THE TEXEL MUSEUM: ITS FUNCTION IN RELATION TO THE HARBOUR SEAL POPULATION IN THE DUTCH WADDEN SEA

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History

The Texel Museum was founded in 1931 as a museum of Natural History, which meant mainly archeology in those days. Originally housed in a few rooms of a public school, it was moved after the second World War to army hutments, situated in a small forest. A new centre was built in 1975 and its name was changed into 'Natuur Recreatie Centrum', indicating a strategy to offer educational recreation to its visitors. The museum is located on the isle of Texel, a part of an archipelago of islands, separating the Wadden Sea from the North Sea (fig. 1). In view of this location it is not surprising that an important part of the interest of the Texel Museum has always been focused on marine mammals occurring in that area, i.e. the harbour seal *(Phoca vitulina)*, the bottle-nose dolphin *(Tursiops truncatus)* and the common porpoise *(Phocoena phocoena)*. The first abandoned seal pup arrived at the museum in 1951 and at present the marine mammal collection consists of 26 harbour seals and 4 grey seals *(Halichoerus grypus)*. Five animals are born at the museum and the others are found on the beach and brought in as pups.
This paper deals with problems concerning the husbandry of the common seals in the museum and its contribution in solving the problem of the severe decrease of the seal population in the Wadden Sea.

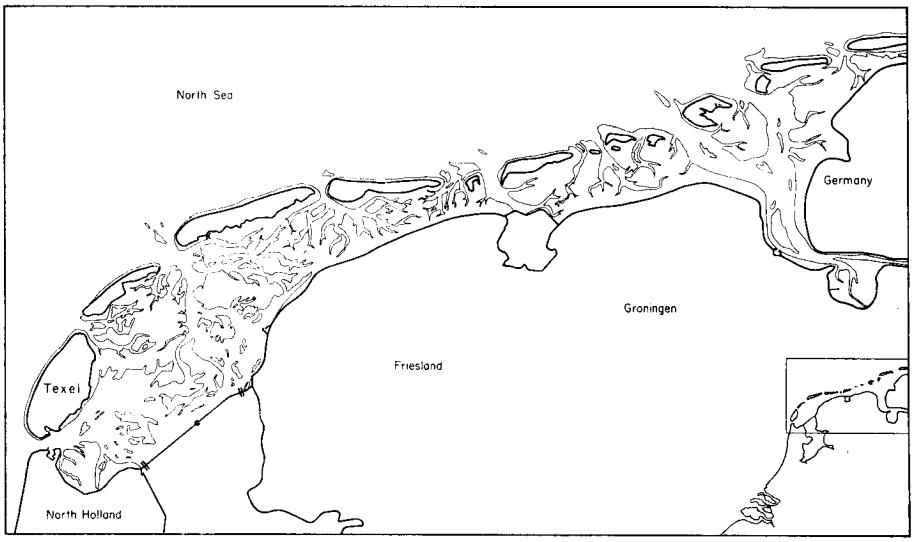

Fig. 1. The Dutch Wadden Sea with flats occupied by harbour seals.

Acknowledgements

Mentioning the Texel Museum is speaking of Mr. and Mrs. De Haan, as they managed it since the second World War already. In my research on seals the co-operation of the museum has always worked fruitfully and I am indebted to the director and his co-workers. In view of that co-operation this paper is written. The critical reading of the manuscript by Messrs. A. D. G. Dral (Neth. Inst. for Sea Research) and W. H. Dudok van Heel (Dolfinarium, Harderwijk) is greatly appreciated. Further I want to thank the reprographic department of the NIOZ: Messrs. H. Hobbelink, R. P. D. Aggenbach and B. Verschuur.

