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Case study of the neonatal period of a Grey Seal pup (*Halichoerus grypus*) in captivity

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Summary

On 30 January 1987 a Grey Seal (*Halichoerus grypus*) cow gave birth to a female pup at the Harderwijk Marine Mammal Park.

Constant observation of mother and pup during the suckling period in undisturbed conditions produced the following details:

—Mother and pup usually only came together for suckling.
—After a long total suckling time per day during the first few days, the total suckling time decreased gradually and then stabilized.
—The duration of a suckling session was independent of the duration of the previous non-suckling interval and was also of no influence on the duration of the following non-suckling interval.
—The duration of the non-suckling intervals and suckling sessions was more or less constant during the whole suckling period.
—The left and right nipple were used equally.
—Both the mother's and the pup's activity increased until the time of weaning.
—There was as much suckling at night as during the day.
—The mother's food consumption was low just before and during labour, and in the suckling period, but increased greatly after the suckling period (i.e. after copulation).
—Moulting started 16 days after birth and finished 6 days later.

Introduction

As far as is known only a small percentage of Grey Seals (*Halichoerus grypus*) born in the wild survive their first year (Davies, 1949; King, 1964). The main causes of death of young Grey Seals are the following, in order of importance: 1) Starvation, 2) Prenatal problems resulting in still-birth and mortality associated with birth, 3) Injuries caused by other Grey Seals, 4) Infections and 5) Accidents (Coulson & Hickling, 1964).

However, also in zoos the first phase of a Grey Seal's life is often problematic (for example Leslie, 1974). The Harderwijk Marine Mammal Park has a pair of adult Grey Seals. The cow gave birth on 26 January 1985 and on 22 January 1986. Both pups died: the first during a difficult labour, and the second from unknown internal injuries 15 hours after birth. Around the end of January 1987 a third pup was due and several measures were taken to ensure its survival. This was successful and this article will report on the experiences gained. It therefore seems of interest not only to report the procedures used, but also to report in some detail on the interaction between mother and pup until the time of weaning. More knowledge about this neonatal period could contribute to greater chances of survival of young Grey Seal pups in zoos and possibly also to the protection of the species in the wild.

Materials and Methods

At the Harderwijk Marine Mammal Park there are now three Grey Seals: one adult male; born in 1972, found stranded on the Belgian coast in November 1973, and afterwards sent to Harderwijk. One adult female; born in 1973, stranded in Belgium in May 1978 and afterwards also sent to Harderwijk. On 30 January 1987 their (third) pup was born after a pregnancy of 373 days. This report concerns the behaviour of the mother and pup.

The Grey Seals are kept in an outside freshwater pool with a surface area of 560 m^2 and a depth of 1.2 m (Fig. 1). In this pool there are also 6 Harbour Seals (*Phoca vitulina*). Along the embankment a sheltered sandbank was made which slopes down into the water. This sandbank could serve as a pupping area.

To minimize any risks to the pup after birth, measures were taken to move the mother and pup inside if necessary. For that purpose a cage was ready for the mother. The pup could simply be carried.

The space, inside the Park's quarantine area, enabled mother and pup to be kept in peace during

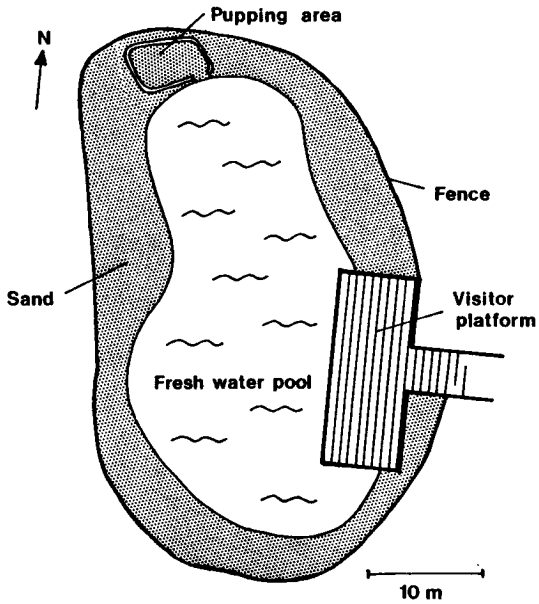

Figure 1. The freshwater pool in which Grey Seals and Harbour Seals are kept.

the suckling period. Tv cameras made it possible to watch and listen to the animals constantly. This quarantine area consists of an upper tiled area (2.2 × 3.0 m), which is linked by 3 steps to a lower tiled area (1.4 × 3.0 m). This lower area could be covered with a layer of water, 30 cm deep. The temperature in this area was 10 °C. Once a day the mother was offered a quantity of fish (herring and mackerel). The leftovers were removed later on. This way of feeding barely disturbed the animals and enabled the mother's food consumption to be recorded. The area was hosed down once a day.

