

# PULSED SOUNDS OF THE BOTTLENOSE DOLPHINS IN THE SADO ESTUARY

Brito, C.<sup>1</sup>, Lourenço, S.<sup>2</sup>, Picanço, C.<sup>3</sup>, Louro, S.<sup>4</sup> & dos Santos, M.E.<sup>5</sup>

<sup>(1,2,3,5)</sup> Projecto Delfim, Apartado 23051, 1147-601 Lisboa, Portugal, [projectodelfim@apoiologico.pt](mailto:projectodelfim@apoiologico.pt)

<sup>(4,5)</sup> ISPA, Rua Jardim do Tabaco, 34, 1149-041 Lisboa, Portugal, [manuel@ispa.pt](mailto:manuel@ispa.pt)

## ABSTRACT

Studies of the sounds emitted by the resident bottlenose dolphins (*Tursiops truncatus*) in the Sado estuary (Portugal) have shown complex acoustic patterns, comparable to other populations of the same and other delphinid species. In the pulsed sounds category (which includes echolocation and social signals), bray series appear as the most conspicuous signal type, but we can also find creaks, moans, squawks, squeaks, screeches and bangs. Here, we investigate the emission patterns of some of the pulsed sounds (click trains, moans, creaks and bray series) and analyze them in relation to social variables. We found no effect of group size in the production of any of these pulsed-sounds. A higher production of bray series was noted when other dolphin groups were near our focal group. No significant differences were found in the emission of slow click trains in the various activities, but we noted that creaks (faster click trains) were more abundant in Feeding and Travel/Feeding. Other fast click trains, the moans, and also the bray series, were particularly abundant both in Feeding and Socializing. These sounds have a probable social function, since their abundance increases with group excitement regardless of the behavioural context.

## OBJECTIVES

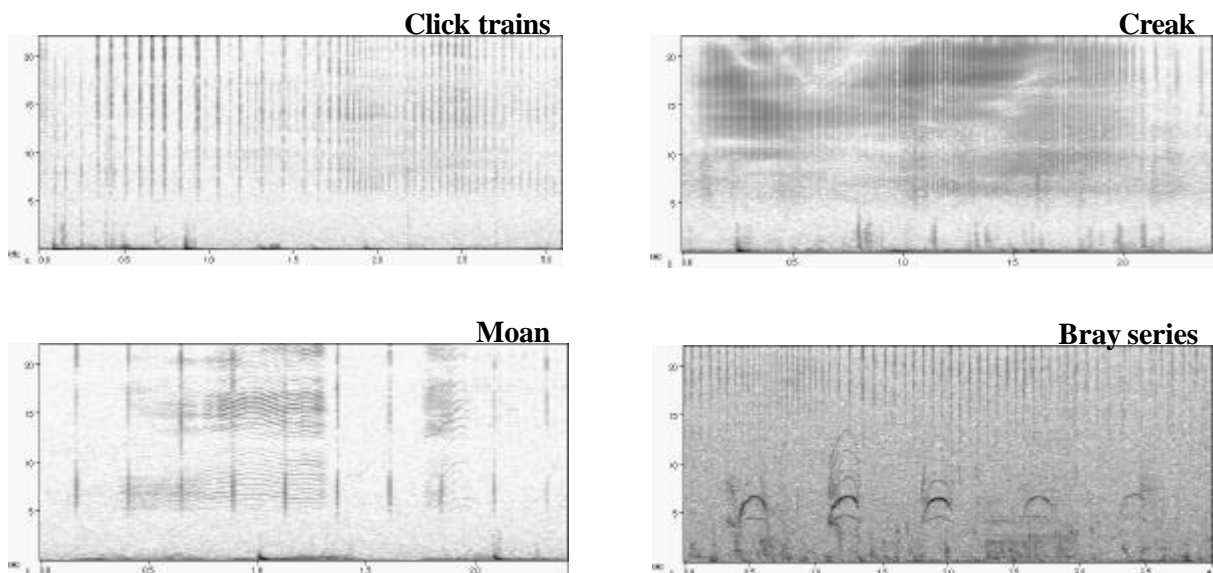
- To analyse the relation between the several pulsed sounds (click trains, bray series, moans and creaks) and the bottlenose dolphin groups characteristics (group size and presence of other groups).

- To relate the pulsed sounds with the predominant behavioural activities of the dolphin groups.

## METHODS

Between June 1999 and December 2002, 71 boat-based surveys were conducted in the Sado estuary, yielding a sampling effort of 394 hours. To record the underwater acoustic signals we used a 8103 Bruel & Kjaer hydrophone, with a preamplifier (Bruel & Kjaer 2646) and a C303 Cetacean Research Technology hydrophone, both connected to a DAT Sony TCD-D10 Pro. Samples were collected with a minimum interval of 20 minutes, from groups located in the proximity of the boat (less than 100 meters). Simultaneously, we recorded informations such as the predominant activities, the number of individuals in a group and the presence of other groups. We used Canary 1.2.4. for Macintosh to produce sonograms and to count the number of sounds in each sample, and STATISTICA for analysis.

