Valuing Water Quality Through Recreational Uses in Iowa

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Project Overview

- A four-year panel data set of survey responses will be collected involving
  - Actual trip behavior and future expected trips, years 2001-2006
  - Water quality scenarios at several target lakes
  - Knowledge and perceptions regarding lake quality
- Data linked to limnological measurements (Downing) at 132 primary lakes in Iowa
- Estimate demand for and value of improved water quality in Iowa's lakes

Measuring Benefits of Iowa Lakes

- Economic value = how much are people willing to give up to get more water quality
  - Want to measure tradeoffs people would be willing to make if they had to
  - Represents the value of others goods willing to give up to get improved water quality
  - Also called "maximum willingness to pay" or just willingness to pay
  - Same concept as used for any good (shoes, cars, yo-yo's, etc.)

- Do people WANT to pay this? No, but they would rather pay it than be forced to live with lower water quality

- Use observed patterns in lake usage to infer WTP for water quality

- Local economic impact = how many dollars exchange hands near the lake
  - Useful and relevant for some questions, but not cost-benefit assessments
  - Represents benefits of economic activity to a region, but some of that activity comes at expense of activity elsewhere
  - And, it misses lots of sources of value: if I visit a lake and don't buy anything near the lake that day, is my value zero?

Baseline Survey

- First of four mail surveys
- 8000 Iowa residents selected at random
- Survey collected
  - trip data for 132 lakes
  - attitudes regarding lake quality
  - Socio-demographic data
- 62.1% response rate

Lakes included in Study

Top 10 Lakes by Usage

Lake Name	Single Day 2002	Total 2002
Saylorville Dam	599,719	651,860
West Okoboji Lake	365,232	629,828
Coralville Lake	457,466	510,096
Clear Lake	354,825	454,321
East Okoboji Lake	291,594	398,888
Red Rock Lake	284,176	372,350
Big Creek Lake	351,392	363,566
Lake McBride	291,558	312,766
Rathbun Lake	248,263	302,237
Storm Lake	231,749	267,162

Variation in Lake Conditions

Table 1. Physical Water Quality Summary Statistics				
Variable	Mean	Std. Dev.	Minimum	Maximum
Secchi Depth (m)	1.17	0.92	0.09	5.67
Chlorophyll (ug/l)	40.93	38.02	2.45	182.92
NH_3+NH_4 (ug/l)	292.15	158.57	72	955.34
NO_3+NO_2 (mg/l)	1.20	2.54	0.07	14.13
Total Nitrogen (mg/l)	2.20	2.52	0.55	13.37
Total Phosphorus (ug/l)	105.65	80.61	17.10	452.55
Silicon (mg/l)	4.56	3.24	0.95	16.31
pH	8.50	0.33	7.76	10.03
Alkalinity (mg/l)	141.80	40.98	73.83	286.17
Inorganic SS (mg/l)	9.43	17.87	0.57	177.60
Volatile SS (mg/l)	9.35	7.93	1.64	49.87

