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Twelve years of “Astro” in Sergipe State: in search of harmony between the manatee and the local waterside communities

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ABSTRACT. The Antillean manatee (*Trichechus manatus*) is the most threatened aquatic mammal in Brazil. It was considered to be extinct in Sergipe until 1998, when a re-introduced animal (Astro) arrived. Given plans for the re-introduction of more animals, a survey was conducted of the waterside communities of the animal’s home range, on the southern coast of Sergipe. Between March and November, 2009, 27 people were interviewed in 12 communities, using a 14-item questionnaire. All the interviewees knew Astro and were familiar with his behaviour. The primary source of tension between the animal and the community is its habit of approaching vessels and, in particular, fishing equipment. Some fishermen reported that he takes fish from their nets. While most local residents are tolerant of the animal’s presence, some interviewees reported aggression in the context of fishing. Most of the interviewees agreed with the idea of re-introducing more animals locally, but conflicts related to fishing were seen as the main potential problem. Given this, there is a clear need for a comprehensive environmental education programme, in order to guarantee the conservation of the species in the region.

Keywords: antillean manatee, *Trichechus manatus*, Sergipe, behaviour, conservation, communities.

Doze anos de “Astro” no Estado de Sergipe: buscando harmonia entre o peixe-boi e as comunidades ribeirinhas

RESUMO. O peixe-boi marinho (*Trichechus manatus*) é o mamífero aquático mais ameaçado no Brasil. Era considerado extinto em Sergipe até 1998, quando chegou um animal reintroduzido (Astro). Visando a eventual reintrodução de mais animais, foi realizado um levantamento de comunidades ribeirinhas de sua área de vida, no litoral Sul de Sergipe. Entre março e novembro de 2009, 27 pessoas foram entrevistadas em 12 comunidades, usando um questionário com 14 perguntas. Todos os entrevistados conheciam o Astro e tinham alguma noção de seu comportamento. A fonte principal de atrito entre o animal e a comunidade é seu hábito de se aproximar de embarcações e, principalmente, de equipamentos de pesca. Alguns pescadores relataram que o animal retira peixes de suas redes. Apesar da tolerância geral em relação à presença do animal, alguns entrevistados relataram agressões no contexto da pesca. A maioria dos entrevistados foi acessível à ideia de reintroduzir mais animais na região, embora o atrito em relação à pesca se destacou como o maior problema em potencial. Assim, ficou clara a necessidade de um programa abrangente de conscientização ambiental, para garantir a conservação da espécie na região.

Palavras-chaves: peixe-boi marinho, *Trichechus manatus*, Sergipe, comportamento, conservação, comunidades.

Introduction

The manatees (order Sirenia) are the only preferentially herbivorous mammals (HARTMANN, 1979). They are large, long-lived animals, but are extremely vulnerable to human activities, such as hunting, fishing, and boating (NOWACEK et al., 2004). They are found in shallow tropical waters of rivers, estuaries, and the sea, with a range limited by the 24°C isotherm (ACKERMAN et al., 1995; IBAMA, 2005).

All the sirenians are at some risk of extinction (IBAMA, 2001). Two species occur in Brazil, the

Amazonian *Trichechus inunguis*, and the Antillean manatee, *T. manatus*, which is the most endangered aquatic mammal found in Brazil (IBAMA, 2001). In Brazil, manatees have been protected by law since 1967 (Fauna Protection Act, 5197/67), but only received specific attention from the federal government in the 1980s, when the Manatee Project was created (LUNA et al., 2008b).

Trichechus manatus manatus was assumed to be extinct in the Brazilian state of Sergipe by the mid 1980s (LIMA, 1999), but some years later, an individual migrated to the state’s southern coast. This animal was “Astro”, an adult male that was

raised in the National Centre for the Research and Conservation of Aquatic Mammals (CMA-ICMBio) in Itamaracá, Pernambuco State. Astro was one of the first batch of animals to be released into the wild, in 1994, by this institution's re-introduction programme. He was released in Alagoas, the state bordering Sergipe to the north, but migrated south to the estuary of the Vaza-Barris river in 1998, where he has remained ever since.

