now, no ritualised fights between small monitors have been observed in the wild, which is understandable when one considers the maximum 0.2-1 metre total length of members of the subgenus Odatria. Apart from the relatively small size of these animals, they mainly react much more sensitively than the large lizards, and break off the fight immediately when observed. This behaviour is no doubt founded on the fact that the great lizards have only a few enemies to fear, while little lizards not only have other reptiles such as larger lizards and snakes to fear, but also many of the bigger birds such as kookaburras, kingfishers, crows and birds of prey. Until now only one fight has been observed, in V.gilleni. The manner of the combat differs very clearly from that of the large monitors. The most conspicuous part of this ritual, which has been observed many times between January and April, is the phase which can be described as the curve or bridge position, whereby the opponents, both moving ventrally or laterally, reach the floor in succession with the head and tail. In this position they try to overturn their rival by rotating the body, and using pressure to try to flick themselves over. At the end of the fight the victor bites into the root of the looser's tail, whereby the males take on a circular head-to-tail position (Murphy and Mitchell 1974. Carpenter et al. 1976).

Even relatively young V. gilleni, about 5 months after birth, with a total length of 24.1 cm fight in this way. In older specimens the fight appears more stylised (Horn unpublished). The most succinct differences in the fights of monitors exist in the clinch position of the large species, and the bridge postion of V. gilleni. The question of whether great lizards bite each other during these fights (as Auffenberg maintains for V. bengalensis) can also be applied to V.gilleni

Beitrage zur Biologie des Rauhnackenwarans, Varanus (Dendrovaranus) rudicollis GRAY.

A summary of: Some notes on Varanus rudicollis.

Hans-George Horn and Gunter Petters. Salamandra 1982 18 1/2:29-40

Translated by Heather Truelove and Daniel Bennett.

V. rudicollis is at home only in regions of southern Asia - south Burma, Malayan peninsula from Rio-Archipelago to Sumatra, Bangra and Borneo. So named because of the large scales on the neck.

AUFFENBERG reported that the species is found in the Philippines but this is doubtful (1976).

The rough necked monitor has been known since 1845. The skull is strange; slim with long septomaxillaria which give it the appearance of a predatory bird. In contrast to other Varanids it has many small well-formed teeth (71). Adults are almost completely black (MERTENS).

HARRISON & BOO LIAT say that on the forehead yellow dominates with black flecks, whilst the rest of the head is black with yellow markings. Possibly they only inspected younger animals (max length 100cm). They gave it the name "Harlequin monitor". Otherwise only all black animals have been seen. Those from south Thailand are completely black (MERTENS).

Hardly anything is known about the biology of V. rudicollis. All later works refer to 2 older works; Werner in SCHNEIDER (1900) says the animal is found in thickest jungle . LADIGES (1939) saw in "near Langhat (Sumatra) in mangrove forest near a small coastal river ... it lay on a mangrove root near the water surface, but quickly ran up a tree and disappeared from sight when our presence was noticed, jumping on other trees". This is correct, they are known to prefer trees as places of abode (MERTENS). Diet is also uncertain. Schneider inspected stomach contents and found only digested and undigested insects. MERTENS believed that ants and probably termites were eaten, and that the animals use their long tongues to lap the insects up.

Behaviour of V.rudicollis in Captivity.
Because there are so few observations of this monitor in the wild, we must rely on observations in captivity. V. rudicollis is a fairly shy lizard, and its behaviour changes very little even after prolonged captivity. When approached they flee to the shadow of a tree trunk, and give a threat display consisting of loud hissing from the throat with the neck and head bent downwards and forwards. This reaction seems more extreme than with other types of Varanids. Whether they would attack the annoyer cannot be said. According to MERTENS V. exanthematicus is known to feign death if threatened. The same behaviour was observed when a rough necked monitor (male 135 cm, 300 grammes) was taken from its transporting bag, lying flat on the floor with the eyes open, making no sound and offering no resistance when a limb was moved forwards or backwards.

Stranger behaviour has been observed with a newly born specimen (around 25 cm), which, when offered a substrate of 10cm depth of leaves would bury itself, and only emerge occasionally. Similar behaviour has been noticed in V. dumerilli (HORN & SCHULTZ 1977), the reason seems to be to do with camouflage. When placed in a terrarium with a leafy peat floor, 5 V.rudicollis buried themselves, and would not emerge of their own accord for 15-20 days. They were weighed immediately afterwards, and thereafter in short intervals. Four of the five animals had lost weight. Burial perhaps serves as a safeguard against being eaten after the monitors leave the egg. There is enough food already in the body to sustain them over this period.

Incubation period of the rough necked monitor is long compared to V.gilleni (this seems to be the rule with the larger Varanids). It is possible that a long rest is needed after the great energy expenditure of breaking out of the eggshell. Number 5 (see table 1) left the egg with 4cm of its umbilical cord still attached to the abdomen. After 24 hours it went black and was cut without complications.

Food.

In captivity rough necked monitors accept chicks, mice and rats. In one case a specimen 1.5 metres long ate 15 grasshoppers, and then ate up to 8 chicks at one feeding. The animal found it difficult to kill a large rat, and swallowed it only after it was killed by its keeper. They are not specialised insect eaters; large mammals (such as anteaters) which feed on ants and termites have few teeth (30-40). The same is true of Varanids that are insectivorous (e.g. V. gilleni - 43 teeth (MERTENS). Because of this there is a possibility that birds or fish form a major part of the diet.
The following insects have been offered as food; house crickets (Acheta domesticus) of differing sizes, freshly caught chicks, spiders, flies, as well as snails. Refusal of this food may have been because of the general abstinence of newly born monitors, or because the "right" food was not offered. In consideration of the function of the teeth, Danio malabaricus were put into a bowl 30X15X10 cm). A few minutes after one of the young V. rudicollis was seen devouring one of the big fish head first. Unfortunately the "chase" was not seen. Later the animals ate more fish (but not always). If the sighting by LADIGES is correct it is possible that the lizards catch fish in the brackish water (e.g Periopthalmus mudskippers). An objection against the relationship of a large number of teeth and piscine diet is that V. mertensi has 55 teeth, only a few less that V. nilocticus which are both aquatic and take fish for food. Further stomach examinations are necessary to learn more about the function of the teeth.
To see if the young Varanids would eat fish, (at least temporarily) they were given small living fish every week between the 3rd and 6th weeks of life. After a while they took them willingly, along with bigger house crickets, and later baby mice and migratory locusts. The young need fresh water daily for drinking and bathing. (this probably also applies to adults).

Reproduction in V. rudicollis.
Little or nothing is known. A trader's newly imported female (115.5 cm) laid 4 fully formed eggs (sizes given in table 2) and 8 brown empty eggshells. This specimen was from Thailand. Unfortunately the eggs were infertile. In 1980 2 (legally imported) V. rudicollis were purchased, and on 17.1.81 one (110.5 cm - incomplete tail) laid 13 eggs, five of which turned out to be fertile. They were incubated at 29 +/-1oC with 100% humidity, and were sprayed daily with lukewarm water. They were not weighed, but it can be expected that they were similar to those described in table 2. At the end of May all the eggs seemed to expand. The first hatched on 15.7.81, the others shortly afterwards (weights and measurements of hatchlings on table 3).
By comparing tables 2 and 3 it can be seen that shortly before hatching the eggs weighed twice as much as the newly laid eggs. Such weight gains have also been recorded for V.timorensis similis.
Incubation period of eggs was 180-184 days, which is similar to other reports (BARNETT 1979, KRATZER 1973, STIRNBERG & HORN 1981). After the egg is cracked with an egg tooth (approx. 1.5 mm) the hatchlings remain in the shell for up to 35 hours (assumed, because the actual opening of the egg has never been observed).

Growth.
After hatching all five were weighed and measured (table 4). For practical reasons the measuring of the snount-vent length was taken from the back of the thigh. Average weight of

hatchlings was 20.6 grammes, about 14 days later they weighed an average of 19.7 grammes, average length 25.9 cm (table 4).

Compared to adults the juveniles are splendidly coloured. Ventral surfaces have yellow and black horizontal bands,; Upper dorsal and caudal surfaces are glossy black with irregular yellow flecks arranged in bands. This pattern of yellow flecks is very characteristic, and can help identification. The sides of the neck on some specimens have light grey (otherwise soft pink) tones. After about six months this colour disappears, while the characteristic yellow banding is retained on a brown/grey/black colour. It cannot be said whether this change is influenced by captivity.

The young monitors develop quickly after they have begun to take food regularly (table 4). Perhaps because of confinement, strong individuals grow quicker than others, so they were separated into 2 enclosures. One animal doubled it's weight after 6 months but its length increased slowly. The heaviest animal had grown one third longer in the first six months. It was possible to predict what the future lengths would be from 5 single measurements of each animal, e.g. for November 1981 we predicted 31.8cm, actual length 31.7 cm.

Key to Terms in the Tables.

Ablegedatun - Date.

Erste Offnung in Ei - First opening of egg.

Verweilzeit im Ei - Time spent in egg after opening.

Zeitigungsdauer - Total time in egg.

Gewicht - Weight.

Lange - Length.

Breite - Breadth.

Durchschnittlich - Average.

Varanus dumerilii, wie ihn nicht jeder kennt.

Varanus dumerili, As Few Know It.

Hans Georg Horn and Bernd Schulz. Das Aquarium 1977 91 (January):37-38.

Translated by Frank Schofield.

Varanus dumerilii is one of the large monitors: the species grows to over 120cm. long. Setting aside the large size, which gives the amateur problems, there remain only the peculiarities of the dissected skull, by which this animal, which apart from a few white to yellowish crossbands, is a very plain light brown monitor, is placed in its own subgenus Tectovaranus, as MERTENS (1942) established. The scientific name of this monitor, therefore, is Varanus (Tectovaranus) dumerilii dumerilii (SCHLEGEL 1839). Only a little different from the nominate form, and sharing many common characteristics, is the subspecies V.dumerilii heteropholis BOULENGER 1892. While the nominate form comes from the Malakka, Mergui and Rhio archipelagos, and the Batu Islands, Sumatra, Banka, Biliton and Borneo, the subspecies is limited to Borneo (MERTENS 1942, 1959).

Armed with this knowledge, one can well understand that we were really suprised by a colour photograph received about two years ago. It showed an outstandingly pretty, black and orange-red monitor. The overall impression was of V. dumerilii, but the photograph was not very sharp, and no size comparison was available. It was all the more pleasing, therefore, when we managed to see such an animal shortly afterwards, and were able to establish that this Dumeril's monitor was even more prettily coloured than the one in the photograph. Because we were dealing with a tiny animal of only 15 grammes weight, and 25.2 cm.long (tail 14cm., head and body 11.2cm.), the bright colouration was understandable. It is well known that in many reptiles the young are more brightly coloured than the adults.As far as the locality was concerned, we could only establish the general area as "north Borneo" (Kalimatan).

The adults measured by MERTENS (1942) showed a tail to head and body ratio of betweeen 1:3 and 1:5. Juveniles (Mertens 1942) are very dark almost brownish black, have prominent cross bands (stripes), the whole side of the head is light yellowish (in life apparently cinnabar coloured) and there is a prominent temporal stripe.

Here is a short description of the living juvenile; snout with weak crossbands, head, neck and first crossbands are cinnabar-red; next three crossbands light yellow., 8 crossbands on the tail. Throat yellow with 6-8 orange coloured stripes., strong black mark on the nape of the neck, prominent "U" shaped temporal stripe, ground colour of the back black, bands bordered with yellow dots, extremities spotted with yellow in marked bands. Flanks "flamed" with cloudy yellow, stomach dirty yellow, soles of feet light grey. Very fine scales on head, neck scales rough and flat; body scales finer and slightly keeled; scales on tail are very fine: post anal scales present; Eyes dark brown, tongue flesh coloured; nostrils round, ear diaphragm white.

It is hard to imagine that this bright colouring does not make young V. dumerilii easy prey for predators. Since observations in the wild are lacking, one can only guess that, to stay alive, they lead a hidden life, perhaps in boggy ground. An indication of this was the way that the young monitor immediately buried himself in the terrarium, and later moved around only on branches. Grasshoppers, house and field crickets were readily taken.

Editor's Note.
In contrast to the authors' argument, the editor sees the bright, sharply contrasting colouration of the juvenile monitors as camouflage. Such brightly coloured markings make the animal invisible in its very much similar habitat, because the outline of the lizard in the tangled undergrowth of the egg-laying site is not recognisable by it's enemies, in the confusing light and shadows. We are at any rate, of the opinion that Dumeril's monitor does indeed come from a matching habitat. Since herpetological observations in the field are lacking up to now, this must remain a moot point. One might also consider the colouration as a warning signal.

Bemerkungen zu Varanus (Odatria) glebopalma MITCHELL, 1955.

Some notes concerning Varanus glebopalma (MITCHELL 1955).

Hans-George Horn and Ulrich Schurer. Salamandra 1978 14 (3):105-116.

Translated by Elizabeth Stodge and Daniel Bennett.

Until now there has been very little written about Varanus glebopalma, one of the most fascinating monitor lizards, and an animal of unique beauty. Mitchell (1955) described this species from a specimen, probably an adult, caught at the southern end of Lake Hubert (South Australia Museum r 3222). Mertens (1958) was able to examine several other animals for his conclusive, systematic report about the Australian monitor lizards, and was able to enlarge on some inaccurate assumptions, especially with regard to habitat and way of life, which were contained in Mitchell's description. Cogger (1975) confirms the systematic ascertainments of Mertens, ands adds a few more accurate details about the way of life.

Some time ago we had the opportunity of observing some of these interesting animals, both in captivity and in the wild. Because of this further details concerning the ecology of the species as well as the distribution can be given.

Characteristic measurements.
Of the animals which are described here there are two large V.glebopalma (specimens 2&3), one with a total length of 65.5cm (tail incomplete) and one 70.1cm, as well as two juvenile specimens (4&5). For specimen 1 only the length is given, whereas further data is given for the other three adult animals (6,7&8; see table 1). The unusually long tail, which tapers into a fine thin point (Mertens (1958) described tail lengths from 2.09 up to 2.38 times as long as the snout-vent length) is obviously very sensitive, because lizard (2) had an incomplete tail and lizard (4) soon lost a part of its tail in captivity - the length of the part of the tail which had fallen off and dried out was measured and later added to the figures. In the case of specimen (1) one can assume, on the grounds of the proportions between length of the tail and snout-vent length, that the tail was not absolutely complete. The details concerning the length of the body

are contained in tables 1 & 3. In table 1 the measurements of both specimens from the Western Australian Museum, Perth (= WAMP11840 and 11841) are also included for comparison. As a result several differences are obvious. Specimens 3, 5, 6 & 7, which have intact tails are most appropriate for comparison, have significantly shorter tails than the specimens from the Western Australia Museum which originate from more westerly regions. It could be supposed that the difference is due to the age of the animals (both WAM specimens are adult, 5 is definitely juvenile). However specimens 3, 5, & 7 have snout-vent lengths similar to the WAM lizards. Over and above these considerations it must be taken into account that the measurements of 2-8 were taken from live animals, which could have resulted in greater inaccuracies. Even more striking are the differences in the length of the heads of the specimens considered here, and those measured by Mertens (1958) - the former have significantly longer heads than the latter.

The opinion that animals originating from more westerly regions have longer tails - in other words, that V. glebopalma tends towards geographical variations - is supported by specimen 8, which originates from the most westerly region of Arnhem land and has the longest tail of all the monitors considered here (see table 1).

Cogger (1975) says that the maximum length attained by V.glebopalma is 1 metre. One could suppose that there has been some confusion with juvenile V. giganteus. However this length is verified by the specimen R2252 captured by G.F. Gow (see table 3). There are also a few deviations in the number of scales counted by Mitchell (1955) and Mertens (1958) (compare figures in table 2). Thus Mertens counts 83 to 84 scales from rictus to rictus, whereas only 69 to 77 scales were found on those considered here. Number 7 is an exception. The same also applies for scales around the body: 157 to 163 (Mertens) and 145 to 162 for specimens 2-7 with the exception of number 6. Also in this instance, specimen 8 which originates from a different locality than 2-7, does not fall into the general pattern. It has scales on its head which are in part extremely small and cannot be detected with the naked eye. Altogether then the given measurements and scale counts are not very constant, and are therefore only suitable for the characterisation of this species.

DESCRIPTION.

Scales on head and neck are very fine, those on tail and back somewhat coarser; supraoculars very fine; there is an obvious canthus rostralis. This is applicable not only to the adults (2,3,6,7&8) but also to the subadults (5&4). Scales on the underside of the foot are yellowish with deep-black flecks which form a sort of cushion. These black, cushion-like scales, which came to the attention of Mitchell, and which led to the nomenclature, could be interpreted as parts of a sense organ, which is sensitive to temperature, and which acts as a protection against heat and skidding on the hot rocks it lives among. A more accurate explanation can only be gained by histological examinations.

Colouring of specimens 2-8: body is the brown colour of a deer, with a fine black lace pattern; sides of the neck are rust-brown, the tail, from approximately the distal two thirds is a black brown colour with unclear yellow rings; proximal third is a one tone clay yelllow (see

photograph 1). Extremities are dark brown with yellow flecks, which form unclear rings; the throat is grey-blue with cream coloured flecks, which extend in rings over to the end of the nose. The iris is composed of a yellow, almost orange band; tip of tongue is black-blue, otherwise flesh coloured.

In the same way that specimen 8 differs from 2-7 in the extreme length of its tail, so too does it differ in its colouration (see photo 2). The basic colour is also a reddish-brown, but the black lace pattern is extremely coarse. In addition, there are small white flecks dispersed over the whole of the body, so that one is reminded of V. timorensis. On the top of the head the small white scales are dispersed completely irregularly, whereas on the back they form occellations. The most marked difference in colouring between 8 compared with 2-7 is a definite black temporal stripe, which extends from the ear over the eye and almost to the tip of the snout. Ventral regions of all specimens described here are a dirty yellow-white colour with faintly recognisable rings.
Contrary to the colouration of the tail in adult specimens, the distal two-fifths of the tail are pale, without any dark pigment (Mertens 1958), specimen 4 possesses a tail which is completely dark brown to the tip, where darker rings are discernable. The tail of number 5 has slightly more resemblance to that of an adult specimen: two-thirds are brown black, the distal third has narrow brown rings on a clay-yellow background (photo 3). In the course of time this colouration gradually fades into the one tone colour of the adults. This specimen is 16.5 cm. long (snout-vent length). The total length cannot be given because the specimen had lost part of its tail. the juvenile specimens shown on table 2 which came from the Northern Territory Museum possess a completely ringed tail. Specimens of V. gouldii also show differences in the colouring of the distal third of the tail; as far as can be judged from a colour photograph, juveniles have a tail which is dark brown up to the tip with yellow diagonal stripes; on the other hand the adults have a tail which is dirty-yellow in the distal third. V. gouldii from New Guinea retain the juvenile colouration in adult life; specimens from the region around Merauke have confirmed this fact, as has photographic evidence.

Mertens (1958) ascertains that the closest relative to V.glebopalma is V. prasinus, and supports this claim with similarities in the habitus, especially the narrow body, long tail and the presence of enlarged scales on the soles of the feet which both species have in common. However he does not ground their homogeny on the basis of more detailed examinations. The allegations of an arboreal life style in this species are definitely inaccurate, as will be demonstrated below. V.glebopalma has a quite different habitat to the one Mertens supposed it to have. In our opinion, V. glebopalma is by far more similar to V. tristis tristis and V. t. orientalis, this similarity having already been recognised by Mitchell (1955). Not only do these lizards have similarities in scalation, but they also have similarly sharp curved claws, a relatively flat skull and a tail, which at the base, seen sideways, looks almost quadratic. Indeed, seen sideways V. glebopalma is a very "flat"
looking monitor, whereas V. prasinus definitely looks "higher" when in motion. One may assume that the flat shape of the body is an adaptation to its rocky habitat, where they hide themselves in narrow crevices.

Distribution, Habitat and Observations in the Wild.

The first V. glebopalma known to science was found by Mitchell (1955) at the southern end of Lake Hubert [translators note: in fact this specimen was "shot by R.R. Miller and F.M. Setzler....." (Mitchell 1955) DB]. Mertens (1958) names Wotjulum, in Kimberley, Western Australia as the locality where the two specimens shown in table 1 were found (WAMP 11840-1). The two other animals (Mertens 1958) could have been captured in the vicinity of Wyndham (Forest River Mission), Northern Territory, whereas specimens 2-7 originate from the vicinity of Mt Isa, Queensland. Number 8 was observed by us in the rock formations in the vicinty of Nourlangie, Northern Territory. Further localities where specimens have been found are given in table 3. Cogger (1975) names the tropical north of Australia as the area of dispersal, starting from Kimberley Plateau, Western Australia, over the northern part of the Northern Territory up to the western part of Queensland. V. glebopalma appears in rocky, stony landscapes with sparse vegatation, as shown in photographs 4 and 5 (Mt. Isa, Queensland), and photographs 6 and 7 (Nourlangie, Northern Territory.

In the latter area V. glebopalma hides itself in rocky crevices and hollows, appearing early in the morning, approximately between 0900 and 1000 hrs., in order to bask, or it lies in wait, sitting motionless on an elevated block of stone, for prey, which it will captue with a lightening quick spring. The temperature of one of the crevices it lives in was 32oC. The temperature of a block of stone, as mentioned above, measured early in the morning and in direct sun was 35oC (end of May - Australian winter). On a clear spring day in October , on the other hand, shortly after dawn at 0715 hrs., the temperature was 15oC, and at 1315 hrs. the temperature in the shade was 37oC. Table 4 gives an overall picture of air temperatures recorded in such areas over the year.

Climatic data for the town of Cloncurry, which lies only 100km to the east of Mt. Isa, and is therefore ideally suited for comparison (and thus can provide indications of the requirements of V. glebopalma), is given in table 4. From this data it can be seen that the average daily maximium temperature during the summer months from the beginning of October to the end of February is over 40oC, and that the corresponding minimum temperature varies between 18.3oC and 20.6oC. During the coldest winter months, from May until August, the maximum temperatures are from 30 to 33.8oC, and during the night the temperature drops to 5.6 to 9.4oC on average. This is also the driest part of the year; precipitation fluctuates between 0.3 and 1.5 cm, whereas during the summer months precipitation rises up to 11.3 cm (January).

During the summer months (February) the observations was frequently made that during rainfall V. glebopalma would lie under thin stone slabs and either doze or alternatively would observe its surroundings. In the latter case it was seen that its eyesight is so sharp, and that it is so shy and cautious, that even in the case of disturbances from 30 to 50 metres away the animal would withdraw into an inaccessible hiding place. V.glebopalma shows a similar watchfulness when it is basking. According to Cogger (1975) the "cushion" monitor is active during the day and at dusk, so that even after sunset the lizard can be observed hunting. This

ascertation is also verified by the fact that one night a specimen could be seen by the light of a pocket torch in front of it's den.

Mertens (1958) supposed that this species was a tree inhabitant. However this has never been observed by us, and is most improbable. Although there are trees in the habitat of this lizard, which thanks to its sharp claws it would be able to climb, up to now all the animals observed have been on the steep surfaces of rock walls, in rock crevices, niches and cracks, but never in trees. The animal's sharp claws allow it to climb up an almost vertical rock wall three metres high, as has been observed. It preys upon smaller reptiles, including juveniles of its own species (see below). Other prey includes (Egernia hosmeri) and Agamas (eg Amphibolurus caudicinctus) as long as they are of a suitable size. The more usual type of prey would include geckoes as well as other types of Agamas; Gehyra australis and Lophognathus gilberti. Probably the major component of the diet is insects, eg grasshoppers. Pianka investigated the stomach contents, and found grasshoppers in the stomachs of V.eremius (1968), V. caudolineatus and V. gilleni (1969), all these reptiles inhabit a similar habitat. Nothing at all is known about the reproductive behaviour, size and incubation period of the eggs.

Observations in Captivity.
The terrarium was set up according to the space needed by the animals in the wild. The floor was 100X40X50 cm and was composed of clay and washed river sand. A heating cable (15W) was laid, one half running from under the flat, somewhat large water basin, the other half running under a mound of loosely heaped sandstones of irregular shape). The two inhabitants of the terrarium often waded through the water basin, and in doing this moistened the skin and also washed the dust away from their bodies. Monitor number 2 quite obviously suffered from burns on the back, as a result of the 100W lamp hanging in the terrarium - V. acanthurus suffered no such burns- thus the lamp was replaced by a 60W parabolic reflector.

The daily habits of V. glebopalma in the terrarium were contrary to nature. On the one hand the lizards are very shy, and used to flee quickly into the mound of sandstone. But on the other hand they used to remain motionless, with a fixed look, so that one gained the impression that they were not aware of the people observing them. They would noticeably raise the head when they were expecting to be fed, and indeed they would spring greedily towards the hand that was feeding them. The same behaviour was observed with the animals that were being fed to them. When the prey was thrown in the enclosure next to the lizard, one minute it was not noticed at all, the next minute it would jump on the prey with considerable violence. In this respect V. glebopalma differs considerably from the other monitors, both small and large, which in general jump on their prey without hesitation, or they wait with great timidity until the person observing them is no longer visible.

Even the choice of food is sometimes strange. Number 2 likes eating mice, and also lizards and geckoes. locust hoppers, which are gladly eaten by other types of monitors of the same size, are not given any attention at first, and then only hestitatingly eaten. On the other hand the smaller number 4 would, for a long time, only eat lizards and geckoes, and finally it would eat house crickets (Acheta domesticus); but it would never eat a black cricket (Gryllus

bimaculatus) nor young mice. If one tried to trick the animal, by throwing a single house cricket at it, and then suddenly a black cricket this would not be accepted (this trick only succeeded once). Continuing this trick house crickets would be eaten at once, whereas a second black cricket thrown at it would not be eaten. In the course of time however, number 4 would accept black crickets without this trick being used. If it had a choice between house crickets and black crickets it would choose house crickets. Even fully grown locusts were eventually gladly eaten. Up to now the somewhat smaller number 5 has only eaten lizards and geckoes, as well as house crickets. Cannabalism was also observed in the terrarium with this species.

We thank Mr G. F. Gow of the Northern Territory Museum, Darwin for his willingness to help - he gave us the results of research which is set out in table 3.

Summary.
Through personal observation the authors have reached a different conclusion to Mertens (1958) concerning the sytematic position of V. glebopalma. According to his suppositions, its nearest relative is V. prasinus. We believe this to be inaccurate. We agree with Mitchell (1955), who believed that V. tristis tristis or V. tristis orientalis are more similar to V. glebopalma.

Distribution and habitat have been described. V. glebopalma is not an inhabitant of trees as Mertens supposed - rathermore it inhabits rocky cliffs. A change in the colour of the body relating to age was noticed. Juveniles possess a more or less dark coloured tail, whereas in adults the distal third becomes a one tone yellow. This is confirmed by photographs.

In the terrarium the tail of this species is extremely delicate, and often breaks off. The data concerning climate of a specific locality (near the place where the animals were captured) were adhered to in setting up the terrarium. Finally observations concerning behaviour in the wild as well as in captivity, and observations concerning feeding habits have also been given.

Freiland beobachtungen und einige morphometrische Angaben zu Varanus giganteus

Observations on Varanus giganteus with some Morphometric Statements.

Hans-Georg Horn & Gerard Johannes Visser. Salamandra 1988. 24 (2/3): 102-118.

Translated by Naomi Cowgill and Daniel Bennett.