Figure 1: Percentage of respondents who took at least one trip

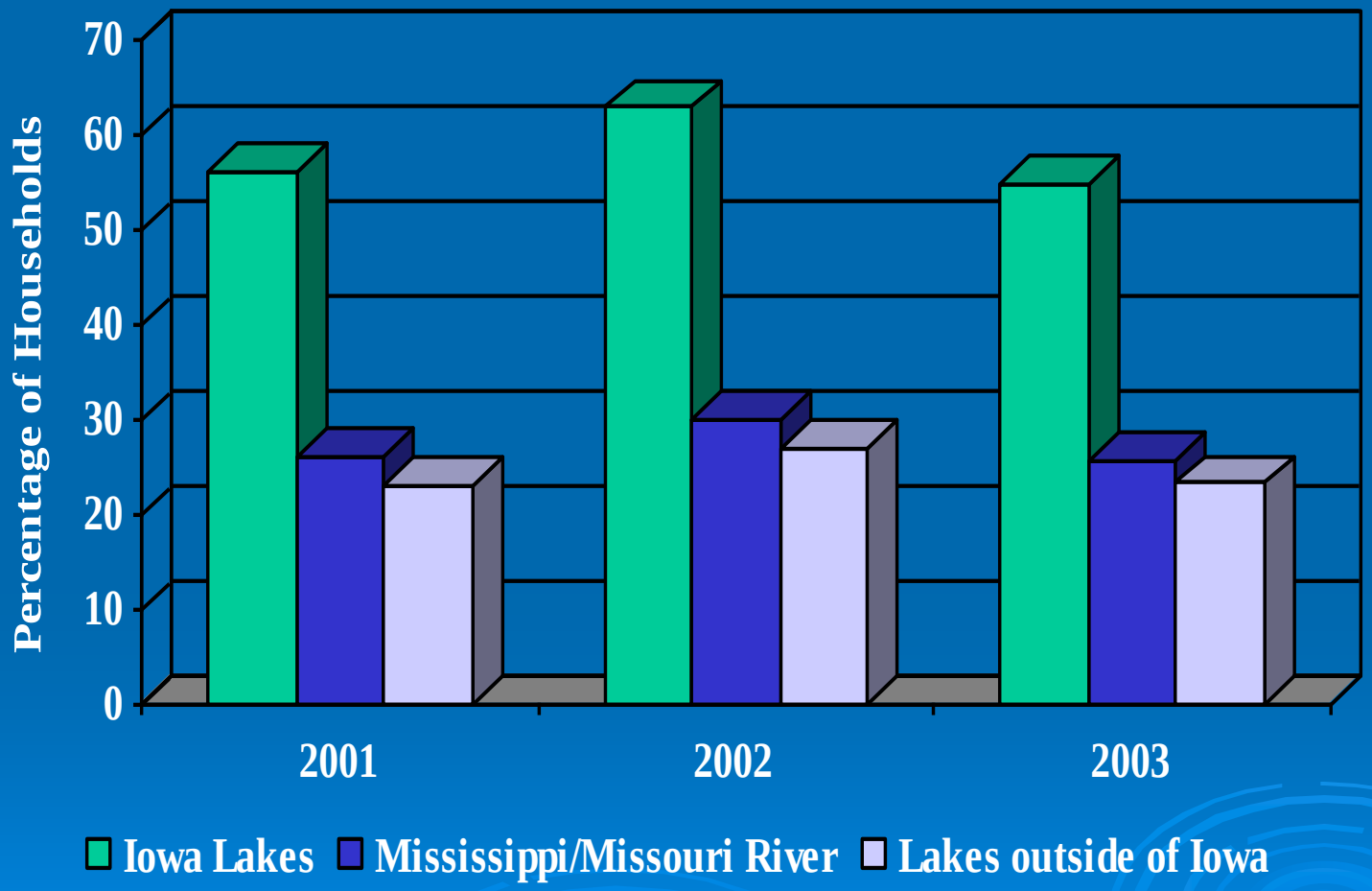
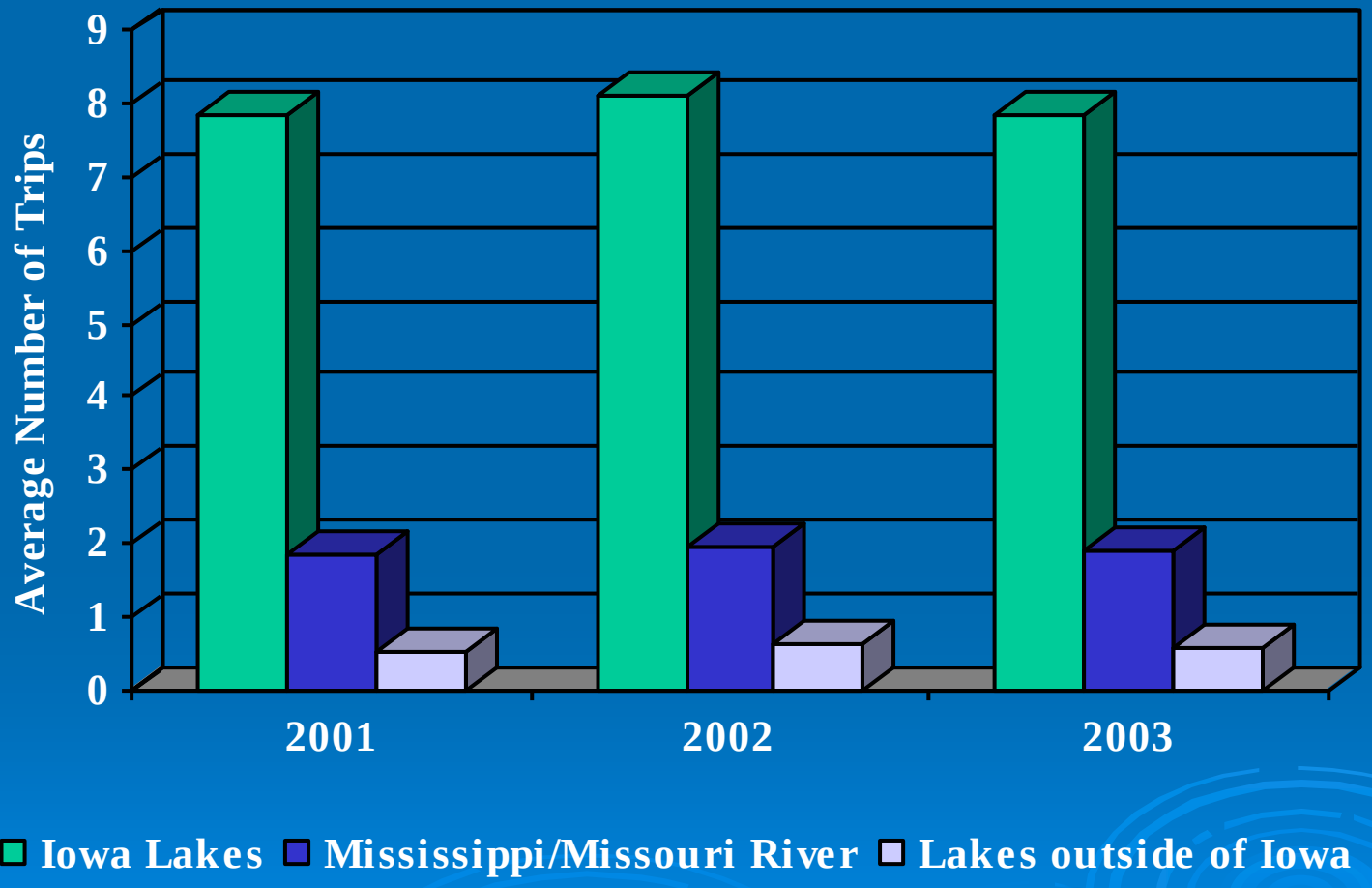


Figure 2: Average number of day trips



How frequently do you or your family swim in Iowa Lakes?

