

# Coastal Response Research Center

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**January 2007**

**European Tour**



# Topics Covered

- 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



# Handouts & Packet Contents

- 2005 Center annual report
- One page description of Center
- 2006 requests for proposals
- Table of projects funded
- One pagers on each project funded
- Today's slides
- Contact information
- On Center website ([www.crrc.unh.edu](http://www.crrc.unh.edu))
  - Current projects, presentations, events, links



# 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 (ORR) wanted partnership with university to address its 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, internationally)



# Specific Center Missions

- Conduct and oversee basic and applied research and outreach on spill response and restoration
- Transform research results into 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

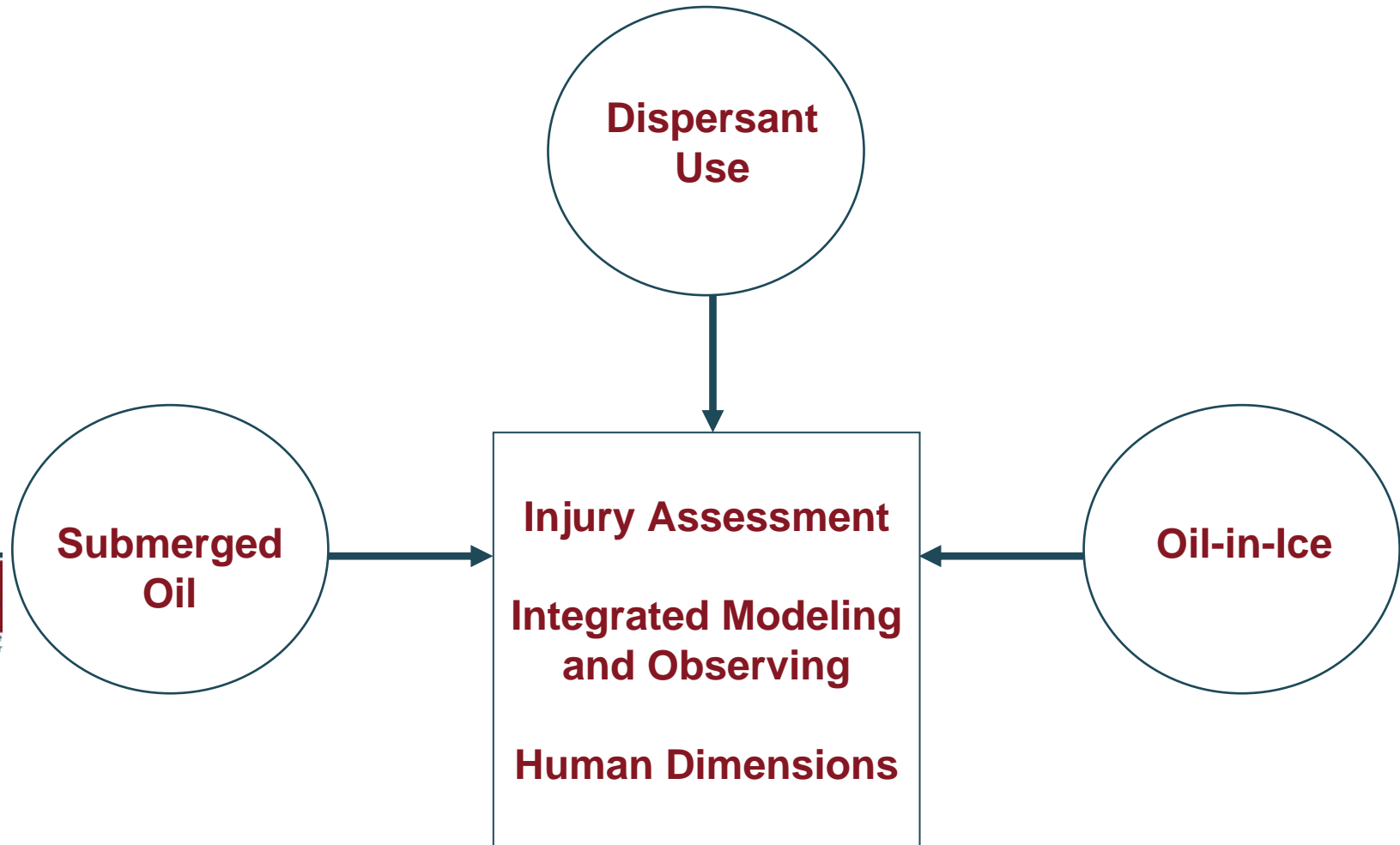


# Center's Strategic Plan

- 3-5 year horizon starting in 2007
- Three topics of Center focus
  - Dispersant use
  - Submerged oil
  - Oil-in-Ice
- Within each topic, three areas of emphasis
  - Injury Assessment
  - Integrated Modeling and Ocean Observing
  - Human Dimensions