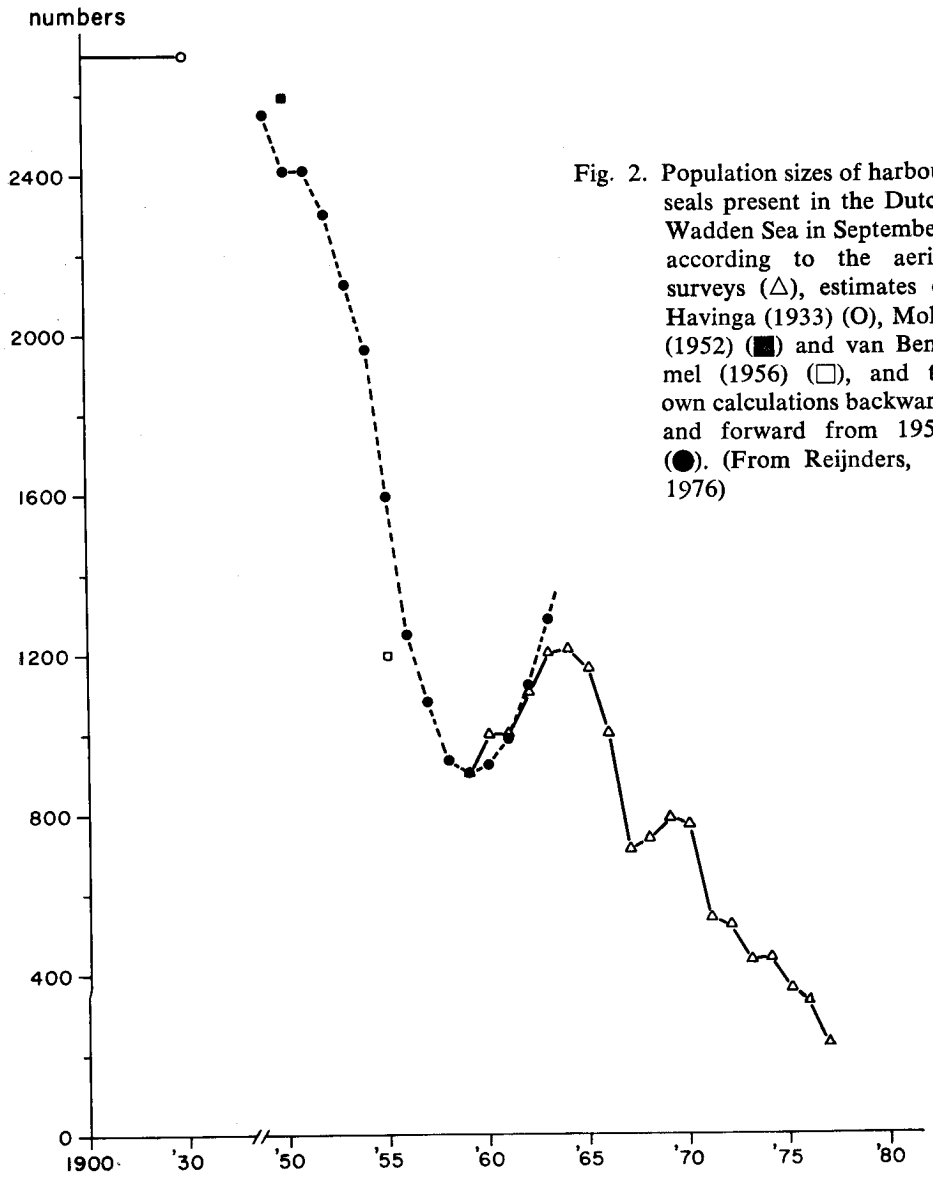

Fig. 2. Population sizes of harbour seals present in the Dutch Wadden Sea in September, according to the aerial surveys (△), estimates of Havinga (1933) (O), Mohr (1952) (■) and van Bemmel (1956) (□), and to own calculations backward and forward from 1959 (●). (From Reijnders, 1976)

