



**ВСЕЛЕННАЯ
БЕЛОГО МЕДВЕДЯ**
НАУЧНО-ПРАКТИЧЕСКАЯ КОНФЕРЕНЦИЯ



ПРАВИТЕЛЬСТВО
ЧУКОТСКОГО АВТОНОМНОГО
ОКРУГА



МИНИСТЕРСТВО ПРИРОДНЫХ
РЕСУРСОВ И ЭКОЛОГИИ
РОССИЙСКОЙ ФЕДЕРАЦИИ

Breeding of South African fur seal, *Arctocephalus
pusillus pusillus* in captive environment
--- Comparison between hand-raised and natural nurturing

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ВСЕЛЕННАЯ БЕЛОГО МЕДВЕДЯ: Арктические экосистемы

19 - 21 марта 2024 года

Pinnipeds

- Pinnipeds belong to the order Carnivora in the phylum Chordata. Most animals have a spindle shaped and fin-like feet, semi-aquatic and highly adapted to aquatic life. They are originated from a group of terrestrial mammals that entered the ocean and lived, and their closet relatives are musteloids (weasels, skunks, red pandas, racoons).
- Today's pinnipeds comprise of 3 families:
 - Odobenidae: only 1 species, *Odobenus rosmarus*
 - Otariidae: eared seals, include 6 species of sea lions and 9 species of fur seals
 - Phocidae: earless seals, or true seals, 18 species



Representatives of the 3 families of pinnipeds



- Fig. 1: Representative from the 3 families of the pinnipeds. (left) Baikal seal; (center) California sea lion; (right) walrus.



Abstract

- Captive breeding of South African fur seal, *Arctocephalus pusillus pusillus* at Fuyang Andover Ocean Park is reported in this study.
- A group of 2 males and 4 females were kept together in an exhibition pool since August 2020. Only one female fur seal was successfully impregnated, and it given birth twice in July 2021 and July 2022, respectively.
- The first male pup was abandoned by its mother seven days post-delivery and had to be manually hand raised. The pup unfortunately died after 45 days.
- When the same female was found pregnant again, it was removed from the social group and individually cared for in a separate holding area. The second male pup was eventually born in July 2022 and continued to be raised by its mother without any interruption or human intervention. The second pup grew and weaned successfully.
- The delivery and rearing protocols of these two young pups are discussed on how it could improve the survival rate of captive bred South African fur seal.



Photos of South African fur seal



- Fig. 2: The female (left) and the male (right) South Africa fur seal. There are differences in body size and appearance between the male and the female.



Social group of the South African fur seal

Fur Seal's Nickname	Gender	Body Weight (kg)
Lufei	M	88
Tuanzi	M	55
Leo	F	45.5
Laifu	F	44.5
Dali	F	41
Nuomi	F	36

- Table 1: Body weight (as at June 2021) of the group of South Africa fur seal rears in Fuyang Andover Ocean Park. The fur seals aged 4-5 years old, and sex ratio is 1:2. “Lufei” is the dominant male in the group.



Living environment in captivity



- Fig. 3: The indoor exhibit pools that were used to keep the fur seal group. Pool 1 (left) was used to keep the group between 2020 to 2022 (land area = 53.8m^2 , pool depth = 1.4m , water surface area = 61.5m^2 , and water volume = 90m^3). Pool 2 (right) was used to keep the group after 2022 (land area = 390m^2 , pool depth = 2.6m , water surface area = 57m^2 , water volume = 148m^3).



Husbandry and desensitization of the female fur seal, “Laifu”

- 1) The female South African fur seal, “Laifu” first pregnancy was diagnosed in May 2021. It was not segregated from the main social group because the original plan was for natural nurturing. It lived together with the other five fur seals even after given birth to a male pup which was later nicknamed “Yang Yang”. However, other fur seals in the exhibition area had repeatedly harassed “Yang Yang” and “Laifu”. Seven days after birth, the keeper found that “Laifu” went into the water to mate again.
- 2) “Yang Yang” was also born during the summer peak visitor season. It was inferred that the noises and disturbances from both summer visitor crowds and the other fur seals in the group distracted “Laifu” from properly caring for “Yang Yang” and eventually led to its total abandonment. “Yang Yang” was then removed from the exhibition area and hand raised by the keeper. Unfortunately, “Yang Yang” died after 45 days in nursing.



