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GROWTH PATTERN DIFFERENCES OF CAPTIVE BORN ANTILLEAN MANATEE (*TRICHECHUS MANATUS*) CALVES AND THOSE RESCUED IN THE BRAZILIAN NORTHEASTERN COAST

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Abstract: The aim of this work was to analyze whether there are differences between the development pattern of Antillean manatee (*Trichechus manatus*) calves born in captivity and those rescued and kept under rehabilitation. Biometrics data were collected from 1990 to 2010 from 38 calves, 29 of which still had the remnants of the umbilical cord and had been rescued from the Brazilian northeastern coastline (Group I), and nine individuals that were born in captivity and remained with their mothers (Group II). Among the measures obtained through biometry, the total length and weight of the animal were recorded. Given that the breastfeeding of calves occurs approximately until the age of 2 yr, data obtained until the 24th month of life of each individual were evaluated. An average increase in weight of 53.50 ± 38.54 kg (mean ± standard deviation [SD]) was detected in Group I and a gain of 106.87 ± 47.21 kg (mean ± SD) in Group II. From months 13 to 24, no significant difference in the weight increment was observed. A similar pattern occurred with regard to the increase in the overall length during the first year, where animals from Group I grew 34.81 ± 17.94 cm (mean ± SD) and from Group II grew 83.83 ± 28.21 cm, a statistically significant difference. The growth was not significantly different from 13 to 24 mo. The results found in this study identified the need for a review of the nutritional diet offered to orphaned calves rescued and kept in captivity. The results also support the need for a better adequacy of facilities for these animals as a way to encourage the management strategies adopted for manatee calves maintained in captivity.

Key words: Antillean manatee, biometry, length, *Trichechus manatus*, weight.

INTRODUCTION

Considered to be the most endangered aquatic mammal in Brazil, the population of Antillean manatees (*Trichechus manatus*) is discontinuously distributed in the northern and northeastern regions of Brazil,[15,18] and the stranding of newly born calves is one of the main problems related to the conservation of this species.[19,21]

Antillean manatee calves are sensitive to changes in their habitat and, therefore, the degradation of estuarine environments in the Northeastern region is identified as a triggering factor of stranding events.[17,19,21] The difficulties that this species finds in the use of many estuaries, which are considered natural nurseries for these animals, affect an important part of their life cycle from birth throughout the period of parental care.[16] As a conservation strategy for this species, stranded calves are rescued and taken to the Rescue and Rehabilitation Unit of the Aquatic Mammal Center–ICMBio, located in the state of Pernambuco, Brazil.

In addition to keeping calves under rehabilitation in order to acquire scientific knowledge on this species, Antillean manatees rescued from inadequate captivity situations, or those unsuitable for the reintroduction program,[12] are kept in these facilities for research and environmental education purposes. It should be stressed that since 1996, births in captivity have been registered and these calves are kept in continuous contact with their mothers.

Although an increase in publications about Antillean manatees has been observed in recent years, there are still gaps in the knowledge about this species. According to Parente,[22] research projects related to growth curves are among those of relevance which can contribute to an evaluation of the development of calves in the rehabilitation process and also assist in the monitoring of adult animals. The information obtained through mor-

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phometry can be related to natural history data, generating valuable information about the size of newborn manatees and the body development rate throughout the life of the animal.[28] In this regard, several studies on aquatic mammals have assessed their total weight-length.[2,13,24,25,30]

Based on the premise that both the diet offered in captivity and the type of management contributes to animal growth determination,[1,7] there may be differences in the development pattern of calves hand-reared in captivity versus those that are mother-reared.

Thus, the aim of this work was to analyze whether there are differences between the development pattern of Antillean manatee calves born in captivity and mother-reared and those rescued and hand-reared while kept under rehabilitation.

