

# RRT Alaska Meeting

## Coastal Response Research Center

Nancy E. Kinner  
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](http://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



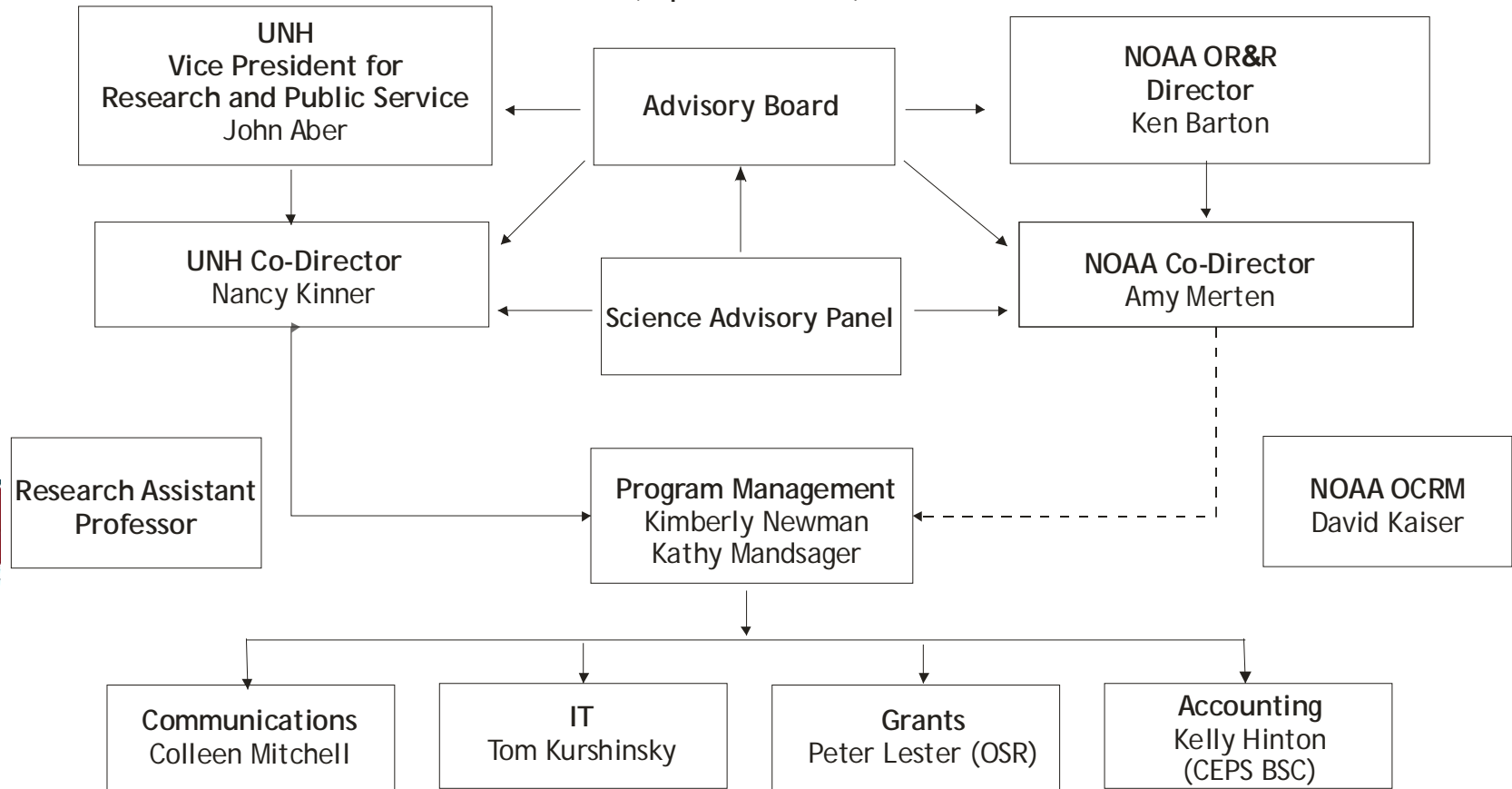
# Science Advisory Panel Membership

- 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)



