



Cumulative Noise Impacts to Marine Mammals from Offshore Wind Development and Operations



WCS



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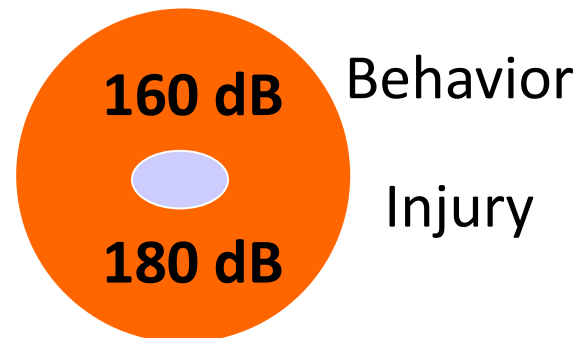
NYSERDA State of the Science Workshop, November 2020

Human Noise Impacts: Historical U.S. regulatory view

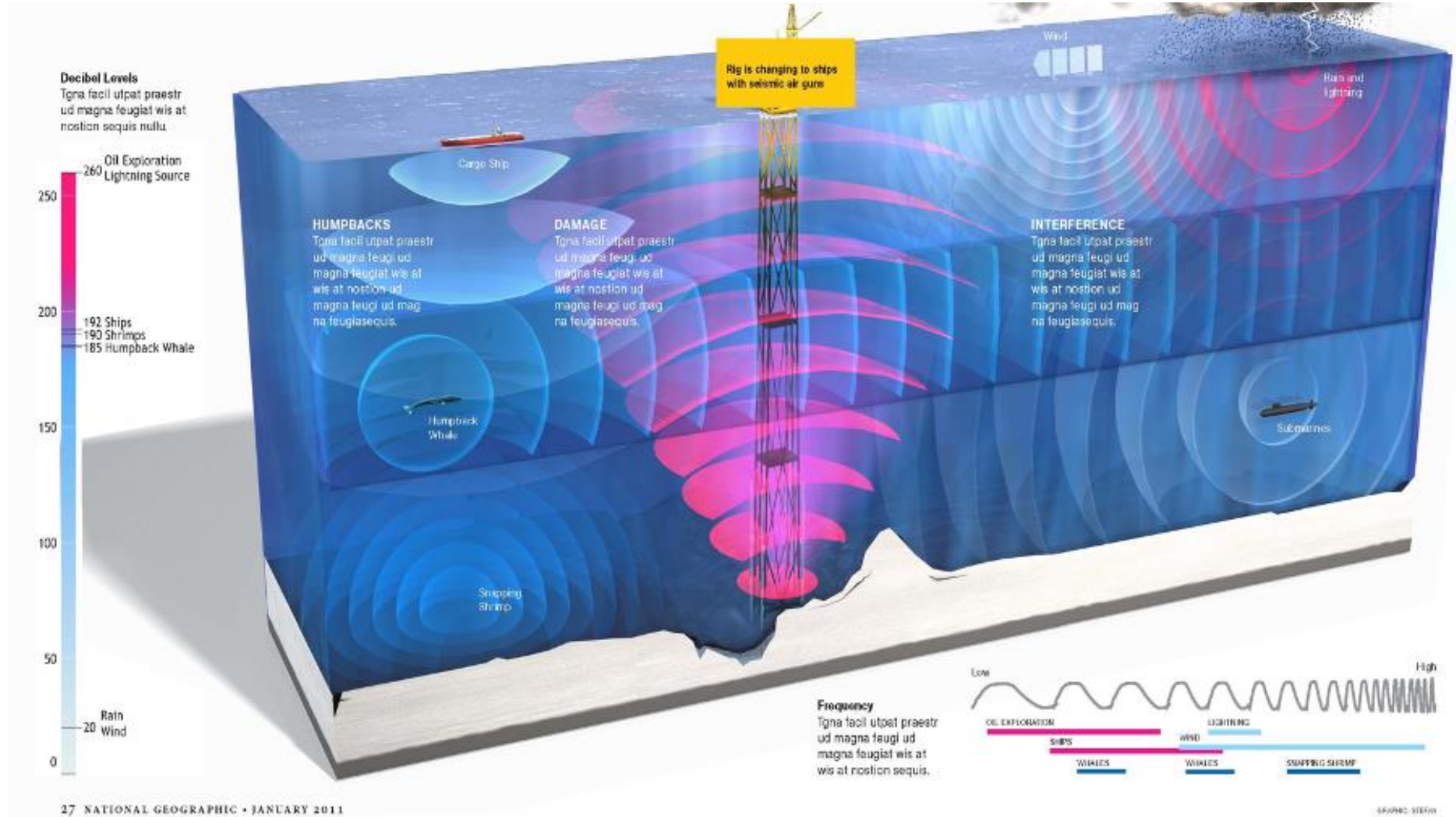
Single sound source



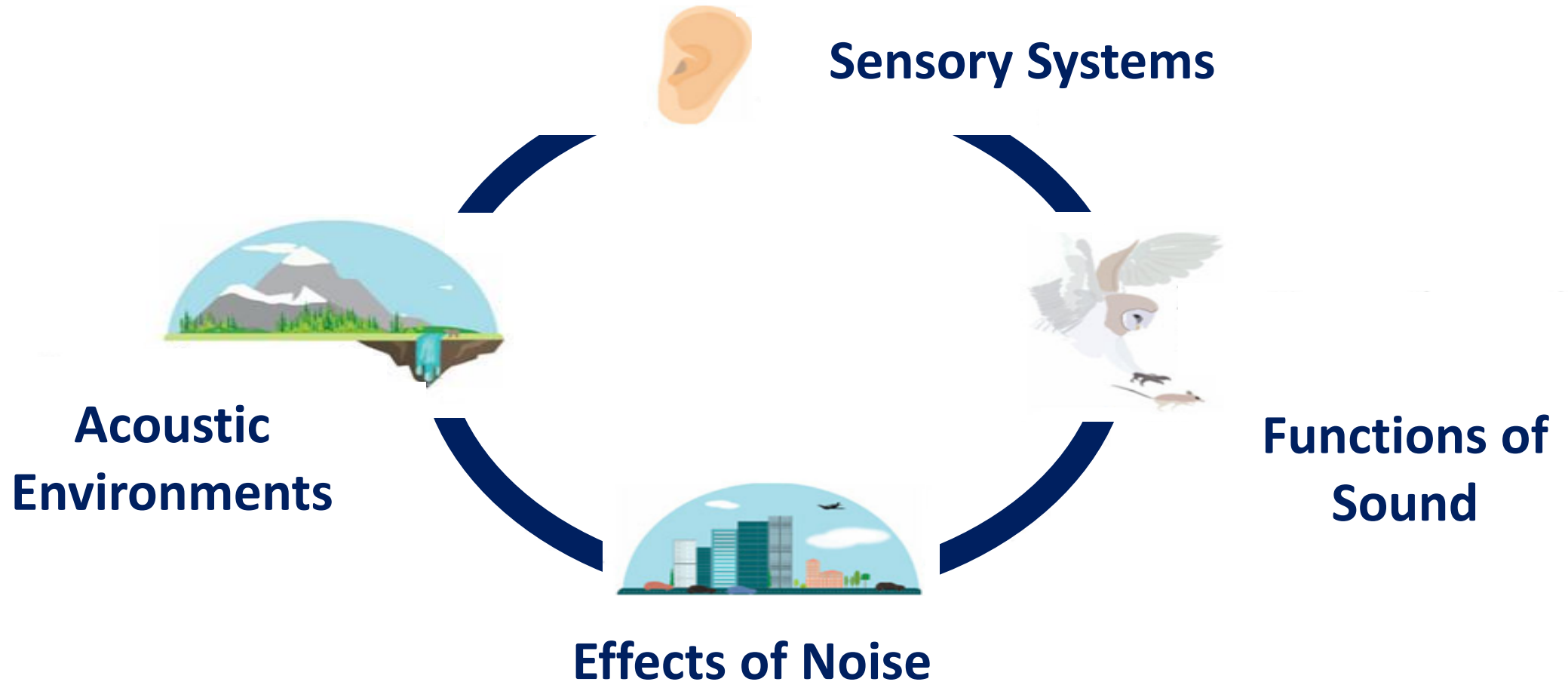
2-D sound “isopleths” with impacts based solely on (single metric) exposure level “thresholds”



