

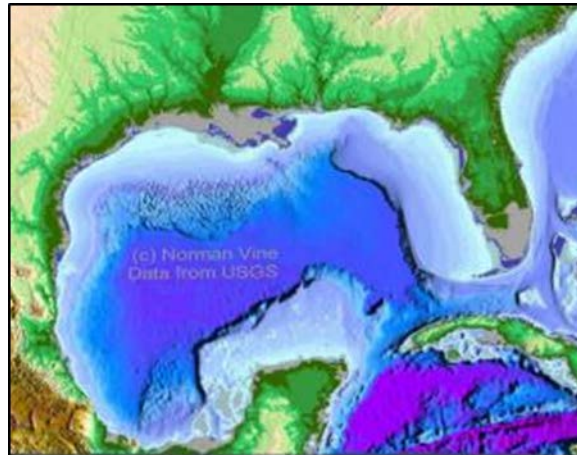


NOAA
FISHERIES

Southeast
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Science Center

GoMMAPPS Marine Mammal Assessment Research

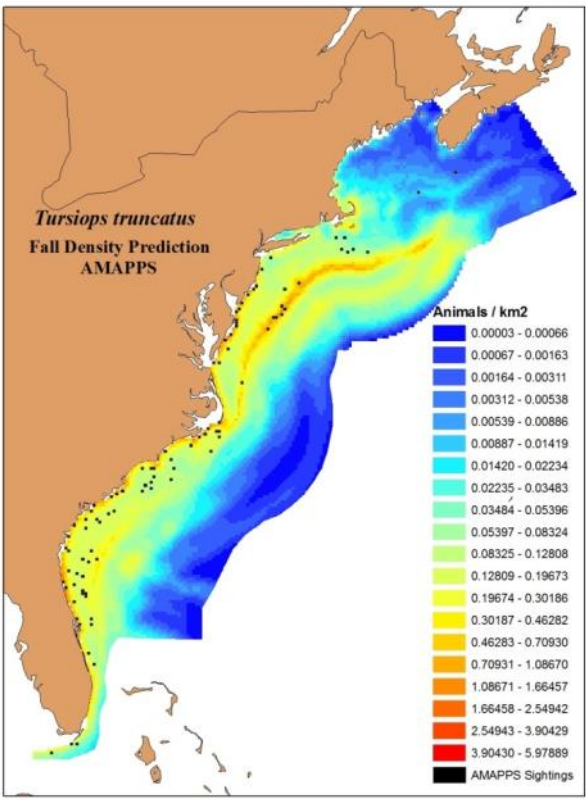
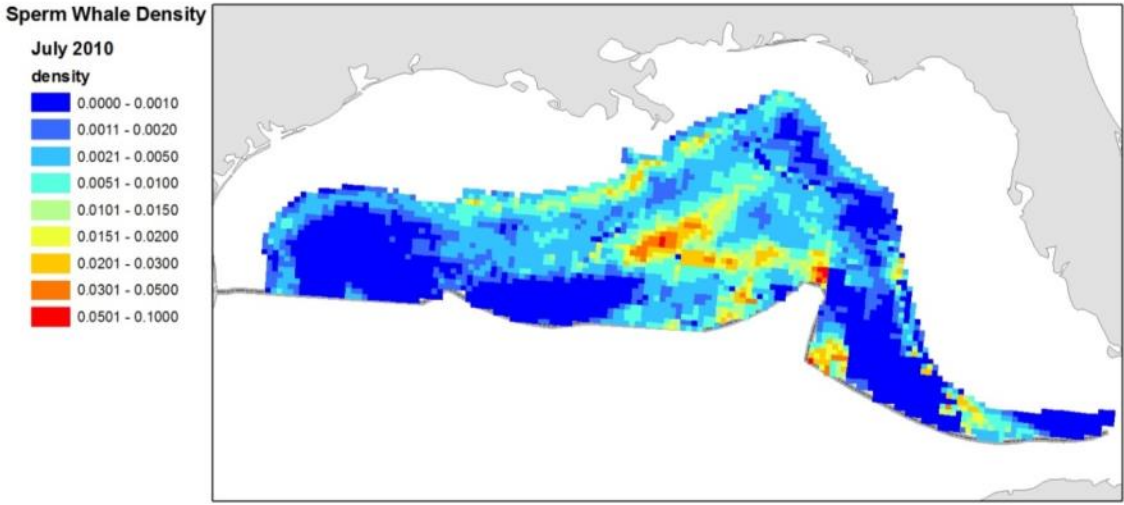
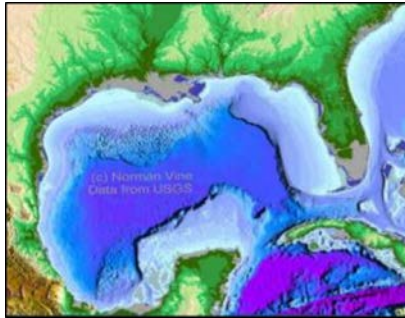
Jenny Litz, Keith Mullin, Lance Garrison,
Anthony Martinez, Kevin Barry, Melissa
Soldevilla, and Laura Aichinger-Dias



23 August 2017
BOEM ITM
New Orleans, LA

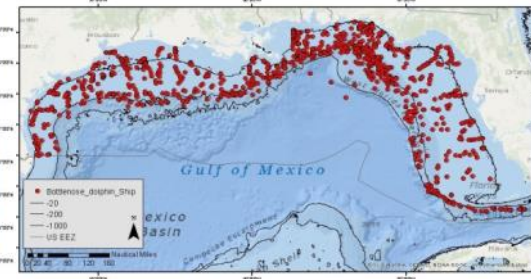
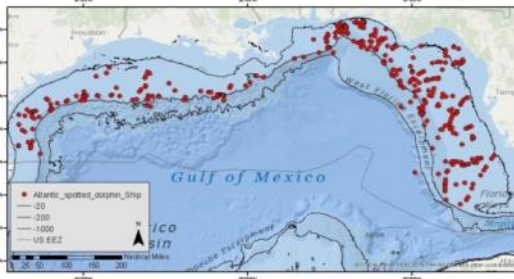
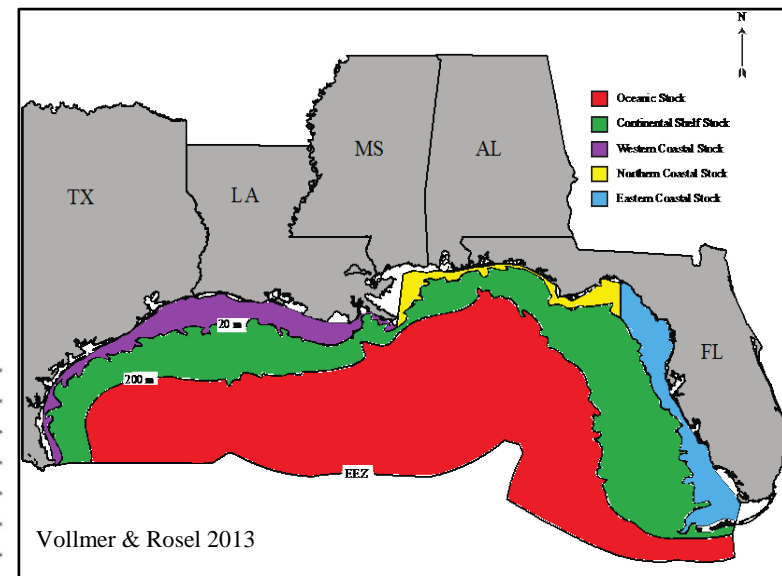
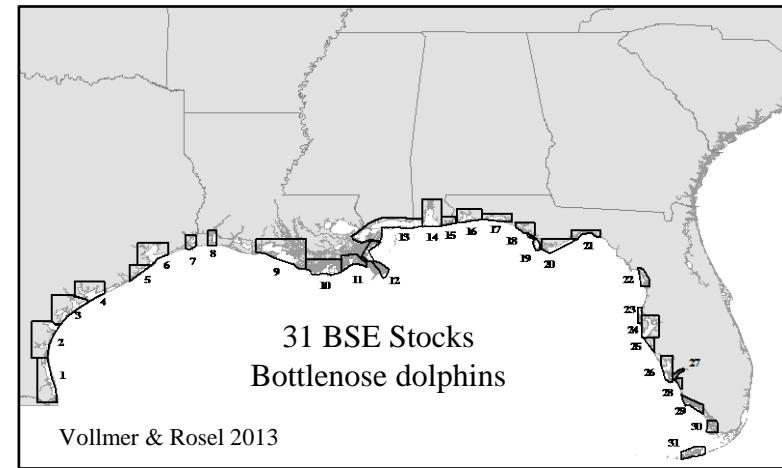
GoMMAPPS Marine Mammals: Objectives