The area was artificially lit 24 hours a day, and 2 tv cameras constantly monitored events (which could be observed on screens in an adjacent room). During the day additional daylight was provided through the windows in the ceiling. Through this ceiling photos could be taken of the animals and further filming could be done by means of a video camera.

The behaviour of mother and pup could be followed by means of the tv cameras. This was monitored every quarter of an hour between 0800 and 1800 hours, and every hour between 1800 and 0800 hours (max. recording rate per day 54).

All suckling periods were also monitored (beginning and end). This was possible because the beginning of every suckling session was announced by the pup vocalizing. These sounds served as a warning to the observers, who were continually present in the observation room.

The following parameters were recorded:
—Rest or activity
—Together or separate (a distance of less than 1 m was considered as being together)
—The beginning and end of a suckling session; intervals of less than 1 min were considered as interruptions of one suckling session. The duration between 2 suckling sessions was usually more than 30 min.
—Which nipple was suckled
—Other observations (such as rate of moulting)

The previously mentioned photos were taken on a daily basis to follow the rate of the pup's growth. The length of the tiles on the floor was used as a point of reference. The pup was weighed a few times. The mother's food consumption was also recorded for some time before the birth and after weaning by the quantity of fish taken with each feeding.

Results

The pup was born on 30 January 1987 between 22.15 and 22.30 hours, after the mother had visited the pupping area twice on the two days preceeding birth. One hour after birth it was observed that the pup was lying partially in the water. Because of the severe cold (−8 °C) the mother and pup were immediately taken to the quarantine area. The mother came on heat approximately 17 days after giving birth. She became restless and sometimes rolled over the pup. To avoid risks, the mother was returned to the father in the outside pool. This was on day 24 after birth and resulted in copulation half an hour later. During the 2 days following separation from its mother the pup was force fed on fish. The pup then began to eat fish thrown to her in the water. On 16 March 1987 (aged 45 days) the pup started to eat from the hand. On 9 April 1987 (aged 69 days) the pup was returned fit and healthy to the outside pool.

Sixteen hours after birth the pup vocalised for the first time. This announced the start of the first suckling session. This session and the following ones displayed the following ritual. The pup awoke and after a few minutes started to stretch out and explore its immediate surroundings. It then called its mother a few times. After approximately 3 volcalisations the mother came to the pup, and offered her nipples. Usually the pup started to search around the chest area. At this moment the mother stuck out her pectoral fin and made horizontal scratching movements, that usually gently touched the pup. The pup then found a nipple. After suckling for a few minutes the pup stopped briefly and then proceeded to suckle the other nipple. One or two pauses were usual and changing from one nipple to another could occur more than once. During suckling the mother often seemed to sleep. When the pup was satisfied it rolled away from its mother. The mother then usually rolled towards the pup once or twice to offer her nipples again. These efforts were always refused by

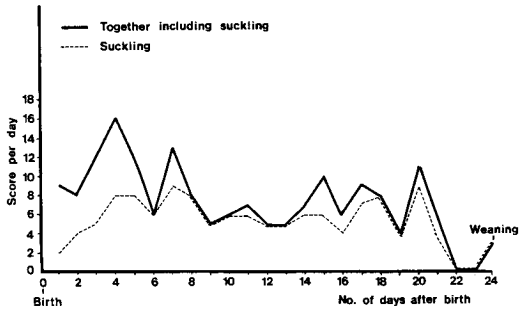

Figure 2. The number of observed occasions per day that mother and pup were found together, and the number of times per day suckling took place during the entire suckling period (max. score per day: 54).

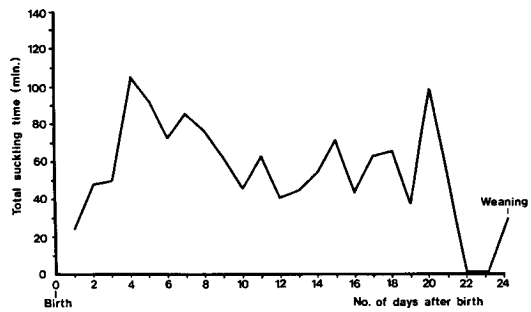

Figure 3. The total suckling time per day during the entire suckling period.