The presence of Astro in the Vaza-Barris raises a number of questions with regard to the conservation of the species in the region. As the animal has survived in the area for more than ten years, it seems reasonable to assume that the ecological conditions of this area are favourable to the survival of manatees (LIMA, 2008). However, Astro still exhibits the behavioural repertoire typical of animals raised in captivity (ARAÚJO; MARCONDES, 2003), which actively seek human company. This has caused certain tensions with local communities, in particular the fishermen, who have suffered direct interference from the animal.

Obviously, a population consisting of a single individual is doomed to eventual extinction. Given this, the CMA has developed plans for the re-introduction of additional animals, which is scheduled for 2012, with the aim of establishing a viable population over the long term. While the evidence indicates that the area is ecologically appropriate for a population of manatees, the re-introduction of more animals raised in captivity may provoke further tensions with local communities. Given this, the present study proposed to evaluate the relationship between Astro and the local waterside communities, and provide a database for the eventual management of any *T. manatus* established in the region.

Material and methods

Study area

Astro spends the majority of his time in the Estuary of the Vaza-Barris river in State of Sergipe (11°08'29"S, 37°09'32"W), but during the local summer months (September to March), he migrates regularly to the beaches of the southern extreme of the state, as far as the estuary of the Rio Real-Piauí (11°26'58"S, 37°21'03"W), at the border with Bahia state. He may remain in this area – primarily Saco Beach (Praia do Saco) – for a number of weeks before returning to the Vaza-Barris. The region is characterised by low-lying coastal plains, with flat sandy beaches and extensive tracts of natural vegetation (mangrove and sea grasses) in the estuaries.

Data collection

The data were collected using a simple 14-item questionnaire (Appendix 1), based on the procedure used by (ALVES, 2007) in Ceará and Rio Grande do Norte. Some of the questions were straightforward, with simple yes/no/don't know options, while others were open-ended, allowing the interviewee to respond at will, and provide more than one answer, if pertinent. The answers were compiled in the form of relative frequencies for the evaluation of patterns.

A total of 27 persons resident in 12 different communities within Astro's home range (Figure 1) were interviewed for the present study. The initial aim of the study was to interview at least two residents from each community, but logistic limitations determined the inclusion of only a single interviewee at some locations (Table 1). Each main estuary was nevertheless relatively well represented, with more than ten interviewees each. The relatively long stretch of open beach that separates the two estuaries (Cauceira and Abais) may appear to be under-represented here, but this area is visited by Astro only during his migrations between the two estuaries, and he is rarely observed here by anyone.

The communities were visited by car or motorised boat, depending on the location, between March and November, 2009. Up to four residents were interviewed at each locality (Table 1), depending on the availability of persons with good knowledge of the manatee. None of the subjects approached by the interviewer demonstrated any objection to the proposed questionnaire, and were invariably willing to answer all the questions. All subjects were heads of households (two were female), with ages of between 51 and 73 years. This group was chosen due to their being the most experienced and responsible members of their respective communities, and therefore, the persons most likely to provide truthful and reliable answers to the questionnaire.

Both absolute and relative frequencies of the different answers were evaluated, according to the type of question and objective of the analysis. In addition to the overall aim of understanding the interviewees' knowledge of the manatee and assessing the potential for conflict between the animal and local communities, the interviews served to provide information on the legislation regarding the protection of manatees and other wildlife, the procedure for claiming compensation for damage caused by the animal, and how to avoid injuring the animal when using motorised boats.

