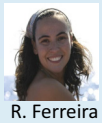
IMPACT ASSESSMENT OF WHALE-WATCHING BOATS ON CETACEANS IN MADEIRA ARCHIPELAGO (SE NORTH ATLANTIC), PORTUGAL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INTRODUCTION

There is a generalized concern about **whale-watching (ww) impacts**, since the use of cetaceans as a touristic attraction may be seen as another form of harmful exploration (Orams, 1999). Although the long-term impacts present a higher biological significance, the **short-term reactions** are more readily related to a potential source of disturbance (IFAW *et al.*, 1995), being effectively used to verify changes in cetaceans' behaviour. In **Madeira Archipelago**, whale-watching is mainly done on a **non-dedicated manner** and is regulated by a **voluntary code of conduct** established by the Madeira Whale Museum.

AIMS

To evaluate the compliance with the voluntary code of conduct

To detect cetaceans' behaviour changes due to whale-watching

METHODS

- Observations were made on the south coast of Madeira Island, **land-based** using Steiner® binoculars 15x80 and 25x80, and **boat-based** through opportunistic trips on whale-watching boats. Data was collected between January and September 2007, totalling 500 hours.
- Data regarding the **compliance** with the **voluntary code of conduct** by the whale-watching boats was collected.
- Data regarding **cetaceans' behaviour with and without contact with whale-watching boats** was collected through the use of a digital **theodolite** and the *Phytagoras* software. Theodolite fixes with more than 210 seconds of interval were considered separately.
- **Behaviours** were registered through a focal-group sampling (Mann, 1999). For all the species, four **behaviour categories** were established (*travelling, resting, socialising and feeding*) and four **reactions** were registered (*avoidance, neutrality, proximity and interaction)* (Ritter, 2003).

RESULTS & DISCUSSION

- **All ww-boats had the same conduct while observing cetaceans** (including manoeuvres and velocity), independently of having joined to the voluntary code of conduct.
- Generally, this conduct was **positive**, with a **large compliance** of the code (table I).

Table I. Compliance (%) of ww-boats with the rules of the voluntary code of conduct established by the Madeira Whale Museum while accompanying cetaceans

Rules of the Voluntary Code of Conduct	Compliance (%)
Minimum distance of 50 meters between ww-boats and cetaceans	0
1 ww-boat less than 200 meters from cetaceans	38,2
Maximum 30 minutes' observation period dividing for all ww-boats	64,1
Avoid cetaceans' path broken by ww-boats	66,5
Avoid abrupt change of ww-boats' direction	70,1

- Results contrary to Dinis *et al*. (2004), where ww-boats non adherent to the voluntary code had higher velocities when accompanying the animals.

Higher concern from the ww-operators towards cetaceans

Significant differences (p=0.00) **in the velocities of small delphinids** between ***before*** and ***during-after*** periods, with the animals demonstrating slower velocities before the encounter with the ww-boats (fig. 1).

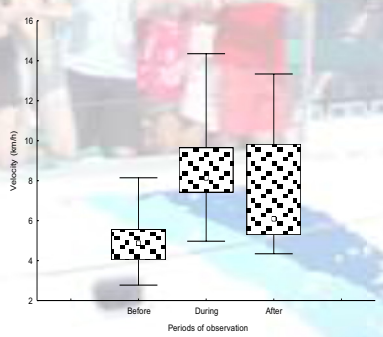

Fig. 1. Median velocity (km/h) of small delphinids before, during and after the encounter with ww-boats. The top and bottom of the box represent the upper and lower quartiles, respectively, the centre represents the median and the extremes of the whiskers represent the maximum and the minimum values.

Increase of velocity may be linked to **interaction** or **escape** behaviours.

The *after* period was very random, not allowing to determine how long it took for the animals to recover the velocity existing before the encounter.

Cetaceans **maintained their behaviour** (mainly **travelling**) in **89.1%** of the times

However, travelling can hide other behaviours not as easily identifiable, such as foraging and reproduction (Mann, 2000).

More common reactions of the species to ww-boats:

- Small delphinids are the most interactive
- Sperm whales are mainly neutral
- Bryde's whales tend to avoid
- Short finned pilot whales have very random reactions

FINAL REMARKS

- **The voluntary whale-watching code of conduct was complied in most occasions.**
- **There was no difference between the conduct of ww-boats adherent and non-adherent to the voluntary code of conduct.**
- **Short-term impacts on the velocity of small delphinids due to the presence of ww-boats were detected.**

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