In: Dolphins
Editor: Joshua B. Samuels
ISBN: 978-1-63117-952-5


*Chapter 1*

# BEHAVIORS OF BOTOS AND SHORT-FINNED PILOT WHALES DURING CLOSE ENCOUNTERS WITH HUMANS: MANAGEMENT IMPLICATIONS DERIVED FROM ETHOGRAMS FOR FOOD-PROVISIONED VERSUS UNHABITUATED CETACEANS

*M. Scheer[1], L. C. P. de Sá Alves[2], F. Ritter[3], A. F. Azevedo[4] and A. Andriolo[5]*

[1]Bremen, Germany
[2]Instituto Estadual de Florestas, Barbacena, MG, Brazil
[3]Berlin, Germany
[4]Universidade do Estado do Rio de Janeiro,
Rua São Francisco Xavier, Rio de Janeiro, RJ, Brazil
[5]Departamento de Zoologia, Instituto de Ciências Biológicas,
Universidade Federal de Juiz de Fora, Campus Universitário,
Juiz de Fora, MG, Brazil

## ABSTRACT

Wildlife encounters of humans diving, swimming and wading in the vicinity of cetaceans in open water environments have increased

worldwide. At the same time, the quality and quantity of close-up or interactive cetacean behaviors addressed towards humans appear to vary widely. In the past, free-ranging cetaceans were reported to avoid, affiliatively or aggressively interact with, injure or even kill humans. Indirect effects compromising the health status of target species such as entanglements, boat strikes or alterations of behavior have been reported as negative by-products. From the management perspective, encounters have to be regulated in order to reduce the likelihood of detrimental outcomes for both sides. It has been proposed to conduct studies on the quality of behavioral interactions to enable a comparison between species and locations, as well as to conduct research before commercial programs are implemented. However, self-initiated cetacean behaviors addressed towards humans still have received little attention, hence their structure and function largely remain unclear. This study compares self-initated behaviors addressed towards human feeders and swimmers as well as intraspecific behaviors adressed towards cetacean conspecifics during encounters with food-provisioned Amazon botos (*Inia geoffrensis*) and unhabituated short-finned pilot whales (*Globicephala macrorhynchus*) in the Canary Islands. Encounters with botos were observed for a total of 18 h 30 min in Novo Airão city, Amazonas State (Brazil), during two field seasons in 2008 and 2009. Short-finned pilot whales were observed 9 h 06 min off Tenerife and La Gomera (Spain) during three field seasons in 1996, 2001 and 2012. For the first time, an *á priori* ethogram on inter- and intraspecific behaviors was used in each location and for each species to enable a comparison. During the majority of encounters (71%), short-finned pilot whales addressed affiliative behaviors towards swimmers. Neutral or avoidance behavior was shown during 29% of encounters. Intraspecific agonistic behaviors were rare. In contrast, botos did not show avoidance reactions to human feeders but were permanently attracted to them. During 36% of encounters, botos initiated affiliative behaviors. However, risky behaviors occurred during all encounters and botos also showed agonistic behaviors towards conspecifics. Nearly all risky interspecific behaviors remained constant or increased and all agonistic intraspecific behaviors increased from 2008 to 2009. Thus, humans continually were exposed to health risks. Food-provisioning of botos is now being managed aiming to reduce risky interactions. Swim programs seem to be the more preferable form to closely encounter cetaceans in the wild. However, it remains unclear how unhabituated animals would react when being exposed to repeated swim activities. Thus, we recommend that close interactions between humans and cetaceans -be it feeding or swimming- should be generally discouraged. Where such interactions with tourists take place, they have to be regulated ideally from the very beginning. Our results can be used as referential data before initiating new interactive programs.

**Keywords:** Whale watching, swim-with-cetacean programs, food provisioning, *Globicephala macrorhynchus*, *Inia geoffrensis*

## INTRODUCTION

Wildlife encounters with cetaceans have become a global industry and can be found on all continents (Hoyt, 1995; 2001; O'Connor et al., 2009). Next to boat-, land- and air-based whale watching activities, commercial swim-with cetacean as well as food-provisioning programs have become popular segments of this industry. Swim programs have increased worldwide (Hoyt, 2001; Rose et al., 2005; O'Connor et al., 2009) and food-provisioning of wild cetaceans has become increasingly popular (Connor and Smolker, 1985; Green and Corkeron, 1991; Orams, 1995; Alves et al., 2011a). More than 20 cetacean species have been reported to be encountered by human swimmers, divers, waders or feeders (Samuels et al., 2000; 2003; O'Connor et al., 2009). In contrast to boat-based whale watching, swim-with and provisioning programs have their specific encounter characteristics (Samuels et al., 2000). During both, humans are in close contact with the animals in their open water environments and may even establish physical contact. Although there is a vast popular belief that cetaceans are „friendly and peaceful "animals, in the past free-ranging cetaceans were reported to aggressively interact with humans and even injure or kill them (e.g., Lockyer and Morris, 1986; Bloom, 1991; Shane et al., 1993; Dudzinski et al. 1995; Santos, 1997; Mann and Smuts, 1999; Orams 1995; Frohoff et al., 2000; Cunningham-Smith et al., 2006; Smith et al., 2008). On the other hand, cetaceans were shown to avoid human swimmers while food-provisioned animals have been exposed to inappropriate human behaviors such as hugging, touching of sensitive body parts or teasing (Constantine, 2001; Samuels and Bejder, 2004; Smith et al., 2008). Chronic encounters with humans can also cause indirect hazards for cetaceans. Food provisioning of wild dolphins was reported to increase the risk for entanglements and ship strikes (Cunningham-Smith et al., 2006; Finn et al., 2008; Donaldson et al., 2010), alter maternal and calf behavior (Mann and Smuts, 1999; Mann and Kemps, 2003; Foroughirad and Mann, 2013), increase calf mortality (Mann et al., 2000), induce the acquisition of risky foraging traditions of calves by social learning (Mann and Sargeant, 2003), increase the likelihood of dominance hierarchies among dolphins competing for food, and promote intraspecific aggression (Alves et al., 2013a).

It generally depends on the intention of cetaceans to approach and stay with humans, to terminate an encounter, or to avoid humans and stay out of sight. However, "encounter history" at specific locations, types of interaction, and the presence or absence of regulations will have an impact on the quality and quantity of self-initiated behaviors of cetaceans. As reviewed by Scheer (2010), among 53 different behaviors documented for ten odontocete and one mysticete species, 33 were affiliative, 18 aggressive/ threatening and 2 sexual in nature. Aggressive/ threatening and sexual behaviors were reported mainly for food-provisioned and lone and sociable dolphins whereas affiliative behaviors were predominant among unhabituated animals (Scheer, 2010).

## Short-Finned Pilot Whales in the Canary Islands

The short-finned pilot whale (*Gobicephala macrorhynchus*) is a common species in the Canary Islands (Heimlich-Boran, 1993; Montero and Arechavaleta, 1996; Politi et al., 1996; Ritter, 2003; Pérez-Vallazza et al., 2008; Carrillo et al., 2010) and the area represents an important feeding (Aguilar Soto et al., 2008) and breeding ground (Heimlich-Boran, 1993; Carillo et al., 2010). The social structure of sympatric groups living in the Canary Islands and other locations was observed to be long-lasting and resembles group structures observed for matrilineal cetaceans (Kasuya and Marsh, 1984; Marsh and Kasuya, 1984; Heimlich-Boran, 1993; Alves et al., 2013c). They are especially abundant in coastal waters off the islands La Gomera and Tenerife and the resident population was estimated to size 362-495 animals (Heimlich-Boran, 1993; Carrillo et al., 2002). Their year-round presence in the area was the precursor of the development of a local whale watching industry. The southwest coast of Tenerife, in terms of tourist numbers, represents one of the most important whale watching locations worldwide with short-finned pilot whales as its main target species. In 2008, 26 licensed boats operated in the area with a daily passenger capacity of 2,356. About 470,000 whale watchers were estimated for that year (Elejabeitia and Urquiola, 2009). In contrast, off La Gomera a different type of whale watching has been developed. Less operators usually use smaller boats resulting in a much smaller daily capacity. Additionally, some operators conduct educational programs before, during and after excursions (Ritter, 2003). Part of the habitats of short-finned pilot whales southwest of Tenerife and La Gomera have been designated as Special Areas of Conservation under the European Union Habitat Directive (Elejabeitia and Urquiola, 2009; Ritter, 2010). Since

1996, whale watching activities have been legally regulated and commercial as well as private swim activities with cetaceans have been banned (Gobierno de Canarias, 1995; 2000). Since then, all research and filming activities targeting pilot whales during in-water encounters have to be authorised by the Canary Island Government.

## Amazon Botos

The Amazon river dolphin or boto (*Inia* sp.) is widely distributed in the south American river systems, however their abundance geographically varies (Best and da Silva, 1993; Vidal et al., 1997; Aliaga-Rossel, 2002; Gomez-Salazar et al., 2012). Botos often seem to be tolerating human activities as they can be observed in close proximity to boats, swimmers and fishermen. They were reported to have grasped fisherman's paddles and rubbed against canoes, some individuals have become habituated to human presence (Best and da Silva, 1989). As a consequence, several provisioning locations have been established as tourist attractions in Amazon State (Brazil) by now (Alves et al., 2011a). At Novo Airão City, locals have regularly provisioned botos since 1998 from a floating structure, and there are at least 13 individuals conditioned by food-handouts (Alves et al., 2011b). Before and during this study, there was neither a regular provisioning schedule nor a code of conduct or any other type of regulation. Tourists were able to feed and interact with dolphins during all daylight hours and seven days a week. Botos can be regularly found in the area and remained close to the wooden structure.

