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North Atlantic right whale status update

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Population status update for North Atlantic right whales: 2022-2023

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The North Atlantic right whale (*Eubalaena glacialis*) is listed as endangered under the U.S. Endangered Species Act (ESA) and critically endangered on the IUCN Red List. Despite ongoing management measures by both the U.S. and Canada, the species continues to decline in abundance (Pace 2021). The median total abundance during 2021 calculated from the posterior of a Bayesian, hierarchical state-space model was 340 (credible interval 333-347). Those model results continue to show a diverging sex ratio with an estimate of only 143(137-149) females in the population during 2021 (Figure 1). As noted in Pace et al. (2017) the last estimate in the time series from this model is slightly biased low in expectation, however the continued downward trend in estimated abundance is well demonstrated. The overall abundance decline between 2011 and 2021 was 29.37% (derived from 2011 and 2021 median point estimates).

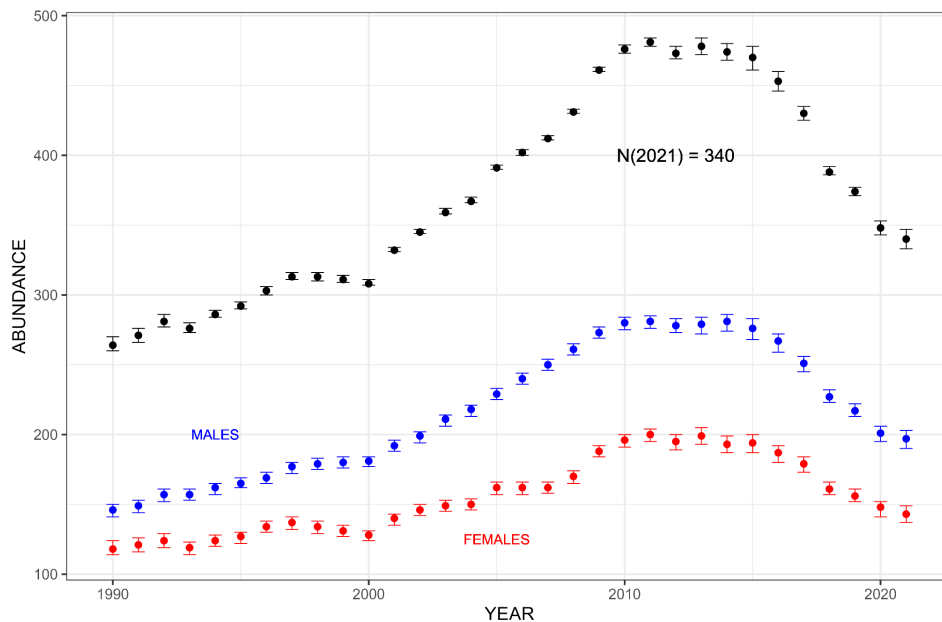


Figure 1. Abundance estimates (medians and 95% credible intervals) from hierarchical state-space models of North Atlantic right whale mark-resight data including separate estimates for the total number of males and females.

Reduced Survival

Since 2010, a well-documented and substantial change occurred in the feeding area-use patterns among North Atlantic right whales (Davis et al. 2017, Davies et al. 2019, Simard et al. 2019; O'Brien et al. 2022). Pace (2021) used a revised parameterization of the Pace et al. (2017) abundance model to test the hypothesis that survival rates changed after 2010. The model continues to support a decline in survival rates during 2011-2020 (Figure 2). The total estimated mortality continues to far exceed the recovered carcasses (Pace

et al 2021), and model results continue to support the declared unusual mortality event by the US National Marine Fisheries Service (Figure 3). Results from the hierarchical state-space model, combined with available datasets on animal health, serious injuries and mortalities, indicate that observed carcasses accounted for only 36% of all estimated deaths during 1990-2017 (Pace et al. 2021).