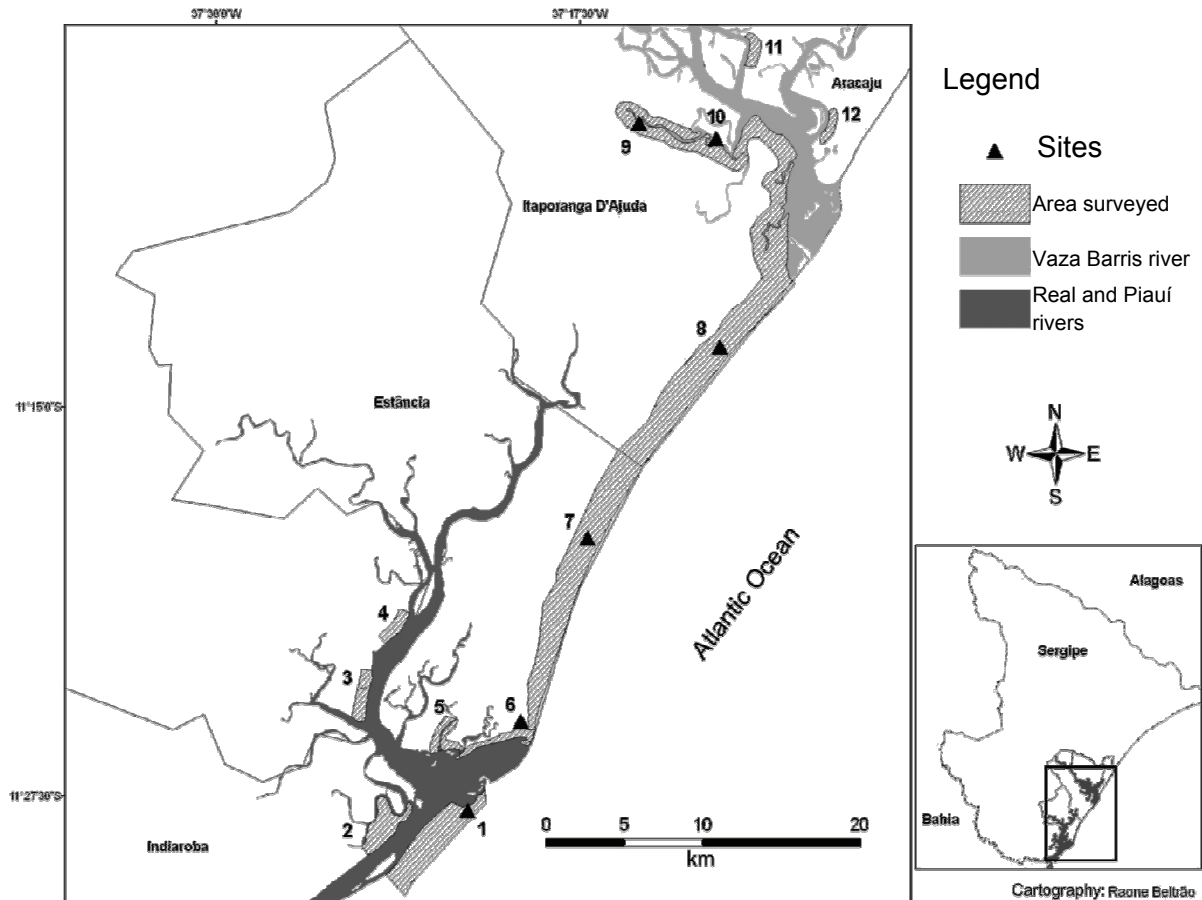


Figure 1. Current home range of the manatee Astro, and the location of the waterside communities visited during the present study. The numbers correspond to the sites in Table 1.

Table 1. Distribution of interviewees by community and profession. All municipalities are located in Sergipe, with the exception of Jandaíra, which is in Bahia. Professions: Fs = fisherman; Bg = buggy driver; At = artisan; FC = ferry captain; TG = tourist guide; CR = community representative; Fr = farmer; TM = turtle monitor (employee of the TAMAR Project); SP = school principal.