## Scope of This Study

From the management perspective, close encounters with cetaceans have to be investigated in order to reduce the likelihood of aggressive and hence dangerous interactions (IFAW et al., 1995; Samuels et al., 2000). It has been proposed to conduct baseline studies to enable a comparison between species and locations, and to initiate research before commercial programs are implemented ( IFAW et al., 1995). From the human perspective, one aspect are behaviors initiated by cetaceans towards them. Such behaviors have received little attention by researchers, thus their structure and function mostly remain unclear. Species-specific behavioral repertoires can be described and catalogued with an ethogram which are required in order to pursue further

behavioral analysis (Lehner, 1987). In the past, affiliative and aggressive/ threatening behaviors towards humans rarely have been qualitatively described (e.g., Connor and Smolker, 1985; Shane et al., 1993; Orams, 1994; 1995; Orams et al. 1996; Mann and Smuts, 1999; Ritter and Brederlau, 1999; Ritter, 2002; Kuczaj and Yeater, 2007), or quantified (Orams et al., 1996; Samuels and Bejder, 2004; Scheer et al., 2004; Smith et al., 2008). Intraspecific behaviors during encounters with food-provisioned and unhabituated cetaceans remained almost unstudied so far (except Alves et al., 2013a). Due to varying research designs, comparability of results is sometimes limited (Mann, 1999). Observational discrepancies cannot be ruled out. As pointed out by Scheer (2010), information on cetacean self-initiated behaviors towards humans is anecdotal and data often was obtained opportunistically. Some studies had a different research focus and reported interactions were rather a by-product. It might be that reports did not describe the whole behavioral repertoire and certain behaviors occurred but were not reported. This study qualifies and quantifies self-initiated behaviors by two cetacean species in two different settings in order to promote a better understanding of the complex interaction with human beings.

## METHODS

In the Canary Islands, inter- and intraspecific behaviors of unhabituated short-finned pilot whales (*Globicephala macrorhynchus*) with human swimmers were examined for the first time during three field seasons in 1996, 2001 and 2012. In a contrasting setting, for the first time inter- and intraspecific behaviors of food-provisioned Amazon botos (*Inia geoffrensis*) were examined during two field seasons in 2008 and 2009. To enable a comparison between seasons, an *á priori* ethogram was applied for each species. Comparability between species is facilitated by using the same sampling methodology.

## In-Water Encounters with Short-Finned Pilot Whales in the Canary Islands

Behavioral observations were made in August-September 1996, June-July 2001 and September 2012. The 6 m motor vessel Caldéron, the 10 m sailing vessel Delfin and the 10.6 m sailing vessel Kalimba (all with an auxiliary diesel engine), respectively, were used as a research platform off the islands of Tenerife and La Gomera in deep waters (>500-2,000 m; see Figure 1).

Only in situations during sea states of 1-2 Beaufort and when no other boats were in sight, and the pilot whales showed synchronized, relatively stationary behavioral activities (milling, resting, travel/resting or socializing), one to three swimmers entered the water. An encounter was defined as a swimming attempt with one or more pilot whale/s within visual range underwater (<20 m) for 3 min or longer (Dudzinski, 1996; 1998). Behavioral observations underwater were made using the *ad libitum* method during focal group follows (Altmann, 1974; Martin and Bateson, 1993). Interspecific behaviors towards human swimmers were defined as behaviors initiated by a pilot whale and directed towards a swimmer within a 20 m range. Herzing (1996), Herzing and Johnson (1997) and Herzing and Elliser (2013) documented mixed-species activities and categorized these as foraging, aggressive (including sexual behaviors) and affiliative. Thus the authors assume that animals produce interspecific behaviors which are similar to those used during intraspecific interactions. Other researchers noted that wild dolphins addressed behaviors towards people during interspecific in-water interactions which they also used during social intraspecific interactions (Frohoff and Packard, 1995; Herzing and White, 1998).

Pryor (1973) noted that captive dolphins responded to humans as if they were dolphins. For this study it is assumed that short-finned pilot whales address behaviors towards human swimmers similar to those they use during (social) interactions with conspecifics.

Intraspecific behaviors were defined as a) ‘affiliative’ if there were no signs of threat or aggression, and b) ‘aggressive/threatening’ if there were indications of threat or aggression and/or put swimmers at health risk. Additionally, intraspecific agonistic behaviors were documented during encounters (Table 1). Inter- and intraspecific behaviors were catalogued and applied *á priori* (adopted from Scheer, 2010) during all three field seasons. During the 2012 field season, group size and composition was documented, too.

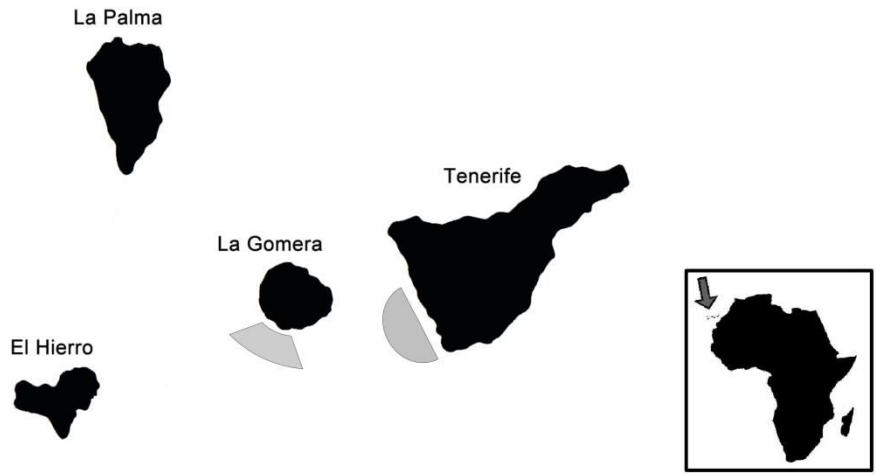


Figure 1. Study sites (grey shaded areas) off La Gomera and Tenerife, Canary Islands.

Only masks, snorkels and fins were used during encounters. A code of conduct (adopted from Scheer et al., 2004) was applied. An encounter was terminated when either the whales left the swimmers by increasing their swimming velocity or changing direction in order to avoid the swimmers, or swimmers lost sight of the animals.

The occurrence of each type of interactive behavior per encounter was measured on a one/zero basis (Martin and Bateson, 1993). Mean values of occurrences were calculated by dividing the number of encounters with/without by the total number of encounters.

Encounter duration was defined as the time span from a swimmer entering the water until swimmers left the water. Observations were recorded immediately after each encounter using dictaphones.

The time from when swimmers entered the water to when the swimmers established visual contact was generally less than one minute. Some behaviors were photo- and/or video-documented using Canon EOS analog and digital SLR cameras in underwater housings, and a handheld GoPro Hero 2 camera, respectively.

## Food-Provisioning Encounters with Amazon Botos

Observations were made May-August 2008 and March-May 2009 from a floating wooden structure located in Novo Airão city (Amazonas State, Brazil)

in the Anavilhanas National Park (Figure 2) located on the southern banks of the Negro River (02°37′13.7″S and 60°56′45.9″W) next to the city of Manaus. This area also has two 4 m wide wooden platforms close to water level, separated by a 3 m submersed tree trunk, where people access the water and interact with botos. Interactions with botos occur at a 7 m long, 11 m wide section at the rear of the floating structure.

Observations were made at the provisioning site at the rear of the floating structure during daylight hours.

**Table 1. Inter- and intraspecific behaviors during encounters of unhabituated short-finned pilot whales with human swimmers off the Canary Islands**

| Behavior | Code | Description |
|---|---|---|
| *Interspecific* | | |
| Belly presentation | BP | The animal swims beneath or next to a swimmer and its ventral side is positioned towards the swimmer. |
| Bubble release | BR | Animal releases bubbles from its blowhole while close (<5 m) to the swimmer. |
| Close approach | CA | Animal closely approaches a human swimmer up to 5 m or less. During this approach, the ventral or the dorsal body part can be orientated towards the water surface and the head is orientated towards the swimmer. During an approach in a ventral position, the animal glides below the swimmer's whole body axis who is lying motionless at the water surface. During an approach in an upright position, the animal turns to the left or right while entering a one body length proximity to the swimmer. |
| Closed eye | CE | Animal has at least one eye closed while being positioned close to a swimmer (< 5 m). |
| Direction accomodation | DA | While at the surface and 5-20 m away from swimmers, animal temporarily changes its swimming direction in accordance to a swimmer's direction. |
| Echolocation | ELO | Animal emits click vocalizations in close proximity to swimmers while directed towards the swimmer/s. |
| Encircling | ENC | Animal swims around swimmer in circles once or several times in a small radius (<5 m). |
| Escorting | ESC | Human swims away from animal/s, e.g., to approach the vessel in order to leave the water. One or more individual/s follow/s the swimmer. |

**Table 1. (Continued)**

| Behavior | Code | Description |
|---|---|---|
| Eye contact | EC | Swimmer and animal have eye contact while in close proximity (< 5 m). |
| Headshake | HS | Animal shakes its head from the left to the right while directed towards the swimmer. |
| Speed accomodation | SA | Animal within 5 to 20 m range and while at the surface does not change its projected swimming track while effectively matching its swimming speed with a swimmer. |
| Whistling/Calling | W/C | Animal/s emit/s whistle/s or call/s while within close proximity (>0.5 – 20 m) to the swimmer/s. |
| *Intraspecific* | | |
| Open mouth | OM | Animal opens its mouth with teeths visible. |
| Rough housing | RH | Adult animal forcefully pushes a calf to prevent it from approaching a swimmer. |

Tourists either stood in upright position outside the water, sat on the platform with legs and feet submerged in the water, or waded and/or swam close to the platform in the water. Behavioral observations were made during focal follows using the *ad libitum* method (Altmann, 1974; Martin and Bateson, 1993). Interspecific behaviors were defined as behaviors initiated by a boto and directed towards a human or shown within 20 m range. Encounters were video-documented using a Panasonic PV-GS90 Mini-DV digital camcorder. Only behaviors that occurred above or near the water surface were documented (Slooten, 1994). The video material was scanned twice: in a first step behaviors were identified and described, and in a second step their relative occurrence was measured for each encounter. Encounter sampling and video recording started when one or more human/s approached the edge of the floating structure and terminated when they moved away from it. The relative occurrence of interactive behaviors per encounter were measured on a one/zero basis (Martin and Bateson, 1993). This enabled a comparison with the data obtained for pilot whales. Mean values of occurrences of behaviors were calculated by dividing the number of encounters with/without occurrences by the total number of encounters.

