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Summary

The survival of marine mammals is under pressure. To study them thoroughly and to learn how to breed them in captivity, before their number in the wild has dwindled too low, are important prerequisites in our struggle to prevent extinction.

Three births, two normal and one miscarriage, in the Dolfinarium at Harderwijk in 1971, 1972 and 1973 are discussed. Our observations lead us to conclude that a mature male of at least 12 to 15 years of age seems to be the crucial factor in successful mating, rather than a sexually mature female. The behaviour of the mother, i.e. her experience towards the baby in particular in the first period, in relation to pool dimensions is essential. The behaviour of other animals in the pool may play a part. Ample pool dimensions are essential. In this respect a minimum standard for pool size should be incorporated into legislation and standard rules and guidelines.

Introduction

In different ways interest in cetaceans has increased since World War II and in some respects with devastating results. Pelagic whaling has brought most of the larger species close to extinction if not virtually so and Tuna fishing is taking too heavy a toll of some delphinid species (PERRIN, 1968). Besides these direct threats there are two indirect ones which may be just as fatal - overfishing and pollution (DUDOK VAN HEEL, 1972). Therefore from the point of view of conservation it is clear that breeding of marine animals should be on the top of the priority list of any institution keeping them. Every establishment should have at least a group of three - one male, two females - provided its pool(s) is (are) large enough.

The Dolfinarium Harderwijk imported the first four animals in July 1965 (DUDOK VAN HEEL, 1970). The group consisted of one male "Moby Dick", estimated age + 8 years, one male "Wiki Wiki", + 4 years old, one female "Mamma", large and old, probably 25 years or more and one female "Peppy", + 4 years old. Mamma was reported to be caught in the spring of 1965 with a calf which died later. This might explain the very thorough attachment she showed towards the young Peppy. This affection is mutual and although less intense has not died out yet (Oct. 1973).

After about two years of operation we knew there was a kind of rhythm in mating throughout the year and this has shown itself to be consistent until the present time. Mating activity starts during November and lasts to the end of May or early June. There is a decline until the second part of August when there is again a lot of activity until the end of September or early October after which follows a second decline. This does not mean that during the active periods mating behaviour is observed each day nor that during the periods of decreased activity no mating is seen. It is possible that mating and courting is even more important as a social function than as a means of reproduction. One sees as much mating and courting behaviour between two males or two females as between a male and female.

Although we have observed a lot of mating, this never resulted in offspring nor even a premature birth. Perusal of literature (SLIJPER, 1962, CALDWELL and CALDWELL in RIDGWAY, 1972, SERGEANT, 1962 and discussion with colleagues, the staff of Marine-land of Florida in particular) led us to conclude that the age of the male was involved, the general opinion being that an odontocete

male must be 12 to 15 years of age before complete sexual activity is reached. We learned from Mr. G.J. de Haan, director of the Texels Museum, Texel, Netherlands, that he was only able to reach breeding successes in his group of 22 harbour seals, *Phoca vitulina* L., after he had established a group of mature males of various ages, including subadults, all competing with each other for the females. So I did not expect a successful mating before the spring of 1970 when Moby Dick, the oldest male would reach an estimated age of between 12 and 15 years. This would result in our first birth in 1971. By chance it happened to be so, and in May of that year Peppy, who came to us as a juvenile in July 1965, gave birth to a male infant.

As a result of my considerations we ordered in the autumn of 1969 from Milton Santini of Grassy Key, Florida, one full grown adult male and one mature female in order to form a breeding group. In March 1970 we received "Jouri", a seasoned fully grown magnificent bull, and "Lara" a mature female accompanied by her + 8 months old female calf which was still suckling. To this pair was added Mamma, the old female imported in July 1965 and later "Monique", also an adult female imported in January 1971.

After a settling down period Jouri came into his own and it was immediately clear there is a world of difference in the behaviour between young adult males and a mature one. The drive of the older animals is far more intense and everything we had seen so far in courtship and copulation had been playing and exercise; the success between Moby Dick and Peppy seemed to be a happy coincidence.

