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U.S. Department of the Interior

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EPIDEMIOLOGY of RECREATIONAL FATALITIES at LAKE MEAD NATIONAL RECREATION AREA: A FIVE YEAR ANALYSIS

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RESEARCH QUESTIONS

1. Which visitors (based on gender, age group) are more likely to be injured at Lake Mead National Recreation Area (LMNRA)?
2. What are the prevalence rates of visitors' fatalities?
3. What are the leading causes of fatalities at LMNRA?
4. What times (months/days/time of day) are fatalities more commonly occurring?
5. To what degree are weather-related conditions, consumption of alcohol, and lack of wearing a personal floating device (PFD), a factor in reported fatalities?
6. Are fatalities clustered at specific locations at LMNRA?

Significance of the Study:

- Effectively target injury prevention efforts
- Provide a science-based approach to understanding the cause of visitor's injuries and fatalities at LMNRA during the last five years.

THEORETICAL FRAMEWORKS

This study was guided by the following theories:

- Heinrich's Domino Theory
- Human Factors Theory

METHODOLOGY

Data Sources and Collection:

- Cross-sectional (descriptive) data from Incident Reports
- January 1, 2010 to December 31. 2010
- Visitor Injury Data system (VIDS)

-Classifications within VIDS are based on definitions used by the *Centers for Disease Control* and *Prevention's* web-based Injury Statistics Query and Reporting System (WISQUARS).

The Data Collected Were Based On:

- ***date of incident***
- ***time of injury***
- ***wind speed***
- ***air temperature***
- ***gender and age***
- ***race/ethnicity***
- ***place of residence***
- ***pre-death activity***
- ***cause of fatality,***
- ***area of park***
- ***primary contributing factor of each incident***

DATA ANALYSIS

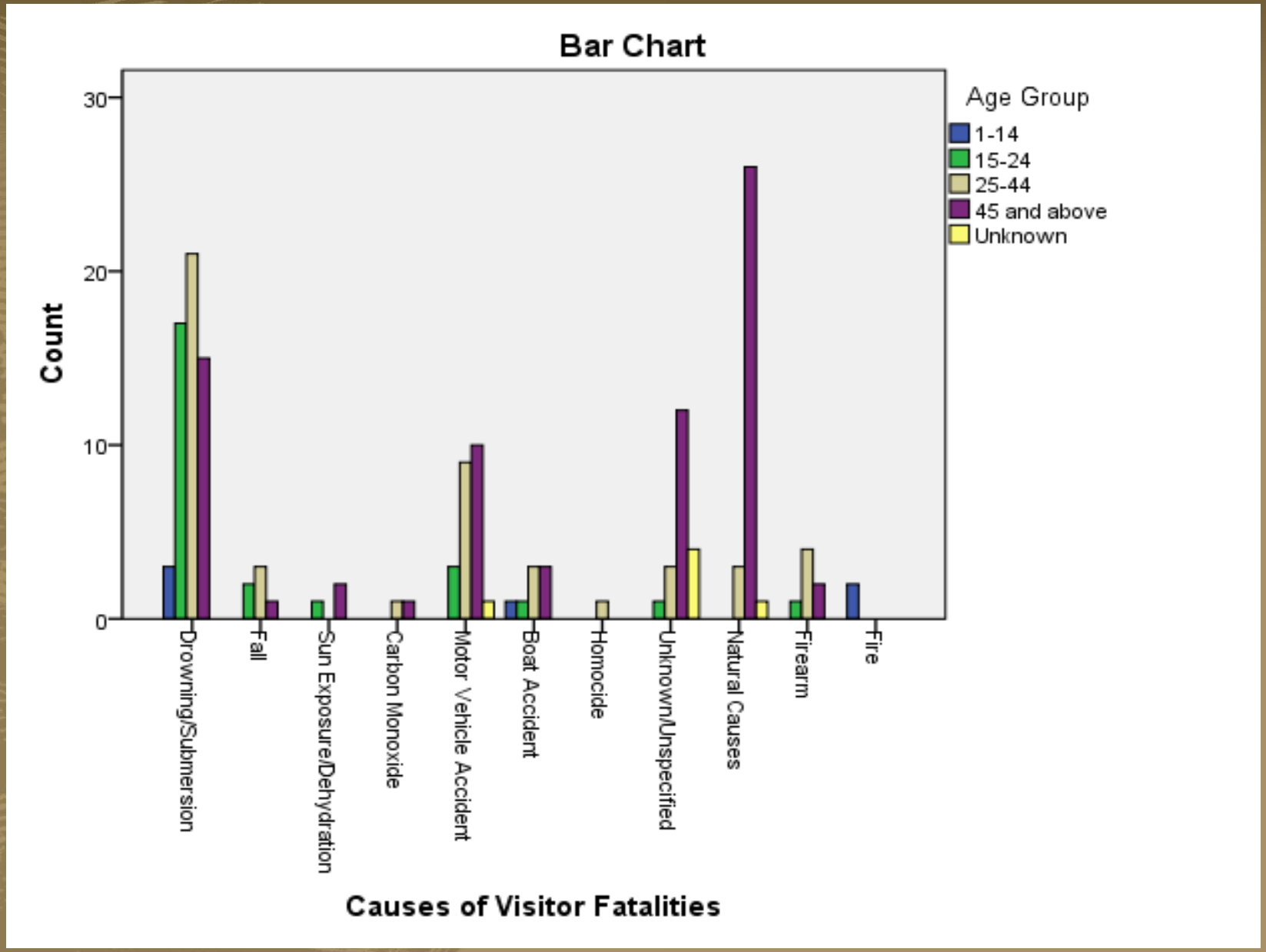
- Statistical Package for the Social Sciences-SPSS (Version 18 for Windows™)
- Pearson product-moment coefficients and Davis' (1971) conventions
- Effect sizes were computed using Cohen's (1988) d coefficients and indices

