

## Interspecies interactions between Atlantic spotted dolphins, *Stenella frontalis* and bottlenose dolphins, *Tursiops truncatus*, on Great Bahama Bank, Bahamas

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### Abstract

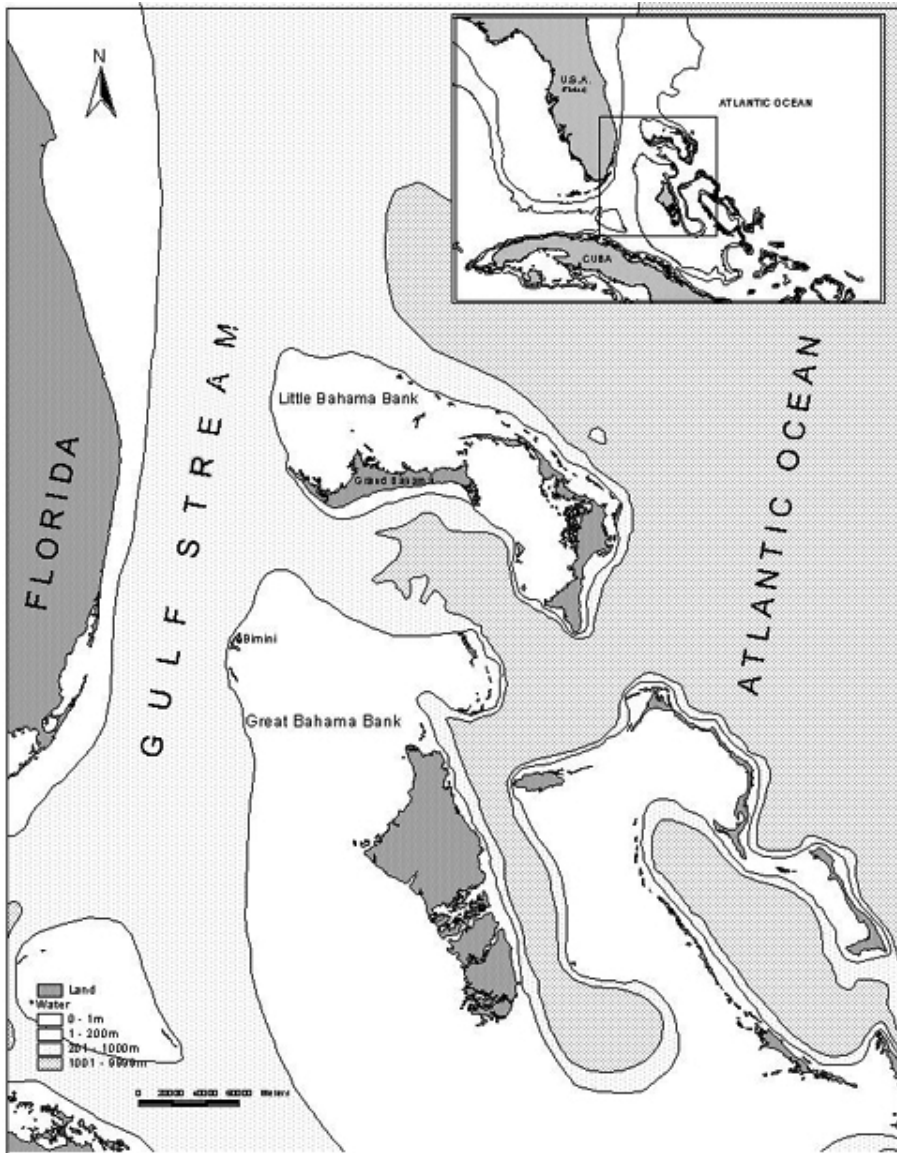
Atlantic spotted dolphins (*Stenella frontalis*) and bottlenose dolphins (*Tursiops truncatus*) inhabit the western edge of Great Bahama Bank (GBB), Bahamas. In 1998, a photo-identification and behaviour project was initiated in this area. Over three consecutive winters (64 days) dolphins were observed on GBB. Interspecific behaviours are described over 6 years (1998 & 2003). Habitat of GBB is comparable to an adjacent study site on Little Bahama Bank (LBB) that has been under observation since 1985. To date, no photo-identification overlap has been documented between the two study sites (62 identified spotted dolphins on GBB and 220 identified spotted dolphins on LBB). Size of single species groups (GBB=9.1 ± SD 6.8/LBB=9.3 ± SD 8.0) and average duration of encounters (GBB=28 min/LBB=31 min) were similar. Mothers with calves on GBB were mottled in coloration, similar to first parturition coloration reported for LBB spotted dolphins. The majority of behavioural activities documented for LBB spotted dolphins during summer months were observed on GBB during winter months, including foraging in the sand, travelling, resting, playing, disciplining, courtship/mating, and intra and interspecific aggression with bottlenose dolphins. In addition, in 2002 male spotted dolphins were observed in dominant mounting behaviour of male bottlenose dolphins (reverse roles to LBB). In the winter of 2003, a hybrid male calf was repeatedly observed with a lactating adult female spotted dolphin. The offshore form of the bottlenose dolphin was observed on GBB, engaging in aggressive activity with resident spotted dolphins. Ongoing research in these adjacent study sites includes genetic sampling and habitat analysis to provide insight into the comparative natures of these two adjacent sandbanks and delphinid species.