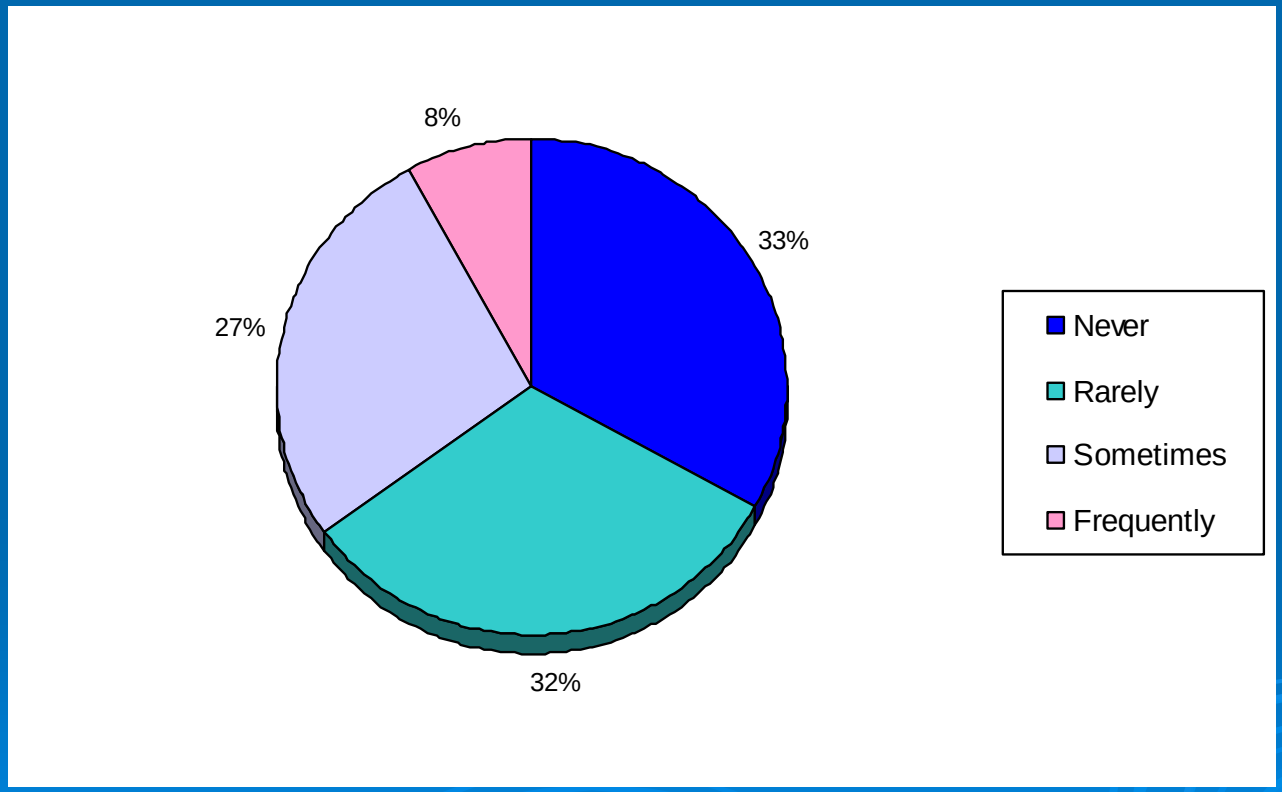


Figure 3: Average allocation of importance points to factors important in choosing a lake for recreation

