sampling. In addition, these flexor muscles may be considered as being representative of active skeletal muscles. Other muscles would be possible to sample also, but less readily localized.

Blubber sample sites were less specifically defined, and were usually taken from the ventro-lateral or -abdominal area of the seal. Blubber biopsies, as may be expected, caused the least trauma.

The risks in this procedure are minimal if carried out with care, but increase with the number of biopsies executed on an individual animal, particularly for sampling of liver tissue. Infection is a factor which may be minimized by the usual sterile procedures, as well as either prophylactic or therapeutic antibiotic administration, as required. It is recommended that the procedure be followed for several days by hematological monitoring of the sample animal. The technique has been used successfully by the author and by Dr. J. R. Geraci of the University of Guelph.

— — —

ABSTRACT - PHOCID HEARTWORM, *Dipetalonema spirocauda*, INFECTIONS OF THE ATLANTIC HARBOR SEAL *(P. vitulina concolor).*

by J. L. Dunn, VMD and R. E. Wolke DVM, Ph. D.***

Clinical and pathologic studies of captive and feral Atlantic harbor seals, *Phoca vitulina concolor,* have revealed new facts concerning the Phocid heartworm, *Dipethalonema spirocauda.* The intermediate host involved in the transmission of infective larvae has not yet been identified, but all available data suggest that it is a simulid fly. Microfilaremia was not detected in four captive animals until at least six months after natural exposure to infection. A fifth infected animal never developed microfilaremia. The cause of death in three animals was determined to be occlusion of a branch of the pulmonary artery by a verminous embolus dislodged from the heart. The only other significant gross finding was the presence of numerous small areas of focal necrosis in the livers of all three animals. Transaminase levels (SGPT, SGOT) have not been significantly elevated in these animals or in three additional animals which have been infected for two years.. Microscopic lesions were present in the lungs, liver, spleen and vascular system. Microfilaria were observed within the lumen of vessels, hepatic and splenic parenchyma. Hepatic lesions varied from foci of acute eosinophilic necrosis to chronic focal granulomas with foreign body giant cells. Microfilaria were often present in the acute lesions. Acute focal necrosis of the spleen was present in one animal. Vascular lesions were of two types. Vilous hypertrophy of the endothelium was observed in relation to adult parasites and vasculites and perivasculitis was present in relation to microfilarial migration tracts. An acute suppurative bronchopneumonia with bronchiectasis was present in two animals and an acute interstitial pneumonia in a third.

* Mystic Marinelife Aquarium, Mystic, CT 06355, USA

** Marine Pathology Laboratory, University of R. I., Kingston, RI 02881, USA

THE CARE AND HANDLING OF LEOPARD SEALS *(HYDRURGA LEPTONYX)* IN CAPTIVITY

Wayne Reid, formerly trainer at Marineland of New Zealand, Napier N'Z present adress : Windsor Safari Park, Windsor, Berks, England.

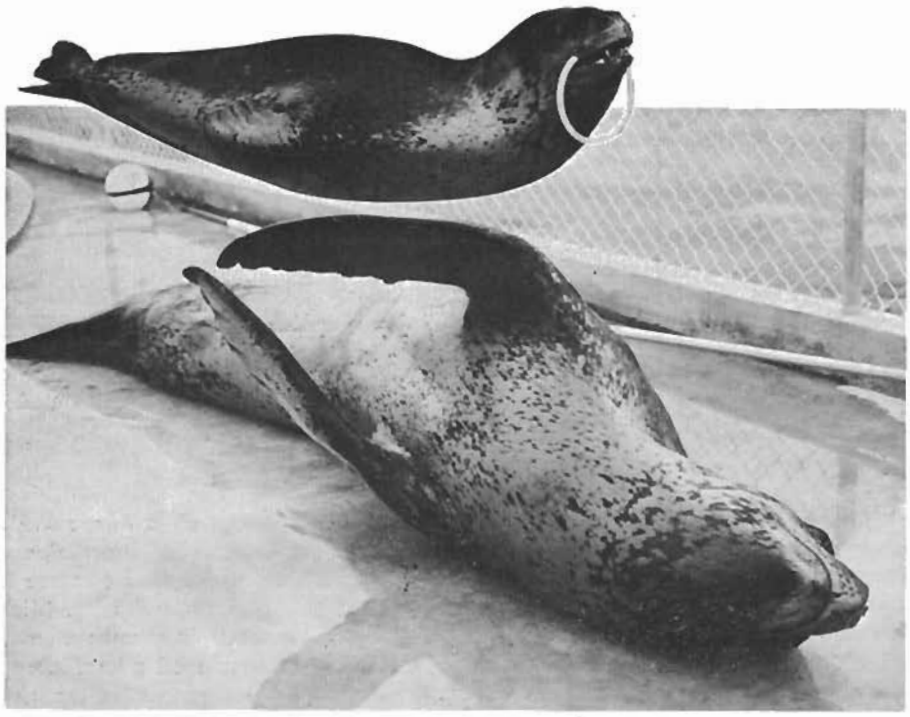

Figure 1. The leopard seal.

