Southeast Fisheries Science Center Reference Document MMTD-2025-07

Rice's Whale (*Balaenoptera ricei*) Passive Acoustic Detections Report: January 2020 – January 2021

Amanda J. Debich[1,2], Kaitlin E. Frasier[3], Lance P. Garrison[1], Adolfo Gracia[4], John A. Hildebrand[3], Arturo Serrano-Solis[5], Melissa S. Soldevilla[1*]

[1] NOAA Fisheries, Southeast Fisheries Science Center, 75 Virginia Beach Drive, Miami, FL33149
[2] Cooperative Institute for Marine and Atmospheric Studies, University of Miami, Miami, FL
[3] Scripps Institution of Oceanography, University of California San Diego, La Jolla, CA
[4] Universidad Nacional Autónoma de México, Mexico City, Mexico
[5] Universidad Veracruzana, Xalapa, Veracruz, Mexico
[*] Corresponding Author

US DEPARTMENT OF COMMERCE
National Oceanic and Atmospheric Administration
National Marine Fisheries Service
Southeast Fisheries Science Center
Miami, Florida

May 2025

Southeast Fisheries Science Center (SEFSC)
Reference Documents

This series is a secondary scientific series designed to assure the long-term documentation of and to enable the timely transmission of research results by Center and/or non-Center researchers, where such results bear upon the research mission of the Center (see the outside back cover for the mission statement). These documents receive internal scientific review, and most receive copyediting. The National Marine Fisheries Service does not endorse any proprietary material, process, or product mentioned in these documents.

If you do not have internet access, you may obtain a paper copy of a document by contacting the senior Center author of the desired document. Refer to the title page of the document for the senior Center author's name and mailing address. If there is no Center author, or if there is corporate authorship, contact the Center's Miami Laboratory Library (75 Virginia Beach Drive, Miami, FL 33149).

Information Quality Act Compliance: In accordance with section 515 of Public Law 106-554, the SEFSC completed both technical and policy reviews for this report. These pre-dissemination reviews are on file at the SEFSC Editorial Office.

This document may be cited as:

Debich, A., Frasier, K., Garrison, L., Gracia, A., Hildebrand, J., Serrano-Solis, A., & Soldevilla, M. 2025. Rice's Whale (*Balaenoptera ricei*) Passive Acoustic Detections Report: January 2020 – January 2021. US Dept Commer Southeast Fish Sci Cent Ref Doc. 2025-07; 4 p.

NOAA Southeast Fisheries Science Center

Rice's Whale Passive Acoustic Detections Report: January 2020 – January 2021

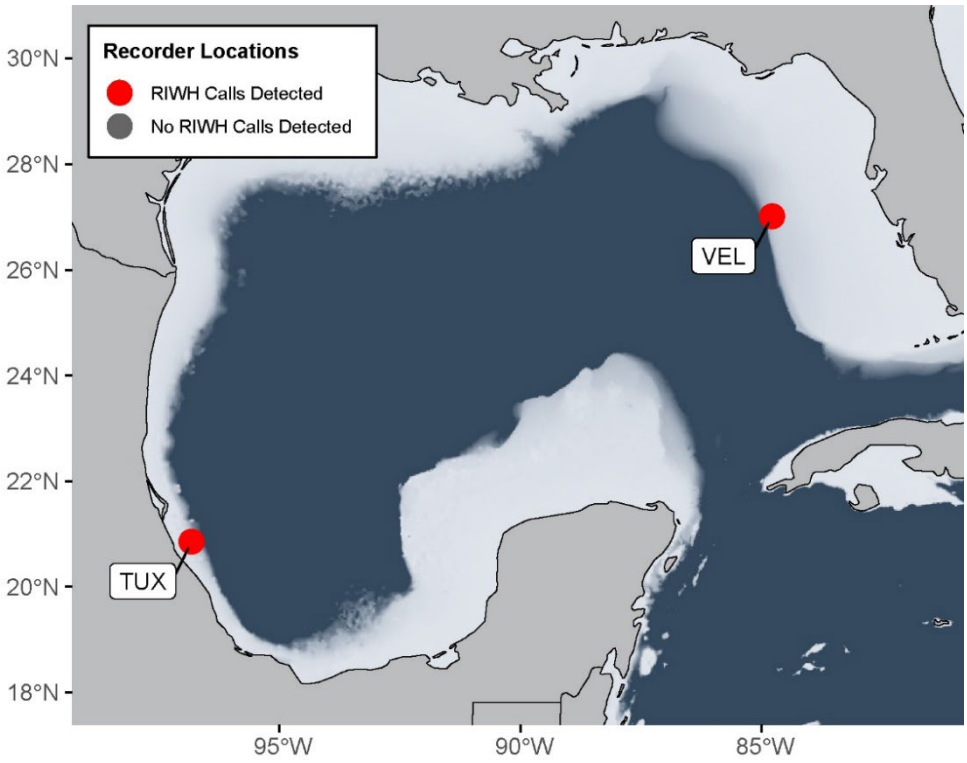

Figure 1. Map of acoustic recorder locations.