Site (see Figure 1)	Community	Municipality	N	Interviewee occupation
1	Mangue Seco	Jandaíra	4	2 Fs, 1 Bg, 1 At
2	Porto de Indiaroba	Indiaroba	1	1 Fs
3	Terra Caída	Santa Luzia do Itanhý	2	1 Fs, 1 FC
4	Crasto		1	1 Fs
5	Porto do Mato	Estância	3	1 Fs, 1 TG, 1 CR
6	Saco Beach		3	2 Fs, 1 Fr
7	Abais Beach		1	1 TM
8	Cauceira Beach	Itaporanga d’Ajuda	1	1 TM
9	Água Boa		3	2 Fs, 1 SP
10	Porto da Ilha		3	3 Fs
11	Pedreira	São Cristóvão	2	2 Fs
12	Mosqueiro	Aracaju	3	2 Fs, 1 FC

Results

The residents of all the communities visited during the study were very receptive to the visit by the researcher, and all prospective interviewees were willing to respond to questions unconditionally.

On a typical visit, local residents would be encountered conversing in small groups or fixing fishing-nets. They invariably reacted with good humour when asked about the manatee, and all the subjects chosen for interview were completely at ease with the questions, and did not require any kind of pressure or encouragement.

All interviewees provided the same answer to questions 1 and 2, i.e., that they knew Astro, and had witnessed him personally. The vast majority of the interviewees (92.6%) had observed Astro in one of the two estuaries (question 3), while the remaining two individuals had seen him on Saco Beach (Figure 1: point 6), located at the northern entrance to the Real-Piauí estuary. On the other hand, none of the subjects, even those resident at Abais and Cauceira beaches, reported having seen the animal in the sea, during its migrations between the two estuaries, which indicates that these movements are relatively rapid.

All but three of the interviewees had observed Astro in the vicinity of their fishing vessels (question 4), and the remainder, during tourist trips.

A number of the subjects also reported observing Astro on other occasions, when they were on land, at the water's edge. The two ferry captains reported never having seen the animal in the vicinity of their ferries, however, but only when fishing.

With only one exception, all the interviewees reported at least one type of behaviour (question 5), and most reported two kinds (Table 2). Almost all the categories involve vessels or fishing nets. Some of these behaviours – in particular, overturning boats, tearing fishing nets and removing fish – have clearly negative implications for the relationship between the animal and the local community, although they were mentioned relatively rarely.

Table 2. Behaviours reported by the interviewees in response to question 5 (what was Astro doing when you saw him?).

Behaviour	Frequency	
	Absolute	Relative (% of answers)
Swim around boats	12	27.4
Embrace boat	8	18.2
Lie under boats	6	13.6
Accompany boats	3	6.8
Impede the passage of boats	3	6.8
Tear fishing nets	3	6.8
Remove fish from nets	3	6.8
Overturn boat	3	6.8
Approach boats	2	4.5
Respond to calls ¹	1	2.3
Total	44	100.0

¹Manatee approaches when person slaps the surface of the water.

In the context of this potential conflict, six residents of the Vaza-Barris estuary (22.2% of the total sample) admitted to having knowledge of episodes of ill-treatment directed towards Astro (question 6). In four of these cases, the interviewee witnessed the episode. In the Rio Real, by contrast, residents reported only cases of injuries caused by motorised boats. It is unclear to what extent these reports reflect the true frequency of such events, considering the possibility that some of the interviewees may have been unwilling to provide information on such occurrences for fear of the potential repercussions (given unanimous knowledge of the animal's legally protected status – see question 9 below). In all cases, oars were used to attack the animal (question 7), although one subject also reported the employment of a machete, which was used to slap, rather than cut the animal. Other weapons, such as rocks or firearms, were not reported.

Practically all the interviewees (92.6%) are conscious of the fact that the manatee can be injured when it approaches motorised vessels (question 8). The two other subjects answered saying that they did not know that boat propellers could injure the animal, even though they knew he often approaches boats to within close quarters. All the subjects interviewed knew that the manatee is protected by law (question 9).

Despite the reliability of their answers to most other questions, and their knowledge of Astro, none of the interviewees knew exactly how many manatees can be found in the region (question 10). This can be explained by the nature of the question, which appears to require an answer that is beyond the scope of the respondent's experience. The answers to this question appear to confirm not only that the interviewees generally answered questions honestly, but also that no other manatees exist in the region.

