Development of a National-Scale Indicator of Benthic Condition for the National Coastal Condition Assessment.

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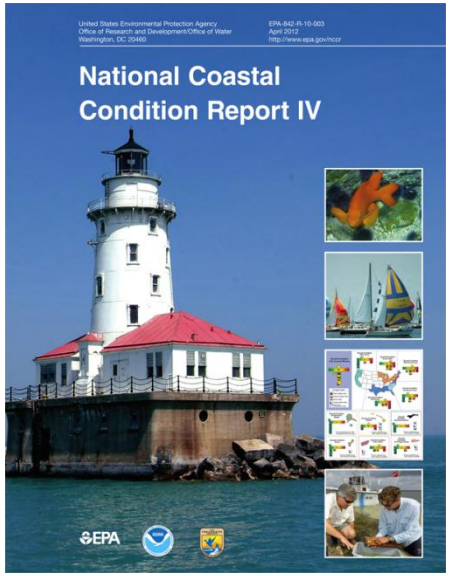
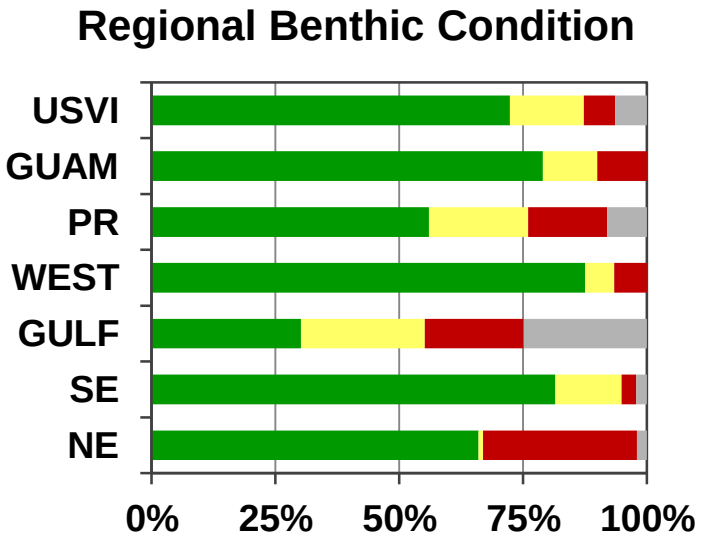
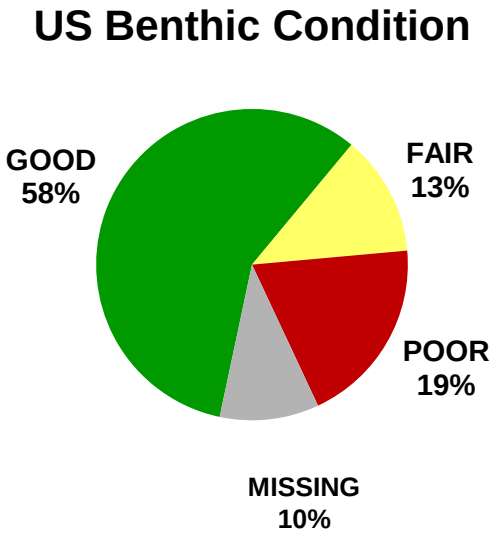
National Coastal Assessment (NCA)

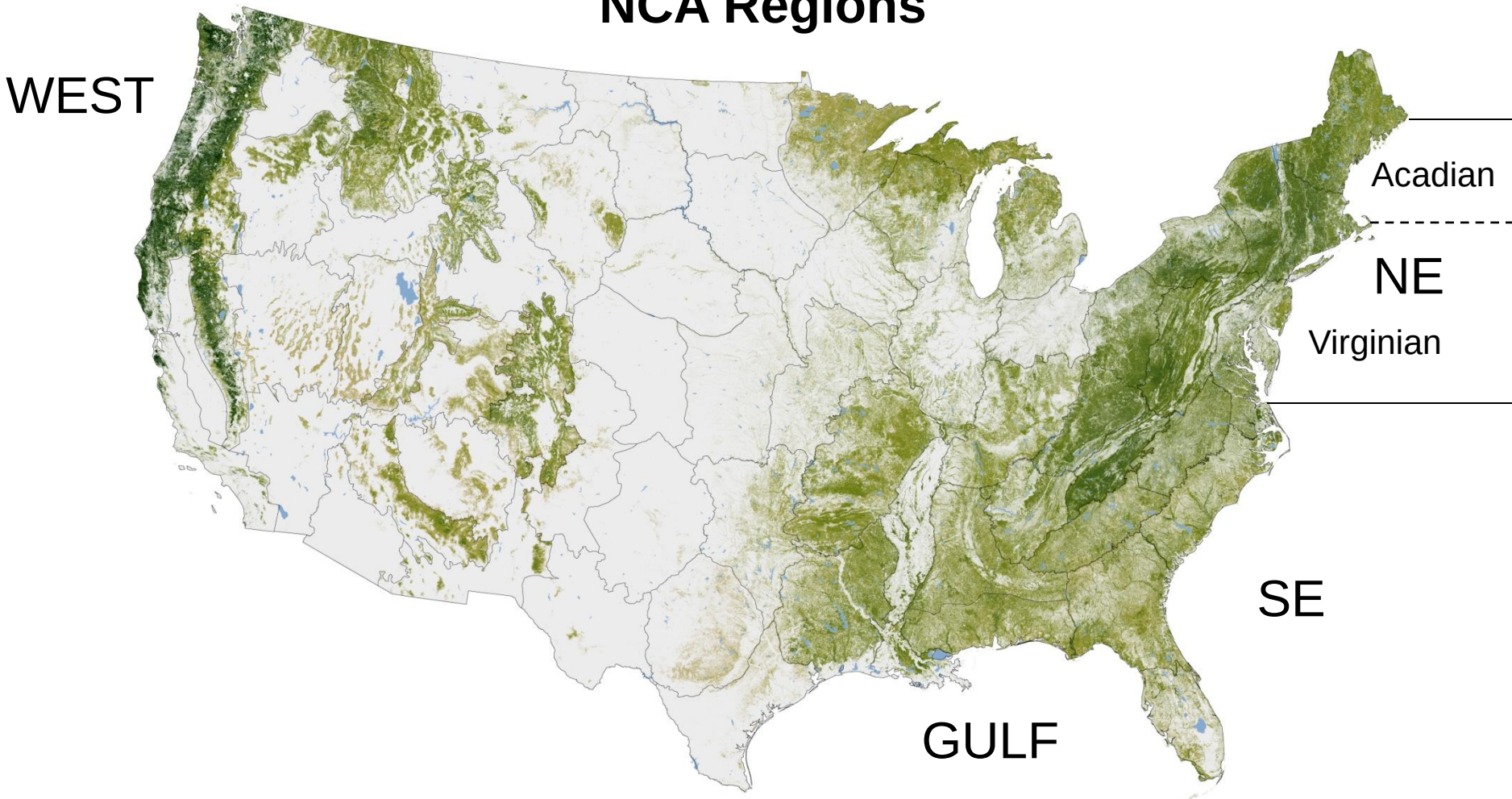
- National surveys of estuarine condition 2000-2006
- Benthic condition based on regional benthic indices
- Benthic indices translated to GOOD, FAIR, POOR scores for regional assessments
- Regional scores combined for national assessment







