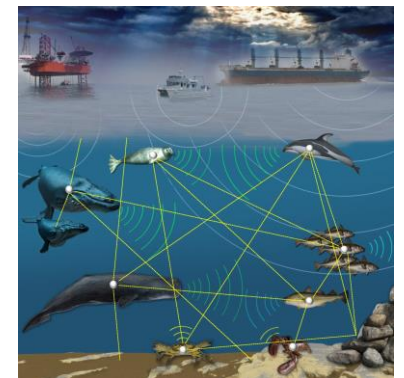
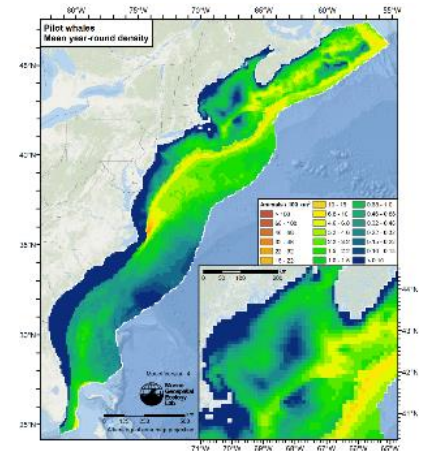
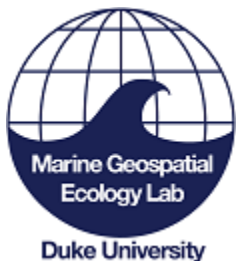


Science perspectives on protected species management for offshore wind energy

March 7, 2017

Jason Roberts and Pat Halpin

Duke University



Science, protected species, and offshore wind: a simplified view

Data collection



Analysis and modeling

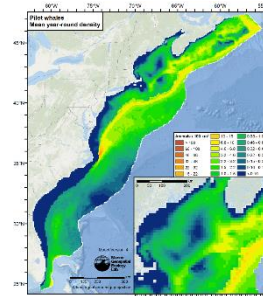


Planning and implementation

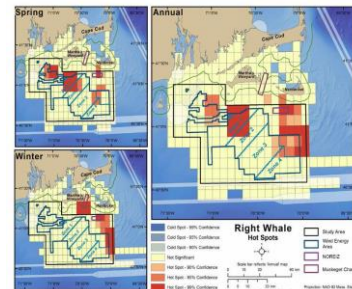
Baseline data

Info about species distributions, habitats, human activities, etc.

Environmental Impact Statements, Environmental Assessments

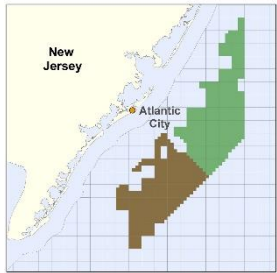


Roberts et al. (2016)



Krauss et al. (2016)

Regional spatial plans

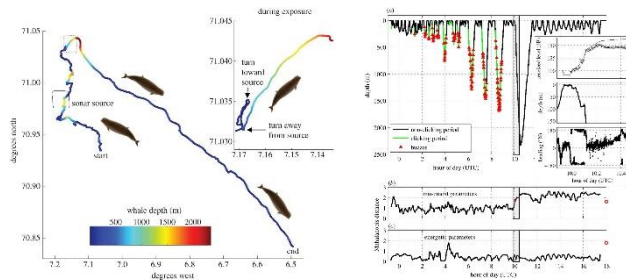


Regulations

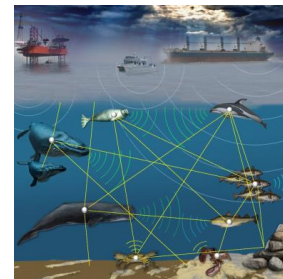
Exposure experiments

Exposure and effects models

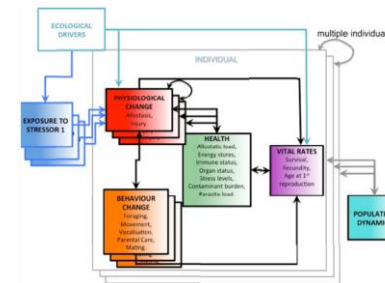
Mitigation strategies



Miller et al. (2015)



NOAA



Natl. Acad. Sci.

Siting and permits

Real-time monitoring



You will see many examples at this workshop; here's one from my own work...