# Focus Topics



# Dispersant Use

- Dispersants have been Center focus
  - Annual RFP topic
  - Sept 2005 Workshop
  - Center heads Dispersants Working Group (DWG)
- Dispersants emphasis continues because of:
  - Continued DWG efforts Pending US Coast Guard (USCG) in-shore dispersant requirements in Spring 2007
  - Many unanswered questions remain



# Submerged Oil

- Increase in amount of heavy oils being transported/used in U.S.
- Recent high profile incidents
  - Athos I
  - DBL 152
- Coincides with Congressional actions and USCG initiative



# Oil-in-Ice

- Global Warming
- Arctic ice melting → Increased human activity
- Coincides with International Polar Year efforts
- Coincides with SINTEF Joint Industry Program
  - Center biological/microbial effects experiments
- Coincides with U.S. Arctic Research Commission concern



# Areas of Emphasis Within Topics



# Injury Assessment

- Emphasis for NOAA in its role as natural resource trustee
- Unique focus of NOAA/Center vs. other oil spill entities
  - MMS, USCG
- Continued emphasis for Center
  - Annual RFP topic
  - Toxicity Working Group



# Integrated Modeling and Ocean Observing

- Integrated modeling focus of Center's Fall 2006 Institute
- Need to develop emphasis on biological integration in physical/chemical spill response and recovery models
- Models are integral parts of dispersant, submerged oil and human dimensions topics
- Models need to interface/incorporate/integrate with ocean observing system information
  - e.g., HF radar and new types of 3D drogues



# Human Dimensions

- Identified as important during Center's Nov 2003 Research Need Workshop
- Focus of June 2006 Workshop
- Needs to be incorporated into planning, emergency response, damage assessment and long term restoration for spills
- Valuing resources, risk communication, social impacts, coordination of response and restoration, subsistence, environmental ethics



# Center Oversight

- Advisory Board
- Science Advisory Panel



# Mission: Advisory Board

- Evaluate Center's:
  - Programs
  - Activities
  - Budget
  - Research themes
  - Priorities
- Help establish partnerships with public and private sectors



# Advisory Board Membership

- NOAA: Ken Barton (ORR), David Kennedy (OCRM)
- 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 funded projects
- Representatives from research community and users groups:
  - Academia
  - Governmental agencies (state/federal)
  - Private sector