NCA Regions



NCA Regional Benthic Indices

Region	Benthic Index Components	Rating	Reference
NE Acadian	Diversity H' Pollution Tolerance Value % Abundance Capitellids	Good ≥ 5 Fair 4-5 Poor < 4	Hale & Heltshe 2008
NE Virginian	Gleason's D (salinity-normalized) Tubificid Abundance (salinity-normalized) Spionid Abundance	Good > 0 Poor < 0	Paul et al. 2001
SE	Abundance & Taxa Richness 100% - % abundance of top 2 dominant taxa % Pollution sensitive taxa	Good > 2.5 Fair 2-2.5 Poor < 2	Van Dolah et al. 1999
GULF	Prop. Expected Diversity H' (based on salinity) Tubificid Abundance % Abundance Capitellids, Bivalves, Amphipods	Good > 5 Fair 3-5 Poor < 3	Engle et al. 1994 Engle & Summers 1999
WEST	Prop. Expected Taxa Richness (based on salinity)	Good > 90% Fair 75-90% Poor < 75%	None

National Coastal Condition Assessment (NCCA)

- National survey of coastal condition in 2010
- Methods & indicators based on NCA
- Investigated potential for single national benthic indicator to assess estuarine condition

- **Multivariate AZTI Marine Biotic Index (M-AMBI)**
  - Used widely in Europe with some applications in U.S.
  - Based on ecological theory of benthic response to stressors and disturbance

Multivariate-AMBI (M-AMBI)

- Combines AMBI, diversity, and richness in a factor analysis
- Relies on reference condition values for salinity zones
- "High" reference values derived from 95th percentiles from "Good" NCA sites by salinity zone.
- "Bad" reference values are lowest possible values
- M-AMBI scores range from 0 (Bad) to 1 (High)

Salinity Zone	AMBI	Diversity	Richness
Tidal Freshwater (0-0.5)	0.95	1.83	12
Oligohaline (0.5-5)	0.85	2.28	21
Mesohaline (5-18)	1.15	2.65	30
Polyhaline (18-30)	1.04	3.04	50
Euhaline (>30)	0.88	3.27	61

M-AMBI Validation using NCA data

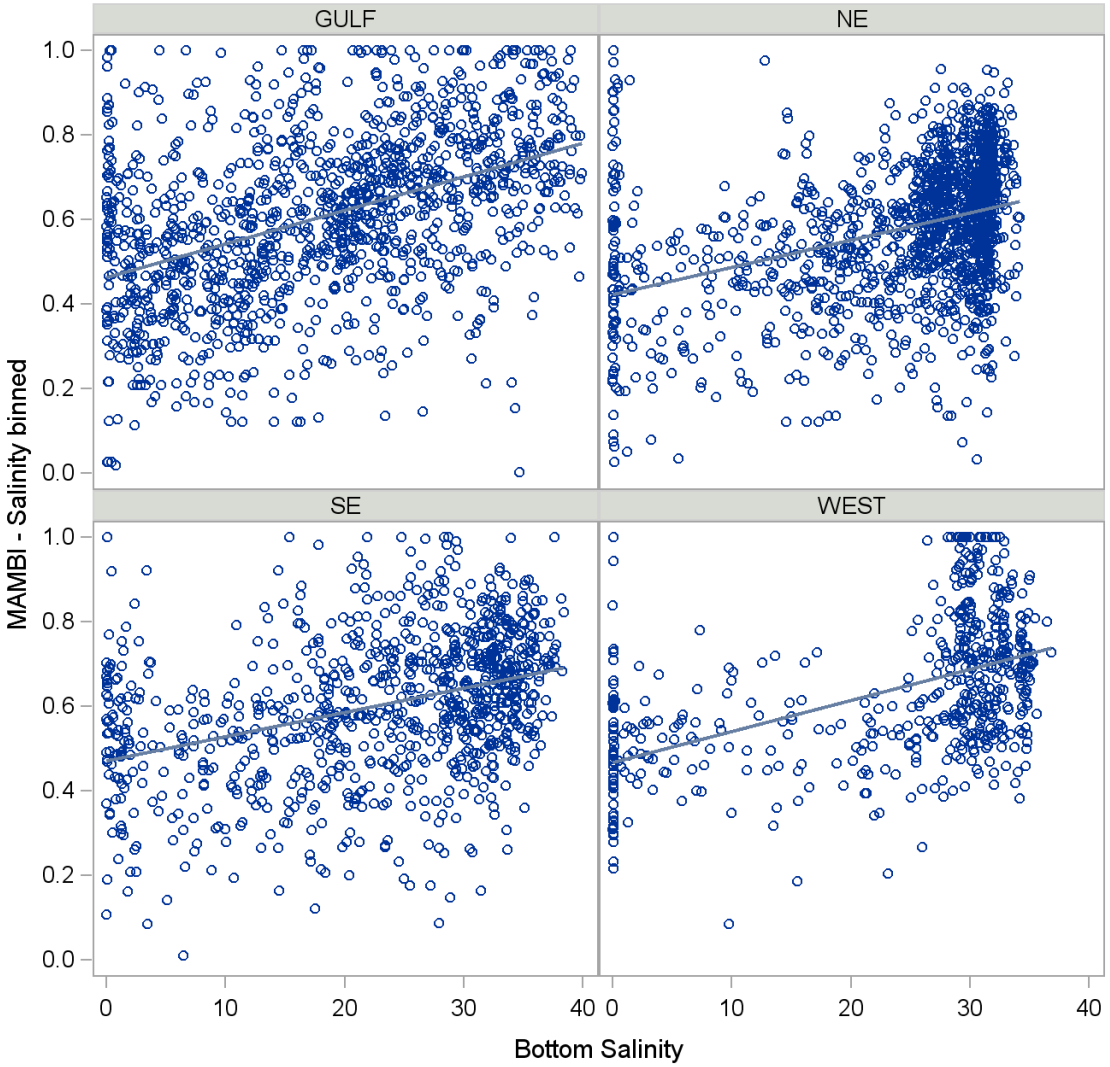
- Categorical comparisons with:
  - *NCA Stressor Threshold Categories*
  - *Regional Benthic Index Categories*
- Correlations with
  - *Regional Benthic Indices*
  - *Stressors (DO, TOC, Sediment Contaminants)*
  - *Salinity & % Silt-clay*

