

Role of Live Marine Mammal Health Assessments in Conservation and Understanding of Coastal Ecosystems

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MM Health Research in Charleston

NMFS Unusual
Mortality Event
Investigation &
Stock Assessment
Research

Center of Excellence for Oceans
& Human Health (OHH)

Cooperative Center for Marine
Animal Health (CCMAH)

Health and Environmental Risk
Assessment (HERA)

Retrospective Risk
(Injury) Assessments

Resource focus

Sentinel focus

Resource & sentinel focus

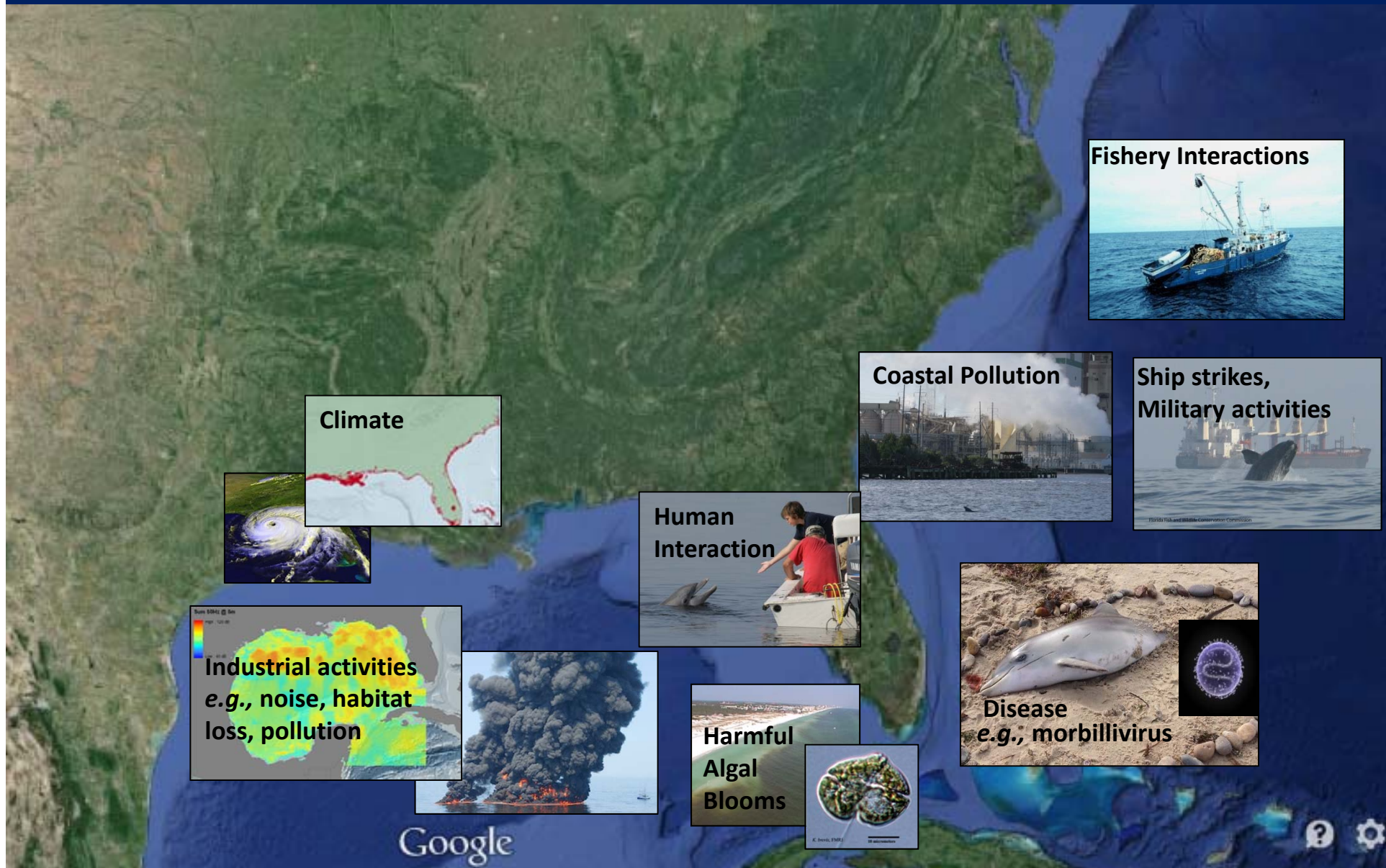
2004

2010





Threats to Marine Mammals in the Southeast U.S.