Key words: Atlantic spotted dolphin, bottlenose dolphin, interspecies interaction, hybrid, *Tursiops Stenella frontalis*.

### Introduction

The Bimini Islands are located on the western edge of Great Bahama Bank (GBB) on the westernmost edge of the Bahamas. Bimini (25.45.00°N/79.20.00°W) is located approximately 90 km east of Miami, Florida, on the shallow sandbanks of GBB next to the deeper waters of the Gulf Stream (Fig. 1). Two species of delphinids, the Atlantic spotted dolphin (*Stenella frontalis*) and the coastal ecotype of bottlenose dolphin (*Tursiops truncatus*) inhabit and are residents of these shallow waters. The larger and differently proportioned offshore ecotype of *T. truncatus* also inhabits these offshore waters in the adjacent Gulf Stream, but are only rarely observed on the shallow sandbanks. Atlantic spotted dolphins on Little Bahama Bank (LBB) have well documented coloration phases correlated with age class including two-tones (calves) 1–3 years, speckled (juveniles (4–8 years), mottled (young adults) 9–15 years, and fused (old adults) 15 years (Herzing, 1997). Many aspects of the lives of these sympatric species have been documented north of GBB, across deep water, on LBB, including life history and age class parameters (Herzing, 1997), behaviour and sounds (Herzing, 1996), interspecific interactions (Herzing & Johnson, 1997), long-term associations of females (Herzing & Brunnick, 1997), coefficients of association and social structure (Brunnick, 2000), developmental social behaviour (Moewe, 2001), mother-calf behaviour (Bayer, 2001), bottlenose dolphin distribution (Rossbach & Herzing, 1999) and feeding behaviour (Rossbach & Herzing, 1997).

This paper describes interspecific interactions between Atlantic spotted dolphins and both the coastal and offshore ecotype of bottlenose dolphins off the Bimini Islands, on GBB, from 1998–2003.



**Figure 1.** Study site of Great Bahama Bank (GBB) and Little Bahama Bank (LBB) separated by deep water. Both study sites are the NW edge of a shallow sandbank in the Bahamas.

General comparisons of group size, age-class, gender structure, and behavioural observations between GBB and LBB are described to give a larger context to the interspecific interactions between these two species.

#### Materials and Methods

A total of 64 days were spent at sea working around the Bimini Islands, (26–31 August 1998, 21

January–2 February 1999, 23 January–17 February 2000, 2–15 February 2001). Additional interspecies behaviours are described for 4 days between 10 February–20 February 2002 and 4 days between 8 February–15 February 2003. Bimini lies approximately 80 km from the southernmost, and 152 km from the northernmost study site on LBB.

A 20-m power catamaran was used for surveys. When dolphins were sighted, underwater still photographs (Nikonos V) and underwater video with

**Table 1.** Comparative encounter information for field time on LBB (1985–2001) and GBB (1998–2001) for Atlantic spotted dolphin and bottlenose dolphins.