SCIENTIFIC REPORTS

OPEN

Habitat-based cetacean density models for the U.S. Atlantic and Gulf of Mexico

Received: 18 November 2015

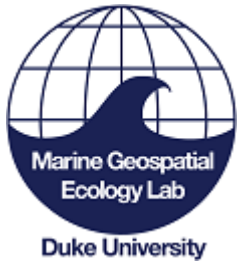
Accepted: 17 February 2016

Published: 03 March 2016

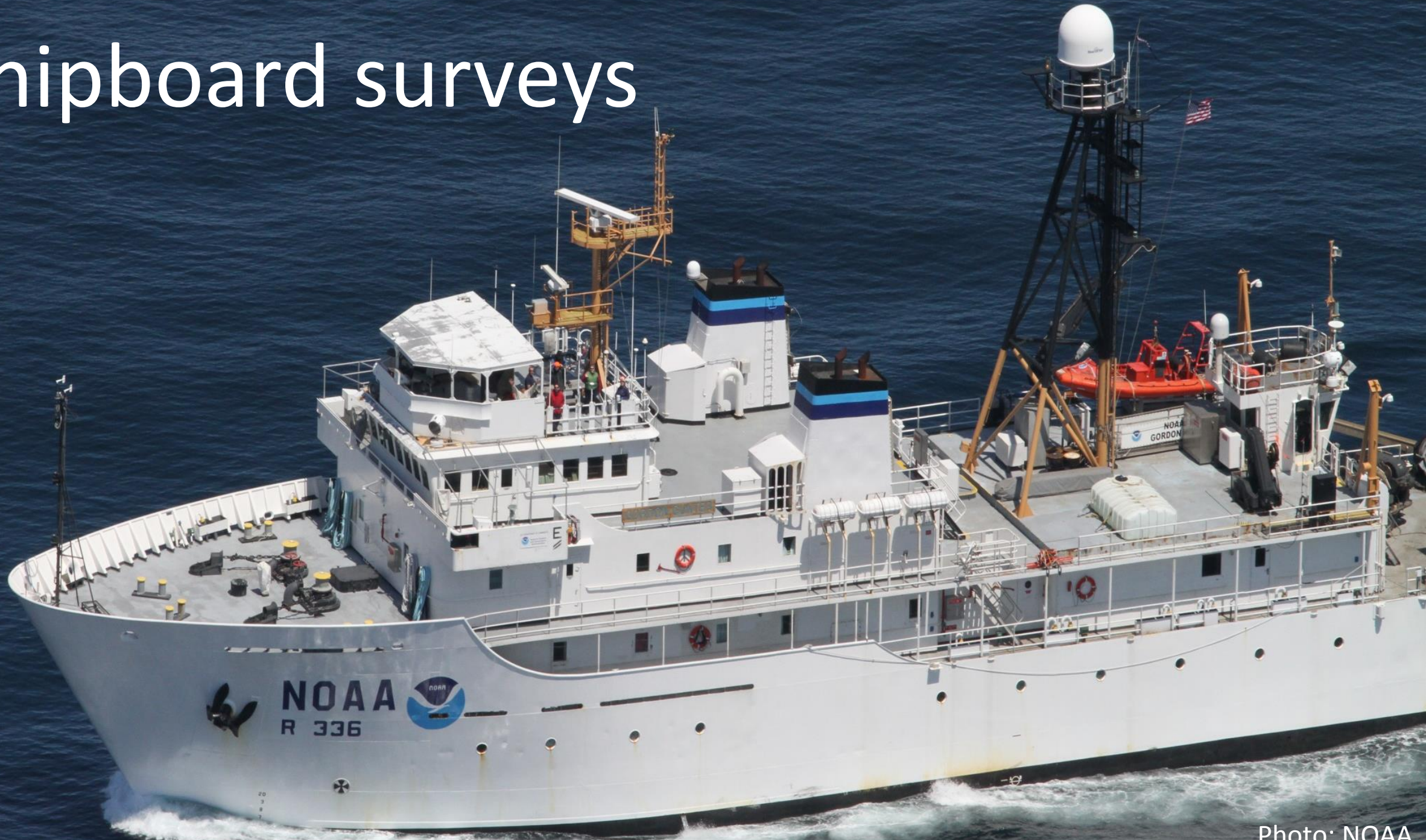
Jason J. Roberts¹, Benjamin D. Best^{1,2}, Laura Mannocci¹, Ei Fujioka¹, Patrick N. Halpin¹, Debra L. Palka³, Lance P. Garrison⁴, Keith D. Mullin⁵, Timothy V. N. Cole³, Christin B. Khan³, William A. McLellan⁶, D. Ann Pabst⁶ & Gwen G. Lockhart⁷

