

Monitoring water column resources: non-invasive hydroacoustic sampling

Chris Taylor¹ and Laura Kracker²

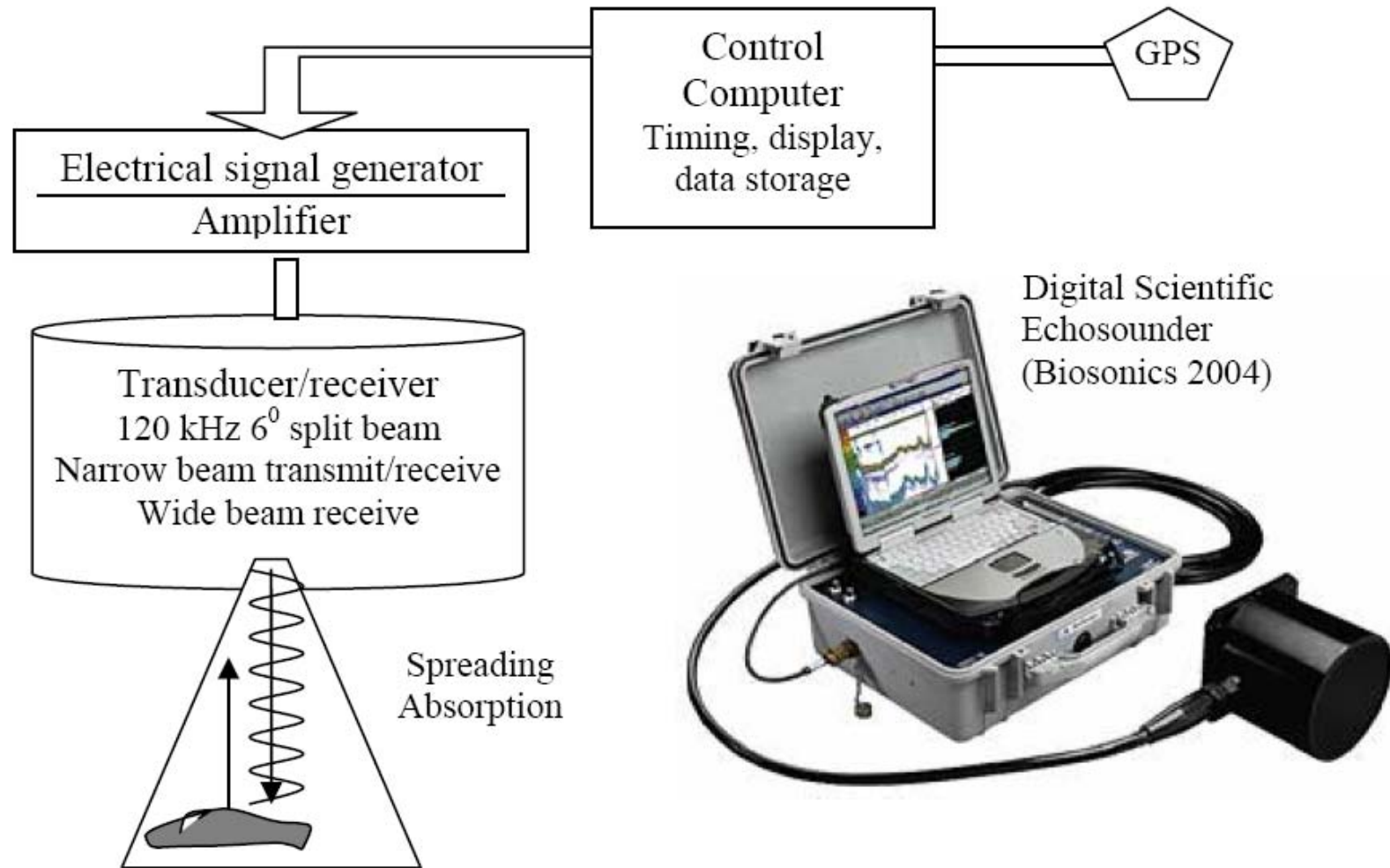
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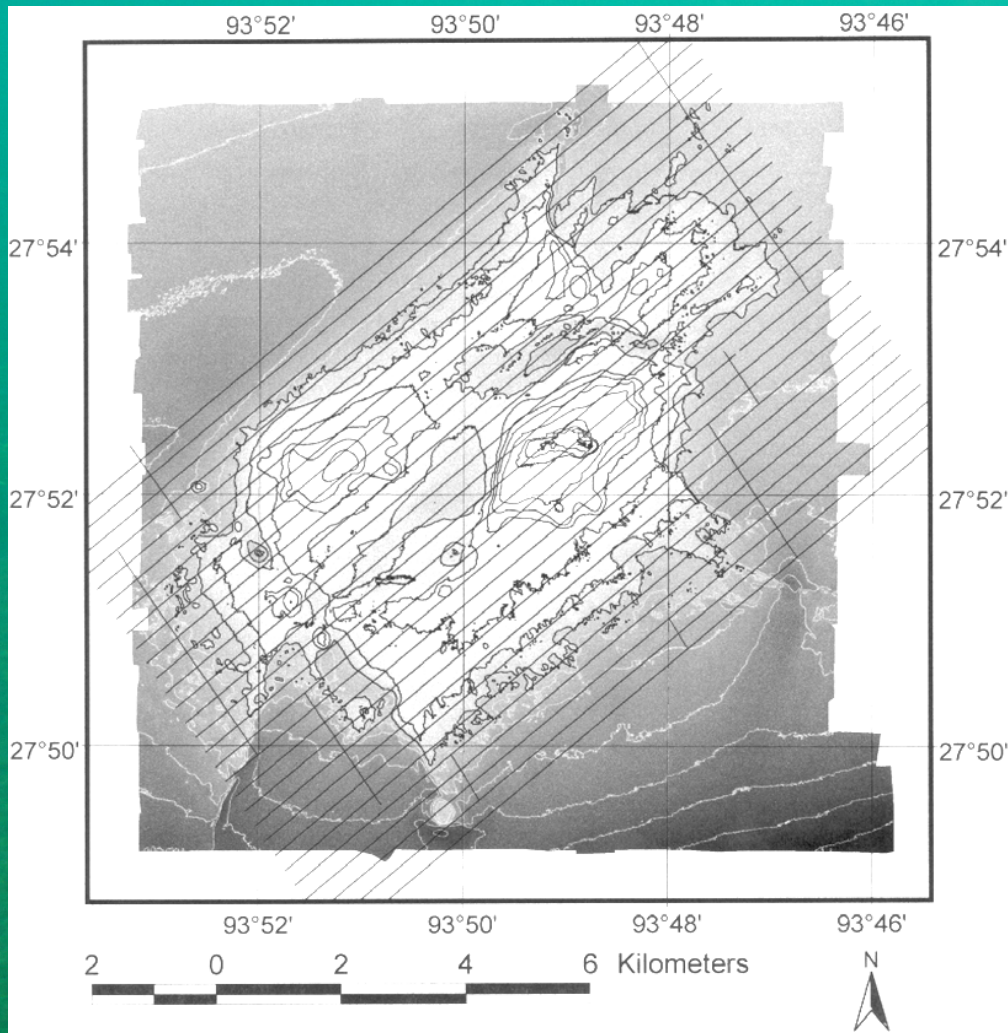
Hydroacoustic survey in integrated assessments