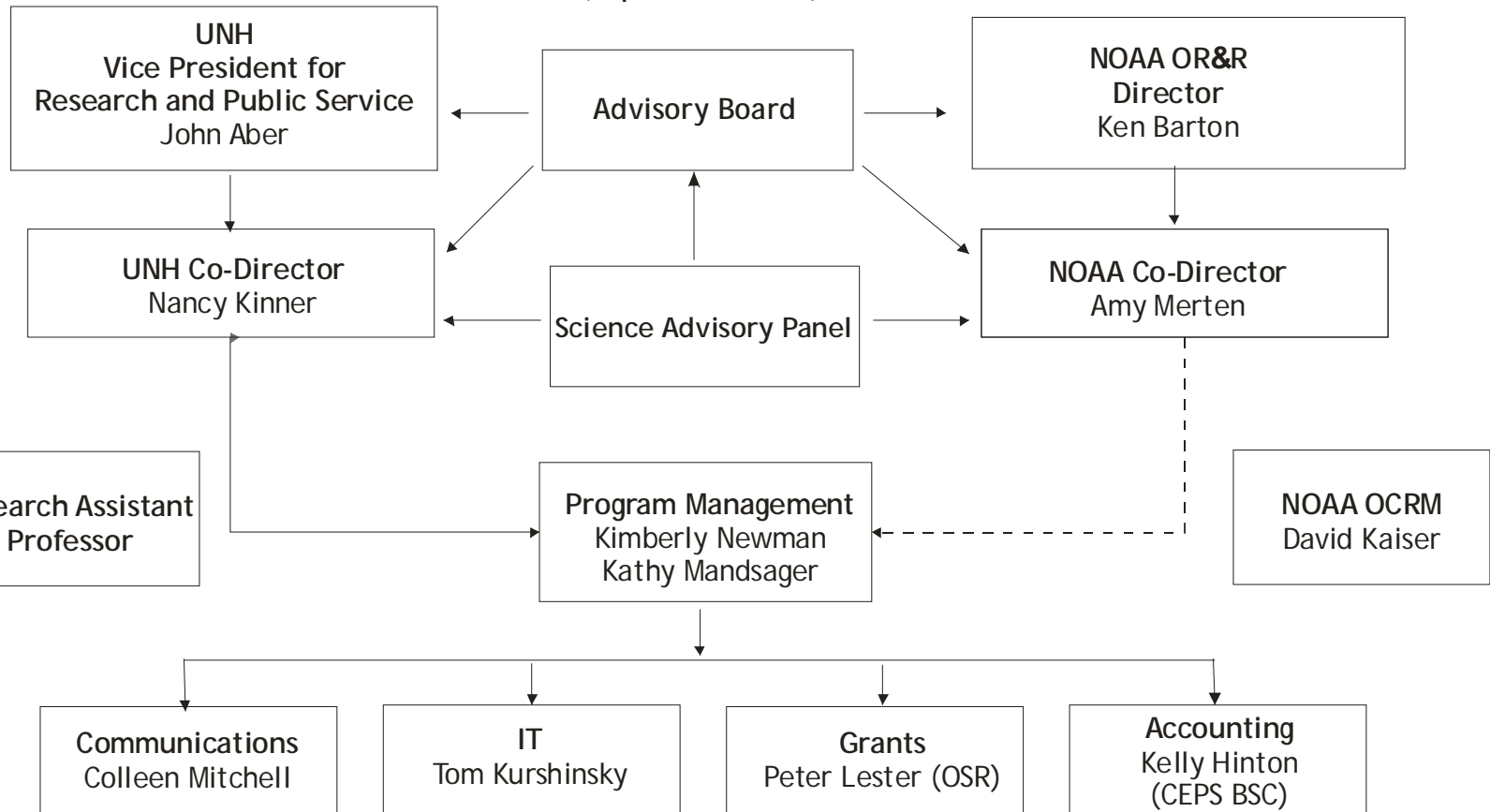
# Science Advisory Panel Membership

- NOAA: Charlie Henry (Gulf Coast ORR SSC)
- Other Federal Agencies: Roger Helm (FWS),
- State Agencies: Yvonne Addassi (CA OSPR)
- Academia: Tom Leschine (UWA), Dennis King (UMD)
- 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
  - Private sector
  - 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 each May
- Projects funded starting following January
- \$1.0 to 1.2M funding available annually
- Modeled after U.S. 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
- 2006 = 4 projects
- 23 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 = 11 projects
- Transport & weathering of released materials = 9 projects
- Human dimensions of oil spills = 4 projects
- Dispersant-related = 12 projects
- Toxicity = 10 projects
- Integration of ocean observing systems into spill response = 2 projects



# Project Demographics

- Government agencies = 3
  - Academic institutions = 14
  - Private sector = 6
- 
- U.S. = 20
  - International = 3
- 
- Average \$ per project ~ \$149,000
  - Average project length = 23 months



