

DOELDE

Rotterdam 2024

ABSTRACTS



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Rough-toothed dolphin exposures to U.S. Navy mid-frequency active sonar at the Pacific Missile Range Facility, Hawai'i

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Eight rough-toothed dolphins satellite tagged between 2011 and 2021 before the start of U.S. Navy training at the Pacific Missile Range Facility (PMRF), Kaua'i, Hawai'i were exposed to mid-frequency active sonar (MFAS) from multiple sources. Received levels from surface ship hull-mounted sonar, sonobuoy, and helicopter dipping sonar transmissions were estimated with propagation modeling. Tag positional data were fitted to a continuous time correlated random walk model to predict locations at 5-minute intervals, and incorporated x and y positional error. Positional error was based upon a 95% confidence interval error ellipse of the northern and easting standard errors at each 5-minute location. Dive behavior data were available for five tags and were utilized to develop dive models that could be used to estimate the receiver depth for propagation modeling when depth data were available. When animal depth data were not available (i.e., tags without depth sensor or dive data not valid for a 5-minute interval), two depth regimes were utilized to represent potential animal depths. A shallow depth regime was used to represent exposures when the animal was within 54 m of the surface where surface ducting was often present, and a deep depth regime covered remaining possible animal depths from 54 to 400 m. Error ellipses were sampled with multiple 2-dimensional radial slices (range vs. depth) taken systematically in azimuth from a source for select sonar transmissions to represent 3-dimensional propagation modeling. Estimated received levels in 5-minute bins are presented as the maximum median level +/- twice the standard deviation and characterize the range of potential exposures. To date, estimated MFAS exposures to these satellite tagged rough-toothed dolphins includes a maximum median received level of 159.8 dB re 1 μ Pa with a range of estimated received levels +/-2*standard deviation of 149-170.6 dB re 1 μ Pa from surface ship hull-mounted sonar. Based on photo-identification, tagged dolphins were part of a resident, island-associated population that broadly overlaps with PMRF, and thus are likely regularly exposed to MFAS.