

# STANDARD OF MEASUREMENT AMONG LOCAL INHABITANTS IN THE MIDDLE SOLIMÕES, OCCIDENTAL AMAZONIA, AND ITS USE IN MORPHOMETRICS OF AMAZONIAN MANATEE (*Trichechus inunguis* NATTERER, 1883)

## PADRÕES DE MEDIDAS ENTRE OS HABITANTES DO MÉDIO SOLIMÕES, AMAZÔNIA OCIDENTAL, E SEU USO NA MORFOMETRIA DE PEIXE-BOI AMAZÔNICO (*Trichechus inunguis* NATTERER, 1883)

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### KEYWORDS:

Amazonian manatee;  
*Trichechus inunguis*;  
Morphometrics.

### SUMMARY

This study analyzed measurements of Amazonian manatees taken by local people on the middle Solimões river, converting the length of the inch of local people to the metric system, and verifying the existence of a difference between the value of local men's inch in metric scale and the international metric standards for the measurement. Field trips were taken to the Mamirauá and Amanã reserves, in Central Amazonia, to confirm the use of the inch as a measurement unit. Interviews were applied and the inches of 508 adult males resident in the town of Tefé and in the Mamirauá and Amanã reserves were measured. The sample consisted of persons whose experience with manatee capture ranged from three to 43 years. The average value for the local inhabitant inch was 21.71 cm. A *Student's t-test* applied to the result demonstrated a highly significant difference in relation to the value of the inch described in the literature. The use of morphometric data contributed by local people, in growth studies of Amazonian manatees must weigh the value of 21.71 cm in the conversion of the local's inch to the metric scale, considering an error of 0.05 cm for each converted inch measure.

### PALAVRAS-CHAVES:

Peixe-boi-da-Amazônia;  
*Trichechus inunguis*;  
Biometria.

### RESUMO

Este estudo avaliou os padrões de medição dos peixes-boi-da-Amazônia efetuados por ribeirinhos do médio Solimões, convertendo o comprimento do palmo dos moradores locais para o sistema métrico, verificando a existência de diferença entre o valor na escala métrica do palmo do ribeirinho e os padrões internacionais métricos da medida. Foram realizadas expedições às Reservas Mamirauá e Amanã, na Amazônia Ocidental para confirmar a utilização do palmo como unidade de medida. Foram também realizadas entrevistas e medidos os palmos de 508 homens, adultos, procedentes da cidade de Tefé e das Reservas Mamirauá e Amanã. A amostra foi constituída por moradores com experiência de três a 43 anos na captura de peixes-boi. Ficou constatada a utilização exclusiva do palmo como forma de biometria. O valor médio do palmo dos ribeirinhos foi 21,71 cm. O teste *t de Student* efetuado no resultado dos palmos dos ribeirinhos demonstrou diferença altamente significativa em relação ao valor do palmo descrito na literatura. Na utilização de dados biométricos fornecidos por ribeirinhos, em estudos de crescimento do peixe-boi-da-Amazônia, deve ponderar o valor de 21,71 cm na conversão do palmo do ribeirinho para a escala métrica, considerando um erro mínimo de 0,05 cm para cada palmo convertido.

## INTRODUCTION

The indiscriminate hunting pressure caused a drastic reduction in numbers of several species of animals. The Amazon turtle (*Podocnemis expansa*) and the Amazonian manatee (*Trichechus inunguis*) almost disappeared due to high-scale hunting (PAROLIN; PIEDADE; JUNK, 2005). Nowadays the manatee is still under hunting pressure throughout its range, especially geared towards subsistence of local communities. An alternative to the human pressure problem are conservation-and-development integrated projects, considered one of the best conservation strategies. The Mamirauá Institute for Sustainable Development (MISD) is one example of these strategies, and integrates the protection of biological diversity to the local habits of the population resident in the sustainable development reserves of Mamirauá (MSDR) and Amanã (ASDR) (PRIMACK; RODRIGUES, 2001; QUEIROZ, 2005).