- Collect broad-scale information on distribution and abundance
- Develop seasonally- and spatially-explicit density estimates for priority species
- Provide information to managers to assist with decisions related to offshore energy development
- Update abundances for NMFS stock assessments



Gulf of Mexico Habitats and Cetacean Species & Stocks

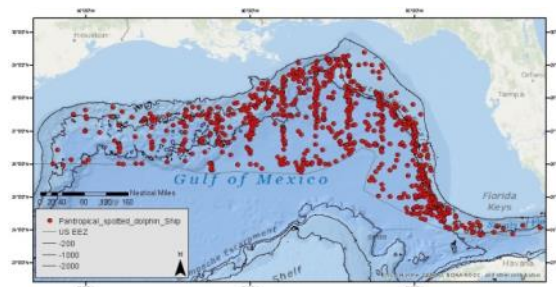
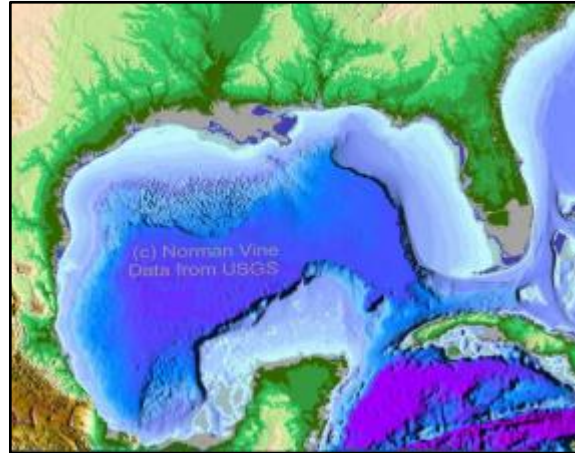
- Bays, Sounds & Estuaries (BSE)
 - Bottlenose dolphins – 31 stocks
- Coastal Waters (0 – 20 m)
 - Bottlenose dolphins – 3 stocks
- Continental Shelf (20 – 200 m)
 - Atlantic spotted dolphins – 1 stock
 - Bottlenose dolphins – 1 stock
- Oceanic Waters (≥ 200 m)
 - 21 species – 21 stocks (tropical cetacean community)



Gulf of Mexico Oceanic Cetaceans

21 species routinely inhabit oceanic waters; currently – 21 stocks

- Bryde's whale (ESA listing proposed)
- Sperm whale (ESA-listed)
- Dwarf sperm whale
- Pygmy sperm whale
- Cuvier's beaked whale
- Blainville's beaked whale
- Gervais' beaked whale
- Short-finned pilot whale
- Killer whale
- Pygmy killer whale
- Melon-headed whale
- False killer whale
- Risso's dolphin
- Bottlenose dolphin
- Rough-toothed dolphin
- Fraser's dolphin
- Atlantic spotted dolphin
- Pantropical spotted dolphin
- Striped dolphin
- Clymene dolphin
- Spinner dolphin



GoMMAPPS Marine Mammal Objectives

Broad-scale multi-year seasonal abundance & distribution data

1. Continental shelf (0—200 m) – Seasonal aerial surveys
2. Oceanic waters (> 200 m) – Seasonal ship surveys

Data Analyses

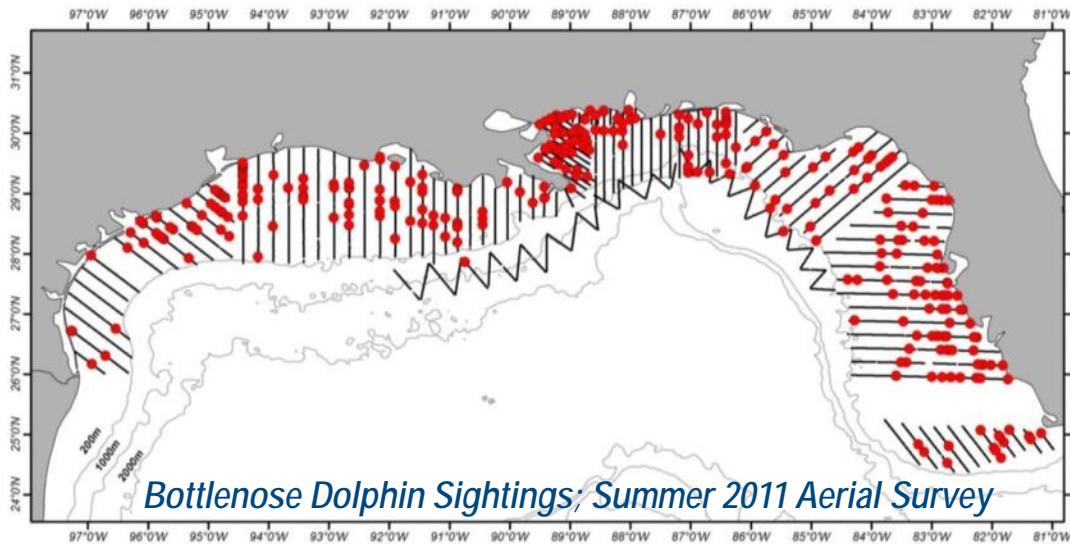
1. Assemble and evaluate historical aerial and ship surveys
2. Estimate bias-corrected population size of species/stocks
3. Develop models that incorporate habitat characteristics to translate current and past surveys into spatially-explicit maps of species density & uncertainty

Program Management

Data Management/Dissemination

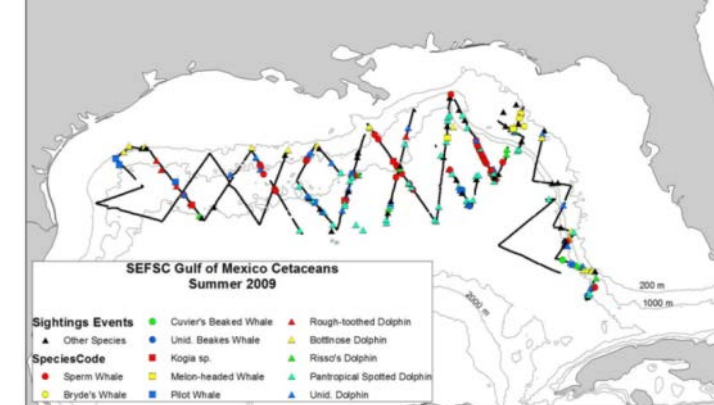
Continental Shelf: Aerial Surveys

- Visual line-transect surveys (60 days)
- 3 surveys (summer '17, winter '18, fall '19)
- Two-team method to account for perception bias
- Bottlenose dolphins, Atlantic spotted dolphins & sea turtles
- Exploring digital photography tools for species id confirmation



Ship-based Surveys

- Seasonal line-transect survey (~60 days duration)
- 3 surveys (summer '17, winter '18, summer/fall '18)
- Visual teams
 - Two-teams to account for perception bias
- Biopsy samples (opportunistic)
 - Stock structure
- Oceanographic data
 - Continuous surface sampling underway
 - Vertical Profiles with CTD and XBT
 - Acoustic backscatter: EK60
- Passive acoustic sampling
 - towed array and sonobuoys
- Plankton sampling added at night
- Seabird survey

