

# INFORM

## First insight on behavioural response of southern right whales (*Eubalaena australis*) to anthropogenic approaches in the Natural Protected Area Bahía de San Antonio, Río Negro.

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### INTRODUCTION

Marine mammal based tourism is one of the fastest growing eco-tourism activities in the world, the highest growth rates found in South-America (Hoyt and Iñiguez 2008). In many cases it helps to improve the appreciation towards marine wildlife but on the other hand the activity keeps raising questions on its effect on the animals themselves. Although it has been proven to induce short-term behavioural changes (Rivarola, 2001, Mattson et al. 2005), increased stress levels (Rose *et al.* 2003) and in a specific case even the abandonment of the region by the whales (Reeves 1977), it remains difficult to measure the long-term consequences they might suffer (Bejder *et al.* 2006).

The southern right whale (SRW) is one of Patagonians most emblematic species, whose charisma attracts nearly 250.000 tourists per year generating over 60 million dollars annually (Hoyt and Iñiguez 2008). With these numbers, Argentina is one of the leaders in South-America in terms of marine mammal tourism but it has in turn raised questions concerning the sustainability of the activity and the consequences of its extent on the whales. Over the last decades, numerous laws and regulations were set up in this country to control this form of tourism but it can be argued whether these regulations effectively ensure the protection of the whales or merely the endurance of the activity itself. Over the last years, a mayor discussion raised concerning a possible legalization of a swimming-with-whales activity, something that has been carried out for many years illegally as it is strictly forbidden by both provincial and federal laws. The debate came to its peak when the province Río Negro finally approved this form of tourism in 2006 in waters under their jurisdiction, based on the assumption that this area is not a main reproductive nor calving ground and whales therefore less vulnerable.

The effect of tourism based on cetaceans has been the aim of several workshops in the last years (IFAW, Tethys Research Institute and Europe Conservation, 1995; IFAW, WWF and WDCS, 1997; IFAW, 1999 and 2000) pointing out that there is a *great individual variety of responses within and among cetacean species* particularly while they reproduce, feed or migrate. It was therefore recommended that one should *evaluate in each case and species the biggest quantity of possible impact factors* (IWC, 1986). Understanding this recommendation, the presented study is aimed to obtain initial information on the reaction of SRWs to the presence of human activity in the Natural Protected Area Bahía de San Antonio (NPABSA), the most touristic coastal area of the Río Negro province, essential for the evaluation of the recent authorized whale-based tourism and the implementation of accurate regulations and conservation measurements.

### METHODS

Data were collected between August and November 2008 in NPABSA, Province of Río Negro, Argentina. Land-based observations were carried out using binoculars Nikon Action 8x40 and Pentax UCF 8x40 and two telescopes Kowa TSN-822 20-60x82 and Kenko Volare 20x50. Boat-based observations were conducted on board of a Kiel zodiac (4.6m) with a Suzuki 40Hp outboard motor. When whale groups were seen, data were noted on group size and composition using following categories: (1) *solitary whale* (2) *mother and calf* (M&C), defined as an adult whale in close association with a whale notably smaller in size that presents orange coloured callosities (3) *Surface Active Group* (SAG), defined by their apparent courtship behaviour (Kraus *et al.*, 2001) and (4) *non-SAG* (Best *et al.*, 2003).

A focal animal observation (Altmann 1974; Martin and Bateson 1993) was used to record an instantaneous point sample of the behaviour of the focal animal every two minutes using three mutual exclusive behavioural states as was done previously by Lundquist (*et al.* 2008, Tomas and Taber 1984, Sironi 2004): (1) *rest* when the animal is motionless in the water (2) *travel* when the animals is moving from one location to another leaving surface “footprints” (3) *socializing and or aerial activity* when the animal is causing white water at the surface by rolling, breaching, tail- or flipper-slapping or the whale is actively rubbing, touching or circling around another animal.