Complex Sound Fields



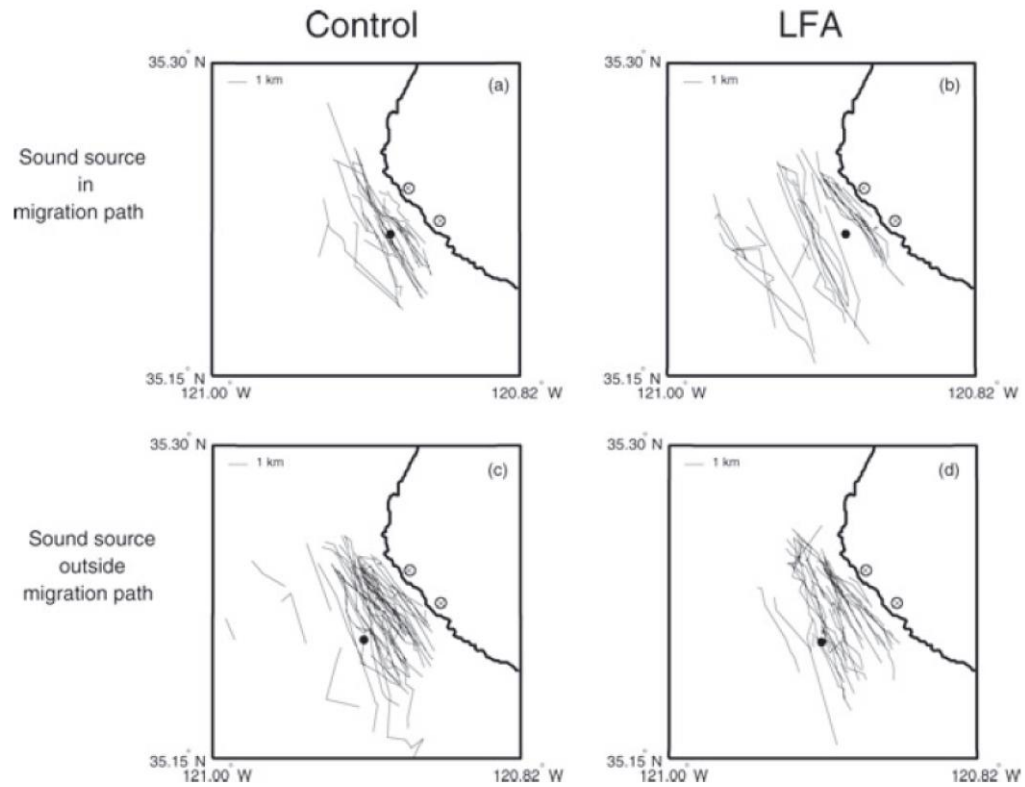
Acoustic Ecology



McKenna (2020) Physics Today

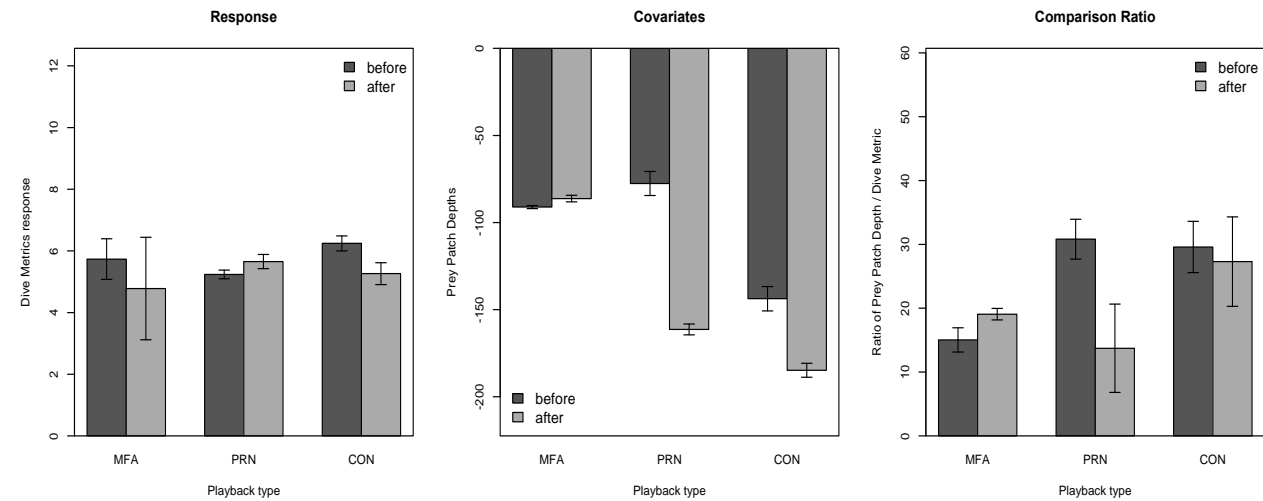
Behavioral Disturbance Complexity

Spatial context



Ellison et al. (2012); Courtesy: J. Buck, P. Tyack

Environmental context

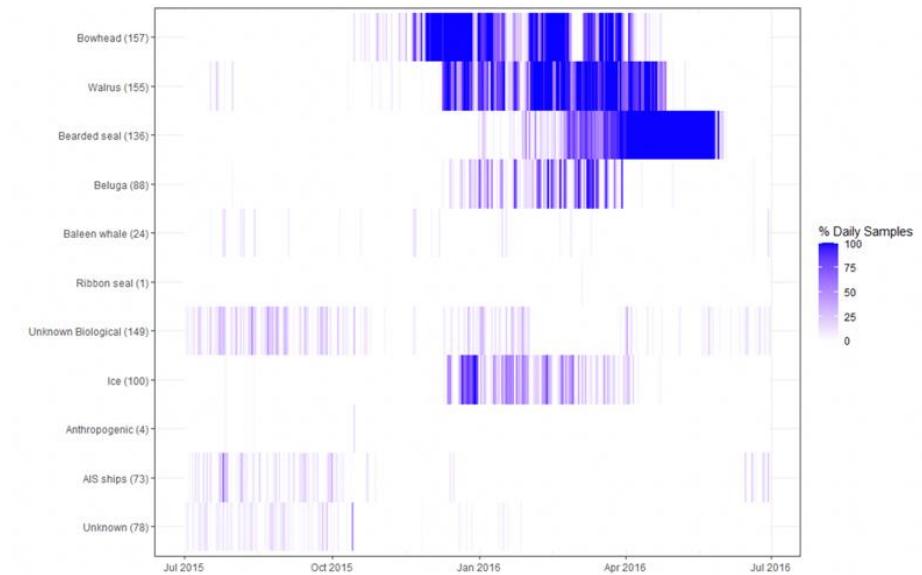
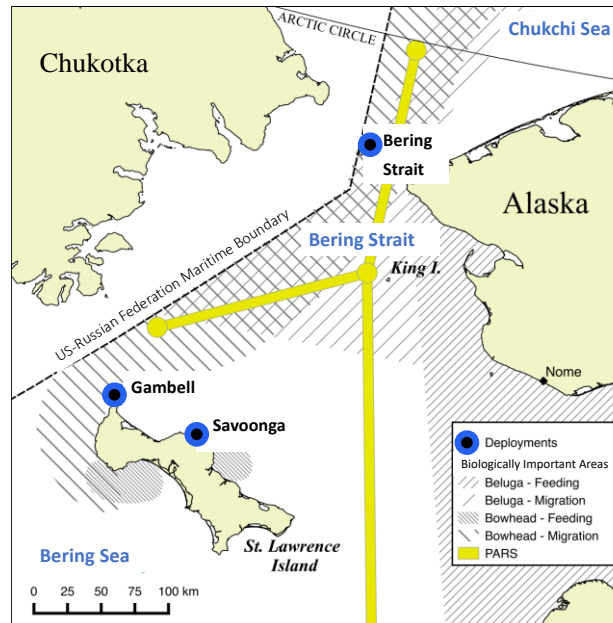


Friedlaender et al. (2016)

Cumulative Effects on Mesoscales: Soundscapes and ecosystem perspectives

Soundscapes:

Spectrally, Spatially, and Temporally explicit standardized measurements of acoustic environments accounting for *ALL* contributing sources



Chou et al. (2020); Southall et al. (2020); McKenna et al. (In prep)

Cumulative Effects on Mesoscales: Soundscapes and ecosystem perspectives

Relevant ecosystem data:

- Species-specific distribution/density (spatio-temporal variance) and population trends
- Environmental drivers: Oceanography, primary and secondary productivity
- Soundscapes (with sufficient “baseline”)
- Non-acoustic impacts (contaminants, entanglement, vessel-strike)

Increasingly Complex Perspective on Evaluating Aggregate and Cumulative Impacts

- **Population consequences of disturbance** (Cormac Booth – previous talk)