The attacks on Astro appear to be related exclusively to its interference in the fishing activities of local residents, rather than to any attempt to hunt the animal or unmotivated aggression. Eleven of the interviewees – all professional fishermen (i.e., almost two-thirds of this group) – claimed to have suffered some kind of damage or loss as a result of Astro's behaviour (question 11). All eleven claimed to have had fishing nets torn by the manatee, and five reported that he had overturned their boats, with highly deleterious consequences. The frequency of reports of the latter behaviour was distinct from that for question 6 (Table 2) due to differences in the type of question.

Only two of the eleven respondents who recorded problems with Astro confirmed that they had reported the situation to the local monitor of the Aquatic Mammals Institute, with the objective of receiving compensation (question 12). In neither case, however, was any reimbursement provided. The remaining nine subjects did not seek any form of compensation, due to the fact that they did not know who, or what institution to approach in such a situation. While it represents only a palliative solution for the problem, the system of compensation available for damage caused by the animal within the study area constitutes an important potential mechanism for the reduction of tension between Astro and the local communities. However, the response of the interviewees here revealed a fundamental flaw in the mechanism, i.e., the lack of information. What is clear from these findings is that, for the system to function effectively, a much more efficient mechanism of communication will be required, to ensure that all the residents eligible for compensation will know exactly how and where to submit their claims. This should obviously be a primary objective of any environmental education programme related to the re-introduction of new animals.

Perhaps surprisingly, the vast majority of the interviewees (89.1%) were receptive to the idea of introducing additional manatees into the region (question 13), although most had some reservations (Table 3). The primary concern here was the effect

of additional animals on local fishing activities. The five subjects who recommended maintaining the animals in captivity also cited this problem, i.e., that in this case, the animals would not affect fishing. The other replies referred to navigational worries, although this preoccupation was relatively less emphatic, perhaps because of the more indirect effects on the residents and their livelihood.

Table 3. Problems mentioned by interviewees in relation to the introduction of additional manatees into southern Sergipe State.

Problem or comment	Frequency	
	Absolute	Relative (% of answers)
Interfere with fishing	18	62.1
Better off remaining in captivity	5	17.2
Increased risk of boating accidents	4	13.8
Impede the transportation of tourists	2	6.9
Total	29	100.0

Only four interviewees provided no suggestions for the improvement of the relationship between the community and the manatee (question 14). Five of the subjects affirmed that it would be extremely difficult to resolve the conflict definitively, given the propensity of the animal to interfere with fishing activities (Table 4), and three insisted that the only practical solution would be to maintain Astro and all other manatees in captivity.

Table 4. Suggestions provided by interviewees for the improvement of the relationship between Astro and the local waterside communities.

Suggestion or comment	Frequency	
	Absolute	Relative (% of answers)
Provide local residents with more information	9	32.2
Provide compensation for damage caused by the animal	6	21.5
Difficult, because he will always interfere with fishing	5	18.7
Introduce female manatees into the area	4	14.3
Maintain the animals in captivity	3	10.7
Remove Astro's radio transmitter	1	3.6
Total	28	100.0

Almost a third of the interviewees reinforced the problem identified in question 13, i.e., the lack of any systematic transmission of information to the communities by the authorities responsible for the wellbeing of the manatee. Complaints referred to both the compensation system, and instructions for avoiding collisions with the animal. This same problem was implicit in the second most frequent response (provide compensation). The singular idea of removing Astro's radio transmitter, which is contained in a small buoy attached to his tail, was forwarded by a fisherman whose nets had been damaged by the apparatus.

The most unexpected suggestion was that of introducing female manatees into the area. The four subjects who recommended this measure are all resident in the Rio Real-Piauí estuary, where Astro is commonly observed approaching boats in a copulatory posture during the breeding season, between October and March. The idea is that the presence of females in the area would modify the animal's behaviour, and prevent or reduce his habit of approaching boats.