- Non-invasive sampling
- Rapid, spatially extensive surveys
- High spatial and temporal resolution
 - Second to diel
 - Sub-meter to kilometer

Scientific split-beam systems



Survey Design – Mobile surveys



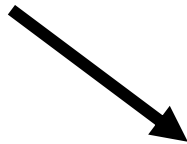
- Systematic transects
- Spatially-correlated data
- Treated using geostatistics or other spatially-explicit modeling

Figure source: Wilson et al. 2003

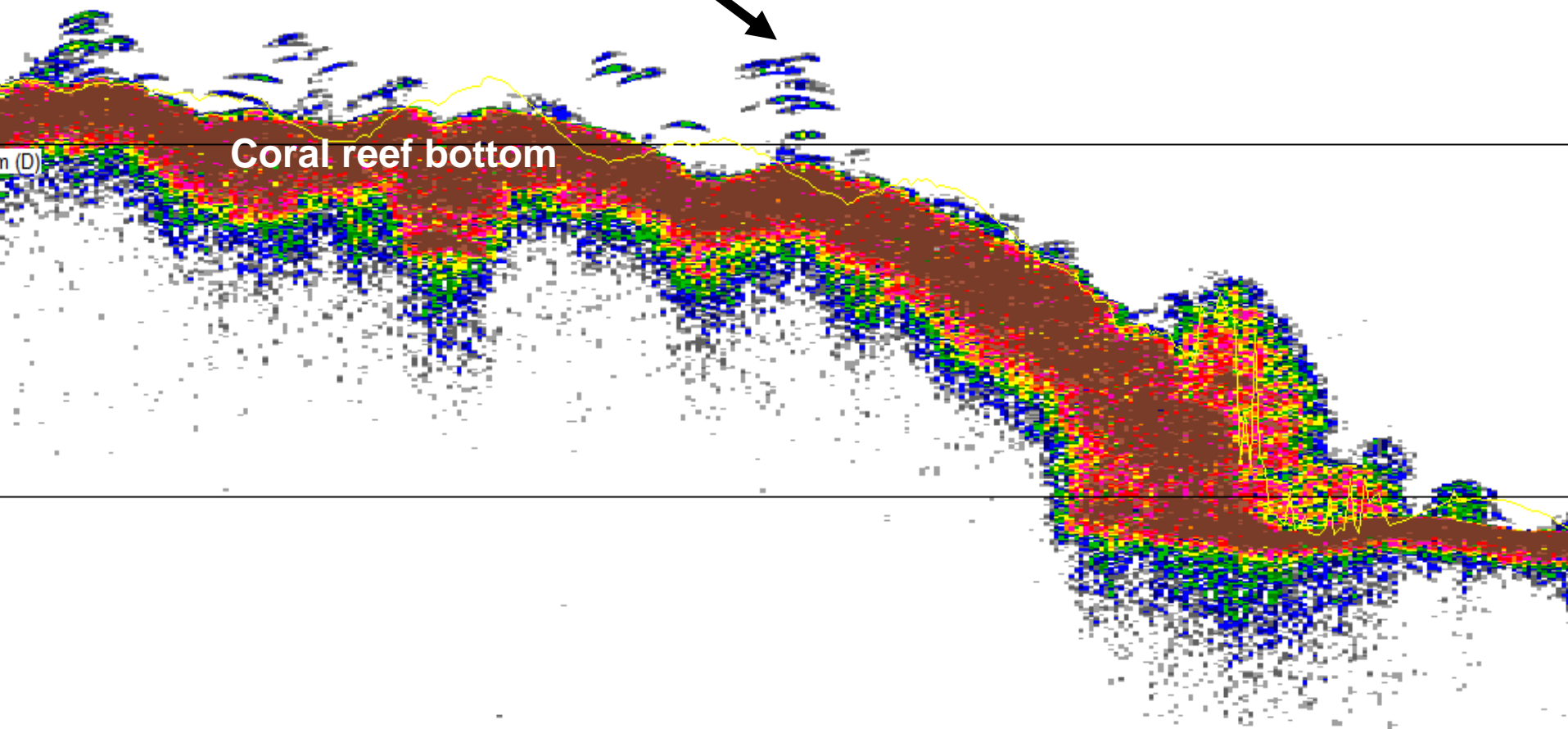
Types of data

- **3-D position of individual targets**
 - Lat/long and off-axis horizontal position
 - Range from transducer (and depth)
 - Acoustic size (*target strength*) \sim fish size
- **Relative densities or biomass**
 - Presence/absence
 - Spatial structure, spatial position
 - Organism/habitat relationships