Varanus giganteus, the giant monitor, which is known as perentie, or more rarely sjonba or echunta (in Australia), is one of the most aesthetically perfect monitors, an animal which is perfectly sited to the ecological requirements of the arid sand and rocky landscape of its homeland. Little is known of its biosphere and its behaviour, and there are only a few details of

its ecology despite the fact that it has been known to science for over 100 years (MERTENS 1942b, 1958, 1963) and has been mentioned in countless herpetological works in which the morphology, colour and pattern have been described (compare for example WAITE 1929, WORRELL 1963, BUSTARD 1970, COGGER 1975, HORTON 1976, STAMMER 1970, SWANSON 1976, STORR 1980, STORR ET AL 1983).

Some time ago STIRLING (1912) recounted a series of observations which he made of these animals in his care, together with a third (?) person. What today's keepers of living animals see as remarkable and illogical is the fact that he was unable to get either of the animals to voluntarily eat either living or dead animals (mice, sparrows, guinea pigs, rabbits) or eggs of over several months old, although he was fully aware that in the wild this monitor overpowers other monitors, snakes, birds and little mammals, and was even observed catiching a small kangaroo. Particularly worth of mention in STIRLING's report is the fact that when this monitor reaches its highest speed, when escaping for example, it can run bipedally (this observation was also made by McPHEE (1979)). Later WAITE (1929) published a photograph of two monitors engaged in a ritual fight; the caption implied that the animals in question were V.giganteus, however they are in fact V.spenceri (HORN 1981).

Only in recent times have further details of the biology of this interesting monitor become known. For example the first captive breeding of the species under human care has been reported (BREDL & HORN 1987). The young animals hatched in the first half of September. At birth they weighed on average 40g, with an average total length of 37.5cm.

This monitor appears frequently on Barrow Island off the coast of Western Australia, where it has been closely examined by D. KING, B.GREEN & H. BUTLER (personal notification and GREEN et al 1986). Without giving all the details, it has been established for example that the mid-body temperature of an active perentie lies at approx. 35.8oC (compare to the figure of 36.8oC given by HEATWOLE 1976), that this type is active throughout the year on Barrow Island, and that the daily activity is interrupted by a daily siesta.

In 1982 PIANKA stated that the active temperature of a perentie in January was 38.8oC. At this time the outside temperature was only 28.3oC. The temperature of a second animal (also active) lay at 37.6oC, whilst the air temperature of this day in March was only 24.8oC. There are turtles on Barrow Island for the perenties' nourishment. On examining the contents of the stomachs of 12 specimens in the Western Australian Museum only vertebrates were assertainable, except grasshoppers in the case of two young animals (KING et al, personal notification). The same authors gave the Australian spring and early summer (September - October) as the egg laying season. That more or less agrees with the dates given by BREDL & HORN 1987) for the laying and hatching of the eggs of the giant monitor. Chronological variations in the timing of the breeding season and the behavioural seasonality of this monitor can be explained by the local differences in climatic conditions.

Some endogenous and ectoparasites of this monitor have also been briefly described; Hence JONES (1985) found, next to the already known Nematode varieties, a species previously

unknown in west Australia, whilst SHARRARD and KING (1981) examined the geographical distribution of "tick" varieties on reptiles and found the variety Amblyomma calabyi on this monitor.

Varanus giganteus, both on its own and in connection with other living monitors, was and is the subject of paleontological and phlyogenetic examinations. Whereas earlier examiners of pleistocene fossil monitors see them as probably belonging to V.giganteus, ESTES (1983) suggests examining the material anew, and provisionally, not subscribing it to a living monitor.

Habitat.
Although it is not possible to specify why V.giganteus may be tracked down in suitable homogeneous landscapes, and also areas which may not be trackable, it can be clearly seen that the perentie favours areas with large rock outcrops and corresponding hiding places as opposed to completely flat areas. One can definitely assume that in the case of two similar ares, the one with the greatest supply of food will be preferred. This is obvious in the area south of Kulgera in the Northern Territory (compare pictures 3 and 4). Next to extensive areas of large and small rocks and with countless crevices and cave-like hidouts, are chains of hills linked by large sandy or muddy plains. The available food (insects which are available here for young animals, reptiles, and in the main copious amounts of rabbits) give the casting vote for the choice of settlement. Even in the areas north and northwest of Alice Springs identifiable traces of the perentie (picture 1) were constantly sighted in the vicinity of rocky areas. Likewise picture 2 succeeds in depicting the landscape. Similar assertations on the habitat of the perentie can be found in COGGER (1975), SWANSSON (1976) and even as early as WAITE (1929). Whereas the previous photo (2) is supposed to give the viewer an oversight, picture 6 portrays a section of such a landscape. Accumulation and unordered chaos of rocks obviously take into account the need for protection of this type. Likewise a Perentie was found under an extremely heavy rock ledge at a distance of about 1 metre from the entrance. The animal, which had only half a tail and an overall length of 1.2m, lay diagonally across the entrance, behind smaller stone peaks rising out of the ground, so tightly wedged together that an attempt to drag the lizard out was unsuccessful. In comparison with the normally grey earth in other places, here it was dusty-red, reddish-brown inside the burrow where it was damp. The entrance to a deeper hiding place, to which the footsteps of V.giganteus lead, is shown in picture 7. At another spot, out of similar hole in the rock of considerable depth, a pair of perenties were drawn out and measured.

An interesting observation in connection with this must be the discovery by PIANKA (1982), who discovered the animal in a burrow approx. 1m deep, 7-8m long, east of the town of Laverton, on the wsetern edge of the Great Victoria Desert.

Thus V.giganteus is an inhabitant of rocky landscapes, whose crevices and low caves are used as a refuge, wherever they are suitable. The sparse vegetation of such landscapes, which is richer in early spring, consists of widely spread trees, bushes, shrubs and clump-forming grasses, e.g. acacia (family Mimosaceae), types of eucalyptus (Myrtaceae), melaleuca (family Myrtadae) and types of grevillea (Proteaceae).

Ecological, Ethological and connected Observations.

V.gouldii inhabits almost the complete Australian continent, with the exception of a small corner of the south-east coast. (COGGER 1975), i.e. its area of distribution extends over that of the perentie. Both are typical carnivorous varieties of monitor, so that corresponding to Monard's "competitive exclusion principle" V.gouldii is rarely or never found in the typical habitat of V.giganteus. Instead the sand monitor inhabits the great free stretches, in which he digs his own home.

One becomes aware of the prescence of V.giganteus in the south Kulgera, Northern Territory, through the discovery of its footprints on the sandy/muddy earth (picture 8). In other places between the rocks one occasionally finds relatively large excrement deposits and, at the same time, excreted uric acid. It appears that this monitor has no consistent spot for excretion..

Between 0800 and 1000 hrs., when the temperature rises to 25oC, the animal can be observed arising from its cave and sunbathing. A suitable spot for basking at Kulgera was, with exception, the east side of an area which in part was surrounded and hidden by rocks. All the animals that were found there had the entrance to their burrows on the east side of the low chain of hills. On a morning i+nspection we recognised, at a distance of less than 2 metres, a very large perentie. He rolled around, paused for a moment under an overhanging boulder and with a truly hellish noise broke through the vegetation on the southern side of the area.

In 1942(a) MERTENS guessed that the range of vision of the larger varieties of monitors is limited to 10m. In the case of V.giganteus this has been contested by amateur Australian herpetologists.

From a high vantage point the latter assume that the perentie may be able to see from 300m away and disappears almost immediately at the sight of an upright human, although it lets riders, motorcyclists and drivers approach fairly near. STANNER holds such a range of vision as possible, for in his own study, ecological examinations with the aid of telemetric devices, of V.griseus south of Holon in Israel he was able to assertain that the animals could see him from a distance of 200m and disappeared into its home.

A small photography tent was set up at a distance of 20-30m below the hills, and was immediately recognised as foreign by a perentie appearing at the summit; it was only possible to take one photograph of the perentie, and a speedy retreat by the animal followed. The occasional rapid disappearence of these monitors may be explained from observations in the terrarium. On several occasions it was seen that a large perentie would suddenly drop onto its stomach, so that it appeared as if the animal had realeased a hinge in its shoulder joint. If the animal then glides a few metres into the protection of adjacent shrubs by twisting on its stomach, one gets the impression that it has disappeared into thin air. The following observation is also interesting: on crossing the habitat at the Undoolya Gap, east of Alice Springs, birds about the size of starlings (probably Manorina flavigula could be observed panicking at the approach of something out of the vision of the human eye. On approach we

observed a very shy perentie. In a warning reaction it spalyed its throat by means of its tongue bone and presented its tail, ready to attack. In this position it would let us approach within 2m (see photo 2) and finally as the climax to this warning reaction its mouth opened in a wide gape. as this did not suceed in driving us away the animal fled, not into the nearby bushes and shrubs, but onto a tree, and observed the photographer from a safe distance (6-8m - see photo 11). That the perentie likes to take refuge on vertical objects like posts and trees (and even on people!) has been reported previously (MERTENS 1942a), yet as far as we know it has not been photographed in such a position before. An illustration of a young perentie on a tree branch can be found in STAMMER (1970), although he gives no explanation for it.

The most interesting observation with regard to the reproductive biology of this lizard must be the discovery of a pair of perenties in a cave about 2.5m deep at the beginning of October south of Kulgera. With some difficulty the animals were drawn into the open. The male was 28.8oC larger than the female, and his tail tip was missing. When they came out of the cave they were relatively cool, and offered little resistance (due to cloud cover the temperature was only 18-25oC). Only the powerful male, who had a large scar on his left shoulder, opened his mighty jaws. An impression of the differences in size can be seen in picture 12 (the male can also be seen in picture 12). The most unusual thing about this observation is that monitors are generally solitary creatures, and only in V.komodoensis (AUFFENBERG 1981) has anything similar to pair formation been seen. After measuring the animals we set them free in an area of sparce vegetation. In the middle of this plain of sand and mud lay the remains of a dead tree and some rabbit burrows. After very brief orientation the female fled into one of the burrows, whereas the male indicated his annoyance with a splayed throat and a hiss, strode leisurely through the low vegetation and finally disappeared into a burrow. Apart from man, adult perenties have few enemies, but the young are in constsant danger from birds of prey. In the Kulgera area dingos are relatively common; sometimes one can hear their calls from near and far. On our several exploratory tours wev sometimes came across these animals unexpectedly and on one occasion met four at once. Dingos are coloured chiefly to fit in with the Australian lanscape, and are therefore uniformly sand coloured or grey. We saw dark brown and black animals, which suggests the animals were crosses between dingos and domestic dogs. This could have very serious consequences for Australian wildlife, because the dingos mate only once a year, whereas a cross with a domestic animal produces a dog capable of reproducing all year round. It is likely that even a large perentie, and certainly a juvenile or subadult, can serve as a meal for the dingos. Possibly the large scar and missing tail tip of the male mentioned above are a reminder of a dispute with a dingo.

Some Morphometric Data.

In 1942(b) when Mertens compiled his study of the monitor lizards, there was no material of this species available, and he had to rely on literary information. Later (1958) he was able to examine five adult animals and measure four of them accurately. The largest of the females he measured (SMF 53263 in the Senckenberg Museum, Frankfurt) had a snout-vent length of 75cm and a tail of 100cm. She may well have come from the most prominent area of the above mentioned Undoolya Gap (MERTENS 1958: 25 miles NE of Alice Springs). STORR (1980) and STORR ET AL (1983), had the most extensive west Australian material from the Western

Australian Museum at their disposal. As a result of these examinations, it is certain that the tail can be 147-192% of the snout-vent length (which is given as a maximum of 70cm). For example a specimen of 70cm SVL can reach a total length of between 172.9 and 204.4cm! The specimen mentioned by MERTENS (1958) which comes from central Australia thus clearly exceeds the maximum SVL of Western Australian specimens given as 70cm. STORR's (1980) given boundaries for scales around the body were undercut by two of MERTENS animals in 1958. Hence there appear to be certain regional variations in the morphological characteristics.

In 1958 MERTENS had no young animals at his disposal; STORR (1980) and STORR ET AL (1983) contain no absolute measurements, hence some personal data and measurements of two larger living animals are given here (TABLE 1).

HEADINGS of TABLE 1: No.- Head and body - Tail - Total - Head Width - Head Length - Length of Front Legs - Length of Back Legs - Place of Discovery - Registration Number.

1. Tip of nose to distal insertion of back legs.

2. Tip of tail to distal insertion of the hind legs.

3. Greatest width (seen from above).

4. Tip of nose to end of nuchal scales (?).

5. Back of legs from torso to soles of feet.

6. 1-7 are preparations in the Western Australian Museum, 8-9 are living animals.

7. Western Australia.

9. Northern Territory.

10. End of tail (approx. 8-10cm) missing.

To aid understanding of these measurements : There is some deviation from usual customs for establishing head and body and tail length; The latter is obtained by measuring the distance from the tip of the tail to the back of the hind legs, and the former from the hind legs to the tip of the snout.

One can draw from the comparisons with the values given in the work of BREDL & HORN (in which the average measurements of six freshly hatched perenties were: head and body 15cm, tail 22.5cm, total 37.5cm) because no. 1 in the table is also newly hatched, or only a few days old. The relationship between SVL and tail length in hatchlings is 1.5, for nos. 1-7: 1.51 - 1.74, for no. 8: 1.3 (in no.9 some of the tail is missing).

Although the measurements cannot be very accurate, one can nevertheless see that relatively large individual variations occur. One can see the same for the relationship between the length of the front and hind legs for 1: 1.24, 2-9: 1.3-1.42. It can be seen that the newly hatched animal has noticeably shorter rear legs than the others. It is possible that this is due to the adaptation of space within the egg, further measurements of freshly hatched eggs would have to be taken.

Further data on nos. 8 & 9 not given in the table which serve to fully characterise these animals: no. 8 is a female with a cloacal depth of 2.2cm, no.9 is a male with a depth of 7.4cm.

The female perentie possessed a tail circumference of 19.1cm at its widest point, the male 24.5cm. Whereas the position of the nostrils of the female were not measured the male's were 11.8cm from the edge of the nostril to the corner of the mouth. The weight of the animals was guessed to be 8kg.

Thanks.
Dr Glen M. Storr, curator of birds and reptiles at the West Australian Museum, is to be thanked for allowing us to take the measurements of animals 1-7 in table 1. We would especially like to thank him for the hospitality shown to us during our two day stay in the museum and for the conversations held there.

We thank Dr D. King of Perth, for allowing us to take notes from his unpublished work. We thank him especially for his considerable hospitality during our stay in his house and his ready support in all our undertakings.

The Propogation of Reptiles in Captivity: The Grey Monitor Varanus griseus.

V.A. Igolkin. Priroda (Nature) No 9: 95-96.

Translated by Edwina Fenwick.

The grey monitor is the biggest lizard in our country. Unfortunately these rare lizards usually die in captivity within two years, although when kept properly their life span can be 8, or even 17 years.

The Varanidae are very demanding with regard to temperature: according to our observations the optimum temperature for them is 32oC.

Terrarium specialists have believed that the Varanidae do not need much water, because they drink a lot only during the moulting season. In actual fact, water is absolutely essential for these `crocodiles of the desert', and should be supplied in quantities sufficent to bathe in

should they wish. They seem to have this desire fairly often, in our terrarium, at a temperature of 29-32oC, they enter the water up to five times per day.

Their bathing is extremely distinctive. Standing up to its belly in the water, the monitor scrapes its claws along the bottom of the reservoir, then, having half submerged its head in the water, rubs it along the walls and then suddenly, as though having just remembered something, quickly leaves the water and begins to crawl around the cage, zealously gathering sand with its tail and belly. 'Having convinced himself' that everything hat could stick to him has done so, the monitor heads back to the water with the majestic step of a dragon and flops into it with a splash, virtually half filling the reservoir with sand. After bathing, having collected the remnants of sand from the floor with its belly, the monitor settles on the back of its nearest neighbour, and calms down for a while.

The Varanids cannot be categorised as clean animals. Consequently they have to be washed regularly. When a monitor has been washed with baby soap, rubbed down with a brush, and held by the tail, lowered into the tank, it paddles around, earnestly thrashing the water with all four feet. These baths facilitate the moulting process, which lasts 15-20 days, whereas in unfavourable conditions moulting can take as long as six months. At our zoo the monitors moult up to three times a year.

If the monitors are adult when recieved they do not become tame, except perhaps the most languid of them. When a person appears they react by hissing and, turning side on to the annoyer, lashing their tails in all directions; incidentally, they never try to use their teeth. Young individuals, as a rule, patiently endure all the tenderness which inevitably befalls 'tame' animals, but in the company of adults they quickly acquire habits of the wild and behave more aggressively.

A sharp difference can be seen in the activity of a hungry monitor, which will wonder around its cage in no particular direction, using its tongue to examine objects in its path, and reacting to the slightest noise from beyond the doors, and the sleepy state of a monitor after feeding, when it hardly reacts to noise and movement in the premises. At feeding time all monitors, as a rule, are extremely friendly towards people. They approach without fear, impatiently claw the sides of the bucket containing live food (as a rule this is mice) and attentively watch the person's every movement, in fear of missing the start of the feeding. The biggest specimens unceremoniously push away the smaller ones, and treading on their feet, try to get the food straight from the bucket itself. With food between its teeth, the lizard rushes headlong to a corner of the cage and devours it there, having first banged it against the wall. If the rodent tries to bite, the lizard presses it against the ground or sharply throws it to one side and then catches it again. Before they have managed to swallow it, often with the mouse's tail hanging from the jaws, the monitor will try to steal another from its cagemates. Fights often arise, and although they do not lead to serious injury some bloodletting may occur. After feeding some go to sleep, whilst others begin to wipe their bloodied jaws on the backs of their neighbours or the walls of the cage.

After the main group have been fed, younger and more timid individuals have to be fed individually, otherwise they weaken after missing several feeds and succumb to open terror from the stronger ones. At times other than feeding the monitors make no distinctions between each other.

Monitors are gluttonous and unpretentious about food. their rations include new born Guinea pigs, fish, vegetation - chickweed or barley which has sprouted. They also eat white rats and field mice, consuming one or two at each feed. With regard to live food they prefer 2-day old chicks and sparrows, and happily eat fresh horse blood or liver. From time to time the monitors swallow small chicken and pigeon eggs. In our opinion it is essential to allow the monitors to hunt, because this is the only opportunity in captivity to allow them to move energetically and essentially, the only enjoyment we can give them under these conditions. The feed of meat, fish and eggs is supplemented with three vitamins (A,D3 & E) mixed with vegetable oil in a ratio of 1:4. Egg shells are also added. Live food is provided twice a week.

As with all reptiles, young monitors need to be fed more frequently: here they are fed every other day.

Often Varanids arrive at zoos so exhausted and weakened by their journey that there can be no question of normal feeding. they either refuse food or regirgitate what they have eaten. According to our observations, in such circumstances the most effective measure is hypodermic injections of a 10% glucose solution. depending on the size and state of the animal, a dose of 20-100ml is given. The dose is distributed to four or five points in the body so as to avoid necrosis. In order to raise the intensity of glucose absorption the lizards are placed under a sunlamp for an hour and a half at 37oC. Subsequent injections are done at intervals of 1-2 days, and are accompanied by a dose of 1ml vitamin B12. As a rule 3-4 injections are sufficent, after which the animal gets 20-30g of liver with egg yolk.

In order to prevent salmonella infection, preventative doses of furazolidone (0.05g per 1000g) are addded to the food.

One of the main reasons for female mortality in captivity is disruption to normal egg laying, when unfertilised eggs stick to the walls of the oviducts. The reason for this anomaly is not definitely clear to us, but there are grounds for regarding it as the result of both the general lack of movement in lizards in captivity and also the passivity of the sexual reactions of the females. Health problems of this type are typical in captivity, and are observed not only in reptiles, but also in mammmals and birds.

From other publication; Peters,U. Observations on a mangrove monitor Varanus (Odatria) semiremex Peters 1869. Aqua-Terra, 6:61-63 (1969).

Otto Klee.

Translated by M.J.Bennett.

The writer reports on a specimen of mangrove monitor which he caught in September 1967 in a mangrove swamp near Townsville, northern Queensland, up a 6m high half dead mangrove tree (Rhizophora micronanta). The animal was discovered 4m up, watching with its head out of an opening in a hollow branch. Other authors have also reported on similar observations to support the view that V.semiremex is primarily a tree dweller. The distribution of this mangrove lizard extends from the coastal region of Queensland as far as the edge of northeastern Western Australia. In the hunting area of Townsville the temperature reaches an average of 82oF, at night it is only a little cooler. The landscape can be described as mostly sunny, with only such plants as mangroves (Avicennia marina, Bruguiera gymnorrhiza, Rhizophora mucronata, Sonneratia alba). The ground is mostly muddy swamp, the area is only 2km from the Pacific Ocean. Next to V.komodoensis one can describe V.semiremex, from Peter's observations, as the tamest monitor. Neither in capture nor captivity was any attempt to bite noted. The author kept the V.semiremex together with a V.mitchelli in a terrarium 70 X 120 X 70cm planted with epiphytes. In captivity the animal also spends most of its time on climbing branches. Both animals get along well. The mangrove monitor can be said to be an onmivore. Besides crab and fish, which are eaten in the wild, in the terrarium it enjoys mice young birds, insects and eggs. The animal is 53cm total length, of which 31cm is tail. The basic colour of the back and sides is a light blue-grey. In between there are numerous black spots. Bright coloured flecks adorn the top of the legs and the top side of the tail is black. The underside is yellowish-white with indistinct grey mottling. The English name "rusty monitor" is derived from the rusty red colour of the throat and chest.

Observations on the incubation time of a clutch of eggs of Varanus salvator.

Henri Kratzer. 1973. Salamandra 9(1):27-33.

Translated by John Hackworth.

Among the multiplicity of observations and publications concerning the reproduction and incubation periods for clutches of eggs of oviparous reptiles, reports concerning corresponding knowledge of monitors are quite infrequent. A possible reason for thsi is that it is not practical for the vast majority of reptile keepers to keep these large predatory lizards under ideal

conditions which are conducive to mating behaviour. Even the various forms of the smaller Australian and Indo-Australian monitors causes problems for their keepers when attempting to keep them under ideal conditions (part of this is the provision of the correct diet). Under these circumstances we should regard the clutches of wild caught and newly imported gravid females as a perfect opportunity of providing an insight into the reproductive biology of this family of lizards,

In the summer of 1970, through the good offices of Mr Walter Zinniker of Rufenach, I was able to obtain the newly laid clutch
of eggs of a V.salvator, imported a few days earlier from Thailand. Whilst lizards of this species can reach a length of some three metres, I was informed by Mr Zinnekar that this female had reached a length of only 1.4 metres. Nevertheless the clutch, which was laid on 15 July 1970, contained a total of 14 relatively large eggs, which were laid singly, and did not adhere together in a clump. As opposed to most snake eggs, the shells were quite strong. However, like snake eggs they were leathery and not at all brittle. The eggs were covered in longitudinal rows of transparent pores and were a dull white in colour. As soon as they had been measured and weighed they were transferred to plastic container containing moist peat, which had been prepared for the incubation. A fine gauze of non-rusting material was laid over the container and a sheet of glass was placed over this so that adequate ventilation was ensured, whilst at the same time ensuring that the contents did not dry out. The temperature in this incubator was maintained at 28-30oC by using a heating pad below the plastic container. Throughout the incubation period temperature variations of some 3-4oC were frequentely registered. These were caused by the room temperature. Because of a severe shortage of time I was unable to make precise temperature registrations. Nevertheless, because all of the eggs were subjected to the same climatic conditions for the entire incubation period, it can be assumed that these minor variations did not have any effect on the extraordinary variations in the hatching dates. Below is a table of the diamensions and weights of all the eggs, registered within 24 hours of being laid.

| No. | Length in mm. | Diameter in mm. | Weight in g. |
|---|---|---|---|
| 1 | 68 | 35 | 49 |
| 2 | 68 | 35 | 50 |
| 3 | 65 | 37 | 48 |
| 4 | 69 | 35 | 50 |
| 5 | 64 | 35 | 50 |
| 6 | 71 | 36 | 55 |
| 7 | 67 | 35 | 50 |
| 8 | 68 | 35 | 50 |
| 9 | 65 | 37 | 50 |
| 10 | 68 | 35 | 48 |
| 11 | 66 | 35 | 50 |
| 12 | 67 | 36 | 46 |
| 13 | 65 | 36 | 48 |
| 14 | 67 | 34 | 50 |

Greatest length 71mm Greatest diameter 37mm
Shortest length 64mm Smallest diameter 34mm
Average length 67mm Average diameter 35.4mm
Greatest weight 55g
Lowest weight 46g
Average weight 49.5g

After a period of two months, and for the purposes of checking, on 14 September 1970, one of the eggs (no 9) was opened, and a well developed live embryo could be seen. On the basis of this positive result I was able to assume that development in the remaining eggs was well under-way. The obvious increase in the size of the eggs, particularly noticable in the diameters, persuaded me, on 11 December, to carry out another check on the diamensions and weights of the eggs. This was after an incubation period of 150 days. The results of this check are given below.

| No. | Length in mm. | Diameter in mm. | Weight in g. |
|---|---|---|---|
| 1 | 68 | 44 | 77 |
| 2 | 70 | 39 | 60 |
| 3 | 65 | 42 | 63 |
| 4 | 70 | 40 | 62 |
| 5 | 67 | 37 | 58 |
| 6 | 74 | 40 | 64 |
| 7 | 67 | 45 | 75 |
| 8 | 68 | 41 | 60 |
| 10 | 68 | 41 | 66 |
| 11 | 67 | 40 | 60 |
| 12 | 68 | 40 | 64 |
| 13 | 66 | 38 | 56 |
| 14 | 68 | 39 | 57 |

Greatest length 74mm Greatest diameter 45mm
Shortest length 65mm Smallest diameter 37mm
Average length 68.1mm Average diameter 40.4mm
Average increase in length 1.1mm Average increase in
Greatest weight 77g diameter 5mm
Lowest weight 56g
Average weight 63.2g
Average increase in weight. 13.7g (ca. 27.7%).

As far as is known, the incubation period for monitor eggs lasts several months. Exact information was obviously difficult to obtain during the sixties. Thus in his detailed treatment of monitors, MERTENS (1942) quotes only a presumption of COWLES (1930) in which the eggs of V.nilocticus required an incubation time of ten months in their chambers in termite

mounds. ROSE (1950) also mentions a ten month incubation period for V.nilocticus, and is therefore probably greatly influenced by COWLES. Even ROTTER (1963) is unable to give detailed information. On the basis of various reports published in the sixities, essentially only vague data can be presented; In San Diego Zoo (California) six V.exanthematicus [albigularis - D.B.] hatched between 170-176 days. At the Wilhelma Zoo in Stuttgart a clutch of V.mertensi eggs hatched after 182-215 days. From a clutch of 18 V.spenceri eggs in the Taronga Zoo in Sydney, 11 young hatched after 122-129 days. From Mr Rene Honneger, an assistant at the Zurich Zoo, I received a verbal report that two V.salvator hatched after 207 and 209 days. On the basis of this data on 22 February 1972 (222 days after being layed) I risked opening another egg. Inside I found a fully developed monitor, which despite still having a considerably large yolk-sac. appeared capable of survival, and which, ahving been forcibly removed from its rather cramped surroundings, took food a few days later in the form of small fish and insects. After a further 19 days the second young monitor hatched independently by slitting the egg shell with the egg tooth situated at the tip of the upper jaw. By expecting the remaining eggs to hatch in quick succession I was to be sadly disappointed.
The following data shows the astounding variation in hatching times:

Birth of the young (sequence not identical to previous tables).