## SONOGRAMS



## RESULTS - PULSED SOUNDS AND GROUP COMPOSITION

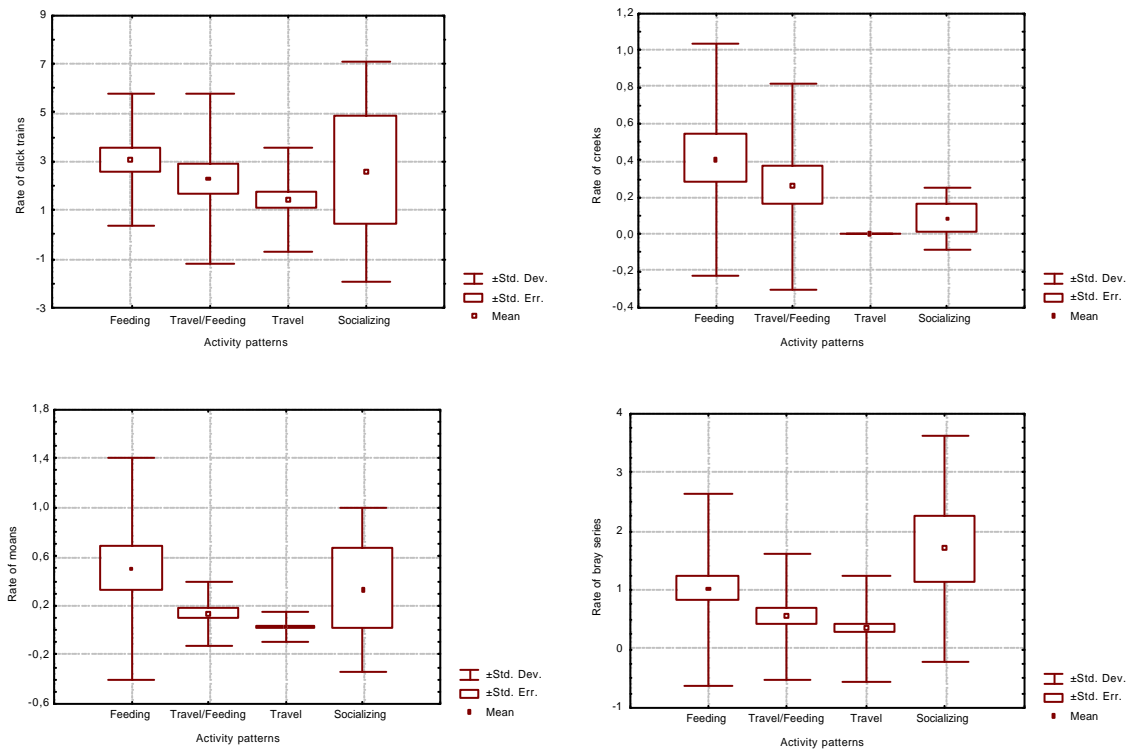
We did not find significant differences between the several types of sound emissions and the group size. As to the sound emissions in relation to the

presence of other groups, we only found a more abundant emission of brays in the presence of other groups (Mann-Whitney U Test (N=193)=3746,5;  $p < 0,01$ ). For the moans, we observed the same tendency.

## RESULTS - PULSED SOUNDS AND BEHAVIOURAL ACTIVITY

For the click trains we just found a tendency of a more abundant production in feeding situations. The creaks are related to the behavioural activity (Kruskal-Wallis test:  $H(3, N=92) = 15,60236$ ;  $p < 0,01$ ) being more abundant in Feeding and Travel/Feeding. The moans (Kruskal-Wallis test:  $H(3, N=92) = 9,328583$ ;  $p < 0,05$ ) and the bray series (Kruskal-Wallis test:  $H(3, N=203) = 14,29204$ ;  $p < 0,01$ ) emissions are also dependent of the activities, being both more abundant in Feeding and Socializing.

**Rate of occurrence (number of sounds per minute) of the different pulsed sounds according to the activity**



## DISCUSSION

The emission of the pulsed sounds analyzed is not related with the number of individuals in a group. In relation to the presence of other groups away from the focal group, we only found a higher emission of brays and moans, which can be indicative of a social function of these two types of sounds or a contact call between individuals. However the occurrence of the vocalizations is related to the predominant activity. The click trains and the creaks are associated with feeding contexts and the probable function of both sounds is echolocation. Creaks (trains with a higher repetition rate, *i.e.*, with smaller inter-click intervals) may allow a more detailed inspection of the surroundings or of an object (Au, 1993). As to the bray series, dos Santos *et al.* (1995) and Janik (2000) suggested that these are produced in feeding contexts, even though their function is still not completely understood. The results of this work indicate that the dolphins produce more brays in situations with a high level of excitement of the group and where the interaction between the elements of the group is predominant, whether or not in feeding. So, it is probable that a higher abundance of brays, simultaneously with the production of other pulsed sounds, is typical in situations of excitement. Moans may function as echolocation signals, allowing an even finer inspection of targets, but their occurrence in situations of group arousal also suggest a strong communicative function. It is possible that the moans and the brays have a social function.

## REFERENCES

Au, W.W.L (1993). *The sonar of dolphins*. New-York: Springer-Verlag.

dos Santos, M. E., Ferreira, A. J. & Harzen, S. (1995). Rhythmic sound sequences emitted by aroused bottlenose dolphins in the Sado estuary, Portugal. In: *Sensory Systems of Aquatic Mammals* (. R.A. Kastelein, J.A. Thomas & P.E. Nachtigall Eds), 325-334. Woerden, The Netherlands: De Spil Publishers.

Janik, V.M. (2000). Food-related bray calls in wild bottlenose dolphins (*Tursiops truncatus*). *Proceedings of the Real Society of London*, **267**: 923-927.

## **ACKNOWLEDGEMENTS**

We would like to thank Miguel Couchinho for making available his acoustic recordings from 1999 field work. The work in 2000 was supported by a Master's Scholarship, Praxis XXI Program, of the Portuguese Foundation for Science and Technology. In 2002, part of the field and laboratory work was supported by "Prémio Milénio Sagres Expresso 2001".

**in 17<sup>th</sup> Conference of the European Cetacean Society**