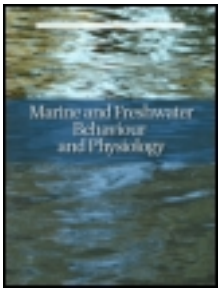

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SHORT COMMUNICATION

Aerial behavior by the fin whale (*Balaenoptera physalus*) in the wake of a freighter and near other boats

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This study confirms that the fin whale (*Balaenoptera physalus*) exhibits infrequent aerial behavior and that it sometimes occurs near different types of boats. We describe this uncommon behavior in the wake of a freighter and near other boats, provide details that expand upon an aerial rotation technique briefly noted in fin whales by others, and show that we have observed only three of these aerial events in 33 years of seasonal effort within our study areas in the Gulf of St. Lawrence, Canada. Collectively our study contributes new information, including kinematics, about aerial behavior in fin whales and suggests that this behavior is not geographically limited to the Mediterranean Sea where it has been reported most often.

Keywords: fin whale; *Balaenoptera physalus*; aerial behavior; boats; Gulf of St. Lawrence; Canada

Aerial or "breaching" behavior in whales varies in prevalence by species, but is uncommon in fin whales (*Balaenoptera physalus*) (Whitehead 1985a; Pryor 1986). The causes and purposes of aerial behavior include acoustic communication, spacing mechanisms, sexual displays, threats to intruding whales or boats, excitement or arousal, annoyance, response to injury, and play behavior (Gilmore 1961; Tomilin 1967; Herman & Tavolga 1980; Whitehead 1985b; Clapham & Mead 1999). Most information about aerial behavior in fin whales has come from observational reports based in the Mediterranean Sea (Marini et al. 1996).

On 21 August 2007 at 17:10 h (EDT) we encountered an evidently sub-adult fin whale (10–11 m) in the Gulf of St. Lawrence estuary (near 48° 24′ 00″ N × 69° 15′ 31″ W) as it performed repeated aerial behaviors behind the wake of a westbound freighter and then near our 4.5 m rigid hull inflatable boat. The whale initially breached 12 times behind the freighter using a technique similar to that described by Marini et al. (1996). It later performed a 90° aerial rotation maneuver, near our boat, whose kinematics has not previously been described in detail (Carwardine 1995). The first sequence began about 200 m aft of the freighter's stern with all breaches oriented toward the ship; the interval between breaches was about 30 s. The first three were near the starboard component of the V-shaped wake, while the remaining nine took place consecutively

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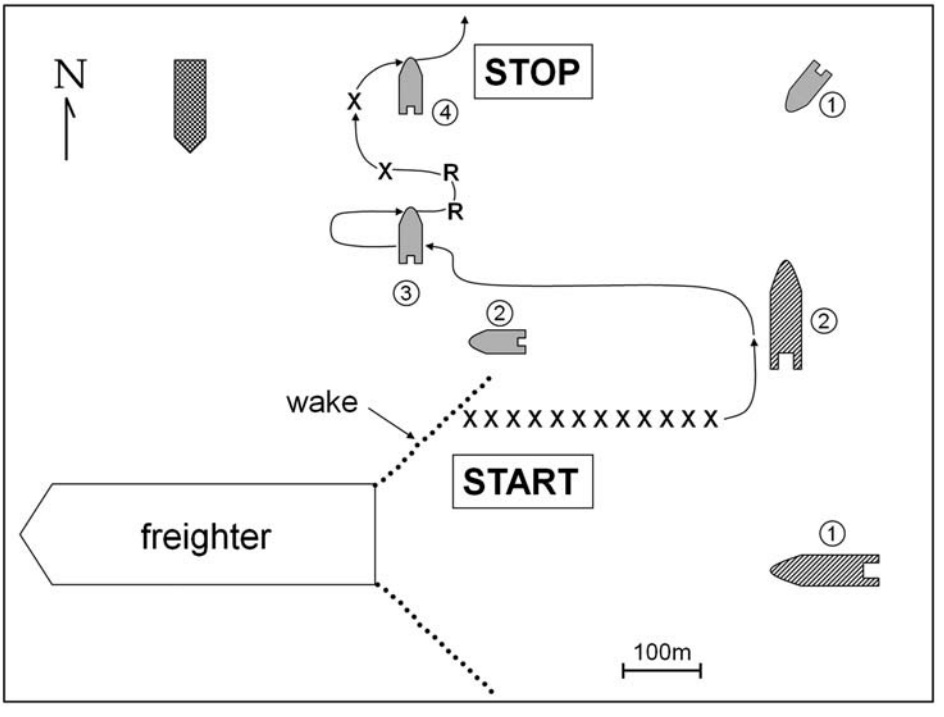