These behavioural observations were made *before* a boat approaches (BI), *during* a boat approach and/or swimmer interaction (DI), and *after* swimmers exited the water and/or the boat left the area (AI) (Bejder and Samuels 2004, Lunquist *et al* 2008). “Before” was defined as all activity from the moment behavioural observations started to the moment the boat first approached within  $\pm 500\text{m}$  of the animal. “During” was defined to begin when the boat approaches within 500m from the animal, includes the entire time the boat was near the whale and/or the swimmers were in the water, and ended when the boat travelled more than 500m from the animal. “After” was then defined as when the boat started returning to the coast and travelled more than 500m from the whale. Additionally to the whale’s behaviour, it was noted whether the whale approached actively the boat and/or swimmers, if it avoided interaction or show no reaction at all (adapted from Watkins 1985, Lundquist *et al.* 2008).

NOTES ON STATISTICAL ANALYSIS (ADAPTED FROM LUNDQUIST, 2007):

As successive behavioural observations are statistically dependent, they were analyzed as a series of time-discrete Markov chains. To further quantify the dependence of each behaviour event on the preceding event in the behavioural sequence, a first-order Markov chain analysis was used to build a matrix of preceding behaviour (at time 0) versus succeeding behaviour (at time 1) for each behavioural transition within the BI, DI and AI chains. The transition probability for each behavioural state transition was calculated by dividing the number of times a transition from preceding behaviour *i* to succeeding behaviour *j* was observed by the total number of times *i* was seen as the preceding behaviour:

$$p_{ij} = \frac{t_{ij}}{\sum t_{ik}}$$

where *t<sub>ij</sub>* is the number of times the transition from *i* to *j* was observed and  $\sum t_{ik}$  is the number of times *i* was the preceding behaviour. Comparing the calculated probabilities between control (undisturbed behaviour) and impact chains, a Z-test for proportions (Fleiss 1981) was used to test whether the interaction with boat and/or swimmers has a significant effect on the behaviour of the animals.

All statistical data were analysed using STATISTICA 6.0 and Zar (1996).

## RESULTS

### EFFORT

#### *Undisturbed*

A total of 11 land-based surveys were made with an average of 4.2h per survey (SD=0.3) resulting in 46h of land-based surveys, of which 3.1h account for undisturbed behavioural observations (at this point of analysis, disturbed land-based observations were excluded from analysis).

#### *Disturbed*

A total of 20 boat-based surveys were carried out with a mean of 5h per survey (SD=2.2) resulting in a total survey effort of 99.1h, of which 14.5h were spent actively noting the whale’s reaction to the presence of both boats and swimmers. After data filtering (including only those observations that had all three BI, DI and AI chains), this observation effort can further be split into a total of 2h BI, 9.3h DI and 1.5h AI, all divided over 17 cases.

### GROUP COMPOSITION

During the study, 31 whale groups were observed inside the NPABSA. Nearly 52% of these whales were solitary animals, 32% were groups of animals engaged in a courtship behaviour (SAG) consisting out of 3 animals on average (SD=0.7) as did the non-SAGs (SD=0.5) accounting for 13% of the groups observed. Only 3% of the whale-groups present in NPABSA during this study were mothers with calves (M&C) (fig.1). As any disturbance of M&C pairs is strictly forbidden by provincial laws, no data could be collected regarding their reaction to anthropogenic influences.