# Coastal Response Research Center Organizational Chart

(September 2006)



# Center Budget

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



# 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	Injury & Recovery of Natural Resources	\$119,864	1/2004-10/2005 (Completed)
<h2>Table in Your Packets</h2>					
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 ~ \$149,000
- 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

### **Gulf Coast/ Caribbean**

- Louisiana salt marshes
- Texas beaches
- Mississippi River delta sediments
- Soft corals
- Deepwater blowouts
- Grass shrimp
- Copepods

### **Alaska**

- Cook Inlet sediments
- Copepods
- Selendang sediments



# 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



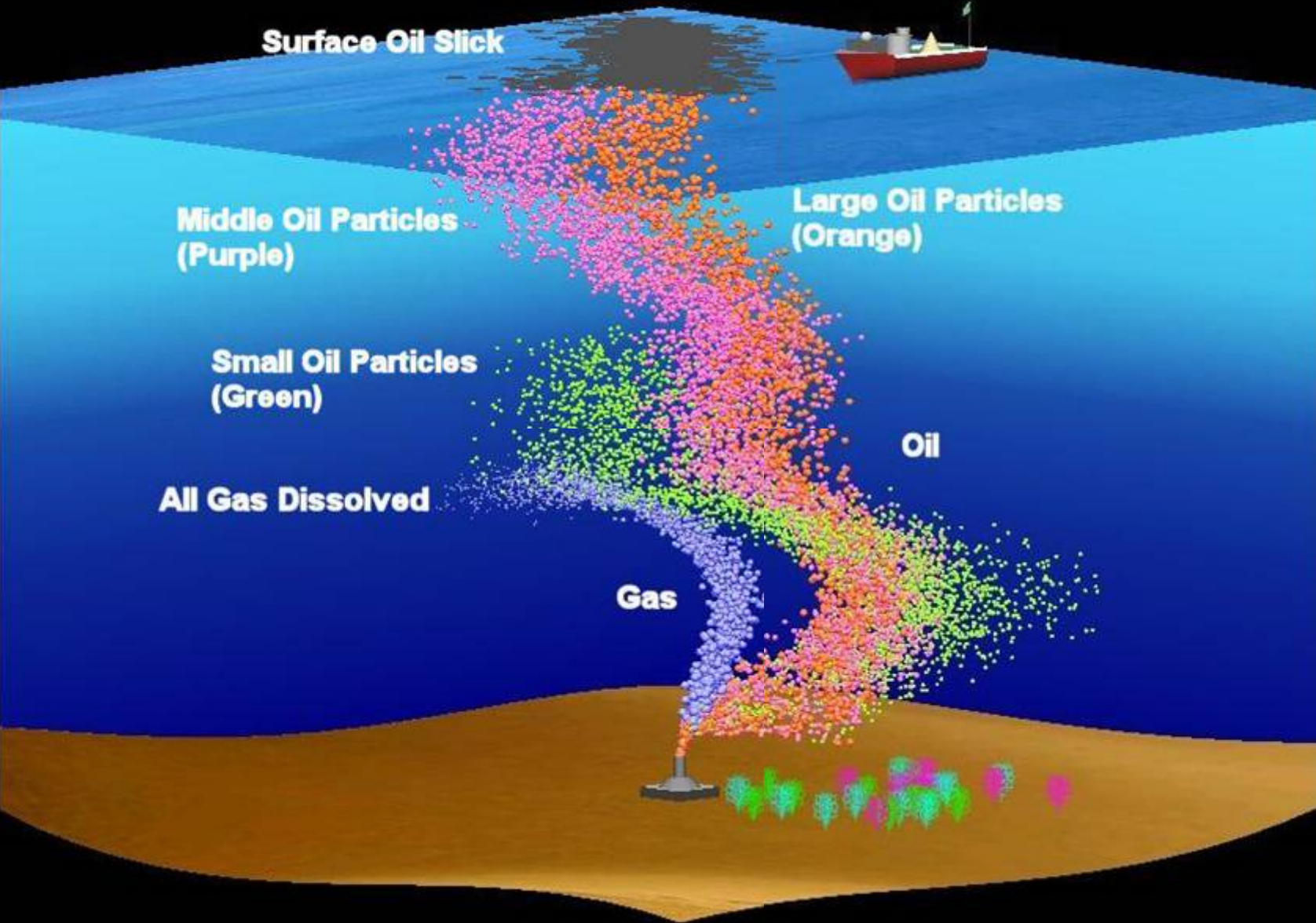
# NOAA Liaisons

- 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



# CDOG Results Yapa and Xie

2.9 hr



- gas
- 0.002000
- 0.009000
- 0.050000

V	⊕
H	⊖
D	⊥
T	⚓
N	⬇

# 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**



# 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

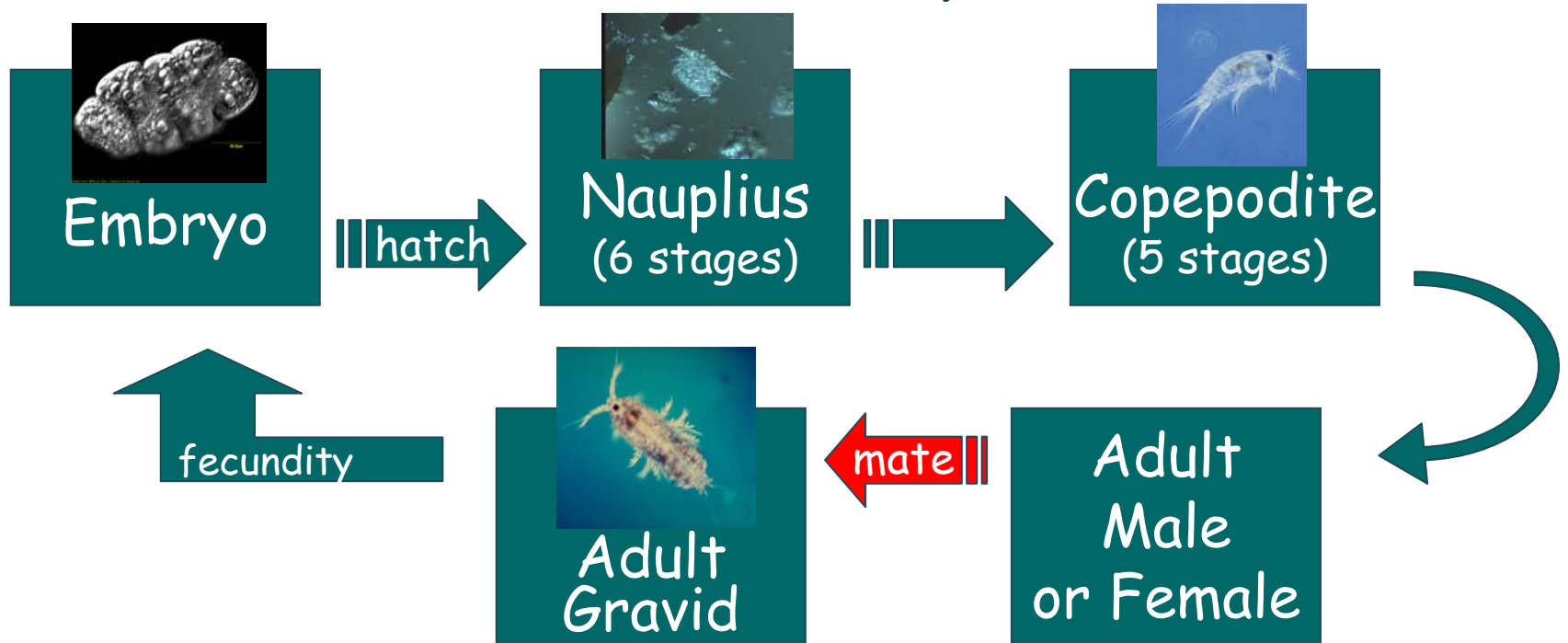


# Objectives of Chandler's Research

- **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 25°C in 96-well microplate culture



