Aquatic Mammals 1986, **12.1,** 17–20

The nutrition of acclimated *vs* newly captured *Tursiops Truncatus*

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Abstract

Two groups of Atlantic bottlenose dolphins, *Tursiops truncatus*—one in captivity for over six years and the other captured in the Mississippi Sound and transported to Hawaii in April 1984—were monitored monthly for weight changes and daily for food consumption. Gross energy was measured on each shipment of fish and used to calculate energy consumption of the individual dolphins. During this time, at least three major diet changes occurred, due to unavailability of preferred fish species and to poor quality of some of the substituted species. Similarities were noted between the two groups of dolphins as reflected in weight change patterns and caloric requirements. It appears that newly captured animals, even after a long-distance transport, permanent change of environment and several diet changes, adapt readily, showing comparable nutritional responses with the acclimated group of animals.

Introduction

Nutrition should be carefully monitored in a complete animal health program. This is of major importance in marine mammal medicine, where a wide variety of commercially available fish, all with seasonal and species differences in caloric value, is used in diets. Although data is available pertinent to food consumption in marine mammals, most of it is expressed on the basis of percentage of body weight or is calculated using average analytical values of a given fish species (Sergeant 1969, Van Dyke & Ridgway 1977). Little data is available relative to the relationship between energy consumption and body weight changes in cetaceans. We considered energy consumption (calculated from actual nutritional analyses of all fish fed) and monthly body weight changes in two groups of *Tursiops truncatus* of different age, weight and time in captivity.

Materials and methods

Sixteen Atlantic bottlenose dolphins, *T. truncatus*, were housed in floating seawater pens in Kaneohe Bay, Hawaii. The animals were grouped according to length of captivity. One group ($n = 10$) had been in captivity less than one year after being captured in the Gulf of Mexico. This newly captured group of animals consisted of two males and eight females with estimated ages of four to nine years. The other group ($n = 6$), all in captivity for over seven years, included two males and four females, ages 11 to 20 years.

All animals were fed a mixture of Pacific mackerel (*Scomber japonicus*), herring (*Clupea harengus*), and either Columbia River smelt (*Thaleichtys vetulus*), capelin (*Mallotus villosus*) or American smelt (*Osmerus mordax*) plus vitamin and mineral supplements.

Each shipment of fish received at our facility was randomly sampled and submitted for laboratory analysis of gross energy to the U.S.D.A. Cooperative Extension Service at the University of Hawaii. Gross energy (kcal/g of fish dry matter) was measured by bomb calorimetry (Maynard *et al.* 1979).

Each dolphin was weighed once monthly, and body weight changes determined. Daily food intake, in pounds and species of fish fed, were recorded by each animal's trainer.

Energy consumption (kcal/kg/day) was calculated using gross energy analysis and daily fish consumption data for each animal.

Differences between means were evaluated by independent t-tests.

Results

The fish analyses (Figure 1) show up to 35% differences in gross energy values in shipments of Pacific mackerel and between Columbia River smelt, capelin and American smelt. Figures 2 to 4 show a comparison of the means of the acclimated and newly captured groups in body weights, monthly weight changes and energy consumption is shown.

The acclimated group lost a significantly greater amount of weight in June 1984 ($t = 2.98$, $df = 12$, two-tailed $p < 0.02$). There was no significant difference in body weight changes between the two groups for 9 out of 10 months (Figure 3). There was a significant difference in energy consumption in May 1984 ($t = 2.62$, $df = 12$, two-tailed $p < 0.05$) and January