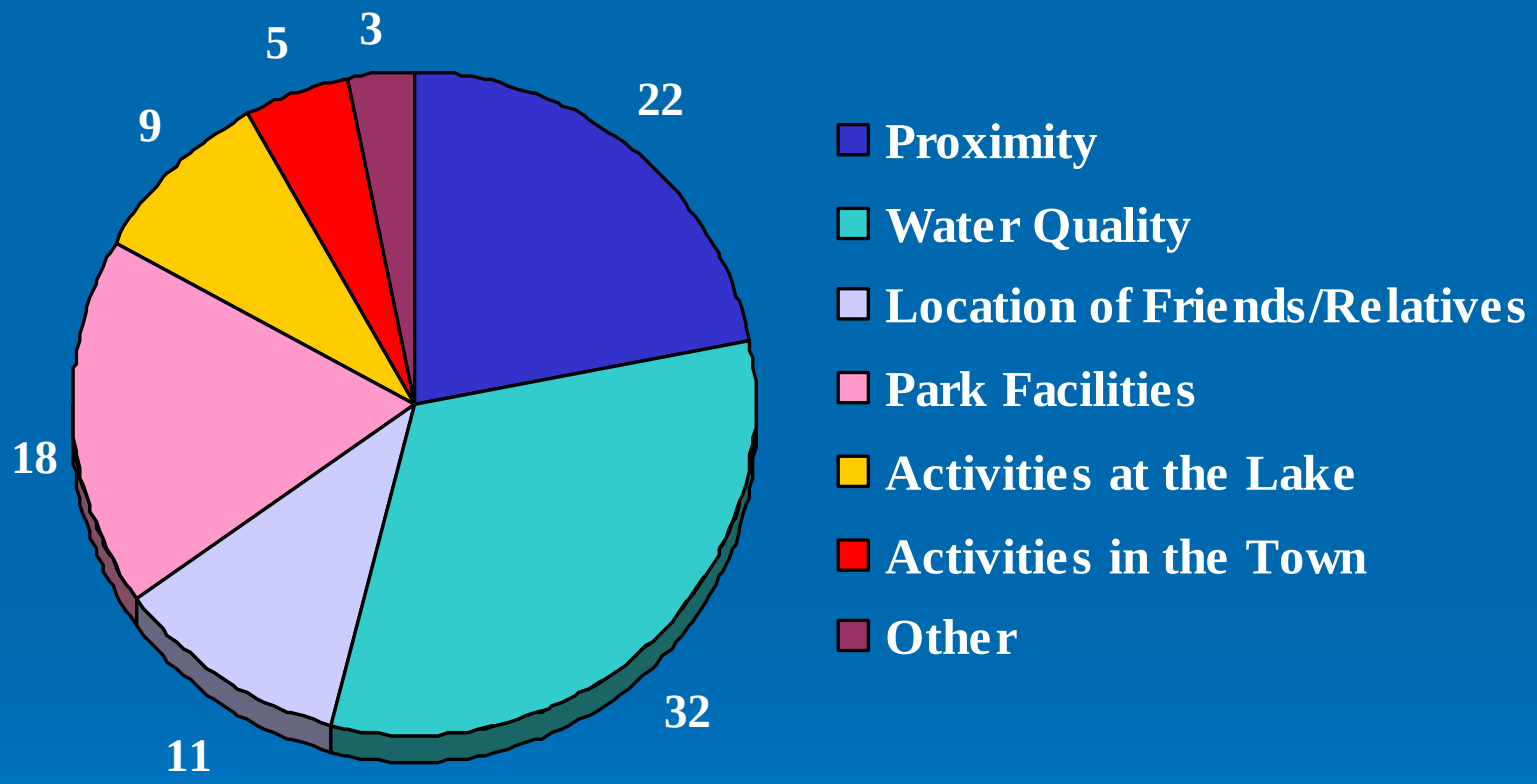
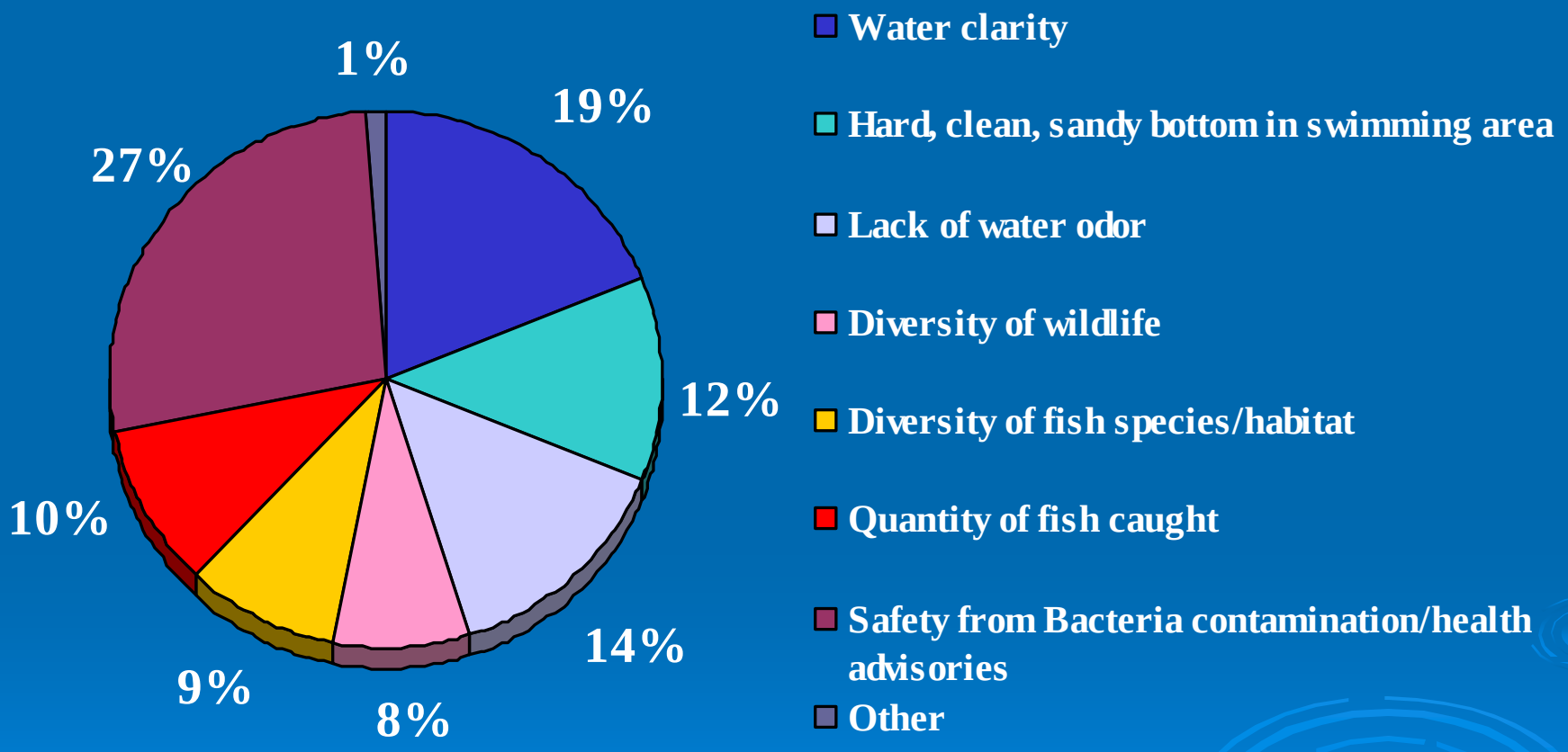
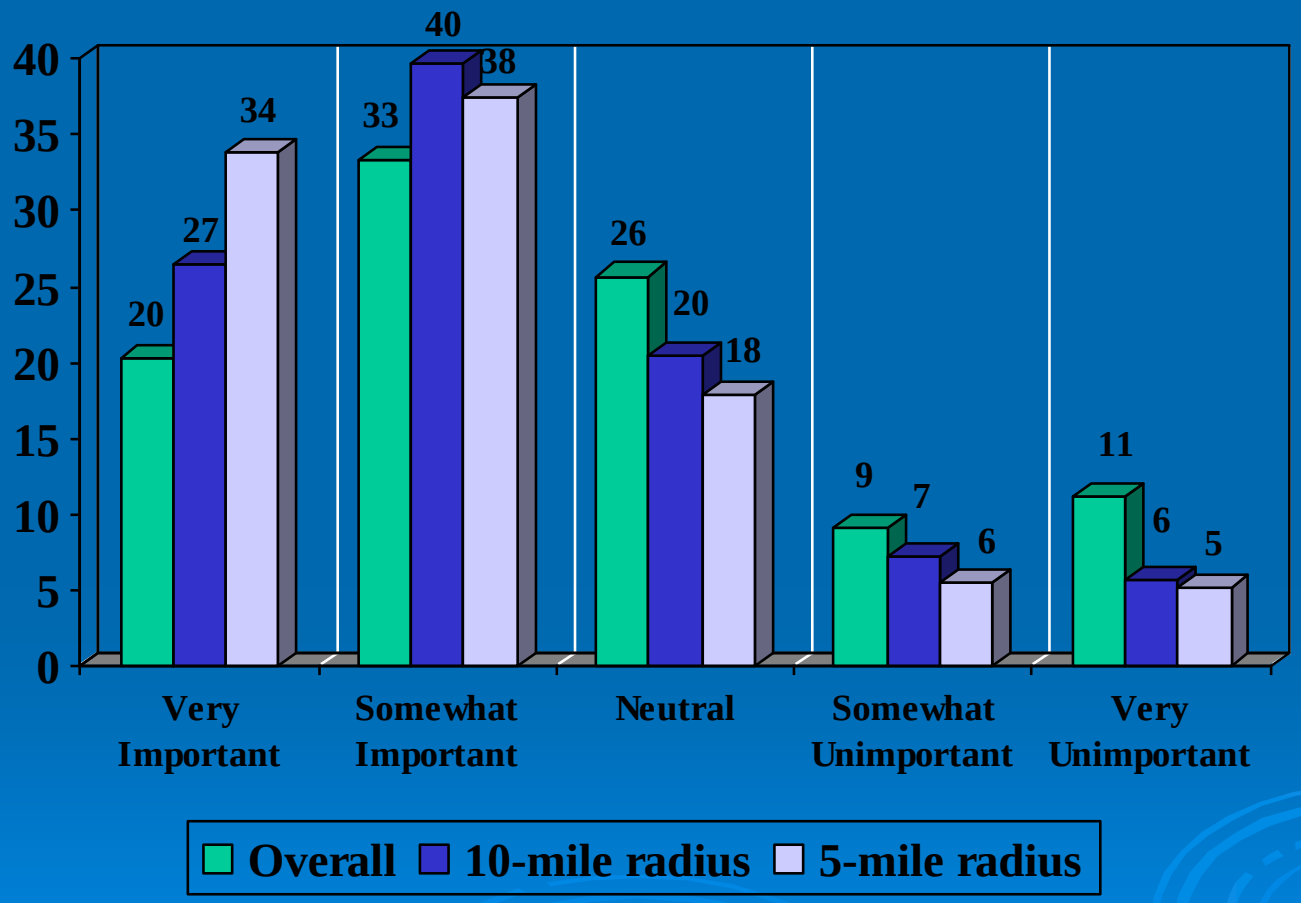


