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Food consumption, body measurements and weight changes of a female Killer whale (*Orcinus orca*)

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Summary

The Harderwijk Marine Mammal Park housed a female Killer whale for 11 years, after which she was sent to Sea World Orlando on a breeding loan basis. This report is on the food consumption, body measurements and weight changes of this animal during her first 11 years.

Introduction

The food consumption, body measurements and weight changes of marine mammal species could be of importance to many interest groups. Marine mammal parks which consider keeping a marine mammal species might want to calculate the costs involved in feeding the animals. Facilities that already keep the species might want to compare their food and weight data to a reference for veterinary purposes. Body measurements and weights can be used in the making of transport equipment or for strength calculations for animal husbandry equipment such as dolphin lifts (Kastelein & Dokter, 1988). Also for the management of a species in the wild, food consumption data from animals in human care can be used as one of the main parameters in evaluating the impact of the species on the fisheries. The data also permits the management of the prey to create/allow for a carrying capacity for a certain number of marine mammals in a particular geographical area.

The Harderwijk Park housed a female Killer whale for 11 years. This paper describes the food consumption of the animal during that period and evaluates the use of a formula based on body measurements, in estimating the weight.

Materials and Methods

Study animal

The study is about a female Killer whale (*Orcinus orca*, code: OoZH001) which was caught on 28 October 1976 in the waters around Iceland. The animal is thought to have been born in October 1975. She arrived at the park on 13 November 1976 and participated in performances from then on.

In spring 1986 she became pseudo-pregnant for the first time. This changed her behaviour dramatically for some weeks. Because this pseudo-pregnancy returned in spring 1987 it was decided to send her to a facility with a male Killer whale. On 17 November 1988 she was transported to Sea World Orlando, USA, on a breeding loan basis. She is now amongst conspecifics, and is pregnant at the moment of writing. Birth is expected in July 1989.

Study area

During her stay at the Harderwijk Park the animal was kept in a main pool of 30 m (l) × 15 m (w) × 4 m (d) and in an adjacent holding pool 10 (l) × 10 (w) × 4 (d). In these pools she was in company of 1.8 Bottlenose dolphins (*Tursiops truncatus*) of which the male was dominant over her. During the year the temperature of the salt water varied between 15 and 22°C.

Food

The animal was fed 3–5 times per day on a diet of 35% Herring (*Clupea harengus*), 36% Mackerel (*Scomber scombrus*), 6% Whiting (*Merlangus merlangus*), 12% Sprat (*Sprattus sprattus*) and 11% Squid (*Illex* spp.). Her food intake was strongly influenced by the training technique used in that period when food was the only reward used. Presently new training techniques are used at the Harderwijk Park in which food is only one of the many types of rewards used.

Weight calculation

The weight was calculated by the following formula based on body measurements:

$$W = \frac{L^2 \times G}{44\,000}$$

in which L is the total body length (cm), G is the maximum girth behind the pectoral fins and dorsal fin (cm) and W the calculated weight (kg). The body

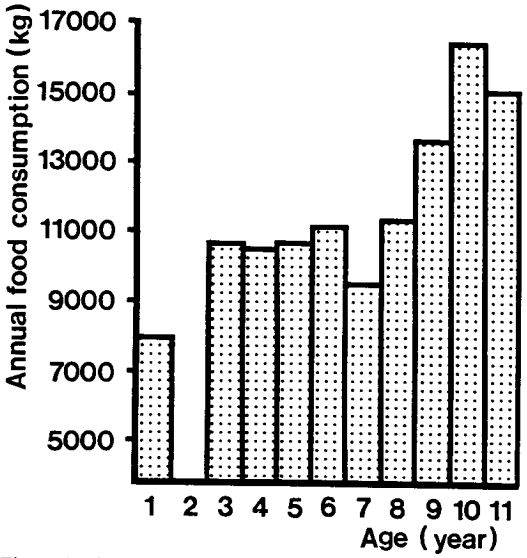

Figure 1. The annual food consumption of the female Killer whale.

Table 1. The body measurements and calculated weight estimates of the female Killer whale. The * indicates a real weight measurement

Date	Age (yr)	Body length (cm)	Girth caudal of pectoral find (cm)	Estimated weight (kg)
13–11–1976	1	270	190	315
25–03–1977	1	298	205	414
01–05–1977	1	300	209	428
23–06–1977	1	320	211	491
01–08–1977	1	321	219	513
26–11–1977	2	330	245	553
21–11–1978	3	400	246	895
13–02–1979	3	400	259	942
06–11–1979	3	410	254	970
29–10–1980	5	450	254	1170
19–12–1983	8	473	—	—
05–09–1986	10	510	310	1832
15–05–1987	11	518	317	1933
17–11–1987	12	—	—	1900*

measurements were taken when the animal was hauled out on land.