<http://www.nature.com/articles/srep22615>

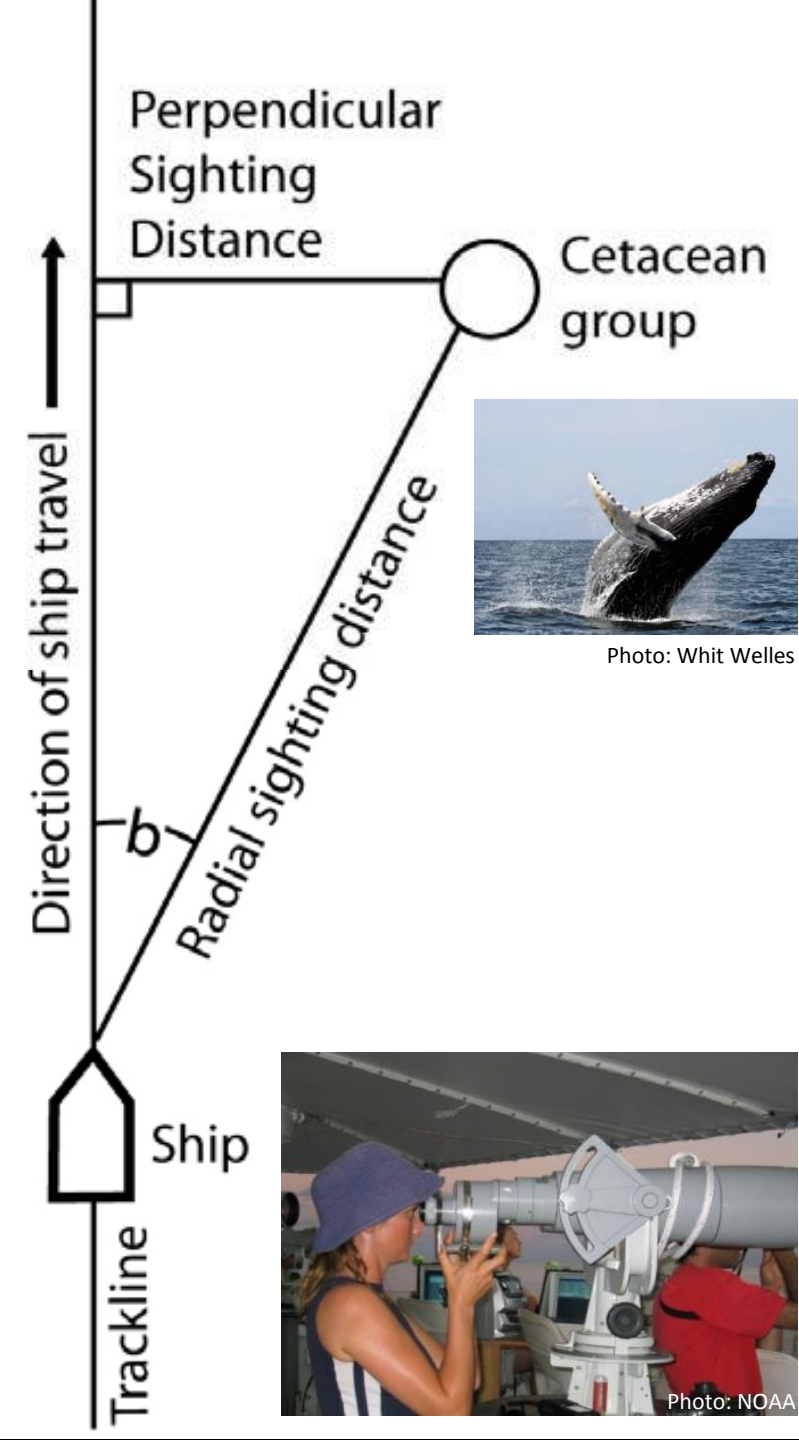
Data collection and analysis funded by:



Shipboard surveys



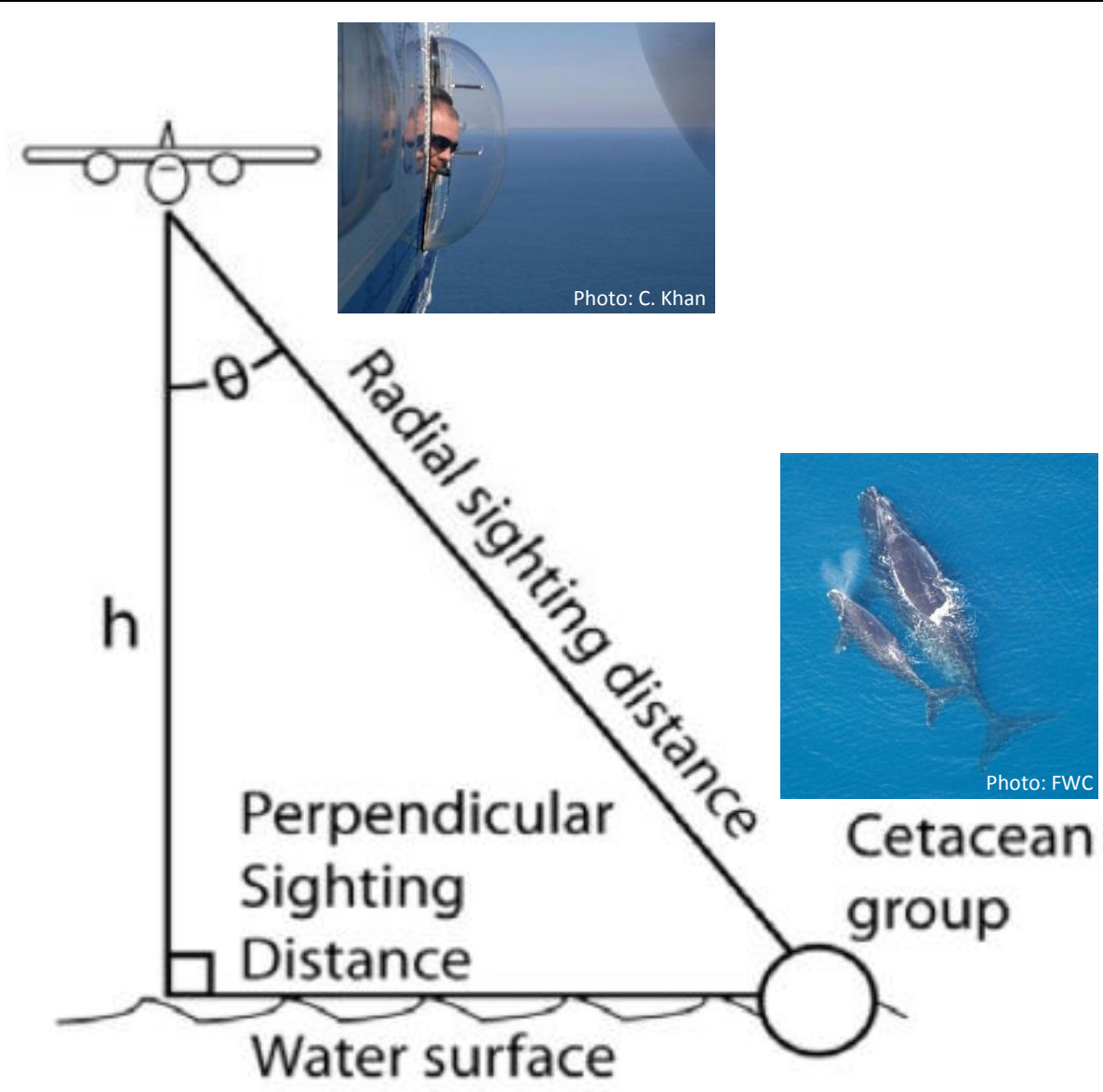
Shipboard observers