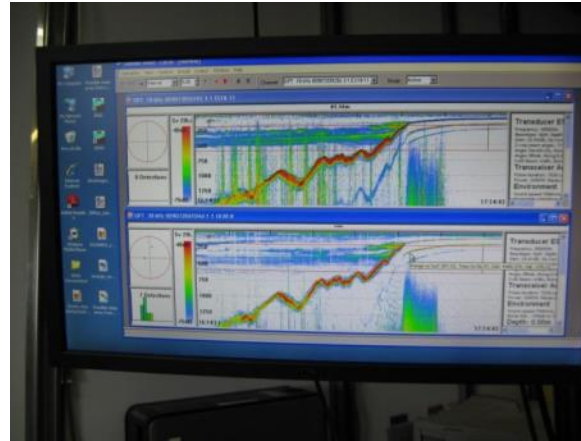


Vessel surveys: *In-situ* Oceanographic Sampling

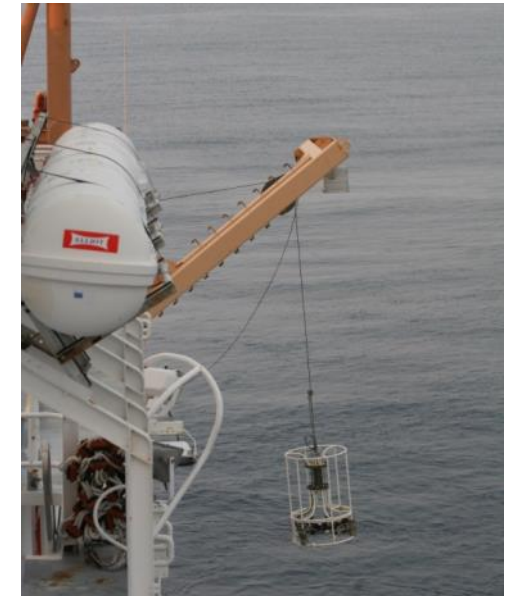
XBT Stations



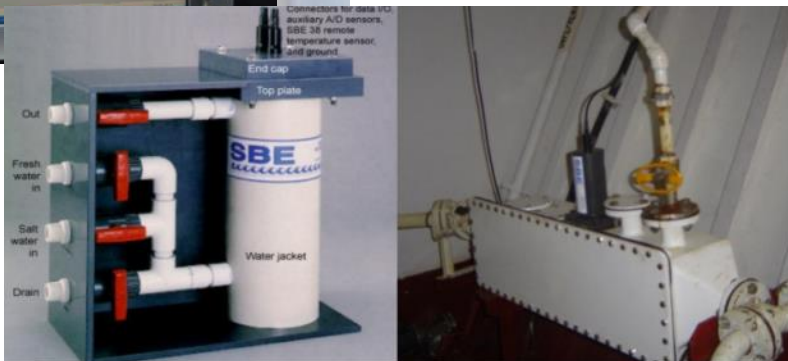
EK60 at night



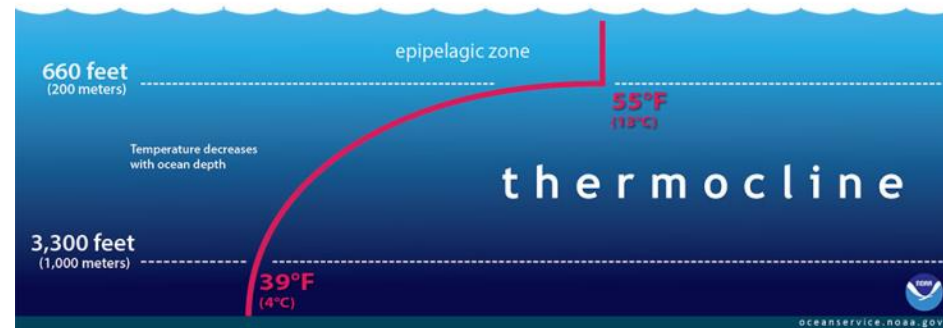
CTD Stations



Continuous Underway Sampling



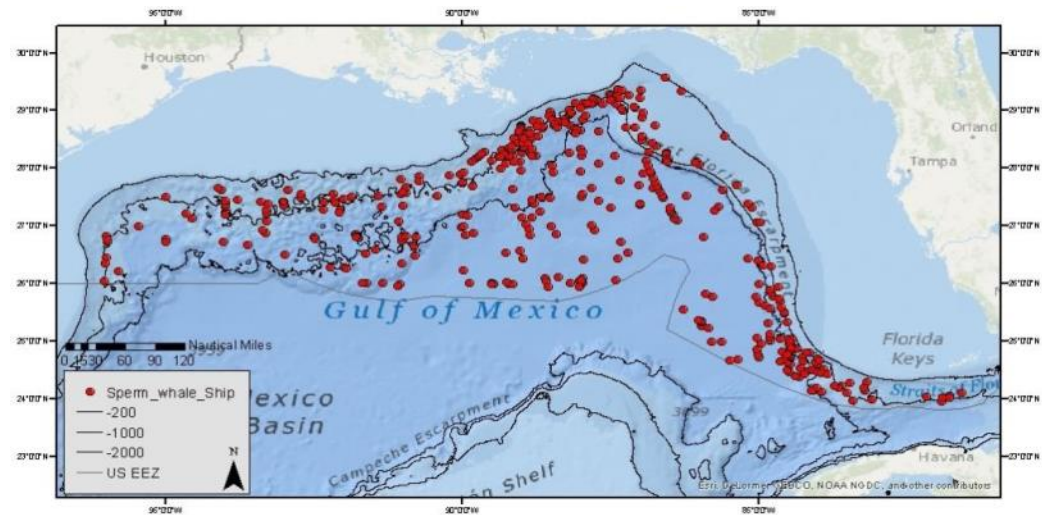
(left) Overall view of the SBE 21 SEACAT Thermosalinograph model. (right) Thermosalinograph installed onboard the NOAA ship Ronald H. Brown.



Outcomes: Spatially Explicit Density Maps

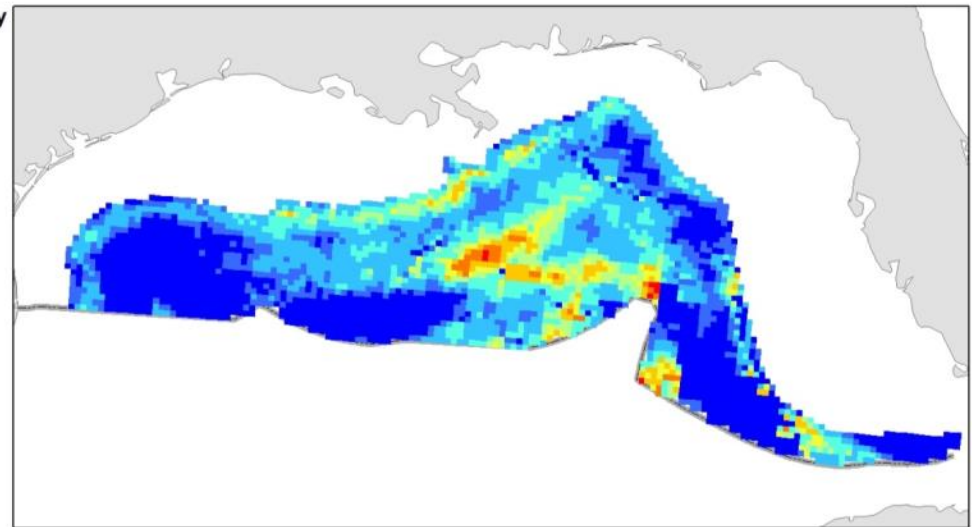
Integrate:

- Historical survey data
- Seasonal survey data
- In situ* oceanographic data
- Remote sensing data
- Topographic data



