Spatial Interpolation as a Tool to Assess Disposal Effects at an ODMDS: Tilefish at Miami ODMDS as a Case Study

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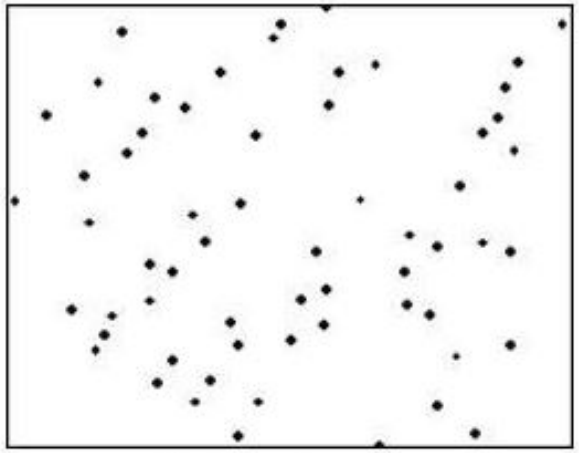
Why Use Spatial Interpolation?

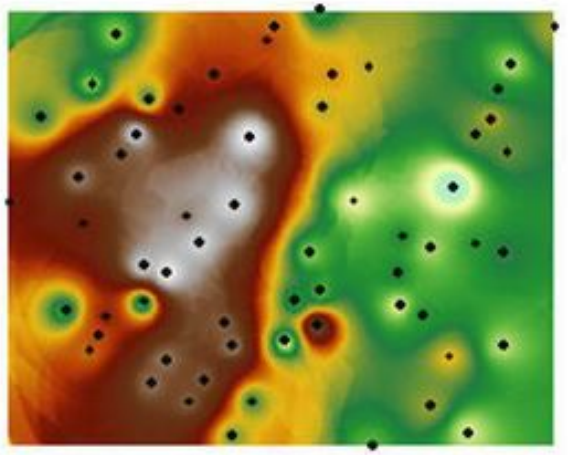
- Let's say you want to know the physical characteristics of the sediment within an ODMDS:
  - The ODMDS is 1 square nmi (36,920,000 ft^2)
  - You've sampled 30 stations (0.00008%)
  - How do you know the remaining 99.99992%?
- Other methods are cost-prohibitive or not feasible (sidescan sonar, ROV video, SPI camera, further sediment sampling)
- Interpolation assumes characteristics are spatially correlated

