Habitat-Based Assessment of Structure-forming Megafaunal Invertebrates and Fish on Cordell Bank, California

Invertebrates as Living Components of Habitat

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3 Point Reyes National Seashore

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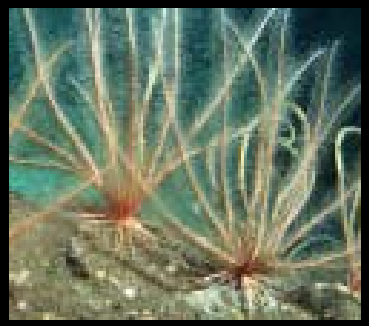
Megafaunal Invertebrates









Epibenthic invertebrates larger than 5cm

Structure-forming Invertebrates

- Large size ≥ 20 cm =

- Complex Morphology =

- High Density =

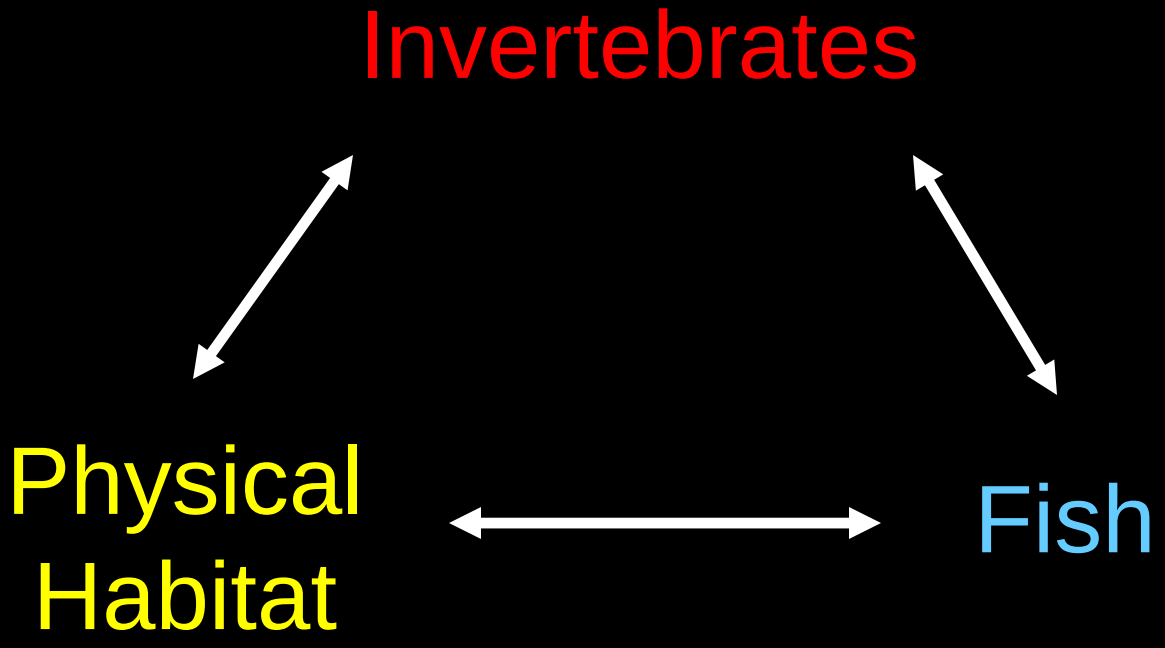
Importance of Structure-forming Invertebrates

- Contribute to biodiversity
- Indicate environmental conditions
- Important ecosystem components
- Ecological role as EFH?
- Unique and beautiful

Structure-forming Invertebrates

- Focus of previous studies
  - General associations
  - Specific interactions
- Clarify role as Essential Fish Habitat
- Combine previous approaches to describe structure within ecosystems
- Informed management