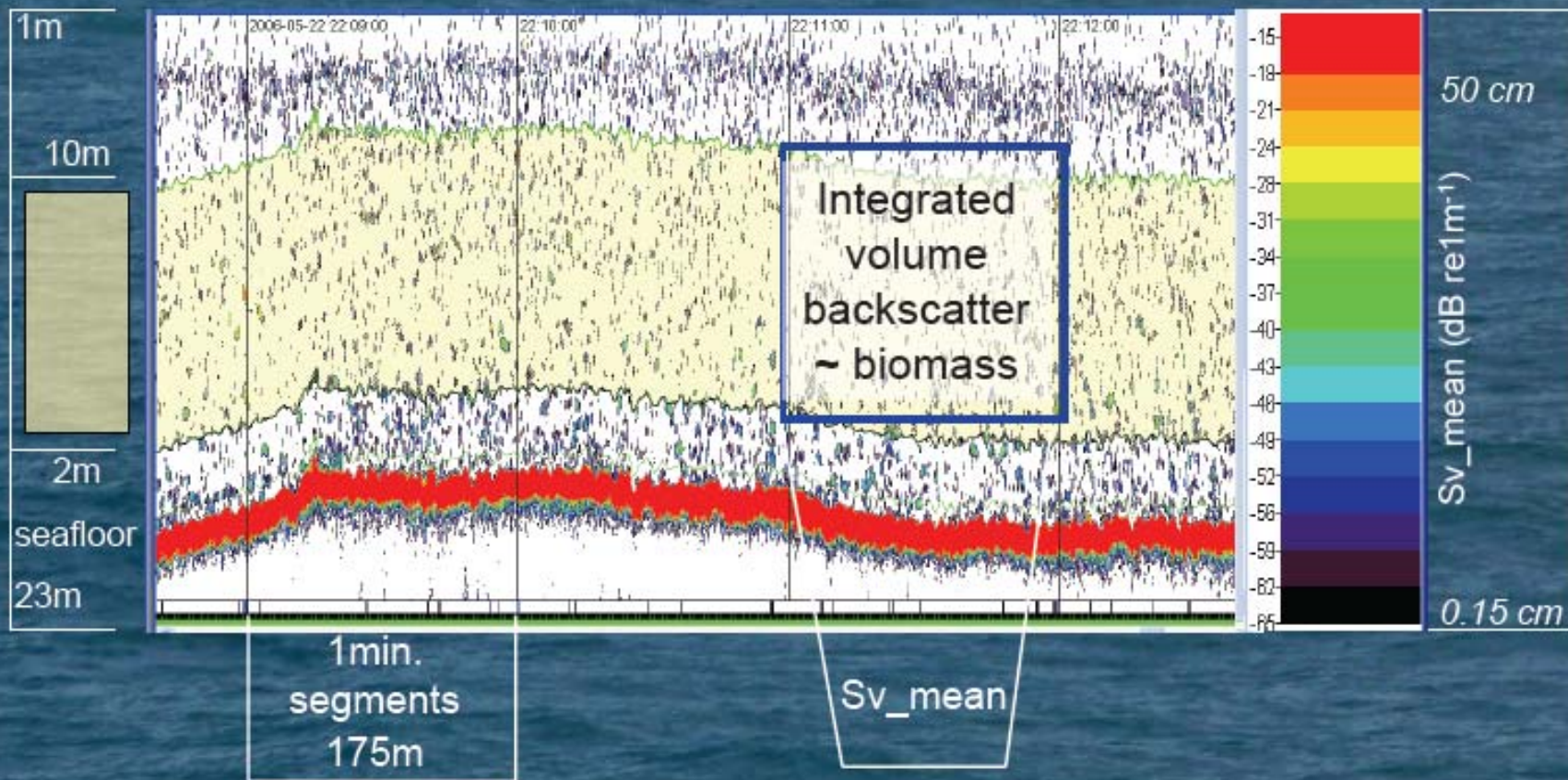
Numerous fishes
over reef surface



Coral reef bottom



Mapping biota in the water column



Advantages and limitations

Advantages

- Non-invasive
- Rapid, spatially extensive
- Multi-dimensional, high resolution data
- Broad depth ranges (2 - >>1000m)
- Sample during night, low visibility

Limitations

- Unable to ID species
- Species specific acoustic size/fish size relationships not well known
- Mixed species may complicate analysis

Study objectives

- **Presence/absence**
 - Broad distribution of fish/zooplankton biomass
- **Spatial distributions**
 - Associated with habitats
 - Habitat connectivity
- **Abundance estimates**
 - Spawning aggregations