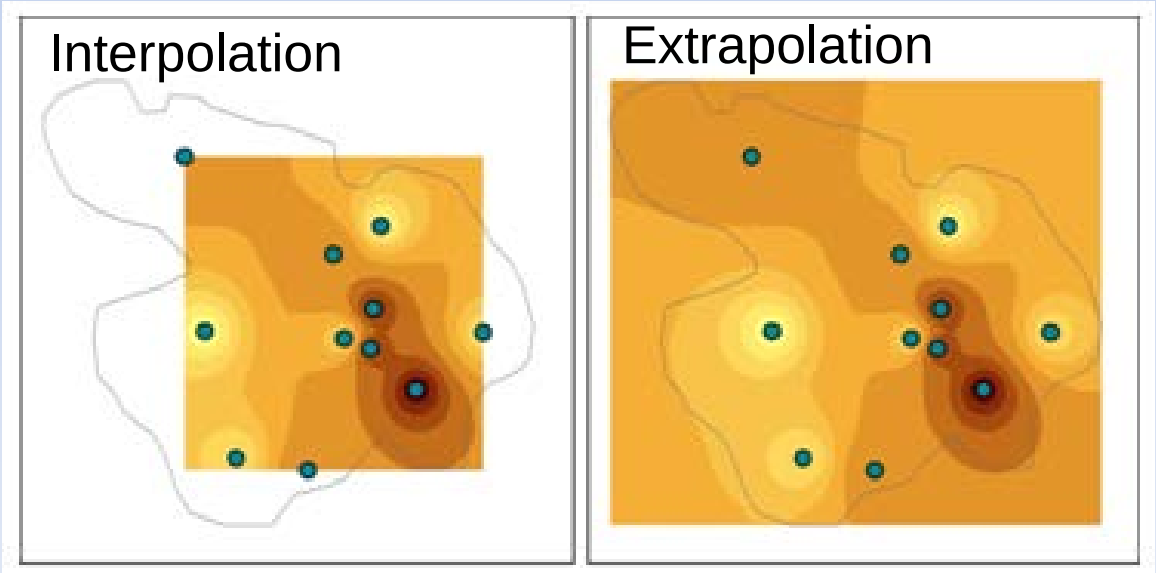
SPATIAL INTERPOLATION

Known Values



Predicted Values





Source: SuperMap.com

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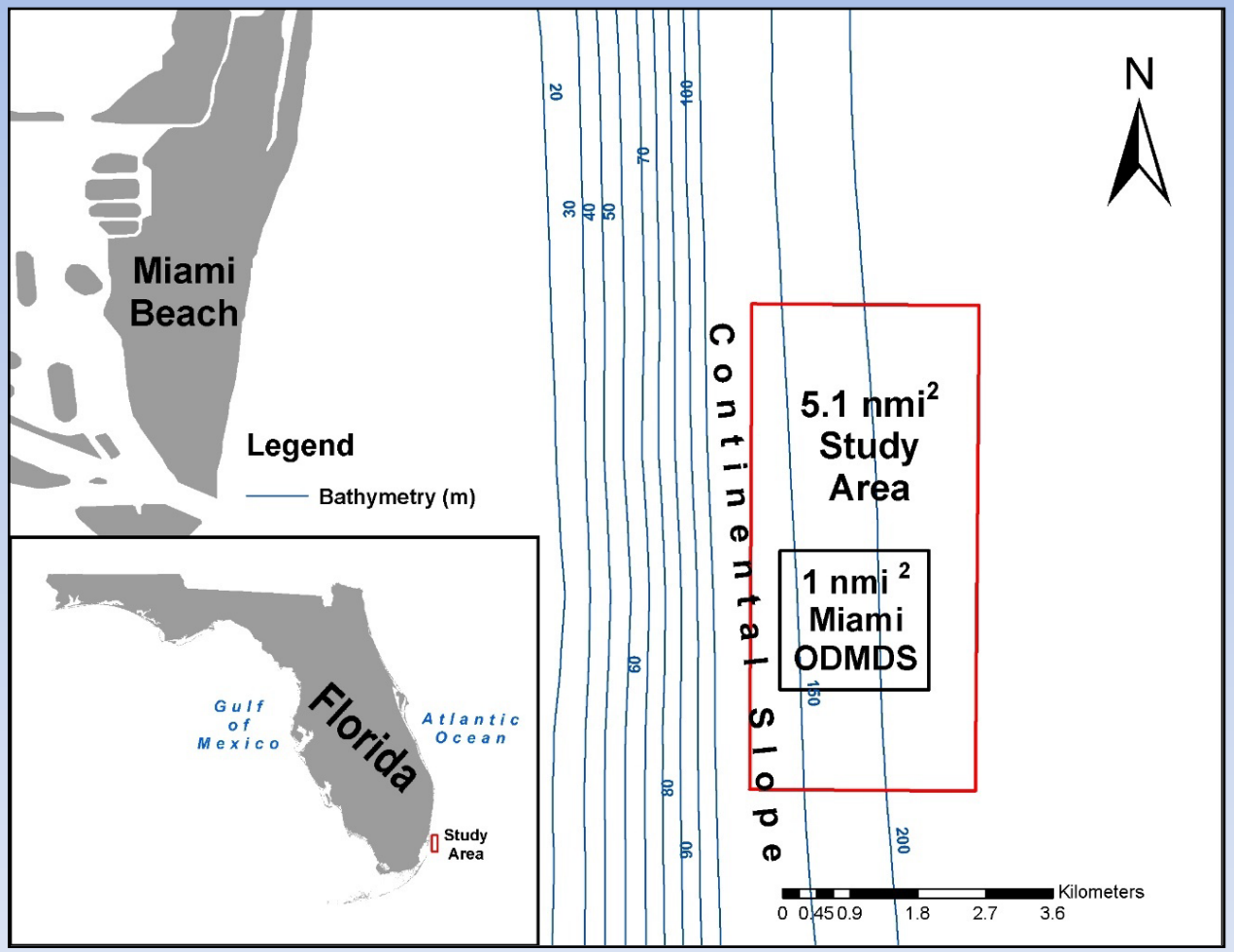
Why Choose Ordinary Kriging?