M-AMBI Validation Results

Compare M-AMBI to Regional BI's	NCA Regions			
	NE	SE	GULF	WEST
Classification of Threshold Sites	>	>	>	ns
Correlations:				
DO	<	=	ns	n/a
TOC	>	>	>	n/a
Mean ERM-Q	>	>	>	n/a
Salinity	>	>	>	n/a
% Silt-clay	>	=	>	n/a

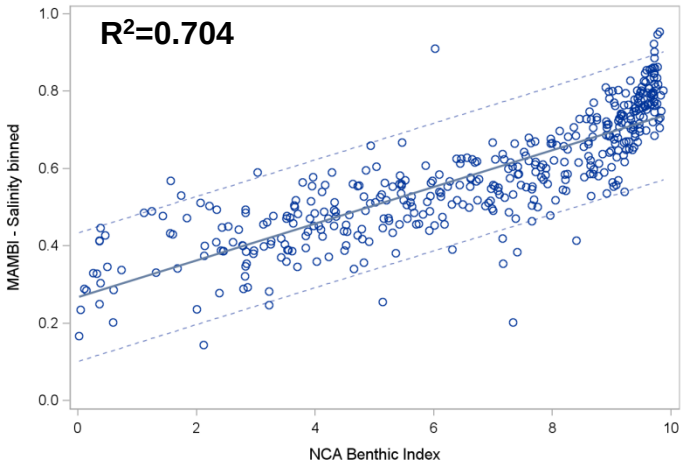
M-AMBI Correlations with Salinity

Region	R^2
GULF	0.16
