OBSERVATIONS ON THE ONTOGENY OF OUNCES, Uncia uncia (Schreber, 1775)

by I. Rieger [1]

1. INTRODUCTION

In recent years, much interest has been focused on ounces in zoological gardens. Reasons for this are : (1) the number of individuals increased rapidely in the last 10 to 20 years (BLOMQVIST 1978, 1980) and (2) two consecutive conferences dealing with this species in zoological gardens were held (Helsinki 1978, Zürich 1980) and two more are planned (Seattle 1982, Krefeld 1984). More or less complete descriptions and reports of adult and subadult ounce behaviour were published since 1968 by several authors (HEMMER 1968, 1972, FREEMAN 1975, 1977, 1978, 198o, LANIER & DEWSBURY 1976, SCHALLER 1977, PETERS 1978, 1980, RIEGER 1978, 1980, in prep., RIEGER & PETERS 1980, WITT 1978). But until now, we lack investigations on the behaviour of mother and mother-reared cubs. The various reports on handraised ounce cubs (ANDERSEN 1957, FRUEH 1968, KITCHENER et al. 1975, McGILL 1975, KOIVISTO et al. 1977, ANON. 1978, BRUNSTEIN 1978, WEILENMANN 1978) cannot replace studies on mother-cub-interactions. Until now, only McVITTIE (1978) reported some observations of the behaviours of ounces between 61 and 70 days of age.

[1] DR. I. RIEGER
Weinbergstrasse 113
CH-8006 ZÜRICH
Schweiz - Switzerland

2. MATERIAL AND METHODS

Birth and rearing of the cubs of the third and forth litter of female ANDRA (ounce register: Zurich 2; BLOMQVIST 1980) were studied (table 1). The main investigation was done during rearing of the third litter in 1979, the observations of the fourth litter were used to support the results and findings obtained from the former.

At Zurich Zoo, the female ounce was kept inside the animal house. She had access to one inside cage plus the breeding den (fig. 1). The inside cage received daylight by windows in the roof above the keeper's area. The animal house is not open to the public. The breeding den is completely dark (WEILENMANN 1978). The floor of the inside cage and the breeding den is covered with a rubber mat, straw was alos added to the breeding den. The walls are concrete, a heating system is situated in one of the breeding den's walls. Inside cage and breeding den are separated by a 15 cm high synthetic plank.

In order to be able to observe the behaviour of the animals inside the breeding den, we installed a infra red sensitive TV camera (PHILLIPS LDH 51 with Vidicon Tube XQ 1401) in the roof of the breeding den. A common light bulb (OSRAM 25, clear) was used as a light source. The visible parts of the emitted light was kept back by an infrared filter. Optical and auditive informations (using a SENNHEISER MD 421 N microphon) were transferred to a video tape recorder (SONY AV 3620 CE) and a TV monitor situated some 18 m away from the breeding den, behind three closed doors. The quality of the transmitted TV information allowed to distinguish the three cubs by using their spotting pattern on their backs, when they were older than 20 days.

3. ONTOGENY

When studying behavioural changes during ontogeny, it is of importance that the cubs of a litter can be recognized individually in order to be able to described individual differences in the behaviour of the litter mates. In this study it was possible to identify the three cubs when the were 20 days old, by using the spotting pattern on their backs. The spotting patterns cranial to the three black bands on the dorsal side of the lumbal region (Pocock 1930, Bree 1968) are individually different.

3. 1. Time spent inside the breeding den (fig. 3)

As the TV camera allowed only to look vertically downward onto the animals inside the breeding den, it was not possible to be sure of the moment when the cubs started real walking (i. e. locomotion without contact belly-floor) instead of crawling. But according to the frequency of locomotory behaviour and its speed, I suppose that following 16 days of age, it is fair to say that crawling is more or leass replaced by walking.

The ounce cubs stayed until four weeks of age inside the breeding den. In her fifth week of age, the female cub FIRBA for the first time (at 34 days) independantly left the breeding den, she overcame on her own the 15 cm high synthetic plank separating breeding den and inside cage. The other tow cubs followed in their sixth week of age. In the first week of her cubs, the mother ANDRA stayed nearly during the whole time of observation inside the breeding den. In the following weeks, the time ANDRA spent inside the breeding den decreased continuousely. She changed her behaviour when the four to five weeks old cubs started to locomote in the inside cage. The female now retreated to the breeding den more and more. In week seven, ANDRA was only seen once inside the breeding den during three observation sessions.