Assessment “Toolbox” for Cetaceans

Source

Measure concentrations in media; “fingerprinting”
Visual documentation
Tagging – distribution & movements

Exposure

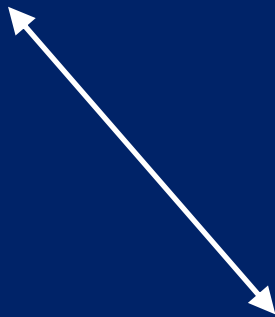
Prey, environmental sampling/analysis
Tissue analysis (remote biopsy/breath, capture-release, carcass sampling)
Photo-ID, tagging to characterize population & movements

Effect

Tissue analysis
Necropsy, pathology of carcasses
Capture-release health assessment
Longitudinal photo-ID for survival & fecundity
Surrogate/in-vitro studies

Epidemiology, Statistical Modeling

Population Risk and/or Ecosystem Modeling





Charleston Estuarine System: Integrated Study Approach

Stranding Investigation



Longitudinal Photo-ID



Remote Biopsy



Capture-release



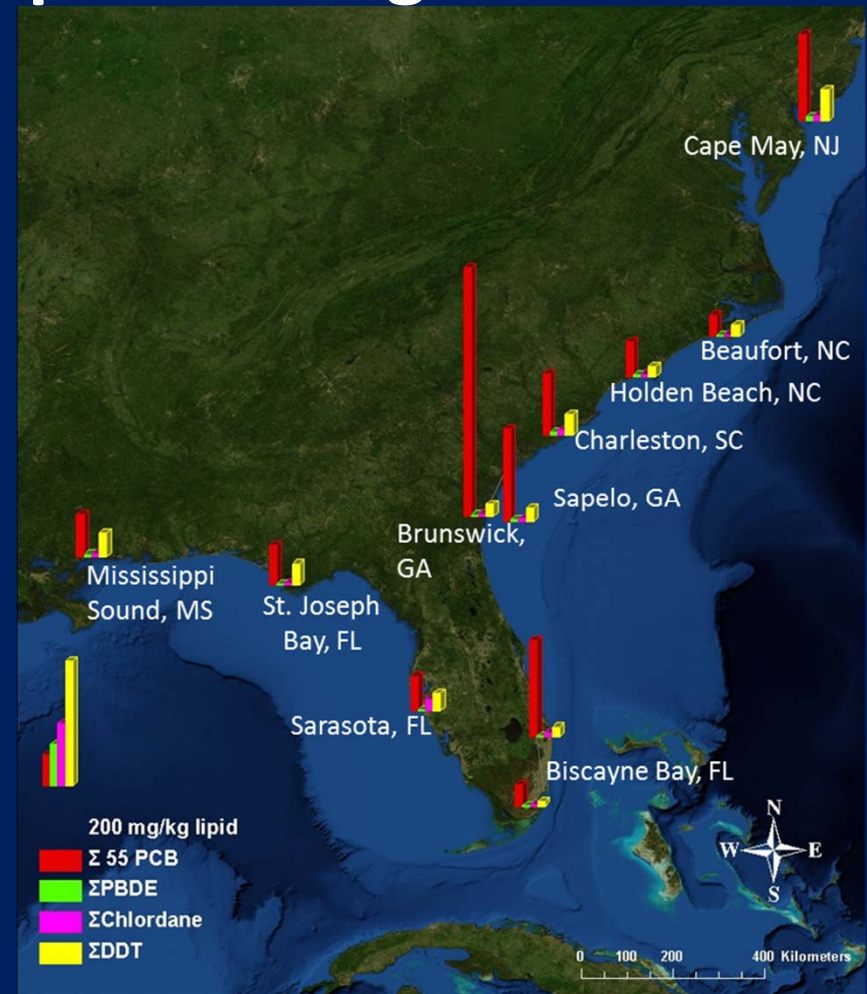
- Serve as reference population
 - Young-of-year, adult survival rates^a
 - Pregnancy success
 - Pathology baselines^b
- Coastal/estuarine stock overlap & interactions
- Reproductive seasonality^c
- Influence of land-use on chemical contaminant exposure^{d,e}
- Mortality/pathology for individuals with known history

^aSpeakman et al. 2010, J Cetacean Res. Manage. 11(2); ^bVenn-Watson et al. (In press), PLoS One; ^cMcFee et al. 2013, Mar Mam Sci, ^dAdams et al. 2008, MarEnv Res 66(4); ^eAdams et al. 2014, Env Res 135.