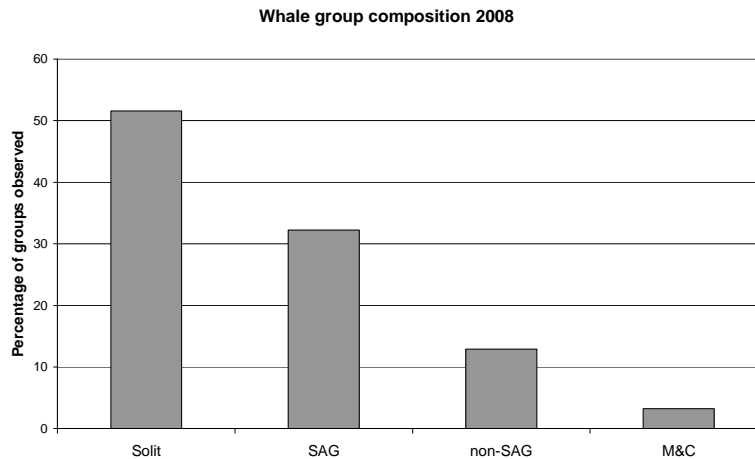


Figure 1: Group composition of SRWs observed in NPABSA during August – November 2008: solitary (solit), Surface Active Groups (SAG), non-surface active groups (non-SAG) and mothers with first year calves (M&C) (n=31)

#### BEHAVIOURAL RESPONSE OF WHALES

Preliminary results indicate that, although all whale-groups mainly showed no reaction to a human approach, solitary whales least approached and mostly avoided the human presence whereas a non-SAG whale-group approached more often (figure 2).

Furthermore, although the initial behaviours remained mostly undisturbed, first results indicate that whales engaged in a social behaviour will be more likely to avoid human presence when compared to resting or travelling whales. Similarly, an approach seemed to be least expected from a travelling whale (figure 3).

Furthermore, figure 4 shows the reaction of the whales related to the activity of the boat, regardless the presence of swimmers in the water. Due to the low amount of data, all further behavioural responses were analysed regardless their group composition or swimmer and/or boat activity level (further mentioned as *interaction*).

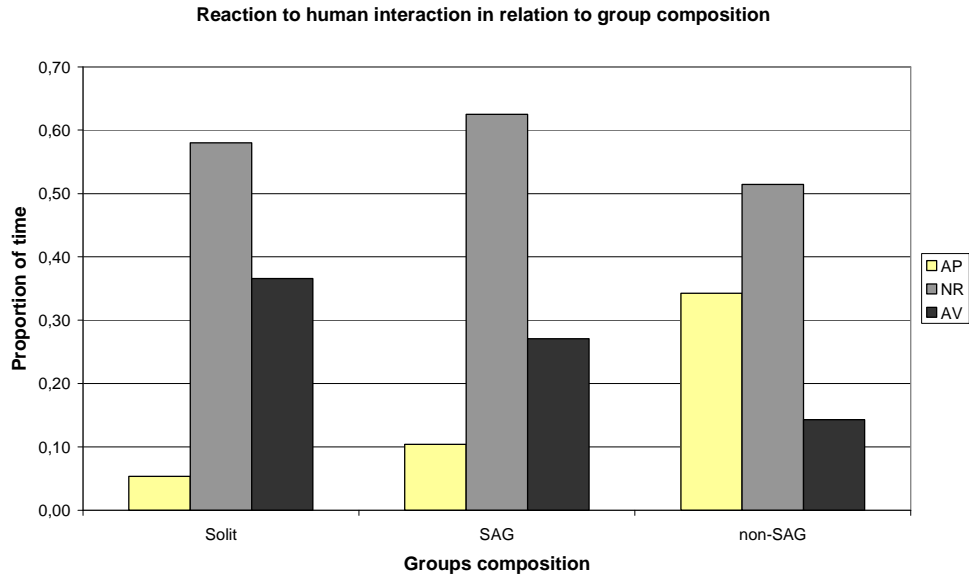


Figure 2: Overall reaction of SRWs towards human interaction related to their group composition: approach (AP), no reaction (NR) and avoid (AV), solitary (solit), Surface Active Groups (SAG), non-surface active groups (non-SAG) (n=17)

