



LISTENING TO THE OCEAN

Underwater Acoustics @ UL Lafayette — Join the Team



Why Underwater Acoustics matters

Underwater sound is the only long-range messenger in the ocean. In water, acoustic waves travel tens to thousands of kilometers, far beyond electromagnetic waves, so sound is the way to “see” and “sense” the ocean.

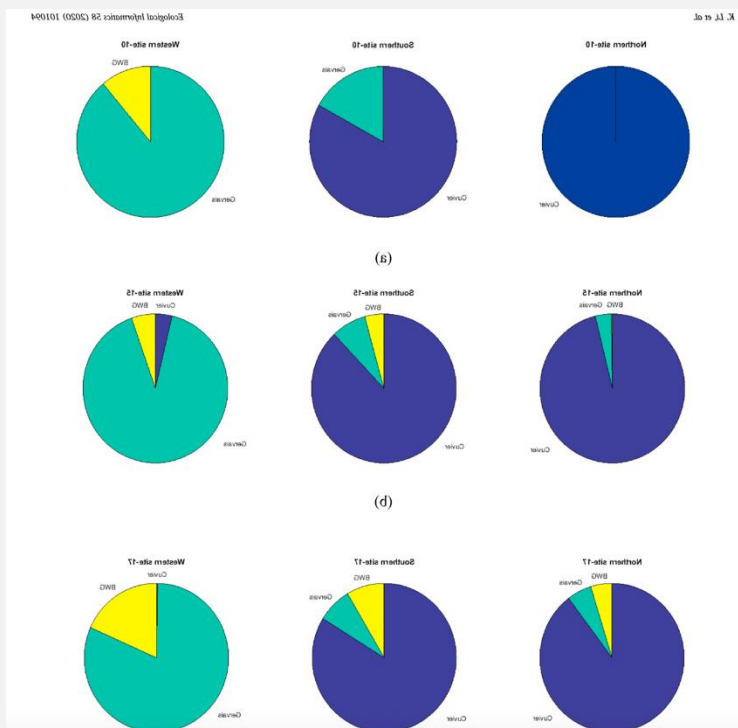
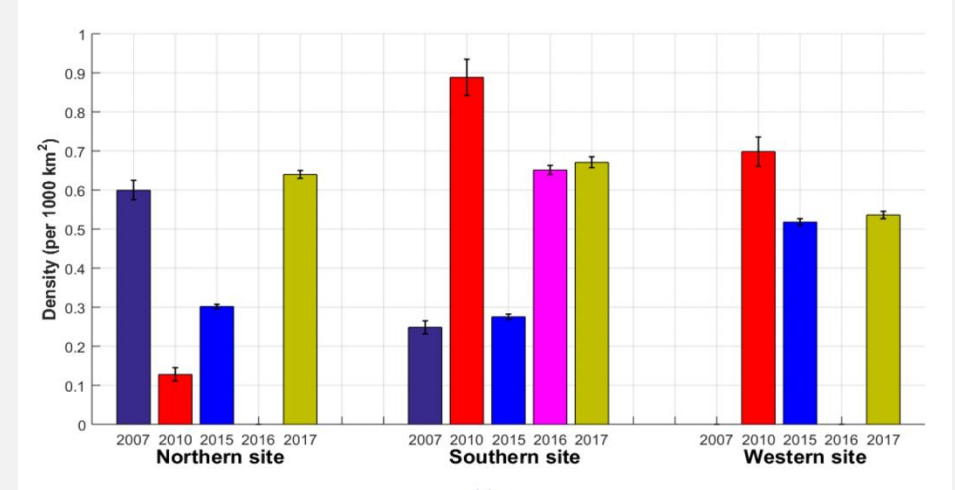
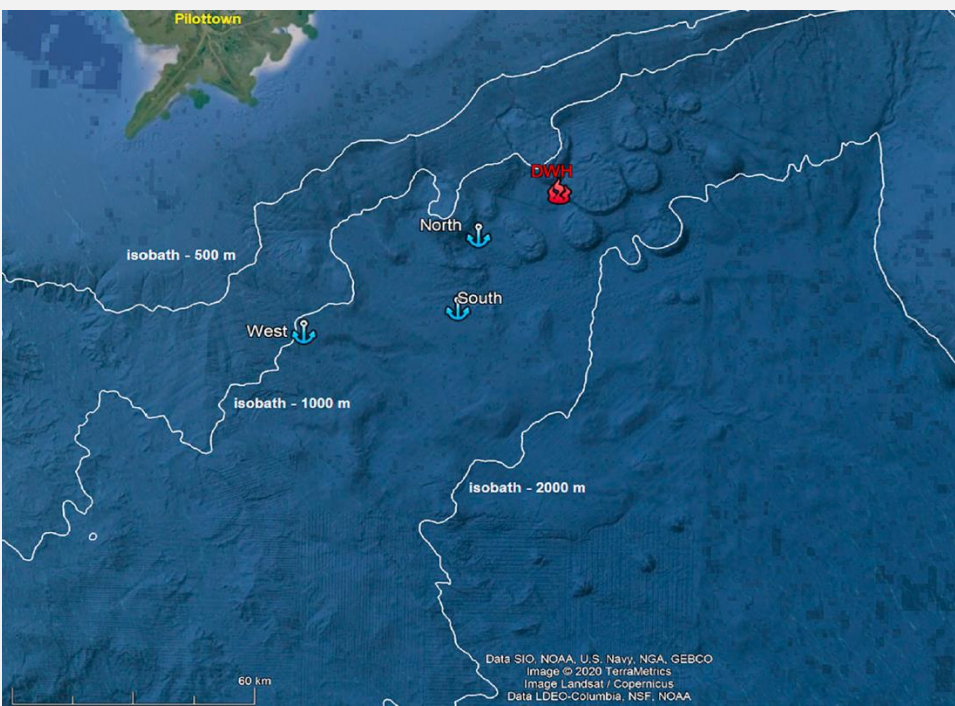
Nature proves it. Whales and dolphins have the most advanced biosonar and hearing on Earth; by listening we can both learn from and protect them.