Abbreviations: L = total length in mm
B = body length in mm
T = tail length in mm
W = weight in g.
IT = incubation time

1. 21 Feb 1971. Egg opened. Completely developed young with IT =222 days residual yolk sac.
L=287 B=125 T=162 W=25

2. 12 March 1 young left shell within 1 day
IT=241 days L=315 B=132 T=183 W=27

3. 4 April 1 young left shell after 2 days.
IT=264 days L=310 B=130 T=180 W=29

4. 6 April 1 young left shell after 6 days (12 April)
IT=266 days L=295 B=123 T=172 W=32

5. 12 April 1 young left shell after 1 day.
IT=272 days L=281 B=121 T=160 W=33

6. 12 April 1 young left shell after 2 days.
IT=272 days L=296 B=124 T=172 W=37

7. 13 April 1 young left egg after 3 days.
IT=273 days L=316 B=129 T=187 W=38.

8. 25 April. 1 young left egg within 1 day.
IT=285 days L=300 B=120 T=180 W=32

9. 27 April. 1 young left egg after 2 days
IT=287 days L=297 B=122 T=175 W=36

10. 5 May 1 young left egg after 3 days
IT=295 days L=281 B=122 T=159 W=30

11. 3 June 1 young left egg after 2 days
IT=324 days L=275 B=120 T=155 W=32

12. 6 June. 1 young left egg after 1 day
IT=327 days L=287 B=124 T=163 W=34

13.7 July.Egg opened, fully developed dead young with small yolk sac.

Greatest total length 316mm
Smallest total length 275mm
Average length 295mm
Greatest weight at birth 38g
Lowest weight at birth 25g
Average weight at birth 32g

From the above the following balance can be drawn:
A total of 14 eggs, all of which were fertile; one egg with living embryo opened prematurely; one egg with fully developed and viable young opened prematurely; one egg with fully developed dead young opened after 359 days; 11 young hatched unaided after 241-327 days, i.e. within a space of 86 days; the time intervals from the first independant hatching (X) amounted to (in days)
X-23-2-6-1-12-2-8-29-3.
The question regarding the cause of the almost improbable difference in the hatching dates between the first and the last young monitors will, for the present time have to remain unanswered.

Conclusion.
In Summer 1970 the Author received a newly laid clutch of eggs from a Varanus salvator. This clutch contained 14 relatively hard shelled eggs. For incubation the clutch was placed in a plastic container containing moist peat covered with fine gauze and a sheet of glass. The

container was kept at 29-30oC. After two months one egg was opened, and contained a well developed living embryo. After an incubation time of 222 days a second egg aws prematurely opened and a fully developed and viable monitor aws found. 11 further young hatched after an incubation time lasting from 241-327 days. i.e. within a space of 86 days. On opening an egg after 359 days, one young monitor was found to be dead.
The reason for the great variation in incubation times of 86 days is at present unknown.

Bibliography - as original.

Summary of a review of Aquaterra 9 (10). 1972:98-102.

Kratzer,H. AquaTerra 10(1) 1973:12.

Translated by Steven Plunkett.

There is a need for well informed and detailed studies of animals, both in the terrarium and in the wild. The authors of such articles are alone responsible for ensuring that their article and photographs are accurate. A.J. Zwinenberg, in his article on a hatching of Varanus exanthematicus albigularis has failed in these respects. His photographs are faked and his text is questionable.

Reptiles lay tough leathery eggs that neither crack nor splinter, as do the eggs of birds. The eggs contain remnants of the amniotic fluid, and thus when born the baby lizards are wet. Furthermore they do not leave their eggs for at least several days after having first opened, the process seeming to exhaust the hatchlings, who use up the rest of their yolk sacs before finally breaking free of the egg. Zwinenbergs' photographs show plump, dry, young V. e. albigularis emerging from birds eggs, and claims that the time from opening of the egg to eating food to be 19 minutes.....

A Case of Cannibalism in a Desert Monitor (Varanus griseus).

Anatoli N. Makarov. Voprosy Gerpetologii. Abstracts of the papers presented at the VI All - Union Herpetological Conference. Leningrad. "Nauka" 1985: 130.

Translated by Marina and Anatoli Makarov.

An adult male monitor lizard was captured in the Gyaur District of Ashkabad region (L 460 Lcd 620mm). The contents of the stomach were obtained by provoked regirgitation and consisted of the following; half digested remains of 2 or 3 young (newborn?) Central Asian tortosises, egg shells and a male monitor (L 300 Lcd 420mm). The stomach contents of the

latter contained 5 newborn gerbils, obviously from the same litter. Lacerated wounds on the body of the eaten monitor and the prescence of non-digested food in its stomach testified to the fact that it was killed and swallowed in an aggressive contact. According to our observations of two young monitors in captivity for 1.5 years fighting was observed only once, whilst the animals were feeding. There are two possible reasons for cannibalism; first, while two animals are swallowing the same prey one can be eaten by the other (generally the smaller by the larger). Secondly, at the sight of food carnivirous reptiles get so aroused that they will sweallow even unedible objects. In this state aggressiveness is greatly increased, even towards members of its own species. The case of cannibalism described must have been caused by an aggressive encounter over prey. The shortage of food items encourages graeter concentration of monitors within a restricted range (such as a gerbil colony) and gives rise to aggressive contacts.

Present Condition and Problems of Conservation of the Desert Monitor Lizard (Varanus griseus).

V.M. Makayev. Naochnie Osnovi I Patsionalnhogo Ispolzovaniya Zhivotnoho Mira. Moscow 1982:36-42.

Translated by Maria Shimanskaya and Daniel Bennett.

The desert monitor (Varanus griseus) is included in the Red data books of the IUCN and the U.S.S.R, and is the only representative of the family Varanidae in the U.S.S.R. In recent decades there has been as disquietening reduction in monitor numbers and habitat which has attracted the attention of specialists (BOGDANOV 1960, 1962, 1965, BANNIKOV ET AL 1977). However, information in the literature regarding density of monitor populations in their various habitats can only be described as extremely imperfect and this puts considerable limitations on general estimates of this species' status. There are virtually no special conservation measures in existence.

For many years (1961-1981) we have collected materials (mainly of venomous snakes) in Middle Asia and Kazakhstan and have also registered a number of monitor lizards. The main method of registration was by the "route" method. The distance at which the lizard was sighted and the length of route were recorded. Then the number of monitors was estimated according to the size of the area. In sand deserts attempts were made to determine the movement of monitors by following spoor. We have also made some observations on the ecology of this species that help to understand the distribution of this species. Our findings have been partially published before (MAKAYEV 1970, 1979). The main collections were carried out in Uzbekistan, Turkmenistan and Tajikstan. In total we encountered 161 monitor lizards, of which 47 were caught. Over the years we have dissected 8 monitors and examined stomach contents in another 39 by the bloodless method.

Condition of Natural Habitat.

In the U.S.S.R. the desert monitor inhabits a large area which is bordered by the Caspian Sea in the west, reaches latitude 46 North and longitude 75 East. Outside the U.S.S.R. the desert monitor is found in northern Africa, Iran, Afghanistan and Pakistan. This vast area contains at least three subspecies of Varanus griseus; Varanus griseus caspius (Eichwald) is found in the U.S.S.R. and Afghanistan.

At present there is no information available about any changes in the monitors' distribution in the U.S.S.R., except the almost complete disappearance of this species in the Ferganskaya Valley. Because this population was already isolated from the main area of distribution (BOGDANOV 1965) the disappearance of this species from the area will result in the eastern boundary moving to longitude 68-70 East.

We can also state confidently that the monitor has disappeared from considerable areas because of the development of land for crops. The most striking example of this is the ousting of the monitors from the territories of Golodnaya and Dalverzinskaya Steppes in Uzebekistan because of the development of these areas for growing cotton (BOGDANOV 1965). Expansion of the area under cultivation and the ploughing up of virgin and fallow lands cause an interesting reconstruction of the monitors' distribution. At first numerous colonies of small mammals - pests of agriculture- appear on the edges of cultured fields. Monitors mass here as well, forming settlements with high population densities. Then the monitors, who are easily noticable, are destroyed by native people, those surviving leaving the area to redistribute themselves more evenly in uncultivated areas.

Ousting of monitors from arable lands and their extermination in populated areas result in an expansion (of populations) in unsettled areas, and the web of natural habitats becomes thinner.

Habitats.

Monitor lizards live mainly on plains. Typical monitor habitats are various parts of sandy and clay deserts. On stabilised and semi-stabilsed sands the lizards dig burrows or widen the burrows of rodents or tortoises. These shelters, as a rule, are used by monitors temporarily. For hibernation the lizards dig their own burrows up to two meters deep. The length of the burrows can reach 6 meters (YADGAROV 1968).

Monitors readily settle in river valleys. On the banks of large rivers monitors hold to riverside terraces and in ravines. In the valleys of smaller rivers this species is found in foothills and lower mountain slopes, but is not found higher than 800-1000 meters above sea level.

In clay foothills and clay deserts populations of monitors are more closely associated with settlements of small mammals. Probably this makes it easier for the monitors to dig burrows in the compact soils and simplifies procuring food. In foothills the monitors avoid dense bushes and prefer open places with grasses in river valleys or on the slopes of hills. However the monitors do not avoid sparse woodland and sometimes climb trees.

Being good swimmers, the monitors are often found near water. In this case the lowest areas are used for hunting animals that live close to the water, the monitors' shelters being on higher terraces. In river valleys monitors often shelter near precipices, using birds' burrows for hunting and as shelters.

Development of river valleys, foothill deserts and lower mountain slopes leads to radical transformation of the landscape that is connected mainly with the development of irrigated agriculture. This causes complete destruction of the monitors' habitat, or their partial transformation. In such transformed areas the monitors hold to the edges of cultivated fields, and if not persecuted can live close to human settlements for a long time.

Development of sand deserts does not usually affect monitors, as it does not cause habitat destruction. Developed sand deserts are used mainly for livestock farming. In thses conditions the monitors experience virually no pressure from mankind and are able to continue life in natural habitats.

Density of Populations.
There is practically no information about the numbers of monitors in a given area. However there are many reports giving numbers of monitors met in a day's excursion (BOGDANOV 1960, 1962, 1965; BANNIKOV ET AL 1977, SHAMMAKOV 1981). Only in the last few years have several works appeared which give data on population densities in this species (MAKAYEV 1979, ZARHIDZE 1981).

Our observations reveal that the distribution of monitors in a certain area in never even. Usually areas with high densities alternate with others where monitors are only occasionally encountered. Taking into account average densities for large areas, we can state that this species is distributed most evenly in sandy deserts. Here, in areas covering many tens of square kilometers, stable desnsities of 2-3 specimens per square kilometer have been recorded. In southeastern Kara-Kum average densities are higher - up to 5 specimens per KM2.

Apparently monitors reach maximum densities around rodent colonies. We recorded densities of up to 10-12 specimens per KM2 on the edge of Karabil, bordering with the valley of the Murgab River, and in sandy desert not far from Karamet-Niyaz (Turkmenistan). A density of 10.5 species per KM2 was recorded by us in Saihan Valley (Uzbekistan - foothills of western slope of Babateg Range). Similar densities were indicated for western Turkmenistan (ZARHIDZE 1981). This author recorded 9-12 specimens per KM2 on the fixed sands of Suyunaksak over a large area.

In other kinds of habitats average densities are somewhat lower. For example, in river valleys monitors keep to a rather narrow belt of riverside terrace, and on average 1-1.5 specimens per KM2 are recorded. Such densities were found by us in the valleys of Sumbar, Chandir and Murgab Rivers in Turkmenistan and in the valley of Vahsh River Tadjikistan. Note should be taken that in the valley of Sumbar River near the settlement of Kara-Kala we recorded a

density of 3 specimens per KM2. In the same vicinity of Kara-Kala in Turkmenistan, in clay and road-metal foothills we counted up to 5 specimens per KM2.

Examining average densities of monitor populations in diverse habitats and comparing them to general natural habitat we can say confidently that the greatest numbers of monitors are to be found in the sandy deserts.

Nourishment.
A great diversity of food species is recorded in the literature. Both invertebrates and rather large vertebrates are included in the list. Without giving any particular details, because the monitors' diet has been discussed in detail in reports on Middle Asia and in identification handbooks (BOGDANOV 1960, 1962, 1965, BANNIKOV ET AL 1977, CHERNOV 1959, SHAMMAKOV 1981) we want to note that this species considers any moving object of a suitable size to be prey. Large monitors are able to swallow animals of a considerable size. More than once young hares and adult levantine vipers have been found in their stomachs. Plant remains are often found in monitors' stomachs, but there is no record of intentional feeding on plant matter in this species, so they are probably accidentally ingested with other food.

That monitors prey on poisonous snakes has been known for a long time (BOGDANOV 1962). This matter was examined in detail by RJUMIN (1968). He noted that monitors were able to swallow levantine vipers 106 and 108cm long. In 1976 we caught a monitor which regirgitated an even larger levantine viper. The undigested part of the snake, without the head and first third of the body measured 100cm.

On the whole monitor diet is directly connected to habitat. Prey animals alter seasonally but they almost always consist of common species. We would like to cite a well-known extraordinary occurence, that in the stomach of a monitor which was caught in eastern Kara-Khum in 1979 we found a gecko (Teratoscincus scincus). The monitor is a diurnal animal, the gecko noctural. We could not imagine when these lizards could have met, and can only suppose that the monitor dug the gecko from its daytime retreat.

Reasons for Reductions in Monitor Numbers.
We have already mentioned the main reasons for the reduction in monitor numbers - transformation of landscape by man for agricultural development. Monitor habitat is also being destroyed for other reasons; building of new settlements, expansion of existing settlements and the building of new roads. Reduction of monitor numbers is also caused by their more frequent encounters with man.

We can divide the reasons for dwindling monitor populations into two groups. The first group of factors is connected with mans' activity without intentionally harming the lizards. Economic activity of people leads to the transformation of natural habitats that results in a reduction of the area suitable for this species and thus a reduction in their numbers. The second group of factors include deliberate destruction of monitor lizards. We can attribute to this group the catching of monitors, practised before the inclusion of species in the Red Data

Book of the U.S.S.R. In the 1930's monitors were often used for leather by the tanning industry, and in the 1960's and 70's they were caught to supplement zoological collections and for export. We also have include direct extermination of monitors, mainly due to prejudices connected with far-fetched ideas that the lizards are dangerous or harmful.

A relatively new factor is the death of monitor lizards on roads. It happens both accidentally (drivers unable to brake in time) and intentionally, as many drivers squash lizards on purpose. Because roads are becoming more common, and traffic becoming heavier the effect of this factor becomes greater. It should be noted that we are speaking not just about an incraese in accidental clashes with transport. The asphelt surfaces of roads affect reptiles because they warm quickly. On spring days reptiles gather on the roads to warm themselves. Above the warm road surface many insect mass in the rising air flows. Small lizards also hunt for insects on the roads, and these gathering attract predators of the second level, including monitor lizards.

Present Condition of Conservation.
After the establishment of the Red Data Book of the U.S.S.R. in 1974 the catching of monitors is permissable only with the permission of the Chief Committee of Nature of the Ministry of Agriculture of the U.S.S.R. This measure controls one of the factors that led to the reduction of monitor numbers. Adoption of the law "Conservation and Use of Animals in the U.S.S.R." (which came into effect on 1 January 1981) strengthened the conservation of this rare species.

From: Zwei neue Warane des Australischen Faunengebeties.

Varanus indicus spinulosus, new subspecies.

Robert Mertens. Senckenbergiana 1941. 23 (4/6): 266-272.

Translated by M.J. Bennett.

Type specimen; Adult male, Natural History Museum, Vienna, no 3709. Albatross voyage 1. 15 February 1897. from George Island, Solomons.

A melanistic monitor. distinguished by fine spiny scales on the neck and back compared to V.indicus. It also differs in scalation and colouring and has a shorter, broader and higher head and a tail which is less powerful and compressed.

Description of the type;
Teeth pointed, compact, head (fig 3) short and high, ending in a point, with a marked bulge in the temporal area. The head is quite high, somewhat distended above the nostrils, and very slightly dished in the middle. longer than the distance from the front rim of the eye to the ear.

Canthus rostralis distinct. Nostril oval, slanting, nearer to snout than eye, (1:1.5). Base of tail thick, laterally compressed with a double ridge along the top. Scales on head are large, biggest in the frontal area, gradually becoming smaller in front, and particularly behind. In the supraocular area 6 or 7 transverse scales. temporal scales very fine (small), scales on the neck very small, increasing in breadth to skittle shaped spines, with fine, pointed little seed shaped scales filling the spaces between. On the back of the neck the scales become higher and more pointed. On the back itself the scales are seed-like, elongated in cross section, even the granules surrounding them are pointed. The scales on the upper sides of the legs are strongly keeled. Belly scales smooth, four sided, longer than broad, in 100 transverse rows from the fold of the throat to the beginning of the hind legs. About 210 scales round the body. Scales on the underside of the root of the tail are smooth, keeled on the top and the rest of the tail. Only on the root of the tail are the scales arranged in rings, otherwise not. Scales on the underside are considerably bigger than those on top.
The basic colour above is black, on the back between the fore and hind legs are large round dirty coloured yellow spots (fig 2) at the front a bigger single spot, and behind are two transverse rows of smaller spots. Between the hind legs and root of the tail a broader similar row of still smaller spots, between these are considerably smaller and less numerous yellow spots which also overlap the rows and are sometimes arranged as occelli. The top and sides of the head are uniformly black, the legs dark brown with scattered yellow spots on the upper sides of hind legs, the underside smokey grey with small pale yellow spots.

Head and body 312mm, tail 550mm.

Its relatives.
At first sight this peculiar monitor looks like a new species; the spiny scales on the neck and back are not found on any other monitor. But on close consideration it tends towards V.indicus in appearance, and I found the creature listed under that name in a collection at Vienna, very likely by Steindachner. If fact V.indicus kalabeck from Weigei show the same tendancy to have very small scales on the back of the neck and pointed ones on the back, but not as extreme as the thorn shaped scales of spinulosus. Kalabeck also has a longer and narrower head than the new monitor, and quite different colours. In comparison to V.i. indicus - this means all the other indicus forms - which hardly show any distinction - spinulosus stands out, distinguished by its thorny scales, through the much smaller size of its scales, it shows also in the much finer scales of the temporal area and the higher number of scales around the body of spinulosus (210, compared with 168 for indicus, according to HOCHSTFALL). Furthermore, the shorter, broader and higher head with a clearly defined canthus rostralis especially stands out in comparison with indicus. To illustrate, the measurements of spinulosus and two indicus (Senck Mus 11586 from Langgur, Kei-Islands and 11581 from Ternate) are set out below.

| | Spinulosus | 11586 | 11581 |
|---|---|---|---|
| Length of Head | 54.4 | 55.8 | 57.5 |

| | | | |
|---|---|---|---|
| Width of head. | 34.7 | 29.8 | 31.2 |
| Height of Head. | 26.8 | 23.5 | 24.5 |

It can be seen that alongside (or in the case of indicus in spite of) the rather significant length of the head the breadth and height are less indicative. It further turns out that spinulosus has a more stongly compressed tail than indicus or kalabeck. Finally, the colour as mentioned above is black, a variation found in other monitors suich as V.prasinus and V.salvator togianus, but is not yet established for indicus.

The most conspicuous differences of the new monitor; the small slim head, thicker tail, small and numerous scales and the dark colour, portray characteristics also found in other lizards on small islands. St George in the Solomons is obviously that by Ysabel in the Solomon Archipelago. The conclusion to be arrived at is that V.indicus there is represented by the form decribed here.

Uber die Rassen des Wustenwarens, Varanus griseus.

The races of Varanus griseus.

Robert Mertens. Senck. Biol. 36 5/6:353-357, 1954.

Translated by Naomi Cowgill and Daniel Bennett.

Although Varanus griseus is widely dispersed through north Africa, and South west Asia, no geographical races have been described, due to insufficent material (see MEERTENS 1942:338-347. Nevertheless, possible differences in colouring, tail form and relative tail length had been noted. Several specimens from different localities were recently examined, making it possible to differentiate three varieties; a north African-Arabian, a trans-Caspian, Iranian and a west Pakistan-Indian.

Of the characteristics mentioned above, the length of the tail is of the greatest importance, because this depends not only on age, but also apparently on sex. It is noticable that the west Pakistan-Indian variety have a shorter tail than those from north Africa; four of the former have tails 1.18 - 1.27 the length of head and body, whilst those from Africa are 1.31 - 1.46. Possibly those from trans-Caspia and Iran have even longer tails, 3 have values of 1.23, 1.58 and 1.67.

Particularly noteworthy is the tail formation. V.griseus generally has a tail that is rounded in cross section. In fact this is mostly the case with north African specimens. Eichwald (1841:49) pointed out that caspius has a laterally compressed tail. I found this characteristic mentioned

even earlier with an animal from Jasgly-Olun (southeastern coastal area of the Caspian Sea and now find it anew in the case of 2 specimens from Ispakeh and Iranshar (Iran) from W Richter's expedition and presented to me by the state Museum for Natural history in Stuttgart. It is noteworthy that VOHGEL (1954:35) draws attention to the longitudinally compressed tail, as being characteristic of the Russian-Asian form. He maintains that they have the tail squashed together sidewards, from approx the first sixth to to the last third, with the end of the tail rounded. Even if the shape of the tails of monitors depends on nourishment, and therefore also on the season, I have always found the tails of animals possess tails which are rounded in cross section, even in the distal half, compared to those from trans-Caspia and Iran. Whereas those from north Africa have tail scales which show no peculiarities, those from Russia and Iran have two at least minimally-enlarged rows of scales in the distal part. Animals from Pakistan do not show this characteristic, their tail formation is somwhere between the other two, with a compressed tail not as extreme as those from Iran/Caspia. In the case of the north India variety, CARLLEYLE (1869: 194) even goes as far as to indicate a completely rounded tail.

Most striking, however, are the differences in colour on the tail and back, as I have already emphasised in my work. The north African variety are distinguished by the greater number of crossbands, the Pakistan Indian by the least. The species distributed from north Africa to Mesopotamia and Arabia have 5-8, usually 6 fairly narrow grey crossbands (not including the prominent neck band, in front of which there is a smaller, weaker band). These bands loose their clarity with the age of the animal and bright spots appear. The tail of younger animals is distinctly cross banded with numerous markings (19-28) and mostly stretch to the tip of the tail. The Caspian/Iranian variety has about the same number of dorsal bands: 5-8, mainly 6. They are narrow, but a strikingly dark sepia colour, as as a consequence contrast sharply with the bright green colouring. Only the proximal two thirds of the tail are banded, and the tail end, according to my conclusions, is often bright yellow. Animals from west Pakistan and India are distinguished by less numerous but broader bands, my 4 animals from Pakistan (Hab River, Korangee and Phar, all around Karachi) have only 4 dorsal bands of a grey colour, whereas in one animal the 4th band is irregular, so that on the left a 5th band appears. In some areas animals with only 3 bands appear. The number of tail bands is also minimal. in general there are 7-12 (in my Karachi aninmals only 7-11) but can be more. The tail tip is unmarked.

As a result, 3 forms of Varanus griseus deserve scientific names. they are as follows;

VARANUS (PSAMMOSAURUS) GRISEUS GRISEUS (DAUDIN).
Table 33, Fig 1.

1803 Tupinambis griseus Daudin Hist.. nat. Rept. 8:352. (Terra typica: Egypt). Synonyms; Varanus scinus MERREM 1820. Tupinambis arenarius J. Geoffroy 1827; Varanus terrestris SCHINZ 1834; Varanus arenarius GERVAIS 1848; Psamosaurus arabicus HEMPRICH & EHRENBURG 1899.

Tail round in cross section. also in distal half. Back with 5-8, usually 6 narrow grey crossbands which fade in older animals and is replaced with bright spoted markings, and 1 or 2 neck bands. Tail with 19-28 dark crossbands which reach almost to the tail tip.

DISTRIBUTION.
North Africa, west Asia from Syria and Israel as far as and including Arabia.

VARANUS (PSAMMOSAURUS) GRISEUS CASPIUS EICHWALD.

1831 Psammosaurus caspius Eichwald Zool. spec. 3:190 (Teraa typica Dardsha Peninsula, east coast of Caspian Sea. Synonym Varanus caspicus Grey 1845.

Diagnosis.
Distal half of the tail narrow in cross section, tightly compressed forming a distinct keel at the top; the back, except for the diagonal neck bands, is covered with 5-8 (mostly 6) narrow sepia coloured bands, tail with 13-19 dark diagonal bands, tail tip is unmarked.

Distribution.
From the east coast of the Caspian sea across the southern regions of Khazakstan to the central Asian republics as far as Iran, or possibly west Baluchistan and Afghanistan.

VARANUS (PSAMMOSAURUS) GRISEUS KONIECZNYI. N.Subsp. Table 33, fig 2.

Diagnosis.
Distal half of tail weakly compressed, forming a distinctive keel at the top. On its back (not including neck bands) 3-5 (mostly 4) broad grey bands, tail with 8-15 dark crosbands, tail tip unmarked.

Description of Type.
Body form very similar to nominate race, head is distinctly broad and flat however, its width is contained only 1.57 times and its height 2.25 times in the length. Temporal region is scarcely distended; nostrils - a large slanting fisure. lying directly in front of the eyes, ear holes fairly small, forming a vertically upright opening. The middle of the tail is only weakly compressed, showing a weak stubby keel at the top. Scales as in griseus, 58 across the back of the head from one corner of the mouth to the other, interparientals not noticable, 136 scales around the body, 118 scales from the gular fold to the insertion of the hind legs. Preanal pores not noticable, only at the end of the tail are the bands irregular, otherwise they form a regular pattern. Basic colour is sand yellow. Parietal region with a large grey spot, likewise also the lip region with some grey transverse bars, temporal region with two stripes (supraanciliar and supraocular stripes), which blend into a broad lateral neckband behind the ear opening, which in the rear nuchal area meets its partner from the other side. On the back between the fore and hind legs are 4 transverse bands which fork and divide on the flanks, every diagonal band is bordered both front and back by a transverse row of bright, round, darkly lined scales,

upperside of the proximal two thirds of the tail is marked with 7 bands, which however are narrower than the brighter ones between them. The distal third is completely yellow white, the stomach is yellow without markings, only the underside of the head is marked laterally with some long grey stripes.

Measurements.
Head and body 315mm, tail 400mm, ratio of head and body vs tail 1.27. Body length 59.1mm, width of head 37.7mm, height of head 26.2mm, front leg 72mm, raer leg 93mm.

Variations.
This variety seems to be constant at least in the Karachi region. Remarks on the remaining varieties will appear in my work on the amphibians and reptiles of west Pakistan, which is in preparation.

Taxonomy and Nomenclature.
It is possible that the animal described here as new is identical with Varanus ornatus CARLLEYLE 1869;192). The terra typica of V.ornatus is Sikandra, near Agra, India. This spot is however situated so far away from Karachi (about 1200km), that a further race of V.griseus can be expected from there. Instead of the absent dorsal transverse bands there is a narrower, blacker middle stripe, and a brightly orange coloured base tone on the back. CARLLEYLE mentions V.ornatus twice (as Tupinambis ornatus, Daudin 1803 and Uuranus ornatus GRAY 1845), nevertheless, I have decided to introduce no new name for these animals, but rather to set up a new race which I name after my host in Pakistan; Mr M. G. Koniecznyi. Further material may determine whether or not ornatus CARLLEYLE is a synonym of koniecznyi or whether it deserves a new name.

Distribution.
Apart from west Pakistan it is possible that V.g.koniecznyi may also appear in northwestern India. Whether or not the desert monitor in Afghanistan belongs to this race or to caspius remains to be seen.

