

Effects of humans on dolphins during Humans-Dolphins encounters in the Azores

A preliminary study

(Authorisation from The Azores Department of Turism) Licenca 10/CN/2003

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Aknowledgements

We thank the Portuguese Ministry of Tourism for its authorization for conducting the present study, all the participants, the two sailors (our skippers) for their enthusiasm, their ability to find the dolphins and their respectful approach of dolphins, Mario (AquaAcores) for his constant and efficient help and the dolphins for their interest in the study.

Preliminary considerations: context of the study

The aim of this study was to get information and improve the methodology for getting insights on the "*Effects of humans on dolphins during Humans-Dolphins encounters off the Azores*", the ultimate goal of the encounter being to swim with dolphins.

The present study was conducted by a French association (association loi 1901, non profit organization), called Conscience Dauphins. Conscience Dauphins is devoted to

- permit human and dolphin encounters, in a respectful and non intrusive approach,
- teach people about cetaceans in order to make them respecting cetaceans and their environment,
- develop scientific studies on the ethology of human and cetaceans encounters.

The study was conducted by members of the association (Sophie Boyer, Aurélie Célérrier, ...) in the context of one of the recurrent swimming-with-dolphins' sessions, from the 4th to the 11th of July 2003, off Pico Island.

A special authorization was provided by the Portuguese Ministry of Tourism.

It involved two boats (AquaAçores company) and fifteen participants, voluntary and informed of the current study.

The observation of dolphins' behaviour presents two main but essential difficulties:

- marine environment, which is difficult to access by humans observers and in which it is difficult to use observation equipment;
- general lack of knowledge about dolphins' behaviours and their meaning.

This preliminary study did not answer the aim because, a posteriori, the experimental conditions were not optimal for so (time, material, experimenters, ...). Nevertheless the study suggests that each specie (Tursiops, Rissos, Commons) has its own behavioural signature during encounters with a boat and during swimming.

A special methodology providing more information on the impact of humans-dolphins encounters on dolphins is finally proposed.

1. Introduction

Humans are interested by approaching dolphins.

This is to a point that dolphins are captured and put in marinelands.

However, putting marine mammals in captivity may rather drive people to consider that this situation is normal rather than allowing people to become aware that a marine mammal suffers from being in captivity.

An alternative to satisfy people for both their curiosity and pleasure, to sensitize them to cetacean's life and to improve their protection and preservation is whale-watching or swimming sessions with free dolphins. This alternative requires a maximum of precaution to avoid as much as possible disturbing the cetaceans as it may not be totally free from any type of effects on the cetacean. Growing number of such types of sessions all over the world lead us to wonder about the real effects of human presence on dolphin behaviours.

In the Açores, these types of eco-touristic activity is under restrictive law constrained such as providing an ethical and respectful approach of dolphins. Moreover, it is well known that dolphins are not reluctant to human encounters and often come and play at the boat's stem.

2. Scope of the study

The aim of the study was thus an attempt to identify and operate a first approach on the effect of humans on dolphins' behaviour and to precise the most adapted methodology for answering this question.

We focussed on two dimensions of dolphins' behaviours, a qualitative one (any behaviour of moving away, approach or indifference) and a quantitative one (variety, duration and pattern of interactions).

Other criteria of contextual nature may be taken into account such as dolphin species and the related number and composition of the group (notably presence of calves), current activity which can be related to the moment of the day, and finally the whale-watching or swimming situation.

3. Description of the study

Days and location of the observations

The experiment was planned from the 5th to the 10th. It was however conducted during the 6th, 7th, 8th and 10th of July, because the 4th one experimenter was sick and the 9th the weather was stormy. The experiment was hold off Pico Island.

Subjects

The dolphins species observed were Common dolphins (*Delphinus Delphis*), Stripped dolphins (*Stenella Coeruleoalba*), Tursiops (*Tursiops Truncatus*) and Risso dolphins (*Grampus Griseus*).

Material

One motor boat with eight participants and one motor boat (see data analysis section for complementary information) with seven participants on board were involved in the study: two children (girls), one teenager (girl) and twelve adults between 18 and 50 years old (four males and eight females). Their professional activity were as varied as student, speech therapist, computer consultant, trade executive manager, sports and dancing teacher, actress, tourist guide, psychologist, retired from the army and school teacher. They were all highly enthusiastic by encountering dolphins, by participating to the study (information was provided one month before the session and at the beginning of the session) and were swimmers. The participants were free to take part in, or to withdraw from, the observation.