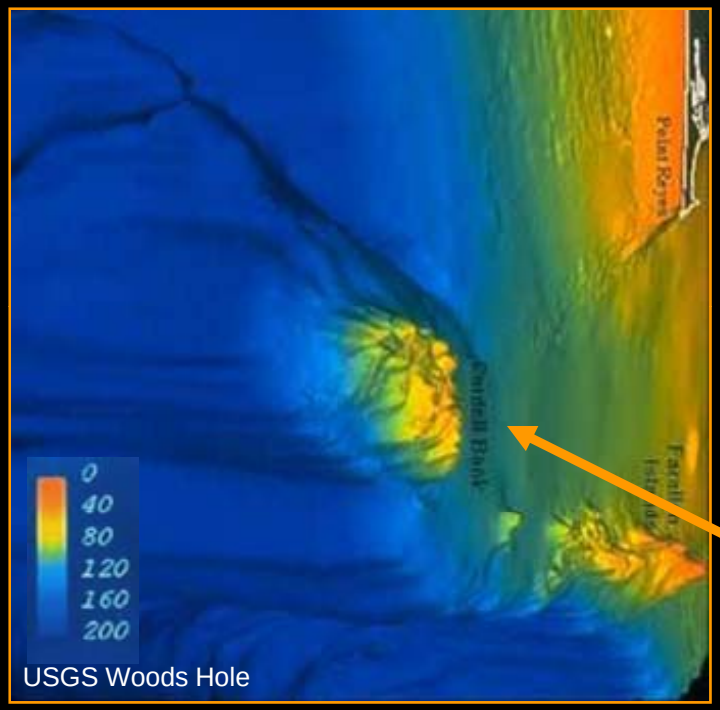
Ecosystems

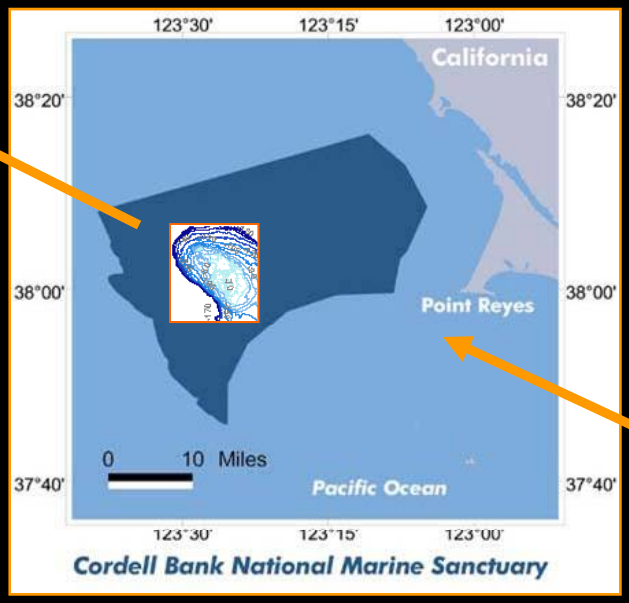


Objectives of Study

1. Determine spatial patterns of the physical habitats at Cordell Bank
2. Identify structure-forming invertebrates in this ecosystem
3. Describe community structure
4. Document associations between invertebrates and fishes

