

AREA Committee Meeting Delaware Bay

Coastal Response Research Center

Nancy E. Kinner
April 19, 2006



Today's Talk

- Coastal Response Research Center history, mission and administration
- Center 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
- 2005 requests for proposals
- Table of projects funded
- Current project descriptions
- 2005 Center annual report
- Contact information



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



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, AREA Committees)



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



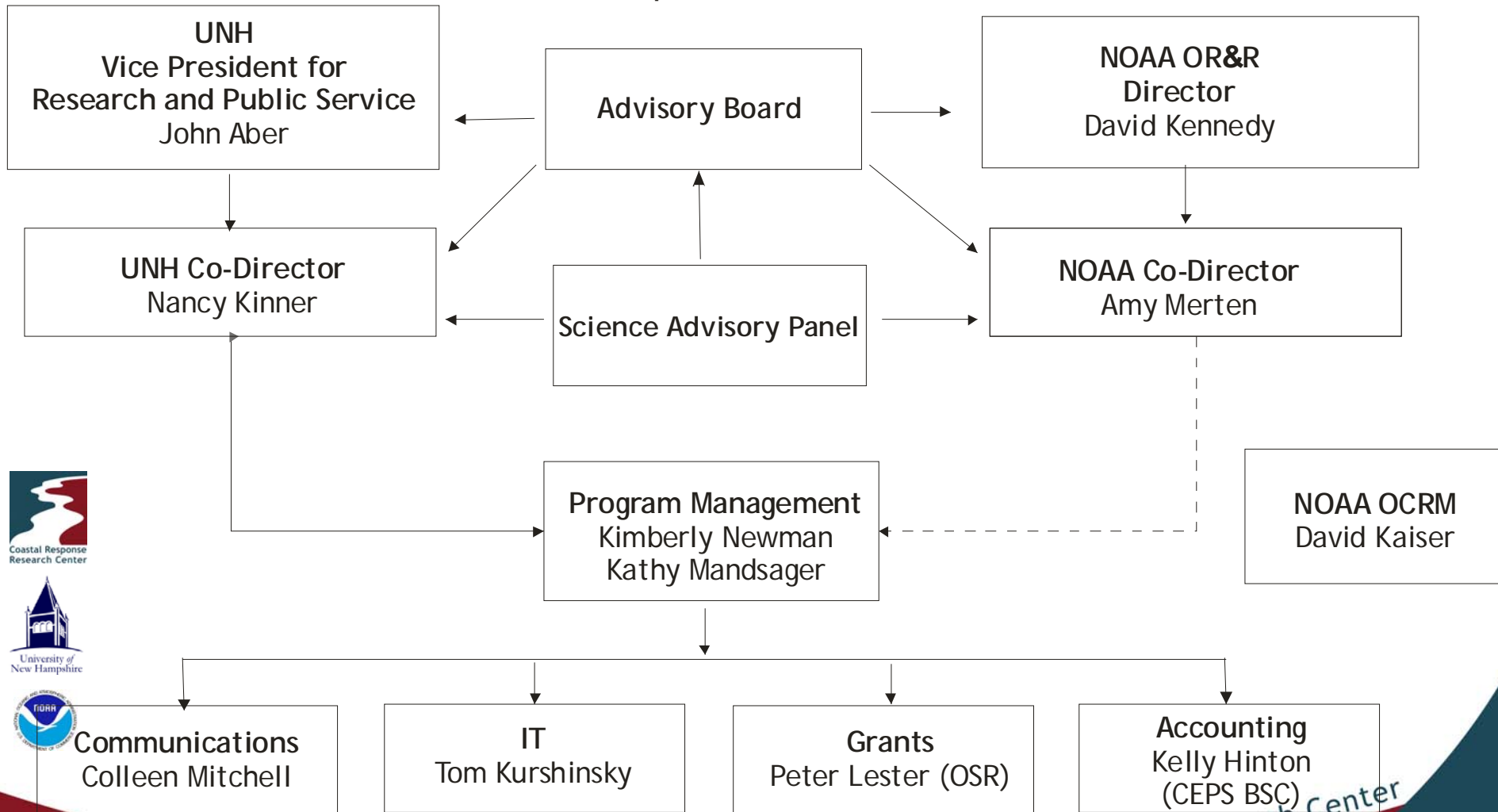
Science Advisory Panel

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



Coastal Response Research Center Organizational Chart

(April 2006)



