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SEASONAL INCIDENCE OF BOAT STRIKES ON BOTTLENOSE DOLPHINS NEAR SARASOTA, FLORIDA

In Florida, marine mammals share shallow coastal waters with large and increasing numbers of boats. As of 1990–1991, more than 716,000 boats were registered in Florida (Florida Dept. of Environmental Protection, unpublished data, in Wright *et al.* 1995). High and increasing numbers of Florida manatees (*Trichechus manatus latirostris*) die each year from collisions with watercraft (Wright *et al.* 1995); in addition, sublethal injuries to manatees from boats contribute to distinctive scarring that has permitted scientists to recognize well over 900 manatees (Beck and Reid 1995). The quicker-swimming bottlenose dolphin, *Tursiops truncatus,* lives in these same waters but suffers relatively few boat-related injuries. Such injuries do occur, however, and there is concern that, as boat traffic increases, dolphin injuries and deaths may increase as well. In Sarasota, Florida, injuries believed to be the result of collisions with boats from 1983 to 1996 have been documented in four cases involving members of the 100-dolphin resident community (Scott *et al.* 1990, Wells 1991). Interestingly, the seasonal distribution of these collisions was tightly clustered and correlated with periods of higher-than-normal boating activity.

The first case involved an 11-yr-old male, FB78, observed with a fresh dorsal fin injury on 2 July 1983. Seven parallel, evenly spaced vertical cuts were evident in the fin, the top half of which curled to the left (Fig. 1a). The freshness of the wound was indicated by the clearly demarcated white and red regions evident in the cross-sectional slices. The dolphin swam slowly, trailing a group of other dolphins. The wounds eventually healed and repigmented, but the fin is still splayed and curled. Although its dorsal fin previously lacked distinctive markings, the dolphin was recognizable from the scoliosis (a spinal deformity) apparent in its caudal peduncle.

