Interested Party Group Meeting Presentation

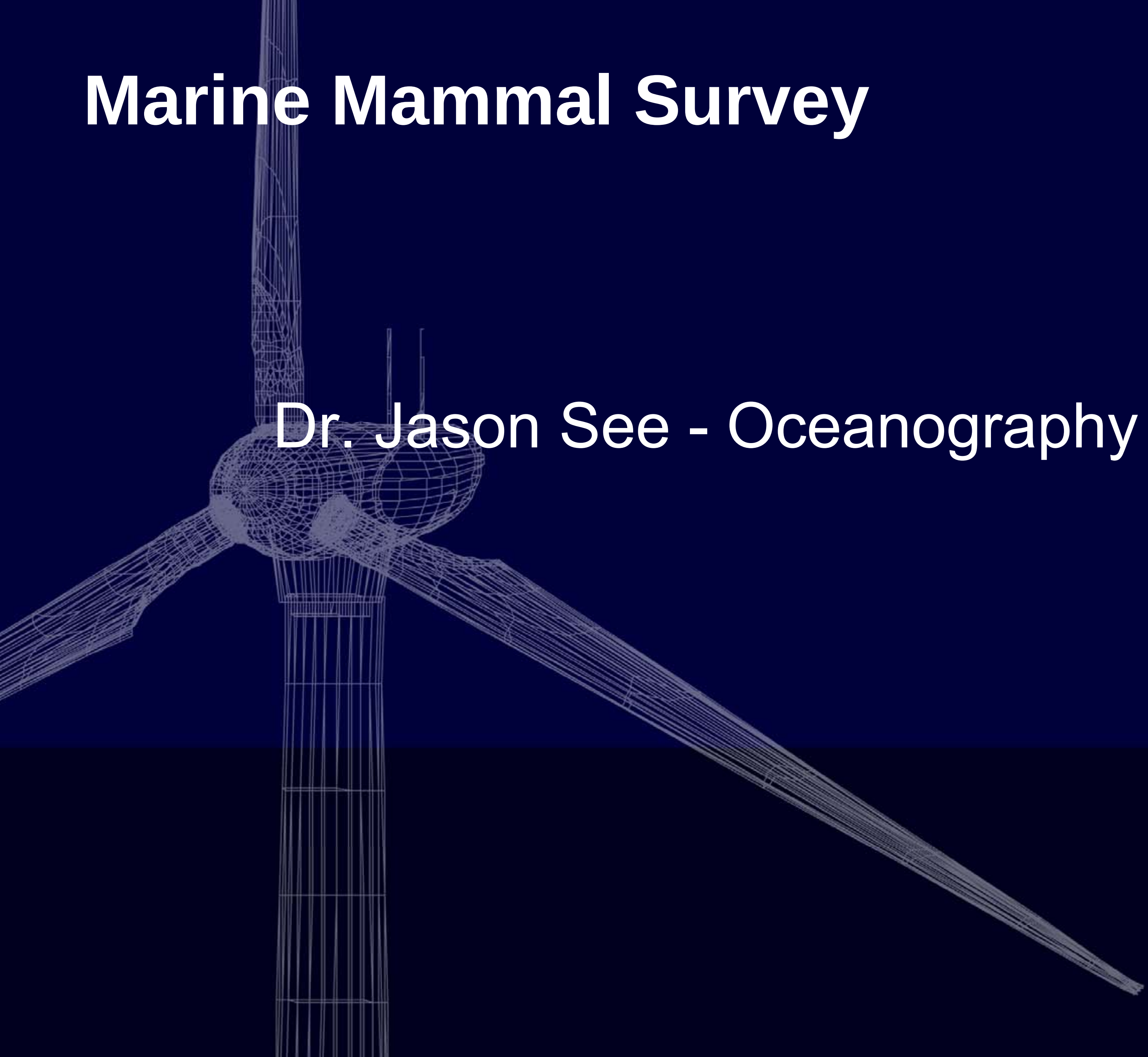
05 March 2009

Introduction

- Marine Mammal Survey - Dr. Jason See
  - Oceanography
- Acoustics - Dr. Kathleen Dudzinski
  - Marine Mammal Behavior and Acoustics
- Fisheries – Juan Levesque
  - Fishery Biologist
- Introduction to Avian – Chris Clark
  - Avian and Radar Studies
- Avian Survey - Dr. Jarrod Santora
  - Ornithology and Modeling
- Dr. Sidney Gauthreaux, Jr.
  - Ornithology and Remote Sensing Techniques

Marine Mammal Survey

Dr. Jason See - Oceanography

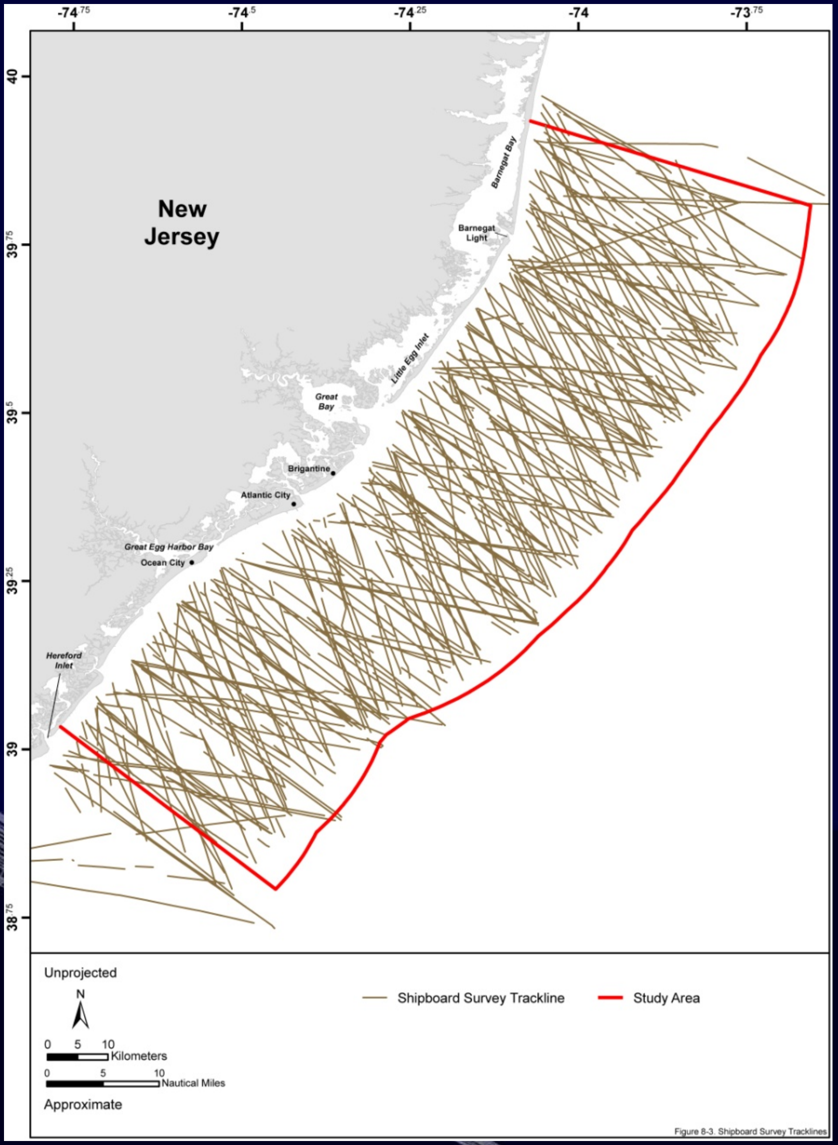


Shipboard Surveys – Marine Mammals and Sea Turtles

Monthly surveys conducted onboard the University of Delaware's R/V *Hugh R. Sharp* under NOAA Permit #10014-01

Survey Effort

- Randomly-generated tracklines (double saw-tooth pattern) using DISTANCE program (Buckland et al. 2004)
- Tracklines were altered only if sea state, glare, or weather inhibited survey effort



Buckland, S.T., D.R. Anderson, K.P. Burnham, J.L. Laake, D.L. Borchers, and L. Thomas, eds. 2004. Advanced distance sampling. New York, New York: Oxford University Press.

Survey Effort

- Visual observations recorded from flying bridge during BSS ≤ 5
- 3 stations: port bigeyes, recorder (naked eye), starboard bigeyes
- Each observer scanned out to the horizon from abeam (90°) on his/her side of the ship to 10° to the opposite side of the bow (100° in all).

Sightings

- Observers went off-effort after a sighting was made
- All sighting data recorded using WinCruz--computer program developed by NMFS-SWFSC and integrated with ship GPS
- Vessel's speed and course altered as necessary to obtain sighting data
- Attempts were made to photograph all the animals in a sighting to document species identification
- Once all the necessary data were collected for the sighting, the vessel resumed the same course and speed as prior to the sighting
- Extensive daily QA/QC procedures conducted by chief scientist

Sightings

Common bottlenose dolphin

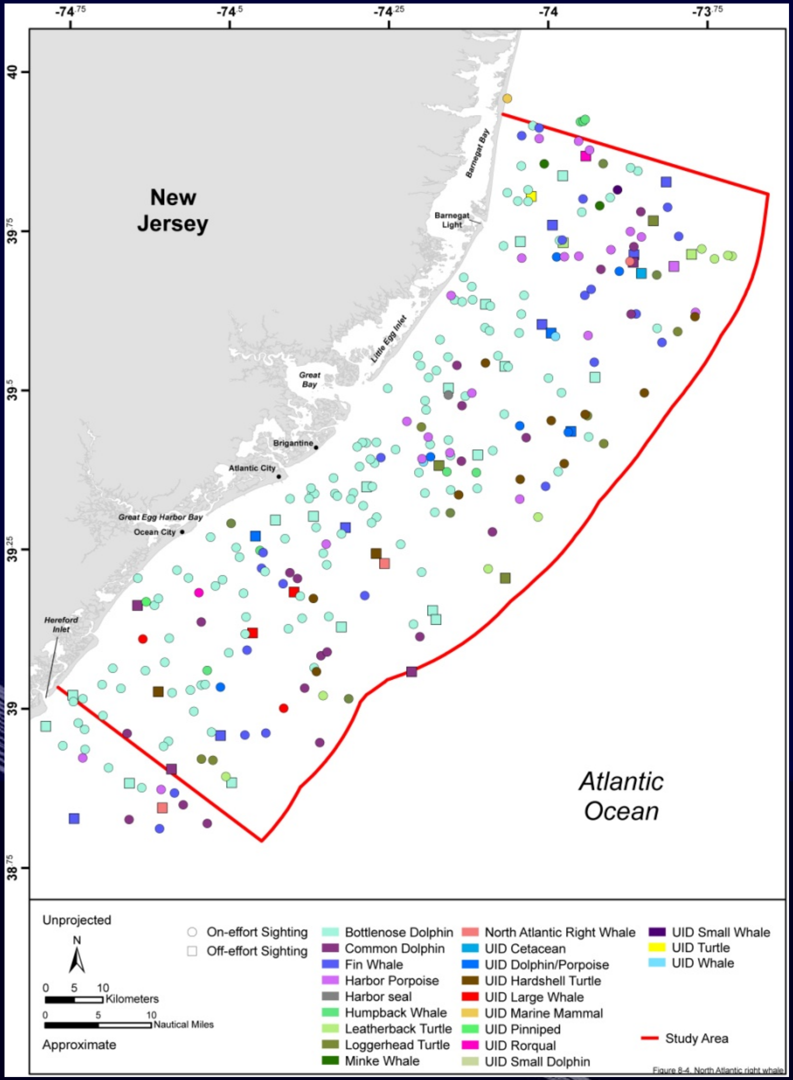
Short-beaked common dolphin

North Atlantic right whale

NOAA Permit
No. 10014-01

Sightings

- Shipboard surveys - Covered 7,090 km (3,896 NM) of on-effort trackline
- Total 260 sightings (215 on-effort)
- 7 cetacean species, 1 pinniped species, and 2 sea turtle species identified
- Bottlenose dolphin was the most frequently sighted species; most of these sightings were recorded in the summer months
- Fin whale was the only species sighted throughout the year



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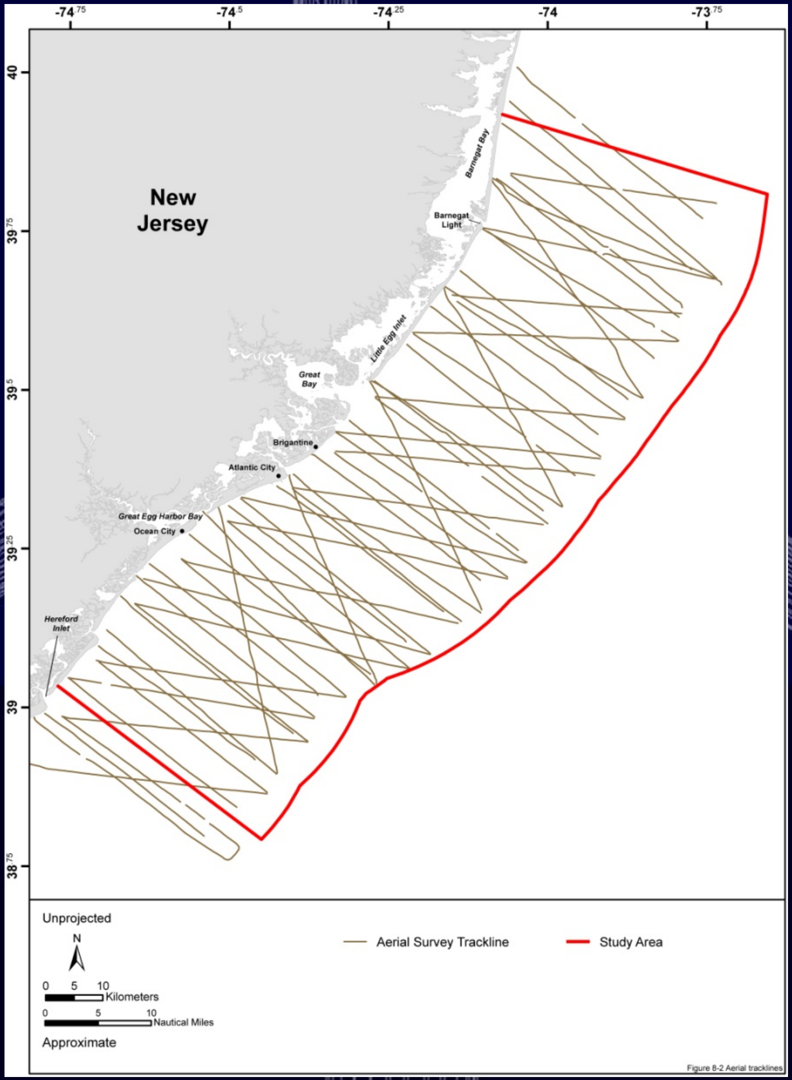
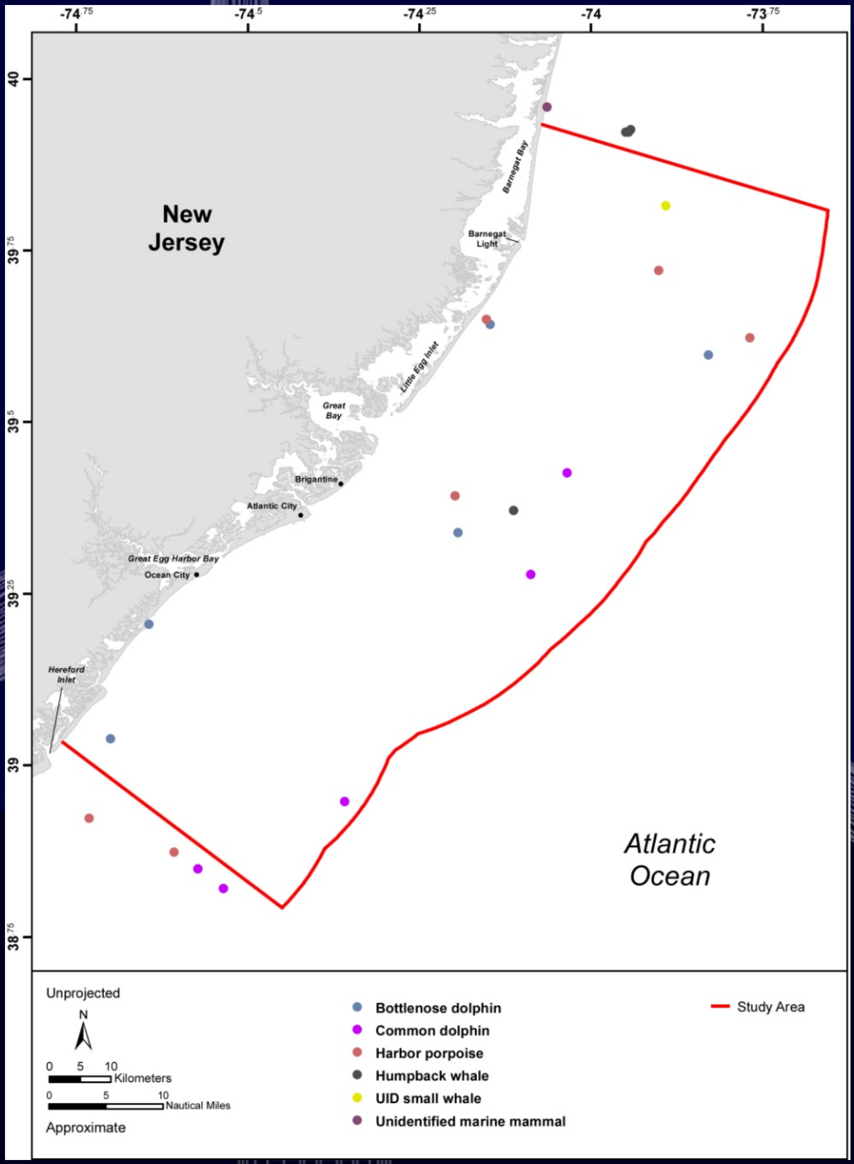
Aerial Surveys



- Conducted February - May 2008
- Aircraft crash in May 2008
- Surveys resumed in January 2009

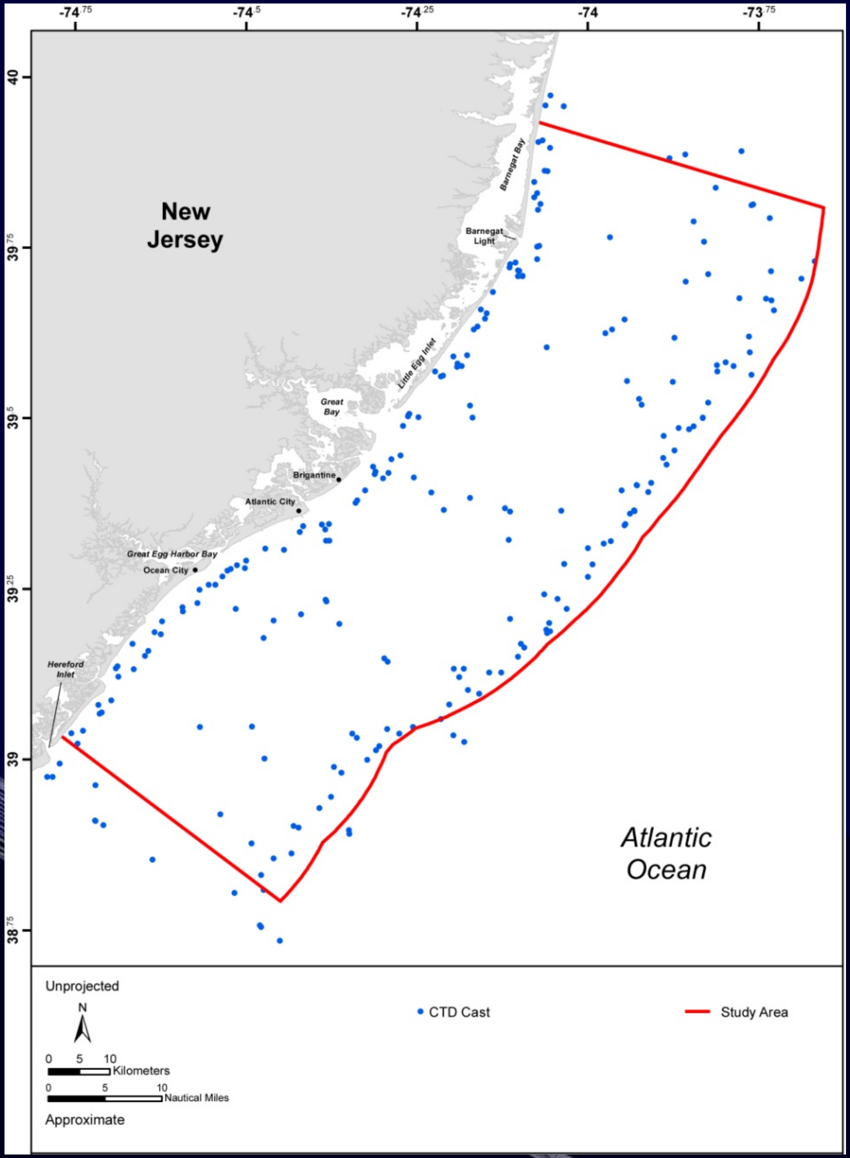
Aerial Sightings



- Aerial surveys - Covered 2,186 km (1,180 NM) of on-effort trackline (February-April 2008) Total 22 sightings (22 on-effort)
- 4 identified species, 2 unidentified species

Concurrent Data

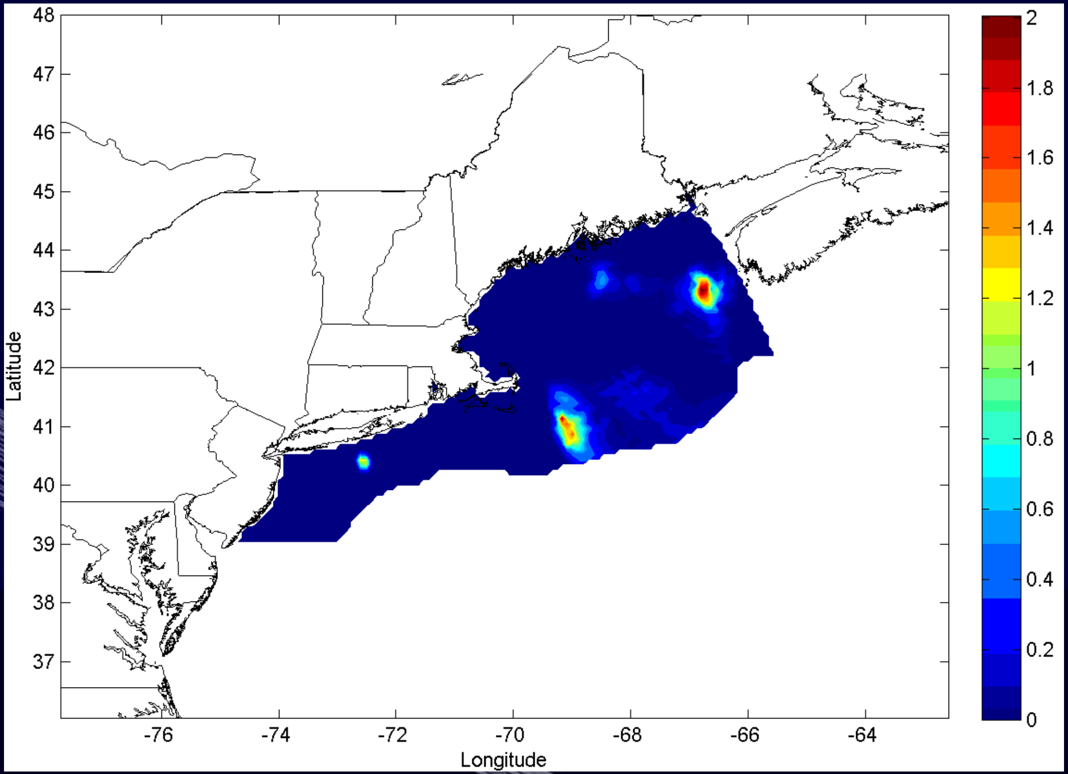
- Collection of oceanographic data for use as co-variates in density models
- CTD casts: salinity, temperature, depth
- Real time surface data
  - Sea surface temperature
  - Salinity
  - Fluorescence
- ADCP data
  - Currents
  - Potential zooplankton 'swarms'



Density modeling

- Distance density estimations
- Spatial modeling (as possible)

- Minimum 20 observations of species
- Species with few observations may be pooled (by family, etc.)



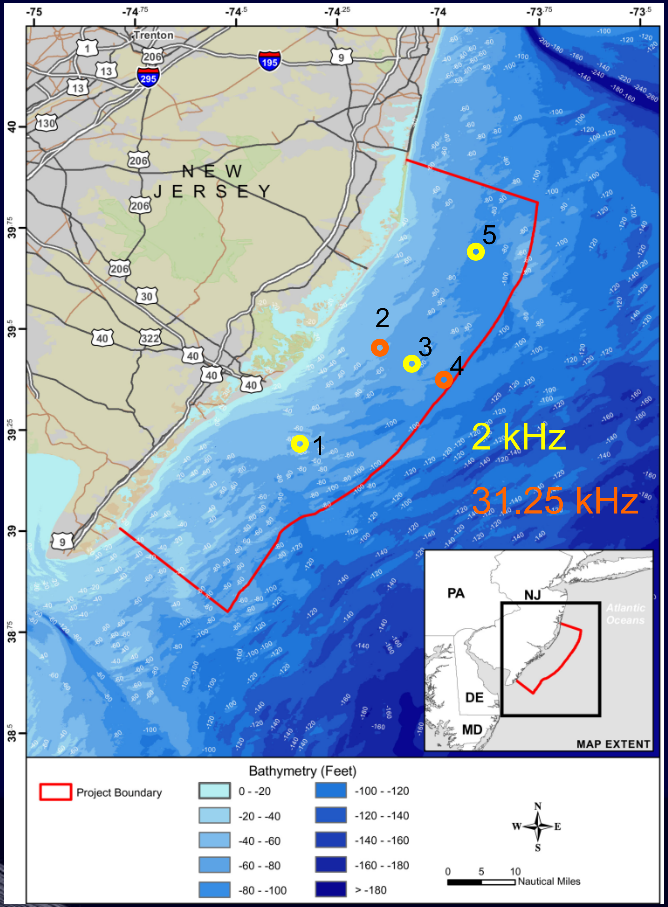
Common dolphin (DoN 2007)

Acoustics

Dr. Kathleen Dudzinski – Marine Mammal Behavior and Acoustics

Underwater Acoustic Survey - Methods

- Methods
  - Study area
  - PopUp locations
  - Sampling rates
- Results
  - Data totals
    - Deployment returns
    - Data format, bytes, hours
  - Species detected, investigated
    - Baleen whales
    - Toothed whales
  - Sample Sounds
- Summary



Photos: GMI

Underwater Acoustic Survey - Results

- Methods
- Results
  - Data totals
    - Deployment returns
    - Data format, bytes, hours
  - Species detected, investigated
    - Baleen whales
    - Toothed whales
  - Sample Sounds
- Summary

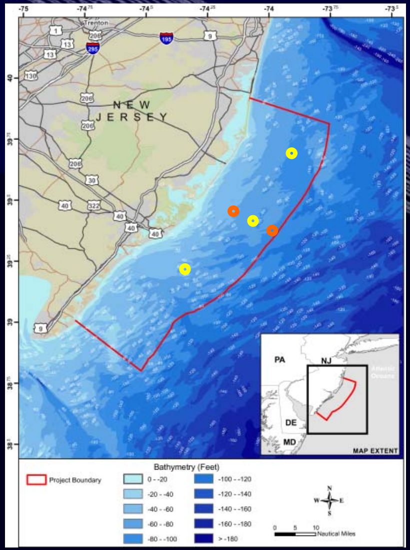
Deployment	# days	units dep'd	units rec'd
March '08	84	5	4
June '08	85	4	4
September '08	64	5	3
December '08	97	5	na

Photos: GMI

Underwater Acoustic Survey - Results

- Methods
- Results
  - Data totals
    - Deployment returns
    - Data format, bytes, hours
  - Species detected, investigated
    - Baleen whales
    - Toothed whales
  - Sample Sounds
- Summary

Deployment	units rec.d	data (gb)	data (hrs)	Species Confirmed
March '08	4	330	8,064	Eg Bp Tt
June '08	4	522	4760	Eg Bp Tt
2 kHz	*2*	*167*	*4,080*	*Eg Bp*
31.25 kHz	*2*	*355*	*680*	*Tt*
September '08	3	279	3,328	Eg Bp
2 kHz	2	105	3,072	Eg Bp
31.25 kHz	1	174	256	TBA
December '08	na	*to be recovered in late March '09*		