Sailors were informed of dolphins' locations and species by in-land watches. The technical equipment for recording the interactions consisted in one camera used on board and one camera used underwater (the cameraman staying near the surface). Moreover, a datasheet for recording elements of dolphins' behaviour observed on the surface was used daily by two scientific observers (one on each boat); another datasheet for recording participants observations were daily available for all participants, on board and off board.

Method

The session consisted in one daily three hours trip.

When dolphins were visible, the observer was supposed to note the species, the number of individuals encountered and their behaviour was registered (see annex 1). The same observer filmed the dolphins as soon as they could be seen. When the two authorized people went to the water, both them and the dolphins were filmed by this cameraman and the second cameraman filmed the swimmers and the dolphins underwater.

Participants were supposed to fill in their personal form (their observations, see annex 2) when back on the boat or back on dry land.

4. Data analyses

We focussed on encounters of dolphins with humans. An encounter corresponds to a situation during which dolphins were close enough to attempt a diving session (dolphins were generally less than 50 meters away). There are two cases to reach such a situation: either the dolphins come to the boat or the boat comes to dolphins.

The number of experimental day was limited to four days and the precise locations of the encounters were not collected.

It was very difficult for the experimenter to complete the task planned: both observing dolphins' behaviour near the boat and away (up to 500m) and recording on the datasheet the behaviour of the dolphins, and film. It was thus impossible to provide full exhaustivity of the whole situation; this constitutes a methodological bias of data collecting.

Moreover, depending on the underwater visibility, wind and sea roughness, the films were in some cases difficult to exploit and evaluating distances and number of dolphins are more or less reliable.

Finally, filling-in of forms was not systematically done by the participants: they were reluctant to filling the datasheets on board, as they were enjoying the encounters with dolphins.

We combined these three types of data sources (films, observations from the boat by the experimenter, filling-in of forms by participants).

As a consequence of the lack some equipment such as video cameras, cameramen and observers, data collected on one of the two boats are not reliable enough. We will thus consider here only the data coming from the conveniently equipped boat. At the end of the stay, one of the participants of this boat refused to be included in the study. We thus computed an index reflecting the gap between the data presented here, including all participants, and the data excluding that participant's data. Almost twice more dolphins were seen by that participant than the whole group including that participant. In the text, we show where the data have to be moderated accordingly by a mark : ^{twice less}.

Finally, we include in the results and discussion sections few additional and complementary observations (*"in italic"*), coming from Sophie Boyer, president of the association Conscience Dauphins. She indeed stayed one week in November 1999, two weeks, June and September in 2001, three weeks in June and July 2002, and one and half month in 2003 in Pico Island, observing and swimming with dolphins. She also has a long experience in observing and swimming with dolphins around the world.

5. Results

Along the four days, the boat encountered 33 times a group of dolphins. These 33 encounters correspond to 15 different groups of dolphins. 7 groups were Common dolphins, 2 groups were Stripped and Common dolphins, 3 groups were Rissos and 1 was Tursiops.

Out of the 33 encounters, in 16 cases (48.5 %) data were insufficient to be exploitable (missing data); in 17 cases (51.5%) observation data were detailed enough to cover the exhaustivity of the encounter situation¹. The unexplainable data won't be analyzed.

Among the 17 encounters, five (29%) were not followed by a swimming session; 3 times the concerned dolphins were Commons and twice they were Rissos: they moved away or maintain a distance with the boat.

Among the 17 encounters, in 12 cases (71%), a swimming session occurred; during these swimming sessions, for each individual diving, dolphins were seen in 87% of cases. Were concerned Commons in 8 cases, Rissos in 2 cases and Tursiops in 2 cases.

The description of these encounters is presented below.

Analyses of the twelve encounters followed by a swimming session

Characteristics of these encounters observed from the boat

Table 1 shows that these 12 encounters concerned 4 different groups of dolphins (Group: 1, 2, 3, 4).

Moreover (not shown on Table 1), eight encounters concerned only 2 different groups of Commons, 2 encounters concerned only 1 group of Rissos and 2 encounters concerned only 1 group of Tursiops, (i.e. three species).