3. 2. Sucking behaviour

Female ounces have two lactating abdominal teat pairs (EHRENBERG 1830, McVITTIE 1978, own observations). Female ANDRA suckled her cubs while lying on a flank or on the back. When the cubs had not sucked for a certain period of time, they immediately after her mother's returning to the den, looked for a teat and started sucking. Approximately three quarters of her time spent inside the breeding den, ANDRA was engaged in suckling (fig. 3).

Just before a cub started sucking and during interruptions while it breaks off contact to the nipple, licking noises were audible. Together with this behaviour called nipple licking, another behaviour that I called head oscillating is observed. During this, an ounce cub moves its head laterally to and fro on the mother's belly. While a cub oscillated its head, it often pushed itself forward with the help of the hindlegs. The head oscillating behaviour is interpreted as a searching movement for the milk source.

While sucking, an ounce cub sometimes showed the milk tread, it tread the mother's abdomen. This behaviour was more vigorous when two or more cubs were sucking at the same time than when a cub was alone at sucking.

We regularly observed the cubs to move their ears in synchrony back and for at the end of a sucking session. As these ear movements were exclusively seen immediately before the cubs broke off contact to the nipple, I am of the opinion that these movement indicate a reduce in milk supply in the teat on which the cub is sucking at the moment. This assuption is further supported by the following observations: When a cub broke off contact to a particular nipple that, according to its vigorous ear movements was no longer productive, and another hungry cub started sucking on this teat, this second cub immediately started with the ear movements and its sucking attempt stopped quickly. Additionally we often saq that two simultaneously sucking cubs started with ear movements at more or less the same moment. All our observations indicate that these ear movements occur only when milk supply is reduced or exhausted. I thus cannot follow McVITTIE (1978) who interpreted sucking with ear movements

as real sucking, that without ear movements as comfort sucking.

Ounce cubs suckle while the female is lying on its flank. They prefer those teat row that is away from the ground, probably because those teats are easier accessible.than those of the other row. When all three cubs wanted to suckle,then this was only excetionally possible without struggles. The two cubs sucking on the upper teats were lying on the third mate that had to suckle on one of the lower teats, or they blocked it up. Usually, the third cub did not even try to suckle on one of the free teats, but tried to push away one of its sucking mates. For this it used fore paws and snout, and it regularly started vocalizing. Such teat struggling was only successful for the not drinking animal, when the mate with which it competed, had previously sucked for some minutes time. Else the drinking cub did not let go the teat. The suckoing mother reacted to these teat sruggles in various ways: (1) She displayed lying-streching which sometimes interrupted contact between a sucking cub and the teat on which it sucked. (2) The female rolled on her back, thus exposing all four teats. (3) The female rolled on the other flank, thus exposing the teats not much used until this moment. And the rolling movement often separated the two competing cubs, at least for some time, because the sucking cub maintained teat contact during the rolling movement whereas the other cub remained behind.(4) The female vocalized angrily or growled at the competing cubs. This latter behaviour pattern was more and more observed with increasing age of the cubs. (5) The female sometimes left the breeding den when the cubs struggled over a teat.

These observations indicate that the ounce cubs studied during this investigation, contrary to thos studied by McVITTIE (1978) did not have any teat ownership. Between their 20th and 51st day of age, the sucking positions of male cub FIRN where in 19 times protocolled, thos of the female cub FIRSA 14 times and thos of FIRBA 15 times. All three cubs were seen sucking at all four teats. Each cub seemed to prefer one teat, as it was seen in more than one half of all cases sucking on this particular teat (fig. 5).

For the last time, we saw the cubs sucking at 62 days of age.