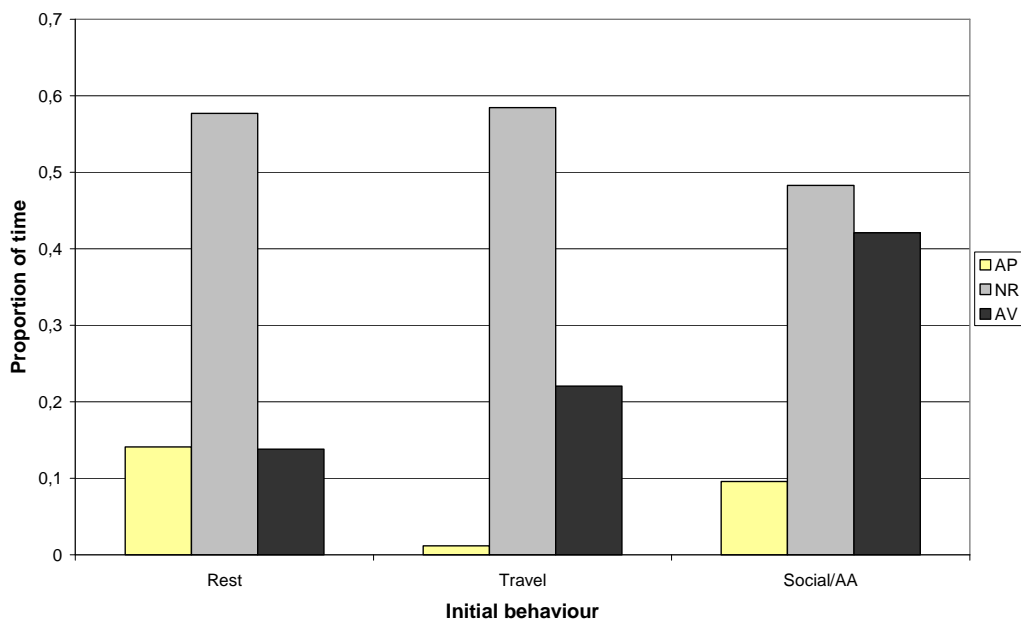


Figure 3: Overall reaction of SRWs towards human interaction related to their initial activity: approach (AP), no reaction (NR) and avoid (AV) (n=17)

Before any interaction occurred, whales spent up to 56% of their time travelling and this remained rather constant both during (61%) and after an interaction had occurred (57%). It could however be observed how the time whales spent resting increased (40%) after an interaction while the time they were socializing or aerially active decreased to barely 2% (figure 5).