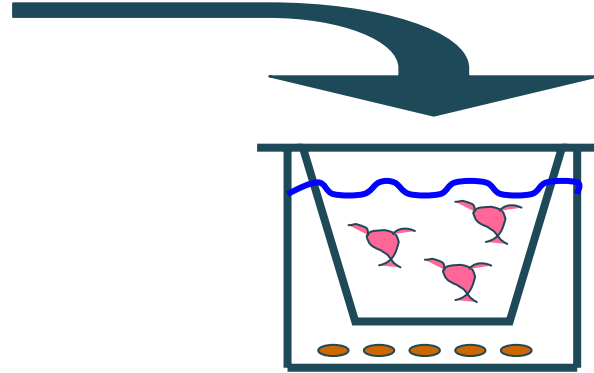
Lifecycle = 17-18 days Egg to Egg  
Avg. Life Expectancy =  $47 \pm 2$  days  
Avg. Clutch =  $6.2 \pm 2$  eggs



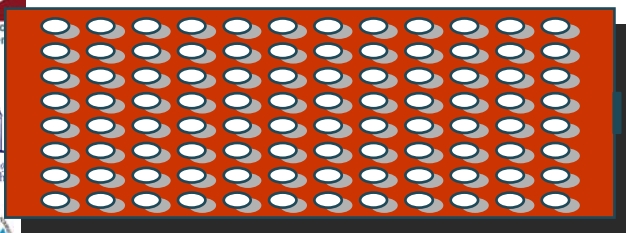
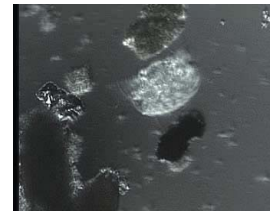
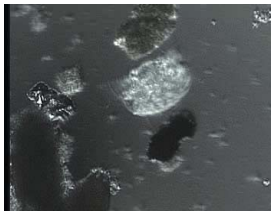
# How the bioassay works..



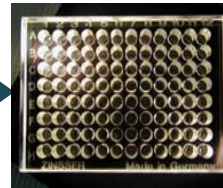
~ 200 gravid *A. tenuiremis*  
(from lab stock mud cultures)



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



X-MATINGS



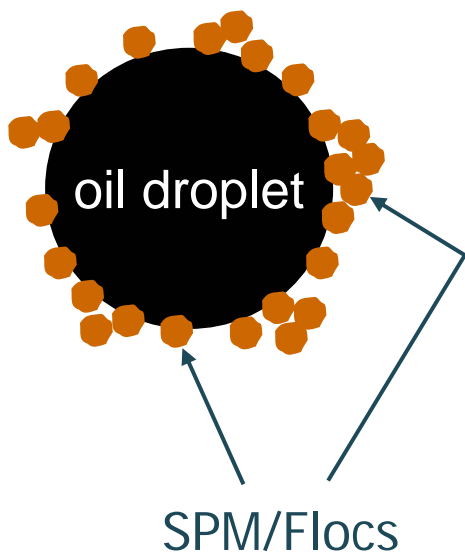
96-well Costar® microplate; 200 µl WSF  
solution per 10 wells