RESULTS

Demographics of Victims:

- *Male:* 84%
- *Mean age of Victim:* 43 years
  (SD=20.98; range=3-91 years)
- *Race/Ethnicity:*
  - White, Non-Hispanic (67%)
  - Hispanic (27%)
  - Other (6%)

Figure 1. Causes of Fatalities by Age Group

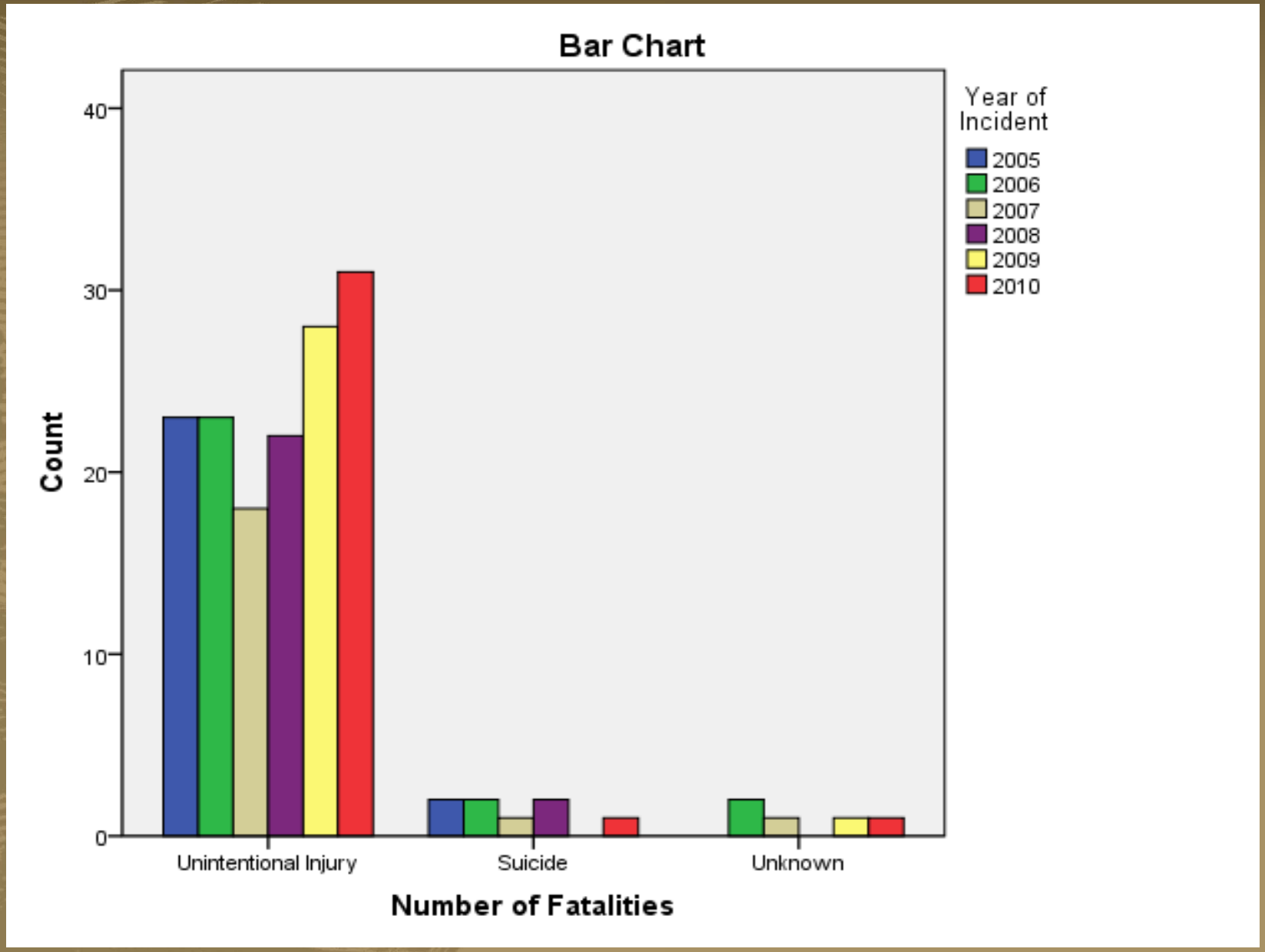


Prevalence of Fatalities:

- A rate of 2.3 fatalities per million visitors in 2007 [Number of Visitors = 7,622,139]

