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UNDERWATER OBSERVATIONS OF BENTHIC-FEEDING BOTTLENOSE DOLPHINS (*TURSIOPS TRUNCATUS*) NEAR GRAND BAHAMA ISLAND, BAHAMAS

Bottlenose dolphins (*Tursiops truncatus*) are known to feed on a variety of fish and non-fish species (reviewed by Leatherwood 1975, Barros and Odell 1990, Cockcroft and Ross 1990). The opportunistic feeding habits of the species are demonstrated by its use of various foraging strategies (reviewed by Shane 1990*b*, Bel'kovich *et al.* 1991). We describe a benthic-feeding method, observed underwater near Grand Bahama Island, Bahamas.

From May to September during 1994 and 1995 we observed feeding bottlenose dolphins as part of a larger photoidentification study of the species in the northwestern Bahamas. The study area (Fig. 1) ranges along the western edge of Little Bahama Bank, between West End, Grand Bahama Island

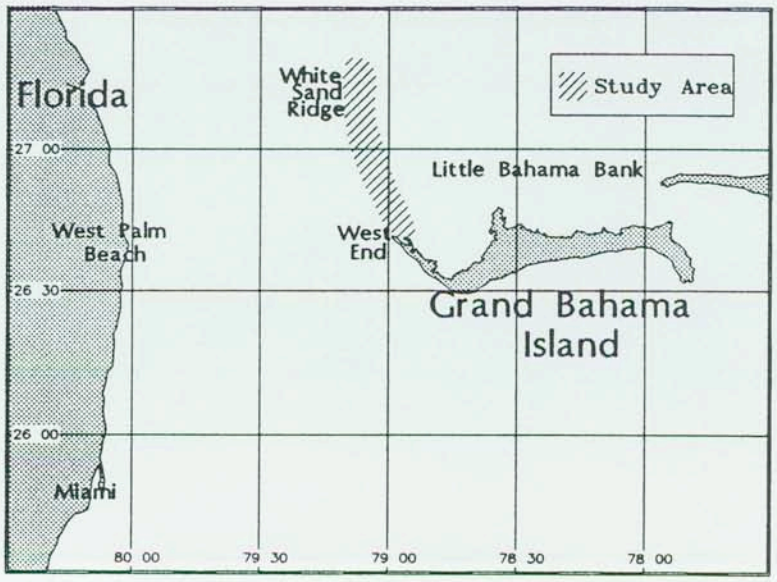

Figure 1. The study area.

(26°42′N, 79°00′W) and the White Sand Ridge (27°15′N, 79°08′W). Water depth varies from about 1 to 20 m. Groups of dolphins were sighted and photographed from either a 20-m power catamaran or a 5.3-m inflatable boat with a 70-hp motor, between dawn and dusk. After photographing dorsal fins from the surface, we occasionally entered the water with snorkel gear to photograph animals underwater, determine their sex, and observe their behavior. All feeding sightings reported here were observed from underwater. The excellent underwater visibility (up to 30 m) and warm temperatures (around 30°C) allowed observers to remain in the water for prolonged periods. A Sony Hi-8 video camera with underwater housing and a Nikonos V still camera were used to identify individuals and to record behavior.

Benthic-feeding groups of wild bottlenose dolphins were observed from underwater between 0.2 and 64.8 km offshore of Grand Bahama Island on 20 occasions, for a total of 33.2 h (0.3– 5 h per session). Groups of 3–16 dolphins ($\bar{x}$ = 7.5 dolphins) fed at bottom depths of 7–13 m ($\bar{x}$ = 8.5 m), with little change in location throughout each observation period. Feeding groups were observed during most hours of the day between sunrise and sunset.

Typically, a dolphin's feeding pattern was to search the sand bottom for several seconds with its head moving side to side and oriented downward (Fig. 2). Individuals swam slowly in different directions along a sand bottom. The dolphins foraged independently but behaved similarly. Fish were not visible in the immediate vicinity, and echolocation clicks were audible in the water (described in Herzing 1996). When forward movement stopped, clicks increased in repetition rate, suggesting that the dolphin detected some cue. The dolphin then dove into the sand, continuing to echolocate, flukes moving

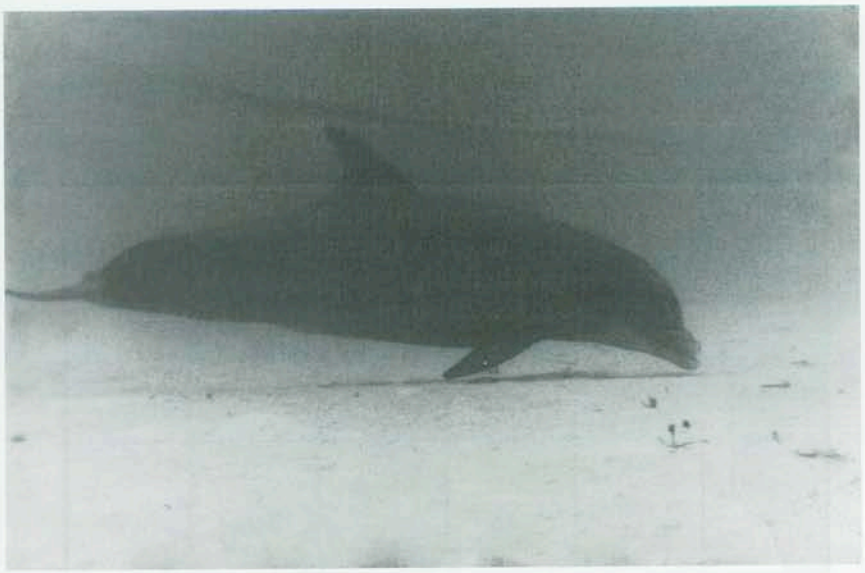

Figure 2. The dolphin searches the sand bottom with head moving side to side, and oriented downward. Echolocation clicks are audible. (Photographs by Dan Sammis)

