A Spatial and Temporal Analysis of Dolphin Community Structure in Southeastern North Carolina

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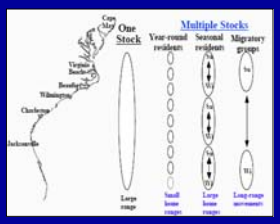
Introduction

- 1987-88 epizootic event: eastern coast of the US
- Stock structure of Atlantic bottlenose dolphins
- GIS applications to scientific studies: Bowyer 1995; Stone et al. 1997; Gerrard et al. 2001; Selkirk and Bishop 2002



Bottlenose Dolphins and Community Structure

- Open populations
- Closed populations
- Mixed populations
- Communities

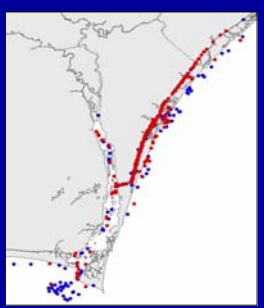
Field Methods

- 330 km^2 study area
- Boat-based photo-identification surveys
- Location and environmental data recorded

Study Area

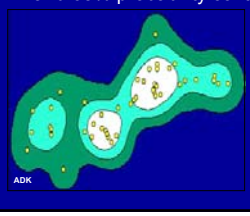
Database Development

- ESRI's ArcView version 3.3
- Study period: 1995 – 2002
- 381 total dolphins (blue and red points)
- 40 dolphins with 10 or more sightings (red points)



Local Area Use

1. Adaptive Kernel estimator (ADK): 95, 80, and 65% probability contours
2. Minimum convex polygon (MCP): 100%
3. Spatial Density Calculation (SDC): 95, 80, and 65% probability contours



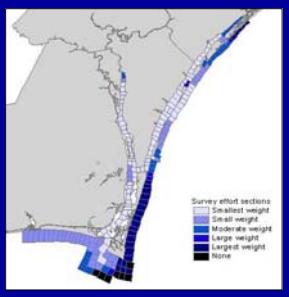
Accounting for Survey Effort

- **Study area divided into 194 sections**
- **Survey frequency calculated:**

  # times ea. section srvyd

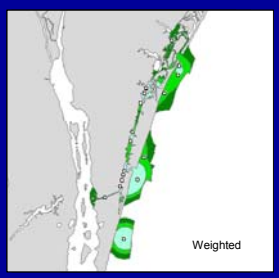
  total # times all sections srvyd
- **Inverse of frequency applied as a weight in one LAU calculation:**

  1 / survey frequency

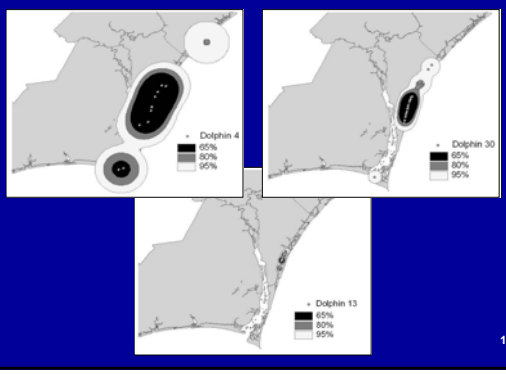


Spatial Density Calculation (SDC)

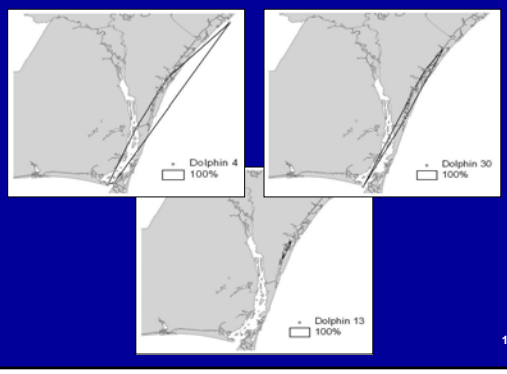
1. Set an analysis mask
2. Calculate average distance between nearest neighbors
   - Apply ranked survey weight
3. Calculate density surface
4. Select cells for each contour and create polygon shapefiles



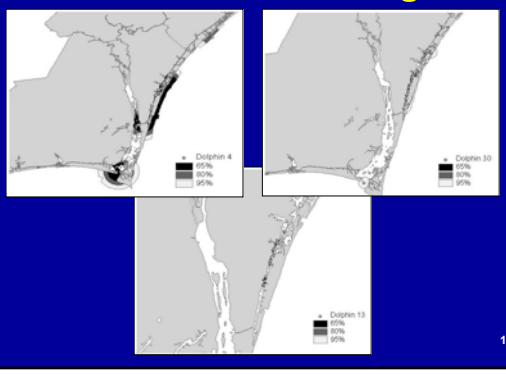
Results: ADK



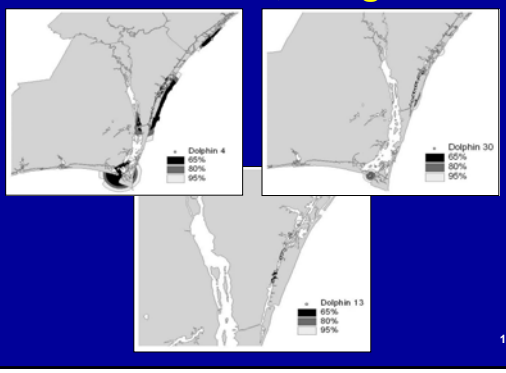
Results: MCP



Results: SDC, Non-weighted



Results: SDC, Weighted



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Testing for Significant Differences