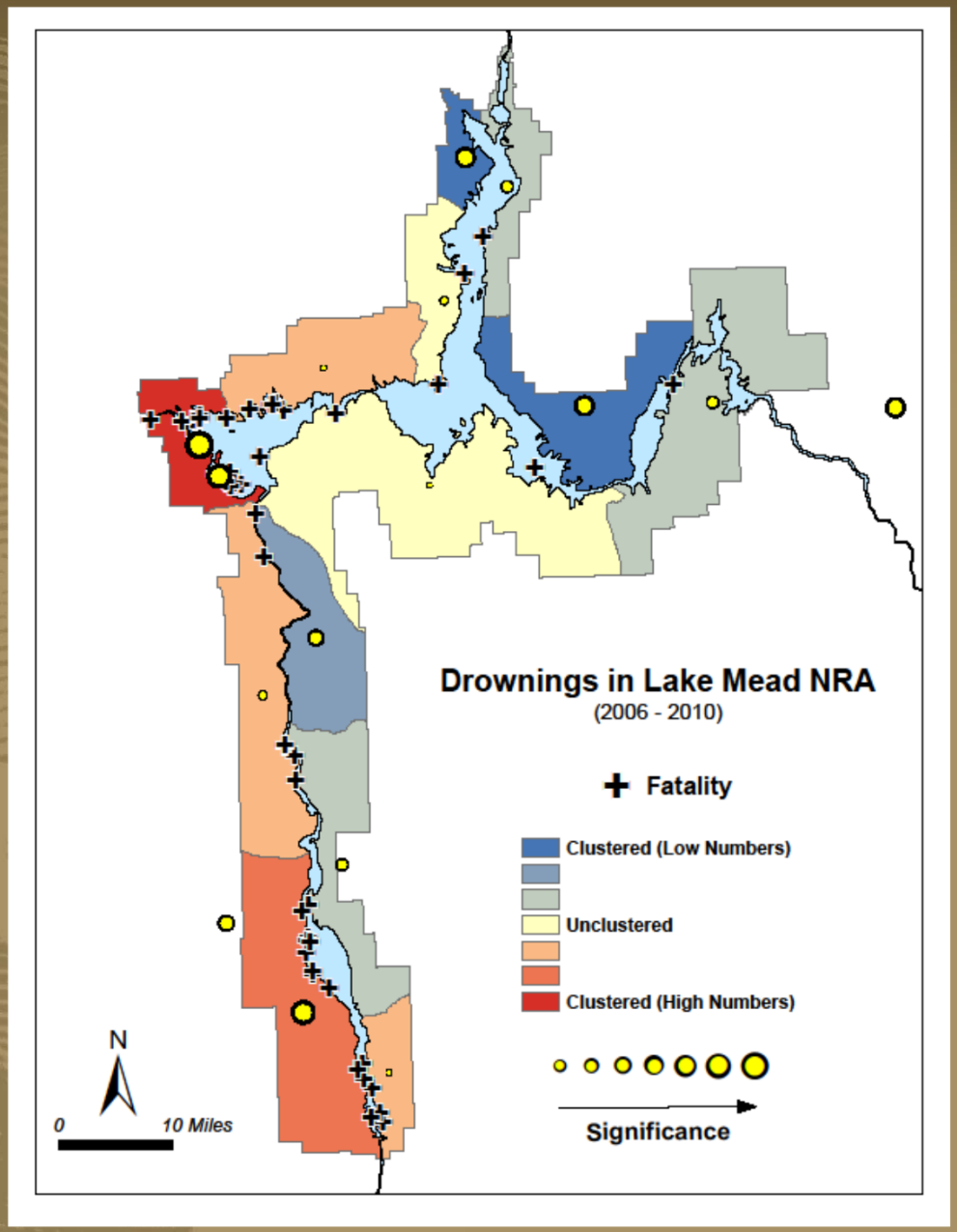
- A rate of 4.3 fatalities per million visitors in 2010 [Number of Visitors = 7,080,758]