For each of these 4 groups, Table 1 shows the moment of the day during which the boat went out, the weather and the sea conditions, the species encountered, the size and the activity of the group, the dolphins' behaviour as observed from the boat and, finally the proportion of seen^{twice less} dolphins during diving as a function of the size of the group observed from the boat.

Group	Time of the boat going out	Weather and wind	Sea conditions	Specie	Size	Activity	Observations from the boat During swimming session	Proportion of seen dolphins during diving as a function of the size of the group observed from the boat ^{twice less}
1	4:30 to 7:30 pm	Cloudy and force 2	Slight becoming slight to moderate	Common	30	Moving along	Transient encounters and the dolphins go away a while after the swimmers entered the water. Few jumps.	20% ^{twice less}
						Hunting	Maintain their hunting activity and few individuals come towards the swimmers.	12.5% ^{twice less}

¹ What do we consider as exploitable data is when the three types of data sources (films, observer and participants' datasheet) first cover all the duration of the encounter and second corroborates each other.

							Swimmers surrounded by dolphins.	
2	4:00 to 7:00 pm	Sunny and force 2	Slight becoming slight to moderate	Common	20	Indetermined	Turn around the boat at 1 to 4 m.	10% twice less
3				Risso	30	Socialization	Dolphins approach at 5-10m of swimmers, dive and go away.	10% twice less
4	4:00 to 7:00 pm	Sunny and force 1	Slight	Tursiop	150	Moving along then hunting	Gradually increasing number of individuals (from 100 to 200) moving along during 1h30 and joining up a place where a quarry takes place. Numerous and various jumps, hyperactive, scattered dolphins. Some draw very near the boat (inferior to 5m from boat and swimmers).	4.8% twice less

Table 1: Characteristics of the twelve encounters followed by a swimming session.

The parameter in the column "*Proportion of seen dolphins during diving as a function of the size of the group observed from the boat*" includes data collected from the boat and from the participants^{twice less}.

Distance of the dolphins when swimmers went into the water ranged from 5 to 25m^{twice less}.

Behaviour of dolphins observed underwater^{twice less}

The behaviour of each specie is shown on Table 2 according to their distance, position, movements, celerity and sounds.

Species	Mean number of dolphins seen /session /swimmer	Distance			Position		Movements				Celerity		Sounds			
		Remote	Distinguishable	Close	Below	Same level	B&F	Approach	Moving away	Staying at the same distance	Slow	Fast	Whistle	Click	Whistle + Click	None
Common	4	14%	47%	39%	60%	40%	20.4%	0%	26.5%	42.9%	49.2%	50.8%	41.2%	17.6%	23.5%	17.7%
Risso	3	31%	69%	0%	31%	69%	12.5%	0%	87.5%	0%	87.5%	12.5%	50%	0%	0%	50%
Tursiops	7	0%	0%	100%	79%	21%	0%	100%	0%	0%	100%	0%	75%	0%	25%	0%

Table 2: Characteristics of the underwater encounters^{twice less}.

Additional information is provided below concerning the determination of these characteristics:

1. Mean number of dolphins seen by session and by swimmer: because each swimming session involve two swimmers, it is impossible to distinguish if the number of seen dolphin by swimmer corresponds to the same or different dolphins-individuals. Because of this constraint, we decided to consider the number of dolphins-individuals and behaviour items as reported from the point of view of each swimmers. The synthesized data entered in this table have been elaborated according to this method.
2. Distance: this parameter corresponds to the distance between the swimmer and the dolphin(s); it is sorted out into three types:
 - remote: around 8 to 10 m;
 - distinguishable: around 5-9m;
 - close : <5m.
3. Position: the position of the dolphin(s) with respect to the swimmer is sorted out into two categories:
 - below: below the swimmer

- same level: the dolphin is at the same depth than the swimmer.
- 4. Movements: behaviour of dolphins in relation to swimmer. Four types of behaviour were found:
 - back and forth: B&F;
 - approaching : approach;
 - moving away;
 - staying at the same distance.
- 5. Celerity: it was sorted out according to slow or fast displacements.
- 6. Sound: type of sounds perceived by swimmers was sorted out into four types:
 - whistle;
 - click;
 - whistle + click;
 - none: nothing was heard.