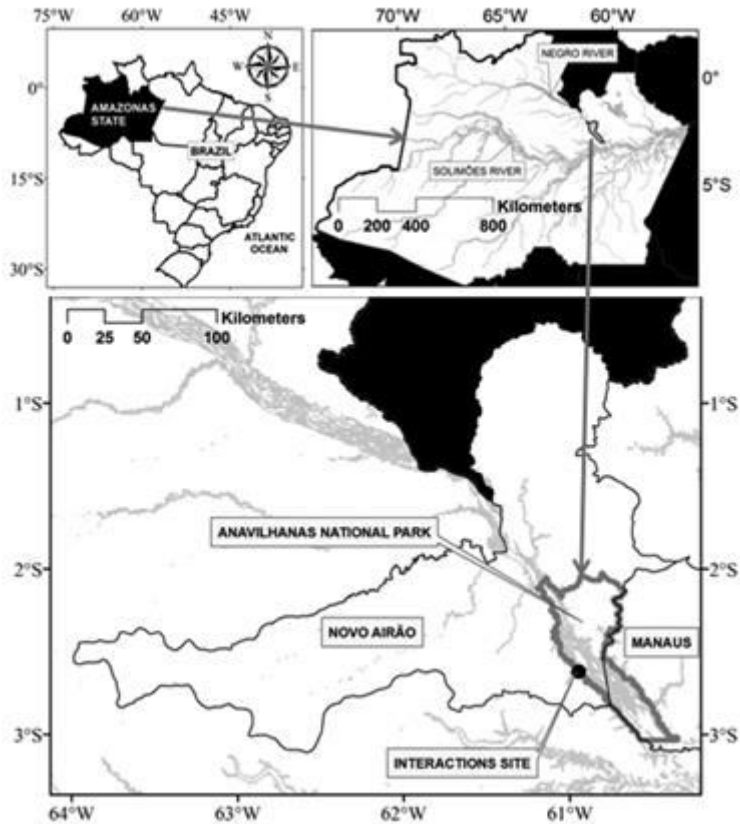


Figure 2. Location maps, upper left: Amazonas State in Brazil; upper right: Anavilhanas National Park in Amazonas State; below: Anavilhanas National Park in the municipalities of Manaus and Novo Airão and the interactions site, located in Novo Airão city.

Food-provisioned wild dolphins were reported to show altered behavioral patterns in contrast to non-provisioned animals (Bryant, 1994; Orams, 2002; Samuels and Bejder, 2004; Finn et al., 2008; Smith et al., 2008; Holmes and Neil, 2012; Alves et al., 2013a). These alterations are presumably the result of positive reinforcements due to food-handouts. Interspecific boto behaviors were categorized as a) 'non-risky' when behaviors were affiliative and did not cause harm or potential harm to humans, and b) 'risky' when behaviors caused physical harm to humans (such as bites, hits or threats) or had the potential to cause physical harm through forceful execution (such as abrupt movements, approaches or accidental contacts). Intraspecific behaviors were defined as

behaviors addressed towards one or more conspecifics in the vicinity. Only intraspecific agonistic behaviors were documented during encounters. Inter- and intraspecific behaviors were categorized (see Table 2) and applied *á priori* (adopted from Scheer, 2010) during both field seasons. 'Eye contact' was not listed in the boto ethogram because the observer was not the person interacting with the animals.

# RESULTS

## Short-Finned Pilot Whales

Short-finned pilot whales were observed for a total of 09 h 06 min during 41 encounters across a time span of 16 years (Table 3).

### *No Response Encounters*

During 12 out of 41 encounters (29%) animals reacted neutrally or avoided swimmers, i.e., no interactive behaviors could be observed although swimmers were able to approach and observe the animals for short periods of time.

**Table 2. Descriptions of inter- and intraspecific behaviors occurring during encounters of food-provisioned Amazon botos with humans in Novo Airão city**

| Behavior | Code | Description |
|---|---|---|
| *Interspecific* | | |
| Accept touching | AT | Animal accepts being touched by a feeder. Contact varies from a simple hand contact to being hugged. |
| Accidental | A | Animal engaged in begging behavior, or competitive behavior with conspecific and accidently hits objects or humans. |
| Avoiding contact | AC | Animal avoids physical contact with humans making a jerky body movement in response to touching or touching attempts. |
| Begging | B | Animal lifts head or whole body (up to the caudal peduncle) vertically out of water and by producing a strong fluke propulsion. The mouth is open to receive a fish-handout (or alternatively following objects such as flip-flops, plastic bags and cameras being held by humans). |

| Behavior | Code | Description |
|---|---|---|
| | | Animal re-entries the water or sustains in that position. Begging might also occur when humans put their hands underwater or close to the water surface while the animal follows that hand while completely or partly submerged. |
| Bite clap | BC | Animal lifts head out of the water and opens and closes its mouth abruptly in very close proximity to the hand of the potential feeder. The animal tries to grab objects with its teeth without success and sometimes bites the hand of the feeder causing serious injuries. |
| Close approach | CA | An animal closely (approximately > 0.5 m-5 m) approaches the floating structure and stays for some minutes. |
| Fish retrieval | FR | A fish is thrown into the water by a human feeder and the animal promptly follows and catches that fish. The animal does not ingest it immediately but swims and surfaces with it for some minutes. |
| Hand feeding | HF | Animal approaches, lifts itself out of the water vertically, grabs fish from the hand of a feeder, holding it with the tip of the rostrum, and then re-entries the water. |
| Initiate contact | IC | Animal initiates single or consecutive gentle physical contact/s with its rostrum in a non-aggressive way. The mouth can be closed or opened. Mostly the animal touches the leg, arm, hand, back or the belly of a human seated at the edge of the floating structure. |
| Open mouth | OM | Animal opens its mouth with teeths visible. |
| Spyhop | SH | Animal lifts its head out of water vertically until the eyes are above water, with a vertical re-entry into the water. Animal has some distance (0.5-2 m) to humans and does not beg for food. |
| *Intraspecific* | | |
| Biting | B | Animal bites a conspecific, sometimes causing visible injuries. This behavior mostly occurs during competitive fish-handouts. |
| Open mouth | OM | Animal opens its mouth with teeths visible. |
| Rostrum hit | ROH | Animal forcefully hits another one with the tip of its rostrum. |
| Supplanting | SP | Animal chases one or more conspecific/s away from the food-provisioning area, or pushes other dolphins in order to come as close as possible to a human feeder. |

**Table 3. One/zero occurrence (x/-) of inter- and intraspecific behaviors of short-finned pilot whales during in-water encounters with human swimmers, Canary Islands. Encounter duration and the variability of different interspecific behaviors occurring during a single encounter are given. Behaviors are listed for each field season (1996, n=24; 2001, n=11; 2012, n=6). See Table 1 for descriptions of behavioral codes**

| | 1996 | | | | | | | | | | | | | | | | | | | | | | | | 2001 | | | | | | | | | | | 2012 | | | | | | total |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 | 20 | 21 | 22 | 23 | 24 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 1 | 2 | 3 | 4 | 5 | 6 | 41 |
| **Duration** (min) | 5 | 5 | 3 | 42 | 13 | 8 | 7 | 14 | 13 | 6 | 8 | 8 | 5 | 5 | 5 | 6 | 5 | 26 | 26 | 7 | 21 | 13 | 16 | 39 | 9 | 23 | 16 | 17 | 6 | 10 | 12 | 11 | 44 | 19 | 11 | 25 | 5 | 9 | 4 | 4 | 15 | 546 |
| **Intersp. Code** *Affiliative* | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| BP | - | - | - | x | x | - | - | - | - | - | - | - | - | - | - | - | - | x | - | - | - | - | - | x | - | - | - | - | - | x | x | - | x | x | x | - | - | - | - | - | - | 9 |
| BR | - | - | - | x | - | - | - | - | - | - | - | - | - | - | - | - | - | x | x | - | - | - | - | x | - | x | - | x | - | x | - | - | x | x | - | x | x | x | - | - | - | 12 |
| CA | - | - | - | x | x | - | - | x | x | - | - | - | - | - | - | - | - | x | x | - | x | - | x | x | - | x | x | - | - | x | x | - | x | x | - | - | - | - | - | - | x | 16 |
| CE | - | - | - | x | x | - | - | - | x | - | - | - | - | - | - | - | - | - | x | - | - | - | - | x | - | - | - | - | - | - | - | x | x | x | - | - | - | - | - | - | - | 8 |
| DA | - | - | - | x | x | - | - | x | x | - | x | x | - | - | - | - | - | x | x | - | x | - | x | x | - | x | - | - | - | x | - | - | x | x | - | - | - | - | - | - | - | 15 |
| EC | - | - | - | x | x | - | - | - | x | - | - | - | - | - | - | - | x | x | x | - | x | - | x | x | - | x | - | x | - | x | x | x | x | x | - | x | - | x | - | x | x | 20 |
| ELO | - | - | - | x | x | - | - | x | x | - | - | - | - | - | - | - | - | x | x | - | x | - | x | x | - | - | x | - | - | x | x | - | x | x | - | - | x | x | - | - | x | 17 |
| ENC | - | - | - | x | x | - | - | x | x | - | - | - | - | - | - | - | - | x | x | - | - | - | - | x | - | - | - | - | - | x | - | - | x | x | - | - | - | - | - | - | - | 10 |
| ESC | - | - | - | x | | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | x | - | - | - | - | - | - | - | 2 |
| SA | x | x | - | x | x | - | - | x | x | - | x | x | - | - | - | - | x | x | x | - | x | - | x | x | - | x | - | - | - | x | - | - | - | x | x | x | - | x | - | - | - | 20 |
| W/C | - | - | - | - | - | - | - | - | x | - | - | - | - | - | - | - | - | - | - | - | - | - | - | x | - | x | - | - | - | - | - | x | - | - | - | - | x | - | x | - | - | 6 |
| ***Aggress./threat.*** | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| HS | - | - | - | x | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | x | - | - | - | - | - | - | - | 2 |
| **Variability** | 1 | 1 | - | 11 | 8 | - | - | 5 | 8 | - | 2 | 2 | - | - | - | - | 2 | 8 | 8 | - | 5 | - | 5 | 10 | - | 6 | 2 | 2 | - | 8 | 4 | 3 | 8 | 11 | 2 | 3 | 3 | 4 | 1 | 1 | 3 | |
| **Intrasp. Code** *Agonistic* | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| OM | - | - | - | - | - | - | - | x | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | x | - | - | - | - | - | - | - | - | - | 2 |
| RH | - | - | - | x | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | 1 |