Second pregnancy of the female fur seal

- 1) The female South African fur seal, “Laifu” was found pregnant again in May 2022.
- 2) Given the failed experience of “Yang Yang” and to avoid the repeat of parenting distraction, a new plan was conceived to remove “Laifu” from the social group to a separate holding area (land area = 16m², pool area = 16m², water depth = 1.4m, water volume = 22.4m³).
- 3) Isolation is partial because the area is just adjacent to the main exhibit pool and the separated animal could still hear the other fur seals. “Laifu” was brought into the separation area daily for 15 days for desensitization purposes.
- 4) The objective of the desensitization process is to reduce the stress of sudden changes in living environment and consequent risks of stillbirth. After two weeks of training, “Laifu” was transferred fully to the separate holding area.
- 5) One infra-red video-camera that can rotate 360 degrees in the independent area was installed, and a dedicated keeper was assigned to observe the animal frequently.



Delivery room



- Fig. 4: The separation area for the female fur seal “Laifu” after she was diagnosed pregnant again in May 2022. The pool is 4m x 4m x 1.4m, and the dry area is 4m x 4m.



Food & supplements for the female fur seal

- “Laifu” consumes mainly herring and capelin, and the amount taken varies with seasonal changes in water temperature and the physiological condition of the animals.
- 1 Akwavit tablet for pinnipeds, 1 multiple vitamin complex tablet for pregnant women and 1 D-Cal calcium carbonate-D3 tablet are given to “Laifu” everyday.
- After “Laifu” delivered, nutritional supplements such as D-Cal calcium carbonate-D3 (1 tablet), multiple vitamins complex (1 tablet) as well as extra vitamin C (2*100mg) are given daily.
- It is speculated that one type of herb made by *Leonurus japonicus* can provide to the post-delivery fur seal to hasten vaginal discharge excretion.