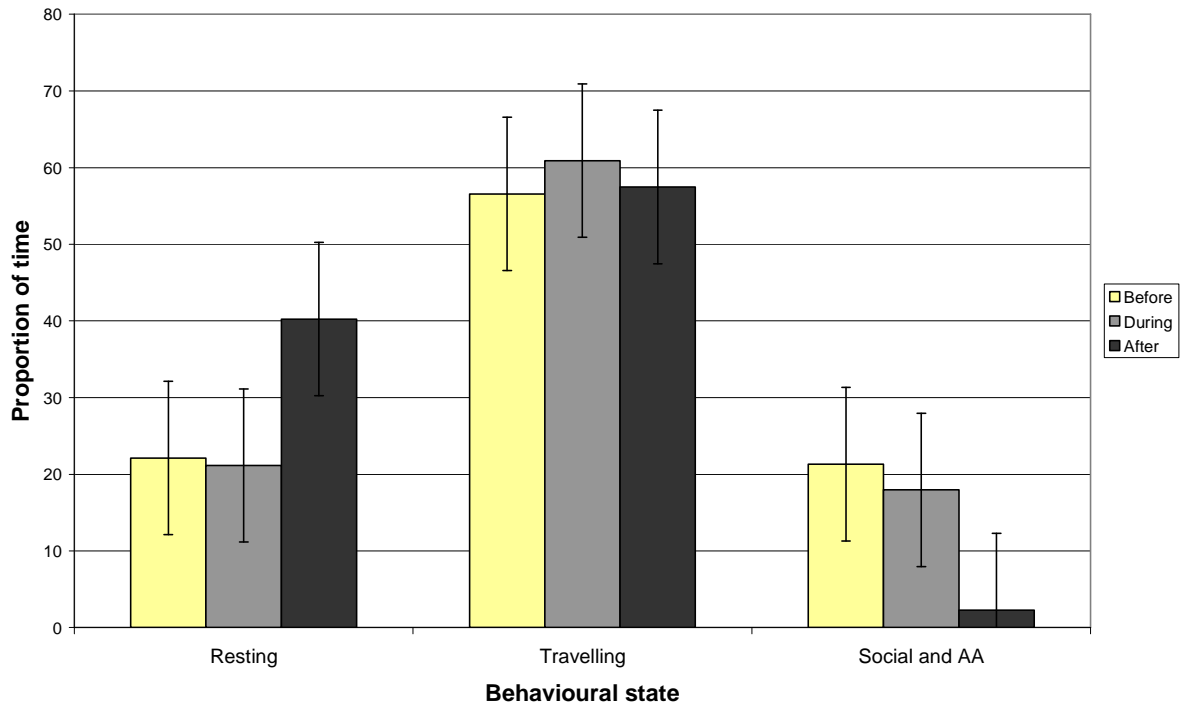


Figure 5: Proportion of time spent in each behavioural state before, during and after an interaction in NPABSA. Error bars are 95% confidence intervals (n=17).

Although whales seemed to spend less time in a social/surface active behaviour (-14%) when affected by anthropogenic interaction, the interaction had no significant effect (Z-test for 2 proportions,  $p > 0.05$ ) on all four behavioural transition probabilities when comparing the BI and DI segments (figure 6). Data is further compared to data obtained by a stimulated swim-with-whale tourism in Peninsula Valdes. As in both studies travelling behaviour seems least affected, only resting behaviour and social and aerial activity are shown.

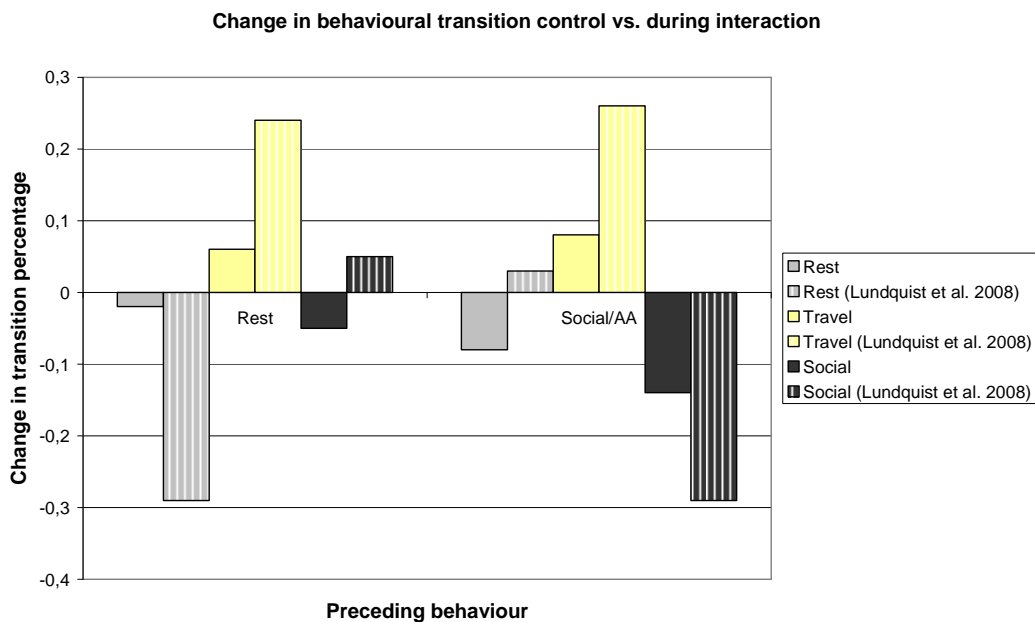


Figure 6: Difference in transition probability between BI and DI segments - comparison of data (boat+swimmer interaction) from NPABSA (n=17) with data from Peninsula Valdes (swimmer interaction; n=93)(Lundquist *et al.* 2008).