MISD's Amazonian Manatee Project has monitored hunting of the species in the middle Solimões area, since de 1990's, initially in Mamirauá, and more recently in Amanã. The Project has produced a considerable and important record of 15 years worth of data on the Amazonian manatee, including biological material. This is the product of integration between the institution and the local human population who, despite practices questionable by the scientific and conservationist community, has contributed with knowledge on the Amazonian manatee by contributing biological material and information such as hunting date and place, sex and total length (measured in inches).

Although the Brazilian official length unit of measurement is the meter (DIAS, 1998), several traditional communities routinely use parts of the human body as a reference to measure a large number of elements, especially those coming from nature, such as land sizes, human stature, and animal length (RAMINELLI, 2001; INSTITUTO NACIONAL DE PESQUISAS DA AMAZÔNIA, 2004; HECK; LEBENS; CARVALHO, 2005). One of those measurement units is the inch, which, although considered archaic and imprecise, is commonly used by local inhabitants of Occidental Amazonia – including those who catch manatees and offer data and biological material do MISD. This practice is used by local people by tradition or by lack of measuring gear.

Local people commonly measure manatees in *inches* on a curvilinear way over the ventral surface, whereas researchers use precise instruments and follow the International System. The hand becomes an interesting tool as a measuring unit in regions like Amazonia, to associate the traditional knowledge of local people to scientific studies conducted by researchers from different areas of the world. Nevertheless, it is important to evaluate the best way in which such information may be used in scientific studies, since variations in the anthropometric standard may occur among countries, and even within a country depending on the region under concern (SCHLOSSER; DEBIASI; PARCIANELLO; RAMBO, 2002; MEISEL; VEGA, 2004).

To standardize units of measurement and avoid anthropometry, at the end of the XVIII century the decimal metric system was established, and

adopted by all countries signatory of the Meter Convention, including Brazil. In 1960, the General Conference on Weights and Measurements defined this system as the International System of Units (SI). The latter had 7 basic measurement units. The meter was considered the unit of length then, and up to this day it is used and accepted by scientific, technical and pedagogic media in all countries (INMETRO, 2003).

In Brazil, information on the population biology of Amazonian manatees is still scarce, even for animals present in the Mamirauá and Amanã Reserves (ARRAUT; MANTOVANI; NOVO ; MARMONTEL, 2005; MARMONTEL, 2005) – emphasizing the importance of biological information derived from captures to improve knowledge and adoption of conservation strategies for the species. This study aimed at analyzing the measurement standards of Amazonian manatees used by local people in the middle Solimões River, such as to convert the size of the inch of the local inhabitant to the “meter” unit of measurement, and test the difference between the local men’s inch and international metric standards of the unit of measurement “inch”.

## MATERIALS AND METHODS

The Mamirauá Sustainable Development Reserve (MSDR) is considered the largest flooded forest reserve in the world. It is located in the confluence of the Solimões and Japurá rivers and was established in 1990 as an ecological station, and later reclassified as a sustainable development reserve (SDR) in 1996. The Amanã SDR was

established in 1998, and is located in the interface of the Negro and lower Japurá river basins, on the Central region of the state of Amazonas. Amanã SDR connects the Mamirauá SDR to the Jaú National Park, therefore creating an ecological corridor. The Mamirauá and Amanã SDR have a high biodiversity value, cover 3,474,000 ha of varzea forest and mainland, and are inhabited by a human population who practices the use of natural resources in the areas (AYRES; AYRES JR.; AYRES ; SANTOS, 1995; QUEIROZ, 2007).

Field trips were taken to the Mamirauá and Amanã reserves, to interview local inhabitants with experience in manatee hunting, to confirm the use of the inch as a measurement unit. These local people responded a questionnaire with information on their personal experience in manatee hunting and ways to measure the carcass.

After the interviews, measurements were taken of the inches of 508 adult males, ages between 20 and 64 years, randomly selected, resident in the town of Tefé, nearby towns and the two protected areas. This minimum age was sought because human bone growth ceases between 18 and 20 years of age (POWERS; HOWLEY 2006; CRESPI; POIT, 2007). The open stretched inch was placed on a straight ruler with a centimeter scale, and measured from the tip of the thumb to the tip of the little finger.

