

## BEHAVIOURAL STUDY ON A GROUP OF MADAGASCAR IGUANA (*OPLURUS C. CUVIERI*) HATCHLINGS

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### ABSTRACT

Behavioural observations on a group of six three week old Madagascar iguanas (*Oplurus c. cuvieri*) were made over a period of 13 hours in order to find out whether a certain dominance and/or rank order among juveniles exists within a group.

Weights and measurements of the six hatchlings were taken at the beginning and also at the end of the observations to see if there is any relation of body size and weight and dominance and if any relation exists between the possession of a territory and the increase of body size and weight.

Also a short behavioural study was made on two groups of 1.2 adult Madagascar iguanas in two different exhibits. During these 1½ hours of observations hardly any activities and/or interactions were seen.

### INTRODUCTION

*Oplurus c. cuvieri* inhabits the subhumid regions of northwestern Madagascar from western Diego-Suarez Province southwards into northern Tuléar Province and inland to the western slopes of the Tananarive Province, with an isolated population in northwestern Fianarantsoa Province (Burghardt and Rand, 1982). Angel (1942) already reported animals on the north west coast.

The species is highly arboreal and active throughout the day. They forage on trees as well as in the leaf litter of the forest floor on all kinds of insects and occasionally on fruits (Bloxam, pers. comm.).

The status of the species is probably one of serious conservational concern. It is severely restricted in distribution and there is a large export trade (Stuart et al. 1990). Little is known of behaviour, reproduction and feeding. Between 1991 and 1995 a total number of 29 animals was reared at Jersey Zoo (Gibson and Buley, 1996). Rotterdam Zoo bred two animals in 1994 and four in 1995.

In general hardly any studies of territorial behaviour of hatchlings of lizard species has been carried out.

Stamps and Krishnun (1994) have studied adult *Anolis aeneus*. They say that there is an interaction between size and familiarity, indicating that juveniles tended to avoid first encounters that they were unlikely to win and conversely, to initiate first encounters when the odds of winning were more favourable.

At Rotterdam Zoo from 1990 - 1993 African Spiny-tailed Agama hatchlings (*Uromastyx acanthinurus*) were reared in small groups. Dominance and stress is briefly discussed by Zwartepoorte (1994)

In the group of six juveniles at Jersey Zoo at the start of my observations a certain "rank order" seemed already established

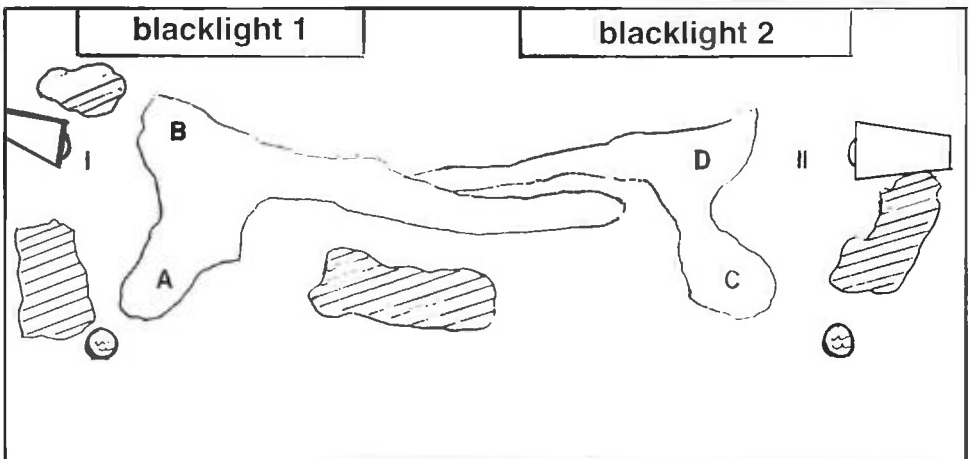
### MAINTENANCE OF ANIMALS

The six animals were born on 30 July 1995 and were housed in a small enclosure which measured 100x60x40 cm (lxwxh) See Fig 1.

The decoration was basic but functional. Different hiding places were created and on both sides there were two places on branches where the animals could bask. On both sides of the enclosure a small waterbowl was present. On the bottom of the bowls pebbles were placed to prevent the animals from drowning.

The four different basking places were heated by one 60 Watt bulb on each side. Two black light tubes (Philips 15W/05) were present on the floor at the back side of the enclosure. They provided additional U.V. light. The animals sometimes used the black lights for warming themselves up.