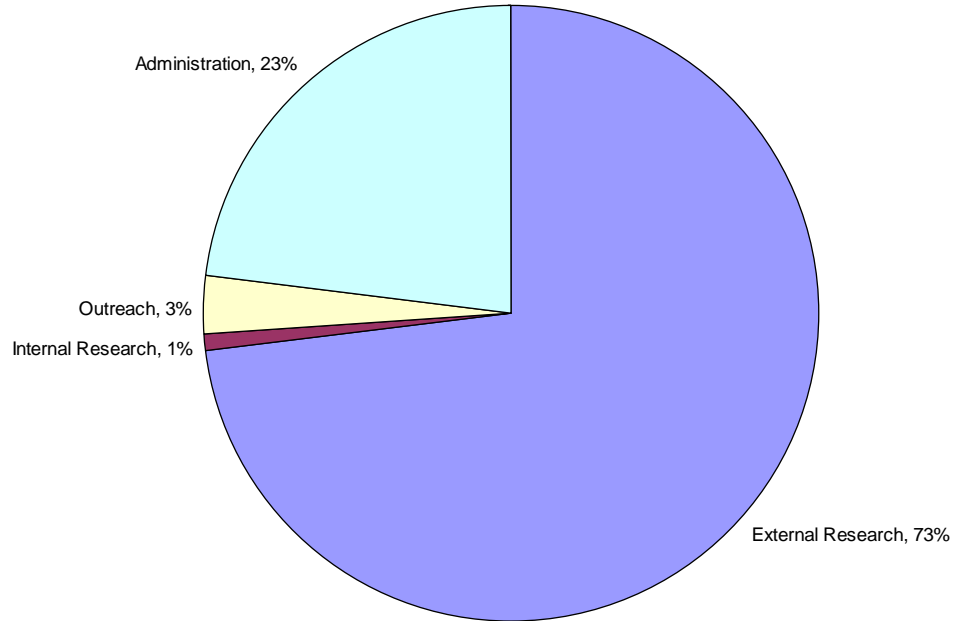
Center Budget

- Function of annual Congressional appropriation
- \$2-3M in FY 2004, 2005 and 2006



Center Budget

Center Budget Distribution through 2005



External Grants Program



Annual Request for Proposals



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 on or about May 15
- Projects funded start following January
- \$1.0 to 1.2M funding available annually

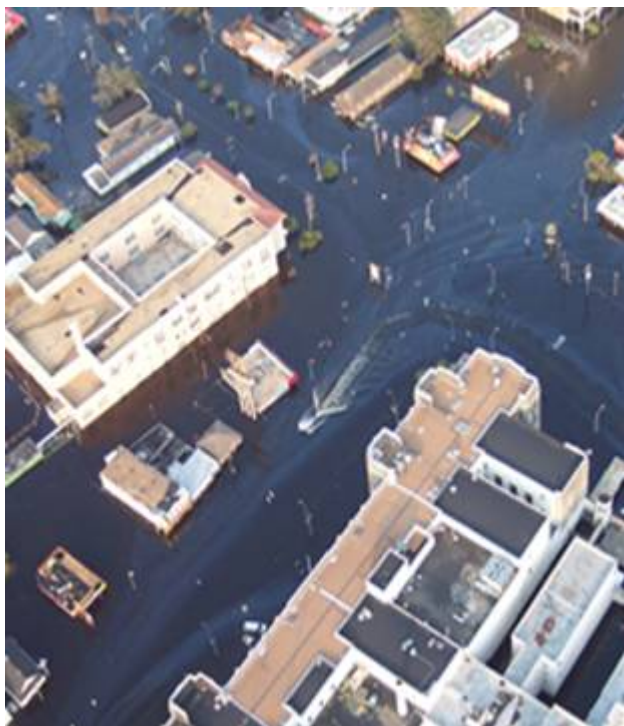


Peer Review

- 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%



Katrina and Rita



- OR&R deployed NOAA scientists and other specialists to assist in evaluating fuel spills and resulting environmental damage from stranded vessels in coastal areas.
- OR&R used aerial surveys along with satellite images to make customized maps for use by the USCG to perform
 - Search and rescue,
 - Assessment of damage to industry and property, and
 - Pollution response efforts



Hurricane Post-Response Lessons-Learned

- Improved integration of NOAA assets and data sets needed
- Remote sensing and processing capabilities needed
- Identification of future spill threats/detection
- Integration of modeling into coastal observing systems
- Human dimensions issues
- Assessing habitat recovery at ecosystem level
- May 2006 RFP will cover these topics