Field effort for combined all dolphin observations	LBB (1985–2001)	GBB (1998–2001)
Days at sea	1492	64
Days with encounters	914	21
Total number of encounters	1897	36
Encounters per day	2	1.6
Hours in water	964	18.6
Average duration	31 min	28 min
Average group size	9.3 ± 8.0	9.1 ± 6.8

sound (Sony PC110, Yashica KXV 70, Labcore 76 hydrophone) were obtained for identification, age class, behaviour, and gender of individual dolphins. Age classes, behavioural categories, and behavioural observation methods were based on those described for spotted dolphins (Herzing, 1996; 1997). GPS location and environmental information also were logged during each encounter.

## Results

### *Species identification and group size*

On GBB dolphins were encountered 58 times over 64 days and observed under water 36 times, for an average of 28 min per sighting (Table 1). The average group size for spotted dolphin groups on GBB (9.1 SD 6.8) was similar to that on LBB (9.3 SD 8.0). The numbers of single vs. mixed-species encounters in the two different locations, and behaviours observed is listed in Table 2. In addition, in 2002, one out of four encounters was mixed-species, and three were single-species spotted dolphins. In 2003, two out of seven encounters were mixed-species, one was single-species bottlenose

**Table 3.** Numbers of age classes and gender of *S. frontalis* on GBB. Parentheses indicate numbers of females with calves.

Age Class	Males	Females	Unknown	Total
Two-tone (calves)	1	4	6	11
Speckled (juveniles)	3	11	1	15
Mottled (young adults)	2	4 (3)	3	9
Fused (old adults)	13	8 (7)	6	27
Total	19	27	16	62

dolphins, and four were single-species spotted dolphin, including two encounters with a spotted female and her hybrid male calf.

### *Identification and sexing of individual spotted dolphins*

At the end of 2001, there were 62 individually identified spotted dolphins on GBB, many of which have been re-sighted over the years. The community can be broken down into the following: 19 males, 27 females, and 16 of unknown sex (Table 3). Age classes consisted of 27 adults (fused), nine young adults (mottled), 15 juveniles (speckled) and 11 calves (two-tone). This included 10 known females with calves, three young adults (mottled) and seven adults (fused).

### *Behavioural activities on GBB*

Bottom foraging as described for spotted dolphins on LBB (Herzing, 1996) has been observed on GBB. Spotted dolphins were observed foraging on the bottom (average depth 8.6 m) six times since 1998. On 30 January 1998, juvenile spotted dolphins were seen chasing snakefish (family Synodontidae) on the bottom. During the other

**Table 2.** Comparative numbers of observed behavioral categories on LBB and GBB for (1) single-species *Stenella* encounters, (2) single-species *Tursiops* encounters, and (3) mixed-species encounters.

	Total number of encounters*	Travel	Play	Forage	Nurse	Courtship	Discipline	Aggression
Little Bahama Bank (LBB) 1985–2001								
<i>Stenella</i> only encounters	1470	329	448	354	110	133	55	54
<i>Tursiops</i> only encounters	147	27	23	18	22	2	1	4
Mixed-species encounters	280	66	78	47	14	51	11	86
Great Bahama Bank (GBB) 1998–2001								
<i>Stenella</i> only encounters	31	12	25	8	1	5	2	4
<i>Tursiops</i> only encounters	2	1	0	1	0	1	0	0
Mixed-species encounters	3	1	2	1	0	0	0	2

\*Encounters can contain more than one behavioural category (i.e. play and aggression).

encounters, the dolphins were seen chasing small, unidentifiable fish species.

Crater feeding, which is described as the immersion of the rostrum of a bottlenose dolphin while deeply digging into the sand, creating a crater on the bottom (Rossbach & Herzing, 1997), also was observed on GBB. On 28 August 1998, ten bottlenose dolphins were seen crater feeding on GBB at a depth of 12 m. Audible razor buzzes (described in Herzing, 1996) also were recorded during crater feeding at GBB.

#### *Bottlenose dolphin encounters*

Single species bottlenose groups were observed under water twice on GBB from 1998–2001. During one of these observations (12 February 2001), two male bottlenose dolphins (identified by body size and proportions as the offshore form of *T. truncatus*) were observed copulating belly to belly. The larger offshore bottlenose dolphins are distinguishable from the smaller coastal form regularly observed and studied on LBB (Rossbach & Herzing, 1999). Of the mixed-species encounters described below, the most aggressive encounter was between the resident spotted dolphins and the offshore form of *T. truncatus*. All other bottlenose dolphins observed were the resident, coastal form.