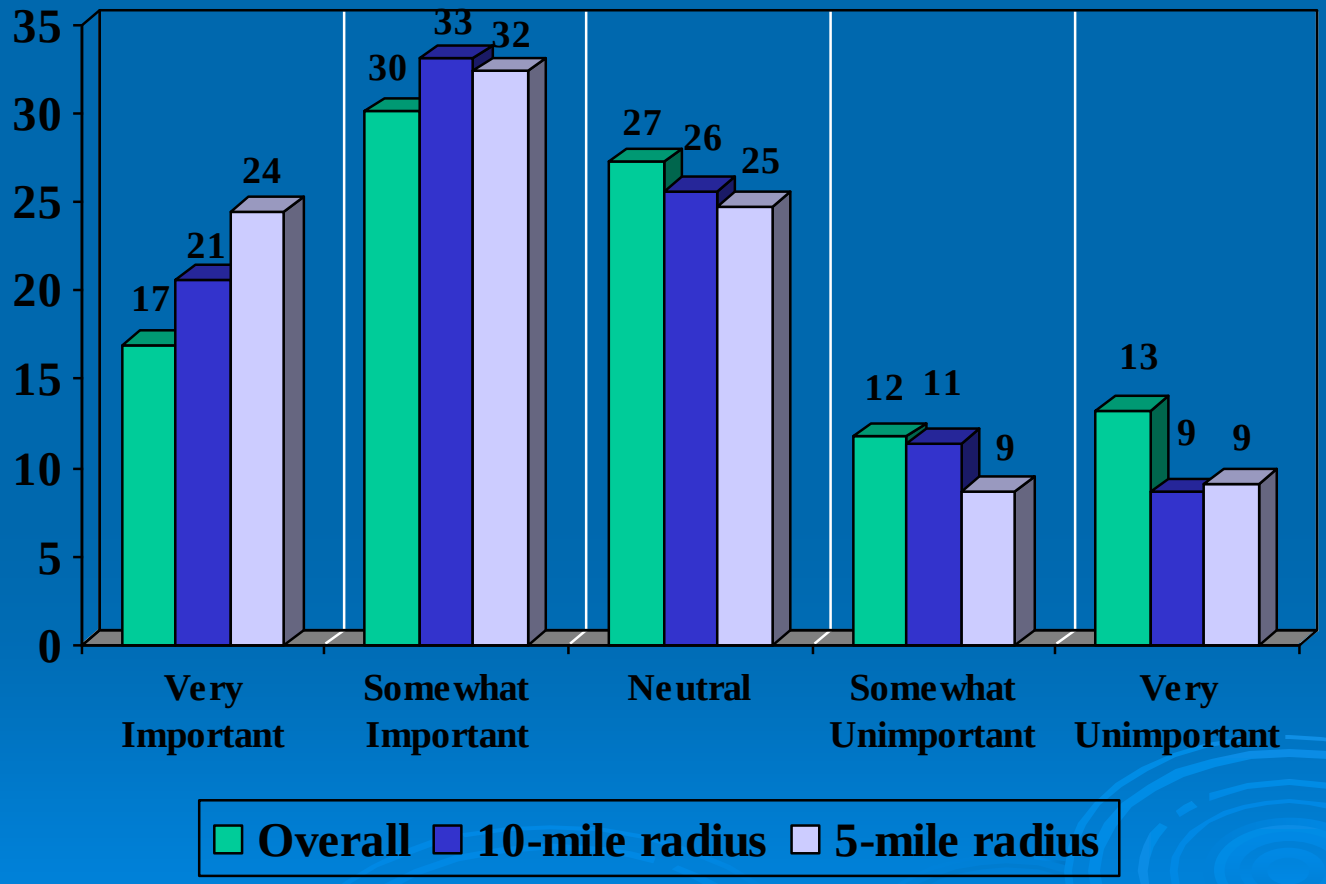
Figure 4: Average allocation of importance points to lake characteristics