Results

Food consumption

The annual food consumption of the female Killer whale increased over the years (Fig. 1). The food consumption records of her second year could not be retrieved. In 1983, when she was 7 years old, she ate less every month than the monthly average of 1982. No illness was detected so this reduced food intake remains unexplained.

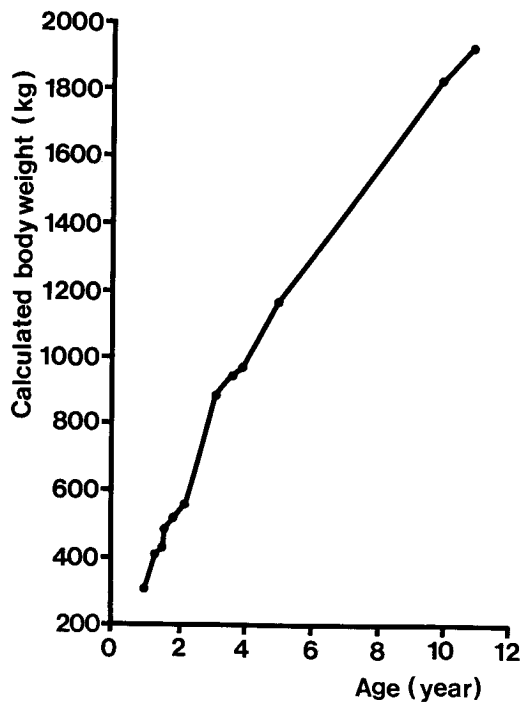

Figure 2. The body weight changes of the female Killer whale during her stay at the Harderwijk Park.

Body measurements and weight estimation

The animal was measured 13 times and the weight estimates could be calculated for 12 of those measurements (Table 1). The animal was also weighed once.

The body weight increased steadily over the years (Fig. 2). The animal grew relatively faster between her first and third year than between her fourth and eleventh year.

More details of the animal were measured on 5 September 1986 (Fig. 3). This data was needed to construct a transport hammock. The relative position of the pectoral fins and genital slit could be used in designing hammocks for different sized Killer whales.

Food consumption relative to body weight

Although few data points exist it was possible to calculate a regression line for the correlation between

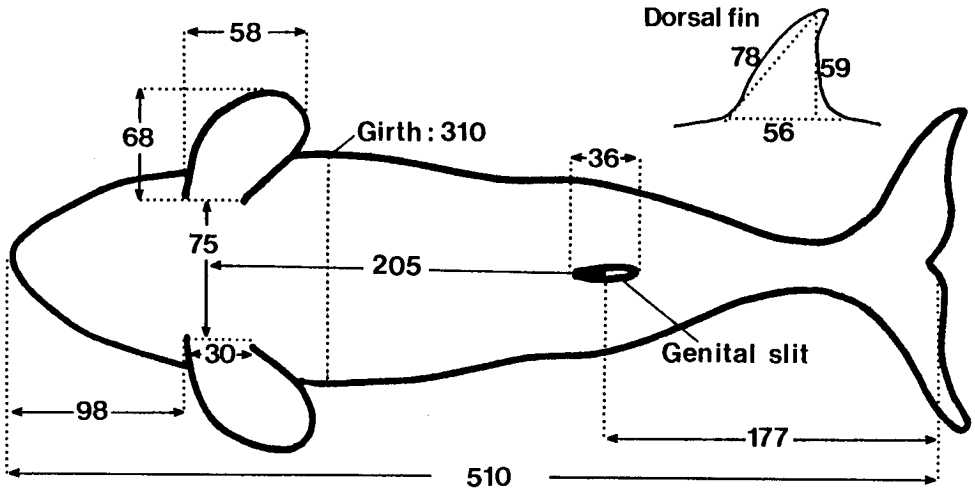

Figure 3. The measurements (cm) of several body parts of the female Killer whale, and their relative position.