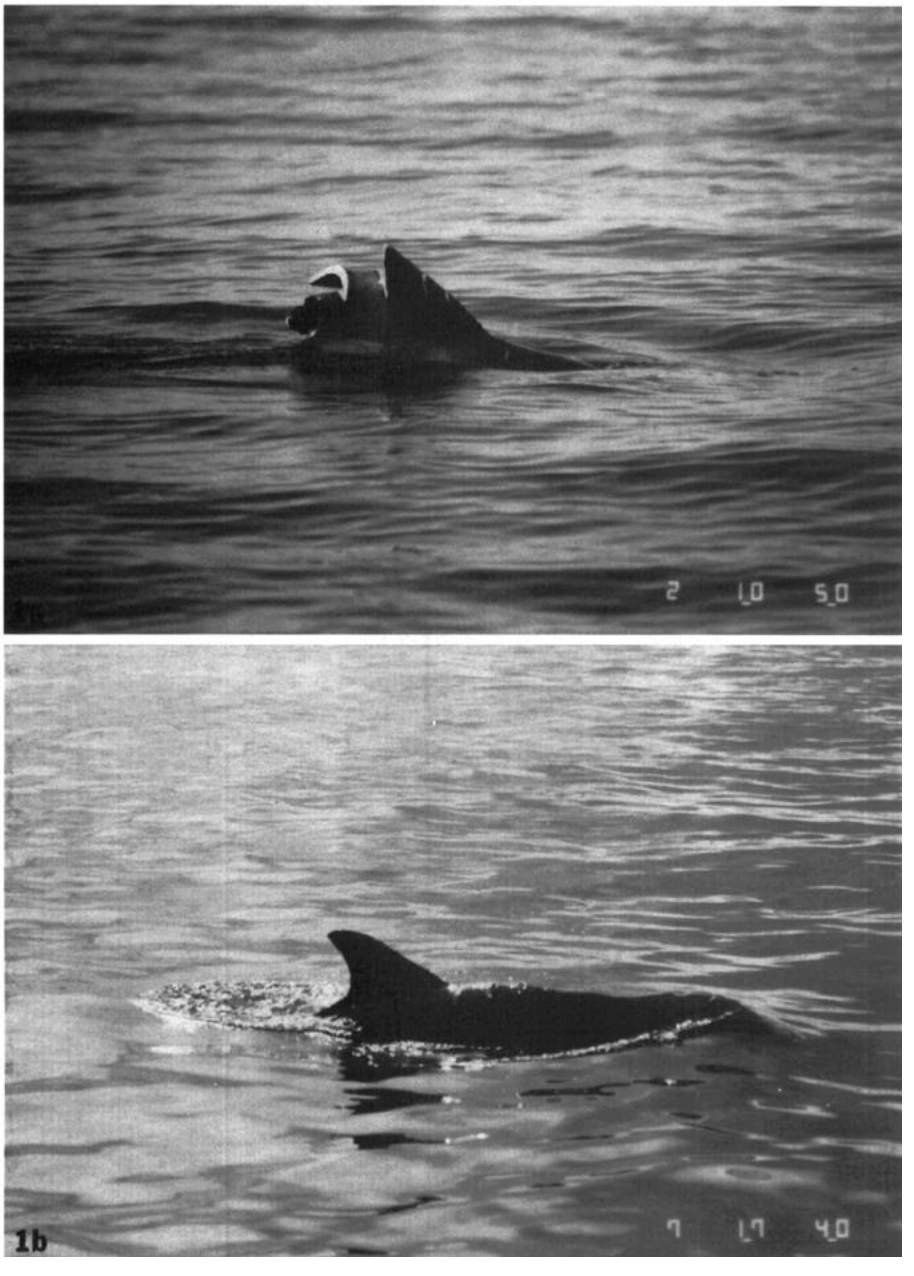

Figure 1. a: Dolphin FB78, on 2 July 1983. b: Dolphin FB108, on 7 July 1984. c: Dolphin FB103, on 8 July 1988, to the left of her mother. d: Dolphin FB09, on 9 July 1996.

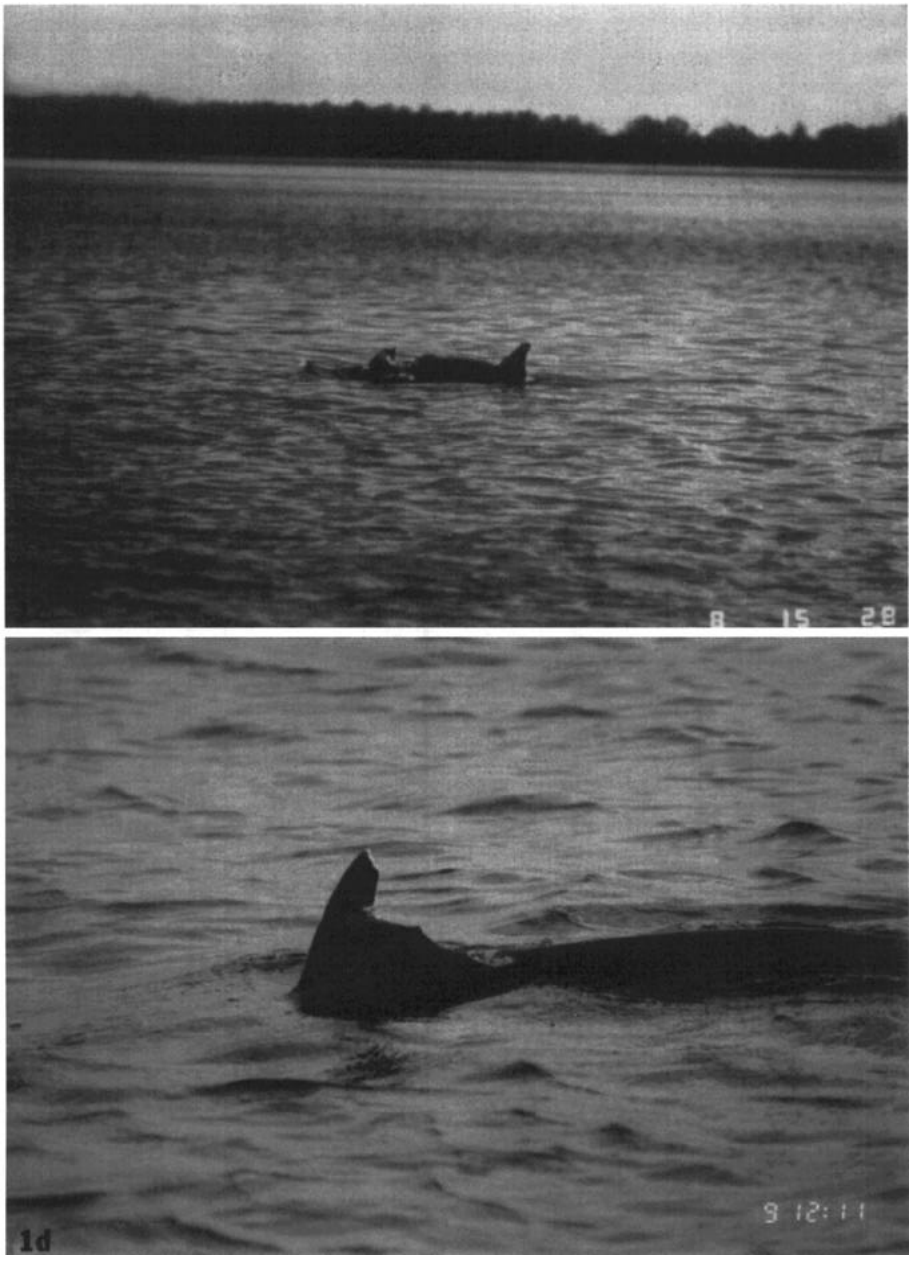

Figure 1. Continued

FB108, a 6-yr-old male, was seen on 7 July 1984 with three fresh, parallel, evenly spaced, transverse gashes anterior to the dorsal fin (Fig. 1b). It had been last identified, uninjured, 13 d previously. The freshness of the wounds suggested that it had been struck within the previous 2–3 d. Its wounds have subsequently healed into parallel scars.