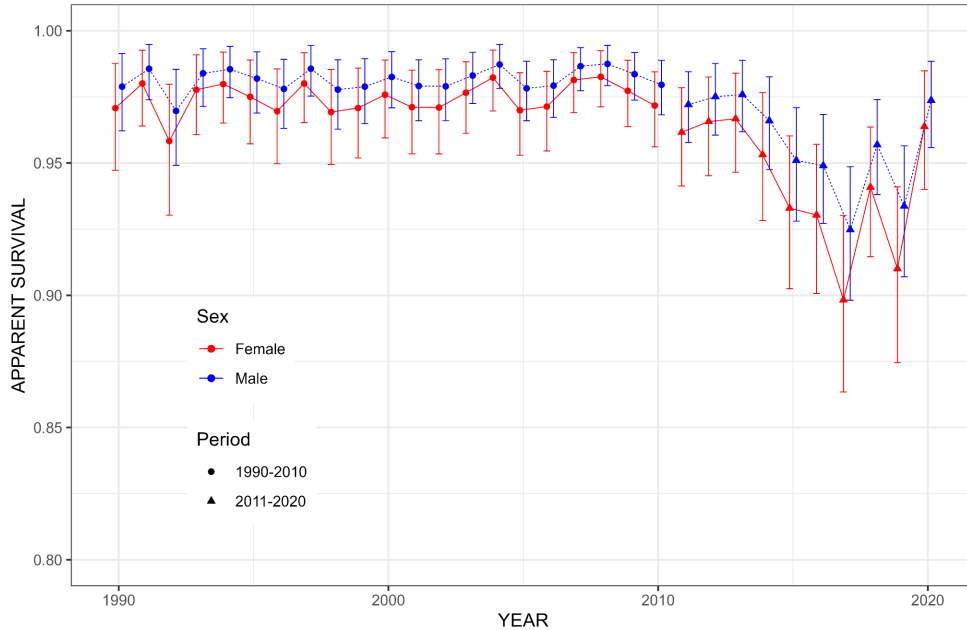


Figure 2. Estimated survival rates (medians and 95% credible intervals) from hierarchical state-space models of North Atlantic right whale mark-resight data parameterized to estimate abundance but with an added effect to test the hypothesis of a change in mean survival during 2011–2020. Point estimates and credible intervals are displayed for adult (5+) males (blue) and adult (5+) females (red). Mean estimates for survival decreased between the periods from 97.4% to 94.1% for adult females and 98.1% to 95.7% for males.

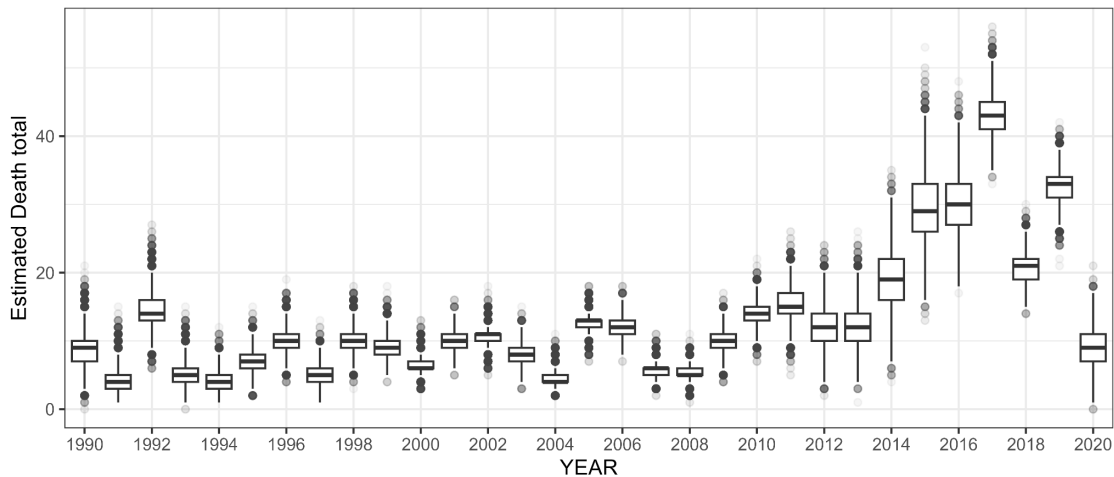


Figure 3. Estimated total number of dead North Atlantic right whales derived from a hierarchical state-space model of mark-resight data evaluated for 1990–2021.

Mortality & Serious Injury

The average observed annual mortality and serious injury rates related to anthropogenic causes increased 6% in 2016-2020, compared to 2015-2019 (8.1 from 7.65; Henry et al. 2022). A total of 37 mortalities were observed from 2016-2020, with entanglements and vessel strikes each accounting for 11 of the mortalities. One perinate calf was found dead, presumably from natural causes. The cause of death for the remaining 14 cases was undetermined. There were a total of 54 confirmed injury events, 20 of which were considered serious injuries, 19 from entanglement and 1 from vessel strike. Thirty injuries were considered “non-serious”.