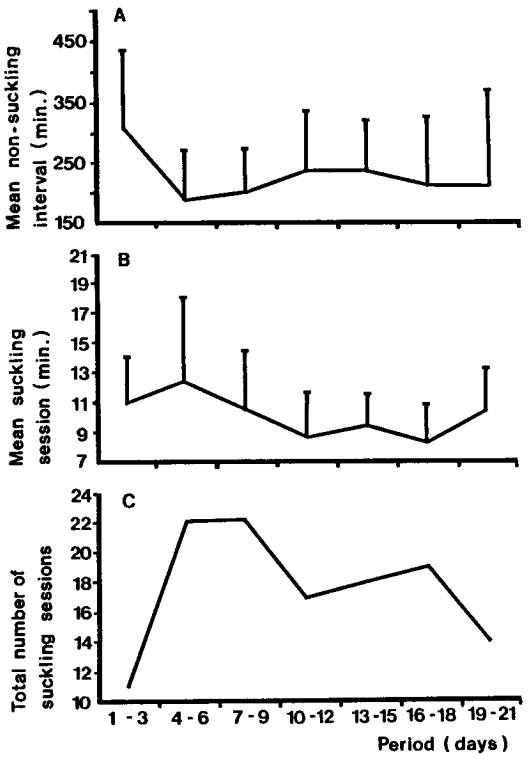

Figure 4. The mean non-suckling interval (A), mean suckling session (B), and the total number of suckling sessions (C) per 3 day interval during the suckling period. The bars indicate the standard deviation.

the pup and it rolled away from its mother once more. The pup and mother then soon fell asleep at a certain distance from one another.

Mother and pup were left to themselves in the quarantine area after the birth. Yet they did not appear to lie next to one another most of the time (Fig. 2). During the first few days mother and pup were relatively often together without any suckling taking place. Of the 176 cases of their being together during the whole suckling period 128 of them were cases of suckling (72.7%). By recording the duration of the separate suckling sessions it was possible to establish the total suckling time per day during the whole suckling period (Fig. 3). This total suckling time increased during the first few days and then gradually decreased towards the end (with the exception of a peak on day 20)

The duration of the separate suckling sessions and the intervals in between appeared to be variable (Fig. 4). In principle this variation opens the question of how a pup's milk consumption is regulated. It may be that the quantity of milk consumed in a suckling session determines the duration of the following interval, or vice versa, the duration of a non-suckling interval may determine the quantity of milk consumed in the next suckling session (compare for example analogous questions regarding the regulation of food consumption through meals: Le Magnen & Tallon, 1966; Metz, 1975; de Ruiter *et al*, 1969; de Ruiter *et al*, 1974). As the quantity of milk consumed during a suckling session cannot be measured directly it was considered to be correlated to the duration of a suckling session. The question was then whether the duration of a suckling session showed a correlation to the duration of the next interval, or whether, on the contrary, the duration of a non-suckling interval was correlated to the duration of the next suckling session. Neither the first ($r = 0.03$) nor the second correlation ($r = 0.02$) appeared to be significant. The first 6 days the mean duration of the suckling sessions increased to approximately 12 minutes. Later it decreased and stabilised around 10 minutes. The non-suckling intervals at first decreased greatly and then increased a little. These changes correspond roughly with the course of the number of suckling sessions every 3 days (Fig. 4).

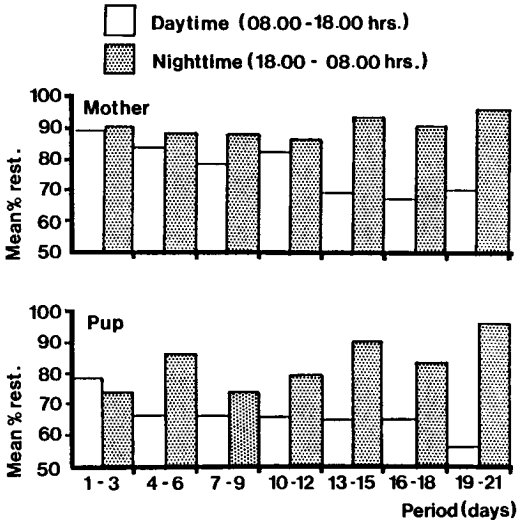

Figure 5. The mean percentage of time spent resting by mother and pup (per 3 day period) during the suckling period.

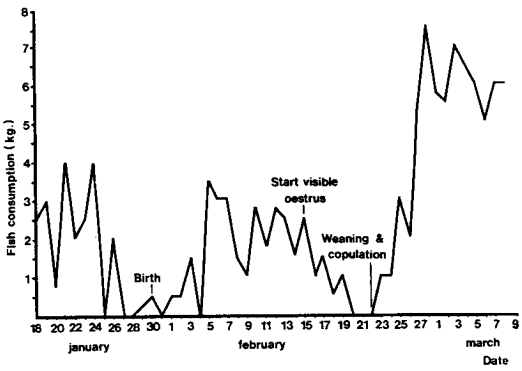

Figure 6. The mother's daily food consumption before, during, and after the suckling period.