Summary

As the leopard seal is a fairly uncommon display animal, experiences with this species in captivity are very limited. Indications for a proper care and handling of these animals could possibly be found in wild life observations. Unfortunately, reports on the subject are also rather scare. The relevant information, summarized below, is extracted from the sources as listed at the end of this paper. In addition personal experiences are presented.

I. The leopard seal in nature.

Description

Leopard seals are grey along the backs, merging to a lighter grey along the flanks and finally to a yellowish or white colouring along the undersides. The pelage measures only about 0.5 to 0.8 mm. (In captivity the fur on their stomach is often rubbed off, possibly due to the alien surfaces they are kept. on.) They are liberally covered with dark spots, thus giving the "leopard" apperance. The number and distribution of these spots varies a great deal from one animal to another.
The front flippers are approximately one quarter of the body length and seem rather to be used as a rudder or for attaining a rapid speed -about 12 km/hr- than the main propulsive force, which is obtained by a powerful sideways movement of the tail section. Thus the animals are capable of planing over the surface of the water. The leading edge of the front flippers measures about 2 to 3 cm in width while the trailing edge is quite thin. There are five digits with the largest being on the leading edge, reducing in size to the fifth. The hind flippers are irregularly shaped and again possess five toes, the two outer being the largest.

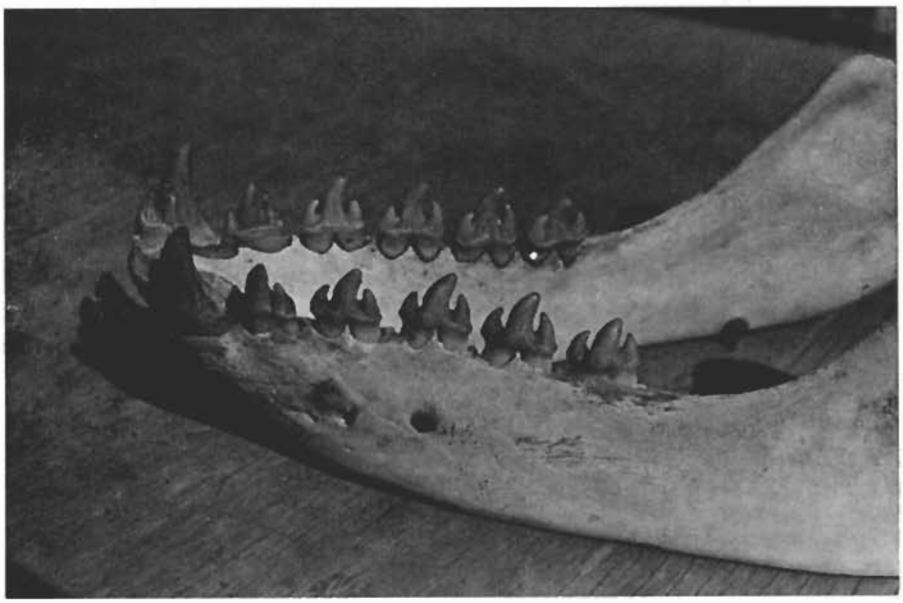

Figure 2. Skeleton of lower jaw. Canines are 25 mm, other teeth 12 mm above gum

The incisors and canines are conical and curve backwards. The lower incisors fit into a gap between the upper incisors and the canines when the mouth is closed. The cheek teeth have three distinct cusps and the whole arrangement is adapted for grasping large prey.

The eyes are large and adapted for use at night in deep, murky water. They are capable of directly looking upward - the animals usually take their prey from below. The pad of the nose is elastic the nostrils are slit-like and normally closed.
At any age, females are bigger and heavier than males. Growing to a maximum length of 3.6 m and a maximum weight of 450 kg they are approximately 0.6 m longer and 180 kg heavier than the average male (GASKIN, 1972).

