RRT Alaska Meeting

Coastal Response Research Center

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August 14, 2006
Today’s Talk

- Coastal Response Research Center history, mission and administration
- Center’s external grants program
- Overview of some Center projects
- Center outreach
- Issues Center is monitoring
- Feedback/Input/Discussion
Packet Contents

- Today’s slides
- One page description of Center
- 2006 requests for proposals
- Table of projects funded
- Contact information
- On Center website (www.crrc.unh.edu)
  - Current project descriptions
  - 2005 Center annual report
Coastal Response Research Center
History, Mission and Administration
Center Creation

• Funding for oil spill research decreasing
  • Government
  • Private sector

• Many research needs exist regarding spill response, recovery and restoration

• NOAA’s Office of Response and Restoration wanted to partner with research-oriented university to create center to address research needs
Center Creation

• ORR/UNH oil spill partnership started in 2002
• Coastal Response Research Center formed in 2004
• Co-Directors:
  • UNH - Nancy Kinner
  • NOAA - Amy Merten
Overall Center Mission

• Develop new approaches to spill response and restoration through research/synthesis of information
• Serve as a resource for ORR and NOAA
• Serve as a hub for spill research, development, and technical transfer
  • Oil spill community (e.g., RRTs)
Specific Center Missions

• Conduct and oversee **basic** and **applied** research and outreach on spill response and restoration
• Transform research **results into standards of practice**
• Encourage strategic **partnerships** to achieve mission
• Conduct **outreach** to improve preparedness and response
• Create a **learning center** for new approaches to spill response and restoration
Center Oversight

• Advisory Board
• Science Advisory Panel
Mission: Advisory Board

- Evaluate Center’s programs, activities and budget, research themes, and priorities

- Help establish partnerships with public and private sectors
Advisory Board Membership

- NOAA: Ken Barton (ORR), David Kennedy (ORCM)
- USCG: Capt. Steve Hanewich
- USEPA: Reg. 1 Administrator Robert Varney
- API: Robin Rorick
- State Agencies: Robin Jamail (Tx GLO)
- UNH: John Aber (VP Research), Jon Pennock (Marine Prog. Director)
Science Advisory Panel

- Advice/recommendations on quality and usefulness of the funded projects
- Representatives from research community and users groups:
  - Academia
  - Governmental agencies (state/federal)
  - Private sector
Science Advisory Panel Membership

- NOAA: Mark Fonseca
- Other Federal Agencies: Roger Helm (FWS), Ken Hinga (USDA)
- State Agencies: Yvonne Addassi (CA OSPR)
- Academia: Tom Leschine (UWA)
- Industry: Jim Clark (ExxonMobil)
Center Budget

- Function of annual Congressional appropriation
- >80% of money is used for research and outreach
- Most research is conducted by external entities
  - Academic institutions
  - Consultants
  - Government agencies
External Grants Program
Annual Request For Proposals

- Identification of priority research needs
  - Center-hosted research needs workshops

- Research needs meetings with NOAA staff
Annual RFP Mechanics

- Internet distribution, preproposal and proposal submittal, and reviews
- Issue RFP in May
- Projects funded starting following January
- $1.0 to 1.2M funding available annually
- Modeled after National Science Foundation process
Peer Review

- Several peer reviews per proposal
  - 4 experts do individual reviews
  - 2 panel reviews

- Reviewed for:
  - Technical approach and innovativeness 30%
  - Scientific and management relevance 30%
  - Transferability 15%
  - Budget appropriateness 10%
  - Qualifications of project investigators (PI) 10%
  - Support and capabilities 5%
2006 Annual RFP Topics

- Dispersed Oil
- Submerged Oil
- Integrating Ocean Observing Systems and Spill Response
- Uncertainty and Risk Communication
- Habitat Recovery
- Restoration Scaling Methods
Projects Funded by Center
2002 to Present
Funded Projects