Broad distribution of relative biomass

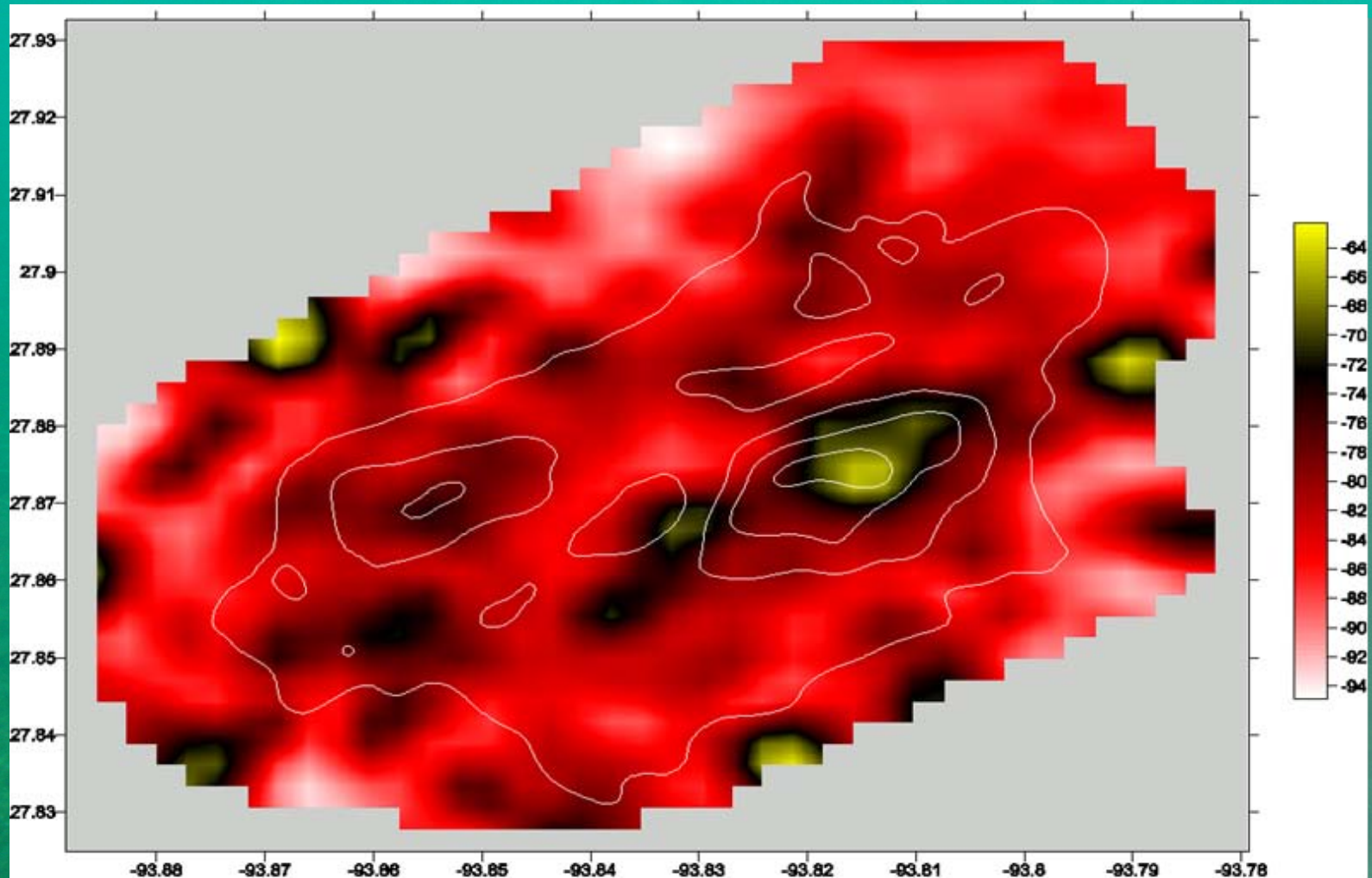


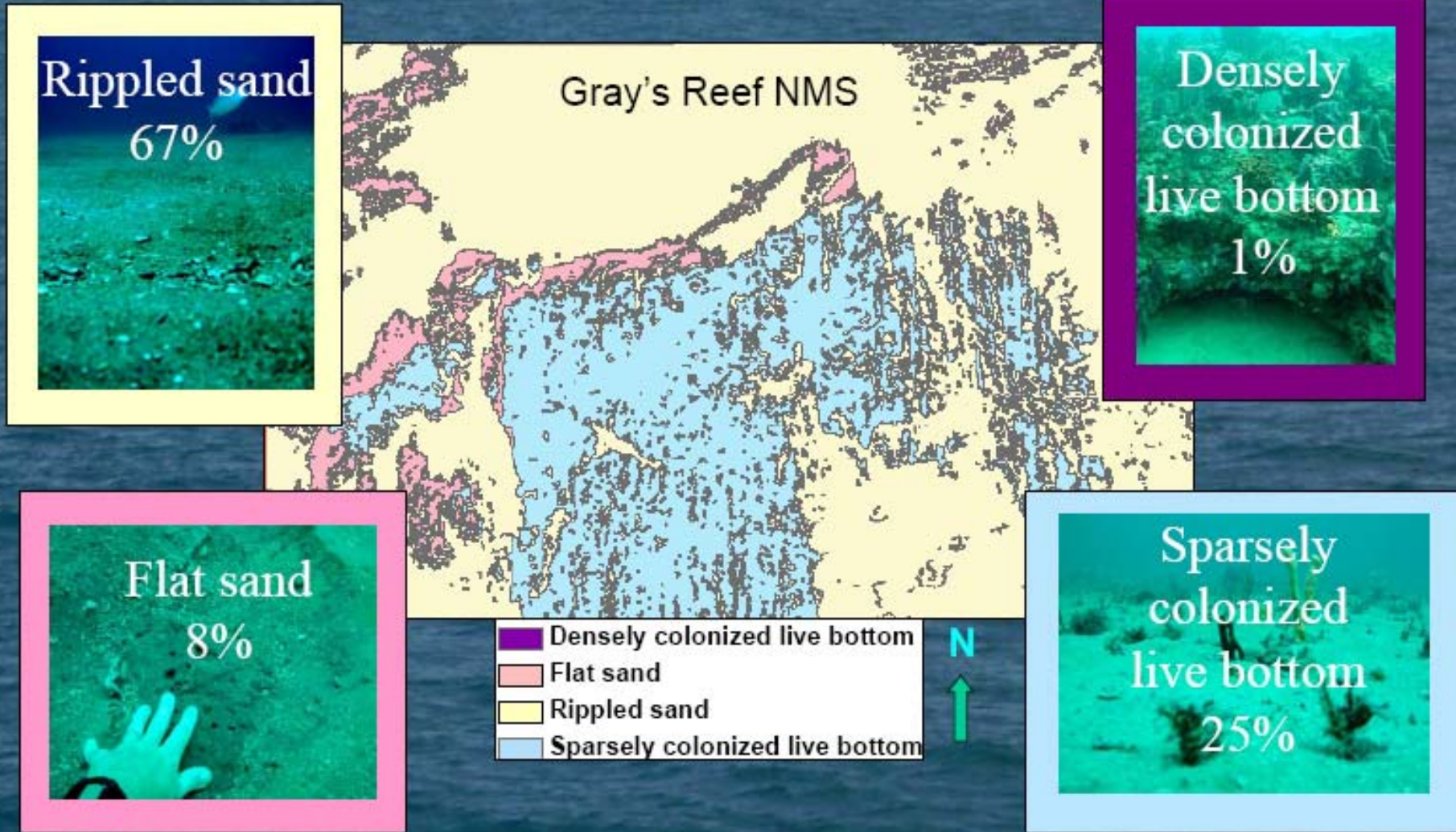
Figure source: Wilson et al. 2003

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


Benthic habitat types

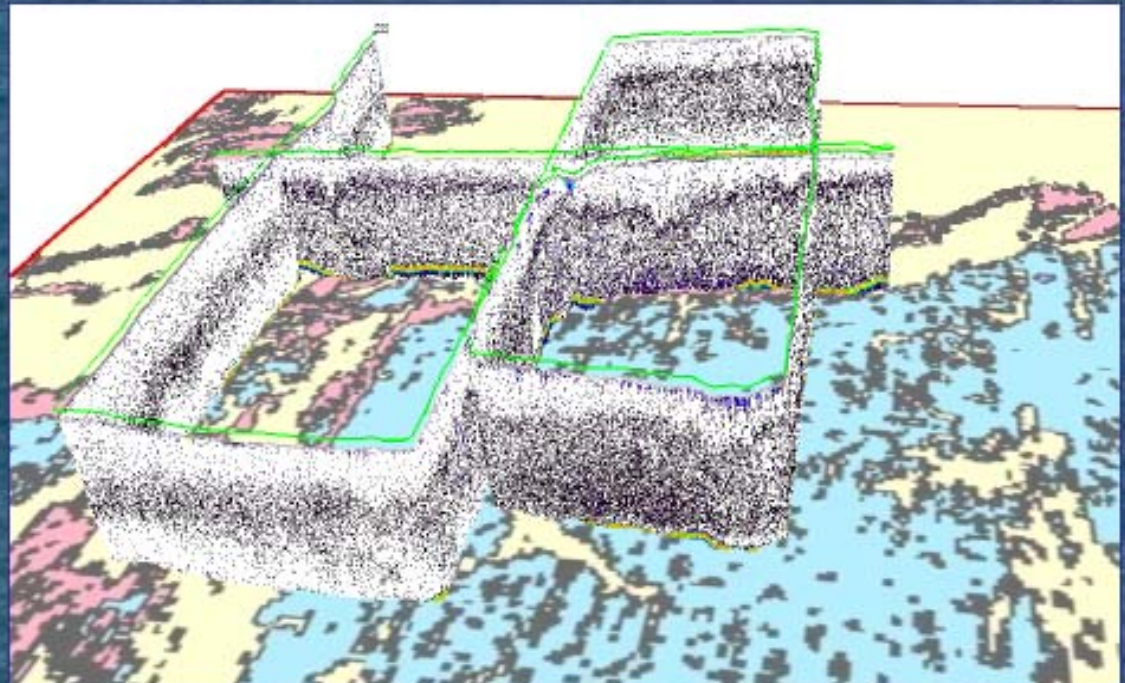


Fisheries acoustics mapping

Echograms from acoustic surveys provide estimates of

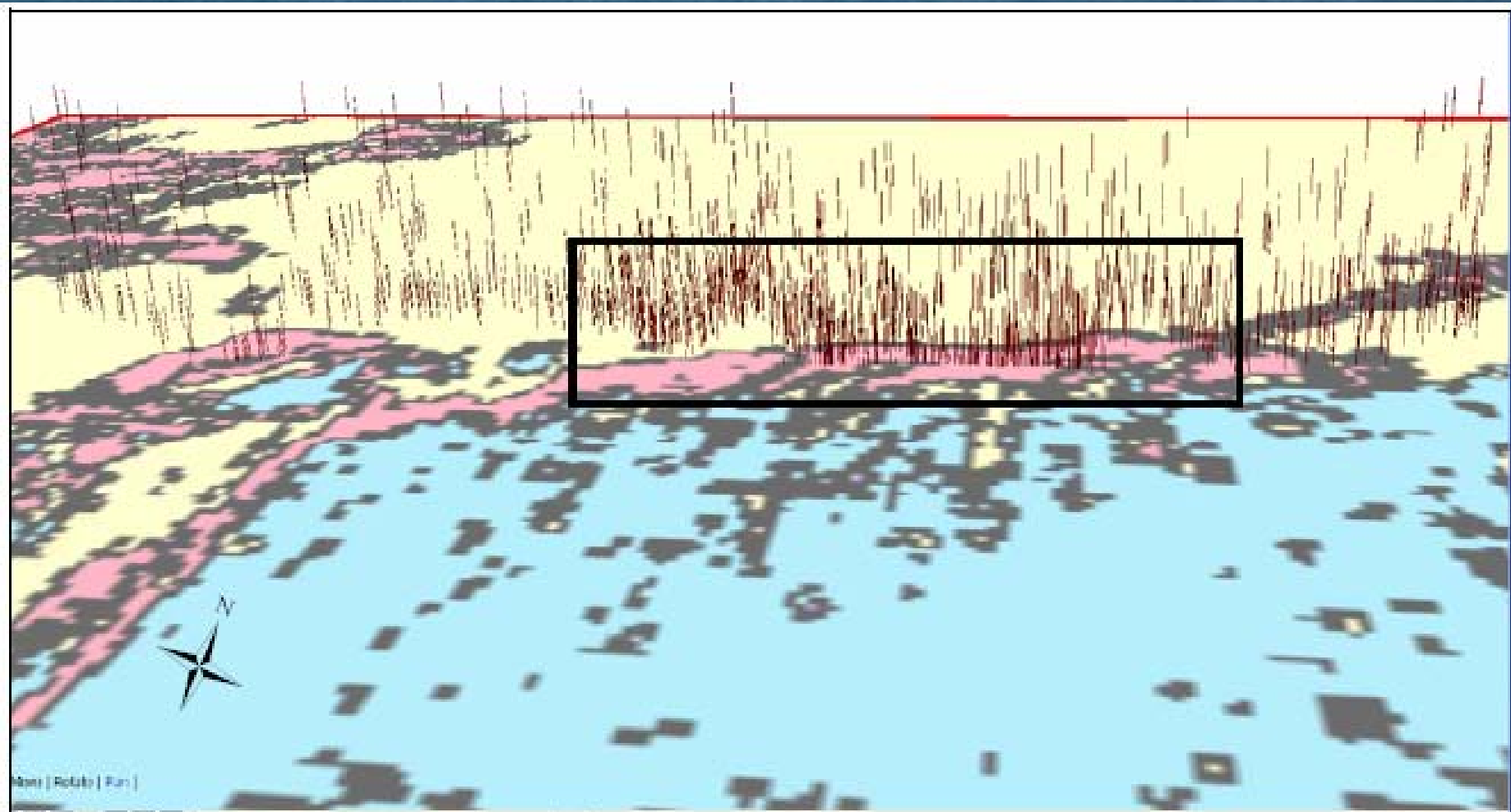