- **Risk assessment methods for evaluating acute and aggregate noise exposure** (BOEM-funded expert working group)
- **Mechanistic and other modeling methods to quantify interacting, non-linear effects of multiple stressors** (NAS study – Peter Tyack later talk)

→ Different, complementary qualitative and quantitative approaches

→ Same overarching data needs: sustained, synoptic spatio-temporal soundscape and ecological sampling with sufficient ‘baseline’ before development

Risk Assessment Methods for Evaluating Acute and Aggregate Noise Exposure

Collaborators: Bill Ellison, Dom Tollit, Chris Clark, Jenn Amaral, Brandon Southall

Exposure Magnitude

Acute Exposure: “Severity” from PCOD magnitude-duration functions

Aggregate Exposure: “Exposure Index” proxy for all noise impacts – quantitative metric based on **Spatial, Temporal, Spectral** overlap with focal species

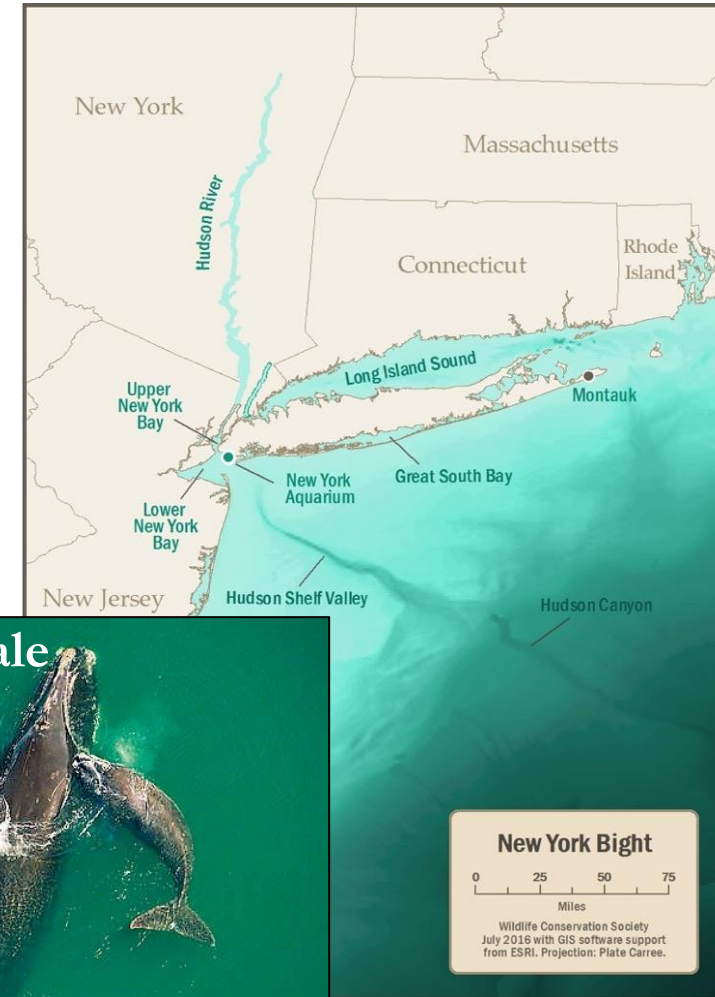
Exposure Index	5	M	H	H	VH	VH
	4	M	M	H	H	VH
	3	L	M	M	H	H
	2	VL	L	L	M	M
	1	VL	VL	L	L	M
	Rating	1	2	3	4	5
Vulnerability						
	Key	Color	Risk Assessment Rating			
		Red	Very High			
		Orange	High			
		Yellow	Moderate			
		Green	Low			
		Blue	Very Low			