INTRODUCTION

The Rice's whale (*Balaenoptera ricei*) is the only year-round baleen whale found in the Gulf of America/Gulf of Mexico, and has a population size of fewer than 100 individuals (Garrison et al., 2020). The majority of visual and acoustic detections of this endangered species occur along the northeastern shelf break near the De Soto Canyon, and some visual detections and passive acoustic recordings indicate some whales persistently occur over a broader range in the Gulf than previously thought (Soldevilla, Debich, et al., 2022). Rice's whales produce stereotyped, species-specific calls that are distinct from the calls of all other baleen whales, including pulsed downsweep sequences, tonal long-moans, and constant tonals (Rice et al., 2014; Širović et al., 2014; Soldevilla, Ternus, et al., 2022). Numerous variants of the long-moan call have been detected, with an eastern variant and multiple western variants (Soldevilla, Debich, et al., 2022). To further explore the extent of their

distribution and better understand the spatio-temporal occurrence patterns of Rice's whales, we deployed long-term passive acoustic recordings at two sites in the Gulf over one year.

METHODS

A High-frequency Acoustic Recording Package (HARP) was deployed in the southwestern Gulf off the coast of Tuxpan, Mexico in 205 m water depths from January 28, 2020 to January 5, 2021 (Figure 1, Table 1). A second HARP was deployed in the eastern Gulf from August 16, 2020 – November 28, 2020 (Figure 1, Table 1). This HARP was located in the southern end of the Rice's whale core distribution area (Rosel & Garrison, 2022) at a depth of 243 m. HARPs are moored to the seafloor and consist of a calibrated hydrophone tethered ~10 m above a data logger, batteries, floatation, acoustic release, and weight system (Wiggins & Hildebrand, 2007). Each HARP had a sensitivity of about -200 dB re V/µPa ± 3 dB over the 10 Hz to 8 kHz range. Both HARPs recorded continuously at a sample rate of 20 kHz. Upon recovery, the broadband recordings were decimated by a factor of 10 to provide an effective frequency bandwidth of 10 Hz – 1 kHz.

Spectrogram cross-correlation detectors were developed and tested in Ishmael 3.0 (Mellinger & Clark, 2000) for Rice's whale long-moan and downsweep sequence calls. When constant tonal calls are produced, they always follow long-moans, so no detector was developed for these calls. The cross-correlation contour kernel for the long-moan call focused on the 150 Hz tone and upper slope of the call, and was defined by a 1.1 s tone from 146 Hz to 145 Hz followed by a 3.7 s downsweep from 145 Hz to 112 Hz, each with a 14 Hz contour bandwidth (Soldevilla, Debich, et al., 2022). The cross-correlation contour kernel for the downsweep sequence was defined as a single 4 s downsweep from 120 Hz to 80 Hz, with a 20 Hz contour bandwidth. A regular sequence algorithm was applied, with the minimum and maximum repetition period between individual pulse detections set to 0.9 s and 1.1 s, respectively, and an 11 s window with 75% overlap used. Both detectors were run on the decimated recordings from the two HARPs, and detections were manually verified to remove false detections.

RESULTS

The TUX deployment experienced some disk corruption issues that resulted in sporadic data loss, with data gaps ranging from a few minutes to a few weeks over the period from January 28, to August 28, 2020. This includes two large gaps from April 30 to June 19, 2020 and August 16 to August 28, 2020.

Rice's whale daily presence by month is summarized for the two sites over the year (Table 1). Three true Rice's whale western long-moan calls were detected at the TUX site and 6,185 true Rice's whale eastern long-moan and downsweep sequence calls detected at the VEL site. Rice's whale calls were acoustically present 1% of days at TUX and 59% of days at site VEL. Rice's whale calls are highly distinctive (Soldevilla, Ternus, et al., 2022), therefore the verified detection of either the downsweep sequence or long-moan call is indicative of Rice's whale presence. Rice's whales are considered present at a site if at least one downsweep sequence or long-moan call is found in one day. These

results indicate minimum Rice's whale presence. A specific date range may contain few or no detections; this does not mean Rice's whales were not present. Passive acoustic monitoring can only determine presence of vocally-active individuals calling within detection range of a recorder. Silent animals, or those calling beyond the range of the recorders, are not represented.