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



Projects Summary

Name	Affiliation	Title	Topic Area	\$ Funded	Project Dates
Don Aurand	Ecosystem Management & Associates, Inc	The Relationship Between Acute and Population Level Effects of Exposure to Dispersed Oil and the Influence of Exposure Conditions Using Multiple Life History Stages of an Estuarine Copepod	Injury & Recovery of Natural Resources	\$232,062	1/2006 - 8/2007
Thomas Chandler	University of SC	Utility of Meiobenthos for Risk Assessment of Low-Level Crude Oil WAFs: Rapid Copepod-based Approaches for Evaluating Reproductive and Population-Level Toxicity	Injury & Recovery of Natural Resources	\$119,864	1/2004-10/2005 (Completed)
Ali Khelifa	Environment Canada	Effects of Dispersants on Oil-SPM Aggregation and Fate in US Coastal Waters	Transport & Weathering of Released Materials	\$126,378	1/2006 - 3/2007
Kenneth Lee	Bedford Institute of Oceanography	Wave Tank Studies on Dispersant Effectiveness as a Function of Energy Dissipation Rate and Particle Size Distribution	Transport & Weathering of Released Materials	\$199,999	1/2006 - 1/2008
Richard Lee	Skidaway Institute of Oceanography	Fate and Effect of Emulsions Produced After Oil Spills in Estuaries	Injury & Recovery of Natural Resources	\$197,593	8/2002-12/2005 (Completed)
Qianxin Lin	Louisiana State University, Wetland Biogeochemistry Institute	Dispersants as an Oil Spill Countermeasure for Remediation and Restoration in Sensitive Coastal Habitats	Injury & Recovery of Natural Resources	\$188,472	1/2004-9/2006

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 = \$149,199
- Average project length = 23 months





West Coast

- Chinook salmon smolts
- Columbia River sediments
- Southern California currents
- Copepods

Northeast

- Buzzards Bay terns
- Buzzard Bay stakeholders
- Copepods

Mid-Atlantic Coast

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

Alaska

- Cook Inlet sediments
- Copepods
- Selendang sediments

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

- Established NOAA Toxicity Working Group
- NOAA liaisons for new projects



Translating R&D - NOAA Toxicity Working Group

- Synthesis of Center-funded research
 - 3 approaches to modeling PAH toxicity
 - Toxicity studies on different trophic levels
 - Sophisticated chemical analyses
- Identification of products useful for field
- Identification of remaining gaps