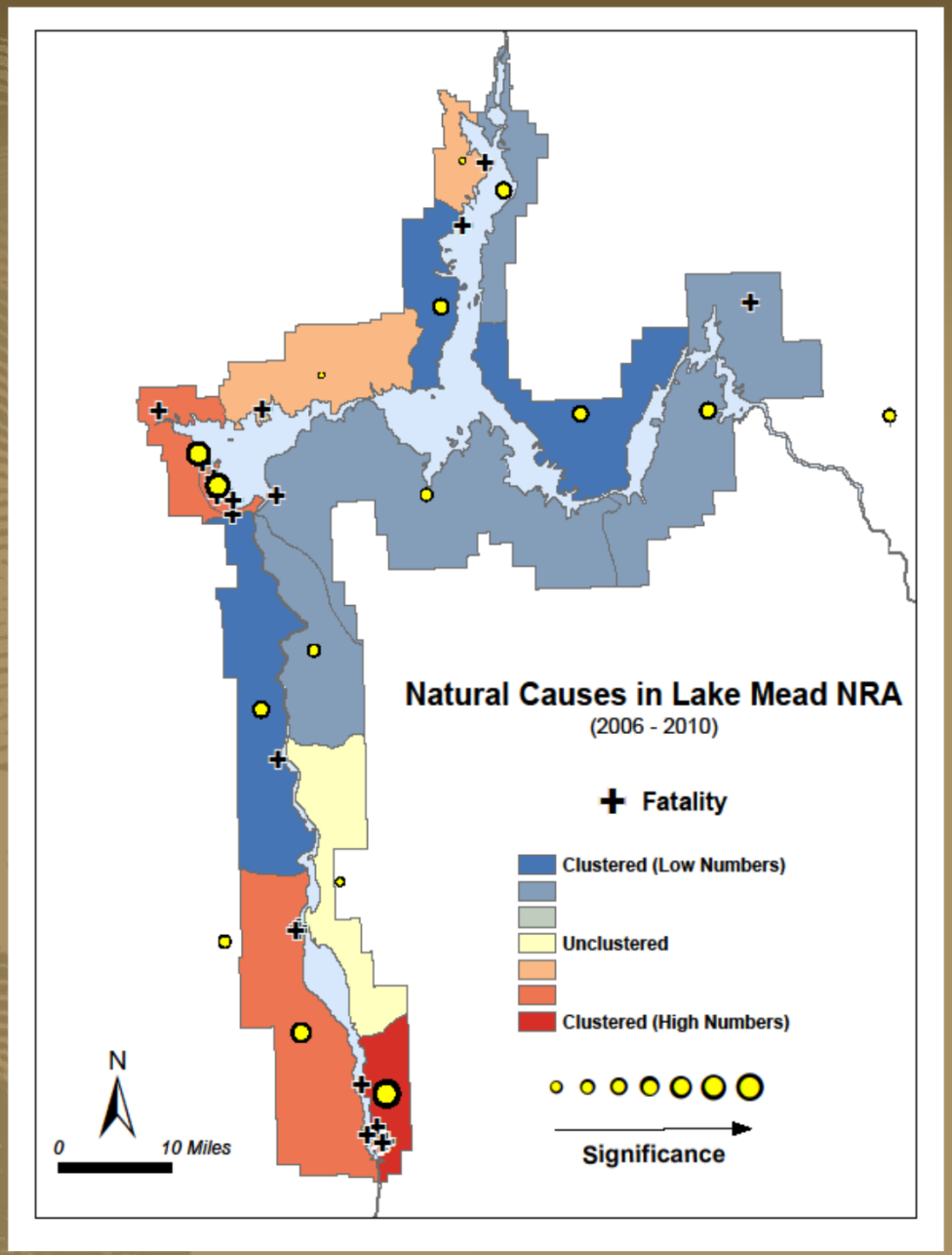
Figure 2. Reported Fatalities by Year

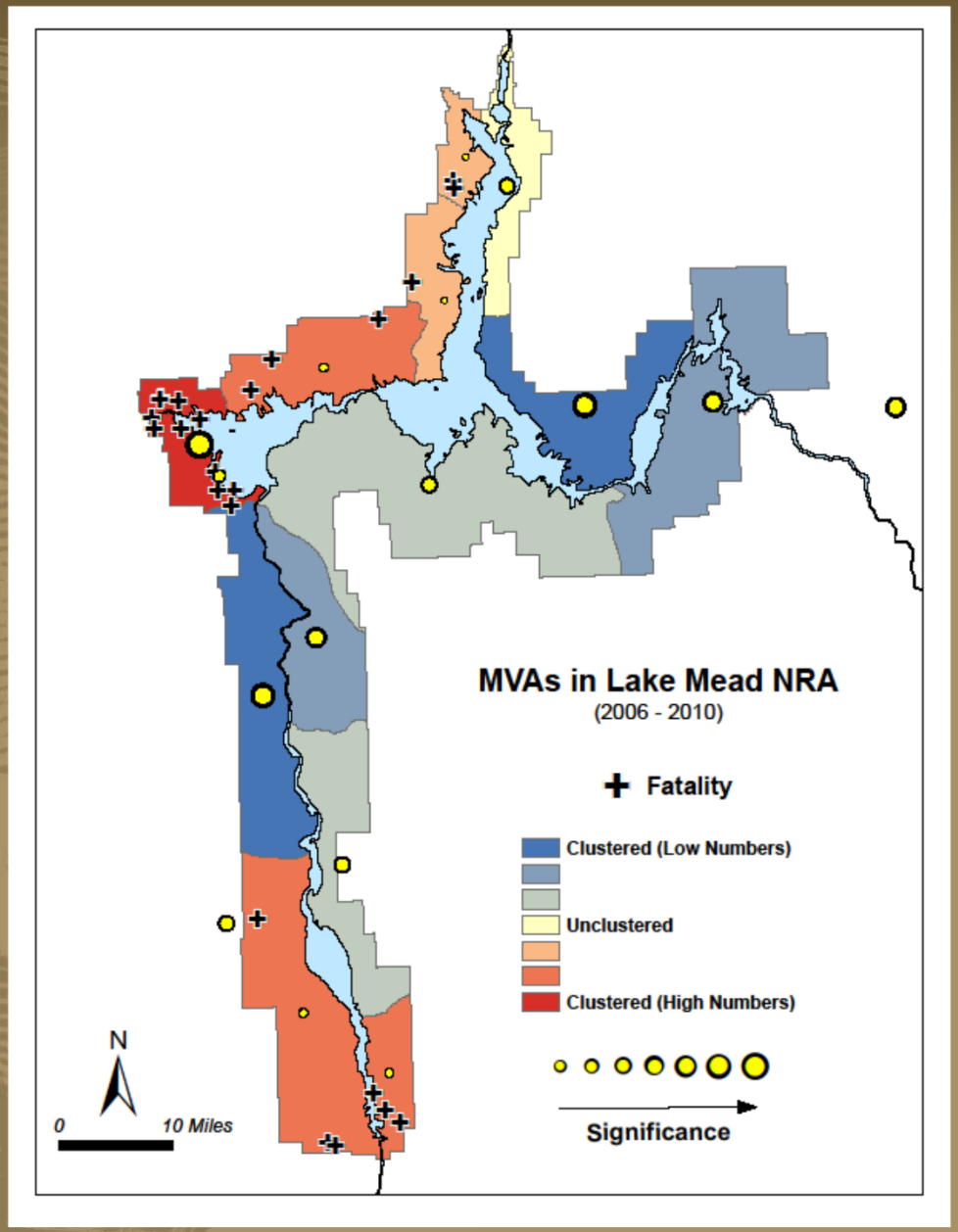


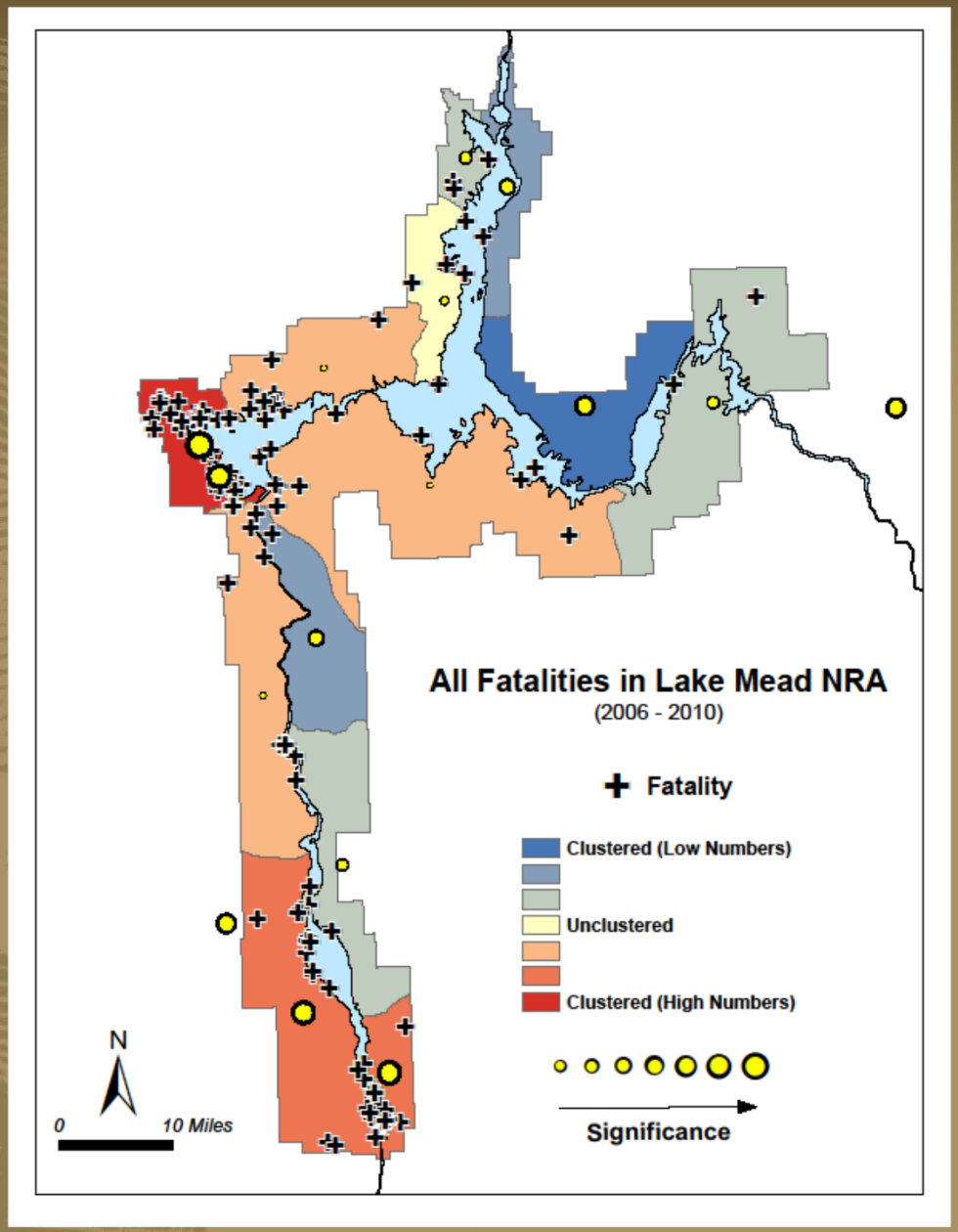
Leading Causes of Fatalities:

- Drowning incidents (35%)
- Natural Causes (19%)
- Transportation related activities (15%)


Drownings in Lake Mead NRA
(2006 - 2010)
Fatality
Clustered (Low Numbers)
Unclustered
Clustered (High Numbers)
Significance
N
0
10 Miles


Natural Causes in Lake Mead NRA
(2006 - 2010)
Fatality
Clustered (Low Numbers)
Unclustered
Clustered (High Numbers)
Significance
N
0
10 Miles


MVAs in Lake Mead NRA
(2006 - 2010)
Fatality
Clustered (Low Numbers)
Unclustered
Clustered (High Numbers)
Significance
N
0
10 Miles


All Fatalities in Lake Mead NRA
(2006 - 2010)
Fatality
Clustered (Low Numbers)
Unclustered
Clustered (High Numbers)
Significance
N
0
10 Miles

Distribution of Fatalities Based on Months, Days, Time of Day:

- **Peaked during the month of** *August*
- **Lowest in** *December*
- **Most common on**

  Saturday, Sunday, & Thursday
- **Most (48%) fatalities occurred between**

  Noon and 6:00 PM

Figure 3. Monthly Distribution of Fatalities (2005-2010)