Sperm Whale Density

July 2010
density



Analytical Framework: Distance Sampling

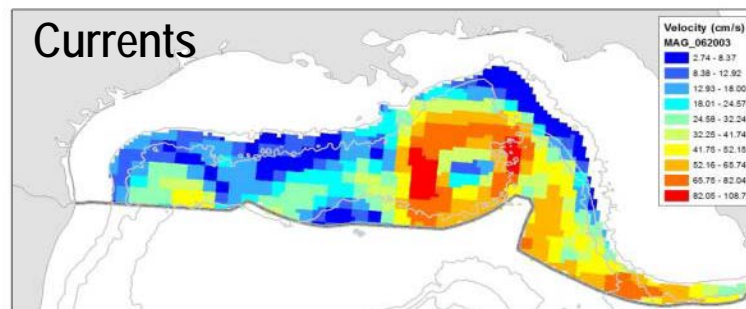
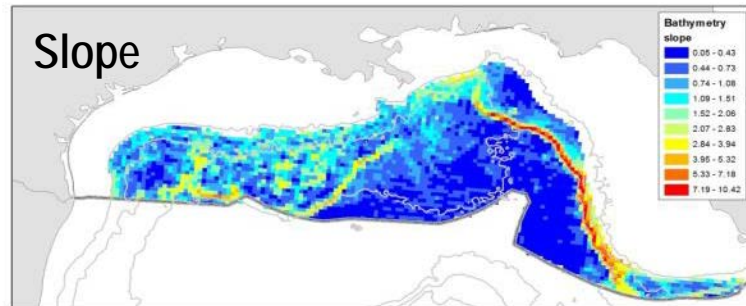
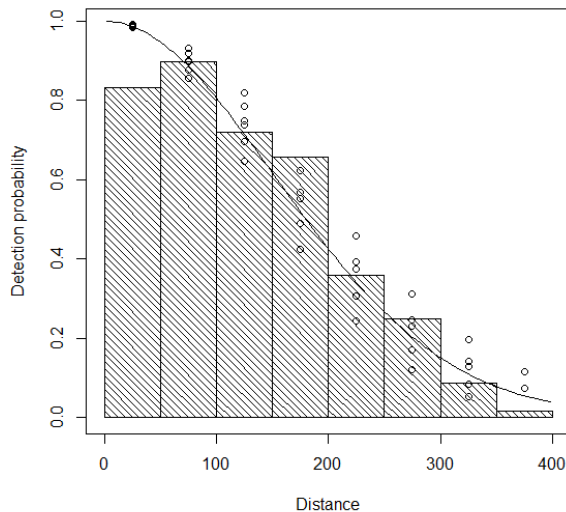
$$\hat{N}_j = \left(\sum_{i=1}^{n_j} \frac{S_{ij}}{P_{0,z_{ij}} g_{y,z_{ij}} P_{a_{ij}}} \right)$$

N_j includes corrections for the effects of sea state, glare, and distance on detection probability

$$E(\hat{N}_j) = \exp \left(\log(2lw) + \beta_0 + \sum_k \beta_k z_{jk} \right)$$

Spatial model accounts for effects of habitat on animal distribution

Detection Function

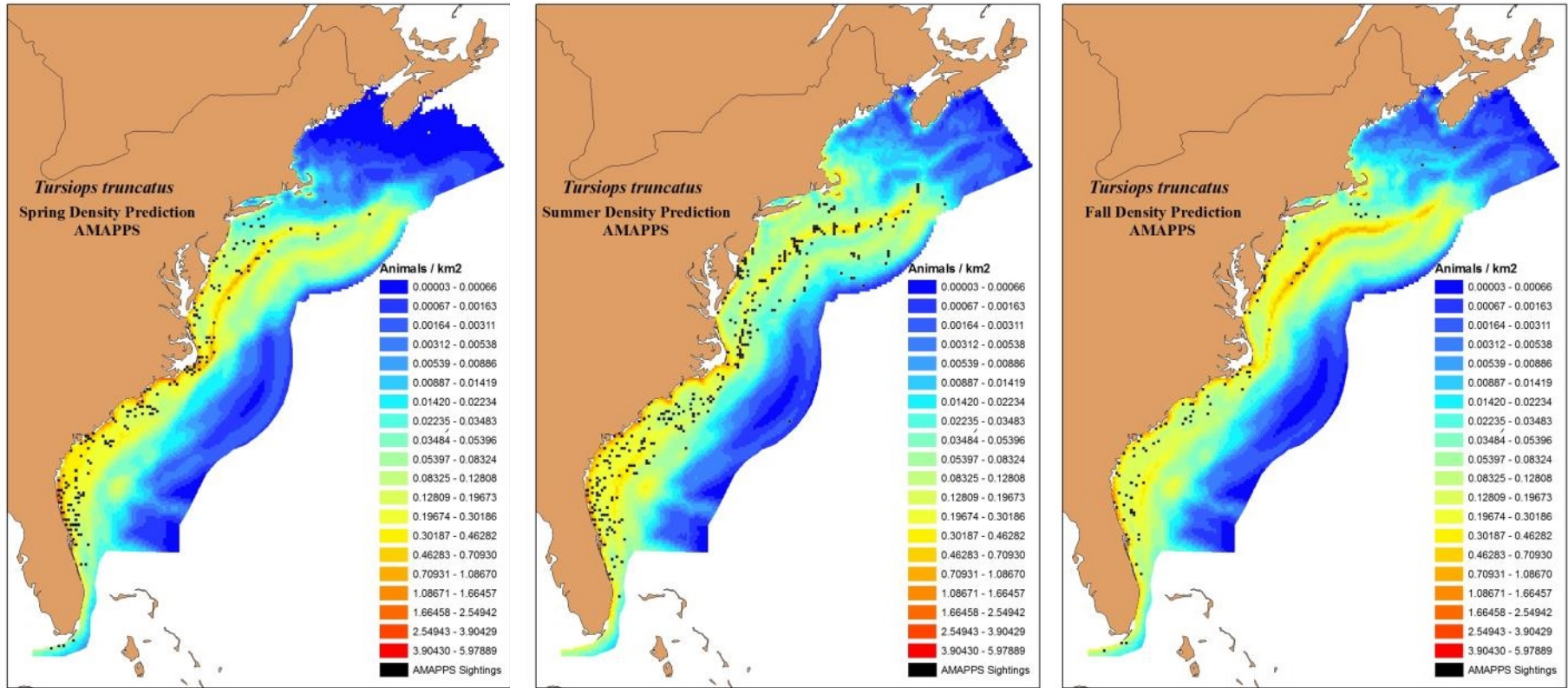


Habitat Variables:

- SST
- Chlorophyll
- Fronts, Eddies
- Depth, Slope
- Canyons
- Salinity
- Water column vertical structure
- Biota(?)

Outcomes: Spatially Explicit Density Maps

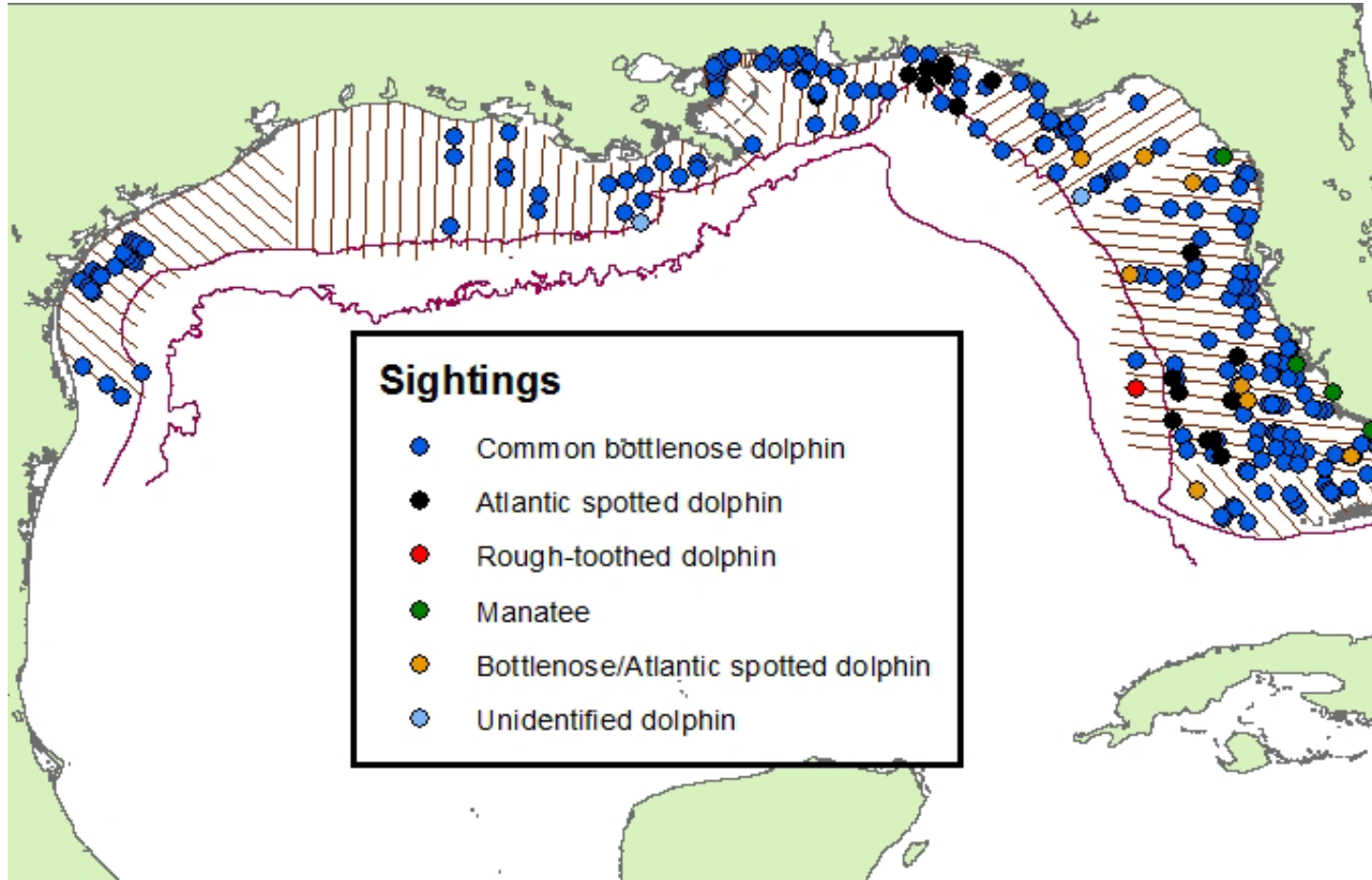
AMAPPS example: Bottlenose dolphin density and spatial distribution