The results presented here represent preliminary analyses. More detailed analyses of call types and total calls per day are in progress. Call detections of low-frequency calls such as those from baleen whales are highly dependent on sound propagation conditions and noise. Additional analyses are in progress to characterize soundscapes and transmission loss to better understand detection ranges. The data used for this study will be archived at NOAA National Centers for Environmental Information (NCEI).

Table 1. Deployment details and number of days with Rice's whale acoustic presence/number of total recording days for the given month.

Site Name	Recording Dates	Depth (m)	Jan 2020	Feb 2020	Mar 2020	Apr 2020	May 2020	Jun 2020	Jul 2020	Aug 2020	Sep 2020	Oct 2020	Nov 2020	Dec 2020	Jan 2021
TUX	1/28/2020 - 1/5/2021 *	205	0/3	0/28	0/31	0/29	--	1/11	2/31	0/20	0/30	0/31	0/30	0/31	0/5†
VEL	8/16/2020 - 11/28/2020	243	--	--	--	--	--	--	--	13/16†	23/30	18/31	7/27†	--	--

* *Disc corruption resulted in multiple data gaps ranging from a few minutes to a few weeks from the beginning of the deployment through August 28, 2020.*

† *Partial recording days.*

FUNDING and ACKNOWLEDGEMENTS

Funding for these passive acoustic deployments was provided by NOAA Fisheries' International Science Program, Ocean Acoustics Program, Southeast Regional Office, and Office of Protected Resources. Support for some vessel time was opportunistically supplied by the RESTORE Science Program, the *Deepwater Horizon* Restoration Marine Mammal Open Ocean Trustee Implementation Group, and the Office of Naval Research Task Force Ocean during LISTEN GoMex HARP servicing cruises. We thank Shelby Bloom, Melisa Coronel, Ashley Cook, Gania Figueroa, Eva Hildalgo-Pla, John Hurwitz, Josh Jones, Kieran Lenssen, Diego Majewski, Erin O'Neill, Joel Ortega-Ortiz, Itzel Pérez Carballo, Ryan Pierson, Natalie Posdaljian, Kristen Rosier, Bruce Thayre, Sam Wagner, Sean Wiggins, Vanessa ZoBell, and the crew of the R/V/ Pelican for their assistance with instrument building, deployment, and recoveries and project logistics. The TUX HARP was deployed under SEMARNAT Wildlife Permit Number SGPA/DGVS/1801/2021 to Dr. Arturo Serrano.

REFERENCES

Garrison, L. P., Ortega-Ortiz, J., & Rappucci, G. (2020). Abundance of Marine Mammals in Waters of the U.S. Gulf of Mexico During the Summers of 2017 and 2018. *Southeast Fisheries Science Center Reference Document PRBD-2020-07 (Miami, FL), p.56*.

Mellinger, D. K., & Clark, C. W. (2000). Recognizing transient low-frequency whale sounds by spectrogram correlation. *Journal of the Acoustical Society of America, 107*(6), 12.

Rice, A. N., Palmer, K. J., Tielens, J. T., Muirhead, C. A., & Clark, C. W. (2014). Potential Bryde's whale (*Balaenoptera edeni*) calls recorded in the northern Gulf of Mexico. *Journal of the Acoustical Society of America, 135*(5), 11. https://doi.org/10.1121/1.4870057

Rosel, P. E., & Garrison, L. P. (2022). Rice's whale core distribution map Version 7 June 2019. *Ref Doc MTMTD-2022-01. NMFS Southeast Fisheries Science Center, Miami, FL*.

Širović, A., Bassett, H. R., Johnson, S. C., Wiggins, S. M., & Hildebrand, J. A. (2014). Bryde's whale calls recorded in the Gulf of Mexico. *Marine Mammal Science, 30*(1), 399-409. https://doi.org/10.1111/mms.12036

Soldevilla, M. S., Debich, A. J., Garrison, L. P., Hildebrand, J. A., & Wiggins, S. M. (2022). Rice's whales in the northwestern Gulf of Mexico: call variation and occurrence beyond the known core habitat. *Endangered Species Research, 48*, 10. https://doi.org/10.3354/esr01196

Soldevilla, M. S., Ternus, K., Cook, A., Hildebrand, J. A., Frasier, K. E., Martinez, A., & Garrison, L. P. (2022). Acoustic localization, validation, and characterization of Rice's whale calls. *Journal of the Acoustical Society of America, 151*(6), 15. https://doi.org/10.1121/10.0011677

Wiggins, S. M., & Hildebrand, J. A. (2007). *High-frequency Acoustic Recording Package (HARP) for broand-band, long-term marine mammal monitoring* International Symposium on Underwater Technology 2007 and International Workshop on Scientific Use of Submarine Cables & Related Technologies 2007 (Institute of Electrical and Electronics Engineers), Tokyo, Japan.