Segmenting Michigan’s Recreational Anglers using Fishing Behavior

Pathways to Success
Estes Park, CO
September 30, 2010

Jody Simoes, Graduate Research Assistant
Michigan State University

Frank Lupi, Department of Agricultural, Food and Resource Economics / Fisheries and Wildlife

Daniel Hayes, Department of Fisheries and Wildlife
Segmenting Michigan’s Recreational Anglers using Fishing Behavior

Presentation Outline

Background
- The Michigan Survey

Previous Findings
- Angler Profiles

Recent Analysis
- Cluster Analysis (fishing behavior)
- Multinomial Logistic Regression (demographics)
Michigan Recreational Angler Survey

- Survey Method:
  - Mail survey
  - Short (4 pg)
  - < 1 oz

- Population:
  - License database

- Measurement:
  - 12 month activity
  - Activity during last month
  - Most recent trip
  - Demographic information
Profiles of Michigan’s Recreational Anglers
Respondent Characteristics: Demographics and License Type

- Michigan Residents: 82%
- Females: 21%
- Mean Age: 50 years
- White, non-Hispanic: 88%
- Employed full-time: 55%
- Income, 25K – 75K: 52%
- Some post HS or college: 39%
- Resident Restricted: 38%
- Resident All Species: 27%
- Non-Resident Restricted: 7%
- Non-Resident All Species: 3%
- Senior Restricted: 7%
- Senior All Species: 8%
- 24 Hour: 9%
- Other: 2%
Respondent Characteristics: Fishing Behavior

- Began fishing: **8 years old**
- Years fished in Michigan: **33 years**
- Fished with family or relatives: **60%**

- Owned a boat for fishing: **62%**

- Competed in fishing events: **5%**

- Fishing Frequency (previous 12 months):
  - 6 or more times: **57%**

- Waterbodies Fished (previous 12 months):
  - Great Lakes and connecting waterways: **42%**
  - Rivers: **44%**
  - Inland lakes: **77%**
  - *Exclusively* inland lakes: **34%**
Defining Angler Subgroups
Bivariate and Multivariate Analysis
Defining Angler Subgroups

- Fishing experience
- Fishing frequency
- Fishing techniques
- Preferred species

- Catch disposition
- Social groups
- Equipment ownership
- Tournament participation

- Bryan (1977)
- Graefe (1980)
- Chipman & Helfrich (1988)
- Ditton et al. (1992)
- Fisher (1997)

- Connelly et al. (2001)
- McClanahan & Hansen (2005)
- Hutt and Bettoli (2007)
- Aas & Arlinghaus (2009)
Defining Angler Subgroups

Bivariate Analysis

- Fishing experience
- **Fishing frequency**
- Fishing techniques
- Preferred species
- Catch disposition
- Social groups
- Equipment ownership
- Tournament participation

**Frequent anglers (20 or more times)**
- More likely to be 25 to 34
- Lower income & education levels
- More likely to fish alone

**Infrequent anglers (< 6 times)**
- More likely to be 45 or older
- Higher education & income levels
Defining Angler Subgroups
Bivariate Analysis

- Fishing experience
- Fishing frequency
- Fishing techniques
- Preferred species

- Catch disposition
- Social groups
- Equipment ownership
- Tournament participation

- Anglers mostly “practicing catch and release”
  - More likely to be 44 or younger
  - Were recruited at an earlier age
  - More likely to fish alone

- Anglers mostly “keeping their catch”
  - More likely to be 65 or older
  - Fish frequently
  - Were recruited at an older age
Defining Angler Subgroups
Bivariate Analysis

- Fishing experience
- Fishing frequency
- Fishing techniques
- Preferred species
- Catch disposition
- Social groups
- Equipment ownership
- Tournament participation

- Fishing behavior and demographic relationships mirror previous angler research

- Fishing behaviors differ significantly by age; income; education; employment; license type; social groups; recruitment; etc.