Results were submitted to descriptive statistics to estimate the average corresponding to an inch of the local Amazonian man. *Student’s t-test* was applied to verify the hypothesis of a difference

between an average value of the inch of local men in relationship to inches described in the literature. Statistical analyses were developed using the program BioEstat 5.0 (AYRES; AYRES JR.; AYRES ; SANTOS, 1995; QUEIROZ, 2007).

## RESULTS

Twenty-two local men who admitted to hunting Amazonian manatees were interviewed in the two protected areas (three from Mamirauá and 19 from Amanã). Experience time varied from three to 43 years (average 26.5 years; SD 13.4); the number of manatees captured by those men ranged from one to 25 animals (average = 7.1 Amazonian manatees/fisherman; SD = 7.1). The average age at which the men started hunting manatees was 15.3 years (SD = 4.5 years).

All 22 local interviewees reported using the inch as a measurement unit for Amazonian manatee's length; no other means of measuring was reported.

The measurement of the local man's inch, based on 508 measures, varied from 18 to 26.5 cm, with an average of 21.71 cm (SD = 1.29; SE = 0.05). *Student's t-test* was applied to the sample and resulted in a highly significant difference ( $t = 19.96$ ;  $p < 0.00001$ ; CI 95% = 21.60 – 21.82) in comparison to a value of 22.86 cm for the inch, reported in the literature.

## DISCUSSION

Meat from hunted Amazonian manatees was used in the past as a protein source for the indigenous tribes in the Amazon basin (SMITH, 1980, 1981; ROSAS, 1994). During the 19<sup>th</sup> and 20<sup>th</sup> centuries hunting activity generated a commercial overexploitation (HUSAR, 1977, ROSAS, 1994) and caused the decrease in manatee numbers (CALDWELL; CALDWELL, 1985, REEVES; LEATHERWOOD; JEFFERSON; CURRY; HENNINGSEN, 1996). Although the average time of experience of manatee hunting observed in this study was 26.5 years, hunting is a current practice nowadays in the Mamirauá and Amanã reserves. Legally, hunting is considered subsistence in local communities, but there are reports of Amazonian manatee meat trade in produce fairs of large cities in northern Brazil (ROSAS, 1994; IBAMA 2001).

Local inhabitants use the inch to measure manatees. Locals do not use more precise methods to measure captured animals because there are no scientific objectives associated with it, turning the animal measurement into a simple anecdotal information to be shared with other fishermen, in daily conversations. Even devoid of scientific rigor by fishermen, the use of their information is paramount for our knowledge of the Amazonian manatee, since after correcting those measures with the international morphometric standards, such information may be used in growth studies of the wildlife animals, filling in a gap in our knowledge of the biology of the species.

It is well known that sizes of the human body may vary among different geographic regions (ZEFERINO; BARROS FILHO; BETTIOL; BARBIERI, 2003; CRESPI; POIT 2007). Measurements of a population are related to genetic factors, but they are also strongly influenced by the environment, not only physically (climate and altitude) but also socially, especially as it concerns disease and nutrition (SCHLOSSER; DEBIASI; PARCIANELLO; RAMBO, 2002; ZEFERINO; BARROS FILHO; BETTIOL; BARBIERI, 2003; MEISEL; VEGA, 2004; CRESPI; POIT, 2007). Therefore, this study confirmed an expected condition in relationship to the variation observed between the local inch size and the inch size described in the literature, since local inhabitants of the Amazon region have nutritional habits and social, and genetic characteristics different from Englishmen, Spaniards, Portuguese and Brazilians from other regions.

The English inch, which corresponds to 22.86 cm, is the most widely used in the literature and adopted in the United States as well. Nevertheless, there are variations in this conversion, such as the Spanish inch, which corresponds to 20.9 cm, and the Portuguese and Brazilian inches, which correspond to 22.0 cm (ROWLETT, 2000). Because the morphometric data in the MISD are recorded in inches, its conversion to the metric scale using the English, Spanish or Portuguese inches would result in a significant error in relation to the local men's

inch. Therefore, using morphometrics provided by the local people in application to growth studies of the Amazonian manatee must only be accepted when the local man's inch (21.71 cm) is used in converting it to the metric scale. Additionally, all studies applying the conversion value of the local inch to the metric scale must consider a minimum error of 0.05 cm for each converted inch.

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