The decrease of the seal population in the Wadden Sea

Figure 2 shows the numbers of harbour seals present in the Dutch Wadden Sea since 1900. For several periods, the bases of the estimates are of different origin and therefore four periods are distinguished: 1900-1930; 1930-1950; 1950-1959 and from 1959 on. Few data are available from the period 1900-1930. No doubt seals were heavily hunted because fishermen regarded them as competitors. From bounty statistics a mean annual kill of about 650 specimen is derived. Because this number remained fairly constant during those thirty years it is assumed that the population size did not fluctuate considerably. On basis of the annual kill, Havinga (1933) estimated the seal population in the Dutch Wadden Sea at about 2700 specimen between 1900 and 1930.
On hand of surveys Havinga assumed the population in 1933 also to be about 2700 specimens.
After the second World War the demand for train-oil ended because in the cosmetic and oil-industry new synthetic substitutes were developed. Besides, in 1949 the bounty payed by the government for every dead seal was abolished. For these reasons the interest of the professional seal hunters became mainly focused at pups, as their skins were used in the fur industry. From the mean annual kill, 600 to 650 pups, it is concluded that in those years almost every pup born was killed. In September 1959 the first aerial survey was performed by Van Haaften (Research Institute for Nature Management, Arnhem, The Netherlands) and he estimated the population size at about 900 animals. Assuming that the pups constituted, on an average, about 30% of the total population and a certain age-independent mortality of about 17% (Boulva, 1974) data about the annual pup kill can be used to estimate the September size of the population in the foregoing year. Starting with the value of 900 seals for 1959 (Van Haaften, 1974) the September population sizes are calculated backwards from year to year (for details see Reijnders, 1976). Though based on several implicit assumptions, the calculation over the period from 1950 to 1959 seems useful to bridge the gap between the time of the stable population and the period of decline. It is supported by two independent estimates by Mohr (1952) and Van Bemmel (1956).
Since 1959 aerial censuses are carried out and provide more reliable data. The seals still decreased in numbers with slight peaks in 1964, 1969 and 1974. The first increase probably resulted from the fast decrease in kills since 1962, when hunting was totally forbidden. This extra quantity of pups started a new wave of births when they became mature 4 to 5 years later and may explain the slight second increase in 1969 and that again in 1974. Apart from this phenomena it is clear that after 1963 another factor than hunting must have been responsible for the continuing decrease in numbers.

The activities of the Texel Museum with respect to the seal decrease

As stated before the attitude of the local people was rather agressive to seals, especially during the late fourties. A lot of people were under the impression that seals eat a fair quantity of fish which was not available any more for their own benefit. In this respect the Museum played an important role by informing people on the real state of affairs: seals in the Wadden Sea consume less than 1% of the annual total catch and besides they prefer species of low commercial value, p.e. flounder *(Pleuronectus flesus)*. Those attempts contributed to raise co-operation of the local people in our research, especially in reporting dead seals in order to be collected for examination.
Since 1951, when the first orphan seal was brought to the museum, nursing and raising of abandoned pups was a more direct impact of the museum on the seal population.