3. 3. Eating and drinking

The ounce cubs did not eat meat during this dtudy, that means that they did not eat while staying inside the breeding den. As the cubs were for increasing periods of time outside the breeding den, in the inside cage that could not be seen on the TV-Monitor, I am unable to give any details on feeding behaviour that might have taken place there. Nevertheless there are reasons to include a section on feeding behaviour in this report as the mother ANDRA between day 6 postpartum and day 24 regularly carried food into the den to eat it there. Usually, she consumed it immediately. But sometimes parts or even the whole piece of meat were left for some time (sometimes up to some hours). A cub 18 days of age was for the first time seen to react towars such a piece of meat, it sniffed at it, without any further reactions. Later, with cubs 19 to 24 days of age, the female behaved aggressively towards them when they came to near while she was eating. But the mother's aggressive behaviour was only of short duration, and she groomed the cub she had just frightened. The TV image did not allow to notice any obvious reations to the female's growling and snarling on behalf of the cub, apart from a turn in the locomotion direction.

From later days of observations not protocol notes on a similar behaviour is available. The female consumed the food from now on in the inside cage. As the cubs remained for increasing periods of time outside the breeding den, one is justified to assume that there their interest in the mother's food was rather higher than in the last few days when the female carried food to the breeding den. The ounce cubs McVITTIE (1978) studied started eating meat at 56 days of age, FREEMAN & BUTCHINS (1978) reproted from a handraised specimen having seen it eating solids at 48 days of age.

3. 4. Social behaviour

In this section, social interactions between the ounce mother and her cubs as well as between the cubs are described. For this, the same method will be used as for the description of social behaviour among adult ounce (RIEGER 1980), first some beahvioural elements and fuctional cycles are treated, followed by a description of the social time and finally, the social initiative is discussed. Contact lying will be treated separately.

In the social behaviour between the ounce mother and her cubs, behaviours belonging to the functional cycle 'social body care' dominated. One of the behavioural elements of this cycle is the 'social fur licking', a very important element in social contacts of adult ounce (RIEGER 1980). On the other hand, the behaviour 'anal licking' belongs exclusively to the social contact patterns between an adult ounce and a cub. During anal licking, the female licked the ventral surface and especially the anogenital region of a cub. ANDRA was seen to hold a cub with a forepaw while anallicking it, she thus fixed the cub on a distinct spot. Both behaviours, 'social fur licking' and 'anal licking' were regularly seen when ANDRA returned to the breeding den. Also while suckling, she now and then licked her cubs. Usually the female lecked parallel to the hair direction, but she sometimes licked also in the opposite direction.

Beside behaviours belonging to the functional cycle of social body care, a behavioural element was regularly seen in social contacts between the mother and a cub, the 'patting'. The same behaviour is known to initiate social interactions in adult ounces (RIEGER 1980). A patting ounce touches a conspecific with a slightly suponated forepaw. In the course of the study on ounce behaviour development, usually the cubs patted their mother. Patting was followed by a short playful interaction consisting of'bites','attack-jumping'and 'embrace' (Beissen, Anspringen, Umarmen; RIEGER 1980) as some of the most frequently seen behaviours in this context. As I used 1 min intervals for protocolling, these short play interactions do not appear in the quantitative results (fig. 6), they lasted like play behaviours in adult ounces, only a few seconds. Patting was first seen when the cubs were 16 days of age.

Considering the fact that it was only possible to distinguish the three cubs on the TV monitor when they had reached the age of four weeks, for a discussion of social time, the study period had to be split up in two sections (fig. 6), the first consisting of the three first weeks of life of the cubs. For this first period, only general statements are possible. Thus, female ANDRA was seen licking the fur of her cubs between 12 and 16 percent of the whole time of observation.

The social time between female ANDRA and the cubs during the second period, when the cubs were four to seven weeks of age and could be distinguished on the TV screen, showed clear individual differences. ANDRA and FIRBA interacted less than ANDRA and the other female cub FIRSA. Social time between ANDRA and the male cub FIRN was, except during the sixth week, in the same order of magnitude as social time between ANDRA and FIRSA. The distinct decrease of social time in the seventh week is probably a study artefact due to the fact that the female as well as her cubs stayed more and more outside the breeding den (fig. 4).

While behaviours belonging to the functional cycle 'social body care' dominated social interactions between mother and cubs, they were of minor importance in the social behaviour between the cubs. The ounce cubs interacted mainly with play behaviours. The one most frequently seen was 'patting', other play behaviours like 'biting', 'attack-jumping' and 'enhancing' were less often noticed (fig. 6).