Discussion

As in previous studies (ARAÚJO et al., 2009; LIMA, 1999; LUNA et al., 2008b; SILVA; MARMONTEL, 2009), the questionnaire used here was relatively effective, and provided extremely useful information for the development of environmental education strategies appropriate to the region and the specific problem of the manatees, in particular, the eventual introduction of additional animals. The vast majority of the interviewees presented reasonably good knowledge of Astro and his behaviour, as well as the practical problems related to the animal's presence. The subjects also presented a number of potentially useful suggestions for the reduction of tensions between the manatee and local communities.

Lima (1999) interviewed six residents of the Rio Real-Piauí prior to the arrival of Astro, and found only one person who reported any knowledge of the species, which had disappeared from the region in the mid-1980s. An important contrast between the results of the present study and those of Alves (2007), collected in Ceará and Rio Grande do Norte States, was the fact that the residents in Sergipe State had observed the manatee personally, whereas those in the other states only knew the animal from the media, posters, and public presentations. This difference is probably due primarily to Astro's behaviour, which is typical of that of animals reared in captivity, and contrasts markedly with that of the characteristically shy wild animals.

Lima et al. (1992) and Luna et al. (2008b) have developed a procedure to estimate the abundance of manatees based on the number of animals reported in interviews. The results of the present study indicate emphatically that Astro is the only *T. manatus* present in the region.

The relationship between manatees and local fishermen has been emphasised in most recent studies (LIMA, 1999; PARENTE et al., 2004; LUNA et al., 2008a), and a propensity for damaging nets and other equipment, and overturning boats is a characteristic of reintroduced manatees at all other

sites. The last record of hunting of *T. manatus* in Brazil is more than 20 years old (PALUDO, 2002), although the accidental trapping of animals in fishing nets is currently one of the principal causes of mortality in this species (LIMA, 1999; LUNA et al., 2008a). This is obviously a major concern in the case of Astro, and even more so with regard to any additional animals that may be introduced locally, but there were no reports of any such problems in the present study.

The scavenging of fish from fishing nets, which was reported by a number of interviewees, appears to be an additional problem. Powell (1978) reported similar behaviour in Jamaica, but it had not been reported previously in Brazil. It is unclear when this habit arose, or the extent to which it may contribute to Astro's diet (this is under investigation), but it is potentially the most problematic aspect of the animal's behaviour, given both the probable increase in interference in fishing activities, and the greater possibility of becoming trapped in a net following the introduction of new animals (COSTA et al., 2005; OLIVEIRA-GOMEZ; MELLINK, 2005)

While there is some evidence of ill-treatment, the overall impression provided by the present study was one of relative tolerance of the presence of the manatee on the part of the local residents. In this context, an important result of the study was the identification of a critical lack of communication between the authorities responsible for the protection of the animal and local residents, in particular with regard to the compensation system designed to offset any damage caused by its behaviour. Obviously, a more systematic implementation of this procedure could contribute significantly to the tolerance of local residents, not only towards Astro, but also any future population.

An additional option here would be the development of a programme of ecological tourism (SOLOMON et al., 2004), based on educational visits for the observation of the animals, like those established at a number of sites in northeastern Brazil (ARAÚJO et al., 2009; PALUDO, 2002; LAIST; SHAW, 2006). As well as providing an alternative source of income for some local fishermen, this activity may also contribute to the conscientisation of residents with regard to local environmental problems. Any such practice would obviously demand careful planning and development in order to ensure an ecologically-sound approach, and guarantee the physical integrity of the animals over the long term.

Despite a certain degree of tension in relation to fishing, the vast majority of the interviewees were receptive to the idea of further reintroductions,

although they also recognised a series of potential conflicts and problems. The results of the study nevertheless point to a clear need for the development of an effective and integrated programme of environmental conscientisation, which will not only provide essential information on the manatee and its behaviour and ecology, but also cultivate empathy for the animal. It is hoped that such efforts will contribute incisively to the conservation of *T. manatus* in Sergipe State and, eventually, the whole of the Brazilian Northeast (LUNA et al., 2008b; PALUDO, 2002).