Total hours collected: 16,152

Additional projected hours
Dec. '08: 7,760*
March '09: 7,760*

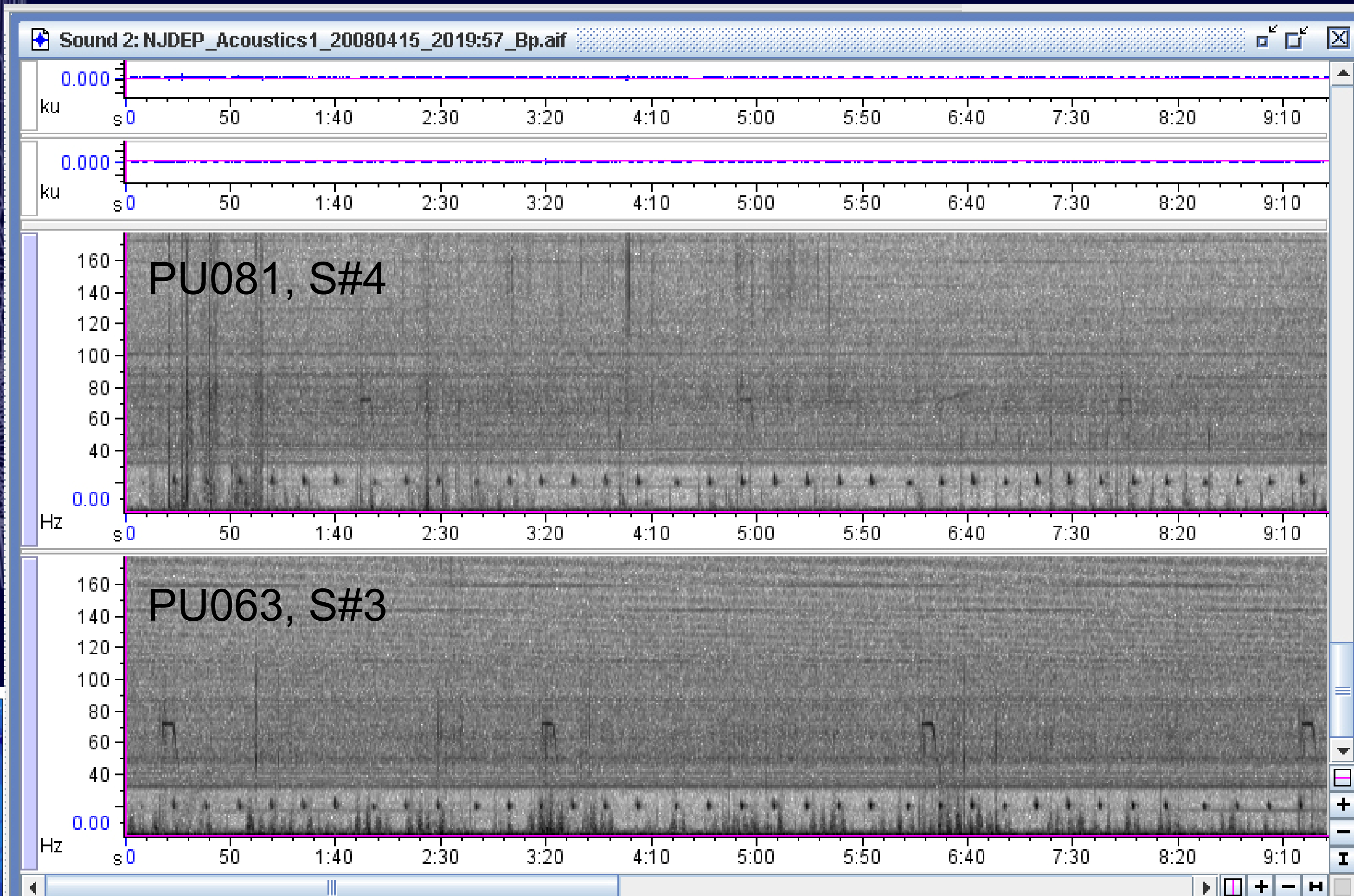
*assuming all PopUps recovered

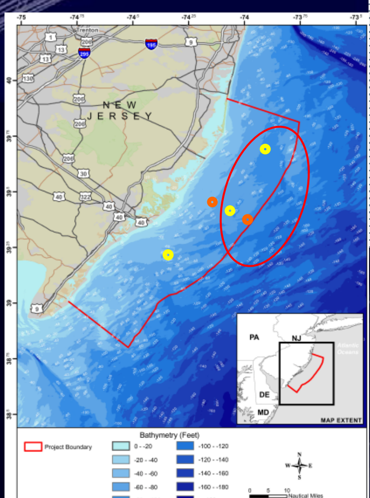
Photos: GMI

Underwater Acoustic Survey - Results

Fin whale pulses

15 Apr 08





S# 3, 4, 5 presented fin pulses, *on this day (March Deployment)*

Ch 2

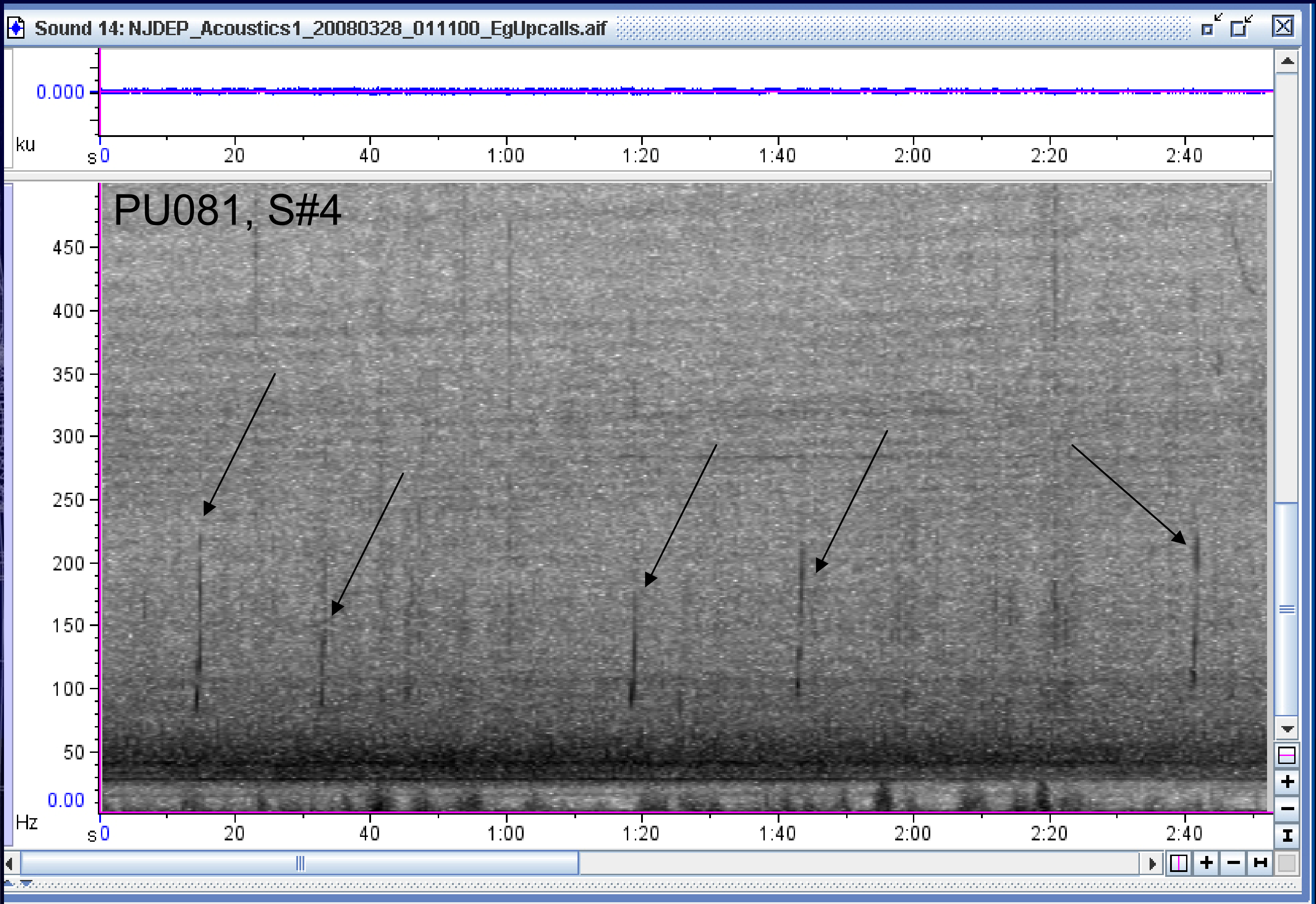
Ch1 (amp)

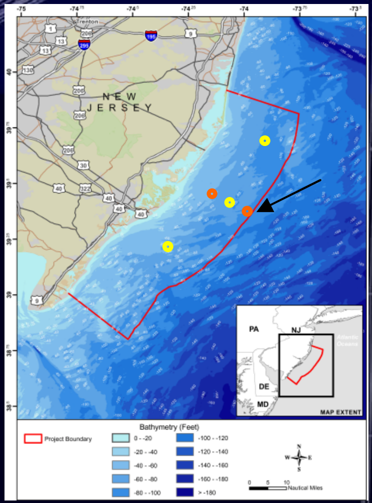
Photos: GMI

Underwater Acoustic Survey - Results

North Atlantic right whale upcalls

15 Apr 08





March 28, 2008 @ ~1:11 AM unamplified, normal speed

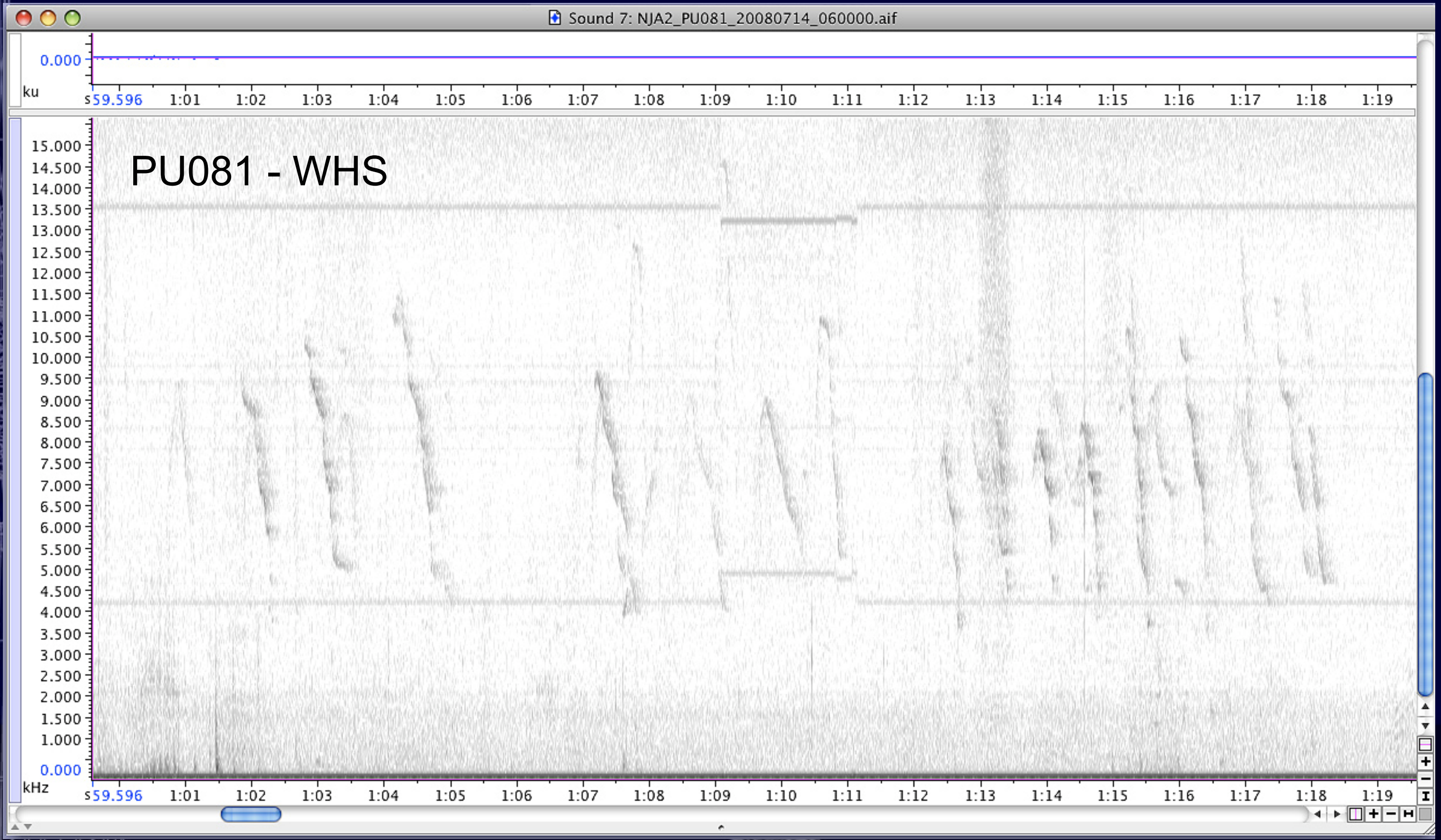
2x rate, amplified 4x

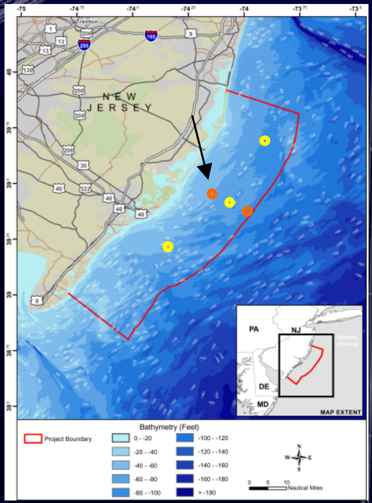
Underwater Acoustic Survey - Results

dolphin whistles

clicks, claps, pulses, squawks, etc, too

14 July 08





July 14, 2008 @ ~6:00 AM

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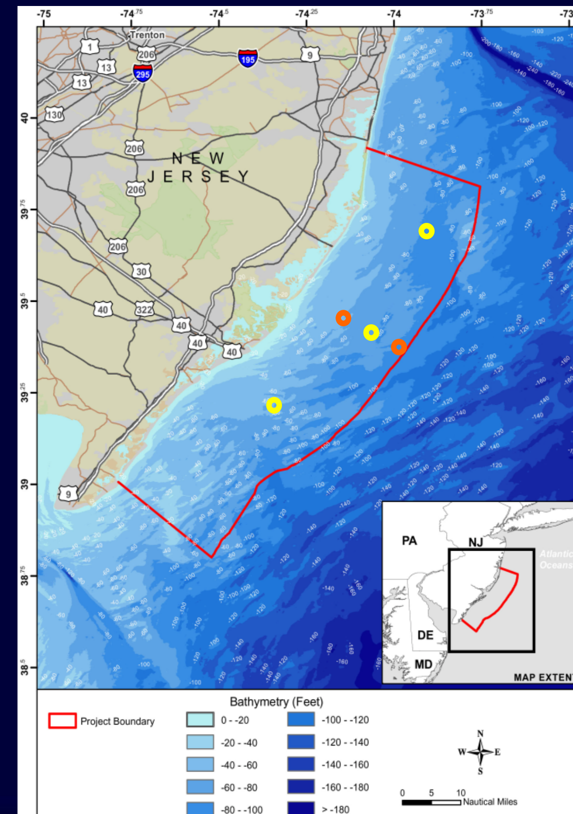
Underwater Acoustic Survey - Results

- Methods
- Results
- Summary
  - Baleen whales detected
    - Call detectors for few species
    - Manual review for most
  - Toothed whales detected
    - Manual review
    - Whistle (FM) call variability
    - Pulsed calls
    - Species differences?
  - Analysis ongoing
    - Toothed whale calls – review related to survey data
    - Other baleen species – related to survey data



Photos: GMI

Fisheries

Juan Levesque – Fishery Biologist

Fish and Fisheries

One of New Jersey's most valuable natural resources

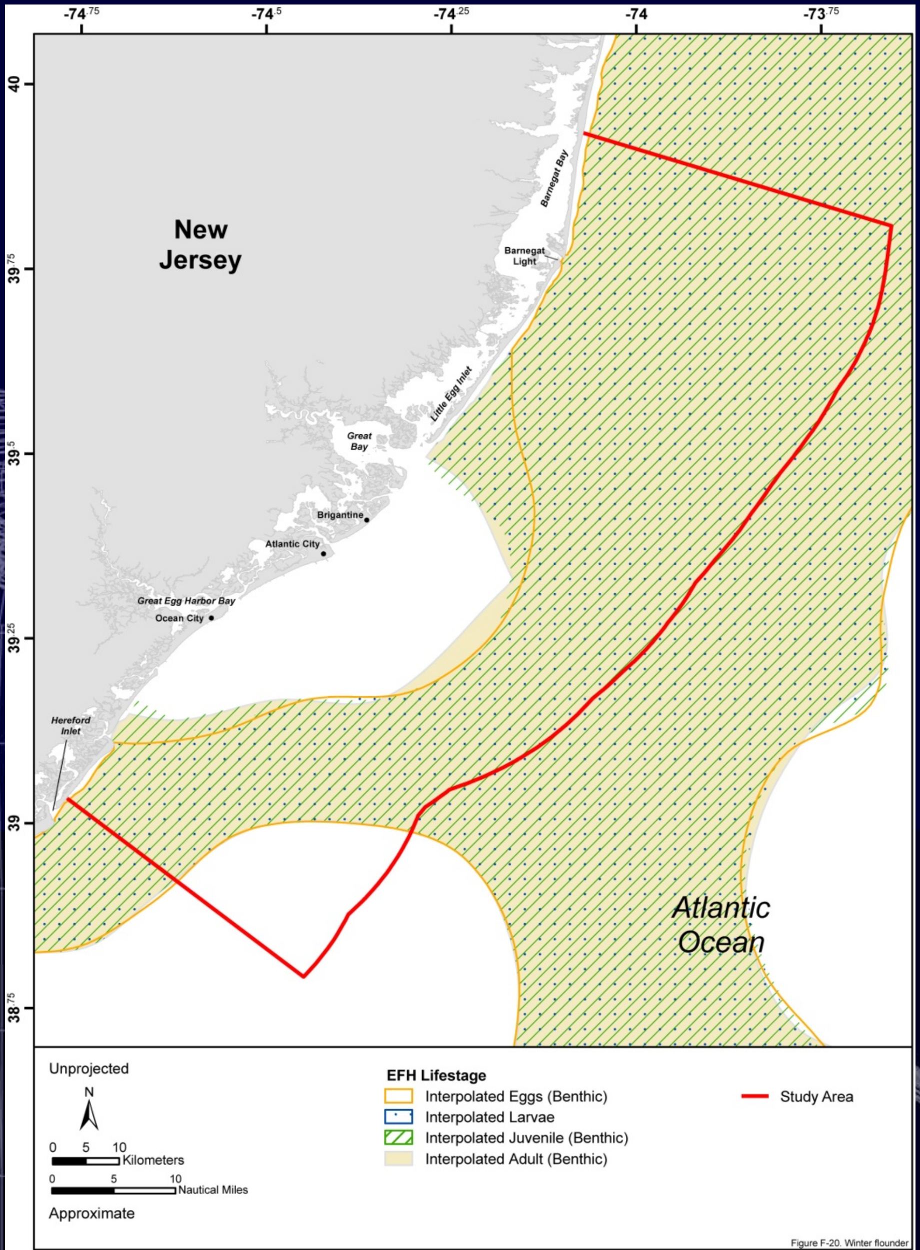
- Fish Diversity
  - 336 fish species classified under 116 families

- Fish Habitats
  1. Inshore
  2. Offshore

  - Study Area:
    - coastal beaches (surf zone)
    - pelagic zone
    - benthic zone
    - artificial reef-structures

    - 38 Essential Fish Habitat (EFH) areas
    - 2 Habitat Areas of Particular Concern (HAPC)
      - Summer Flounder and Sandbar Shark

Fish and Fisheries

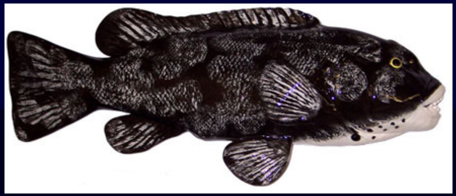


Fish and Fisheries

– Inshore
  - Coastal Beaches (Surf zone): Anchovy, Silverside, Bluefish, Northern Kingfish

– Offshore
  - Pelagic zone (water column): Bluefish, Striped Bass, Atlantic Mackerel
  - Benthic zone (bottom substrate):

1. Sand-mud Plain: Yellowtail Flounder, Silver Hake, Sand Lance, Atlantic Surfclam
   - Shoreface Sand Ridges: Butterfish, Bay Anchovy, Atlantic Surfclam, Decapod crustaceans (e.g., Atlantic Rock Crab and American Lobster)
2. Artificial Structures: Tautog, Black Sea Bass, Red Hake (~ *150 different marine species*)



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Fish and Fisheries

- Commercial Fisheries (2003-2007)
  - Total value $700 Million
  - Annual mean value $178 Million
  - Ranks 7th domestically in value
  - Gear
    - New Jersey:
      - Trawls and dredges
    - Study Area:
      - Clam dredge
      - Sink gillnets
      - Pot/traps

Source: NMFS (2008b)

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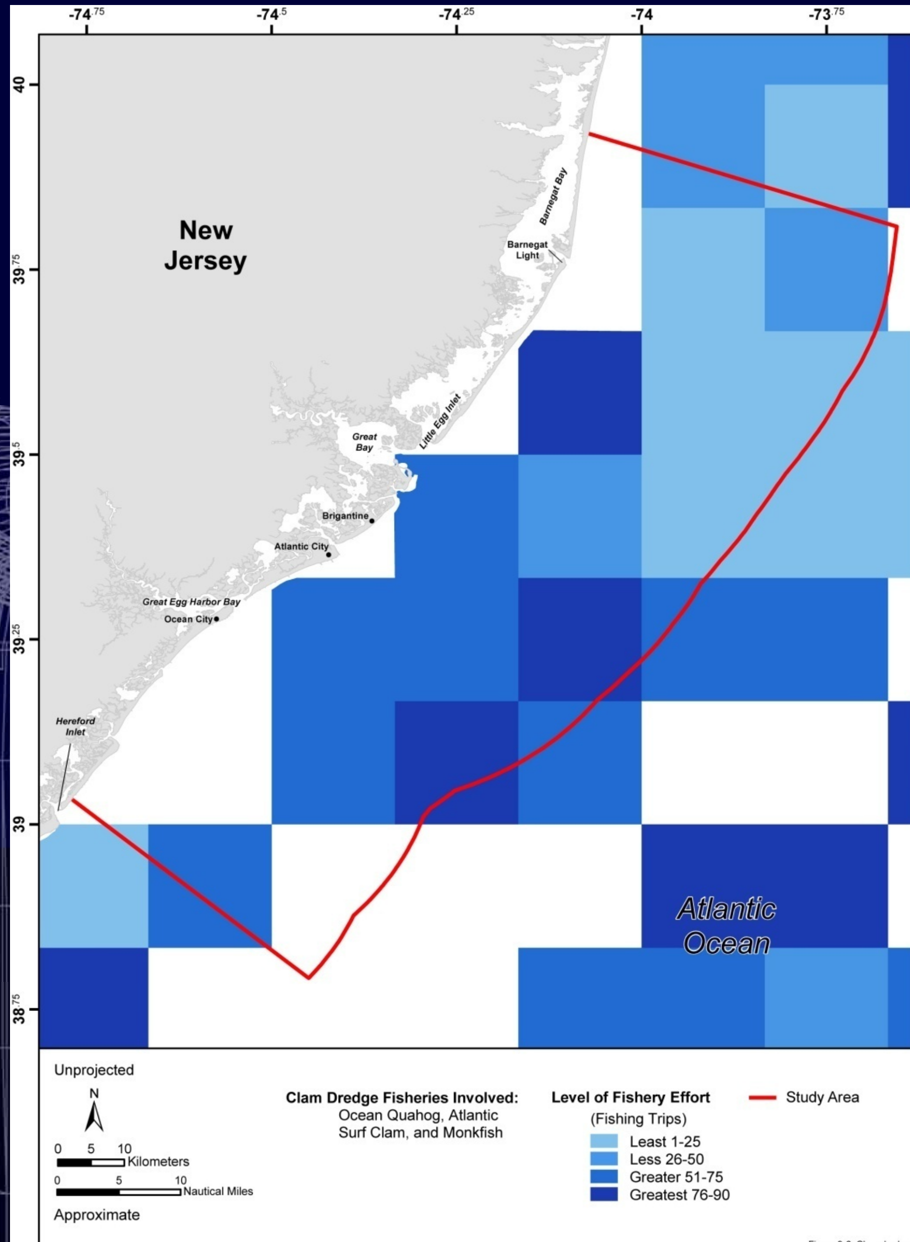
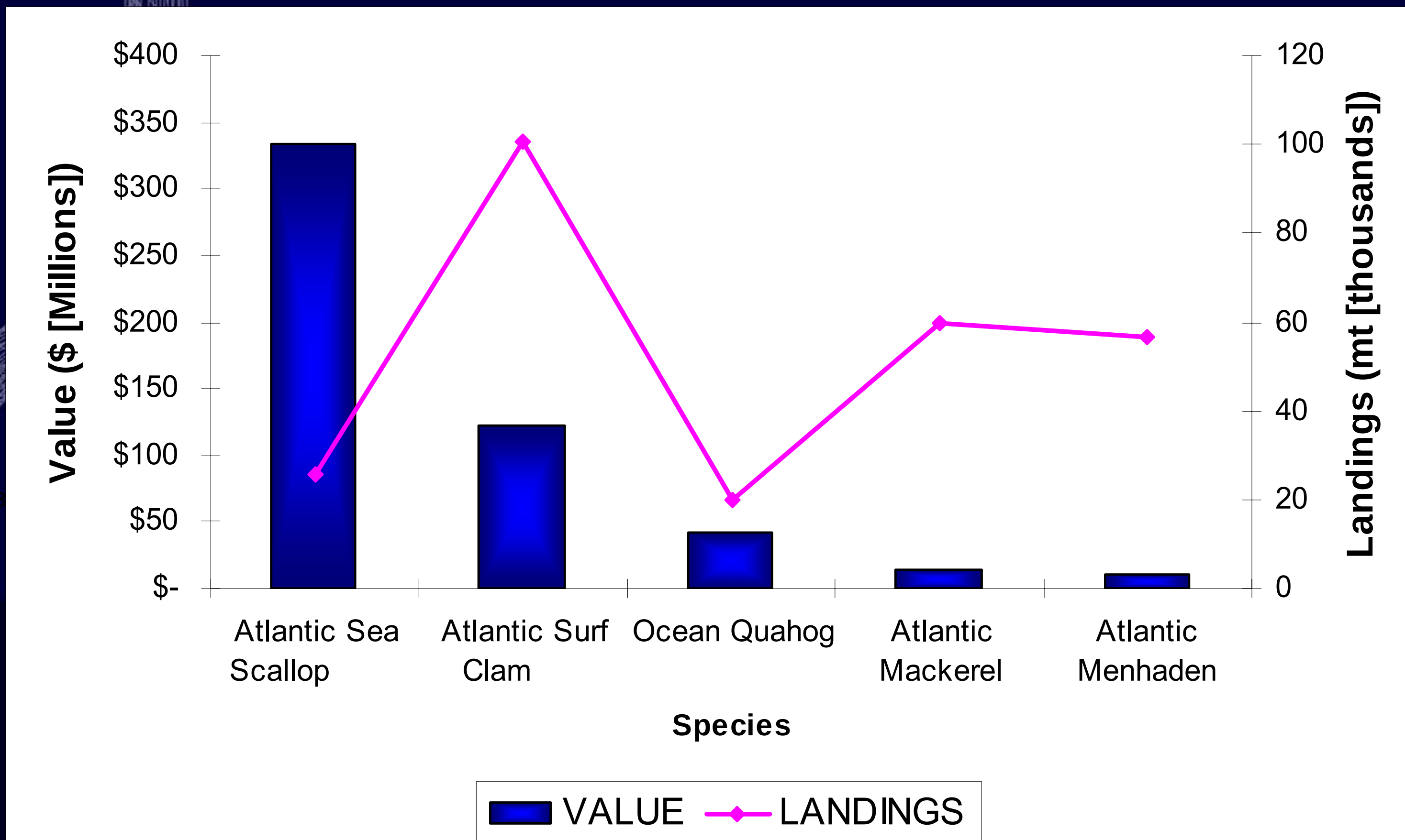
Fish and Fisheries



Source: NMFS (2008b)

Fish and Fisheries

Commercial Fisheries (2003-2007)

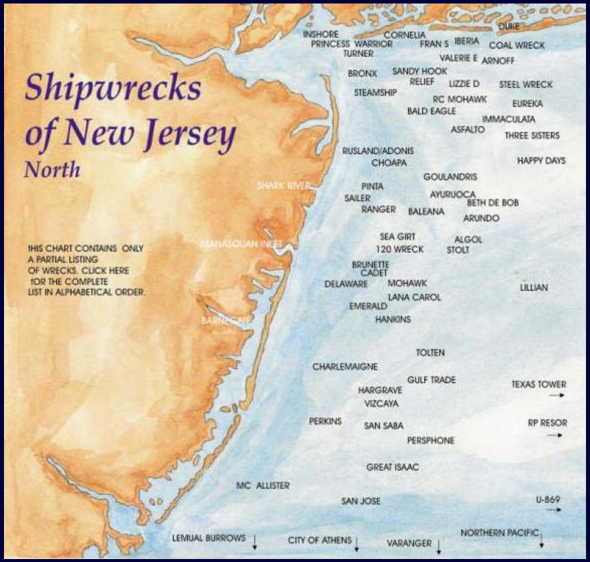


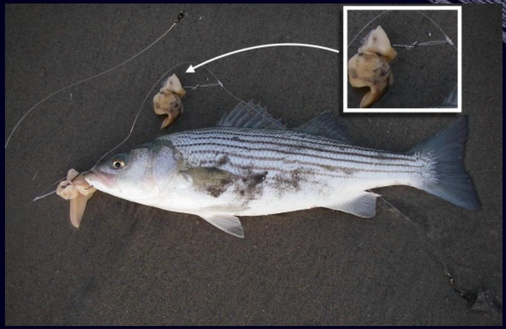
Source: NMFS (2008

Fish and Fisheries

- Recreational Fisheries
  - Fishing Hotspots:
    1. Shipwrecks (~ 102)
    2. Artificial Reef Complexes (9)
    3. Shoals/Lumps (23)
  - Common Species:
    - Black Sea Bass
    - Tautog
    - Striped Bass
    - Bluefish
    - Winter Flounder
    - Atlantic Mackerel
    - Bonito

Source: NMFS (2008b)





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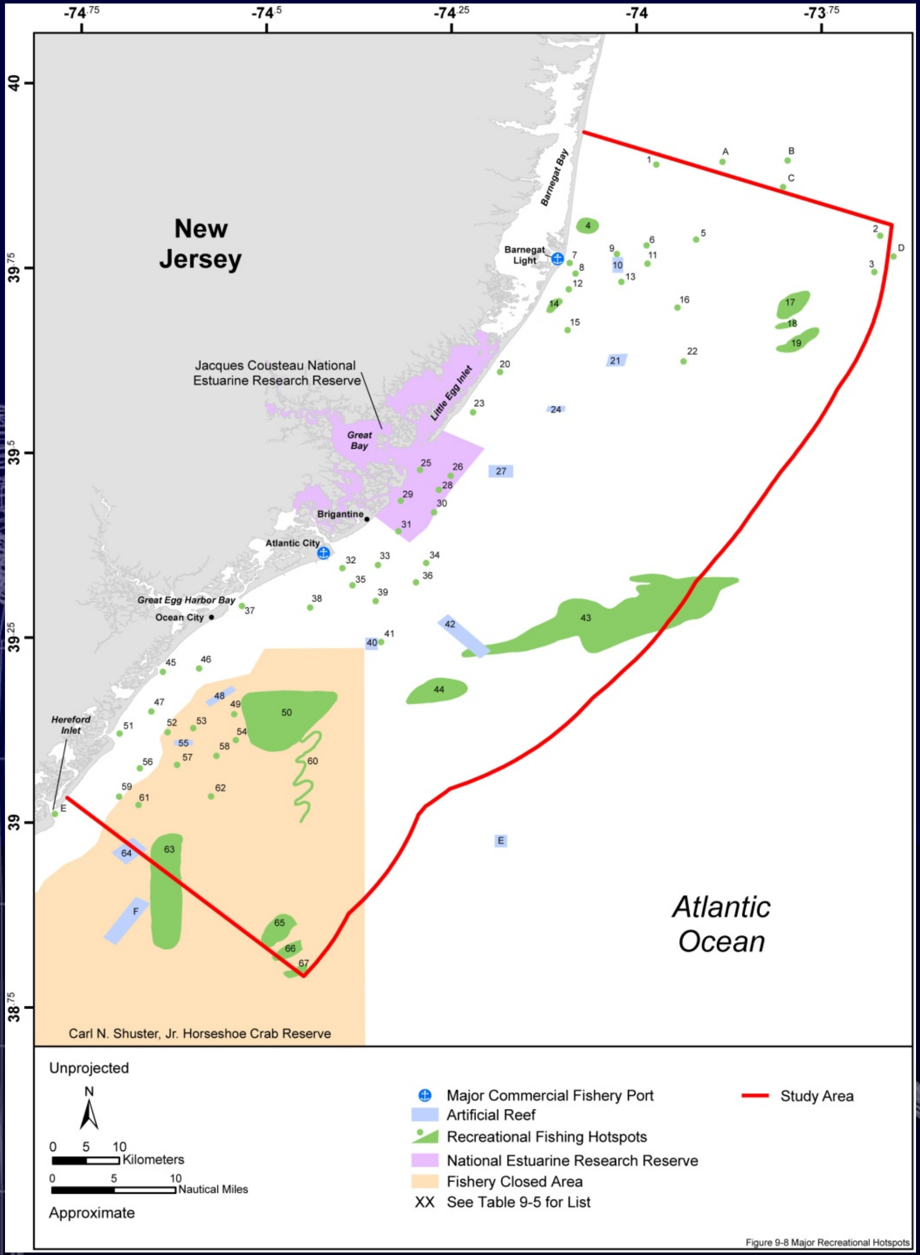
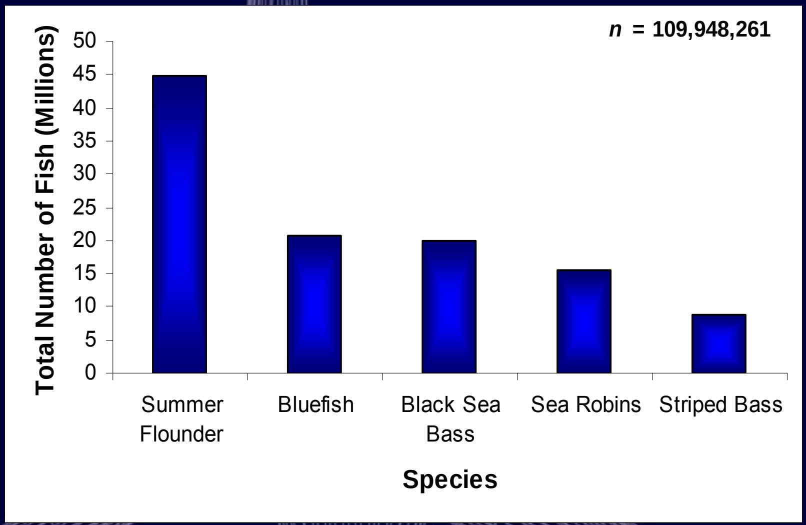
Fish and Fisheries