Above, I drew attention to the fact that for a quantitative interpretation of the results it is important to take into consideration that the behaviour of the cubs was individually recorded when the were older than three weeks. When discussion the ontogeny of social times, this restriction is not serious as the three cubs started to interact socially for the first time at four to five weeks of age.In all three cub dyades, frequencies of social times reached percentage values from 10 to 14. Later, these values decreased continuousely. But this decrease in social time reflects an observational and mathematical error, it is correalted to a decrease of the time during which the cubs

stayed inside the breeding den (fig. 4). According to the frequencies of vocalizations, one can assume that the ounce cubs behaved socially when staying in the inside cage.

The initiator of a social interaction was estimated in the same way as is described in the study report on the behaviour of adult ounces in zoological gardens (RIEGER 1980). In the first four weeks of age, the mother ANDRA initiated all social interactions between her and one of her cubs. In their fifth and sixth week of age, the cubs started to initiate social contacts. In the seventh week of age, it was again the female ANDRA that more actively initiated social behaviours. This is due to the fact that most of the social events ho longer took place in the breeding den, but in the inside cage (fig. 4). Social contacts displayed while staying in the breeding den were restricted to social body care, initiated and executed as in the preceeding weeks by the mother animal.

Frequencies of social initiations among the three ounce cubs did not lead to clearly visible trends. Between the fifth and seventh week of age, in the dyade FIRN-FIRSA, the female cub was more active in initiating social contact than her brother, in the dyade FIRN-FIRBA, the male cub initiated more social contacts that his sister, and between the two female cubs, FIRBA was more active ininitiating social behaviours than FIRSA. A clear tendency for the male to initiate less than the females, as it is typical for adult ounces (RIEGER 1980) could not be proved at this early age.

When estimating values of social attractiveness, one has to consider that absolute values cannot be used for discussions. Table 2 shows an attractiveness value of ANDRA of .29 whereas in the study on adult ounce behaviour, she reached 1.3 . Attractiveness values estimated for group members studied during the same period of time can be compared with each other. Such a task allowed to conclude that much attraction is attributed to the cubs, within the litter, the female FIRSA had a comparatively low attraction. At this early age, the adult pattern of high attractiveness attributed to males (RIEGER 1980) is not visible.

Contact lying: In their first weeks of age, the new born ounces were seen lying in each other's proximity or near and on their mother ANDRA. They clearly prefered to lie between legs and belly of their mother or between her throat and her jaw. Within a few hours after birth, one important function of the long ounce tail became clear. The mother's tail formed a barrier for the crawling cubs that hindered them to crawl away from the mother. Later, the mother's tail was a means to find the way back to the mother's belly and teats.

The common tendency of the three cubs to lie in the proximity of certain parts of ANDRA's belly caused them to lie in contact with each other. When ANDRA left the breeding den, the cubs remained lying in contact with each other. Quite often, two contact lying cubs were lying in an antiparallel direction, i. e. head of one cub near tail of the other. When older than three weeks, contact lying was only seen in the absence of ANDRA. When the mother was present, other behaviours like sucking and struggling for teats as well as play behaviours dominated.

With increasing mobility of the cubs, social preferences in contact lying became visible.(fig. 8). The male cubs FIRN preferred to lie in contact with FIRBA rather than with FIRSA. But a greater frequency of contact lying between the two female cubs as opposed to a male - female dyade, as it is the case in adult ounces (RIEGER 1980), was only seen in the fourth week of age.

In all three cub dyades, a contact lying minimum in the sixth week of age is prominent. This might be a consequence of the increasing time spent in the inside cage. In the seventh week, obviousely the cubs had attained a spatial ogranization of their behaviour. They preferred the breeding den for sedetary behaviours whereas during periods of activity, they dislocated to the inside cage. Thus can be interpreted the increasing frequency of contact lying in the seventh week of age.

3. 4. Ontogeny of selected behaviours

In this section, ontogeny of behaviours belonging to comfort behaviour and the streching syndrome (TEMBROCK 1961) is discussed.

Lying-streching: In adult ounces, one can see regularly that an animal streches one leg or an extremity pair. As early as on their sixth day of age, young ounces show the whole dynamik of this lying-streching behaviour: (1) They streched one leg or a leg pair while lying, or (2) they streched all four legs with the paws being held together. Simultaneousely they arched their back in a convex way. The tail movements associated with lying-streching in adult ounces were also visible in the behaviour of the young ones. During lying-streching, they moved their tails in a vertical plane to an end position where the tail crossed the legs.

