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Observations of a western North Atlantic right whale (*Eubalaena glacialis*) birth offshore of the protected southeast U.S. critical habitat

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The western North Atlantic right whale (NARW) (*Eubalaena glacialis*) is a critically endangered baleen whale with an estimated population below 450 individuals (Pettis 2009, Waring *et al.* 2009). Historically, the NARW occurred throughout the North Atlantic, but due to intense whaling, the population has been severely decimated and is now largely restricted to the eastern seaboard of North America (Reeves *et al.* 2007). The species has been protected from harvesting since 1935, but recovery has been prevented by mortalities from ship strikes and entanglement in fishing gear (Kraus *et al.* 2005, Knowlton and Brown 2007). The NARW's only known calving area is located in the shallow, nearshore waters off the southeastern United States

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(SEUS) (Kraus *et al.* 2007, but see Patrician *et al.* 2009), and in 1994, the US National Marine Fisheries Service designated the coastal waters from Brunswick, Georgia to Cape Canaveral, Florida as right whale critical habitat (U. S. Federal Register 1994). That same year, the early warning system (EWS) aerial surveys were implemented in the SEUS to alert mariners of right whales in the area in an attempt to reduce the potential for ship strikes during the calving season (Brown *et al.* 2007). For the past 16 yr effort has varied, but the EWS surveys have systematically searched the calving grounds and surrounding area, monitoring right whale distribution and calf production. Despite this intense survey effort, only one NARW live birth has been observed, which occurred within the critical habitat (Zani *et al.* 2008). Here we report observations on the birth of a right whale calf 63 km offshore, well outside of the area currently designated as right whale critical habitat.

The United States Navy has proposed developing an Undersea Warfare Training Range (USWTR) 60–150 km offshore from Jacksonville to St. Augustine, Florida (Fig. 1, U. S. Federal Register 2009). Beginning in 2009 a multiinstitutional monitoring program involving aerial, vessel, and acoustic surveillance techniques was established to investigate cetacean and sea turtle abundance and distribution at the proposed Jacksonville UWTR site. The 5,751 km² survey area consists of the 1,717 km² USWTR site and surrounding waters, whose western edge lies 9.3 km to the east of the current EWS survey area. Ten 86-km tracklines, spaced 7.4 km apart, transect the survey area (Fig. 1). Two full sets of tracklines (a total of 20) are flown in each calendar month, weather permitting. In addition, the USWTR survey effort was intensified during the peak right whale calving season in 2010 (January through March), with three full surveys flown per month for 11 d of flights totaling 8,153 km of effort. The current EWS aerial surveys are conducted daily (weather dependent) from December through March from Sapelo Island, Georgia to Crescent Beach, Florida. Thirty-six tracklines, spaced 5.5 km apart, are flown from 0.9 km up to 65 km offshore, approximately the area of the right whale SEUS Seasonal Management Area (SMA) (U. S. Federal Register 2008) (Fig. 1).

Aerial surveys were flown in a CFR Part 135 certified twin engine Cessna 337 Skymaster at 305 m altitude and 185 km/h, with a pilot, copilot, and two observers. During a survey, observers scanned the sea surface recording specific environmental variables (*i.e.*, Beaufort Sea State, visibility, glare, and cloud cover) and searched for cetacean and sea turtle sightings. When a sighting cue was observed, the plane closed on the sighting to obtain positional data, biological parameters associated with the sighting, and images for species identification and right whale photo-identification with a high-resolution digital camera and a telephoto lens (Canon 40D, Canon EF 100–400 mm f/4.5–5.6 IS USM; Canon U.S.A., Inc., Lake Success, NY). Upon completion of a sighting, the plane returned to the position from where it broke track to resume survey effort.

At 1019 on 20 March 2010, during a standard aerial survey of the USWTR survey area, a lone right whale was observed at 30.047°N, 80.677°W in Beaufort Sea State 2 (Fig. 1). In the initial minute of observation, the whale was milling at the surface, with no discernable heading. Four minutes later, the whale began to engage in several 3–4 min long shallow dives interspersed with surface intervals of just over 1 min.

