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Notes

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Why do Indo-Pacific bottlenose dolphins (*Tursiops* sp.) carry conch shells (*Turbinella* sp.) in Shark Bay, Western Australia?

S. J. Allen
L. Bejder
Murdoch University Cetacean Research Unit,
Centre for Fish and Fisheries Research,
School of Biological Sciences and Biotechnology,
Murdoch University,
Murdoch, Western Australia 6150, Australia

M. Krützen[1]
Evolutionary Genetics Group,
Anthropological Institute and Museum,
University of Zurich,
Winterthurerstrasse 190,
8057 Zurich, Switzerland
E-mail: michael.kruetzen@aim.uzh.ch

Indo-Pacific bottlenose dolphins (*Tursiops* sp.) in Shark Bay, Western Australia, exhibit a remarkable array of foraging tactics within a single population (Mann and Sargeant 2003). Those described in some detail to date include: "kerplunking," whereby dolphins scare fish out from vegetative cover with a percussive, bubble-forming tail slap in shallow waters over sea grass beds (Connor *et al*. 2000); "beaching," involving intentional stranding on sandy beaches in the pursuit of fish (Sargeant *et al*. 2005); and, perhaps most notably, "sponging," in which particular matrilines of dolphins apparently use marine sponges as protective "gloves" or shields over their rostra when foraging in the benthos (Smolker *et al*. 1997, Krützen *et al*. 2005). Here, we add a new, rare behavior to this extensive list, hereafter referred to as "conching."

Over the last 13 yr, several researchers in disparate locations in Shark Bay have observed individual dolphins lifting sizeable conch shells (*Turbinella* sp.) out of the water (Table 1). The conches are apparently lifted by the action of the dolphin's rostrum inserted into the shell's broad aperture. Determining the function of this unusual behavior has been difficult, largely due to its infrequent occurrence and the

[1] Author to whom correspondence should be addressed.

Table 1. Occurrences of "conching" in the Eastern and Western Gulfs of Shark Bay.

Date	Identity	Sex	Depth (m)	Behavior of group[a]	No. of dolphins in first 5 min[b]	Total no. of dolphins[b]	No. of sightings/ years individual has been observed
16 December 1996	FIN	F	N/A	forage	2	4	36/9
6 September 1998	ESC	F	5.2	forage	1	1	5/6
5 December 1998	FIN (?)	F (?)	4.0	travel	7	7	36/9 (?)
18 August 2003	Unknown	Unknown	9.8	travel	4	6[c]	N/A
18 August 2003	Unknown	Unknown	4.1	forage/ feeding	4	4	N/A
31 July 2007	CON	F	3.1	forage	2	8	2/1
25 April 2009	WIM	M	1.2	forage	1	1	6/1

[a]Predominant group behavior during first 5 min of behavioral survey.
[b]During a survey, the number of dolphins present (using the 10 m chain rule) during the first 5 min is counted. The total number of dolphins includes all animals that were present at any stage during the entire survey.
[c]Number is estimated. N/A = not available.

relatively fleeting glimpses obtained when it has occurred. Functional hypotheses include feeding on the flesh of the living conch mollusk, play behavior, and use of the conch as a socio-sexual display item (*sensu* Martin *et al*. 2008).

During surveys for photo-identification, behavioral observation, and biopsy sampling of bottlenose dolphins in the Western Gulf of Shark Bay, we obtained a photographic sequence that revealed the function of the conch-carrying behavior. At 1314 on 31 July 2007, we approached two dolphins foraging over sea grass beds in 3.1 m deep water north of Heirisson Prong (Fig. 1).

Once the individuals were photographically identified and a 5-min behavioral survey was completed, we remained in the vicinity in order to attempt biopsy sampling of the previously unidentified individual (CON). At 1330, CON surfaced with a large conch shell held vertically (the apex of the shell oriented skyward) in front of its melon—carried by insertion of its rostrum in the conch's aperture. During this multi-breath surfacing bout, CON actively lifted the conch above the surface of the water and then proceeded with a series of vertical and lateral movements of its head (Fig. 2A, B, respectively). The dolphin then disappeared subsurface and, between 1335 and 1337, four other dolphins arrived in the area. At 1342, CON was again seen at the surface with the conch shell, this time associated with the recently arrived dolphins within 10 m of the focal individual—each of which was oriented toward CON. Further photographs were taken, with two of these clearly revealing the posterior portion of a fish protruding from the conch aperture and held in the dolphin's jaws (Fig. 2C, D). The fish appeared to be a member of the emperor family (*Lethrinus* sp.).

The photographs indicate the presence of a fish in the conch; the dolphin lifted the conch out of the water and manipulated it in such a manner as to drain the water and