# Center-Funded Research

## West Coast

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

## Northeast

- Buzzards Bay terns
- Buzzard Bay stakeholders
- Copepods

## Mid-Atlantic Coast

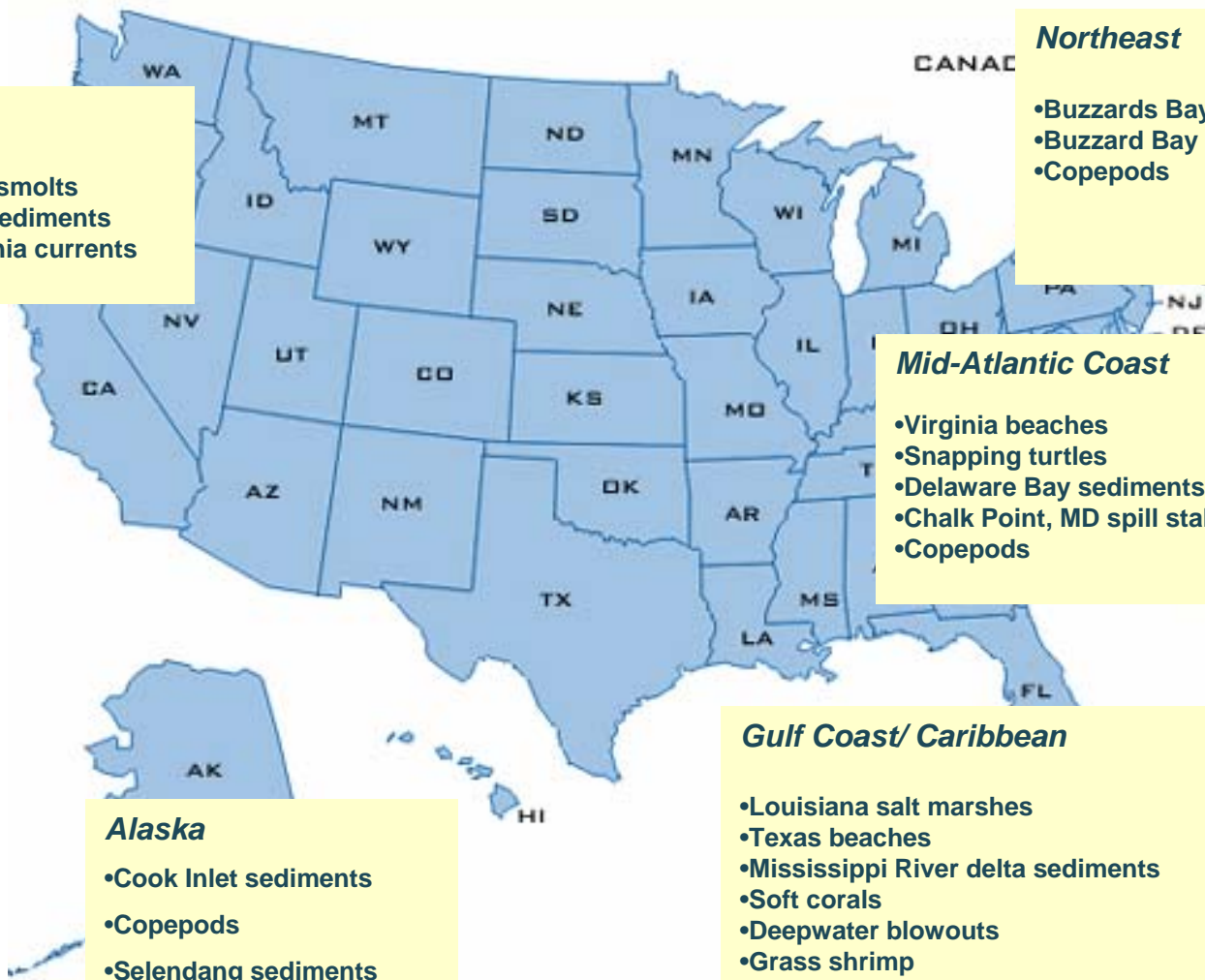
- Virginia beaches
- Snapping turtles
- Delaware Bay sediments
- Chalk Point, MD spill stakeholders
- Copepods

## 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 funded projects



# Translating R&D - NOAA Toxicity Working Group

- Synthesis of Center-funded research
- Identification of products and modeling approaches useful for field/spill response
- Identification of remaining gaps
- August 2006 Toxicity Summit