Relationships.
The koniecznyi race may well be bound into the border areas with both the nominate race and caspius. Judging by the tail form, it is a less advanced animal than the nominate race,. The most ancient of the griseus group is caspius without doubt, not only due to its tail which is laterally compressed, but also due to its marked transverse bands (symbolic of youth) which are more primitive than the less distinctive and lighter transevere bands found in the nominate race and koniecznyi which both have a much more exaggerated adaptive colouring than caspius. It appears, therefore, that the actual home of the desert monitor is western Asia, from where it has extended its range to the south (India) and the west (north Africa).

A Rare Guest at the Zoo: Salvadori's Monitor.

Robert Mertens. Kosmos. 1960 56:547-549.

Translated by Naomi Cowgill and Daniel Bennett.

I was not in the least suprised when a 'phone call came from Andreas Werner, of an animal import business in Munich, saying that they were in possession of a Varanus salvadorii, an animal that had not been kept in captivity before, and which in recent times had formed an opulent rank of imaginative reports, almost like those of the famous Loch Ness Monster or Siegfried's Dragon. In spite of the high cost I decided to travel to Munich, where I bought the magnificent animal and took it to Stuttgart. Particularly pleasing was that this zoological treasure had come to Germany, despite an extremely high offer made by the zoo in Sydney. It has therefore to be said in the honour of Rev. Cribb, that he did not let himself be tempted to break his promise of sending the first V.salvadorii to Mr. Schulze-Westrum by this offer. As the monitor developed a good appetite (consuming about 600 grammes of meat and some eggs every three days) and filled out within a short time, it is hoped that he will stay in good condition for a long time in order to make observations for scientific purposes.

In early July sensational sounding news about a giant lizard from New Guinea was announced in the press and on the radio, it was also shown on the television. The Stuttgart Zoo had aquired this animal from Andrea Werner in Munich and had exhibited it live. As the director of the Stuttgart Zoo, Mr. Albert Schochle was cordially invited to the press reception, which took place as a result of this great occasion, and later he received many enquiries in connection, for which reason a short report from the view-point of zoologists in given.

For the specialist the Stuttgart lizard represents something of great value. In fact it is a representative of the well known family of lizards Varanidae, predatory animals which inhabit the warm zones of the Old World; from Australia, via south Asia to Africa, in 30 varieties of very different kinds; but this lizard is not very noticable for greatness of size, instead it ranks among those variety whose way of life is still completely unknown. Until the present no explorer has ever observed a living V.salvadorii, and the Stuttgart specimen is the first be be kept in captivity. Moreover it is known in only a few museum collections. In Germany only the Berlin Museum possess a specimen; a young animal preserved in alcohol, discovered by the author under a false name. In addition some jaw remains were kept in the Senckenberg Museum in Frankfurt. The type specimen is in the Museum Civico di Storia Naturale in Genoa. It was killed by Dr. Odoardo Beccaris at Dorei in northwestern New Guinea in 1875. Three years later it was described by Wilhelm Peters (then owner of the zoological museum in Berlin) and Marchese Giacomo Doria, the great promoter, and then owner, of the natural history museum in Genoa. The lizard was named after Conte Tommasso Salvadori, the most significant ornithologist in Italy.

In its size V.salvadorii is behind the most colossal representative of the family, and thereby the whole of the animal kingdom. This giant is the well known Komodo Dragon (V.komodoensis).

It's established maximum length amounts to not more than three metres (contrary to the ever emerging, and apparently not yet dead announcements in the popular press). The male brought by the author from Rintja in 1927, for the Senckenberg Museum, and which is still exhibited there, is still the biggest specimen known. It is approached in length, though not in weight by the water monitor V.salvator. In comparison Salvadori's monitor corresponds in maximum length to the Australian V.giganteus or the African V.nilocticus, both of which are approx. 2.4-2.5 metres long. The biggest V.salvadorii measured to date was on the basis of a skin measured by the author in the American Museum of Natural History in New York, 1950. It was 2.5 metres long. The live specimen in Stuttgart is probably not yet fully grown, and looks much smaller.

Externally two features are noticable; firstly its comparatively large head, with a severely bent snout in profile, and secondly it's very long tail. The head resembles that of the Komodo Dragon; the specimen examined by the author in 1950 is certainly slimmer and more delicate than that of V.komodoensis. Very noticeable are the long pointed teeth, which stand almost vertically on the jaw bones, in comparison with the bent teeth of the Komodo Dragon. The tail of V.salvadorii is thin and whiplike, and its relative length in unsurpassed by any other monitor; 2.5-2.6 times the snout to vent length. Thus altogether Salvadori's monitor appears delicate and by far not as huge as the other giant monitors, in which the tail is not even as long as the snout vent length. The tail of this monitor is remarkable in other ways.: without being pronounced in cross section, as is the case with many smaller monitors, it is nevertheless very low, and only slightly compressed to one side. In this Salvadori's monitor is the opposite of many other monitors with tails that are strongly compressed and serve as a rudder when swimming. This points to the fact than V.salvadorii does not lead a pronouncedly amphibious lifestyle. As the tail of the captive specimen is kept constantly rolled up in a spiral-like fashion, there are grounds for the assumption that it is basically a tree dweller that uses its tail to anchor itself to branches. The powerful, strong bent claws also point to an arboreal rather than terrestrial way of life. The colouring and markings show no special features, like many other monitors it is black with oval yellow-white spots arranged in cross bands on the back. On the sides of the neck there are many folds of skin, which may be linked with a distension of the throat as a defence reaction, or perhaps merely to enable the animal to swallow large peices of food. Before the eyes of many spectators the captive in Stuttgart swallows magnificently big pieces of horsemeat, after having first tested them with the long white tongue. In the wild little mammals, birds and their eggs, frogs and other amphibians and reptiles may form the basis of the diet.

Further details about the lifestyle of the animal were not imparted to us from either the Rev. John Cribb, who obtained it from natives, nor from Thomas Schulze - Westrum, who troubled himmselves greatly over the it's enclosure. The animal stems from the hot damp marsh woods of the gold district in the southeast of the giant island of New Guinea, which form its exclusive home, and on which this species appears to be widespread (MERTENS 1942 p.286: 1950a s.2). Alongside this monitor live five others, including the magnificent, tree dwelling V.prasinus, with its long prehensile tail.

Nothing very definite can be said about the near relatives of this monitor. A careful study of the living animal will illuminate not only the special qualities of its lifestyle, but also its relations.

Monitors Encountered in Sri Lanka.

Werner Munsch. Das Aquarium. 1987. 214: 206-210.

Translated by M. J. Bennett.

I enumerate the monitor lizards I came across during a few weeks holiday in Sri Lanka, and compare the tally with the pathetic number of sand lizards which I have clocked up on many excursions at home, so that the monitor can truly be classified as not rare. During my travels in Sri Lanka I was able to observe numerous monitors, from babies to 2 metre specimens. There was, moreover, no locality in which I did not see them, except for the highlands and the middle of towns. Even on the much frequented fortress wall of Galle there was a little Bengal monitor sunning himself outside his house, which was under a flat stone. My observations extended to Varanus salvator and V.bengalensis. According to my notes I came across three V.salvator and about two V.bengalensis. The locals, although in may ways close to nature, are insufficiently informed about these great and celebrated creatures. The term "iguana" is often used to describe the monitors. Presumably this misnomer has been imported by tourists. On my first visit to Ceylon I asked the residents about monitors. Eagerly I was lead to a variety of locations, mostly rubbish dumps, but to no avail. A couple of days later I was able to look round the locality without the handicap of the locals. I came across three 80cm Bengal monitors in a small stand of palms only metres away from the coastal railway line. The ground here was relatively sparsely covered with undergrowth, but there were holes from uprooted palms and quite a lot of piles of fallen palm fronds to provide hiding places. The lizards were good at escaping by climbing palm trunks. Half grown lizards of both species are very skilful climbers. They often find convenient and undisturbed sunny spots on tree trunks or big branches. I did not see the big lizards climbing. When in danger they know the extent of their strength and prefer to beat an ordered retreat. In no cases can I recall a panic-rout.

In three days staying at Habarana, in a hotel-park bordering a lake I was able to observe at least a dozen monitors. The place was something between a botanical garden of colonial times, with fine examples of trees brought in from all continents and a golf course which was treeless. Along the side of the lake could be seen the transition from cultivated garden to natural wilderness. Uprooted trees lining the edge of the lake and the shallows reinforced the impression of a wilderness. On the lake were great expanses of water lilies.

While the tourists generally gathered around the pool, I was able to go about the rest of the compound undisturbed and found Bengal monitors of different sizes living in a small area. They are early risers, the first ones can be seen well before 6 o'clock in the morning. At that time I

went to the lake to see the fisher-snakes (Natrix piscador) hunting for fish. At the same time the nocturnal geckos, looking like bits of pine bark were enjoying the first gentle rays of sunshine. The territories of the monitors are sufficiently marked off from each other so that two big lizards do not confront each other at close quarters. Their breakfast quite surprised me, a large quantity of house snails that were still active in the morning dew. The monitors often consumed them in one bite, with the head held up. They gobbled up dried fruit like rose hips off the ground in large quantities.

I had a lot of fun with a young monitor who was about half a metre long. I was out stalking with my camera and managed to get within a couple of metres of him. When he saw me he adopted a threatening attitude. Still hoping to get a picture I knelt down. What followed I would like to describe in human terms. As soon as it was spotted the animal somehow managed to turn itself into a smaller animal. When I scarcely moved he came to within a metre and a half away, intent on looking for food, not forgetting, however, to give me an occasional arrogant and suspicious quick sideways glance. It was only for seconds that I had him surprised. In order to avoid the distracting movement of the wind-on lever I had a motordrive on my camera. After I had taken my first picture the sound of the shutter release and the wind-on mechanism took the creature so much by surprise that he flew at least 20cm up into the air, like Donald Duck, and then charged off a couple of metres. Any fear that he would be scared off was misplaced. After a little rest the monitor again set about looking for food and again came within the same short distance as before. I took more pictures and he merely twitched briefly, each time adopting a momentary threatening attitude towards me. Our friendship was not to last however, because I had to leave the next day. I am quite sure that with further contact it would have been possible to feed him by hand on a strip of fresh meat.

One reason for there being so many monitors in these parts must be the plenitude of tree hollows. There is hardly a tree of any height that does not provide one or more hollow spaces. Whenever a monitor is disturbed that is his first retreat. If the disturber follows the monitor makes off in the direction of its lair. If the danger is not averted it seeks refuge in its hole for a while. When the morning temperature rises, at around 1000 hrs. the monitors likewise take to their shelters.

There was a mongrel dog the size of a terrier that belonged to the hotel. One morning he decided to be my companion. I had seen him before about the place and he ran past the monitors, which were familiar with him, without taking any notice. He obviously wanted to impress me though: he attacked a Bengal monitor about 1 metre long. The dog had learned from previous encounters and cleverly evaded the monitor's lashing tail. The lizard pressed him so hard that after a few minutes he quit the arena. The monitor clearly won on points.

While staying at the mouth of the Bentota River I encountered many water monitors, not one of them less than 1.5 metres long. Smaller one are obviously easy to overlook. The bank was overgrown with (twisted) palms, but I found a rough path to the river. I used to look in here each day because it was a good place to catch a few fish before going home. At first I was very cautious because I had seen snakes hunting in the plant thickets. After several more visits I

noticed that the fish occurred only in these shallow places. It was only a matter of a few minutes before there was movement amongst the water plants a couple of metres away from me and a fully grown monitor swam out a little way before climbing lazily onto the bank. It would have done me considerable harm to sustain an alarmed swipe from the tail of such a beast while standing up to my knees in water. Events like that keep us on our toes.

On a shopping expedition along the coast road I spotted a water monitor a couple of metres along the ditch. It was about half a metre long. It was rummaging in heap of rubbish. When I took a picture of it, it squeezed itself through a gap in the fence onto an adjoining piece of land. The owner of that land saw my interest in the lizard and opened the gate so that I could take more photographs. The monitor showed no fear of the man, although it ran away from me. I have come across several such situations, where these great lizards were fed by Ceylonese, or looked for titbits amongst the rubbish.

The native Buddhists do not kill or harm any animal, in accordance with their teachings. When you go abroad and see how animals are treated it is particularly cheering. But there is another side to it. Here are two example.

(The next two paragraphs described the ill-treatment of snakes and dogs)

On a visit in 1985 my companion and I had a surprising encounter with a giant monitor on a temple island in lake Koggala. All of a sudden it heaved itself over a slope only a few metres away from us. It stayed a short while on our path, darting its tongue in and out and then proceeded majestically to the water. It disappeared quite slowly and swam away. The creature had come from the monks' rubbish dump.

The water monitors are very attached to water, each day they spend several hours in it. Their fondness for the wet element was demonstrated to me on a 60km boat ride on the Bentota-Ganga. Time and again I saw big monitors in the bays of mangroves in the brackish water. They showed hardly any alarm at the sight of the boat. Later, further downstream, i found more in the quieter tributaries. A group of seven adult lizards made a most imposing sight, wallowing in a heaped up mass of damp bark-litter on the bank. The bark-waste came from a nearby factory. Having up to now known the adult monitors as loners, I could see how these small areas of flat ground, at most 40 square metres, served as communal sites.

I would like to add that all these mini-dragons, from grass-hopper-hunting youngsters to portly adults, seem to enjoy an adequate or generous diet. The water monitors were always the fattest. For lizards in a terrarium the diet available must be adapted to the reduction in mobility, to obviate obesity.

Captions of the Photographs.
I saw the first monitor in the hotel grounds early in the morning. A dog the size of a terrier came off worst against this monitor.

Quieter tributaries of the River Bentota are a favourite place for the bigger water monitors.

In flight, or to take a sun-bath, the smaller water and Bengal monitors run straight up trees.

The riverbank is often a totally impenetrable mass of palms.

While the young lizard in flight threatens me, it still goes on looking for food.

I had a lot of fun with this young monitor.

The water monitor retreated from me.

The Monitor Lizards of Thailand.

Wirot Nutphand. Mitphadung Publishing Office, Bangkok, 33p. No date.

Translated by Jaruin Nabhitabhata.

This booklet is published because I have been asked by so many pet lovers, wild animal dealers, including interested students concerning the Varanid lizards. Some of them wanted to see the actual animals in my pet colection, because they did not really know the difference between Hiah and Ta-kuat. Many wanted to seriously study this lizard group; whilst some visited me with great curiosity about how I keep these animals supposed to bring bad luck to their owners; furthermore, many wanted to raise monitors in farms for their hide. All of my visitors always ask me if there is a book available in the Thai language on the varanid lizards which deals especially with the Thai species. I can confidently say that so far no books concerning the varanid lizards in Thailand has ever been published. So I managed to publish this non-technical booklet with the intention of serving the general laymans interest with a broad knowledge of the Varanid lizards indigeneous to this country.

Authors signature.

Part 4.

Characteristics and specific habits of Varanid lizards.

1. Head is elongate in shape and snout is rather pointed.

2. Lower mandible is rather free, not firmly fixed.

3. Neck and body are long, cylindrical and the neck region is capable of great inflation.

4. Tail is long, always longer than the body.

5. Skin is rough and scaly; those on he nape are enlarged.

6. All four feet are strong and equipped with long, sharp claws

7. Genital opening is at the anus.

8. The tail is flat, covered with scales as is the body.

9. Tongue is long, forked apically, and is intermittently protruded when scenting.

10. Tail is firmly attatched, not shed deviduously like that of the house geckoe.

11. Teeth are small, sharp, with no distinct canines.

12. Non-venomous.

13. In self defence prefers the act of tail lashing.

14. Not very ferocious, but will bite readily if caught or cornered.

15. Some species can swim and dive well.

16. Good at tree climbing; some even prefer to rest on high branches.

17. Being reptiles, they will forage for food every 3-4 days. It eats a large meal and after being satiated it will become sudued and retreats to hiding places.

18. Diurnal in habit.

19. In consuming prey they will always tear the flesh into large peices before being swallowed; but if the prey is small it will be swallowed whole.

20. It is catholic in feeding habit, the prey items comprise terrestrial, aquatic and feathered animals such as duck, chicken, birds, fish, crabs, frogs, rodents etc.

21. It can feed on both fresh meat and carrion, but prefers the former.

22. Normallly prefers a slow walking gait, which will shift to a run when chasing prey or threatened.

23. Unable to jump on level plain, except when jumping from high perches.

24. High tough with strong endurance.

25. all species are oviparous, laying elliptically-rounded eggs with a tough flexible shell.

26. Laying eggs in burrows or tree hollows.

27. No parental care, after hatching the young wil forage for themselves.

28. Normally lays eggs once a year, but many species lay 2-3 clutches per year.

29. Egg laying season is from January to March.

30. Hatchlings feed on small frogs and insects.

31. Adults are not so different from hatchlings, except for in colour, which is always different.

32. Do not like strong sunshine, but frequently sun themselves.

33. The optimum temperature for varanids lies between 70-80[F.

Part 5.

Water Monitor: Varanus salvator (Hiah)
The water monitor is the second largest member of the family, the largest being the Komodo monitor, and is the largest of the 5 (4!) native species. Generally the total length of the adult is from 200-250cm, and the body is fat. This species prefers water more than other species, so its habitats are always near water; it can swim and dive well and is also good at tree climbing.

The water monitor is widely hated by the general public, because it is believed that they can bring bad luck or is even considered as a jinx, which is absolutely untrue. Actually the water monitor is a type of reptile, so the bad luck gained must come from other sources, or by one's deed. The reason of its supposedly being a jinx may arise from its habit of stealing domestic animals since the ancient times, which is a natural habit of general animals. For instance, the house geckos which naturally forage for insects in the forest later tend to congregate around lights in houses to catch the attracted insects. The water monitor also utilises the same feeding adapatation. They coexist with humans in the riverside habitat, and possesing the same predatory habit often raid or steal human belongings for food. Since this bad impression became firmly fixed as a general attitude a monitor has been so serious a jinx that whenever ones swims close to a boat, one has to wash the head of the boat in order to obliterate bad luck. The vernacular name Hiah is widely used as a word of abuse. Some foolish persons dare not pronounce the word "Hiah", but instead call it "Tua-nguen-tua-tong" (a creature of silver and gold).

For decades I have raised monitors in my home and none of the bad luck I have had is attributable to possesion of monitors; in fact they have provided me with benefits in several instances.

A water monitor has a black body with rows of transverse bands of white or pale yellow circular spots; the tail is crossed by alternate rings of balck and white or black and pale yellow. Some individuals are completely black, so-called Hiah-dam (black water monitor). I have seen numerous water monitors, but never one possessing a red tail as is widely believed (a monitor with a red tail is believed by Thai people to be the worst creature - translators note).

Normally the water monitor is rather ferocious, when approached by an enemy it will lash out with the long tail. When seriously threatened it will bite. the captive monitor becomes docile and adaptable to human approach, but cannot be carried in one's arm or left outside the cage. It can only be fed and gently touched inside the cage.

This monitor is distributed throughout Thailand and is common in moist situations. Outside Thailand it can be found in Sri Lanka, Indonesia, China and parts of the Philippines.

Yellow Tree Monitor, Varanus bengalensis. "Ta-kuat".
Ta-kuat or Lan is the commonest Thai monitor, and inhabits all parts of the country . The name Ta-kuat is a general vernacular term, but Lan is the name given in northern and eastern regions. A mature specimen is smaller than a water monitor and is third in body size, after V.salvator and V.rudicollis. The total length from snout tip to tail tip is about 100cm. It is adept at tree climbing and prefers to sun itself on a high branch. This monitor is not a water loving species as is V.salvator.

Because of its inability to swim and dive well, it is rarely blamed as a fish pond raider, and so is not treated as a jinx. Instead its delicious flesh is greatly esteemed by locals.

The ground colour is yellow grey or greyish brown; scales are yellow all over, so it looks as if it is yellow throughout its body. Immature specimens have a dark brown pattern that gradually diminishes and has completely disappeared when it is about 1 foot long. The yellow monitor is not as ferocious as the water monitor, and in captivity it becomes docile and accustomed to its owner more readily. It has a high breeding potential, and eggs have a high hatching rate, so it is believed that it can lay several clutches of eggs in a year. In addition, young monitors about a foot long are caught for sale in large numbers in all months of the year.

Apart from Thailand this monitor is abundant in neighbouring countries such as Burma, Cambodia, Vietnam and Peninsular Malaysia.

Black Jungle Monitor, Varanus rudicollis. (Hao-chang).
This monitor is second to V.salvator in size, but larger than V.bengalensis or V. dumerilii. A mature individual is about 130cm in length. It is seldom found in the southern part, usually far

away from human habitatin. All captured monitors are caught deep in the forest by forest dwellers searching for forest products. Large individuals are usually caught, youngsters are seldom captured because they are adept at concealing themselves. I once tried to test the concealing abilities of three monitor species; V.rudicollis, V.salvator and V.bengalensis, in a wide cage provided with grasses and stones. On being alarmed the young of V.rudicollis are the quickest to dash for cover.

This monitor forages on the forest floor, but it is also good at tree climbing and prefers to rest in the inside wall of a tree hollow. Some were even observed sleeping lengthways on high branches.

In body colour it is the blackest monitor in Thailand, with a faint transverse pattern; except that young individuals have a distinct pale pattern. In habit this monitor is more ferocious than V.salvator; on being approached it will inflate its neck region and hiss loudly. But if being handled it will feign death and flee whenever opportunity offers. The diagnostic characters of this monitor are the pointed snout and sharply pointed nuchal scales.

Apart from Thailand this monitor also occurs in southern Burma, Sumatra, Borneo, Malaysia and parts of the Philippines (unlikely to occur in Philippines - D.B.).

The black jungle monitor is a well known creature among the southern forest dwellers and is treated extremely superstitiously as is V.salvator. It is even believed to possess a powerful venom, but in fact it is entirely non venemous. Southerners call it Ngu-Hao-chang) (= cobra elephant); I would like to omit the first word because it is not a snake (Ngu in Thai). Some also call it Haih-hao-chang (= water monitor cobra elephant) of which the first word should be neglected because it is a distinct species from the water monitor called Hiah by Thai people. Its vernacular name stems from its hissing cobra-like sound and from the belief that its venom is potent enough to kill an elephant just by biting or spitting.

Red Headed Monitor, Varanus dumerilii. (Tut-too).
This monitor is the smallest of our 5 (4!) native species, but only slightly inferior in size to V.bengalensis. It has a habit of being less active than other species, and is more sedentary; preferring to sleep in tree hollows or rock crevices. Driven by hunger it will come out to forage in the surrounding area and when being satiated retreats to the same hiding place. Generally it is not as ferocious as V. salvator and V. rudicollis.

Thail people always misunderstand the name Tut-too as a kind of rodent or a kind of geckoe. Most animal trappers from the south call this animal Hao-chang-kao (a white jungle monitor), as opposed to Hao-chang-dam.

Its ground colour is brown with white transverse bands, and under the chin is white or pinkish. The youngsters are colourful, having bright red heads and contrasting black and white

bodies. The red on the head will fade with age and completely disappear when reaching maturity, with the black of the body becoming brown.

Although frequently encountered in the southern forest, this monitor is also occasionally but rarely caught in the west around Kanchanaburi province. Apart from Thailand, it is reported from Malaysia Sumatra and Borneo.

Photo 9 caption: Large numbers of V.salvator are prepared as trophies every year.

Beobachtungen an Varanus varius in natur.

Observations on Varanus varius (Shaw) in the wild.

Uwe Peters. 1967. Aquar. Terrar. 20:120-121.

Translated by M. J. Bennett.

Only about 10km from Sydney, the capital of New South Wales lies a little park, completely overgrown. This is Fuller Park, measuring about 2 X 2km., in the angle between two very busy motorways. The picture shown here gives the general impression of the nature of the rocky and bushy terrain. Through this area flows a a small brackish branch of the Lane Cove Rivers, in which I observed some Chelodina longicollis and Emydura macquarri. How amazing to find here, amongst the traffic of the big city, the largest lizard yet in New South Wales, Varanus varius (Shaw). During the previous nine mouths I had the opportunity to do herpetological research in this area and observe these remarkable huge lizards in the wild. In this my son was a helpful companion, and much better at climbing trees. In that period we counted 11 large lace monitors but for all our efforts we were not able to spot any young ones or newly hatched specimens. Presumably the young coloured monitors stay in the trees until they reach breeding age, while the old monitors are to be found everywhere. and only take to the trees to sun themselves, to plunder eggs and to lay their own eggs in the nests of the tree termites. We caught six of the lizards we observed, to measure them and examine their droppings. Then we let them go. The smallest specimen was 98.5cm, the largest 153cm. In spite of their conspicuous colouring which gives them their name in German (colour-monitors), the monitors are only (sic) hard to spot when sunning themselves 3-8 meters up a tree, stretched along a branch. Catching them is not altogether without its perils, for when seized a monitor defends itself fiercely. The instant a noose is put over its head one hell of a fight begins. Any animal collector who keeps monitor lizards knows very well what strength and ferocity even a 60cm lizard is capable of. Above all you must beware of three danger points; teeth, claws and tail. The foot of a 150cm lizard is as big as a child's hand, and its claws are like sharp knives. You can't expect to have much fun when you are confronted by such a big specimen high up in the air on a fairly rotten branch and the brute rears up on its forelegs, puffs up its throat and lashes with its tail. After each capture of a monitor lizard my son and I were torn to shreds

with bites and scratches all over our hands and arms, and twisted ankles from jumping out of trees and falling off branches

In the wild Varanus varius lives in a variety of lairs. Mostly they lie in high trees or on branches, but also in deep wide crevices, in abandoned rabbit holes or holes under big trees which they dig for themselves. Their natural diet is predominantly of rodents and reptiles. We saw a specimen estimated at 170cm long disappearing into the undergrowth with a rabbit in its jaws. In the animals' droppings we found remains of rats skulls, bits of skin and small fragments of the ever-present water skink (Sphenomorphus quoyii), wing (cases?) of cicada and locusts. The droppings of the 153cm lizard mentioned above, deposited one day after its capture, consisted mainly of skin fragments and the undigested tail of a broad-tailed gecko (Phyllurus platurus). One would like to think that a big gecko would pick on a correspondingly much larger prey animal than this little gecko, only 10-15cm long. The broad-tailed geckos spend the daytimes hidden in deep narrow crevices (only 0.5cm wide), and leave their holes only at twilight or night. From that we may deduce that the monitors also go after their prey in the evening or at night, even though they are really diurnal creatures. What is not likely, though, is that the monitors can prise geckos from their holes. I have both Varanus acanthurus acanthurus and V.acanthurus primordius that crash about at night hunting small geckos and moths in the terrarium.

During the winter months, May to October there is not a monitor to be found, because the creatures stay in their winter lairs at this time. Not that the winter in NSW is comparable with Germany. In the daytime the temperature reaches 20-24 C, and at night it drops to 6-10 C. I have never yet seen frost or snow in the Sydney area. Although we find the other reptiles all year round only the big lizards like monitors and water agamid disappear during the winter months.

For several months I have kept a 1.1 meter V.varius in the livingroom, for want of a bigger container. During the day he roams about in the sunshine coming through the window and is quite tame. If anybody bursts abruptly into the room he inflates his throat and lashes with his tail. But if you approach him quietly he lets you feed him by hand without more ado and takes mice and skinks. He refuses eggs in any form. Now we are waiting for an opportunity to catch a young specimen to rear, to be able to make further observations on the habits of this wonderful lizard.

[Illustrations]
Left: Varanus varius in a threatening posture.
Right: This half burnt tree sticking out of the scrub is a typical monitor residence in Fuller park, N.S.W.

Bemerkungen uber Mitchell's Wasserwaran Varanus (Varanus) mitchelli MERTENS, 1958.

Remarks on Mitchell's Water Monitor.

Uwe Peters. 1971. Aquaterra Z. 8:75-77.

Translated by John Hackworth.

