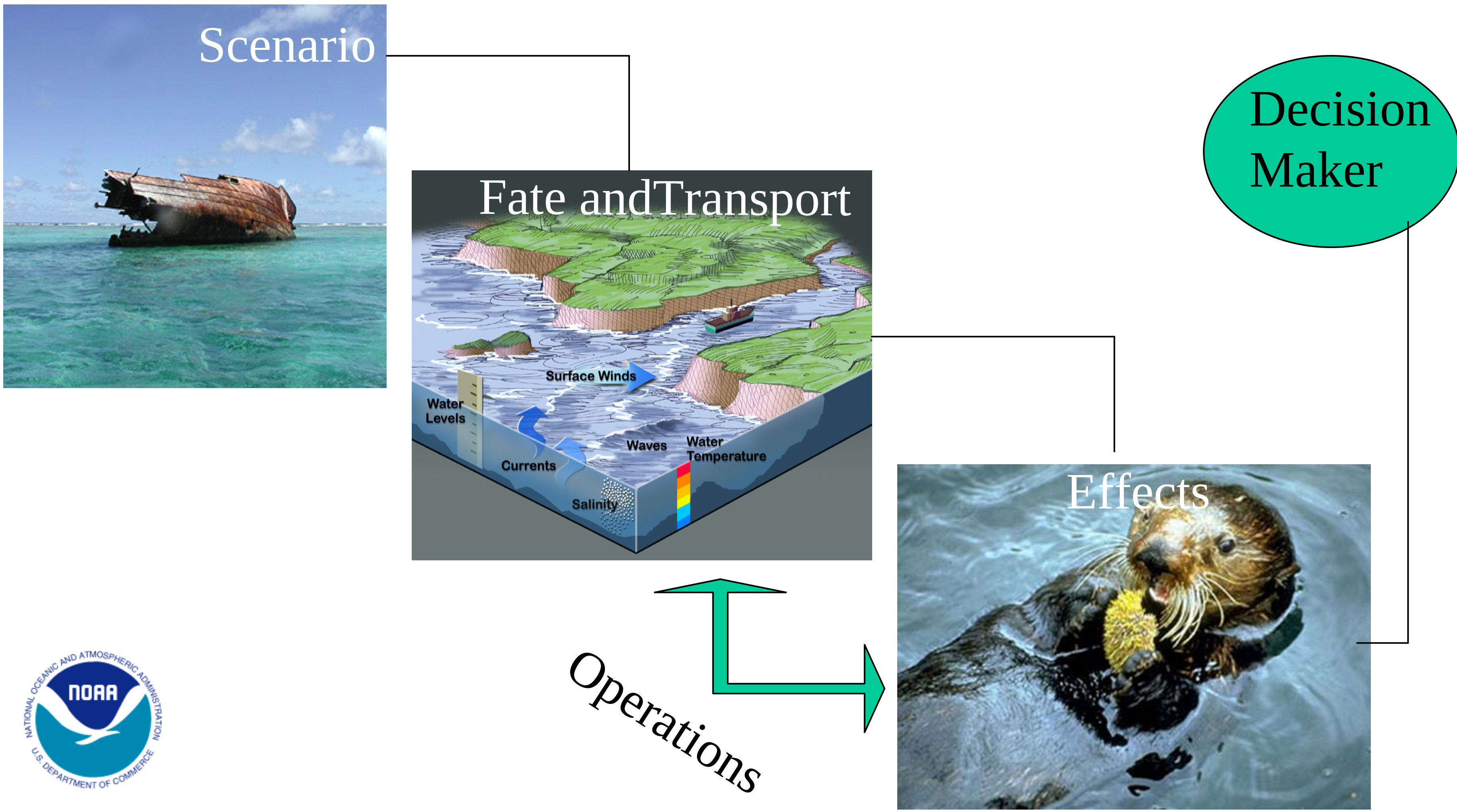
Defining the Challenge - Fate, Transport and Effects Modeling for Emergency Response