Ordinary kriging:

- Most often used form of kriging
- Categorized as a Best Linear Interpolation Unbiased Predictor
- Constrains the weighting of predicted values so values at sampled locations = known values
- Allows an error estimation to be made

Study Area off Miami, Florida



Source: Seitz (2010)

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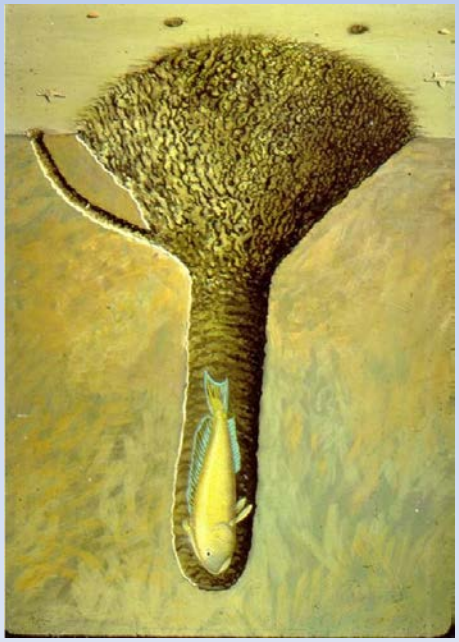
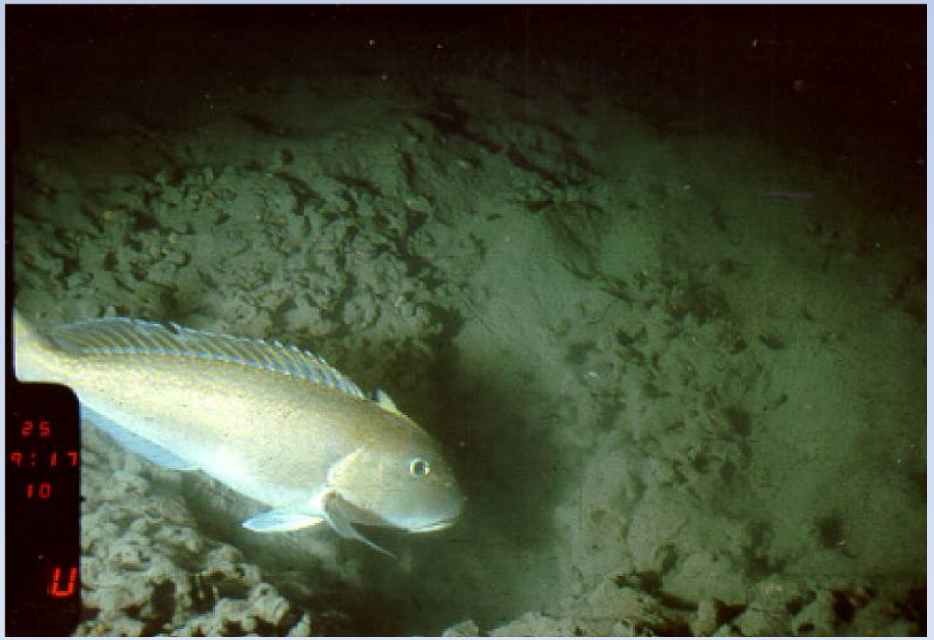
Study Animal: Golden Tilefish

- Require significant silt and clay for burrows
- Large, demersal, non-migratory species
- Valuable commercial (>$1.7m annually) and recreational species (4.6k landed annually) in Florida and elsewhere