Streching: Although ounce cubs started locomoting with ease at 16 days of age, the streching behaviour that according to my definition occurs only in a standing, not lying, animal, was for the first time seen in a cub 25 days of age. Contrary to lying-streching, streching was comparatively infrequent. Adult ounces regularly streched following a period of rest. The cubs did not behave alike during this study.

Twiching: One of the most remarkable behaviours in the new born ounce cubs was the twiching. It consisted of sudden short movements of one or several extremities, the tail or the whole body of a sleeping cub. They twiched spontaneousely, but also following tactile stimulation by a lying-streching or twiching litter mate with which the twiching individual was contact lying . The two behaviours twiching and lying-streching appeared in the first three weeks of life, that are not included in table 3 because at this time, we could not individually recognize the cubs on the TV monitor, at considerably higher frequencies than in the period afterwards. As an example, on day eleven the three cubs were protocolled twiching and lying-streching in 42 out of 153 (27.7 percent) observation minutes.

Connections between these behaviours and sleeping and dreaming cannot be overlooked. Both of them were similar to dreaming movements in adult ounces. And in recent years, several authors collected evidences supporting the assumption that dreaming is possible in infancy (reviewed in HEDIGER 1973).

Fur & paw licking: First indications of autogrooming behaviours were seen in a cub 13 days of age. From 18 days of age onward, these behaviours were noted regularly.

Shaking: Parallel to the autogrooming behaviours fur and paw licking appeared shaking. It was first seen on day 13. From then on, it was seldom, but regularly protocolled.

Ear twicking: These, in case of movements of both ears, synchronous movements, cannot be mixed with the ear movements associated with sucking when milk supply is exhausted. In the latter case, the ear movements are comparatively slow, their duration is longer than one second. During ear twiching, ounces ounces move their eas repeatedly back and for in less than one second. These behaviours, primarly belonging to the functional cycle of autogrooming (in adult ounces they are seen as displacemente activities during agonistic encounters, RIEGER 1980) were first seen in ounces cubs at 18 days of age.

Face rubbing: A face rubbing ounce moves a fore paw over its face downwards to the nose. This behavioural element is part of the face washing pattern during which face rubbing alternates with paw licking. The female ounce cub FIRSA was for the first time seen face rubbing at 41 days of age. Although at this time, the young ounces mastered paw licking, the combination of these two elements, face washing, was never observed.

Elsewhere, I criticized HEMMER's (1968) statement that face rubbing ounces never move their fore paws over eyes and ears (RIEGER 1980). This criticism again turned out to fe founded during the observations on the ontogeny of ounce behaviour. Without difficulties, young ounces start their face rubbing

movements from behind their ears. With increasing age, the frequency of this clear form of face rubbing decreasec. Actually adult xm ounces only rarely showed face rubbing starting from behind the ears or eyes.

Yawning: Young ounces were for the first time seen yawning at 9 days of age.

Beside these remarks on the ontogeny of autogrooming behaviours, a few additi onal statements are necessary. On the TV monitor, we could see that at 9 days of age, the cubs hat their eyes opened. At 11 days of age, they clearly reacted by terrified twiching to sudden noises outside the breeding den. Therefore, one is justified to assume that by this time the external auditory meatus is opened and hearing is possible.

During the whole time of observation, mother ANDRA never carried her cubs around. Only one exception was protocolled at six weeks x of age. In this week, the cubs started exploring their surroundings, they left the breeding den on their own. ANDRA sporadically carried a cub back from the inside cage to the breeding den. For this, she held the cub's neck-head-region in her mouth. Cub carrying was on thw whole rare and from TV images, we could not forther describex this behaviour. As an example, we were not able to judge whether the carried cub assumed a "transport catalepsy" or not.

The young ounces emitted a number of different vocalizations. Although the noises x noise from the breeding den were registered with the aid of a high quality microphone and recorded on the TV recorder, here we cannot discuss ontogeny of ounce vocalizations because (1) the quality of sound records was low, (2) back ground noises were relatively high,and (3) the concrete walls reflected sound waves several timesxxWx and caused echo efects. Under these presuppositions, sonagraphic treatments of the recorded ounce vocalizations would not lead to exact results.