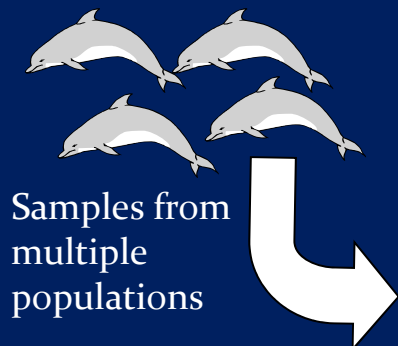


Southeast Collaboration → Health Reference Values → Foundation for Epidemiological Studies

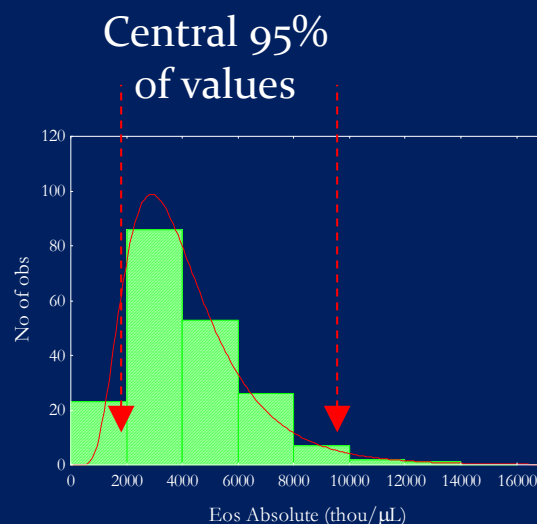
- Established reference intervals for many health parameters (body condition, blood parameters)^{a,b}
- Understanding of spatial trends in broad range of contaminants & pathogen exposure^{c,d}
- Baseline age-specific survival rates for population models



^aSchwacke et al. 2009, AJVR 70(8); ^bHart et al. 2013, Aquat Bio 18; ^cKucklick et al. 2011, ES&T 45(10); ^dRowles et al. 2010, Mar Mam Sci 27(1).

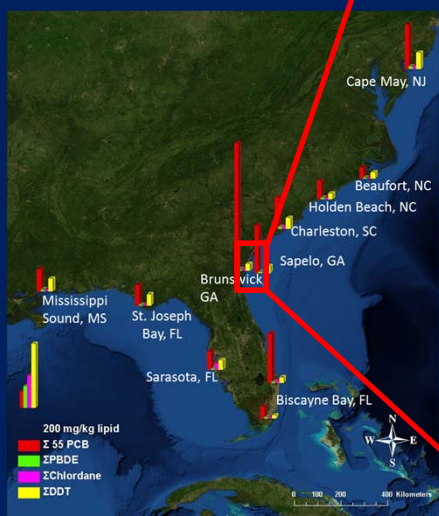
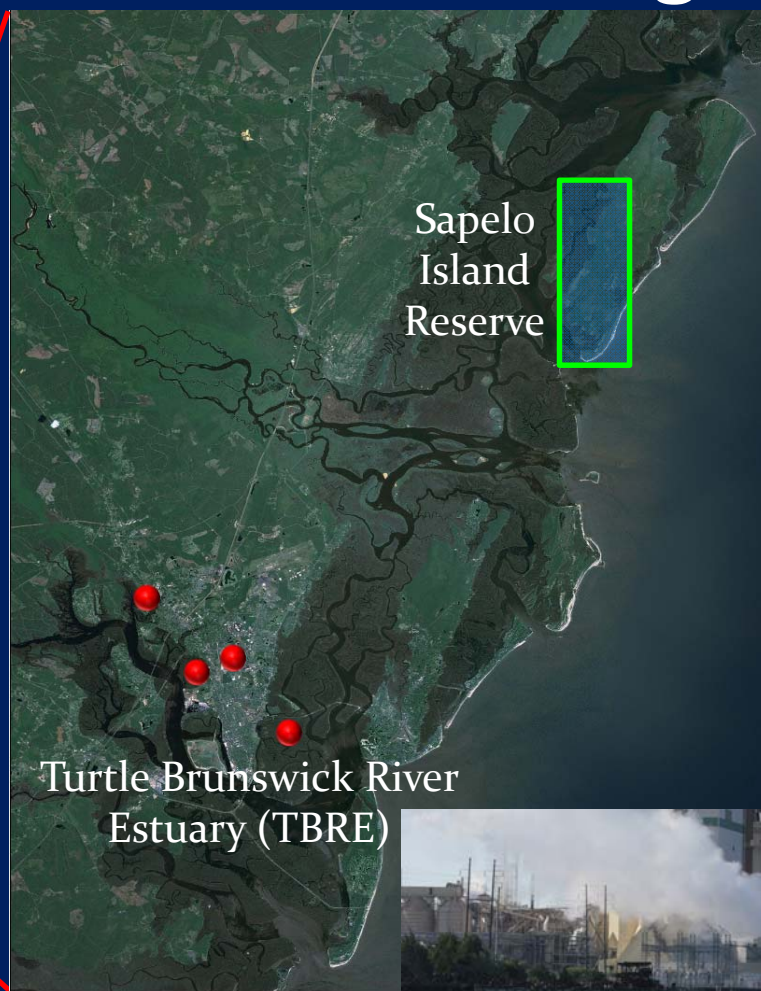