- AMAPPS seasonal maps of density from vessel and aerial survey data (SEFSC and NEFSC)
- Primary GoMMAPPS objective is to produce and disseminate operational mapping products

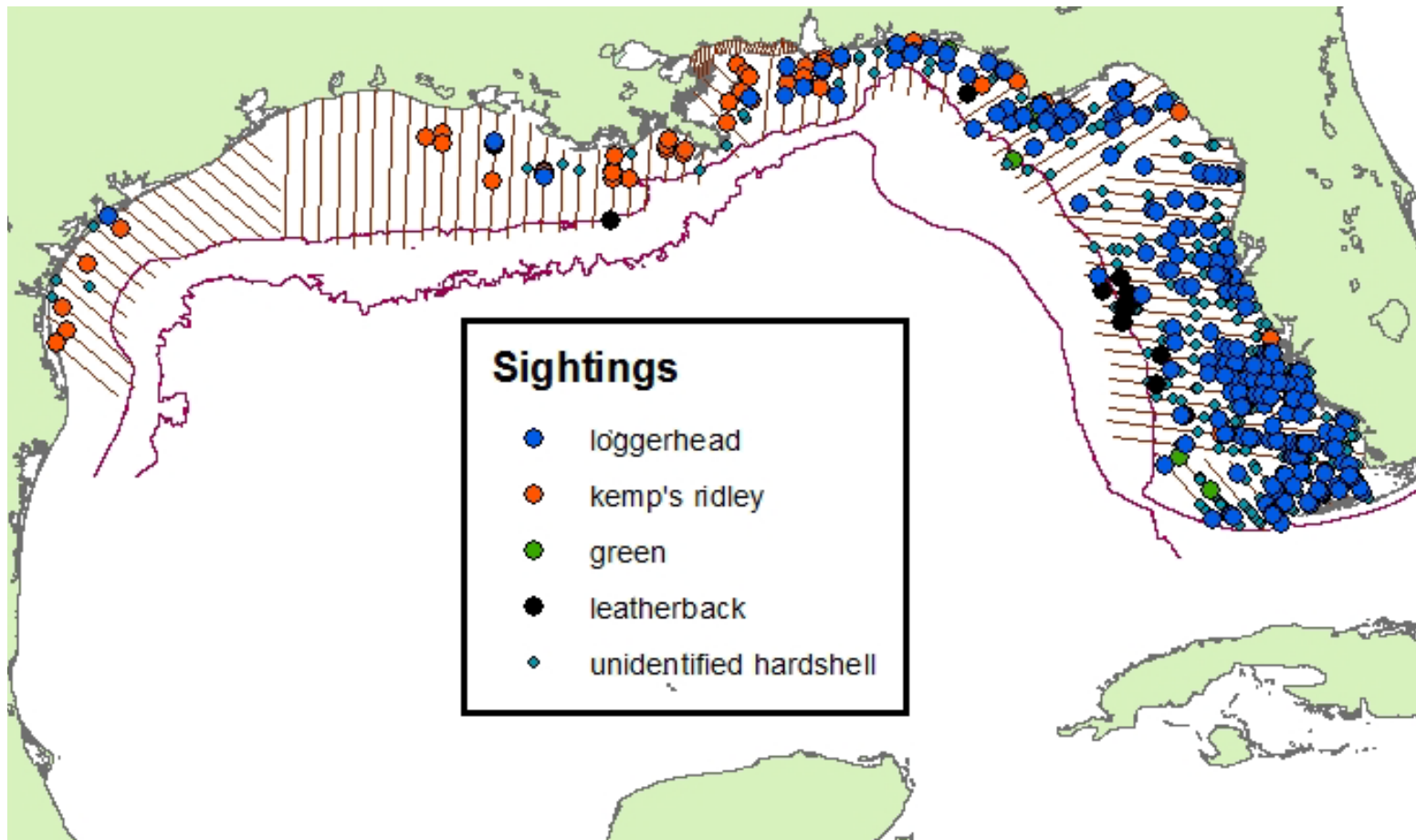
Aerial survey – Preliminary data through 8/4/17

226 marine mammals sightings, primarily bottlenose dolphins followed by Atlantic spotted dolphins.



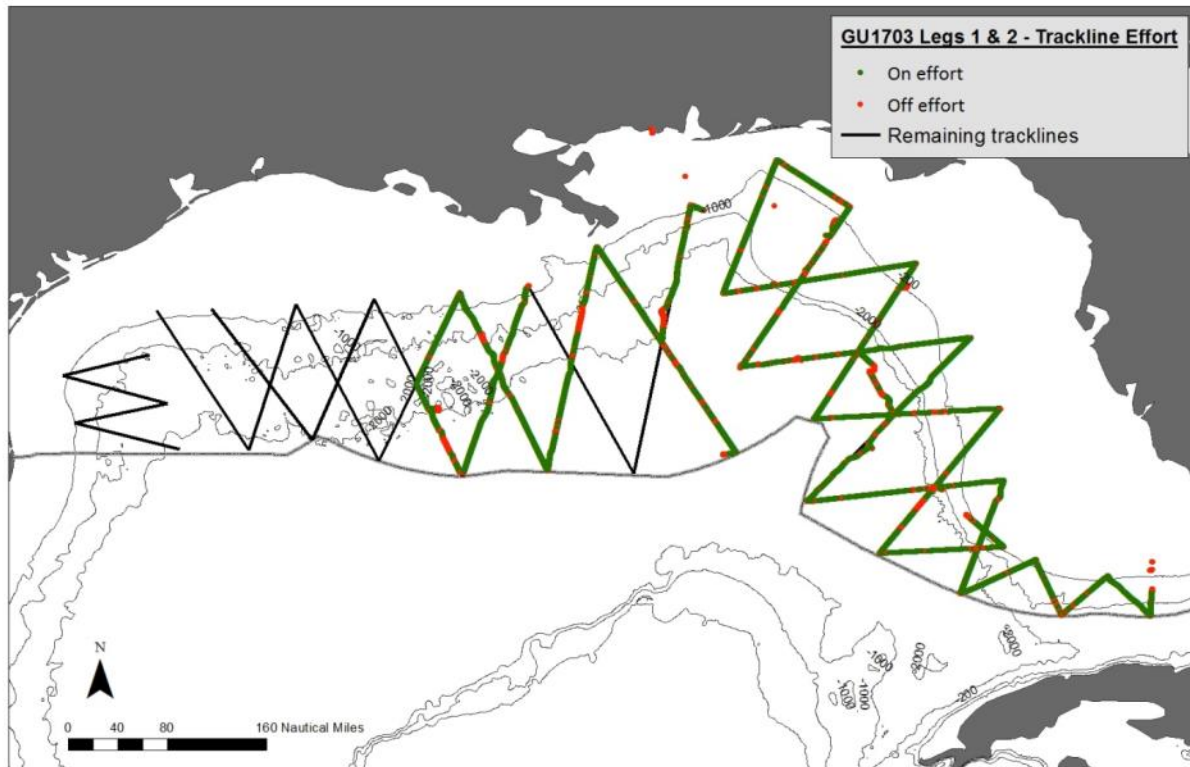
Aerial survey – Preliminary data through 8/4/17

606 sea turtle sightings, primarily Loggerhead.