- 2002 = 3 projects
- 2003 = 5 projects
- 2004 = 5 projects
- 2005 = 6 projects (Started in Feb 2006)
- 19 Total Projects
<table>
<thead>
<tr>
<th>Name</th>
<th>Affiliation</th>
<th>Title</th>
<th>Topic Area</th>
<th>$ Funded</th>
<th>Project Dates</th>
</tr>
</thead>
<tbody>
<tr>
<td>Kenneth Lee</td>
<td>Bedford Institute of Oceanography</td>
<td>Wave Tank Studies on Dispersant Effectiveness as a Function of Energy Dissipation Rate and Particle Size Distribution</td>
<td>Transport &amp; Weathering of Released Materials</td>
<td>$199,999</td>
<td>1/2006 - 1/2008</td>
</tr>
<tr>
<td>Richard Lee</td>
<td>Skidaway Institute of Oceanography</td>
<td>Fate and Effect of Emulsions Produced After Oil Spills in Estuaries</td>
<td>Injury &amp; Recovery of Natural Resources</td>
<td>$197,593</td>
<td>8/2002-12/2005 (Completed)</td>
</tr>
</tbody>
</table>
Project Topics

- Focus on ecosystem modeling and effects because of NOAA’s mission
- Injury & recovery of natural resources = 10 projects
- Transport & weathering of released materials = 6 projects
- Human dimensions of oil spills = 3 projects
- Dispersant-related = 10 projects
- Toxicity = 10 projects
Project Demographics

- Government agencies = 2
- Academic institutions = 11
- Private sector = 6
- U.S. = 17
- International = 2
- Average $ per project ~ $149,000
- Average project length = 23 months
West Coast
- Chinook salmon smolts
- Columbia River sediments
- Southern California currents
- Copepods

Alaska
- Cook Inlet sediments
- Copepods
- Selendang sediments

Northeast
- Buzzards Bay terns
- Buzzard Bay stakeholders
- Copepods

Mid-Atlantic Coast
- Virginia beaches
- Snapping turtles
- Delaware Bay sediments
- Chalk Point, MD spill stakeholders
- Copepods

Gulf Coast/ Caribbean
- Louisiana salt marshes
- Texas beaches
- Mississippi River delta sediments
- Soft corals
- Deepwater blowouts
- Grass shrimp
- Copepods
Translating R&D into Action
-- Evolving Process

• **Major Emphasis and Unique Aspect of Center**

• **Examples:**
  • Established NOAA Toxicity Working Group
  • NOAA liaisons for new projects
Translating R&D - NOAA Toxicity Working Group

- Synthesis of Center-funded research
- Identification of products useful for field
- Identification of remaining gaps
- August 2006 meeting
NOAA Liaisons

- NOAA liaison for each new project
  - Technical advisors to Co-Directors
  - Work with PIs to communicate research and develop products
  - Participate in site visits and field experiments
- Success story: Yapa et al. Deepwater well blowout model (CDOG)
  - MMS-funded research
  - Model for liaison initiative
Yapa et al. Center Research Results

- Integrated CDOG-GNOME models allow users to run complete deepwater through surface scenarios for response and planning
- User centered design is key to successfully moving research model into operational use
- User starts with NOAA Deepwater Spill Incident Data Preparation Sheet to aid responders in entering data quickly
- Integration designed with future compatibility in mind
- Both GNOME and CDOG have extensive error checking
Risk assessments of oil spill effects on wildlife require *population-level* information to have highest predictive power.

Despite this need, *rapid lifecycle* bioassays have been unavailable for sediment organisms most at risk of oil exposure.

Chandler uses copepods as model organisms.
Objectives of Chandler’s Research

• Developed lifecycle assay for water soluble fractions of crude oil
  • Benchmarked against National Institute of Standards crude oil standard
  • Using Chandler’s ASTM standard harpacticoid copepod bioassay
Discrete Lifestages of the Meiobenthic Copepod *Amphiascus tenuiremis* at 25°C in 96-well microplate culture

- **Embryos**
  - Hatch: 2 days

- **Nauplii** (6 stages)
  - 7 days

- **Copepodites** (5 stages)
  - 8 days
  - Fecundity

- **Adult Gravid**
  - Mate: 1 day
  - Male or Female

Lifecycle = 17-18 days Egg to Egg
Avg. Life Expectancy = 47 ± 2 days
Avg. Clutch = 6.2 ± 2 eggs
Life-cycle Endpoints:
- Survival & Molting Success
- Time to first Copepodite
- Time to Adult
- Sex Ratio
- Fertilization Success
- Clutch Size & Egg Quality
- Hatching Success & Production

How the bioassay works...