Samples from multiple populations





Application: Understanding Transport & Effects of PCBs in Georgia Estuaries



- Dolphin studies (remote biopsy) demonstrated highest PCB levels ever recorded for marine mammals^{a,b}
- Provided first indication that PCBs are being transported significant distance from site to Sapelo NERR
- Capture-release health assessments showed correlation of blubber PCB concentration and endocrine & immune effects^c



^aKucklick et al. 2011, ES&T 45(10); ^bBalmer et al. 2011, STOTEN 409; ^cSchwacke et al. 2011, Proc Roy Soc 279.



Application: *Deepwater Horizon* NRDA

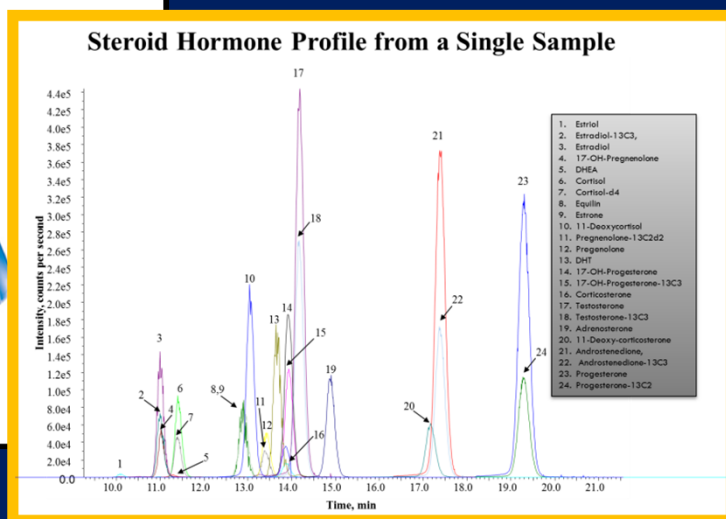


- Integrated live dolphin health studies have been critical to understand effects of DWH oil spill on Gulf marine mammals
- Combined with UME findings, results to date show chronic poor health, failed pregnancies, and increased mortality of dolphins in the aftermath and footprint of the DWH oil spill^{a,b,c}
- Findings are informing planning for restoration projects to promote stock recovery

^aSchwacke et al. 2014, ES&T 48; ^bVenn-Watson et al. 2015, PLoS One 10(2); ^cVenn-Watson et al. (In press), PLoS One;



New & Developing Technologies



- Rapid real-time PCR for detection of *Brucella* (and genotype ST27) and other pathogens in blowhole swabs^a
- Molecular diagnostics, e.g., transcriptomics, proteomics from blood, urine & skin/blubber^b
- Steroid hormone profiles from single blood or blubber sample (A. Boggs, NIST)

^aWu et al. 2014, Journal of Microbiological Methods 100, 99-104.

^bVan Dolah et al. (In review), PloS One.



Summary & Conclusions

- Integrated live animal health studies have significantly advanced science for injury assessment (retrospective risk assessment) for dolphins
- But, existing and emerging stressors along southeast coast require consideration of cumulative effects; need new, innovative prospective risk assessment approaches
- New approaches also needed to expand baseline health data for coastal/pelagic *Tursiops* stocks and other cetacean species





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Thanks to the many collaborators who have made the dolphin health studies possible....

- Dr. T. Rowles & NMFS Marine Mammal Health & Stranding Response Program
- Dr. F. Townsend, Bayside Animal Hospital
- Dr. R. Wells and colleagues at the Chicago Zoological Society
- National Institute of Standards & Technology
- Dr. C. Smith & National Marine Mammal Foundation colleagues
- Drs. P. Rosel, K. Mullin and colleagues at NMFS Southeast Fisheries Science Center
- Drs. S. DeGuise & M. Levin, Univ of Connecticut
- GA & SC Dept of Natural Resources, LA Dept of Wildlife & Fisheries, MS Dept of Env Quality
- Dr. G. Ytalio, NMFS NWFSC
- Dr. N. Kellar, NMFS SWFSC
- Cornell Animal Health Diagnostic Center
- SeaWorld/Busch Gardens
- Georgia Aquarium
- Harbor Branch Oceanographic Institute