Analyses of the five encounters not followed by a swimming session

Characteristics of these encounters observed from the boat

These 5 encounters concerned 2 different dolphins' groups (Group: 1, 2):
3 encounters concerned only 1 group of Commons; they were preceded and followed by swimming sessions.

2 encounters concerned only 1 group of Rissos; they were followed by a swimming session.

For each of these 2 groups, Table 3 shows the moment of the day during which the boat went out, the weather and the sea conditions, the species encountered, the size and the activity of the group and the dolphins' behaviour as observed from the boat.

Group	Time of the boat going out	Weather and wind	Sea conditions	Specie	Size	Activity	Observations from the boat
1	4:30 to 7:30 pm	Cloudy and force 2	Slight becoming slight to moderate	Common	30	Moving along	Leaping dolphins at 300m from the boat, boat getting close; maintaining a 100m distance; coming to the stem and leaving. Dolphins swimming at 20m from the boat. Maintaining a 100m distance (Few striped dolphins joined the initial group)
2	4:00 to 7:00 pm	Sunny and force 2	Slight becoming slight to moderate	Risso	30	Socialization	Stay at 200m and leave Stay at 100m and leave

Table 3: Characteristics of the five encounters not followed by a swimming session.

6. Discussion & Outcomes

Before attempting to describe the effect of human-dolphins encounters on dolphins, it firstly has to be pointed out that the number of encounters is high: 33 times during four days, for one boat, i.e. on average 8.25/day (3 hours), and that only 29% was not followed by an attempt to swim with the dolphins. During swimming sessions, dolphins were seen in 87%^{twice less (i.e. 43%)} of cases.

→ Though we do not have any element of comparison, these results suggest that, overall, dolphins are not reluctant to encounter boats and people swimming^{twice less}.

Secondly, encounters not followed by swimming sessions occurred in the same context as encounters followed by swimming sessions which are during cloudy or sunny weather, when the strength of wind is low, when water is quite flat and at the end of the day. The dolphins' activity during the encounters is varied: hunting, moving along, socialization and undetermined. Data are not enough to conclude that activity of dolphins and the weather would be a strong predictor of the success of the swimming sessions. Indeed, *"In relation to certain periods of the day, especially afternoon after 4 pm when they were coming nearest from the coast for feeding and socialising, they were more open to encounters than when they are travelling."* Further analyses on longer observations periods are thus required.

Both types of encounters (followed^{twice less} or not followed by swimming sessions) were mixed. This suggests that when dolphins are encountered, they are prone to both interact or not.

Finally, there was a few number of time, during which dolphins were seen away, followed away by the boat and no approach could be attempted.

→ These observations suggest that the dolphins control the period during which encounters with humans occur.

Additionally but important descriptive information is that the most frequently encountered species followed^{twice less} or not by swimming sessions, in the decreasing order, were Commons, Rissos, Commons and Stripped and Tursiops. There is no correlation between the frequency of the encountered species and the number of group individuals.

Moreover, data also show that during swimming sessions, swimmers saw^{twice less} more Tursiops, than Commons, than Rissos; but proportionally to the size of each group, Commons, then Rissos then Tursiops seem decreasevely participative to the swimming encounter^{twice less}. *"It also has to be mentioned, that by the time the study was conducted, spotted dolphins were not met, as they probably had not arrived yet this year; these dolphins are however generally the most interactive specie off Pico; then Commons, Tursiops and finally Rissos were decreasevely interactive during the past. We have done a special observation this year about*

the Tursiops who seemed to have a different behaviour from usually: it was significantly easier to see and approach them and to interact with them." However, this observation concerns only one group of Tursiops.

Behaviors of dolphins during encounters with humans

Description of dolphins' behaviours during encounters followed by a swimming session^{twice less}

Rissos^{twice less}:

They never come closer than 5m from the swimmers; when swimmers go into the water, one or few individuals approach the swimmers at 5-10m, dive, disappear and reappear further. *"Generally, one Risso at least, and more often few, came close to swimmers each time swimmers went going into the water; then they usually dived quite deeply and according to the visibility, their white shadow was still visible."*

For example, during a socialization period, one adult male quickly approached the swimmers, keeping a certain distance from the swimmers, then came back to the group, socializing.

Risso were most of the time socializing during the approach. They never come to the stem.