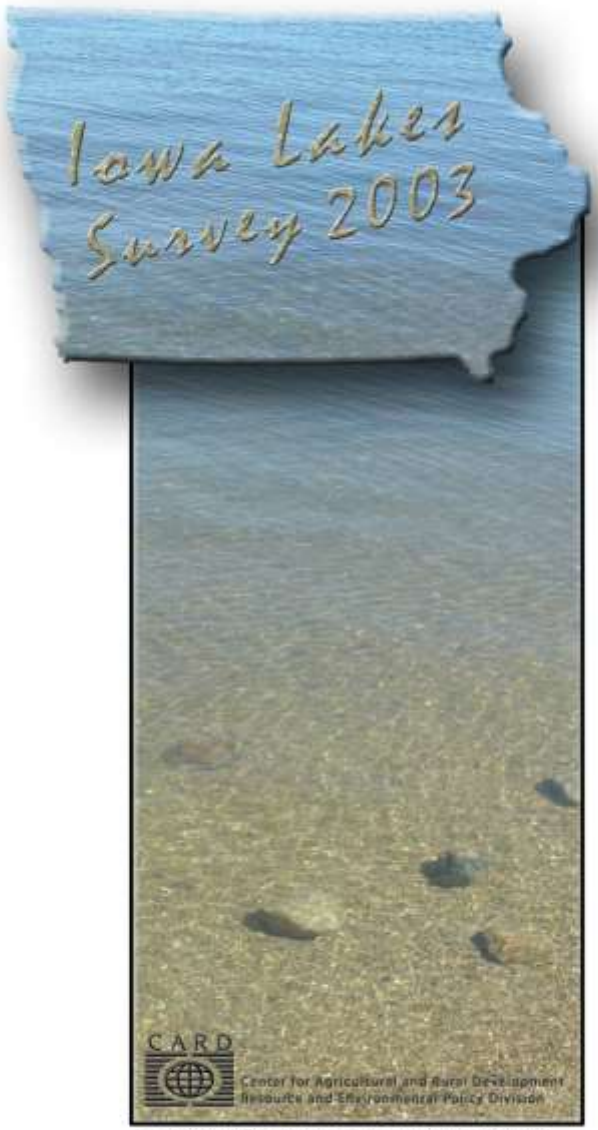


How important is the presence of the lake nearest your permanent residence to making your community an interesting and vibrant place?

