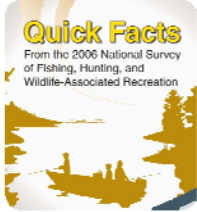


Lost: Assessing Student Basic Survival Skills in the Statistical Wilderness Using Real Data

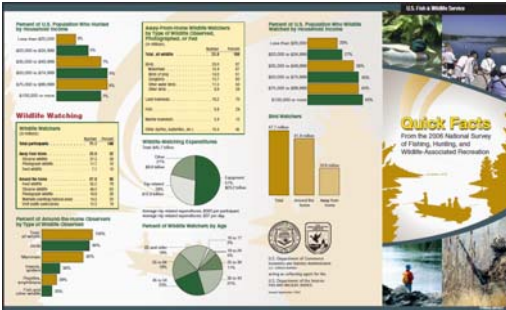


Marc Isaacson – Augsburg College
2012 ASA-JSM

Background

- **Statistical Literacy:**
 - Ability to read, write and reason about numbers and statistics in everyday contexts including tables, pie charts, and bar graphs.
- **Methodology:**
 - Activity done as an in-class activity in teams of 2 students (n = 215 groups) from 2008 - 2012
- **Context:**
 - Data Source: 2006 US Census Bureau Survey of Fishing, Hunting and Wildlife Watching.

Background



Reading Tables of Counts / Percents

Fishing

Anglers and Days of Fishing
(In millions)

	Anglers		Days	
	Number	Percent	Number	Percent
Total fishing	30.0	100	517	100
Freshwater, total	25.4	85	433	84
Freshwater, except				
Great Lakes	25.0	84	420	81
Great Lakes	1.4	5	18	3
Saltwater	7.7	26	86	17

Q: Write out a statement comparing the number of days spent Freshwater fishing vs. Saltwater fishing.

Reading Tables of Counts / Percents

Fishing

Anglers and Days of Fishing
(In millions)

	Anglers		Days	
	Number	Percent	Number	Percent
Total fishing	30.0	100	517	100
Freshwater, total	25.4	85	433	84
Freshwater, except				
Great Lakes	25.0	84	420	81
Great Lakes	1.4	5	18	3
Saltwater	7.7	26	86	17

Q: Write out a statement comparing the number of days spent Freshwater fishing vs. Saltwater fishing.

Correct Answer:
Multiple Answers

Results:
Correct Answer: 81% of groups

Non-Arithmetic Comparison 53%
Statement of Facts 41%
Ordinal Comparison 12%

Arithmetic Comparisons
Share of Total by group 6%
5 times as many 7%
5 times more (incorrect) 10%
Simple Difference 5%

Reading Tables of Counts / Percents

Anglers Pursuing Selected Fish by Type of Fishing
(In millions)

Fish sought	Number of anglers	Percent
Anglers, total	30.0	100
Freshwater except Great Lakes	25.0	83
Black bass	10.0	33
Panfish	7.5	25
Catfish/bullhead	7.0	23
Trout	6.8	23
Great Lakes	1.4	5
Walleye, sauger	0.5	2
Perch	0.5	2
Salmon	0.4	1
Lake trout	0.3	1
Saltwater	7.7	26
Flatfish (flounder, halibut)	2.1	7
Red drum (redfish)	1.8	6
Sea trout	1.5	5
Striped bass	1.4	5

Q: What percentage of Great Lakes anglers fished for perch?

Reading Tables of Counts / Percents

Fish sought	Number of anglers	Percent
Anglers, total	30.0	100
Freshwater except Great Lakes		
Black bass	10.0	33
Panfish	7.5	25
Catfish/bullhead	7.0	23
Trout	6.9	23
Great Lakes		
Walleye, sauger	0.5	2
Perch	0.5	2
Salmon	0.4	1
Lake trout	0.3	1
Saltwater		
Flattish (flounder, halibut)	2.1	7
Red drum (redfish)	1.8	6
Sea trout	1.5	5
Striped bass	1.4	5

Q: What percentage of Great Lakes anglers fished for perch?

Correct Answer: $.5 / 1.4 = 36\%$
or $2 / 5 = 40\%$

Results:
19% Correct Answer
Most Common Wrong Answer:
2 Percent: 76% of Groups

Reading Tables of Counts / Percents

Q: What % of Great Lakes anglers fished for perch?