Genesis of this Workshop

- *September 2005 CRRC Workshop: Research and Development Needs for Making Decisions Regarding Dispersed Oil*
- *Conclusions:*
  - *Models that predict dispersed oil fate need to be improved, verified and validated*
  - *Need a determination of how good the answers need to be and the physical, chemical, biological, toxicological and operational uncertainties that have to be considered*
  - *Need a better understanding of levels of concern necessary and realistic for extrapolating from exposure and toxicity to operational decisions*

What we hope to get from this workshop

- *Define the scope and direction for more closely integrated modeling for emergency response*
- *Capture ideas and expertise from diverse fields*
- *Get input from various disciplines on realistic temporal/spatial scales for physical, biological, toxicological inputs and outputs*
- *Generate innovative suggestions on model related tools/outcomes that could be used in decision making*

Why We Invited You to UNH

- *Diverse backgrounds (but not too diverse!)*

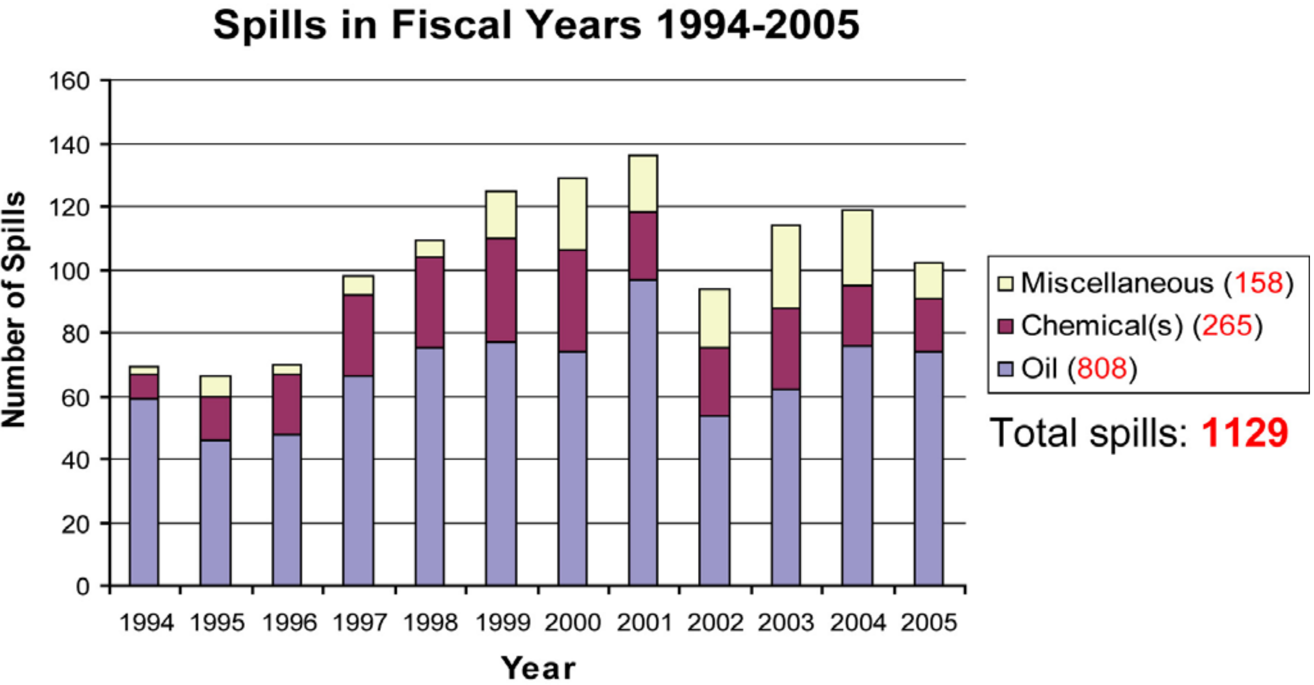
  biological oceanography, physical oceanography, systems modeling, numerical modeling, injury recovery modeling, data resources, biochemistry, toxicology, sediment toxicity, sediment transport, bioavailability, chemical fate, human effects, hydrodynamics, integrated systems, marine ecology, eco-risk assessment, damage assessment

