Entanglement and mortality of bottlenose dolphins, *Tursiops truncatus*, in recreational fishing gear in Florida

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Effects of fishing gear interactions are among the most pressing issues currently being addressed by marine mammal management agencies in the United States. Information is needed on the rates and fates of entangled dolphins for evaluation of mortality caused by different fisheries. Virtually the entire emphasis of management agencies has been on marine mammal interactions with commercial fisheries; little notice has been taken of the impacts of recreational fisheries.

Along the central-west coast of Florida, near Sarasota, ongoing research initiated in 1970 on a resident community of about 100 bottlenose dolphins, *Tursiops truncatus* (Scott et al., 1990; Wells, 1991) has resulted in opportunities to examine closely the effects of interactions between dolphins and human activities, including both commercial and recreational fisheries (e.g. Wells and Scott, 1994; 1997). We report here on one case in which we removed a large quantity of fishing line trailing from a free-swimming bottlenose dolphin, and we include information on the behavior and health of the animal over the first year following entanglement and removal of the gear. We also compare the extent of commercial vs. recreational fishing interactions with dolphins.

On 4 June 1996, a seven-year-old female bottlenose dolphin ("FB03") was observed traveling alone near shore in the Gulf of Mexico off Anna Maria Island (27°33'N, 82°45'W), trailing large quantities of thin line that extended in clumps to 5 m behind the animal. The line was wrapped around the tail flukes and peduncle but did not appear to affect noticeably the dolphin's swimming ability. The dolphin (FB03) was known from birth as a member of a four-generation maternal lineage (Wells et al., 1987; Wells, 1991). She had been seen 146 times in this area prior to this incident, and was within her well-established home range. She had been observed six days earlier without any line.

This dolphin was seen next at 10:28 on 6 June 1996, in Palma Sola Bay (27°29'N, 82°40'W), several miles from her 4 June location and still within her home range. She was alone and surfacing slowly, still trailing the line. She was swimming more slowly than during the previous observation (as measured in relation to boat speed), and the clumps of line extended farther behind her, to a distance of about 8 m. Ventilations occurred at average intervals of 35.7 sec (±12.71 sec SD, n=58), comparable to previously measured rates for Sarasota dolphins (Irvine et al., 1981; Waples, 1995). The line was cutting into tissues of her flukes and peduncle. We decided to try to remove the line, assembled a team by 12:47, and approached the dolphin in our 6-m long research vessel powered by a 115-hp outboard engine. Because the trailing line followed the dolphin to the surface at each breath, we were able to reach and retrieve most of it. At 13:10 we secured the line with a boat hook, and cut all but about 2 or 3 m of line from the animal as she continued swimming. The dolphin swam rapidly and "porpoised" for about 3.7 km, left the bay, and continued to the south. We approached her again in shallow water (<2 m deep) and she maintained position, riding slowly beneath the bow of our vessel for the next 38 minutes; this is the longest recorded instance of bow-riding in the history of our research program. Her position beneath the bow afforded us an opportunity to examine closely the wounds and remaining line. Cuts around the peduncle at the insertion of the flukes and through the anterior edges of the flukes were evident. The remaining line circled the peduncle once and two freely trailing ends were draped across and extended about 1.3 m behind the

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flukes. We tried unsuccessfully a number of times to grasp the remaining line with the boat hook as the dolphin rode the bow wave. Throughout these attempts, the dolphin held her position directly below the bow, clearly watching the boat hook as it moved within several cm of her flukes, and she made no effort to move away.

The next observation of the dolphin was on 18 June 1996, on Sister Key Flats (27°27'N, 82°39'W), near where we had left her on 6 June. She was swimming normally and no line was evident, although indications of scarring were seen where the line had been. Through 1 July 1997, she was observed 33 more times and her behavior was considered normal each time. She was alone each time that she was seen while entangled; she was seen alone in only 24% of her unentangled sightings. Prior to entanglement, she was found in groups of 4.9 dolphins on average (SD=4.32, n=73). Following removal of the line, she was in groups of 4.4 dolphins on average (SD= 4.56, n=30).