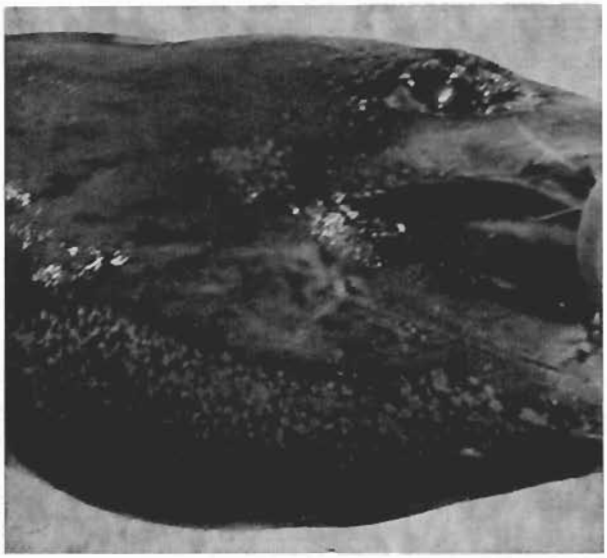

Figure 3. Inflated throat during vocalisation.

Behaviour

No Pinniped lives as solitarily as the leopard seal. Only during the breeding season, which lasts very short, are animals found in groups. Their solitary attitude may well explain their agressiveness, which will be dealt with later.
Leopard seals are able to emit a wide range of vocal sounds. This can best be described as "canary-like" and consists of long musical warblings interspersed with grunts, clicks and whistles. In sound production the throat regions are inflated.

Distribution

Leopard seals range widely from the edge of the Antarctic Pack Ice to the shores of South Africa, South America and Australasia. It has been estimatetd that the total population is in the region of 250,000 animals (SCHEFFER, 1958, repr. 1969).

Breeding

Females reach sexual maturity at about two and a half years of age whilst the males do not reach sexual maturity until their fourth year. The pups are born between November and January, their eyes are open and the tips of the canines are visible through the gums. They weigh approximately 27 kg and measure about 1.5 m. Lactation lasts two months, after which mating occurs between the adults. They separate until the following year. (BROWN, 1952).

Food.

In the wild these animals feed on a diet of fish, squid, krill and penguins. The latter are taken from beneath, literally shaken out of their skins and swallowed. (GASKIN, 1972). In addition it is reported that they can eat appreciable quantities of broad leaved *Fucus* (MAXWELL, 1967).

II. The leopard seal in captivity

General health

The pool size has been found to be quite important. One of our leopard seals was kept in a fairly small pool for a prolonged period. This pool left the animal restricted movement possibilities and it was found that a growth of algae developed over his back, head and flanks, which proved hard to remove. After the seal's transfer to a larger pool, which offered him a chance to become more active, the growth of algae disappeared. They are individualistic animals but can be kept together if the pool area is big enough. This will invariably include many threatening displays but no real injuries.

Like any animal in captivity, leopard seals need a balanced diet. For practical reasons the main food will be dead fish. The considerations of VAN DE HURK (1972) are also valid in our case, so a mineral and vitamin supplement is necessary. After several experiments it has been found that this should include around 600 mg of iron, 200 - 400 mg vitamin B1 and about 400 mg vitamin A. In lack of better knowledge, some type of multivitamin capsule might also be advisable.

It should be noted here that the animals' heat production is proportional to the food intake. Thus the hotter the climate the lower his food intake should be. In hotter climates they should be kept in air-conditioned pens and acclimatised gradually. We have found at Napier that a daily intake of between ten to twenty kg is desirable.

According to reports, the animals moult once a year. From observations at Marineland it is possible that a complete moult does not take place every year. It obviously causes quite a bit of annoyance to the animal and they can become lethargic and un-cooperative during the period. Once this is over they will quickly return to normal. During the moulting many small blood spots appear. These are mainly confined to the underside and around the head. Where the animal has been lying on the land for a while quite a big stain will beleft.Although it might seem that the animal is "bleeding to death", the amount of blood lost is minimal. The animals at Napier were observed to scratch themselves a great deal during the moulting period which can last up to three or four weeks for a complete moult.

