# Block Island Monitoring Experience: Changes in Fish Densities & Recreational Fishing


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SSC Workshop September 2021



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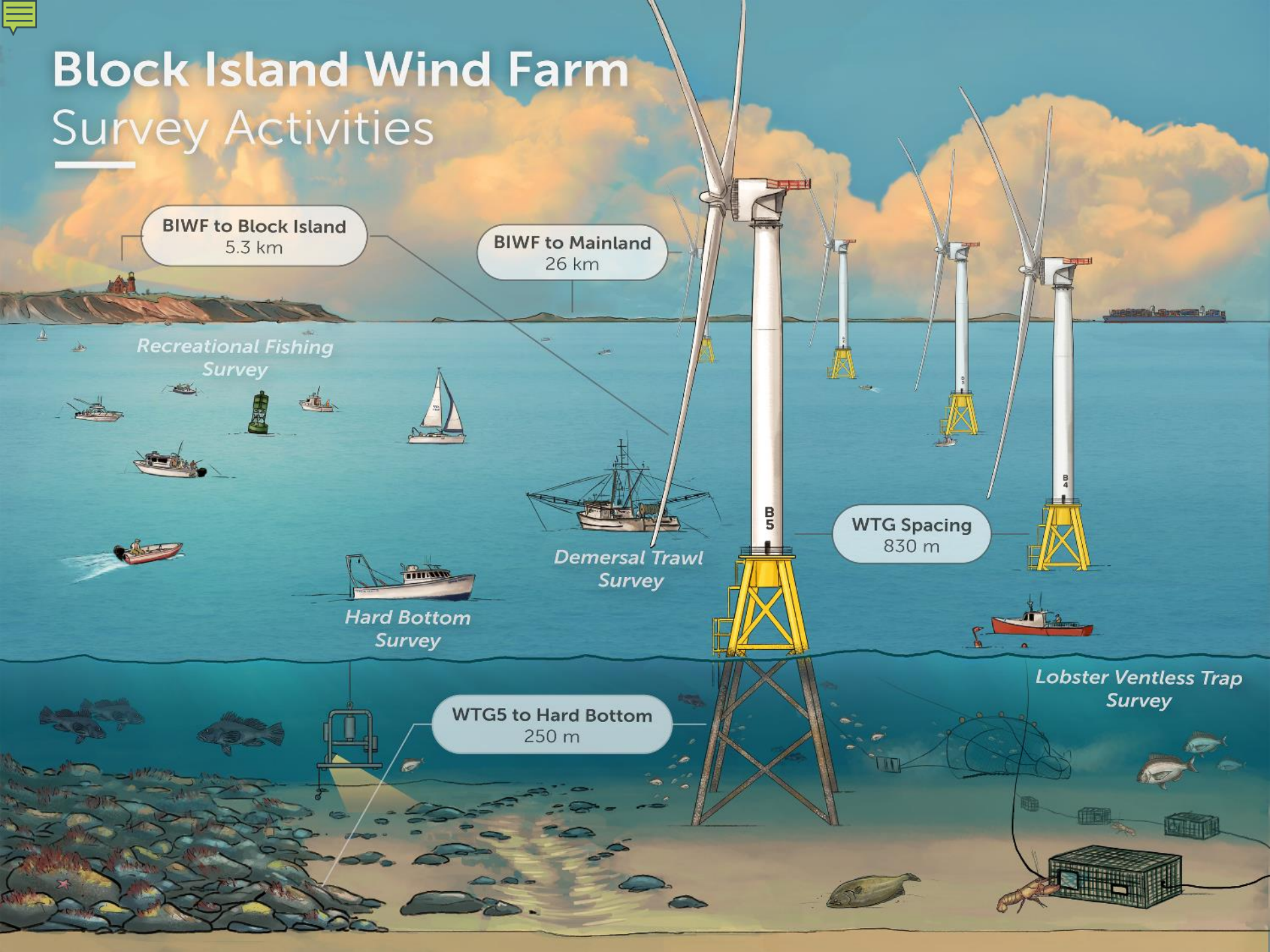
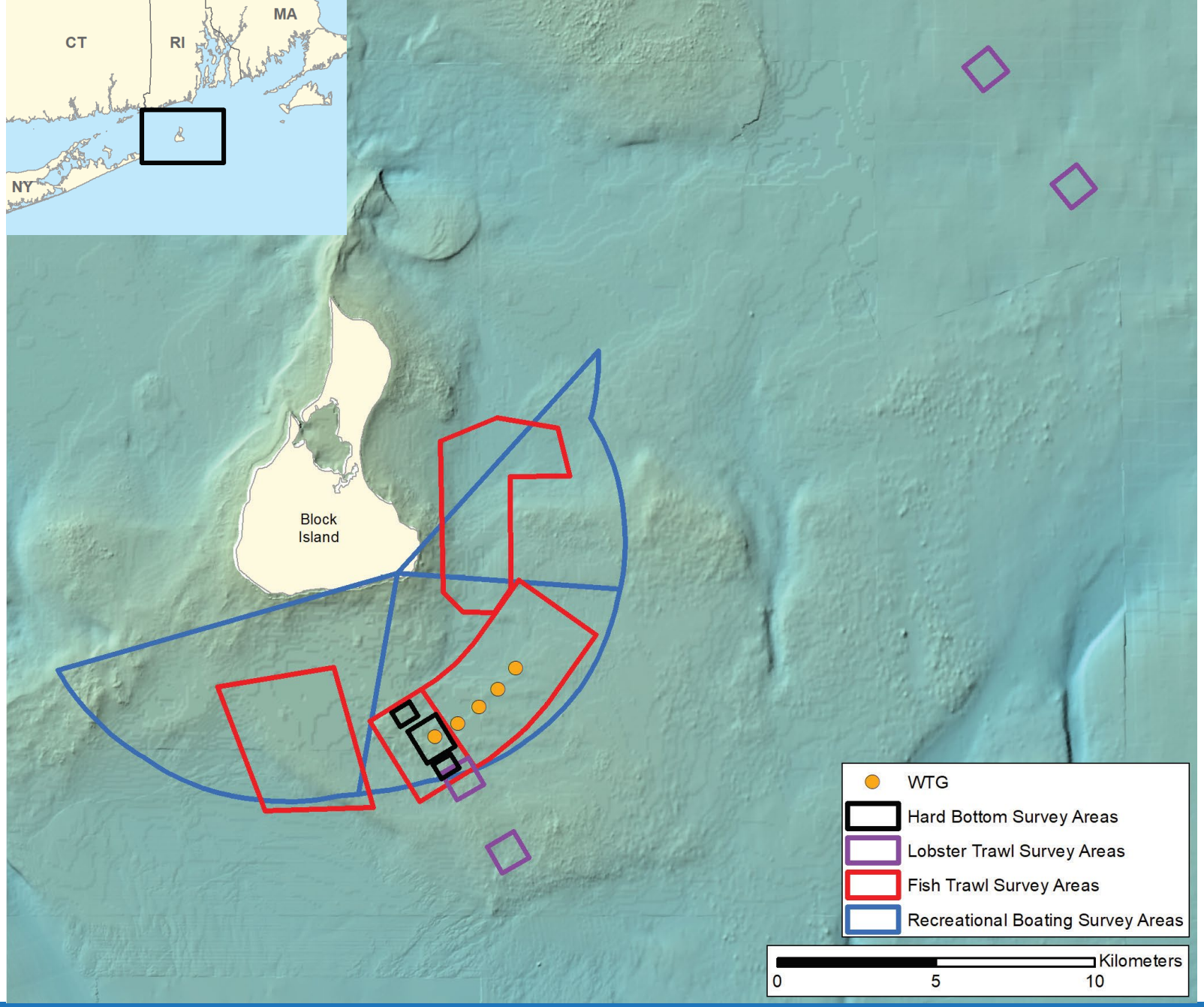
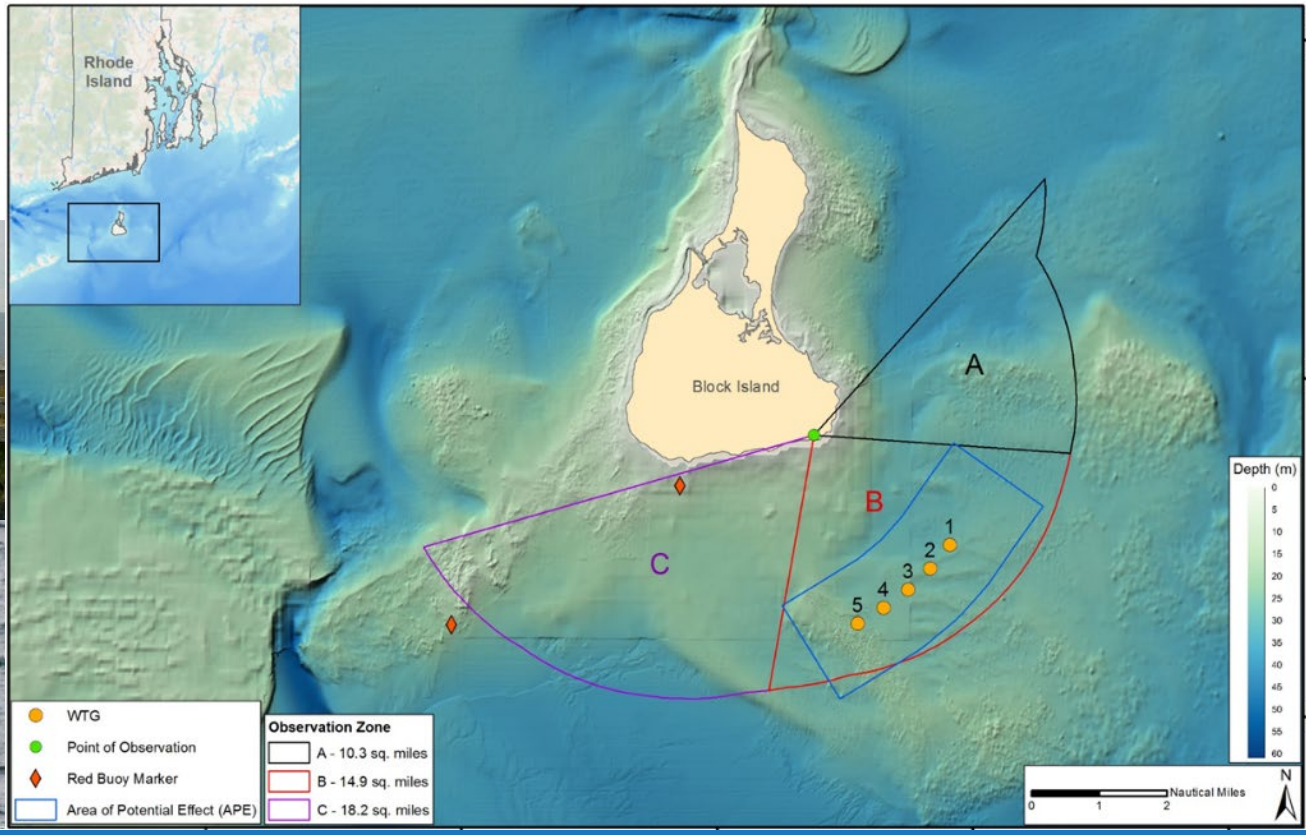