## DISCUSSION

***This report shows very preliminary information on the reaction of SRWs on the approach of boats and swimmers inside the Natural Protected Area Bahía de San Antonio. In first instance, the human interaction with SRW in the area shows to have an effect on the behaviour of the whales present, although not on significant level. Nevertheless, one should be very cautious reading and interpreting these first results and no conclusions can be drawn based upon these preliminary data.***

More than 50% of the whales observed in NPABSA during the study period were solitary animals. This is according to the trend seen in 2007 (48%). In general, very few mothers with newborn calves can be seen in the area which, in combination with the prohibited interaction with mother and calf pairs, makes that the present results do **not** include mothers and calf pair reactions.

The time whales spent avoiding or approaching the boat seemed to vary with their group composition. Despite the general trend of whales not approaching nor actively avoiding interaction, some variations can be noticed. Solitary animals were the ones avoiding the interaction more often whereas non-SAGs approached most. Moreover, it can be seen that whales initially resting tend to approach the boat more often, whereas whales in a social and aerial activity tend to avoid the human interaction more often. Out of these pieces of information one could deduce that non-SAGs initially resting tend to approach the boat more often whereas solitary animals in an aerial active behaviour or SAGs in a social behaviour tended more to avoid any interaction. In general, at times the boat was close enough to the whale to turn off the motor (still), less whales remained unaffected by the vessel. However, although only the minority actively approached the boat at any moment, they mostly did so at that time. To interpret this information one should take into account that no separation was made in this analysis between boat- and swimmer interaction, and that swimmers will only enter in the water when the boat lies still. It is necessary to carry out a separated analysis on swimming activity to clearly understand this piece of information. In any case, it seems clear that at all times, the vast majority of whales did not actively approach nor avoid the boat.

It is furthermore shown how the probability of a social active whale to remain in this social active state during interaction decreased notably. On the other hand, it was observed how whales tend to increase the amount of time resting after an interaction had occurred, which could be a reflection of an elevated stress level experienced during interaction. However, up to now the changes in transition probability after an interaction could not be tested statistically due to the small dataset. Even though whales seem least affected in their behaviour when travelling from one site to another, no exact conclusions can be drawn yet from these results.

When furthermore data are compared to information obtained Peninsula Valdes (Lundquist 2007, Lundquist *et al.* 2008), it can be seen that whales in Peninsula Valdes react in a similar way to anthropogenic approaches but to a greater extent. This could be explained by the fact that up to 41% of the whale groups studied in Peninsula Valdes were mothers and calves, found to be the most vulnerable group composition in their study (Lundquist 2007). This vulnerability has been described before by Payne (1986).

Swimming with whales is a highly discussed touristic activity in Argentina, involving many ecological, economical and political interests. In 2006 it was approved by law in the province Río Negro, but commercialization of the activity is still dependent on its regulation. Up to now, there is only one operator executing the activity in an opportunistic way, not promoting the activity in public and therefore reaching no more than 50 people per year (pers. comm.).

At this moment, any touristic activity with mothers and calf pairs and surface active groups remains forbidden, a restriction that seems valuable regarding the first results. Furthermore, at the field it can be observed and experienced easily that non-SAGs are the groups most accessible for interaction, therefore possibly becoming the preferred group for tourism activities. However, although it is rather easy to recognize mother-calf pairs on the field, it might be difficult to distinguish surface active groups from the preferred non-SAGs. Furthermore understanding the possible impact of human interaction on social and therefore possible reproductive behaviour, this differentiation seems vital for the sustainability of any touristic activity. It would therefore be advised to redefine limitations, forbidding any touristic activity with whales or groups of whales that are not solely travelling from one site to another. Moreover, more than once tourists were lifted out of the water by the whales during the study period, all by active whale groups (pers. comm.). Although it seems

understandable that active groups result more sensational and therefore preferred for tourism, one might additionally not lose sight on the safety of the people carrying out the activity.

Whale-based tourism can have a positive effect on conservation through an increase in awareness, but it must be regulated and monitored at all times to ensure the least possible impact in the whales themselves. Adequate regulations should furthermore reduce any impact on the long term to its minimum.

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