96-well Costar® microplate; 200 μl WSF solution per 10 wells

~ 200 gravid A. tenuiremis (from lab stock mud cultures)

12-well plate Yields ~ 500 nauplii in < 24 h

X-MATINGS
Oil-SPM Aggregates (OSA)

Ali Khelifa & Merv Fingas
Environmental Technology Centre
Environment Canada
Ottawa, Ontario, Canada

Oil Droplet
Suspended Particulate Matter (SPM)
Oil-SPM Aggregate (OSA)
Example Observed OSA: Heidrun + Chalk

UV light (fluorescence)

Transmitted light

(Khelifa et al., 2005)
Issue: What Are Effects of Chemical Dispersants (CD) on OSA Formation?
Effects of CD on OSA formation

• Very little has been done and reported results are conflicting

1. Mackay & Hussain (1980) found from their laboratory experiments that presence of suspended clay particles accelerates sedimentation of C-D oil.
2. Chemically-dispersed oil associate less with mineral matter than naturally dispersed oil (Mackay & Hussain, 1982).
3. Guyomarch et al. (1999, 2002) measured high amount of C-D oil trapped in OSA.
4. OSA formation with C-D oil was related to the efficiency of treating CD (Guyomarch et al. (1999)
5. Guyomarch et al. (2002) concluded that formation and transport of OSA must be studied further to determine whether it is beneficial to apply oil dispersant in coastal regions loaded with SPM.
6. Sterling et al. (2004) obtained OSA formation when Medium Arabian Crude oil (artificially weathered)/Corexit 9500 was mixed with bentonite.
Objectives of Khelifa’s Research

- Quantify effects of dispersants on OSA formation under:
  - Various mixing conditions
  - Several sediment types and concentrations
Experimental Procedure

• Conditions

**Sediments**
Natural from four U.S. coastal waters
\( C_s = 25, 50, 100, 200, 300 \text{ mg/L} \)

**Oils**
Three most shipped crudes in the U.S. waters

**Chemical Dispersants**
Corexit 9500 and Corexit 9527
DOR= 0, 1:10, 1:20, 1:40

**Mixing**
Controlled temperature =15\(^{\circ}\)C
Constant mixing energy
Acute/Chronic Effects of Crude and Dispersed Oil on Chinook Salmon Smolts
Tjeerdema et al.- UC Davis

- Joint funding with CAOSPR and CA Oiled Wildlife Care Network
- Compare relative toxicity using 96 hr flow-through, declining exposure experiments
  - WAFs and CEWAFs of Prudhoe Bay crude
  - Corexit 9500
- Measure lethal and non-lethal endpoints (amino acids, energy molecules)
- LC$_{50}$ WAF = 0.88 mg/l
- LC$_{50}$ CEWAF = 152 mg/L
- Smolts exposed to WAF and CEWAF devoted resources to cell repair at expense of energy generation
  - Long term growth implications
Field Verification of Oil Spill Fate and Transport Modeling and Linking CODAR Data with SIMAP Predictions

Payne et al.

- Jointly funded with CAOSPR (2 releases each)
- Release of fluorescein dye to simulate dispersed oil and test tracking with High Frequency (HF) Radar and subsurface drogues
- Using vessels and airplanes off San Diego
- Measure small scale vertical and horizontal diffusivities and develop algorithms to improve/validate models including uncertainties
Communication

• Establishing Performance Metrics for Oil Spill Response, Recovery and Restoration
  • S. Tuler, SERI, 2 years
  • Including public in review and examination of metrics used in describing progress of spill response and restoration
    • e.g., Using actual spills as case studies
    • Chalk Pt, MD pipeline leak
    • Bouchard Barge 120 leak in Buzzards Bay, MA
Valuing Restoration

- Combined two “Valuing Restoration” projects at suggestion of peer and panel reviewers
- Monetary Values and Restoration Equivalents for Lost Recreational Services on the Gulf of Texas Due to Oil Spills and Other Environmental Disruptions. G. Parsons (U. Delaware) (Random Utility Model)
- Convergent Validity Test of the Parameter Updating Method. C. Poulos (Research Triangle Institute) (Benefit Transfer Model)
D. Information Transfer and Outreach
Outreach