- Results highlight the diversity of anglers fishing in Michigan
## Defining Angler Subgroups
Multivariate Analysis

<table>
<thead>
<tr>
<th>Author</th>
<th>N</th>
<th>Methods</th>
<th>Groups</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fisher (1997)</td>
<td>9,981</td>
<td>Hierarchical &amp; nonhierarchical</td>
<td>7</td>
</tr>
<tr>
<td>Connelly et al. (2001)</td>
<td>3,553</td>
<td>Hierarchical</td>
<td>7</td>
</tr>
</tbody>
</table>
Divisive Clustering: k-means
Data Characteristics

- Statewide random sample
- \( N = 15,088 \)
- Observations/rows = Anglers
  - Licensed MI Anglers
- Variables/columns = Questions
  - Fishing Frequency
  - Waterbodies fished
  - Tournament participation
  - Equip. / boat ownership
  - Catch disposition
  - Species targeted
Divisive Clustering: k-means

<table>
<thead>
<tr>
<th>N</th>
<th>Groups</th>
<th>Group sizes</th>
</tr>
</thead>
<tbody>
<tr>
<td>15,088</td>
<td>7</td>
<td>2,663 2,508 1,136 2,251 1,673 1,897 2,960</td>
</tr>
</tbody>
</table>
### Divisive Clustering: k-means

* N = 15,008

#### K-means, k = 7

<table>
<thead>
<tr>
<th></th>
<th>Avidity</th>
<th>Waterbody</th>
<th>Tournament</th>
<th>Boat</th>
<th>Catch</th>
<th>Species</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>4</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>5</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>6</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>7</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Divisive Clustering: k-means  
N = 15,088

K-means, k = 7

<table>
<thead>
<tr>
<th></th>
<th>Avidity</th>
<th>Waterbody</th>
<th>Tournament</th>
<th>Boat</th>
<th>Catch</th>
<th>Species</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>18%</td>
<td>Higher</td>
<td>Great Lakes</td>
<td>Y</td>
<td>Y</td>
<td>Mixed</td>
</tr>
<tr>
<td>2</td>
<td>17%</td>
<td>Inland</td>
<td></td>
<td>N</td>
<td>N</td>
<td>release</td>
</tr>
<tr>
<td>3</td>
<td>8%</td>
<td>Lowest</td>
<td>River</td>
<td>N</td>
<td>N</td>
<td>release</td>
</tr>
<tr>
<td>4</td>
<td>15%</td>
<td>High</td>
<td></td>
<td>Y</td>
<td>keep</td>
<td>pan. + wall.</td>
</tr>
<tr>
<td>5</td>
<td>11%</td>
<td>Highest</td>
<td>All</td>
<td>Y</td>
<td>release</td>
<td>Bass + pike</td>
</tr>
<tr>
<td>6</td>
<td>13%</td>
<td>Low</td>
<td>Great Lakes</td>
<td></td>
<td>keep</td>
<td>salmon</td>
</tr>
<tr>
<td>7</td>
<td>20%</td>
<td>Inland</td>
<td></td>
<td></td>
<td>mixed</td>
<td>panfish</td>
</tr>
</tbody>
</table>
### Divisive Clustering: k-means

N = 15,008

### K-means, k = 7

<table>
<thead>
<tr>
<th></th>
<th>Avidity</th>
<th>Waterbody</th>
<th>Tournament</th>
<th>Boat</th>
<th>Catch</th>
<th>Species</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>18%</td>
<td>Higher</td>
<td>Great Lakes</td>
<td>Y</td>
<td>Y</td>
<td>Mixed</td>
</tr>
</tbody>
</table>

### Multinomial logistic regression [MLR]

[Dependent = cluster variable; Independent = demographic variables]

- Angler age
- Gender
- Education
- Income
- Residency
- Recruitment Age
- Years fishing in MI
## Divisive Clustering: k-means