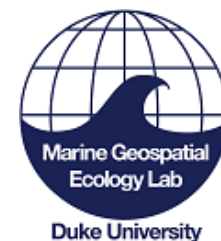
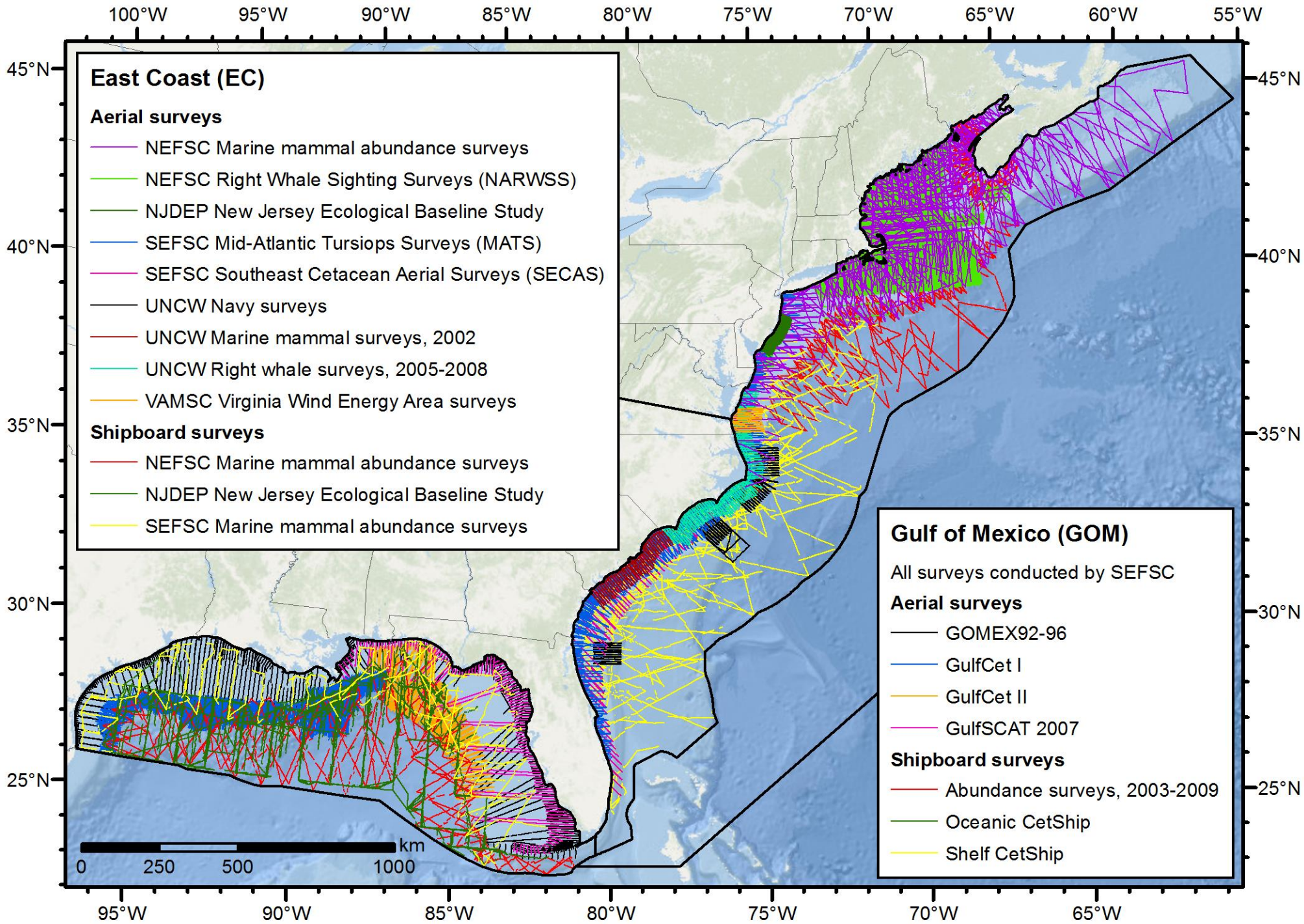
Aerial surveys