Figure 1. Track of the sub-adult (10–11 m) fin whale in this study as it performed aerial behavior (X) and rolling behavior (R) near three boats including a freighter (labeled), a whale- watching boat (cross-hatched) and our research boat (solid). Encircled numerals indicate sequential positions of each boat relative to the whale. A recreational boat (stippled) was also in the area but was not approached by the whale. Boat sizes are not to scale.

farther as the freighter continued west and the whale exhibited no obvious attempt to follow it. Figure 1 shows a track of the whale's positions and behaviors relative to the freighter and three other boats in the vicinity. When the freighter was about 1 km away, the whale stopped breaching and swam at moderate speed alongside a nearby whale-watching boat for a short series of breaths before approaching our boat. It swam under us twice, while we slowly advanced. It then rolled twice in a counterclockwise

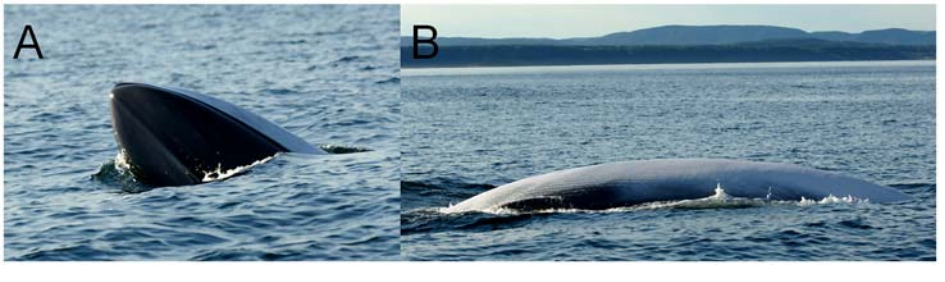

Figure 2. A sequence of photographs of the same fin whale as it performed two counterclockwise rolls at the surface, just prior to performing multiple aerial behaviors. About half of the rostrum first rose above the surface (A) before the whale rolled onto its back, exposing the belly and genital areas (B). No feeding behavior was observed.

direction, where half of the rostrum rose above the surface just before the belly and genital areas were exposed (Figure 2). At no point did we observe any evidence of feeding behavior, which typically includes an opened mouth and distended ventral pouch (Orten & Brodie 1987; Goldbogen et al. 2006, 2007). After rolling, the whale dived toward the bow of our boat and performed two breaches in front. It broke the