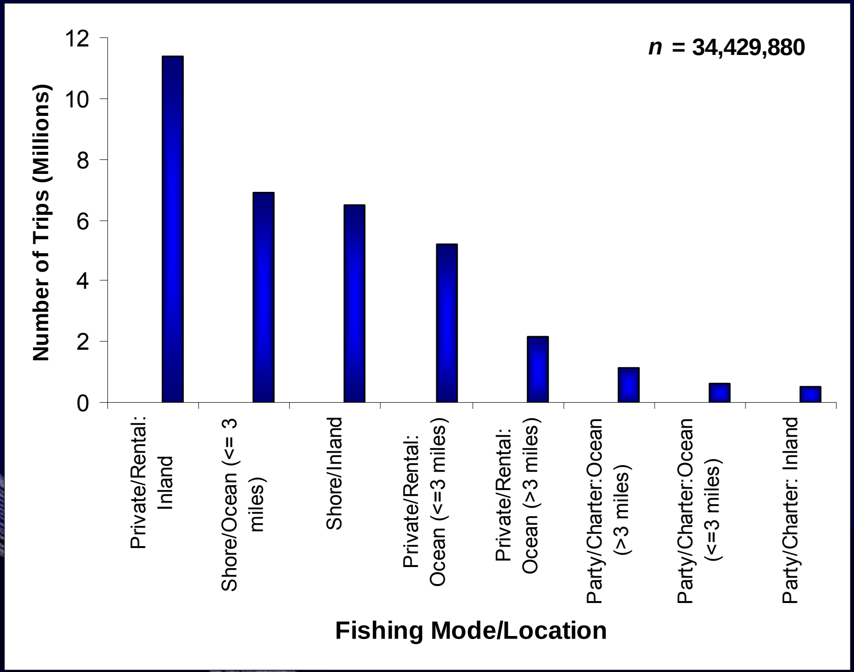


Source: NMFS (2008b)

Fish and Fisheries

- **Recreational Fisheries (2003-2007)**





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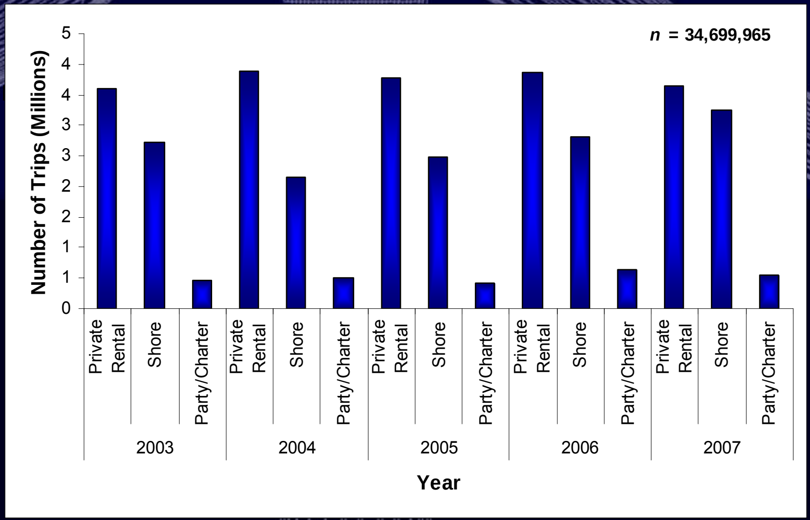

Introduction to Avian Studies

Chris Clark – Avian and Radar Studies

Avian Studies - Introduction

Visual Surveys

- Large Boat
- Small Boat
- Aerial

Remote Sensing

- Radar
  - Coastal
  - Marine
- Thermal
- Ground Truthing and Observations

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Avian Aerial Survey Track lines

- 16 April 2008
- Total length = 593 NM

Data Review

- Report submitted to NJDEP
  - Peer Review Group comments
  - Consultation with USFWS
- Conclusions
  - Possible biasing towards larger birds
  - Limited number of surveys compared to other efforts
  - Utilization of resources for other tasks (e.g., radar validation)

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Avian Studies – Technical Presenters

- Dr. Jarrod Santora
  - Ornithology and Modeling

- Dr. Sidney Gauthreaux, Jr.
  - Ornithology and Remote Sensing Techniques

Avian Studies - Overview

Dr. Jarrod Santora

- Visual Surveys:
  - Density Mapping
  - Project Area Coverage
  - Monthly Break-outs
  - Flight Directions and Hotspots
  - Objectives of Density and Modeling

Dr. Sidney Gauthreaux, Jr.

- Radar Surveys:
  - Radar Background
  - Clutter Environment
  - Comparable Studies
  - Horizontal Data
  - Radar Post-Processing
  - Vertical Data
  - Filtering
  - Altitude
  - TI/VPR

Avian Shipboard Surveys: Research, Development, and Prediction

Dr. Jarrod Santora – Ornithology and Modeling

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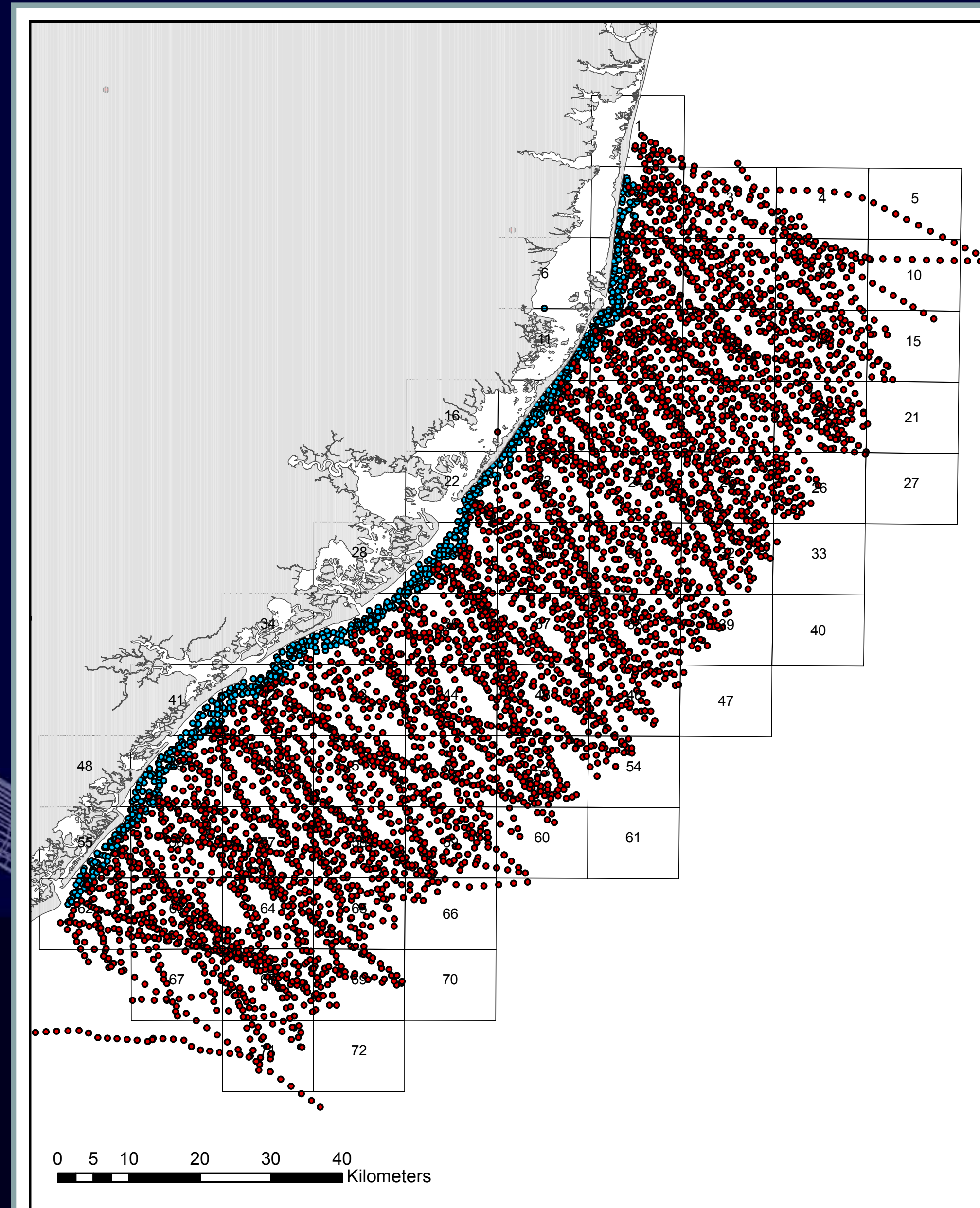
Avian Density Mapping: Shipboard and Coastal Surveys

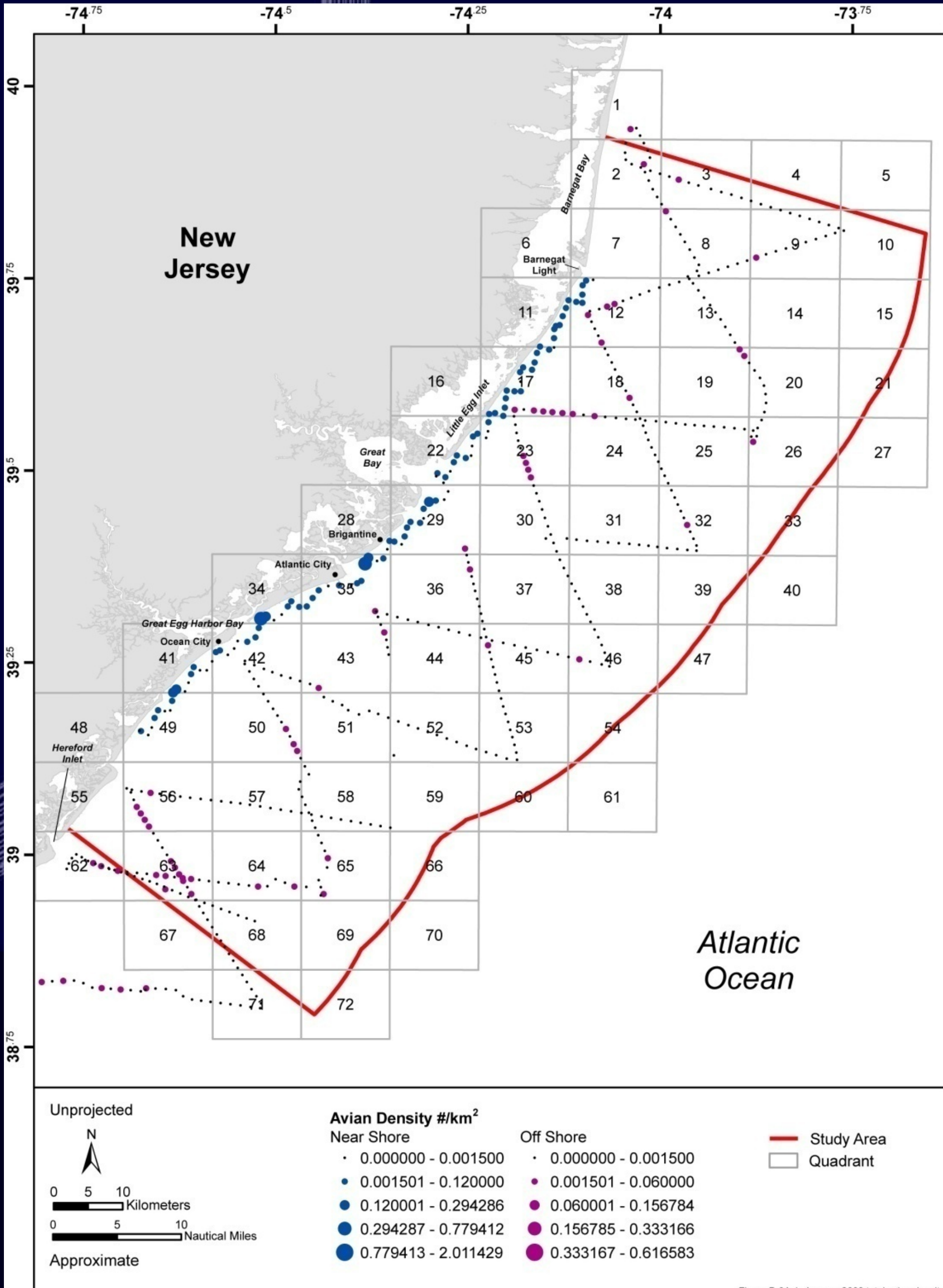
- Offshore (14) and coastal surveys (13)
- Standardized strip-transect methods (300m)
- Data used for density calculation:
  - Vessel speeds ≥7knots, Sea State ≤5, Good Visibility
- Density estimates (birds km^2)
  - calculated using the standard formula:
    - $D = n / (l \times w)$, where D is density (birds per square kilometer), n is the number of birds observed, l is the transect length, and w is the width of the strip.

SURVEY COVERAGE

- January-November
- Offshore (11): 5160 km
- Coastal (10): 924 km



Distribution Patterns?



JANUARY

January 2008 Shipboard Offshore In-Zone[1]		
Common Name	**N**	**Abundance [2]**
Northern Gannet	776	1.55
Red-throated Loon	118	0.24
Common Loon	83	0.17
Herring Gull	71	0.14
Black Scoter	63	0.13
Total	**1,111**	**2.23**

[1] includes avian observations within the 300-m x 300-m survey strip transect when the ship was traveling ≥7 kts

[2] No./km

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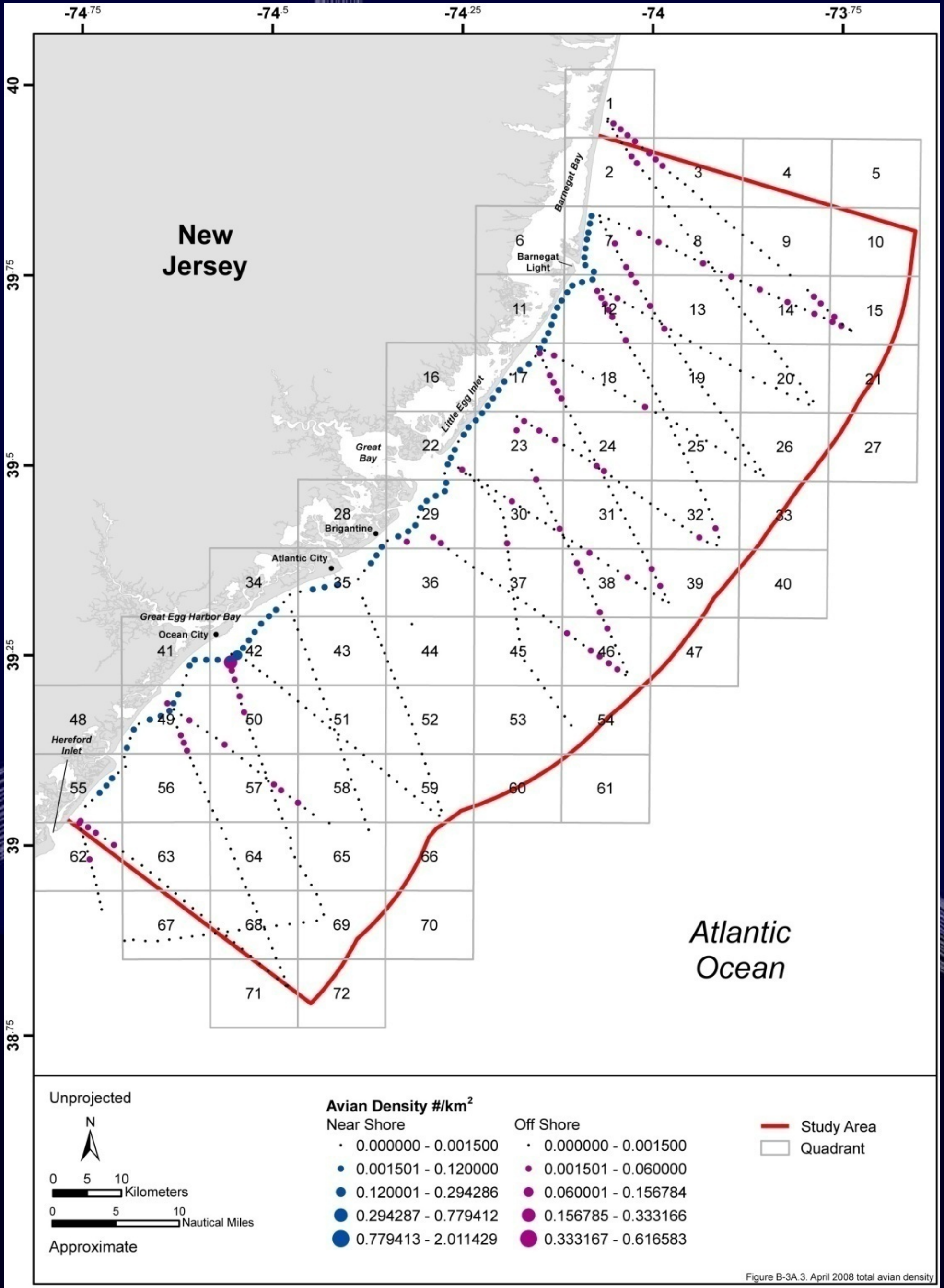
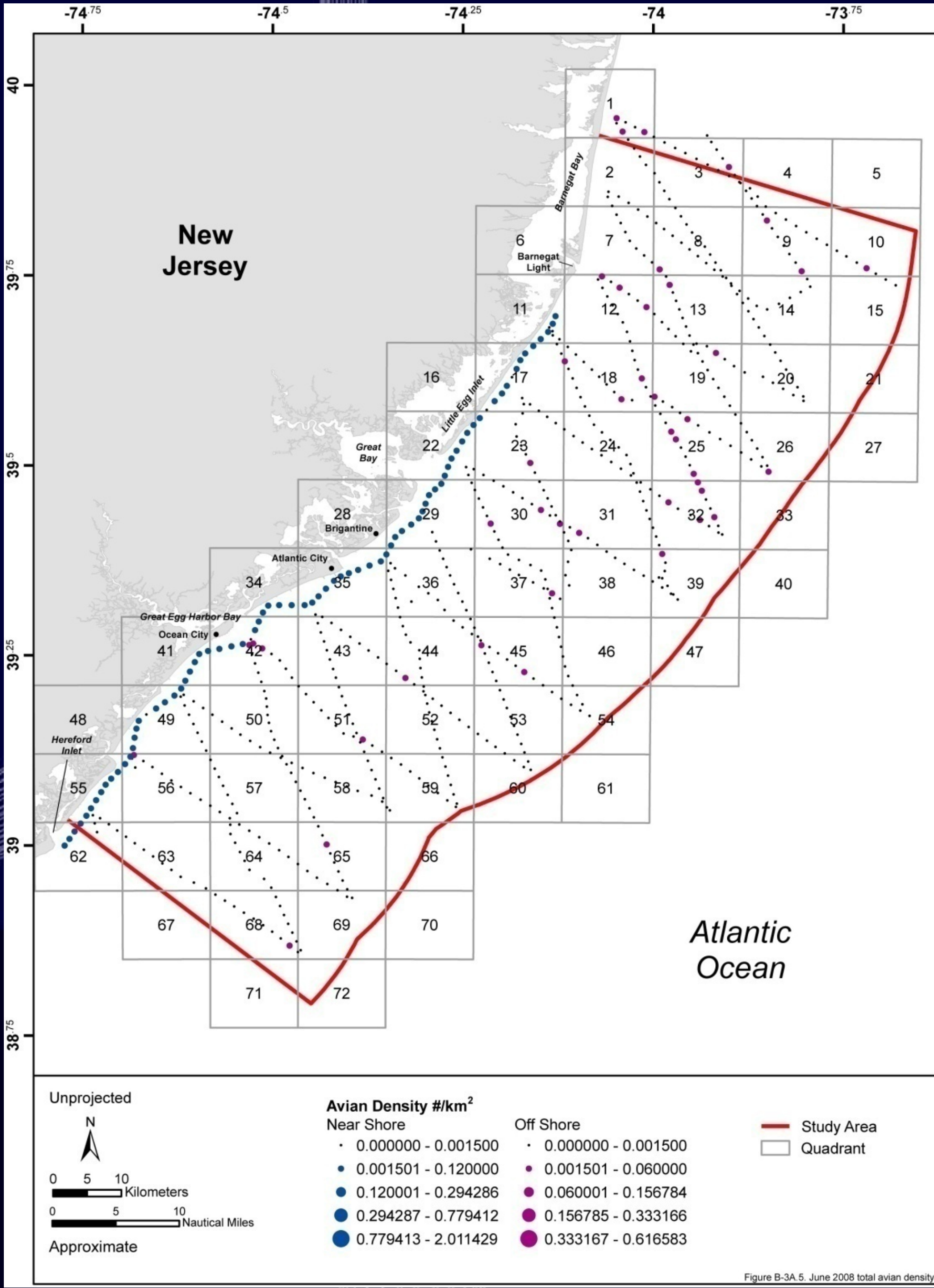


APRIL

April 2008 Shipboard Offshore In-Zone[1]		
Common Name	**N**	**Abundance [2]**
Surf Scoter	1,297	1.80
Northern Gannet	809	1.12
Black Scoter	335	0.46
Scoter, dark-winged (unknown)	204	0.28
Herring Gull	160	0.22
Total	**2,805**	**3.88**

[1] includes avian observations within the 300-m x 300-m survey strip transect when the ship was traveling ≥7 kts

[2] No./km



JUNE

June 2008 Shipboard Offshore In-Zone[1]		
Common Name	**N**	**Abundance[2]**
Wilson's Storm-petrel	338	0.41
Common Tern	182	0.22
Laughing Gull	174	0.21
Northern Gannet	132	0.16
Cory's Shearwater	57	0.07
Total	**883**	**1.07**

[1] includes avian observations within the 300-m x 300-m survey strip transect when the ship was traveling ≥7 kts
[2] No./km

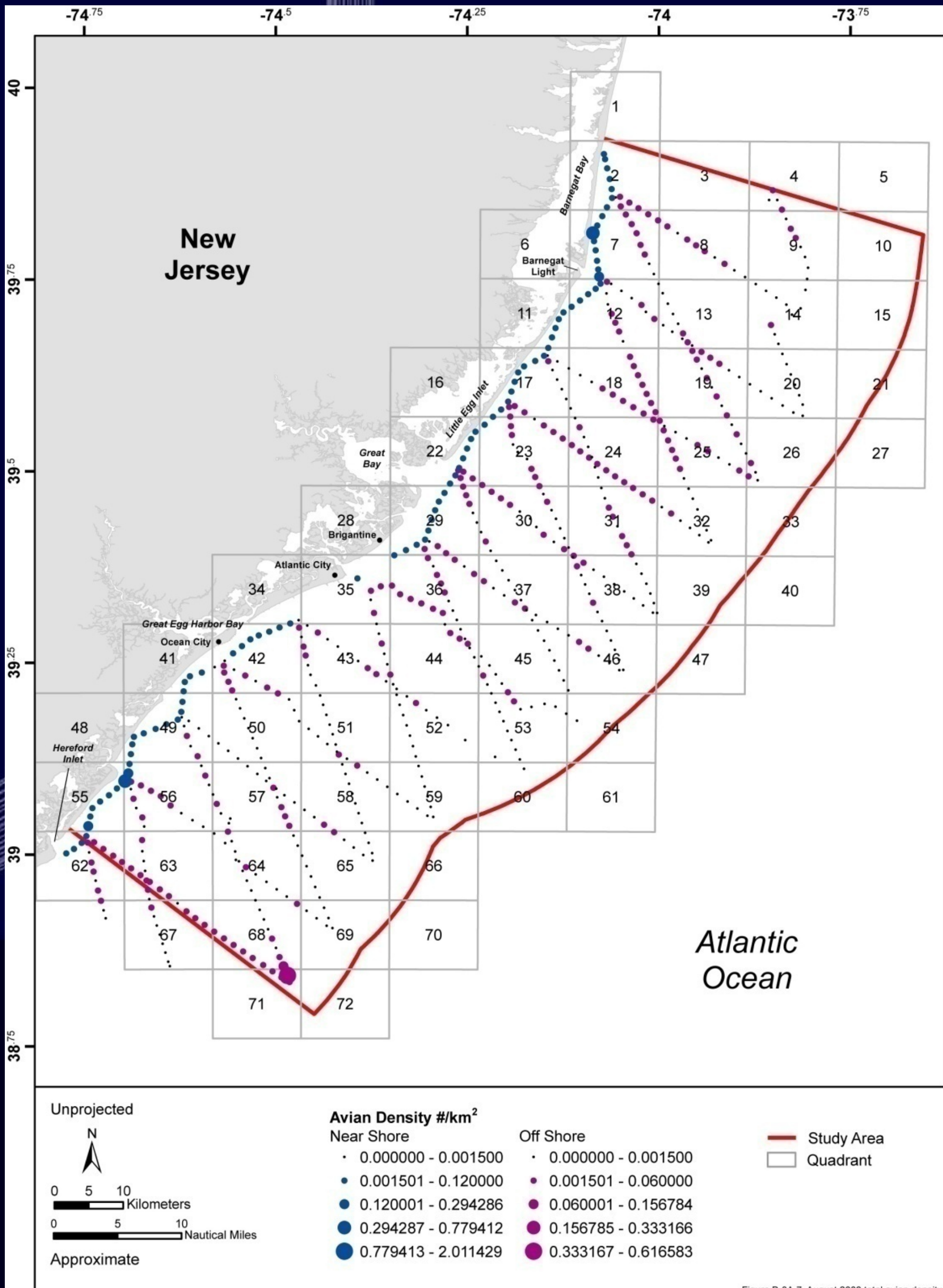


Figure B-3A.7. August 2008 total avian density

AUGUST

August 2008 Shipboard Offshore In-Zone[1]		
Common Name	**N**	**Abundance[2]**
Wilson's Storm-petrel	1,245	1.55
Laughing Gull	517	0.64
Common Tern	510	0.63
Great Black-backed Gull	56	0.07
Purple Martin	47	0.06
Total	**2,375**	**2.95**

[1] includes avian observations within the 300-m x 300-m survey strip transect when the ship was traveling ≥7 kts
[2] No./km

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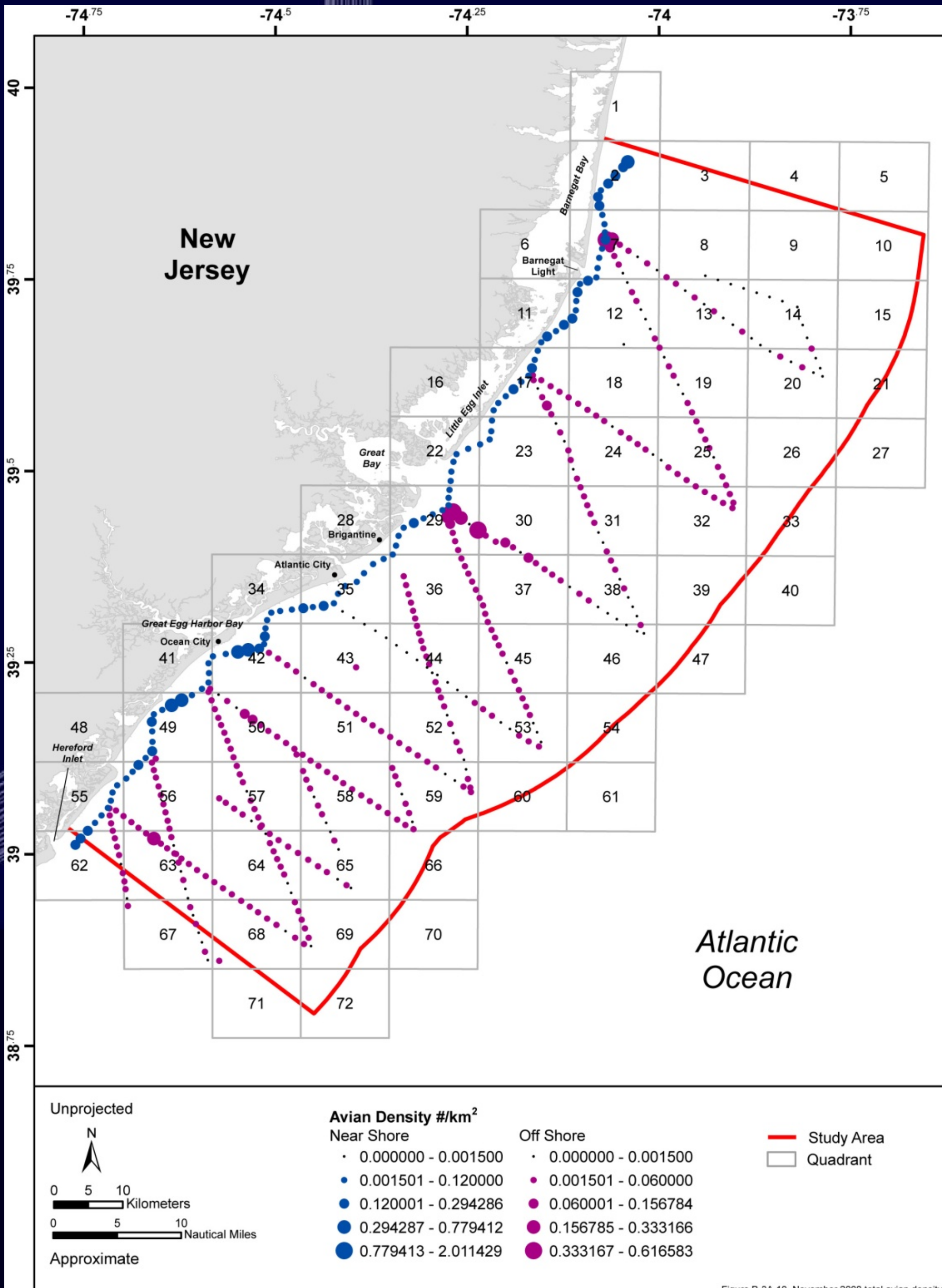

Figure B-3A.10. November 2008 total avian density

NOVEMBER

November 2008 Shipboard Offshore In-Zone[1]		
Common Name	**N**	**Abundance[2]**
Surf Scoter	2,101	3.85
Laughing Gull	1,323	2.43
Northern Gannet	1,065	1.95
Black Scoter	1,062	1.95
Scoter, dark-winged (unknown)	510	0.94
Total	**6,061**	**11.12**

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Flight Direction

- **Relevance of Circular Uniformity vs. Mean Flight Direction**
- Importance to subsequent calculations of avian mortality strikes.
- Collision rate of birds with wind turbine blades depends on relative directional orientation between birds and blades.

