

Food sharing in wild bottlenose dolphins

Sharlene M. Fedorowicz, David A. Beard and Richard C. Connor

Department of Biology, University of Massachusetts, Dartmouth, North Dartmouth, MA 02747, USA

Abstract

In Golfo Dulce, Costa Rica, we documented the first case of two bottlenose dolphins sharing a fish. The fish was shared between a male and female dolphin (who was accompanied by a calf). Possession of the fish changed 11 times during the 30-min observation period. No obvious attempts were made by any of the dolphins to steal or escape with the fish. Interestingly, apparent consumption of the fish did not commence until possession of the fish had changed several times. The relationship between the male and female is unknown, but sexual behaviour between the two was observed the previous day. Although food sharing has been reported in a number of mammals in a variety of contexts, the repeated changes in ownership of the food item reported here is, at best, extremely rare in other taxa.

Key words: Food sharing, Bottlenose dolphins, *Tursiops* sp., Costa Rica, mother–calf interaction, behaviour, mating relationships

Introduction

The bottlenose dolphins, *Tursiops* spp., is the most well studied cetacean (Barros & Wells, 1998; Connor *et al.*, 2000). They live in complex fission-fusion societies where the size and composition of groups changes often as individuals join and leave (Wells *et al.*, 1987; Connor *et al.*, 1992a; Smolker *et al.*, 1992; Smolker *et al.*, 1993; Mann & Smuts, 1999). The bottlenose dolphin fission-fusion society, like those primate fission-fusion social systems to which it is often compared (e.g., chimpanzees and spider monkeys, Goodall, 1986; Symington, 1990, see Connor *et al.*, 2000), may have an ecological basis in a food distribution that is spatially and temporally patchy.

Types of feeding and foraging behaviours

Bottlenose dolphins feed on a wide variety of fish, as well as cephalopods (squid and octopus), shrimp (Gunter, 1951) and small rays and sharks (Mead &

Potter, 1990). They hunt schooling and solitary prey using a variety of solitary and group feeding strategies throughout the water column, on shore or above the water surface (Connor *et al.*, 2000). For example, bottlenose dolphins dive rostrum first into the sand up to their eyes after prey in the Bahamas (Rossbach & Herzig, 1997). In Shark Bay, Australia, bottlenose dolphins carry cone-shaped sponges on their rostra, possibly to protect their rostra when they forage on bottom dwelling prey (Smolker *et al.*, 1997). Bottlenose dolphins pursue prey onto mud banks in Georgia and South Carolina (Petricig, 1993) and some stun or kill fish by ‘whacking’ them with their flukes (Wells *et al.*, 1987). Individual dolphins have been reported to pursue their prey by swimming upside down near the surface (Leatherwood, 1975; Bel’kovich *et al.*, 1991) or by swimming belly up to chase a fish along the surface then grabbing it as it jumps in the air (Connor *et al.*, 2000). Solitary or groups of bottlenose dolphins also have been observed circling around schools of fish and darting into the schools to feed (Morozov, 1970; Leatherwood, 1975; Bel’kovich *et al.*, 1991). In spite of the dazzling array of feeding and foraging behaviours observed in numerous locations around the globe, food sharing, defined as the ‘joint use of a monopolizable food item’ (Stevens & Gilby, in press), has not been observed in this genus. Here we detail the first such observation.

Materials and Methods

The food sharing occurred in a group of three dolphins (a male, female and her calf) on 5 August 1998 in Golfo Dulce, a bay on the south Pacific coast of Costa Rica (8°23’N–8°45’N). The gulf is about 50 km long and 10 to 15 km wide containing a shallow outer slope with a deep inner basin reaching to a depth of 215 m (Acevedo-Gutiérrez & Burkhart, 1998). The food sharing observation was made from a 4 m vessel with an outboard motor during the course of a 4 month study of mother–calf interactions, that included general surveys of group composition and activity and focal follows on adult

females accompanied by calves (see Connor *et al.*, 2000). Individual dolphins were identified photographically (Würsig & Würsig, 1977). The behaviour described here was recorded *ad libitum* using a small hand-held cassette recorder and a video camera to supplement the observation that began when we encountered these dolphins at 0915 h. While using the video camera, data were spoken into one acoustic channel and a hydrophone recording dolphin sounds was fed into the other acoustic channel.