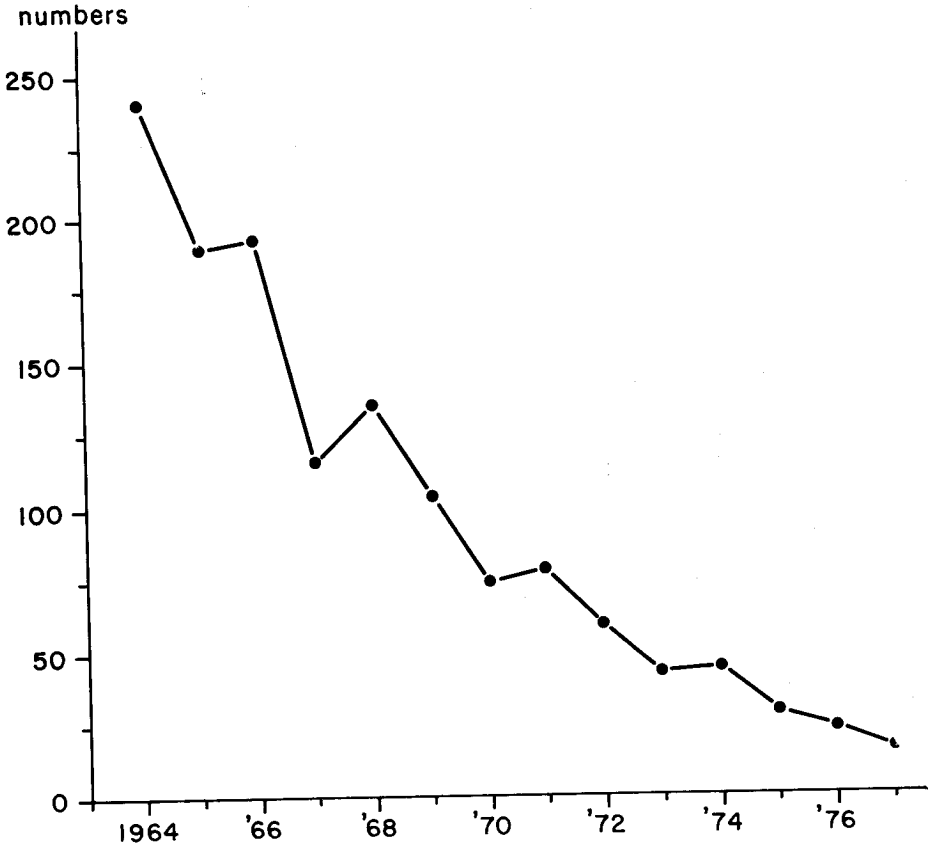

Fig. 3. Number of seals present in the seal sanctuary 'Eyerlandsche Gat'.

Initially they remained in the museum but since a few years they are returned to the Wadden Sea after their recovering together with some pups born at the museum. The seal decrease is most clearly manifested in the Western part of the Wadden Sea. In spite of the establishment of a seal sanctuary in this area in 1964, the population diminished by more than 90% (fig. 3). Annually about six young seals are returned to that reserve and though it is uncertain how many survive and stay in that area this number is a valuable support to that small stock. In The Netherlands, seal research has always been parished and when Van Haaften started his work on seals he was really acting as a pioneer for years. Through his interference World Wildlife Fund Holland enabled the author by a grant to start a project in 1973 on the population dynamics of the seal population in the Dutch Wadden Sea. Initially the museum rendered hospitality literally and figuratively. A small experiment was started to trace a possible intermediate host of the nematode *Otostrongylus circumlitus* in order to determine the life cycle of this important seal-parasite. One of the aims of the present research was to obtain a reliable estimate of the age-composition of the seal population. The numbers of seals were too small to take samples for determination of their age by examining the growth zones, or annuli, in the cementum layer of their teeth. Therefore a method was

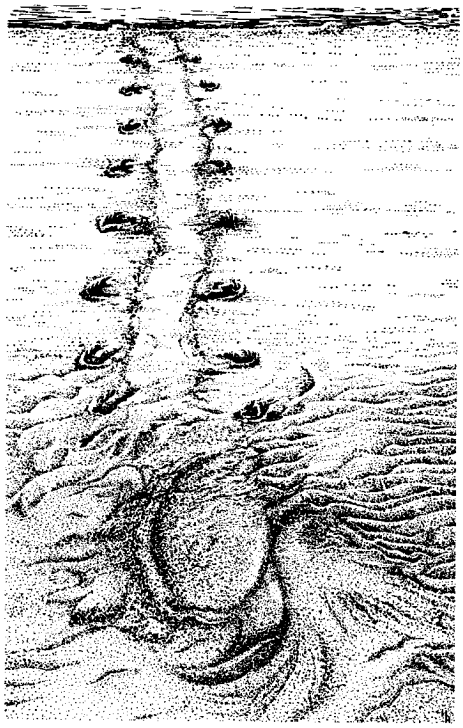

Fig. 4 Resting place and seal track on sand bank.