The autumn activities of 1971 appeared to be successful as Lara gave birth to a female infant in November 1972.

"Doris" came to us in September 1969 and belongs to the pollution victims described earlier (DUDOK VAN HEEL, 1972). Because of her health, which deteriorated at irregular intervals, she has not been in training since autumn 1970 and has been kept with our exhibition group and in company with Jouri for some time. She was suspected to be pregnant in the spring of 1973. In a way to our surprise, as we did not suspect it in an animal that was not always well. We did not like it as we were of the opinion her body would not be healthy enough to bear the strain of pregnancy. Our misgivings turned out to be true. Her health deteriorated and luckily in June 1973 she gave birth to a female, premature calf, still born, 50 cm of length. The miscarriage enabled us to

pull the mother through.

Report of first case

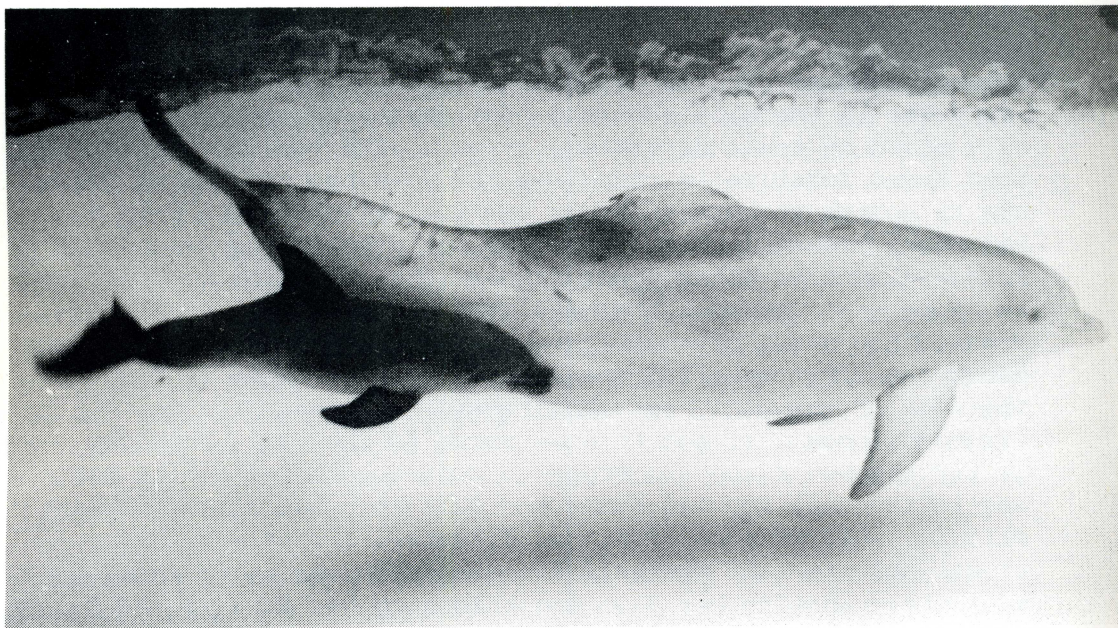
Since her arrival in Harderwijk in 1965 Peppy has been an excellently performing animal for eight years. She was kept under close observation from Christmas 1970 and in March 1971 she was reported to behave differently during the show and towards the males. She also was observed to flex her spine now and then and we noted her abdomen had thickened and she was stealing several pounds of fish daily off her mates. We kept her in the show but she was not allowed to do high jumps and her favourite somersault. On May 10 she did her somersault unexpectedly and therefore was brought into a separate pool measuring 12 x 6 m, 2.80 m deep, in company with two adult females. One of them was Mamma, a dominating old female to which Peppy was very attached. During the following week Peppy flexed increasingly, stretching in both dorsal and ventral curves while lying still in one place at the surface, exactly as described by TAVOLGA and ES-SAPIAN (1957). Mamma especially showed much interest in all her doings and, as we thought at the time, behaved like the ideal aunt never leaving Peppy's side. The other female, "Kathy" mostly went her own way.