Ongoing Field Work

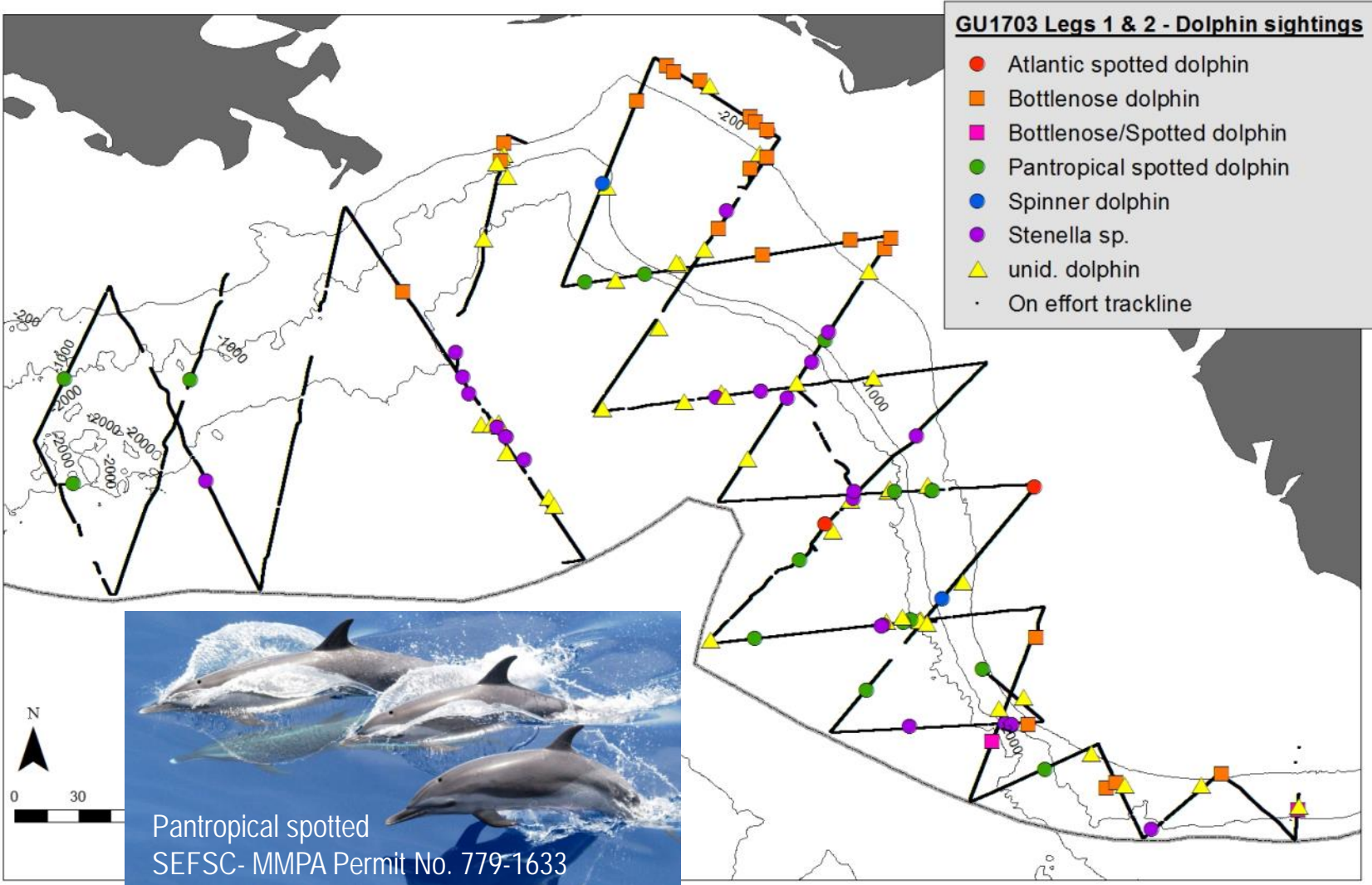
- Summer '17 aerial survey began June 28th
- Summer '17 vessel survey began July 2nd
- Preliminary data presented through August 4th



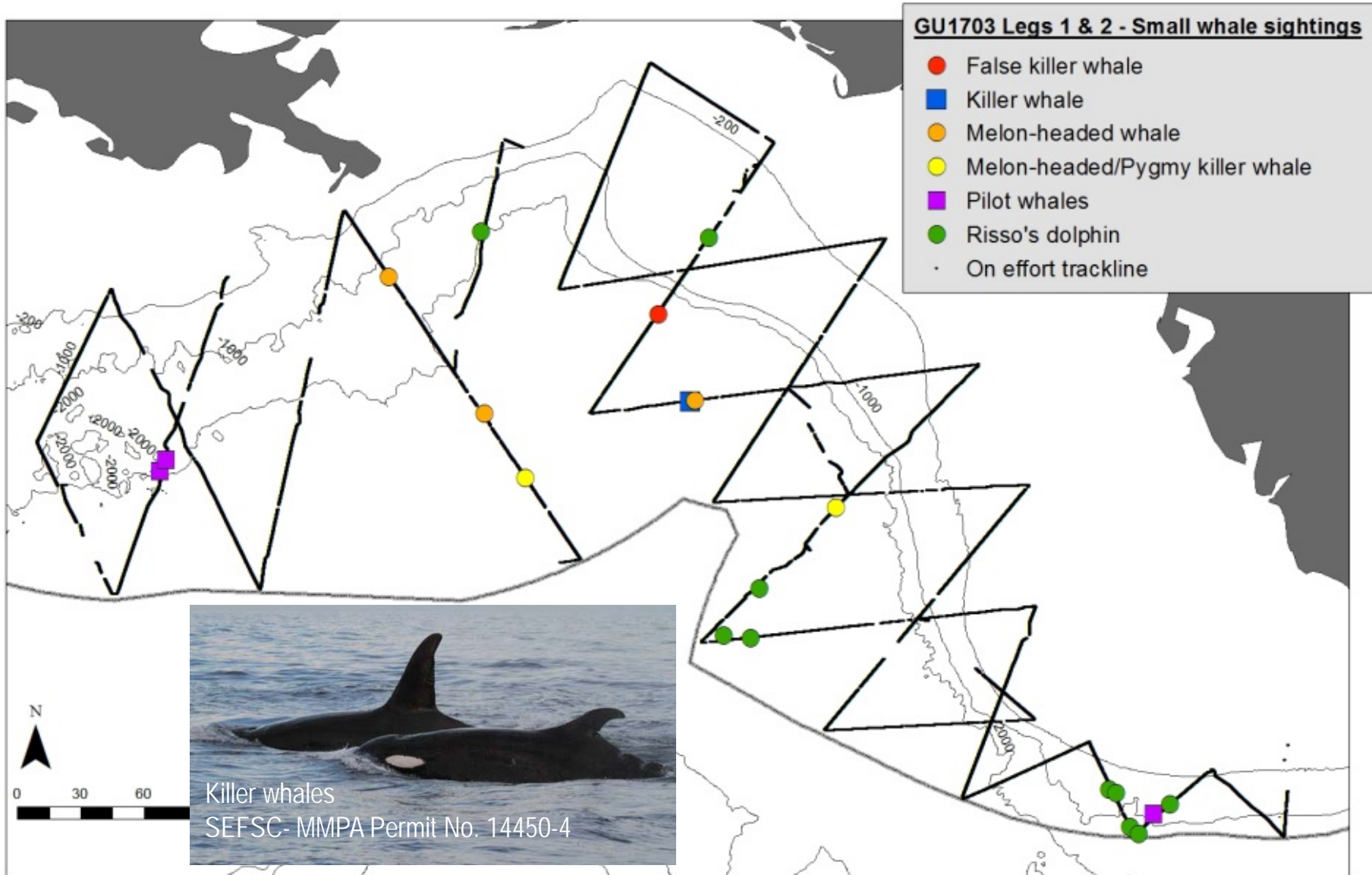
Vessel survey legs 1 & 2:

- 218 group sightings
- 37 sperm whale
- 2 Bryde's whale
- 1 killer whales
- Remaining sightings comprised of at least 10 other species

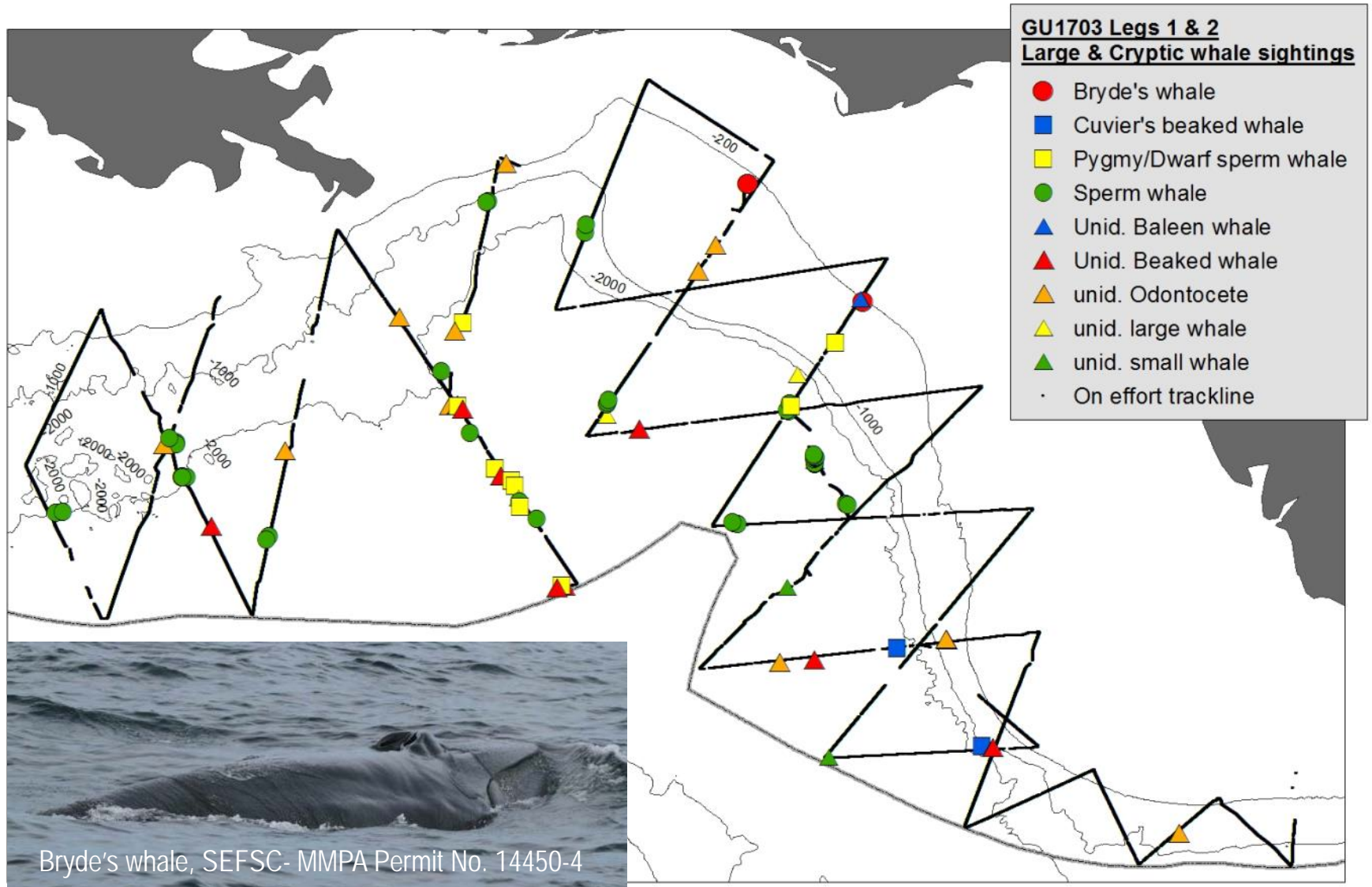
Vessel survey legs 1 & 2 - Preliminary sighting data