From noise to knowledge. Oceans are noisy. Acousticians build sophisticated systems to capture natural and human-made sounds and then decode them with physics-laws-based signal processing and AI to protect our coasts, improve marine weather and hurricane forecasting, monitor earthquakes, tsunamis, and underground nuclear tests, study whales and marine ecosystems, discover natural resources, probe Earth interior, and even capture cosmic neutrino.

BIG IDEA: The ocean communicates through sound. We turn those signals into scientific discoveries

Littoral Acoustic Demonstration Center – Gulf Ecological Modeling and Monitoring

- Collected over 100 TB of acoustic data
- Pioneered the use of autonomous acoustic platforms in the Gulf
- Developed novel signal processing tools and machine learning algorithms for marine mammals’ detection, identification, habitat use and demographics analysis, and regional abundance estimations
- Demonstrated post-spill shifts in sperm whale and beaked whale regional densities, suggesting long-term ecological impacts
- Proposed the ecological niche hypothesis of habitat-division between Cuvier’s and Gervais’ beaked whales impacting future field studies
- Introduced matrix population models to the field and developed models for calculating the population mean-recovery-time as a function of the magnitude and duration of the disturbance



Experimental capabilities



Deep-water Autonomous Moorings EARS

- Long—term autonomous recordings from months to years
- To 3000 m depths; up to 192 kHz sampling rates
- Baseline soundscapes, marine mammal studies, remote oceans



Autonomous Underwater Vehicles G3 Slocum Glider “Sedna”

- Dives to 1000 m, carries variety of sensor
- Transmits data and receives new mission instructions via satellite when surfacing
- Makes decisions and does not require real time operator



Shallow coastal reef recorder LOR-EAR

- Compact autonomous recorder integrated with other sensors for shallow, tidally influenced sites
- Real-time data transfer
- Sea grass health & reef habitat acoustics, fisheries soundscapes, harbor/estuary soundscapes

Skills you will gain

Fieldwork: long-term research expeditions, glider and drone remote piloting, oceanographic and acoustic instruments calibration and deployment