NE	0.13
SE	0.14
WEST	0.24

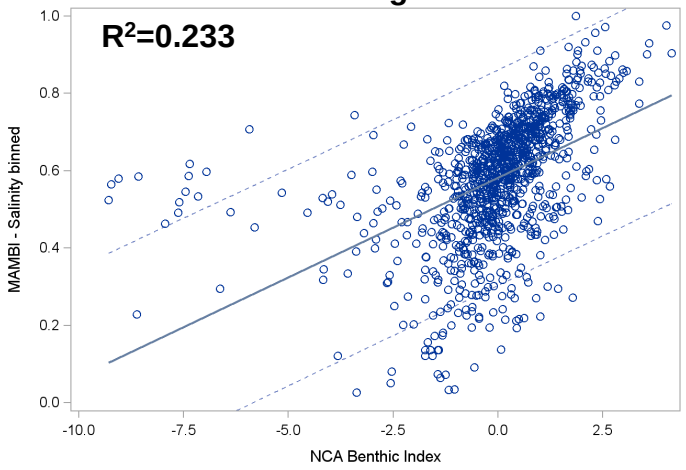


MAMBI Correlations with NCA Regional BI's

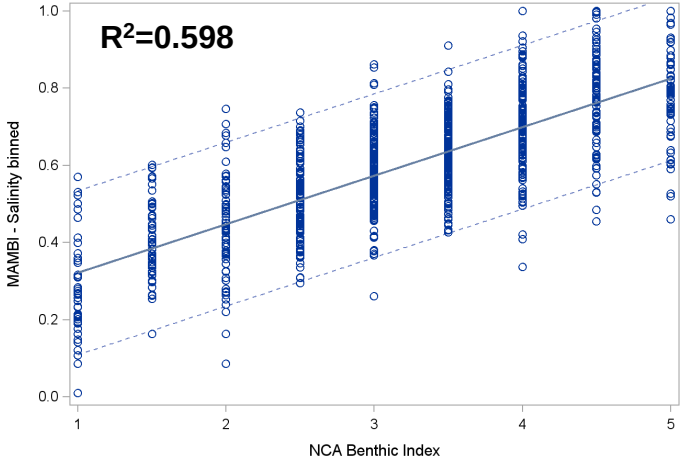
NE Acadian



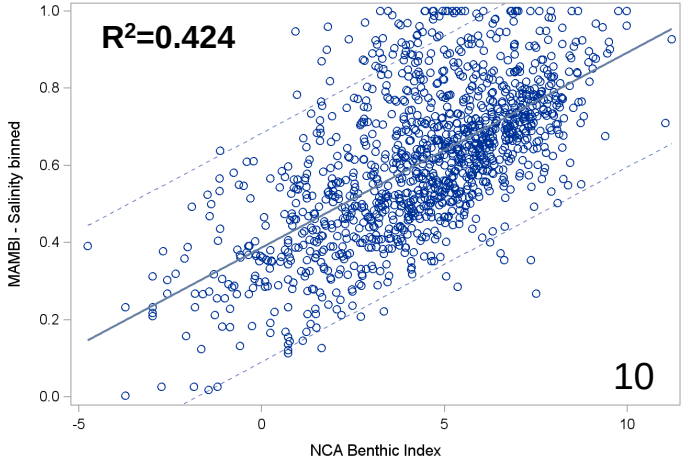
NE Virginian



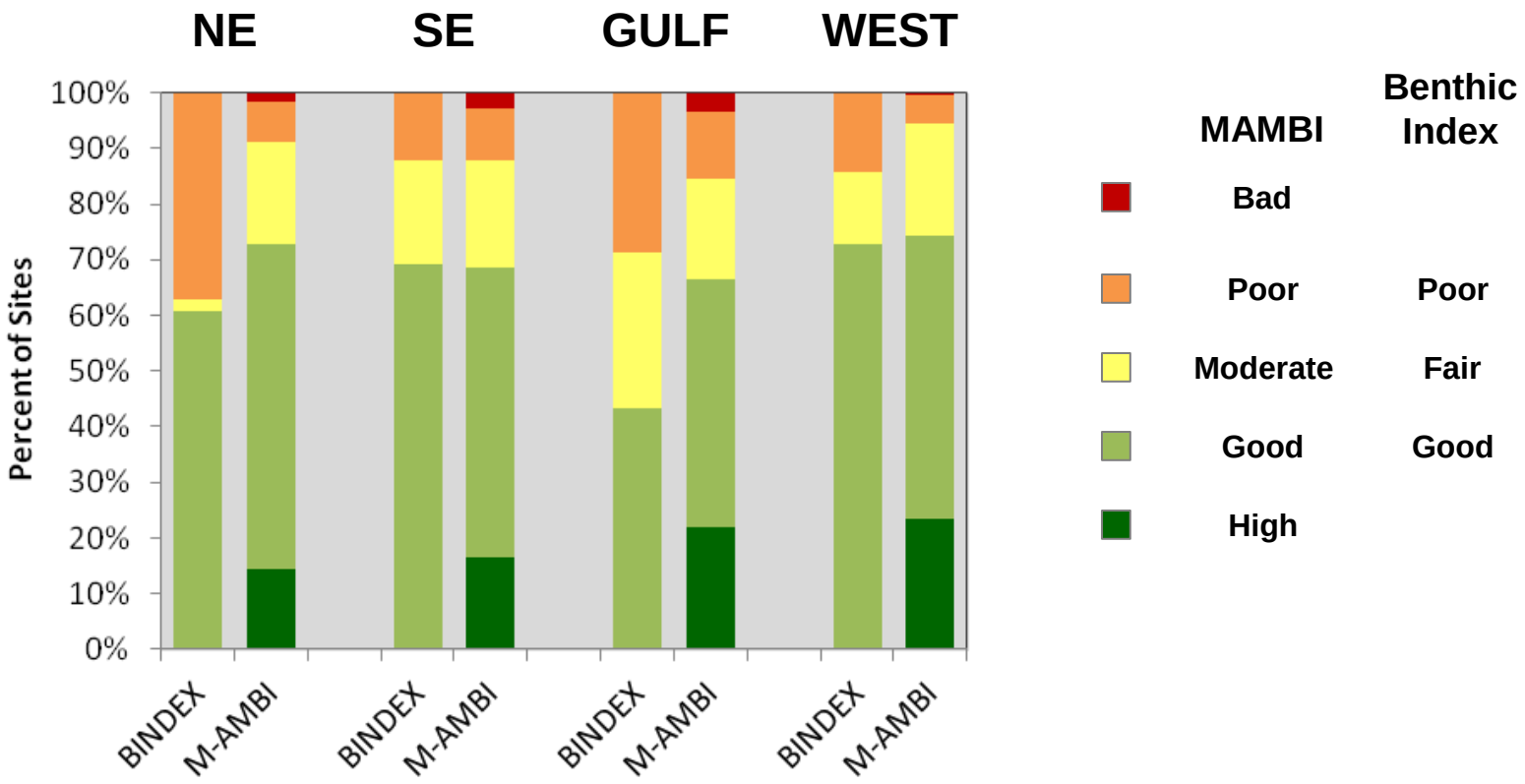
SE



GULF

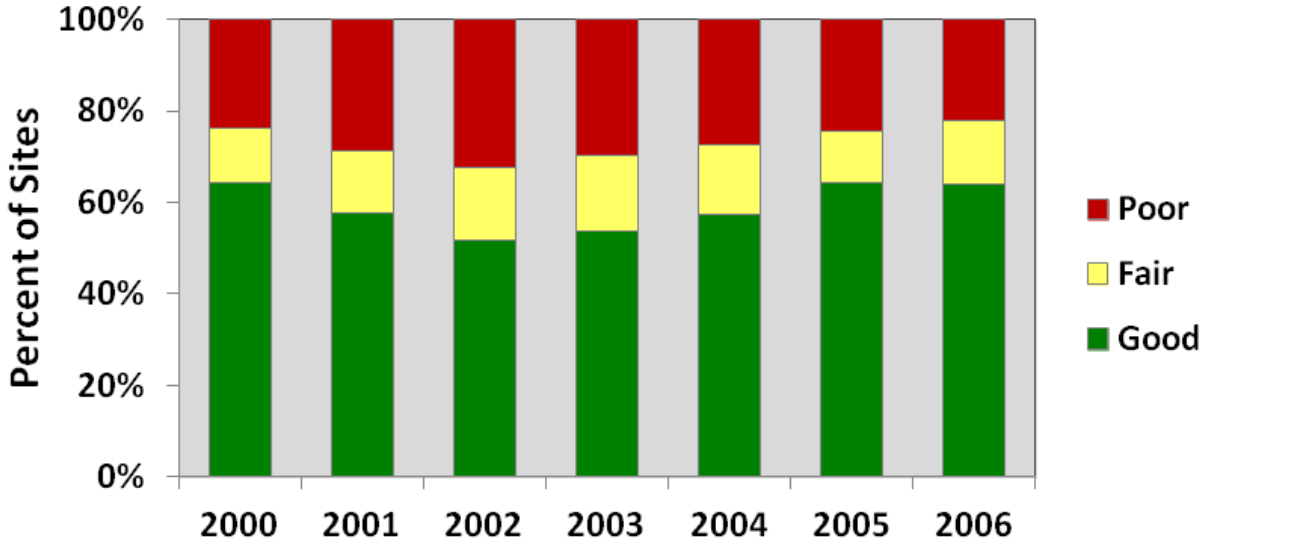