NOAA/HAZMAT Modeling Roles/Responsibilities

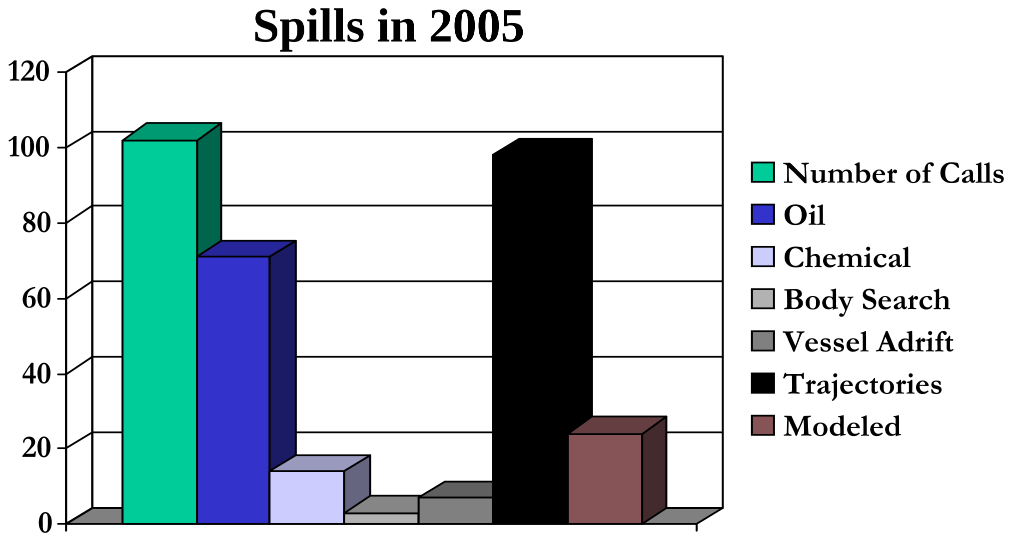
Mandates/Drivers

- *National Oil and Hazardous Substances Contingency Plan*
- *National Response Plan (ESF-10)*
- *Emergency Planning and Community Right to Know Act (SARA Title III Ammendment)*


heidi snell



Spills in Fiscal Years 1994-2005
Number of Spills
160
140
120
100
80
60
40
20
0
1994
1995
1996
1997
1998
1999
2000
2001
2002
2003
2004
2005
Year
Miscellaneous (158)
Chemical(s) (265)
Oil (808)
Total spills: 1129



Spills in 2005
120
100
80
60
40
20
0
Number of Calls
Oil
Chemical
Body Search
Vessel Adrift
Trajectories
Modeled

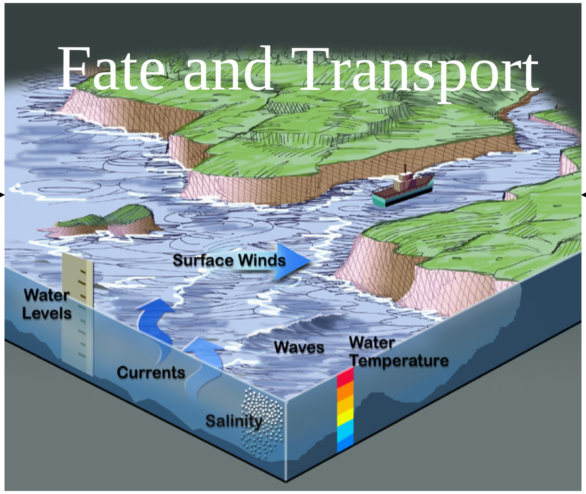
What Got Spilled?

Where Will it Go?

Who Will it Hit?

How Will it Hurt?