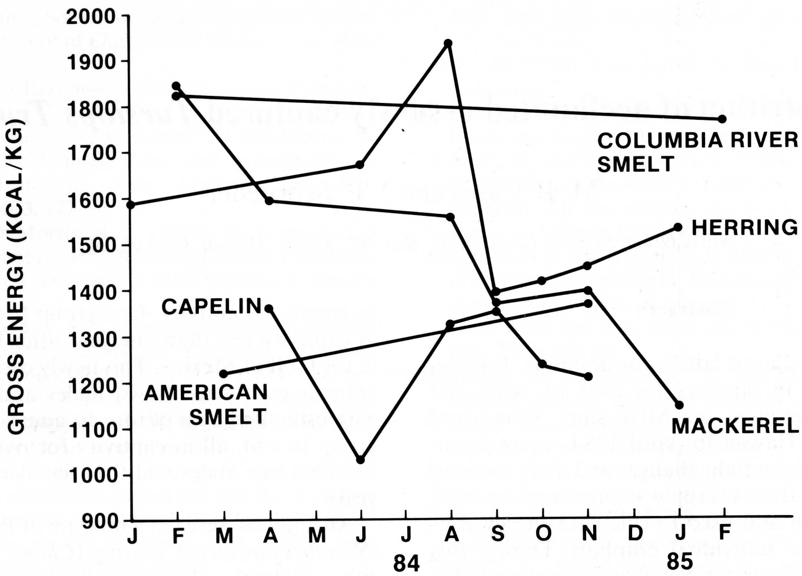

Figure 1. Gross energy values of fish shipments received in 1984–85.

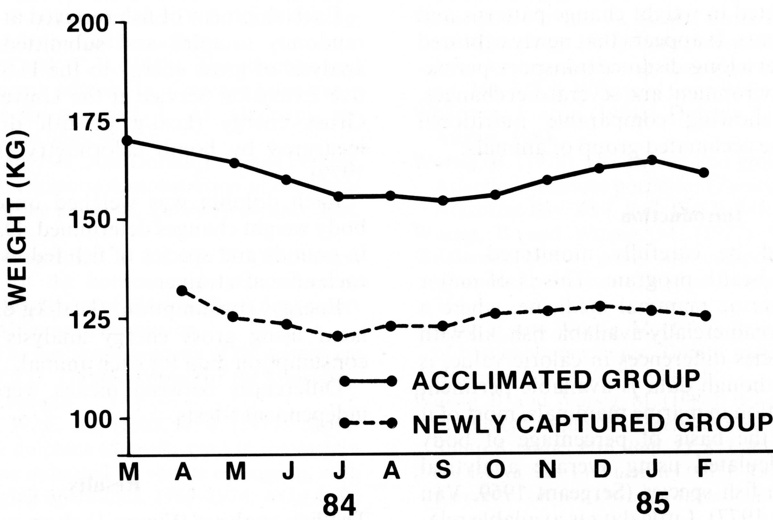

Figure 2. Average monthly body weights.

1985 ($t=2.26$, $df=12$, $p<0.05$). The newly captured group consumed a significantly greater amount of calories during those months. There was no difference in energy consumption during the other eight months (Figure 4).

Discussion

Other reports have shown similar results in fish analysis (Geraci 1978, Oftedal & Boness 1983) but none have shown the wide variability between Columbia River smelt and capelin and other smelts nor has such a low and wide range been reported for Pacific mackerel. American smelt and capelin were substituted from April 1984 to February 1985 when Columbia River smelt became unavailable. Time delays in laboratory analyses, coupled with any substantial differences in gross energy values in new fish shipments, sometimes resulted in undesirably low energy consumption and subsequent weight losses

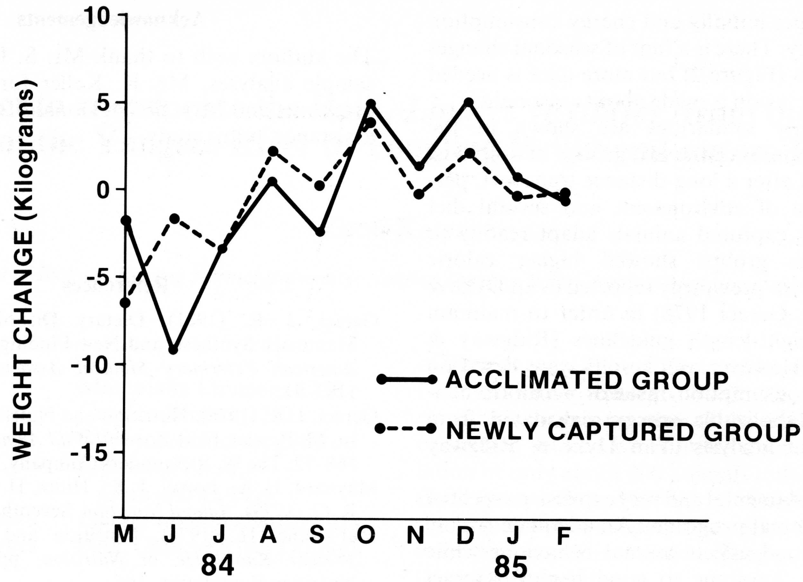

Figure 3. Average monthly body weight changes.