Block Island Wind Farm
Survey Activities
BIWF to Block Island
5.3 km
BIWF to Mainland
26 km
Recreational Fishing Survey
Demersal Trawl Survey
Hard Bottom Survey
WTG Spacing
830 m
B5
B4
WTG5 to Hard Bottom
250 m
Lobster Ventless Trap Survey


CT
RI
MA
NY
Block
Island
WTG
Hard Bottom Survey Areas
Lobster Trawl Survey Areas
Fish Trawl Survey Areas
Recreational Boating Survey Areas
Kilometers
0
5
10

# Recreational observations

- Unique opportunity to observe vessel activities
- Results distinct from participant-observation or snowball sampling interview approach
- Based on line of sight from high vantage point

Could be modified for drone or aerial surveys with ground truth

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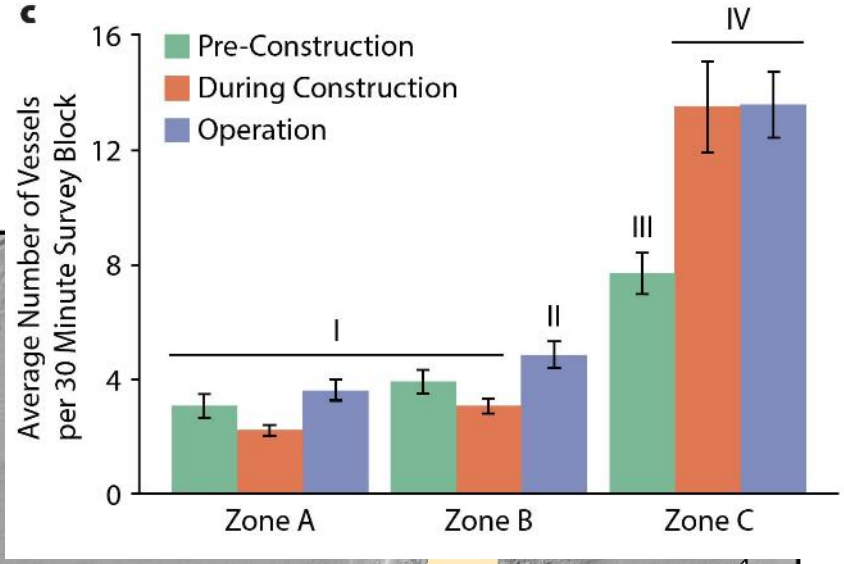
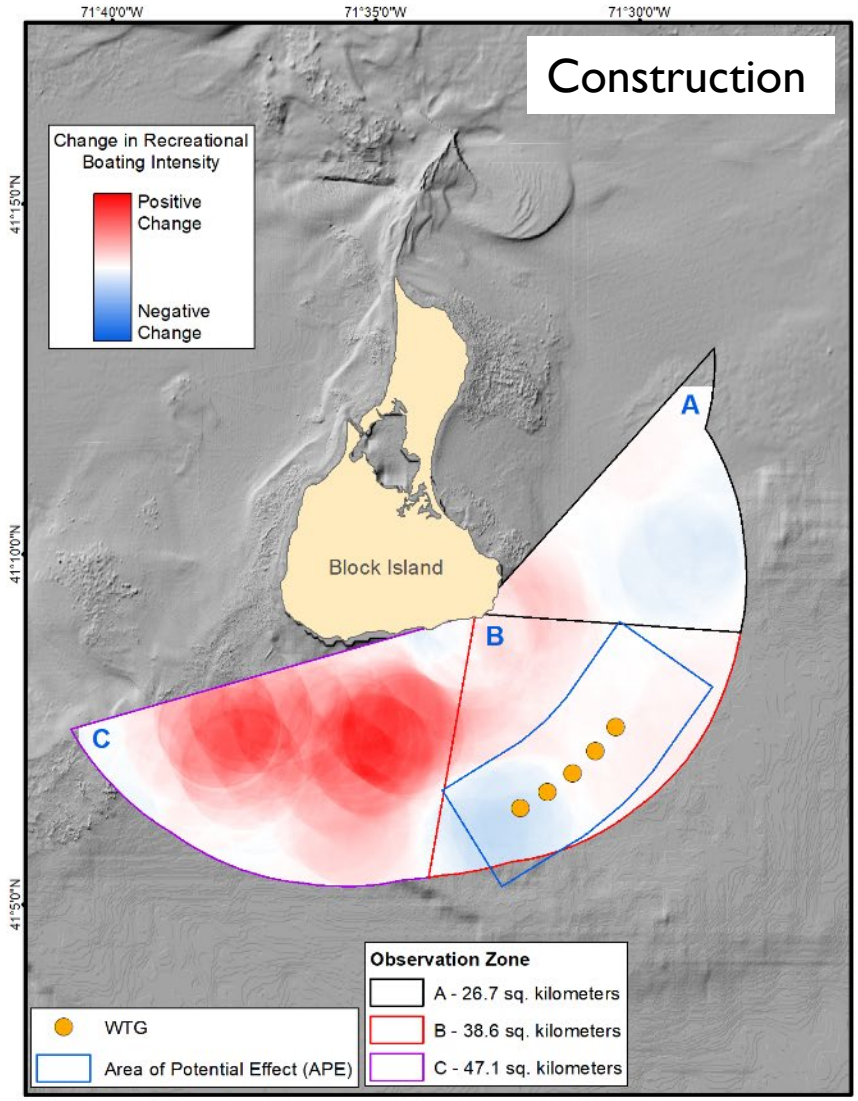
# Narrative from interviews: 'lots more fish at wind farm'



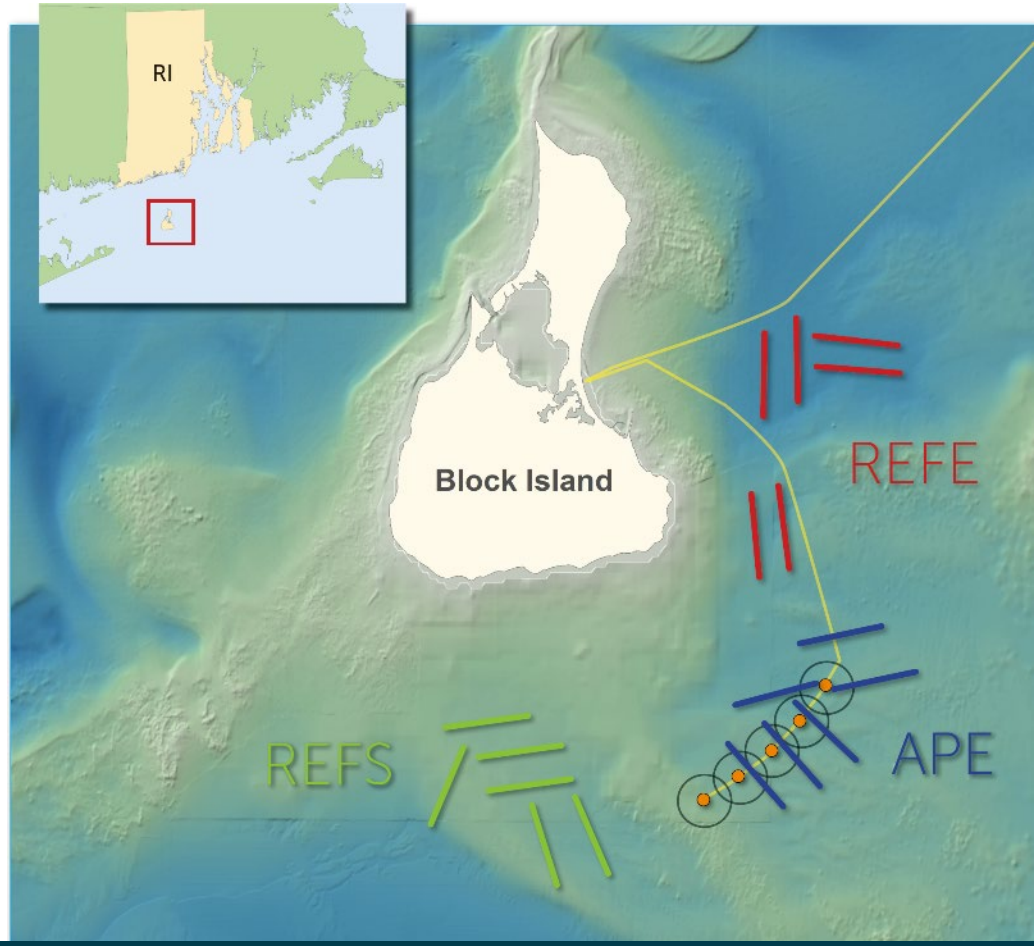



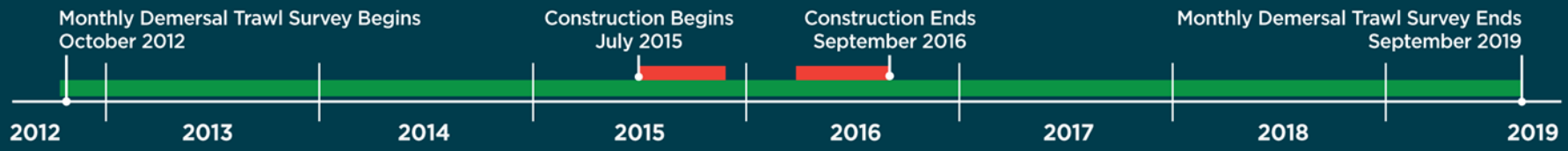
# Lessons learned from Recreational boating and hard bottom surveys

- Direct observation of vessel activities can provide a reality check on perceptions
- Recreational fishing far more prevalent than sailing, but sailing received more attention from regulators initially
- We added prey assessment as a result
- Indirect effects on habitats and usage should be considered
- Biological sampling design can be informed by vessel activity assessment
- Habitats adjacent to wind farm may be just as important for activities and biological effects