FB103, a female, was less than 2 mo old when it was apparently struck by a boat between 6 July and 8 July 1988. Its wound was first evident as a large gash on the left side below the dorsal fin, trailing yellowish necrotic tissue (Fig. 1c). The dorsal fin curled to the right. It swam normally alongside its mother when first seen with the wound. The wound healed, although a large scar remained, and the fin remained curled. FB103 died at 4 yr of age, apparently from a severe lung infection; the role of the severe injury early in life remains unknown.

FB09, a 12-yr-old female, was struck by a boat propeller between 25 June 1996 and 9 July 1996. Its injuries included three roughly parallel, evenly spaced, diagonal cuts in its dorsal fin and caudal peduncle (Fig. 1d). The dorsal fin cuts removed approximately 25% of the tissue along the posterior edge. The freshness of the wound suggested that the injury had occurred within the previous week. Prior to the injury, FB09 had been accompanied by a yearling calf, but the calf was not seen during surveys by as many as three research boats during 9–11 July, although FB09 was observed repeatedly during the same period. The calf rejoined FB09 by 12 July, however, and appeared to be nursing.

All of these injuries were first observed on free-swimming dolphins, but three (FB78, FB108, FB103) later had veterinary examinations during capture-release efforts as part of a health assessment program and/or during necropsy following stranding. Each dolphin had straight, deep cuts into the dorsal fin or body. The multiple cuts were parallel and evenly spaced, with the spacing approximating that observed for propeller scars on manatees in the same area (Wright *et al.* 1995). Although none of these injuries was immediately fatal, long-term effects on survival are unknown.

The narrow seasonal distribution within which these injuries occurred is particularly noteworthy. Each dolphin was first observed to be injured before, during, or a few days after the Independence Day weekend in four different years. No such injuries were observed during the rest of the year (the probability of four injuries all occurring by chance only within a specific eight-day period during a year is about 2.3×10^{-7}). Because of the large number of boats registered within the two counties that comprise the home range of the Sarasota dolphins (27,685 in 1995), the dolphins are exposed to boats throughout the year. More boaters use their boats during April than during any other month (89.7%), but the differences from month to month are minor; 80.1% of boaters surveyed used their boats during July (Whelan 1993).

Several factors may contribute to summer being a more dangerous time for dolphins. First, from late spring through early autumn the dolphins shift their daily ranges from deeper coastal waters to shallow inshore waters and narrow channels (Wells, 1993), making them more vulnerable to collisions with rec-

reational boats in the sheltered bays. Second, major holidays during the summer greatly increase the level of boat traffic during certain weekends. In general, twice as many boaters use their boats on weekends as on weekdays (Whelan 1993). Based on fuel sales at a marina located centrally within the range of the resident dolphins (Cannons Marina; J. Bergbom, personal communication), boating activity increased approximately 65% on holiday weekends as compared to other late spring/early summer weekends during 1996. Finally, the Independence Day holiday period, during which all of the injuries discussed apparently occurred, involves perhaps the highest level of boat activity during the entire year. Since 1985, the annual Suncoast Offshore Grand Prix powerboat race has been conducted during this period. These races take place over several days, in both inshore and coastal Gulf of Mexico waters. The combination of high-speed race boats and, perhaps more significantly, several thousand spectator boats associated with the races and holiday activities increases the risk of collision with dolphins.

Third, the conditions of the animals themselves may also have contributed to the collisions. In three of the four cases, the animals were compromised in some way. The scoliosis of FB78, the extreme young age and inexperience of the neonate FB103, and the presence of a dependent yearling calf with the relatively inexperienced mother FB09 may have been contributing factors. The peak of the calving season occurs during May–July (Wells *et al.* 1987), and neonates and mothers may be particularly vulnerable to boat strikes.

In the case of the Sarasota bottlenose dolphins, the combination of compromised animals inhabiting shallow waters with heavier-than-normal boat traffic, increased underwater engine noise, and high-speed races could make boat collisions difficult to avoid and may explain why boat-strike injuries occur during such a limited part of the year. More generally, a boat disturbance study on killer whales, *Orcinus orca* (Kruse 1991), together with preliminary data from Sarasota (Wells 1993) suggests that boat traffic can affect the distribution, behavior, and energy requirements of these and other toothed whales and may be a cause for concern (see Richardson 1995 for a review). The available evidence suggests that management plans need to address other potential threats in addition to human-induced mortality, as has been done for the Florida manatee (O'Shea 1995). The potential harm to dolphin populations from boat-caused injuries and behavioral disruptions should be considered as well, particularly given that increasing boat traffic can only increase the vulnerability of these populations.

Acknowledgments

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