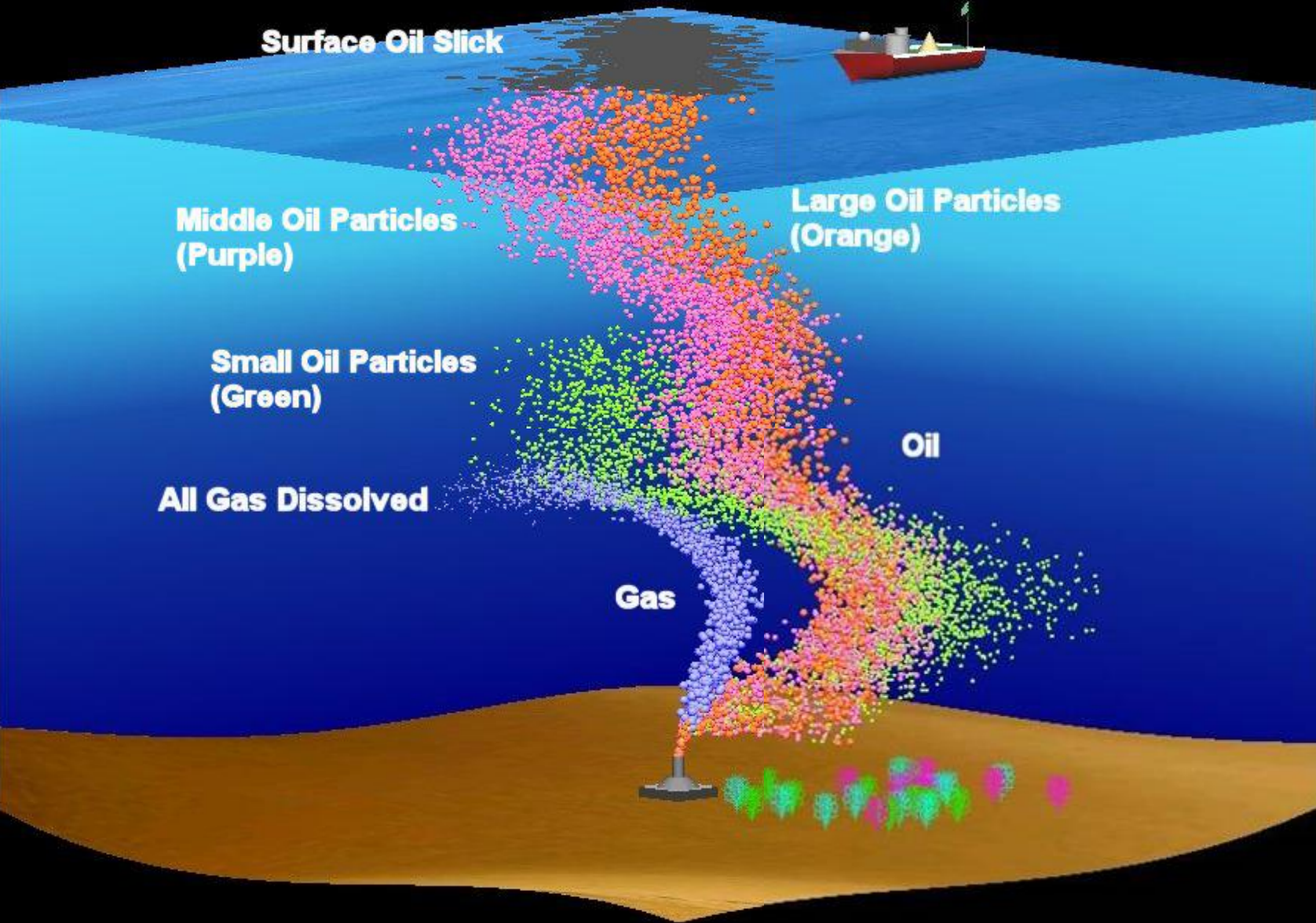
# NOAA Liaisons

- NOAA liaison for each new project
  - Technical advisors to Co-Directors
  - Work with PIs to strengthen 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



# Yapa et al. Center Research Results

- **With integrated CDOG-GNOME models can run complete deepwater through surface transport scenarios for response and planning**
- **NOAA Deepwater Spill Incident Data Preparation Sheet helps responders enter data quickly**
- **Integration designed for future compatibility**



# Example of Toxicology Research Chandler et al.

- Risk assessments of oil spill effects on wildlife require population-level information to have highest predictive power
- Rapid lifecycle bioassays are unavailable for sediment organisms
  - Most at risk of oil exposure
- Chandler uses copepods as model organism