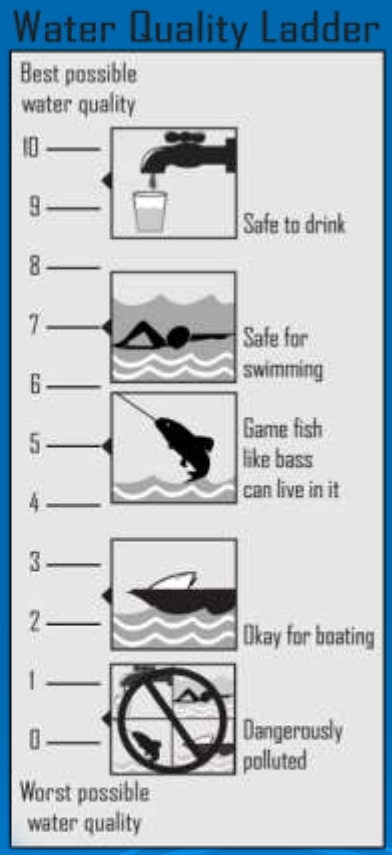


How important is the presence of the lake nearest your permanent residence to retaining the interest of young people to remain in your community or in attracting prospective residents to your area?




Iowa Lakes
Survey 2003
CARD
Center for Agricultural and Rural Development
Resource and Environmental Policy Division
IOWA STATE UNIVERSITY
DEPARTMENT OF ECONOMICS

Name of Lake (County)	Check if you have ever considered visiting this lake	Number of visits (January-December) in 2003		Water Quality Assessment
		Single-Day	Over-night	
Arbor Lake (Poweshiek)				
Arrowhead Lake (Pottawattamie)				
Arrowhead Pond (Sac)				
Avenue of the Saints Lake (Bremer)				
Badger Creek Lake (Madison)				
Badger Lake (Webster)				
Beaver Lake (Dallas)				
Beeds Lake (Franklin)				
Big Creek Lake (Polk)				
Big Spirit Lake (Dickinson)				
Black Hawk Lake (Sac)				
Blue Lake (Monona)				
Bob White Lake (Wayne)				
[illegible] Wood[illegible] (Hamilt[illegible]				



Survey Results (Cont'd)

- Water Quality Assessments

	Mean	Std. Dev.	Min.	Max.
Mean WQ Perception	5.75	0.51	4.11	6.81
Standard deviation of WQ Perception	1.66	0.28	1.06	2.42

Water Quality Perceptions
Correlations with Observed Physical Measures

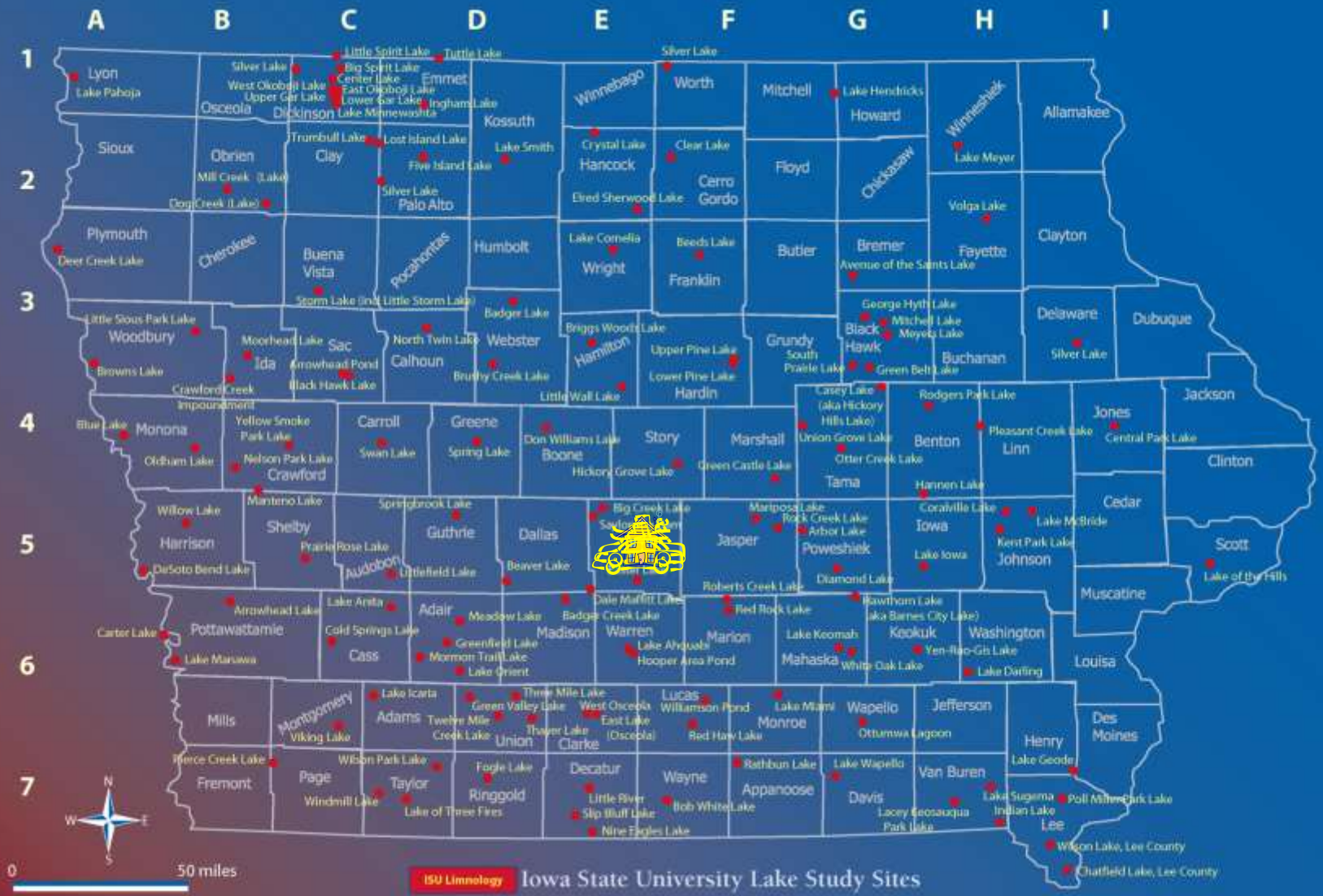
	Full Sample	Water Contact	Non-Water Contact
Day Trip Per Capita	0.25	0.26	-0.10
Secchi Depth	0.42	0.43	0.13
Chlorophyll	-0.30	-0.29	-0.16
NH3+NH4	-0.24	-0.23	-0.11
NO3NO2	-0.04	-0.03	-0.15
Total Nitrogen	-0.19	-0.18	-0.20
Total Phosphorus	-0.33	-0.32	-0.25
Silicon	-0.40	-0.39	-0.27
pH	-0.09	-0.10	0.03
Alkalinity	-0.20	-0.21	-0.13
ISS	-0.33	-0.34	-0.10
VSS	-0.38	-0.38	-0.15