Species Vulnerability Factors

1. Population factors
2. Habitat and compensatory abilities
3. Potential masking
4. Environmental risk (non-acoustic)

Setting the Stage: Concentrations of large baleen whales & large numbers of small cetaceans

- Critically Endangered **NARW** occurring outside of expected periods
- **Humpback** and fin whales occur in NYB for extended periods of time, including foraging
- Sightings and detections of blue, sei, and **minke** whales
- Large concentrations of small cetaceans – acoustically sensitive species (e.g., beaked whales, harbor porpoise)

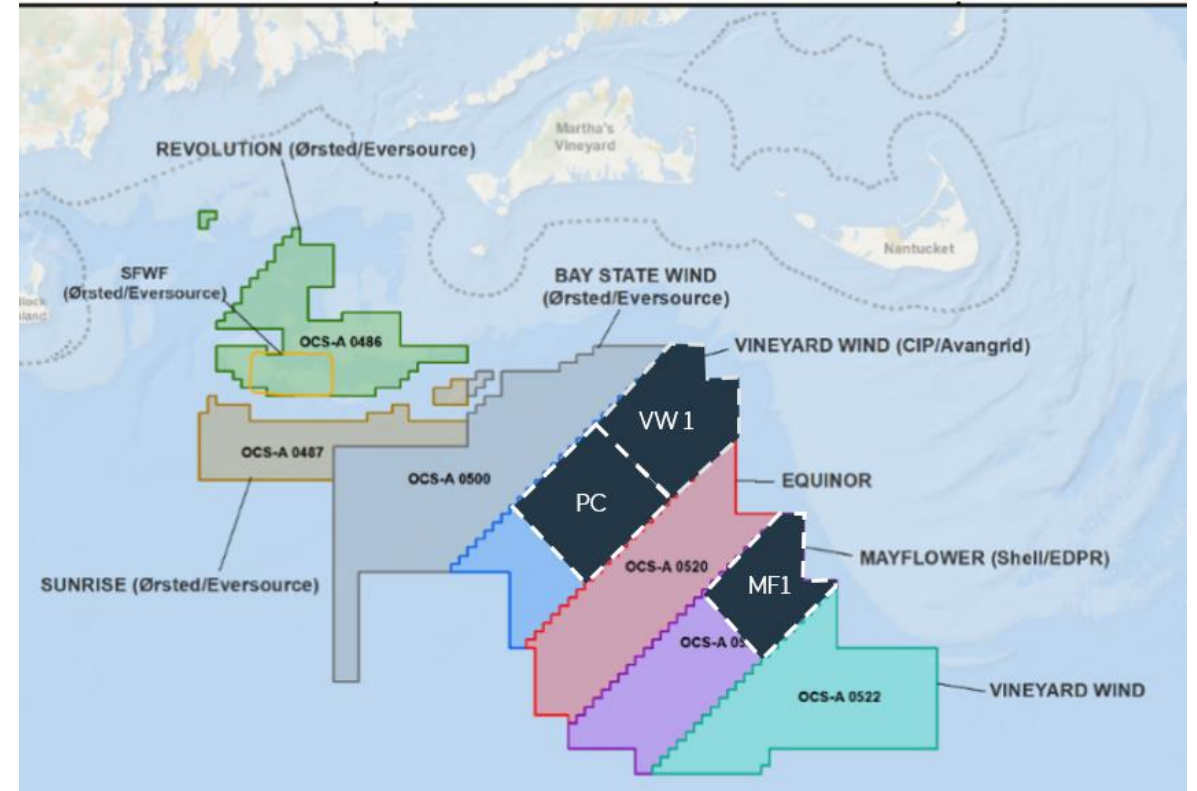
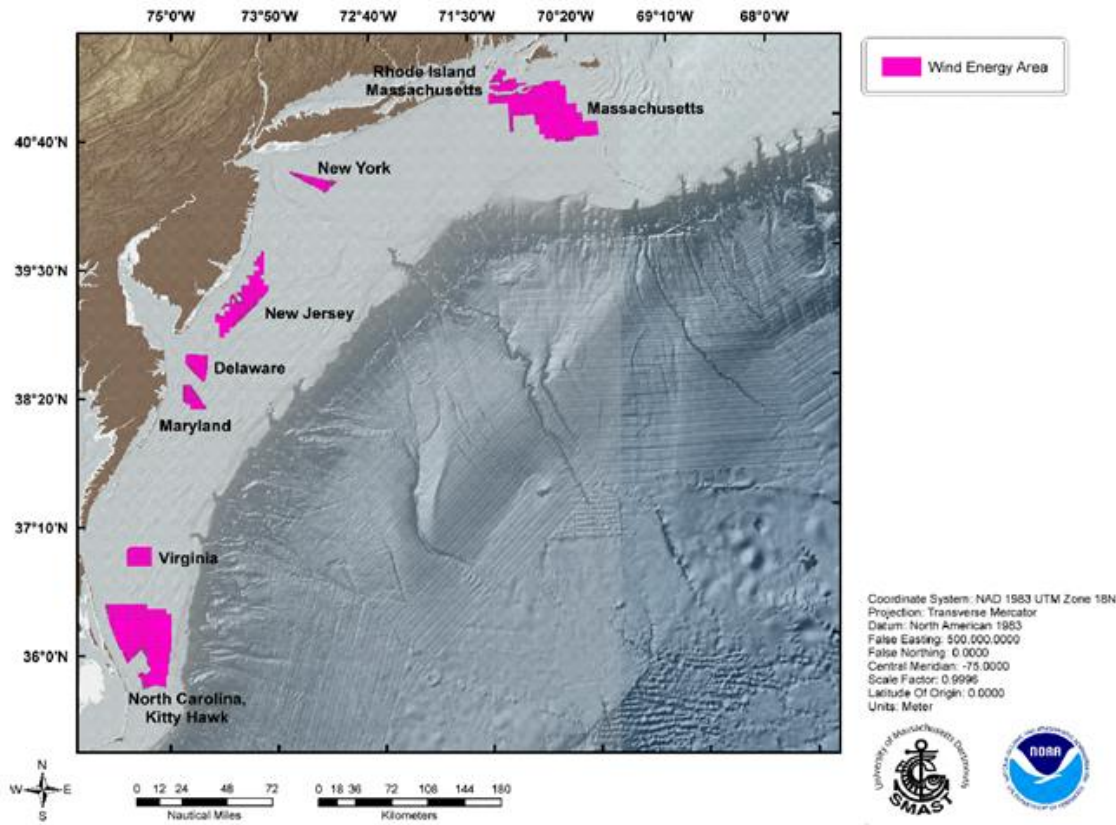


