

BOAT-RELATED BEHAVIOURS OF CETACEANS AS A TOOL FOR THE DEVELOPMENT OF SPECIES-SPECIFIC WHALE WATCHING GUIDELINES

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Introduction

Since the 1990s, the whale watching industry has world-wide growth rates of more than 10% per year and the numbers of whale watchers has increased exponentially to more than 10 million in 2000 (Hoyt, 2001). Despite the need for stricter control, whale watching regulations often lack scientific background or are too vague (Herzing, 1995). Rarely the spectrum of the whales' and dolphins' reactions to boats is known, hardly ever it is documented scientifically.

Different species (re)act in different ways, and even within a species the behaviour can vary (Frohoff & Dudzinski, 1996; Constantine, 1997; Ritter, 2003). Off La Gomera (Canary Islands), numerous cetacean species can be sighted, some of them staying all year round (Ritter, 2001). Here it is feasible to study their behaviour in a comparative way in the context of still moderately developed whale watching activities. The study arose from a co-operation between a tour operator and the German NGO M.E.E.R.

Materials & Method

From 01 September 1995 until 31 December 2001, behavioural interactions of cetaceans with whale watching boats were studied. Data were collected during regular whale watching trips. Eight behavioural units defined as boat-related were sampled: *approach* (APP), *scouting* (SCO), *bowriding* (BOR), *wake riding* (WKR), *spyhop* (SPY), *orientation towards the boat* (ORI), *accommodation of speed* (ACS) and *accommodation of direction* (ACD) (Ritter, 2002). Additionally, sightings were categorised into *avoidance*, *no response*, *proximity* and *interaction* (compare Würsig *et al.*, 1998). Non-parametric statistical tests were used to answer the following questions:

- Is there a difference between species in the frequency of occurrence of boat-related behaviours?
- Do the species differ in the occurrence of sighting categories?
- Does the frequency of boat-related behaviours vary in different behavioural states?

Results

A total of 1680 samples (80.2 hours of observation) were analysed: 600 (30 h) for bottlenose dolphins (*Tursiops truncatus*), 363 (18.2 h) for rough-toothed dolphins (*Steno bredanensis*), 356 (17.8 h) for pilot whales (*Globicephala macrorhynchus*), 284 (14.2 h) for Atlantic spotted dolphins (*Stenella frontalis*), 39 (2 h) for striped dolphins (*Stenella coeruleoalba*) and 38 (1.9 h) for common dolphins. 268 sightings, additionally comprising encounters with dense beaked whales (*Mesoplodon densirostris*), were categorised.

The predominant type of boat-related behaviour was *bowriding* (41% of samples), followed by *approach* (26%) and *scouting* (13%, see Figure 1). *No response* (35%) and *proximity* (31%) made up the major part of sighting categories, *interaction* 24% and *avoidance* 10% (see Figure 2).

Bottlenose dolphins showed a wide range of responses to boat presence and their behaviour was not predictable. Atlantic spotted dolphins interacted with boats more than all other cetaceans off La Gomera. Pilot whales in general were not attracted by boats, although they could be easily approached. Rough-toothed dolphins showed a marked ambiguity, sometimes being inquisitive, on the other side behaving quite reserved. The common dolphin in general appeared to be "open" for attractions from outside. Of the delphinids, striped dolphins were the least easy to approach, they generally behaved warily. Sightings of dense beaked whales typically lasted only about 2-3 minutes with the whales disappearing afterwards.

Some species performed all types of boat-related behaviours, others didn't. The frequency of boat-related behaviours differed significantly between the species for all but two boat-related behaviours (Kruskal-Wallis, all $df=5$, all $H>25.5$, all $p\leq 0.001$ for APP, BOR, WKR, ORI, ACS and ACD). Only *scouting* and *spyhop* showed non-significant results (Kruskal-Wallis, both $df=5$, SCO: $H=6.885$, $p=0.227$; SPY: $H=1.486$, $p=0.958$). Also, the frequency of sighting categories differed significantly between six species (Pearson Chi-Square=200.186, $df=18$, $p<0.001$).

Relating the frequency of boat-related behaviours with behavioural states, the results were highly significant for the bottlenose dolphin (Chi-square=52.984, $df=4$, $p<0.001$) and the Atlantic spotted dolphin (Chi-square=18.804, $df=3$, $p<0.001$). Bottlenose dolphins interacted more than expected (by chance) during *travel*, and less than expected during *dive* and *dive travel*. In the spotted dolphin, during *travel* and *milling* the animals interacted more than been expected and less during *socialising* and *surface feeding* behaviours. In the pilot whales, though not significant, during *resting* behaviour the animals interacted more with the boats than expected.

Discussion

Different cetacean species (re)acted differently in relation to whale watching boats, strongly suggesting that each species has its own character, which is reflected by the way the animals are dealing with vessel presence.

The results can be used to establish species-specific and behaviour-specific guidelines for boat-based whale watching: The likelihood of occurrence of boat-related behaviour in different cetacean species was ranked (see Table 1). A listing of this kind is a valuable tool for whale watching skippers (and boat drivers in general) to evaluate, which kind of interaction can be expected and to accommodate their conduct accordingly.