Peppy stopped eating in the afternoon on May 18, when she was flexing every 5 to 15 minutes. Nothing special was seen until at half an hour past midnight the night watchman saw Peppy jumping out of the water three times, after which a little tail was seen protruding from her belly. The staff was warned and we all saw some unexpected scenes happening in the next two hours. After an hour of intense labour, alternated by nervous sprints around the pool and meticulously observed and assisted by Mamma, the calf was born. The actual breaking of the umbilical cord could not be seen from above the water surface. For a moment the calf remained still at the place of birth, then moved its tail to swim upwards to the surface. It broke the surface at a steep angle, emerging so that the insertion of the flippers were visible, fell forward, while in the mean time the first puff was heard, and stayed at the surface. Mamma hurried near and took possession of the baby, made it surface again and led it to the other side of the pool. A curious behaviour not yet mentioned in literature followed. Mamma pushed the baby, after blowing, down to a depth of $\pm 1\frac{1}{2}$ m, pushed it upwards and down, and up again four or five times in quick succession.

We expected Peppy, after recovering, to take over the calf but to our astonishment she was not allowed the slightest chance to get near. Mamma, however Peppy tried, carefully and deftly took care to keep the calf for herself, placing herself between the calf and Peppy. She took it down between her flippers to the bottom many times to follow and surfaced sometimes even without giving the calf a chance to breath. Once she pushed the calf down for so long that it screamed and airbubbles left the blowhole. Mamma reacted immediately by pushing it to the surface. Peppy was in the middle of the pool facing the pair and repeatedly moved in their direction, in vain; the result was merely that Mamma fanatically rushed up and down the pool, from surface to bottom in between Peppy and the wall with the calf on her beak. Meanwhile Kathy made her own circles just watching from a distance. After about an hour the situation quieted down as Peppy gave up. Then the calf started to try and suckle Mamma. This urged us to prepare the separation of the calf from Mamma. At first we tried the simplest way to catch it from the side of the pool, but immediately Mamma got wise to this trick and took care not to come close to the wall. Then we gently removed Kathy and Peppy to separate but adjoining pools and in the same way led Mamma and calf into another adjoining circular shallow pool of 6.5 m. diameter. Promptly a trainer was able to take the calf from her side. Although she fought fiercely, clapping her jaws and thrashing her tail in the direction of the trainer, Mamma was quickly ushered away and in a few minutes Peppy and her calf were reunited in the circular pool. Peppy's first reaction was to push the calf down and bring it to the surface on her beak, repeating this three times before she led it to the original pool. She spent the next hour forcing the calf to swim in circles at her side, keeping it at the inside directed towards the middle of the pool. Whenever it tried to speed away from her and threatened to collide into the wall or disappear into one of the sluices she violently pushed it down or threw it to the centre of the pool again and it obediently followed her until its next sprint. Breathing of the calf was observed to be \pm 17 seconds at 06.00 hrs. By now the tackling sessions had decreased to rare incidents and the calf was often seen to search Peppy's belly while Peppy lay still to give it a chance. At 07.35 hrs we actually saw it drinking. At 07.38 Peppy rubbed her belly against the edge of the sluice and the placenta stayed hooked on it. At 08.30 hrs we opened the gate to the exhibition pool, measuring 20 x 8 m., with a depth of 2.80 m., having a 20 m. glass wall, where the two were

to pass the days to come. After calling Peppy to the large pool we let her choose how to do it by herself. She took about half an hour to train and guide her calf through two pools into the larger one. She did it quickly and step by step. In the evening it took her less than five minutes for the return trip.

Fig. 1. Peppy with her male calf.



During this first morning we once more tried to give Peppy companionship of Kathy but she furiously attacked her until Kathy fled out of the pool. Three times daily we observed breathing times of the calf and behaviour of the pair during feeding. Once every 20 to 30 minutes it nuzzled the offered belly and after 10.00 hrs most of the efforts were successful. Breathing was every 23.5 seconds on average. One thing curious must be noted, that from the first day once in a few hours Peppy suddenly put up a sprint and hurried at high speed around the pool 2 or 3 times with the calf effortlessly clinging to her side, after which she calmed down to normal speed. The next days all followed the same pattern, breathing varying from 23 to 25 seconds. On Friday we saw something puzzling to us, whatever meaning it had. Peppy took the calf down to the bottom and kept it there, pressing it and stroking it gently.