MATERIALS AND METHODS

Data were collected from 1990 to 2010 from biometrics performed on 38 Antillean manatee calves, males ($n = 22$) and females ($n = 16$), that had been rescued from beaches along the coastline of the states of Paraiba, Rio Grande do Norte, Ceará, Maranhão, and Amapá, Brazil (Group I); 29 of the calves still had remnants of the umbilical cord. Nine individuals were born in captivity and remained with their mothers (Group II). Animals from Group I were kept in rehabilitation facilities isolated from the public, alone or in the company of other calves, while animals from Group II remained with their mothers and were exposed to public visitation.

The rescued calves were clinically evaluated shortly after their arrival at the Rehabilitation Unit, initially being kept in individual circular pools 5.51 m^3 (3 m diameter $\times$ 0.87 m deep) until they were adapted to these facilities. Later, each calf was kept with another specimen of similar age in oval pools that were 9.5 m^3 (4 m long $\times$ 2.50 m wide $\times$ 1.20 m deep). After 12 mo, the calves were transferred to the reintroduction oceanarium which consisted of two interconnected structures, one with a capacity of 67.84 m^3 (5.30 m long $\times$ 4 m wide $\times$ 3.20 m deep) and one that was 31.80 m^3 (5.30 m long $\times$ 4 m wide $\times$ 1.50 m deep). Calves born in captivity were kept in two octagonal oceanaria with a capacity of up to 348 m^3 (10 m diameter $\times$ 4.40 m depth) and were with their mothers and other animals of varying ages.

Information obtained through biometry included 24 body measurements, according to previous standardization,[3,10,11] and arranged in individual spreadsheets containing name, specimen registration, and date. The frequency was defined according to the age of animals, and measurement collections ranged from weekly to quarterly intervals. Measurements were obtained using flexible tape measures graduated in centimeters (537B – 20 cm, Starret Indústria e Comércio LTDA, Itu, SP, 13306–900, Brazil). The calves were kept in a dry area and on foam mattresses.

Animals from Group I were fed with artificial formulas based on delactosed milk powder[32] (0-Lac, Cooperativa dos Produtores de Leite de Leopoldina de Resp. Ltda, Leopoldina, MG, 36000–970, Brazil) or isolate soy protein (Soymilke, Olvelbra Industria S/A, Eldorado do Sul, RS, 92990-000, Brazil) diluted in mineral water, supplied in feeder bottles, with a frequency and amount that varied according to age and physical conditions.[31] The food supplements (Aminomix Pet, Vetnil Ind. e Com. de Produtos Veterinários Ltda, São Paulo, SP, 13290-000, Brazil), and on some occasions (with clinical signs of anemia, anorexia, and infectious diseases) multivitamins (Potenay Gold B12®, Fort Dodge Sacede Animal Ltda, Campinas, SP, 13064–798, Brazil), were added and supplied until the animal reached the age of 2 yr. The dosages administrated were 0.5g/kg p.o., s.i.d. of Aminomix Pet and 1–2 ml/10 kg p.o., s.i.d. of Potenay Gold B12.

In addition, sea grass (*Halodule wrigthii*) and seaweed (*Sargassum* sp., *Caulerpa* sp., *Halimeda opuntia*, *Penicillus capitatus*, *Dictiopteris delicate*, *Dictyota* sp.) were offered daily from the first day in captivity. Beyond the last two items mentioned, calves from Group II also received carrot, lettuce, squash, and sometimes fruits in addition to ad libitum feeding from their mothers.

In this study, among the measures obtained through biometry, the total length and weight of the animal were recorded, and the time intervals in bimonthly and quarterly periods were used in the analyses of this research. Moreover, given that the breastfeeding of calves occurs approximately until the age of 2 yr, data obtained until the 24th month of life of each individual were evaluated.