In Table 2, proposals for the best conduct so as to acknowledge different responsiveness according to behavioural states, is presented. Rules should be established recognising *feeding/foraging* and *social* behaviours to be critical activities with a higher degree of co-ordination and intra-group interactions and thus should be dealt with special care. *Resting* pilot whales should be left alone soon after the recognition of this behaviour.

The establishment of species- and behaviour-specific guidelines is but one way to protect cetaceans from (excessive) whale watching. To further apply the precautionary approach, it is recommended to establish a marine protected area the waters south of La Gomera (MPA). This should be an *MPA of IUCN Category VI: a protected area mainly managed for the sustainable use of cetaceans* (see Salm *et al.*, 2000), to bring fisheries, recreational use and whale watching in line within the same area. Thus a basis can be created for the reconciliation of economic development and ecologic sustainability. A detailed presentation of a model for an MPA off La Gomera is given in Ritter (2003).

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Figure 1. Relative frequency of boat-related behaviours (all species)

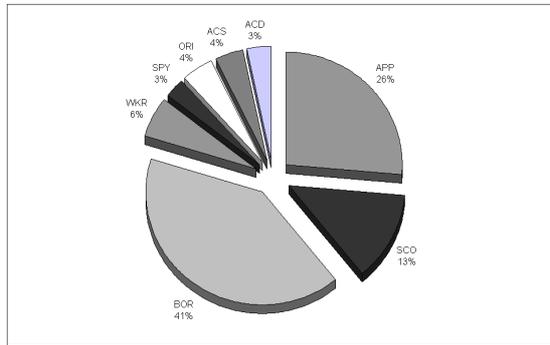


Figure 2. Relative frequency of sighting categories (all species)

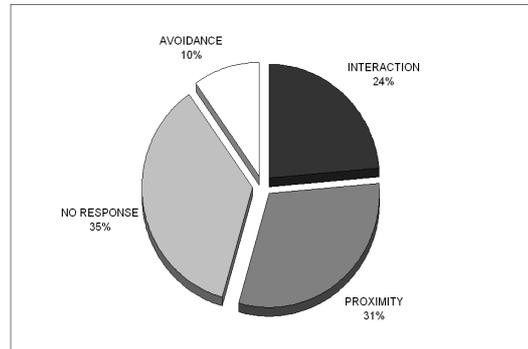


Table 1. Likelihood of occurrence of boat-related behaviour in different cetacean species (organised according to decreasing likelihood of interactions in each species)

Species	Interactions to be expected	Likelihood of occurrence
Atlantic spotted dolphin (<i>Stenella frontalis</i>)	Interactions in general	Very likely
	Close distance	Likely
	Approach	Very likely
	Bowriding	Very likely
	Scouting	Likely
	Accommodation of speed	Possible
	Accommodation of direction	Possible
Common dolphin (<i>Delphinus delphis</i>)	Interactions in general	Likely
	Close distance	Likely
	Scouting	Likely
	Approach	Likely
	Bowriding	Likely
Bottlenose dolphin (<i>Tursiops truncatus</i>)	Interactions in general	Depending on behaviour
	Close distance	Depending on behaviour
	Scouting	Possible
	Approach	Possible
	Bowriding	Possible
Pilot whale (<i>Gl. macrorhynchus</i>)	Interactions in general	Less likely
	Close distance	Possible
	Orientation towards boat	Possible
	Approach	Possible
	Scouting	Less likely
Rough-toothed dolphins (<i>Steno bredanensis</i>)	Interactions in general	Less likely
	Close distance	Less likely
	Approach	Likely
	Scouting	Possible
	Bowriding	Less likely
Striped dolphin (<i>Stenella coeruleoalba</i>)	Interactions in general	Unlikely
	Close distance	Unlikely
	Bowriding	Less likely

Table 2. Relation of interactions and behavioural states in four cetacean species off La Gomera with proposals for the "best conduct"

Species	Behaviour	Best conduct
Atl. spotted dolphin (<i>Stenella frontalis</i>)	SOCIAL	Keep observation to a minimum of time Do not approach animals closer than 100 m
	Close distance	Possible
	Interactions with boat	Less likely
	SURFACE FEEDING	Keep observation to a minimum of time Do not approach animals closer than 100 m
	Close distance	Possible
	Interactions with boat	Less likely
Bottlenose dolphin (<i>Tursiops truncatus</i>)	DIVE TRAVEL	Keep observation to a minimum of time Do not approach animals closer than 100 m
	Close distance	Not possible
	Interactions with boat	Unlikely
Pilot whale (<i>Gl. macrorhynchus</i>)	REST	Leave animals after 15 minutes the latest Inform others not to approach the group
	Close distance	Possible
	Interactions with boat	Possible
Rough-toothed dolphin (<i>Steno bredanensis</i>)		In general: very careful conduct The type of approach will influence the responsiveness of the dolphins