

## The use of molluscs to occupy Pacific Walruses (*Odobenus rosmarus divergens*) in human care

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### Summary

Walruses in human care are mainly fed on fish. Because of this food source they only spend a small amount of time feeding compared to walruses in the wild. The lack of occupation can cause abnormal behaviour, such as regular circle swimming. In this study molluscs were added to the walruses' diet in the hope that the time spent on feeding would increase substantially. Each time molluscs were given a record was made of the amount of time the walruses spent searching for them and processing them. Because the walruses in this study could investigate the entire bottom of the pool fairly quickly and because the process time was relatively short, the best way to utilize the molluscs was to feed many small portions over the day.

### Introduction

Walruses are benthic feeders that consume mainly bivalve molluscs (Fay, 1982; Nelson & Johnson, 1987). Because molluscs are relatively small prey for such large animals, walruses have to spend a large proportion of their time digging in the substrate to find, excavate and process the shellfish. Oliver *et al.* (1983) observed walruses in the wild and found that they could consume at least 6 clams per minute. The average weight of the gapers in this study being 40 g, an adult walrus would have to eat 1500 of them a day to reach the 60 kg of food that it needs per day. A walrus feeding at the rate of 6 gapers a minute would have to spend at least 4 hours a day processing the gapers underwater. Allowing time for the animals to find their feeding ground, it seems clear that a number of hours should be added to the processing time. As the prey density in the wild is not homogenous, a walrus would not only have to find a mollusc bed, but would search for the richest and best. Therefore, an average of 6 hours spent daily on searching for and processing gapers is probably an underestimation.

Walruses in human care however, are usually fed on fish, and only spend a maximum of one hour per day on feeding. If this lack of feeding behaviour is not compensated for by social interactions with conspecifics, members of other species or by training (Kastelein & Wiepkema, 1988), negative behaviours such as stereotypes can develop. In the Harderwijk Marine Mammal Park, the social interaction between walruses was limited, and although they were occupied for 4 hours a day with training and educational performances, stereotypes (circle swimming) were seen. In this study, molluscs were fed to increase the time walruses spent feeding, and hopefully to reduce the performance of stereotypes.

### Materials and Methods

#### Study animals

The Harderwijk Marine Mammal Park houses a pair of Pacific walruses (*Odobenus rosmarus divergens*),

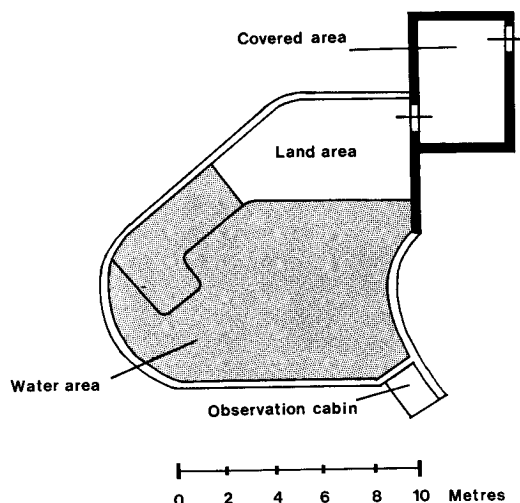


Figure 1. The study area showing the pool in which the two walruses were kept.

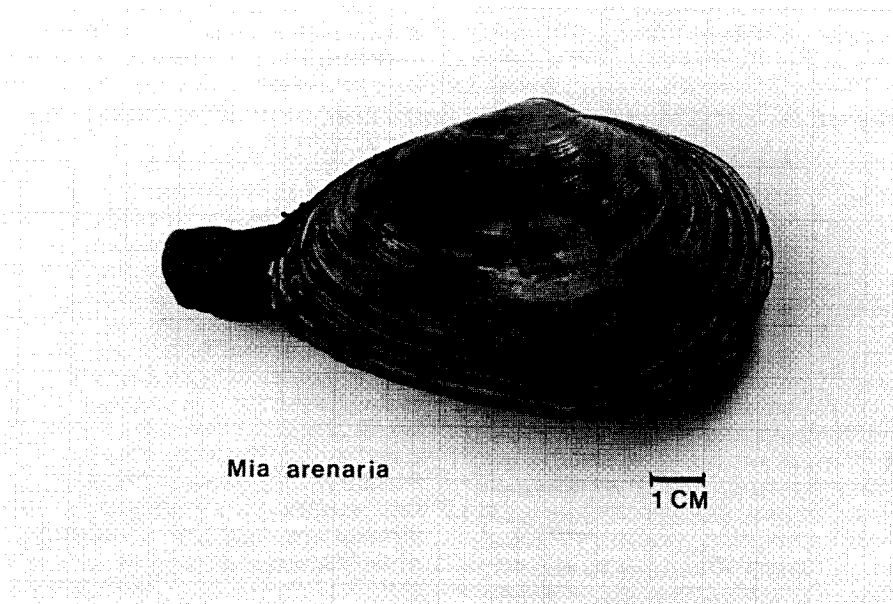


Figure 2. A gaper (*Mya arenaria*), a soft shelled bivalve mollusc containing a lot of meat.

that were born in 1982 (codes: OrZH003 and OrZH004). These animals arrived at the park in 1985 and have been kept together since then.

#### Study area

The study area consists of an outdoor pool with an adjacent land area. The pool is 4 m deep, and has reinforced concrete sides and bottom. An observation cabin with two-way mirror windows was placed next to the pool in such a way that the entire study area could be observed without disturbing the animals (Fig. 1). The study was done in January 1987 when the park was closed to the public. During that period the air temperature varied between  $-17^{\circ}$  and  $+14^{\circ}\text{C}$  and the water temperature of the pool between  $0^{\circ}$  and  $+9^{\circ}\text{C}$ . The pool was surrounded by a fence to reduce the influence of personnel.