#### *Interspecific interactions – bottlenose and spotted dolphins*

Interspecific interactions were observed three times on GBB (1998–2001):

(1) On 23 January 1999, five male spotted dolphins (two juveniles and three adults) and two adult male bottlenose were observed interacting for 60 min. Several types of aggressive behaviours/vocalizations were observed from both species of dolphin, including head-to-head postures, open-mouth behaviours, and squawks. The male bottlenose dolphins had erections and were side-mounting male spotted dolphins and attempting and succeeding in intromission. One juvenile spotted dolphin, that was repeatedly side-mounted by a male bottlenose dolphin, kept returning to an adult male spotted dolphin to copulate after the repetitive side-mounting behaviour.

(2) On 31 January 2000, twelve offshore bottlenose dolphin (only observed twice over 17 years, 5 months/summer, on LBB) interacted with three spotted dolphins for 140 min. The observations were primarily made from the surface, because the dolphins were moving too quickly to follow them underwater. The spotted dolphins often positioned themselves below the bottlenose dolphins while swimming together. From the deck of the research vessel, an offshore bottlenose dolphin was observed pushing a spotted dolphin out of the water, and then displayed synchronous lunging behaviour with

other bottlenose dolphins while chasing the spotted dolphins.

(3) On 11 February 2001, two bottlenose dolphins and five spotted dolphins were seen swimming together for 15 min. The spotted dolphins were foraging in the area.

#### *Interspecies observations on GBB, 2002 and 2003*

On 20 February 2002, 16 spotted dolphins (six male fused, one fused unsexed, two male speckleds, three female speckleds, four unidentified), and six bottlenose dolphin (three adult males, one juvenile male, two juveniles unsexed) were observed underwater for 44 min. The spotted dolphins were observed chasing the bottlenose dolphin. Male spotted dolphins repeatedly side-mounted male bottlenose dolphins. Spotted dolphins also held-down a bottlenose dolphin on the bottom. Male spotted dolphins were observed engaging in beak-genital buzzing of a male bottlenose dolphins pushing him into a passive float. In addition, bottlenose male groups chased and mounted male juvenile spotted dolphins.

On 8 February 2003, 18 spotted dolphin and five bottlenose dolphin were observed for 125 min. Although three bottlenose dolphin left area during beginning of the observation, at least two male adult bottlenose dolphin were observed mounting two male juvenile male spotted dolphins.

#### *Fused female spotted with hybrid male calf*

On 8 February 2003, a male calf estimated <3 months old with foetal fold still visible was observed with an adult female spotted dolphin for 125 min. The female was clearly lactating although no nursing was observed. The calf had an extremely short rostrum and body proportions similar to bottlenose calves observed in the area (Fig. 2).

On 11 February 2003, the adult female spotted and hybrid calf were observed again over 45 min with no other dolphins in the area. The mother was scanning from the surface, 10 m off the bottom. The mother dove to the bottom with calf in tow, and caught and consumed a fish (unknown species).

## Discussion

Although field time on GBB has been more limited than observations on LBB, and has occurred primarily in winter vs. summer months on LBB, preliminary observations suggest that the behavioural activity of Atlantic spotted dolphins, durations of underwater access (31 min vs. 28 min) and average group size (9.3 vs. 9.1) is similar in the two locations. Females with calves on GBB are mottled or fused in coloration, similar to that reported for LBB (Herzing, 1997).

Most behavioural activities that have been observed on LBB for the past 19 years have been



**Figure 2.** Top photo shows the hybrid calf with his adult (fused) spotted dolphin mother from GBB. Especially striking is the shorter rostrum of the hybrid calf. Bottom photo depicts a normal spotted dolphin calf with an adult (fused) spotted dolphin mother from LBB.

observed on GBB, with the exception of nocturnal feeding behaviour in deep water (Herzing & Brunnick, unpublished data). However, this is likely due to our lack of ability to do nocturnal work on GBB because of harsh weather conditions in the winter. The parallel observation of bottom foraging activity in the two locations is not surprising, considering the similar habitats and bottom ecology (both are western edges of the sandbanks juxtaposed to the deep waters of the Gulf Stream).