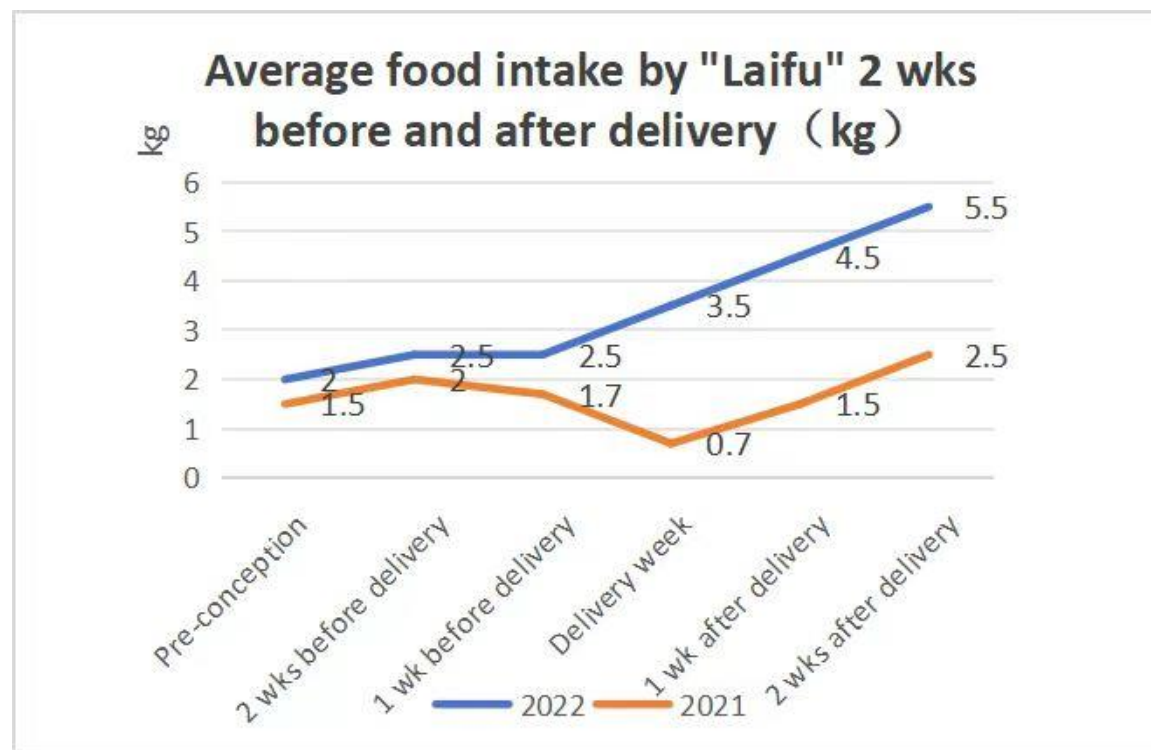
Frozen fish food and supplements



- Fig. 5: The frozen fish food (left) and the supplements are given to the fur seal daily.



Food intake by the female fur seal



- Fig. 6: Average food intake by “Laifu” two weeks before and after her delivery in the year 2021 and 2022. It showed that the appetite in 2021 is different from 2022, where she eats more food in 2022. The difference may be due to “Laifu” being reared in different environment. The amount of food taken is normally at about 1.8kg/day, which is about 4% of her BW. The highest she ate was about 7% of her BW.



Rearing of first young pup, “Yang Yang”

- In the first week after giving birth, “Laifu” occasionally goes into the water and breast-feeds normally.
- Starting from the second week, “Laifu” went into the water to mate again, and did not come ashore. The keeper suspected that “Yang Yang” was abandoned by his mother. After observing “Laifu” for 3 consecutive days without breast-feeding, the young pup was taken out from exhibition area and was hand-raised.
- Because it was during the Covid-19 pandemic, the keeper couldn’t purchase milk powder specifically for marine mammal, and goat milk was used as alternative.
- The young pup did not open his mouth or swallow the goat milk. The keeper manages to obtained some marine mammal milk powder (Zoologic® Milk Matrix 30/52) from other aquarium, and “Yang Yang” response well to the marine mammal milk powder.
- But after the marine mammal milk powder was used out, it was out of shelves during the pandemic. After that goat milk was use again for the young pup. Unfortunately, the young pup passed away after 45 days



Rearing of second young pup, “Bora”

- On the 5th day after giving birth, “Laifu” went into the pool, but did not stay long in the water. On the 7th day after birth, “Bora” went into the water and swim for a short time, but the pool is too high for him to move back on land. He was brought back on land by the mother.
- “Bora” grew healthily and after nursing for six months, the keeper started introducing boneless cut fish slices into the pool to let “Bora” familiarize with solid food. After nursing for about 7 months, the duration of each breast-feeding session began to shorten. This was suspected due to insufficient milk production. The keeper then increased the amount of fish food up to 4.5kg/day to “Laifu” and also attempted to force feed the young pup with boneless fish fillet. The keeper prepared 100g herring fish fillet for the young pup.
- Initially “Bora” hesitated to chew and swallow the fish fillet. However, after 2 days he became familiarized with the feeding procedure and fish food, and swallowed the fish fillet after it was put into his mouth. After 15 days of force-feeding, “Bora” can eat by himself. One tablet of Akwavit supplement and calcium carbonate-D3 was given daily.
- Currently, “Bora” has a daily food intake of 1-2kg and is in good conditions.
- At the age of 18 months, “Bora” has undergone basic husbandry training and weighted at about 30kg.