#### Food

The walruses were hand fed 4 times daily on their normal diet of herring, mackerel, whiting, sprat and squid. In addition, molluscs were given to occupy the animals between the fish feedings.

#### Choice of mollusc

First it was necessary to determine which readily available molluscs would be accepted by the animals and therefore mussels (*Mytilus edulis*) were offered. This was not a success probably because of the small meat content (too small a reward for the effort). Secondly, oysters (*Ostrea edulis*) were tried which

were not accepted either, maybe because of the hard and sharp shell. Finally an attempt with gapers (*Mya arenaria*) was successful. This species of bivalve mollusc has a soft shell and contains a lot of meat (Fig. 2). Species of the same genus have been found in the stomach of walruses (Fay, 1982). For safety reasons the heavy metal and PCB content of the gapers from the Dutch Waddenzee was measured by the TNO laboratory in Ijmuiden (lead: 0.42 mg/kg, cadmium: 0.08 mg/kg; mercury: 0.08 mg/kg and total PCB: less than 0.05 mg/kg). These small amounts were considered to be of no danger to the animals.

#### Method

Mostly twice a day, in between the usual fish and squid feedings, gapers were thrown into the water and landed on the concrete bottom. The number of gapers given varied from 10 to 40 per presentation and over 10 days there were 22 presentations. Every time gapers were given, the amount of time spent by each animal on searching for and processing gapers was recorded.

#### Results

When the gapers were thrown into the water, they sank to the bottom of the pool. Both walruses soon started to swim along the bottom and investigate them with their vibrissae. For both walruses the searching/processing time following the presentation of a variable number of gapers could be anywhere

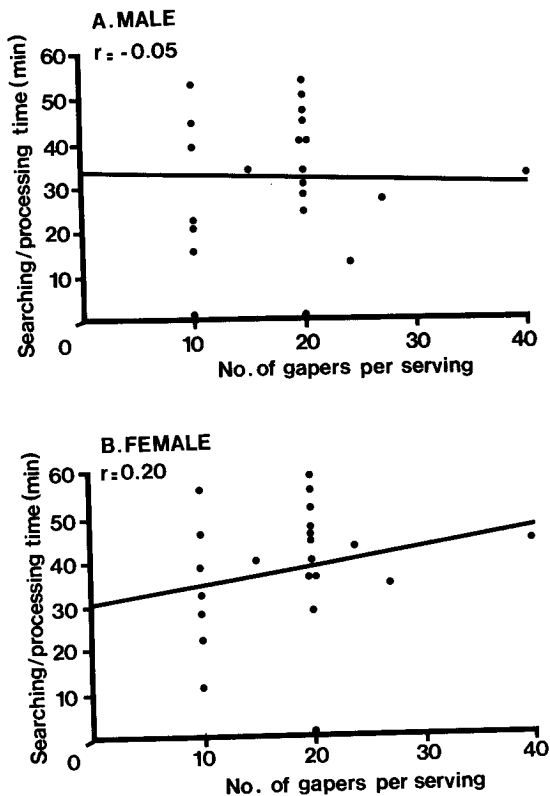


Figure 3. The searching/processing time of the male walrus (A) and the female walrus (B) after feeding different amounts of gapers. The correlation coefficient to the regression lines is indicated by  $r$ .

between 15 and 60 minutes (Fig. 3). No significant correlation was found between the number of gapers presented and the searching/processing time (male OrZH003,  $r = -0.05$ ; female OrZH004,  $r = 0.20$ ).

#### Discussions and conclusions

Although the number of times gapers were offered to each animal was very low, it is clear that, within the range used (10–40 gapers), a doubling of the amount of gapers per presentation did not result in a doub-

ling of the searching/processing time. Presumably searching time is relatively much longer than processing time. In most cases the walruses only needed 30 to 40 minutes to investigate the whole of the bottom of the pool with their vibrissae, and during this investigation they quickly sucked the contents from the shells. The nutritional value of such small numbers of molluscs (which only weigh approximately 40 g each), compared to the large amount of fish taken per day (approximately 30 kg for these 4-year-old animals) can be neglected. In order to use gapers effectively as an occupational therapy for walruses in a pool of these dimensions, one has to offer the animals several feeds a day, each of approximately 10 gapers. A larger amount of gapers per feed in a pool of this size is an uneconomical way of utilizing the molluscs. Considering the fact that average searching and processing time is 40 minutes (if a random number, between 10 and 40, of gapers was fed), the best way to approximate the time spent feeding in the wild would be to give the walruses about 7 servings of 10 gapers a day in addition to their fish diet.

#### Acknowledgements

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#### References

- Fay, F. H. (1982). Ecology and biology of the Pacific Walrus, *Odobenus rosmarus divergens* Illiger. United States Department of the Interior. Fish and Wildlife Service. North American Fauna, No. 74. Washington DC.
- Kastelein, R. A. & Wiepkema, P. R. (1988). The significance of training for the behaviour of Steller sea lions (*Eumetopias jubatus*) in human care. *Aquatic Mammals* **14**(1), 39–41.
- Nelson, C. H. & Johnson, K. R. (1987). Whales and Walruses as tillers of the sea floor. *Scientific American*, February 1987.
- Oliver, J. S., Slattery, P. N., O'Connor, E. F. & Lowry, L. F. (1983). Walrus, *Odobenus rosmarus*, feeding in the Bering Sea: a benthic perspective. *Fishery Bulletin* **81**(3).