M-AMBI vs. NCA Regional BI's

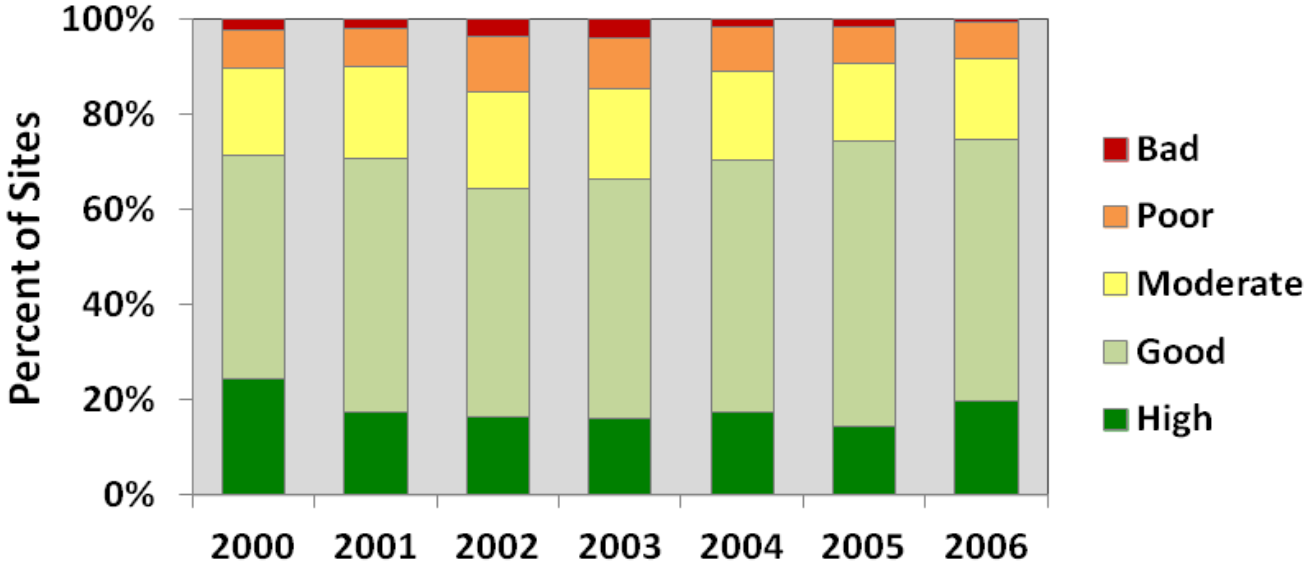


NCA US Coastal

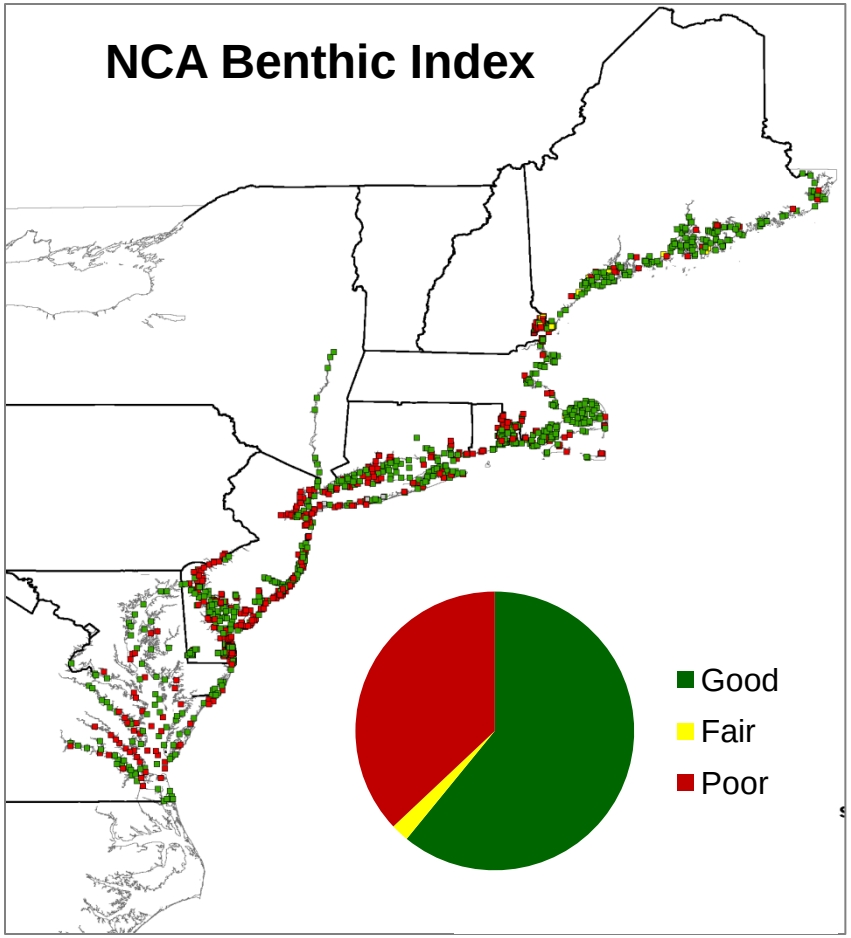
NCA Benthic Index

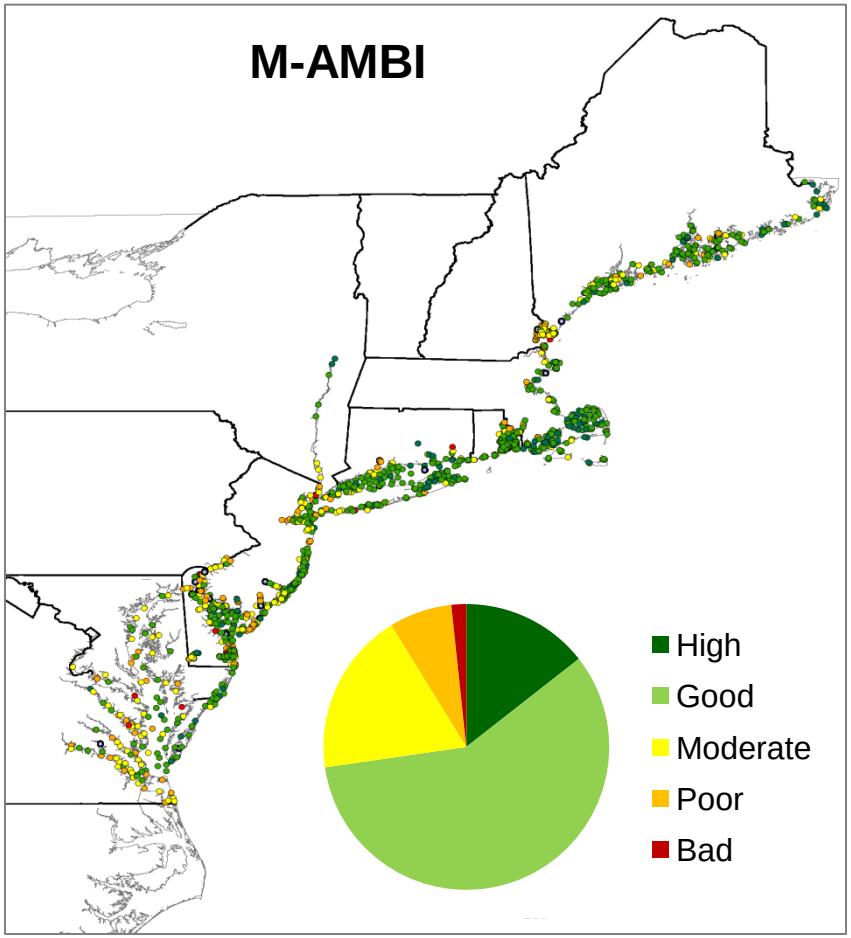


M-AMBI

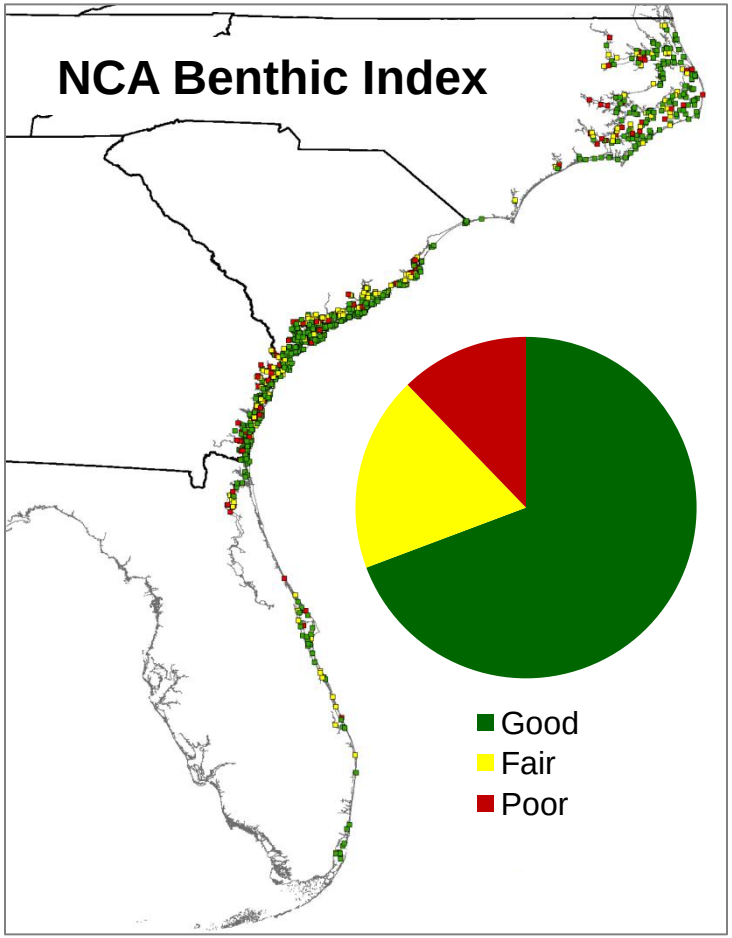


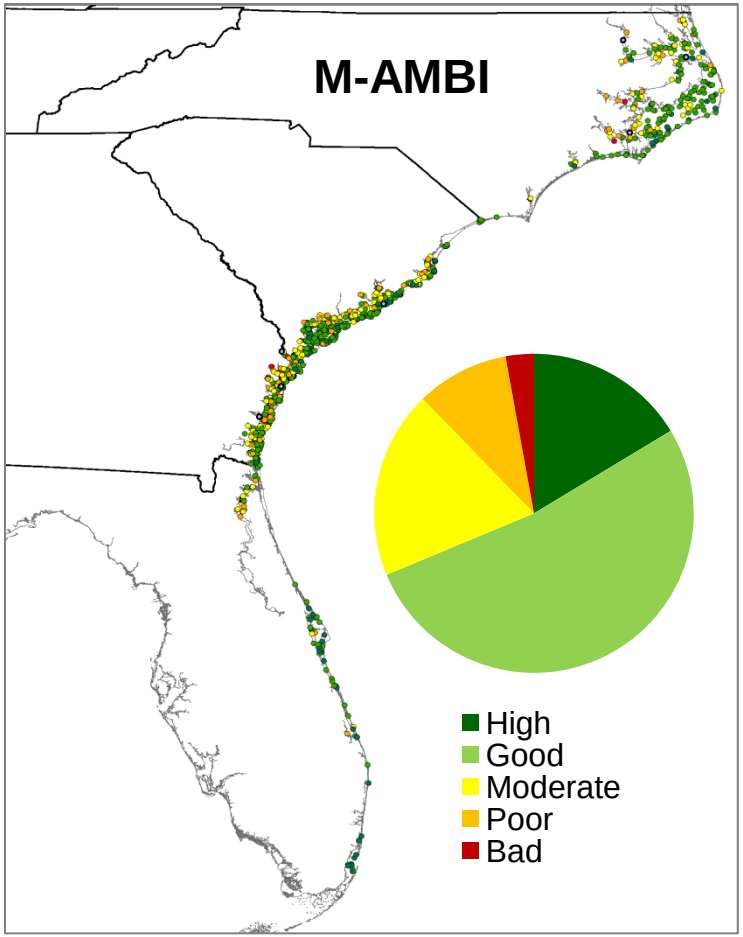
NCA NE 2000-2006



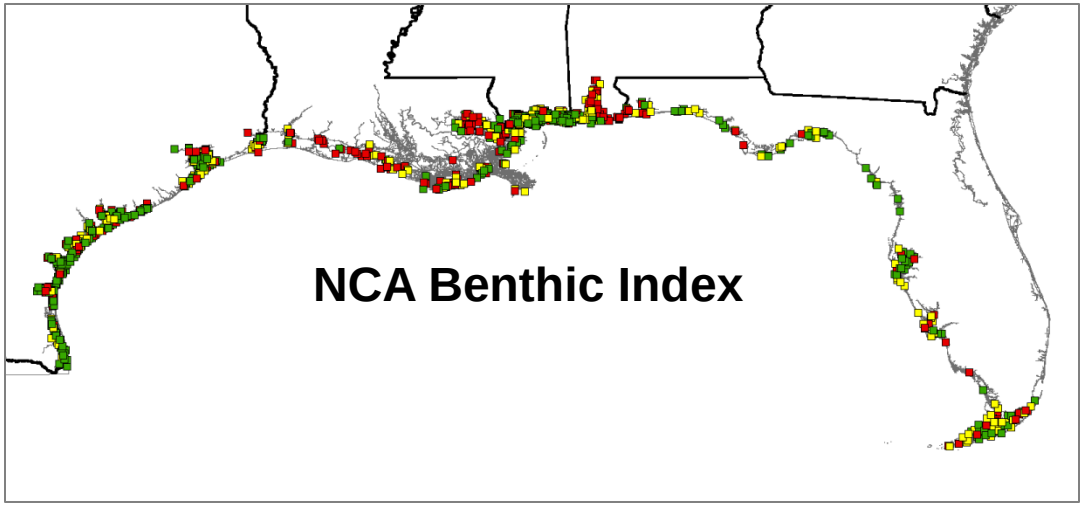