In Aquaterra 6 (1969) pp.61-63 I wrote about keeping Varanus (Odatria) semiremex and V. mitchelli together. In reply to this the publishers remarked that I should write exclusively about V.mitchelli, although they were of the opinion that many habbyists would be interested in keeping speceis of monitors with differing requirements together. Unfortunately I must disappoint both publishers and readers, because in the meantime an incident has occured with makes it impossible to keep the mangrove monitors and water monitors together.

The distribution of V.mitchelli stretches over the coasts and rivers of northern Australia. The specimen which I mentioned in Aquaterra was caught on a concrete bridge over the Catherine River, in the vicinity of Catherine in the Northern Territory.

I am unable to give any exact details of the biotope because I have not personally been to northern Australia. The photograph of the Catherine River (fig.2) howver shows the jungle-like vegetation on both banks. The monitor in question was caught in the vicinity of the area where the photograph was taken. According to the information provided by its captor, Mr Steve Swanson, the preferred resting places of V.mitchelli are branches which overhang the water. The monitors are most easily caught at night whilst they are sleeping on the branches of these trees.

The total length of the animal described here is 68cm, of which 33.4cm is the tail and 6.1cm the head. The skin is finely scaled and feels like velvet. The ground colour on the back is blueish grey, with innumerable small yellow spots. Along each side of the head there is a reddish brown stripe which reaches the throat. The throat and underside of the body are a cream colour. The tail is laterally compressed to assist this very adept swimmer. The vivarium is described in detail in Aquaterra 6/1969, and remains the same. Although in the wild V.mitchelli spends most of its time in trees it cannot be described as an exclusive tree dweller because it is often found amongst rocks. Our specimens rarely climb amongst the abundance of branches which are provided. they prefer to remain on the ground in a hollow log or in the large water pool. This is a very timid species which flees and hides at the slightest disturbance.

In captivity V.mitchelli has proved to be a willing feeder. As well as mice they wil accept any sort of fish cut into strips. To date eggs and insects have been refused. One specimen of the above mentioned size requires 2-3 mice or a few fish weekly.

The reason the friendly joint housing of V.mitchelli and V.semiremex had to cease was the introduction of a new specimen of V.mitchelli of a similar size to that described above. The

exact origin of the new animal is unfortunately unknown, but it is certain that it was caught in northern Australia between the Catherine and Darwin rivers. On the day it was introduced to the terrarium the new monitor immediately began to hunt the mangrove monitor. It also occasionally occupied itself with our acclimatised V.mitchelli, which is only a few millimetres longer, but which, beacuse of better feeding, is much stronger. After they had "introduced themselves" to each other by mutual head bobbing and tonguing, they both began to hunt the V.semiremex as soon as it came within their field of vision. their behaviour bcame so wild that on one occasion the victim was forced to seek refuge by clinging to the ventilation gauze of the ceiling. When I saw this I felt complelled to remove the animal, after which peace again prevailed. Since then the two V.mitchelli have lived together in perfect harmony. They are often to be found lying side by side warming themselves on the floor heating.

In the meantime the V.semiremex has recovered and is housed in a large vivarium together with a pair of adult V.mertensi which completely ignore the animal even if it crawls over them or makes itself comfortable lying across their wide backs. Although V.mitchelli, V.spenceri and V.komodoensis count as some of the most peaceful and tame of the monitors, the possibility of mishaps with these large carnivorous lizards must always be reckoned with, as has been proved by this instance.

Ein Beitrage zur Okologie von Varanus (Odatria) storri.

A Note on the Ecology of Varanus (Odatria) storri.

Uwe W. Peters. Das Aquarium 1973 53:462-463.

Translated by M.J. Bennett.

In September 1972 an opportunity presented itself during a trip to northern Queensland to study Varanus storri in the wild. The distribution of the dwarf monitors has been discussed elsewhere in such detail that further remarks here are unnecessary (MERTENS 1942, 1963 & 1966). But on the whole it is worth adding that for several years I hunted in the neighbourhood of Charters Towers, north Queensland, and found a male with a total length of 440mm (PETERS 1969), while in the literature the maximum length was given as 330mm (MERTENS 1966).

The observations of 1972 extended over an area .75km2., 40 miles east of Charters Towers on either side of a highway. Scattered trees, mostly (80%) dead, spear grass and stones complete the picture of a wasteland. The biotope was bounded to the south by a railway embankment, to the west by a slightly rolling stony rise. To the north are clusters of stones about 50m from the roadside. In this little peice of grassland I was able to observe and catch 22 V.storri; 13 males and 7 females, all fully grown. 5 of the females were gravid. The general length of these lizards was between 240 and 295mm, the otehr two were half grown (170 & 182mm). Typical

of the population is the predominance of males and the absence of last year's young, whose length should have been 100-120mm. It does not follow that V.storri is generally cannibalistic, but the low number of young in a small population could lead to that conclusion.

The monitor always lives alone, in holes which are dug under stones. The den consists of a "U" shaped passage which widens somewhat towards the end. The stones over the den rarely exceed 16-18cm in height. These stones serve well as protection against the baking heat on the sun-scorched plain, flatter stones would serve only as a refuge to retreat to. In this colony 2o additional dens were counted, proved to be inhabited by fresh tracks. These animals were simply not at home, or could not be found because of heavy lumps of rock. It can be assumed that the population stands at 45-50 animals.

V.storri is not easily found at daybreak. Between 0900 and 1100hrs the majority of the obviously inhabited dens are empty while the lizards are foraging. A wide choice of food is available including grasshoppers, crickets and spiders. Here and there they also capture small ground dwelling geckoes (Heteronotia binoei) which figures as their favourite prey. During the hot midday the lizards retire to their dens until late afternoon. There the temperature is on average 6-9oC lower than above ground. In February 1972 the midday temperature was 25-27oC, but by September it had become almost impossible to catch the lizards. In the rising midday heat the animals are so warmed up and lively that they disappear as fast as a dart into the long grass, before the stones are properly turned over.

In the plain described here I was not able to catch any other Varanids, even though it seemed an absolutely ideal habitat for V.g. gouldii. Foxes, birds of prey and snakes can be listed as V.storri's natural enemies, which are to be found in the same habitat.

Further populations of V.storri can be observed along the highway to Charters Towers, always 8-10 miles apart. I have had reliable accounts of another place where V.storri is found, only 15 miles from Townsville, north Queensland, but I have not seen it myself.

In conclusion, let it be known, as my observations suggested, that from 22 animals in captivity two fine pairs were established in an authentic terrarium in Sydney. The heated floor was made of clay, with undulations of 5-10cm. True to nature burrows were portrayed in damper clay, with a big stone here and there. Scattered dry grass-scrub and a water bowl complete the set-up. The air was warmed with a heater to 28oC, additional light is provided with a Grolux lamp. The lizards quickly settled in, and individuals occupied four of the five dens and were very soon following their daily routine - proof that they were doing well.
Gelungene Aufzuch von Varanus spenceri.

The Successful Rearing of Varanus spenceri.

Uwe Peters. Das Aquarium, 205, Juni 1986.

Translated by Naomi Cowgill and Daniel Bennett.

It is a rare occurence for larger monitors to breed in captivity. I can recall the breeding of a water monitor (V.mertensi) which was successful in the Wilhelma Zoo in Stuttgart, but that was a long time ago now. I personally succeeded on one occasion in artificially incubating the eggs of V.varius. If the title of this article is to be interpreted as "the successful rearing of V.spenceri" this means that the matter in hand is not one of a successful breeding, as the parents were found copulating in an area near Tennants Creek, north Australia.

Unfortunately there is no exact date of capture so I can only report from the day of oviposition. The female laid 18 eggs, the average size of which was 52 X 36mm. As the monitor was not able to bury its eggs they were strewn on the sphagnum moss which covered the floor of the terrarium. Four of the 18 eggs were small and unformed with an unhealthy yellow colouring. The 14 remaining eggs were incubated under different conditions;

a) In order to prevent rotting two eggs were given radiation treatment with ultra-violet light and were then accomodated in a glass lined with damp paper towels.

b) I bedded four eggs in a clay container which was filled with sand. I sunk this container into a plastic vessel which was likewise filled with sand. During the whole of the incubation period I only kept the sand around the egg container damp.

c) Three eggs were buried in a plastic vessel filled with sand. The eggs were covered with only a 2-3mm depth of sand, so that it was easier to carry out occasional checks.

d) Three eggs were treated as in "b" except that both containers were plastic.

e) The two remaining eggs were kept like "a", in a sterile glass lined with damp paper towels. As before the eggs were treated with ultra-violet light.

Vessels complete with eggs were kept in a darkened terrarium with a constant temperature of 29oC. After four days I noticed that one egg in "d" had rotted. As a result of this I dusted all the remaining chambers except for "a" with Amoxal dusting powder which has an anti-bacterial effect. The powder has the following active ingredients; 2% Pentyloxybenzamid and 0.5% Hexachloroform. The treatment was succesful and no further eggs rotted.
The eggs were laid on the 1st of November, on 2nd of February I noticed that the eggs in "C" were 2/3rds dry. On opening the eggs I found two embryos 78 and 83 mm long.

On 13 March after an unexpectedly short incubation period of four months the eggs began to hatch. In the case of V.varius my eggs had taken nine months. Those in "b" hatched first, three lizard heads appearing at 0630 hrs. On 14 March the fourth head appeared, and at 1400 hrs. that day the first animal emerged completely, closely followed by the second. Over the next 7 days all the monitors hatched from the remaining 11 eggs in the following order b, c, a & d.

The length of the first animal was 222mm total of which the tail was 88mm, the head 22mm. The young monitors were clearly different from their parents because of their colour. On the upper side of the neck are 2-3 "V" shaped yellow stripes. On the brown body are 8-9 broad yellow stripes, becoming irregular dots and stripes on the tail. The stomach is white. Four days after hatching the first animal ate worms and baby mice. After six weeks three animals had doubled in size. The other animals also developed well. As an additional food they were given strips of meat and raw egg.

Varanus spenceri lives in central parts of north Australia and Qeuensland. This variety is not particularly widespread, and is only rarely kept in the terrarium. For this reason the success of this rearing is worth recording, as previously this monitor has been rarely kept and never reared. Externally Spencer's monitor somewhat resembles the African varieties. In its character however it is not as impetuous as the latter. Although it is always a little mistrustful, it tolerates being approached without biting, scratching or fighting as we know is the case with the African variety. Some of the young animals were given to the Zoological Garden of Ubersee. Later we unfortunately had to give up the reared and now fully grown animals because of a lack of space.

Der PazifikWaran im Terrarium.

The Pacific Monitor in the Terrarium.

Rainer Polleck. Aquar. Terrar. Z. 1979. 32:285-286.

Translated by Naomi Cowgill.

Varanus indicus, the Pacific monitor, lives in the form of three subspecies (V.i.indicus, V.i. kallabeck and V.i.spinulosus) in the southeastern Asian region. With a total length of over 1.5m this animal makes a great impression, but in the terrarium they rarely exceed 1.2m.

In July 1975 I bought a young Pacific monirtor which was approx. 60cm long, because I noticed an unusual colour and pattern on the animal. At first I housed the monitor in an enclosure 80 X 50 X 60cm. A 150W parabolic reflector lamp was positioned at 30cm above the baisin and served to light and heat the enclosure. The terrarium was closed on three sides, the other was made of wire netting for ventilation. The water bowl was also heated with a cable.

The Pacific monitor seemed to feel at home in the enclosure because he developed very well. At first I fed him twice a week, later only once. Now he receives food only every 14 days. He accepts everything offered and refuses neither mice, rats, meat nor eggs. . From the start he was very lively and quickly became tame because he realised that I would not harm him. Most of all the monitor likes to be scratched on the back and tickled under the chin, the firmer the better. Likewise crocodiles love this rough tenderness. The trust relationship developed so far

that I was soon able to release the monitor from its enclosure for about an hour (under supervision of course) and in doing so I learned that the monitor is active for six hours a day.

By May 1976 the monitor had reached a length of 1m and therfore had to be moved to a larger enclosure. The new terrarium measures 160 X 80 X 50cm, and is still inhabited today although the end of his growth is not yet in sight and he is now 130cm. Soon I will have to install a more suitably sized water enclosure. In the meantime the monitor has learned to open the sliding doors of his enclosure, on two occasions I have observed him parading about the room on accomplishment of the deed. As I also have two other terrariums in situ with smaler varieties of monitor in them, the risk is too great. The scoundrel can quite easily demolish the other enclosures and a diet of Australian spiny-tailed monitors would be too lavish.

So in a few days my monitor will move home, and I will look around for a new partner for him. I've already tried this on two occasions, but unfortunately both animals were considerably smaller than him. Instead of love, he thought only of his stomach and only with great toil and trouble could I prevent the worst. After meeting him, lady monitors came away with deep neck wounds and looked much the worse for wear. The successful female must be at least 120cm in length. Recently, I too have been made aware of the strength of the animal's jaw.

The Breeding of Varanus timorensis similis.

Roland Ruegg. Das Aquarium 1974. 62 (August): 360-363.

Translated by Jens Labohm and Daniel Bennett.

In May 1972 the Basel Zoo purchased two V. timorensis similis, one of the smallest monitors. In contrast to this lizard, the zoo also keeps V. komodoensis. There is a considerable difference in size between these species (V.t.similis 60cm, V. komodoensis 300cm (male)).

Fortunately the pair we acquired had lived together in the wild, and so they got along well in captivity. For this reason we hoped to breed them. In November and December I observed two copulations. On the evening of 19 January five eggs were laid underneath the roots of a plant.

Three of them were put into an earthernware vessel, which was filled with a mixture of sand and peat. The vessel was put into an incubator, and kept at 28-31oC, relative humidity was 80%.

On 17 March one egg was removed because it had gone mouldy. The two eggs which had been left under the plant roots in the terrarium had been destroyed by accident.

On 8 June 1973, after 139 days one of the eggs hatched. It left the egg the next day, but died shortly afterwards. Another hatched on 9 June, and seemed able to stay alive. As with most reptiles the hatchling was a miniature copy of its parents. It had the same pattern, a yellow throat and transverse lines across the back on a dark background. Newly hatched lizards always have the remnants of their yolk sacs in their intestine, which keeps them nourished for the first two or three days. On the third day the hatchling ate crickets, and then moths shortly afterwards. Later we fed him with guppies (Poecilia reticulata), heart and flies. The little monitor was very lively and had a large appetite, so he developed very well. On 17 June (a week after hatching) he measured 153mm total length, 58% of which was tail. By 12 September he was 198 mm (tail 56%), and weighed 9.5 grammes.

From birth the hatchling climbed on rocks and branches, and would hang vertically from a branch for hours at a time, as would his parents. The young lizard could not be kept with his parents because they would eat him. This is common and normal among reptiles. The female lays the eggs and does not care for them afterwards. Thus they do not know their own young, and of course the young do not know their parents, so cannibalism is common.

Editorial Notes.
There are three geographical races of V. timorensis. The nominate race V.t.timorensis is found on the islands of Timor, Rotti, Samao and Savu.

V.t. scalaris* however, can be found in the northwest of Australia (Dampierland, Kimberley) and differs from the nominate form in having more extended lateral post anal scales. These scales are seen as projecting thorns on either side of the vent and are present only in males. Furthermore, the males show a more distinct dorsal pattern, and in extreme cases resembles a "stair" or "ladder" pattern (hence scalaris =like a ladder). It does not exceed 53 cm, while the nominate form grows to 59 cm (total lengths). The third subspecies, V.t.similis is very similar to V.t.scalaris, but lacks the clear transverse lines on the back. In V.t.similis only the marks around the eyes are arranged in bands. This subspecies is found in the north of Australia from Treachery Bay to Queensland, on islands off north Australia and on the coast of the Torres Straits in Papua New Guinea.

The Ecology of the Desert Monitor (Varanus griseus) in southern Turkmenistan.

A. V. Rjumin. Herpetology of Middle Asia. Academy of Sciences, Uzbek SSR. Tashkent 1968. pgs 28-31.

Translated by Maria Shimanskaya and Daniel Bennett.

Monitors feeding on snakes.
According to our observations, the diet of Varanus griseus in southern Turkmenistan is very varied. In April the monitors usually eat young Horsefield's totoise (Agrionemys horsefieldi), large tenebrionid beetles (Tenebrionidae), caterpillars and rodents. In the end of April and the beginning of May they eat tortoises' eggs. In the summer and autumn monitors feed on tortoises, tenebrionid beetles and sometimes toads. More rarely they catch lizards. Other authors (1,7) have made similar reports about the monitors' diet.

Some authors (2,3) report that the monitors feed on snakes. N.A. Zorudnij found saw-scale vipers (Echis carinatus) in the stomachs of dissected monitors, M.K. Laptev found the remains of snakes. E.I. Sherbina caught a monitor near Kushka in 1951 (personal communication) which regirgitated a levantine viper (Vipera lebertina) 70cm in length. We found two instances of monitors feeding on levantine vipers in the same area, but found no data in the literature which suggests that monitors regularly feed on snakes.

In 1961 in the Murgap Basin we observed monitors hunting and feeding on levantine vipers. They regularly examined the snakes haunts. Several monitors hunted on levantine vipers and ate them. According to our analysis of stomach contents, all large monitors fed on levantine vipers.

In 1961 - 1964 22 cases of monitors feeding on large levantine vipers were discovered. In the end of April and beginning of May the monitors began to eat them systematically, so that they became a major item of diet. The length of two vipers eaten by monitors were 106 and 108cm. One instance where a monitor had eaten a cobra (Naja oxiana) was discovered. In other areas we havwe never observed monitors feeding on snakes.

Monitors hunting venomous snakes.
In 1961 - 1964 we repeatedly observed monitors feeding on large venomous snakes; levantine vipers 105 - 110cm in length. No similar cases can be found in the literature. One case is cited below as an example.

The monitor found a viper near a bush. The viper saw the lizard and moved in to the bush. The monitor rushed at the snake and seized it first by the end, then by the middle of the body. The viper, writhing in the lizards' jaws bit it in the mucous membrane of the mouth. The monitor gripped the viper by the neck, shook it several times and began to swallow it. Soon a third of the snake had been swallowed (its full length was 108cm). We examined the snake and found gashes in the skin and muscle where the monitor had held it.

Monitors tolorance to snake venom.
It is well known that snake venom has a greater or lesser effect on all vertebrates, especially birds and mammals. Some species however are rather tolorant. Fatal doses of adders' (Vipera berus) venom for a hedgehog is 2,4.10-3 g/kg, 40 times more than for a cavy (5). It will be interesting to find animals with more immunity to snake venom, and determine the limit of this immunity. Such material will give us the opportunity to create and perfect serums against snakebite.

We turned our attention to the monitor lizard; according to our observations the monitors regularly eat venemous snakes (levantine vipers and cobras) and appear to be unaffected by their bite.

Experiments with monitors in 1963-1964 revealed their exceptional tolorance to the venom of levantine vipers and cobra. The experiments were carried out in the following way. The snake was allowed to bite the monitor in such a way that there was no loss of venom (both animals were hand held). Three monitors were subjected to the bites of six vipers and six cobras. The vipers bit the lizards in the belly, lips and cheeks, exhausting their supply of venom (no less than 1.5 - 3g. Dark dots, sometimes spots, appeared in the bite areas. The behaviour of the monitors was unchanged after the bites, and no signs of envenomation were observed. Neither oedemas nor haemorrhages appeared after the bites, and the marks in the affected areas disappeared within a few days.

Taking into consideration the difference in the weights of dry and raw poison (1:4), each monitor received .4 -.75g of dry vipers' vemon, equivalent to .2 - 1.9kg, 30-200 fatal doses for man. The quantities of liquid venom introduced into the monitor's body by two cobras was no less than 1.2g, or approx. .25-.5g of dry venom, 400 - 4000 fatal doses for man, or 5 -52 times more than the highest permissable dose for immunization of serum-producing horses.

After bites from levantine vipers and cobras, modern serums are introduced in quantities of 10ml or more, up to 80-130ml in serious cases (4). Large quantities of serum are harmful for organisms and can induce shock. Thus it is necessary to create serums which are effective in small quantities.

The monitor lizards' ability to tolorate huge quantities of cobra and viper venom without harm is an exceptional phenomena and indicates the polyvalent nature of the lizards' immunity. The monitors' immunity is universal, because the venoms of cobra and viper are antipodal in their effects.

Studies of the peculiarities of monitors' immunity will help people reveal the laws of the creation of universal serums which are effective in minimal doses.

Notes sur l'elevage et la reproduction en captivitie du Varan de Timor.

Notes on the Rearing and Reproduction of Varanus timorensis.

Loic Sautereau and Peter de Bitter. Bull. Soc. Herp. Fr. 1980 15:4-9.

Translated by Daniel Bennett.

This study is based on observations of 11 Timor monitors (2 males, 2 females and 7 young born in captivity in October 1979) demonstrating that this animal adapts well in the terrarium, despite its apparent fagility, and breeds without many problems.

Systematics.
Family: Varanidae.
Genus: Varanus.
Species: timorensis.
Subspecies timorensis.

This slightly-built monitor is similar to other members of the family with its long mobile neck, flattened head and pointed snout and strong legs armed with long curved claws. The colour of the back is basically brown, covered more or less less regularly with whitish occellations. Below they are striped black and white (the colour of the juveniles is a little brighter).

Fig.1.
A. Light tube.
B. Walls of brick.
C. Infra -red lamp.
D. Brick base of terrarium.
E. Ventilators.
F. Glass.

They are found in northwest Australia, in Queensland New Guinea and the Lesser Sunda Islands Timor, Samao, Semaoe, Savu and Rotti. Its habitat is chiefly that of rainforest and grass palins furnished with trees in which they can easily catch prey. Its activity is diurnal, they like the sunshine, and show hardly any aggression. They eat small mammals, rodents, young birds and insects. Reproduction is oviporous.

Breeding Two Pairs of Varanus timorensis in the Terrarium.
The two pairs were kept by P. de Bitter in a terrarium 140 X 70 X 100cm (high). It was made of brick, with two sides of glass. The substrate was coarse gravel/sand and pebbles. Furnishings consisted of a stone shelter, some large branches, robust plants and a water bath.

Heating and Lighting.
The terrarium was illuminated by "true light" tubes and heated with infra red lamps. Daytime temperature was 30-33oC, dropping to 18-20oC at night.

Water.
The monitors drank frequently, and the water was changed daily. Furthermore, we noticed that a large baisin with shallow water was indispensible for the daily baths of these animals. The water in the baisin was also changed daily.

Nutrition.
The animals were fed every day in the afternoon, on domestic mice, small lizards (not essential), insects (crickets, beetles etc) eggs and occasionally newly hatched chicks and meat. Vitamin supplements were added to food and water as directed.

Copulation.
P. de Bitter observed a mating on May 5 1979.

Oviposition.
The female laid 7 eggs on 18 June 1979, 43 days after copulation.

Incubation of the Eggs.
Immediately afetr oviposition, the eggs were placed in a clay container, as described below.

Fig.2.
I Clay pot.
J.Eggs deposited in damp peat.
K. Sphagnum moss covering eggs.
M. Plastic container which contains clay pot.
N. Water, depth = 0.5cm.

The whole apparatus was placed in an incubator at a temperature of 33oC, regulated by a thermostat, and a humidity of 90-95%.

Birth of the Young.
Dates are from the cracking of the eggs.
15.10.79. 2
17.10.79. 1
18.10.79. 2
19.10.79. 1
20.10.79. 1

We had achieved a 100% hatch rate at 33oC with an incubation period of four months. The young measured about 15cm at birth. They were placed in a glass aquarium with sand substrate at a temperature of 30oC (provided by a lamp). M. de Bitter gave two of the hatchlings to L. Sautereau, who made the following observations.

After two months the youngsters measured 18cm. They were very quick and lively, digging and burrowing untiringly. Every morning they explored their terrarium, excavating below the stones and bark.

The Terrarium.
80 X 40 X 40cm.
Fig.3: Terrarium for young V.timorensis.
G. Ventilators on two sides and top.
H. Front of glass.

Substrate and Furnishings.
The substrate consisted of a layer of quite coarse sand 5cm deep. The furnishings were stones, branches and fragments of pine bark.

Water.
Two water receptacles were used. A little saucer was always positioned at a suitable angle, and a circular dish for bathing (3cm deep, 17cm diameter) placed in the middle.

Light and Heat.
A 100W infra-red light keeps the diurnal temperature at 30-34oC, this lampo is on 10 hours per day, supplemented 3 days a week with a 6W ultra-violet lamp. At night the temperature drops to 19-20oC and red lamp is kept on to maintain the ambient temperature.

Feeding the Youngsters.
This subject is extremely important, and concerns all young lizards. They must be observed to begin to feed, and continue to do so frequently. Mr Sautereau noted a marked preference for crickets (Grillus bimaculatus), locusts, cockroaches, butterflies and grasshoppers. They refused flour and wheat moths, possibly because of their rapid movements which failed to attract the attention of the youngsters. Three times aweek they were given a mixture of beaten egg and milk in a saucer, which they would accept. The mixture regularly contained Vitapaulia (T.M.) (composition = iron - manganese - copper - cobalt - magnesium - zinc - calcium, vitamins A, D3, E, K, B1, B2, B3, B6, B12). After
one or two months they were also given young mice.

Der getupfelte Baumwaran, Varanus timorensis similis.

The Australian Spotted Tree monitor, Varanus timorensis similis.

Gunther E Schmida. 1971. Aquar. Terrar.Z. 24:168-170.

Translated by M.J. Bennett.

Australia is the home of many monitors, of which the best known is well represented by the lace monitor (Varanus varius), which lives in the east. From the north comes the considerably smaller V. timorensis similis, of which an account is given here. This monitor lives in trees and reaches a length of about 55cm, and is suitable to keep in a moderately sized terrarium. But it is not only its modest size that makes it easy to keep; it is not excessive in its demands for food and makes no great demands on its keepers equipment (or arrangements). A couple of branches to climb on and a temperature of about 26 C plus or minus 5 C will suffice for its comfort. Unfortunately these creatures are rarely kept in petshops, not because they are rare - they are plentiful enough in their native land- but because Australian law prohibits both the export and import of live animals, and only allows exchanges with well known zoos. At the same time, occasionally Australian animals are available, and then we have to thank certain broad minded collectors who go outside the law; in a word, smuggling. That is quite a risky business, and is the reason why prices for Australian reptiles are high.

As suggested by its (German) name [Baumwaran, tree monitor], V. t. similis lives chiefly in trees. All of about 50 specimens that I have encountered were found in hollow branches or in loose bark. On the whole the creatures keep well hidden, so that they can seldom be observed in the wild in the course of hunting. When I stayed at Half Island Cove in the Gulf of Carpenteria for 14 weeks I found myself in the distribution area of these monitors, and met the first specimens purely by chance. It was on a building site on a rocky hill on the coast. Rooted there, and scattered over the barren earth were a number of Pisonia trees, misshapen and eaten by termites. They were up to 10 meters high and 10cm across. As one of my colleagues was hanging his water bottle on one of these trees a section of bark fell off, and underneath was a young lizard of this species about 15cm long. My hunting instincts were aroused. So during a break I disappeared into the bush with a crowbar, looking for hollow branches to break open. In about 30 branches that I investigated I found 14 tree monitors, from 15 to 53cm in length, in an area not greater than 50 square meters, but providing plenty of hiding places and a rich supply of food. While the monitors do live here on the low Pisonias close to the ground they also go up to the bigger trees with airier heights, as far as they can find enough hiding places and food.

Like all monitors V.t.similis is a flesh eater; in the wild they catch predominantly insects, geckos (Gehyra australis, Oedura lesueurii rhombifer, O.marmorata) and skinks (Ablepharus). Adult specimens can cope with smaller agamids (Diporiphora) and mammals and small birds as well. In captivity they will also take meat cut into strips.