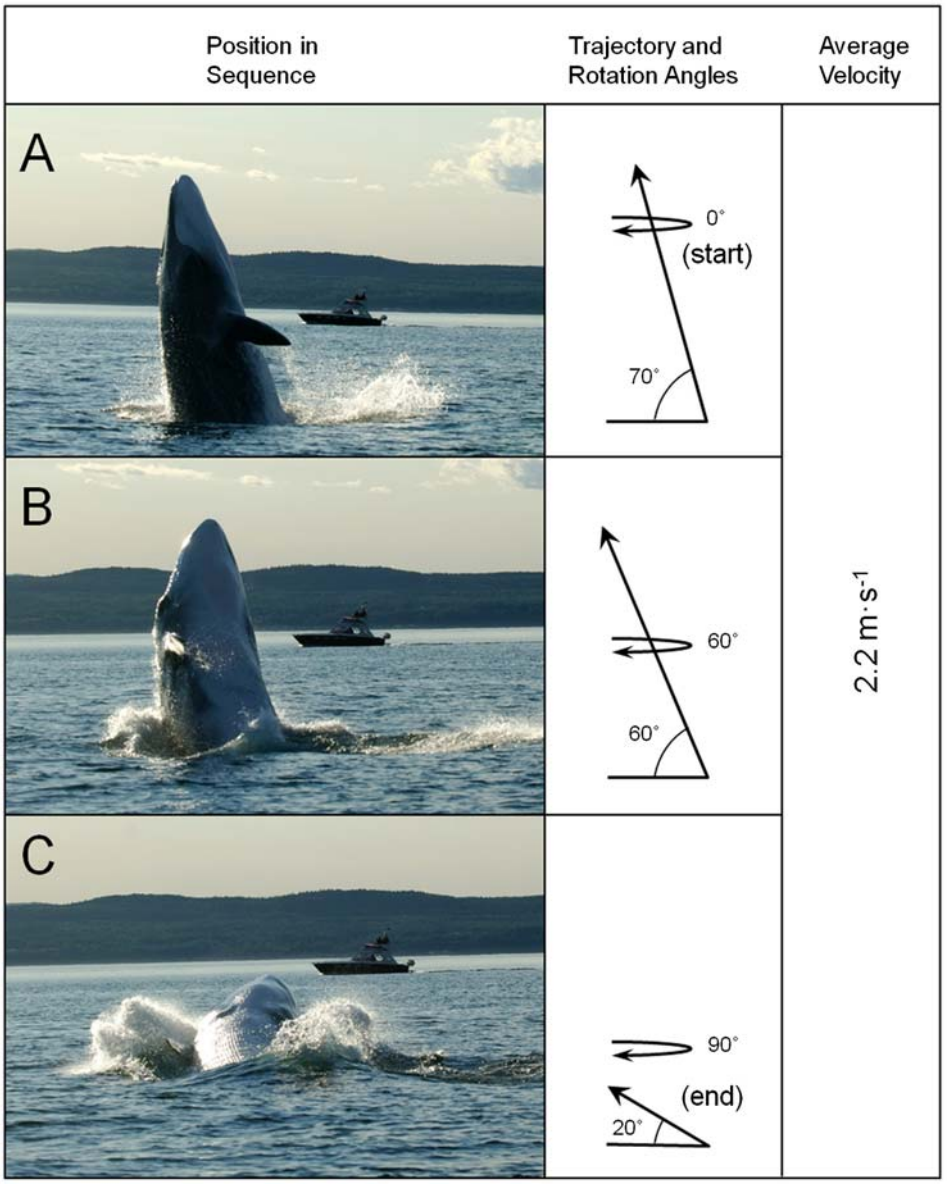

Figure 3. Photographs showing three sequential body positions with their corresponding trajectory and rotation angles during the breaching event from the fin whale. The whale exited the surface with a trajectory angle of about 70° relative to the surface (A). About midway through the sequence, the body began rotating counterclockwise (B). The whale then landed on its back after completing a 90° rotation (C). Average velocity for the breach was 2.2 m s^{-1}. The recreational boat referenced in Figure 1 is shown in the background.

Figure 4. A photograph of the fin whale exhibiting aerial behavior without any body rotation (similar to observations by Marini et al. (1996)). The whale exited the water at about a 45° angle with the surface and then landed on its left side. The right eye and extended right pectoral fin can be seen near the middle of the photograph. This ventral perspective clearly shows the asymmetric pigmentation characteristic of fin whales. Unsuitable photographs prohibited a velocity calculation for this behavior.

surface with about a 70° angle and then rotated counterclockwise in mid-air before landing on its back (Figure 3). Its average velocity was 2.2 $m\,s^{-1}$, which was calculated using photogrammetric techniques similar to those by Kot et al. (2009). Without taking a breath, the whale then breached a second time but did not rotate in the air (Figure 4). Whether rotating or not, both series of breaches were followed by 3–5 min of slow, linear swimming. No further aerial behaviors, near or away from boats, were observed over the next hour as the whale increased speed and traveled north out of the area.

Table 1 provides information about our three observations of fin whale aerial behavior over 33 years of effort during the summer months in our study areas within the St. Lawrence. This behavior is rare, yet those including rotational elements are even less frequent (Carwardine 1995). Perhaps due to body size and mass, fin whales have difficulty performing aerial rotations compared to the smaller humpback whale (*Megaptera novaeangliae*) that can rotate during 80% of its breaches (Whitehead 1985b).

Table 1. Our collective observations of fin whale aerial behavior in the Gulf of St. Lawrence, Canada during 33 years of seasonal effort (1979–2012). The sub-adult in the current study is included; all times are EDT.

Species	Date	Time (h)	Latitude	Longitude	Age class
B. physalus	8/23/1992	13:21	49° 55′ 25″ N	63° 29′ 26″ W	Adult
B. physalus	8/2/1995	16:35	50° 07′ 25″ N	64° 19′ 50″ W	Adult
B. physalus	8/21/2007	17:10	48° 24′ 00″ N	69° 15′ 31″ W	Sub-adult

Causal mechanisms of any whale behavior are not easily determined by single observations such as in this study. Recognizing this limitation, one possible explanation for this uncommon behavior by the sub-adult fin whale is play behavior involving the nearby boats and their wakes. Aggression toward the boats and any nearby whales is also possible. However, aggressive breaching typically accompanies other behaviors that we did not observe (e.g. tail slashing, tail slapping, and trumpet blowing: Weinrich 1995; Scheidat et al. 2004) and no other whales were observed in the area, although they could have been within acoustic range (Mellinger & Clark 2003). We cannot rule out the possibility that prior to our arrival, the whale-watching boat followed too close to the whale, initiating aggressive behavior (Norris & Reeves 1978). However, considering that the whale performed aerial behaviors near the freighter's wake and that it calmly rolled and swam just under our boat, it is likely that the purpose of these breaches was not related to aggression but rather to play behavior known in sub-adult whales (Herman & Tavolga 1980; Marini et al. 1996).

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