The temperatures of the frame of the tubes went up to 65 degrees Celsius and the animals sat on it for several minutes with their toes lifted to prevent burning. The floor was covered by a 2 cm layer of wood chippings.



**Figure 1.** Diagram to show the general layout of the enclosure. Letters A - D refer to the four different basking areas on the branches. The two circles at the left and right front are water bowls. The striped areas are terra cotta pot sherds. I and II are the 60 Watt bulbs.

At the beginning of the observations all the animals were individually marked with red nail polish (four animals on one different leg, one on the tail and one on the back between the shoulders). Body weight and snout vent length(SVL) plus total length(TL) were taken. Little difference was noted, although nos. 4 and 1 were the heaviest with respectively 6.2 gr. and 6.0 gr. Nr 2 was the lightest.

From the start all the animals showed a variety of activities. A few animals were clearly more aggressive and stronger than the others. The activities could be defined as different social interactions(See Table 2) and observations were made to determine whether there was a certain dominance linked to the possession of a territory or not, and if the dominance was related to body weight and size.

**Four different methods of observation were carried out:**

1. I started with an ad hoc pilot observation of two hours in order to get to know the animals; when they are were moving fast it was sometimes difficult to see which was which.

During this pilot observation I observed a certain dominance of the animals 1 and 4 having their territory on A/B and C/D on respectively the left and right side of the enclosure.

The animals 2 and 6 did not show any sign of aggression to one-another and were often chased away by 1 and 4 from areas A/B and/or C/D. In two hours time no 2 was chased away by 1 and 4 four times in different places of the enclosure.

The reactions of no. 2 in these social interactions varied from running away and pressing his body to the surface to just stepping aside for about 10 cm.

During these two hours no. 6 had three social interactions with nos. 1 and 4. He did not show the frightened and subordinate behaviour that no. 2 showed. At the end of the pilot observation my conclusion was that there was rank dominant behaviour from nos. 1 and 4 and a low place at the “rank order” for nos. 6 and 2. No. 3 and 5 played an intermediate role in the interactions, as they showed dominant behaviour such as head bobbing, bites and chases but only towards nos. 6 and 2.

Temperatures were measured at spots A,B,C, and D as well as in the middle of the enclosure. See Table I.

Date	Time	Temperature on Area				Ambient temp.
		A	B	C	D	
8/8	12.40	35	35	34	34	30
8/8	14.00	36	36	35	35	31
9/8	9.15	33	33	32	32	29
9/8	10.45	33	33	33	33	29
9/8	12.00	-	-	-	-	30
9/8	14.35	36	36	35	35	31
10/8	10.30	34	34	33	33	30
10/8	11.30	33	33	33	33	30
10/8	14.10	-	-	-	-	31
10/8	15.30	-	-	-	-	32
11/8	10.45	33	33	33	33	32
11/8	12.05	-	-	-	-	32
14/8	15.35	36	34	35	34	31

**Table I.** Showing temperatures measured in degrees Celsius varying during the day during the observation period.

- Bite : a fast single bite at a short distance towards another animal.
- Chasing : prolonged pursuance.
- Head bobbing : distinct, rhythmic, vertical head movements
- Lunging : fake attack, no contact.

**Table II.** Showing different types of behaviour performed during social interactions.

After the first ad hoc pilot observation I decided to use three more different observational methods.

A. Instantaneous observation on one animal (no. 1) during one hour at two minute intervals in order to see where he is at that particular moment.

B. Registration of the possession of the four different basking places (A,B,C,D) by the different animals at two minute intervals over one hour.

### SOCIAL INTERACTIONS

Observation method A showed that animal no. 1 spent most of the time at basking places A and B. Between 14.12 and 14.44 o'clock at a particular day he was there almost continuously. Within the hour he showed head bobbing behaviour twelve times. Ten out of these twelve times the result was that the approaching animal disappeared. Nine times he was recorded on the floor of the enclosure. During the observation hour animal no. 4 spent most his time at baskingplaces C or D, so that it seemed that there were two territories (from now one called Territory I on the left side and Territory II on the right side of the enclosure). It therefore appeared that there was a borderline between the two areas that demarcated the territory boundaries.

Observation method B ( a two minute interval check) one day later proved that there were two significant territories with a border line in the middle. See Table III.