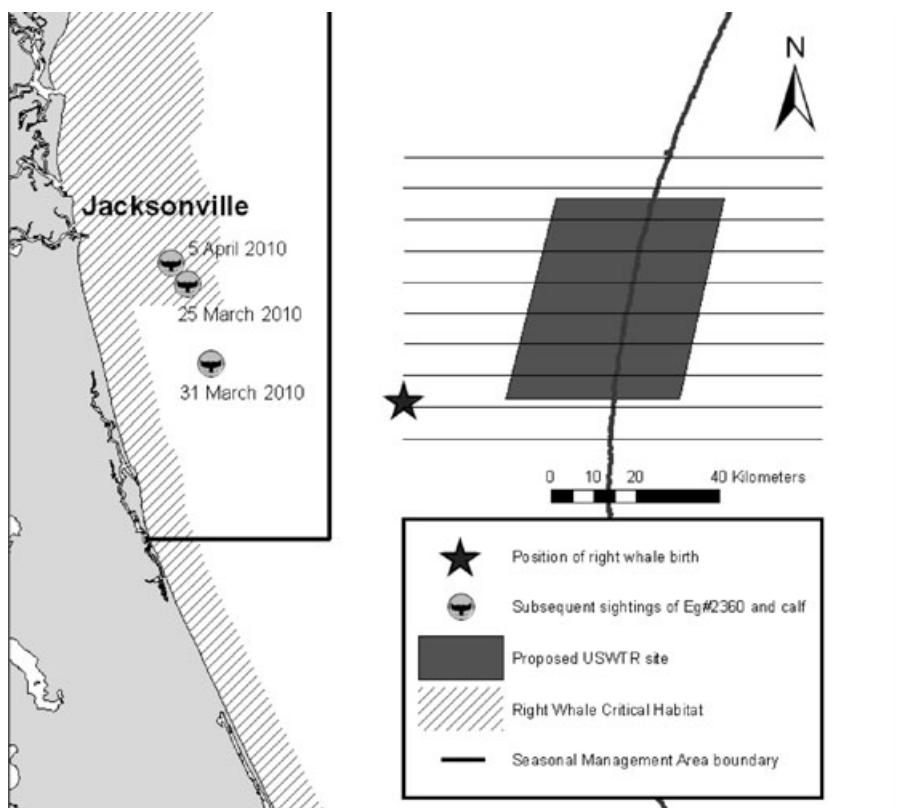


Figure 1. Location of observed right whale birth on 20 March 2010 off of Jacksonville, Florida including proposed Jacksonville Undersea Warfare Training Range (USWTR) site, aerial survey tracklines, Right Whale Critical Habitat, and Seasonal Management Area boundaries. Subsequent sightings of Eg#2360 and calf are also plotted.

Each dive was preceded by a slow, shallow tail-slap. During this time the whale was never out of sight, remaining just a few meters beneath the surface. This abnormal behavior led observers to suspect the animal might be entangled in line, which upon later review of images, was determined not to be the case. The aircraft continued to circle the whale to obtain photographs. After 24 min, during which the whale made four shallow dives with associated surface intervals, the whale lobtailed multiple times and descended out of view.

Following 4.5 min with no visual observation of the whale, two large clouds of blood appeared in the water. Seconds later, a small calf was observed at the surface next to the blood clouds. During this initial surfacing the calf appeared bloody, its flukes were limp (Fig. 2A), and fetal folds were obvious along its flanks (Fig. 2B). A distinct smooth callosity pattern was discernible on the calf's rostrum but no cyamids (light-colored amphipods of the family Cyamidae) were observed (Fig. 2C). Following the initial surfacing the calf was alone at the surface for 34 s, approximately 50 m ahead of