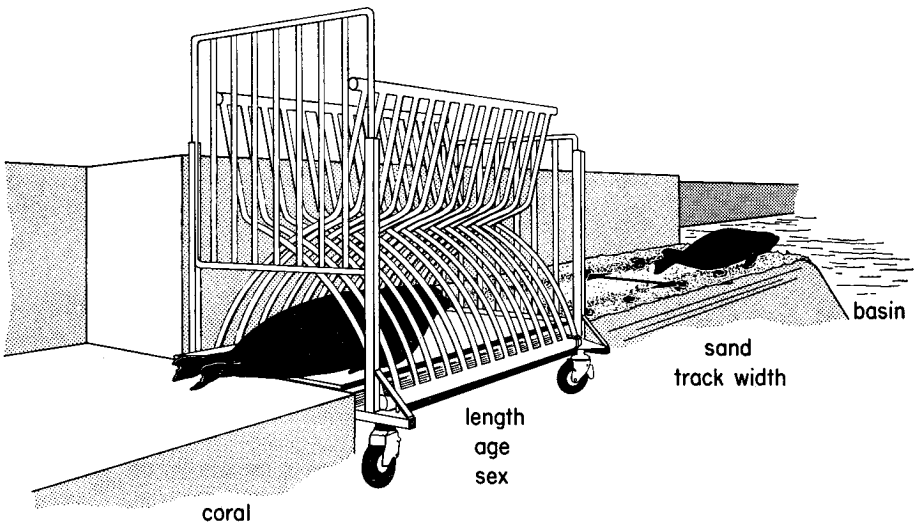

Fig. 5. Scheme of the experiment to use track width as an indication of age.

developed using the tracks the seals leave behind on the sandbanks when they move from their resting places to the water edge. The seal uses the nails of the left and right fore-flipper to crawl over the sand and the distance between those imprints was measured and refered to as 'track width' (fig. 4). The width of those tracks may be a means to determine their approximate age. Seals kept in captivity at the Texel Museum provided basic measurements. The animals were sent one by one through a rather narrow lock with a moist sandy bottom (fig. 5). The track each animal left behind was measured and compared with its (known) age, thus providing reference data for the establishment of a track width-age relationship of the harbour seal (Reijnders, 1975). At present some animals are involved in a radio-telemetric experiment which is in a developmental stage.

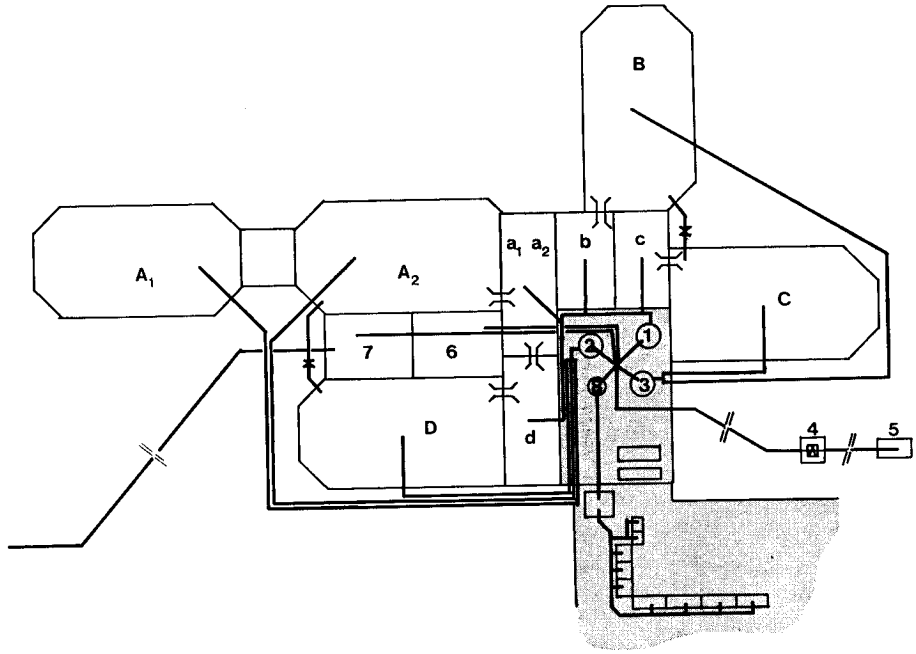

Fig. 6. Scheme of the water circulation system at the Texel Museum.