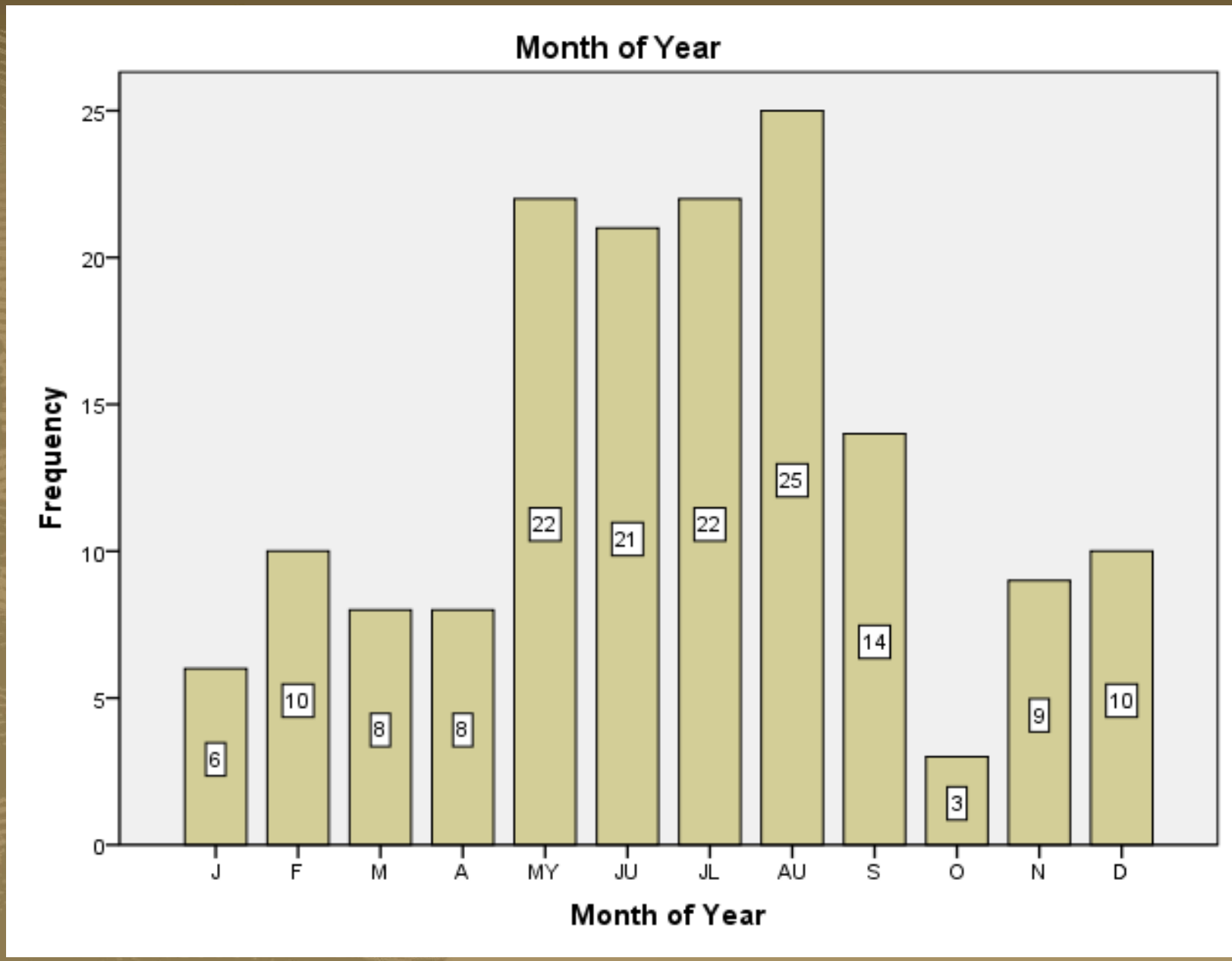


Figure 4. Distribution of Fatalities by Day of Week (2005-2010)

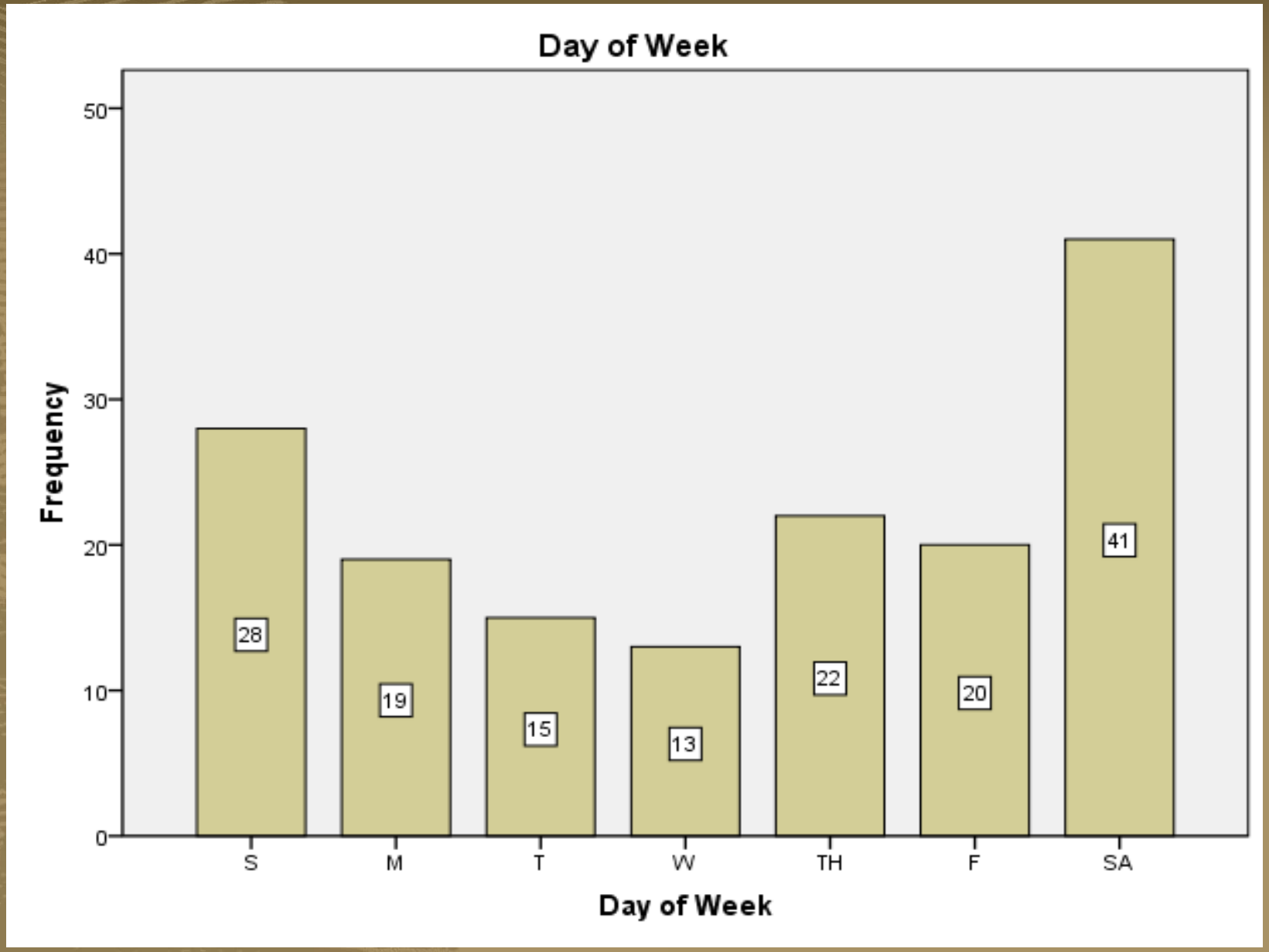
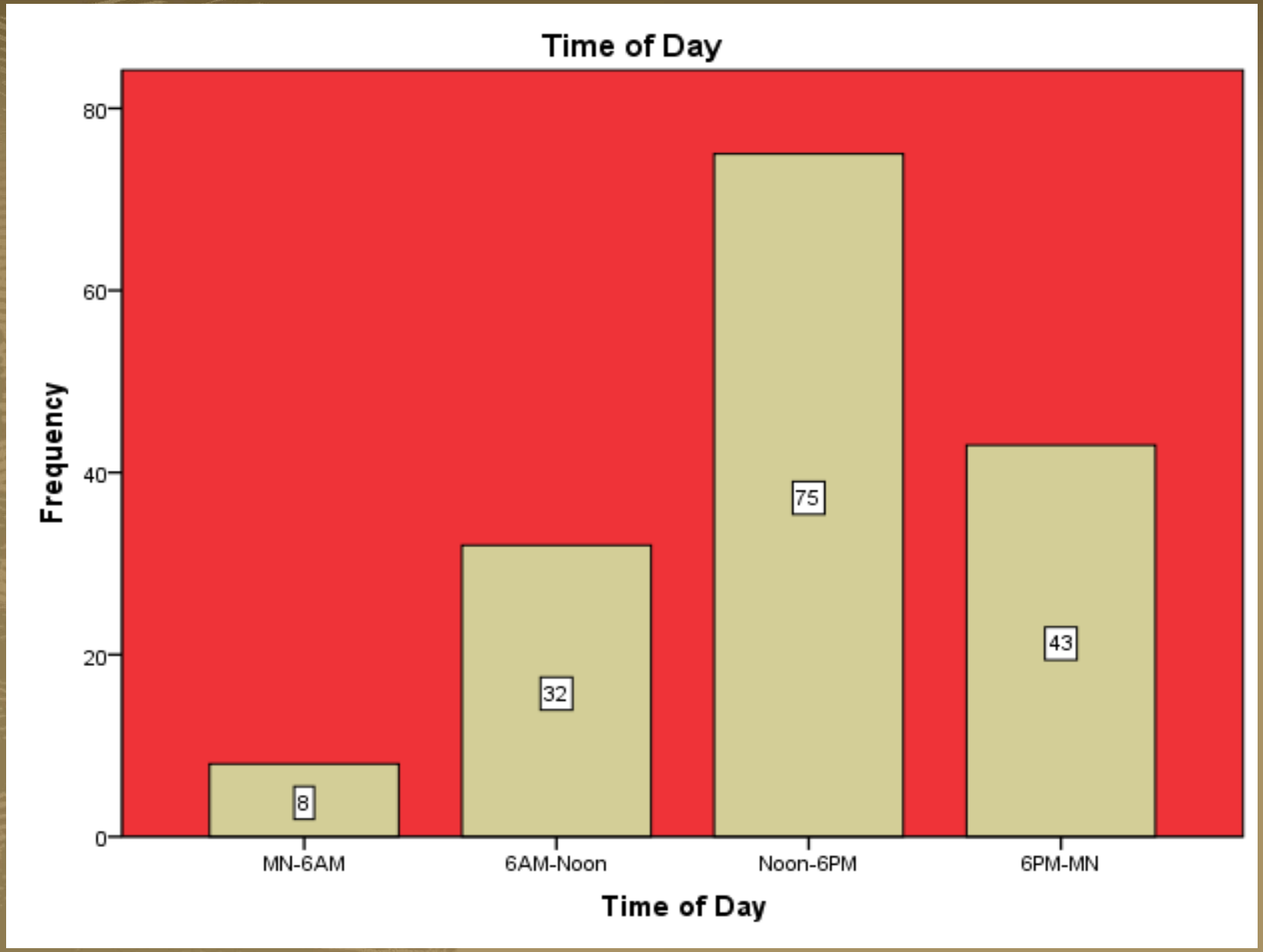