Fish sought	Number of anglers	Percent
Anglers, total	30.0	100
Freshwater except Great Lakes		
Black bass	10.0	33
Panfish	7.5	25
Catfish/bullhead	7.0	23
Trout	6.9	23
Great Lakes		
Walleye, sauger	0.5	2
Perch	0.5	2
Salmon	0.4	1
Lake trout	0.3	1
Saltwater		
Flattish (flounder, halibut)	2.1	7
Red drum (redfish)	1.8	6
Sea trout	1.5	5
Striped bass	1.4	5

Correct Answer: $.5 / 1.4 = 36\%$
(or $2 / 5 = 40\%$)

Two True Statements:
36% of all Great Lakes anglers fish for perch.
2% of all anglers fish the Great Lakes for perch.

Reading / Interpreting Pie Charts

Percent of Anglers by Age Group

Q: What Percentage of Anglers are 55 and older?

Q: What Percentage of Anglers are between 35 and 54?

Reading / Interpreting Pie Charts

Q: What Percentage of Anglers are 55 and older?

Correct Answer: 25%

Results:
97% Correct Answer
Most Common Wrong Answer:
Can't Tell: 1% of groups

Q: What Percentage of Anglers are between 35 & 54?

Correct Answer: 47%

Results:
99.5% Correct Answer

Reading / Interpreting Pie Charts

Percent of Anglers by Age Group

Q: What percentage of 18 to 24 year olds are anglers?

Reading / Interpreting Pie Charts

Q: What percentage of 18 to 24 year olds are anglers?

Correct Answer:
Can't Tell (with pie chart given)

Results:
30% Correct Answer
Most Common Wrong Answer:
Eight Percent (67% of groups)

Reading / Interpreting Pie Charts

Percent of Wildlife Watchers by Age

Age Group	Percentage
16 to 17	2%
18 to 24	5%
25 to 34	11%
35 to 44	21%
45 to 54	23%
55 to 64	19%
65 and older	19%

Q: What percentage of 35 to 44 year olds are wildlife watchers?

Q: What percentage of wildlife watchers are between 35 & 44 yrs of age?

Reading / Interpreting Pie Charts

Percent of Wildlife Watchers by Age

Age Group	Percentage
16 to 17	2%
18 to 24	5%
25 to 34	11%
35 to 44	21%
45 to 54	23%
55 to 64	19%
65 and older	19%

Q: What % of 35 to 44 year olds are wildlife watchers?

Q: What % of wildlife watchers are between 35 & 44 yrs of age?

Correct Answer:
Can't Tell (with pie chart given)

Results: 56% Correct

Common Wrong Answer:
21% (38% of groups)

Reading / Interpreting Bar Charts

Percent of U.S. Population Who Wildlife Watched by Household Income

Household Income	Percentage
Less than \$20,000	23%
\$20,000 to \$34,999	27%
\$35,000 to \$49,999	36%
\$50,000 to \$74,999	40%
\$75,000 to \$99,999	40%
\$100,000 or more	43%

Q: What percentage of low income (<\$20k) households are wildlife watchers?

Q: What percentage of those under \$35k households are wildlife watchers?

Reading / Interpreting Bar Charts

Percent of U.S. Population Who Wildlife Watched by Household Income

Household Income	Percentage
Less than \$20,000	23%
\$20,000 to \$34,999	27%
\$35,000 to \$49,999	36%
\$50,000 to \$74,999	40%
\$75,000 to \$99,999	40%
\$100,000 or more	43%

Q: What percentage of low income (<\$20k) households are wildlife watchers?

Correct Answer: 23%

Results: 83% Correct

Common Wrong Answer:
Can't Tell (9% of groups)

Reading / Interpreting Bar Charts

Percent of U.S. Population Who Wildlife Watched by Household Income

Household Income	Percentage
Less than \$20,000	23%
\$20,000 to \$34,999	27%
\$35,000 to \$49,999	36%
\$50,000 to \$74,999	40%
\$75,000 to \$99,999	40%
\$100,000 or more	43%

Q: What percentage of those under \$35k households are wildlife watchers?

Correct Answer:
Can't Tell

Results: 41% Correct

Common Wrong Answer:
50% (45% of groups)

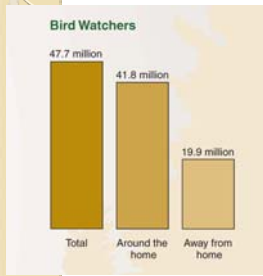
Reading / Interpreting Bar Charts

Bird Watchers

Category	Number
Total	47.7 million
Around the home	41.8 million
Away from home	19.9 million

Q: How many bird watchers participate in that activity both around the home and away from home?