At Gove I saw the monitors more frequently each day, in the mornings between 7 and 8 o'clock, at about 25 C they creep up on cicadas on the twigs and catch them in mid jump. Sometimes they fall with their prey from 3-5 meters up, but they simply climb back up the trunk, holding their prey in their jaws. They repeatedly shook themselves energetically, in the manner of monitors, crashing about and carrying themselves with jerky movements of the head and throat, and bending the head against the belly they normally swallow their prey head first.

Although they themselves are predators, these little monitors have many enemies in the wild. Birds of prey, shrikes, crows and not least "Lachende Hans" pressure them, but also (Beutel) martens, snakes and probably even their tree dwelling cousins V.tristis and V.varius are happy to hunt them down wherever they are on the menu.

V.t.similis, however, is very quick and nimble. Moreover, they are effectively camouflaged. When in danger they either press themselves flat against rough bark, so that they can hardly be seen, or they carefully keep to the opposite side of the tree as their opponent. If they feel themselves pressured they can run up smooth vertical trunks, on run down them in a spiral, head first. If no other means of escape presents itself they jump from a great height. When a colleague was trying to catch a 20cm tree monitor which was hunting geckos on the steel scaffolding of a water tower the creature leapt spreadeagled, with its legs stretched and sideways through the air with a wriggling motion, at an angle of about 45o. When it landed it made off at once for the next tree. We eventually managed to catch the monitor, and it has been living in one of my terrariums for three months, having previously spent a similar period in the care of a friend. In its six months of captivity the lizard has become quite tame. He takes his food from tweezers and is no longer as wild when I handle him in his enclosure. If it tempt him with food he runs up my arm. On the other hand, faced with anything unfamiliar he is very timid. If several people appear in front of the terrarium he retreats back into his den. He gobble up anything he can manage - grasshoppers, crickets, cockroaches, and for a special treat, geckos. When I was cleaning the tanks I put an Oedura robusta in his terrarium, almost as big as himself, just for five minutes because I was short of space. After two minutes the monitor had chewed off the gecko's fat tail, and had gobbled it up, after a lot of hard work. His body was swollen to twice its normal size, and it took a whole week to get back to normal. The monitor is, above all things, a greedy fellow, and since he was caught he has increased in length by at least 4cm.

Other specimens of this species that I have observed in captivity particularly enjoyed mice, which they killed and consumed in the way I have described, but also dead fish, up to 10cm long, strips of meat and frogs. They refused only the little false-toad Pseudophyrne; if they took one of these by mistake they would immediately spit it out again. Evidently the secretion from the skin of Pseudophyrne irritated their mucous membranes, so after making such a mistake the monitors would rub their snouts on something hard for at least a minute.

The monitors can be kept in the company of others of the same kind of a compatible size, and also with other peaceable lizards, such as the blue-tongued skink, Egernia and the bearded agamid. But if you put males of a like size together then soon begin to fight, usually resulting in the total domination of the weaker. Then they must be separated. V.t.similis can be kept with other species of monitor as long as they are not too big, and they will live together and take food from the hand.

V.t.similis is difficult to sex. Certainly I know males in which the post anal scales on either side of the vent were lengthened, spiny and arranged in groups as described in the literature, but

also other males, who have everted their sex organs, are externally undistinguishable from females. So far, reproduction in this species is as good as unknown.

V.t.similis seems very stretched out. The plump tail is about 1.5 times as long as the head and body and the limbs seem short in comparison. The colouring is very variable. Dorsally they can be anything from yellowish-grey to deep black. Light coloured specimens have a more or less clean ocelli of dark scales, while on dark ones this pattern predominates. Often the spots go across the body in bands, continuing on the throat and tail, until they disappear in scattered dots. Between the rows of ocelli can be found brownish bands or red-brown spots scattered over the back. The ocelli pattern is not found on specimens from mid-Queensland, instead there is in irregular scatter of dark spots. The underside is usually dusty white; only on specimens from the rain forest of north Queensland is the throat egg yolk-yellow, extending from the belly upwards, on the flanks and the tail a greenish colour predominates.

The distribution of V.t. similis extends from the northeast of Western Australia across the Northern Territory to Queensland and the northern end of New South Wales (one specimen was reported by John Canns in May 1970 50 miles south of Goodiwindi in Queensland near the border of New South Wales). The monitor is also found on the islands of the Torres Straits and in New Guinea. It is found in nearly every kind of environment, except particularly treeless parts.

In the northern part of its habitat the climate is tropical. In the winter (June-August) it is very dry, but in spring (September-November) the humidity increases until in summer (December-March) heavy monsoons flood the land. The temperatures along the coast ranges in summer and winter between 25-30oC, but inland it is much more variable; in the summer the thermometer can go up to 45 C, in the winter there can be frost at night. So the lizards take themselves off for sort of winter breaks and appear again on specially warm days. But the lizards of comparatively warmer areas also take a break because everything dries up and food becomes scarce.

Apart from V. timorensis similis, we know of two other varieties of this species, namely the nominate race V.t.timorensis from several small Sunda Islands (Timor, Savu, Rotti and Samao) and V.t.scalaris in Western Australia. The differences between the subspecies, however, are very slight.

[Photos] Left: Yellow-throated colour form of Varanus timorensis similis from the tropical rain forest of northern Queensland.
Right: Adult specimen of the inland variety.

Der Kurzschwanzwaran (Varanus brevicauda).

The Short Tailed Monitor (Varanus brevicauda).

By Gunther E. Schmida. Aqua. Terra. (Z). 1974 27 (11):390-394

Translated by Frank Schofield and Daniel Bennett.

It is well known that the largest lizard belongs to the monitor family: the well known Komodo dragon (V. komodoensis). In the same family and genus there are also some species that are scarcely bigger than a sand lizard. We are concerned here with one of these small species, namely the smallest of all, the short tailed monitor (V. brevicauda), which belongs to the subgenus Odatria.

V. brevicauda lives in Australia, the home of more than 20 different forms of Varanus, where other dwarf species occur, scarcely growing bigger than a green lizard, such as V. eremius, V. storri, V. primordius, V. gilleni and V. caudolineatus. Since the description of V. brevicauda by Boulenger (1898) few authors have given any information; the most recent being E.R. Pianka, who studied this species and other dwarf monitors in the wild in 1967. Until then only about 20 specimens were known to science, and to date not many more have been forthcoming.

The short tailed monitor is restricted to north west Australia: it is known from Carnarvon in the south, along the coast to Broome in the north, as well as from Tanami Desert in the Northern Territory (Slater 1964) and from the Lake Carnegie district of mid-western Australia (Pianka 1967). Information from the huge intervening areas is lacking, but the lizard must occur there too. The habitat is fairly uniform in all these areas and, because of the very low rainfall level, is of a half desert nature. The ground is partly stony, partly sandy and always of a more or less reddish-yellow colour. Of plants, spike grass (Triodia) is predominant, offering the monitors and other small creatures excellent hiding places. Tree growth is sparce and consists mainly of Eucalyptus, Acacia and Casuarina. Only along water courses, which are dry for most of the year, and the valleys of the fairly low mountain ranges do we find more luxuriant tree growth. In particularly sandy districts, trees are often competely absent; only the spike grasses and low lying bushes are present. Here it is difficult to find small creatures, especially those which are secretive. This certainly applies to the short tailed monitor, since because of its small size it has many enemies, particularly birds of prey, but also larger monitors such as V. eremius, V. acanthurus, V. gouldii and V.giganteus. The short tailed monitor eats mainly insects - grasshoppers are particularly abundant, and also small geckos and skinks.

Temperatures in this habitat get very high, especially inland. In the summer (November to February) temperatures of 40oC in the shade are not uncommon, but in the winter (June to August) frost often occurs in the interior and in higher areas. The day -night differential can be as high as 20oC.

As a lover of monitors, I wanted to find out more about this species. In 1971 I had to go on duty to Port Hedland in N.W. Australia, and took the opportunity gladly because the district is the home of the dwarf species mentioned, and also of a number of the larger monitors. In order not to bypass the localities of the species that interested me during my car journeys,I marked

them on a road map, which proved a very sensible idea. At the "Ajana" farm on the Murchison River, which I had marked as a locality for the not very common V. caudolineatus, I did indeed find three specimens in rotten stumps, and two more in dead Cassowary trees on highway 1, 443 miles north of Perth. All the lizards were found within 50 metres of the road. I had spent no longer than an hour searching for them. Perhaps I would have found many more animals if I had had more time. I found no other monitor species on the visit, but these V. caudolineatus were later to facilitate the discovery of V. brevicauda.

In Roebourne, 120 miles before Port Hedland, I visited my friend Paul Horner. When he saw my V. caudolineatus he began to search for dwarf monitors himself. I, however, had to continue my journey and reached Port Hedland the next day. I stayed there for 8 months, until the end of January 1972.

It was early June, and unusually warm and close for the time of year. After 3 days the rain began to pour down. It rained uninterruptedly for a full week. At first the dried up earth soaked up the water, but then the low-lying land in the neighbourhood of the town began to flood. The formerly dry rivers changed to raging torrents, side roads were impassable and the town became cut off even to air traffic.

It was three weeks before the situation returned to normal. Then I received a letter from Paul in Roebourne saying "have been able to catch 2 V. brevicauda during the rains". I wrote back immediately, and asked cheekily for the animals. As I had scarcely expected a reply I was very suprised when Paul paid me a visit in early July, and brought the animals for me.

The smallest of the monitors seemed to me very different from all the other Australian species, not only because of their small size. The skull is very short and relatively high, and the sharply bent profile is reminiscent of the monitors of the subgenus Empagusia from India and Africa. The round nostril is about half way between the front edge of the eye and the end of the snout. The iris of the relatively large eye is a pretty orange-red colour. The ear hole is oval and slightly pointed at the top. Between the eye and the upper edge of the ear runs a weak temporal stripe. The animal's neck looks short and thick, whereas the body appears round and stretched. The limbs are short and muscular and have strong claws, which show the monitor to be a digger. In comparison to most other monitors, the tail is exceptionally short and corresponds roughly with the head and body length of the animal. In cross section it appears roundish. rather broader than it is deep, and thicker in the middle than at the base.

One of the animals was a dark brown above, the other a pretty reddish brown, and both had a pattern of irregular spots. The underside was a uniform dirty - white. The head, sides and limbs were relatively finely scaled and the belly covered in small shields, while the tail scales were weakly spiky. The overall length of the reddish brown specimen was 175 mm, of which half was the tail. The dark animal was about the same size, but a few millimetres of its tail were missing. I could see no other differences apart from the colour. At first I judged both to be males, though this later proved to be wrong.

Paul had found both monitors together under a stone between Triodia-grass bushes on a hill near the Roebourne reservoir. They had obviously been flooded out and sought higher ground and shelter under the stone.

At first I put the monitors in a terrarium with my gecko Nephrurus l. laevis, which I had done previously with a V.gilleni. Since this monitor is a diurnal arboreal animal and the geckoe a nocturnal ground dweller, they never got in the way of each other, and this was very successful. But it was to be different with the short tailed monitors. Within two days they had built a labyrinth of tunnels in the 12 cm deep substrate of sand in the terrarium, in which they moved to and fro during the day. The geckoe did not mind this, but was robbed of it's sleep, and went on "hunger strike" in protest. So I placed him in a smaller terrarium.

In the 12 cm deep substrate of fine sand was a 15 Watt heater warming about half of the floor area. On the sand lay a few flat stones and a small hollow branch. A 25W incandescent bulb provided lighting and basking areas. In spite of these heaters, temperatures in the terrarium were largely dependant on room temperature, and subject to fluctuations of up to 15oC. The thermometer read between 10 and 25oC in winter, between 20 and 35oC in summer. Only the heated part of the enclosure maintained a fairly steady temperature of 20oC. The temperature rose steadily towards summer and onwards, enabling the floor heating to be switched off. Once a week I sprayed the sand liberally with lukewarm water. Although the upper layer of sand quickly dried out, the lower levels always remained damp. In my experience this is of the greatest importance for the care of terrestrial desert dwelling lizards, just as important as a permanent drinking dish.

Both monitors were good eaters from the start, although from July to September they were in view for only about two hours a day (from 1200 to 1400hrs). They ate two 3cm long grasshoppers or one 5-6cm geckoe per week. As temperatures rose, their food intake rose correspondingly. In summer they fed daily on one or two 3cm long grasshoppers, praying mantids, cockroaches, moths and beetles, and in addition one or two 6cm long skinks or geckoes each week. They took only live or freshly killed food, I was unable to get them used to meat of any kind.

Because I was used to feeding all my other monitors by hand, for the sake of better control, and they always eagerly took the food items, I tried this with the short tailed monitors too, but without success. Above all they seemed to me less aggressive than their relatives. When I put food animals into their cage they initally would take no notice of them, but would often run past them and smell the without seizing them. Even when the food animals fled they did not chase them. I could never see in them any outward sign of excitement such as I saw in my other monitors, such as tongue waving or tail movements. But when they seized a prey item, it was in typical monitor fashion, namely by the head or first third of the body. Then they shook the prey violently to and fro, beat it on the floor and finally swallowed it head first. After a meal they usually sought the drinking dish. Their droppings were regularly deposited as small balls.

Short tailed monitors are enthusiastic diggers. Their cage, after long digging sessions, looked like a moon landscape and so every couple of weeks I used to even out the sand, to give them more scope for further digging. To do this I sought out the monitors to remove them, and as I did this mostly in the evenings I had to dig them up. I always found them hidden deeply in damp sand in the coolest part of the terrarium. In sleep their tails were were coiled in a spiral to one side, with the head bent round towards the body. The closely related V. caudolineatus and V. gilleni sleep in this position too, from my observations.

Because the monitors were active only by day, and their cage became dimly lit at night, I put in a few geckoes. Small terrestrial geckos were out of the question for this purpose. The robust and active 10cm long Gehyra punctata seemed suitable, and it was abundant in the stony areas near Port Hedland. At first this social arrangement went well: the monitors took no notice of the geckos, and vice versa. The geckos, also diurnally active, showed no shyness, and did not flee when approached by the monitors. One afternoon I made the following observations: as usual the monitors were running around, occasionally resting or basking under the light. One of the geckoes got in the way of a monitor, and smelt him enthusiastically but did not worry about him. Suddenly the light - coloured monitor seized it by the tail base. The geckoe did not shed it's tail as they normally do, but struggled. It bit the monitor where it could, but was unable to penetrate its thick skin. The monitor held the gecko tightly with closed eyes. After a short time the gecko became tired, cast it's tail and ran off very fast. Then the monitor began to shake and swallow the wildly flailing tail, thick end first. I did not attribute any particular meaning to this observation until a few days later I discovered that another gecko had lost its tail, and then they all became tailless without showing any further injury. Obviously the monitors had begun to specialise in gecko tails, because throughout this time they had been offered a wide range of living food. So I removed the geckos and the monitors reverted to their normal diet.

Meanwhile it was September, and so Spring in this part of Australia. I had prepared a larger terrarium for the monitors, and settled them in it. The layout was similar to the previous one, but because the container was not watertight I could not keep the lower levels of the sand damp. The monitors had been in their new enclosure for two weeks, when during a check I found two dried up eggs. During the previous week I had seen the light brown monitor in this spot for long periods. Thus at least one had proved to be a female; perhaps I even had a pair, but I saw no signs of copulation. At any rate, on 27 September I replaced the monitors in their original terrarium.

On 5 and 6 October I saw the light brown monitor digging up against the glass in the right hand corner. On the 14 I found a clutch of eggs there, which I immediately removed with forceps for measuring. They were oval and 26mm long, 12mm wide,. The shell was like parchment and dirty white. Without changing their position I carefully recovered the eggs with damp sand. I had to move the monitors again because I feared they might disturb the clutch by digging. For the following three weeks I left the eggs undisturbed . When I checked them again they were all in good condition and now I was pretty sure that they were fertile and that I had a true pair of monitors.

It was now mid November and with temperatures steadily rising the floor heater became unnecessary. The temperature of the sand now varied between 18 and 25oC. I continued to dampen the sand every week. When checking I found the eggs unchanged. On 3 January, 10.5 weeks after the eggs were laid my wife thought she saw a baby monitor in the tank, but I found all the eggs intact and put this down to imagination. Three days later, however, I saw a lizard's tail under the hollow branch, and found a young monitor in it. It resembled both of the adults, but was noticably darker in colour. A dark brown reticulated pattern showed on a yellow background. Its length was 80mm, of which 38mm was tail, which was thus a good bit smaller than the snout to vent length. I estimated the lizard to be about a week old.

The little monitor was extremely lively, and I put it back in the enclosure which I thoroughly checked. When I looked in the hollow log I found two more young monitors, looking just like the first. When I went to dig out the egg skins I found a still undisturbed clutch. there had therefore been a second clutch present all along, of which I knew nothing. I eventually found its remains in the front right hand corner of the terrarium, near the heater. Both clutches must have been laid within a period of two weeks. The incubation time of the hatched clutch must have been 10-12 weeks. I now waited impatiently for the hatching of the other clutch, but it was not to be. At the end of January there had been no change and it was time to leave Port Hedland.

Of the three young, one proved to be a weakling. I killed it in order to give it to the Western Australian Museum. the other two ate well and preferred small moths and freshly sloughed grasshoppers. The cage with the eggs and animals in it went with me in the car. The two well fed adults I put in a crate. Everything was packed together in a polystyrene box to minimise temperature fluctuations during the journey. At first all went well. Half way to Sydney I decided to put one of the youngsters in a bag since travelling in a cage seemed too risky. In Adelaise however there was a sudden drop in temperature which caused the death of the adult male and the juvenile in the bag. But I still had the female, the other juvenile and the three eggs. In Sydney the female was put in a new terrarium along with a V. gilleni 60X40X40cm. I placed the young monitor in a small cage. Both lizards ate well again and now were also fed mealworms. In mid April the youngster stopped eating. Within 10 days it was so thin that it's kneecaps could be clearly seen under the skin. As nothing coulkd be done to persuade it to eat I decided to force feed it. But this proved easier said than done because of the lizard's small size. I finally succeeded in getting it to eat a small amount of minced grasshopper , with a stick, which the monitor digested well. A second feeding was also succesful, but the third time I saw that the eyes were sunken, to me a sure sign of a dying monitor. The animal did die on that very day. So I had succeeded in breeding, but not rearing, this monitor.

The remaining eggs did not change during the journey. At the beginning of March one egg was darkening and I decided to open it.An evil - smelling rotten mass appeared. Another egg contained a living embryo in very early stages of development, it was clearly a monitor. I left the third egg in position and covered it up, but a week later I found it collapsing, so ending my hopes of further success.

Why were there such differences in the development of the eggs? Probably my checking of them was to blame, causing fluctuations in the temperature (cooling). The successful clutch had been subjected to higher temperatures in the early weeks of development. Experience was giving me new knowledge all the time. But many questions remained unanswered: they can only be solved through further observations.

Although I spent nearly all my free time looking for these monitors, I only managed to find the dried up corpse of one adult. It was under a rock at Tabba Tabba Creek on the road to Marble Bar, 40 miles south of Port Hedland. That was four weeks after the beginning of the rains mentioned earlier, in which the animal presumably died. To date I still have my female short tailed monitor. I have now had it for 14 months, and it enjoys the very best of health.

Freiland- und Gefangenschaftsbeobachtungen am australischen Wasserewaran, Varanus mertensi.

Observations of Wild and Captive Australian Water Monitors: V.mertensi.

Ulrich Schurer & Hans-Georg Horn. Salamandra 1976 12 (4):176-188.

Translated by Naomi Cowgill and Daniel Bennett.

Varanus mertensi, the Australian water monitor or Merten's monitor was described by Glauert (1951) and named after Robert Mertens. Some time later Mitchell (1955) referred to a lizard in captivity from Lake Hubert in the Northern Territory as V.varius, but which was recognised by Mertens (1958) as V.mertensi. Finally this lizard was described once more by Worrel as V. bulliwallah. Whereas the description by Glauert was of a semi-adult specimen, that by Worrel was of an adult. In 1958 and 1963 Mertens referred to the synonomity of V.bulliwallah with V.mertensi, as did Worrel in 1964. It is possible that the older reports about the occurence of V.salvator in northern Australia, (Mertens 1942) are based on a confusion with V.mertensi (Mertens 1958).

This report should sum up all that has been previously been made known in literature about V.mertensi. Our own observations in the wild and in the terrarium should widen previous knowledge thereof, in order to show where further observations are necessary. Furthermore, with these hints it should be possible to build an idea of the life of these lizards.

Description.
In spite of the relatively heavy body and small head, V.mertensi looks brawny and stocky. Mertens described it's morphology as follows (summarised); distal half of the tail is strongly compressed, about 1.4 to 1.5 times the length of head and body. The width and height of the head are contained in it's length 1.6-2.1 and 1.9-3.0 respectively. The nostrils are round to oval

and point upwards, much nearer to the tip of the snout than the edge of the eye, the ratio of these distances is 1:1.8 - 1:2.25. The ear aperture is large. The claws are fairly slender, but long and curved, so that they can give support when climbing. The animal described here was measured on the 14.8.1976: snout - vent length 44cm, tail length (a few centimetres are missing) 57cm, weight 1.82 kg.

Mertens (1958) specified the length measurements of 13 individuals, they were between 31.5 and 106 cm. All those measured by Brotzler (1965) were longer, total lengths of 111, 115 and 126cm were specified, with weights of 1.7, 2.8 and 4.9 kg. From the viewpoint of other authors (Bustard 1970) 3kg was seen as the maximum.

Scalation: Mertens (1958) described the scales as follows (summarised) relatively large head scales, supraoculars largest, 40-46 scales from rictus to rictus, midbody scales 158-181, ventrals 96-112.
Of the living animals considered here head scales are large; 46 from rictus to rictus, in comparison the back scales are small, 175 scales around the body, 110 ventrals.

Colouring.
This deviates from Mertens (1958) description (because these are living animals). Dark brown above, becoming darker on the extremities. On the freshly skinned animal this brown appears to be mixed with yellow. The back and proximal third of tail are covered with yellow spots at great intervals, which cover 1-4 scales. The spots form 10-12 weakly marked crossbands. Glauert (1951) and Mertens (1958) describe these spots as white, presumably because they have turned white in preparation. Sides of the head are yellowish, throat is lemon yellow, a short blue grey stripe runs diagonally across the mouth. It diffuses into a band along the gular fold and blurs on the side of the neck. The eyelids are yellow, the iris blue-grey, the tongue is blue-black, stomach and underside of the tail are yellow to bright yellow, with blurred dark crossbands, partly interrupted by yellow segments, the crossbands are recognisable from the front legs to the proximal third of the tail. On closer observation it is possible to identify deep black squarish patches. All the V.mertensi found in the wild corresponded in colour to the one described here. Mertens (1958) stresses the slight individual variations of these monitors.

Distribution.
According to the previously known places where these monitors have been found, they are limited to the "torresian sub regions" of Australia (Keast 1959). Cogger's map of distribution bears in mind present day knowledge. Nevertheless we are only certain of V.mertensi's distribution in Cape York because of the personal communications of P. Krauss. The area where Worrel sighted V."bulliwallah", lie outside the region given by Cogger(1975) Keast's opinion (1959) that V.mertensi is limited to the northwest coastal areas is now out of date. On Cogger's given area of distribution (1975) V.mertensi is definitely not continuously distributed, as suitable biotypes are only present in some areas. Hitherto nothing is known about the existence of any geographical races.

Table 1. - Places where V.mertensi has been found.

| Place. | State | Cited by. |
|---|---|---|
| Moola Bulla Cattle station, at Hall's Creek, East Kimberley.(type) | WA | Glauert 1951. |
| Wotjulum, Kimberley. | WA | Mertens 1958. |
| Katherine River, at Katherine. | NT | P.Krauss (Peters 1971). |
| Marsh at Lake Hubert | NT | Mertens 1958. |
| Edith Waterfalls, upper reaches of Edith river | NT | Worrel 1956. |
| Waterhouse River | NT | Worrel 1956. |
| Source region of Katherine, Waterhouse and Roper River at Matranka. | NT | Worrel 1956. |
| Mt. Brokman. | NT | Cogger 1975. |
| Mawuwu Creek, Coburg Peninsula. | NT | Cogger & Lindner 1974. |
| Darwin River | NT | Peters 1971. |
| Belyando River, Bulliwallah Station | QU | Worrel 1956. |
| East Mt. Isa. | QU | Our observation. |
| Mt. Isa. | QU | Peters 1970. |
| Normanton | QU | P. Krauss (pers. comm.). |
| Archer River | QU | P. Krauss (pers. comm.). |
| Endeavour River. | QU | P. Krauss |

(pers. comm.).

60 km south of Charter Towers QU P. Krauss
(pers. comm.).

WA = Western Australia.
NT = Northern Territory
QU = Queensland.

Habitat.
V. mertensi lives in different types of habitats, in which, however, flowing or still water is always present. We inspected three habitats. At the first location, in the vicinity of Mt. Isa, Queensland, V.mertensi lives in a long, flowing brook, the banks of which are covered for the most part with weeds (picture 1). On the remaining parts of the bank, grass reaches almost up to the water. Here and there Eucalyptus trees border the banks. The bank is constantly changing, sandy, muddy or rocky, in parts very steep, in others flat. The second locality is a man made reservoir, which lies only a few hundred metres from the first. The banks of the reservoir are steep with wide rocky areas devoid of vegetation. In the area of the dam lie lumps of rock with countless splits, crevices and caves between them. In the reservoir great areas are occupied by submerged water plants.
A third habitat where V.mertensi is found, according to Krauss and Peters (1971b) is the fast flowing Katherine River in the Northern Territory (Picture 2). The river bed is sandy in part, rocks rise out of the water. The banks are thickly covered with trees (Pandanaus sp.) whose roots are secured in the sand. Many hiding places are found amid the stiff roots and hollow Pandanaus stems.

In 1970 Bustard published an illustration of the habitat of V.mertensi. It deals with a so-called bilabong, i.e. The un-dried out area of the course of a stream, in which water is normally stationary, and only flows after a heavy rainfall. The banks are covered in great Eucalyptus, and are overgrown with grass. In this respect it is very similar to the holotype at Mt. Isa, described above, but the areas of reeds are not present. In 1974 Cogger and Lindner found V.mertensi in a great flat pond, with grass and Pandaus growing around it.

Temperature and humidity was ascertained near Mt. Isa. At the time, on 16 and 17 June 1976, it was winter. At a distance of approx 30m. from the basking areas of the monitors, the temperature was taken at a height of 1 metre (with a mimimum/maximum thermometer). The humidity was measured in the same place with a simple hygrometer (table 2). The highest temperature during the two days was 28oC in the sun, lowest was 12oC at night. The temperature of the water in which the monitors were seen swimming was 17oC, at a depth of 20cm below the surface 17.5oC. The body temperature of a V.mertensi, caught fresh in the water was 18oC. It therefore lay only slightly above the water temperature. The animal gave the impression of being very versatile, while basking temperature in the sun was 21.5oC.

Explanation of table 2.
These exemplary measurements should be supplemented by some general climatic information. The highest average temperatures in the biotype of V.mertensi prevail in December and January, the lowest in June, July and August. From July to September the slightest fall is noticed, the greatest in January and February. Seasonal climatic differences are distinct here. Effects on the seasonal activity rythm and reproduction cycle of the monitors are to be expected, but there is no further knowledge on this.

Other types of monitors live in the vicinity of the described habitats, in Mt. Isa V.gouldii, V.glebopalma and V.acanthurus, and on the Katherine River V.gouldii and V.mitchelli.

Behaviour.
Complete statements about activity during the day are lacking. During the winter months V.mertensi is found from early morning to midday in the sun. It is probable that most of these lizards subsequently go to the areas of high reeds in search of food.