vigorously, and dug, occasionally burying itself nearly to the pectoral fins (Fig. 3). As the dolphin lifted its head, a small fish was sometimes visible in its mouth (Fig. 4). Scanning usually resumed immediately. We termed this foraging behavior 'crater-feeding' because a crater ($\bar{x}$ diameter = 47.3 cm, $\bar{x}$ depth = 14.9 cm, n = 7) was left in the sand after a dolphin fed. After a group of dolphins fed, the bottom resembled a moonscape (Fig. 5).

Of 195 individuals identified in 1994 and 1995, 35 (18%) were photographed in crater-feeding groups. About half of these (17) were photographed frequently (4–9 times) during the 20 feeding sessions. Each of the 17 dolphins was photographed between 9 and 34 times overall (including sightings only at the surface), and each was seen in crater-feeding groups 18%–47% of those times. All 17 animals were sexed (9 females, 8 males). Sex was confirmed on 14 animals from a photo that included both the genital area and I.D. mark (*e.g.*, fluke or flipper notch, body scar), and three animals were sexed by visual observation of the genital area.

The only prey we were able to positively identify was one conger eel (family Congridae), which was dropped by a crater-feeding dolphin. Other benthic fish species occurring in the area include wrasses (family Labridae) and clinids (family Clinidae). Dolphins may consume fish of more than one species from the sand. We did not observe dolphins taking crustaceans from the sand.

It appears that, at least for the 17 most-often-sighted dolphins, crater-feeding is an important feeding strategy. Some dolphins apparently spend a substantial amount of time crater-feeding. Feeding periods (0.3–5 h) are minimum actual feeding durations, because feeding sessions were never observed from start to finish. The total number of sightings per animal that was in

Figure 3. The dolphin dives into the sand, flukes moving vigorously, and digs, burying itself nearly to the flippers.

crater-feeding groups (18%–47%) is also a minimum, because we did not enter the water to positively identify behavior at every sighting. Dolphins may have been crater-feeding at times when we did not enter the water. At the surface, flukes-up diving (Shane 1990*a*) was often associated with, but not a positive indicator of, crater-feeding.

Other marine vertebrates are known to leave a distinct record of their bottom-feeding behavior. Gray whales (*Eschrichtius robustus*) feed on ampeliscid amphipods and other infaunal invertebrates found in the upper 2 cm of sediment (Oliver *et al.* 1983*b*, Nerini 1984). They are thought to use suction to capture prey from sediment (see Ray and Schevill 1974), occasionally coming into physical contact with the bottom (Kasuya and Rice 1970). Walruses (*Odobenus rosmarus*) use their snout and vibrissae in excavating bivalves from the sea floor by hydraulic jetting (Oliver *et al.* 1983*a*). Dugongs (*Dugong dugon*) graze on seagrass meadows and consume a substantial amount of belowground plant material (Preen 1995). Sea turtles (*Caretta caretta*) are also known to produce pits in sand during infaunal feeding (Preen 1996). All of these

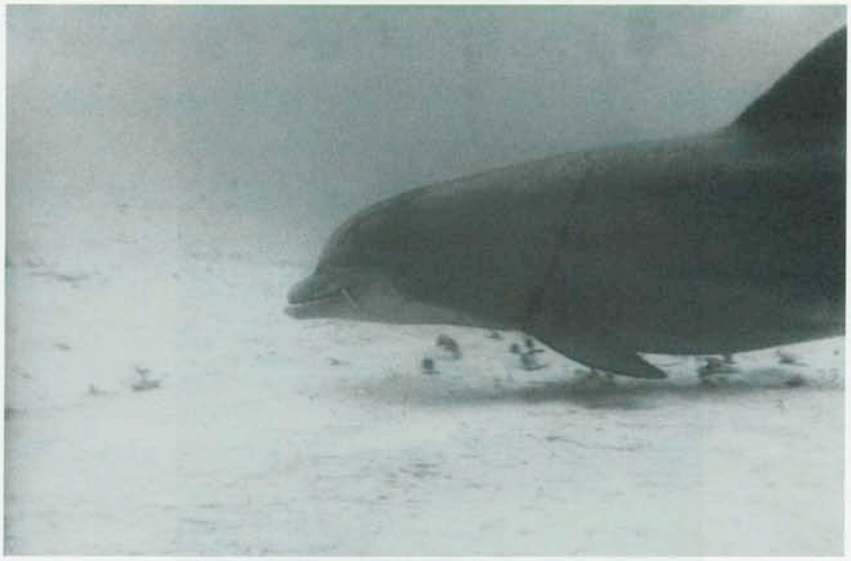

Figure 4. As the dolphin lifts its head, a small fish is visible in its mouth.

species considerably affect the local benthic community (Johnson and Nelson 1984; Oliver and Slattery 1985; Nelson and Johnson 1987; Preen 1995, 1996). Further studies in the Bahamas may shed light on the ecological significance of crater-feeding bottlenose dolphins.

Figure 5. After a group has fed, the bottom resembles a moonscape.

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