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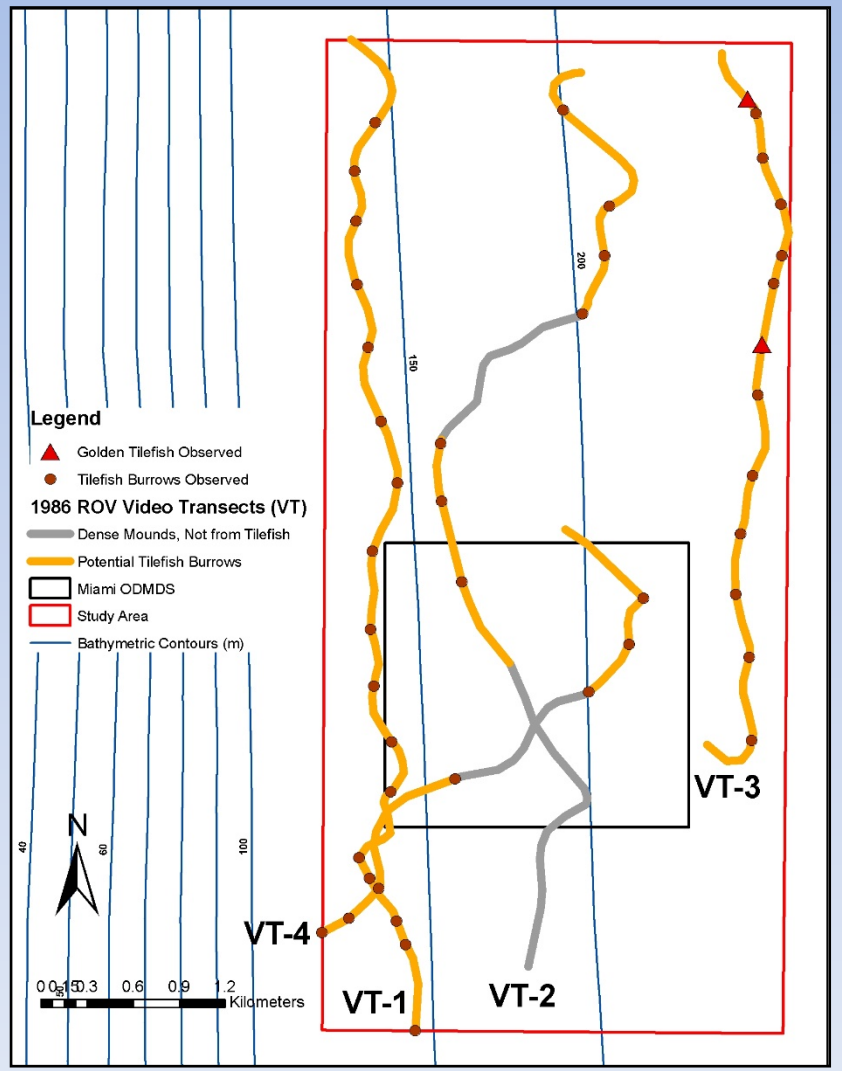
Drawing and photo courtesy of Ken Able of Rutgers University

Pre-disposal Conditions: Results of 1986 ROV Video Transect Survey

- Substrate mostly sand and fines (silts & clays)
- Video data verified with 1985 sediment sampling results
- 1000s of tilefish burrows obs. (diam. 30–150 cm)
- 81.7% of transected seafloor had burrows
- Entire 5.1-nmi^2 study area suitable for tilefish habitat



Source: Seitz (2010)

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Predicting the Current Status of Tilefish Following Disposal Activities

Time Frame	Volume Disposed (m^3)	Project Type	Dredge Method
1990–1999	2,504,147	Federal maintenance	Hopper, mechanical
2000–2009	1,237,050	Federal maintenance & new work	Hopper, mechanical
2010–2015	4,202,167	Federal, permitted, new work	Hydraulic, mechanical
TOTAL	7,943,364	Including coarse sand, gravel, limerock	

Source: USACE (2018) (https://odd.el.erdc.dren.mil/ODMDSSearch.cfm)