- fish biomass
- size of fish
- location of fish

Benthic habitat type	
	Densely colonized live bottom
	Flat sand
	Rippled sand
	Sparsely colonized live bottom



22 May 2008 7:30 pm to 10:30 pm

Fisheries acoustics mapping

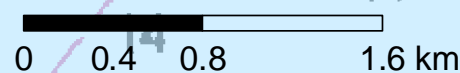
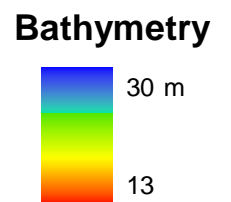
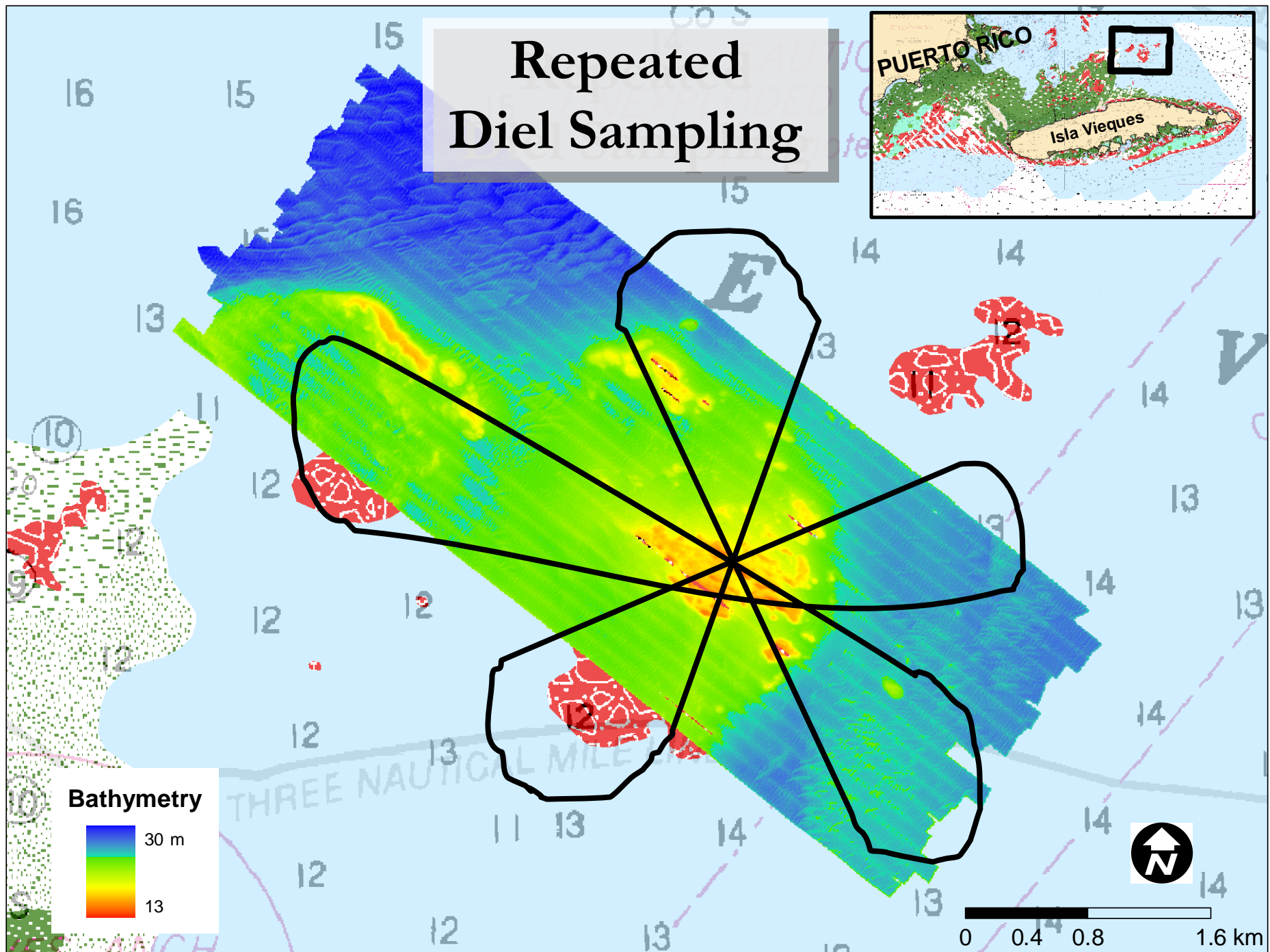
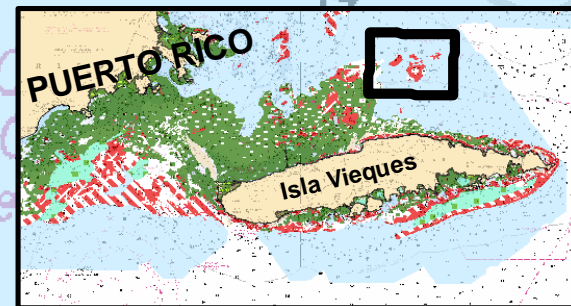