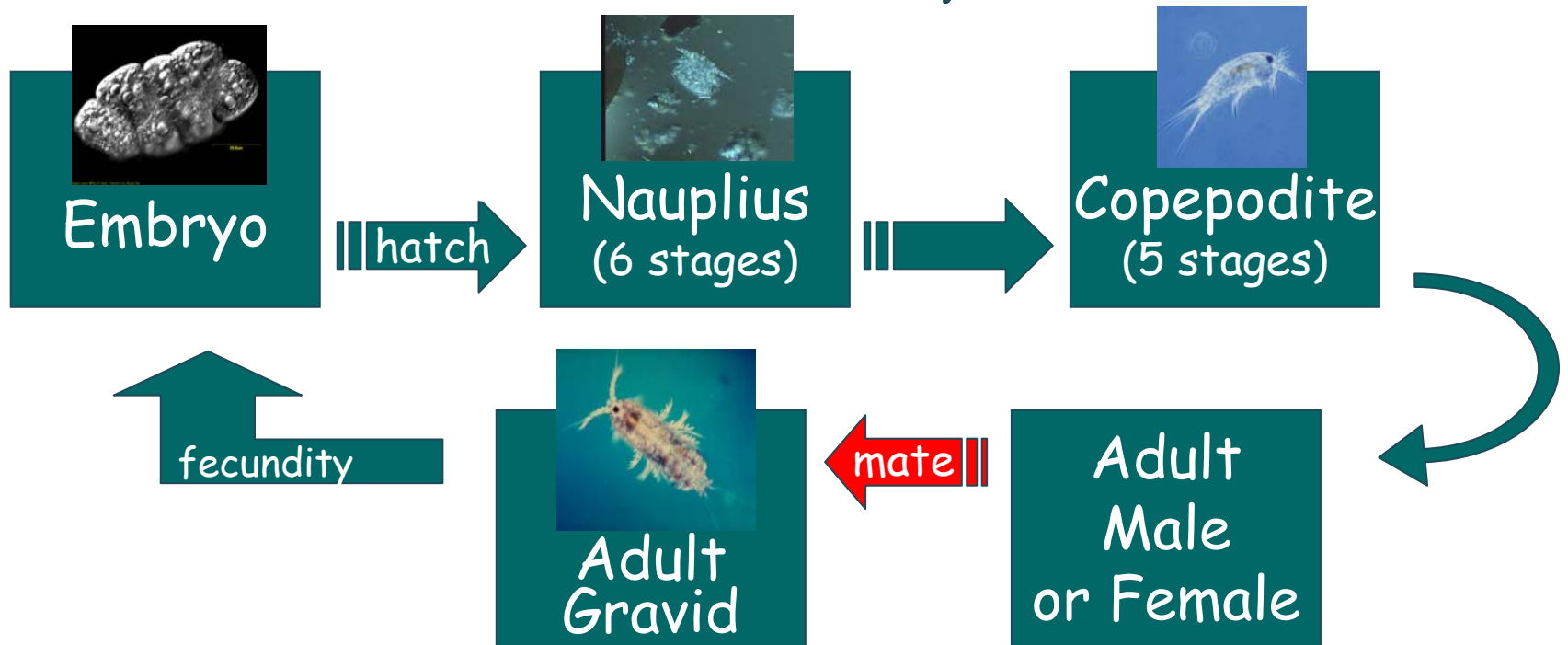


# Objectives of Chandler's Research

- **Developed lifecycle assay for water accommodated fractions (WAF) of crude oil**
- **Benchmarked against National Institute of Standards crude oil standard**
- **Used Chandler's ASTM standard copepod bioassay**



# Discrete Lifestages of Copepod Amphiascus tenuiremis at 25C in 96-well microplate culture



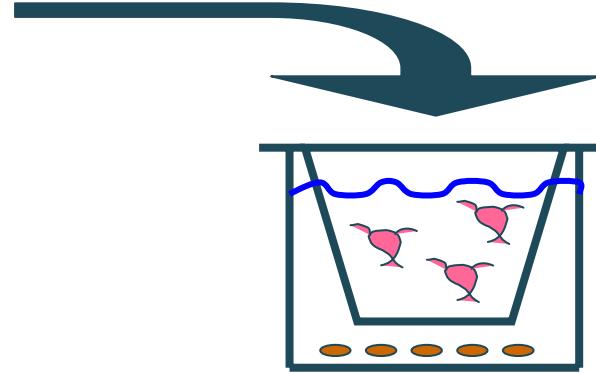
Lifecycle = 17-18 days Egg to Egg  
Avg. Life Expectancy =  $47 \pm 2$  days  
Avg. Clutch =  $6.2 \pm 2$  eggs