Setting the Stage: Cumulative impacts from noise and more

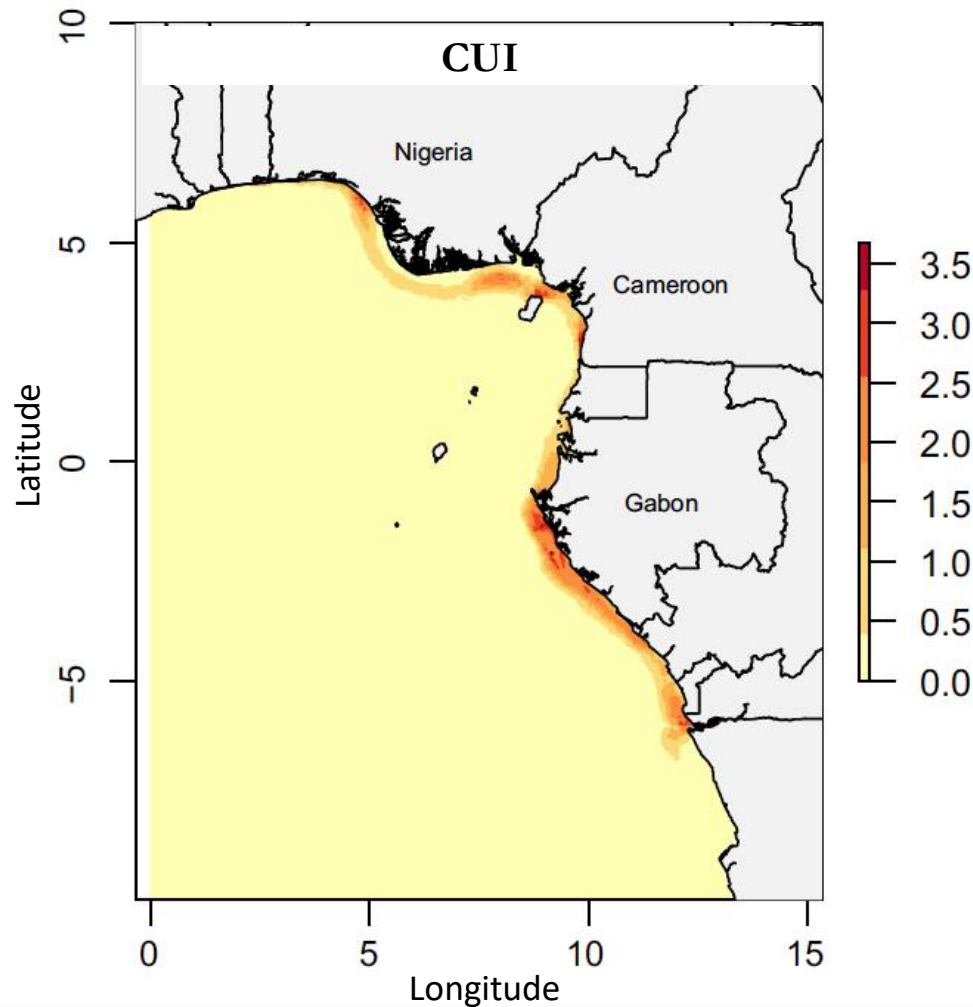
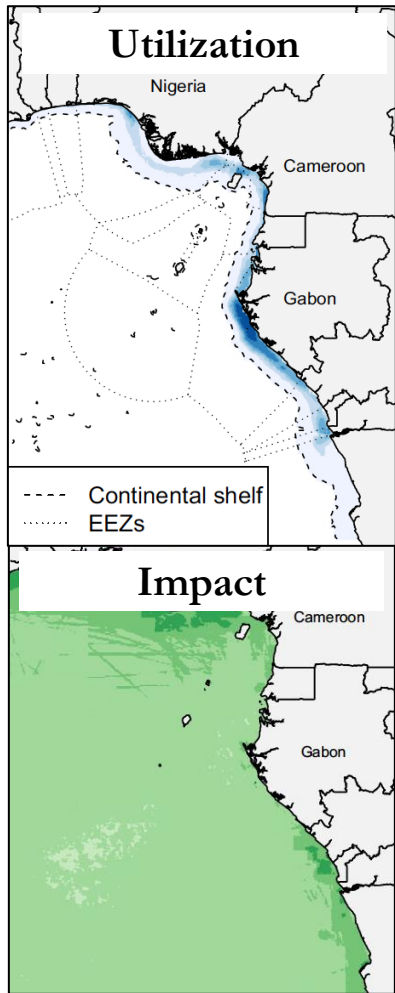
- Impacts on individuals and habitat
- On-going Unusual Mortality Events along Atlantic coast for humpback, minke, and NARW
- Humpback whale necropsies: ~50% evidence of human interaction
 - Ship strike, entanglement



Setting the Stage: The current extent of OSW in the Atlantic



Visualization of Multiple Anthropogenic Activities: Overlap with humpback whale habitat utilization



