

Title: Ecological risk assessment frameworks: A spectrum of approaches, assumptions, and applications

Time: October 29, 2025

Presenters: Brandon Southall & Saana Isojunno

Duration: a 40-minute presentation followed by a Q&A session

Audience: those interested in the impact / risk assessment of underwater noise, and other sources of risk to marine mammals, especially in data-poor contexts

Goal: raise awareness of common assumptions underpinning impact/ risk assessments, discuss different approaches and ways forward for risk analysis and decision-making in data-poor contexts

Webinar outline:

- Introduction, outlining why we need
 - risk assessment approaches in the context of sound in the ocean, including the issues that regulators face
 - a spectrum of approaches to risk analysis in different contexts
- Example approaches to multi-species risk analysis
 - A structured scoring approach (published and ongoing work; Southall et al 2023)
 - Interim Population Consequences of Disturbance (iPCoD) approach (ongoing work as part of Grace Edmondson PhD)
- Risk analyses in data-poor contexts: common approaches and ways forward
 - Adjust assessment objectives and endpoints
 - Combine input data/parameters, trait-based approaches
 - Use proxies, ideally tested/validated
 - Simplify modelled impact pathways
 - Propagate uncertainty in input data/parameters
- Take-homes
 - Within the spectrum of approaches, there is a hierarchy of preferable options, depending on the goal and feasibility in each assessment context
 - Going forward, more cross-validation of different approaches is needed. Clearly defined endpoints, causal pathways of impact, and consistent language across receptor groups will help align different approaches.

DOSITS resources:

- Scientific topics
 - Behavioral changes in marine mammals <https://dosits.org/animals/effects-of-sound/potential-effects-of-sound-on-marine-mammals/behavioral-changes-in-mammals/>
 - Hearing <https://dosits.org/science/measurement/what-sounds-can-animals-hear/>
- Risk assessment and mitigation to inform decision-making
 - Ocean sound policies <https://dosits.org/decision-makers/ocean-policies/>
 - Population Consequences of Disturbance (PCoD) framework <https://dosits.org/animals/advanced-topics-animals/population-disturbance/>
 - Tutorial: how do you determine if a sound affects a marine animal? <https://dosits.org/tutorials/effects-introduction/determine/>
 - Tutorial: How can we moderate or eliminate the effects of human activities? <https://dosits.org/tutorials/effects-introduction/moderate-effects/>
 - Uncertainty: scientific uncertainty <https://dosits.org/decision-makers/scientific-uncertainty/> , and statistical uncertainty <https://dosits.org/science/advanced-topics/statistical-uncertainty/>

Other resources:

- Structured scoring example
 - Southall et al 2023 “Managing human activity and marine mammals: A biologically based, relativistic risk assessment framework” <https://doi.org/10.3389/fmars.2023.1090132>
- Interim population consequences of disturbance example
 - King et al 2015 “An interim framework for assessing the population consequences of disturbance” <https://doi.org/10.1111/2041-210X.12411>
 - Analysis adapted from code made available by SMRU Consulting. For more information, see <https://www.smruconsulting.com/population-consequences-of-disturbance-pcod>
- Spectrum of approaches, example papers
 - Joy et al 2022 “A fine-scale marine mammal movement model for assessing long-term aggregate noise exposure” <https://doi.org/10.1016/j.ecolmodel.2021.109798>

- Harris et al 2017 “Marine mammals and sonar: Dose-response studies, the risk-disturbance hypothesis and the role of exposure context”
<https://doi.org/10.1111/1365-2664.12955>
- Dunlop et al 2021 “Assessing Population-Level Effects of Anthropogenic Disturbance on a Marine Mammal Population”
<https://doi.org/10.3389/fmars.2021.624981>
- Wade et al 1998 “Calculating limits to the allowable human-caused mortality of cetaceans and pinnipeds” <https://doi.org/10.1111/j.1748-7692.1998.tb00688.x>
- Roberts et al 2016 “Habitat-based cetacean density models for the U.S. Atlantic and Gulf of Mexico” <https://www.nature.com/articles/srep22615>
- Davidson et al 2012 “Drivers and hotspots of extinction risk in marine mammals” <https://www.pnas.org/doi/10.1073/pnas.1121469109>
- Collision risk modelling, R package and ShinyApp “stochLAB”:
https://dmpstats.shinyapps.io/avian_stochcrm/, <https://hidef-aerial-surveying.github.io/stochLAB>
- Pooling input data/parameters
 - Hearing groups, Southall et al 2019 “Marine mammal noise exposure criteria: updated scientific recommendations for residual hearing effects”
https://www.aquaticmammalsjournal.org/wp-content/uploads/2019/03/45_2_southall.pdf
 - Multi-species dose-response R package and tutorials;
<https://pjbouchet.github.io/espresso/>
 - Trait-based assessment
 - Baird et al 2008 “Trait-based ecological risk assessment (TERA): The new frontier?” https://doi.org/10.1897/IEAM_2007-063.1
 - Thaxter et al 2017 “Bird and bat species' global vulnerability to collision mortality at wind farms revealed through a trait-based assessment” <https://doi.org/10.1098/rspb.2017.0829>
 - Galic et al 2024 “Ecological risk assessment when species-specific data are scarce: how trait-based approaches and modeling can help”
<https://doi.org/10.1093/biosci/biae086>