- Center Website (www.crrc.unh.edu)
- Information on research projects
  - Proposals
  - Progress reports
  - Final reports
  - Presentations
  - Articles
- Upcoming events/workshops/meetings of interest on spill response, recovery and restoration and related topics
- Center contact information
Dispersants Initiative

• NRC report on dispersants efficacy and effects discussed need for integrated research plan
  • Need for collection and dissemination of peer-reviewed information
    • Scientifically-robust and environmentally-meaningful context
  • Center’s mandate from NOAA to address national issues related to spills
    • Act as a hub for oil spill research
Dispersants Initiative

- Center and NOAA convened meeting of NRC, USEPA, MMS, USCG, TXGLO, OSRI, LA OSRD, CAOSPR, API and Industry reps
  - July 2005

- General willingness by all parties to participate in formulation of integrated research plan (Dispersants Working Group)

- Workshop on R&D needs for making decisions regarding dispersing oil
Dispersants Workshop

- UNH on Sept 20-21, 2005 followed by Working Group planning meeting on Sept 22
- ~35 invitees from regulatory agencies, academia, private sector
- Outcome of workshop = list of RFP topics and brief descriptions
- Working Group will use these as basis for their upcoming RFPs
Dispersants Workshop

• Discussion topics:
  • Dispersants effectiveness: Parameters that affect overall effectiveness
    • Chemical
    • Operational and hydrodynamic
    • Modeling integration
  • Effects of dispersants
    • Fate of oil and dispersed oil in the water column and other habitats
    • Realistic exposure regimes
    • Toxicity testing
Dispersants Website

- Workshop summary report available on Center’s website
- Dispersants link on Center’s website
  - www.crrc.unh.edu/dwg/
  - Description of Dispersants Working Group (DWG)
  - One pagers on each DWG member including research, funding opportunities
  - Links to on-going RFPs of members
  - Workshop report
Dispersants Working Group Members

- CRRC
- API
- BP
- CA OSPR
- CI RCAC
- Exxon Mobil
- MMS
- NOAA
- OSRI
- LA OSRADP
- PWS RCAC
- TxGLO
- USCG
- US EPA
Human Dimensions of Spills

- High priority for NOAA and Center
- **Selendang Ayu** - Unalaska, AK -- Subsistence and cultural issues major driver in response, seafood contamination, risk communication, and damage assessment
- Hurricane Katrina experience
- Examples of where regional expertise is critical
Human Dimensions of Spills Research Needs Workshop

• Communication, valuing natural resources, social impacts, subsistence, environmental ethics, institutional analysis
• Date: June 13-15, 2006 at UNH
• 33 invitees representing response community, regulators, researchers, responsible parties, local stakeholder groups
Human Dimensions Workshop

- Identified several key areas in need of research
- Emphasis on including stakeholder input during planning and restoration
- Methods of valuing resources and informing stakeholders during immediate response
- Report will be available on website in late Fall 2006
- Center will initiate Human Dimensions Working Group
NOAA Fall Institute

- NOAA-identified “Hot Topic”
- Sept. ‘06: Innovative Coastal Modeling for Decision Support: Integrating Physical, Biological, and Toxicological Models
- 50% NOAA (NOS, Fisheries, and OAR) participation
- 50% distinguished researchers with broad applicability
Goals of ‘06 Fall Institute

• Discuss alternative approaches to developing integrated models
• Identify directions for future R&D
• Provide opportunity for NOAA to learn from other disciplines
• Develop response outcome predictions that reflect uncertainties of situation and are useful to decision makers
Future Outreach Initiatives

- Submerged/Heavy Oil Research Needs Workshop
  - Winter 2006/2007
- Coastal/Ocean Observing Systems and Oil Spill Response/Recovery Integration Workshop
  - Spring 2007
Submerged Oil Issues

- Increasing trend in commerce of heavy oils to the U.S.
- Little capabilities for detecting, recovering, or mitigating submerged oil
- Limited capabilities to predict fate and transport of submerged oil
- Center developing initiative with UNH Joint Hydrographic Center
Coastal Response Research Center

www.crrc.unh.edu