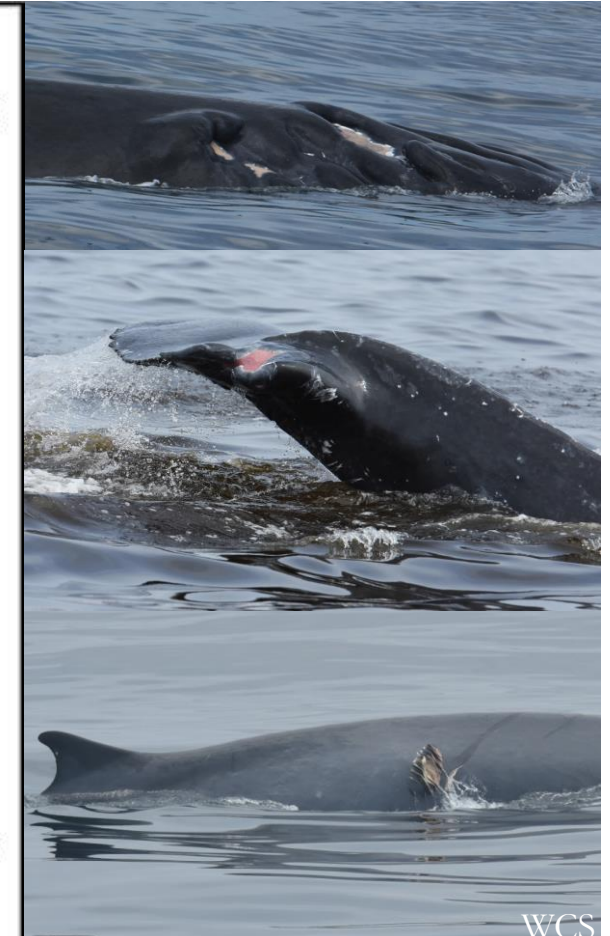
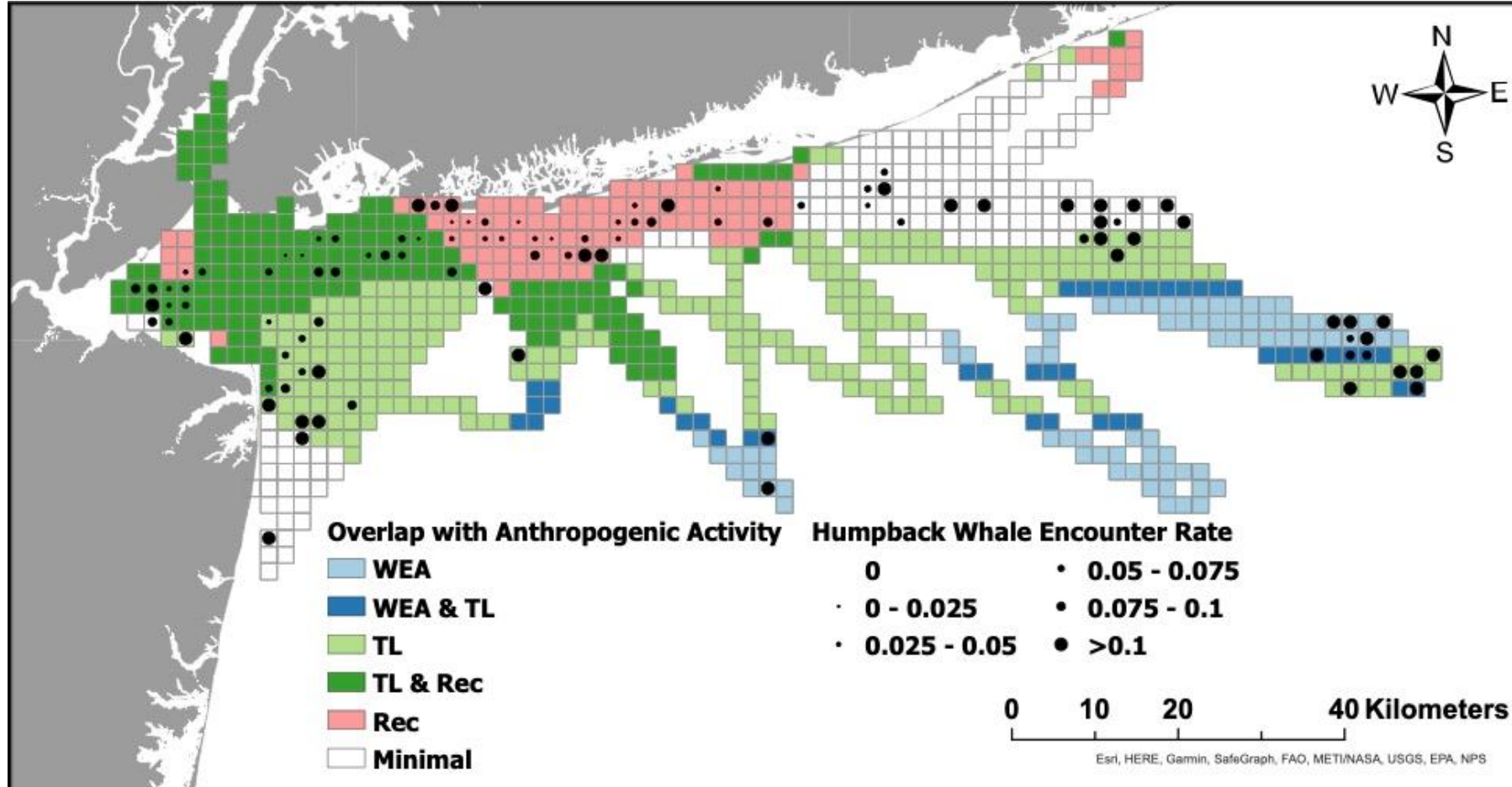
Cumulative Utilization and Impact (CUI) Analysis

habitat distribution + stressors/impacts

- Habitat-use models from visual surveys (aerial, vessel) and telemetry data
- Quantitative and spatially explicit measure of extent and degree of overlap/potential cumulative impact
- Proxies for noise; more plausible with soundscape information
- Identify high impact/priority areas
- CUI areas roughly 2x the size of the New York Bight

Maxwell et al. (2013); Rosenbaum et al. (2014); Chou et al. (2020)