**Table 4. Total encounter duration and mean one/zero values for inter- and intraspecific behaviors of short-finned pilot whales during encounters with human swimmers per field season. See Table 1 for descriptions of behavioral codes**

| | 1996 | | 2001 | | 2012 | | total |
|---|---|---|---|---|---|---|---|
| Duration (min)<br>N | 306<br>24 | | 178<br>11 | | 62<br>6 | | 546<br>41 |
| Intersp. Code Affiliative | | | | | | | |
| BP | 0.17 | | 0.45 | | 0 | | 0.22 |
| BR | 0.17 | | 0.45 | | 0.50 | | 0.29 |
| CA | 0.38 | | 0.55 | | 0.17 | | 0.39 |
| CE | 0.21 | | 0.27 | | 0 | | 0.20 |
| DA | 0.49 | | 0.36 | | 0 | | 0.37 |
| EC | 0.38 | | 0.64 | | 0.67 | | 0.49 |
| ELO | 0.38 | | 0.45 | | 0.50 | | 0.41 |
| ENC | 0.29 | | 0.27 | | 0 | | 0.24 |
| ESC | 0.04 | | 0.09 | | 0 | | 0.05 |
| SA | 0.58 | | 0.36 | | 0.33 | | 0.49 |
| W/C | 0.04 | | 0.09 | | 0.33 | | 0.15 |
| Aggress./ threat. | | | | | | | |
| HS | 0.04 | | 0.09 | | 0 | | 0.05 |
| Intrasp. Code Agonistic | | | | | | | |
| OM | 0.04 | | 0.09 | | 0 | | 0.05 |
| RH | 0.04 | | 0 | | 0 | | 0.02 |

(Photos: Michael Scheer).

Figure 3. Top: Juvenile short-finned pilot whale closely approaches two human swimmers. Bottom: Adult short-finned pilot whale prevents a calf from approaching a human swimmer (rough housing behavior), Canary Islands.

During these encounters whales did not change their speed or direction and swimmers were able to keep up for some minutes, or avoided swimmers by increasing their swimming speed and/or changing their direction. Thus, the

encounter was terminated after a few minutes. Durations ranged 3-13 min (mean 6.7, SD ± 1.8).

***Interactive Encounters***

During 29 encounters (71%) the animals initiated one or more (mean 4.7, SD ± 2.7) interspecific behaviors. Encounter duration ranged 4-44 min (mean 16.1, SD ± 8.4). During three encounters (7%) the animals showed a single intraspecific agonistic behavior (Table 3).

Eleven different affiliative behaviors were addressed towards human swimmers or were shown in close proximity (Table 3 and Figure 3). Numbers of one/zero occurrences per encounter ranged from 0.05 to 0.49. The most common affiliative behaviors were 'eye contact' and 'speed adaptation' (mean one/zero value: 0.49). 'Escorting' was the least common affiliative behavior (0.05).

The only interspecific aggressive/ threatening behavior observed was 'headshake' (0.02). Though pilot whales sometimes approached swimmers at a relatively high speed, these fast approaches seemed to be affiliative or neutral and were not followed by any aggressive, threatening or avoidance behavior. Short-finned pilot whales showed two intraspecific aggressive behaviors during encounters: 'open mouth' (0.05) and 'rough housing' (0.02; see Figure 3). See Table 4 for mean one/zero values of all documented behaviors.

Group size and composition was documented for six encounters in the 2012 field season. Group size ranged 4-25 animals (mean 14.7, SD ± 9.3). Next to adult animals, four groups contained one or more calves and all six groups contained juvenile animals. During the 1996 and 2001 seasons group size and composition was not documented systematically. However, the presence of juveniles and calves during encounters with human swimmers was common (MS, personal observation).

## Amazon Botos

Botos were observed and video-recorded for a total of 18 h 30 min during 58 encounters and two consecutive field seasons (see Table 5). As food-provisioning permanently took place during daylight hours seven days a week, the predictability to meet botos at the provisioning site was almost 100%.

The measured encounter duration ranged 4-42 min. The animals did not show avoidance of humans but were permanently attracted to them. Humans initiated a variety of potentially dangerous behaviors such as teasing with

objects as plastic shoes or bags, photographic cameras, hugging, touching the dolphin's rostrum, fluke, pectoral fins, as well as shouting and splashing.

Three non-risky behaviors were addressed towards or were shown in close proximity to human feeders (see Table 5). However, non-risky behaviors occurred during 21 (36%) of all encounters. Mean values of one/zero occurrences ranged 0.09-0.49. The most common affiliative behavior was 'spyhop' (0.49). 'Close approach' was the least common affiliative behavior (0.09). Botos showed eight different risky behaviors during all encounters (range 1-8). Mean one/zero occurrences ranged 0.12-1.00. The most common risky behaviors were 'begging' (1.00) being performed during all encounters, 'hand feeding' (0.81; see figure 4) and 'accidental' (0.67). The least frequent was 'open mouth' (0.12). Except for 'avoiding contact', the mean one/zero values for risky behaviors remained constant or increased from 2008 to 2009 (see Table 6). Botos showed four different intraspecific agonistic behaviors: the most common were 'biting' (0.90; see Figure 4) and 'supplanting' (0.60), least frequent was 'rostrum hit' (0.09). 53 encounters (91%) showed at least one agonistic intraspecific behavior (range 1-4). Except 'supplanting', mean one/zero values for agonistic intraspecific behaviors increased from 2008 to 2009. Table 6 shows mean values for inter- and intraspecific behaviors.

## DISCUSSION

### Swim Encounters with Short-Finned Pilot Whales

Samuels et al. (2003) defined unhabituated animals as having infrequent contact with humans and showing disturbance reactions in response. However, they also stated that the distinction from habituated cetaceans was often difficult and described some cetacean species as unhabituated although these have been exposed to commercial swim programs for many years. In that sense, short-finned pilot whales in our study clearly are not habituated to in-water encounters with humans, especially when we consider that this activity has been prohibited in the Canary Islands since 1996. Authorized as well as illegal opportunistic swim encounters do still occur (Heimlich-Boran et al., 1994; MS, personal observation), but these neither were commercial nor common.

**Table 5. One/zero occurrence (x/-) of inter- and intraspecific behaviors of Amazon botos during food-provisioning encounters with humans in Novo Airão city. Sample duration and the variability of different interspecific behaviors occurring during single encounters are given. Behaviors are listed for the 2008 (n=38) and 2009 (n=20) field seasons. See Table 2 for descriptions of behavioral codes**

