Introduction

• Marine casualties – allisions, collisions, groundings

• Objectives:
  – Identify most hazardous sections of U.S. inland waterway network (2010)
    • Assess quality and limitations of relevant datasets
  – Determine weather effect (river gage, wind speed, visibility) on inland casualties (2012)
Technologies

• Geographic information systems (GIS)
  – Cluster analysis and spatial joins

• Database management systems (DBMS)
  – Manage and relate historical data

• Data visualization/analytics
  – Discover trends in data, ad-hoc drill-down into details, animate events
Internet GIS

- GIS functionality through browser
- Advantages
  - Centralized
  - Easy to use
  - Report management
Internet GIS – Report Management
Data

• 1981-2012: 3 USCG reporting systems
  – MINMOD (1992 - 2001)
  – MISLE (2002 - present)

• Merged into common data structure
  – Attributes: Date, casualty type, damage, lat/long
  – Other attributes retained, but not used
    • Vessel(s) involved, vessel type, fatalities, injuries, contributing factors
Damage by Year (drill-down)
Methodology

• Entire dataset contains 51,458 ACGs (1981-2012) – Inland approx. 54%

• Compute casualties by mile marker

• One-mile square grid to detect clusters
Illinois River – MM151
Issues and Limitations

• Casualty data quality
  – Coordinate typos prevent identification of specific bridge piers and lock walls that present hazard

• Lack of detailed trip data (USACE)
  – Necessary for rate calculation
  – Aggregation performed due to confidentiality concerns
Results: Hotspots

- Validated with river industry personnel
- Allisions
  - Illinois River bridges
- Collisions
  - Lower Miss. near Southwest Pass
- Groundings
  - Memphis, St. Louis
- Overall:
  - Galveston Bay and Gulf Intracoastal Waterway West

Intersection of Gulf Intracoastal Waterway West and Houston Ship Channel
Weather Data

• Weather attributes inconsistently populated in casualty datasets

• Weather data (NOAA)
  – 29,266 stations worldwide
  – Wind speed, visibility
  – Hourly observations
River Gage Data

- USGS (175 stations)
- USACE (84 stations)
- Daily gage readings (7am)
- Flood level categories not available for all gages
  - Gage readings normally distributed
  - Used percentiles instead of flood categories

Green = USACE gages
Purple = USGS gages
Weather Results

• Wind speed data unreliable
• Restricted visibility does not appear to be a factor in inland casualties
• Groundings occur primarily between 11pm-5am
• Allisions occur primarily between 8am-4pm
• Allisions and groundings correlated with seasons
• Allisions and river gage levels correlated

<table>
<thead>
<tr>
<th></th>
<th>River Gage Distribution Function</th>
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<tbody>
<tr>
<td></td>
<td>0</td>
</tr>
<tr>
<td>Allision</td>
<td>6%</td>
</tr>
<tr>
<td>Collision</td>
<td>11%</td>
</tr>
<tr>
<td>Grounding</td>
<td>24%</td>
</tr>
</tbody>
</table>
Future Research

• Closely examine corridor and specific hotspots
• Automatic Identification System (AIS):
  – Combine with lockage data to generate precise trip data
  – Detect near-miss events
  – Correlate with “black box” data (engine rpm, rudder angle) to detect difficult maneuvering areas
Conclusions

• Combination of GIS, DBMS, data visualization tools is powerful

• GIS can make spatial linkage between seemingly unrelated datasets
  – Possible to reconstruct events using external data sources

• Internet GIS can be effective as a casualty data maintenance platform
Questions?

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