Results

Previous observations

Three dolphins, Top Notch, Smash and a calf were observed during the described food sharing period. Top Notch was photographed (Würsig & Würsig, 1977) during a previous field season that year (March), when he was determined to be a male by the absence of mammarys and a ≥ 2.5 cm gap between the genital and anal slits (Connor *et al.*, 1992). Our first observation of Smash was the day before the food sharing event when she was observed foraging and travelling with her calf (judged to be about 3 years old based on size) in 'infant position' (Connor & Smolker, 1995; Mann & Smuts, 1999). In Shark Bay, infant position is a reliable indicator that a calf is not weaned (Mann *et al.*, 2000).

Top Notch also was observed with Smash and her calf on 4 August. This observation lasted for over 2 h, beginning at 1043 h. We first encountered Top Notch foraging alone for 26 min, about 20–50 m south of Smash and her calf. Top Notch approached, then joined Smash and her calf, and the group then traveled for 17 min followed by a 7-min period of foraging. A 77-min bout of socializing and sexual activity followed. During this period of social/sexual behaviour, Top Notch engaged in tail slaps and mounts (including inverted and side mounts) on Smash, who often rolled belly up. Considerable whistling and clicking accompanied the social behaviour. The group travelled for the last 8 min of the observation.

Food sharing observation

Observations of Top Notch and Smash (her calf remained close) with the fish were made during a 30-min period on 5 August 1998 beginning at 0915 h. When we first observed them, Smash, was already holding the fish in her mouth, visually estimated to be approximately 55 cm long and 15 cm wide. The fish appeared to be a Carangid, but the species could not be determined. Initially, the fish was whole, alive, and in good condition. During the observation period, when visible at the

surface, all three dolphins spent a majority of their time within 2 m of each other.

Initially, Smash held the live fish in her mouth shaking it and swimming on her side causing considerable splashing as her calf and the other animal, Top Notch, trailed her within 2 m. She did not obviously attempt to break the fish apart or eat it. After holding the fish for approximately 90 s, she released it. At this point, the fish appeared dead, but was still whole. The fish floated for about 7 s at the surface of the water until Top Notch took it, shook it back and forth in his mouth, and then dove with the fish followed by Smash and her calf next to him. Upon the next surfacing, Top Notch released the fish, which was still whole, and Smash, who was about 1 m behind Top Notch, took the fish and dove with it in her mouth. The fish was released and changed possessions 11 times during the observation period, and each possession lasted for approximately 10 to 145 s (except for the last surfacings in which Top Notch had the fish (see Table 1). The fish was left floating at the surface for 2–18 s between possessions and was never passed directly between the dolphins (Table 1).

On one occasion, Smash reclaimed the fish three consecutive times within approximately 1 to 14 s after release (Table 1). During the second surfacing of this series, about 8 min into the observation, the first damage was noticeable on the fish; it appeared slightly mangled and torn. Between the second and third possession, splashing involved Smash, Top Notch, and the calf. In each case, Top Notch remained within 2 m of Smash but made no attempt to take the fish after she had released it. After Smash dove with the fish for the third consecutive time, Top Notch resurfaced with it approximately 165–170 s later. At this stage, the fish was slightly more damaged. This was the only observation where an underwater exchange occurred and the only sequence that included any indication (i.e., splashing) of social behaviour other than the fish exchange itself.

During the 23 min after we observed the first damage, the dolphins exchanged the fish seven times slowly breaking it apart. The last dolphin seen with the fish was Top Notch, who dove with the last remaining piece, which was approximately one-fourth the size of the original fish.

Whistles and clicks were heard on five separate occasions lasting from 52–80 s each (Table 1).

No obvious attempts were made by any of the dolphins to steal or escape with the fish during the 30-min period. It is interesting in this regard that the fish did not become ragged until part of the way through the observation period even though it changed possession frequently. After the fish was consumed, the animals began to forage at a distance greater than 10 m from each other, a typical

Table 1. Order and duration of food sharing possessions between Top Notch and Smash in Golfo Dulce, Costa Rica.