4. Discussion

4. 1. Birth

Detailed descriptions of ounce births cannot be found in the literature. One reason for this is the fact, that it is still not a routine task to breed this species in zoological gardens. Until now, we only know of birth reports that were done with the aid of a closed circuit TV system (ANONNYMOUS 1978, FREEMAN & HUTCHINS 1978, WEILENMANN, in prep.). These reports do not differ from our observations at Zurich zoo.

Comparative investigations on duration of a birth and daytime of its occurence lead to some interesting results. Based on the up to now rather poor material available (table 4), one is allowed to guess that the birth of a cub lasts approximately one hour. In a few cases, extremely long intervals between succeeding births were observed (ANDERSEN 1957, FRUEH 1968) in primiparous females.

The daytime of an ounce birth is variable. MARMA & YUNCHIS (1968) recorded most births at Kaunas Zoo in the morning. Other observers reported birth moments at other daytime. The available data do not confirm the assumption of NAAKTGEBOREN & SLIJPER (1970) saying that births take place during the species' typical period of non-activity.

4. 2. Litter size

BLOMQVIST (1978) reported litter sizes of ounces in zoological gardens. 138 litters produced 284 offspring. 31 of them (22.5 percent) consisted of only one cub, 67 (48.6 percent) consisted of two, 36 (26.1 percent) consisted of three and four (2.9 percent) consisted of four cubs.

4. 3. Ontogeny

In order to compare to observations from Zurich zoo with others, it was tried to get reports on ounce ontogeny. But most available data come from handraising protocolls. It is thus only possible to compare some morphological changes (fig. 9) that occur in the first few weeks of life of an ounce. According to the available material, one can see that at the end of the first and the beginning of the second week of age, the optical and auditive senses start functioning. Some days later, the ounce cub shows first interests in its own body by performing autogrooming. Exploratory and social behaviours are first seen around 30 days of age.

From figure 9 a very remarkable variability in the time of the first tooth eruption is visible. It erupts between 2 and 30 days of age. HEMMER (1976) found a positive correlation between teething age and body weight, when comparing different cat species. Possibly a similar correlation might cause this high variability in teething in young ounces. It is a fact that weights of young ounces vary considerably. And a number of factors like litter size, age and condition of the mother animal, primiparous or multiparous litter, health, etc. influence the pre- and post-natal weight of young mammals. under these conditions, it is practically impossible to compare weight developments by using measurements published by different authors.

Several authors tried to present a common formula for describing ontogeny of mammalian species(WILLIAMS & SCOTT 1954, ALLYN 1974, ROSENBLATT 1976, POGLAYEN & POGLAYEN 1977, TRUMLER 1980). As ontogeny varies from species to species, the described stages in the development of the young vary parallel to the main study subjects of these authors. And terminology of the various stages, periods or phases differs considerably. ALLYN (1974) made an attempt to interrelate some of these different interpretations of ontogenetic periods. From his overview and further publications not discussed there, it becomes clear that in the time following birth, two to three different periods are recognized:

1. Neonatal/thermotactile stimulation, lasting until opening of the eyes.
2. Transitional/olfactorial stimulation, characterized by an increase in locomotion.
3. Socialization/visual stiumaltion, begin of social interactions.

In the behaviour of new born ounces, these periods can also be recognized. The first, neonatal period starts with birth and ends with eye and ear opening at 8 to 10 days of age (fig. 9). The main behaviour of the cubs consists in sleeping, sucking and contact lying. The transitional period, introduced by eye and ear opening, comes to an end when the cubs are four weeks of age. In this period, they improve their locomotion. At the end of this period, the cubs are able to cross a 15 cm high barrier. Beside locomotion, sleeping and sucking are still important. The socialization periods beginns when the cubs are five weeks of age. Then, they start interacting with their litter mates, they initiate social contacts, namely play behaviours, with their mother, and they explorate their environment. In this period, they are still sucking, but they also show interest in the food of their mother.

The investigation on the ontogeny of ounce behaviour did not allow to recognize further distinct periods.until the cubs reached seven weeks of age.