



A comparison of pectoral fin contact behaviour for three distinct dolphin populations

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ABSTRACT

Tactile exchanges involving the pectoral fin have been documented in a variety of dolphin species. Several functions (e.g., social, hygienic) have been offered as possible explanations for when and why dolphins exchange pectoral fin contacts. In this study, we compared pectoral fin contact between dolphin dyads from three distinct dolphin populations: two groups of wild dolphins; Atlantic spotted dolphins (*Stenella frontalis*) from The Bahamas and Indo-Pacific bottlenose dolphins (*Tursiops aduncus*) from around Mikura Island, Japan; and one group of captive bottlenose dolphins (*Tursiops truncatus*) residing at the Roatan Institute for Marine Sciences, Anthony's Key Resort. A number of similarities were observed between the captive and wild groups, including; rates of pectoral fin contact, which dolphin initiated contact, posture preference, and same-sex rubbing partner preference. Unlike their wild counterparts, however, dolphins in the captive study group engaged in petting and rubbing at equal rates, females were more likely to contact males, males assumed the various rubbing roles more frequently than females, and calves and juveniles were more likely to be involved in pectoral fin contact exchanges. These results suggest that some aspects of pectoral fin contact behaviour might be common to many dolphin species, whereas other aspects could be species specific, or could be the result of differing environmental and social conditions.

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1. Introduction

Studies reporting comparisons of wild versus captive delphinid behaviour are rare in the scientific literature. Comparative studies on this subject predominantly discuss husbandry, survivability, or rehabilitation (Woodley et al., 1997; Reeves et al., 1994; Robert and Douglas, 1995; Wells, 2009), as well as biological and morphological differences (Ridgway and Fenner, 1982; Akamatsu et al., 1998; Urian et al., 1996), with only a handful reporting comparisons of a purely ethological nature (Smolker and Pepper, 1999; Gubbins et al., 1999). Moreover, studies comparing social behaviour are even less common (Caldwell et al., 1965; Brown et al., 1966; Mann and Smuts, 1999). Some of these reports found differences in social behaviour between captive and wild studies (see 'Maternal behaviour' in Mann and Smuts, 1999, p. 560) whereas others reported strong similarities (Gubbins et al., 1999). On the whole, quantitative studies of the differences/similarities in the social behaviour of captive and wild populations of dolphins are scarce, and many questions remain largely uninvestigated. In contrast, terrestrial species have received much more attention in this area,

especially within the context of domestication (Scott, 1967; Boice, 1981).

There are many reasons to compare the structure and potential causes of differences between wild and captive delphinid social behaviour, including: (1) providing substantive guidelines for those working in rehabilitation and husbandry, (2) determining the external validity of captive studies, and (3) assessing the overall appropriateness of applying studies of wild species to captive studies and *vice versa*. With these goals in mind, this study focused on one aspect of delphinid social behaviour (i.e., pectoral fin contact) in order to provide a detailed comparison among three species of dolphin to determine the importance of contact behaviour for dolphins. Pectoral fin contact is an affiliative behaviour involving the contact (touching or rubbing) of part of one dolphin's body and another dolphin's pectoral fin (see Sakai et al., 2006a; Dudzinski et al., 2009 for an overview). It has been studied in both captive and wild cetacean populations. Wild species include Indo-Pacific bottlenose dolphins (*Tursiops aduncus*) (Mann and Smuts, 1998, 1999; Sakai et al., 2003, 2006a,b; Dudzinski et al., 2009), spinner dolphins (*Stenella longirostris*) (Johnson and Norris, 1994), Atlantic spotted dolphins (*Stenella frontalis*) (Dudzinski, 1996, 1998; Dudzinski et al., 2009), belugas (*Delphinapterus leucas*) (Smith et al., 1992), rough-tooth dolphins (*Steno bredanensis*) (Kuczaj and Yeater, 2007), and sperm whales (*Physeter macrorhynchus*) (Whitehead and Weilgart, 2000). Captive dolphins observed engaging in pectoral fin con-

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tact include bottlenose dolphins (*Tursiops truncatus*) (Tavolga and Essapian, 1957; Samuels et al., 1989; Tamaki et al., 2006), spinner dolphins (Johnson and Norris, 1994), and Commerson's dolphins (*Cephalorhynchus commersoni*) (Johnson and Moewe, 1999).

In a previous study following the same protocols and sampling techniques used in the current study, striking similarities in pectoral fin contact behaviour were found between two separate populations of wild dolphin species at two geographic locations (Dudzinski et al., 2009). In order to determine if these similarities were also present in the behaviour of a captive population, the results reported in Dudzinski et al. of two wild groups of dolphins (Indo-Pacific bottlenose dolphins from Mikura Island, Japan and Atlantic spotted dolphins from Little Bahama Bank, The Bahamas) were compared with one captive group of bottlenose dolphins at the Roatan Institute for Marine Sciences (RIMS), Roatan, Honduras. The type, quantity, frequency, and location of pectoral fin contact were investigated and compared between the three sites. The primary aim of this investigation was to examine whether the exchange of pectoral fin contact is a conserved behaviour among different species of dolphin.