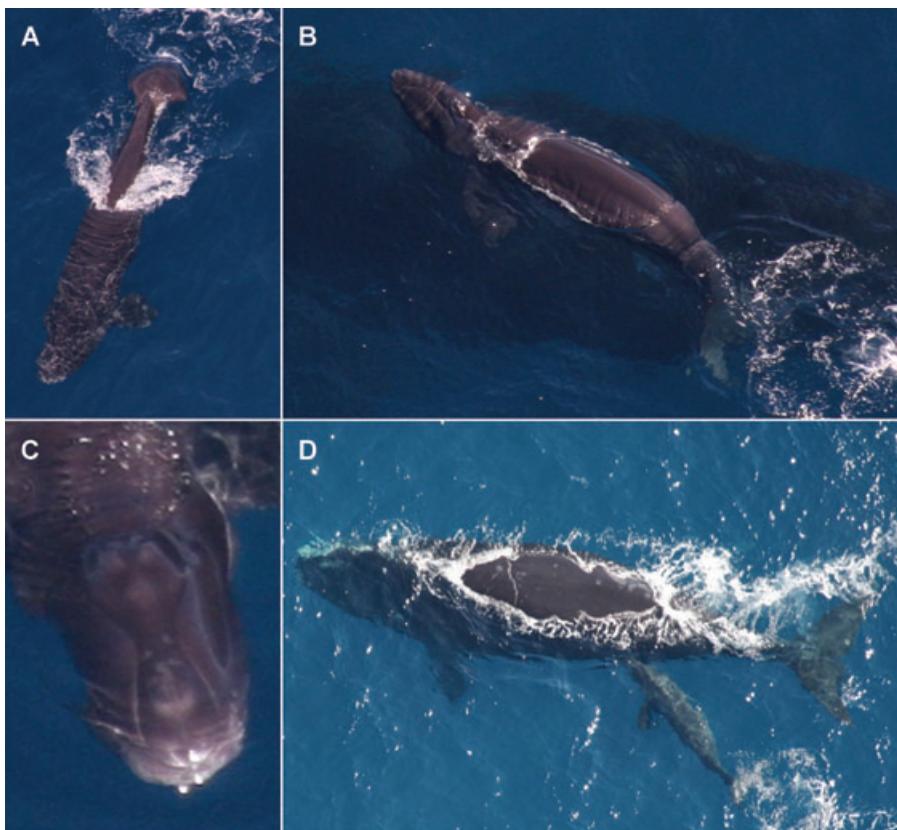


Figure 2. (A) Limp flukes with curled tips are visible on neonate calf. (B) Fetal folds visible on left side of neonate. (C) No cyamid coverage visible on neonate's rostrum, but callosity pattern is discernible. (D) Behaviors interpreted as attempted nursing which started 10 min after birth.

the submerged female, in which time it was swimming, submerging, and breathing unassisted. The female then began to approach, and moved within approximately 7 m of the calf. For the next few minutes the female and calf moved progressively closer, and after 3 min the first tactile interactions were observed. The female left distinct trails of bloody discharge, which continued for several minutes. No tactile interaction between female and calf was observed until most of the discharge ceased, although the female was observed sporadically emitting small amounts of blood up to 13 min after the pair joined. After the continuous discharge ended, the female whale proceeded to swim with the calf in a circular fashion until the trail of discharge was no longer visible. At this point the pair engaged in an extended period of physical contact, with the calf "riding" on its mother's back and nuzzling. Ten to 13 min after the time of birth, the calf investigated its mother's tail stock area, alternating between the left and right sides, although it was not possible to determine whether nursing was successful (Fig. 2D).

Forty-seven minutes after initially sighting the animal, the USWTR survey team departed the area. The Fish and Wildlife Research Institute's (FWRI) EWS right whale aerial survey team arrived 8 min later to continue documentation and remained on scene until 1143. During this time period, the female and calf swam in circular patterns, at or below the surface. The female frequently nuzzled the calf and slowly overtook it with her forward momentum, at which time she would shallow dive and circle back to locate it, surfacing with her head next to the calf's head and nuzzle it again. This behavior was observed six times over 13 min. The female and calf were separated by approximately 14 m for less than a minute approximately 30 min after the first blood cloud. During the remainder of the observation the female and calf were in close proximity to one another with the calf often alongside or on the back of the female. The calf's flukes remained limp throughout the observation and its swimming behavior appeared awkward and uncoordinated. No attempted nursing was witnessed during this second observation period. The female was later identified as Eg #2360 by researchers at the New England Aquarium. Eg #2360 is at least 17 yr old and is known to have given birth twice in the past (North Atlantic Right Whale Catalog²).