Number of switch	Dolphin with fish	Duration of possession (s)	Splashing bouts	Damage
Initial	Smash	96		0
1	Top Notch	46*		0
2	Smash	143*		0
	Smash	*	Splashing (20 s)	0
	Smash	*	Splashing (15 s)	0
	Smash	*	Splashing (6 s)	0
3	Top Notch	49		0
4**	Smash	56		0
**	Smash	8*		1
**	Smash	*	Splashing	1
**	Smash	*		1
5	Top Notch	*	Resurfaces 165–170 s later	2
6	Smash	*		2
	Smash	*	Splashing (13 s)	2
	Smash	*	Splashing (7 s)	2
	Smash	*	Splashing (5 s)	2
	Smash	*	Whistles & clicks (52 s)	2
7	Top Notch	10*		3
8	Smash	10		3
9	Top Notch	104		3
	Top Notch	*	Splashing (*)	3
	Top Notch	*	Whistles & clicks (60 s)	3
	Top Notch	*	Splashing (*)	4
10	Smash	4*		5
11	Top Notch	5.5 min from here to last evidence of fish . . .		5
	Top Notch	*	Whistles & clicks (*)	5
	Top Notch	*	Splashing (*)	5
	Top Notch	*	Whistles & clicks (*)	5
	Top Notch	Last evidence of fish	Splashing & whistles & clicks (*)	5

Number of the switch and the duration of time each animal possessed the fish including splashing and sound events. The (*) indicates either close approximation times since exact times were not available, or unavailable times. The (**) indicates Smash's multiple possession bouts where she released the fish at the surface and reclaimed it. Damage was on a scale from 0–5; 0=no damage, 5=most damage.

distance for foraging behaviour. The calf never had possession of the fish, but remained close to the other two dolphins; the calf also did not forage or feed on his/her own during the food-sharing event.

Discussion

Ours is the first observation of food sharing in wild bottlenose dolphins. In Shark Bay, where dolphin feeding behaviour has been observed for hundreds if not thousands of hours, no similar case has been reported. Observations in Shark Bay suggest a strong sense of 'ownership' where dolphins may toss a fish up to 3 m, but other dolphins do not attempt to take it (Connor *et al.*, 2000). In Sarasota, Florida, the longest running bottlenose dolphin study site, Randall Wells (pers. comm.) has observed dolphins feeding on Carangid fish without obvious sharing. In both sites, observations include

dolphins feeding in the company of other dolphins on large prey items that require considerable time to break up and consume.

Food sharing may be a rare behaviour in bottlenose dolphins that just happened to be observed for the first time in Golfo Dulce. A more interesting possibility is that food sharing occurs more commonly in Golfo Dulce than in the more intensively studied Sarasota and Shark Bay sites, either among particular individuals or in the population generally. This possibility is suggested by the increasingly frequent observation of site-specific or individual foraging behaviours that have been reported in bottlenose dolphins and other marine mammals (Connor *et al.*, 2000; Connor, 2001). That such foraging 'specializations' might include social components would not be surprising, either because social behaviour and bonds also vary between sites (Connor *et al.*, 2000).

Obviously, with a single observation we can only speculate about the function of the food sharing between Top Notch and Smash. We do not know if the two are related and we do not have any long-term association data that might suggest a bond between the two. The sexual behaviour observed between Top Notch and Smash on the previous day suggests that the sharing may have been associated somehow with a mating relationship. The size of the calf with Smash suggests that Smash could have been in estrus; in Shark Bay three-year old calves frequently accompany their mothers during consortships (Connor *et al.*, 2000). The observation suggests a 'food for sex' hypothesis, but we do not know which dolphin caught the fish.

Although food sharing has been reported in a variety of taxa (reviewed by Stevens & Gilby, in press), the behaviour described here may be unique. 'Food sharing' may apply to a range of behaviours where more than one individual consumes a monopolizable resource. Individuals may feed simultaneously on a large food item, they may alert others to the presence of food, or they may passively or actively give food to another individual (for specific examples see Stevens & Gilby in press). However, in no case that we are aware of, have two individuals been observed repeatedly exchanging control of the same food item.

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