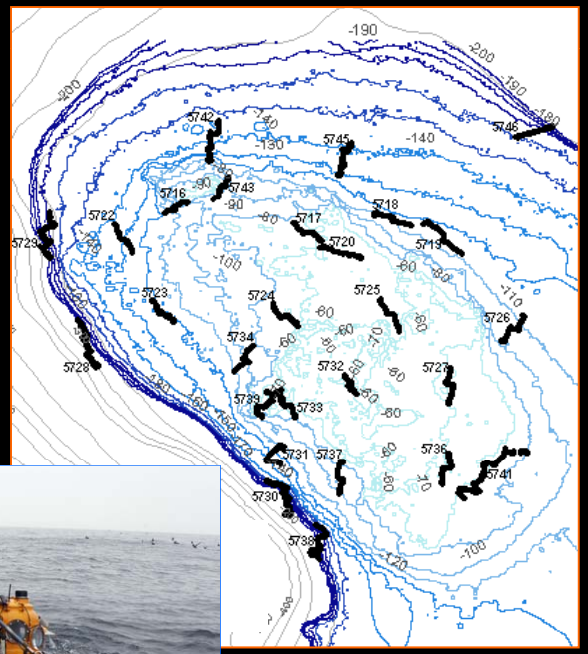
Cordell Bank Location





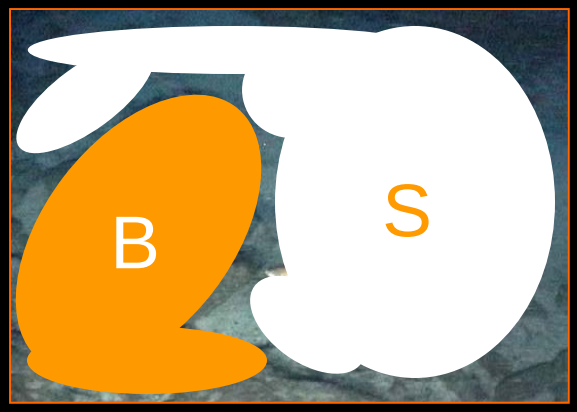
Methods – Submersible Dives

- Variety of depths and locations
- 27 dives using *Delta*
- Pilot and observer
- 15 min transects
- Video documentation



Methods – Physical Habitat

- Unique habitat patches
- Categorized by substrate
  - R, B, C, P, G, S, M
- Binary code combination
  - Primary code > 50%
  - Secondary code ≥ 20% < 50%



Results – Physical Habitat

- 31 combinations of physical substrate
- Pooled into 17 based on similarity

Habitat Codes

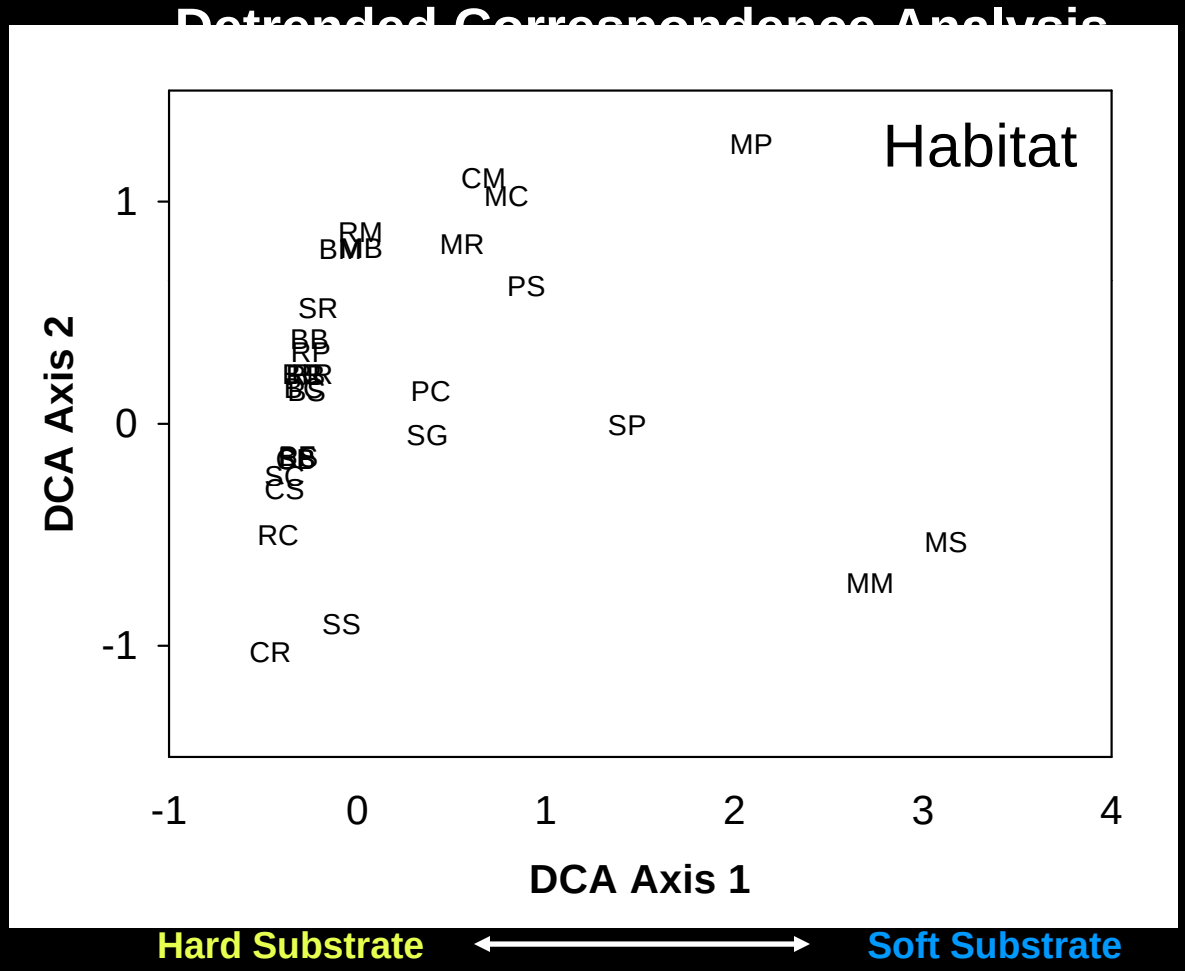
RR, RB, BR, BB, BC, RS, RM, CB, BS, SR, CS, SB, BM, MB, MR, SS, MM