It seems thus that Rissos generally prefer to stay away from boat and people and make rather frequently rapid incursions. Only 10% of the group makes close encounters (they are mainly distinguishable), three individuals on average are seen by one participant, they rather swim at the same level slowly and half of the time they whistle or do not emit sounds.

Commons^{twice less}:

Their behaviour ranges from getting very close to boat, moving around the boat, surrounding closely the swimmers and away dolphins maintain their activity and make jumps (little sliding jumps, slapped jumps...). Less than 10% were calves.

Dolphins seen correspond to 12.5 to 20 % of the whole group. A participant sees four Commons when entering water. The dolphins are rather below them, staying at the same distance of the swimmer or making quick encounters which are rather close (dolphins are mainly distinguishable and close), they can move slowly or quickly, they mainly whistle. *"Commons systematically came very close (at few meters) to the swimmers. Some individuals approached, generally a small group of four, five, then went away."*

Commons are most of the time moving along and hunting or their activity is undetermined or similar to socialization; in that latter case, they swim quietly near the boat.

Tursiops^{twice less}:

Their behaviour was moving along then engaged in a hunting task. Numerous and various jumps and hyperactive behaviours were observed; dolphins were scattered but some individuals draw very near the boat (inferior to 5m from boat and swimmers) and were moving around the boat. Less than 10% were calves.

Dolphins seen correspond to 4.8 % of the whole group. A participant sees seven individuals, coming very close, approaching slowly below them and mainly whistling.

Description of dolphins' behaviours during encounters not followed by a swimming session

Commons:

The behaviour of the Commons range from coming at the stem a moment and leaving, swimming at 20m from the boat and maintaining a 100 to 300 m distance from the boat; all the behaviour can apply at the same the time or separately. Some are leaping at 300m from the boat.

Rissos:

Rissos maintain a constant 100 to 200m distance with boat and leave.

Additional observations by Sophie Boyer

"The dolphins' behaviour depends on the quality of presence of the swimmers. Their swimming ability, general behaviour (speed of moving, ...), emotional state (quietness, ...) may also determine dolphins' behaviours. Dolphins seems systematically curious to small children (8 years old) and often a dolphin mother comes with a baby when a child is one of the swimmers.

The most confident a person is in getting into the sea environment, the more dolphins are generally approaching."

Conclusions

We were able to determine the main characteristics of dolphins' behaviour (Tursiops, Rissos, Commons) during encounters with a boat and during swimming. Results suggest that each specie has its own behavioural signature with respect to the boat and the swimmers as a group^{twice less}. However, the duration of this study and the logistic means were definitely too limited to provide enough and reliable data^{twice less}. Nevertheless, dolphins exhibited either avoidance or approaching behaviours of the boat and swimmers and never exhibited aggressive behaviour.

We believe that correlating the evolution of the number of individuals, of the species of dolphins encountered, of locations of encounters, of the activity, along years, with dolphins' behaviours with respect to boats and swimmers (approachs and avoidance) will provide more in-depth information on the impact of dolphin-watching on dolphins behaviour.

Outcomes

As almost half of the data collected was not exploitable, numerous methodological aspects have to be taken into account in order to provide more reliable data and more information of the impact of human on dolphin's behaviours:

1. A collaboration with two graduate students inventorying dolphins is definitely needed by boat:
 - a. One student for determining the specie, counting the individuals (adults and young) and providing the exact location of the encounter (recurrence of encounter at peculiar places may be interesting to show); this activity is actually done by the graduate students of the Canaries Island;
 - b. Two graduate students for determining the macro-behaviours of dolphins at the beginning of the encounter and for describing the changes in their behaviour all along the encounter, according to a macroscopic view, i.e. displacements and jumps at different distances (3 categories of distances).
 - c. A debriefing session each day is required.
2. In order to get more data on dolphins micro-behaviours and to correlate humans and dolphins behaviours, are required on board:
 - a. Two observers who observe and record the interaction of the two swimmers and the dolphins moving around swimmers;
 - b. One cameraman focussing on the humans-dolphins encounter (verbal descriptions : names of the participants and description of events);
 - c. Two cameramen into the water;
 - d. Equipment for recording dolphins sounds.
 - e. Determining precisely the meaning of the dolphins' behaviours appears important, as their interpretation is controversial. For instance, the meaning of the jumps and of swimming at the stem.
3. A way to motivate participants to fill in their datasheet has to be found out.
4. The datasheet for observers and participants have to be improved.
5. Observers have to be trained to evaluate distances on the water.

