Observations on life history of Uromastyx ornatus in Eilat Mountains.

By Danny Molco, ranger of the Nature and Parks Authority of Israel.

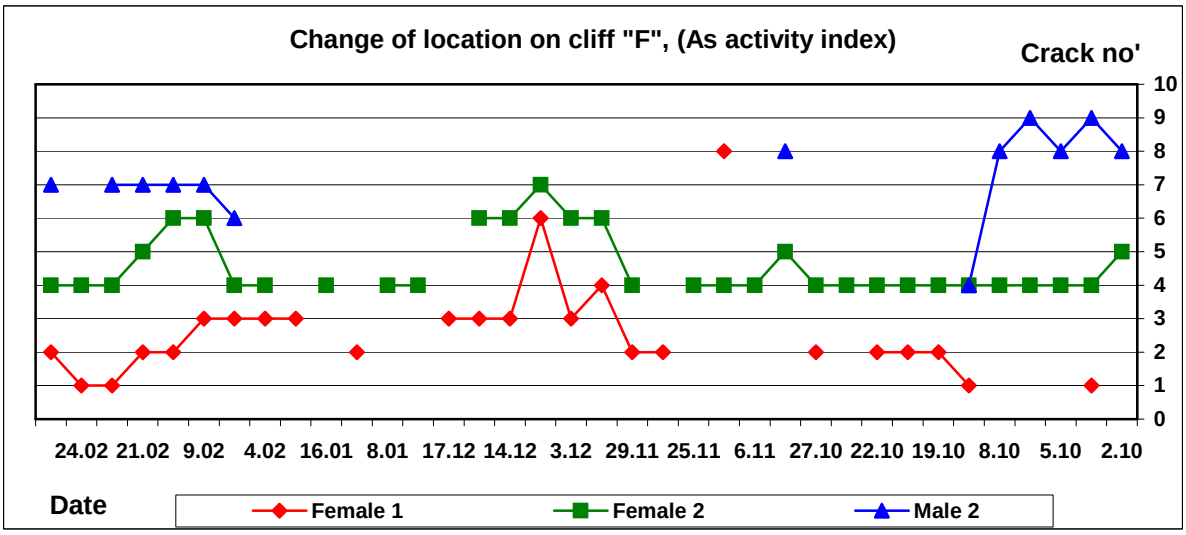
I studied the ecology and biology of the ornate spiny-tailed agama Uromastyx ornatus in the Eilat Mountains. Since little is known about the life history of this rare reptile, our main goal was to gather basic data needed for conservation of this species, and evaluate possible change (escalation) of its IUCN red list status.
The work was guided by Dr. Amos Bouskila of the Ben-Gurion University in the Negev, together with Osnat Ben-David, from the Nature and parks Authority of Israel.
Data collected from spring 1996 until winter 2000.
We amassed in total 750 hours of observations, using simple tools: binoculars, a camera, chronometer and thermometer.
We learned about seasonal and daily activity cycles, behavior, population size, and feeding habits; all this while avoiding animal capture, by using photo-identification.

Uromastyx ornatus lives in rocky habitats, using cracks and fissures in rock outcrops as shelter.
It is found in a wide range of magmatic and sedimentary rock types. It is active year round but is focused mainly during the hottest months of the year and the hottest hours of the day.
We focused our observations on specific sections of certain wadis, thus we were able to follow specific individuals and study their interactions and behavior.
We found that U. ornatus maintain a complex social system.
We observed various reproductive behaviors: courtship, mating, digging a burrow for oviposition, sealing of this burrow, guarding of egg burrow, and hatchling emergence.
Intra-gender fighting (males and females) was also observed.
The most surprising behavioral aspect observed was males flipping females over and slowly walking over them in a circular motion, belly to belly, as if marking them chemically.
We are the first to report such behavior in Uromastyx.
The aim of this behavior is not yet known, but the circumstances point to some sort of bonding between males and females.