On 13 June 1997, this dolphin was examined by veterinarians as part of a dolphin health assessment program. The wounds from the line were well healed, but deep scars remained (Fig. 1). Her health was comparable to that at the time of her previous examination on 17 June 1994. Her weight (132 kg) was 19 kg greater than three years before. Veterinary staff considered her blood chemistry and hematology values to be within acceptable limits, and results of ultrasonic examination of organ condition were unremarkable. Thus, it appears that no long-term effects beyond scarring resulted from this relatively brief entanglement event. The depth of scars, however, suggests that her flukes could potentially have been severed if the line had not been removed. The line was determined to be 80-pound (approx.) test "squidding line," a floating-core braided Dacron line often used locally for tarpon fishing from late spring to early summer. Tarpon fishing occurs in the immediate Gulf coastal waters, especially in the area where this dolphin was first seen with the line around her flukes. A large number of snarls and cuts in the 484 m of line

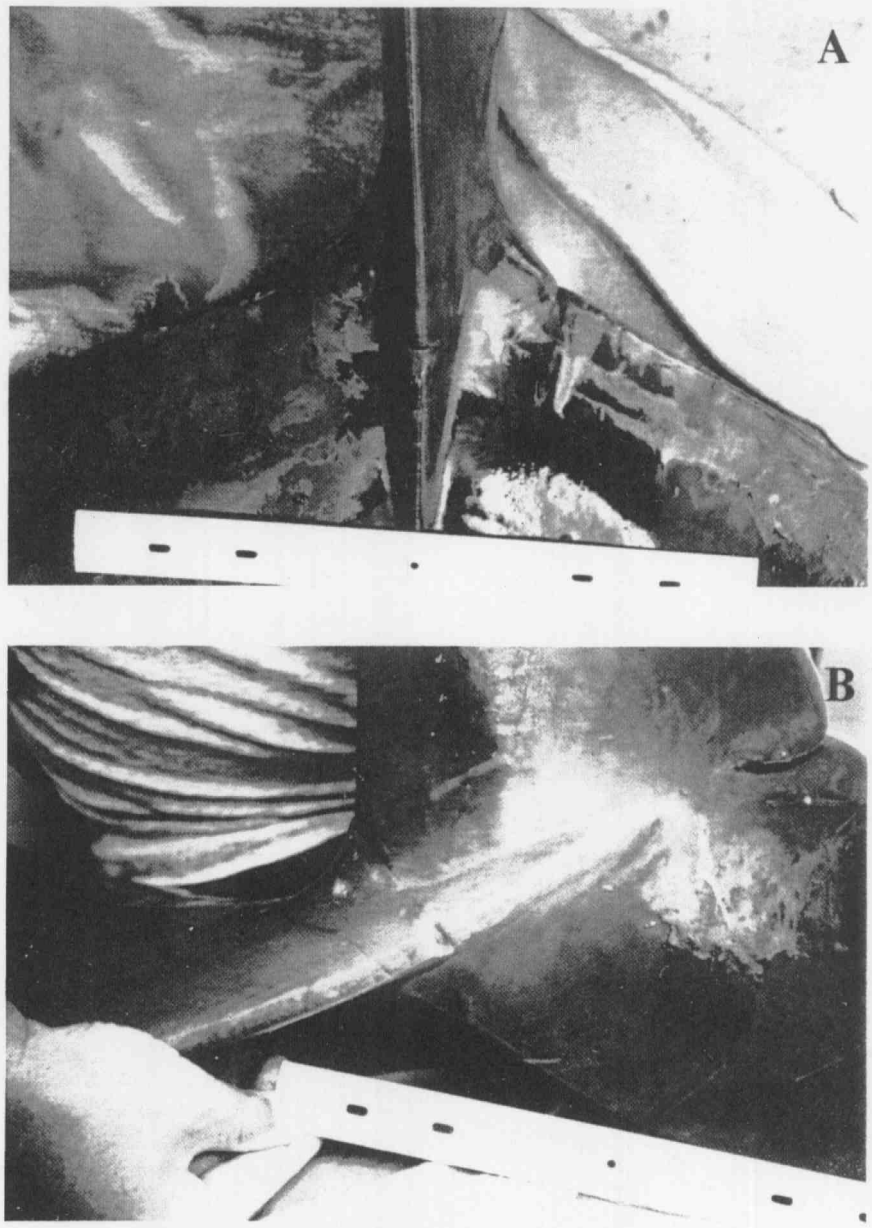

Figure 1

(**A**) Dorsal view of the scars on peduncle and flukes of the entangled dolphin (FB03) approximately one year after removal of the fishing line. (**B**) Ventral view of the scars on peduncle and flukes of the same entangled dolphin (FB03) approximately one year after removal of the fishing line.

removed suggested that it had been removed from a reel and discarded, rather than it had been actively involved in fishing at the time of entanglement.

Recreational fishing activities pose a largely ignored threat to bottlenose dolphins near Sarasota. Of 11 carcasses of resident Sarasota Bay dolphins recovered during 1993–1996, monofilament fishing line was implicated as a contributing factor in three deaths (27%). Large quantities of fishing line were found around two dependent calves (MML 9314=1.5 yr old and MML 9417=0.3 yr old). In one of these cases (MML 9314), growth of invertebrates on the line indicated that the line had been discarded prior to entanglement. The third case involved ingestion of line by an adult female (MML 9514) that had consumed a hooked sheepshead (*Archosargus probatocephalus*), as reported by Gorzelany (in press).