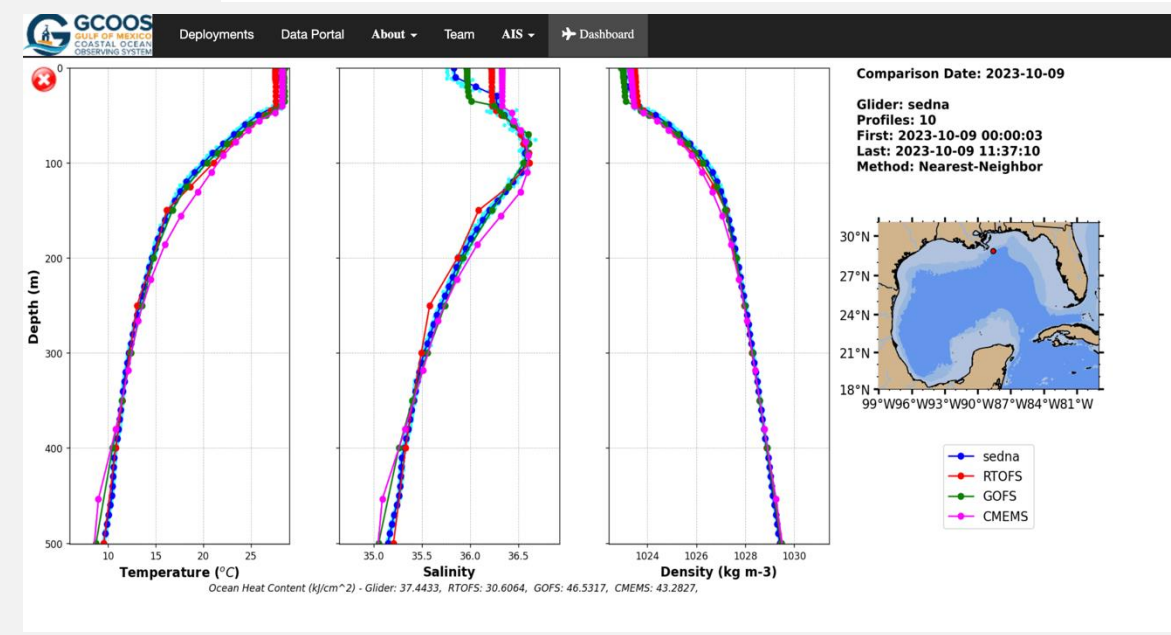
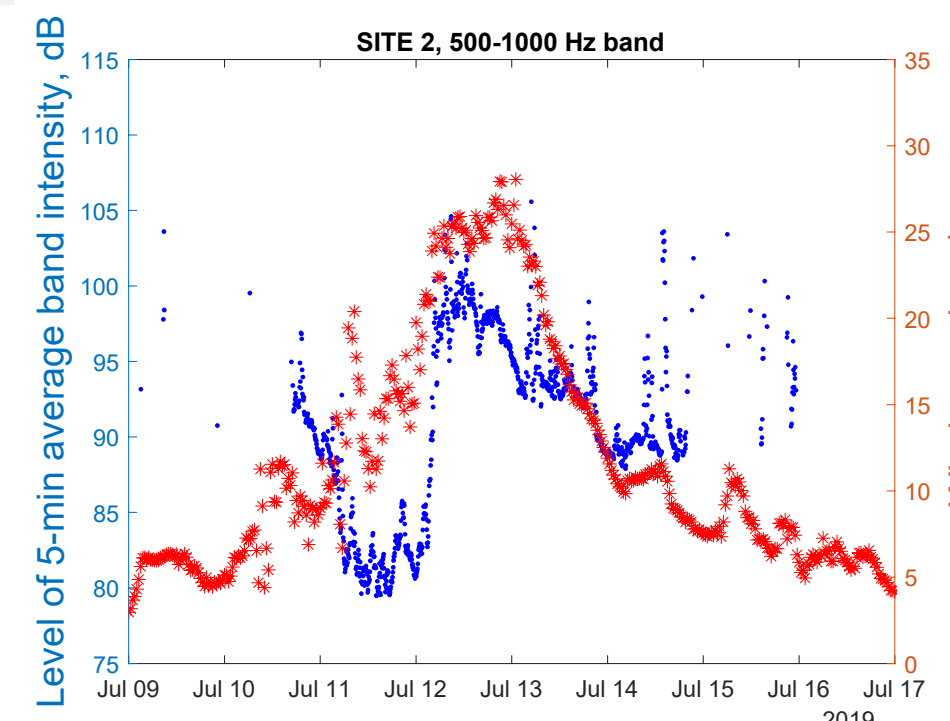
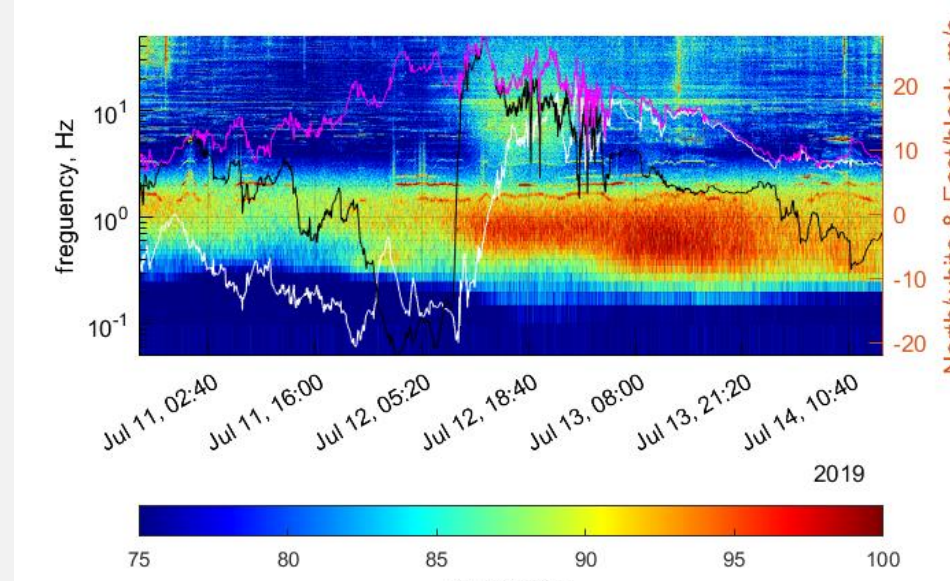
Programming: MATLAB, Python, C++, R