This lasted for at most a minute before she continued her way, to be repeated a few times that day.

On Sunday, May 23rd, nothing abnormal was seen, feeding, drinking and breathing were as before. In the afternoon favourite playing movements already developed were often observed. A favourite being to glide from and roll over mothers back when the latter was floating at the surface. At 19.00 hrs everything looked fine, but at 24.00 hrs the calf was found dead on the bottom. Post mortem indicated a fatal pneumonia in both lungs with *Staphylococcus* and *Escherichia coli*.

Report of second case

Lara was caught in Florida in 1970 with a not yet weaned female calf "Nicky". They were successfully transported to Harderwijk in March 1970 in 23 hours and the calf started nursing 10 minutes after being lowered into the pool. Without any problems she continued to grow and we marvelled at her playful behaviour. She did not take any fish and Lara constantly took 10 Kg. of fish against the other animals averaging to 4½ Kg. In late spring Nicky started to take fish and by the end of May was apparently weaned completely while Lara was down to an average of 7 Kg. However, on the 8th of August Nicky suddenly refused fish and turned to Lara for milk. Lara responded quickly, her appetite increased to 9 Kg. For 4 days Nicky did not touch fish, then she started to take fish again and this time for good. In May 1971 Lara and Nicky were separated. Her ultimate fate has been described earlier (DUDOK VAN HEEL, 1972).

In the summer of 1972 Lara was obviously pregnant. We removed all her mates including Mamma, and added Kiana, a timid female, and put her in a pool which measured 10 x 11 m. with a depth of 4 m. On November 29th, 1972 in the afternoon Lara stopped eating. Since a few weeks she had flexed increasingly but not as yet as often as Peppy. All afternoon she rubbed the bottom of the pool with her belly. At 17.10 hrs the author saw nothing special and there was no indication of imminent activity but at 20.50 hrs he saw a female calf swimming at Lara's side. There was no faecal contamination in the water and the calf's dorsal fin had stiffened already of which we may conclude that it must have been born sometime near 17.30 hrs. We observed the pair all evening and several times the calf put on a sprint in

Fig. 2.

Lara with her female calf.



a line straight ahead. Lara hurried after it to prevent it bumping into the wall in much the same way as Peppy did, but although this did not happen as often as in Peppy's case, Lara reacted as violently but swifter and more effectively. We once tried to lead her gently into the large adjoining pool but she refused and we let her alone at midnight. The breathing rythm of the calf was 16.2 sec. then. In the morning, after removing the placenta, they quietly settled down and the calf was seen drinking every 15 to 20 minutes successfully. Once in a while she took a sprint followed by Lara who punished her dutifully. Breathing rythm was 20 seconds. This situation did not alter for two days, after which the calf obediently and calmly followed Lara and was allowed short diversions upto 1½ m. She suckled every half hour, breathing ranging from 15 to 34 seconds. On the sixth day the breathing rythm had decreased to at most 24 sec. On the 8th day in the end of the morning she was observed to swim somewhat laboriously. In the afternoon at 14.30 hrs she was clearly in distress. Lara pushed her to the surface on her beak repeatedly and at 14.45 hrs she died. It took some time to remove her from Lara. Post mortem showed a clear cut case of pneumonia with *Staphylococcus aureus*.

An incident took place during the short life of this calf: the day after birth the group of performing animals had been lying in front of Lara's pool being very curious and vocalizing a great deal all day long. In the evening at 21.00 hrs we were astounded to find that the whole group of five animals had forced its way in by pushing the solid gate and bending the 16 mm. stainless steel sliding pin, causing it to slip out of its socket. Lara was swimming in her own corner very excitedly with the calf and Kiana, while the intruders were having fun in the other corner, jumping and racing joyfully. We will never know what happened in the preceeding hours. When commanded out of the pool the gang obeyed immediately.