The observation of the birth of a right whale is an exceedingly rare event, and only one such event has been previously published (Zani *et al.* 2008). This sighting is unique in that several minutes of the female's behavior before giving birth were recorded, in addition to the parturition and subsequent interactions between the neonate and its mother. Unlike the birthing event witnessed by Zani *et al.* (2008), Eg #2360 displayed no violent tail slapping while rolling the body or sudden movements during this sighting although the female's body movements during the birthing event occurred at depth and out of view.

Also in contrast to the right whale birth observed by Zani *et al.* (2008), and those reported for a number of other cetaceans (false killer whales, *Pseudorca crassidens*, Notarbartalo-di-Sciara *et al.* 1997; killer whales, *Orca orcinus*, Stacey 1997, NARW, Zani *et al.* 2008), Eg #2360 remained physically separated from her calf for approximately 3 min after its initial appearance at the surface. Thus, the calf surfaced unassisted and remained by itself before being joined by its mother.

After this initial sighting of the observed birth far offshore, Eg #2360 and calf were sighted three additional times by FWRI in the EWS survey area. These sightings occurred on 25 March, 31 March, and 5 April 2010 when the calf was 5, 11, and 16 d of age, respectively. Body contact (e.g., head-to-head and side-to-side contact) between female and calf was the most common behavior observed during these sightings. Attempted nursing was not observed during any of the three postbirth sightings which totaled 30 min. These serial observations also offered insight into the development of the right whale callosity pattern, used to identify individual whales within the population (Kraus *et al.* 1986). Distinct markings that appear consistent with known callosity patterns were visible on the rostrum, chin, and mandibles of Eg #2360's calf at birth. However, the markings were smooth in appearance, unlike

²Personal communication from Phil Hamilton, New England Aquarium, Central Place, Boston, MA, 21 March 2010.

callosity, and the pattern had no cyamid coverage, which is consistent with the observations of Zani *et al.* (2008). Sixteen days after the birth this pattern remained visible and there was no accumulation of cyamids on the rostrum other than along the lips. Analysis of photographs from the four sightings of Eg #2360's calf suggests the basis for callosity patterns may form before birth and the callosity itself does not begin to emerge until the calf is greater than 16 d of age.

Eg #2360 has an unusual sighting history. After giving birth for the first time in January 2004 in the SEUS, she was observed with her calf (Eg #3460) in the Gulf of Mexico in April of that year (Patrician *et al.* 2009). Upon leaving the calving grounds, right whales generally head north to feeding grounds off of New England and Canada (reviewed by Firestone *et al.* 2008). Patrician *et al.* (2009) proposed that her second calf (Eg #3760) was born sometime between late April and early June 2007 in the waters off the northeastern United States, well outside of the typical calving area and season. The pair was subsequently sighted off of Florida in July of the same year, which constituted the first time a NARW had been observed off the SEUS in summer (Patrician *et al.* 2009).

The observations of this parturition event, along with the data presented by Patrician *et al.* (2009), and sightings of newly identified NARW neonates in waters off North Carolina and South Carolina (Waring *et al.* 2009), demonstrate that some right whales give birth outside the SEUS Right Whale Critical Habitat. This birthing event also occurred offshore of the recently established SEUS Seasonal Management Area (U. S. Federal Register 2008) and in a region that has not before been the focus of systematic surveys. The observation of the birth of a NARW offers interesting biological insights into this critically endangered whale, but also identifies the need to investigate appropriate critical habitats and associated management areas vital to the continued recovery of this species.

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