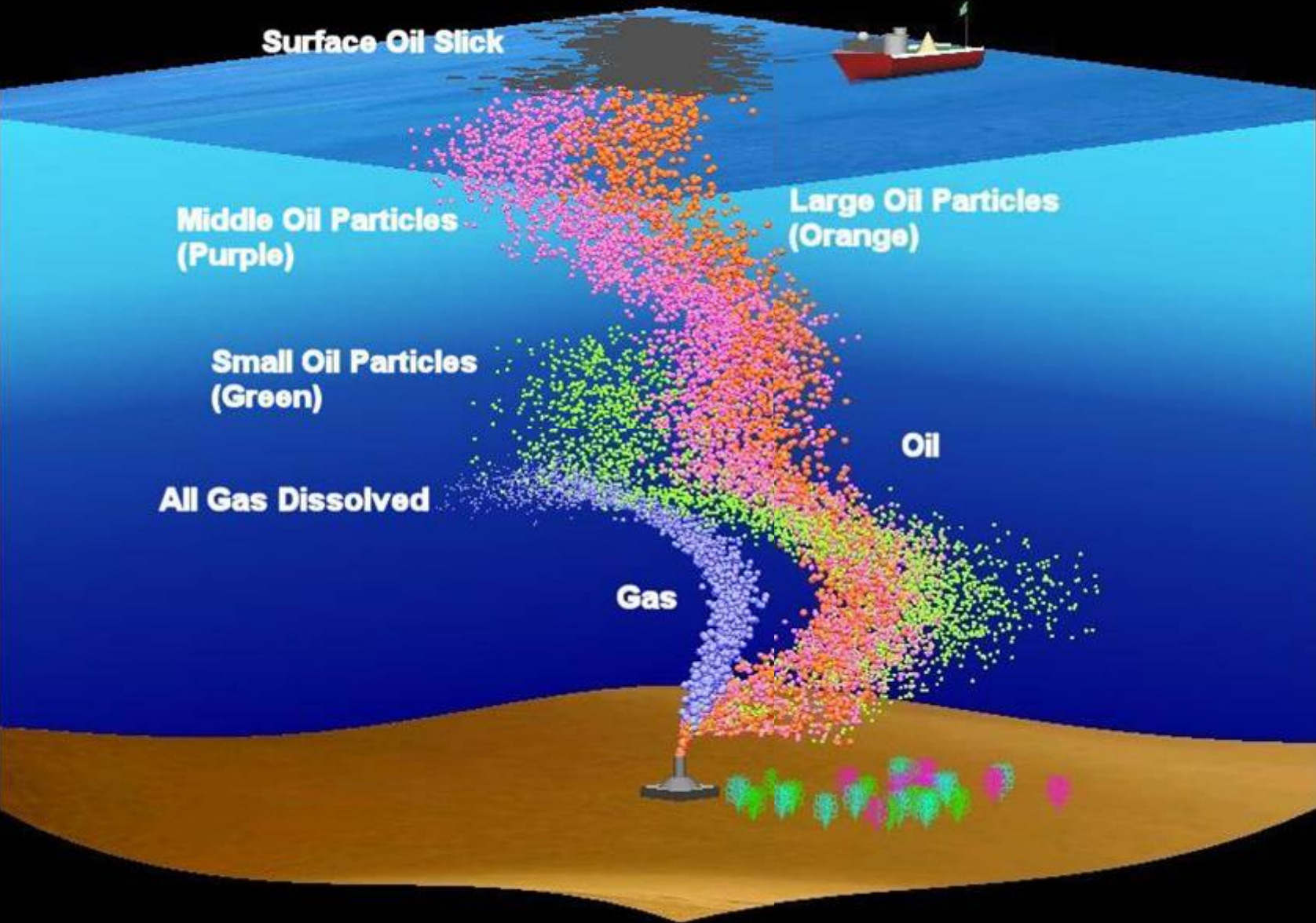
NOAA Liaisons

- 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
 - MMS-funded research
 - Center funded development of integrating MMS 3-D model with existing NOAA surface trajectory model (GNOME)
 - Model for liaison initiative



CDOG Results Yapa and Xie

2.9 hr



Surface Oil Slick

Middle Oil Particles
(Purple)

Small Oil Particles
(Green)

All Gas Dissolved

Gas

Large Oil Particles
(Orange)

Oil

Salinity

2.40
3.90

- gas
- 0.002000
- 0.009000
- 0.050000

V	⊕
H	⊖
D	⊥
T	⚓
N	⬇

Yapa et al. Research Results

- Integrated CDOG-GNOME model system 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



Example of Center-Funded Toxicology Research Chandler et al. (U South Carolina)