Figure 5. Distribution of Fatalities by Day of Week (2005-2010)



Usage of PFDs:

In 2009, water-based victims (over 15%) were less likely to use a PFD

Table 1

Use of Life Jacket (PFD) by Year of Incident

		Use of Life Jacket				
		No	Yes	Not Applicable	Unknown	Total
Year of Incident	2005	6	2	17	0	25
	2006	9	6	12	0	27
	2007	5	3	11	1	20
	2008	7	3	14	0	24
	2009	11	4	14	0	29
	2010	8	0	24	1	33
Total		46	18	92	2	158

Relationships among Selected Variables and Causes of Fatalities:

- Four variables (age group, alcohol use, usage of PFDs, air temperature) accounted for a significant relationship with causes of fatalities.
- Prevalence of alcohol use was LOW ($r=.22$, $p<.01$)
- Alcohol use was highest within the 25-44 age group
- PFD ($r=.74$, $p<.01$) [strong positive correlation]

Table 2:

Bivariate Correlations of Selected Variables of Interest with Causes of Visitors' Fatalities

		Age Group	Causes of Visitors' Fatalities	Alcohol Use	Usage Rate of PFD	Air Temp	Wind Speed
Age Group	Pearson Correlation	1	.356**	.228**	.414**	-.228**	-.213**
	Sig. (2-tailed)		.000	.004	.000	.004	.007
	N	158	158	158	158	158	158
Causes of Visitor Fatalities	Pearson Correlation	.356**	1	.294**	.740**	-.205**	-.122
	Sig. (2-tailed)	.000		.000	.000	.010	.128
	N	158	158	158	158	158	158
Alcohol Use	Pearson Correlation	.228**	.294**	1	.289**	-.218**	-.133
	Sig. (2-tailed)	.004	.000		.000	.006	.095
	N	158	158	158	158	158	158
Usage Rate of PFD	Pearson Correlation	.414**	.740**	.289**	1	-.331**	-.147
	Sig. (2-tailed)	.000	.000	.000		.000	.065
	N	158	158	158	158	158	158
Air Temp	Pearson Correlation	-.228**	-.205**	-.218**	-.331**	1	.126
	Sig. (2-tailed)	.004	.010	.006	.000		.116
	N	158	158	158	158	158	158
Wind Speed	Pearson Correlation	-.213**	-.122	-.133	-.147	.126	1
	Sig. (2-tailed)	.007	.128	.095	.065	.116	
	N	158	158	158	158	158	158