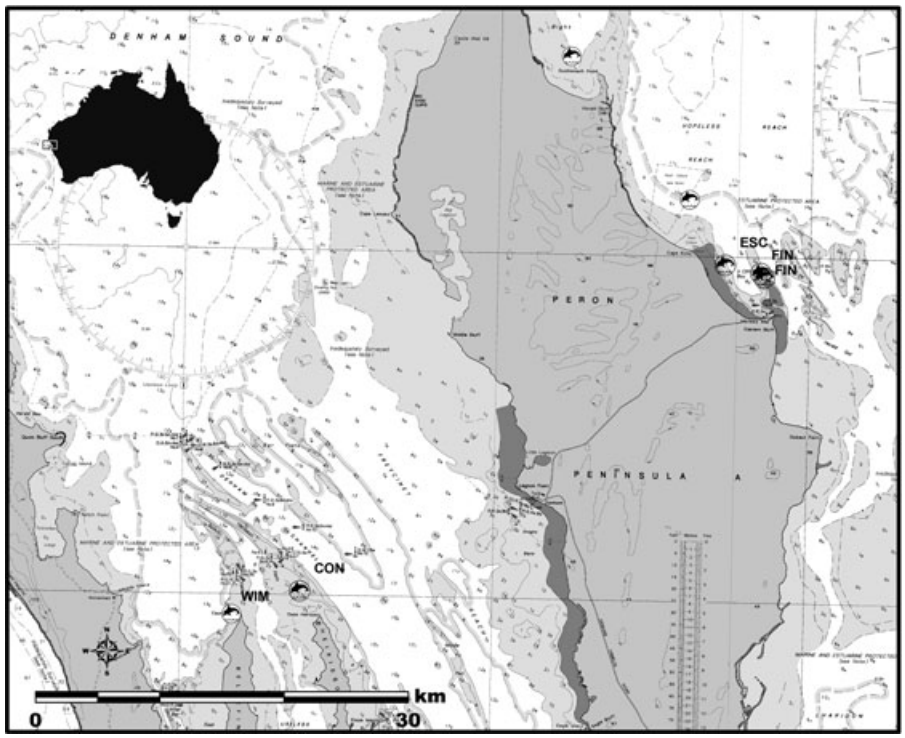

Figure 1. Locations of dolphins observed carrying conch shells in the Eastern and Western Gulfs of Shark Bay, Western Australia, from 1996 to 2009: Bellefin Prong is the headland just south of WIM's sighting, Heirisson Prong is due east from it.

the fish from the shell. It could well be that fish enter otherwise vacant conch shells lying on the substrate when they detect foraging dolphins nearby, or alternatively, during actual pursuit. The extent to which the conch shell is manipulated and the rarity of the behavior suggest that "conching" takes some skill and practice and might thus be another rare individual foraging tactic in Shark Bay (*cf.* Mann and Sargeant 2003).

Further to these observations made north of Heirisson Prong in 2007, on 25 April 2009 we approached a single dolphin foraging in 1.2 m deep water northwest of Bellefin Prong (Fig. 1). For several breaths in one surfacing bout, the dolphin (WIM) raised a conch shell above the surface of the water. No photographs of the conch or its contents were obtained on this occasion, but the survey was conducted in the same location as that referred to in the personal communication detailed below and in a similar environment to that referred to above (relatively shallow water over sea grass covered sand flats).

The researcher-recorded sightings of conch carrying, and indeed the photographic evidence of function provided here, corroborate the astute observations of an experienced marine wildlife observer when asked previously about whether or not he

Figure 2. (A) After the dolphin (CON) surfaced pushing a large conch shell through the water, it began jerking its head vertically up-and-down (note the crease immediately posterior to the blowhole) in the subsequent surfacing bout. (B) The dolphin then jerked its head laterally from side-to-side (again, note the crease posterior to the blowhole and the splash from the thrust of the conch shell). (C) Photographic evidence of an object protruding from the conch shell. (D) Photograph revealing the posterior portion of a sizeable teleost fish held in the dolphin's jaws (all photographs: K. Bacher).

had seen sponging behavior in South Passage, Shark Bay: "We have seen similar behavior to that mentioned above [sponging], except using a dead baler [conch] shell (30–40 cm in size) on the Bellefin Prong, just north of the boat channel. [. . .] A possible explanation was that something had taken refuge in the shell and the dolphins were trying to dislodge and eat it."[2] In addition to these records from Shark Bay, an esteemed dolphin researcher has photographs of bottlenose dolphins lifting

[2]Personal communication from Craig Shankland, Brisbane, Australia, June 2006.

large baler and conch shells above the surface of the water in southeast Queensland, Australia.[3]

Foraging or feeding was the predominant group activity recorded for the majority of individuals during the first 5 min of five of the seven occasions when conching was observed in Shark Bay (Table 1). There were two cases in which conching was observed when the predominant group behavior recorded was traveling rather than feeding/foraging. In one survey (5 December 1998), however, it was noted that an individual was foraging ~50 m away, suggesting that at least some animals in the area were foraging at the time. Another conching report (6 September 1998) included the notes: "[The dolphin] came up with a large conch shell in mouth; swung it back and forth; we could hear crunching; returned to surface with light-colored flesh (of conch?) in mouth and ate it." We cannot strictly rule out that dolphins may actually eat the flesh of the mollusk in some instances. However, without photographic or other evidence to the contrary, it is just as likely that the dolphin had caught a fish seeking refuge in the conch shell on that occasion as well.

Similar to other foraging tactics observed in Shark Bay's bottlenose dolphins, could conching qualify as an "innovation," *i.e.*, a rare, learned behavioral variant (*cf*. van Schaik *et al*. 2006, Ramsey *et al*. 2007)? To qualify as an innovation, by definition, the behavioral variant should be non-universal and individuals under appropriate ecological conditions must have been observed for long enough to be able to record it. The rarity of the conching behavior (seven confirmed sightings in 25 yr of field research resulting in over 15,000 behavioral surveys in the Eastern Gulf of Shark Bay and 3 yr of research totaling more than 1,000 surveys in the Western Gulf of Shark Bay) suggests that it is non-universal. Given the conspicuous nature of this behavior, it also seems unlikely that researchers could have overlooked it. Conching appears to be carried out by very few individuals and may be part of the foraging repertoire of those few (*cf*. Estes *et al.* 2003). One might assume a single origin for the conching behavior, but given the distances between sites where conching has been observed relative to the small home ranges of Shark Bay dolphins (Watson 2005, Connor and Mann 2006) and the high levels of philopatry found in both sexes (Krützen *et al*. 2004), it seems most plausible that this foraging tactic has been independently innovated.

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[3]Personal communication from Daniele Cagnazzi, Southern Cross University, Lismore, Australia, March 2010.

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