AI + AII - B - C and D: basins
a_1-a_2-b-c: quarantine basins
1-2-3: sand filters
4: pumping house
5: inlet on the beach
6: fresh water storage tank
7: drain water storage tank

The functioning of the Museum with respect to its seal-herd

accommodation

In fig. 6 the various basins are shown. Basin a, b, c and d are quarantine basins; a and d have a length of 10 m, a width of 4 m and a depth of 1½ m; b has a length of 6 m, a width of 4 m and a depth of 1½ m; c has a length of 6 m, a width of 4 m and a depth of 2½ m. Basins AI, AII, B, C and D measure 15 m in length, 8 m in width and the depth is 1½ m except basin C which reaches 2½ m. Basins AI and AII are separated by a stone platform which is just submerged. Some basins contain small wooden platforms on which the animals can lie but they seldom use them in the day-time when people are around. Only after closing time they come out of the water and lie on the edges of the basins or on the pavement around these.

operation

The basins are filled with sea water which is taken directly from the sea. For this purpose an inlet shuttering was build in a breakwater. By way of a suction-pump the water is transported through a pipeline with a diameter of 10 cm and a length of 300 m to a pumping house and from there pressed through a pipeline of the same diameter over about 600 m to the museum. The system can be used during 5 hours; 4 hours before and 1 hour after high tide. The capacity is fluctuating around 12½ m^3/hour. The water level in the 1½ meter basins is about 1.20 m and in the 2½ meter basins about 2 m which implies a total water content of about 1000,000 liters (264,170 gallons). There are three separate closed recirculation circuits with a pumping capacity of 110 m^3/hour: I for the quarantine basins, II for the three basins AI, AII and D, and III for basins B and C. The water in the quarantine system passes a sand filter with a volume of 4,25 m^3 and the turnover of this water body takes place every 2 hours. The water in the other two circuits passes a sand filter with a volume of 5,4 m^3; the turnover of this water body is estimated to take place every 4 hours. The filters require back-washing which is carried out nearly every day. For this purpose a storage tank of about 15 m^3 fresh water is available. Under this operating conditions only 1% of the water is sent to waste each time. In frosty weather the water is passed via a heat exchanger to keep the basins free of ice. In keeping marine mammals in captivity one always has to deal with problems concerning water quality. Before salt water was available, sodium hypochlorite was used for that purpose but this was rather unsatisfying. Despite constant addition of hypochlorite the amount of combined chlorine comprising substances, toxic to mammals, increased. Besides, the adequate quantity of hypochlorite was difficult to estimate and often an overdosis had to be compensated by adding sulphite. For that reason and because sea water is used at present chlorination is nearly abandoned and it is tried to solve the problem by a rather fast recirculation and daily back-washing.
Till now, the results are quite promising and this offers an opportunity for a new husbandry policy to be discussed in the next chapter.

husbandry

At present the size of the herd is 26 harbour seals, the oldest one being 20 years of age. It is endeavoured to maintain that number of common seals in view of the expenses for food, cleaning capacity and minimum size for a breeding unit. It is aimed to keep more

females than males, because harbour seals are polygamous and adult males can be quite agressive during mating time. Some wild, abandoned seals are kept in stead of pups born in the museum in order to ensure genetic variation.