- Results of the four LAU methods (ADK, MCP, SDC weighted, SDC non-weighted) were tested for significant differences using a **Wilcoxon / Kruskal-Wallis test** in JMP IN version 5.1
- SDC weighted and non-weighted were significantly different from the ADK and MCP

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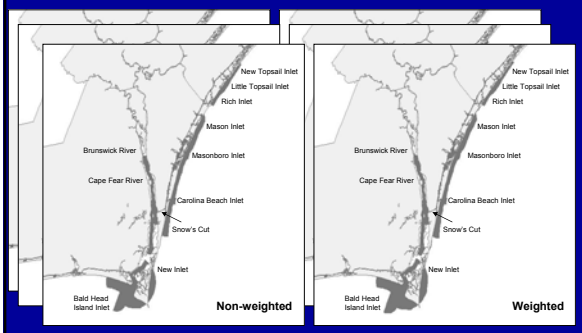
65% SDC 80% SDC 95% SDC



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Coefficients of Association (CoA)

- Half weight index:

$$\frac{x}{0.5(n_a + n_b)}$$

  x: number of times animals A and B were seen together
  n_a: number of times animal A was seen
  n_b: number of times animal B was seen
- SOCPROG (Hal Whitehead)
- Equal interval classes **(0, 0.01- 0.2, 0.21-0.4, 0.41-0.6, 0.61- 0.8, 0.81-1.0)**

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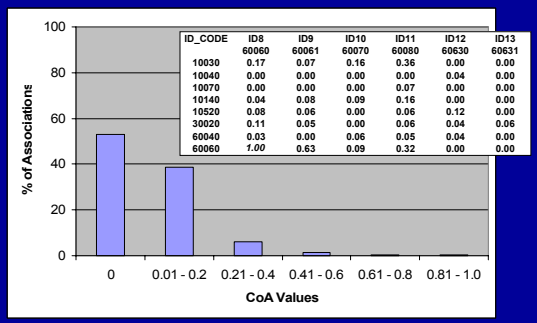
CoA Values



ID_CODE	ID8 60060	ID9 60061	ID10 60070	ID11 60080	ID12 60630	ID13 60631
10030	0.17	0.07	0.16	0.36	0.00	0.00
10040	0.00	0.00	0.00	0.00	0.04	0.00
10070	0.00	0.00	0.00	0.07	0.00	0.00
10140	0.04	0.08	0.09	0.16	0.00	0.00
10520	0.08	0.06	0.00	0.06	0.12	0.00
30020	0.11	0.05	0.00	0.06	0.04	0.06
60040	0.03	0.00	0.06	0.05	0.04	0.00
60060	*1.00*	0.63	0.09	0.32	0.00	0.00

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Community Structure

- **SDC and CoA were combined to determine core community(ies)**
- **Calculated the percent overlap of SDC**
- **Groups:**
  - high overlap/high CoA (HH)
  - moderate overlap/high CoA (MH)
  - low overlap/low CoA (LL)
  - high overlap/low CoA (HL)
  - moderate overlap/low CoA (ML)
  - low overlap/high CoA (LH)

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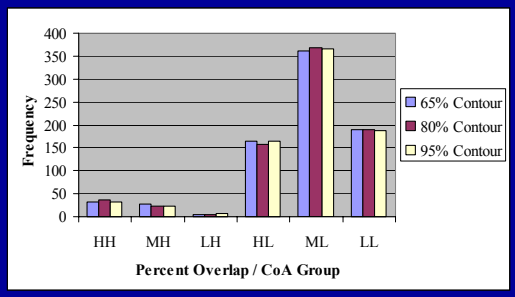
Community Structure Conclusions:

Majority are not seen together but share the same area



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Regional Preference

- ICW, Cape Fear River, inlets, nearshore ocean
- Individual chi-square tests on each of the 40 dolphins' sighting locations
- Expected values based upon survey effort

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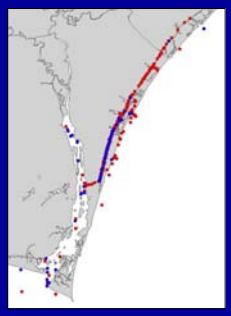
Results: Regional Preference

- 4 regional zones:
  - ICW, Cape Fear River, inlets, ocean
- Significant chi-square values for 33 dolphins
- ICW preference for all 33 (red points)
- No preference for 7 (blue points)



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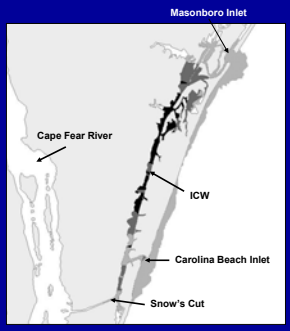
Conclusions

- Single, core community of bottlenose dolphins
- Assessment of four LAU methods
- Regional preference of ICW



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