2. Materials and methods

Data collected on each population during this study were part of a long-term, longitudinal and comparative examination of dolphin communication and signal exchange (Dudzinski, 1996, 1998; Dudzinski et al., 2003, 2009; Paulos et al., 2007; Gregg, 2008; Gregg et al., 2008).

2.1. Study sites and populations

Data were gathered at three locations over a total of 18 years on the Little Bahama Bank, The Bahamas, around Mikura Island, Japan, and at RIMS, Anthony's Key Resort, Roatan, Honduras. The Atlantic spotted dolphins are found near the White Sand Ridge of the Little Bahama Bank, located ~64.5 km north of West End, Grand Bahama Island. This area ranges from 6 to 10 m in depth with a white sandy bottom and good visibility to at least 30 m. Dolphins are most often sighted in the northwest section of this sand bar. Approximately 150 individual spotted dolphins were identified with relative age categories and sex determined for all individuals (Dudzinski, 1996; Herzing, 1997; Brunnick, 2000).

The Indo-Pacific bottlenose dolphin group is a population resident to the area within 300 m of Mikura Island, Japan. Mikura is a dormant volcanic island roughly 200 km south of Tokyo with a circumference of 16.4 km, and is characterized by a boulder-strewn seafloor with depths ranging from 2 to 60 m at 2 to 250 m from shore, respectively. DNA analysis confirms that the dolphins around Mikura are *aduncus*-type (Kakuda et al., 2002). The Mikurajima Bandouiruka Kenkyukai (M.B.K.) conducted a photo-identification research study on this group of dolphins between 1994 and 2004 (Kogi et al., 2004): the identified population consisted of approximately 165 dolphins. Both study sites of wild dolphins are adjacent to fish-productive, deep waters (Gulf Stream for The Bahamas and Marianas Trench for Mikura Island, Japan).

Founded in 1989 at Anthony's Key Resort, RIMS is located on the northwest coast of Roatan, the center of three Bay Islands approximately 27 miles north of Honduras. The facility is located inside a fringing reef against the northern side of Roatan, in a natural lagoon with the enclosure encompassing about 300 m² in surface area. The sea floor is covered with natural coral, sand and sea-grass beds with depths in the enclosure ranging from the shoreline to approximately 8 m. Members of this captive population of bottlenose dolphin range in age from neonate to 30+ years; the social dynamic is similar to that observed for wild bottlenose dol-

phins (Connor et al., 2006; Kogi et al., 2004). That is, age and sex distribution for the group matches most coastal wild bottlenose dolphin study groups with this study population ranging annually between 16 and 24 dolphins (total number of dolphins varies depending on distribution between other facilities managed by RIMS).

2.2. Data collection

A mobile video/acoustic system that permits real-time synchronous video and audio recordings under water was used to record dolphin behaviours and sounds at each study site (Dudzinski et al., 1995). Underwater swims were video-documented opportunistically with limiting factors including poor weather, sea, and visibility conditions. Behaviour data were collected using focal-animal and all-occurrence sampling (Altmann, 1974), otherwise termed "focal-animal sampling" (Mann, 1999). Identified individuals were opportunistically observed, based upon which dolphins were near the vessel for the wild dolphins, and which individuals were readily in view for the captive dolphins. Follows and recordings of dolphins began as soon as the video camera and observer were in a favorable underwater position and group composition was assessed. An individual was selected and recorded until it was no longer within the field of view. Even though it was possible to focus on a specific, identified individual dolphin from within the captive study population to collect observational data, the methods employed for collecting video data from each wild study group were followed when recording the captive dolphins such that all data collected had the same basic assumptions to facilitate direct comparison between datasets. Pectoral fin contact behaviour was coded only from videotaped segments (for reliability and repetition). Additionally, because time spent searching for wild dolphin groups is traditionally included in calculations of effort, only video data were used to assess effort related to time spent under water looking for dolphins versus the time dolphins were actually in view of the camera lens.

Event sampling for pectoral fin contact between individual dolphins was conducted from all video data gathered from each dolphin study group. Each contact event between one dolphin's pectoral fin and another dolphin's body (including the pectoral fin) was documented. Other relevant, recorded information included: date of occurrence, "real" time of contact, initiating dolphin identification, age and sex, receiving dolphin identification, age and sex, each dolphin's posture, duration of contact, whether contact was a touch or rub, and identification of the departing dolphin. In addition, whether the initiating and receiving dolphins were the *rubber* or *rubbee* and which body part was contacted on the *rubbee* were documented.

2.3. Definitions

Several definitions have been followed during the course of this study; these definitions are presented in Dudzinski et al. (2009). Generally, rubbing behaviour or contact between pectoral fins or a pectoral fin and the body of a second dolphin are defined in various ways in the published literature (see Sakai et al., 2006a for an overview). Pectoral fin tactile exchanges were begun by one dolphin (either the *rubber* or *rubbee*) approaching and physically contacting another dolphin and were ended by one of the dolphins departing from the other (Dudzinski et al., 2009). We defined this behaviour unit between the start of contact and the departure as a pectoral fin contact episode.

To record the dolphin body part in contact with a pectoral fin, we divided the body surface of the dolphin into 11 parts (after Dudzinski et al. (2009)). Dolphin posture during pectoral fin contact exchange was categorized into the following types: horizontal

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