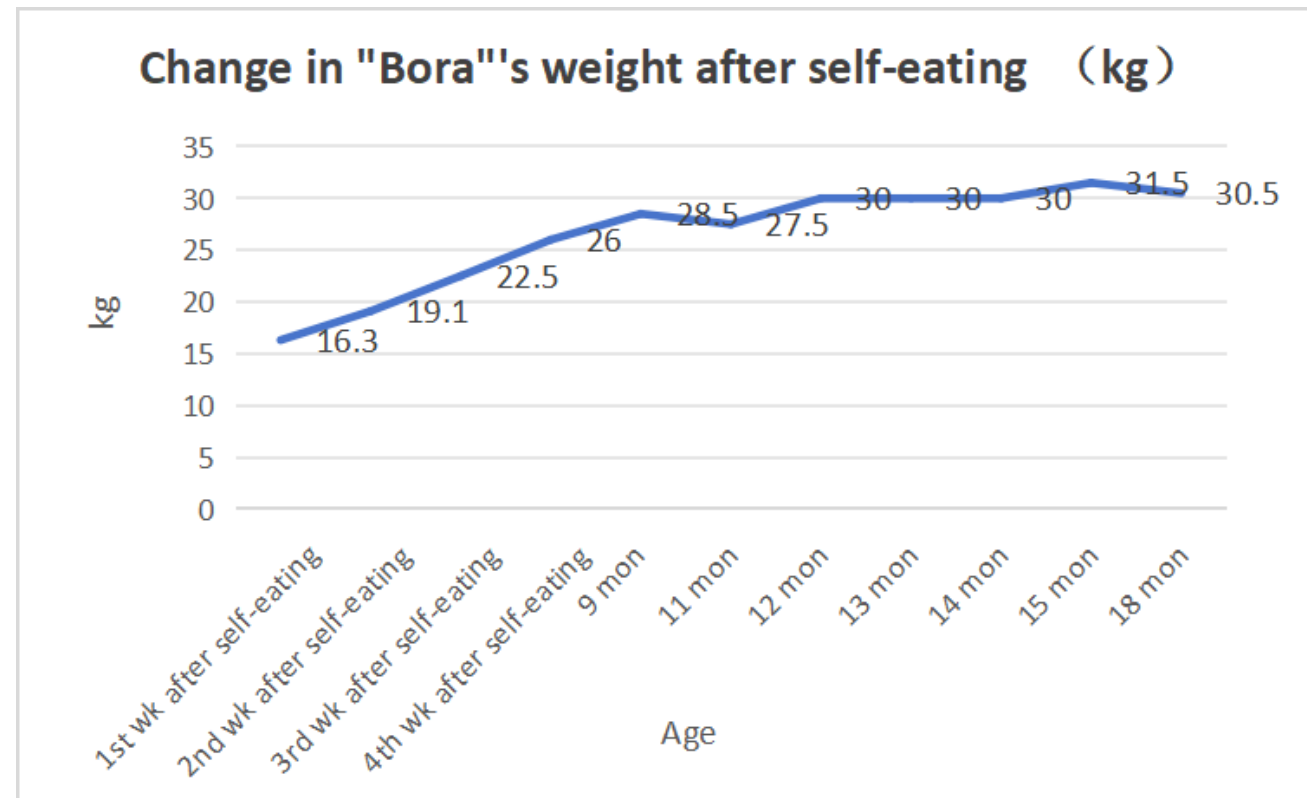
“Bora” and his mother



- Fig. 7: The second young pup, “Bora” was born in 11 July, 2022.



Change in body weight of “Bora”



- Fig. 9: Change in weight of “Bora” after self-eating of solid fish fillets.