Relationship between Recreation Trips and Physical Water Quality Measures: 2002 Data

Zone 3 Lakes	Average Trips within Zone 3	Secchi Depth (m)	Chlorophyll (ug/l)	Total Phosphorous (ug/l)	Total Suspended Solids (mg/l)
George Wyth Lake	1.28	1.1	17	50	7.2
Silver Lake	0.02	0.2	177	246	27.9

Silver Lake

Using Travel Patterns to Reveal Valuation



Valuing Lake Restoration/Preservation

- Lake restoration efforts can be costly, involving
  - dredging
  - watershed management
- However, the benefits to Iowans can also be substantial
  - recreational benefits
  - benefits to local residents
  - non-use values
- The benefits to any restoration "program" depends upon the mix of lakes being restored *not* just on the sum of benefits from each lake

A Lake Prioritization Analysis
The Cost Side

- IDNR provided a list of 35 priority Lakes for possible restoration
- Preliminary lake restoration costs were estimated for each lake by IDNR and John Downing, incorporating
  - In-lake restoration costs including dredging to an average depth of 10 ft.
  - Permanent watershed protection (per acre)
  - Yearly watershed maintenance costs
- Resulting lake changes were projected assuming
  - a 70% reduction in total nitrogen, total phosphorous and suspended solids
  - a 90% reduction in cynobacteria
  - corresponding changes in Secchi depth, chlorophyll, and total phytoplankton

Single Lake Rankings
Sorted by Total Net Benefits ($million)

Ranking	Lake	TNB	TB	TC
1	Big Creek	733.74	755.76	22.03
2	Brushy Creek	490.70	517.20	26.50
3	Hickory Grove	275.94	277.80	1.86
4	Lake McBride	218.18	226.21	8.03
5	Clear Lake	185.32	202.93	17.61
6	Lake Geode	161.34	166.11	4.77
7	Three Mile	153.36	163.67	10.32
8	Easter	102.33	113.48	11.15
9	Lake Ahquabi	86.91	88.55	1.64
10	Little Wall	76.78	81.85	5.07
11	Lake Anita	68.81	69.67	0.86
12	Kent Park	61.28	61.99	0.71
13	Springbrook	60.69	61.79	1.10
14	Red Haw	54.65	55.10	0.45
15	Don Williams	54.12	66.14	12.02

Single Lake Rankings
Sorted by Benefit/Cost Ratio

TNB Ranking	Lake	TNB	TB	TC	TB/TC
3	**Hickory Grove**	275.94	277.80	1.86	149
14	**Red Haw**	54.65	55.10	0.45	122
12	**Kent Park**	61.28	61.99	0.71	87
11	**Lake Anita**	68.81	69.67	0.86	81
13	**Springbrook**	60.69	61.79	1.10	56
9	**Lake Ahquabi**	86.91	88.55	1.64	54
21	**Hannen**	25.45	25.95	0.49	53
18	**Lake of the Hills**	39.69	40.48	0.79	51
25	**Central Park**	22.23	22.75	0.52	44
6	**Lake Geode**	161.34	166.11	4.77	35
1	**Big Creek**	733.74	755.76	22.03	34
19	**Viking**	30.04	30.99	0.95	33
4	**Lake McBride**	218.18	226.21	8.03	28
2	**Brushy Creek**	490.70	517.20	26.50	20

Conclusions

- Iowans value water quality, revealing this through their patterns of lake usage
- While the costs of lake restoration are substantial, they have the potential to pay back within the first year, improving the recreational opportunities within the state

West Okoboji Lake