- 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

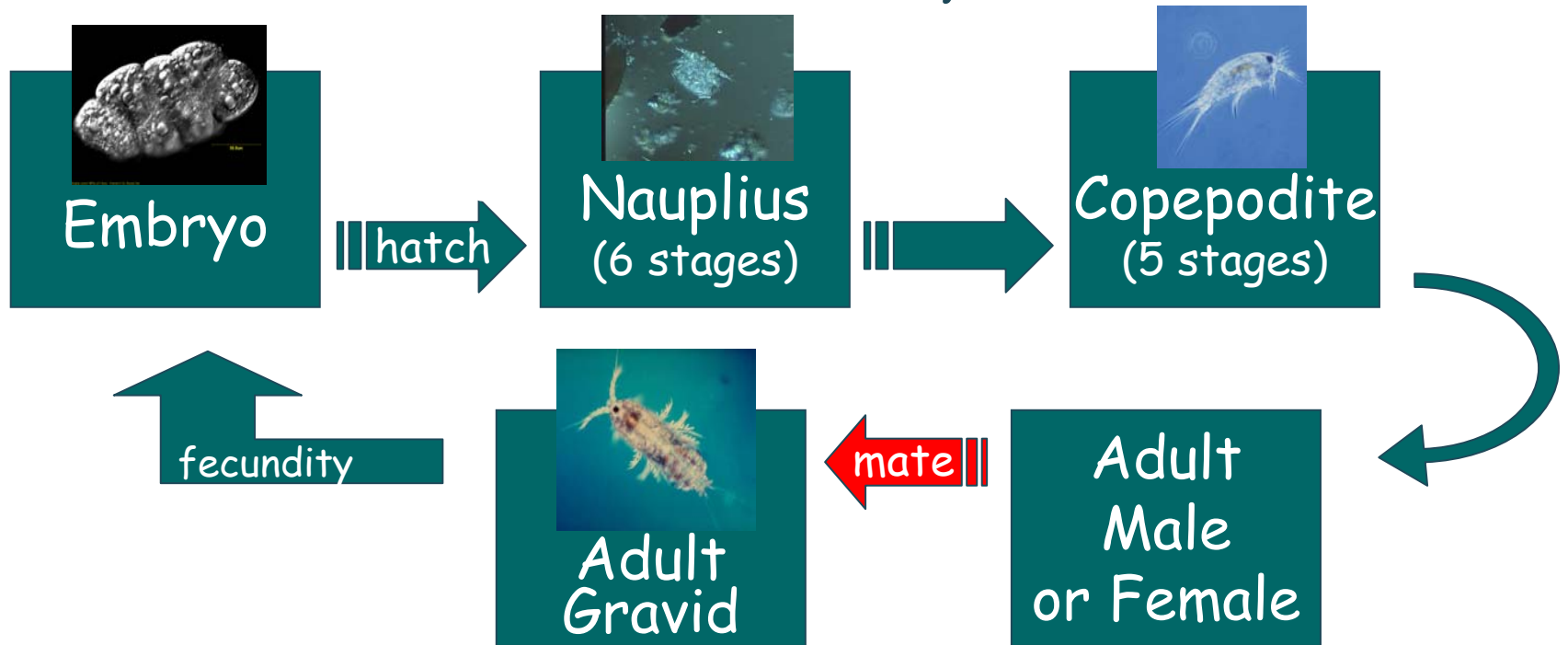


Objectives of Chandler's Research

- **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 25C in 96-well microplate culture



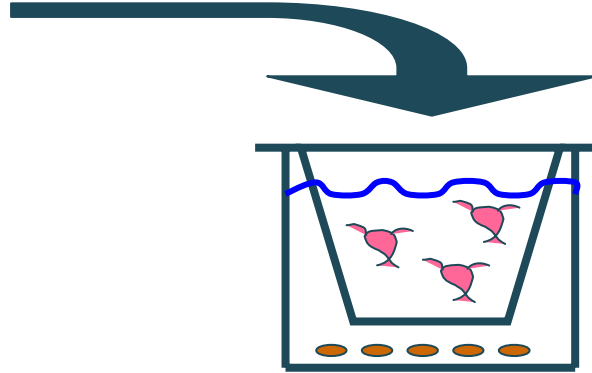
Lifecycle = 17-18 days Egg to Egg
Avg. Life Expectancy = 47 ± 2 days
Avg. Clutch = 6.2 ± 2 eggs
8-9 Clutches/Life



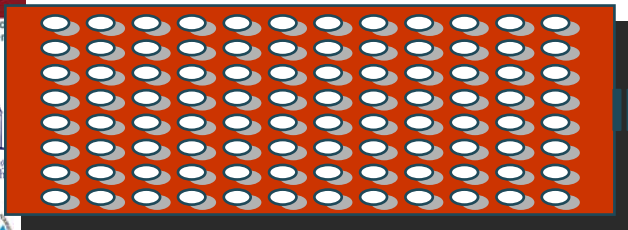
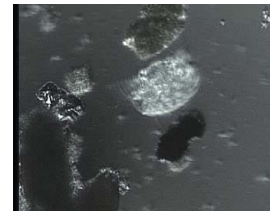
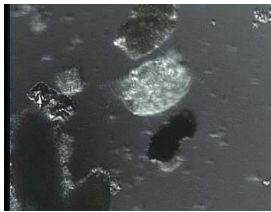
How the bioassay works..



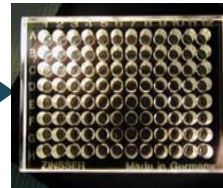
~ 200 gravid *A. tenuiremis*
(from lab stock mud cultures)



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



X-MATINGS

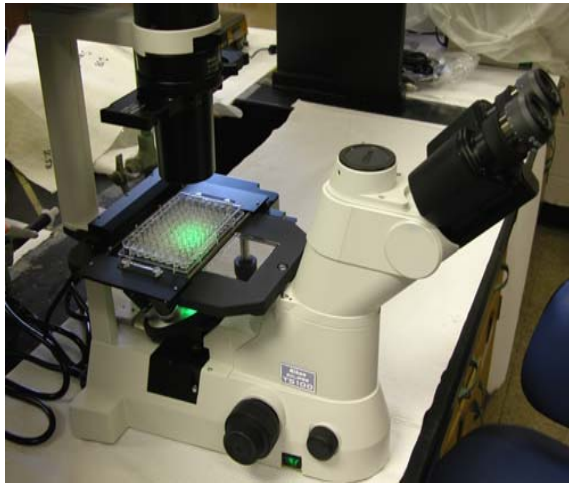


96-well Costar® microplate; 200 µl WSF
solution per 10 wells

Life-cycle Endpoints:

- Survival & Molting Success
- Time to first Copepodite
- Time to Adult
- Sex Ratio
- Fertilization Success
- Clutch Size & Egg Quality
- Hatching Success & Production



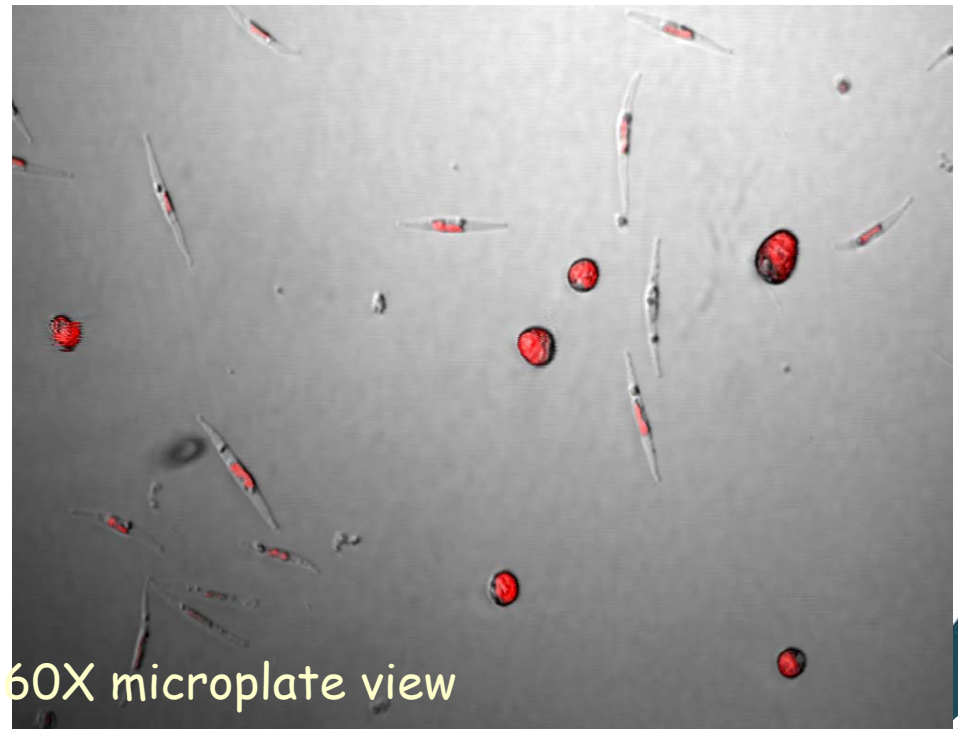


Algal food - 20Xmag



20Xmicroplate view

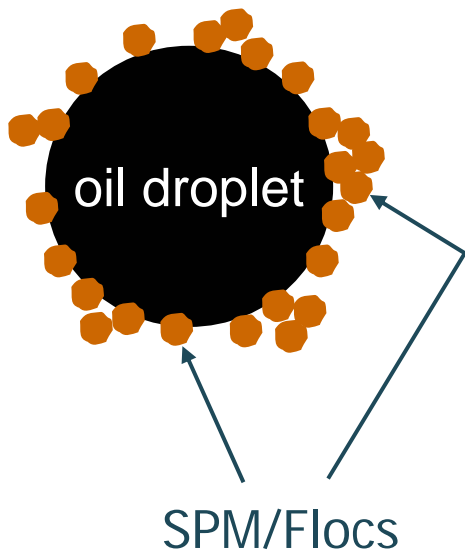
Fecal pellets



60X microplate view

Oil-SPM Aggregates (OSA)