# Demersal Trawl Survey

- Conducted on commercial trawler from Pt. Judith
- Otter trawl consistent with other regional studies
- 20 minute tows, once a month
- Three Study Blocks
  - Reference South – 2 tows
  - Reference East – 2 tows
  - Area of Potential Effect – 2 tows
- Seven Years of Surveys
  - 2 years before construction
  - 2 years during construction
  - 3 years after construction



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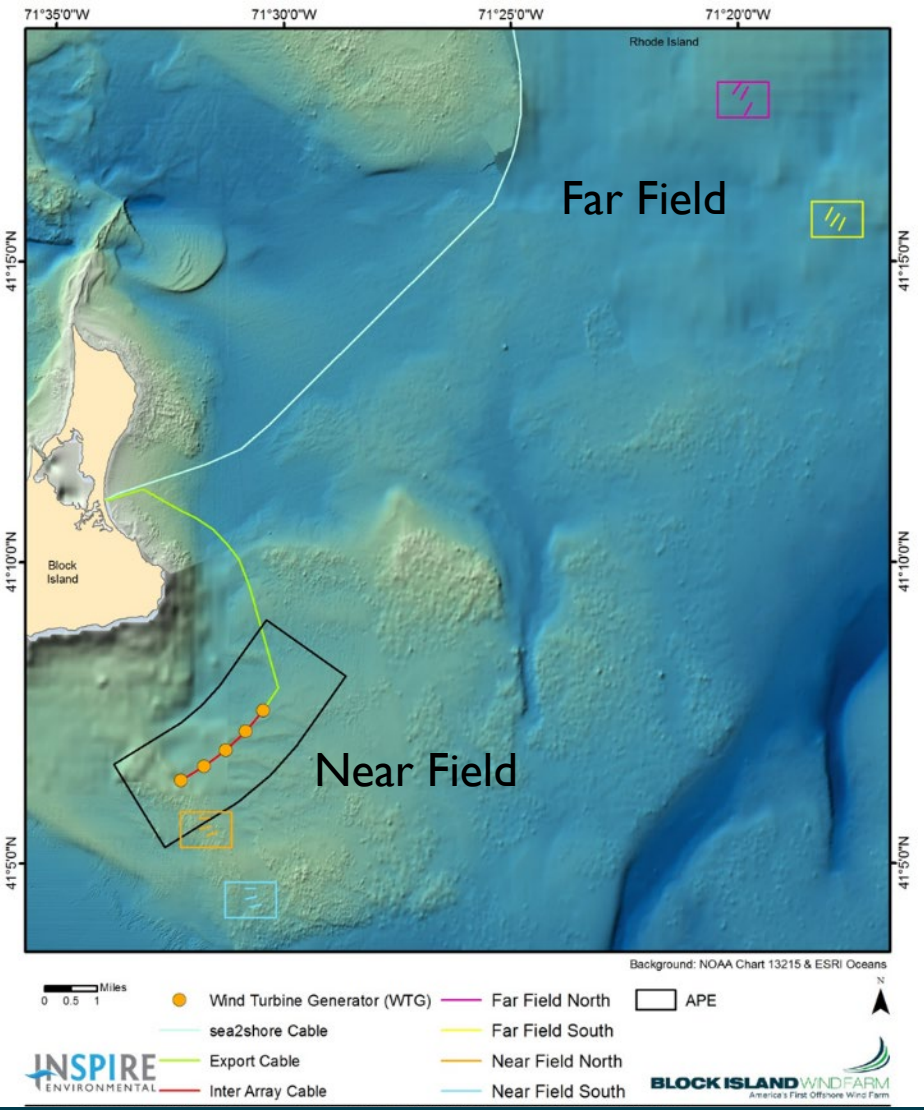
# Lobster Trap Survey

- Commercial lobster boats from Pt. Judith and Newport
- Design consistent with other regional studies
- 5 night soak, twice a month
- Vented and ventless traps
- Four Study Blocks
  - 2 Near Field
  - 2 Far Field
- Seven Years of Surveys:

  May – October 2013-2019
  - 2 years before construction
  - 2 years during construction
  - 3 years after construction







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# Block Island Wind Farm Trawl Survey Sampling October 2012 – September 2019

- 497 tows (using regional sampling protocol)
- > 750,000 fish and invertebrates collected
- Nine species account for 90% of all individuals
- Numerical dominants:
  - Butterfish
  - Little skate
  - Scup
  - Winter skate
  - Longfin squid

