



INVISIBLE YET DETECTABLE: WILD AMAZONIAN MANATEES (*Trichechus inunguis*) CAN BE MONITORED BY PASSIVE ACOUSTICS

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INTRODUÇÃO

Direct observation of wild Amazonian manatees (*Trichechus inunguis*) is almost impossible due to low water visibility (~1m) and the cryptic behavior of the animals that became extremely shy after centuries of hunting (Best 1982, 1984). Thus, alternative non-invasive methods are needed to monitor populations of this endangered species, which is both endemic to the Amazon region and the only exclusively freshwater manatee (Rosas 1994). *Trichechus inunguis* is known to emit sounds in captivity (Evans & Herald 1970; Sonoda & Takemura 1973; Sousa-Lima *et al.* 2002) that can be attributed to specific individuals and to different sexes and age classes (Sousa-Lima *et al.* 2002). Call differences potentially allows for estimation of population size and structure by means of passive acoustic monitoring (PAM, Sousa-Lima *et al.* 2002). Here we provide the first published recordings of Amazonian manatee sounds in the wild and evidence that PAM can be used for detection and monitoring of these elusive mammals in the wild.

OBJETIVOS

The objectives of this study are: 1) to obtain recordings of manatees in the wild, and compare them with recordings from captivity, 2) to verify if Amazonian manatees can be detected in the wild using PAM.

MATERIAL E MÉTODOS

Data Collection Recordings were made between June and July in the Amazon River basin in Brazil, dedicated manatee acoustic surveys in the Urini Lake (Amanã Sustainable Development Reserve, Brazil) and in the Purus River (Brazil; Rosas *et al.* 2003) were done using a Sony Walkman Pro (WM-D6C; flat audio frequency response 0.04-15kHz \pm 3 dB) and an omnidirectional hydrophones (model 50Ca of the Cetacean Research Technology – CRT or HTI 94 SSQ) with a sensitivity of -161dB re 1 μ Pa and a frequency range response of 0.01-310kHz. We recorded wild individuals calling in response to captive manatee calf calls played back using an Oceanear underwater speaker (DRS-8, frequency range 0.1-16kHz with peak resonance frequency at 4.5kHz, 158dB re 1 μ Pa) connected to the same recorder used in the acquisition of the signals. In Peru, recordings were made opportunistically in July at Pacaya Samiria National Reserve during fish surveys conducted by Operation Wallacea (Rountree 2012) with a SQ26-H1 recorder system from CRT (frequency response of up to 40kHz). Despite our efforts the animals were never seen during the recordings. Sound Analyses and Species identification Manual identification of calls in the recordings was done visually and aurally in Raven Pro 1.4 (Cornell Lab of Ornithology) using following parameters: Hann window; 256 points window size. Clear calls with high signal-to-noise ratio were selected for extraction of the following acoustic parameters: peak fundamental frequency (pf0); fundamental range (difference between maximum and minimum value of the fundamental = Δ f0); and signal duration (Δ t). The acoustic parameter values obtained in the sample of calls selected from recordings in the wild were used to compare with the published range of values for captive animals (Evans & Herald, 1970; Sonoda &

Takemura, 1973; Sousa-Lima *et al.* 2002).

RESULTADOS

We recorded 114 calls in the Urini Lake, 166 calls in the Purus River (Rosas *et al.*, 2003), and 35 calls in Pacaya Samiria National Reserve. Twenty calls were selected from the Brazilian sample of calls and 20 from the Peruvian data set. These 40 calls were pooled for further acoustic analyses. We found no significant differences for pf_0 (t-test; $p = 0.88206$) between our sample and published data (Sousa-Lima *et al.* 2002). The range of values for fundamental frequency found were lower ($\Delta f_0=0.44-4.4\text{kHz}$) than previously known ($\Delta f_0=1.07-8\text{kHz}$; Sousa-Lima *et al.* 2002); and the maximum value for signal duration found ($\Delta t=0.14-0.75\text{s}$) was higher ($\Delta t=0.05-0.50\text{s}$; Sousa-Lima *et al.* 2002). Additionally, the frequency modulation pattern and overall aspect of the signals recorded in the wild were recognized by experts in the field as manatee calls.

DISCUSSÃO

The acoustic parameter values and overall aspect of the calls recorded in the wild matched information for Amazonian manatee calls in captivity. *Trichechus inunguis* has seasonal reproduction with births peaking between February and May (Best 1982, 1984). Our recordings were made shortly after the birth period; therefore we probably recorded the most vocal individuals: lactating females (3-5.5calls/min: Dantas 2009) and their calves (2-8 calls/min: Dantas 2009; Sousa-Lima *et al.* 2008). The use of playback of calls to acquire the Brazilian data might have elicited calls back from less vocal individuals (other adults call less than once per minute, Sousa-Lima *et al.* 2002; Dantas 2009).

CONCLUSÃO

It is possible to monitor Amazonian manatee populations in the wild by means of passive acoustics especially during and following the peak of birth for the species aided by the use of playbacks.

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Agradecimento

We thank Fundação O Boticário de Proteção à Natureza, CNPq, Instituto de Desenvolvimento Sustentável Mamirauá, INPA/MCT and Petrobrás Ambiental for the logistical and financial support in Brazil and Operation Wallacea (<http://opwall.com/>) in Peru.