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



Solid-Stabilized Droplet

Clay-Oil Flocculation

Sediment-Stabilized Droplet

Mineral-Stabilized Droplet

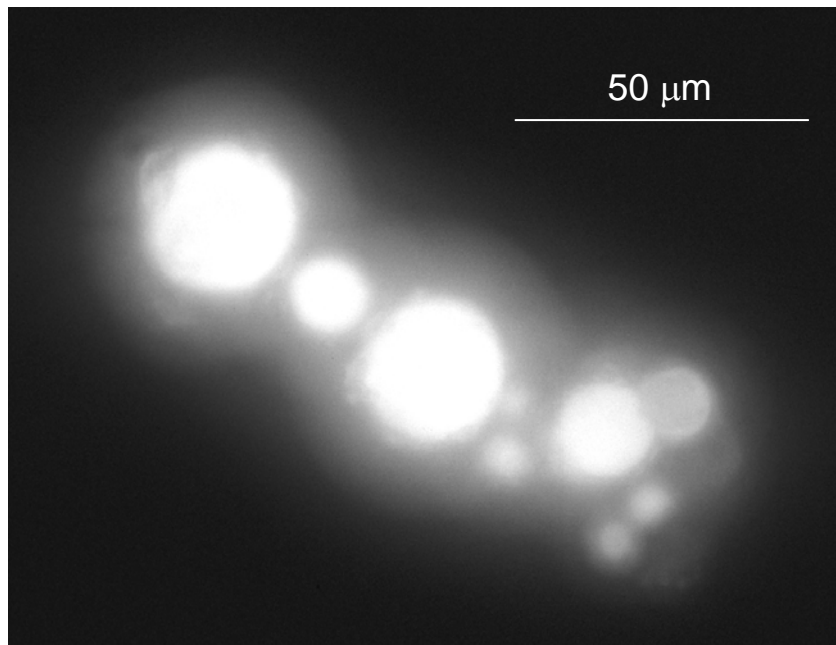
Oil-Mineral Aggregate

Oil-Fine Interaction

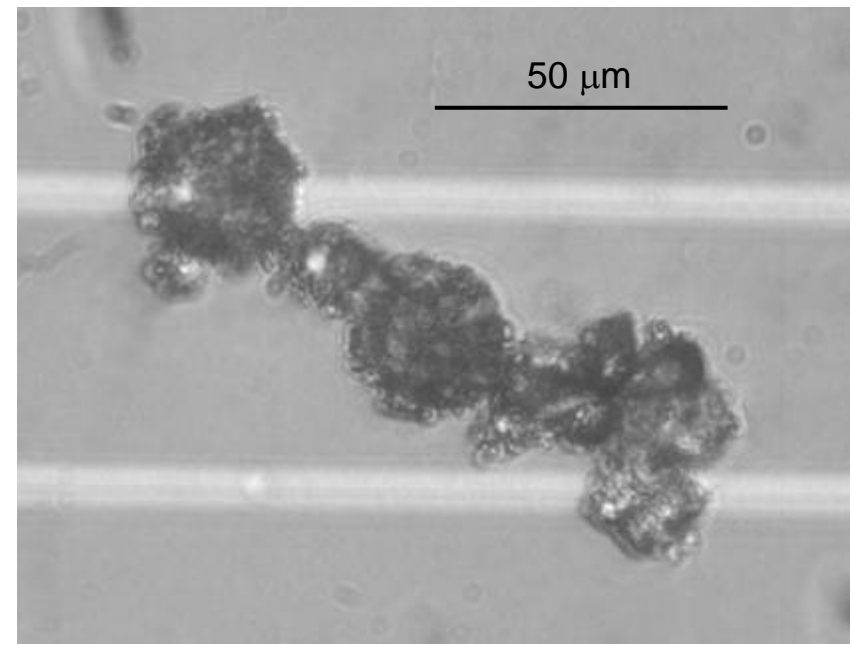
Oil-SPM Interaction



Example Observed OSA: Heidrun + Chalk



UV light (fluorescence)