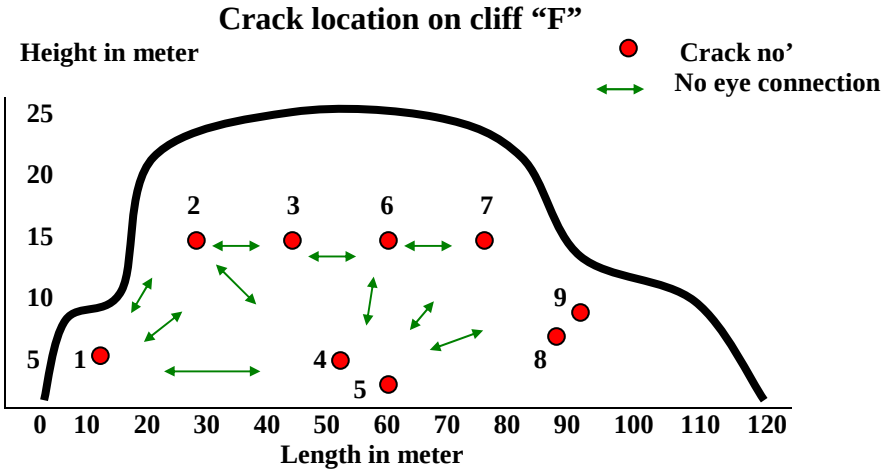
Analysis of our many hours of observation gives rise to something akin to an Uromastyx ornatus calendar:
January – March: minimal activity, basking on sunny days and occasional descent to the wadi bed for feeding.
April – May - courtship behavior, males flipping over females and walking on them, copulation, aggression (both sexes) towards congeners.
Late May – early June: females dig burrows for oviposition.
Early June - oviposition.
June – July: mainly basking, feeding, males flip & walk on females.
Early August: hatchlings emerge.
August – October: feeding, dispersal of juveniles. Occasional cases of males flipping & walking on females.
November – December: minimal activity, basking with occasional feeding, instability in female territorial allocation.
We believe that current conservation efforts in Eilat Mts, if sustained, adequate for protecting U. ornatus populations in Israel. However, not all is well with other species of this genus, mainly due to the illegal pet trade.
Israel has petitioned IUCN to re-evaluate and escalate the red list status for all Uromastyx species, This is currently being taken into consideration.

Activity.

The lizard is active year-round, mostly in the hot season and at the hottest hours of the day (10:00 – 16:00).
The activity defines as showing up in front of the crack and all the rest of the activities happen outside the crack.
Most of the activity observed happened on the cliff.
Going down to the wadi is for feeding, and partly for the reproduction activity, courting, send away of invasion, and digging incubation burrows.
At the cold season (October-February), the activity performed only on sunny days, in spite of decline at the air temperature, over 30°C in the shade to less than 25°C.
The diagrams show activity during the winter of 1997-1998.



- You can see that the dominant female "1" has influence on the location of female "2".
- Passing crack by female "1", act as a signal for female "2" to move.
- It looks like that crack 2 is the best crack on that cliff, at the next winter, after female "1" disappeared, female "2" chose it as her favorite crack.
- It seems that the male has the last choice.