As to the behaviour of Kiana, she did only a few times a day swim close to Lara and the calf and mostly went her own way at a certain distance. There was no obvious animosity between the adults.

Discussion

The behaviour of Jouri seems to confirm the observations of CALDWELL and CALDWELL in Ridgway (1972) that the male has to be at least 12 to 15 years old to be mature and those of TOWNSEND (Marineland of Florida, pers. comm.) that the majority of successful births have been due to the mating of an old bull. This seems to be emphasized by the fact that Lara, after having her baby in December 1972, was immediately returned to her original group where she was seen in active company with Jouri immediately. This has resulted in a post partem conception as since the summer of 1973 she is clearly pregnant, being a suspect since spring and now (October 1973) we will not be surprized if she gives birth before Christmas. In the mean time old Mamma gives all signs of being pregnant. Birth is expected to be this winter.

Old Monique is one of the most playful animals we have and always extremely active to rouse the bull using all kinds of techniques. She and the bull have been extremely active for about three weeks at the end of July 1973 and the first part of August. From about mid August onwards their overt partnership ended and we have noted this "just in case".

There is no need to enlarge on behaviour during pregnancy. This has been described extensively by TAVOLGA and ESSAPIAN (1957) and we cannot furnish new details. Peppy, the young female having her first calf, flexed and rested far more, especially when term approached, than Lara. Both Peppy and Lara showed distinct swollen bellies. Scraping and bumping their bellies, sometimes even forcibly, against the bottom of the pool or corners of connecting channels or gates should be noted. Neither Peppy, although she did steal fish from others, nor Lara did show a very marked increase of appetite. Lara and Mamma are eating now $1\frac{1}{2}$ to 2 times as much as they used to do i.e. 7 to 8 Kg. per day, but so do Jouri and Monique lately.

Both Lara and Peppy stopped eating in the course of the day of parturition and we intend to use it as a sign we can expect a baby within 12 hours. The trainers have been ordered to warn

the staff as soon Lara and Mamma quit eating.

It should be mentioned here that the feeding of the mother in the first days after parturition may present a problem. Peppy came as a juvenile animal and was faced with her first calf. Moreover, she was a fully trained and performing animal. When it came to feeding she came up to the side of the pool as usually to be fed by hand. This meant she left the calf go, which immediately bumped into the side of the pool. Lara, on the contrary, is not a trained animal, came to us with a calf and therefore has experience in rearing. She refused fish during the first two days, being too occupied in looking after the calf and guiding it around. In case of a trained and/or young inexperienced mother extra precautions in feeding the mother are necessary.

My experience is limited but perusal of literature, discussions with colleagues who have witnessed births, and my own observations, lead me to believe that a female dolphin is very well able to cope with a birth alone. Unless one has a breeding group in a large tank like Marineland of Florida, I am inclined to advise separation of the pregnant female if the signs are there that term is at hand. In this respect it is a great pity that so far most Oceanaria have been so reticent in publishing details of births and especially of failures. Failures like we are describing here have come to pass, I know from personal communication. They teach us more about the real problems in births in dolphins than successful ones. This is of relevant importance, in particular in the cases of successful births followed by death about a week later, such as described in this paper. These two cases do not stand alone. Milton Santini, at that time still on Grasse Key, Florida, told me about a baby born in one of his open water pens, which died after six days from pneumonia as confirmed by Dr. J. White of Seaquarium, Miami. From Barcelona Zoo there is a similar report (CALDES c.s.). Dr. Gewalt, Duisburg Zoo, Germany, after visiting Japan reported to me (pers. comm.) a rather high mortality in babies born in captivity. However, nothing is known whether this includes premature births, abortions near full term, because of catching and transport etc. It is said, according to this source, that only 25 to 30% of the babies survive.

Close observation of the behaviour of the little infant during

the first 36 hours of its life clearly demonstrates the hazards and easily explains the pneumonia which killed the little ones after about one week.