**N = 15,088**

### K-means, k = 7

| 1   | 18% | Higher  | Great Lakes | Y | Y | Mixed | All |

### Multinomial logistic regression [MLR] *

- Income
- Gender
- Age
- Residency
- Fishing Experience
- Recruitment

* $p < .05$
Divisive Clustering: k-means
N = 15,088

K-means, k = 7

| 2 | 17% | Inland | N | N | release | Bass |

Multinomial logistic regression [MLR] *

Age
Fishing Experience
Education
Gender

* $p < .05$
Divisive Clustering: k-means
N = 15,088

K-means, k = 7

<table>
<thead>
<tr>
<th>Avidity</th>
<th>Waterbody</th>
<th>Tournament</th>
<th>Boat</th>
<th>Catch</th>
<th>Species</th>
</tr>
</thead>
<tbody>
<tr>
<td>3</td>
<td>8%</td>
<td>Lowest</td>
<td>River</td>
<td>N</td>
<td>N</td>
</tr>
</tbody>
</table>

Multinomial logistic regression [MLR] *
- Recruitment
- Fishing experience
- Education
- Income
- Residency

* $p < .05$
Divisive Clustering: k-means  
N = 15,088

K-means, k = 7

<table>
<thead>
<tr>
<th>Avidity</th>
<th>Waterbody</th>
<th>Tournament</th>
<th>Boat</th>
<th>Catch</th>
<th>Species</th>
</tr>
</thead>
<tbody>
<tr>
<td>4</td>
<td>15%</td>
<td>High</td>
<td>Y</td>
<td>keep</td>
<td>pan. + wall.</td>
</tr>
</tbody>
</table>

Multinomial logistic regression [MLR] *

Age
Fishing experience
Income

* p < .05
Divisive Clustering: k-means

$N = 15,088$

<table>
<thead>
<tr>
<th>Avidity</th>
<th>Waterbody</th>
<th>Tournament</th>
<th>Boat</th>
<th>Catch</th>
<th>Species</th>
</tr>
</thead>
<tbody>
<tr>
<td>5</td>
<td>Highest</td>
<td>All</td>
<td>Y</td>
<td>release</td>
<td>Bass + pike</td>
</tr>
</tbody>
</table>

Multinomial logistic regression [MLR] *

- Fishing Experience
- Education
- Age
- Recruitment
- Gender

* $\rho < .05$
Divisive Clustering: k-means  
N = 15,088

K-means, k = 7

<table>
<thead>
<tr>
<th>Avidity</th>
<th>Waterbody</th>
<th>Tournament</th>
<th>Boat</th>
<th>Catch</th>
<th>Species</th>
</tr>
</thead>
<tbody>
<tr>
<td>6</td>
<td>13%</td>
<td>Low</td>
<td></td>
<td>keep</td>
<td>salmon</td>
</tr>
</tbody>
</table>

Multinomial logistic regression [MLR] *

- Age
- Fishing Experience
- Income
- Gender

* $p < .05$
Divisive Clustering: k-means 
N = 15,088

K-means, k = 7

<table>
<thead>
<tr>
<th></th>
<th>Avidity</th>
<th>Waterbody</th>
<th>Tournament</th>
<th>Boat</th>
<th>Catch</th>
<th>Species</th>
</tr>
</thead>
<tbody>
<tr>
<td>7</td>
<td>20%</td>
<td>Inland</td>
<td>N</td>
<td>mixed</td>
<td>panfish</td>
<td></td>
</tr>
</tbody>
</table>

Multinomial logistic regression [MLR] *

- Gender
- Fishing experience
- Age

* $p < .05$
Management Applications

- Standardized inventory for describing statewide angling behavior and demographic characteristics
- Quantify impact of angler groups on resources
- Inform management decisions & focus management efforts
Caveats & Conclusions

- Determine important attributes of fishing participation
- Determine “angler markets” needs
- Fishing behavior segmentation method??
- Cross validation? (e.g. Connelly et al. 2001)
- Comp. clustering techniques (e.g. Fisher 1997)
- Variable choice, coding, etc.
Acknowledgements

- Great Lakes Fishery Trust
- American Fisheries Society
- Michigan DNRE, Fisheries Division
- MSU, Fisheries and Wildlife
- MSU, Agriculture, Food & Resource Economics
- Great Lakes Fishery Commission
- Dr. Howard A. Tanner Fisheries Excellence Fellowship
- Federation of Fly Fishers, Red Cedar Chapter