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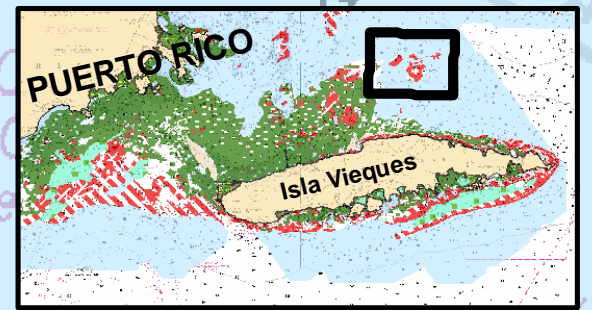
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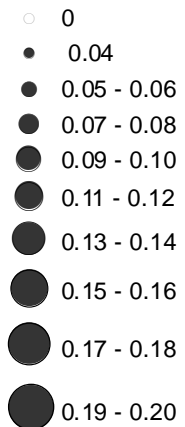
Repeated Diel Sampling



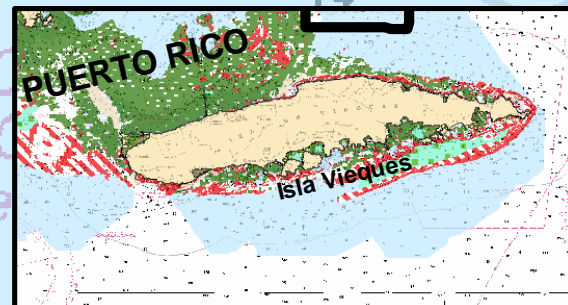
Survey time
~1700h



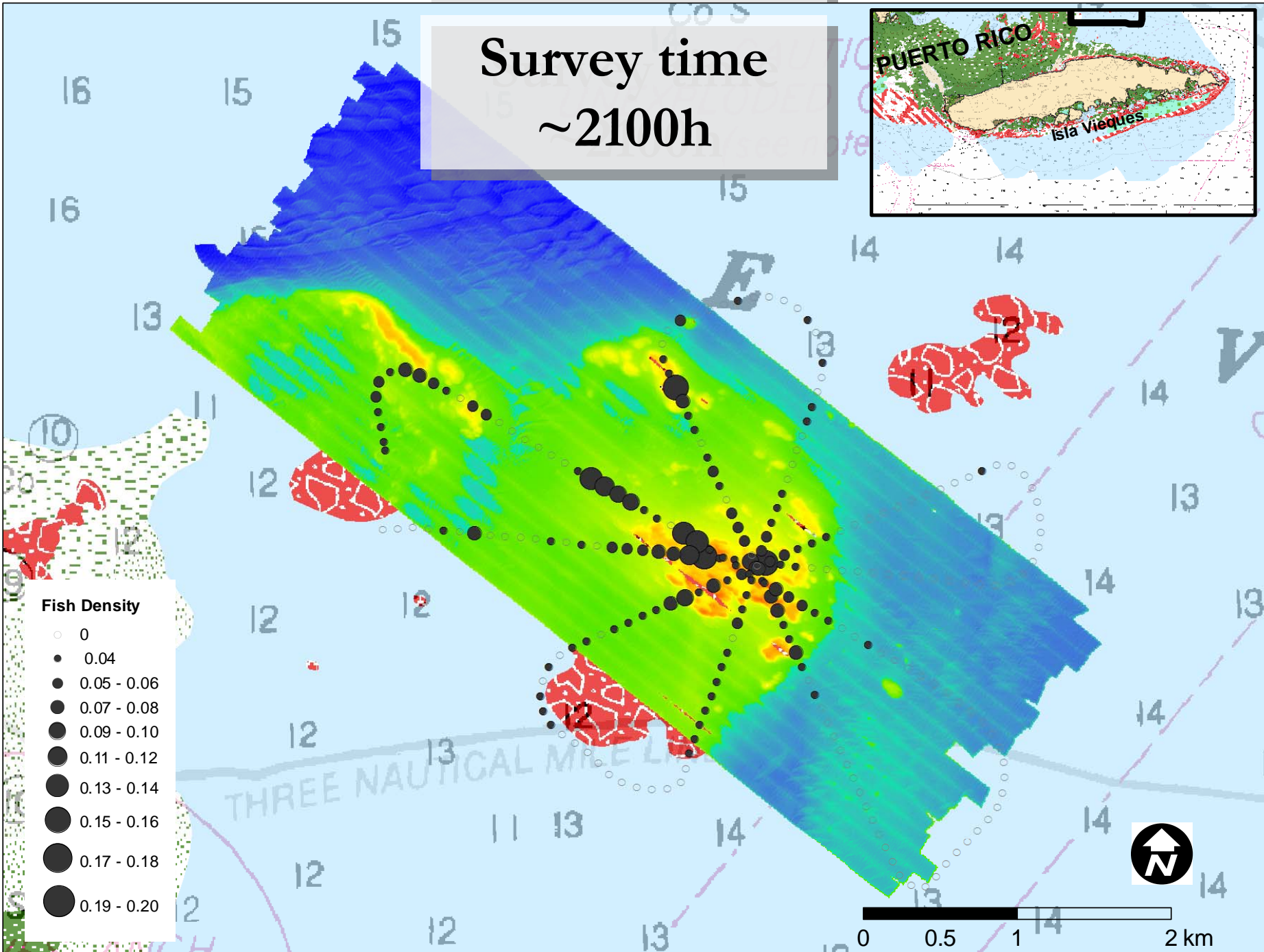
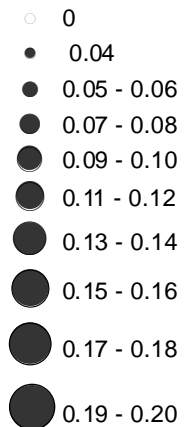
Fish Density