High ← Relief → Low

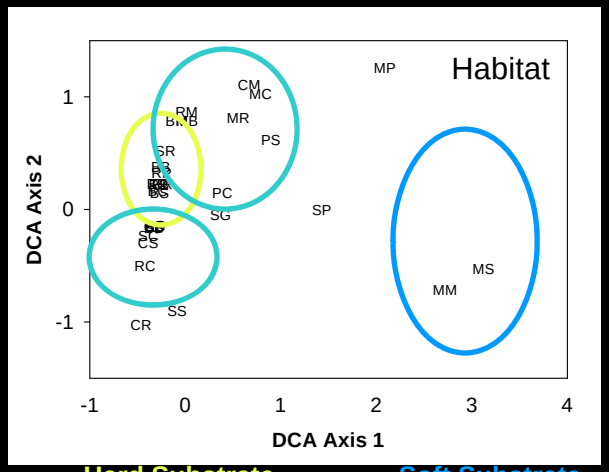
Methods – Ecosystem

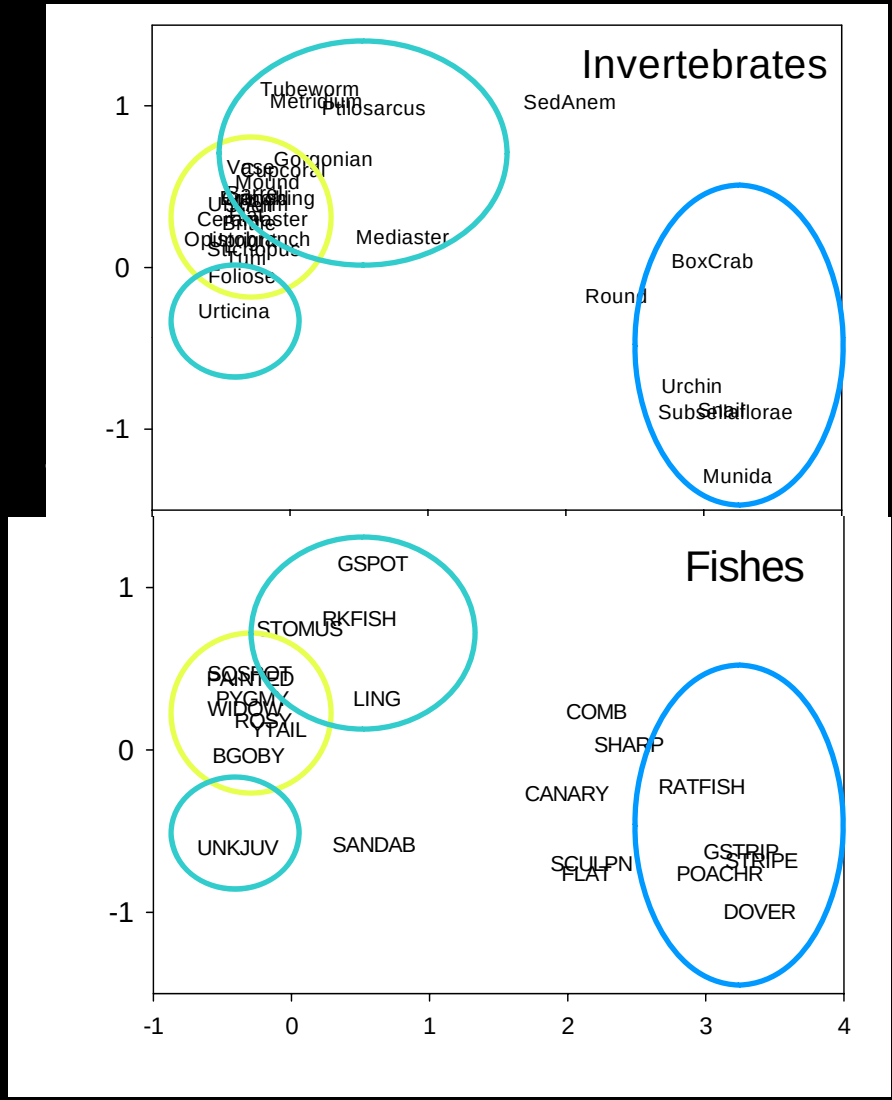
- Species quantified within habitat patches
- Patterns of association between species and physical habitats
- Detrended Correspondence Analysis
  - Multivariate technique
  - Ordination of observations in space
  - Assigns multivariate scores
  - Identifies ecological patterns