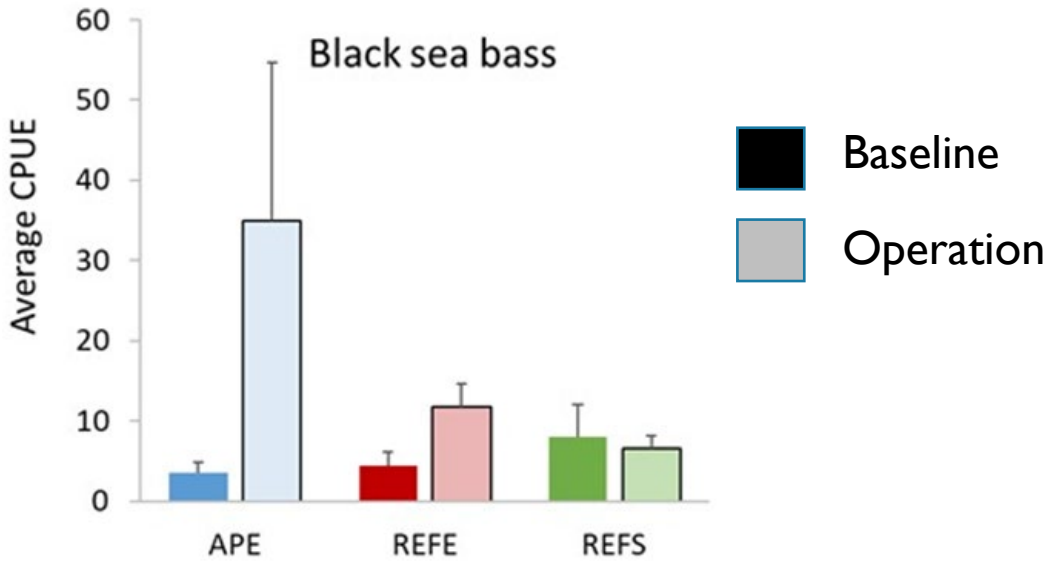
# Fish Catch Models

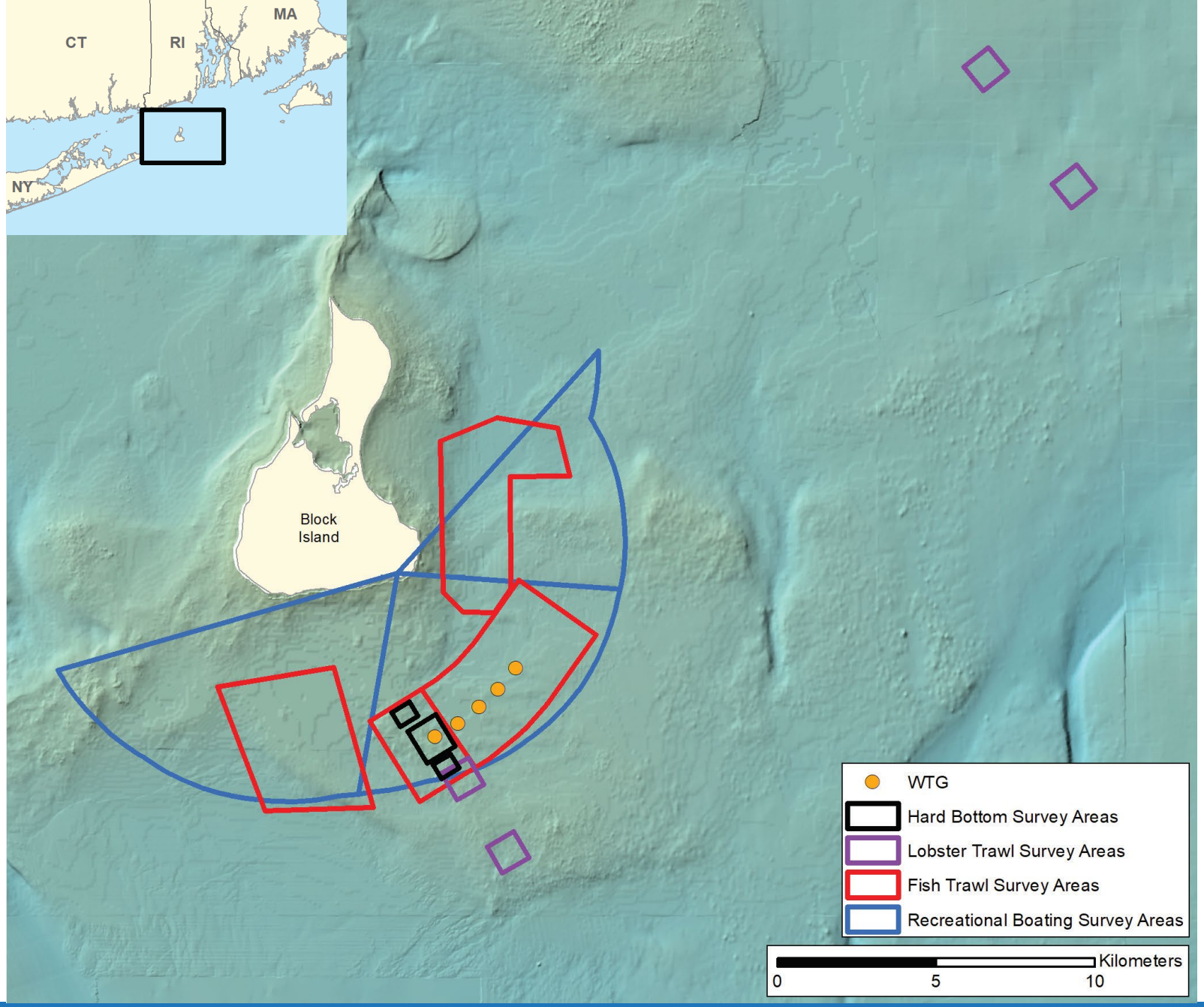
CPUE (mean monthly catch/tow) modeled with GLM (negative binomial distribution with log-link)

- Each species model considered:
  - Fixed factors for block, period, season (+ interactions)
  - Environmental covariates (temperature, DO, depth)
- Linear contrasts used to calculate:
  - temporal differences by area (APE, REFE, REFS)
  - spatial differences by time period
  - spatial-temporal interaction (APE vs REFE, APE vs REFS)
  - Results presented as estimated change, with 90% confidence intervals to illustrate magnitude.

# Fish Catch Model – Results
# Black sea bass – Baseline vs Operation

| Proportional Change over Time by Block | | | Temporal-Spatial Interaction | |
|---|---|---|---|---|
| APE | REFE | REFS | REFE vs APE | REFS vs APE |
| 408%<br>[+137%, +1012%] | 202%<br>[+44%, +527%] | +7%<br>[-47%, +116%] | -41%<br>[-79%, +70%] | -79%<br>[-92%, -40%] |

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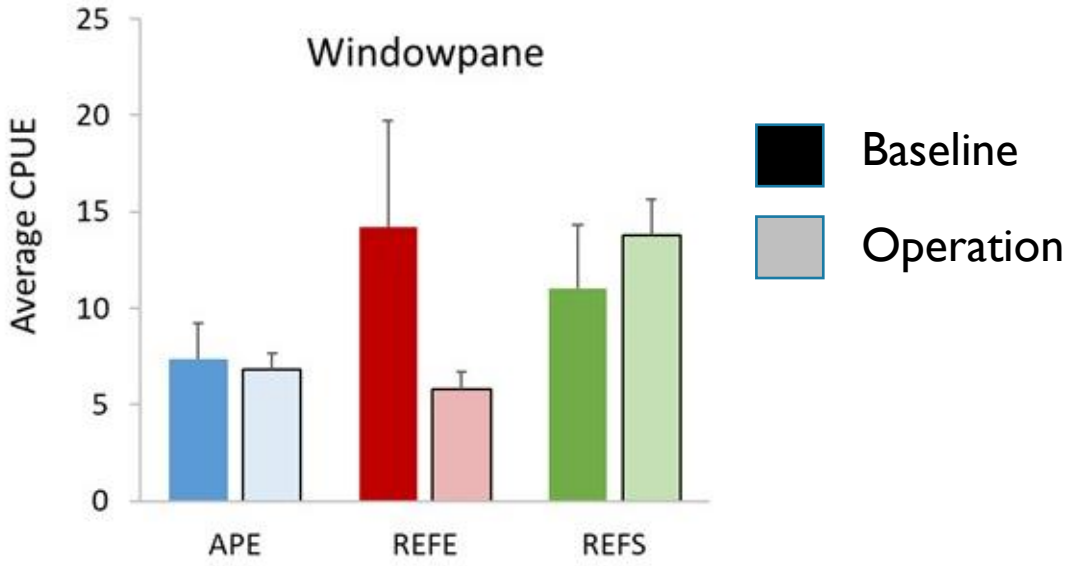
# Artificial Reefs