| | 2008 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | total |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 | 20 | 21 | 22 | 23 | 24 | 25 | 26 | 27 | 28 | 29 | 30 | 31 | 32 | 33 | 34 | 35 | 36 | 37 | 38 | 38 |
| **Duration** (min) | 18 | 8 | 22 | 11 | 8 | 12 | 38 | 4 | 17 | 11 | 15 | 24 | 5 | 41 | 16 | 27 | 7 | 9 | 28 | 33 | 8 | 21 | 5 | 26 | 9 | 22 | 27 | 32 | 49 | 8 | 15 | 24 | 12 | 16 | 36 | 17 | 21 | 13 | 715 |
| **Intersp. Code** ***Non-risky*** | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| CA | - | - | - | - | x | - | - | - | x | - | - | - | - | - | - | - | - | - | - | - | - | x | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | 3 |
| FR | - | - | - | - | - | - | - | - | - | - | - | x | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | x | - | - | - | - | 2 |
| SH | x | - | - | - | x | x | x | - | - | - | - | - | - | x | - | - | - | - | - | - | - | - | - | - | - | - | - | - | x | - | - | - | x | - | x | x | - | - | 9 |
| ***Risky*** | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| AT | x | - | - | - | - | - | x | - | - | - | - | - | - | - | - | - | - | - | x | x | - | - | x | - | - | - | - | x | x | - | - | x | x | x | x | - | x | - | 12 |
| A | x | - | x | x | - | - | x | - | x | - | x | x | x | x | x | x | - | - | x | x | - | - | - | x | - | x | x | x | x | - | - | x | - | x | x | x | - | - | 22 |
| AC | - | - | x | - | - | - | x | - | - | - | - | - | - | - | - | x | - | - | - | - | - | - | - | x | - | - | x | x | - | - | - | - | - | - | x | - | - | - | 7 |
| B | x | x | x | x | x | x | x | x | x | x | x | x | x | x | x | x | x | x | x | x | x | x | x | x | x | x | x | x | x | x | x | x | x | x | x | x | x | x | 38 |
| BC | - | - | - | - | - | - | x | - | - | - | - | - | - | x | - | - | - | - | - | x | - | - | - | - | - | - | x | x | x | - | - | - | - | x | - | - | - | x | 8 |
| HF | x | x | x | x | x | x | x | - | x | x | x | x | - | x | - | x | x | x | x | x | - | x | x | x | x | x | x | x | x | - | - | x | - | - | x | x | x | x | 30 |
| IC | - | - | - | - | - | - | x | - | - | - | - | - | - | x | - | - | - | - | x | x | - | - | - | x | - | - | - | - | x | - | - | - | - | - | - | - | - | - | 6 |
| OM | - | - | - | - | - | - | x | - | - | - | - | - | - | x | - | - | - | - | - | x | - | - | - | - | - | - | - | - | x | - | - | - | - | - | - | - | - | - | 4 |
| **Variability** | 5 | 2 | 4 | 3 | 4 | 3 | 9 | 1 | 4 | 2 | 3 | 4 | 2 | 7 | 2 | 4 | 2 | 2 | 5 | 7 | 1 | 3 | 3 | 5 | 2 | 3 | 5 | 6 | 8 | 1 | 1 | 4 | 3 | 4 | 7 | 4 | 3 | 3 | |
| **Intrasp. Code** ***Agonistic*** | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| B | x | x | x | x | x | x | x | - | x | x | x | x | x | x | x | x | - | x | x | x | x | x | - | x | x | x | x | x | x | - | x | x | x | x | x | x | x | - | 33 |
| OM | - | - | x | - | - | - | x | - | - | - | - | x | - | - | x | x | - | - | x | x | - | - | - | x | - | - | x | x | x | - | - | - | - | - | - | - | - | - | 11 |
| ROH | - | - | - | - | - | - | x | - | - | - | - | - | - | - | - | - | - | - | - | x | - | - | - | - | - | - | - | - | x | - | - | - | - | - | - | - | - | - | 3 |
| SP | - | - | x | x | - | - | x | - | - | - | x | x | - | x | x | x | - | - | x | x | x | x | - | x | - | x | x | x | x | - | - | x | x | x | x | x | x | x | 24 |

**Table 5. (Continued)**

| | 2009 | | | | | | | | | | | | | | | | | | | | total |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | **1** | **2** | **3** | **4** | **5** | **6** | **7** | **8** | **9** | **10** | **11** | **12** | **13** | **14** | **15** | **16** | **17** | **18** | **19** | **20** | **20** |
| **Duration** (min) | 29 | 5 | 20 | 11 | 8 | 6 | 19 | 42 | 17 | 38 | 13 | 27 | 32 | 16 | 7 | 6 | 29 | 25 | 34 | 11 | **395** |
| **Intersp. Code** ***Non-risky*** | | | | | | | | | | | | | | | | | | | | | |
| CA | - | - | - | - | - | - | - | - | - | x | - | - | - | x | - | - | - | - | - | - | **2** |
| FR | - | - | - | - | - | - | - | x | - | - | x | - | x | - | - | - | x | - | - | - | **4** |
| SH | - | - | - | - | - | - | - | x | - | x | - | x | x | - | - | - | x | x | x | - | **7** |
| *Risky* | | | | | | | | | | | | | | | | | | | | | |
| AT | - | - | - | - | x | - | x | - | - | x | - | x | x | - | - | - | x | x | x | x | **9** |
| A | x | - | x | x | x | x | x | x | x | x | x | x | x | x | - | - | x | x | x | x | **17** |
| AC | - | - | - | x | - | x | - | x | - | x | - | - | - | - | - | - | x | - | - | - | **5** |
| B | x | x | x | x | x | x | x | x | x | x | x | x | x | x | x | x | x | x | x | x | **20** |
| BC | - | - | - | - | - | - | - | x | - | x | - | x | x | - | - | - | - | x | x | - | **6** |
| HF | x | x | x | x | x | x | x | x | - | x | x | x | x | x | - | - | x | x | x | x | **17** |
| IC | x | - | - | - | - | - | - | x | - | x | - | x | - | - | x | - | - | - | x | - | **6** |
| OM | - | - | - | - | - | - | - | x | - | x | - | - | x | - | - | - | - | - | - | - | **3** |
| **Variability** | 4 | 2 | 3 | 4 | 4 | 4 | 4 | 9 | 2 | 10 | 4 | 7 | 8 | 4 | 2 | 1 | 7 | 6 | 7 | 4 | |
| **Intrasp. Code** ***Agonistic*** | | | | | | | | | | | | | | | | | | | | | |
| B | x | x | x | x | x | - | x | x | x | x | x | x | x | x | x | x | x | x | x | x | **19** |
| OM | x | - | x | - | - | - | x | x | x | x | - | x | - | x | x | - | x | x | x | - | **12** |
| ROH | - | - | - | - | - | - | - | - | - | x | - | x | - | - | - | - | - | - | - | - | **2** |
| SP | x | - | - | - | - | - | x | x | - | x | - | x | x | x | - | - | x | x | x | x | **11** |

Our results showed that during the majority of encounters (71%), short-finned pilot whales showed affiliative behaviors towards swimmers. No response or avoidance was shown during 29% of encounters. Though swimmers seemed to be tolerated, they can still have a negative impact because animals might still be detracted from naturally occurring behaviors (see Bejder et al., 2009). Hence we have to assume that pilot whales were disturbed by human swimmers to some extent, although their overall reaction was interpreted as “indifferent”.

During 29 in-water encounters with short-finned pilot whales off La Gomera, Ritter (1996) reported a mean encounter duration of 4.3 min (range 1-14 min). It remains unclear why mean encounter duration was nine min less in comparison with this study. However, possible reasons include a) differences in criteria for establishing encounters resulting in a higher 'success rate' during

this study, e.g., encounters initiated during travelling behavior, b) activity of human swimmers within visual contact where the code of conduct in this study might lead to less avoidance reactions, c) the number of swimmers in the water, and d) differences in measuring encounter durations. Pilot whales mostly performed affiliative behaviors towards swimmers during this study while interspecific aggressive/ threatening and intraspecific agonistic behaviors were rare. We did not observe aggressive behaviors directed towards swimmer except two 'headshakes' which can be interpreted as a threat display. Carwardine (1994) observed a jawclap during a swim encounter with this species off Tenerife and Shane et al. (1993) reported an encounter with five adult short-finned pilot whales off Hawaii which was dominated by aggressive and life-threatening behaviors of a male pilot whale.

**Table 6. Encounter durations and mean one/zero values for inter- and intraspecific behaviors of botos during encounters with human feeders per field season. See Table 2 for descriptions of behavioral codes**

| | 2008 | 2009 | total |
|---|---|---|---|
| Duration (min) N | 715<br>38 | 395<br>20 | 1,110<br>58 |
| Intersp. Code Non-risky | | | |
| CA | 0.08 | 0.10 | 0.09 |
| FR | 0.05 | 0.20 | 0.10 |
| | 2008 | 2009 | total |
| SH | 0.24 | 0.35 | 0.49 |
| Risky | | | |
| AT | 0.32 | 0.45 | 0.36 |
| A | 0.58 | 0.85 | 0.67 |
| AC | 0.18 | 0.13 | 0.21 |
| B | 1.00 | 1.00 | 1.00 |
| BC | 0.16 | 0.30 | 0.24 |
| HF | 0.79 | 0.85 | 0.81 |
| IC | 0.16 | 0.30 | 0.21 |
| OM | 0.11 | 0.15 | 0.12 |
| Intrasp. Code Agonistic | | | |
| B | 0.87 | 0.95 | 0.90 |
| OM | 0.29 | 0.60 | 0.40 |
| ROH | 0.08 | 0.10 | 0.09 |
| SP | 0.63 | 0.55 | 0.60 |

(Photos: Mario A. Sartori).

Figure 4. Left: A human hand-feeds a boto which also tolerates being touched. Right: A boto bites a conspecific during hand feeding.

The male tolerated being touched by a swimmer who was then attacked shortly afterwards. The almost complete absence of aggressive behaviors in our study could be explained by the absence of any touching attempts and the general avoidance to actively initiating close contact with the animals. As a consequence, we recommend that swimmers should generally avoid physical contact with cetaceans during in-water encounters. During this study swimmers behaved carefully and swimmer number was low. In order to reduce the likelihood of aggressive interactions, we strongly recommend that a code of conduct similar to the one described in this paper shall be established for in-water encounters with cetaceans.

As pointed out by Samuels et al. (2000), to better understand short-term impacts on the animals, research on a) cetacean behaviors during in-water encounters and responses to swimmers, and b) baseline data before initiation of swim programs is necessary (see also IFAW et al., 1995). This study was an attempt to follow that route. Generally, research is conducted after commercial swim programs have been in place for many years. As a consequence, swim-with cetacean programs were mostly regulated after habituation of the target

species took place. As habituation to swimmers appears not to exist so far, we argue that the general prohibition of swim-with programs should be maintained.