Vessel survey legs 1 & 2 - Preliminary sighting data

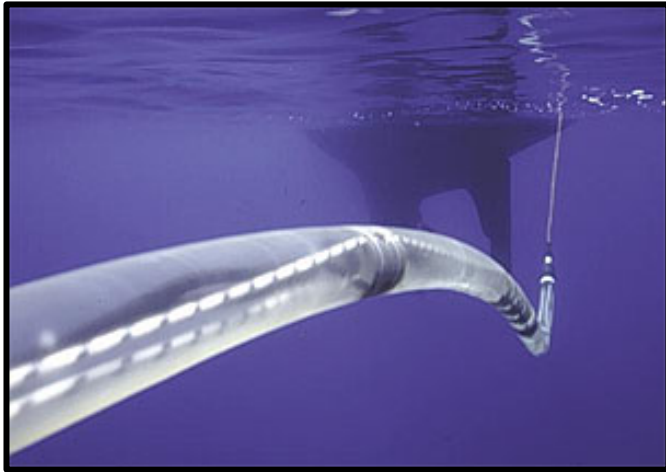


Vessel survey legs 1 & 2 – Preliminary sighting data



Vessel survey legs 1 & 2 – Preliminary acoustics data

Towed Hydrophone Array

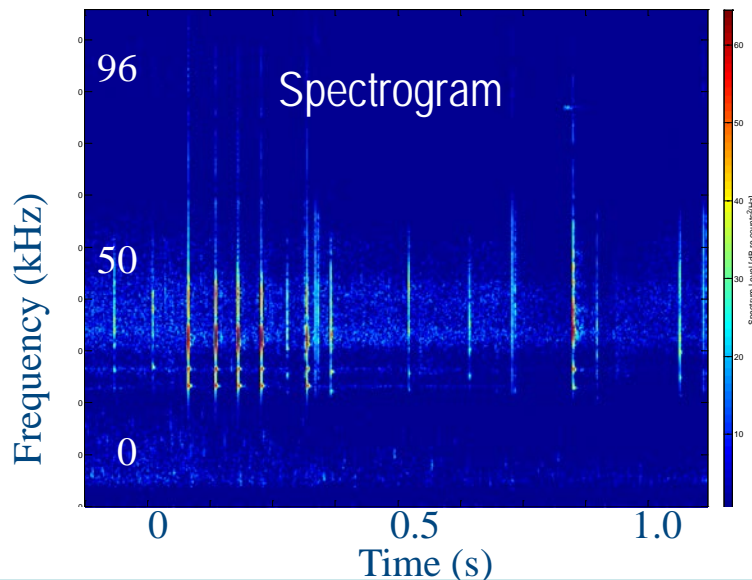


4- element array towed during daylight hours

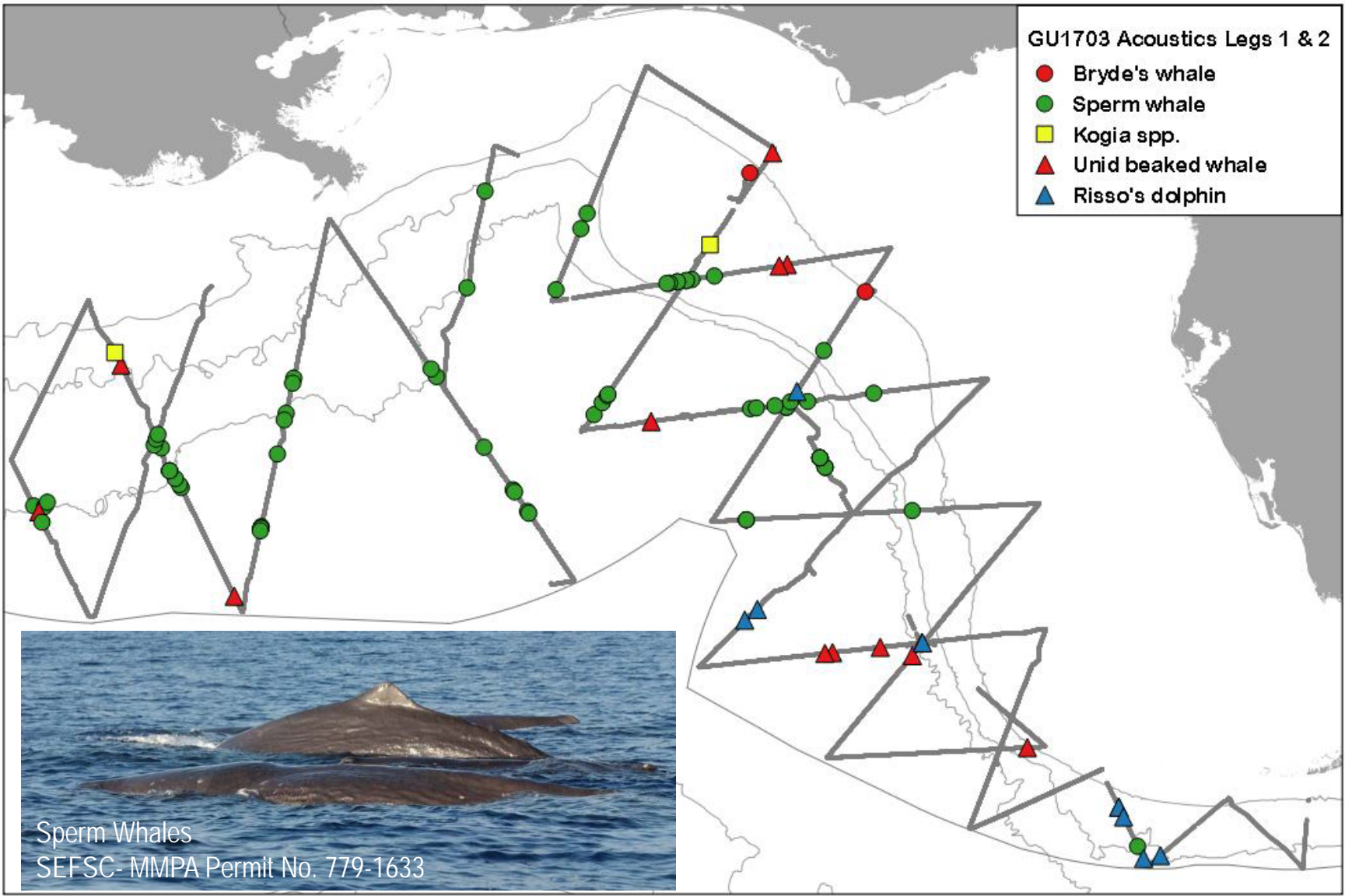
- 327 acoustic detections
 - 137 also sighted by visual team
 - 13 beaked whale groups
 - 32 sperm whale groups

20 sonobuoys deployed

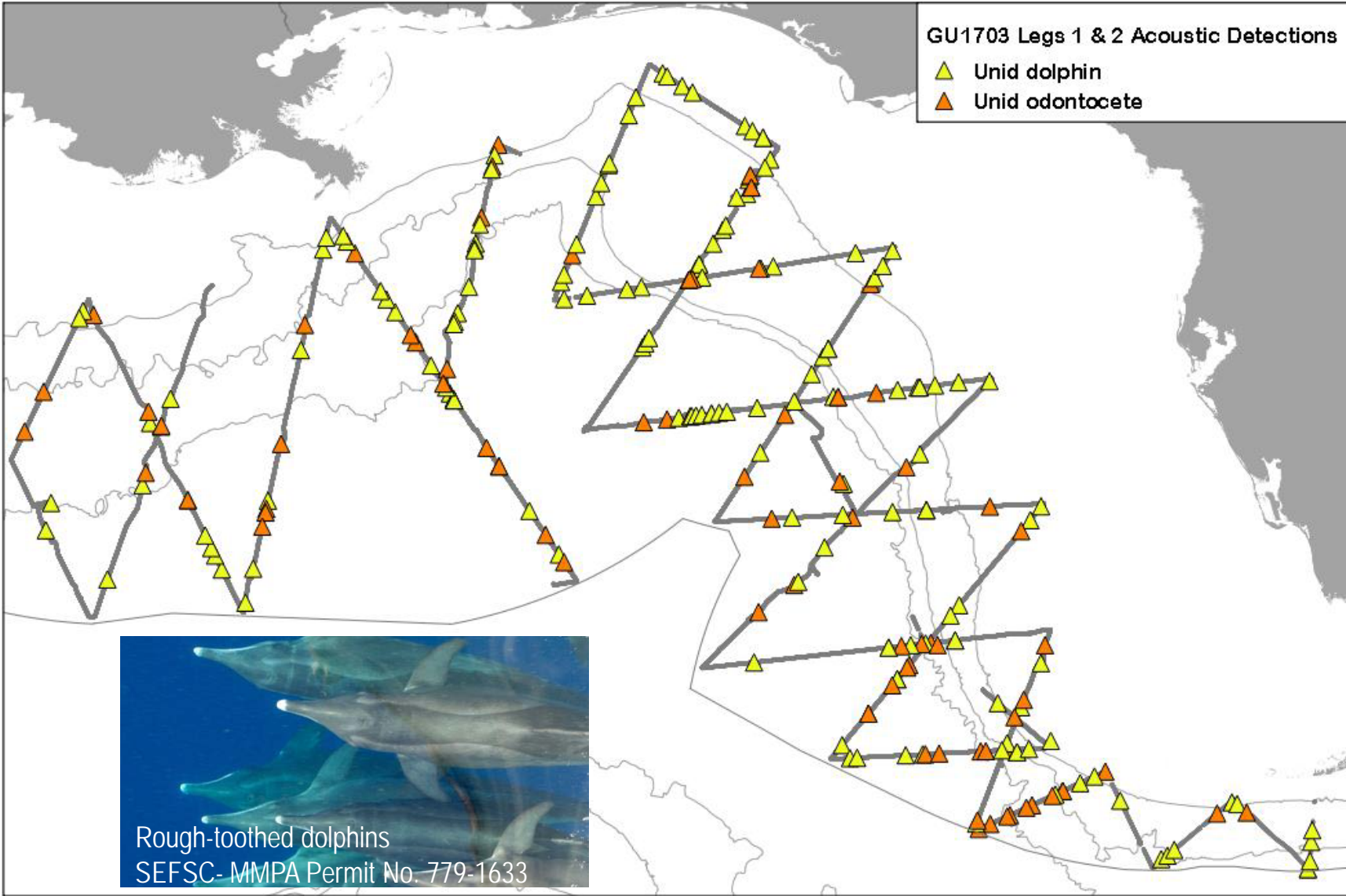
- 16 at track intersections with 250 m isobaths
- 4 during Bryde's whale sightings



Acoustic survey legs 1 & 2 – Preliminary detection data

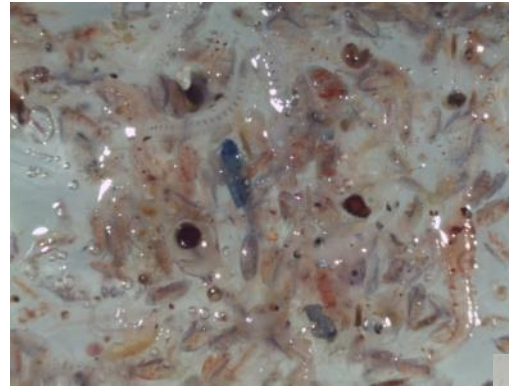


Acoustic survey legs 1 & 2 – Preliminary detection data



Vessel survey legs 1 & 2 – Plankton sampling

- Completed 92 plankton stations
- 90 Bongo tows
- 87 CTD casts
- Bongo samples preliminarily sorted for taxa of interest including tuna, billfish, snapper, grouper, and lionfish



Average plankton sample



Lookdown (*Selene sp.*)



Cephalopod - paralarva or larval squid

Summary

- Summer 2017 field work is nearing completion
- Maintaining coordination with the turtle and bird groups
- Next steps will include QA/QC of the data coming off the summer surveys and planning for the winter surveys
- Beginning analysis including integration of habitat data and historical sightings data

Sperm Whale
SEFSC- MMPA Permit No. 779-1633



Spinner dolphin
SEFSC- MMPA Permit No. 779-1633



This study was funded by the U.S. Department of the Interior, Bureau of Ocean Energy Management through Interagency Agreement M17PG00013 with the U.S. Department of Commerce, National Oceanic and Atmospheric Administration (NOAA).