It appears essential to increase the duration of the study to at least two times 6 days and to conduct this study every year to provide information about the evolution of dolphins' behaviours along years, in order to determine whether the frequency of the encounters, the number of individuals and the nature of the behaviour of every specie evolves.

Finally, for conducting such a study based on such an elegant but complex methodology, one may insure that all these conditions are met; or the risk is to get unreliable data, as here, impossible to objectively disentangle. Especially, the analysis of the films has to be done according to a multi-judge approach (2 to 3 persons confronting their data sorting).

Annex 1:

Datasheet for the experimenter: general observations of dolphins' behaviors

Fiche dauphins

Consignes : compléter les ... et/ou entourer la réponse adaptée

Expliciter si nécessaire

Journée ... /07/03

Heure de sortie ...

Nom du bateau :....

Etat de la mer

Force du vent	Appellation	Vitesse nœuds	du vent km/h	État de la mer
0	Calme	1	1	Calme (mer d'huile)
1	Très légère brise	1 – 3	1 – 5	Calme (mer ridée)
2	Légère brise	4 – 6	6 – 11	Belle (vaguelettes)
3	Petite brise	7 – 10	12 – 19	Peu agitée (petits « moutons »)
4	Jolie brise	11 – 16	20 – 28	Peu agitée à agitée (nombreux « moutons »)
5	Bonne brise	17 – 21	29 – 38	Agitée à forte (vagues, embruns)
6	Vent frais	22 – 27	39 – 49	Forte (Lames) (vagues de 2 à 4 m)

Distance de la côte, coordonnées géographiques

Espèces

Delphinus Delphis (dauphins commons)

Stenella Frontalis (dauphins tachetés)

Stenella Coeruleoalba (dauphins blanc & bleu)

Tursiops Truncatus (grand dauphin)

Grampus Griseus (dauphin de Risso)

Mode de repérage **vigie** **pas vigie** (demander au skipper)

Nombre approximatif de dauphins

Adultes :

Petits :

Activité du groupe au moment de la rencontre

Alimentation
route

Repos

Socialisation (calins ou jeux)

En

Autres (activités indéterminées)

Bateau en mouvement (comportements des dauphins par rapport au bateau)

Maintien du comportement en cours : oui non

Distances par rapport au bateau :

- éloignement
- rapprochement
- distance stable :

étrave
10 m
50 m
100 m

Style de nage

Nage uniquement

Nage + Sauts (dénombrement) : Sauts glissés

Sauts claqués

Sauts acrobatiques (vrilles, sauts verticaux, chandelles, sauts cambrés)

Claquement de queue

Spy-hopping

Bulles : oui non

Bateau à l'arrêt (comportements des dauphins par rapport au bateau)

Maintien du comportement en cours : oui non

Distances par rapport au bateau :

- éloignement
- rapprochement
- distance stable :

étrave
10 m
50 m
100 m

Style de nage

Nage uniquement

Nage + Sauts (dénombrement) : Sauts glissés

Sauts claqués

Sauts acrobatiques (vrilles, sauts verticaux, chandelles, sauts cambrés)

Claquement de queue

Spy-hopping

Bulles : oui non

Autres observations

Annex 2:

Datasheet for the participants : general observations of dolphins' behaviour

Fiche individuelle d'observation en plongée

N° ou Prénom/Nom :

Date: ...

Numéro de la plongée durant la sortie bateau:

Consigne

Rencontre		Première	Deuxième	Troisième
Espèces				
Nombre d'individu	Total: ...			
Positions des dauphins	-Au même niveau -En profondeur			
Proximité	-Très proche (vision des détails) -Individu distinguable -Forme lointaine			
Déplacement	Rapide Lent Stationnaire			
Comportement par rapport au plongeur	S'éloigne Se rapproche Maintien de la même distance			
Sons	Clics (ressentis ou entendu) Sifflements			

Relater l'expérience (description) si vous en avez envie.

Relater le ressenti si vous en avez envie (émotions: joie, peur, mal à l'aise, excitation, frustration, autres ...)