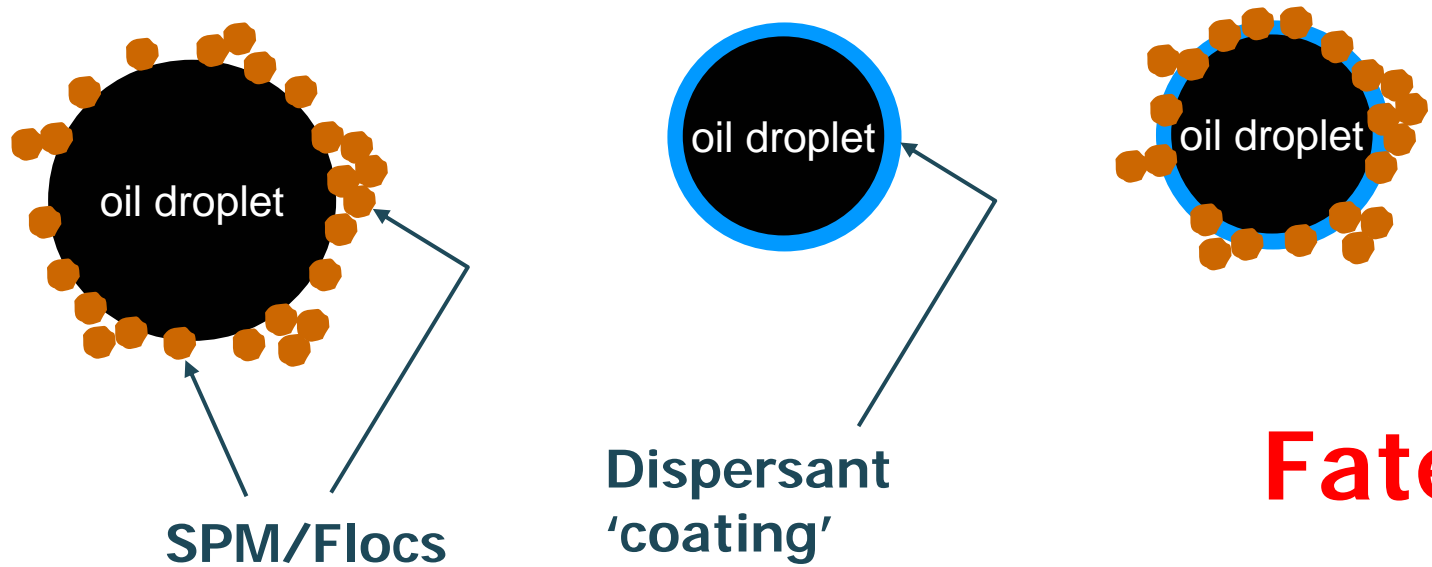


Transmitted light

(Khelifa et al., 2005)



Issue: What Are Effects of Chemical Dispersants on OSA Formation?



Fate?



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 the effects of dispersants on OSA formation under various mixing conditions with several sediment types and concentrations



Experimental Procedure

- Conditions

Sediments

Natural from 4 US coastal waters

$C_s = 50, 100, 200, 300$ mg/l

Oils

3 most shipped crude's in the US waters

Chemical Dispersants

Corexit 9500 and Corexit 9527

DOR= 0, 1:10, 1:20, 1:40

Mixing

Controlled temperature of 15 °C

Constant mixing energy



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, CA OSPR, 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
- Jacqui Michel = facilitator
- 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 reports



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
- Example of where regional expertise is critical



Human Dimensions of Spills Research Needs Workshop

- Communication, valuing natural resources, social impacts, subsistence, environmental ethics, institutional analysis
- Identified as research needs in 2003 and 2004 workshops
- Center has had RFPs/projects on communication/performance metrics and valuing restoration
- Date: June 13-15, 2006 at UNH
- 35 invitees representing response community, regulators, researchers, responsible parties, local stakeholder groups



2006 Outreach

Human Dimensions Workshop

- Organizing committee to work with Co-Directors
 - 3 members from NOAA
 - Mary Beth Bauer (NCCOS), Ed Levine (HAZMAT), Steve Thur (DAC)
 - Yvonne Addassi: CAOSPR, Science Advisory Panel, Dispersants Working Group
 - Two others from list of researchers suggested by NSF and NRC
 - Duane Gill (Miss. State) and Carol Silva (TAMU)



NOAA Fall Institute

- NOAA-identified “Hot Topic”
- Fall '06: Innovative Coastal Modeling: Integrating Physical and Ecotoxicological 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 the uncertainties of the situation yet are useful to decision makers



Future Outreach Initiatives

- Participation in Experimental Oil Spill in Pack Ice
 - Planned for International Polar Year (2007/2008)
 - Possible sites: Canada, Norway



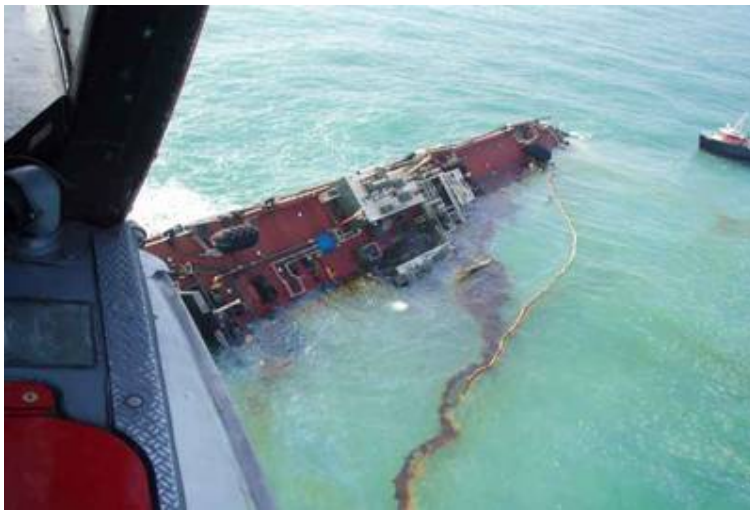
Future Outreach Initiatives

- Submerged/Heavy Oil Research Needs Workshop
 - Fall 2006
- 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