Circular Statistics

Objectives

Assess the statistical distribution of avian flight directions and their variability with respect to species, taxonomic group, month, and season.

Estimate a **mean direction angle** and calculate associated statistical errors (circular SD, 95% confidence interval, etc.)

Hypothesis testing: Do the directional data exhibit **circular uniformity** (random directional distribution) or a **mean flight direction**?

Mean flight direction can exhibit monthly/seasonal variability in accordance with seasonal flight migration patterns.

Flight Direction: Summary

- **Mean angle** is dependent on **species**, **group**, **month**, and **season**.

Offshore (Ship) Surveys:

- **Mean angle = 148.20°** (95% CI: 142.05° to 154.34°) for total birds.
- Data exhibit **circular uniformity** with respect to species, group, month, and season.

Coastal (Boat) Surveys:

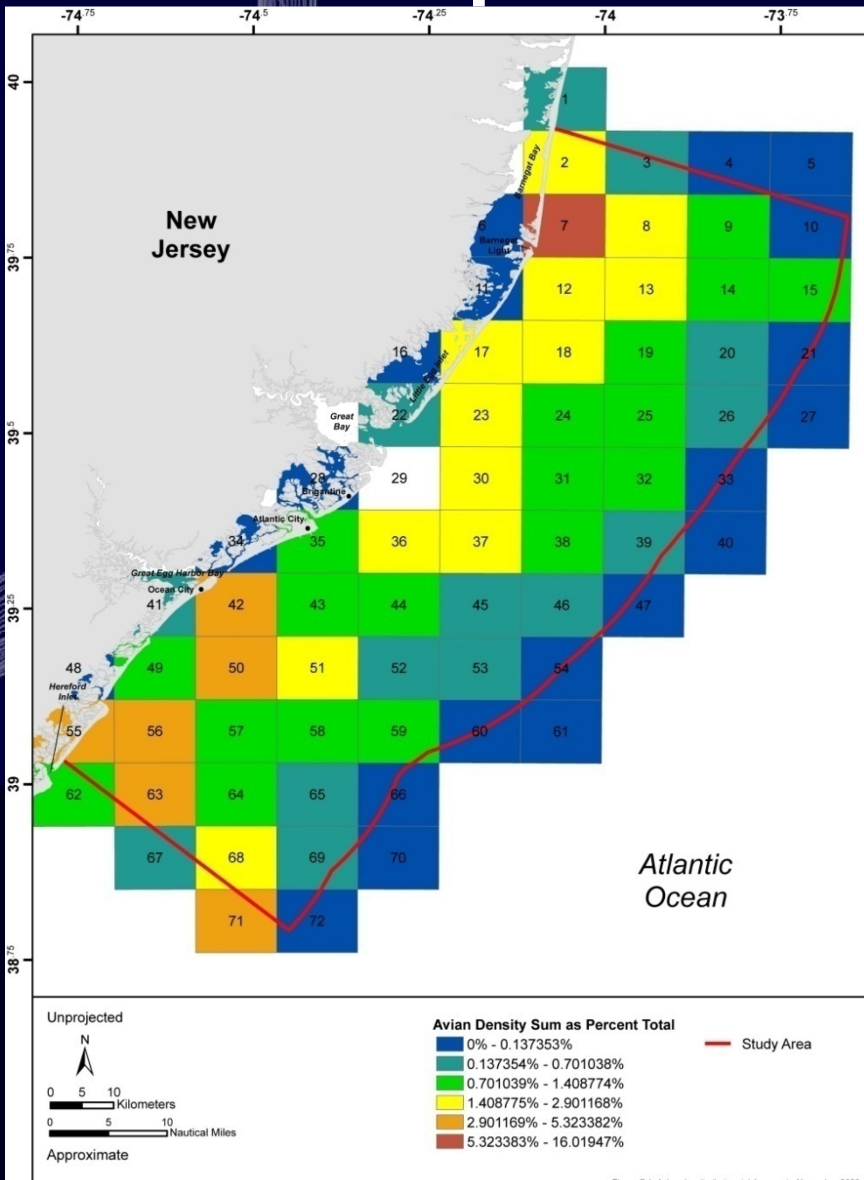
- **Mean angle = 200.75°** (95% CI: 199.84° to 201.66°) for total birds.
- Data exhibit **circular uniformity** with respect to season, but **not** species, group, or month.

Avian Hotspot Mapping

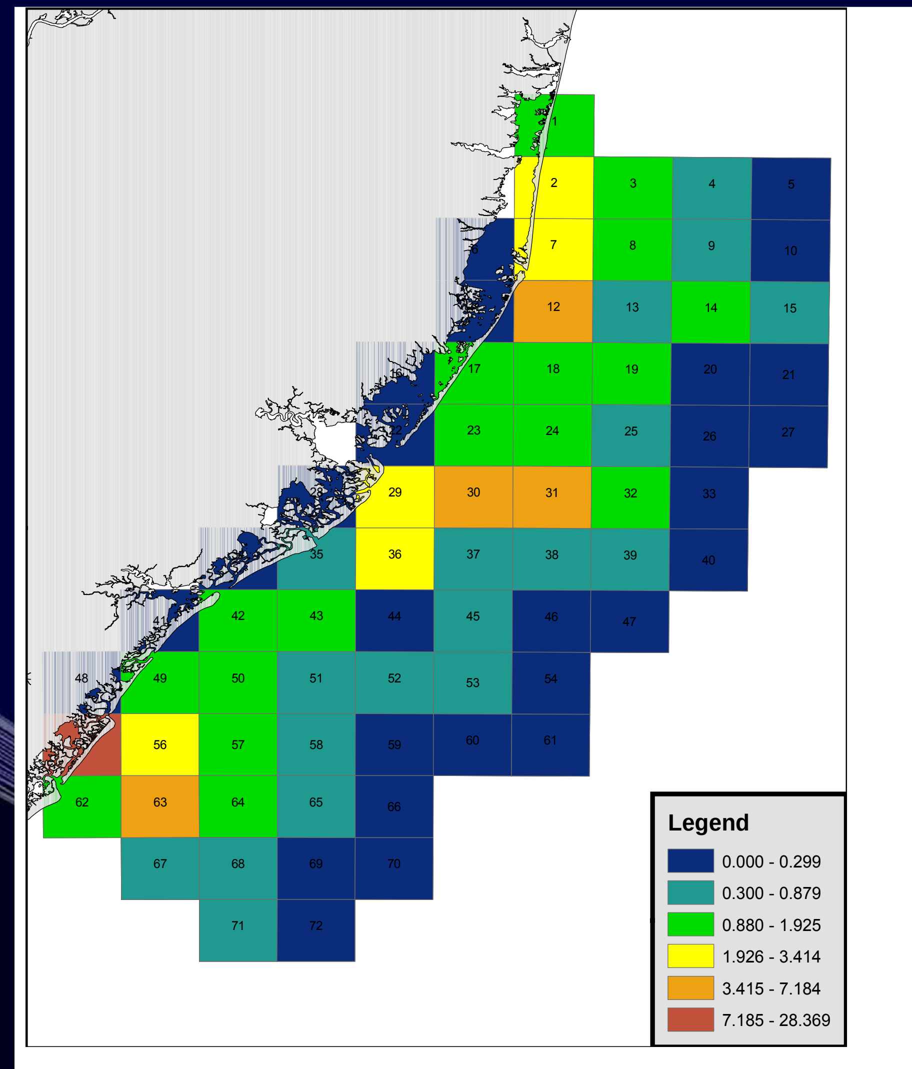
- Hotspot maps provide a direct link between sampling effort and observed avian density
- Effective tool for tracking changes within and among cells through time (Seasonal Variability)
- Examine changes in
  - Species diversity
  - Community Composition
  - Interspecific associations

JANUARY - NOVEMBER

Total Species



Northern Gannet



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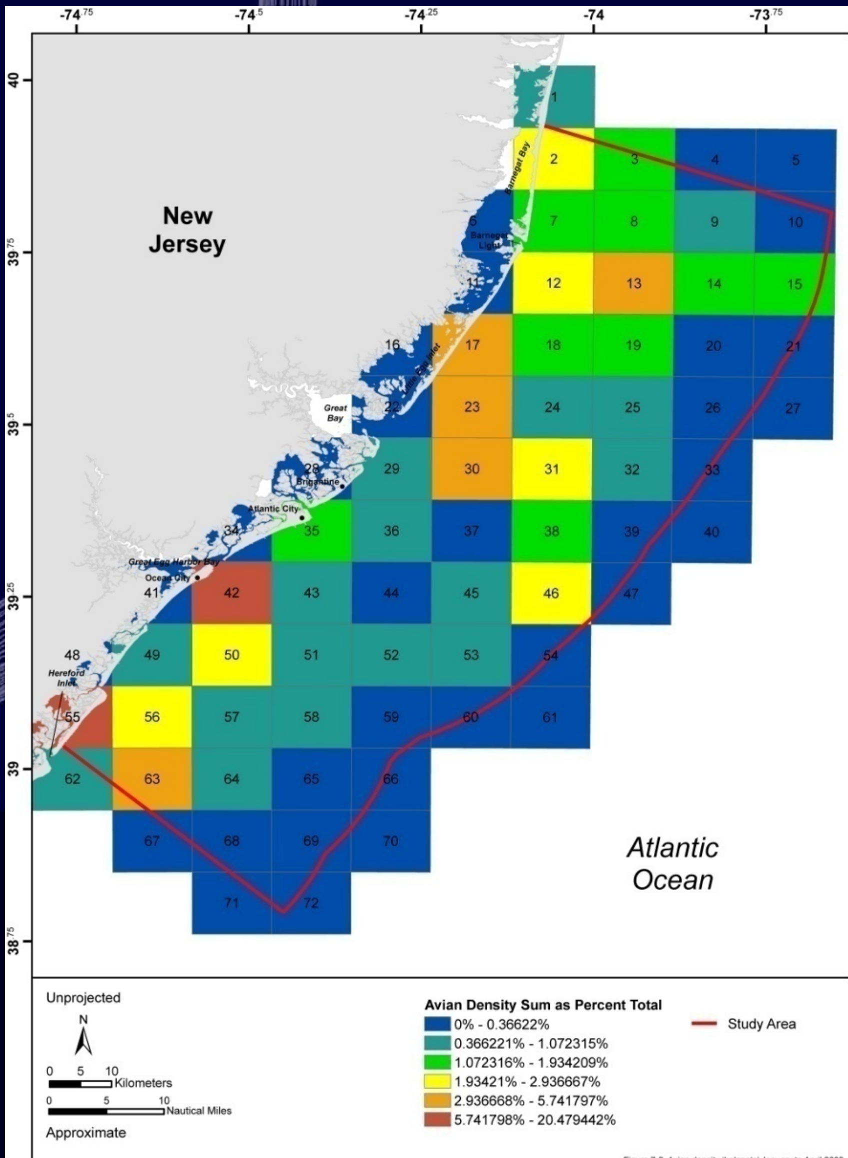
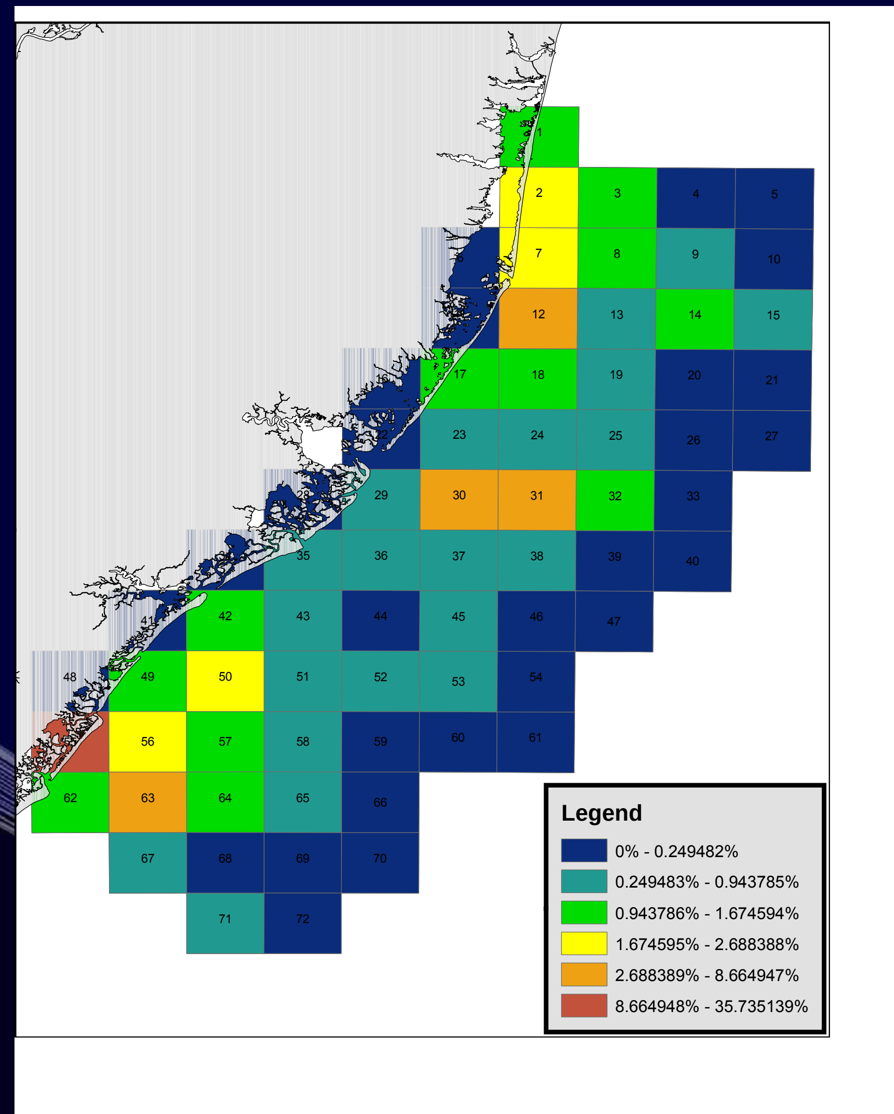
JANUARY - APRIL

Total Species



Northern Gannet



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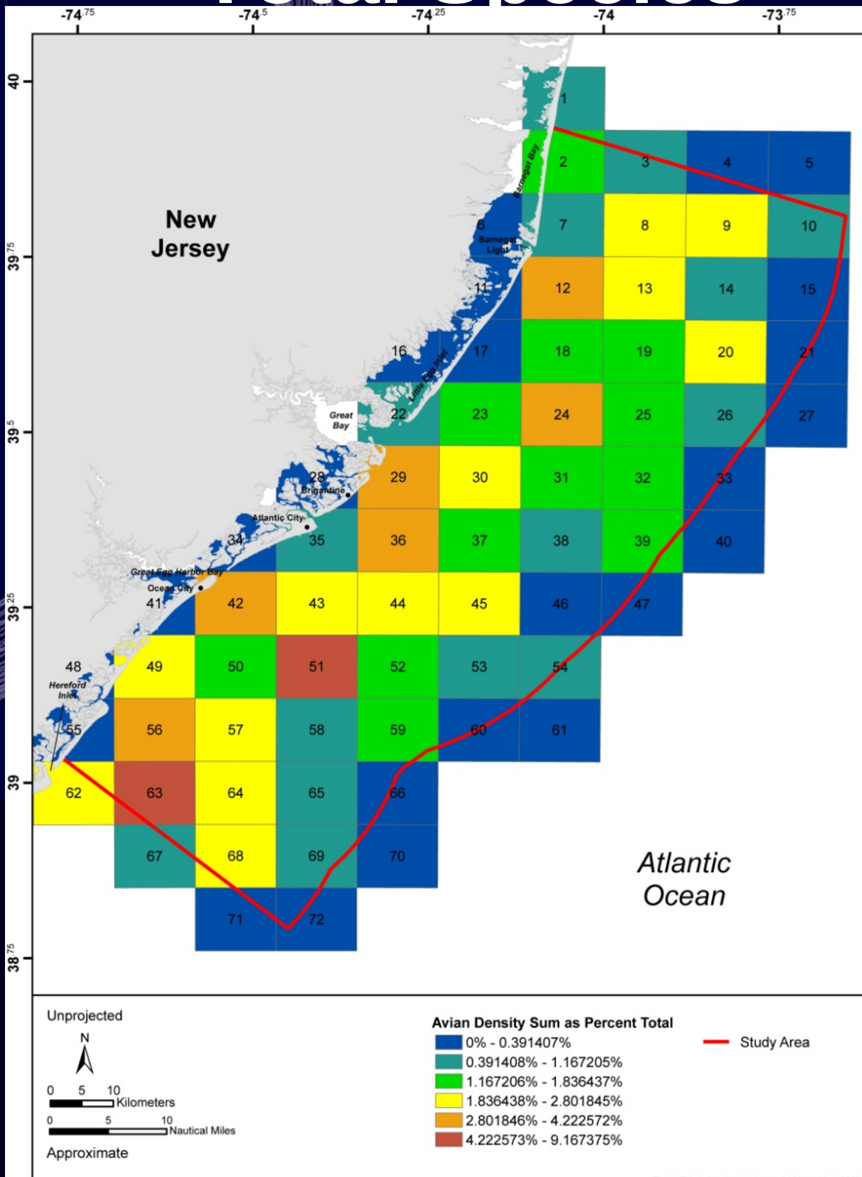
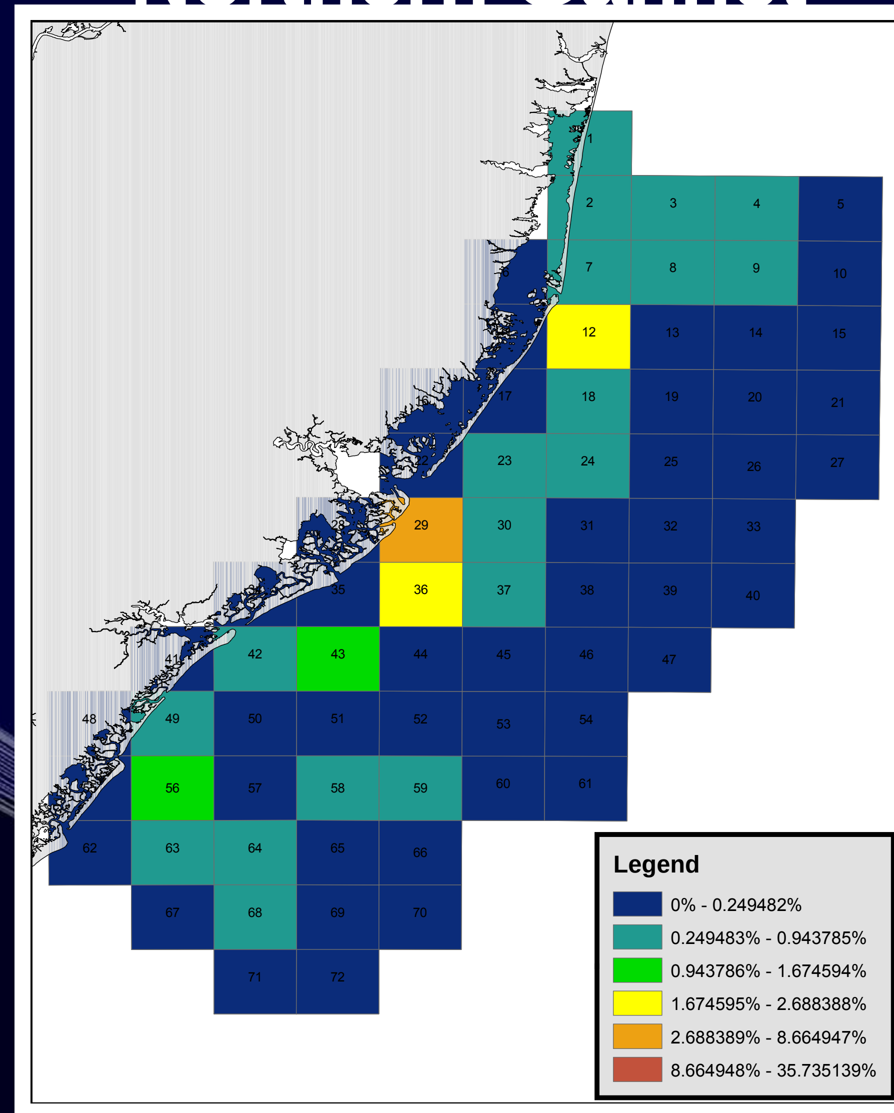
MAY- JULY

Total Species



Northern Gannet



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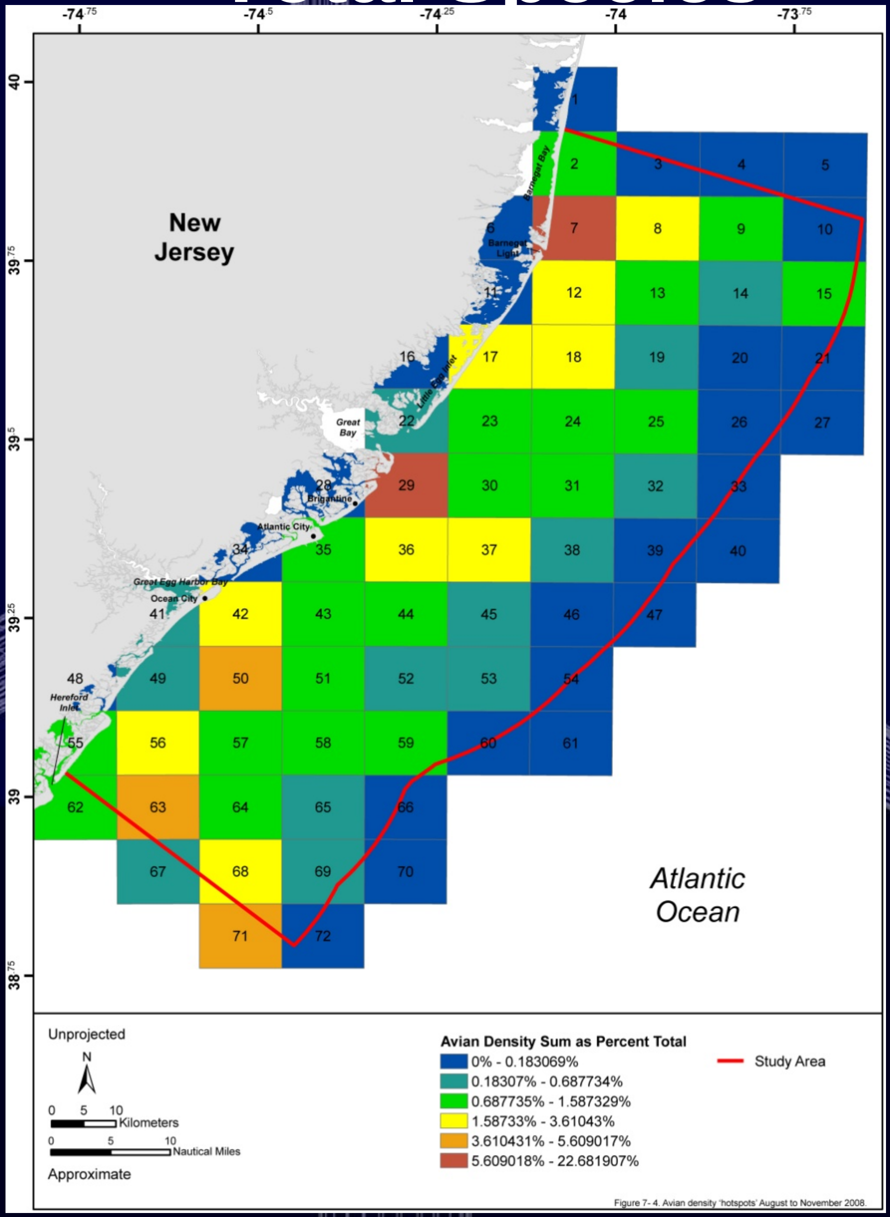
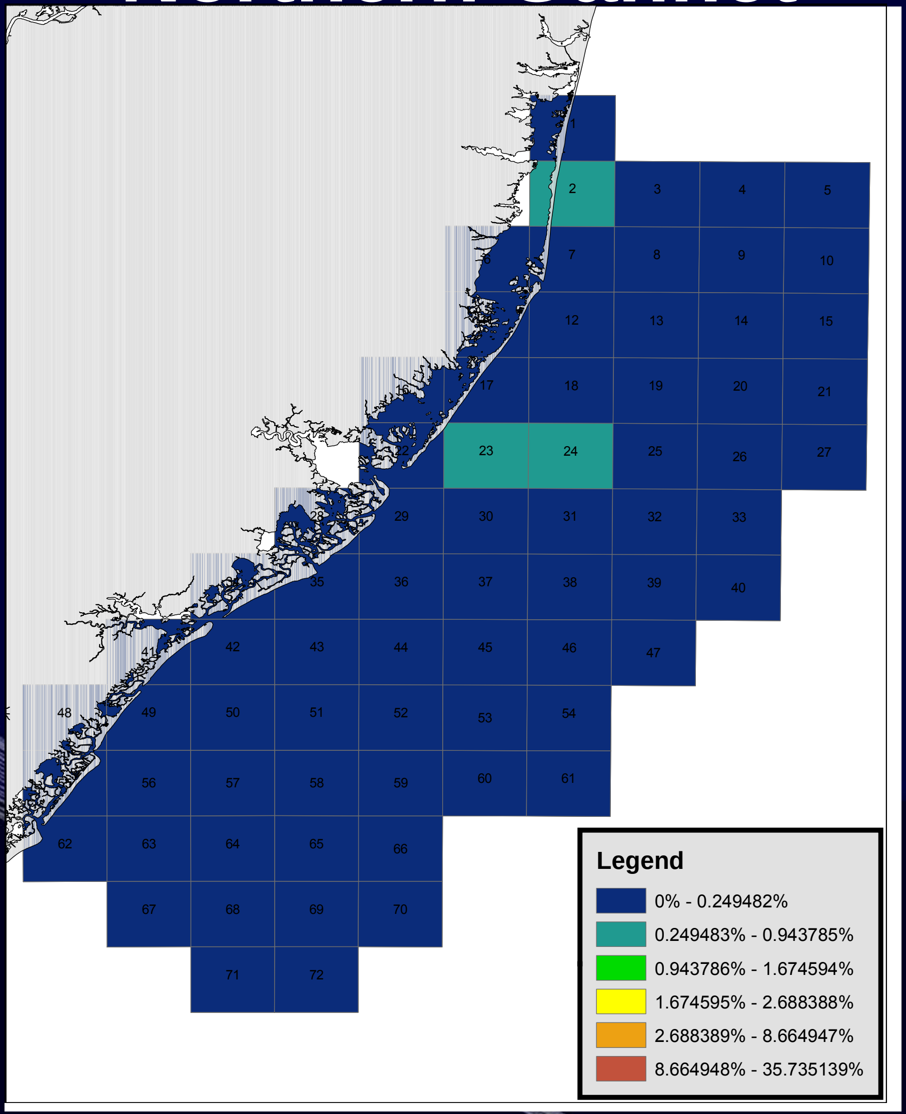
AUGUST - NOVEMBER

Total Species



Northern Gannet



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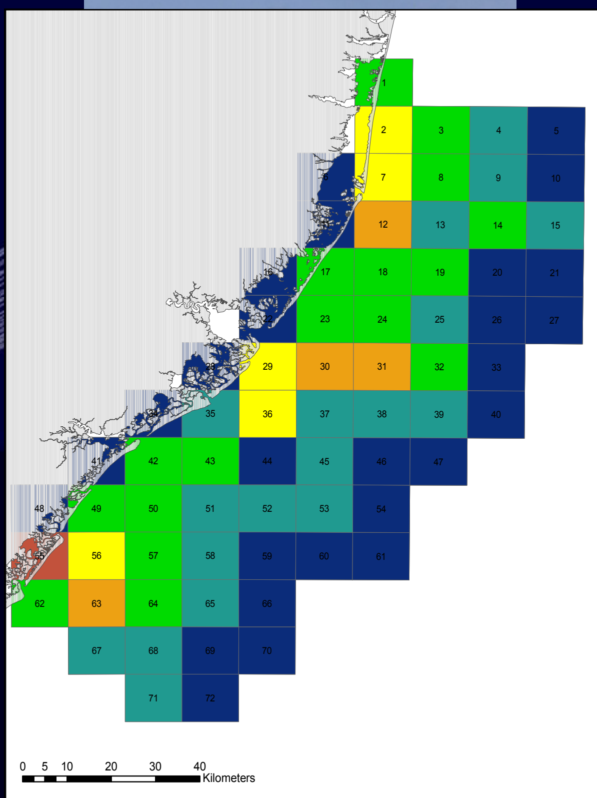
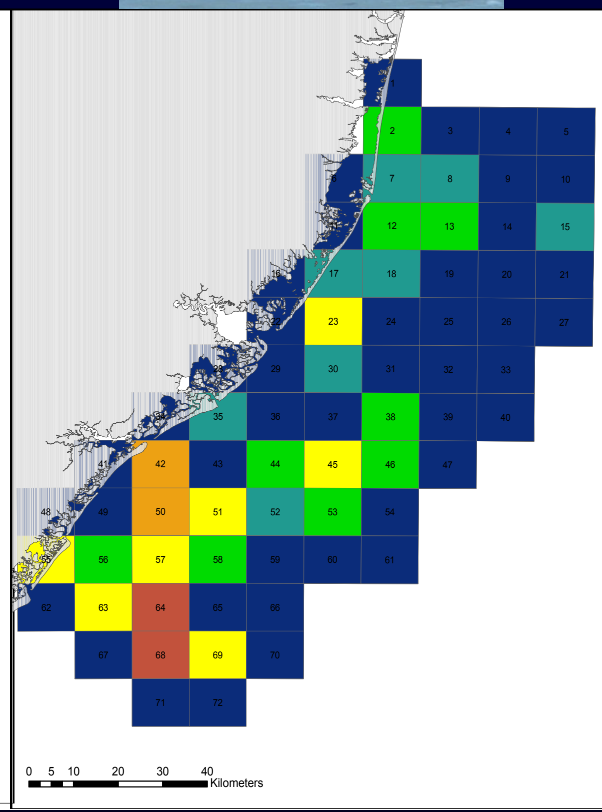
Comparative Habitat Use of Seabirds January-November

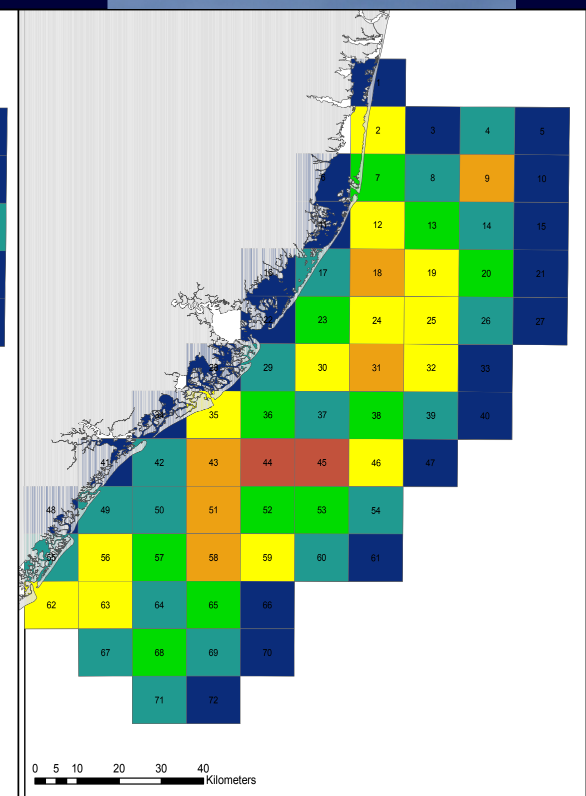
Northern Gannet

Scoter Spp.