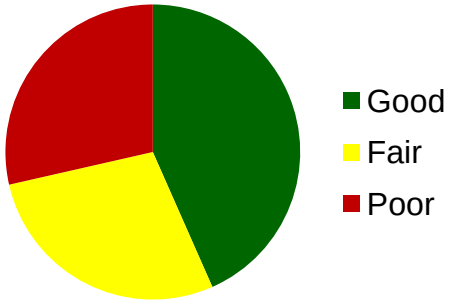
NCA SE 2000-2006

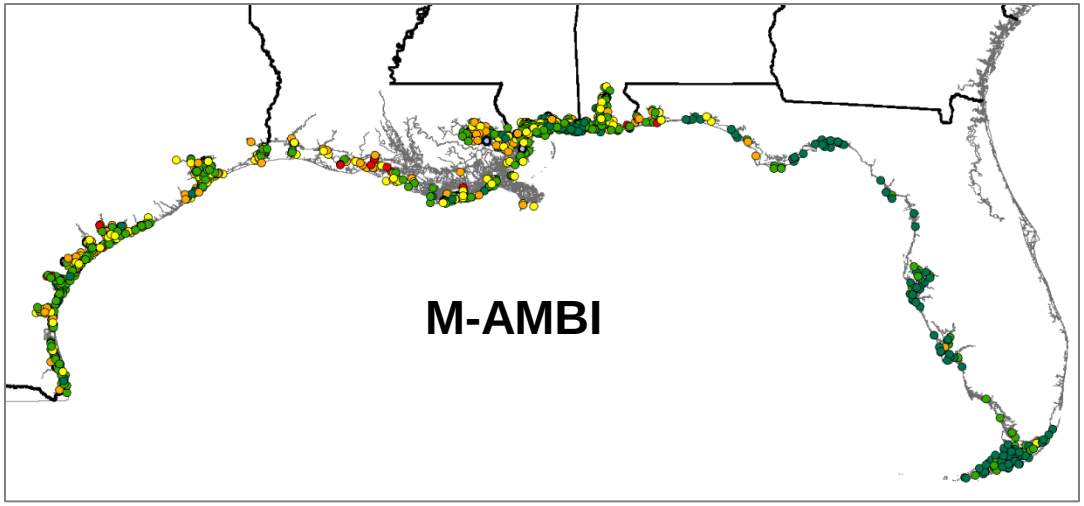


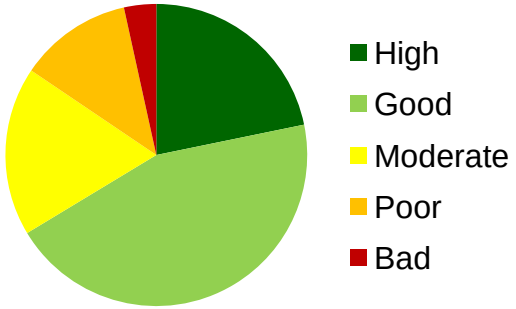


NCA GULF 2000-2006



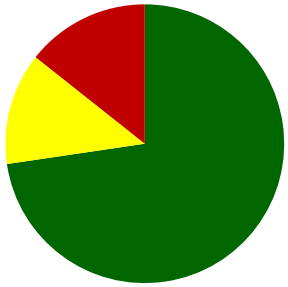


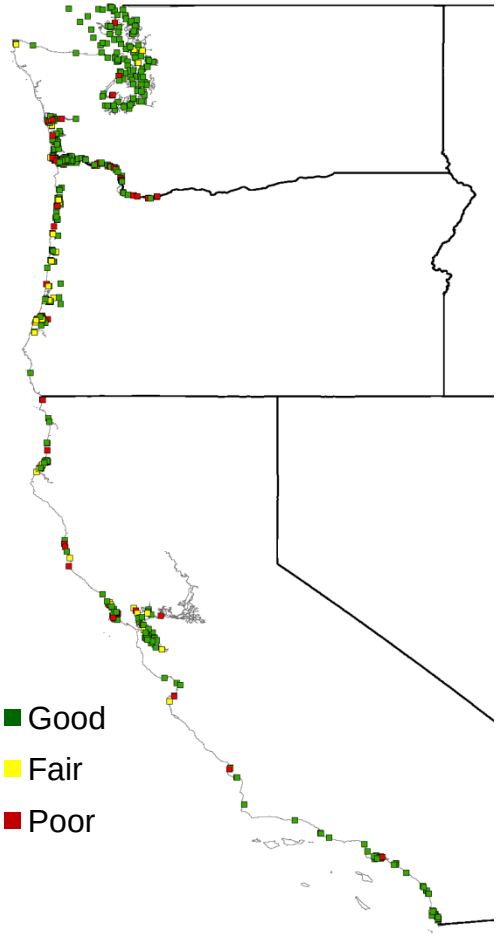




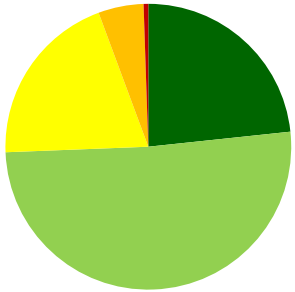
NCA WEST 1999-2006

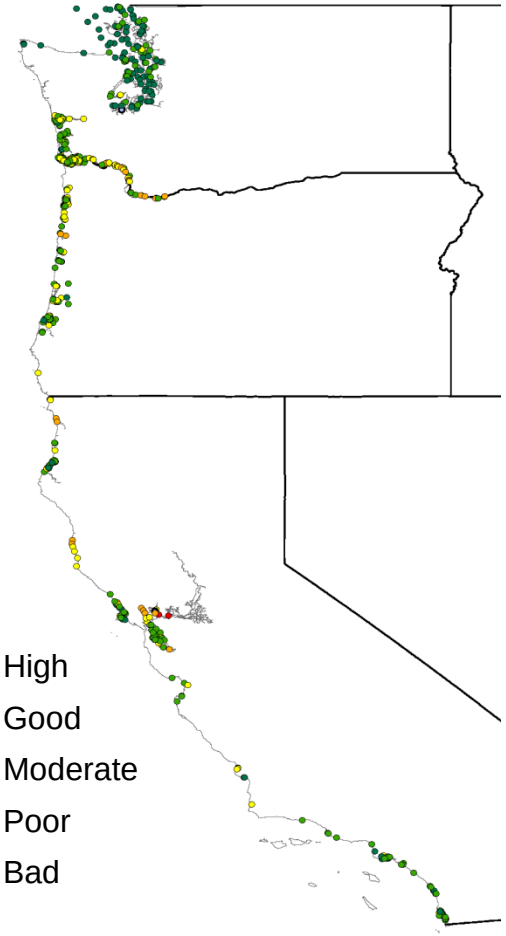