Animal No.	A	B	C	D	Upon		Underneath		Elsewhere
					BL1	BL2	BL1	BL2	
1	2	-	-	-	3	1	10	4	10
2	2	4	-	-	-	-	4	1	19
3	7	7	-	2	1	3	3	-	7
4	12	1	6	1	2	2	-	2	4
5	11	3	3	-	-	-	4	2	7
6	7	-	-	1	3	2	5	-	12

**Table III.** Showing observations on the animals spending times at the different places (A,B,C,D, and Black-Lights 1 and 2) in the enclosure on 9/8 from 9.20 till 10.20 o'clock (a two minute interval check).

The branch in the middle actually formed a bridge between the different territories and was used by all the animals as a way of avoiding crossing the borderline on the floor. In the middle they stayed there only for a few seconds.

Observation method C involved two hours of observations on all the different social interactions among all the animals mentioned in Table II.

This method was carried out between 10.45 and 13.00 o'clock with a break of 15 minutes from 11.45 till 12.00 o'clock.

These observations showed a much better pattern of overall behaviour. See Table V. Animal no. 4 showed dominant behaviour towards no. 2 which meant head bobbing (4 times), lunging (3 times); all these activities took place on the floor of the enclosure while no. 1 sits high on basking place A.

No. 4 showed also dominant behaviour towards no. 3; there were fifteen interactions between the two, including lunging(six times), head bobbing(six times) and bites(three times). In all these cases no. 3 seemed not to react and on only two occasions he ran away and in all the other interactions he simply stepped aside and stayed at a 10 cm. distance.

In fifteen interactions no. 1 was involved, and he showed dominant behaviour towards no. 3 (four times), no. 2 (three times), no. 5 (2 times) and no. 6 (three times) that consisted mainly of lunging and head bobbing. Only once did no. 1 show an interaction with no. 4 in territory II.

At this time it became more obvious that there were two territories; territory no. I owned by no. 1 and territory no. II by no. 4. No. 2 was probably the lowest ranking individual. During the two hours of observation he showed more and more escape-behaviour at the right side of the enclosure. During this period no. 4 showed a remarkable feeding on small flies on the ground.

Animals	no.	1	4
Head bobbing		5	14
Chase		-	5
Bite		2	3
Lunging		1	6

**Table V.** Showing the number of different social interactions of the animals nos. 1 and 4 during two hours of observation from 10.45 till 11.45 and 12.00 till 13.00.

The fact that there was hardly any interaction between nos. 1 and 4. could mean that they are equal in dominance also related to their body weight and size. They both were the longest and heaviest from the beginning till the end of the study.

The observations made early in the morning between 9.00 and 10.00 o'clock showed a different basking behaviour. Nos. 1 and 4 started heating up on the black lights; they tolerated the others on the basking places A,B,C and D. Later on in the morning nos. 1 and 4 moved to their look out places to get a better control over their territories.

Observations with method C one day, later showed a pattern that was a little different from the day before. During 1½ hours' observation (10.30-13.00) subordinate behaviour within the group was showed by no. 3 and it was usually directed towards nos. 2(2 times) and 6 (3 times). Nos. 1 and 4 seemed to tolerate his behaviour; they spend most of their time equally in territory I and II.

On one occasion nos. 1 and 4 were seen at point A in territory I with one eye closed preventing visual contact with each other; a behaviour seen more often in lizards (for example on Chuckwalla (*Sauromalus obesus*) hatchlings in my private collection and on

African Spiny-tailed Agama (*Uromastyx acanthinurus*) hatchlings at Rotterdam Zoo).

During 1½ hours of observation between 14.10 and 16.00 o'clock the rank order changed completely. The dominant role was taken over by no. 5. In eight social interactions with no. 1 as well with no. 4 he showed bites (4 times) and head bobbing (7 times). These interactions took place in territory I at point A/B or in the surrounding of it. Also no. 3 was seen in five social interactions in which he took the initiative; once towards no. 2, once towards no. 6 and three times towards no. 4.

A one hour observation with method C from 10.45 till 11.45 o'clock showed again the more important role for nos. 3 and 5. Their dominant behaviour was mainly shown towards nos. 1 and 4 and they mainly took place on the baskingplaces A/B and C.