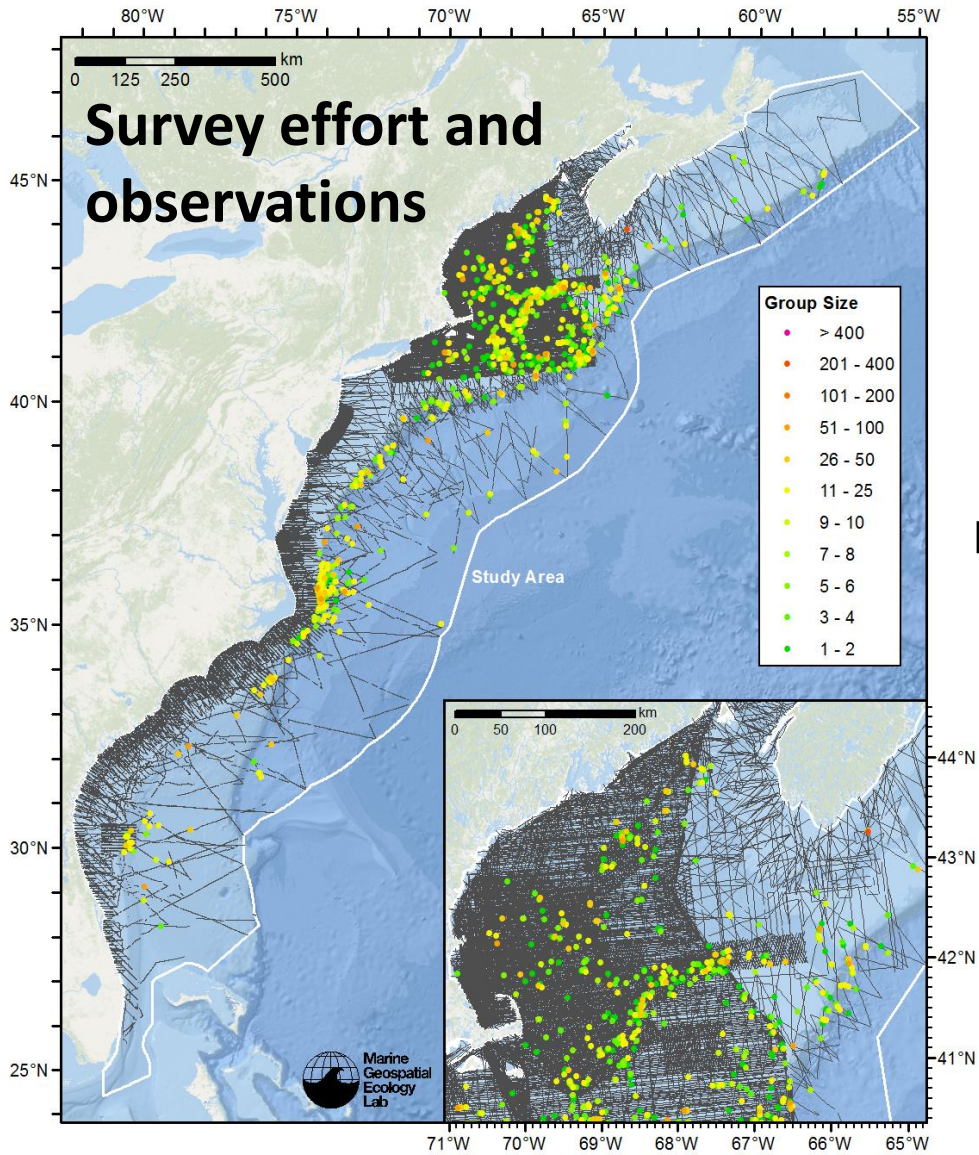
Aerial observers



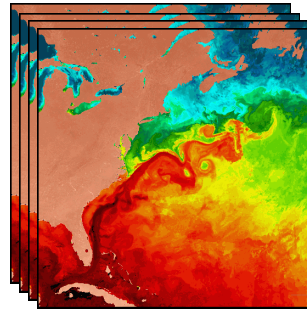
Visual line transect surveys 1992-2014



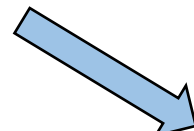
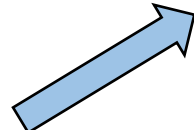
Density modeling process



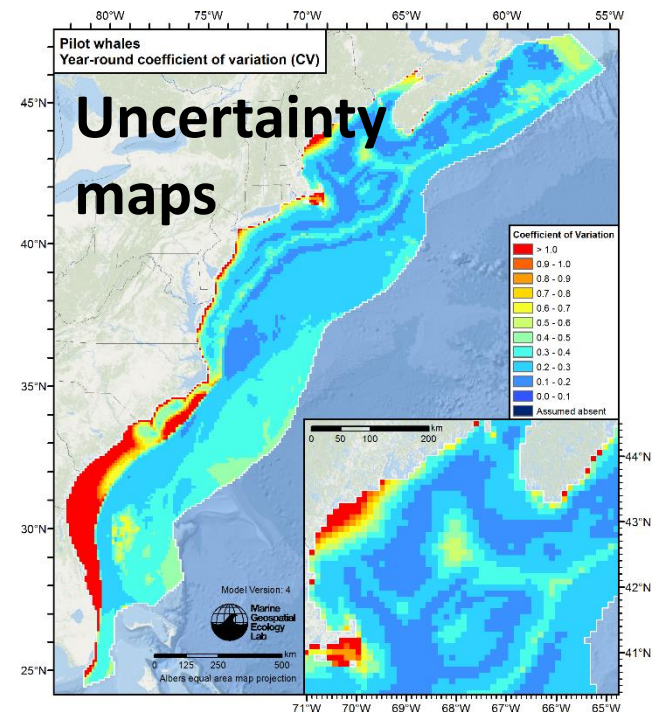
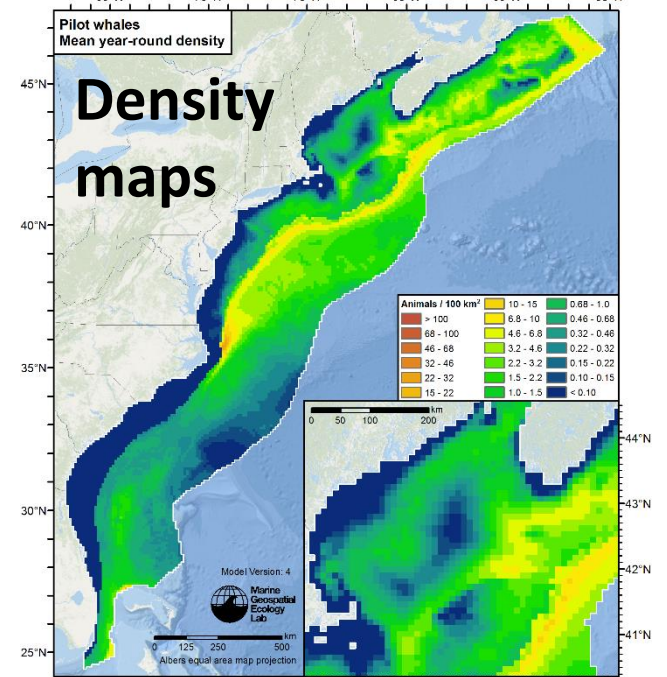
Oceanographic data