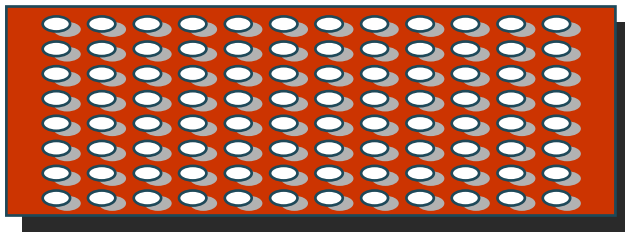
# How the bioassay works..



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



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



96-well microplate; 200  $\mu$ l WAF solution  
per 10 wells

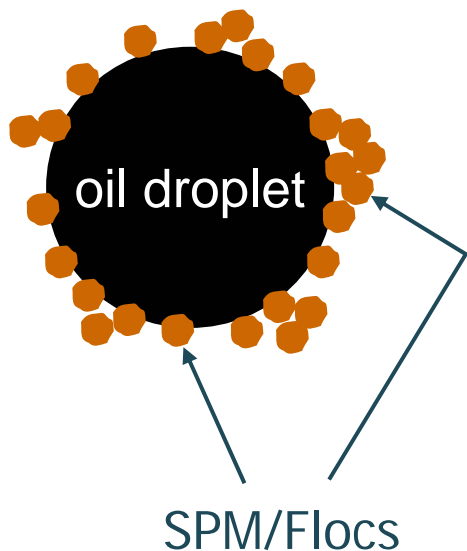
## Life-cycle Endpoints:

- 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)