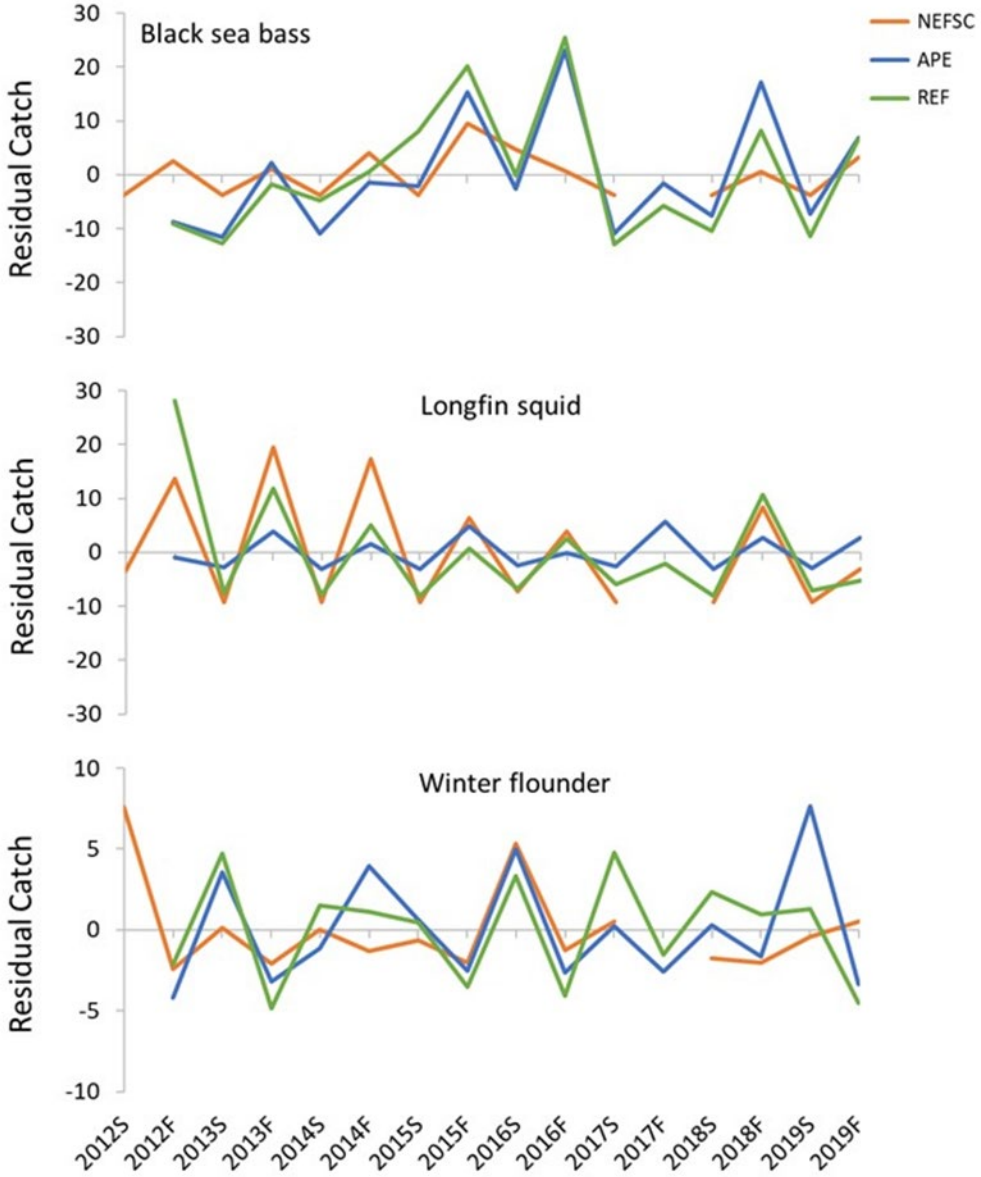
- All foundation types introduce hard substrata (surfaces) into the ocean
- Intertidal surfaces are not typically found offshore, so vertical ‘island’ from sea surface to seafloor
- Materials used and complexity of structure affects ‘epifaunal growth’ – plants and animals that attach
- Attached epiflora use nutrients and create ‘biomass’ (primary productivity)
- Attached epifauna feed on phyto- and zooplankton in water column, create biomass and discharge waste
- Presence of epifloral and epifauna attract fish and mobile epifauna (crabs, lobsters, small crustacea)
- Presence of structure attracts finfish that use structure as refuge
- Complexity of structure might provide more refuge and variety of use
- Growth and feeding activities increase local biomass (secondary productivity) that spreads to seafloor


Video available at Dominion Coastal Virginia Offshore Wind

# Fish Catch Model – Results
# Windowpane – Baseline vs Operation

| Proportional Change over Time by Block | | | Temporal-Spatial Interaction | |
|---|---|---|---|---|
| APE | REFE | REFS | REFE vs APE | REFS vs APE |
| -24%<br>[-48%, +11%] | -63%<br>[-75%, -46%] | +4%<br>[-26%, +48%] | -52%<br>[-72%, -18%] | +36%<br>[-18%, +127%] |

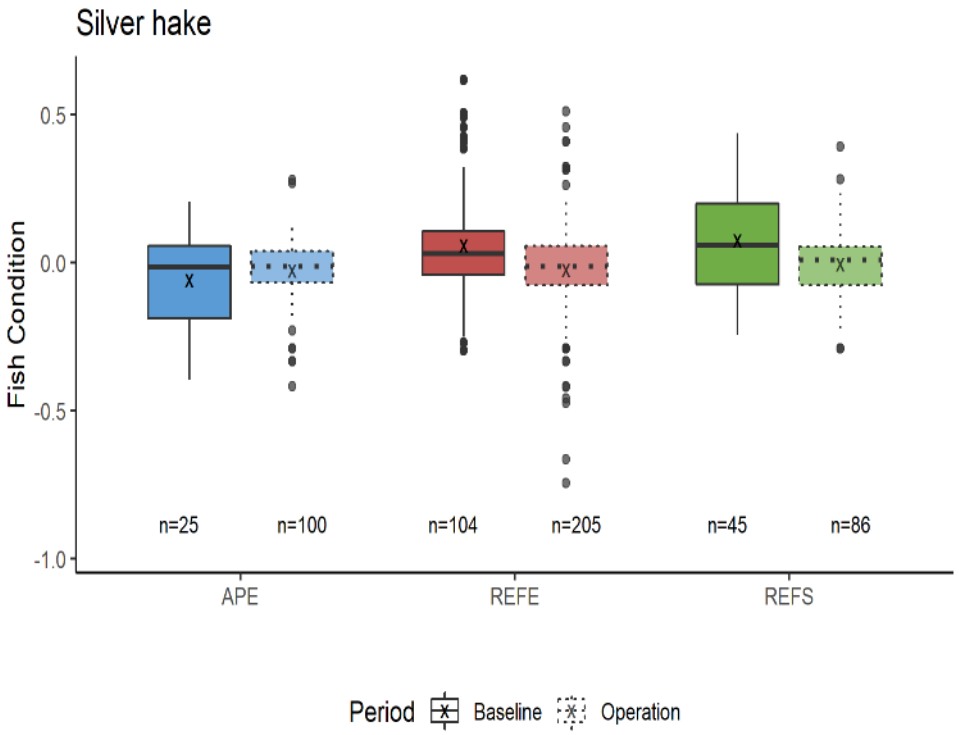



Black sea bass
Longfin squid
Winter flounder
Residual Catch
NEFSC
APE
REF
30
20
10
0
-10
-20
-30
5
-5
2012S
2012F
2013S
2013F
2014S
2014F
2015S
2015F
2016S
2016F
2017S
2017F
2018S
2018F
2019S
2019F