For statistical analysis, the increases in weight and total length of animals at the end of each year were compared between Groups I and II. The increases in weight and total length at the end of each year were also compared between sexes of animals from Groups I and II. Statistical analyses were performed using Sigmastat 10.0 software (Scientific Solutions SA., Pully-Lausanne, Switzerland 1009), and the means of each treatment

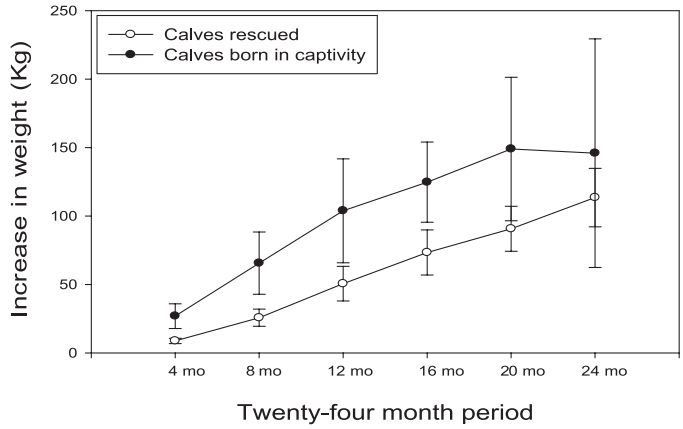

Figure 1. Increase in weight of rescued calves and those born in captivity at 4-mo intervals.

were compared by the Student's *t*-test with a significance level of 0.05.

RESULTS

It was determined that there was an average increase in weight of 53.50 ± 38.54 kg (mean ± SD) in Group I and of 106.87 ± 47.21 kg (mean ± SD) in Group II, both of which were statistically different (Student's *t*-test, $P = 0.007$). From 13 to 24 mo, no significant difference in the weight increment was observed ($P = 0.228$) (Fig. 1).

Considering a total period of 24 mo, the average increase in weight in Group I was 112.70 ± 50.25 kg (mean ± SD), lower than the increase in Group II which was 174.87 ± 58.98 kg (mean ± SD) (*t*-test, $P = 0.037$; Fig. 2).

Both groups were born with similar average initial weights (Group I $\bar{x} = 34.6$ kg, Group II $\bar{x} = 34.2$ kg). However, during their development, there was a greater weight gain in animals born in captivity, both at the end of 12 mos (Group I with average final weight of 89.5 kg, Group II with average final weight of 158.8 kg) and at the end of 24 mo (Group I with average final weight of 157.1 kg, Group II with average final weight of 218.7 kg) (Fig. 3).

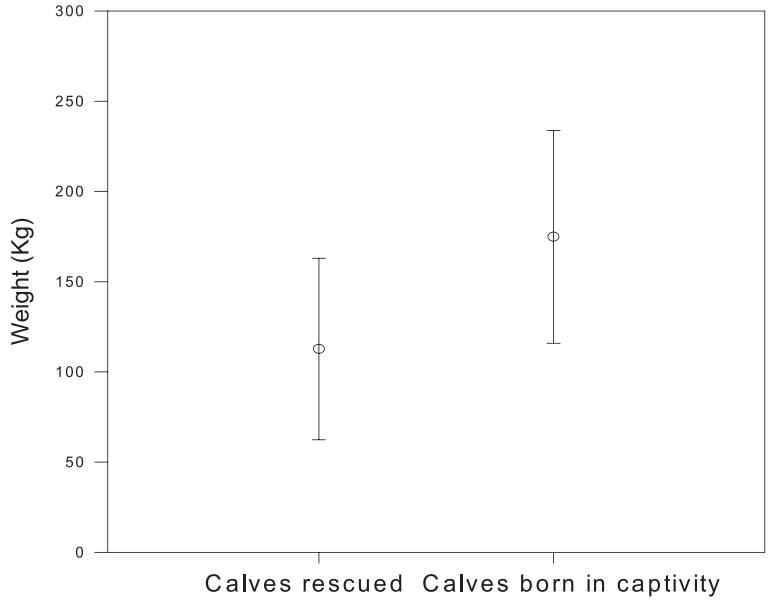

Figure 2. Increase in weight of rescued calves and those born in captivity at the end of 24 mo.