Without support or assistance of adult animals - either mother or so-called aunts - the baby is able to reach the surface within seconds after parturition and blows for the first time, distinctly audible from a distance of at least 6 m. Peppy's infant stayed at the surface and blowed again before Mamma took possession of him. It was obvious that water had entered the blowhole as a distinct cough could be heard. Of course this happened again after the violent treatment of Mamma later on.

It is obvious that the method of surfacing in order to blow as adults do has to be learned. During the first days the calf surfaces obliquely, poking its head out as far as the insertion of the flippers. The calf blows and the head splashes forward and as the arc of the wheeling movement of the calf is therefore longer than that of the mother it has to hurry by way of some extra quick strokes of the fluke to be able to resume its position lateral of the dorsal fin of the mother. It takes more than a week to learn the ultimate manner of surfacing well known in cetaceans.

As it is, no physician objects to coughing of a baby after birth, as it is said this will clear the lungs of possible remains of mucus and amniotic fluid. However, in a dolphin water entering the blowhole shortly after birth, in captivity in particular, means faecal pollution for sure. As in other mammals with parturition a large cloud of faeces may be liberated with the infant as we saw in Peppy's case and the little one shot up to the surface through this cloud and stayed on top of it for at least up to 10 seconds, blowing again. Actually pieces of faeces were found at post mortem in the inflammed lungs. It takes at least two hours for the filters to clear up the pool completely and 10 to 20 minutes before the pool was visibly clear. With Lara no faecal discolouration was seen and no particles were found in the infant's lungs. In Peppy's case we were in doubt whether the entering of water in the lungs was caused by Mamma's behaviour only or that the pool sides were unfavourable as well. In Lara's case it was clear that in particular during the first two days there was the constant watch to keep the baby away from the walls. Lara's methods were almost violent and often the calf was pushed or thrown to the middle of the pool just in the act of blowing.

This invariably resulted in heavy coughing and extra blowing. It is almost sure that the chance of water entering deep into the nasal hole system and even the lungs was drastically increased.

It is our firm opinion that a circular pool should have a diameter of at least 12 metres or 10 x 15 m. in case of a rectangular or oval pool. Even then the constant watch and circling in narrow surroundings is a considerable strain.

During the discussion of this paper at Duisburg Mr. J. Tiebor, who has considerable experience of keeping animals in small pools endorsed this view strongly, adding that only one or two perhaps three establishments in Europe were large enough to encourage breeding. He was adamant in stating that all others should refrain from breeding and keep males and females separated to prevent failures.

In my opinion this is at the same time a "testimonium pauper-talis" and a self condemnation. It means the small pool establishment is not good enough for dolphins as they will not be able to perform their normal life cycle. It also means that in legislation and the accompanying minimum standards, rules and guidelines, minimum pool sizes should be incorporated.

References

- CALDWELL, M.C. and D.K. CALDWELL, 1972. Behaviour of marine mammals. In: Ridgway, S.H., 1972. Mammals of the Sea; biology and medicine. C.C. Thomas Publishers, Springfield, Illinois: pp. 419-457.
- DUDOK VAN HEEL, W.H., 1970. Dolfijn, hoe doe je het? P.N. van Kampen en Zoon N.V. Amsterdam, Netherlands. (Dutch)
- DUDOK VAN HEEL, W.H., 1972. Raised levels of mercury and chlorinated hydrocarbons in newly captured *Tursiops truncatus* from Florida waters. J.Aq.Ma. 1(2): pp. 24-36.
- PERRIN, W.F., 1968. The porpoise and the tuna. Sea Frontiers, 14 (3): pp. 166-174.
- SERGEANT, D.E., 1962. The biology of the pilot or pothead whale *Globicephala melaena* (Traill) in Newfoundland waters. Bull. Fish. Res. Board of Canada: 132: pp. 32-67.
- SLIJPER, E.J., 1962. Whales. pp. 349-390.
- TAVOLGA, M.C. and F.S. ESSAPIAN, 1957. The behaviour of the bottle-nosed dolphin (*Tursiops truncatus*): Mating, pregnancy, parturition and mother-infant behaviour. Zoologica, 42(1): pp. 11-37.