NCA Benthic Index





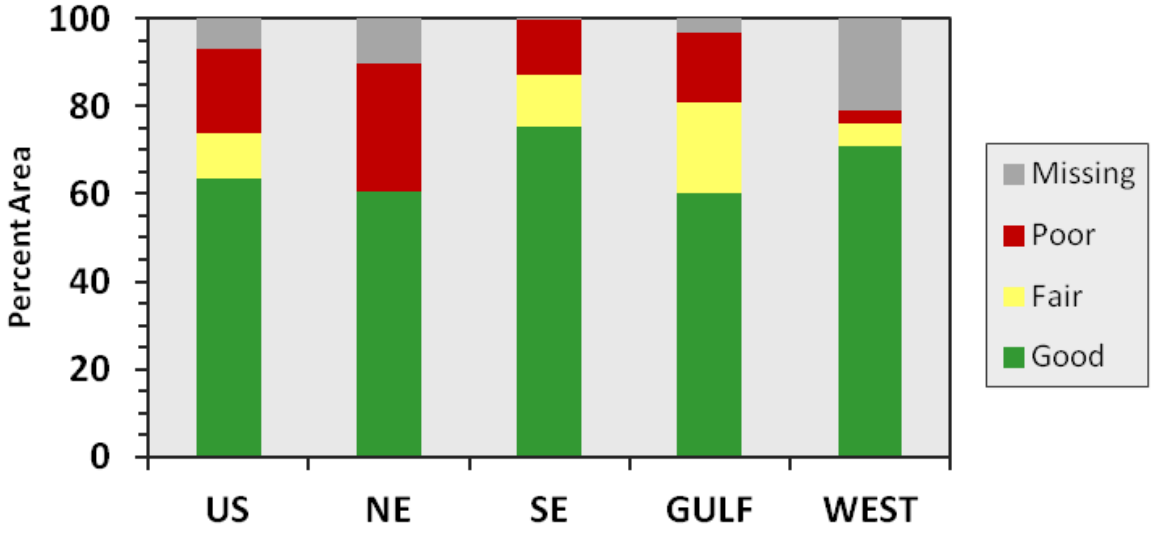
M-AMBI



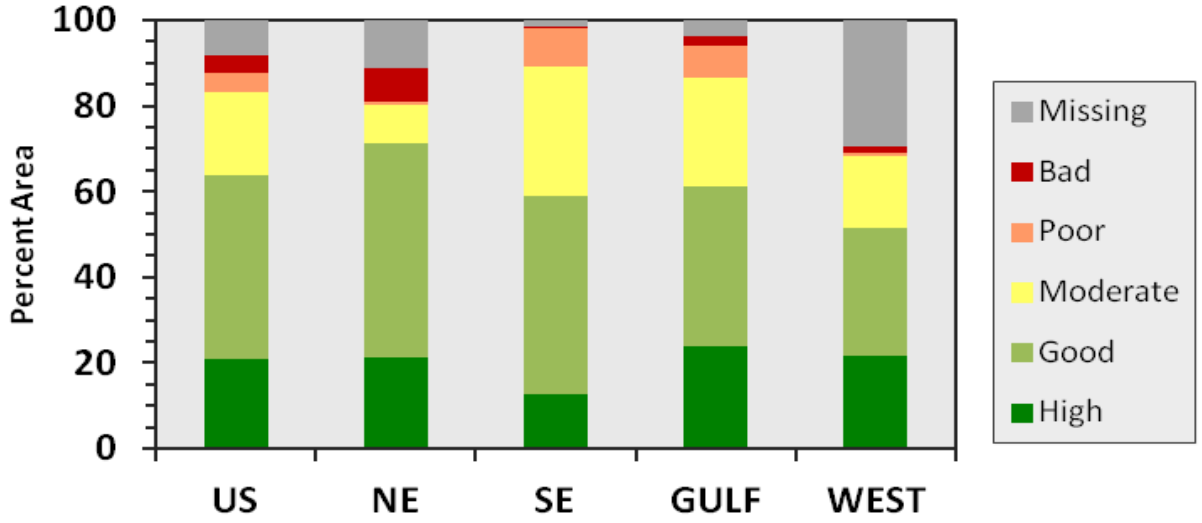


NCCA 2010

NCA Benthic Index



M-AMBI



Pros & Cons

	NCA Regional Benthic Indices	M-AMBI
PROs	• Historical use • Published • Used by some states	• Nationally consistent approach • Published • International relevance • Easy to communicate
CONs	• Regional differences • Difficult to communicate • No West Coast index	• Relies on BPJ to assign EGs • Validation results are mixed • Residual correlation with salinity

Thanks!

- Treda Grayson
- Peg Pelletier
- Anna Hamilton
- Erik Leppo
- David Gillett

- NCCA Benthic Indicator Workgroup