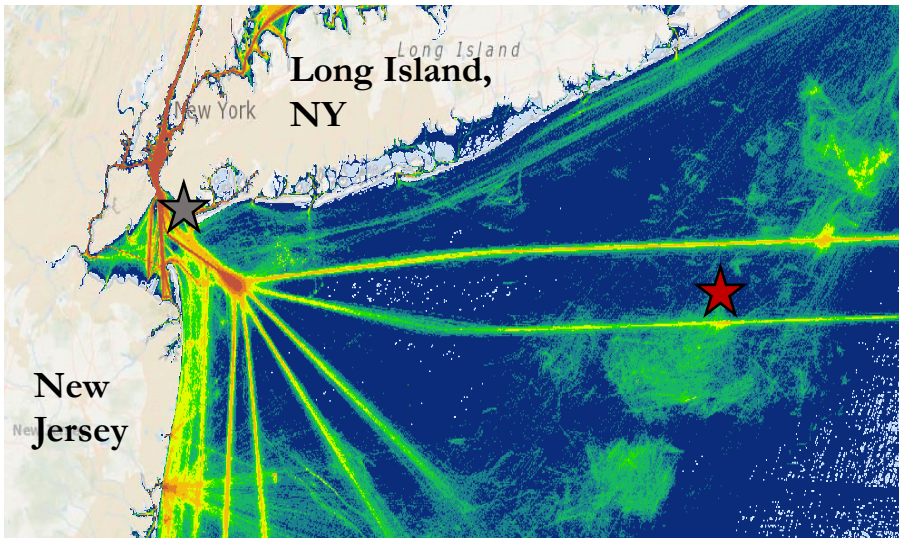
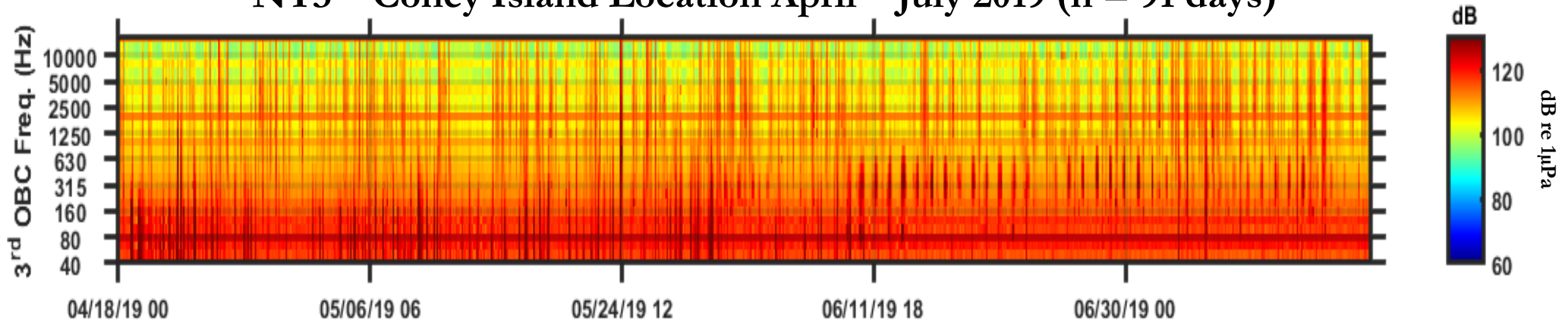
Overlap of current anthropogenic activity with large whale sightings in the NY Bight (humpback whale example)



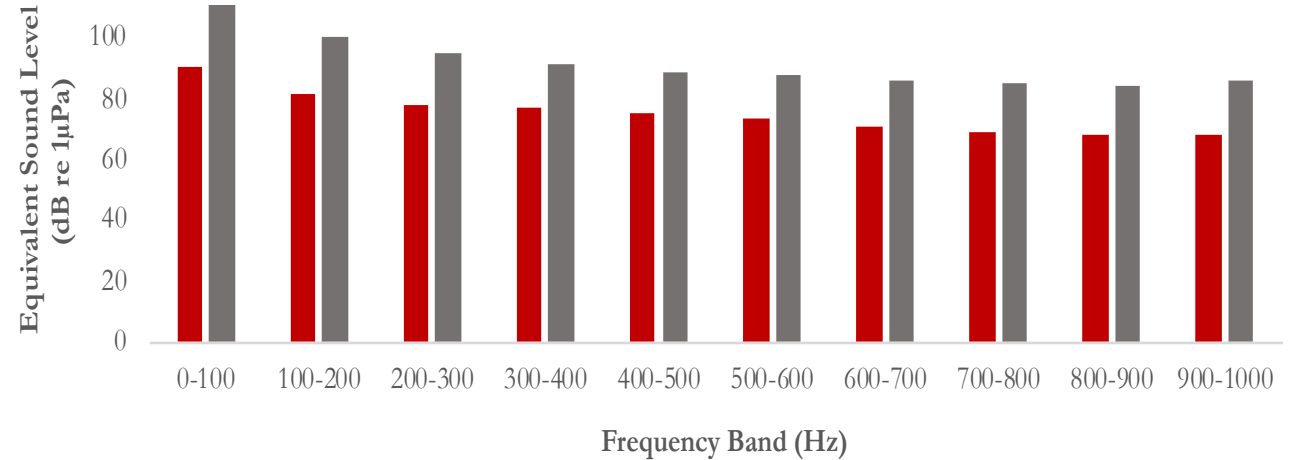
King, Rekdahl et al. (submitted)

Understanding the Existing Soundscape

NY3 – Coney Island Location April – July 2019 (n = 91 days)



Time (mm/dd/yy HH)



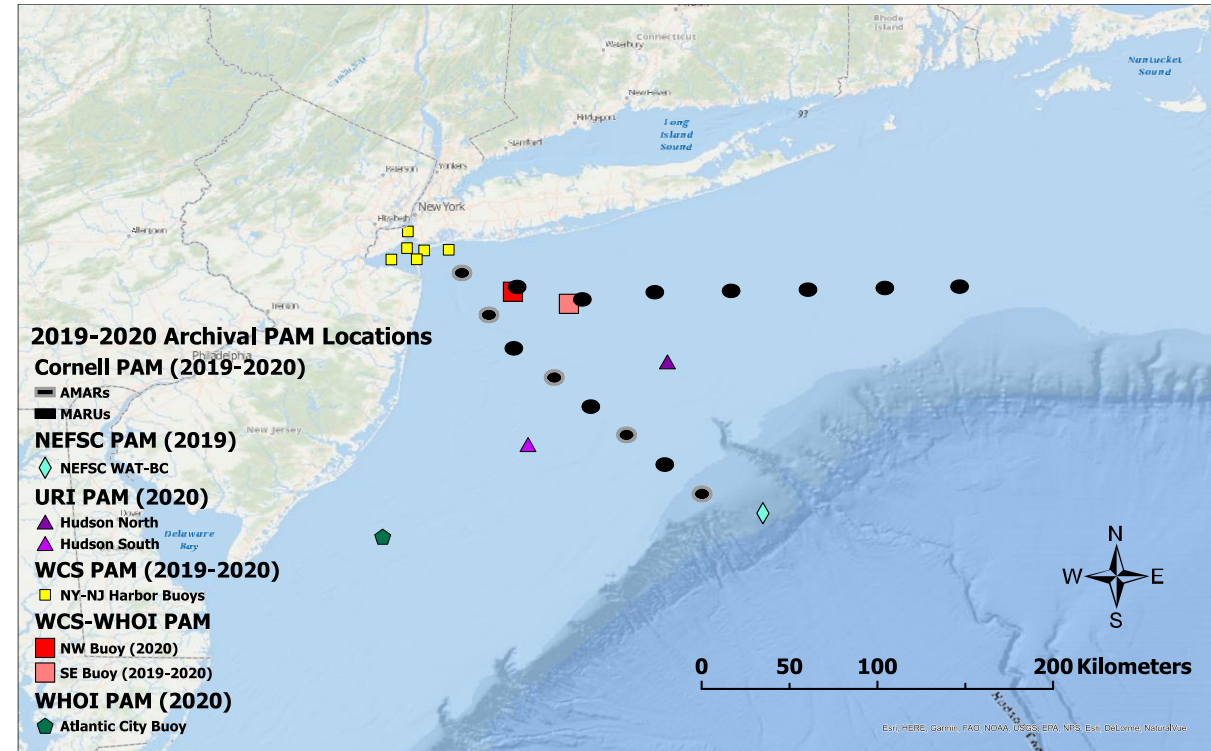
★ NY3 – Coney Island ★ Rice et al. (2014)