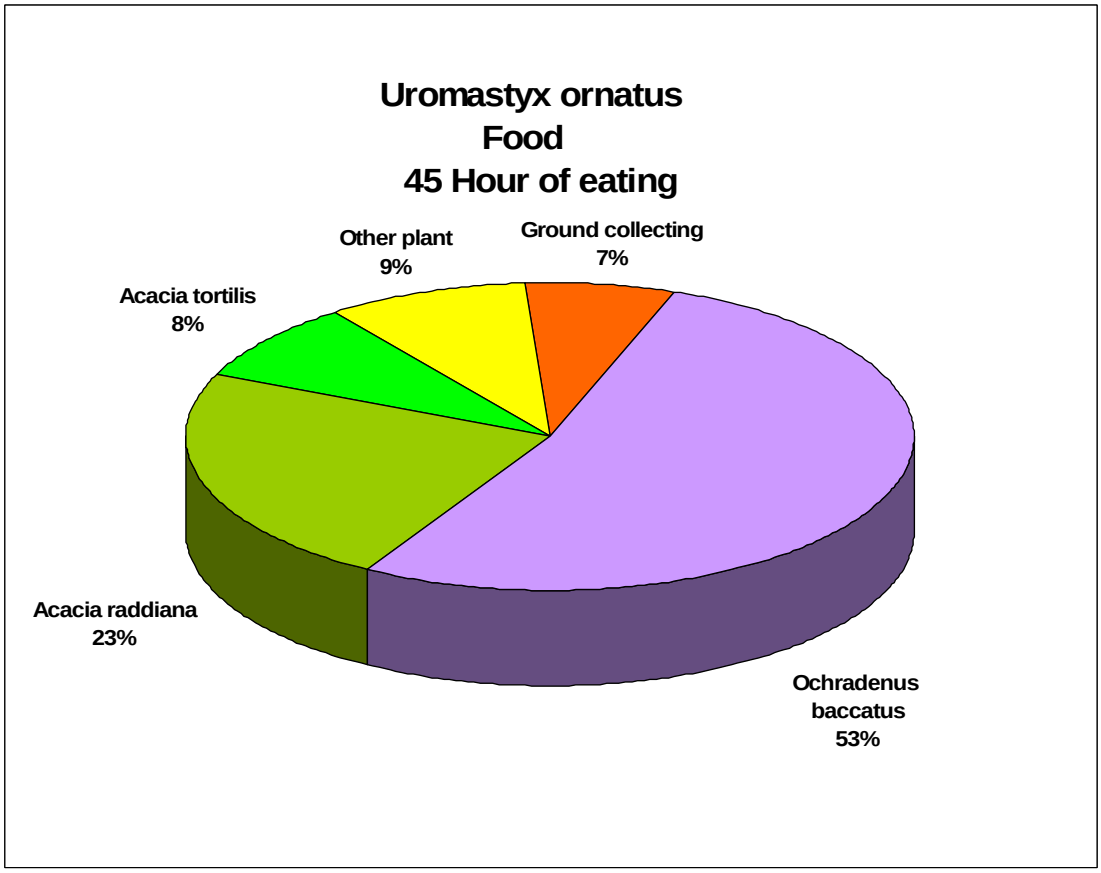
Ornatus life

August afternoon, 1 o'clock, 40^{o}C in the shade, as if the desert is dead.

"Smiley" (the name of one of our males) spends the last 3 hours in his observation point near his crack. He saw a few "air-conditioned aquariums" - all terrain vehicle moving on the desert pathway below, unaware of his existence above them on the cliff, Decided that the time is good and went down to the wadi for his meal.

Being a fastidious eater, he went directly to the ***Baccatus*** bush, searching for the fresh flower and finished with the dessert of the juicy fruit.

Twenty minutes of eating were enough for him, as he climbed up on the cliff, rested for several minutes near his crack in the shade, "Thinking" life is not bad – no female to run after, good sun, good food. And so he returns to his crack, as tomorrow is another day.



The Ornatus live in extreme desert conditions (30 mm mean annual rainfall) in steep rocky, hot wadies that hold *Ochradenus baccatus* bushes and *Acacia* trees. Ninety percent of their diet consists of perennial plants.

Actually, they have amazing climbing ability and they "swim" on the trees medium, get to the top part of the shrubs/trees in order to get their favorite food, easily.

The ground collection is under the Acacia tree and the Baccatus bush so they depend on perennial plants that consist of 90% of their diet, even when there is a lot of annuals, most of the time they ignore it.

Most of the *Ochradenus baccatus* bushes grow in the contact line of the cliff with the wadi, and flower year round, giving high amounts of protein, sugar and water.

From the Acacia tree, they mostly eat the flower that blooms between June and October. The flowers bloom on the treetops, and I never observed them eating the pod.

Compare to Aegyptius diet, that eat rough food, mostly leaves, pod and flowers of the Acacia tree under it.

An analysis of their droppings showed that it equal to our direct observation except the finding of small part of gravel (less then square cm').

The information that at least the young eat insects, we could not find any evidence.

Social behavior

Territorial marking

Slow walking by males on the rock surface, at the front of cracks or certain points.
We show it 24 times.
Strange observations; During August, a day old hatchling performed the same act, only at a faster pace, on stone, 10 times.
One of them did it on his mother's head, once.

Courtship

We did not discover anything new. The male has a hard life out there on the cliff.
He sees the female basking at the front of her crack, or sometimes waiting for her while she's still inside her crack. When she gets out, he bows and approaches but then she gets back in, "saying" not now! His honors wait nearby to show the lady and to the world, his beautiful back.
After several minutes, she approaches the impatient male (exiting her crack), who bows and approaches again. She, of course, re-enters her lair again, showing no interest. It is a nerve racking play that takes a while on the steeply cliff. It does not have to be at the first day. It Looks familiar. At the end she will comply and let him flip her over and walk on her belly. That is a bonding ceremony.
Only after a few days, the female is ready, and always know when the right time for copulation comes.
During this time, the female stays loyal to the male, while the male loyal to all females at his territory.