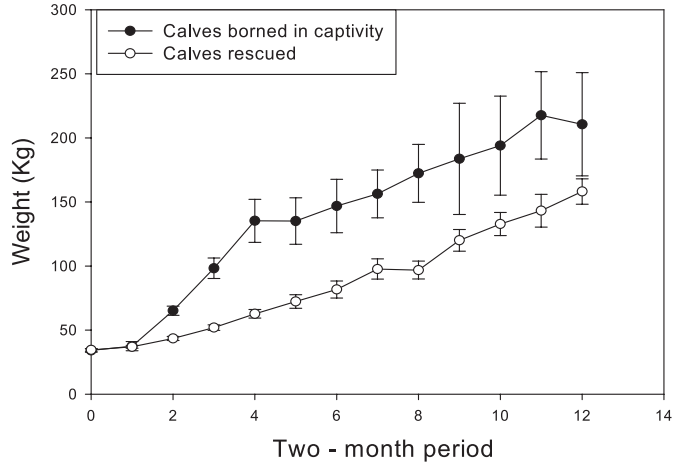

Figure 3. Comparison of average weight gain, at bimonthly intervals, between rescued calves and those born in captivity.

A similar pattern occurred with regard to the increase in the overall length in the first year, where animals from Group I grew 34.81 ± 17.94 cm (mean ± SD) and Group II animals grew 83.83 ± 28.21 cm (mean ± SD), a statistically significant difference (Student's *t*-test, $P < 0.001$). The growth was not significantly different from 13 to 24 mo ($P = 0.571$). However, a significant difference was observed when considering the total period from 1 to 24 mo (*t*-test, $P < 0.001$), in which animals from Group I grew 71.53 ± 19.28 cm and those from Group II grew 113.58 ± 23.64 cm (Fig. 4).

The total length at birth was similar between groups (Group I $\bar{x} = 126.3$ cm, Group II $\bar{x} = 123$ cm) and, at the end of the first year, a greater growth of calves born in captivity was observed (Group I $\bar{x} = 167$ cm, Group II $\bar{x} = 190$ cm), a growth which was also observed at the end of the second year (Group I $\bar{x} = 199.1$ cm, Group II $\bar{x} = 220.6$ cm) (Fig. 5).

There were no statistically significant differences between the increase in weight (*t*-test, $P = 0.550$) and length (*t*-test, $P = 0.724$) between males and females from the different groups studied.

DISCUSSION

The use of biometric measurements based on total length and weight proved to be a good indicator to monitor the development of manatee

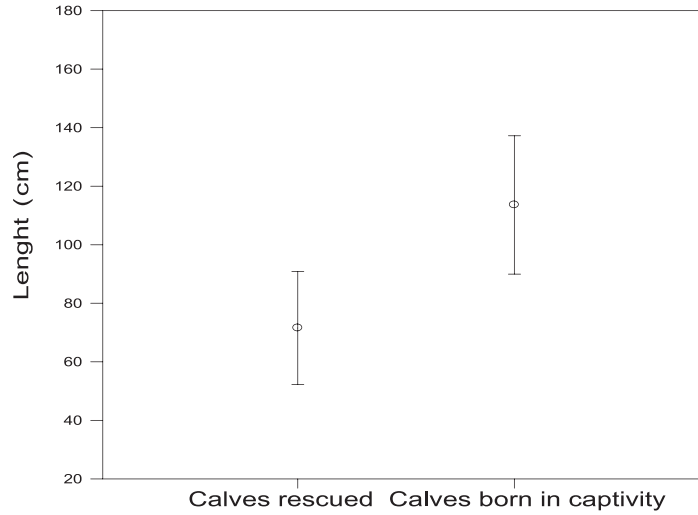

Figure 4. Increase in total length at the end of 24 mo of rescued calves and those born in captivity.