**. Correlation is significant at the 0.01 level (2-tailed).

Table 2: Practical Significance of Selected Variables of Interest

VARIABLE	*EFFECT SIZE*	*COHEN'S INDEX*
PFD	.54	LARGE
AGE GROUP	.13	SMALL
USE OF ALCOHOL	.08	NEGLIGIBLY SMALL

TOP FIVE LOCATIONS OF INCIDENTS BY GIS:

TOP 5 LOCATIONS OF INCIDENTS BY GIS:

#1Boulder Beach

http://www.riverlakes.com/boulder_beach_campground.htm

#2 Callville Bay

http://callvillebay.com/

TOP 5 LOCATIONS OF INCIDENTS BY GIS:

#3 Six Mile Cove

_1497_1139916132.jpg
http://locations.splocs.com/kitesurf/loc/pictures/lake_mohave___6_mile_beach.html

http://locations.splocs.com/kitesurf/loc/pictures/lake_mohave___6_mile_beach.html
adb092Bild1.png

TOP 5 LOCATIONS OF INCIDENTS BY GIS:

#4 Government Wash

http://kitfoxgale.blogspot.com/2011/04/lake-mead-government-wash.html

http://www.superstock.com/stock-photos-images/1848-43238

#5 Las Vegas Wash

http://en.wikipedia.org/wiki/Las_Vegas_Wash 2005

Katherine's Landing accounted for 40% of fatalities attributed to natural causes

http://www.coleandfran.com/lakemohave.html

http://www.desertusa.com/colorado/lm_nra/lake_mohave/du_lkmojave.html

CONCLUSIONS

- Results of this study support public policies aimed at increasing the use of PFDs as well as reducing alcohol consumption (O'Conner & O'Conner, 2005; McCarthy & Talley, 2001).

- The results of this study indicate that human factors contributed to most of the fatalities.

- The typical victim of a water-based fatality was more likely to be an adult male within the 25-44 age category.
- Natural causes and transportation-related victims were more likely to be male visitors in the 45 and older age category.

Victim’s characteristics,

pre-existing health conditions, activities, and selected locations of fatalities

vary in discernible patterns with age.

NEXT STEPS

Based on the findings of this study, Lake Mead has the opportunity to develop specific strategies that will minimize the incidence of accidents and the severity of injuries.

This proposed solution can be accomplished by developing a risk management plan for visitors.

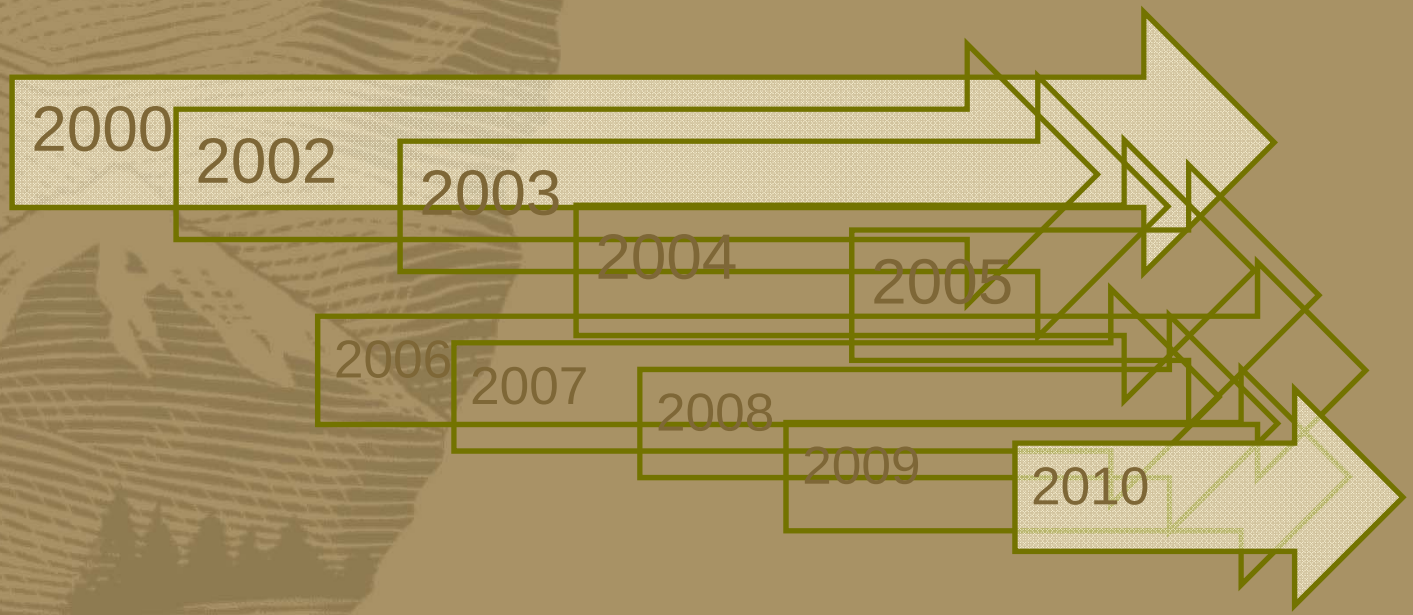
Having access to data indicating times, months, and days when most fatalities occur; may assist park personnel to develop selected schedule patterns to reduce fatalities.

Collaboration with a cadre of professionals to address:

- …prevalence of natural causes,
- …water-based incidents, &
- …motor vehicle accidents affecting high risk groups.

Collecting data for a 10-year period (2000-2010) may reveal more robust results in predicting fatalities when compared to the current

5-year data.



http://themappingnetwork.com/nopcommerce/products/143-lake-mead-map-aerial.aspx

LAKE MEAD NATIONAL RECREATION AREA:
E X P E R I E N C E Y O U R A M E R I C A

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