During these sessions there appeared to be no preference for the left or right nipple, both the mother's nipples were generally suckled during a suckling session.

The mother and pup appeared to rest a great deal both at night and during the day in the beginning of the suckling period (Fig. 5). This changed towards the end of the suckling period in that both animals rested mainly at night and started to develop most of their activities during the day. However, during the whole of the suckling period there were as many suckling sessions during the day as during the night.

The food consumption of the mother showed remarkable changes before, during and after the suckling period (Fig. 6). While in January she consumed on average 3 kg per day, her intake decreased to less than 1 kg per day around the time of birth. During the suckling period this intake was still relatively low, but increased considerably in the post-suckling period (after copulation with the male).

Table 1. Weight and length changes of the pup and the weight of the placenta.

Time	Day	Weight pup (kg)	Weight placenta (kg)	Length (nose-end tail flipper) (cm)
Birth	1	17.0	2.2	105
	13	—		113
	20	59.0		120
Weaning	24	—		—
	40	—		120
	63	47.0		—
To pool	69	47.5		—

During the study period the weight and length of the pup changed as shown in table 1.

When the pup was 16 days old it started to moult on its head and paws. This moulting was complete by day 22.

Discussion and conclusions

During the first four days the mother spent a considerable amount of time, outside the suckling sessions, with her pup. This suggests that the bond between mother and pup is formed in this period. Burton *et al* (1975) found that physical contact (particularly nose-body contact) between mother and pup during the postnatal period took place particularly during the first 50 minutes.

In undisturbed natural conditions on Orkney (Fogden, 1971), the mothers use a combination of their senses to find and identify their young. The mother first hears the pup, and reacts by sighting and going to the place where the previous suckling session took place. Once she comes to the spot she recognizes her pup by smell. She then visibly smells the pup by mutual nose contact.

In cases of great Grey Seal density, the mother goes into the sea after each suckling session. With low density the mother remains with the pup on land during the whole suckling period. The amount of time spent on land by the mother also depends on the terrain of the colony and the accessibility of the pupping area (Fogden, 1971). In the present study mother and pup appeared to display the same actions in the same order as in a situation in the wild when the mother remains with the pup on land during the whole suckling period (Fogden, 1971). Only the visible smelling of the pup did not take place. Perhaps

the sense of smell is only used as a means of recognition when there is some doubt about the pup's identity.

The pup was suckled for the first time 16 hours after birth. On Ramsey Island the pups began to suckle 6 hours after birth at the earliest (Davies, 1949). The total suckling time per day increased during the first 4 days, which suggests that the milk production of the mother needs to be stimulated by the pup during the first few days after birth.

On day 19 after its birth, the pup got separated from its mother by lying on the lower level of the observation area. For some reason the mother did not go to the pup. The following day the pup seemed to catch up on the suckling sessions it had missed.

After day 22 and 23 when the pup was once again found to be separated from its mother, it was decided to return the mother to the outside pool on day 24. In Aberdeen Zoo a mother left her pup after 23 days of suckling (Leslie, 1974). On Ramsey Island, the suckling period usually lasted 15–17 days, regardless of the pup's condition (Davies, 1949).

Normally, the pup clearly determined when it wanted milk and how long it suckled for. The pup called out to its mother when it was hungry and the mother reacted every time by rolling towards the pup and offering her nipples. When the pup had had enough milk, it rolled away from its mother although the mother often continued to offer her nipples. Obviously the beginning and end of the suckling session were determined by the pup's appetite. It could be that because of the relatively undisturbed conditions in the present situation there was no correlation between the duration of a suckling session and the preceding non-suckling interval.

Exceptions such as extremely short suckling sessions can often be explained by the fact that sessions were disturbed. Long non-suckling intervals only occurred when the pup could not reach its mother. Often the mother (influenced by an external factor) was responsible for the extremes observed. Under natural conditions disturbances probably occur more frequently. In that case the duration of suckling sessions and non-suckling intervals is often influenced by non-feeding factors. On Orkney it sometimes happened that the pups were disturbed while sleeping, and then started to call out from hunger, which resulted in short non-suckling intervals (Fogden, 1971). On Ramsey Island the pups called out for their mothers and were suckled, with irregular intervals between sessions of 2 to 5 hours. There were no changes in the duration of the non-suckling intervals during the suckling period as was also reported by Davies (1949).