Signal processing/Machine Learning/AI/Big Data Intelligence: time-frequency analysis, detectors, classifiers, computational ocean models, physics-informed ML, data fusion

Science communication: research conferences, scientific papers, outreach

Hurricane Reconnaissance

- Established UL Lafayette glider lab and annual glider operations in the Gulf
- Conducted three Deployments: 2022, 2023, 2024 (covered over 1000 km)
- Extended mission goals: soundscapes, marine mammals, wind speed reconstruction, and oceanographic data
- Collected over 7 Tb acoustic data
- Contributed real-time data to NOAA hurricane monitoring program
- Developed inversion algorithms to reconstruct atmospheric wind speeds from underwater soundscapes
- Identified the need for low-frequency measurements for effective cyclone monitoring



Career paths and future jobs:

Government & Labs: NOAA, BOEM, USGS, Navy/NAVSEA/ONR labs, NASA

Industry & Startups: Marine robotics, environmental consulting, offshore energy, hydrographic survey (e.g., Fugro), ocean tech (e.g., Teledyne), acoustic engineering firms.

Academia & Nonprofits: Universities, aquariums, NGOs

Roles: research acoustician, ocean data scientist, environmental analyst, acoustics engineer, ML/AI engineer, product R&D.

Li, K., and Sidorovskaia, N. (2024). Marine compressed air source array acoustic field characterization from at-sea measurements: long-range propagation. The Journal of the Acoustical Society of America 156, 2022–2033 (2024), <https://doi.org/10.1121/10.0029024>

Li, K., Sidorovskaia, N., Guilment, T., Tang, T., Tiemann, C.O., Griffin, S. (2023). Investigating Beaked Whale’s Regional Habitat Division and Location Density Trends near the Deepwater Horizon Oil Spill Site Through Acoustics. Frontiers in Marine Science, 9. DOI:10.3389/fmars.2022.1014945

Guilment, T., Sidorovskaia, N., and Li, K. (2020). Modelling the Acoustic Repertoire of Cuvier’s Beaked Whale Clicks. The Journal of the Acoustical Society of America 147, 3605–3612, <https://doi.org/10.1121/10.0001266>

Contact information: Dr. Natalia Sidorovskaia, Department of Physics, Broussard Hall 213, natalia.sidorovskaia@louisiana.edu