Reading / Interpreting Bar Charts



Bird Watchers

Total	47.7 million
Around the home	41.8 million
Away from home	19.9 million

Q: How many bird watchers participate in that activity **both** around the home and away from home?

Correct Answer: 14 Million

Results: 10% Correct


Common Wrong Answer:
 Can't Tell (31%)
 47.7 Million (34%)
 61.7 Million (8%)

Summary of Error Rate Results

- Ignorance or misusing union-intersection equation (90%)
- Percentage of a subgroup (80%)
- Confusion of the inverse (70%)
- Treating common-part % as distinct-parts (60%)
- Confusion of the inverse when asked both questions back to back (45%)
- Comparison of counts/sums (20%)
- Identifying/adding parts in a pie chart (1%)

Conclusions / Discussion

- This is not rocket science!
 - Reading Tables, Pie Charts and Bar Graphs
 - Writing Statements including #'s
 - Interpreting Summary Data
- Yet, Students are LOST in what many might consider "fly-over" material.



Conclusions / Discussion

- Statistical Literacy is more than just statistical / calculation competence
- All Students must be able to navigate amongst real-world summary statistics
- Where are students going to learn this?
 - Should we make room in the traditional course?
 - Should we have a pre-inference "2nd Course"?

Conclusions / Discussion

- Test it out with your students!
 - Link to Census Brochure:
 - www.census.gov/prod/2008pubs/fhw06-qkfact.pdf
 - Link to 10 item sample survey:
 - www.StatLit.org/pdf/2008IsaacsonQuestionsPKAL.pdf
 - Questions / Comments?
 - Email address: isaacson@augsburg.edu

Reading Text with Numerical Facts

Quick Facts

In 2006, 87 million U.S. residents 16 years old and older, 38 percent of the population, participated in wildlife-related recreation activities.

Wildlife-Related Recreationists: 2006

30.0 million anglers
12.5 million hunters
71.1 million wildlife watchers

These recreationists spent \$122 billion on their fishing, hunting, and wildlife watching (closely observing, feeding, and photographing wildlife).

The 2006 National Survey of Fishing, Hunting, and Wildlife-Associated Recreation is a comprehensive source of wildlife-related recreation information. Information is provided in national and state printed reports and at <http://federalaid.fws.gov/surveys/surveys.html>.

Q: In 2006, how many people participated in wildlife-related activities?

Correct Answer:
87 Million U.S. Residents 16+

Results:
 Correct Answer: 76%
 Most Common Wrong Answer:
 113.6 Million (7%)

Reading Text with Numerical Facts

Quick Facts In 2006, 87 million U.S. residents 16 years old and older, 38 percent of the population, participated in wildlife-related recreation activities.

Wildlife-Related Recreationists: 2006
30.0 million anglers
12.5 million hunters
71.1 million wildlife watchers

These recreationists spent \$122 billion on their fishing, hunting, and wildlife watching (closely observing, feeding, and photographing wildlife).

The 2006 National Survey of Fishing, Hunting, and Wildlife-Associated Recreation is a comprehensive source of wildlife-related recreation information. Information is provided in national and state printed reports and at <http://federallaid.fws.gov/surveys/surveys.html>.

Q: How many people did they interview for this survey?

Correct Answer:
Can't Tell

Results:
Correct Answer: 72% of groups
Most Common Wrong Answer:
113.6 Million (9%)

Abstract:

- This presentation describes a classroom assessment activity using a 2 page "Quick Facts" summary of a U.S. government produced survey on Fishing, Hunting and Wildlife. With a combination of summary statistics, tables and graphs, this activity probes student understanding of topics which are often considered fly-over territory by many introductory statistics instructors. The results and discussion of this activity provide instructors with insight into the preparation and background knowledge of students entering introductory statistics. In addition, it becomes an excellent vehicle for demonstrating and introducing the need for statistical literacy skills using real-world data in a context that is familiar to many students and not discipline specific. Results from over 200 undergraduate and 100 graduate students at multiple schools will be discussed along with recommendations for instructors on improving student performance on these important yet often-ignored topics.