Conclusion

The questionnaire applied in this study proved to be very effective for the evaluation of local communities. It was possible to collect information on the biology and behavior of the single manatee found in Sergipe State, including ranging patterns. The findings of the study also indicate that the southern coast of Sergipe offers the ecological and socio-environmental resources necessary for the establishment of a *T. manatus* population over the long term, as targeted by CMA/ICMBio. The database compiled during the study will also provide a sound platform for the development of environmental awareness projects in the local communities and other conservation-oriented activities, such as eco-tourism.

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References

- ALVES, M. D. O. **Peixe-boi marinho, *Trichechus manatus manatus*: ecologia e conhecimento tradicional** no Ceará e Rio Grande do Norte. Brasília: Ibama, 2007.
- ARAÚJO, R. C. P.; SOUZA, H. C.; OLIVEIRA, R. R. A. **Atitudes e comportamentos das comunidades costeiras com relação à preservação do peixe-boi marinho no Estado do Ceará: o caso de Icapuí**. Porto Alegre: Universidade Federal do Ceará, 2009.
- ARAÚJO, J. P.; MARCONDES, M. C. Comportamento de dois peixes-bois marinhos (*Trichechus manatus manatus*) em Sistema de Cativeiro no Ambiente Natural da Barra de Mamanguape, Estado da Paraíba, Brasil. **Bioikos**, v. 17, n. 1-2, p. 21-32, 2003
- ACKERMAN, B. B.; WRIGHT, S. D.; BONDE, R. K.; BECK, C. A.; BANOWETZ, D. J. Trends and patterns in mortality of manatees in Florida, 1974-1992. In: O'SHEA,