Laughing Gull





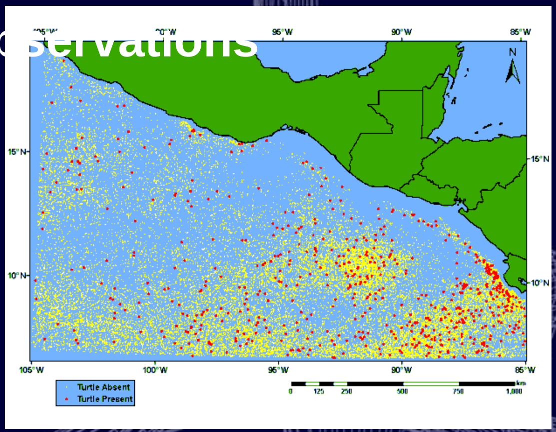


Avian Density and Distribution Modeling

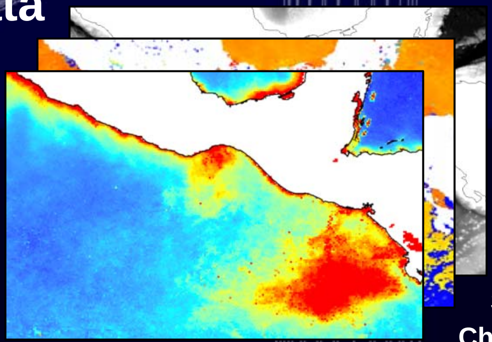
- Objectives:
  - Determine probability of occurrence and spatial distribution for birds.
    - Density Plots
    - Presence/Absence
    - Hotspot Mapping
  - Use spatial interpolation tools to examine changes in avian density over the study area and through time.
    - Kernel Density and Kriging
  - Design and implement Marine Geospatial Ecosystem tool to predict spatial distribution of birds using survey data and environmental predictors.

Example: Species Habitat Modeling

Presence/absence observations



Sampled environmental data



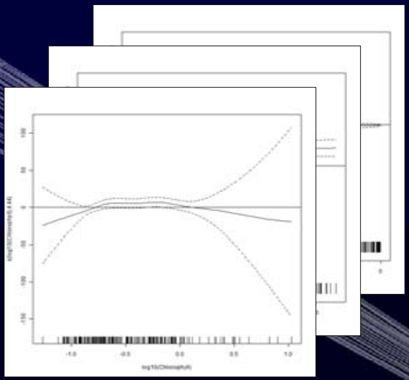
Bathymetry

SST

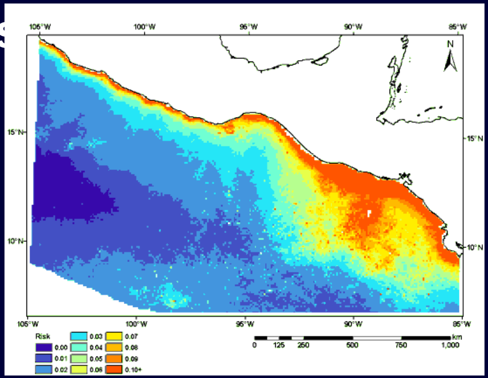
Chlorophyll

Multivariate statistical model (GAM's)

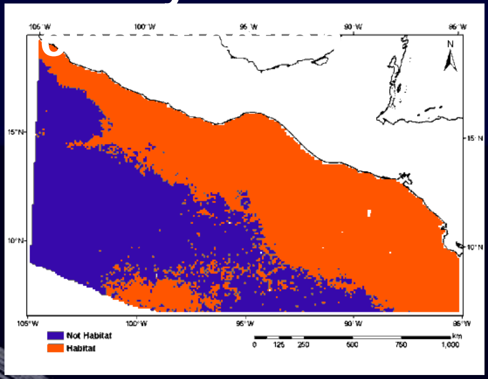
$$g(\mu) = \beta_0 + \beta_1 x_1 + \cdots + \beta_m x_m$$



Probability of occurrence predicted from environmental covariates



Binary

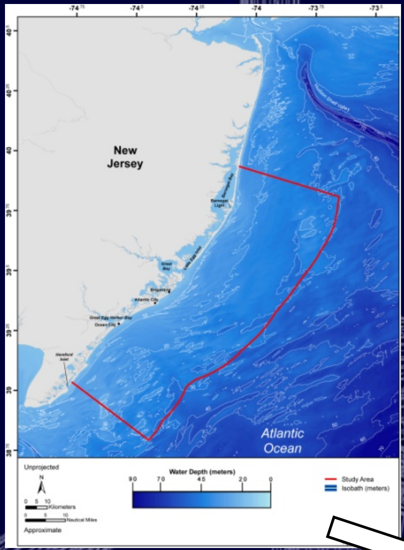


From MGET Marine Geospatial Ecosystem Tool; J. Roberts, Duke University

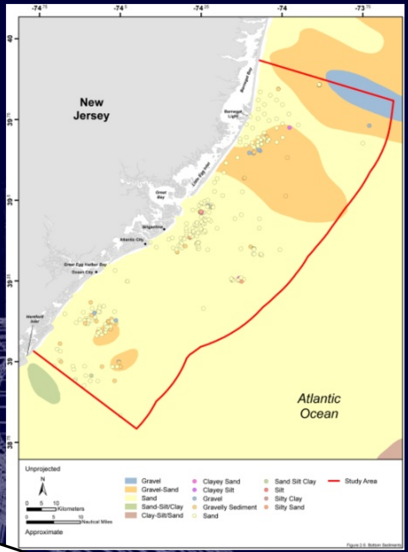
Guisan, A., Zimmermann, N.E., 2000. Predictive habitat distribution models in ecology. Ecological Modeling 135, 147–186.

Example: NJ Seabird Density and Environmental Pre

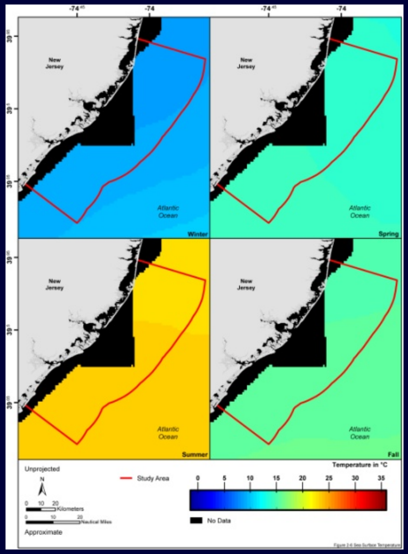
Bathymetry



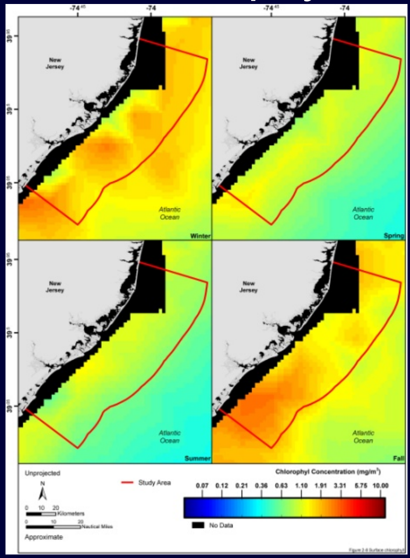
Sediment

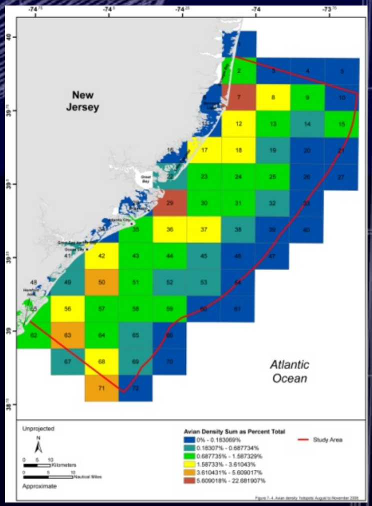


Sea Temperature



Ocean Color Chlorophyll-a

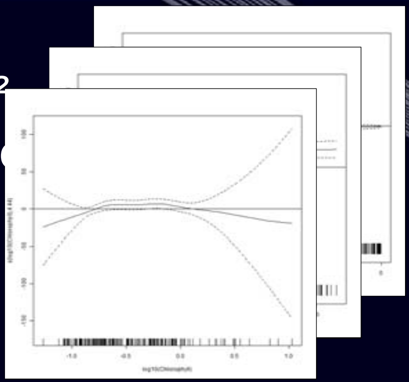




Avian Density km^2
Presence/Absenc
Hotspot Maps
Species

Multivariate statistical model (GAM's)

$$g(\mu) = \beta_0 + \beta_1 x_1 + \cdots + \beta_m x_m$$



Probability of occurrence predicted from environmental covariates

Example: Predicted densities of seabirds using shipboard surveys and GAM's off Central Ca

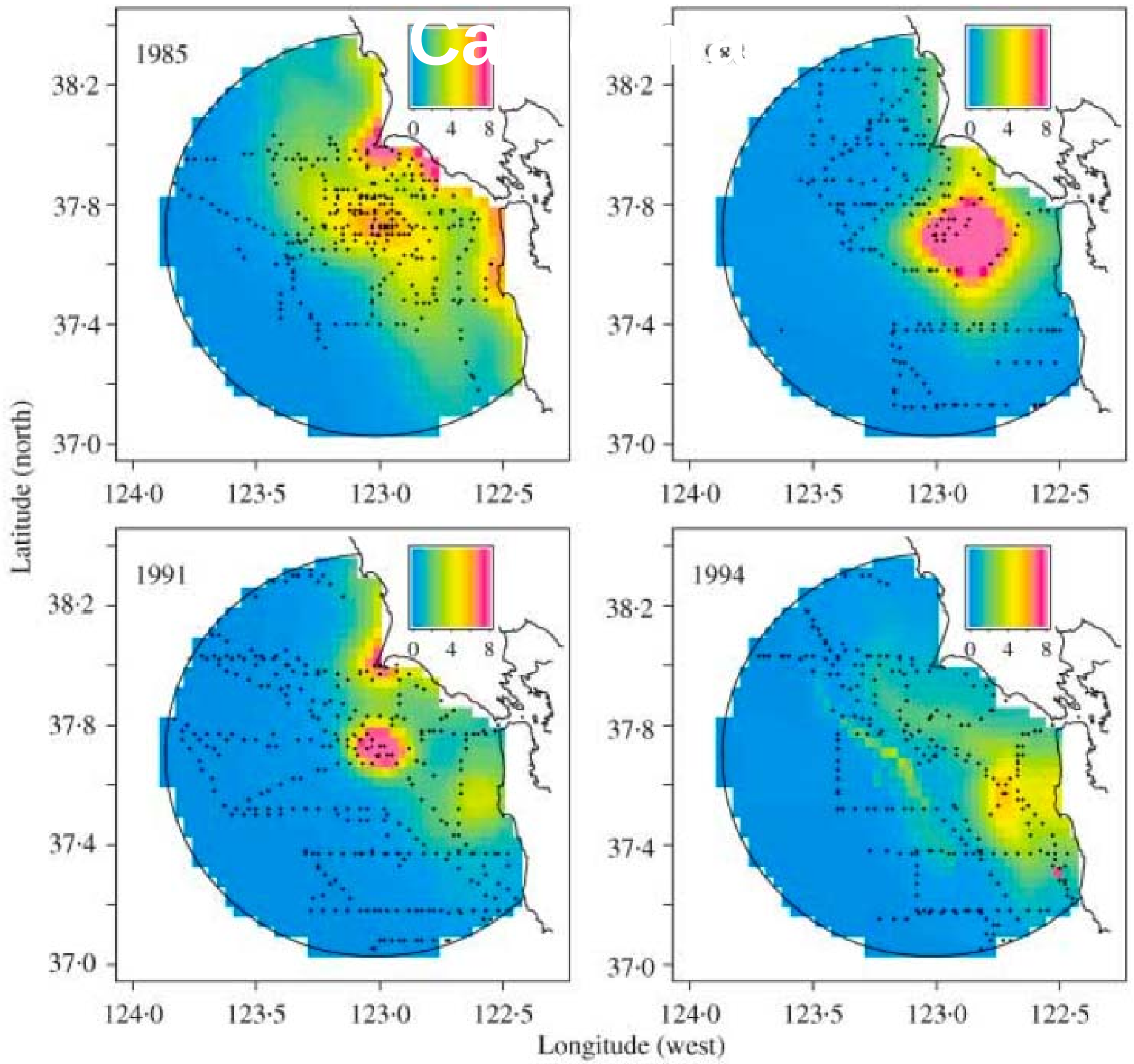


Fig. 4. The predicted densities of adult western gulls within their foraging range from the primary breeding colony on south-east Farallon Island, during spring 1985, 1988, 1991 and 1994. The positions of the survey segments are superimposed. Densities greater than 8 birds km^{-2} have been set to 8 birds km^{-2} to show changes in density more clearly.

From Clarke et al. 2003

Example: Using GAM's to explore the shape bird/mammal-habitat relationships.

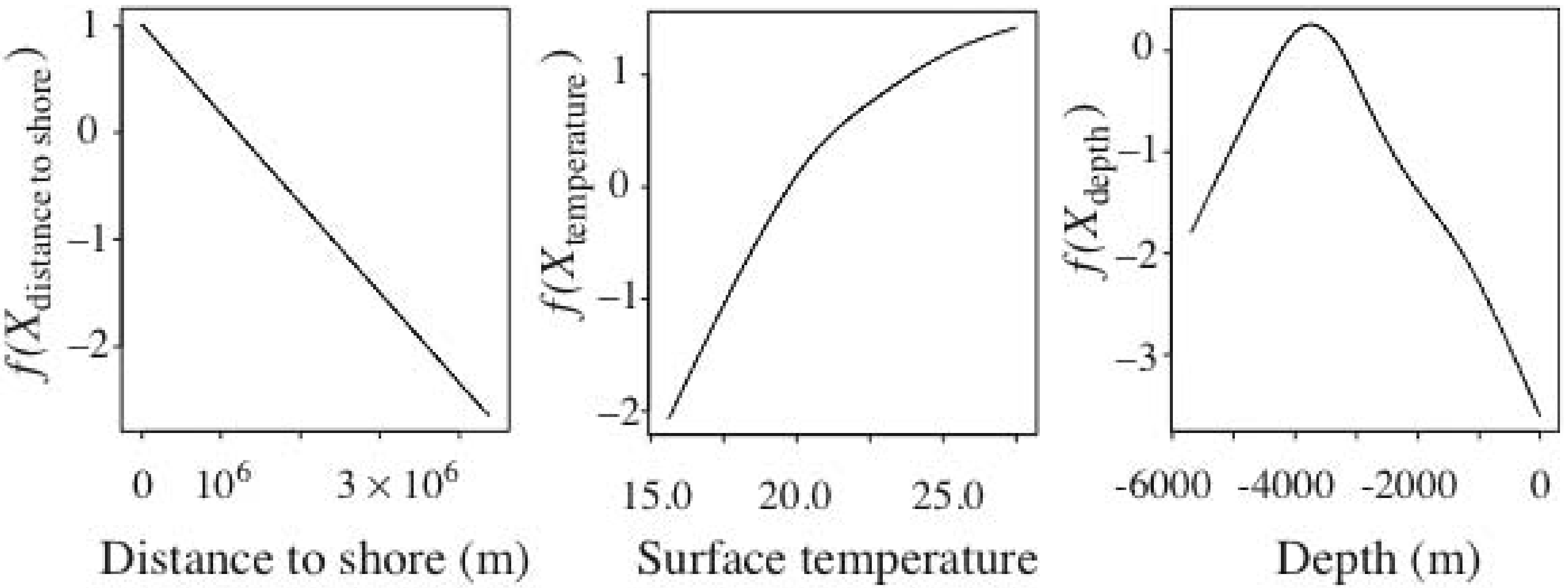


Fig. 5. Generalized additive models can be used to explore the shape of cetacean–habitat relationships. In this hypothetical example, smoothing splines were used to model the relationship between cetacean encounter rate and several habitat variables. A linear fit was selected between encounter rate and distance to shore. A smoothing spline with 2 degrees of freedom suggests that encounter rates may level off with increasing temperature, while a smoothing spline with 3 degrees of freedom captures a peak in encounter rate at a depth of approximately 3500 m

From Redfern et al. 2008

Example: Predicting probability of occurrence of Right Whales and ship strikes

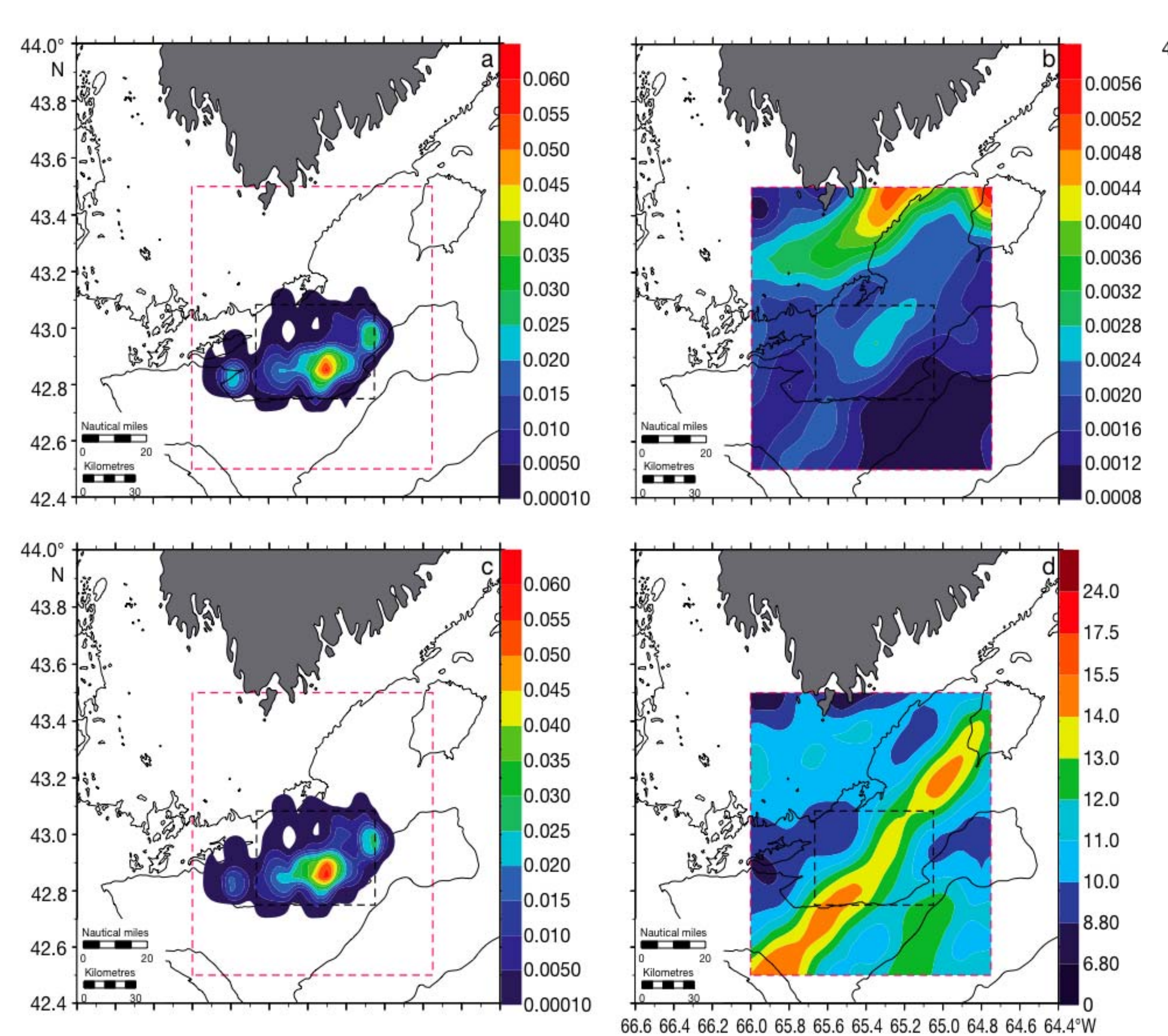
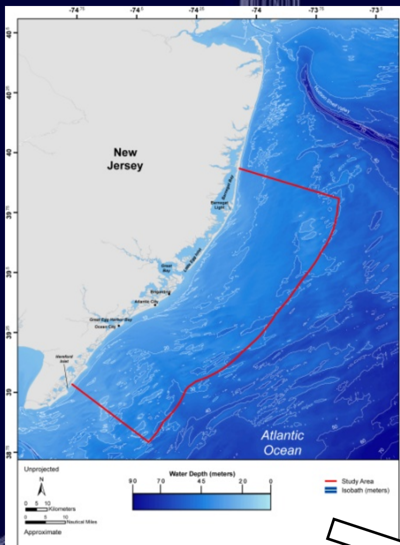


Fig. 5. Bathymetric (100 m resolution) chart of the Roseway Basin region illustrating the study domain (red dashed line), Canadian Right Whale Conservation Area (black dashed line), and showing the relative probability of (a) observing a right whale, (b) observing a vessel, (c) a vessel encountering a right whale, and (d) average vessel speed (knots) and (e) relative risk of a lethal collision between a vessel and a right whale. The recommendatory area to be avoided is outlined (solid black line). Note panel (d) is colour-scaled to match that of lethal collision as a function of vessel speed shown in Fig. 1b

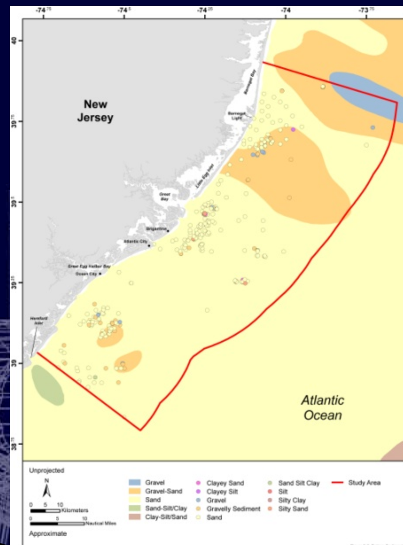
From Vandrlaan et al. 2008. Reducing the risk of lethal encounters: vessels and right whales in the Bay of Fundy and on the Scotian Shelf. MEPS, 4:283-297

Example: NJ Seabird Density and Environmental Pre

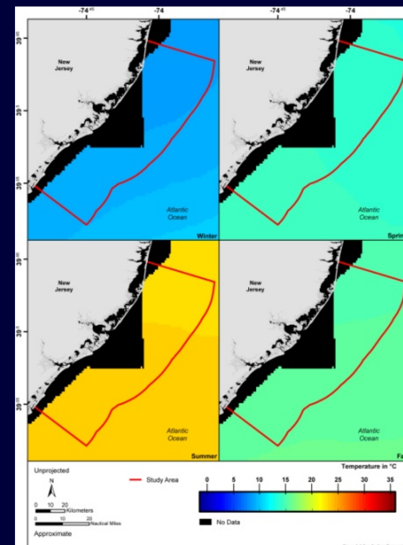
Bathymetry



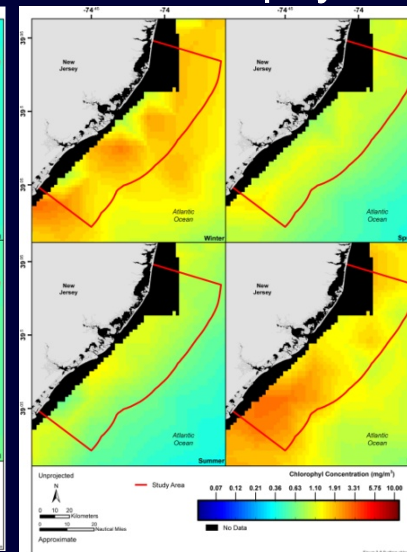
Sediment

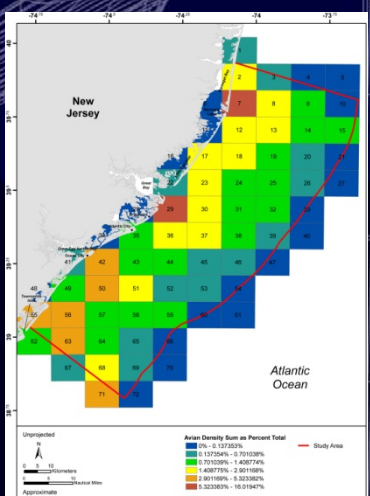


Sea Temperature



Ocean Color Chlorophyll-a

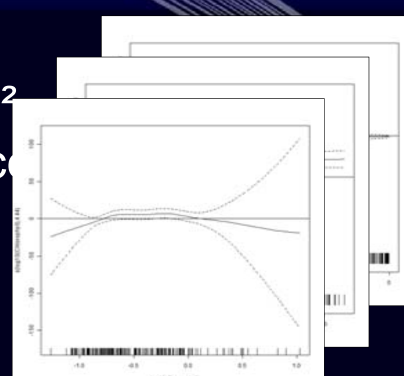




Multivariate statistical model (GAM's)

$$g(\mu) = \beta_0 + \beta_1 x_1 + \cdots + \beta_m x_m$$

Avian Density km²
Presence/Absence
Hotspot Maps
Species



Probability of occurrence predicted from environmental covariates

Avian Radar/TI-VPR

Dr. Sidney Gauthreaux, Jr. – Ornithology and Remote Sensing Techniques

Mobile Avian Radar System (MARS®)

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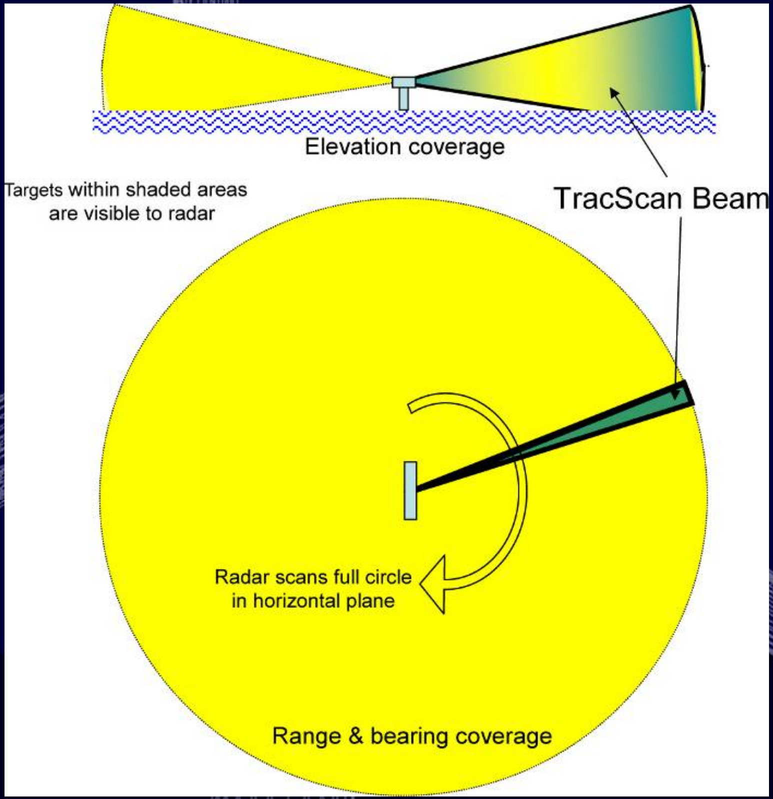
Mobile Avian Radar System (MARS®)

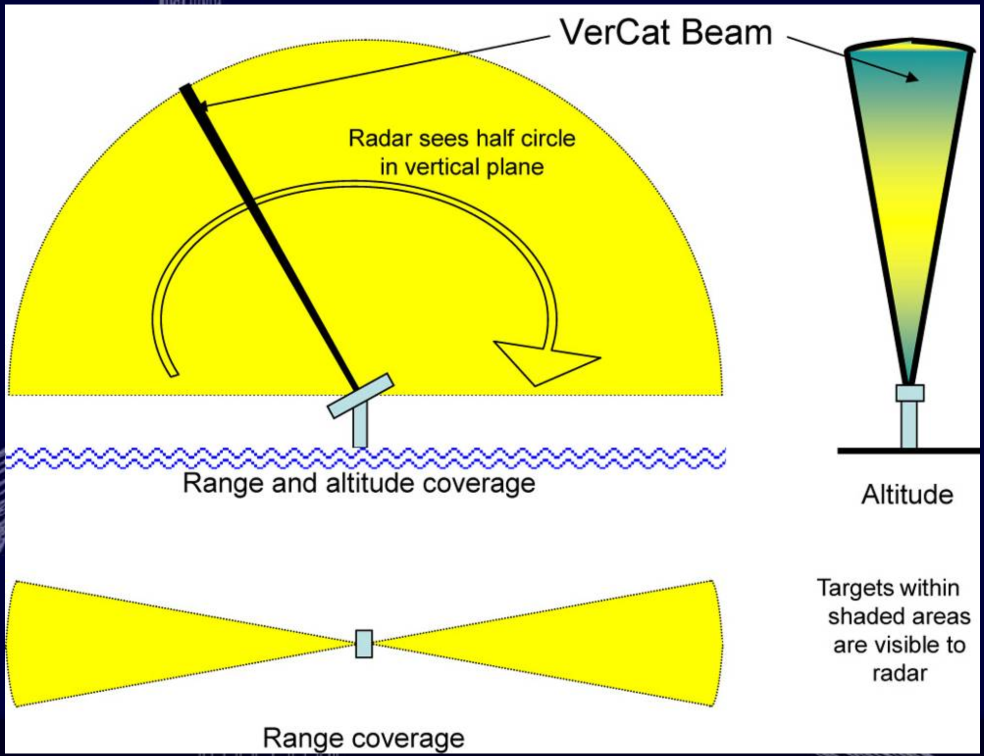


TracScan® Coverage Pattern

(Furuno FR-2165)
Wave-length: S-band, 10 cm
Peak Power: 60 kW
Transmit Frequency: 3040 MHz
Pulse Length: 80 ns
Pulse Repetition Frequency: 1900 Hz
Horizontal Beam Width: 2.2°
Vertical Beam Width: 25°
Maximum Study Range: 4 NM (7.4 km)
Polarization: Horizontal

Determines range, flight direction, speed, and heading of targets

Mobile Avian Radar System (MARS®)



VerCat® Coverage Pattern

(Furuno FR-2155)
Wave Length: X-band, 3 cm
Peak Power: 50 kW
Transmit Frequency: 9415 MHz
Transmit Pulse Length: 80 ns
PRF: 2200 Hz
Beamwidth: 20° x 0.95°
Maximum Study Range: 1.5 NM downrange (2.8 km) both directions; 3.0 NM (18,200 ft) altitude
Antenna Polarization: Vertical

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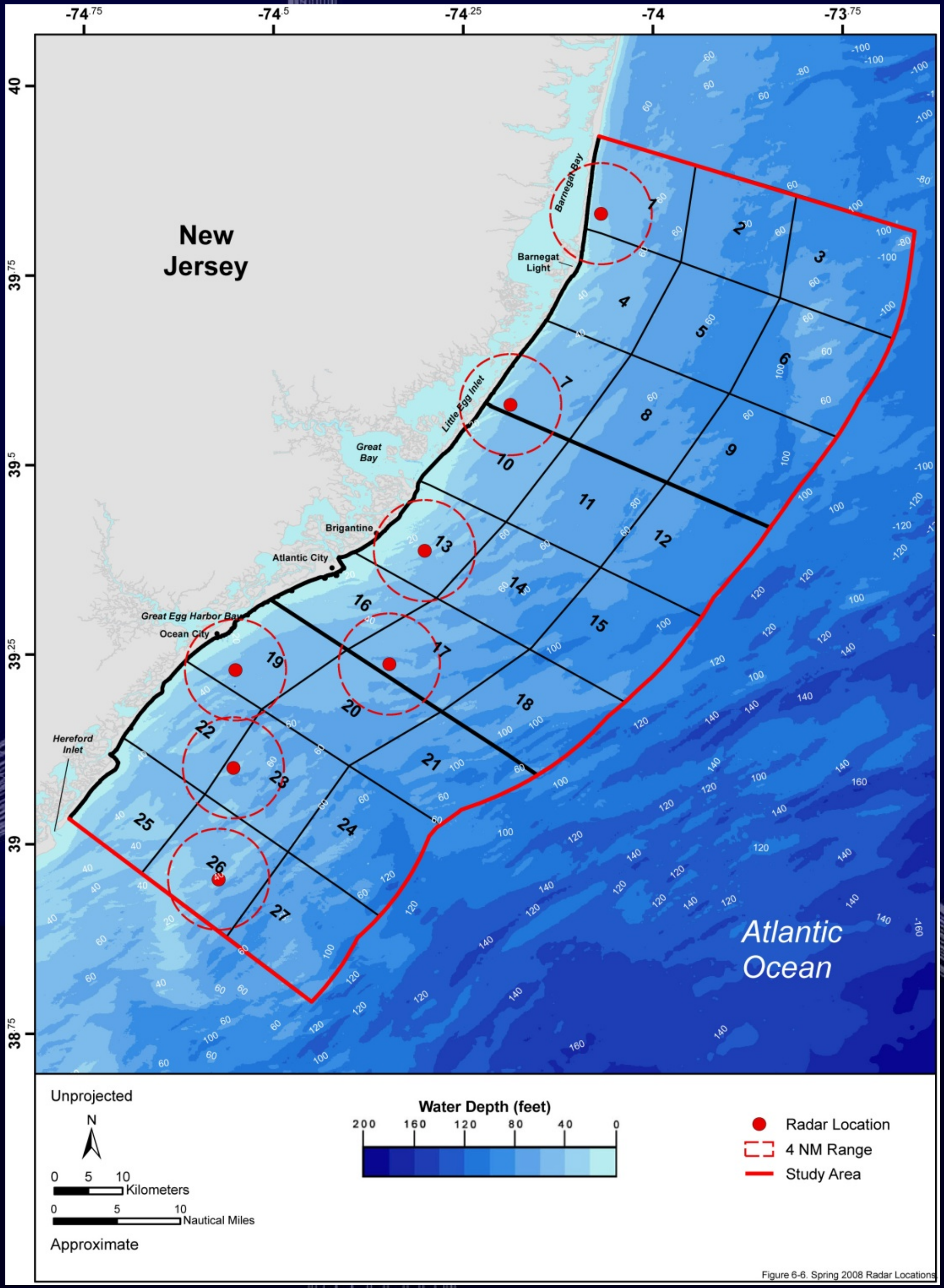


Locations of offshore radar in the New Jersey Study Area during Spring (March through May) 2008.