## Life-cycle Endpoints:

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

# Oil-SPM Aggregates (OSA)

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



Oil Droplet

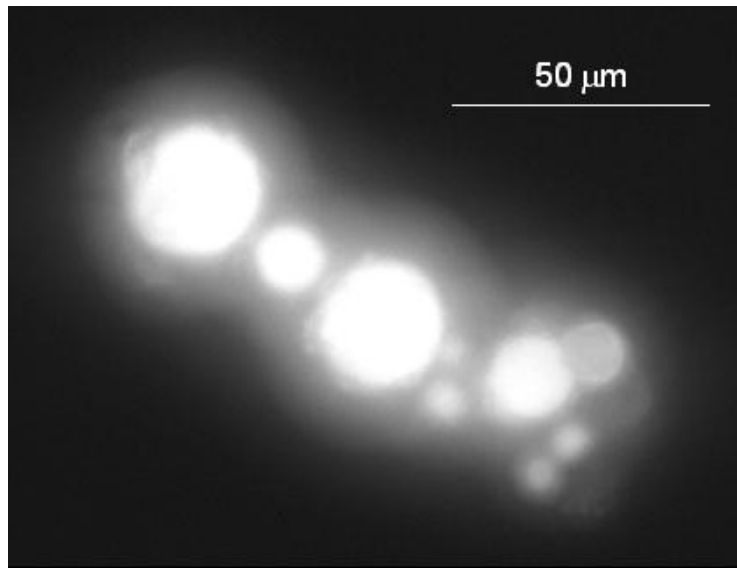
Suspended Particulate  
+ Matter (SPM)

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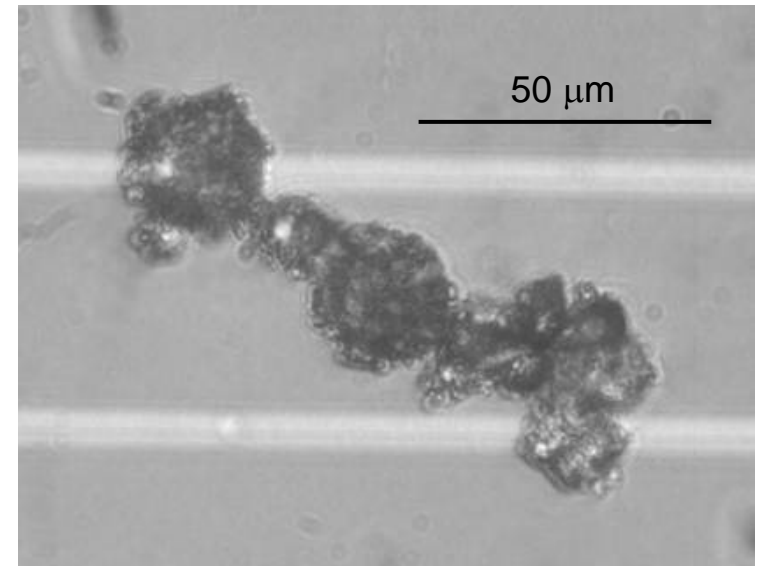
Oil-SPM Aggregate (OSA)