## Food-Provisioning of Botos

Bottlenose dolphins are the only food-provisioned species studied so far during tourist wildlife encounters (Connor and Smolker, 1985; Green and Corkeron, 1991; Orams, 1995; Samuels and Bejder, 2004; Finn et al., 2008). In this study, botos did not show avoidance reactions to human feeders but were permanently attracted to them. Thus, the predictability to encounter botos in the area is almost 100%, which makes this site highly attractive for tourists and operators. During 36% of encounters, botos showed affiliative behaviors. However, risky behaviors occurred during all encounters and botos additionally addressed agonistic behaviors towards conspecifics. Thus, humans are permanently exposed to health risks.

The relationship between provisioned animals and human feeders can change over time (Knight, 2009). First, animals might accept food-handouts from humans while generally remaining passive. When food-handouts become a daily and "secure" food source, animals become habituated and start actively seeking out interactive situations. In this way, more and more risky behaviors such as begging can spread among animals, including an increase of intraspecific aggression, as was shown during this study. Ultimately, this might expose human feeders to increased health risks. Begging was the most common behavior observed for botos during this study, as was the case at provisioning sites with bottlenose dolphins in different areas (Connor and Smolker, 1985; Samuels and Bejder, 2004; Orams, 1995; Finn et al., 2008; Donaldson et al., 2010). The frequency of almost all risky behaviors remained constant or increased from 2008 to 2009. Likewise, agonistic intraspecific behaviors increased between seasons. An increase of risky behaviors during consecutive years was also reported for food-provisioned bottlenose dolphins (Orams et al., 1996). Our results showed that, similar to Knight (2009), botos in the study area are already in the last stage of the development of provisioning wild animals.

Next to risks for humans, botos initiated agonistic behaviors towards conspecifics which may unduly compromise their health. As pointed out by Alves et al. (2013a), provisioned botos established a dominance hierarchy where subordinates are prevented from obtaining food. A mean of 3.92 (±

1.44) botos attended each feeding session (Alves et al., 2013a). Genetic analysis of the sex of botos in the study area revealed that all food-provisioned animals were males (Gravena, 2007). This exclusive aggregation of males at the provisioning site can be considered as an unnatural association, similarly as found for food-provisioned bottlenose dolphins at Monkey Mia, Western Australia (Smith et al., 2008). Botos are considered to have a solitary lifestyle. Animals are rarely seen in cohesive groups of more than three individuals though also larger aggregations may occur (Best and da Silva 1989; 1993; McGuire and Winemiller, 1998; Martin and da Silva, 2004a; Denkinger, 2010; Gomez-Salazar et al., 2012). Females with calves were reported to spatially separate from males (Martin and da Silva, 2004b). Hence, the level of stress posed on provisioned botos might have increased due to the observed level of intraspecific aggression. Cetaceans regularly food-provisioned by humans might become dependent on these food resources. Orams et al. (1996) showed that bottlenose dolphins increased the occurrence of a so-called 'pushy' behavior (a forceful contact behavior) addressed towards human waders when more dolphins are simultaneously present in the feeding area. The increase in pushing behavior could be the result of a decrease of available food items per individual and dolphins responded to this by begging for food more forcefully. Similarly, botos in the study area appear to have become dependent on food supplies by tourists. Regular food provisioning might prevent animals from natural foraging behavior and thus may reduce foraging competencies, especially of younger animals. In 2010, coordinated by the responsible federal environmental agency, the process of regulation and licensing activities conducted with the botos at the Anavilhanas National Park began (Vidal, 2011), and is still being experimentally implemented, evaluated and discussed. Measures include regulation of the number of tourists interacting with the conditioned botos at the same time, duration of interactions, and more restrictive rules concerning touching and feeding. The wooden border of the floating structure is now covered with shock absorbing material in order to protect the botos that constantly hit it. Trash cans are available now and no more food for tourists is being prepared in the kitchen of the floating structure (Vidal, 2011; Alves et al., 2013b). This is meant to decrease frequencies of risky behaviors, to stop the growth of this activity, and to raise awareness among tourists. We encourage the local government to continue regulating this type of human-cetacean interactions so as to avoid detrimental consequences for individuals as well as on population level. Further research is urgently needed to determine differences between provisioned and non-provisioned animals regarding to stress hormone levels, skin diseases, heavy metal levels,

behavioral patterns such as reproductive, social, territorial and calf rearing behaviors, movement patterns, feeding strategies, diet alterations and human-induced injuries.

## Swim-with Programs *versus* Food-Provisioning

Swim-with cetacean programs as well as food-provisioning of wild cetaceans have been described as the most intrusive market segments of whale watching (Garrod and Fenell, 2004). A global review of 58 whale watching codes of conduct found that swim-with activities and food-provisioning was prohibited in 34.5% and 31.0 %, respectively (Garrod and Fenell, 2004). Swim and provisioning programs have often been banned following a precautionary approach. Habituation and attraction have been reported as the main ways how wild animals can be made available for humans (Knight, 2009). Food provisioning induces the animals tolerating things they naturally would not accept and hence provokes negative impacts such as described above. Although tourists will experience behaviors likely generating a high level of satisfaction, this market segment is clearly invasive to dolphin populations. At the same time, human feeders are exposed to significant health risks. Food-provisioning should only be conducted where strict management with effective control mechanisms and long-term monitoring is in place (see Smith et al., 2008). On the other hand, it can generate significant social, economic and environmental benefits (Orams, 2002). Botos are sometimes perceived negatively by local inhabitants and are the target of negative attitudes (Alves et al., 2012). We believe that, by benefiting from the economic value of botos, locals can change their perceptions regarding this species. Despite that, tourist activities should generally avoid providing food for the animals wherever possible (Alves et al., 2013b).

The quality and quantity of interactive behaviors towards humans are essential for customer satisfaction. Eye-contact, touch, food-provisioning, close proximity, and the perception of the dolphin's sonar represent key factors in this context (Muloin, 1998; DeMares, 2000; Curtin, 2006; Wiener, 2013). It is reasonable to assume that customers prefer to be exposed to affiliative behaviors and would neither feel comfortable to experience aggressive/ threatening or risky behaviors nor watching agonistic behaviors between the animals they provide food with. Managers are confronted with a general paradox: customers want to be as close as possible while environmentalists want to establish regulations preventing customers from approaching too close

(Knight, 2009; Wiener, 2013). This study showed that human feeders experience four of five key behaviors (except being echolocated). Though 'eye contact' was not covered during observations, it presumably is a common behavior during encounters (see e.g., Figure 4). Consequently, these encounters are very attractive to tourists. However, the majority of boto interspecific behaviors were risky and they produced a lot of intraspecific agonistic behaviors while being in close proximity to humans. In contrast, short-finned pilot whales showed avoidance behaviors to some extent and the predictability to closely encounter animals underwater was low. However, they initiated a low level of interspecific aggressive/ threatening and intraspecific agonistic behaviors and the majority of interspecific behaviors were affiliative in nature. Swimmers might experience three of the five key behaviors (eye contact, close proximity, echolocation). Comparing “customer quality” between both settings, swim programs seem to be the more preferable form to closely encounter cetaceans in the wild. However, it remains unclear how unhabituated animals would react when being exposed to repeated swim activities. As shown for bottlenose dolphins, animals increase avoidance due to long-term exposure to swim-with-dolphin tourism (Constantine, 2001), and this might happen with short-finned pilot whales as well. Thus, we recommend that close interactions between humans and cetaceans -be it feeding or swimming- should be generally discouraged. Where such interactions with tourists take place, they have to be regulated ideally from the very beginning. Our results can be used as referential data before initiating new interactive programs.

## ACKNOWLEDGMENT

Field studies on short-finned pilot whales were authorized by the Canary Islands Government (Viceconsejería de Medio Ambiente and Ministerio de Agricultura, Alimentación y Medio Ambiente). The 2012 field study was financially supported by the Heinz Sielmann Foundation (Germany) and the foundation 30 Millions d'Amis (France). Thanks to Tomás de Azcárate y Bang, Erika Urquiola Pascal, Juan Luis Rodriguez Luengo, Rogelio Herrera, Pablo Saavedra Inajara, Javier Pantoja Trigueros, Mónica Moraleda Altares, Manuel Arechavaleta and Reiner Seifarth (TUI Deutschland GmbH) for administrative and logistic support in the Canary Islands. Thanks to Itay Peter Behr, Bianka Hofmann, Manuel Louro Agraso, Juan Ramon Padilla Sanz, Carlos Goméz, Emilio Sanchez Amador, Pedro Diaz Lorenzo, Roland Gockel,

Heinz Cadera, Ricarda Fiebig, Volker Böhlke and Samyo Hoheisel for their essential support during field work and data sampling on pilot whales.

Boto research was financially supported by the Duke University, Oak Foundation, Cetacean Society International and Instituto Aqualie. Thanks to Programa de Pós-Graduação em Meio Ambiente from the Universidade do Estado do Rio de Janeiro, ICMBio staff from the Anavilhanas National Park, Marilda Medeiros, the staff from Restaurante Boto Cor-de-Rosa, Marcelo Derzi Vidal, Núbia Santos Constâncio, David Janiger, Robson Carvalho, Fernanda Romagnoli, and Mario Angelo Sartori. During this study, L.C.P.S. Alves was supported by Coordenação de Aperfeiçoamento de Pessoal de Nível Superior (CAPES).

## REFERENCES

Aguilar Soto, N., Johnson, M. P., Madsen, P. T., Diaz, F., Dominguez, I., Brito, A., and Tyack, P. (2008). Cheetahs of the deep sea: deep foraging sprints in short-finned pilot whales off Tenerife (Canary Islands). *Journal of Animal Ecology*, 77, 936-947.

Aliaga-Rossel, E. (2002). Distribution and abundance of the pink river dolphin, bufeo (*Inia geoffrensis*) in the Tijamuchi River, Beni-Bolivia. *Aquatic Mammals*, 28, 312–323.