Grid 1: 14-21 March 2008

Grid 7: 22-27 March 2008

Grad 13: 3-13 April 2008

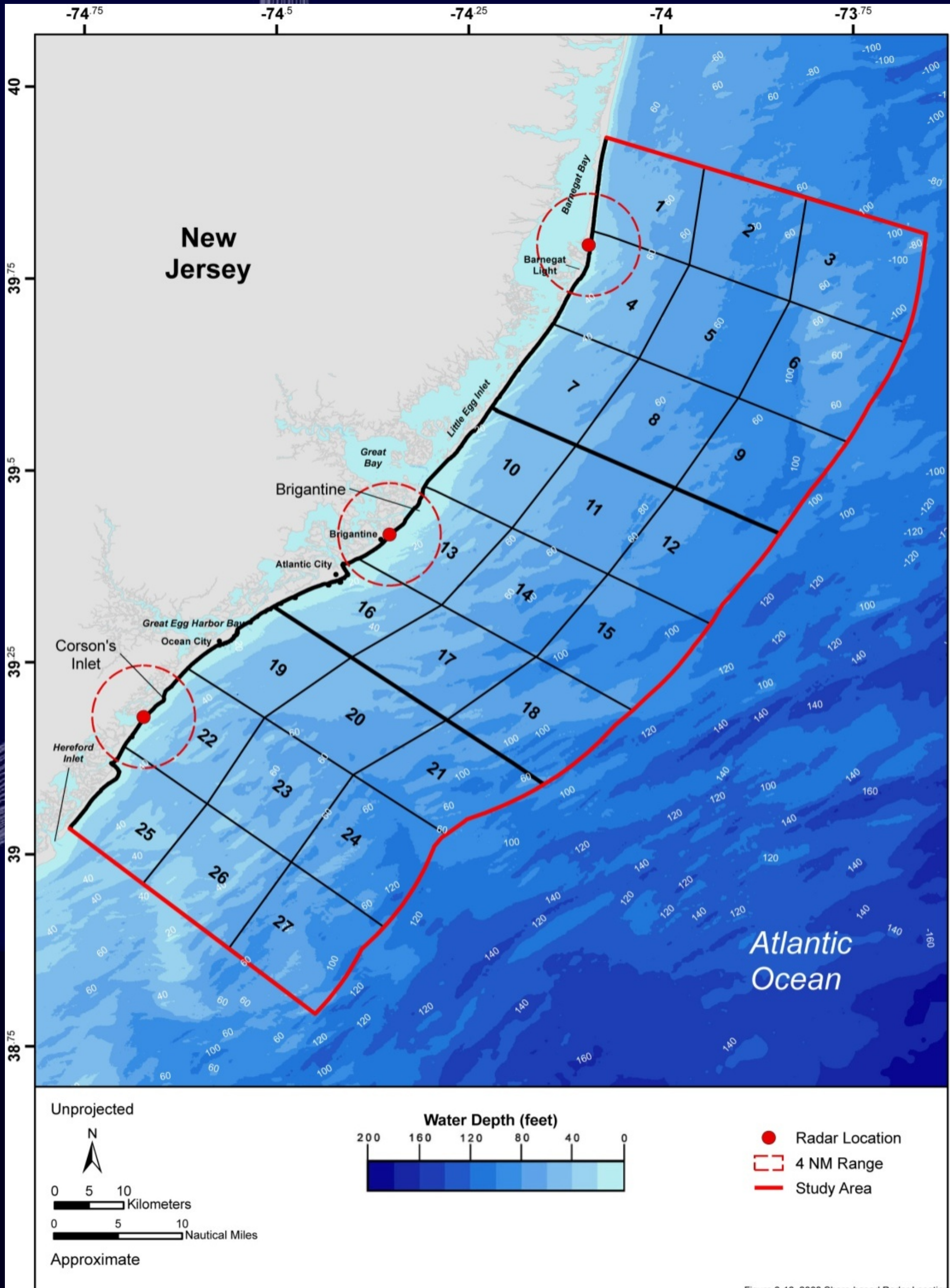
Grid 19: 13-19 April 2008

Grid 26: 24-30 April 2008

Grid 23: 30 April- 7 May 2008

Grid 17: 7-11 May 2008

GMI



Locations of onshore radar in the New Jersey Study Area during Spring (March through May) 2008.

Site 1: Island Beach State Park
15-23 May 2008

Site 2: North Brigantine Beach
29 May-8 June 2008

Site 3: Corson's Inlet
9-19 June 2008


CAUTION
CUIDADO

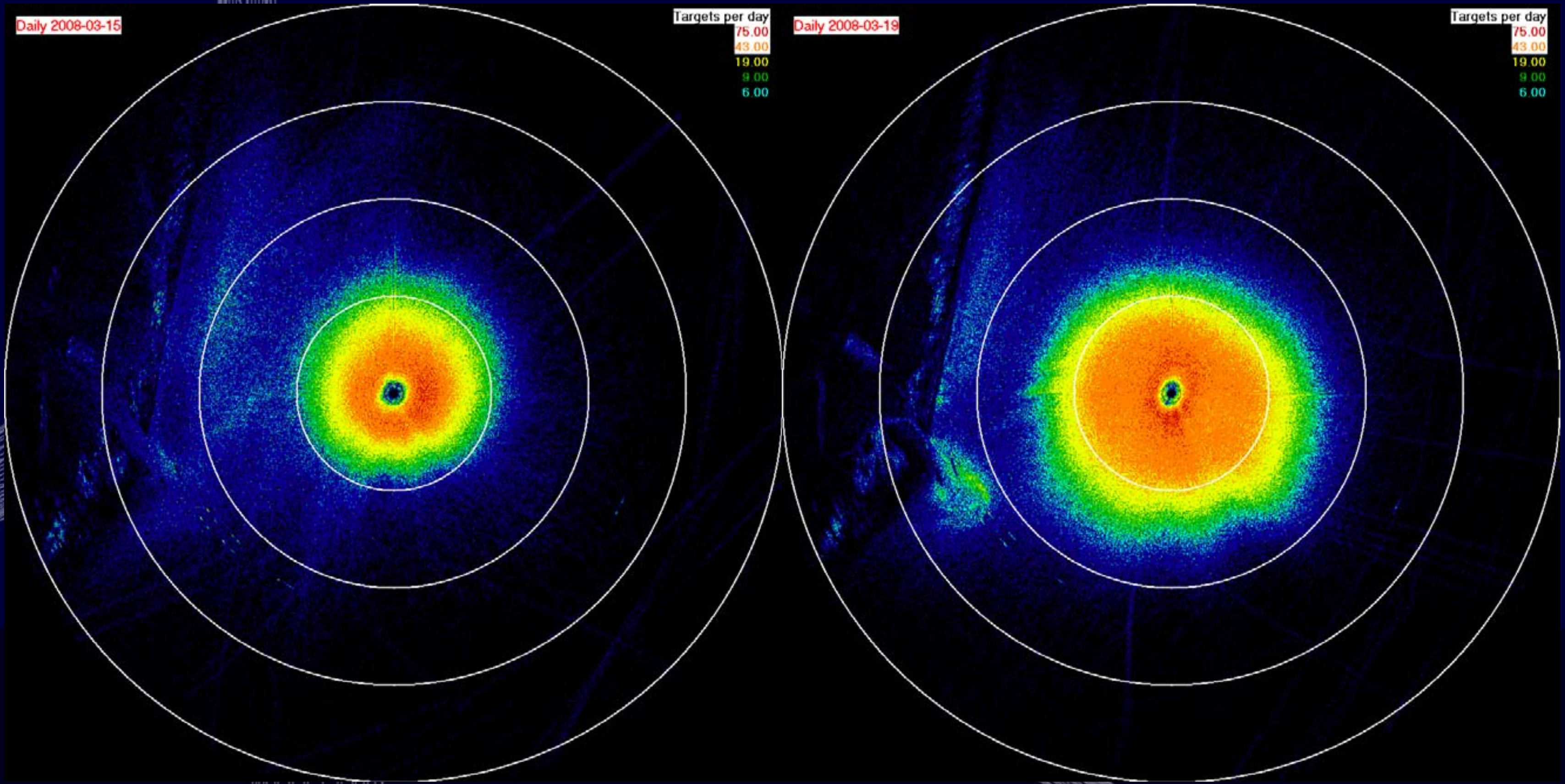
TracScan® Radar Data Processing

European radar studies of local and migratory bird movements in offshore areas selected for wind development projects have noted that rain and waves affect marine radar performance when the radar is operated in the conventional horizontal scan mode (Tulp et al. 1999, Christensen et al. 2004).

One study of bird movements and collision risks at the offshore wind farms Horns Rev, North Sea, and Nysted, Baltic Sea, in Denmark, have been conducted only when the sea is relatively calm with winds less than 2 m/sec or 4 knots (Blew et al. 2006).

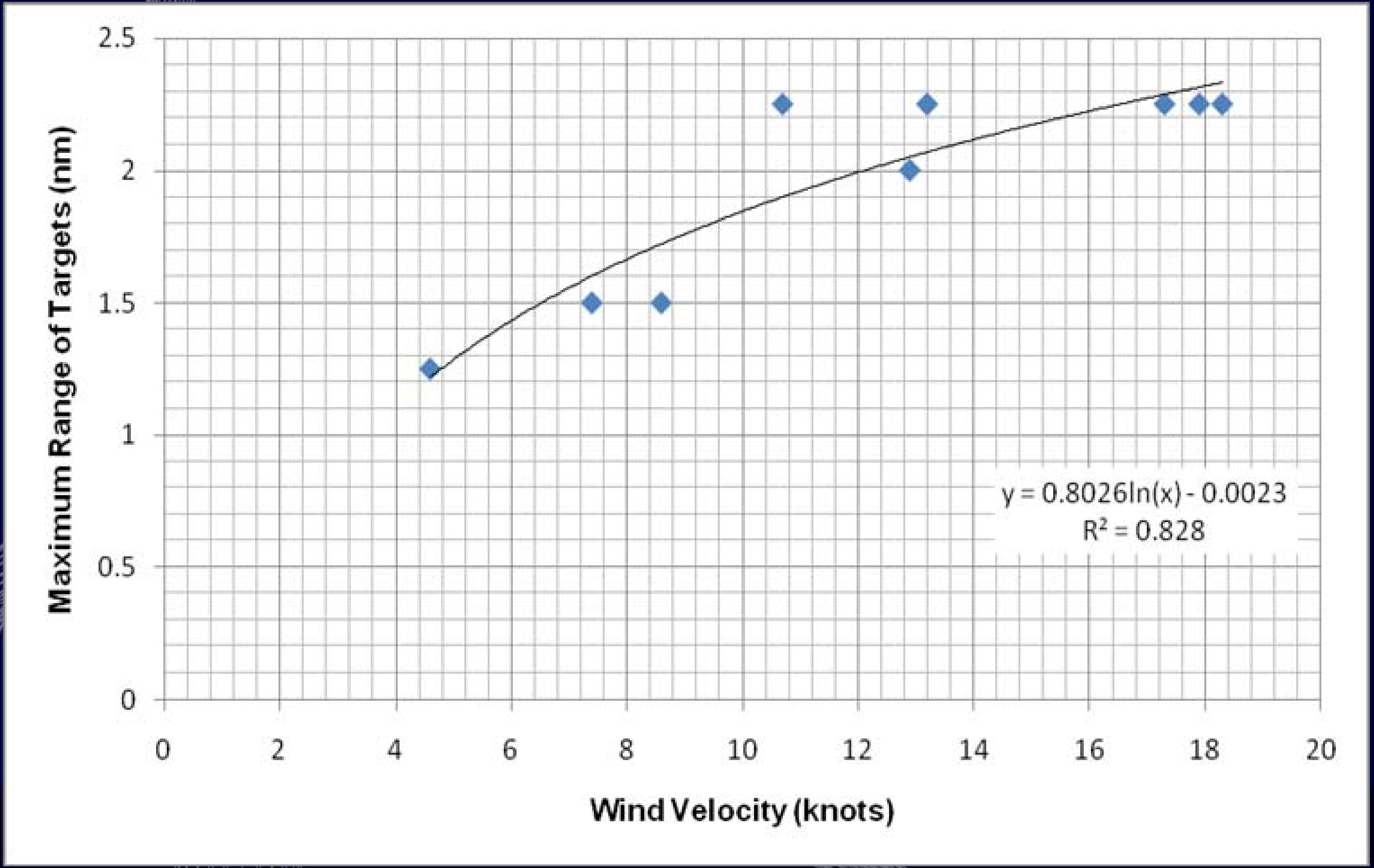
Marine radar has a sea clutter filter but use of this filter decreases the detection of all targets close to the radar—both sea clutter and birds.

TracScan® Targets per Day



15 March 2008

19 March 2008

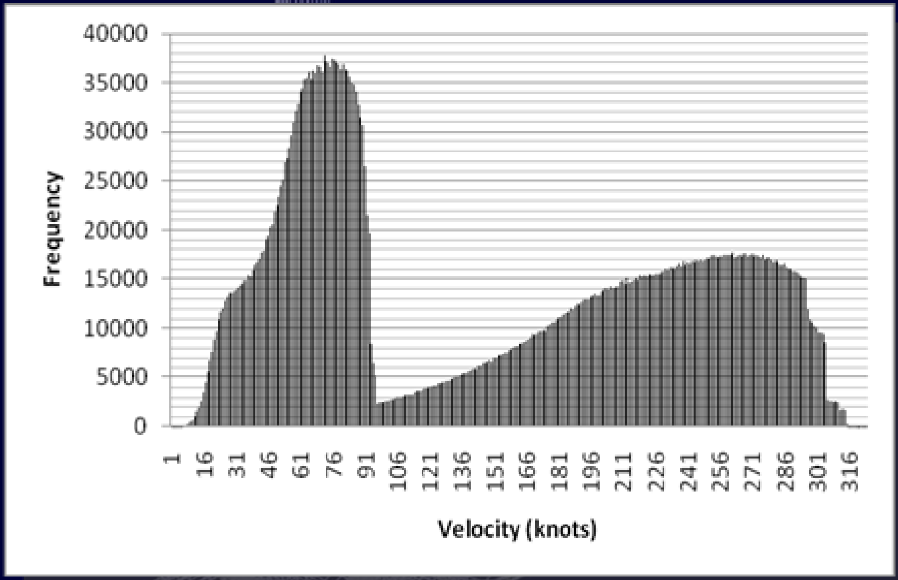


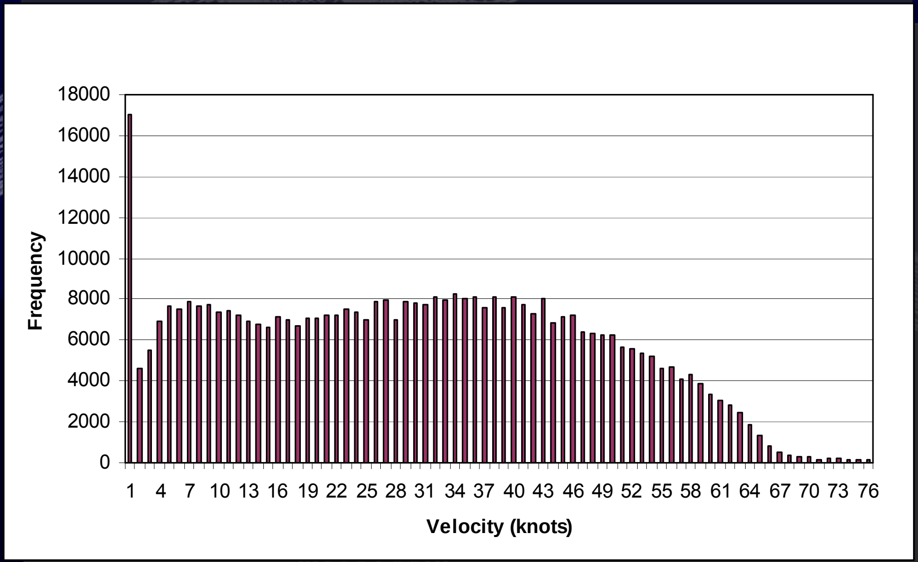
Relationship between mean wind velocity and maximum range of targets (sea clutter) in TracScan®

At least one European offshore radar study has reported results from a horizontally scanning marine radar (S-band, 30 kW, 25° beam width, 6-NM range) with digital processing similar to MARS® TracScan® (Kreijgsveld et al. 2005).

The authors noted that sea clutter produced 85% of the tracks (false tracks) and cautioned readers that even after the application of a clutter removing procedure, the data still contained an unknown number of false tracks within the ranges affected by sea clutter.

Mark Desholm (AWEA offshore teleconference, 4 Feb 2009) confirmed sea clutter is still a problem in offshore radar studies of bird movements.





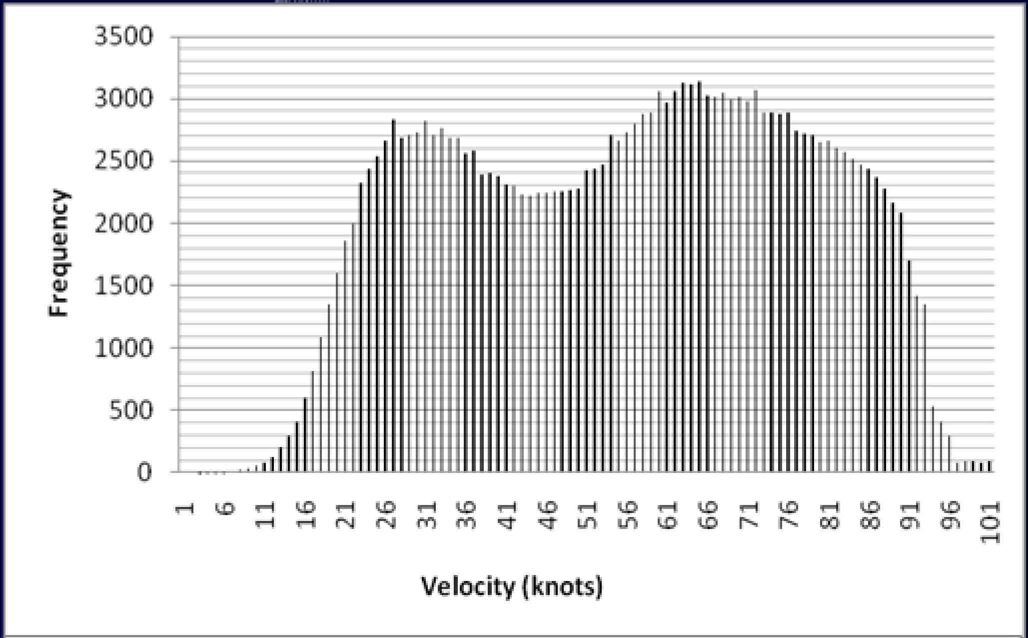
Histogram of total ground speeds between detections for 15 March 2008

MARS® TracScan® also produces false detections and tracks when sea clutter is present. The false detections are particularly evident when the velocity measured between two detections is plotted in a histogram.

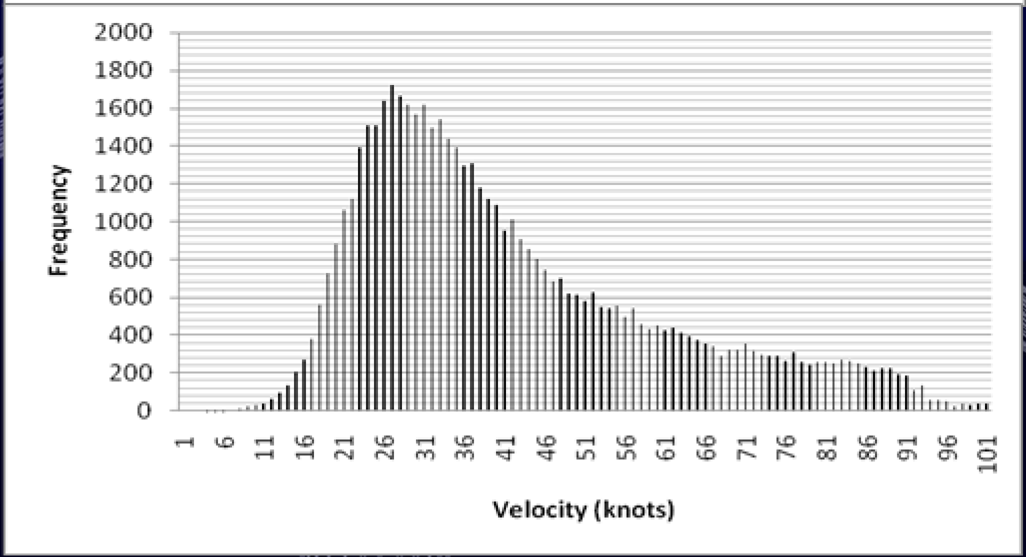
We do not know exactly how the plotting algorithms produce these false detections, but we suspect that sea clutter is responsible, because the histograms of velocity measured between detections with MARS® VerCat® do not contain the abnormally fast velocities

To enhance Quality Assurance/Quality Control we developed filtering rules to eliminate false detections and tracks from sea clutter. The filtering rules are similar to those used by Kreijgsveld et al. (2005).

1. Eliminated tracks with distances greater than 0.06 NM between successive detections (i.e., tracks with velocities above 100 kts)
2. All tracks with gaps in detections were treated as separate tracks to avoid treating two unrelated tracks as one and generating false tracks.
3. Selected only tracks with nine or more continuous detections (number of echoes per track).
4. Only used tracks beyond the sea clutter range (tracks equal to or greater than 1.5 NM. If a portion of a track occurred at 1.5 NM the entire track was included in the analysis.

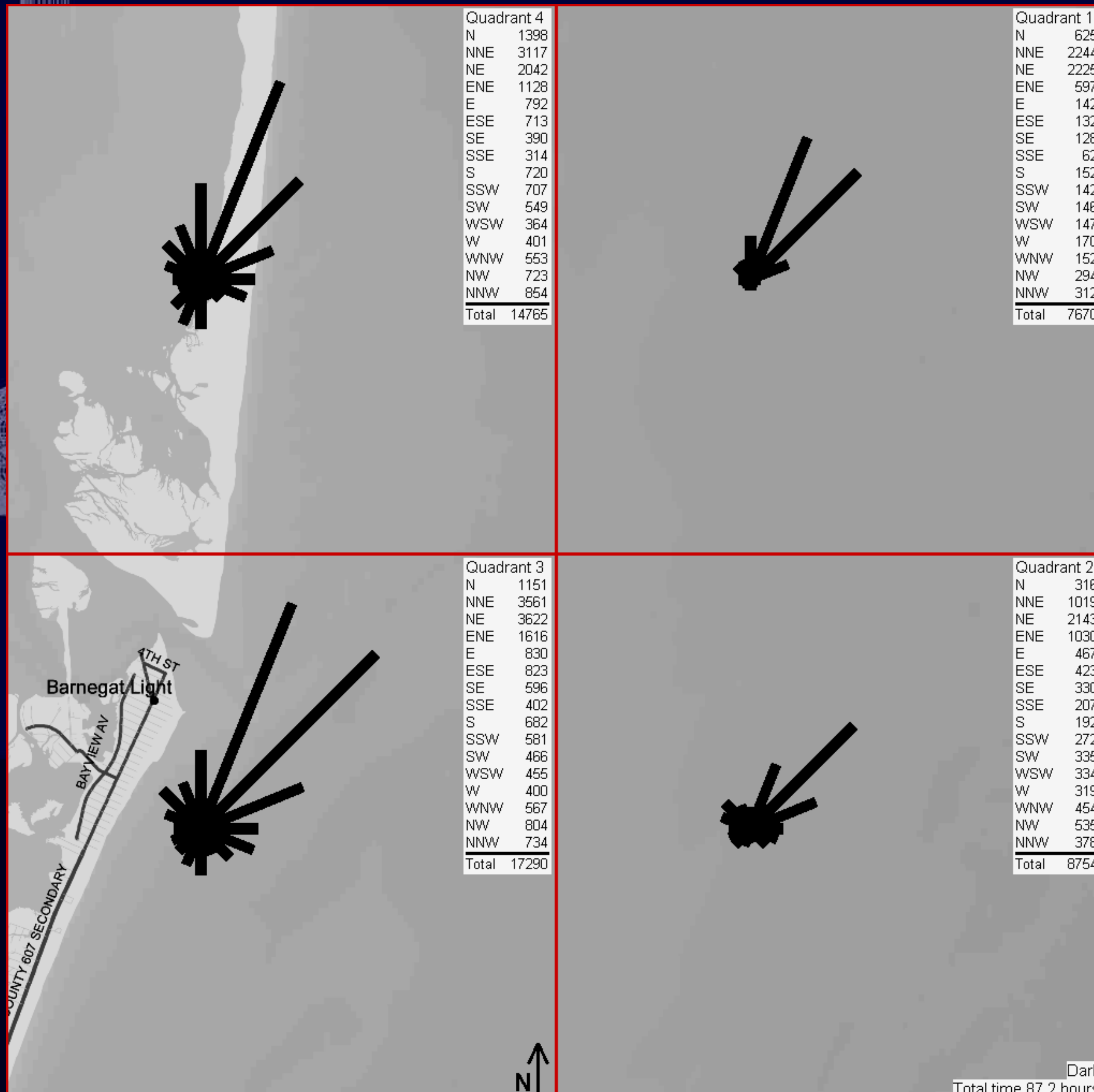


Histogram of total ground speeds between detections for 15 March 2008 after eliminating tracks that did not have nine continuous detections in a track for MARS® TracScan®.

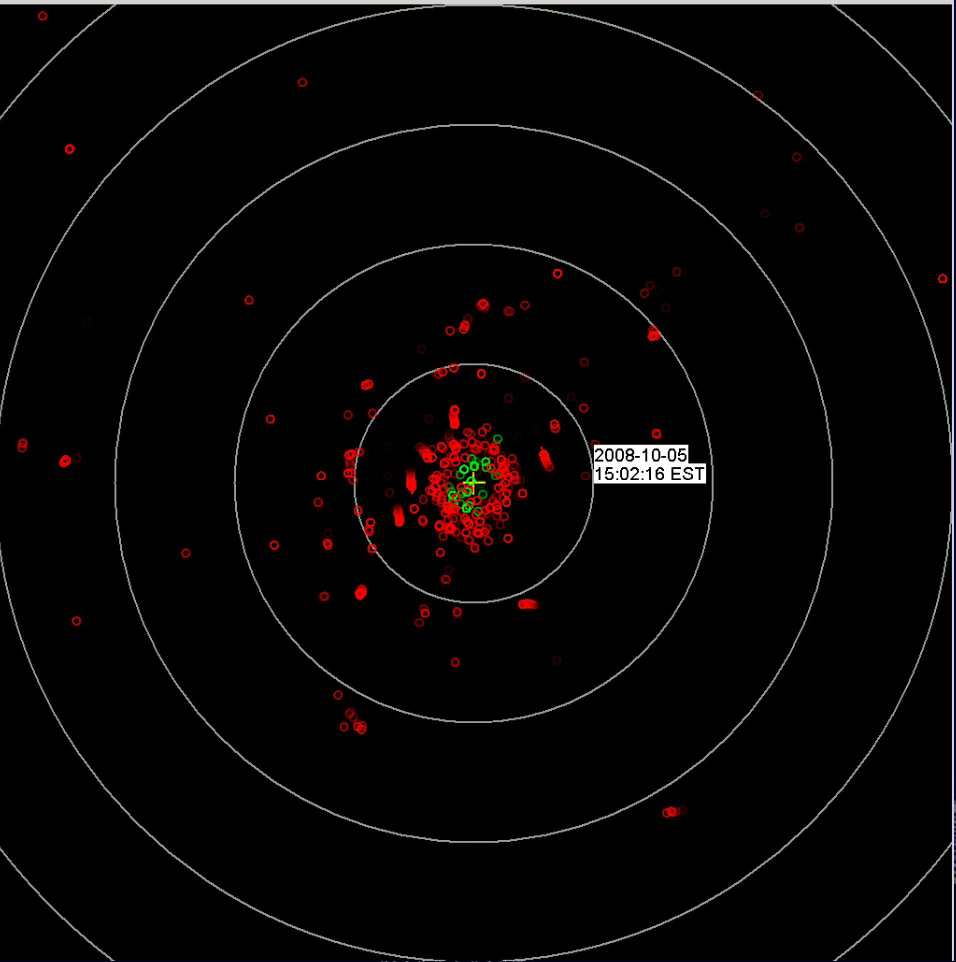


Histogram of total ground speeds between detections for 15 March 2008 after eliminating tracks within 1.5 nautical miles of the radar for MARS® TracScan®.