Results – Patterns of Physical Habitat



Results – Communities and Physical Habitats

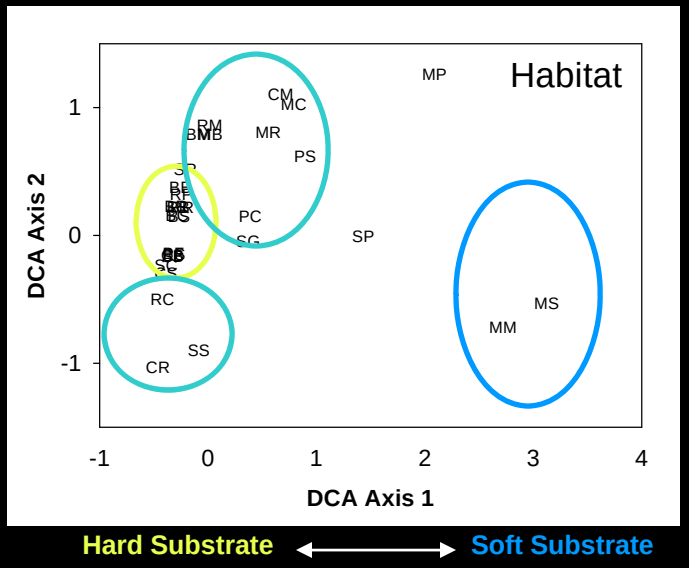




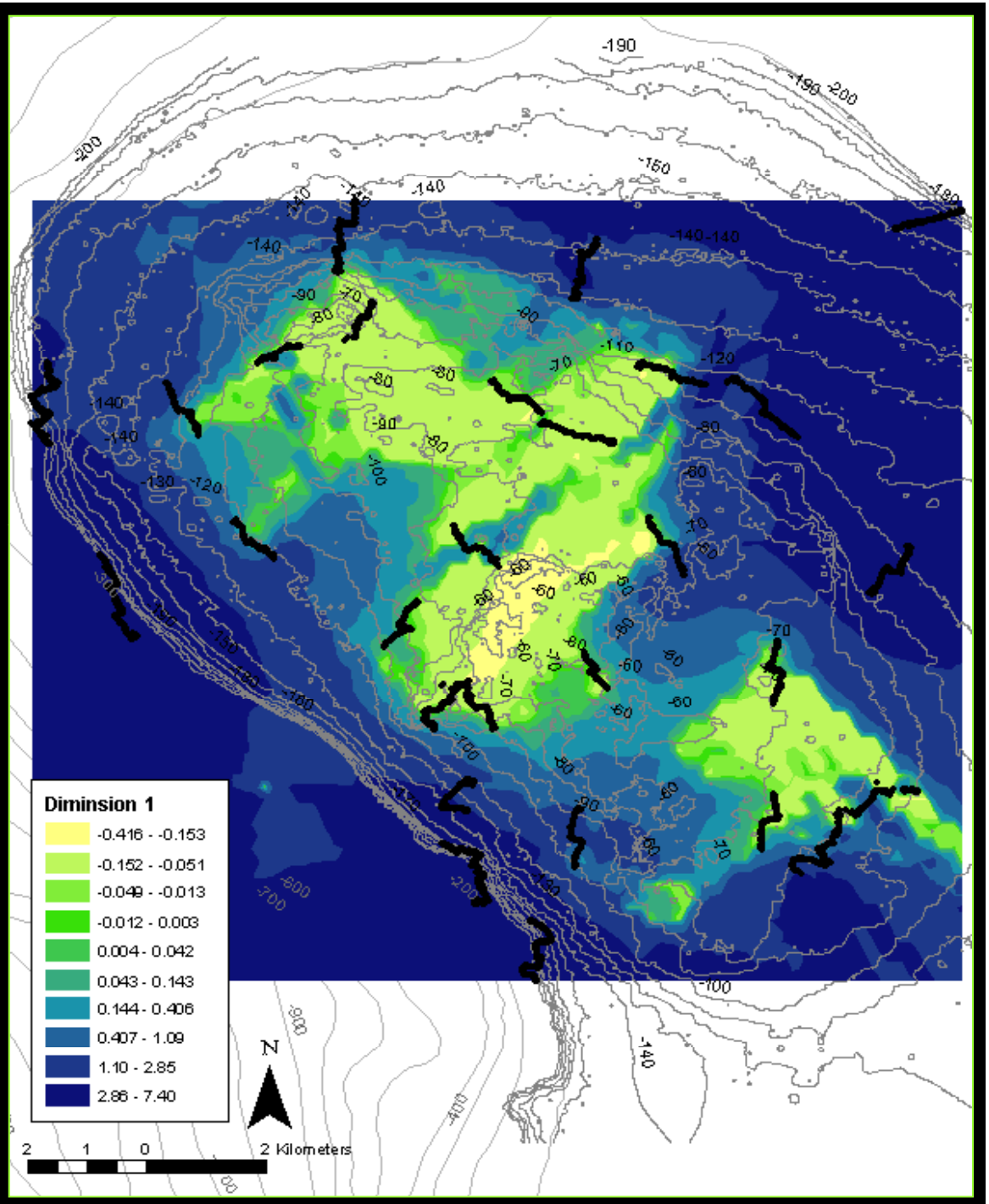
Methods – Ecosystem

- Map physical habitats and communities
- Multivariate scores from first ecological gradient to determine spatial patterns
- Kriging Analysis in ArcGIS
    - Weighted measures
    - Predicts joint spatial patterns of physical habitat and species distribution

Ecological Communities at Cordell Bank



Hard Substrate ⟷ Soft Substrate



Cordell Bank Ecosystem

Methods – Non-random Associations

- Nearest Neighbor Analysis
- Calculate nearest neighbor distance
- Derive geographic location in ArcGIS
- Compare to fish observations overall
- Statistically significant, non-random associations identified with Chi square

Methods – Close Associations

- Identified from video
- Categorized by level of association

  0 = No close association

  1, 2 = Hovering $\leq$ 1m or $\leq$ 1 fish body length

  3 = Resting $\leq$ 1 fish body length

  4 = Physical contact

Close Association Categories

Hovering ≤ 1 m

Hovering ≤ 1 bl

Resting ≤ 1 bl

Contact

Results – Nearest Neighbor Analysis

- High occurrence of non-random associations
- Sponges and Gorgonians
  - median distances < 1.5 m
- Large Anemones
  - median distances < 1 m
- Present in all communities

Results – Close Associations

Decreasing size

Foliose sponge						
Shelf sponge						
White-plumed anemone						
Barrel sponge						
Mound sponge						
Gorgonians						
Branching sponge						
Round sponge						
Fish eating anemone						
Plumed sea pen						
Totals	**2368**	**51.5**	**46.4**	**0.4**	**0.3**	**0.1**

Conclusions – Close Associations

- Structure-forming invertebrates contribute physical structure
- Facultative associations likely
- Potential for shelter or foraging
- Examine ecological significance

Conclusions – Overall

- Distinct communities within specific physical habitats at Cordell Bank
- Non-random associations
- Specific close associations
- Structure-forming invertebrates have an ecological role as living habitat in this ecosystem

Conclusions – Implications for Fisheries Management

- Consider community structure and species associations
- Recognize ecological importance of living habitat
- Minimize impacts to all habitats and communities

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Jodi Pirtle Cordell Bank, 2004