# Fish Condition Index – Baseline v Operation

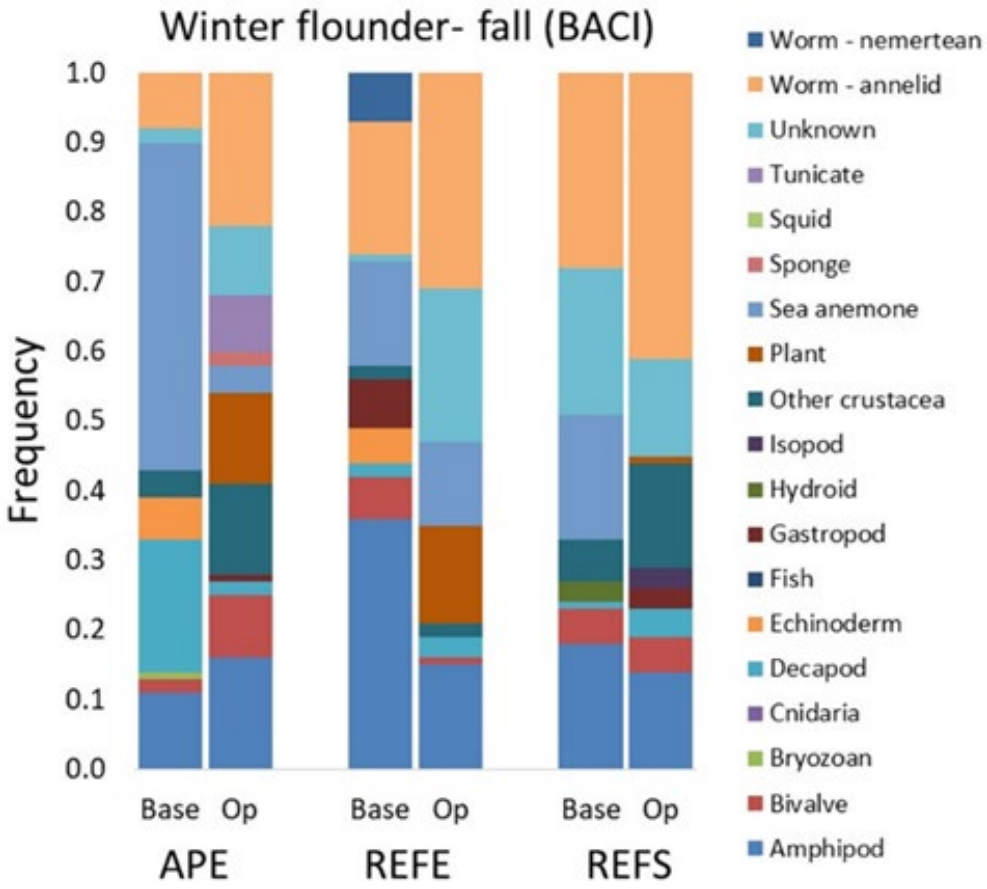
Condition index values = residuals from a log(Weight)-log(Length) regression

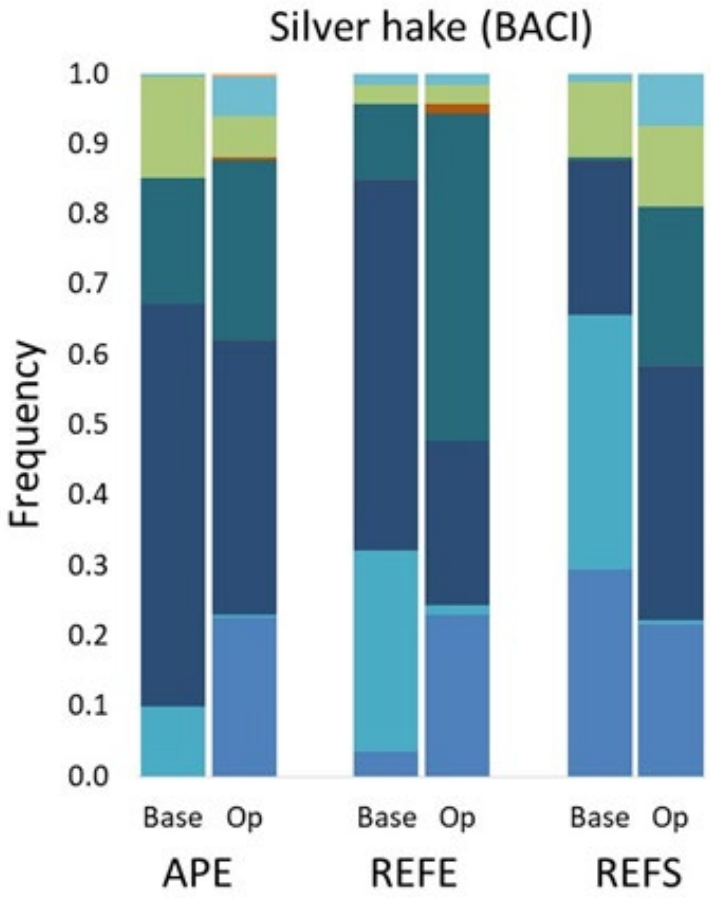
- Standard 2-factor ANOVA (Block x Period)
- Silver hake, summer flounder, winter flounder