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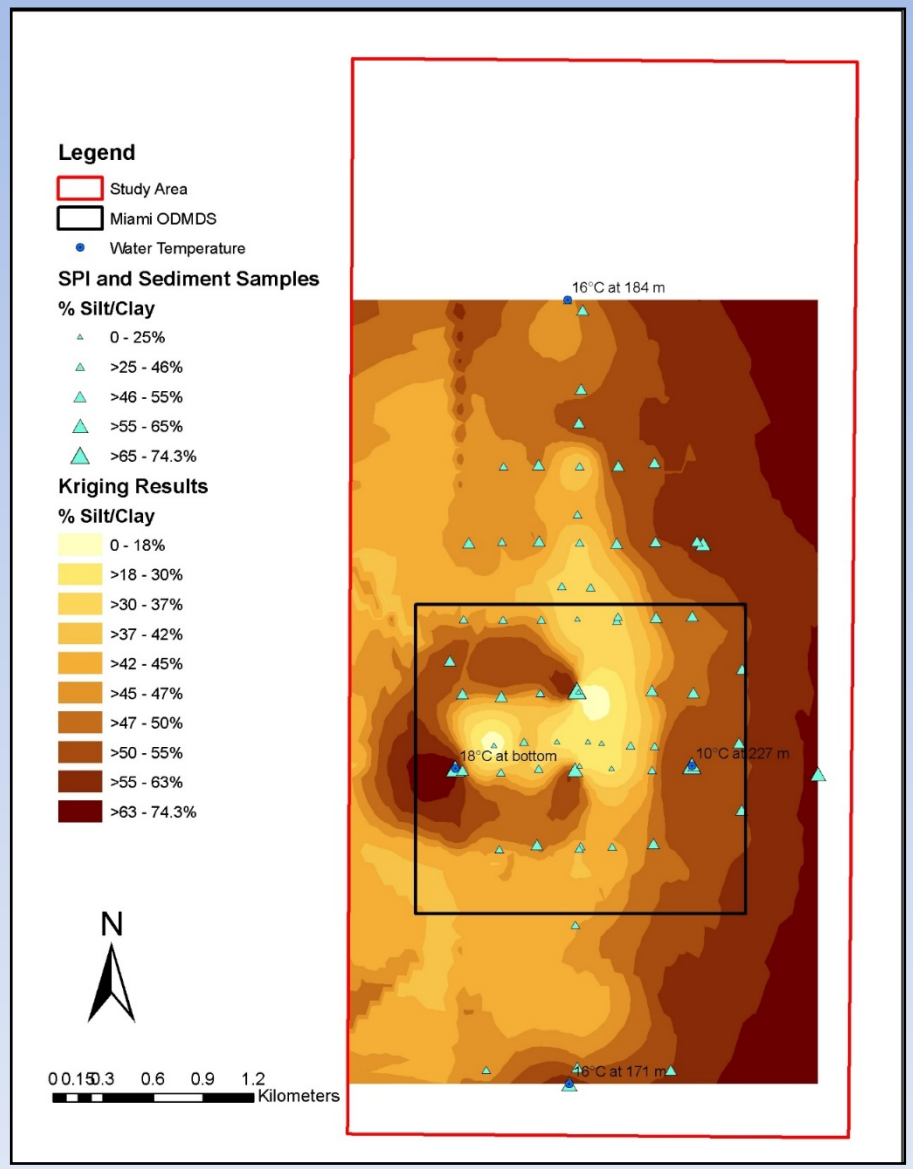
Spatial Interpolation Methods

- ArcMap extension Spatial Analyst was used
- Sample dataset: SPI results (58 stations, 2006), physical analysis from 12 stations (2008), water temperature data (2007)
- See Webster and Oliver's 2001 book *Geostatistics for Environmental Scientists* for methods of data investigation or see my paper in the WEDA conference proceedings

Ordinary Kriging Analysis Results



Prediction error = 8.8 (fair)

Source: Seitz (2010)

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RESULTS

Results suggest that most of the 5.1-nmi^2 study area remains suitable for tilefish

- Sediment still favorable for tilefish burrows
- Small area within ODMDS & north of it may no longer be suitable for tilefish
  - Coarse sand, gravel, & limestone rubble
- Areas now containing rubble may be more suitable for groupers and snappers

Photo courtesy: Amanda Bemis of FLMNH, UF

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DISCUSSION

- Study had significant limitations (low sample size, clustering of samples, surficial sediment, etc.)
- Spatial interpolation is a low-cost method of predicting habitat suitability of ODMDSs for managed stocks using existing datasets
- Tilefish habitat may not be strongly affected by dredged material disposal based on this study, so effects to the fishery may be minimal
- Local fishery stakeholders may not experience strong changes to the fishery if the ODMDS continues to provide habitat for tilefish stocks

Photo courtesy: Amanda Bemis of FLMNH, UF

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THANK YOU!

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Photo courtesy: Amanda Bemis of FLMNH, UF

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