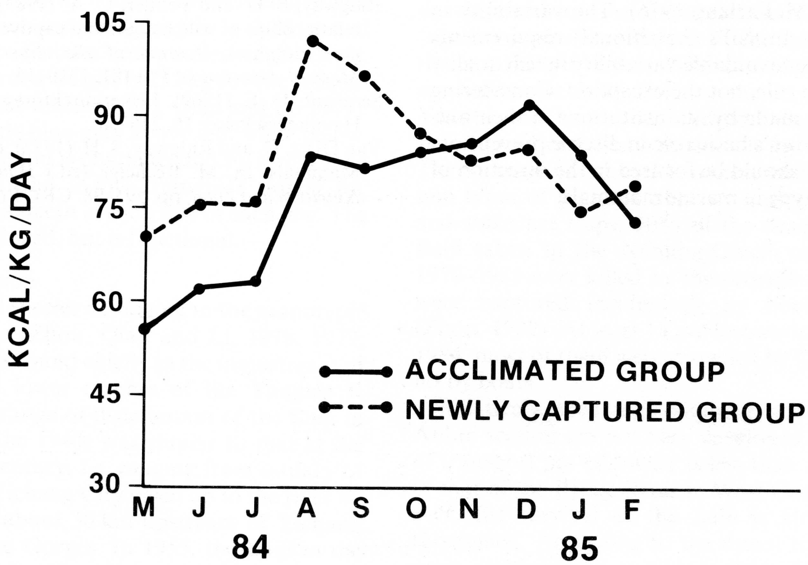

Figure 4. Average energy consumption.

before adjustments could be made in the diet. The low caloric intake of the acclimated group in May 1984 and their significant weight loss in June 1984 are good examples.

Other factors, such as water temperatures, seasonal temperature changes, total digestibility of the food, and training, must also be considered in any evaluation of nutrition. These animals were housed in tropical waters (constant temperature of 75–80°F.) where it has been reported that *T. truncatus* have lower body weights in captivity than those held in cooler California waters (Ridgway & Fenner 1983). The newly captured group came from 55–60°F water, were 'free-fed' during their first two months in captivity, and then began a training program. This may account for some of the differences in weight changes initially and energy consumption later in the study. There is a hint of seasonal changes in body weights (Figure 2) but more data is needed before any conclusion is made about seasonality.

Overall, many similarities are shown in the nutritional responses of the two groups of dolphins. We found, that after a long-distance transport, permanent change of environment and several diet changes, newly captured animals adapt readily to captivity. Both groups showed higher caloric requirements than previously reported (Van Dyke & Ridgway 1977, Geraci 1978) in order to maintain established weight-length guidelines (Ridgway & Fenner 1983). However, our results were based on gross energy consumption instead of caloric consumption (metabolizable energy) calculated from fat and protein analysis (Van Dyke & Ridgway 1977).

Food is a fundamental and very expensive aspect of all marine mammal programs. An adequate supply of nutritious food affects animal behaviour while also being the 'keystone to good health' (Geraci 1981). Many maladies can be directly attributed to malnutrition, and, in humans, malnutrition alone can impair the immune response of an individual (Geraci 1981, McFarlane 1976). The variability in an individual animal's nutritional requirements along with the unavoidable variability in fish quality seems to be the rule, not the exception. Considering the investment made by all institutions in their animals and nutrition's basic role in disease prevention, more attention should be focused in the direction of studies of this type in marine mammals.

Acknowledgements

The authors wish to thank Mr. S. Ishizaki for the sample analyses, Mr. K. Keller for the computer programs and Mrs. D. McDonald for the technical assistance in this study.

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