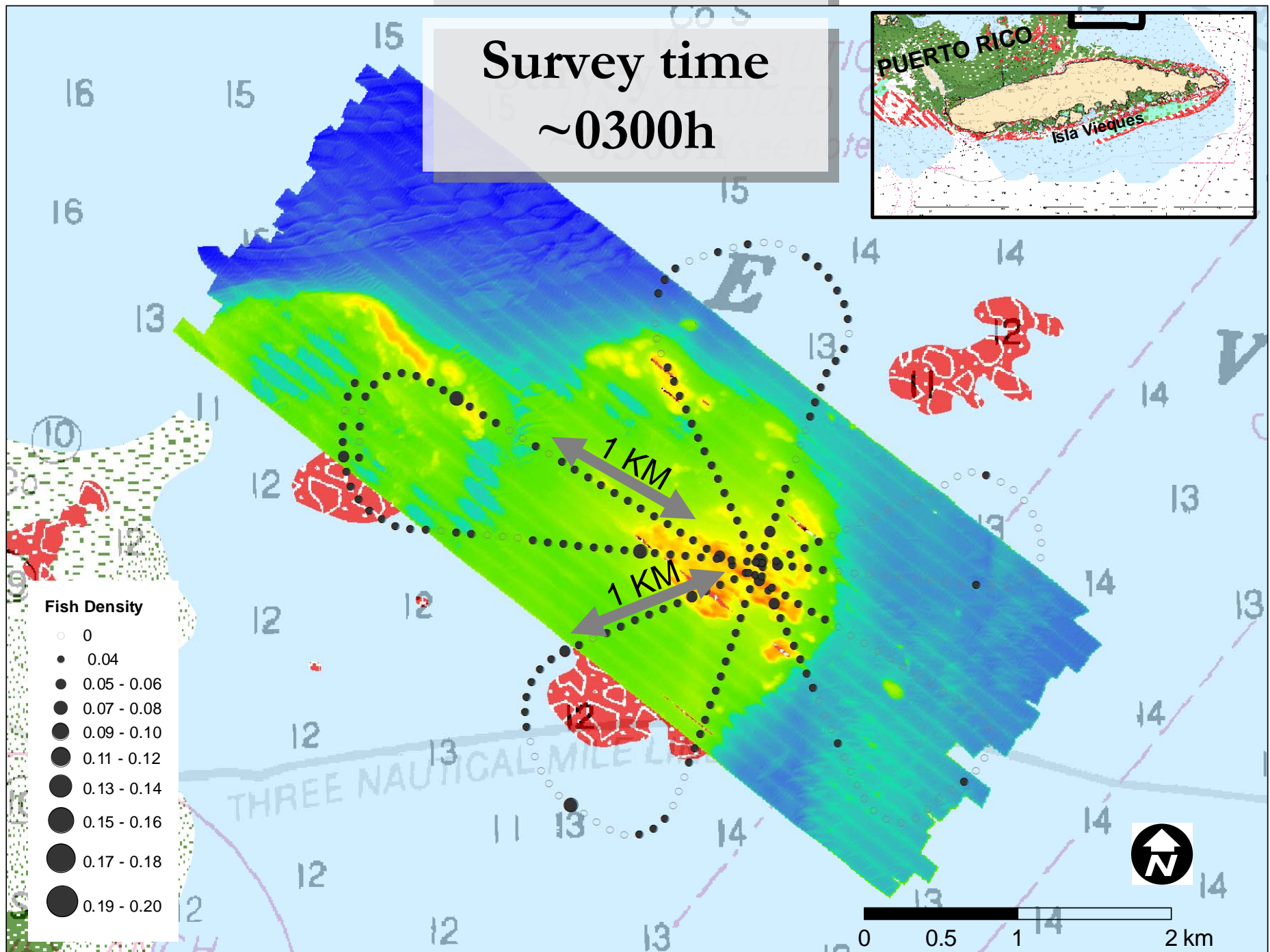
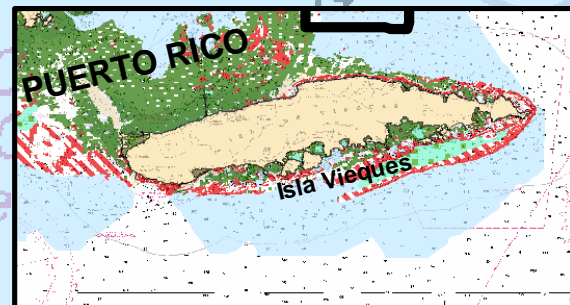
Survey time
~2100h



Fish Density



Survey time
~0300h



Fish Density

- 0
- 0.04
- 0.05 - 0.06
- 0.07 - 0.08
- 0.09 - 0.10
- 0.11 - 0.12
- 0.13 - 0.14
- 0.15 - 0.16
- 0.17 - 0.18
- 0.19 - 0.20

Study objectives

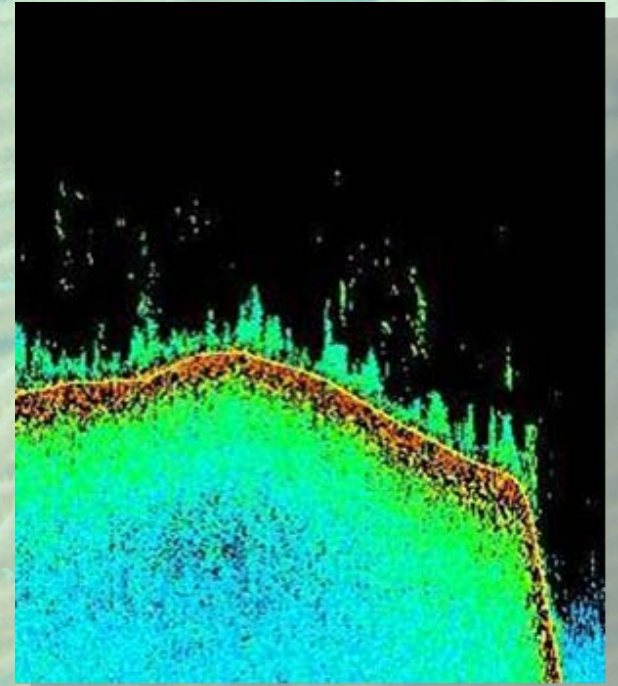
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Assessments of reef fish aggregations