Styled bows

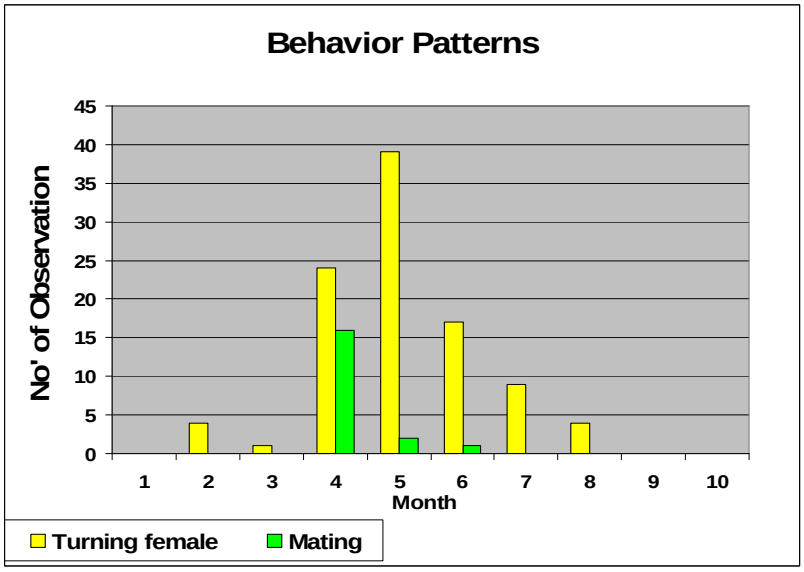
Moving the head up and down and walking so it looks like the head moves in circular motion.
Male do it toward females. The meaning is courting.
We have seen it 256 times, at 119 cases the female dodges from the male but all the other cases lead to contact.

Flipping females over

The first contact quite surprising behavioral is flipping females over and slowly walking over them in a circular motion, belly to belly, as if marking them chemically.
We saw 10 male do it on 11 females more then 100 time.
The most surprising was "smiley" which did it 15 times along 65 minute.
The dominant female of his cliff did not allow him any contact at the normal time.
Only when she realized that her dominant male vanished and "smiley" is now the men of her cliff she went back to him and forced him to do it 2 month after oviposition time.
The second female of that cliff live at the front of her incubation burrow at the wadi bed during the incubation time. She bothers every few day to cross the wadi and climb toward "Smiley", which was on the cliff fifteen Meter above and let him do it. After ten minutes, she went down to the wadi to eat and then back to guard her incubation burrow. I can say for sure it is not "the female said no".

Copulation

Copulation could be only with male that flips over the female a few days earlier and on the last autumn.
The male holds the female by her neck and for a minute fixes his stability then pushes his tail under her tail; they stay like that for four minutes. After that tail separation, he holds her neck and shakes her for a minute, then they each go about their business. We have seen it just 17 times.



Chase and Battle

The males hold an area which could contain few female, they are very aggressive toward other male. Locating of invader is done by hearing and sight, it stops all other activities including mating and to beginning of a chase. Only third of them lead to contact. Battle that happens on the cliff is quite dangerous and we saw falling of a few meters and injury too of the participants.

At some cases, the invader succeeds hiding in a crack so the pursuer can not locate him.

We saw 21 chases and 6 battles.

Aggression between the females is quite rear but exists (three chases and two battles).

Incubation burrow and hatchlings emerge

We located three incubation burrows; all of them were dug at the base of a wadi step.

Two of them were at the front of cliff "F".

The first one from spring 97, which was destroyed by a fox, was belong to female 1.

We dug it until reaching the eggs chamber; it was 185 cm' long and at the depth of 107 cm'. There were eleven empty new egg shells. Therefore, we think that the fox prey the hatchling while they have been at the front place of the incubation burrow. He destroyed only the first eighty cm' of the burrow.

The incubation time was 64 days.

Anyway, on that burrow we dug and put at the eggs chamber a probe of min/ max thermometer and cover it all. Then we took a weekly measurement; we'll discuss that later.

While digging her burrow, the female would enter headfirst and then exit tail first.

The day that she came out headfirst we knew she had laid the egg.

Of course, we noticed that she was significantly less puffy. In addition, at that evening she blocked the burrow.