Altmann, J. (1974). Observational study of behavior: sampling methods. *Behaviour,* 49, 227-265.

Alves, L. C. Pinto de Sá, Zappes, C. A., and Andriolo, A. (2012). Conflicts between river dolphins (*Cetacea*: Odontoceti) and fisheries in the Central Amazon: a path toward tragedy? *Zoologia*, 29, 420-429.

Alves, L. C. Pinto de Sá, Andriolo, A., Orams, M. B., and Azevedo, A. F. (2013a). Resource defence and dominance hierarchy in the boto (*Inia geoffrensis*) during a provisioning program. *Acta Ethologica,* 16, 9-19.

Alves, L. C. Pinto de Sá, Machado, C. J. S., Vilani, R. M., Vidal, M. D., Andriolo, A. (2013b). As atividades turísticas baseadas na alimentação artificial de botos-da-Amazônia (*Inia geoffrensis*) e a legislação brasileira. *Desenvolvimento e Meio Ambiente*, 28, 89-106.

Alves, L. C. Pinto de Sá, Sartori, M. A., Andriolo, A., Orams, M. B., and Azevedo, A. F. (2011a). Alimentação artificial de botos-da-Amazônia (*Inia geoffrensis* de Blainville 1817) como atração turística e sua dispersão pela Amazônia Brasileira. *Revista Brasileira de Zoociências*, 13, 253-262.

Alves, L. C. Pinto de Sá, Andriolo, A., Orams, M. B., and Azevedo, A. F. (2011b). The growth of "botos feeding tourism", a new tourism industry based on the boto (Amazon river dolphin) *Inia geoffrensis* in the Amazonas State, Brazil. *Sitientibus Série Ciências Biológicas*, 11, 8–15.

Alves, F., Quérouil, S., Dinis, A., Nicolau, C., Ribeiro, C., Freitas, L., Kaufman, M., and Fortuna, C. (2013c). Population structure of short-finned pilot whales in the oceanic archipelago of Madeira based on photo-identification and genetic analyses: implications for conservation. *Aquatic Conservation: Marine and Freshwater Ecosystems,* 23, 758-776.

Bejder, L., Samuels, A., Whitehead, H., Finn, H., and Allen, S. (2009). Impact assessment research: use and misuse of habituation, sensitisation and tolerance in describing wildlife responses to anthropogenic stimuli. *Marine Ecology Progress Series*, 395, 177-185.

Best, R. C. and da Silva, V. M. F. (1989). Amazon River dolphin, boto, *Inia geoffrensis* (de Blainville, 1817). In S. H. Ridgway, and Harrison, R. J. (Eds), Handbook of marine mammals (pp. 1-23). London, UK: Academic.

Best, R.C. and da Silva, V.M.F. (1993). *Inia geoffrensis*. *Mammalian Species*, 426, 1-8.

Bloom, P. (1991). The diary of a wild, solitary, bottlenose dolphin (*Tursiops truncatus*), resident off Amble on the north Northumberland coast of England, from April 1987 to January 1991. *Aquatic Mammals*, 17, 103-119.

Bryant, L. (1994). Report to congress on results of feeding wild dolphins: 1989–1994. Silver Spring, U.S.A. National Marine Fisheries Service.

Carrillo, M., Tejedor, M., Pena, A., and González. G. (2002). Estudios aplicados a la conservacion de las poblaciones cetaceos. Santa Cruz de Tenerife, Spain. Provincia de Santa Cruz de Tenerife. Direccion General de Política Ambiental. Gobierno de Canarias.

Carillo, M., Pérez-Vallazza, C., and Álvarez-Vázquez, R. (2010). Cetacean diversity and distribution off Tenerife (Canary Islands). *Marine Biodiversity Records*, 3, e97.

Carwardine, M. (1994). The snorkel party: swimming with pilot whales in the Canary Islands. In M. Carwardine (Ed.), On the trail of the whale (pp. 76-87). Surrey, England: Thunder Bay Publishing Co.

Connor, R. C and Smolker, R. S. (1985). Habituated dolphins (*Tursiops* sp.) in western Australia. *Journal of Mammalogy*, 66, 398-400.

Constantine, R. (2001). Increased avoidance of swimmers by wild bottlenose dolphins (*Tursiops truncatus*) due to long-term exposure to swim-with-dolphin tourism. *Marine Mammal Science*, 17, 689-702.

Cunningham-Smith, P., Colbert, D. E., Wells, R. S., and Speakman, T. (2006). Evaluation of human interactions with a provisioned wild bottlenose dolphin (*Tursiops truncatus*) near Sarasota Bay, Florida, and efforts to curtail the interactions. *Aquatic Mammals*, 32, 346-356.

Curtin, S. (2006). Swimming with dolphins: A phenomenological exploration of tourist recollections. *International Journal of Tourism Research*, 8, 301-15.

DeMares, R. (2000). Human peak experiences triggered by encounters with cetaceans. *Anthrozoos*, 13, 89-103.

Denkinger, J. (2010). Population density, abundance estimates, habitat preference and social structure of Amazon river dolphins (*Inia geoffrensis*) in the Cuyabeno Reserve, Ecuador. *Avances*, 2, 91-97.

Donaldson, R., Finn, H. and Calver, M. (2010). Illegal feeding increases risk of boat-strike and entanglement in bottlenose dolphins in Perth, Western Australia. *Pacific Conservation Biology*, 16, 157-161.

Dudzinski, K. M. (1996). Communication and behavior in the Atlantic spotted dolphins (*Stenella frontalis*): relationships between vocal and behavioral activities. PhD Dissertation. Texas, U.S.A. Texas A&M University.

Dudzinski, K. M. (1998). Contact behavior and signal exchange in Atlantic spotted dolphins (*Stenella frontalis*). *Aquatic Mammals*, 24, 129-142.

Dudzinski, K. M., Frohoff, T. G., and Crane, N. L. (1995). Behavior of a lone female bottlenose dolphin (*Tursiops truncatus*) with humans off the coast of Belize. *Aquatic Mammals*, 21, 149-153.

Elejabeitia, C. and Urquiola, E. (2009). Whale watching in the Canary Islands. Report to the International Whaling Commission (IWC/61/CC10). Cambridge, United Kingdom. International Whaling Commision.

Finn, H., Donaldson, R., and Calver, M. (2008). Feeding flipper: a case study of a human-dolphin interaction. *Pacific Conservation Biology*, 14, 215-225.

Foroughirad, V. and Mann, J. (2013). Long-term impacts of fish provisioning on the behavior and survival of wild bottlenose dolphins. *Biological Conservation*, 160, 242–249.

Frohoff, T. G., Kinsman, C., Rose, N., and Sheppard, K. (2000). Preliminary study of the behavior and management of solitary, sociable white whales (*Delphinapterus leucas*) in Eastern Canada. Report to the International Whaling Commission ( SC/52/WW3). Cambridge, United Kingdom. International Whaling Commission.

Frohoff, T. G. and Packard, J. M. (1995). Human interactions with free-ranging and captive bottlenose dolphins. *Anthrozoos*, 8, 44-53.

Garrod, B. and Fennell, D. A. (2004). An analysis of whalewatching codes of conduct. *Annals of Tourism Research*, 31, 334-352.

Gobierno des Canarias (1995). Decree 320/1995. *Boletín Oficial de Canarias (BOC),* 148.

Gobierno des Canarias (1995). Decree 178/2000. *Boletín Oficial de Canarias (BOC),* 133.

Gomez-Salazar, C., Trujillo, F., Portocarrero-Aya, M., and Whitehead, H. (2012). Population, density estimates and conservation of river dolphins (*Inia* and *Sotalia*) in the Amazon and Orinoco river basins. *Marine Mammal Science*, 28, 124-153.

Gravena, W. (2007). Isolamento e caracterização de marcadores microssatélites para análises de parentesco no boto-vermelho (*Inia geoffrensis*). Masters Thesis. Manaus, Brazil. Instituto Nacional de Pesquisas da Amazônia and Universidade Federal da Amazônia.

Green, A. and Corkeron, P. J. (1991). An attempt to establish a feeding station for bottlenose dolphins (*Tursiops truncatus*) on Moreton Island, Queensland, Australia. *Aquatic Mammals*, 17, 125-129.

Heimlich-Boran, J. L. (1993). Social organisation of the short-finned pilot whale, *Globicephala macrorhynchus*, with special reference to the comparative social ecology of delphinids. PhD Dissertation. Cambridge, England. University of Cambridge.

Heimlich-Boran, J. L., Heimlich-Boran, S. L., Montero, R., and Martín, V. (1994). An overview of whale-watching in the Canary Islands. *European Research on Cetaceans*, 8, 37-39.

Herzing, D. L. (1996). Vocalizations and associated underwater behavior of free-ranging Atlantic spotted dolphins, *Stenella frontalis* and bottlenose dolphins, *Tursiops truncatus*. *Aquatic Mammals*, 22, 61-79.

Herzing, D. L. and Elliser, C. R. (2013). Directionality of sexual activities during mixed-species encounters between Atlantic spotted dolphins (*Stenella frontalis*) and bottlenose dolphins (*Tursiops truncatus*). *International Journal of Comparative Psychology*, 26, 124-134.

Herzing, D. L. and Johnson, C. M. (1997). Interspecific interactions between Atlantic spotted dolphins (*Stenella frontalis*) and bottlenose dolphins (*Tursiops truncatus*) in the Bahamas, 1985-1995. *Aquatic Mammals*, 23, 85-99.

Herzing, D. L. and White, T. I. (1998). Dolphins and the question of personhood. *Etica and Animali*, 9, 64-84.

Holmes, B. J. and Neil, D. T. (2012). „Gift giving“ by wild bottlenose dolphins (*Tursiops* sp.) to humans at a wild dolphin provisioning program, Tangalooma, Australia. *Anthrozoos*, 4, 397-413.