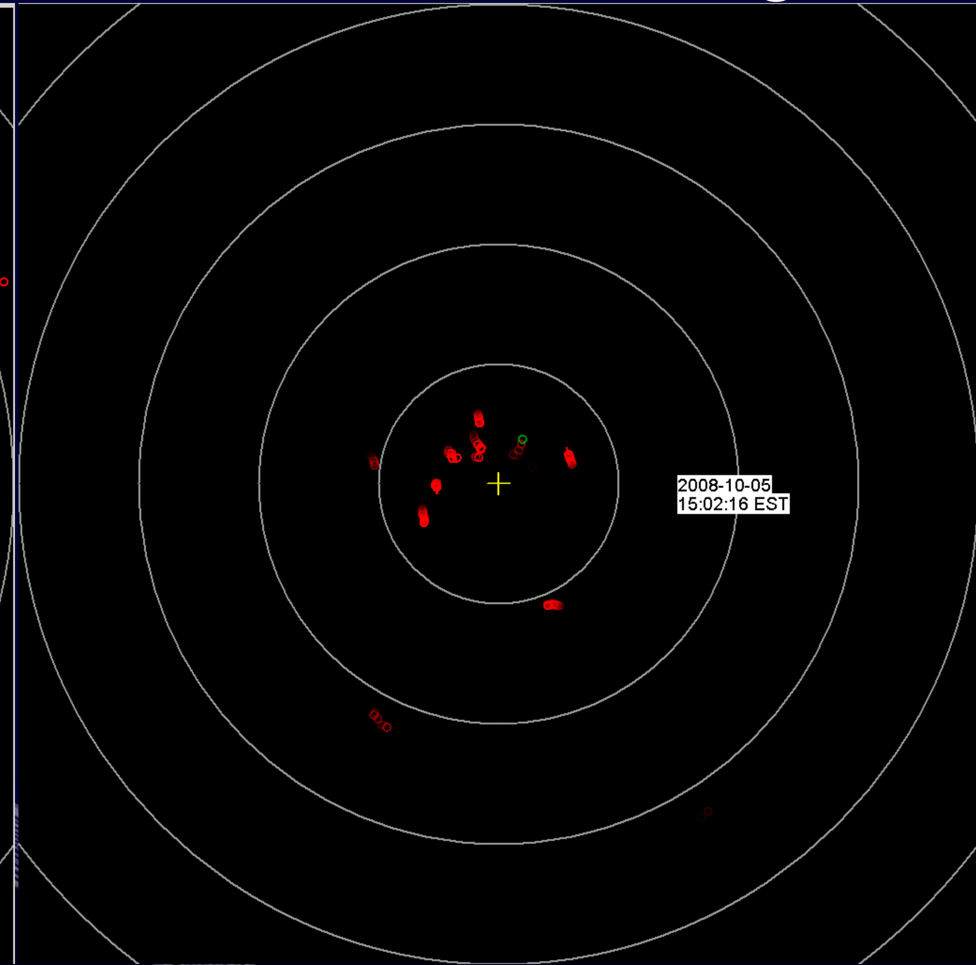
Directional plots from TracScan data in Quadrants



TracScan® Radar Data Processing



Before filtering rules applied



After filtering rules applied

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VerCat® Radar Data Processing

Sea clutter is not a serious contamination problem in the VerCat® data, because the radar does not transmit below the horizontal.

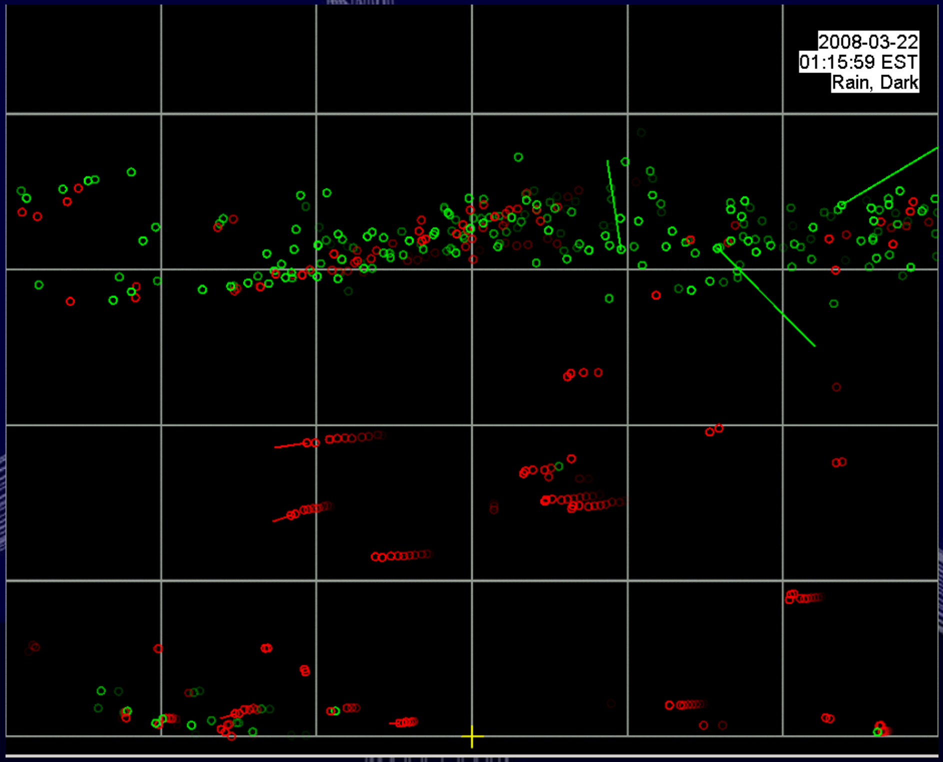
Precipitation (i.e., rain, sleet, snow) and virga (precipitation that falls from a cloud but evaporates before reaching the ground) generate detections (echoes) that may produce false tracks when algorithms process the data. When this occurs VerCat® counts are inflated and the median altitude distribution is increased.

To avoid the problems, for the Interim Technical Report we eliminated from analysis time periods containing precipitation and virga.

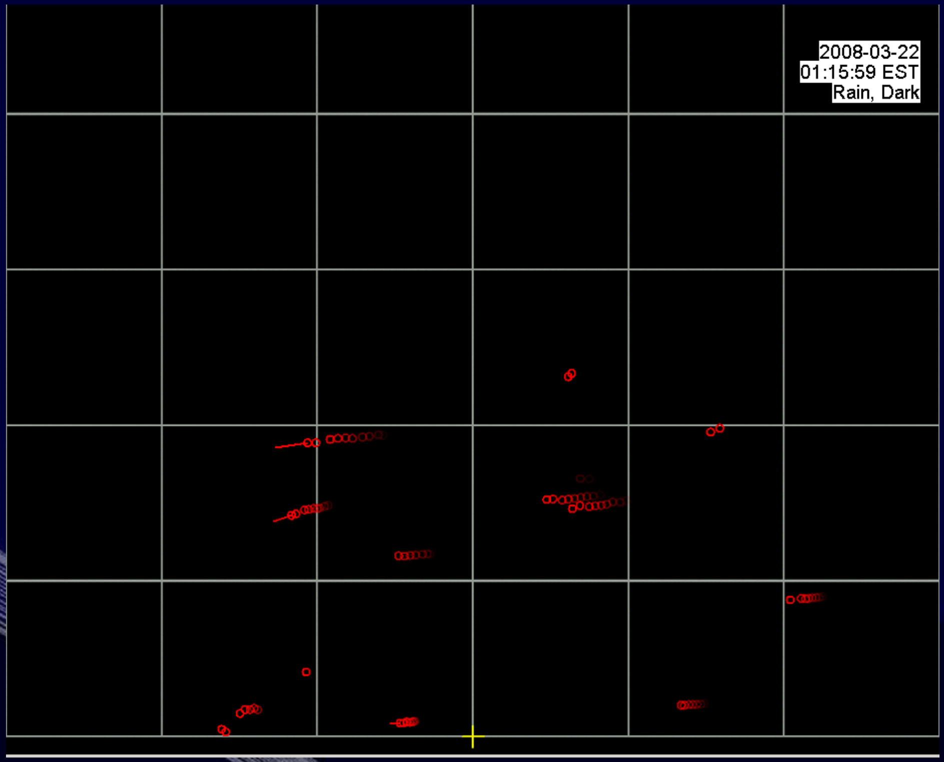
Since receiving comments from reviewers we have developed a rain clutter filter that greatly reduces false tracts and allows us to use data with precipitation and virga.

VerCat® Radar Data Processing

Virga Conditions



No Rain Filtering

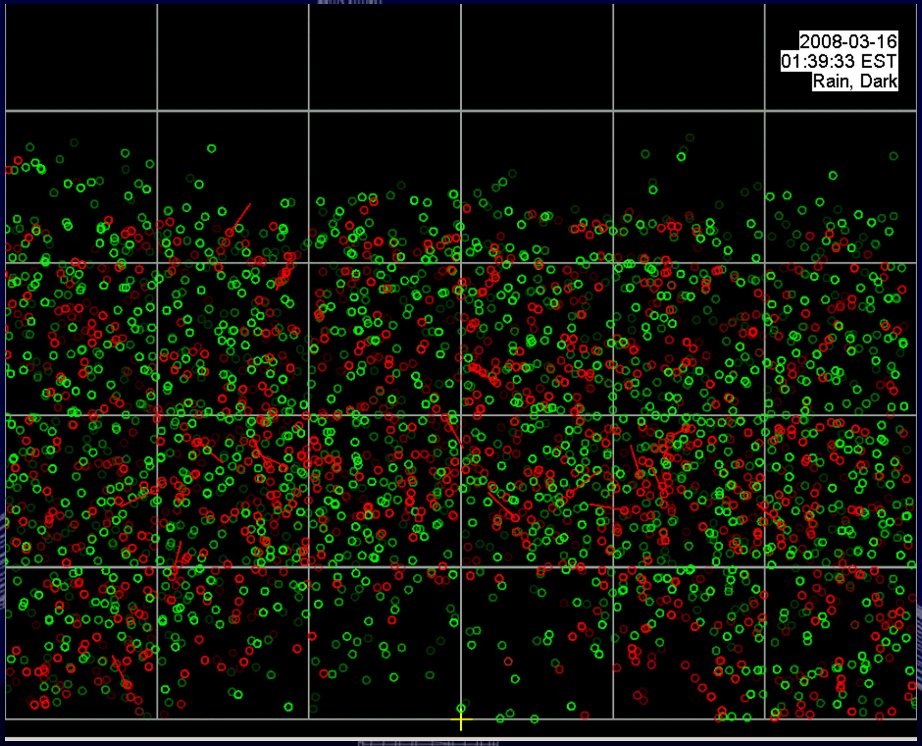


With Rain Filtering

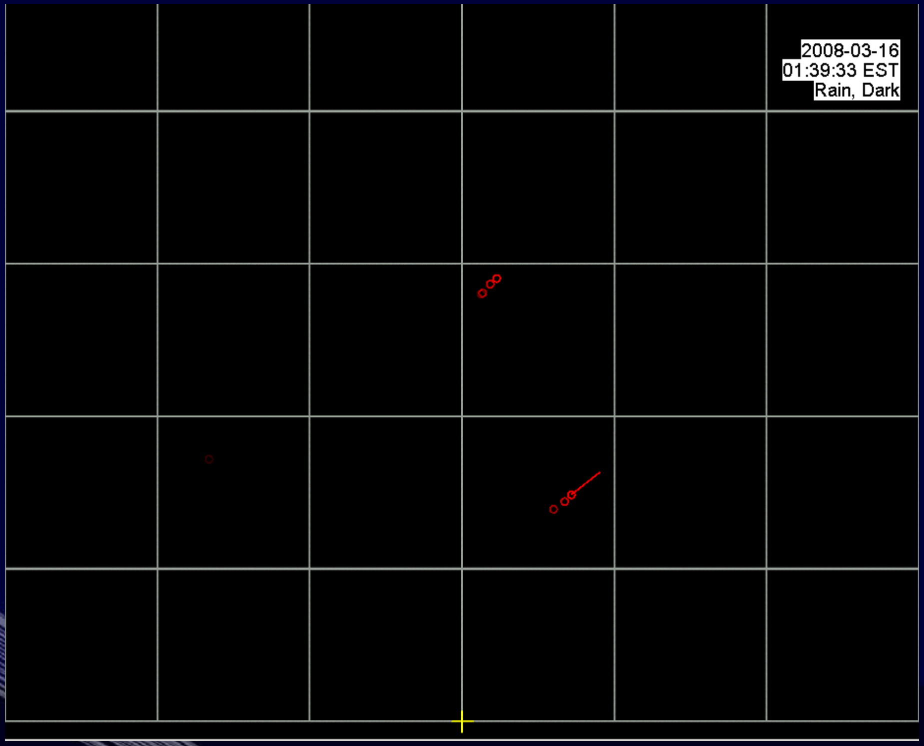
GMI

VerCat® Radar Data Processing

Rain Conditions



No Rain Filtering

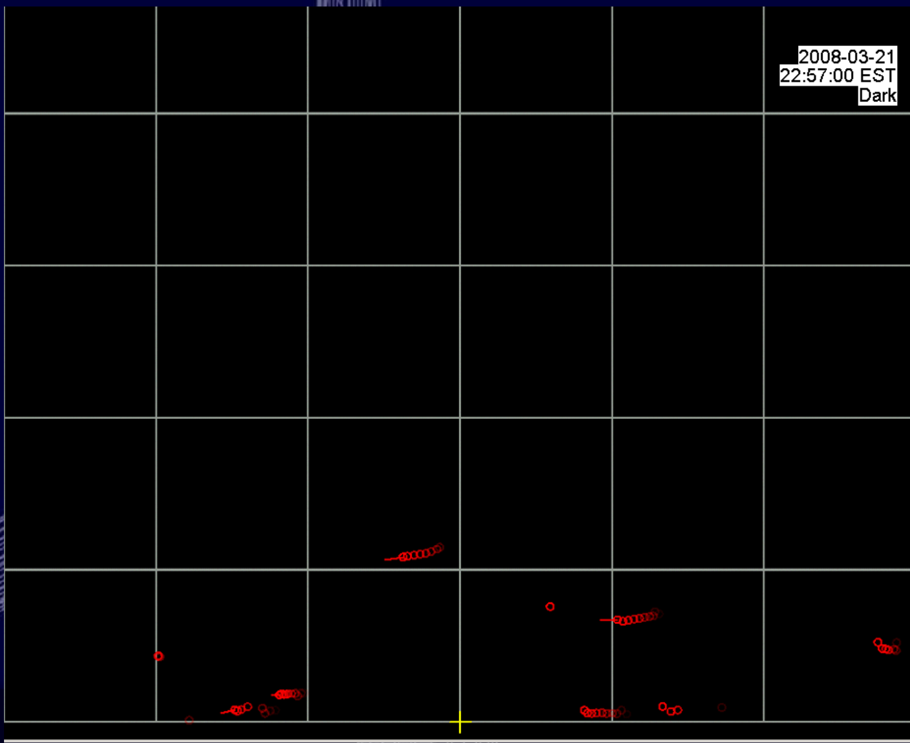


With Rain Filtering

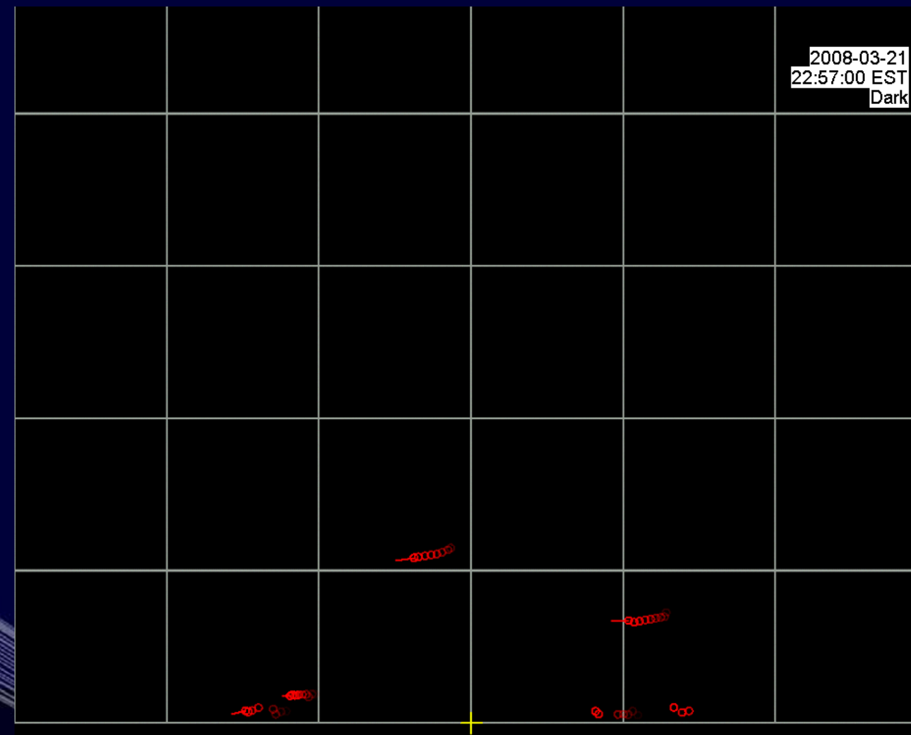
GMI

VerCat® Radar Data Processing

Clear Conditions

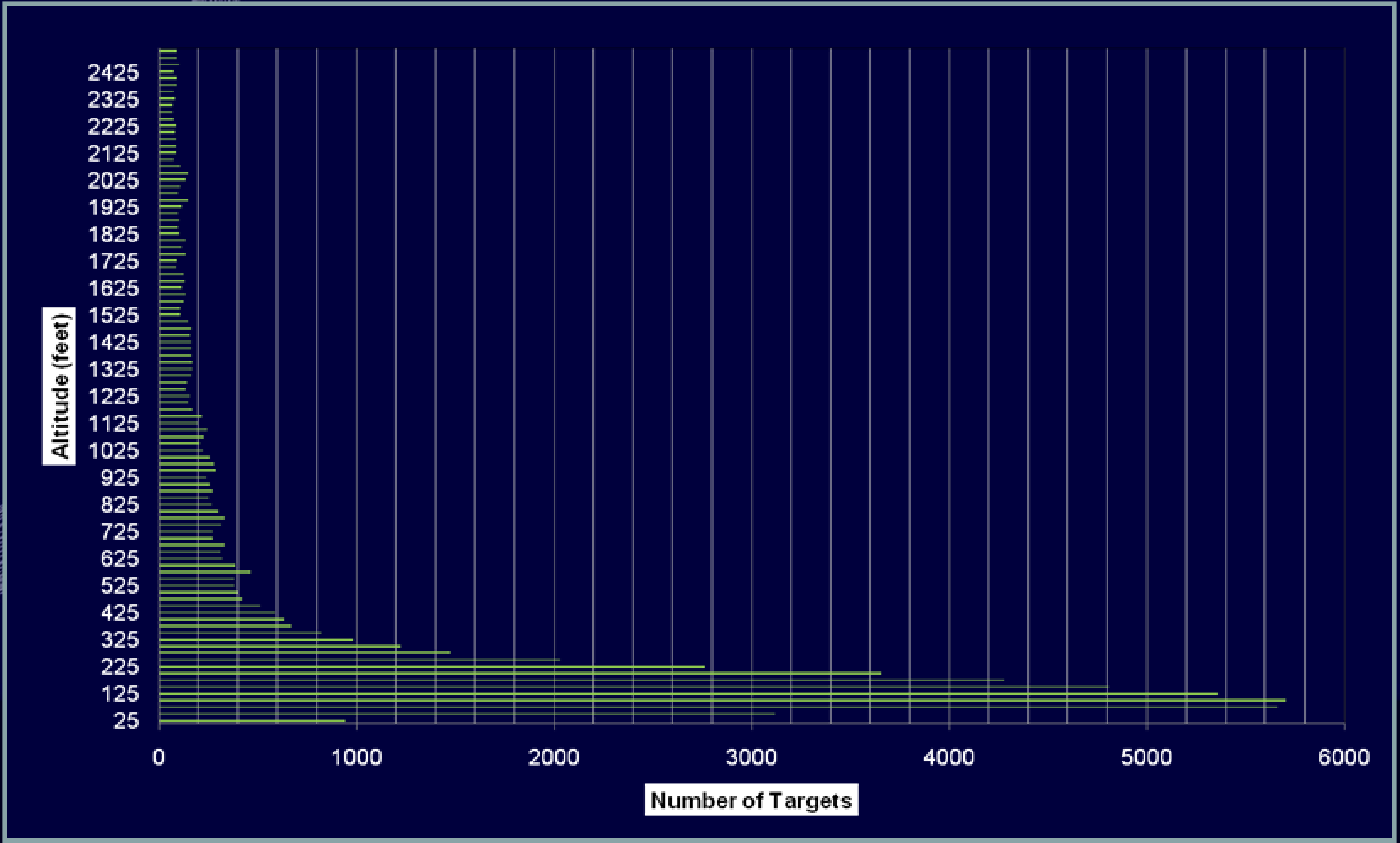


No Rain Filtering

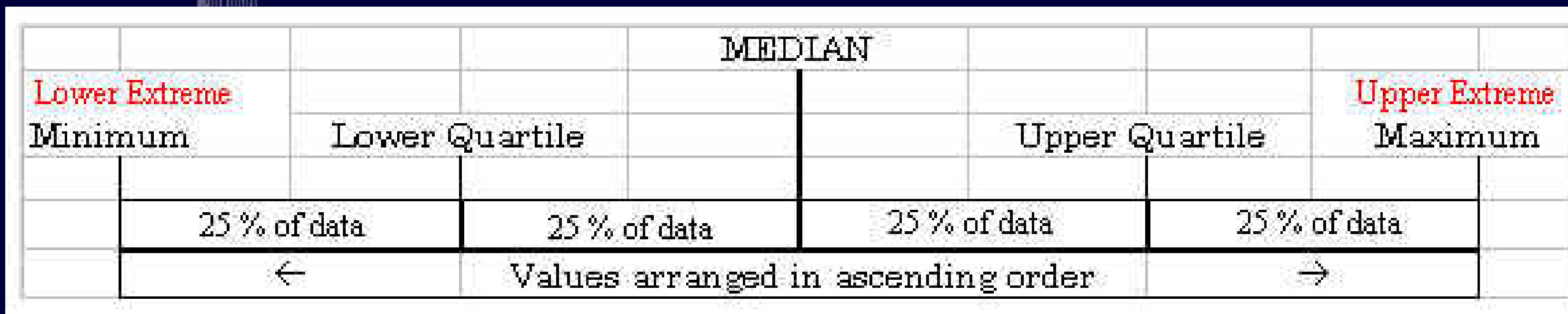


With Rain Filtering

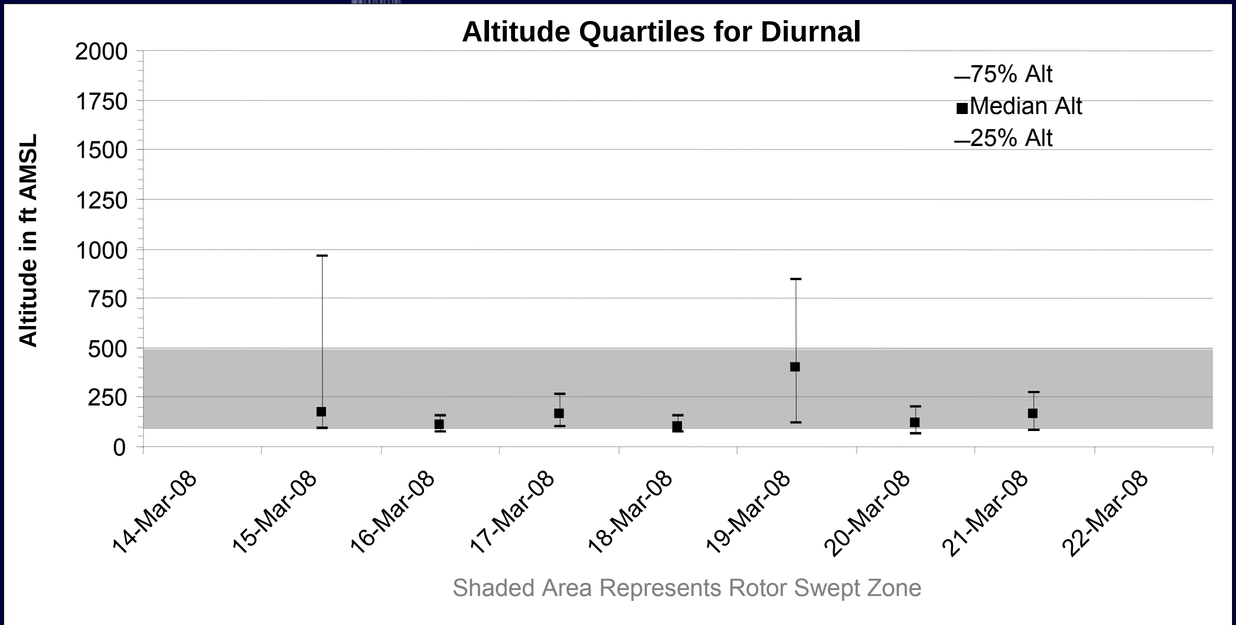
VerCat® Radar Data Processing



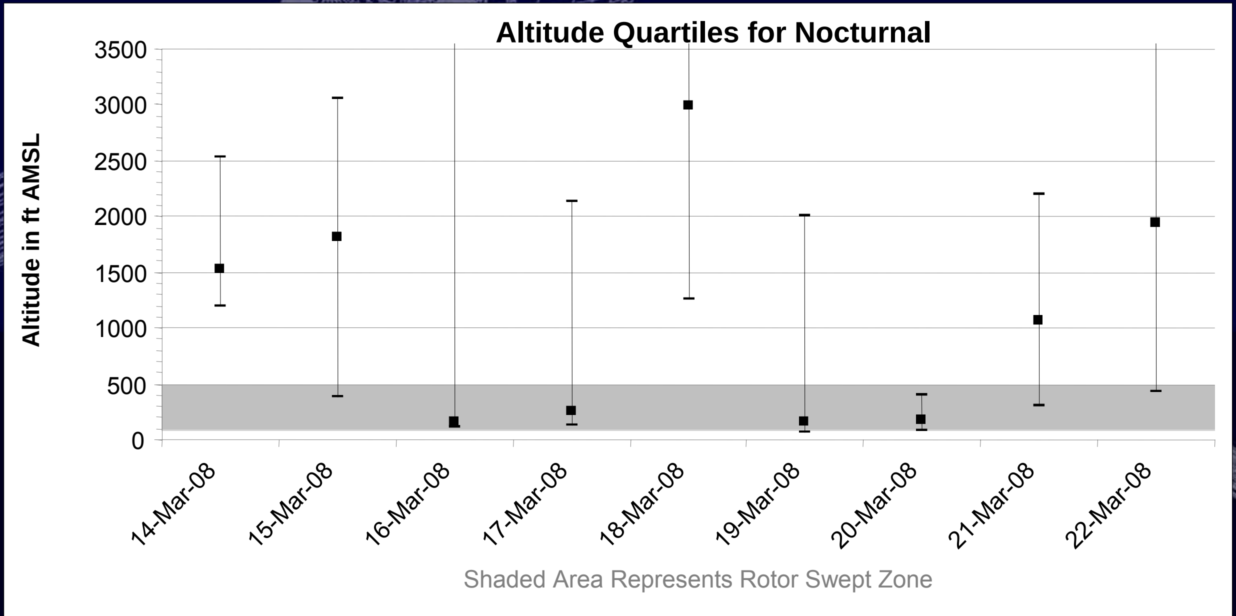
Altitude Histogram: 14-22 March 2008 (Grid 1) limited to 2500 feet maximum



MEDIAN
Lower Extreme
Minimum
Lower Quartile
Upper Quartile
Upper Extreme
Maximum
25 % of data
25 % of data
25 % of data
25 % of data
←
Values arranged in ascending order
→



Grid A1 diurnal (clear weather) altitude quartiles, 14 to 22 March 2008



Grid A1 nocturnal (clear weather) altitude quartiles, 14 to 22 March 2008.