- Species validation & population assessments
 - Nassau Grouper FSAs (CI & Bahamas)
 - Red Hind FSAs (Puerto Rico, USVI)
 - Mutton Snapper FSAs (Riley's Hump)



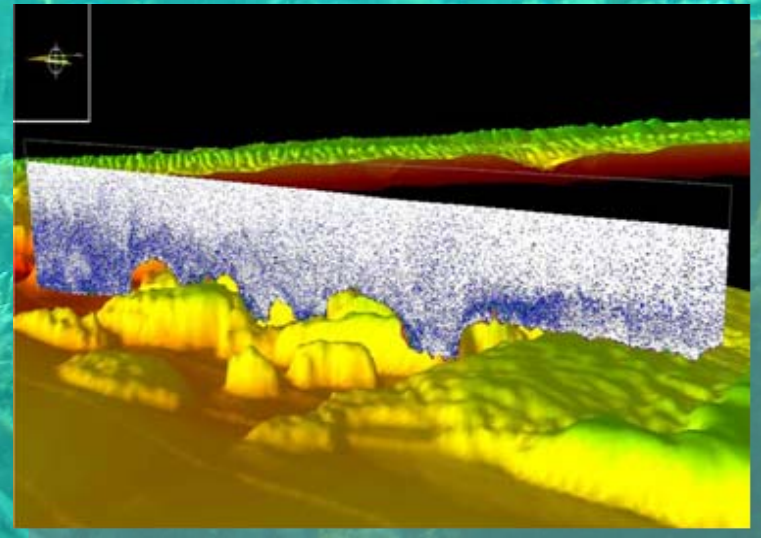
Photo credit: P. Bush



Towards complimentary sampling designs

Multibeam
(habitat)

Split-beam
(fish)



Informed diver surveys
(random/adaptive cluster sampling)



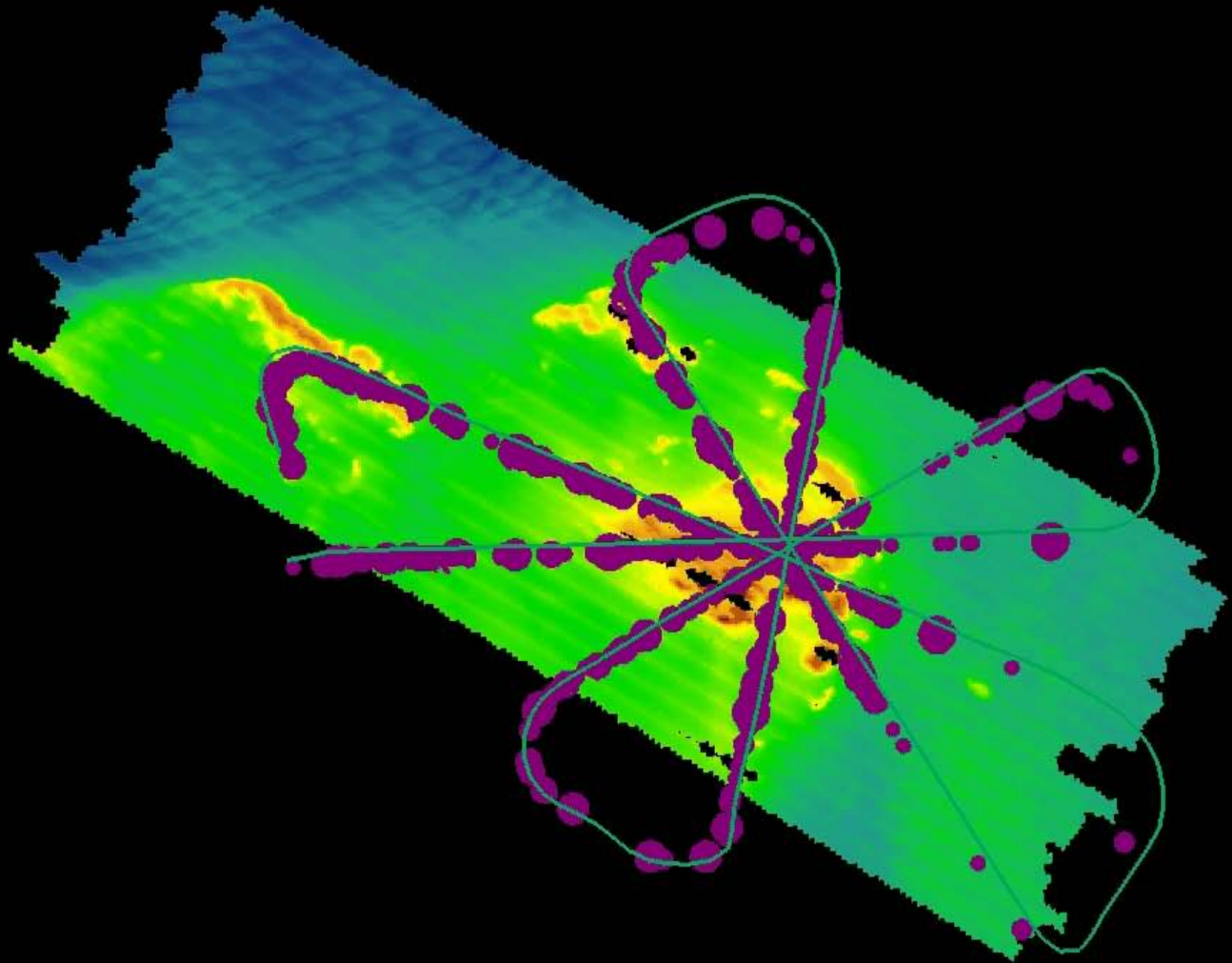
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Acknowledgements

- Flower Garden Banks National Marine Sanctuary
- LSU Center for Coastal Fisheries (K. Boswell and C. Wilson)
- Applied Ecology and Restoration Research Branch
Center for Coastal Fisheries and Habitat Research
- Gray's Reef National Marine Sanctuary
- Crew of NOAA Nancy Foster

Informing ecosystem management: non-invasive hydroacoustic sampling

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