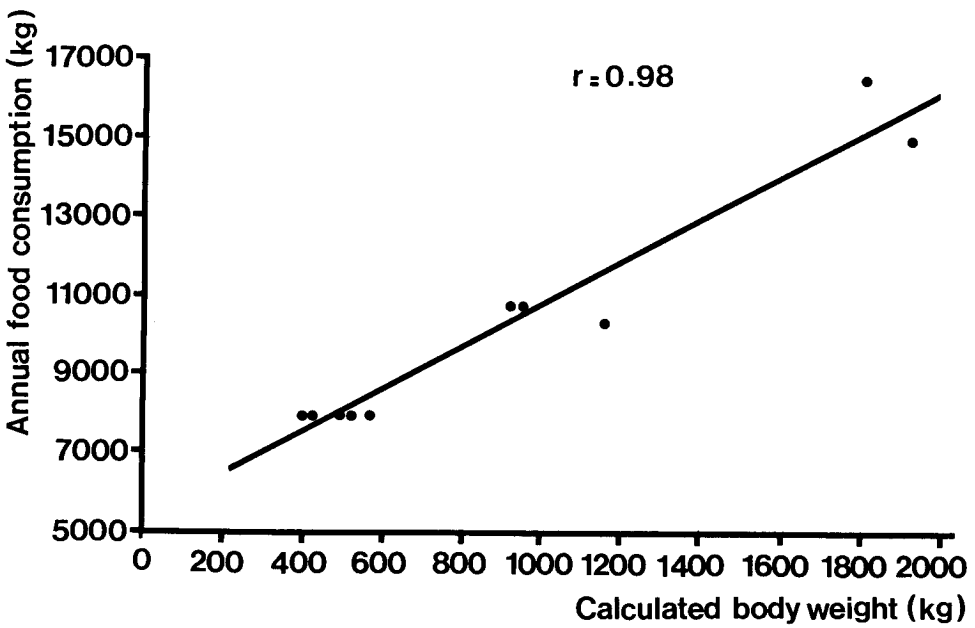

Figure 4. The relation between the calculated body weight and annual food consumption of the female Killer whale. r = correlation coefficient.

the calculated body weight and the annual food consumption (Fig. 4). There is a close correlation between these two parameters (r = 0.98).

Discussion and conclusions

We do not suggest that the annual food consumption of this animal was equal to that of other females of the same age, but the food consumption per kg body weight might well reflect that of conspecifics in the wild, because this animal was in good physical condition during the 11 years that she was at the Harderwijk Park.

No regular pattern was seen in the monthly food consumption of this animal. Although the natural light cycle could have influenced the food intake, this

Table 2. The body measurements, weights and food consumption of Killer whales found in the literature. An * indicates a subjective weight estimate

No.	Sex	Age (yr)	Body length (cm)	Girth (cm)	Weight (kg)	Food consumption (kg/day)	Source
1	F	4.5	411	—	1088	36–63	Burgess, 1968
2	F	6	450	—	1358	—	Burgess, 1968
3	F	—	439	322	1200*	45	Hewlett, 1968
4	M	—	660	—	3600*	—	Griffin, 1968
5	F	—	250	—	270*	—	Griffin, 1968
6	F	—	330	—	700*	—	Griffin, 1968
7	M	—	430	—	1000*	—	Griffin, 1968
8	F	—	460	—	1360*	—	Griffin, 1968
9	M	—	698	—	4554	—	Griffin, 1968
10	F	—	579	—	2540	—	Griffin, 1968
11	M	—	385	—	1031	—	Griffin, 1968
12	—	neonate	—	—	158	—	Benirschke, 1987
13	—	neonate	—	—	155	—	Benirschke, 1987

cycle (if there is one) was probably overruled by the food ration offered by the trainers.

The formula for calculating the body weight estimate of Killer whales used in this study proved fairly accurate when the calculated weight on 15 May 1987 (1933 kg) was compared to the real weight measured during transport on 17 November 1987 (1900 kg). The animal at that time had fasted for two days prior to transport which would have reduced her weight by at least 50 kg.

Data on food consumption, body weight and body measurements found in the literature are compiled in Table 2. Unfortunately most authors give incomplete information. Some data can be compared to data from this study. The weight and body measurements of animal No. 1 and No. 2 fit very well in Figure 2. However, our animal ate an average of 29 kg/day when she had that weight compared to the 36–63 kg/day of No. 1 and 2. The subjective estimated weight of No. 3 was probably an underestimation. The calculated weight estimate, using the formula used in this study, is 1410 kg.

The subjective weight estimate of animals No. 5, No. 7 and No. 8 are close to the calculated weight of the animal in this study at the same length. The subjective estimate of No. 6 is probably too high. The other animals in Table 2 are too large or too small for comparison with our data.

We are aware that we are comparing the weight of the food consumed irrelevant of its food quality. Fish species have different calorimetric contents, and even fish caught in a different region or season may vary in composition and caloric content. The diet of the animal in this study consisted for 71% of species with a high calorimetric content (Herring and Mackerel).

It seems that body measurements combined with real weight measurements fit well with the calculated weight estimates of this study. This supports the accuracy of the formula. Subjective weight measurements can be very inaccurate.

Acknowledgements

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