Now What?



Response - What makes it successful?

- *A 24/7 national network*
- *Scientific Support Coordinators (SSCs) with distributed presence*
- *On-call experts*
- *Integration with other Federal agencies and State/local responders (planning, drilling, training,responding)*

Trajectory Analysis vs. Modeling - Physical

- *Identify Length/Time Scale of Problem*
- *Describe Boundaries (shoreline/bathymetry)*
- *Currents (Observed/Forecast)*
- *Winds (Observed/Forecast)*
- *Regional Physics*
- *Chemical Behavior (partitioning, reactivity)*
- *Integrate Spill Information (source, observ.)*

M/T Igloo Moon

Location: Biscayne Bay, Florida

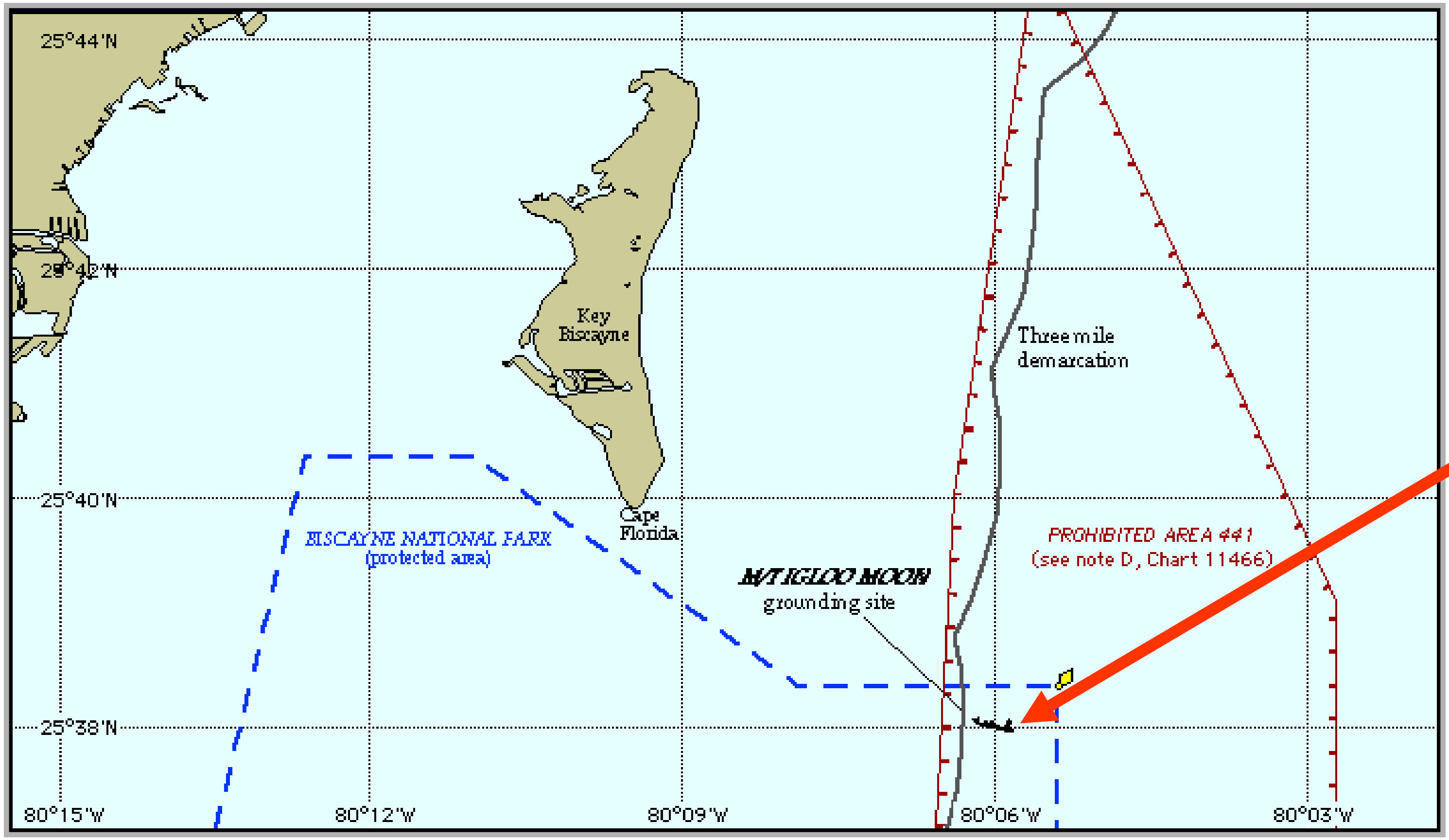
Cargo: 6,589 metric tons Butadiene
57,000 gallons IFO 380
30,00 gallons marine diesel
6,00 gallons lube oil