Discussion

- Unavailability of suitable marine mammal milk appeared to be a key factor attributed to the unsuccessful attempt to hand rear the first pup, “Yang Yang”.
- Suitable milk powder is crucial for the developing immature fur seal pups as it is prone to digestive tract diseases.
- The composition of South African fur seal’s milk composition: protein $10.8 \pm 1.2\%$; lipid $23.2 \pm 8.2\%$; water $58.1 \pm 6.8\%$; ash $2.0 \pm 0.6\%$. The amount of protein is lesser than the goat milk powder and milk powder for marine mammals, whereas the lipid content is much less than the milk powder for marine mammals, but not much difference with the goat milk. Nonetheless, the water content is much higher in South African fur seal milk.
- It is well known that the lipid content of pinniped milk is relatively higher than other animals, and it is almost free of lactose.
- Consumption of inappropriate milk powder may lead to gastrointestinal diseases. The symptoms observed were loss of appetite, vomit, reflux, black stools, diarrhea, and seborrhea. Abdominal pain or discomfort usually manifests as loss of appetite, drowsiness, or depression.
- Young pup under hand rearing lack of maternal antibodies and intestinal probiotics, which make it easily suffer from digestive system diseases, diarrhea and decline in physical fitness, leading to severe dehydration and death.



Composition of the milk powder

Component	Goat milk powder	Milk powder for marine mammal
Protein	$\geq 24\%$	$\geq 30\%$
Lipid	$\geq 24\%$	$\geq 52\%$
Crude fiber		$\leq 0.25\%$
Water	$\leq 8\%$	$\leq 5\%$
Calcium	$\geq 1\%$	

- Table 2: Composition of the milk powder.



Conclusion

- 1) If the animals are suspected to be pregnant or shows signs of pregnancy, it is necessary to plan in advance whether the current living area is suitable for delivery and nurturing or not. It is not necessary to make significant changes in the ambient of the living site during this period. Maintaining the original breeding environment can help improve the success rate of delivery and natural nurturing. But if there are too many interfering factors, then the living area should be adjusted as soon as possible or the pregnant animal displace to a quiet independent delivery room.
- 2) After discovering pregnant animals, the keeper must have 2 protocols: natural nurturing and hand rearing.
- 3) The milk powder (Zoologic®Milk Matrix 30/52), which is suitable for the young pup must prepare in advance and a contingency plan is also required. The keeper must prepare sufficient materials and medicines required for both plans.



Conclusion

- 4) During this time, a hand rearing team should be formed (including breeders, veterinarians and technicians), the team members can learn the know-how of hand rearing techniques before the young pup is born. It is necessary to monitor and record young pup's body weight and excretion daily in order to adjust the amount of milk in a timely manner and avoid insufficient feeding causing hunger or overfeeding leading to indigestion.
- 5) In the early stage of hand rearing, gastric tube should be used to provide food to the young pup to ensure the daily food intake of animals, and in the later stage, can change to milk bottle allow the young pup to suck the milk by itself and for comfort purpose.
- 6) The timing of intervention is also crucial. Early intervention may results abandonment of the young pup by the mother, but too late may affect the development of the young pup. Three days after birth should be sufficient. During these 3 days, if the mother has no breast-feeding the young, it can immediately choose to hand-raise the young pup. If hand-raise is necessary, the keeper must prepare sufficient food and suitable tools. The keeper must familiar with the protocol, and prepare medicines to overcome the stress response of the young pup.
- 7) Based on our experience of hand-raised young fur seal pups, it can be seen that under suitable food conditions, the growth and development of the young pup increase linearly. Therefore, it is feasible to hand-raise the young fur seal pup.



The milk powder for marine mammal



- Fig. 10: The milk powder for marine mammal, Zoologic[®] Milk Matrix 30/52. This milk powder is crucial for successful hand raised of fur seal young pup.



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Two young fur seal pups



- Two young fur seal pups were born in Fuyang Andover Ocean Park. (Left) The 3rd young pup nicknamed “Momo”, born in 9 Jan 2023. (Right) The 2nd young pup nicknamed “Bora”, born in 11 July 2022.



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New born spotted seal



- (Left) A newly born spotted seal young pup on 29 Feb. 2024. (Right) The photo was taken on 6 Mar morning shown that the young pup was nursed by the mother.



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