The specimen in the terrarium is exclusively active during the day. Its activity is often interrupted by long periods of rest.

Locomotion.
We have not noticed differences from other known monitor in regard to locomotion on firm ground. V.mertensi is able to run very quickly, lateral body movement is marked. They have not been observed in a bipedal stance, as has V.gouldii, for example.

In water the lizards move in two ways. According to the observations of Swanson (1976:50), it can stride in a normal four legged manner in the water, and can remain below the surface for long periods. The specimen kept in a terrarium showed similar behaviour, by hunting for fish in the water bowl. We have often observed V.mertensi diving and swimming in the wild. When swimming in deep water only the head is above the surface (picture 3 clarifies the swimming movements). Whilst swimming in open water the front and hind legs are held next to the body, The legs are used only when swimming in shallow water, or amongst dense water plants.

V.mertensi is able to climb up vertical reed stalks. In contrast to V.varius, we have not seen them on sloping tree trunks.

Rest Behaviour.
One must discriminate between places where the monitors bask in the sun, and those where they merely rest during bad weather, or in order to hide. Several different basking places are used. As may be seen in picture 4, they use the rocky areas in and at the edge of the water. Bales of roots of caved in reed plants are sought for sunbathing at Mt. Isa, often in the manner that only the body lies on them, while the tail hangs into the water (picture 5). In all cases mentioned so far the body had a more or less horizontal position. V.mertensi may also rest in a vertical position, with the head upwards. One morning in Mt. Isa up to 12 water monitors

basked on a stretch of about 50m. in length at the same time. It is not often that two animals are found in the same place, or have any bodily contact. In two places we were able to observe conflicts over obviously favourable resting places, each time the new arrival pushed aside the resident. On climbing out of the water, the approaching lizard inflated its neck, so that the yellow underside was clearly visible, and then moved towards the other. Only on being touched did the original lizard flee. In some rare cases we saw two lizards lying next to each other for long periods.

In the open we did not find any of the hiding places into which V.mertensi withdraws. In 1970 Bustard notes that they hide in hollow tree trunks, of which there was no lack in both examined biotopes. In the third there were numerous rocky crevices. In 1976 Swanson mentions that during warm nights they can be seen sleeping on tree trunks, which offer no protection from view.

In the terrarium a hollow space is sought out, under the tree stumps. There the water lizard rests curled up on its side, or it sleeps stretched out in the water bowl, with its head resting on the edge of the bowl.

Feeding.
What V.mertensi eats in the wild has not been established, either by observation nor examinations of stomach contents. However its appearance by and in the water make it possible to guess. In the habitat at Mt. Isa live small water dragons (Physignathus sp.), little rainbowfishes (Melanotaenia sp.), freshwater crabs of about 10cm in length and great water insects which could be seen as food for V.mertensi of all ages. A rail (Rallus philippensis) which was cleaning itself in the direct vicinity of the water monitors, and was looking for food, was ignored by the lizards, and showed no shyness with them. Thus it is unlikely that they are preyed upon.

The captive specimen catches living fresh water fishes, and in doing so shows typical characteristic hunting behaviour. The fish are persued for minutes underwater, with a slightly open mouth, open eyes and a succession of swift movements of the tongue. Eventually they are seized, usually by the upper half of the body, by a quick thrust of the head. The captured fish is raised above the water level, and after a few movements of the jaw, which change the fishes position in the mouth only insignificantly, is swallowed, usually head first. In doing so the lizard raises itself up on its front legs. The swallowing of a fish that is caught by the tail obviously brings difficulties.

Another method of hunting consists of the monitor standing with the front of its body raised up in the water bowl, scouting for prey. With half open jaws the prey fish is seized from above and swallowed as described previously.

Mice are seized on suitable spots, and are devoured whole, head first. They were not observed to tear their prey apart, as has been observed with V.komodoensis, for example.

Escape behaviour and defence.
Escape behaviour in the wild depends very much on the particular situation, and the manner of the disturbance. Fleeing from comrades of the same species, the monitor can withdraw quickly into thick vegetation. In the case of sudden, strong disturbances from humans, they spring noisily from where they are basking into the water, and dive away. Water monitors are able to stay underwater for a long time, or else they rise to the surface after a few seconds and swim away with only the head above the water. If a V.mertensi notices a person some distance away, it will usually slide slowly and silently into the water and dive away.

In 1970 Peters reported that the water monitors cultivated by him were tame immediately after their arrival. However the animal we kept behaved in a completely unfriendly manner. Even some time after its arrival it threatened anyone who approached too closely with a slightly bent head, powerfully inflated throat, exhibiting the yellow underside, a tail that was only slightly curled up and ready to strike and made a loud hiss. If one tried to open the terrarium the animal would try to bite, or strike with the tail. One occasionally had the impression that the attack was not serious, and was only for exhibition. The succession and heightening of the threat or attack behaviour is interesting. The lizard begins to dart its tongue in and out, hisses and inflates the half yellow neck region, unrolls its tail to the side, strikes with the tail or bites. The yellow on the neck is obviously a warning sign, which has meaning both to comrades of the same genus and enemies alike.

Posture.
On obtaining the water monitor, which was a male, it was subjected to quarantine, which, due to the fact that it accepted food well, consisted in giving him a broad-spectrum vermicide (Telamin Firma Janssen Dusseldorf) in doses of 70mg per day, on five consecutive days. At this point the lizard weighed 1.5kg. After 14 days the same treatment was repeated. Several examinations of the faeces showed that the animal was free from parasites. Now the animal was transferred to a 200 X 80 X 100cm enclosure. The floor consisted of an aluminium bath, 20 cm in height, so that the animal can splash water out of its water bowl. About a third of the floor is covered in a mixture of leafmould and peat, a third with grit, on which the waterbowl stands on a 60W heating cable. The grit helps stop water reaching the leafmould and peat. A powerful, weather worn stump of an oak tree, and a heavy double branch of Robina about 3 metres in length complete the furnishings. The lizard dug a burrow under the tree stump to sleep in. The terrarium is lit with a 120 cm. flourescent tube and a 150W. spotlight, under which the animal likes to bask. The lights come on at 0715hrs. and go off at 1700hrs.

The water is kept at a constant 26-30oC, and the air temperature lies on average between 24 - 26oC. 37cm under the spotlight is a basking spot warmed to 36-38oC.

Preferred food is fish, especially those about 10-16cm in length and weighing 10-40 grammes. 6-8 of the smallest fish can be aten one after the other before interest dwindles. A fish almost 30cm long was killed but not eaten. Either the lizard was full, or the fish was too long. Other animals for food are mice, which cannot be too large as the lizard obviously has difficuly in swallowing even the smallest ones. It was obviously not used to eating them, and they were

accepted with hesitancy. After having been accepted however, it was seized like a flash of lightening and swallowed, usually head first, regardless of whether the mouse was on the floor of the terrarium or on the branches. V.mertensi had trouble with frogs (Rana temporalia), other lizards were hardly noticed. Especially important food are dead chicks (so far sparrows have not been accepted), for these contain valuable vitamins and trace elements. Thus deficencies which cause the peeling of skin can be stopped in the early stages with doses of 0.5 - 1g of Miragest (Hefa-Frenon. Werne), or with vitamin salts (vaccine works, Friesoythe).

Breeding.

Previously very little has been known of the breeding of V.mertensi. There are several reports of newly captured animals laying eggs (Kratzer 1973, Peters 1969, 1971a). Bustard (1970) reports of a specimen that laid three lots of eggs in four years. Of the first batch 3 out of 14 were deformed, then 3 out of 13 and 2 out of 10. Unfortunately yearly statements and comments on whether the eggs hatched or not are missing. Hence the description by Brotzler (1965) is of particular significance. The parent animals were acquired in 1961 and 1963, their measurements have been given previously. In January 1964 the female laid eggs for the first time which were as big as hens' eggs. They failed to develop and died. Exactly one year later, 6.1.65 13 eggs were laid, of which 7 were deformed. Gestation period was between 182 days and (7.7.65) and 217 days (11.8.65). The following weights and measurements were given for four of the hatchlings: 27cm, 27.9g; 25.2cm, 23.7g; 26.5cm, 23.6g; 27cm, 27.7g. The incubator in which the eggs hatched quickest contained sphagnum moss, at a temperature of 29oC. The other was a mixture of sand and peat at a temperature of 30oC. After 5-6 days the hatchlings began to eat little fish, crickets and young mice painted with egg yolk. After 34 days the first hatchling weighed 44.5g, and was 31cm long. On 10.8.65 the other animals had the following measurements: 30cm, 34.5g; 28.5cm, 33.6g; 30cm, 37g. Unfortunately we do not know whether copulation was observed, or how long it took from copulation to the laying of eggs.

Beobachtungen bei der Pflege und Nachzucht von Varanus (Odatria) t. timorensis

The Habitat of Varanus timorensis timorensis.

Erwin Schmutz & Hans-Georg Horn. Salamandra 1986 22(2/3):147-156.

Translated by M. J. Bennett.

Introduction.

The Timor monitor was the commonest small monitor imported into Germany. It can be regarded as well researched (MERTENS 1942, 1959) and was often kept by amateur herpetologists as well as zoos. The first written account of breeding (2 specimens) is by BHERMANN (1981), who succeeded in rearing the animals, About the same time breeding occured in an American zoo (ANON 1981, Belcher personal communication), and recently a (second generation?) was reported (EIDENMULLER 1986). It is amazing that there is no description in the literature of this monitor's habitat, so that anyone concerned with this species can come to some reasonable assessment of its habitat and the conditions in which to keep it in comparison with some Australian monitors. So, in what follows, advice about ideal conditions to keep them in will be given based on observations in the wild, and, in addition a brief summary of the geological evolution of Timor, the climatic conditions and the emergence of present day vegetation.

Geology, climate and vegetation on Timor.

The Indonesian island of Timor, of which the eastern part used to belong to Portugal, lies west of New Guinea and east of the Indonesian islands of Sumba and Flores. The geology seems to belong to the so-called outer mountain range of the tertiary Sunda system (Ormeling 1956) rising out of two deep sea trenches (Savu & Timor Seas) surrounding Timor and the neighbouring islands; Savu, Roti and Seman. This means that the accessible rock formations are generally much older than those of the inner range, and the fertile range of the said island rests on obviously more recent volcanic events. Alongside older volcanic rocks (Perm), crystalline slate (!) which comprisises the whole mountain range on Timor presumably belongs to the oldest rock formation (Timor range) e.g. Miumafo Berge (1397m), Molo (1635m) or Mutis (2427m). Nowadays it is assumed that the formation of the mountains came to an end in the tertiary period, followed by severe sinking and levelling of the surface along the length of Timor. From this period are derived the beginning of marine sedimentary deposits, particularly of chalk and marl, flooded by the sea in Pliocene & Pleistocene. Afterwards there occured a strong uplift in Timor, so that reefs of chalk were found in
various peaks (Ormeling 1956). Subsequent erosion brought these horizons to the surface again. In many places the coast falls away steeply, although in some parts (alluvial mangrove swamps) are regularly flooded and result in areas of brackish water; the consequence is a strongly contoured outline.

The climate of the island was substantially stabilised in clean-cut wet and dry periods, probably of different duration. It conforms to a typical pattern of monsoon climate, where the west and east monsoons alternate, so that the west monsoon goes with the wet season and the east with the dry. The change comes in the month of April (beginning of the dry season) and October (beginning of wet season) when the winds change direction. Timor lies between the warm wet climate of Indonesia and the hot dry climate of central Australia. In the season of the east monsoon it can be unpleasantly cold at night and in the mornings. In different seasons strong whirlswinds can have disasterous effects, not only on human habitations but also on the vegetation and the habitat of animals. (Ormeling 1956).

An impression of the climatic conditions, and particularly of the tropical rains so essential to the land is presented by the data in tables 1& 2, from two weather stations on Timor, namely Kupang at the southwest end of the island, and Dili on the northwest coast (Muller 1983). Details of the climate of Timor can provide advice about the rearing and breeding of Timor monitors.

The following remarks are relevant to the vegetation of Timor, important for the occurence of the Timor monitor, a semi-arboreal species. In the opinion of various botanists the earliest vegetation of Timor at an altitude of less than 1000m was predominantly what is called monsoon forest, whilst even today at altitudes in excess of 1000m mountain forest persists, for the most part consisting of evergreens. Among the later are predominatly species of Eucalyptus, the biggest and commonest being E.urophylla, and tropical conifers. Similarly common and worthy of mention is Podocarpus species, Dacrycarpus imbricatus (formerly Podocarpus imbricatus) which is not much smaller than E.urophylla.

Today the monsoon forest has almost entirely disappeared through the influx of people (e.g. through Brandrodung), and has given way to a vestigal tree-savannah, lightly wooded savannah. Palms, Eucalypts and Acacias are characteristic of different parts of this savannah (see fig.1). Typical of these savannah sorts are giant palms Corypha gebanga (Gebanga palm) and Borassus flabellifer (Palmyra or Lontar palm), the Australian Eucalyptus alba and Acacia leucophloea. Also worth mentioning is the clustering species Lantana camara L. which since its introduction has taken over large areas of the countryside.

Field observations of V.timorensis

V.timorensis is limited to the islands of Timor, Samao (now Seman), Roti and Sawu (Mertens 1942, 1959, Brandenberg unpbl.). Comparing Merten's accounts of where it is found, we see that most accounts of sighting places in Timor refer to locations with an altitude of between 0-50m on the coast, e.g. Kupang and Pritti in Kupang Bay, both places on the extreme southwestern coast, Atapupu west of the midpoint on the north coast; Vila de Liquica and Maubara east of the midpoint on the north coast. All the more interesting are two places inland, namely Soe, situated in the southwest of the island at about 800m, and at Nikiniki which lies at 670m. Most of these provinces are in the western half of Timor, while we have less information about the eastern part.

Our observations of Timor monitors lead to the area of Tulu, a settlement near Kupang. The ground in this area is thick with innumerable lumps and chunks of coral limestone (see acompanying snapshot) which provide perfect breeding chambers for insects and small animals like the monitors, because of the availability of nook and crannies to breed in. Walls around gardens and dwellings were almost exclusively built of such coral limestone, which gives additional hiding places (fig 2). Thanks to these, and the disposition of the climate, but more likely because of the small number of its downright enemies, the Timor monitor is often to be seen in the sunshine on such walls. Occasionally a very poisonous spider lurks in the chinks and cavities of the stones, and on turning the stones over one finds an abundance of small insects such as ants and termites, which explains the occurence of a blind snake

(presumably Typhlops braminus). Countless remains of snail-shells indicate a large population of snails, including an introduced species of the great or wine snail, but with an elongated shell. The chain viper also occurs here (Vipera russeli) but nothing was to be found out about the Timor python (Python timorensis).

So far examinations of the stomach contents of V.timorensis have not been carried out, so this matter is reduced to speculation. From a native was heard the remark that they eat small snakes, so that one is reminded of the little Typhlops braminus mentioned earlier. But we must consider the plentiful supply of termites and geckoes (e.g. Gehyra multilata and Hemidactylus frenatus) and that these other creatures, because of their noctural appearance, hardly come into the question as prey for the diurnal monitor. One would rather expect skinks as prey animals, e.g. the diurnal Mabuya multifasciata (widely distributed in Indonesia), or crickets and grasshoppers. research at Tulu showed that in September (during the dry season) at 1100 hrs, when the sun is already very hot, not a single lizard was seen sunning itself on the rocks, although this was the time the villagers said was best to begin observing them. Obviously it was already too hot. Nearby a well hidden adult specimen was found under a dried up lontar palm leaf. As a couple of plants which obscured it from view were pushed aside the lizard ran up a tree (fig 3) and took refuge on the hidden side of the trunk. Meanwhile some schoolchildren who had come along rushed to that side of the tree and the lizard let itself slide to the ground and sought refuge in the stump of a lontar palm (fig.4). While the lizard was climbing about in this stump it presented a sudden glimpse, with the front part of its body vertical to the trunk, and then disappeared over the edge inside the trunk. By getting closer, just the extreme tip of the tail was visible in a crack in the palm stump. This could be the first recorded contact in the field with the Timor monitor.

Additional information.
This lizard is also frequently found on the coast of the island of Roti, where it sits on fences sunning itself, so that it can easily be caught by hand. Measurements of a captive specimen; overall length 52cm, of which 31cm was tail.

From: The Reptiles of Turkmenistan. p.144-150: Varanus griseus caspius (Eichwald 1831).

S. Shammakov. 1981. Acad. Nauk. Turkmen. SSR., Ashkabad. pp 312 .

Translated by Maria Shimanskaya and Daniel Bennett.

Size and Weight.
Body length of males (n=19) was 290-585mm (Mean 442.6 +\-17.5), in females (n=19) 250-460mm (mean 402.5 +\-10.3). Tail length in males was 407-815mm (mean 568.4 +\-23.2), in females 340-625mm (mean 534.7 +\-25.1). In both sexes the tail is 130% of the snout vent length (in males 125.8mm longer, in females 132.2mm). Weight of males was 250-2850g (mean 1188.9 +\-141.5), females 480-2700g (mean 1148.9 +\-121.3). Body length of young monitors

caught in May, September and October ranged between 125-270mm, tail length 165-390mm, weight 21-500g.

Distribution.
The grey monitor is widespread in all parts of Turkmenistan except the upper belt of mountains (fig. 32).

Habitat.
The biotope of the grey monitor in Turkmenistan (KARATASHEV 1955, RUSTANOV 1956, BOGDANOV 1962, SHAMMAKOV 1968, 1968, ATAYEV 1969) is clayey and sandy deserts, precipices on river banks, tugai of tamarisk (Tamarix), ruins of ancient buildings, foothills and highland steppe. In its search for food the lizards wil also enter irrigated areas. We found specimens on 12 June 1962 10km north of Geok-Tepe settlement, a cabbage-growing area. At Malyi Balhan the vertical limit of the monitors' distribution is 400m above sea level; on Kopet Dag 800m (ATAYEV 1969).

Behaviour and Shelters.
In an emergency the monitors speed over short distances (100-150m) reaches 15-20km per hour (RUSTANOV 1956). When cornered it stops, raises and inflates its body, hisses loudly with the mouth wide open and the tongue protruding. Sometimes they strike with the tail. When hunting the monitors mass in colonies of the great gerbil (Rhombomys opimus) and visit roads where prey is easily obtainable. According to our observations the lizards will inhabit the burrows of both the great and Midday (Meriones meredianus) gerbils, and also cracks in old wattle and daub houses. The monitor readily visit reservoirs to drink.

Population Densities.
According to our investigations and information in the literature (RUSTAMOV 1956, BOGDANOV 1962) in central and eastern Kara-Kum, Badhiz and Karabil, 2-3 specimens can be encountered in a day, but in other places, especially in northwestern Turkmenistan, numbers are low. For example, in the neighbourhood of the Kirpili Well (200km north of Baharden settlement) 3 monitors were encountered over three 5-6 hour excursions (on 16, 19 and 14 of May 1964) around colonies of the great gerbil (R.opimus). On 11 June 1967, 12km north of Geok-Tepe settlement 4 monitors were encountered. Identical numbers were found in April and may 1966-1972 near Porsykuyu well, north of Gyaurs station, close to Yagbil and Sultanoyuk wells and in the territories between Iolotan and Karametniyaz settlements and also between Karametniyaz and Nichka settlement. Within the same period, in the clayey desert of Chatskaya plain, between Malyi Balhan and Kyurendag ranges, it was possible to see only a single monitor in 8-10 days of searching.

Moulting.
In Varanus griseus moulting begins before the end of hibernation. The first monitor we observed after the cold winter of 1969, on 27 April was moulting. From April to June 1959-1969 moulting monitors were caught in Chataskaya Plain between Malyi Balhan and Kyurendag ranges, in the foothills of Kopetdag, in central Kara-Kum and in Karabil. In April 76.9% of

monitors found were moulting (n=13), in May 14.4% (n=14), in June 14.3% (n=7) and in October 66.6% (n=3). It is likely that the grey monitor moults three times each year (BOGDANOV 1962, 1965, SHAMMAKOV 1968, SAID-ALIYEV 1979).

Diurnal Activity.
According to our observations grey monitors spend 9-10 hours on the surface in April, but can often be seen most commonly between 1000 and 1300 hrs (fig 33). On 4 April 1959 the first monitor (of the year) was seen at 0922 hrs. at air temperature of 18 C near Kyrkiyuyk well. Near Poryskuiu well an active monitor was seen at 1900 hrs. In May the monitors spend 11-12 hours on the surface, agreeing well with radiotelematric investigations of impellant activity of this species (SOKOLOV ET AL 1975). Near Kirpyly well the lizards left their burrows at 0730 and the latest active monitor was registered at 1900. During this month the rise and decrease in the monitors activity is marked.The first peak of activity is from 1000 until 1300, the second from 1700 until 1900, between these periods the monitors retreat to the shade of their burrows. On the northern slope of Kiurendag, not far from the Danata settlement an active monitor was seen at an air temperature of 36 C. It was the highest temperature recorded for an active lizard. According to our observations and those of BOGDANOV (1962) monitors are active only early in the morning (0700-1000) and late in the afternoon (1700-2000) from June until August. In cool or cloudy weather they are also active in the middle of the day (RUSTANEV 1956). According to our observations in the southeast of Turkmenistan (SOKOLOV ET AL 1975) the monitors' period of activity decreases in September to 7-8 hours. In September - October we met them between 1200-1600 hrs.

The earliest specimen we recorded was found not far from Kurtlinskaye Lake to the north of Ashkabad on 3 March 1977, when air temperature reached 29-30 C in the middle of the day. Usually Varanus griseus emerges from hibernation at the beginning of April according to our observations and those of BOGDANOV (1962); for example, near Yagbil well, on 4 April 1959, and 22km southeast of Tedjen settlement on 6 April 1966. The winter of 1968/69 was unusually cold, and because of this the monitors left their shelters considerably later. Near Sharlauk settlement in the west of the republic the first lizard appeared on 27 April 1969.

The monitors commence hibernation earler than other lizards, and from the middle of September they are very rare. For example, of 73 monitors registered between 1956-1979 only 2 were caught in September. The latest monitor recorded by us was active near Kizipily well on 6 October 1964 (air temperature was 17 C).

Reproduction.
According to data in the literature the grey monitor reaches sexual maturity after three years (PARASKIV 1956, BANNIKOV et al 1977). According to our data sex ratio in this species is 1:1. There were 9-12 yellow follicles (weight 17-147g, diameter 12-28mm) in females (SVL 400-415mm) caught on 24 May 1964 and 11 July 1967 near Kiripily well and north of the Geok-Tepe settlement. On 11 June 1955 a female was caught in Badhiz that contained 21 eggs ready to be laid (RUSTAMOV 1956). Size and weight of (testes) of males caught in afore-mentioned areas

in 1964-1967 reached 12 X 16mm, weight 1g (n=1) in April, 14-15 X 23-30mm, weight 5g (n=2) in May, 14-15 X 20-25mm, weight 3-6g in June, 9 X 20mm, weight 1.5g in July.

Diet.
The stomach contents of 10 road-killed monitors, and stomach contents of 12 live specimens removed by "bloodless" method were examined between 1956 and 1979. According to the results (table 39) tenebrionid beetles and lepidopteran were the predominant prey. An important role in the diet of V.griseus is played by young Horsefield's tortoise (Agrionomys horsefieldi) and lizards, which were found in 36.2% of stomachs, also rodents (13.6%) and solpugida (9.1%). In Turkmenistan the diet of monitor lizards also includes insects, green toads, 10 species of lizards, 6 species of snakes, 4 species of birds and their eggs and 6 species of rodents and insectivorous mammals.

Enemies.
In Badhiz and Pulghatumskaya Grove grey monitors were found in the nests of black kites and grey vultures (SUHININ 1958, 1971) and in the nests of serpent eagles close to Madau settlement. Remains of monitors were found 12 times in fox excrement from Karabil and Obruchiovskaya steppe in 1959-1962. Monitors in search of food die under the wheels of cars in Badhiz, Karabil and other places (KOLODENKO & NURGELDIYEV 1977: ATAVEY ET AL 1978).

Hibernation.
5km from Dushak station two monitors were found in a torpid condition in burrows 60-75cm deep on 21 October 1967. In one burrow two specimens of A.horsefieldi were found 45cm deep.

Figure 33. Activity of Varanus griseus: 1-April (according to the results of 25 excursions), 2-May (18 excursions), 3-June July (10 excursions).

X=hours Y=number of sightings.

Figure 39. Stomach contents of Varanus griseus (22 stomachs; April-July 1956, 1960-61, 1964-67, 1970-71 and 1978).

| FOOD | FREQUENCY(%) | QUANTITY | |
|---|---|---|---|
| | | No of Specimens | % |

A Case of Intoxification from the Bite of Varanus griseus.

O. Sopiev, V. M. Makeyev, S. V. Krudrjstev, A. N. Makarov.

Turkmenistan Academy of Science 1987. 598 112:615.

A summary translated by Marina.

There are claims that the bite of Varanus griseus can be toxic, another explanation is that similar symptons are psycologically induced by trauma brought on by secondary inflamation and/or bleeding. In the authors' opinion this case proves that the bite of V.griseus is indeed toxic. Whilst a young male monitor (weighing 900g and measuring 400mm SVL (550mm in total)) was being captured it bit the subject on the middle finger of the right hand. The animal grasped the finger and tried to chew on it, as is normal for this species, moving his head from side to side. No attempt was made to free the finger, the monitor dropped it of his own accord after 60 seconds. Deep bite wounds had been caused just behind the nail. The bleeding was not significant and was treated with iodine at at strength of 5%. 30 minutes later the first sign of intoxification appeared; muscular weakness, dizziness and a lack of appetite. He had aches and pains in all muscles, most noticably in the bottom of the mouth cavity and when swallowing. He had some difficulty breathing through the mouth and there was no oedema of the soft pallet, although he could breath normally through his nose. The patient also experienced pain in the eyes. 30 minutes later there was pain in the lymphonodae in the right elbow and armpit, pulse increased to 104 (normally 60-70). The pulse rate dropped to 90 then returned to 104. The symptoms persisted until the evening when they diminished and the patients general condition improved. The next morning he had just a general weakness and sleepiness, within four days the wound had healed. The authors are of the opinion that the bite alone was responsible for these symptoms.

An Unexpected New Generation in a Terrarium: Varanus (Odatria) storri.

Eduard Stirnberg & Hans-George Horn. Salamandra 1981 17 1/2:55-62

Translated by Jens Labohme and Daniel Bennett.

To breed Varanids in captivity, or even to make them lay eggs, is still the exception rather than the rule. In the International Zoo Yearbook (table 1) only the number of hatchlings is given, without mentioning how the parents were kept and the circumstances under which eggs were laid successfully. It is not even known whether these hatchlings are truly captive bred, or whether the eggs were laid by a gravid female that had mated in the wild.
Some facts about the laying of eggs and hatching of Varanids can be found in HORN (1978), which includes observations of Varanus storri and above all with an unexpected breeding, and the circumstances surrounding it.

General Details.
V. storri is a small Varanid which was described by Mertens (1966). Its average length is 32-34 cm, but occasionally a total length of 44 cm can be reached (PETERS 1969, 1973). Its distribution is limited to the southern part of north Queensland (COGGER 1979, PETERS

1973), eastern and western Charters Towers where it lives in areas of sparse arid woodland in small self dug burrows under scattered rockpiles (see pictures 1-2). The soil is loamy with thin plant growth , trees can be absent or dead (PETERS 1973). Its food probably consists of insects (grasshoppers, locusts, crickets and spiders) as well as occasional geckoes (Heteronatia binoli (PETERS 1973)) and young agamas (Diporiphora australis).
As with many other, but not all kinds of Varanids, sex ratios have been found to be in favour of males (2:1 (PETERS 1973)).