Khelifa & Fingas  
Environment Canada



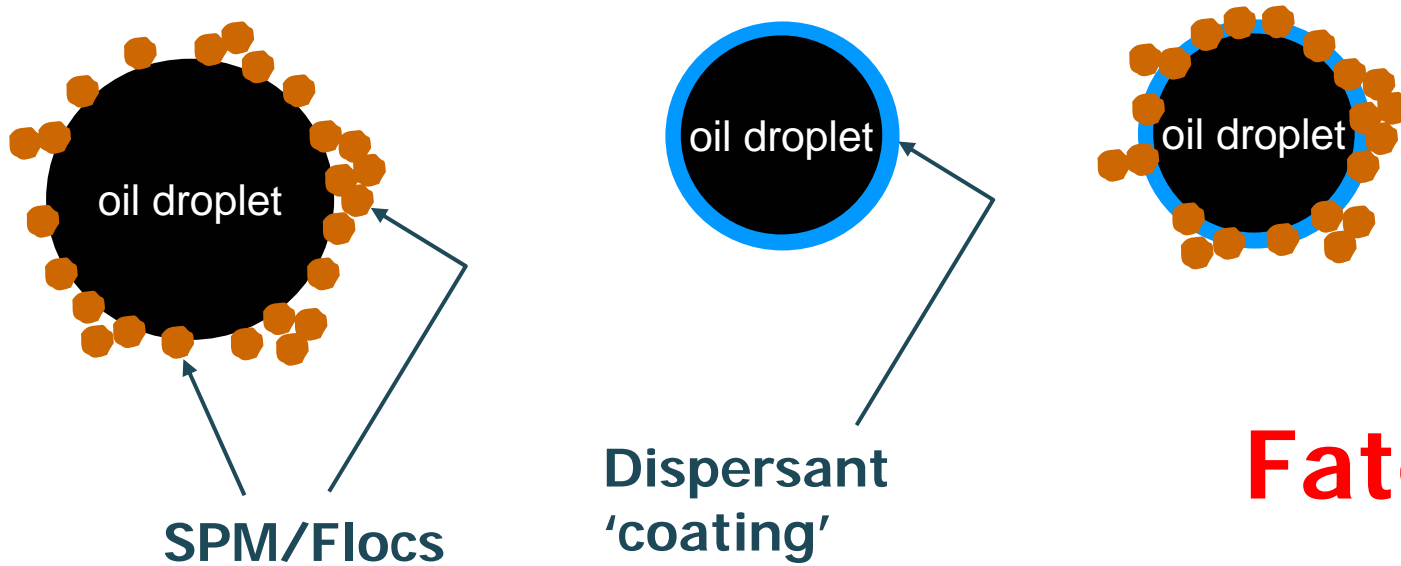
Oil Droplet

+  
Suspended Particulate  
Matter (SPM)

Oil-SPM Aggregate (OSA)



# What Are Effects of Chemical Dispersants on OSA Formation?



**Fate?**



# Objectives of Khelifa's Research

- Very little has been done and reported results are conflicting
- Quantify effects of dispersants on OSA formation under:
  - Various mixing conditions
  - Several sediment types and concentrations



# Experimental Procedure

- Conditions

## Sediments

Natural from five 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



# Oil Spill Fate and Transport Modeling and Linking HF Radar and Drogues with SIMAP Model Predictions

Payne et al.

- Jointly funded with CAOSPR (4 total dye releases)
- Release fluorescein dye to simulate dispersed oil and test tracking with High Frequency (HF) Radar and subsurface drogues and drifters
- Using vessels and airplanes off San Diego
- Measure small scale vertical and horizontal diffusivities of dye
- Develop algorithms using diffusivities to improve/validate 3D model of dispersed oil plume
  - Including uncertainties



# Communication

- Establishing Performance Metrics for Oil Spill Response, Recovery and Restoration  
Tuler et al.
  - Including public in review and examination of best metrics used to describe progress of spill response and restoration
    - Using stakeholders from actual spills in case studies
    - Chalk Pt, MD pipeline leak
    - Bouchard Barge 120 leak in Buzzards Bay, MA
  - Using statistical Q method to categorize stakeholder views of metrics from answers to survey questions



# 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 peer-reviewed information
    - Environmentally-meaningful studies
  - Center's mission 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
- All willing to participate in integrated research plan
  - Dispersants Working Group (DWG)
- Workshop on R&D needs for making decisions regarding dispersing oil



# Dispersants Workshops

- UNH on Sept 20-21, 2005
- Outcome of workshop = list of research needs, RFP topics and brief descriptions on Center website
- DWG members use these as basis for their RFPs
- February 1-2, 2007: Dispersants Research Forum in New Jersey, USA
  - DWG PIs presenting current research followed by DWG meeting to assess progress on research needs
  - Including international participation in DWG and presentations by SINTEF and CEDRE
  - DG will meet to determine which research needs have been addressed and what remains to be answered



# Dispersants Website

- Dispersants link on Center's website
  - [www.crrc.unh.edu/dwg/](http://www.crrc.unh.edu/dwg/)
- Description of DWG
- One pagers on each DWG member including research, funding opportunities
- Links to on-going RFPs of members
- Workshop summary 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
- Hurricane Katrina experience



# Human Dimensions of Spills Research Needs Workshop

- Topics Discussed:
  - Communication,
  - Valuing natural resources
  - Social impacts
  - Subsistence
  - Environmental ethics
  - Organizational (institutional) behavior
- Date: June 13-15, 2006 at UNH



# 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 on research needs available on website in Feb 2007



# Other Outreach Initiatives

- Submerged/Heavy Oil Research Needs Workshop
  - December 2006 held jointly with US Coast Guard
  - Topics: Detection and Monitoring; Containment and Recovery; Fate and Effects; Protection of Intakes
  - Report available on website in May 2007
- Coastal/Ocean Observing Systems and Oil Spill Response/Recovery Integration Workshop
  - Mid to late 2007



# Oil-In-Ice Experiment

- SINTEF (Norway) and Joint Industry Program conducting “experimental” oil spill in Norwegian waters in 2009
- Numerous physical, chemical and modeling projects
- Center and NOAA will head biological effects research
  - Fate and effects of oil on the microbial community at ice/water interface
  - Repercussions for under-ice food webs



# Coastal Response Research Center

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