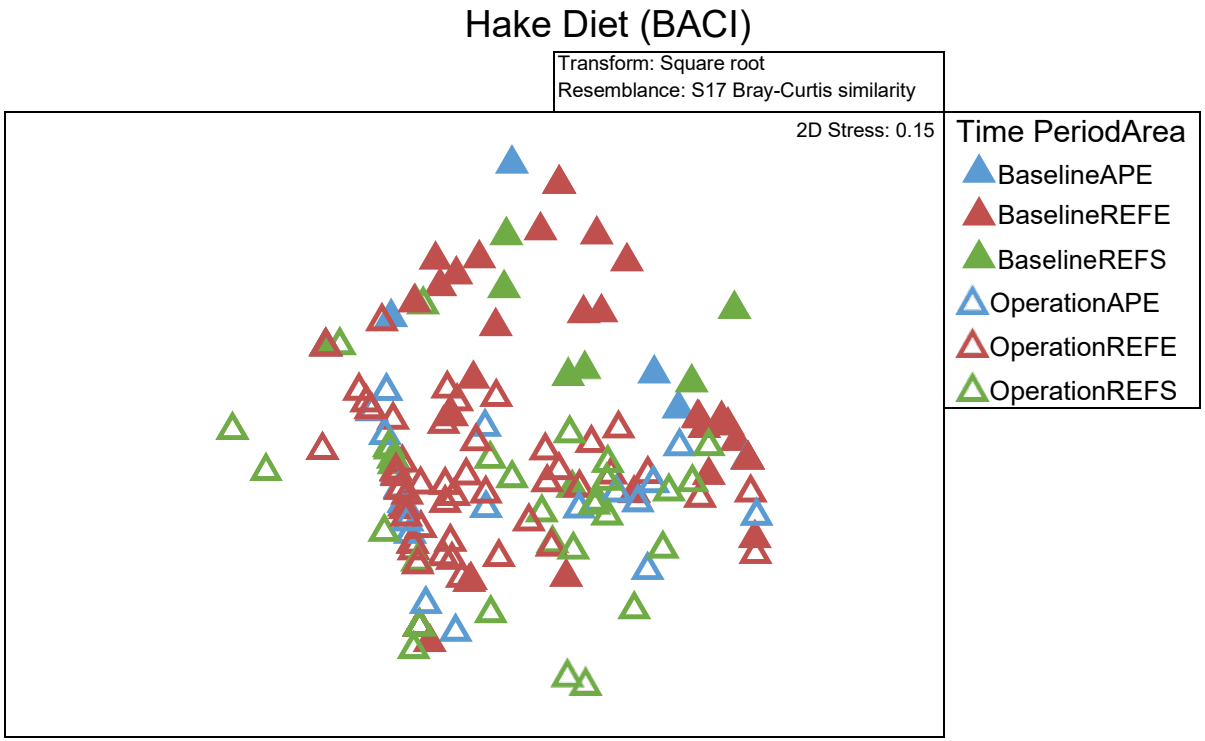



- These 3 species showed highly significant ($p << 0.001$) decreases in condition values from Baseline to Operation (averaged across areas)
- Silver hake condition increased at APE, decreased at reference (interaction $p = 0.016$).

# Stomach Content Analysis

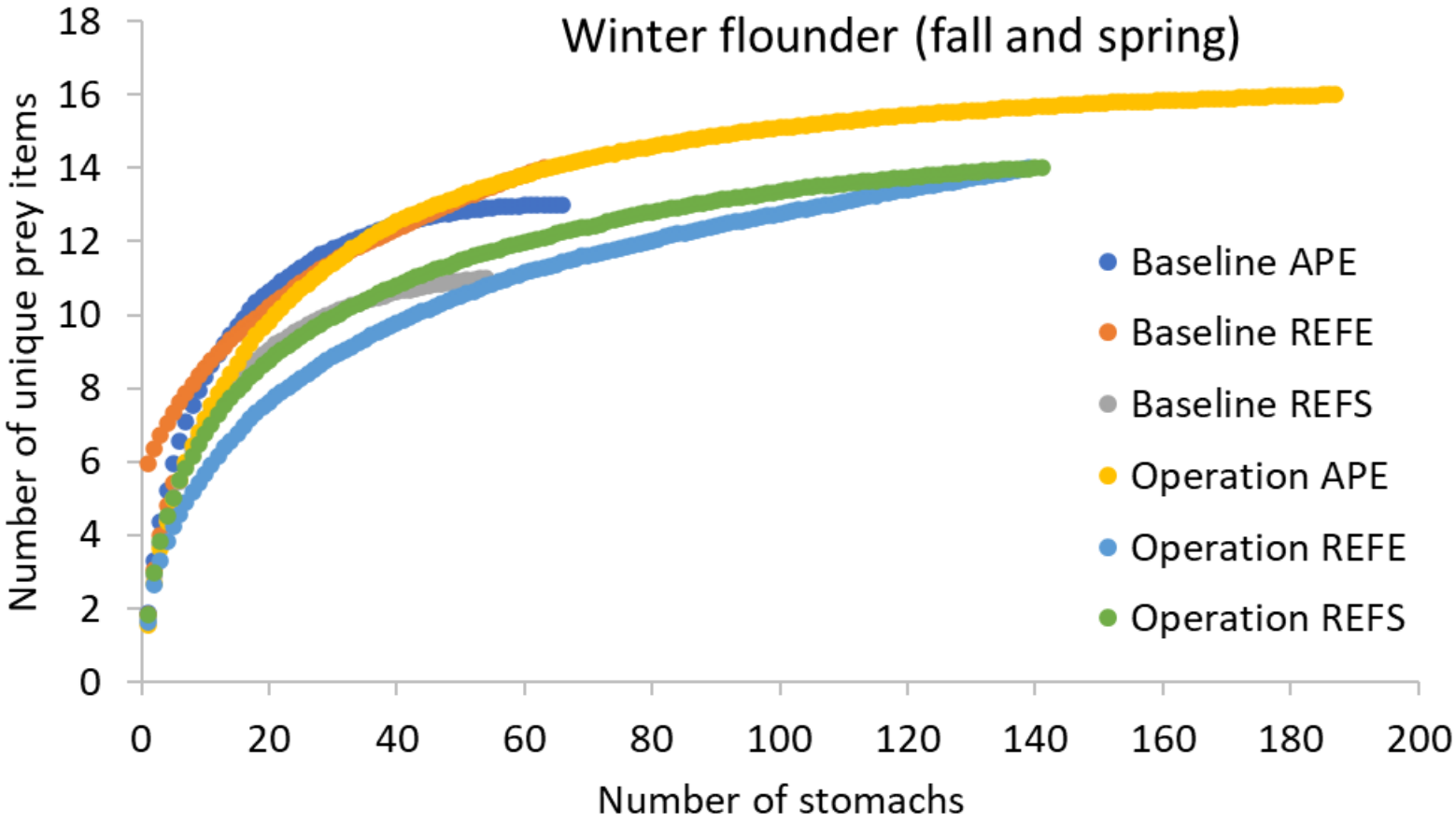





PERMANOVA was used to determine whether the taxonomic composition of prey assemblages differed by the BACI contrast or by either the time period or area, followed by SIMPER analysis to identify which prey items were most responsible for observed differences.

# Prey Accumulation Curves



# Lessons learned

- Study design should balance fishing community interests and science interests
- Conduct power analysis to determine sampling effort to detect target effect size
- At BIWF, a 65% difference in catch rates between reference sites is the minimum effect size
- Site-specific designs and results

# Apply to future

- Engage as broadly as possible to ensure design meets information needs
- Manage expectations: small changes may not be meaningful
- Access to regional data is necessary to interpret site-specific data
- Regional funding and cooperation would leverage efforts to address causality as well as cumulative effects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Zach McKelvey, Jeanine Boyle
Deepwater Wind Block Island LLC

BLOCK ISLAND WIND FARM
America's First Offshore Wind Farm

# Contrasts Express Proportional Change

| Proportional Change over Time by Block | | | Temporal-Spatial Interaction | |
|---|---|---|---|---|
| APE | REFE | REFS | REFE vs APE | REFS vs APE |
| +100%<br>[+50%, +150%] | +200%<br>[+40%, +500%] | +10%<br>[-50%, +120%] | +100%<br>[+80%, +250%] | -90%<br>[-95%, +40%] |

Temporal change: +100% [+50%, +150%]

- CPUE during Operation period was 100% larger (2x) than CPUE during Baseline, with 90% CI [1.5x, 2.5x]

Temporal-Spatial Interaction:

- REFE Temporal change was +100% (2x) APE temporal change
- REFS Temporal change was -90% (0.1x) APE temporal change

90% CIs that do not contain 0 are statistically significant ($\alpha$=0.10)