Statistical models



Data shown for pilot whales



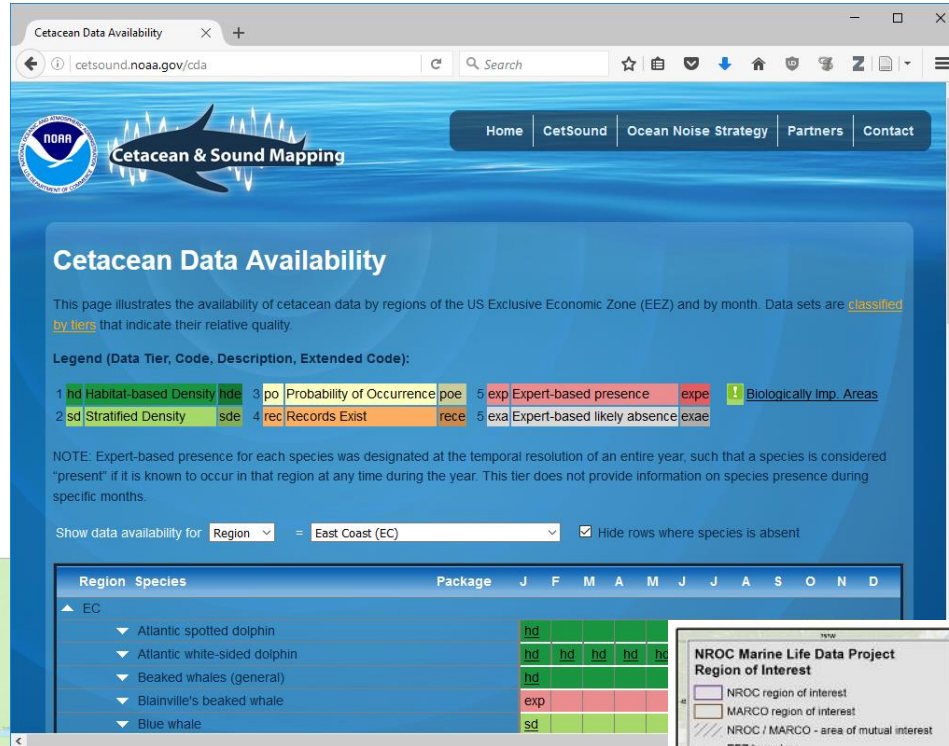
Uptake and application of results

NOAA Fisheries:

- MMPA permitting
- CetSound

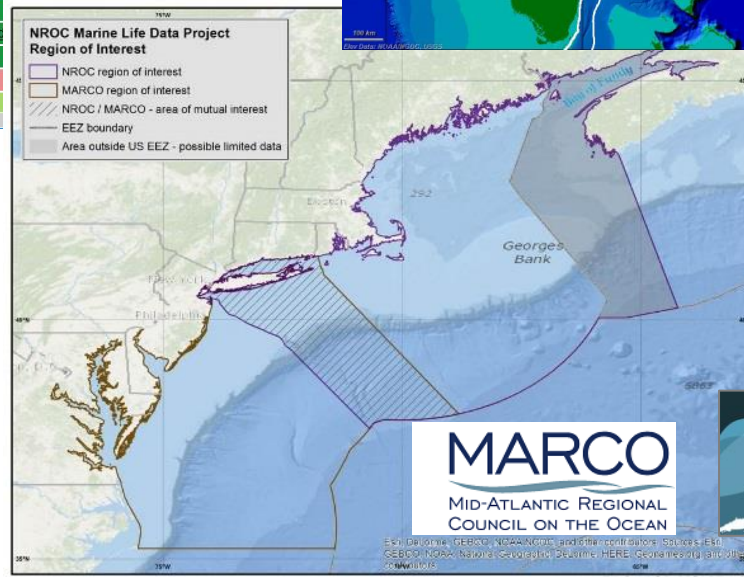
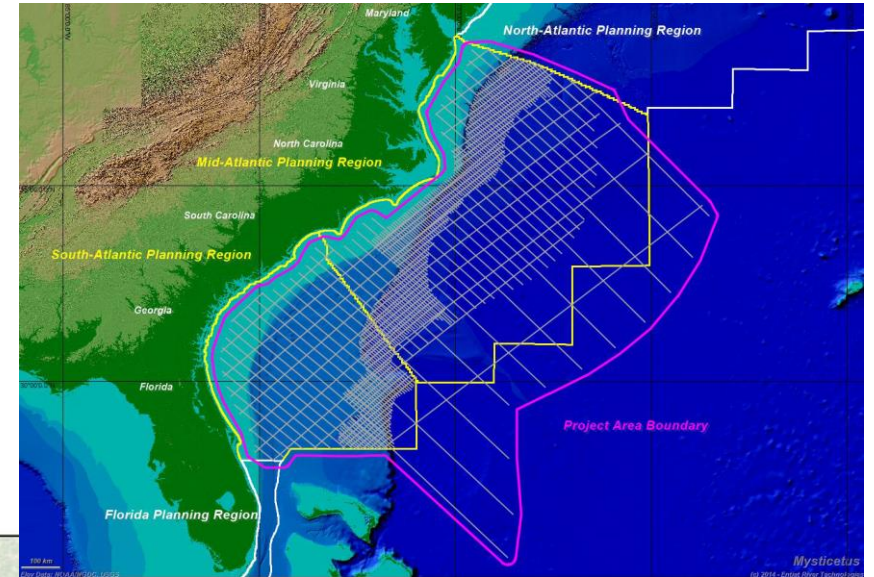
U.S. Navy:

- Take estimation for AFTT EIS



BOEM:

- Atlantic G&G permitting
- 2017-2022 OCS PEIS



- Planning bodies:
- Regional ocean plan development

Science, protected species, and offshore wind: a simplified view

Data collection



Analysis and modeling

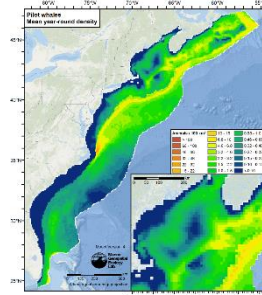


Planning and implementation

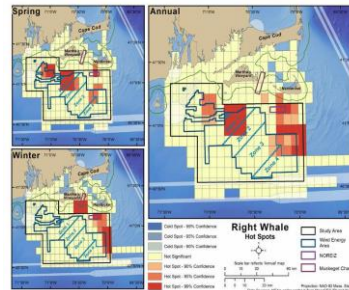
Baseline data

Info about species distributions, habitats, human activities, etc.

Environmental Impact Statements, Environmental Assessments

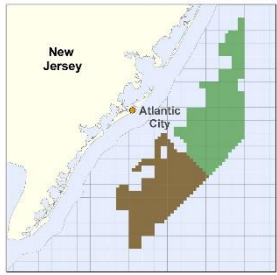


Roberts et al. (2016)



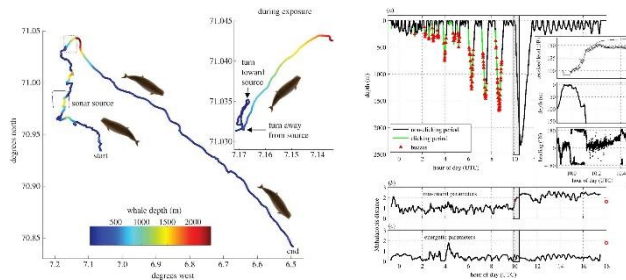
Krauss et al. (2016)

Regional spatial plans



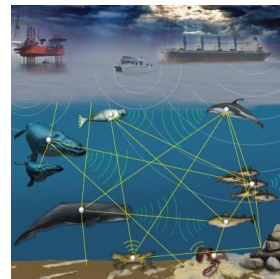
Regulations

Exposure experiments

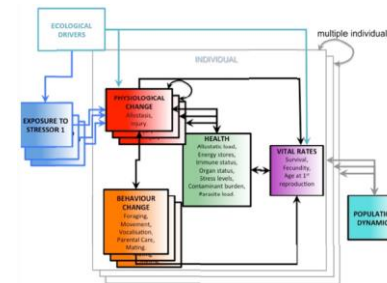


Miller et al. (2015)

Exposure and effects models



NOAA



Natl. Acad. Sci.

Mitigation strategies

Siting and permits

Real-time monitoring



Best Management Practices