Hoyt, E. (1995). The worldwide value and extent of whale watching: 1995. Bath, United Kingdom. Whale and Dolphin Conservation Society.

Hoyt, E. (2001). Whale watching 2001: worldwide tourism numbers, expenditures, and expanding socioeconomic benefits. Crowborough, United Kingdom. International Fund for Animal Welfare.

IFAW, Tethys Research Institute, and Europe Conservation (1995). Report of the workshop on the scientific aspects of managing whale watching. Montecastello di Vibio, Italy. IFAW, Tethys Research Institute, and Europe Conservation.

Kasuya, T. and Marsh, H. (1984). Life history and reproductive biology of the short-finned pilot whale, *Globicephala macrorhynchus*, off the Pacific coast of Japan. Report to the International Whaling Commission, (Special Issue 6, pp. 259-268). Cambridge, United Kingdom: International Whaling Commission.

Knight, J. (2009). Making wildlife viewable: habituation and attraction. *Society & Animals*, 17, 167-184.

Kuczaj, S. A. II and Yeater, D. (2007). Observations of rough-toothed dolphins (*Steno bredanensis*) off the coast of Utila, Honduras. *Journal of the Marine Biological Associations of the United Kingdom*, 87, 141-148.

Lehner, P. N. (1987). Design and execution of animal behavior research: an overview. *Journal of Animal Science*, 65, 1213-1219.

Lockyer, C. and Morris, R. J. (1986). The history and behaviour of a wild, sociable dolphin (*Tursiops truncatus*) off the north coast of Cornwall. *Aquatic Mammals*, 12, 3-16.

Mann, J. (1999). Behavioral sampling methods for cetaceans: a review and critique. *Marine Mammal Science*, 15, 102-122.

Mann, J. and Sargeant, B. (2003). Like mother, like calf: the ontogeny of foraging traditions in wild Indian ocean bottlenose dolphins (*Tursiops* sp.). In D. M. Fragaszy and S. Perry (Eds.), The biology of traditions: models and evidence (pp. 236-266). Cambridge, U.S.A.: Cambridge University Press.

Mann, J. and Smuts, B. (1999). Behavioral development in wild bottlenose dolphin newborns (*Tursiops* sp.). *Behaviour*, 136, 529-566.

Mann, J., Connor, R. C., Barre, L. M., and Heithaus, M. R. (2000) Female reproductive success in bottlenose dolphins (*Tursiops* sp.): life history,

habitat, provisioning, and group-size effects. *Behavioral Ecology*, 11, 210-219.

Mann, J. and Kemps, C. (2003). The effects of provisioning on maternal care in wild bottlenose dolphins, Shark Bay, Australia. In N. Gales, M. Hindell, and R. Kirkwood (Eds.), Marine mammals: fisheries, tourism and management issues (pp. 292-305). Collingwood, Australia: CSIRO Publishing.

Marsh, H. and Kasuya, T. (1984). Changes in the ovaries of the short-finned pilot whale, *Globicephala macrorhynchus*, with age and reproductive activity. Report of the International Whaling Commission, (Special Issue 6, pp. 311-335). Cambridge, United Kingdom: International Whaling Commission.

Martin, P. and Bateson, P. (1993). Measuring behaviour: an introductory guide. Cambridge, England. Cambridge University Press.

Martin, T. A. and da Silva, V. M. F. (2004a) Number, seasonal movements, and residency characteristics of river dolphins in an Amazonian floodplain lake system. *Canadian Journal of Zoology*, 82, 1307–1315.

Martin, A. R. and da Silva, V. M. F. (2004b). River dolphins and flooded forest: Seasonal habitat use and sexual segregation of botos (*Inia geoffrensis*) in an extreme cetacean environment. *Journal of Zoology*, 263, 295–305.

McGuire, T. L. and Winemiller, K. O. (1998). Occurrence patterns, habitat associations, and potential prey of the river dolphin, *Inia geoffrensis*, in the Cinaruco River, Venezuela. *Biotropica*, 30, 625-638.

Montero, R. and Arechavaleta, M. (1996). Distribution patterns, relationships between depth, sea surface temperature and habitat use of short-finned pilot whales south-west of Tenerife. *European Research on Cetaceans*, 10, 193-198.

Muloin, S. (1998). Wildlife tourism: the psychological benefits of whale watching. *Pacific Tourism Review*, 2, 199–213.

O'Connor, S., Campbell, R., Cortez, H., and Knowles, T. (2009). Whale Watching Worldwide: tourism numbers, expenditures and expanding economic benefits. Yarmouth MA, U.S.A. International Fund for Animal Welfare.

Orams, M. B. (1994). Tourism and marine wildlife: the wild dolphin of Tangalooma, Australia: a case report. *Anthrozoos*, 7, 195-201.

Orams, M. B. (1995). Development and management of a feeding program for wild bottlenose dolphins at Tangalooma, Australia. *Aquatic Mammals*, 21, 137-147.

Orams, M. B. (2002). Feeding wildlife as a tourism attraction: issues and impacts. *Tourism Management*, 23, 281–293.

Orams, M. B., Hill, G. J., and Baglioni, A. J. (1996). „Pushy“ behavior in a wild dolphin feeding program at Tangalooma, Australia. *Marine Mammal Science*, 12, 107-117.

Pérez-Vallazza, C., Álvarez-Vázqueza, R., Cardonaa, L., Pintadoa, C., and Hernández-Brito, J. (2008). Cetacean diversity at the west coast of La Palma Island (Canary Islands). *Journal of the Marine Biological Association of the United Kingdom*, 88, 1289-1296.

Politi, E., Notarbartolo di Sciara, G., and Mazzanti, C. (1997). Cetaceans found in the waters surrounding Lanzarote, Canary Islands. *European Research on Cetaceans*, 10, 107-112.

Pryor, K. (1973). Behavior and learning in porpoises and whales. *Naturwissenschaften*, 60, 412-420.

Ritter, F. (1996). Abundance, distribution and behaviour of cetaceans off La Gomera (Canary Islands) and their interactions with boats and swimmers. Diploma Thesis. Bremen, Germany. University of Bremen.

Ritter, F. (2002). Behavioural observations of rough-toothed dolphins (*Steno bredanensis*) off La Gomera, Canary Islands (1995-2000), with special reference to their interactions with humans. *Aquatic Mammals*, 28, 46-59.

Ritter, F. (2003). Interactions of cetaceans with whale watching boats – implications for the management of whale watching tourism. Berlin, Germany. M.E.E.R. e.V.

Ritter, F. (2010). Quantification of ferry traffic in the Canary Islands (Spain) and its implications for collisions with cetaceans, *Journal of Cetacean Research and Management*, 11, 139-146.

Ritter, F., and Brederlau, B. (1999). Behavioural observation of dense beaked whales (*Mesoplodon densirostris*) off La Gomera, Canary Islands (1995-1997). *Aquatic Mammals*, 25, 55-61.

Rose, N. A., Weinrich, M., Iniguez, M. A., and Finkle, M. (2005). Swim-with-whale tourism – an updated review of commercial operations. Report to the International Whaling Commission ( SC/57/WW6). Cambridge, United Kingdom. International Whaling Commission.

Samuels, A. and Bejder, L. (2004). Chronic interaction between humans and free-ranging bottlenose dolphins near Panama City Beach, Florida, USA. *Journal of Cetacean Research and Management*, 6, 69-77.

Samuels, A., Bejder, L., and Heinrich, S. (2000). *A review of the literature pertaining to swimming with wild dolphins*. Silver Spring, MD. Marine Mammal Commission.

Samuels, A., Bejder, L., Constantine, R., and Heinrich, S. (2003). Swimming with wild cetaceans in the Southern Hemisphere. In N. Gales, M. Hindell, and R. Kirkwood (Eds.), Marine mammals: fisheries, tourism and management (pp. 265-291). Collingwood, Australia: CSIRO Publishing.

Santos, M. C. de O. (1997). Lone sociable bottlenose dolphin in Brazil: human fatality and management. *Marine Mammal Science*, 13, 355-356.

Scheer, M. (2010). Review of self-initiated behaviors of free-ranging cetaceans directed towards human swimmers and waders during open water encounters. *Interaction Studies*, 11, 442–466.

Scheer, M., Hofmann, B., and Behr, I. P. (2004). Ethogram of selected behaviors initiated by free-ranging short-finned pilot whales (*Globicephala macrorhynchus*) and directed to human swimmers during open water encounters. *Anthrozoos*, 17, 244-257.

Shane, S. H., Tepley, L., and Costello, L. (1993). Life-threatenting contact between a woman and a pilot whale captured on film. *Marine Mammal Science*, 9, 331 - 336.

Slooten, E. (1994). Behavior of Hector's dolphin: classifying behavior by sequence analysis. *Journal of Mammalogy*, 75, 956-964.

Smith, H., Samuels, A., and Bradley, S. (2008). Reducing risky interactions between tourists and free-ranging dolphins (*Tursiops* sp.) in an artificial feeding program at Monkey Mia, Western Australia. *Tourism Management*, 29, 994-1001.

Vidal, O., Barlow, J., Hurtado, L., Torre, J., Cendon, P., and Ojeda, Z. (1997). Distribution and abundance of the Amazon river dolphin (*Inia geoffrensis*) and the tucuxi (*Sotalia fluviatilis*) in the upper Amazon River. *Marine Mammal Science*, 13, 427–445.

Vidal, M. D. (2011). Botos e turistas em risco. *Ciência Hoje*, 47, 73-75.

Wiener, C. (2013). Friendly or dangerous waters? Understanding dolphin swim tourism encounters. *Annals of Leisure Research*, 16, 55-71.