Escape behaviour by no. 2 was often seen in the right front corner of the enclosure during the first two days of the observations. On the third day at 10.45 o'clock a piece of black polythene was taped on the outside of the glass. After one hour the escape behaviour and scratching at the glass disappeared and during the rest of the observation only twice did he scratch at the glass in the back corner on the right.

### FEEDING AND SOCIAL INTERACTIONS

During six times of feeding nos. 1 and 4 were seeing feeding more aggressively than the others. This occurred during the period when they played a dominant role (the first two feedings); they also kept on searching for food longer than the other animals. During the other four feedings no dominant behaviour was observed. All the animals ate the same amount of crickets. Even no. 2 fed very quickly and he did not show the subordinate behaviour that he showed at the first feeding. At the last feeding on 15/8 all the animals ate about six crickets just after being weighed. The weight of six crickets is 1.8 g.

Animal no.	SVL in cm	TL	Weight in grammes			%Increase in body weight	Condition	
			8/8	11/8	14/8		Before	After
1	5.3	7.4	6.0	6.8	6.9	15	4.03	4.63
2	4.9	7.0	4.3	5.1	5.3	23	3.65	4.50
3	5.1	7.6	5.8	6.1	6.2	7	4.37	4.67
4	5.4	7.5	6.2	6.4	6.6	6	3.93	4.19
5	5.4	7.3	5.4	5.6	5.9	9	3.43	3.75
6	5.1	7.4	5.8	6.1	6.1	5	4.37	4.60

**Table IV.** showing body weight, snout-vent length (SVL), total length(TL), % increase in body weight and condition(body weight related to body length) - as WT/SVL<sup>3</sup>

### CONCLUSIONS

A constant rank order from 1 to 6 is not likely to exist within the group. Depending on temperature and time of day there seems to be a constant testing of each others' capacities by nos. 1,3,4 and 5 with a slightly stronger and aggressive behaviour for the nos. 1 and 4 which can be caused by their heavier body weight. See Table IV. Nos. 2 and 6 did not show any dominant behaviour at all and they always avoided confrontations. During certain hours of the day they were tolerated by the others on the places A,B,C and D ; this was during periods that the other four were at the warmest places for heating up upon or underneath the blacklights for example.

From the beginning of the observations no. 2 has been the lightest in body weight. Probably due to giving him more attention at feeding, such as offering him some additional crickets, his body weight increased during the observations. Also his escape behaviour disappeared. Maybe the stress-factor causes lesser appetite and worse digestion.

More intensive observation over a longer period is necessary to obtain a better view of the development of dominant behaviour within a group of hatchlings. It would be interesting to enlarge the enclosure in order to observe a possible change of behaviour.

On 16/8 the head-width of all the animals was measured. The results were as followed:

Nr. 1 13.4 mm.  
Nr. 2 12.0 mm.  
Nr. 3 12.7 mm.  
Nr. 4 13.2 mm.  
Nr. 5 12.8 mm.  
Nr. 6 12.4 mm.

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### REFERENCES

- Angel, F. (1942): Memoires, Acad. Malgache. *Bulletin Mus.nat.hist.nat.*, Paris 1950(2), 22(5): 553.
- Blanc, C.P. (1982): Biogeographical aspects of the distribution of Malagasy Iguanids and their implications. *Iguanas of the world*. Noyes Publications, New Jersey, U.S.A. : 34-35.
- Gibson, Richard C. and Kevin R. Buley (1996): Captive management and breeding of Madagascar spiny iguanas *Oplurus cuvieri cuvieri* Gray, 1831. *The Dodo. Journal of the Wildlife Preservation Trust*, Vol. 32: 137-143.
- Stamps, J.A. and V.V. Krishnun (1994): Territory acquisition in lizards 1, First encounters. *Animal behaviour*, part six. Academic Press Limited: 1375-1385.
- Stamps, J.A. and V.V. Krishnun (1994): Territory acquisition in lizards 2, First encounters. *Animal behaviour*, part six. Academic Press. Limited: 1387-1400.
- Stuart, S.N., R.J. Adams and M.D. Jenkins (1990): Biodiversity in Sub-Saharan Africa and its islands. Conservation, Management and Sustainable use. *Occasional Papers of the I.U.C.N. Species Survival Commission* No. 6.
- Zwartepoorte, H.A., (1994): Verzorging, paargedrag en meervoudige kweek met de Afrikaanse doornstaartagame (*Uromastix acanthinurus*). *Lacerta* Vol 52, no. 3: 70-75.