The spotted dolphins on LBB have been observed feeding on a variety of benthic fish, including lizardfish (family Synodontidae), clinid (family Clinidae), flounders (family Bothidae), and conger

eel (family Congridae) (Herzing, 1996). The spotted dolphins at GBB also have been seen foraging on benthic fish. Bottlenose dolphins at LBB often 'crater feed' to catch fish on the bottom (Rossbach & Herzing, 1997) and this behaviour also has been observed at GBB. Comparative observations at both sites indicate that benthic fish are a regular resource for both spotted dolphins and bottlenose dolphins on GBB.

The first striking difference between LBB (19 years of regular observation) and GBB (very restricted field time as noted) during interspecific interaction is the role of males during side-mounting and copulation during interspecific

aggressive behaviour. The side-mounting of male bottlenose dolphins by male spotted dolphins observed on GBB has never been observed on LBB. The second difference is that although regular and complex interactions (including aggression, alloparental care, and travelling) between resident coastal bottlenose dolphins and resident spotted dolphins occurs regularly on LBB (Herzing & Johnson, 1997), the presence of the larger offshore ecotype of bottlenose dolphins, and aggressive interaction with resident spotted dolphin has never been observed on LBB (Herzing, pers. comm.). While interspecific side-mounting and intromission have been observed during aggressive encounters at both LBB and GBB, observations of bottlenose dolphins (as described on GBB with the offshore ecotype) violently pushing smaller spotted dolphins out of the water is unusual. Aggressive bottlenose dolphins have fatally attacked harbour porpoise (*Phocoena phocoena*) in the Moray Firth, Scotland (Ross & Wilson, 1996). Aggressive encounters between other sympatric odontocetes include Risso's dolphins (*Grampus griseus*) and pilot whales (*Globicephala macrorhynchus*) in southern California waters (Shane, 1995), Pacific white-sided dolphins (*Lagenorhynchus obliquidens*) and harbour porpoise (*Phocoena phocoena*) off Washington State (Baird, 1998), and narwhals (*Monodon monoceros*) and beluga whales (*Delphinapterus leucas*) in the Arctic (Orr & Harwood, 1998). It is possible that the northwestern edge of GBB is frequently accessed by travelling offshore bottlenose dolphins that come into contact with resident (coastal) spotted dolphins of GBB. Alternatively, a seasonal difference in the presence of offshore bottlenose dolphins could exist between winter observations on GBB and summer observations on LBB.

A third interspecific difference between LBB and GBB is the observation of a hybrid calf on GBB. Although a few cases of interspecific alloparental behaviour has been observed on LBB by maturing (nulliparous) female spotted dolphins tending bottlenose calves, after 19 years of regular observation on LBB a hybrid has not been observed. Although it is not uncommon for male bottlenose dolphins to pursue female spotted dolphins to copulate on LBB, these activities are usually deterred by male spotted dolphin coalitions (Herzing & Johnson, 1997). Male spotted dolphins occasionally attempt copulation with female bottlenose dolphins on LBB (Herzing, unpublished data) but it is considered rare. Although it is likely that such behavioural isolation mechanisms are normally sufficient to keep sympatric species from hybridizing, fertile hybrid offspring have been documented in both captivity (Sylvestre & Tasaka, 1985) and in the wild (Arnason *et al.*, 1991). In addition, unusual coloration and body markings have been

described in other areas where species are sympatric, suggesting other potential hybrids (see review in Frantzis & Herzing, 2002).

These shallow sandbanks are separated by 56 km of deep (250–700 m) water and, to date, no exchange of individuals between these two study sites has been observed through photo-identification techniques. Parsons (2001) indicated that utilizing both photo-identification and genetic methods with bottlenose dolphin on LBB can yield such information. Both such methods are currently being applied on LBB and GBB.

Although many basic life history and behavioural aspects for Atlantic spotted dolphins are the same on LBB and GBB, striking differences in interspecific interactions between these two sympatric delphinid species are clear. Continued photo-identification, underwater behaviour and acoustic work, Global Information Systems (GIS) habitat work, and the analysis of genetic samples can help illuminate the complexities of these two species and study sites in the future.

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