- T. J.; ACKERMAN, B. B.; PERCIVAL, H. F. (Ed.). **Population biology of the Florida Manatee**. Collins: National Biological Service Information Report, 1995. p. 223-258.
- COSTA, L. P.; LEITE, Y. L. R.; MENDES, S. L.; DITCHFIELD, A. D. Conservação de mamíferos no Brasil. **Megadiversidade**, v. 1, n. 1, p. 103-112, 2005.
- HARTMANN, D. S. **Ecology and behavior of the manatee (*Trichechus manatus*) in Florida**. Florida: American Society of Mammalogists, 1979.
- IBAMA-Instituto Brasileiro do Meio Ambiente e dos Recursos Naturais Renováveis. **Mamíferos aquáticos do Brasil**: plano de ação. 2. ed. Brasília: Ibama, 2001.
- IBAMA-Instituto Brasileiro do Meio Ambiente e dos Recursos Naturais Renováveis. **Protocolo de conduta para encalhes de mamíferos aquáticos**. Recife: Ibama, 2005.
- LAIST, D. W.; SHAW, C. Preliminary evidence that boat speed restrictions reduce deaths of Florida manatees. **Marine Mammal Science**, v. 22, n. 2, p. 472-479, 2005.
- LIMA, R. P.; PALUDO, D.; SOAVINSKI, R. J.; SILVA, K. G.; OLIVEIRA, E. M. A. Levantamento da distribuição, ocorrência e status de conservação do peixe-boi marinho (*Trichechus manatus*, Linnaeus, 1758) no litoral nordeste do Brasil. In: IBAMA (Ed.). **Coletânea de trabalhos de conservação e pesquisa de sirênios no Brasil**, v. 1, n. 1, p. 47-72, 1992.
- LIMA, R. P. **Peixe-boi (*Trichechus manatus*): distribuição, status de conservação e aspectos tradicionais ao longo do litoral Nordeste do Brasil**. Brasília: Ibama, 1999.
- LIMA, R. P. Distribuição espacial e temporal de peixes-bois (*Trichechus manatus*) reintroduzidos no litoral nordestino e avaliação da primeira década (1994- 2004) do programa de reintrodução. **Tropical Oceanography**, v. 36, n. 1-2, p. 55-80, 2008.
- LUNA, F. O.; ARAÚJO, J. P.; LIMA, R. P.; PESSANHA, M. M.; SOAVINSKI, R. J.; PASSAVANTE, J. Z. O. Captura e utilização do peixe-boi marinho (*Trichechus manatus manatus*) no litoral Norte do Brasil. **Biotemas**, v. 21, n. 1, p. 115-123, 2008a.
- LUNA, F. O.; LIMA, R. P.; ARAÚJO, J. P.; PASSAVANTE, J. Z. O. Status de conservação do peixe-boi marinho (*Trichechus manatus manatus* Linnaeus, 1758) no Brasil. **Revista Brasileira de Zoociências**, v. 10, n. 2, p. 145-153, 2008b.
- NOWACEK, S. M.; WELLS, R. S.; OWEN, E. C. G.; SPEAKMAN, T. R.; FLAMM, R. O.; NOWACEK, D. P. Florida manatees, *Trichechus manatus latirostris*, respond to approaching vessels. **Biological Conservation**, v. 119, n. 4, p. 517-523, 2004.
- OLIVEIRA-GOMEZ, L. D.; MELLINK, E. Distribution of the Antillen Manatee (*Trichechus manatus manatus*), as a function of the habitat characteristics, in Bahia de Chetumal, México. **Biological Conservation**, v. 121, n. 1, p. 127-133, 2005.
- PALUDO, D. Use of space and temporal distribution of *Trichechus manatus manatus* Linnaeus in the region of Sagi, Rio Grande do Norte State, Brazil (Sirenia, Trichechidae). **Revista Brasileira de Zoologia**, v. 19, n.1, p. 205-215, 2002.
- PARENTE, C. L.; VERGARA-PARENTE J. E.; LIMA R. P. Strandings of Antillean Manatees, (*Trichechus manatus manatus*), in northeastern Brazil. **Latin American Journal of Aquatic Mammals**, v. 3, n. 1, p. 69-75, 2004.
- POWELL, J. A. Evidence of carnivory in manatees (*Trichechus manatus*). **Journal of Mammalogy**, v. 59, n. 2, p. 442, 1978.
- SILVA, A. B.; MARMONTEL, M. Ingestão de lixo plástico como provável *causa mortis* de um peixe-boi amazônico (*Trichechus inunguis* Natterer, 1883). **Uakari**, v. 5, n. 1, p. 105-112, 2009.
- SOLOMON, B. D.; COREY-LUSE, C. M.; HALVORSEN, K. E. The Florida manatee and ecotourism: toward a safe minimum standard. **Ecological Economics**, v. 50, n. 1-2, p. 101-115, 2004.

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Appendix 1

Questionnaire used in the present study

General data: name of the interviewer; date and locality of the interview;

Subject information: name; age; profession; birthplace.

Questions (possible answers, when appropriate):

- 1) Do you know the manatee? (yes/no);
- 2) Where did you see the animal? (television; talk; poster; personal observation; heard about it; other [specify]);
- 3) Where did you observe the animal? (beach; ocean; estuary; river; open sea; other [specify]);
- 4) What were you doing when you saw the manatee? (fishing; leisure; transporting passengers; other [specify]);
- 5) What happened when you saw the animal?
- 6) Do you know of any episodes of mistreatment of the manatee? (yes/no);
- 7) If yes, what was the object used to attack the animal? (oar; machete; rock; firearm; other [specify]);
- 8) Do you know that the manatee may suffer harm when in the proximity of motorised boats? (yes/no);
- 9) Do you know about the legislation that protects the manatees? (yes/no);
- 10) Do you know how many manatees exist in the region? (yes/no) If yes, how many?
- 11) Have you ever suffered any kind of material loss as a result of the manatee's behaviour? (yes/no);
- 12) If you have suffered losses, who did you consult about the situation? (IBAMA; Police; manatee monitor; no-one);
- 13) What is your opinion about the possibility of additional animals being introduced into the region?
- 14) In your opinion, what can be done to improve the relationship between your community and the manatee?