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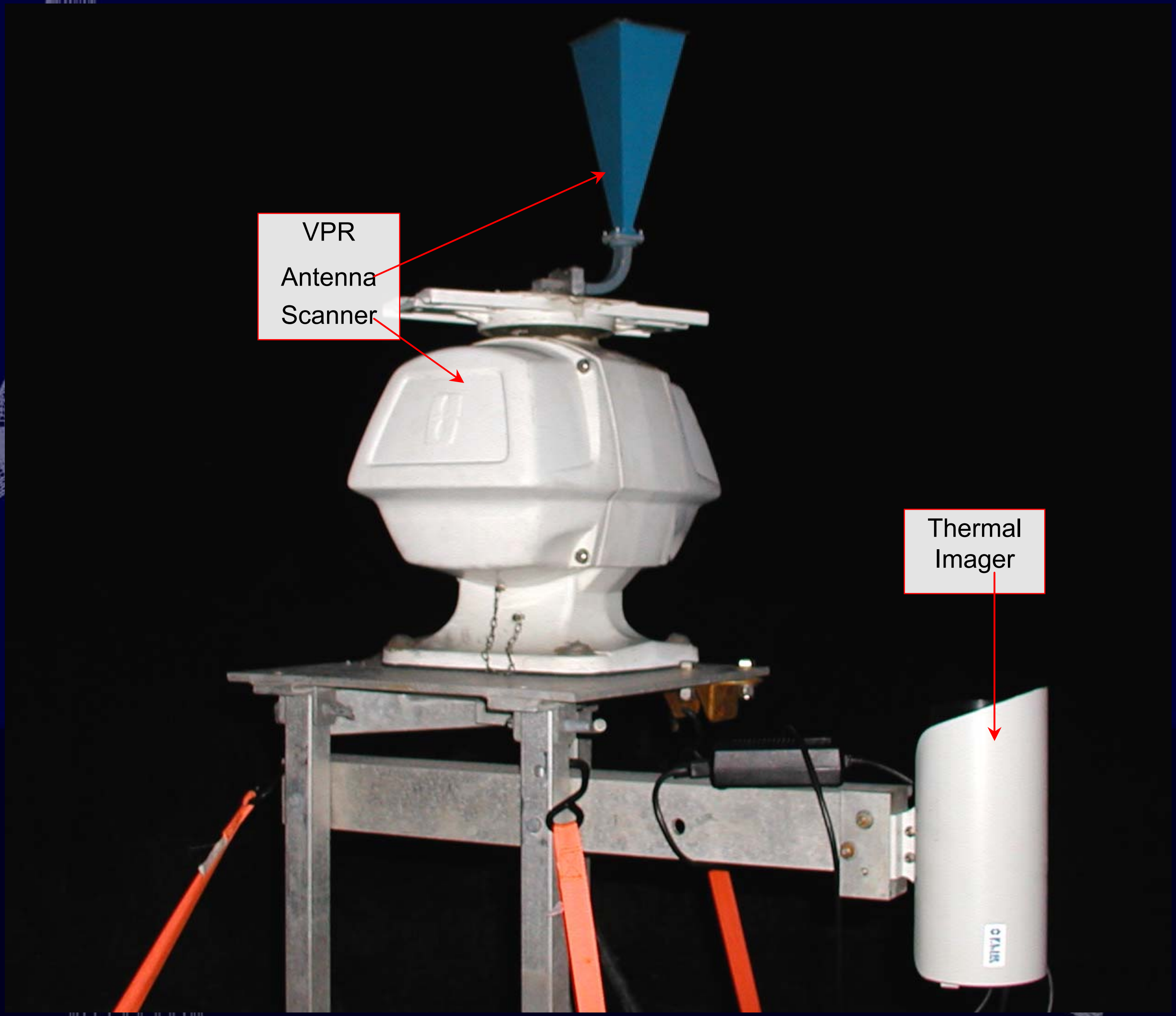
Table 6-3. Grid A1, cumulative diurnal and nocturnal (clear weather) target counts, 14 to 22 March 2008.

Altitude Band	Total Target Count	Percent Composition
Diurnal		
1-100 ft AMSL	2,717	40.05
101-500 ft AMSL	3,314	48.85
501+ ft AMSL	753	11.10
Subtotal	6,784	-
Nocturnal		
1-100 ft AMSL	637	19.90
101-500 ft AMSL	1,082	33.80
501+ ft AMSL	1,482	46.30
Subtotal	3,201	-
Total Dataset	9,985	-

MARS® TI/VPR



Thermal Imager time-exposure

Altitude of target on radar

Number of birds (raw and corrected) within 50-ft altitudinal bands for TI-VPR samples on the night of 11 May 2008

Altitudinal Band (ft)	Raw Count	Corrected Altitudinal Count
0-49	0	0
50-99	6	90
100-149	0	0
150-199	0	0
200-249	0	0
250-299	6	18
300-349	6	16
350-399	0	0
400-449	12	24
450-499	9	15
500-549	18	30
550-599	9	12
600-649	12	16
650-699	0	0
700-749	6	6
750-799	3	3
Total	87	230

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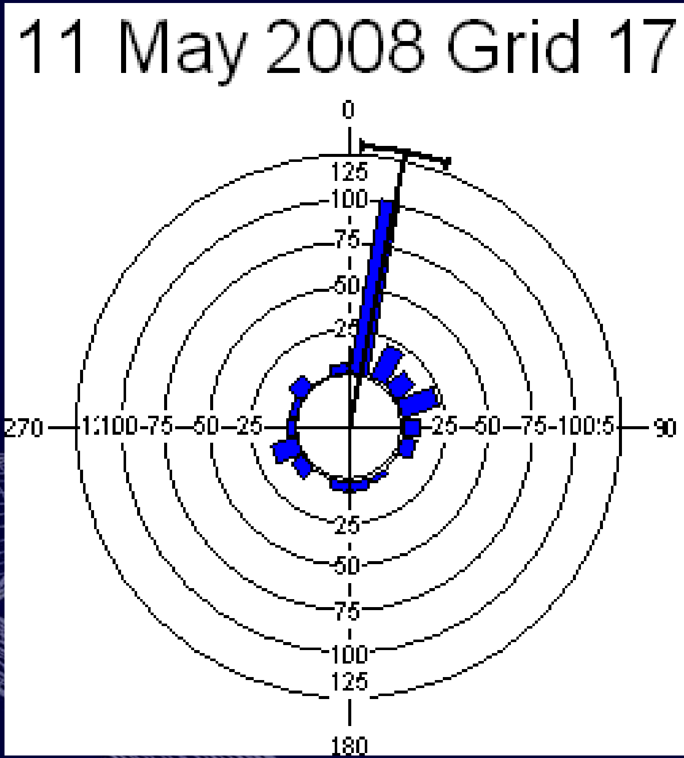
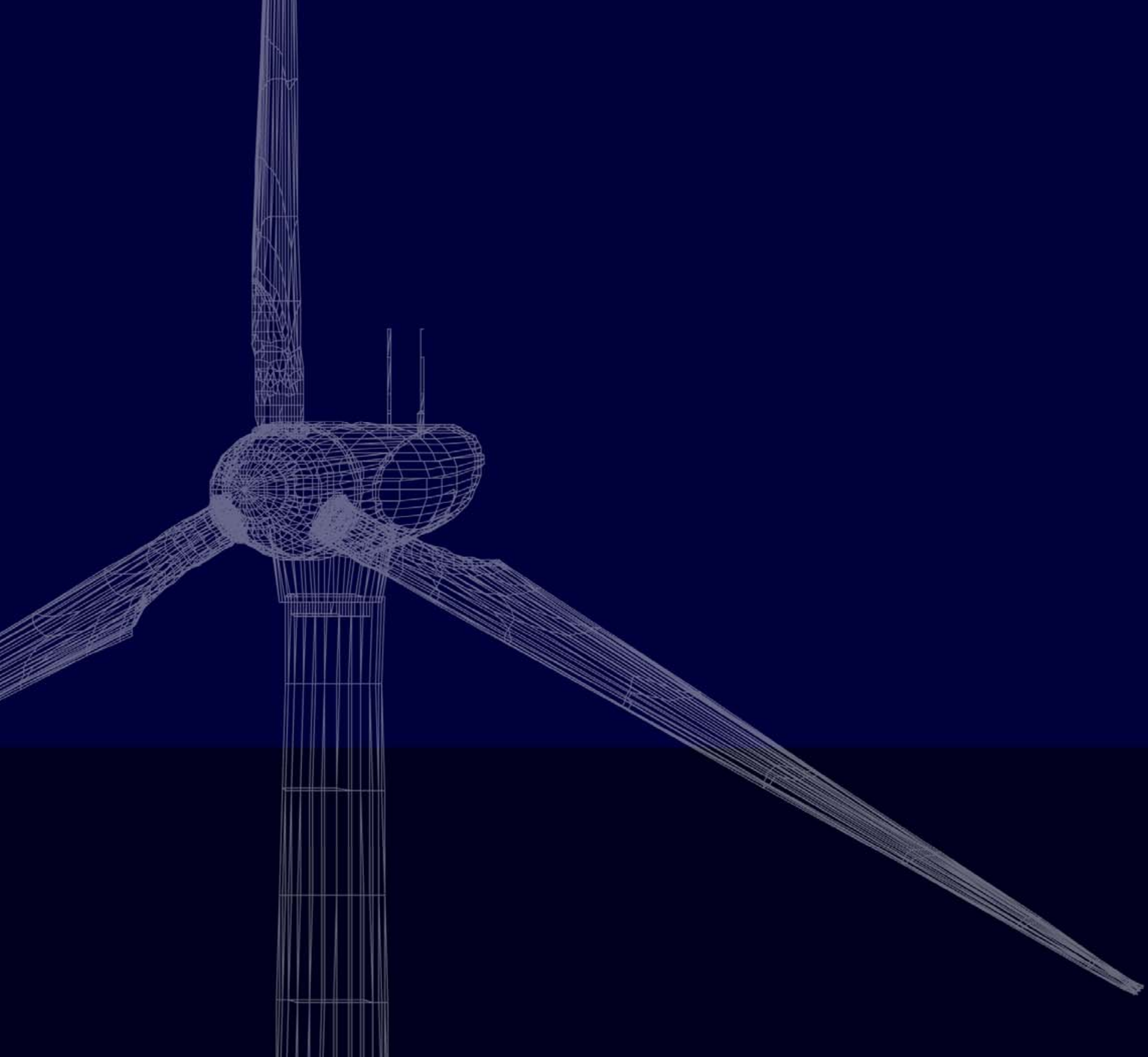


Circular diagram showing the direction of nocturnal bird movements through the TI/VPR field of view on 11 May 2008. The dark line is the mean angle and the arc at the end is the 95% confidence limits of the mean.



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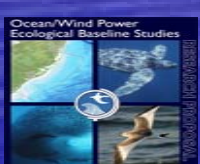
Ocean/Wind Power
Ecological Baseline Studies
NEW JERSEY DEPARTMENT OF ENVIRONMENTAL PROTECTION
DIVISION OF SCIENCE, RESEARCH, & TECHNOLOGY


Ocean/Wind Power
Ecological Baseline Studies

Ocean / Wind Power Ecological Baseline Studies

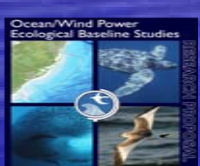
Interim Report

Interested Party Group Meeting
March 5, 2009

Gary A. Buchanan, Ph.D.
Bureau of Natural Resources Science
Division of Science, Research & Technology
NJDEP

Acknowledgments – Technical Review Committee

- Coastal Management – Kevin Hassell
- Fish & Wildlife – ENSP
  - Dave Golden, Ph.D.
  - Sharon Petzinger
  - Jeanette Bowers
- Marine Fisheries - Don Byrne
- Wildlife Management - Ted Nichols



Acknowledgements (cont) - TRC

- NJGS – Jane Uptegrove
- Permit Coordination – Ken Koschek
- Land Use Management – Mark Godfrey
- Science, Research & Technology
  - Joe Bilinski
  - Joel Pecchioli (SRP)
  - Gail Carter

Acknowledgements (cont) - TRC

- USFWS - Carlo Popolizio & Doug Forsell
- NOAA/NMFS
  - Gordon Waring, Ph.D.
  - Debra Palka, Ph.D.
  - Karen Greene
- Minerals Management Service - Will Waskes

Project Objectives

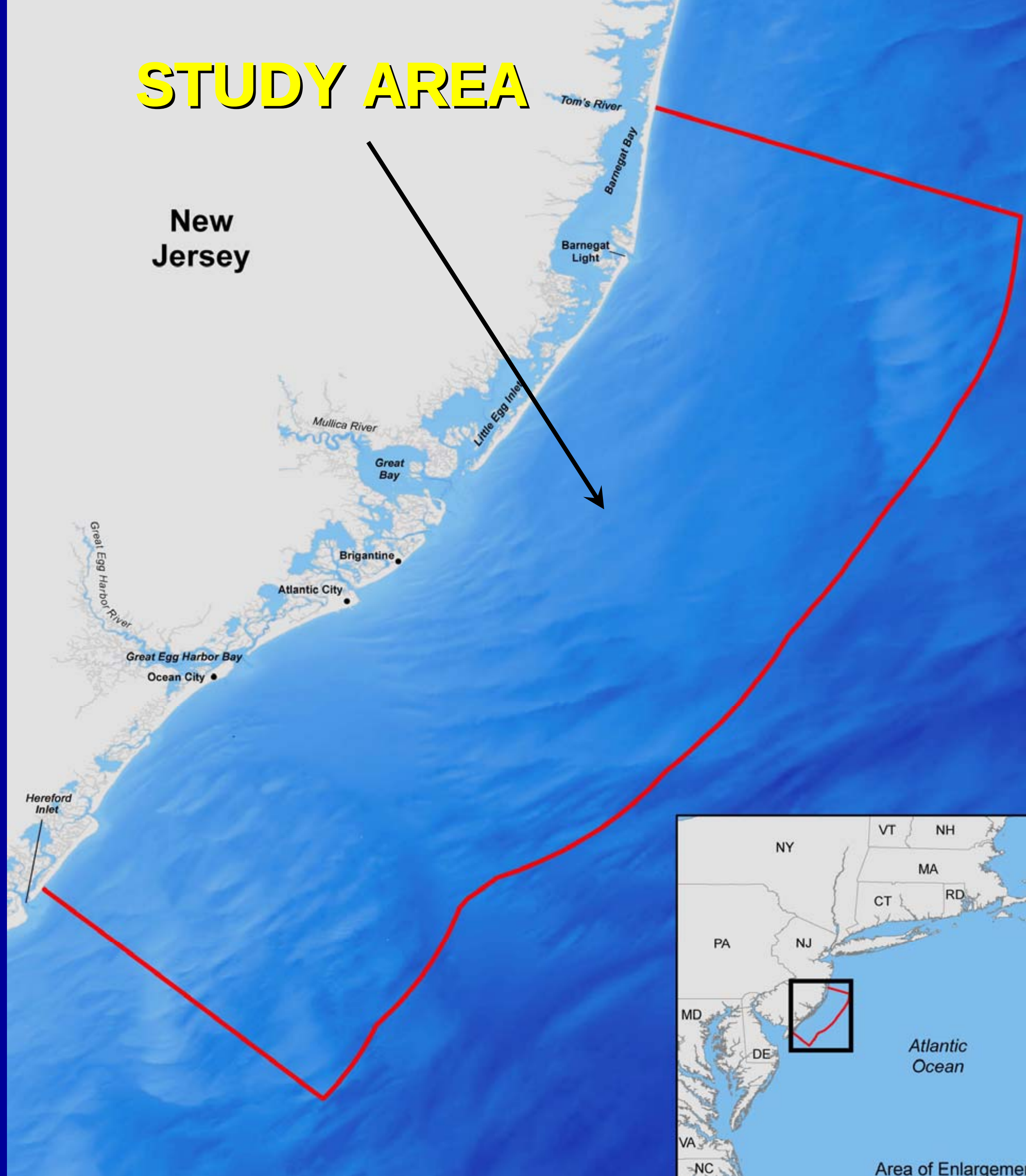
- Address Natural Resource portion of Blue Ribbon Panel Recommendation No. 4:
  - "Baseline data should be collected regarding the distribution, abundance, and migratory patterns of avian species, fish, marine mammals and turtles in the offshore area where development may be feasible."

Specific Objectives

- In the Study Area, what are the abundance, distribution, and utilization of:
  - Bird Species (flight behavior)
  - Marine Mammals
  - Sea Turtles

Specific Objectives

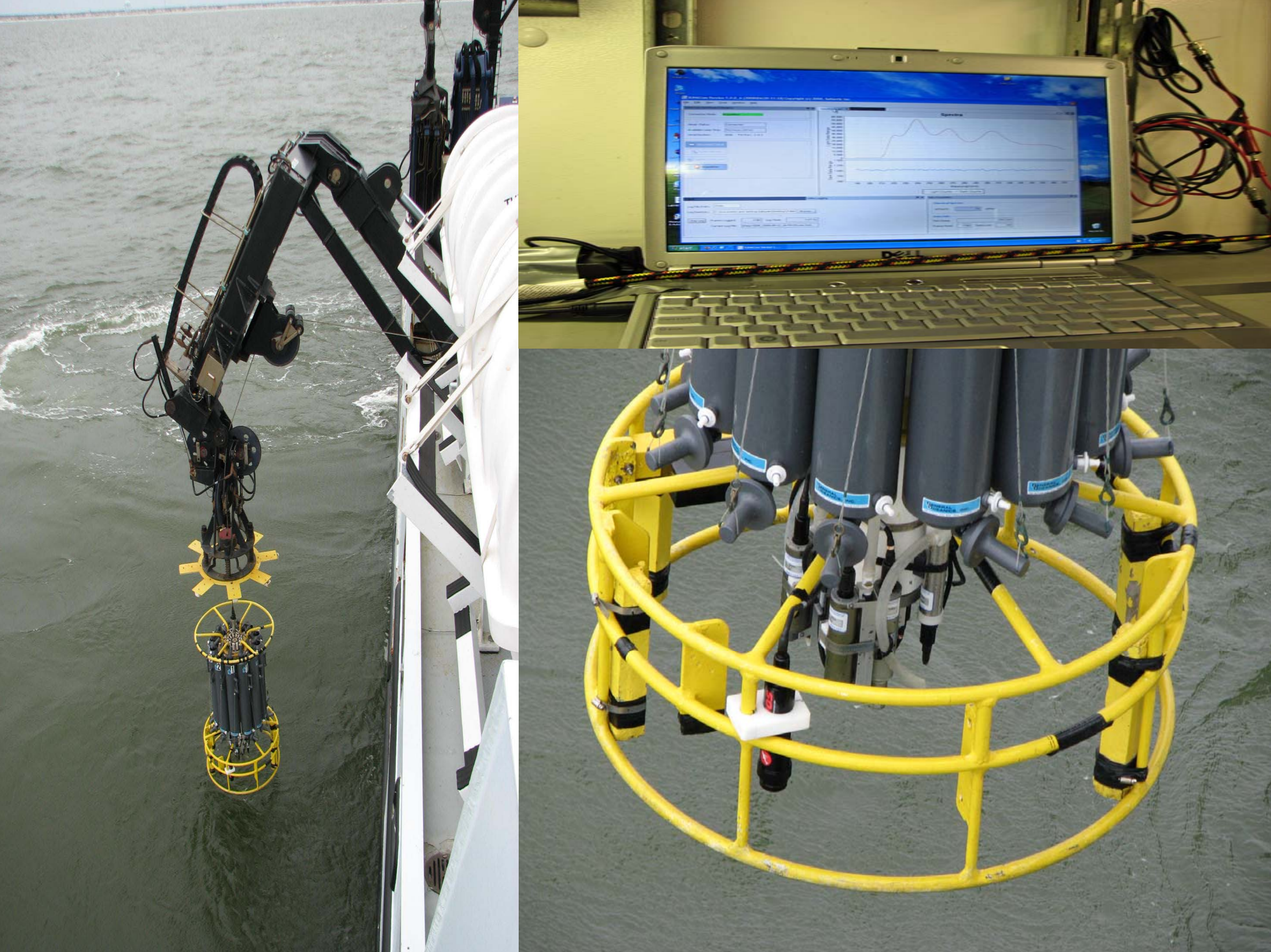
- Using predictive modeling, mapping, and environmental assessment methodologies what portions of the study area are more or less suitable for wind/alternative energy power facilities based on potential ecological/environmental impacts?


STUDY AREA
Tom's River
Barnegat Bay
Barnegat Light
New Jersey
Little Egg Inlet
Mullica River
Great Bay
Great Egg Harbor River
Brigantine
Atlantic City
Great Egg Harbor Bay
Ocean City
Hereford Inlet
NY
VT
NH
MA
CT
RI
PA
NJ
MD
DE
VA
NC
Atlantic Ocean
Area of Enlargement

Field Studies

- Three Primary Surveys:
  - Avian
  - Marine Mammal
  - Sea Turtle
- Supporting Studies:
  - Oceanographic


DL 467 AS







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REAL-TIME BIRD MIGRATION SURVEYS


R/V Robert E.


CAUTION
CUIDADO


DELL
SIBLEY

Other Studies

- Literature Review
- Data Compilation-digital and historical
- Model Development
- Impact Assessment
- GIS
- Reporting

Schedule

- 18-month study
- Field Work: Jan 2008 – June 2009
- Interim Report – January 2009
- Draft Final Report – September 2009
- Final Report – December 2009

Overall Process

- Technical Review Committee – State & Federal Agencies
- Peer Review Group – Independent Review
- Interested Party Group
  - Periodic informational meetings

Project Status

- 14 months of surveys (78%) complete
- 4 months remaining
- Literature Review ongoing
- Data compilation and analysis continuing
- Preliminary Data

Interim Report

- Data Compilation - Summary of 2008 Data
- Preliminary Analyses – INTERIM, NOT FINAL!!
- Spatiotemporal Modeling
- Reviewed by TRC and Peer Review Group
- Mechanism to provide input for Final Report

Interim Report Summary

- Detected 110 bird species
- 10 Marine Mammal/Turtle Species inc. 5 T/E Species:
  - North Atlantic Right Whale
  - Fin Whale: *detected in all seasons
  - Humpback Whale
  - Loggerhead Turtle
  - Leatherback Turtle

Interim Report Summary (cont)

- Extensive Fisheries Section
- Description of Predictive Modeling and Data Analysis
- Data will be used in Final Report to address Study Area suitability issues
- Data are fulfilling Project Objectives!

Nocturnal Bird Movements off Atlantic City

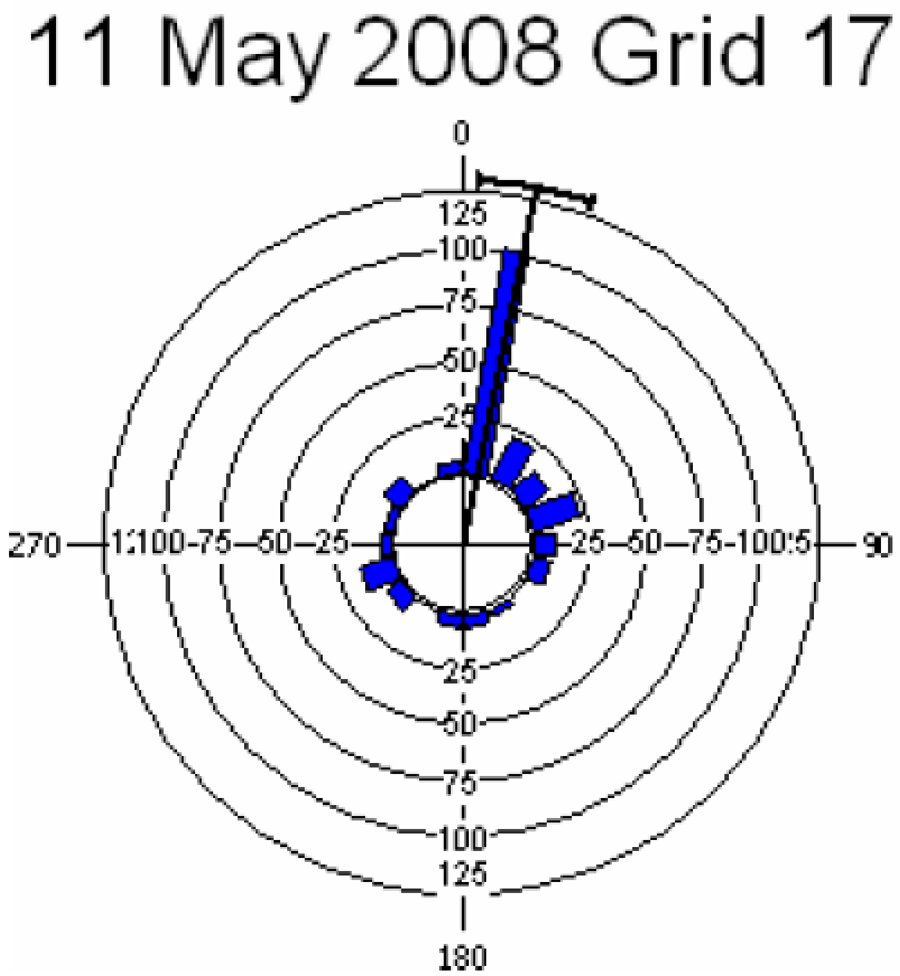
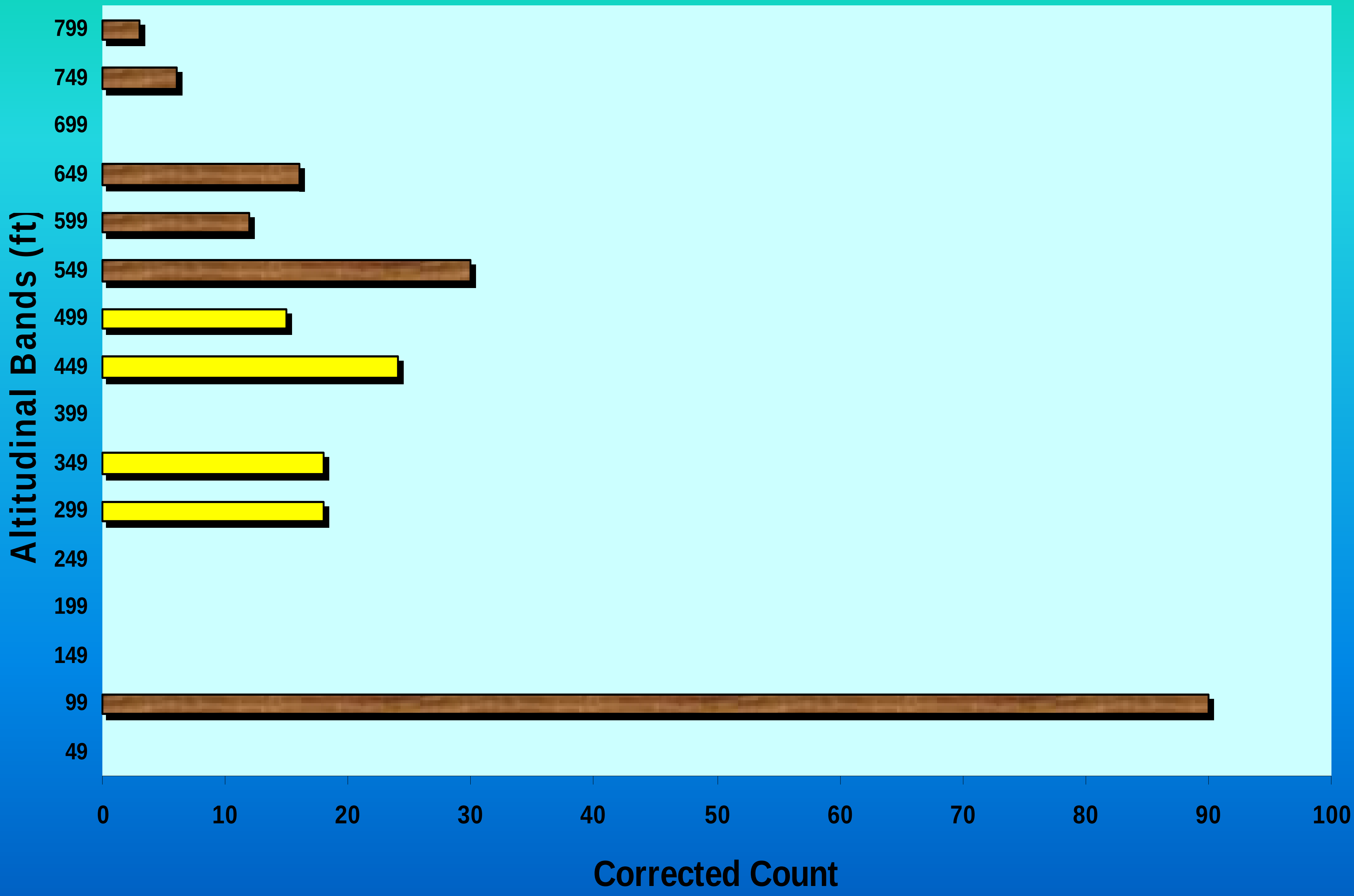
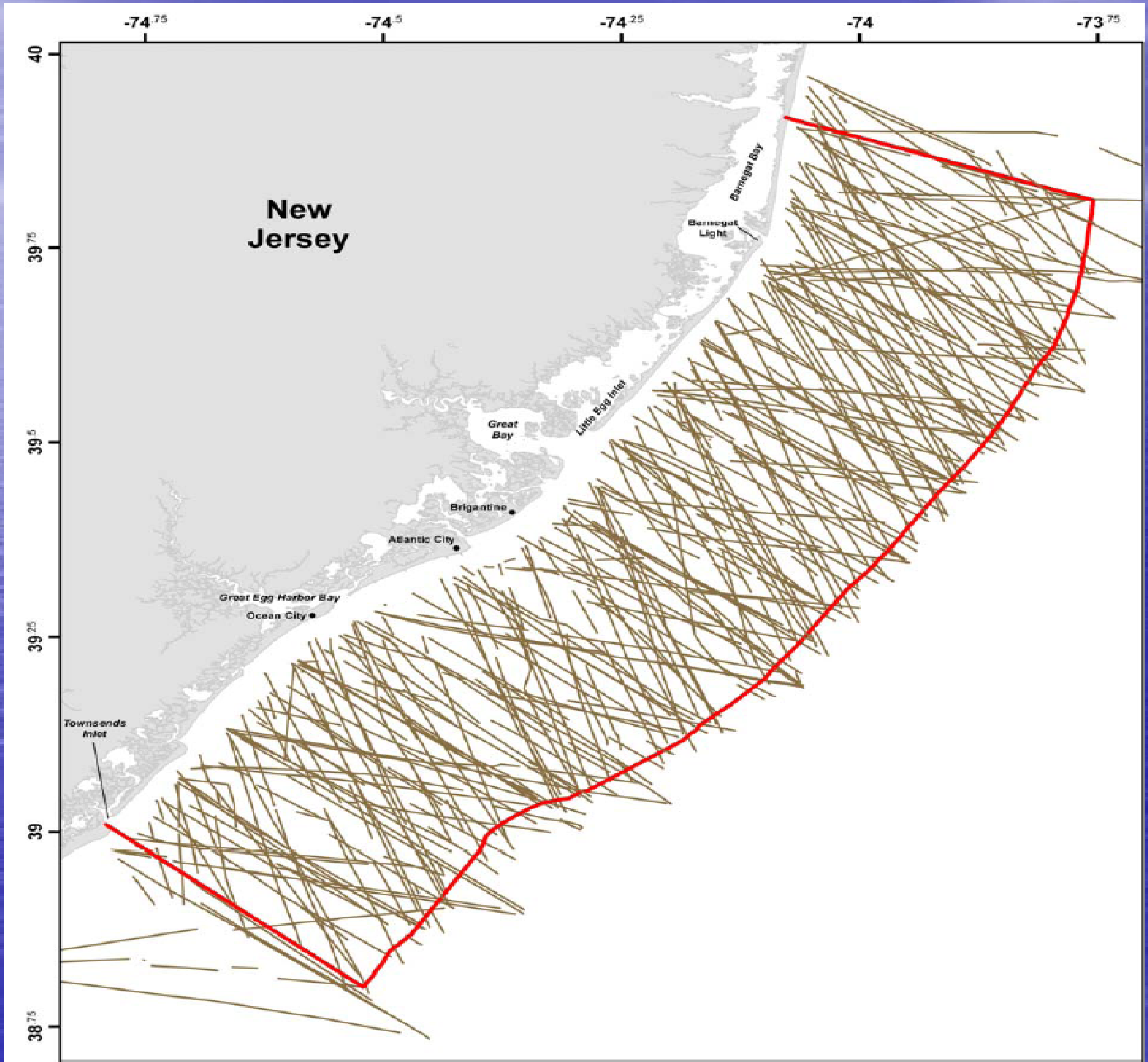


Figure 6-20. Circular diagram showing the direction of nocturnal bird movements through the TI/VPR field of view on 11 May 2008. The dark line is the mean angle and the arc at the end is the 95% confidence limits of the mean.

Example Data: Birds in Altitudinal Bands at Night (TI/VPR)



Marine Mammal/Sea Turtle Surveys



Geo-Marine, Inc.

- Acknowledgement of Project Team
- Dr. Dan Wilkinson – GMI Project Manager
- Interim Report Presentations