Wells and Scott (1994) reported that a disproportionately large number of subadult Sarasota Bay resident dolphins involved in entanglements of all kinds had been recorded through 1989 on the basis of scars observed during veterinary examinations as part of a capture-release program. More than half of the cases involved subadults; the balance were recorded from adults, but the entanglement events had occurred at an undetermined younger age. Dolphin FB03, a subadult at the time of entanglement; and the two dependent calves described above lend further support to this pattern. Similarly, Mann et al. (1995) reported on four cases of infant bottlenose dolphins becoming entangled in Shark Bay, Australia. In three of these cases, it was possible to remove the line from the semiprovisioned calves; in the fourth case, the line came free from the dolphin without human assistance. For many young animals, curiosity, inexperience, and unrefined motor skills place them at greater risk of entanglement through playful and exploratory behavior, the occurrence of which declines as the animal matures. Play may be strongly related to foraging behavior, for example, and may allow younger animals to practice, learn, and develop other behaviors that will be essential to their survival. Such behaviors may have an important role in the development of adult behaviors, but they may also be a costly practice for newborns or subadults who lack the experience of an adult.

In many parts of the world, dolphins are killed in gillnet and other fisheries (Perrin et al., 1994). It is interesting to note that in Sarasota Bay, Florida, an area of heavy recreational fishing activity, the numbers of deaths or serious injuries resulting from recreational fishing could exceed historical levels from small-scale gillnet fisheries. Gill nets were used extensively in this area prior to a state-wide ban, July 1995. Three deaths and one rescue of Sarasota resident dolphins entangled in recreational fishing gear occurred during 1993–96, but only one death (FB20 in 1976) and one rescue from gill nets (FB11 in 1985) were recorded during the 20 years prior to the 1995 gillnet ban. It should be noted, however, that stranding response coverage was uneven prior to the mid-1980s: not all deaths resulted in recovered carcasses, and not all possible entanglement events could be clearly identified as a direct cause of death, nor could they necessarily be distinguished as net or line entanglements.

Mortality and serious injury to dolphins from recreational fisheries have been largely overlooked in management, yet such mortality and injury may be important. Management actions to reduce human-related dolphin mortality are needed to address such issues, particularly in regard to the practice of discarding fishing line. Discarded line poses a risk that is somewhat analogous to that of "ghost-fishing" by commercial nets. Increased education of fishermen, through clear descriptions of the documented consequences of discarded gear is a logical, important, approach to the issue.

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