Both nipples were used approximately the same number of times by the pup and from this may be concluded that both nipples gave the same amount of milk.

As the pup grew, the day-night rhythm of activity developed. A similar trend could be seen in the mother. Her activities increased relatively less than those of her pup. This is probably due to the fact that she preserved as much of her energy reserve as possible for her pup. On Orkney the pups were usually asleep, unless they were hungry or disturbed. The pups only moved a few metres during the whole suckling period. As the suckling period is so short in Grey Seals, most of the milk's nutritional value is used for growth and very little for movement. Grey Seal mothers can produce between 1.5 and 2.8 kg milk per day (Fogden, 1971). The milk is 10 times richer than cow's milk, containing approximately 50% fat (Amoroso and Mathews, 1951).

In Aberdeen Zoo (Leslie, 1974) as well as in the wild (Fogden, 1971), the mothers were lethargic and slept for most of the day during the suckling period. In Nova Scotia the mothers had 2 reasons for moving: firstly to make room for the pup to enable it to suckle in peace, and secondly to push the pup back if it had moved too far away. In some colonies in the West Atlantic Ocean the mothers stay on land for 2.5 weeks after giving birth. During this period they only move a few metres. However, in other colonies the mothers return to the sea after each suckling session, but stay close to the shore (Boness & James, 1979).

There appeared to be no daily cycle for suckling. There was as much suckling at night as during the day. On Orkney night-time suckling was observed, but details such as those in this case study could not be compiled for practical reasons (Fogden, 1971).

It was not possible to record the weight changes of the mother in this study. However, her weight loss was easily detectable. At birth she was fat and at weaning she was so slender that her ribs were visible. The energy that the mother passed on to the pup was not immediately compensated for by an increase in her fish intake. After the suckling period in which the mother's fat reserves had decreased greatly, the mother ate a relatively large amount. Even when a pup dies, the food intake of Grey Seal cows remains relatively low for a while. In Aberdeen Zoo a cow did not eat for 19 days after her pup was still-born (Leslie, 1974). The reason for this diminished appetite is still not clear.

The average weight at birth of 74 pups on the Farne Islands was 14.8 kg (Hewer and Backhouse, 1968). According to Fogden (1971) a Grey Seal pup must increase in weight from 13.5 kg to 38 kg within 21 days (an average of 1.2 kg per day) in order to survive. The greater the weight at the time of weaning the better the pup's chances of surviving the first year (Coulson and Hickling, 1964). In Aberdeen Zoo (Leslie, 1974) a pup gained weight at an average rate of 2.1 kg per day during a suckling period of 23 days, while Amoroso *et al* (1950) reported a weight gain of about 1.5 kg/day during a 15 day suckling period.

The increase in weight during the suckling period in this case study was relatively high (an average of 2.1 kg per day). This was possibly due to the fact that there was little disturbance, no rain, and a relatively high and constant temperature of approximately 10 °C. In the wild, suckling periods are often distrubed by aggressive interactions amongst the cows themselves, and between the cows and other cow's pups (Burton *et al*, 1975).

The increase in the pup's weight during the suckling period was 42 kg. The weight decreased by 20% during the first month after weaning. After that it gradually increased. After weaning, wild Grey Seal pups need to live on their reserves of fat until they are efficient enough at catching and consuming fish (Davies, 1949; Coulson and Hickling, 1964).

The beginning and duration of the moult vary much. The pup in this study still had its full white lanugo fur for the first 15 days of its life. Thereafter it began to moult on its head and paws. Within 6 days the moulting was complete. In Aderdeen Zoo, a pup did not gain its new coat until 29 days after birth (Leslie, 1974). There is often great individual variation in the start and duration of moulting within one breeding site and during the same year (Curry, 1970). The rate of moulting may depend on the pup's degree of activity and the amount of time spent in water. In 30% of the cases on Ramsey Island the moult had already started before birth. Usually moulting started between day 9 and 18 and was completed between 11 and 27 days after birth (Davies, 1949).

Boness & James (1979) speculate about the way in which the males notice that a cow is on heat. In Harderwijk the cow began to scratch restlessly at the fence after day 17 post partum. At the same time the swollen labia could clearly be seen between day 18 and day 24 (the day of mating). In Aberdeen Zoo intercourse was observed once 3 days and once 21 days after the birth of a pup (Leslie, 1974). In the wild in Nova Scotia mating took place on average 10 days after birth and successful intercourse on average after 15 days. Intercourse can last from 5–50 minutes. Often the cows were mounted before they were in their oestrus period (Boness and James, 1979). Premature attempts at mating were also observed in Harderwijk on 11 January 1986. This was 11 days before the birth of a pup.

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