Scenario: Grounded, not releasing oil or product

Coordination Issues

- *Public and responder safety*
- *Chemical threats/stability/inhibitor*
- *Protection and preparedness for resources (shoreline, birds, marine mammals, reptiles, shellfish, habitat, and management/recreational use areas)*
- *Salvage - exotic species in ballast water, hydrography and water levels for extraction*

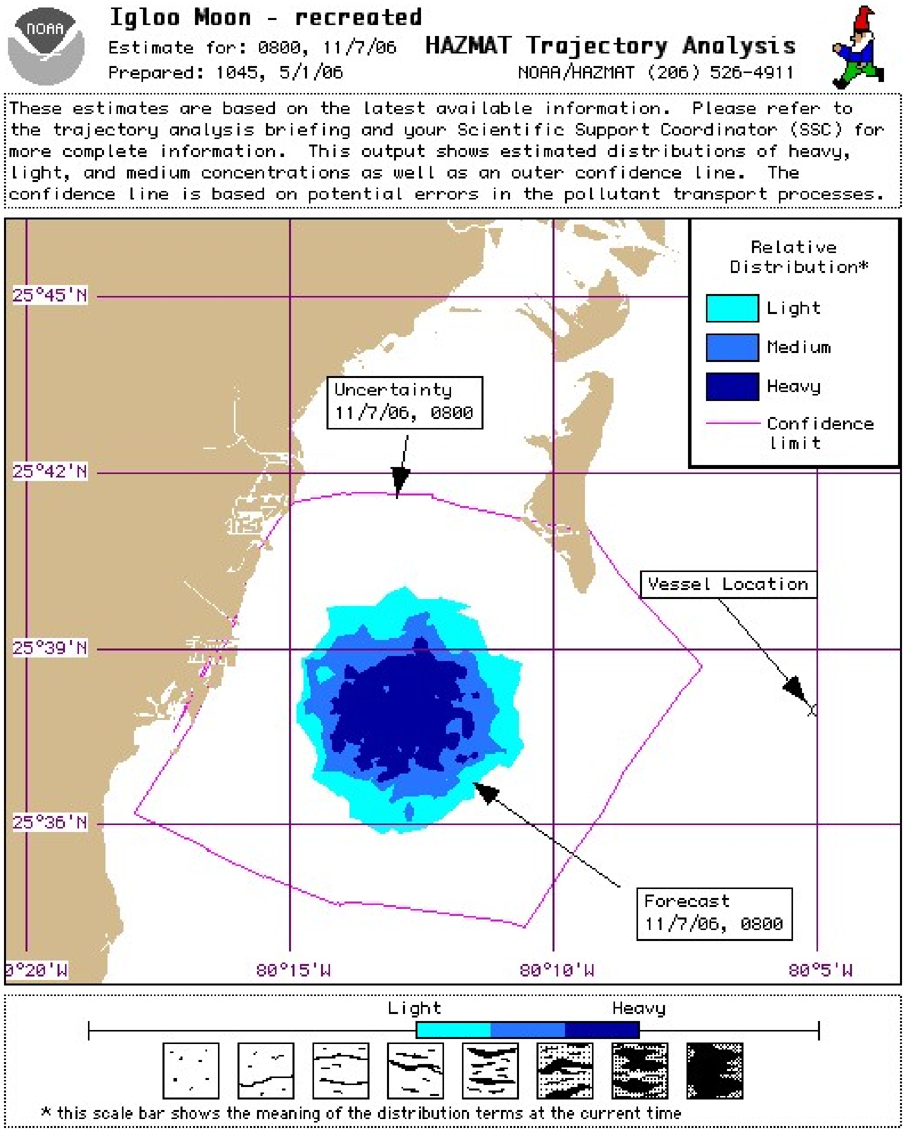
Base Map: M/T *Igloo Moon* Grounding



Igloo Moon

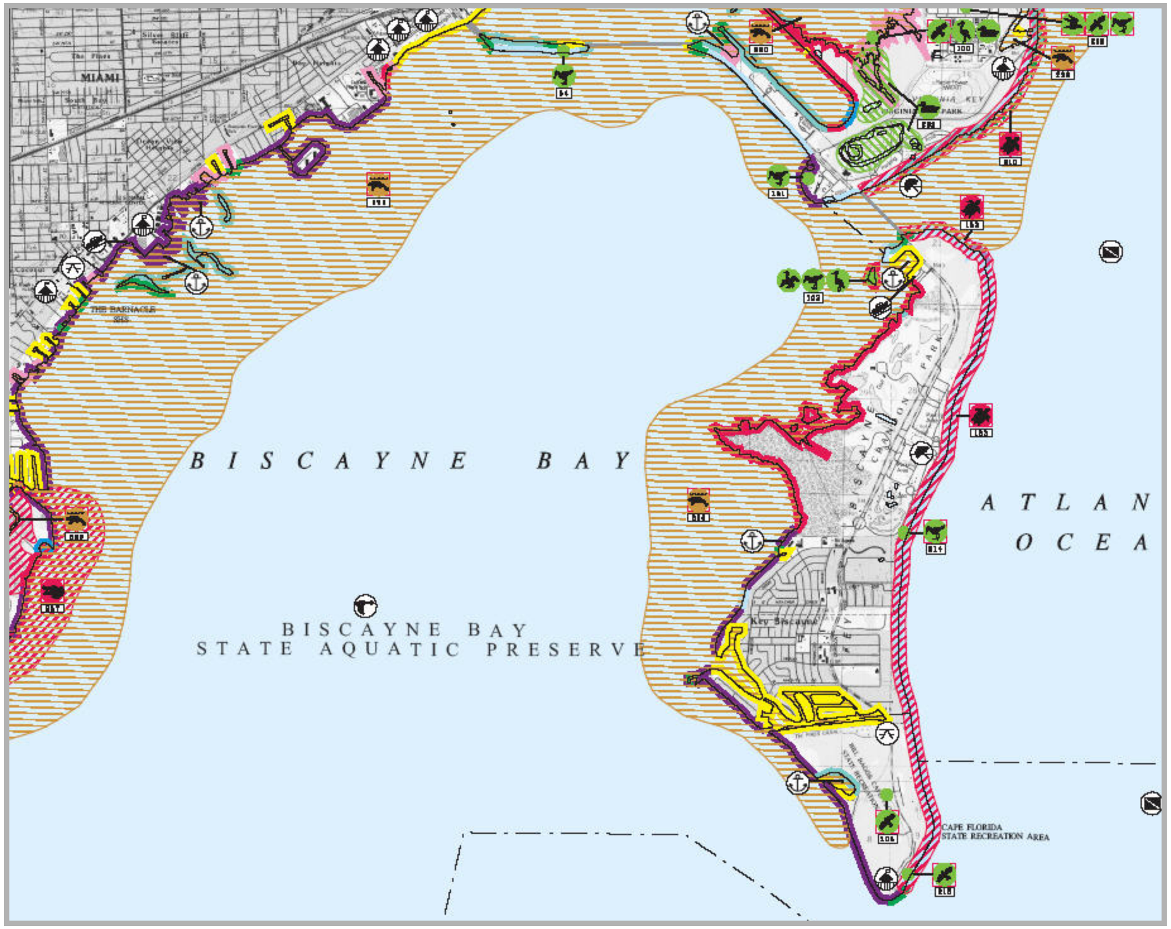
Initial Concerns

- *Is the butadiene going to explode?*
  - *Two factors are keeping the butadiene stable: refrigeration and a chemical inhibitor.*
  - *The refrigeration only works as long as the ship maintains fuel and power.*
  - *The inhibitor is scheduled to expire in a matter of days.*
- *Is the oil going to leak?*
  - *There was significant damage to the ship (and some flooding) when it ran aground.*
  - *The ship does not appear to be leaking at this time.*



Where will it go?

Environmental Sensitivity Index (ESI) maps: Assessing Resources at Risk



Who will it hit?

Resources at Risk

Wildlife: *river otters, West Indian manatee, American crocodile, green hawksbill, Kemp Ridleys and loggerhead turtles, crabs, shrimp, lobster, brown pelican, loons, cormorants, peregrine falcons, piping plovers, herons, and egrets.*

Habitat: *seagrass beds, living coral reef, and hard-bottom communities.*

Shoreline: *mangroves, exposed and sheltered seawalls, and sand beaches.*

Management Areas: *Biscayne National Park, Biscayne Bay State Aquatic Preserve, marinas, recreational boating, sport diving, and fishing.*

Incident Timeline

5:25 AM November 6: MSO Miami notified of grounding of *Igloo Moon*

November 6: OR&R notified and begins providing scientific and technical support for the incident

November 8: Most of the fuel and oil has been transferred

November 8: Chemical Inhibitor tested and recertified through December 1 (original expiration date was November 9)