This information allowed us to determine the total incubation time.

Next spring 98, female 2, that mate with "smiley" dug her incubation burrow at the burrow she used to live while rejected from the cliff by female 1. At that year female 1 let "smiley" mate too late. After 56 days, we saw the hatchlings emerge. At last, we located six of them, which after a nice basking went directly to theirs mother's dry drops and chew on them.

At spring 99, female 2 dug again in the same burrow and she took out 10 empty egg shells.

At that case, we located thirteen of them, which done the same like the hatchlings a year before and went to chew the mother's drops. After 4 days, when the young had spread all over, the female went back to live on the cliff.

At these three cases, we saw the females dig not to far in another burrow, a few days before the hatchlings emerge, and leave there a few drops too; Despite of the hatchling never seen use it.

At the next year it seem that female 2 did not succeed in raising a new generation but we found other incubation burrow, of female 9.

That is what I wrote in my site: "10 new born came out today from the incubation burrow of female 9. They all after a sunbath went directly to chew on their mother's drops. How do they know it is ready for them? They search today up to 2 meter around".

Anyway, the two burrows are in use until now.

Burrow Incubation burrow cracks and the temperature

Min and Max degrees were measured at depth of 107 cm'.

It gave us evidence on the *Uromastyx* aegyptus surroundings life. It means that his body temp at the cold winters stays more then 20^{o}C. All I can say about it that on sunny winter's day they are out of the burrow basking in the sun like the O*rnatus* on the cliff. I really do not know why the aegyptus starts his day at 07:30 while the ornatus on 10:00, four hour after the sunrise.

month	min	max
February	20.7	21.3
March	21.1	25.4
April	25.3	27.4
May	27.2	31
June	30.8	33
July	32.8	34.8
August	34.1	35.0
September	32.8	34.2
October	29.3	32.8
November	26.2	29.3
December	22.2	26.3
January	20.7	22.3

The depth of livening burrow of *Uromastyx aegyptus* is 80 – 160 cm.
The depth of incubation chamber is 80 – 110 cm.
The incubation should not take more then 60 – 65 days, more then that means that your incubation temperature is low and invite troubles. The table here is more precise for the incubation times.

week of	min - 107 cm	max - 107 cm
24-31.05.01	29.0	31.0
01-07.06.01	30.8	31.6
08-16.06.01	31.3	32.3
17-23.06.01	32.2	32.8
24-30.06.01	32.6	33.0
01-07.07.01	32.8	33.2
08-15.07.01	33.0	33.8
16-23.07.01	33.8	34.5
24-31.07.01	34.5	34.8
01-07.08.01	34.7	35.0
08-15.08.01	34.8	35.1

The ornatus lay their eggs at the first week of June.
About the temperature of cracks inside on the cliff, I have no idea.

Growth rate

At the nature, growing rate is very slow comparing to growing in captivity.
Going up and down the cliff just for food is enough, not talking about all the other activity.
Weight in grams. Length in millimeter snout to tail tips.
At one year, they are 22 – 32 gram, and 150 – 175 mm, long.
Second year they are around 50 gram and 213 mm long.
Third year they are between 98 – 116 gram and 247 – 266 mm long.
Fourth year they are more then 180 gram and more then 275 mm long.
I think around this size they become sexually mature, that means four and a half for the females.
The difference at the coloration between male and the female show up just at the second year.

The Uromastyx and me

Even though the observation research ended in 2000, I continue to watch them from time to time.
Mostly the ornatus, but sometimes the aegyptus as well.
I ran a aegyptus rescue mission and dug a few dozen burrows. We took them out and released them at the front of another empty burrow; at a place where it seems that the development is far enough.
By the way, I use to participate in the Uromastyx forum.
My few best advices are:

1. Do not place two males or females together in the same location, as the none dominant will suffer great stress even if it seems otherwise.
2. They are completely herbivorous, and insects are hurtful to their liver in the long term.
3. Try to follow my temperature table, anyway, I did not show any hibernation.
4. During the incubation process, try to start with 30 ^{o}C and then raise it weekly.
5. The most important thing for the hatchling is to leave them a mother's dry droppings as they emerge.

I would like to thank those beautiful lizards for letting me enter their life.
Moreover, to those who read it, in hopes that your lizard receives the best treatment.
Danny Molco - Israel