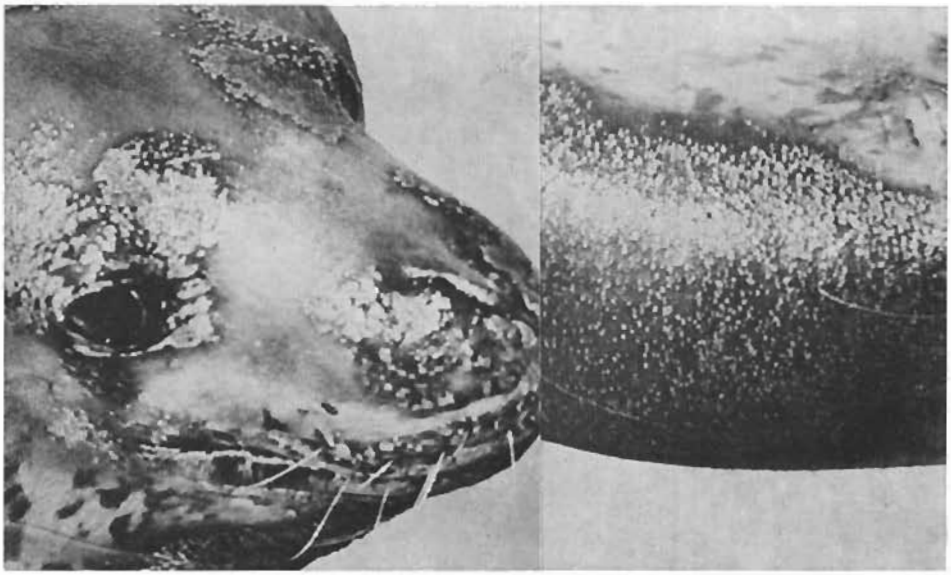

Figure 4. Moulting around the eyes and nose (left) and at the underside of neck and upper chest. Each white mark is a blood spot.

Training

Naturally the animals are extremely nervous when captured but once they have accepted the new situation they will readily settle down. The obvious next step is to allow the animal to accept you, the trainer. This is very important, ever more so than while working with a Californian sea-lion.

When first appoaching a leopard seal in captivity one is shown quite an awesome picture. Probably no other seal has obtained this reputation, but from the trainer's point of view any fears must be overcome at the earliest possible opportunity. The animal's distrust of man is something that will be overcome with time and patience ; on the other hand, they are curious animals and this can get the better of them !

Leopards seals have very flexible necks and are able to telescope them forward quickly and over a considerable distance. Any attempt at biting can be eliminated at an early stage by a quick rap over the nose with the back of the hand ; this seems to have the effect of hurting their pride more than anything. They have very expressive eyes and with some initial study a lot of the quicker movements of the animal can be anticipated.

I have found that these animals have a sensitive skin and thus achieving something as simple as stroking can take quite a while. Once used to this type of handling the animal will respond to it to the same extent that most animals do. This act will achieve two purposes : it will give you confidence in the animal and -more importantly- it will give the animal confidence in you. It is a good policy to introduce a stiff rubber ring at this stage. By training the animal to bite onto this prior to being stroked partially eliminates the danger of the animal biting when you first attempt this act. If he has accepted your touch, the ring can be dispensed with.

Figure 5. Threatening display, shown in any upsetting situation.

Once this all has been achieved then in all probability the animal will have accepted you. This will be the time when the animal is ready for the start of a full training programme, which, however, can not be done as easily as with a sea-lion. Most of the future trained actions will just be extensions of normal behaviour and it will be to the handler 's discretion as to what he capitalises on. All that is involved is getting the animal to associate an act with a signal. Because they are quite awkward on land, a water based act is probably preferred, although a land act will succede if the animal is only required to stay in one place.

In training, the most important aspect is to accept them on their terms and above all to have them accept you. Unless this "bargain" is completed little success will be had. And even then, there remains a higher risk in working with them. They do not like anything or anyone approaching them from behind and are also wary of anything strange which might occur. Though not as savage as is popularly believed, they should still be treated with the respect that they deserve. It is not advisable to turn your back to them, even momentarily.

I have found that leopard seals are quite intelligent and are capable of learning a wide variety of acts. They are intelligent enough to make training exceedingly frustrating at times, and if they become stubborn enough then even the denial of food has no real effect. Ignoring the animals completely for a short time sometimes has the effect of making them more cooperative. Often one must stop the training at a particular point and begin that section all over again. Once they realise just what is expected, they are quick to associate an act with a signal and can become quite reliable.

Each of these animals will be different from the next so this paper can just give some idea of the handling procedure. Any individual will require quite a bit extra of time and patience but this will be amply rewarded in the final act.

References

BROWN, K. G., 1952. Observations on a newly born leopard seal. Nature *170:* 982-983.

GASKIN, D. E., 1972. Whales, dolphins and seals, with special reference to the New Zealand region. St. Martin's Press, New York.

HURK, C. F. G. W. van de, 1972. Observation on the basic nutrition, vitamins and foodpreparation in dolphins. J. Aq. Mammals 1 (2) : 9-21.

KING, J., 1964. Seals of the world. Trustees of Brit. Mus. Nat. Hist., London.

MAXWELL, G., 1964. Seals of the world. Constable & Co. Ltd., London.

SCHEFFER, V. B., 1958. Seals, sea-lions and walruses. Stanford Vino Press.

Acknowledgment

The author feels very much indebted to Mr. A. D. G. Dral, Netherlands Institute for Sea Research, Texel, for his extensive support towards the final wording of the manuscript. He thanks Mr. V. J. A. Manton, DVM, Whipsnade Zoo, England for his critical reading of the manuscript and his suggestions.

— — —