■ NY3 – Coney Island (n = 26 days) ■ Rice et al. (2014) (n = 31 days)

Acoustics Synthesis Workshop & Potential Paths Forward in Assessing and Addressing Cumulative Impacts

WCS-led workshop w/NYSERDA support (Oct 2020): Some Conclusions

- Opportunity to synthesize currently available acoustic data: build baselines & identify knowledge
 - AIS coupled w/ spatial & temporal dependence, Vessel Strike Risk, and more....
 - Synthesis compared/contrasted with other non-PAM data sets (various visual surveys: aerial, digital aerial surveys, and shipboard surveys)
 - Comprehensive look at species detections across NYB, including all cetaceans, etc.
 - Reporting standards – detections, time, sound pressure, GPS, interference, metrics, criteria

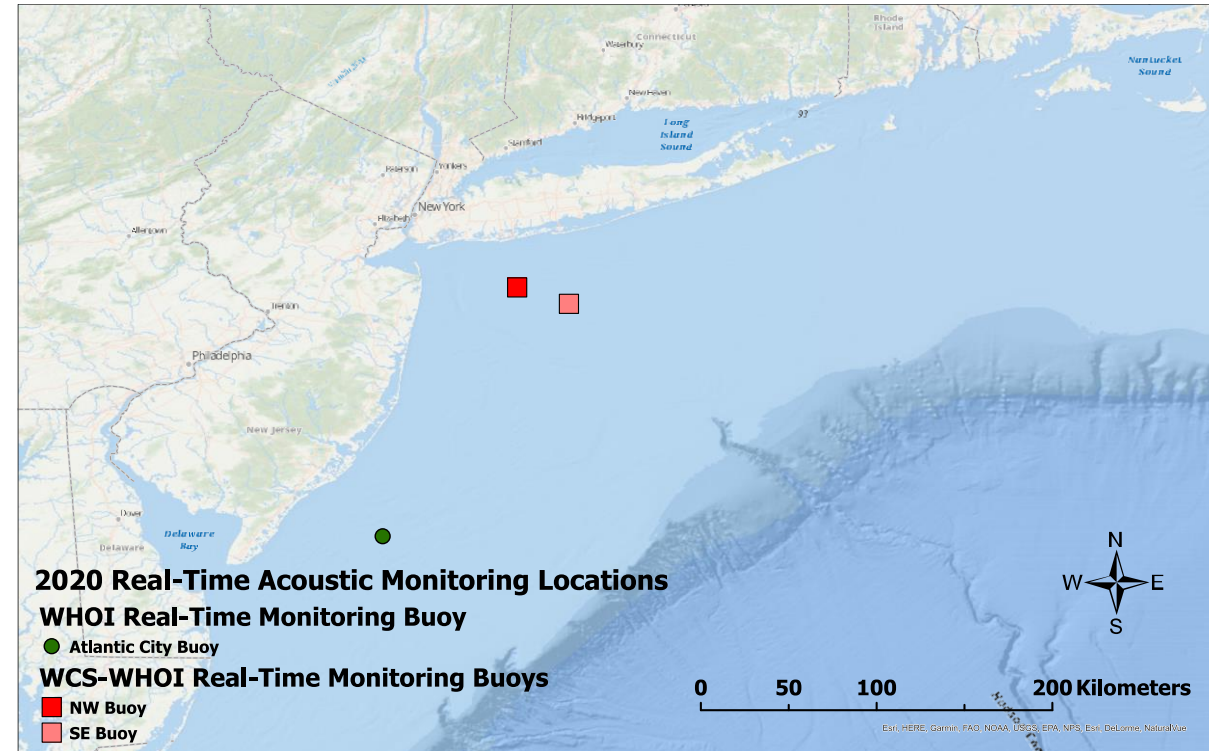


(Adapted from workshop report forthcoming to NYSERDA)

Acoustics Synthesis Workshop & Potential Paths Forward in Assessing and Addressing Cumulative Impacts

WCS-led workshop w/NYSERDA support (Oct 2020): Some Conclusions

- Work towards a more optimal regional scale approach
- Utility to assess Cumulative Impact and Risk
- Application of more Real-Time methods: Monitoring, more effective mitigation?



(Adapted from workshop report forthcoming to NYSERDA)

Near Real-Time Buoy Acoustic Detections of NARW in New York Bight this Week!

- Detected Nov. 17, 2020
- Vessel Slow Speed Zone Southeast of New York City area to protect NARW
 - Voluntary vessel speed restriction zone beyond the NY SMA
 - 10 knots or less
 - Through Dec. 2, 2020
 - Potential for OSW: Early-warning for vessel transits, Pile-Driving, etc...



**ATTENTION ALL BOATERS:
SLOW DOWN TO 10 KNOTS
OR LESS FOR RIGHT WHALES**

NY SMA
NY SLOW Zone
until 12/2/20

Block Isl SMA

SE Nantucket Slow Zone
until 11/30/20

Annual seasonal slow down zones. REQUIRED for boats 65 feet and bigger. Recommended for smaller boats.

Areas where right whales have been sighted (Dynamic Management Area *) or heard. Recommended slow down zones for ALL vessels.



Next Steps and Set-up for Working Group into 2021

- Marine Mammal Working Group kick off: **Friday 12:25 – 13:00 EST**
- Working Group Chair: Brandon Southall
- **Objective:** Identify priority monitoring and research topics for NY Bight (and regionally) to better understand Cumulative Impacts
- **Timeline:** Two subsequent working group virtual meetings to discuss and develop prioritized list to provide to NYSERDA and larger community

Many thanks to:

Dr. Melinda Rekdahl

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Jim Miller

Joe DePalma

John McMurray



WCS/Ocean Giants/Image taken under
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