Since the start of 2021, 4 mortalities have been observed, all in US waters: 1 calf and 1 adult died from vessel interactions, 1 adult from chronic entanglement, and 1 perinate from maternal abandonment.. A recent modeling study found that vessels of all sizes, including those under 20m in length, can cause serious injury or mortality to right whales (Kelley et al. 2021).

The number of mortalities and serious injuries not reported is unknown, and actual levels may be much higher. A recent random forest model applied to live injured whales found that current assessment methods may underestimate risk for injury cases lacking details or long-term observations (Carretta and Henry 2022). Based on the abundance model (Pace et al. 2017, 2021) an estimated 136 (121,195) NARW died during 2016-2020 which was more than 3 times the number of observed deaths. The disparity between observed causes of serious injury in right whales, and causes of mortality determined through necropsies of dead whales, indicate that the cause of death of examined carcasses may not accurately characterize the cause of cryptic mortalities. Ongoing work as part of recovery plan implementation¹ has explored an integrated model of live sightings and carcass recoveries to estimate cause-specific rates of injury and mortality during 1990–2019. Preliminary results indicate higher rates of mortality due to entanglement and vessel strike since 2010, with increased entanglement mortality for females after reproductive events. Examination of estimated death numbers and observed births placed on a *per capita* basis clearly demonstrates this dilemma for the population: since 2012 a low birth rate has failed to replace whales lost during a period of sharply increased mortality rate.

¹ <https://www.fisheries.noaa.gov/new-england-mid-atlantic/endangered-species-conservation/north-atlantic-right-whale-recovery-plan-northeast-us-implementation-team>

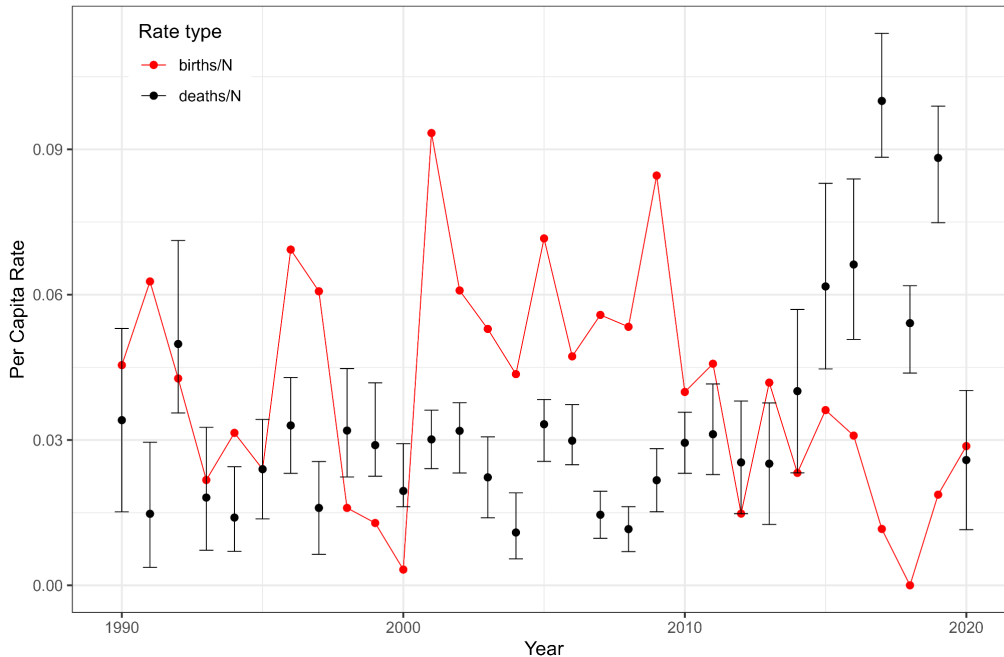


Figure 4. North Atlantic right whale per capita birth rate (red line, closed circles) and death rate with associated 95% credible intervals, 1990 – 2020

Proven Females and Reproduction

In the 2023 calving season (winter 2022-2023), 11 females were observed with calves, with the first sightings ranging from December 2022 through January 2023. Ten females had previously calved, and ranged in age from >20 years to at least 45 years old (based on known ages and/or years in the catalog). One female had her first documented calf at age 10. The number of calves observed each year has varied considerably in recent years. Productivity for this stock has been highly variable over time, but the per capita birth rate has recently trended upward since 0 calves were born in 2018, following a steady decline from 2011 (Figure 4). Based on the most recent population estimate, there are still fewer than 70 females known to have calved that are likely (>50% probability) still alive.

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