# Example Observed OSA: Heidrun + Chalk



**UV light (fluorescence)**

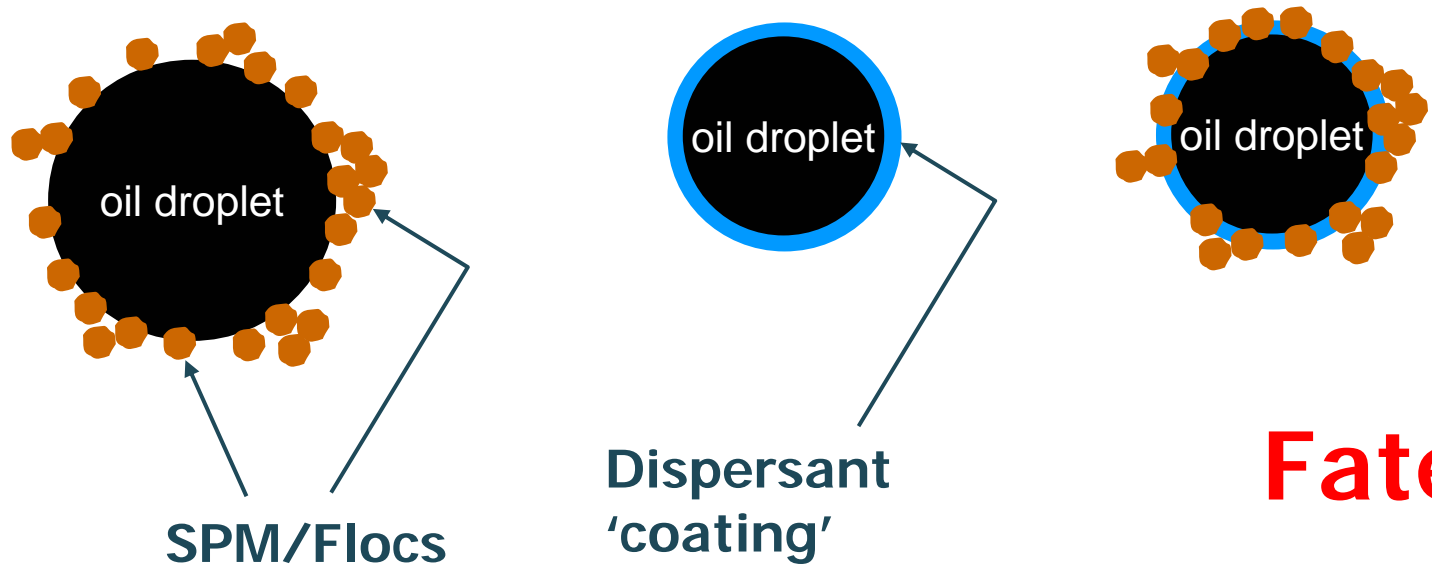


**Transmitted light**

(Khelifa et al., 2005)



# Issue: What Are Effects of Chemical Dispersants (CD) on OSA Formation?



**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 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

$C_s = 25, 50, 100, 200, 300$  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°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](http://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/](http://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



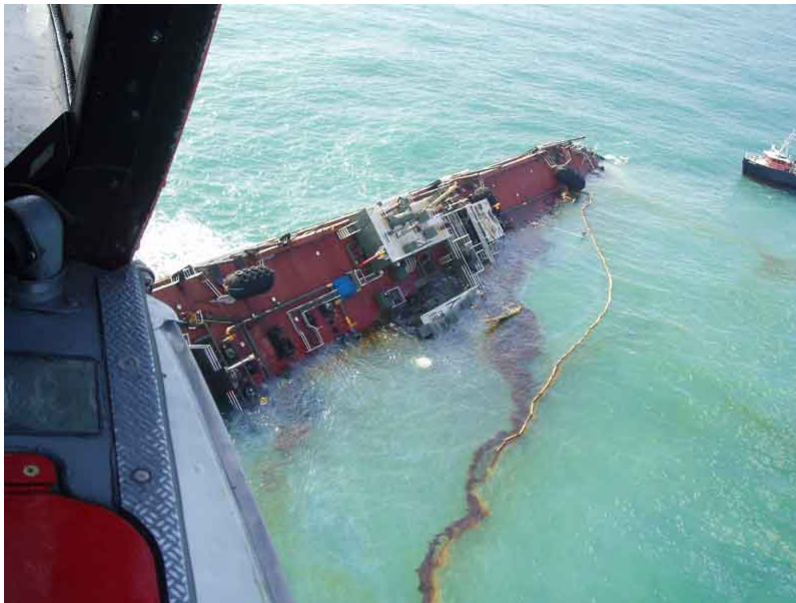
# Future Outreach Initiatives

- 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](http://www.crrc.unh.edu)