The closest relative of this monitor, judging by appearance, is V. acanthurus primordius, although the relationships have not been completely cleared up (MERTENS 1958, 1963. STORR 1966). This monitor is possibly slightly smaller and has a less spinose tail than V. storri. In addition it has different scalation and a skull that appears to be flatter.

MERTENS (1942) described the location of V. storri as "north Australia". STORR (1966) was more precise. He found two specimens at Adelaide River south of Darwin, and thus Mertens desribed it as a new species.

Two other species with spiny tails exist apart from V. storri, but V. primordius appears similar to the western representatives of V. storri, to the not particularly attentive observer.

Behaviour.
It can be observed that various species of Varanus flatten out if a hand is placed on their back. Deviant behaviour can be observed in V. storri. If they are stroked over the back with two fingers they lift themselves up and arch the back and tail, as can be seen with some geckoes in a threat pose (picture 3). This course of events is repeatable. The explanation for this behaviour is unknown. During several years of keeping V. storri we have never observed ritual fighting as described for V.gilleni (MURPHY & MITCHELL 1974, CARPENTER ET AL 1976): both animals try to bite each others forelegs, sides and tails at random. If they are not separated they can seriously injure each other, losing a leg for example. Occasionally the following can happen;
The specimen that is attacked flattens its back towards the attacker (picture 4). The attacker stops fighting for a moment, and then the fight resumes again. Obviously this behaviour is a display pattern in which the animal tries to make itself look bigger. The same behaviour has been observed in a small V. storri when confronted with a Tiliqua multifasciata.

The Terrarium.
The enclosure in which a pair of V. storri were kept measured 70X80X75 cm. The observer standing in front of the terrarium sees a back wall which consists of rough semicircular stones. Substrate is a layer of loam 10cm deep, which contains an electric heating wire. Several rocks and one knotty branch are provided. Two bulbs (each 100W) are situated 75 cm above the ground. They are 45cm apart, and 40 and 50cm from the front window. Some additional daylight is received through a window which is fitted into the roof of the reptile house. The humidity, measured 15cm above the loam is 60-65%, it is not sprayed with water. Because the ground temperature seemed to be the most crucial factor in breeding the animals we made a

map of the distribution of temperature. We used an ordinary quicksilver thermometer stuck 1cm into the loam. It was shown that the temperature did not fall below 30oC anywhere in the terrarium, which would not have been attainable by using only the two light bulbs.

Breeding.

We repeatedly found eggs of V. storri in a provisional container which we had placed in the terrarium. We discovered one egg on 24.6.73. and another on 26.6.73. They were both infertile. On 9.7.73 we discovered another egg, obviously too late, because it was strongly sunken. Average length was 23mm, width 10mm.

On the 8.3.75 we discovered one egg, two more on 1.12.77 and another the next day. They were all infertile. Therefore, we presume that average clutch size is between 3 and 4 eggs.

The size of the eggs appeared considerable compared to the size of the monitors. It seems from this that V. storri lays eggs throughout the year. In addition to this, compare MUDRACK's (1969) description of four eggs laid by V. storri on 17.11.68.

The parent animals with which we were eventually succesful in breeding a new generation, had a total length of 29.5 (female) and 21.5 (male with incomplete tail). We obtained them on 23.3.75. They were fed house crickets, crickets, grasshoppers and young mice. The insects were dusted with mineral salt and vitamin powder, and the drinking water contained approx. one pinch of Euravit to 150ml. These animals also layed infertile eggs in the terrarium described previously. Occasionally copulations and attempted copulations were observed which we did not attatch importance to.

On 29.4.80 we discovered a tiny monitor sitting on a stone in the parents enclosure (photo 6). We looked for egg shell, more eggs and hatchlings but found nothing. Judging by the appearance of the monitor it had hatched the same day, or the day before.

On 2.5.80 it weighed 2.1 grammes, snout-vent length was 5.4cm, and the tail was 6.5 cm = total length 12.3cm. The proportion of tail to body and head was 1:1.28. These measurements are similar to those of a V. gilleni (HORN 1978). The young animal developed well with the help of a diet consisting of small house crickets, moths and their larvae. The drinking water contained vitamins as described previously. Three months after hatching (1.8.80) it weighed 18.1 grammes, snout-vent length was 9.1cm., tail 13.2cm. This means that the proportion between head and body and tail was now 1:1.45. This proportion corresponds to the paratypes, which are between 1:1.42 and 1:1.46. The tail is relatively short in hatchlings, making the most of the space in the egg.

Conclusions.

It seems to be possible, under the described conditions, to breed V. storri in the terrarium. The success of this breeding is seen in the fact that it happened under "natural" conditions (there were probably more hatchlings that were eaten by the parents). It seems crucial that the temperature of the substrate was similar to ground temperatures in an Australian summer. It also seems important that the terrarium was only occupied by a single pair of monitors.

Varanenkweek in het Noorderdierenpark to Emmen.

Breeding Varanus exanthematicus albigularis.

J.J. Van Duinen. Lacerta 1983 42 (1):12-14.

Translated by Claudia Van Dam and Daniel Bennett.

In January 1985 five Varanus exanthematicus albigularis adults were imported into the Netherlands. they were very skinny and nervous. After a few months they adjusted to captive conditions and could be hand fed with day old chicks, and "carnicon". They also eat fish, meat, mice and rats.

Very soon they laid eggs which quickly rotted. They were put on plastic trays on wet soil in an incubator. Eggs from Nile monitors were also laid but eaten. On 9.10.81 22 eggs were laid and incubated as above at 30oC. After two months a dry egg was opened which contained a 2cm long living embryo. After two more months another egg was opened which contained an almost fully developed animal which died after a day. On 10.2.82 four unfertilised eggs were opened. On 1.3.82 three more eggs discoloured and were opened, two of which contained nearly fully developed dead youngsters whilst the third contained a living neonate. It was put back into the incubator for two days and although everybody thought that it would die it developed quickly. On 3.3.82, after 146 days, one egg hatched. The hatchling still had a very large yolk sac. The next day the umbilical cord was severed and bound. The wound was treated with (disinfectant) dermatol. After another day the cord had shriveled and the animal was very lively, but the next morning it was paralysed and died later in the day.

The next youngsters hatched without complications. The yolk dried and fell off after a few days. The hatchlings lived, indicating that it is best to leave the animals alone. From the 3 to 25 of March another seven eggs hatched. The remaining eggs were opened and contained one living animal and fully developed dead embryos. On 19.3.82 the animal born on the 13th died and on 25.3.82 the one born on the 17th also died. Postmortem showed necrosis of the kidneys (nieren). The incubation time of the clutch varied from 146-167 days. Of 22 eggs four were infertile, seven died in the shell, two were opened prematurely and nine hatched of their own accord. Of these three died in the first few weeks. The six others developed very well and after a year they were half the size of the parents. About a week after hatching the youngsters ate newborn miice and crickets.

On 20.6.82 15 more eggs were laid which were incubated in the same way at 29-30oC. In the first few weeks two eggs that were probably unfertilised rotted. On 3.11.82 six babies hatched, two more on 6.11.82 and one more on both the 7th and 8th 11.82. The other three eggs contained well developed dead embryos. Of the 10 youngsters one died on 23.12.82. This animal did not want to eat from the start and was destroyed because it showed severe curvature of the spine. The incubation period of these eggs was from 138-143 days. On 16.9.82 35 more eggs were laid, and another clutch of 40 eggs were laid by another female on 20.9,.82. Of the 75 eggs a few proved infertile or died without hatching, but 50 youngsters hatched, of which four died

in the first week. Many of the youngsters had big yolk sacs attatched to their stomachs. These dried up and dropped off without complication after hatching. If the yolk sacs are dry they are put in a cat litter tray with a mesh bottom. The eggs of 16.9.82 hatched between 2.2.83 and 16.3.83. The eggs of 20.9.82 hatched between 9.2.83 and 15.3.83 = 152-176 days. The incubation temperatures were not very constant and dropped below 29oC for a few days, which explains the long incubation period.

A few days before egg laying the female starts digging. The encosure has not got deep soil. The eggs are usually laid in the evenings or nights, sometimes during the day, in which case the other animals devour them. They try to refill their egg holes and for a day try to rake debris over the mound, even if the eggs have been removed. Removal of the eggs does not affect the behaviour.

Housing.
The animals are kept in a 10 X 5 metre enclosure with ground heating and reflector lights for basking. The enclosure is in a tropical greenhouse where the temperature is 18oC or more, up to 33oC in the sun and probably hotter at the top of the enclosure, where they like to climb.

Food.
Mostly day old chicks with carnicol, dead rats and mice are used as food. The youngest animals get new born mice and do so well that they can soon move on to half grown ones. No vitamins nor minerals are provided, if day old chicks or mincemeat are used a lot of carnicon is added.

Etude Ecologique des Varanus griseus au Sahara-Nord-Occidental.

Study of the Ecology of Varanus griseus in the northwestern Sahara.

Roland Vernet. Bull.Soc.Herp.Fr. 1982 22:33-34.

Translated by Daniel Bennett.

The desert monitor Varanus griseus is found in all the Saharan biotopes, but it is clearly most abundant in the sandy and humid zones. The greater part of our studies were done in the heart of the wadis of Saoura and Great Western Sandhills, near to to palm groves of Beni-Abbes in Algeria. The population densities were three times greater in the wadis (6 per KM2) than in the sand dunes (2perKM2). The study looked at the way trophic relationships, competition for food and the pressure of lawful predation define the role of this species in each of the ecosystems and in the desert as a whole.

The yearly cycle of V.griseus is bimodal, with most activity from April to June. During hot periods 80% of individuals are more or less completely inactive, then. after a brief resumption in Autumn (especially the young individuals) they hibernate for five months (October-

March). Reproduction occurs during a lapse in the relative temperature from mid April to mid July. The home range of the monitor is vast, and the individuals almost always accomplish a change of place daily; the costs in terms of energy of a hunting journey have been recently valued by the measure of rate of renewal of water. The experience of capture-recapture programmes nevertheless, show that the annual change of place is only of slight amplitude. Finally, the study of thermoregulatory behaviour was carried out to allow some definition of the temperature scale of this species, and to compare it with other desert reptiles and to furnish an explanation of the distribution of individuals in the heart of the Saharan biotopes.

Notizen zur Brutbiologie des Gelbwarans Varanus (Empagusia) flavescens (HARDWICKE & GRAY, 1827) im Zoo Rotterdam.

Notes on the Reproductive Biology of Varanus (Empagusia) flavescens (Hardwicke and Gray 1827) in the Rotterdam Zoo.

Gerard Johannes Visser. Salamandra 1985 21 2/3: 161-168.

Translated by Jens Labohm and Daniel Bennett.

Introduction.
Varanus flavescens, the yellow monitor, is a relatively small, stockily built Varanid, with a total length of 1 metre. A description of it's behaviour can be found in Mertens (1942).
The general appearance of this Asian species reminds one strongly of V. exanthematicus from Africa. In fact, V. flavescens is the genotype of the subgenus Empagusia (Gray 1938). The exanthematicus subspecies belong to the same group. In Merten's opinion (1942, 1959a) V. flavescens was the original form within the subgenus. The opinion that V. flavescens and V.exanthematicus are representatives of this subgenus was contradicted recently by morphological investigations of the hemipenis (Bohme 1982, Branch 1982), which show that they do not belong to the same subgenus. Both authors corroborate their reports with the results of carylogical and biochemical reaserch which had been carried out by King and King (1975) and Holmes (1975).

Distributiom.
The area in which V. flavescens is found extends from Pakistan to Bengal in the east, Sind (Pakistan) represents the western border of distribution (Mertens 1959b). Specimens have also been found in the Indian province of Bihar and in Gordon Hill, India (Mertens 1959b), Kharagpur, west Bengal (Sights 1949), Putna (Bihar, India) and Parbatipur, Bengal (d'Abreu 1932).

Habitat.

Believed to be similar to that of V. exanthematicus. V.flavescens in regarded as a lizard of hot, dry areas. However Sights (1949) found a female specimen in a totally different biotype, which is described as follows;

SEE HERPETOLOGICA CHICAGO. 1949. 5(4):81-83.

This biotype of fields of rice, ponds, streams and rivers was quite the opposite of the habitat regarded as typical for the yellow monitor. For example, Rotter's (1963) opinion was that this Varanid lived in the same habitat as V. griseus and V,exanthematicus, but at the same time points out that they show some liking for water. Both specimens at the Rotterdam Zoo spend hours lying submerged in the water of their enclosure (Rotter mentions more examples of the same behaviour). This behaviour has never been observed in our two V. exanthematicus.
In the Thar desert of northwestern India, only V. bengalensis and V. griseus were found (Sharma 1981).Mertens refers to the V. griseus in this area as V. g. koniecznyi.
From these observations it can be concluded that very dry regions are not inhabited by V. flavescens, but only by V. bengalensis and V. griseus, and that the yellow monitor is more tied to water than was thought previously.

Diet, Housing and Observations in Captivity.
Very little is known about the yellow monitors' way of life in the wild, because detailed investigations are lacking. In general it can be assumed that its lifestyle is not very different from that of V. exanthematicus. The species is active exclusively during the day. Its periods of activity are often iterrupted by longer periods of rest. For example, in captivity one can see the monitors lying in the water for a couple of hours, with only their heads above the water. It is assumed that their food in the wild consists of insects, amphibians, reptiles, small birds and mammals, eggs and carrion. It can be assumed that if they live near water crustaceans and fish form part of the diet.

The pair at Rotterdam Zoo are housed in an enclosure 6X2.5X2.8 metres (length, width, height), with an observation window in one side. The floor is concrete covered with a layer of sand approx. 10 cm thick. This sand is changed 2 or 3 times a year. The enclosure is situated in an inner room in the reptile house. Two 250W heat lamps are used to provide basking areas and heat the terrarium. They are on between 0730 and 1800 hrs. There is a heated plate underneath the sand (1X.5metre) which provides additional warmth. Only two florescent tubes (60W) illuminate the enclosure. During the day temperature varies between 24-30oC, underneath the heat lamps the temperature reaches 45oC. At night the temperature drops to 20oC. A water container large enough to allow the animals to completely emerse themselves, some branches to climb on (which they have never been seen using) and some rocks under which they dig holes are provided, with some synthetic plants. They are fed twice a week on young rats, mice, chicks and a mixture of minced meat and eggs enriched with vitamins and minerals.
Shortly after the lights are switched on in the mornings the Varanids appear from their hiding places, and are active for about 30 minutes. Usually they walk around the enclosure and bask under the lamps, after which they rest more or less for a long time underneath or behind the

rocks, or in the water. In the afternoon there is often a second period of activity, usually between 1600 and 1630.

Reproductive Behaviour and Egg Laying.
We received our pair of yellow monitors on 28 August 1982. The previous owner stated that they were 3.5 years old and had been imported from the wild in 1979 as hatchlings. The previous owner had observed copulations, and eggs had been laid, but were eaten by the male. The first reproductive activity noticed in Rotterdam was on 20 June 1983. Actual copulation took place on 25 June and 16 July 1983. More copulations may have taken place because reproductive activity was also observed on 27 June and 4 and 6 of July. During the attemped matings the female evaded the male by running away and hiding under rocks. These activities usually took place between 0800 and 1100 hrs except for 6 July = 1630 hrs.

Eventually an egg was laid on July 21. The occurence of reproductive activity during June and July correspond with the beginning of the monsoon in India. The rain starts in June, after a long drought and continue until October. During the drought huge areas of India look like desert. Temperatures are very high during April and May and remain constant until the first rains.(FOEKEMA 1978).

An female collected by Sights (1949) on 4 July 1945 contained about 30 eggs.

It seems that the yellow monitor's reproductive activities occur mainly in June and July. This appears to be related to the rains in India at this time. This would explain why Sharma (1981) does not mention the appearance of V. flavescens in the Thar Desert. This area is the driest in India with less than 500 mm of rainfall per year(Fokema 1978).

As mentioned before, our female monitor began to lay eggs at 1330 on July 21. To prevent the egg being destroyed or eaten by the male it was removed immediately. Eggs were laid at more or less regular intervals of one hour, so that by about 1730 six eggs had been laid. To raise the humidity to a high level during the night, the entire enclosure was sprayed with lukewarm water after 1730. The next morning another egg was found.
The size of the clutch seems to be very low, but it is possible that the male had eaten some eggs before the first one was discovered. It is even possible that they were eaten during the night. Other possibilities are that the female was not fully grown at this time, or that conditions in the enclosure were not optimal, despite all our efforts. All the eggs were deposited near the radiator. We put the eggs in an incubator.

The only known measurements of the eggs of a yellow monitor were from the Bochum Zoo (Strinberg and Horn, unpublished) in Germany. On 3 May 10 eggs were discovered. Five were deformed. Measurements are given in table 1.

Incubation and Hatching of Eggs. The eggs were incubated in an incubator of the type used for human babies. This equipment has been used successfully in the past at Rotterdam Zoo. A mixture of damp sand and peat was used as the substrate, and the eggs were put in this

mixture in boxes 17 X 13 X 6 cm. Two eggs were half buried in the sand and peat mixture in each box. The tops of the boxes were transparent and perforated, to allow exchange of air. Humidity was 100%, temperature was 30%. This temperature was chosen because eggs of V. exanthematicus had been incubated similarly in Rotterdam (Visser 1981) and elsewhere (Van Duinen 1983). Also eggs of other Varanids had been incubated at a similar temperature (29oC) (see Horn & Petters 1982 or Horn 1978).
On 26 August we removed an unfertilised egg and another which had become discoloured and creased, it contained the remains of a tiny dead embryo. At this point it was decided to continue the incubation in equipment free from substrate, because we had the impression that the humidity was not high enough.
The substrate free incubator consisted of a small round vessel with a hole in the bottom, not large enough to let the egg fall through. This was put into another vessel which was full of water. In this way the egg was kept close to the surface of the water without touching it. The vessels were covered, and holes made in the top to allow air circulation (picture 1). On 13 September another unfertilised egg was removed from the original incubator. From then on everything seemed to be alright, and the remaining eggs appeared to be in good condition. In the beginning of December 1983 a fine long crack appeared on the surface of the egg incubated in the water-filled vessel. On 17 December foul smelling milky liquid came out of the egg. It was opened and contained a fully developed monitor with a total length of 152 mm, which had died shortly before (149 days after being laid). On 23 December another egg collapsed, which was found to contain another fully developed monitor with slight curvature of the spine. Because of this we decided to open the remaining eggs. We thought that we had exceeded the (unknown) time of incubation, and that the remaining monitors were either dead or unable to break open their shells.
Both remaining eggs contained living young. One animal was abnormally small, and showed curvature of the spine and a crippled tail, it was destroyed. The other was wrapped in its umbilical cord, and still had the remnants of the yolk sac. It was removed from the egg and cleaned and disinfected (Betadine, Murdipharma/ Switzerland). The yolk sac was removed, the umbilical cord disinfected and the hatchling was put into a sterile plastic container. It showed slight curvature of the spine, but this did not appear to bother it, because it was very active on the first day. The next day (24.12.83) it was inactive, and slept throughout the day. We woke the lizard up, with some difficulty, and it ran round its enclosure, flicking its tongue, and drank, but did not eat. On 1.1.84 it died. Cause of death is not known, but possibilities include; the disinfection of the animal was not done properly, incubation time was too short, or temperature was too high.

Newly hatched yellow monitors are much more brightly coloured than adults. Basic colour is a bright yellow, and the top of the head, as well as the markings (of the body and tail) are black. The hatchling was 66mm (SVL) long, total length 145mm.

FROM: Reptilien und Batrachier aus Sumatra, gesammelt Herrn. Gustav Schneider jr., im Jahre 1897-1898.

WERNER,F. 1900. Zool.Jahr (syst) 13:479-508.

Translated by M. J. Bennett.

Varanus rudicollis.
Primeval forest, interior of Indragiri (1-1.2m). This monitor lives only in trees in very dense primeval forest. It possesses a throat sac and therefore can puff itself up. In the stomach were found only insects, digested and undigested, so these seem to be its exclusive diet.

Materials on the Ecology of the Desert Monitor (Varanus griseus) in the River Surhandarja Basin.

T. Y. Yadgarov. Herpetology of Middle Asia. Tashkent 1968:24-28.

Translated by Maria Shimanskaya and Daniel Bennett.

The desert monitor is a common and widespread lizard in the Surhanarja Basin. Only one special article devoted to it has been written by authors based on their observations in Turkmenistan (11). There is some information about desert monitors in works on fauna (1-10) but little is known of the biology and ecology of this species.

Our systematic observations in 1961-1966 are the basis of the material for this report. We caught 46 monitors in the territory of the Surhandarja Basin. Monitors are very common near Babatag Range (Kokaidi, Avzikent and Salhan). On 2 - 2.5 hour excursions one can see 4-5 specimens. On the plains of Sherabad and Karasu and near West Gissar (Kenguzar) monitors are rather rare - no more than 1 or 2 specimens seen during 2-3 excursions and in the valley of Amu Darya River (Aral Pajgambar Island) less than 3-4 specimens in one excursion.

Desert monitors live in various biotopes. In the neighbourhood of Avzikent we have found them on stabilised, semi-stabilised and unstabilised sands, in the area of Saihan and Kokaidi in deserts of clay and fine road metal and in Kenguzar (West Gissar) between stony heaps.

On the Aral -Pajgambar Island the monitors live in all biotopes; in sands, salt marshes, between bushes and in semi-stabilsed sands.

Burrows serve as shelters for the monitors. In May 1964 we excavated 9 monitor burrows on Aral-Pajgambar in semi-stabilsed sands. Their depths were 52-78cm, length 300 - 560cm, width 17-43cm. During egg laying the monitor excavates a burrow to a depth of 70-90cm, length 140-150cm. These burrows are made in more exposed areas than the hibernation burrows, which are dug under saxole and other bushes.

The first monitor found in 1963 was seen on 13 March (1300hrs) and in 1965 on 28 March (1400hrs). More commonly they were not seen until the first days of April, and became common in late April and May. To investigate the monitors diurnal activity in May 1964 we marked 32 new burrows in the desert part of Aral Island, most in semi stabilised, some in stabilised sands. We tied white gauze above the burrows and carried out constant observations. In the end of May monitors were seen all day (from 1018 to 1817hrs). In the beginning of June monitors appeared in the morning (0850hrs) and in the evening (1932hrs); in the middle of June females were very active. In 1964-1965 from 10 to 23 of June we caught 8 monitors whilst excavating burrows. 7 were female, one was male. We believe this increase in activity is associated with egg laying. In the first days of July monitors appeared in marked places until 0830 and after 2003hrs, and by the end of the month their activity was so reduced that they appeared on the soil surface for only short periods of time, sometimes not emerging for 2-3 days. According to our observations quantity of monitors decreased considerably in August and September. We found monitors on marked territory only three times (12 & 16 of August and 7 September 1964) and in the second half of September we only found their footprints from time to time. The last footprints were found on 8 October 1964.

The diet of monitors in Surhandarja Basin, according to analysis of stomach contents of 18 stomachs (a further 28 were empty) includes rodents, reptiles, and large invertebrates. In spring, according to our observations monitors mainly eat small tortoises. In April 1965 (from 9 to 14 and 21 to 25) hatchling tortoises 4-8cm in size were found in 10 stomachs.

Desert Monitor food.

| Date | Location. | Sex | SVL. | Tail | Food |
|---|---|---|---|---|---|
| 9.4.63 | Area of Saihan | F | 500 | 700 | 2 young tortoise (Babatag) (4-6.5cm) |
| 10.4.63 | | F | 540 | 720 | 2 young tortoise (5-7cm) |
| 11.4.63 | "" | F | 550 | 670 | 2 young tortoise (5-8cm) |
| 13.4.63 | "" | M | 510 | 680 | 3 young tortoise 4-7cm) |
| 14.4.63 | "" | M | 490 | 690 | 4 young tortoise (5-8cm) |
| 14.4.63 | "" | M | 500 | 690 | 4 young tortoise (5-8cm) |

| | | | | | |
|---|---|---|---|---|---|
| 14.4.63 | "" | M | 480 | 630 | Sheltopusik (Ophisaur -us apondus (39 & 43cm) |
| 21.4.65 | "" | M | 510 | 660 | 3 young tortoise (5-6cm) |
| 23.4.65 | "" | F | 490 | 610 | 4 young tortoise (4.5-6.5cm) |
| 24.4.65 | "" | M | 500 | 630 | 3 young tortoise (5-7cm) |
| 16.5.65 | Between Kaikaidand and Aktau (Balatag) | F | 460 | 620 | Beetles & other invertebrates. |
| 19.5.65 | Aral Island | F | 400 | 590 | Beetles, remains of rodent |
| 21.5.64 | "" | M | 530 | 710 | Beetles. |
| 23.5.64 | "" | F | 440 | 590 | Remains and hairs of rodent |
| 27.5.64 | "" | M | 460 | 640 | Hairs and skull of hare |
| 10.5.65 | "" | F | 490 | 470 | Libyan Jird (Meri -ones lybicus), rem -ains and hairs of rodent. |
| 28.5.65 | "" | F | 500 | 600 | Remains and hair of rodent |
| 18.6.65 | "" | M | 440 | 600 | Beetles & Solfugae |

Information on the reproduction of the desert monitor is fragmentary. Two females (430 + 640 and 450 + 680mm) which were caught on 9.4.63 in the area of Saihan had small follicles in the ovaries. The female from the same area which was caught on 23.4.65 had 43 small follicles in the right ovary and 48 in the left (diameter = 5mm), and the female (420 + 560) dissected on 17.4.61 from Kokaidi had 13 follicles (6 in right ovary, 7 in the left). The length of large follicles was 37mm, width 23mm. Spermaries of the male (410 + 570mm) which was caught on 16.5.64 on Aral Island were 16mm in length and 12mm wide. The female (400 + 600mm) which was caught on 19.5.65 in the same area had 20 follicles (10-12 mm in size) in the ovaries (9 in right, 11 in left) and the female (440 + 600mm) dissected on 20.5.65 had 22 follicles (12-15mm), 13 in right ovary, 9 in left. The female which was caught on 23.5.64 on Aral Island contained 12 follicles (6X9mm) and female (500 + 600mm) found on 28.5.65 in the same area had 20 follicles up to 20mm in diameter (7 in right, 13 in left ovary). The female (400 + 470mm) caught on 10.6.65 had 34 eggs in the oviducts almost ready for laying (17 in each). The smaller eggs measured 25-50mm, larger ones 27-52mm. On 17.5.64 two females were caught. One (450 + 600mm) contained 29 eggs (from 28-50 to 32-55mm in size) ready for laying (15 in right, 14 in left oviduct). The other female (430 + 580mm) layed eggs in captivity on 5.6.64. They measured 22-39 by 31-49mm. On the same day we found 12 monitor eggs from 28-46 by 35-54mm in size. Two females (430 + 300 and 435 + 565mm) which were caught on 22.6.65 on Aral Island had empty oviducts; obviously they had already laid eggs. Spermaries of the males dissected on 29.6.65 were 6 X 11mm in size.

The desert monitor lays its eggs in the second half of June and cintinues through early July. The number of developing eggs (8-34) depends on the size of the female. A young monitor (born the previous year) was found on 16.7.64.

In Surhandarja Basin skin shedding takes place in April. Of six monitors which were caught on 9, 21 & 22 of April in the Saihan area, four were moulting. Freshly shed or shedding monitors were found in the same place on 12, 14 & 23 of April. We caught a monitor at the end of May which moulted again in captivity at the beginning of September. The old skin shed from the head first, then from the neck and body.