November 11-19: Surveying the transfer channel, as weather allows

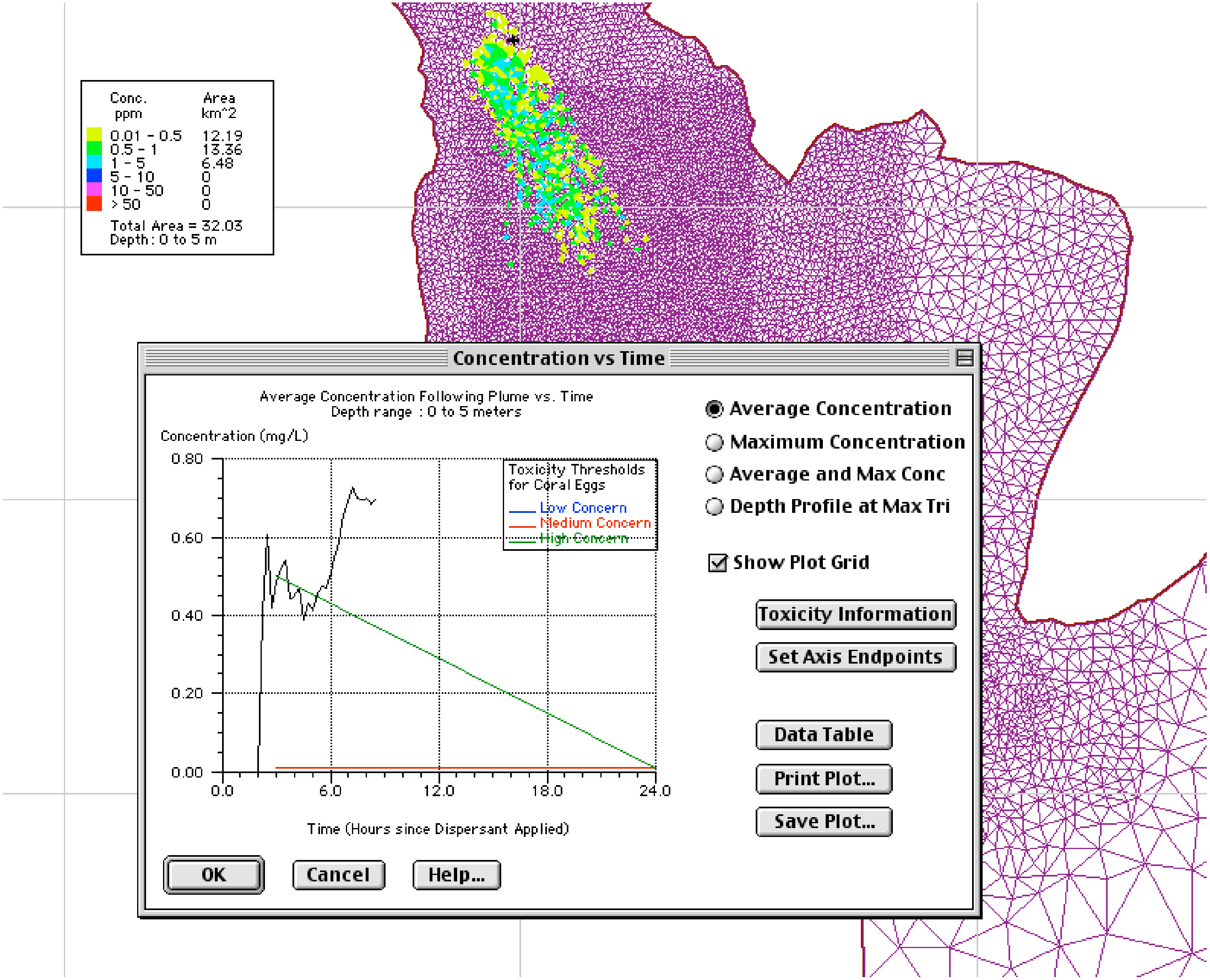
November 12: The *Selma Kosan* arrives from Puerto Rico to transfer the butadiene

November 12-19: Severe weather escalates to gale force winds, postponing the delicate transfer operation that requires calm seas

November 20: 1,000 tons of butadiene was transferred to the *Selma Kosan*

November 20-21: *Igloo Moon* discharged clean ballast water and was refloated on the flood tide

3:30 PM November 21: *Igloo Moon* departs and Unified Command stood down


Conc. ppm
Area km^2
0.01 - 0.5 12.19
0.5 - 1 13.36
1 - 5 6.48
5 - 10 0
10 - 50 0
> 50 0
Total Area = 32.03
Depth: 0 to 5 m
Concentration vs Time
Average Concentration Following Plume vs. Time
Depth range : 0 to 5 meters
Concentration (mg/L)
0.80
0.60
0.40
0.20
0.00
0.0
6.0
12.0
18.0
24.0
Time (Hours since Dispersant Applied)
Toxicity Thresholds for Coral Eggs
Low Concern
Medium Concern
High Concern
Average Concentration
Maximum Concentration
Average and Max Conc
Depth Profile at Max Tri
Show Plot Grid
Toxicity Information
Set Axis Endpoints
Data Table
Print Plot...
Save Plot...
OK
Cancel
Help...

Challenges

- *Lack of validation data*
- *Understanding/conveying uncertainty*
- *Data Assimilation (QA, modifications)*
- *Scaling (physical/biological)*
- *Maintaining Credibility*

Presentations

- Risk Assessment
- Component/Integrated Modeling
- Time/Length Scales

Exercises

- Place of Refuge
- Operational Decisions
- Inference Mapping
- Prediction/Uncertainty

Discussions

Workshop Challenges

- *What are acceptable/useful levels of prediction for biological/resource decision making?*

- *What future effects can be predicted from biological models during response time-scale for use by decision makers?*

- *What spill information is needed on response time-scale (first hours to days) for resource prediction?*

Knowing when better becomes the enemy of good enough


LUCKY BOAT