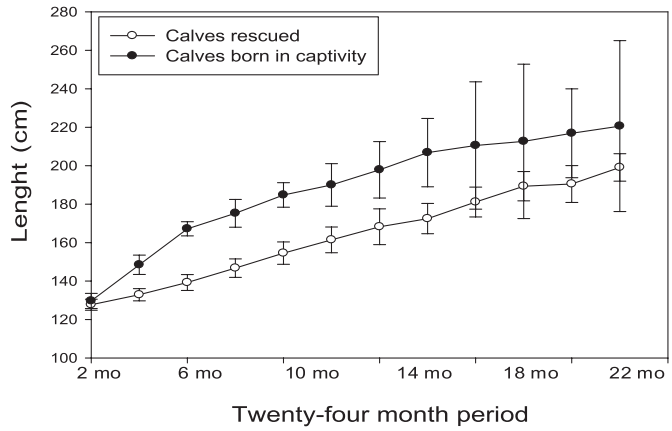

Figure 5. Average growth in length, at bimonthly intervals, of rescued calves and those born in captivity.

calves in captivity, allowing the detection of significant differences between the growth of animals born in captivity versus rescued calves. Similar findings were reported by Colares[7] in studies with the two species of sirenians (*Trichechus inunguis* and *Trichechus manatus*) found in Brazilian waters where, according to the author, biometric measurements and weighing would serve as growth estimators. In some studies, the total length was also used as a variable correlated in research involving the determination of age in Antillean manatees[26] as well as for weight estimates in the Amazonian manatee (*Trichechus inunguis*) and Steller sea lion (*Eumetopias jubatus*).[1,29]

According to the results obtained in this study, differences related to weight gain and growth between groups studied for 24 mo may have been influenced by the type of diet offered and the size of the facilities where calves from Group I were kept. According to Hammond,[8] weight may serve as an indicator of the general state of the animal and provide clues on the quality of diet offered in captivity. The nutritional aspect was also named as one of the factors responsible for morphological differences in studies conducted with a wide variety of captive mammals.[20]

Among aquatic mammals, it was observed that the maternal strategy has a major impact on the growth of calves.[6] According to Boness,[4] baby seal cubs that received milk rich in energy showed a rapid growth and accumulated lipid reserves during the lactation period. On the other hand, some pinnipeds breastfed with milk of lower energy density grew slowly, with little variation in body composition.[5,14,27]

Similarly, even with the use of the well-accepted diet for rescued manatee calves,[31,32] the breastfeeding by their mothers of animals born in captivity, and the intake of other food items (algae, sea grass, vegetables), may have positively influenced the development of animals from Group II.

During the captive management of animals from Group I, they were initially kept in small pools, being generally transferred to the reintroduction oceanarium (which has greater dimensions compared to pools) after 12 mo. Keeping Group I manatee calves in the larger oceanarium, which allows greater movement of animals, may have favored their development and reduced the differences in growth from 13 to 24 mo compared to animals from Group II, who from the time of birth were kept in an oceanarium larger than the pools aimed at manatee calves under rehabilitation (Group I).

The interference of facility factors in the development of manatees was also reported by Colares,[7] who mentioned factors that negatively influenced the growth of animals including the increased capacity of pools, the stress caused by intense visitation, and the changing of animals between different maintenance locations.

Comparing the development between males and females from both groups, no significant differences were found (weight $P = 0.550$, total length $P = 0.724$). The lack of differences in the growth of calves evaluated in this study may be related to the early age of the specimens, as the results obtained by Santana[26] revealed that the morphometric data of Antillean manatees maintained in captivity showed significant differences between sexes, but only when examined from the age of weaning to the age of sexual maturity.

According to Colares,[7] sex influenced the development pattern of Antillean manatees; this was

more evident in older animals where females are generally heavier. In Amazonian manatees, research conducted with captive and wild populations has shown that females grew faster than males.[1,22]

The existence of differences in growth between sexes was also observed in other species of aquatic mammals such as La Plata dolphins (*Pontoporia blainvillei*), where males grew faster than females[23,33] but reached asymptotic sizes that were smaller than females.[9]

The results found in this study identified the need for a review of the nutritional diet offered to orphaned calves rescued and maintained in captivity as well as the need for a better adequacy of facilities aimed at these animals as a way to encourage the management strategies adopted for captive manatee calves.

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