In the early history of the museum the animals were fed live fish but especially the younger seals got infected by parasites: chiefly lung worm and tape worm *(Bothriocephalus* sp.). Therefore it was decided to use only deepfrozen fish as food. Mackerel *(Scomber scombrus)*, caught in the Irish Sea — less effected by water pollution than e.g. the North Sea or the Wadden Sea — was chosen on advice of dr. W. H. Dudok van Heel, Dolfinarium Harderwijk.

The diet of the young seals caused for long many problems. Cow's milk was fed to substitute seal milk and even after discoverage that seal milk contains about 45% fat, while cow's milk contains only about 4% fat, still many pups died. Cow's milk was originally thought to be composed mainly of the protein casein whereas seal milk was a sa called albuminmilk. To compensate for that Reineck (1956) improved the diet by administrating an animal bloodserum. Patton (1969) stated that the number of proteins discovered will be limited only by the patience of the investigators and the sensitivity of the methods they apply. He even discriminates four caseins and mentioned albumin and globulin to be actually a complex group of proteins, known as the whey proteins. One of his remarkable statements is that seal milk does not contain lactose whereas lactose accounts for approximately 5% in cow's milk. As lactose encourages certain bacteria thriving in the intestine it is obvious that those foreign bacteria disturb the original intestinal bacterial flora. In this respect it is not surprising that a very common cause of death in those days was dysentheria entailing a substantial loss of body fluid. By virtue of Mrs. Lenie 't Hart (Seal Nursery Centre, Pieterburen, The Netherlands), who developed a feeding scheme based mainly on force feeding minced herring *(Clupea harengus)* and water, the feeding problem seems to be solved. According to biocultural literature, keeping wild mammals in captivity is bound to raise nutritional problems. A diet of deepfrozen fish often needs to be supplemented with vitamins and minerals (see e.g. Geraci, 1975 and his outstanding reference list). Mackerel is a fish which contains a high concentration of B-vitamins and using this species as food thiamin deficiency is unlikely to occur. Therefore it was decided not to supplement the deepfrozen fish diet until it appeared to be necessary. So far mortality amongst seals in the museum is very low (since 1957 only 6 adult seals died) and severe illness did not occur. Therefore veterinarian care is factually restricted to the treatment of the young orphaned pups, newly brough in. They often suffer from pneumonia, caused by lungworm which is treated succesfully with the anthelminthicum L-Ripercol, supplemented by administration of the wide-spectrum antibiotic Masarun. Ripercol is injected once, as soon as pneumonia is diagnosed whereas Masarun is given five days at a stretch. After a fortnight Ripercol is administered again. Sometimes pups suffer from ocular disease but only uncomplicated injury like scratches by the nail of another animal, responds favourably to palpebral applyance of an ophthalmic ointment, Terramycin.

It is clear that a great discrepancy exists between the natural feeding habits of marine mammals and the diet fed in captivity. Wild seals consume highly varied diets depending on what is best available at time being, whereas seals in captivity usually enjoy an unvaried diet depending on which inexpensive fish species is available on the market. Ridgway (1972) presents a review of marine mammal matabolism and from his statements it is evident that metabolic imbalance is either a primary or secondary event in the course of disease. For this reason and also to avoid nutritive imbalances, it is tried now to feed natural food to the seals in the museum. Having the opportunity to keep seals in sea water without chlorination, experiments are planned to put living fish, flat fish mainly, into the basins. Expectations run high and we hope to report about the results in the near future.

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EXPERIENCES AND PROBLEMS WITH CALIFORNIA SEA LION *(ZALOPHUS CALIFORNIANUS)* — REPRODUCTION IN OUWEHAND ZOO.

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Introduction

In the Ouwehand Zoo in Rhenen, the Netherlands, there has been, since May 1972, a small group of California sea lions *(Zalophus Californianus),* consisting of one male and two females, then estimated at about 2 years old.
It is clear that breeding of animals in Ouwehand Zoo, as in other zoos, is of great importance, but the lack of well educated and interested animal keepers is one of the main problems. With Ouwehand Zoo being privately owned it is difficult to pay the high salaries real top-people want.