

Detection and Monitoring Submerged Oil with Snare



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What causes oil to sink?

Oil Density > Water Density

- Oil type
- Temperature
- Particle interaction
- Mixing energy
- Weathering



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Submerged Oil Detection Techniques

- Sonar Systems
- Underwater Video
- Divers
- Bottom Sampling
- Chemical Sensors
- Sorbents



(US Coast Guard, 2004)



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- **Sorbents**



(US Coast Guard, 2004)



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Snares

- Polypropylene sorbents
- Oleophilic
- Low-cost, low-tech, easily deployed
- Multiple use
 - Beach
 - Surface
 - Water column



(Solhutec.com)



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Deepwater Horizon

- Sentinel placement every mile from TX to FL
- Give insight to models of plume
- *Inform* Shoreline Cleanup Assessment Technique (SCAT) teams



(Deepwater Horizon Response JIC, 2010)



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ATHOS I

- Snare sentinel grid between spill and water intake
- *Monitor* transport of oil
- Validated models
- Salem nuclear power plant shutdown (\$33 million, 11 days)



(NOAA, 2004)



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T/B DBL-152

- 1.9 million gallons of heavy oil (API 4.5°) submerged
- Snares dragged on sampling gridlines
- Helped *locate* oil
- Developing protocol



(NOAA & ENTRIX, 2005)



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Supporting Research

- Collaboration with Steve Lehmann
 - NOAA Scientific Support Coordinator, New England
 - Co-chair of National Response Team's science and technology committee
 - DBL-152 SSC



(NOAA & ENTRIX, 2005)



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Research Needs

- Maximize snare encounter with oil
- Relate extent of observed oiling to subsurface oil
 - Varying environmental conditions & oil types

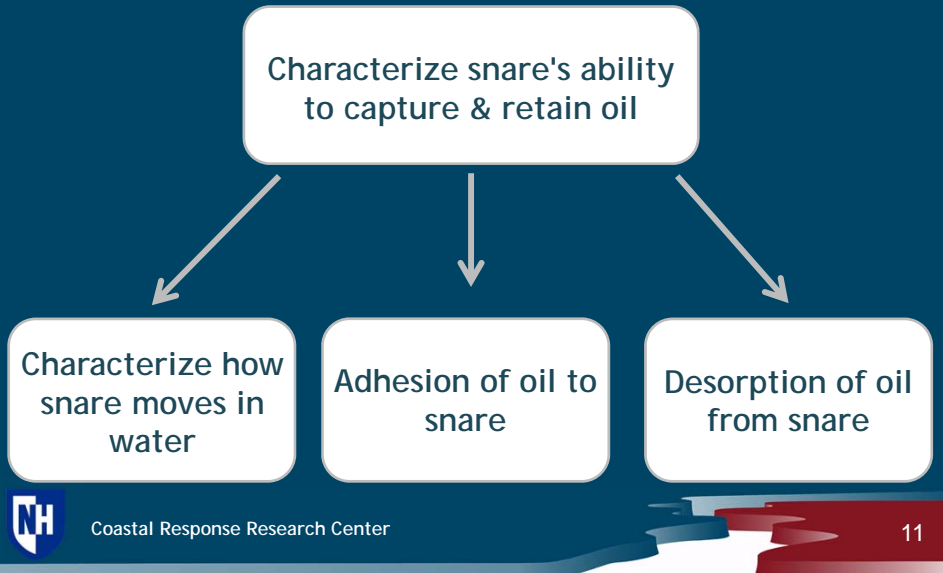


(ENTRIX Inc., 2016)

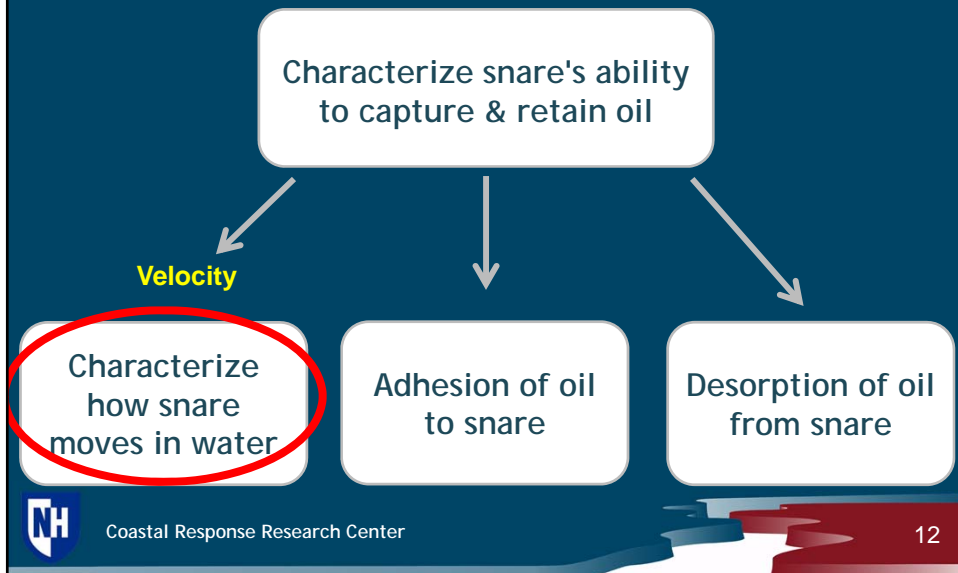


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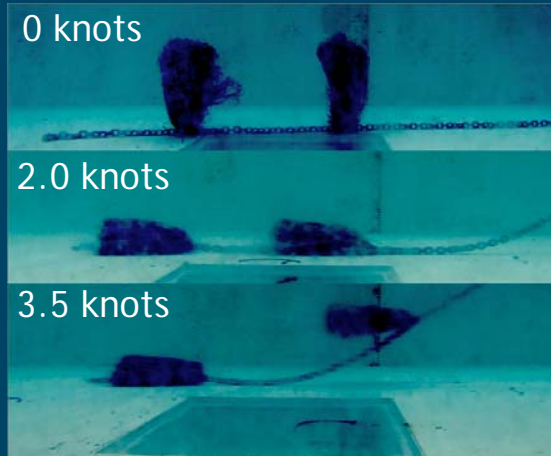
Research Objectives and Overview



Research Objectives and Overview



Location in Water Column



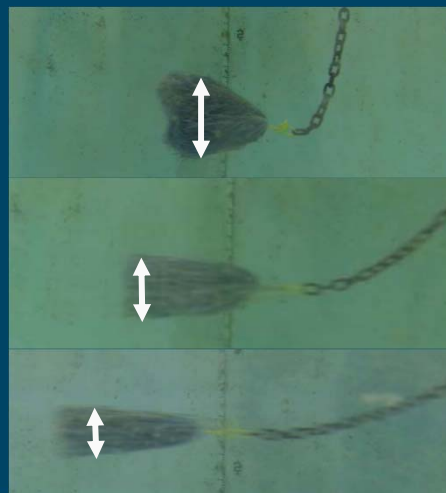
Towed from left to right



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Diameter Change with Velocity



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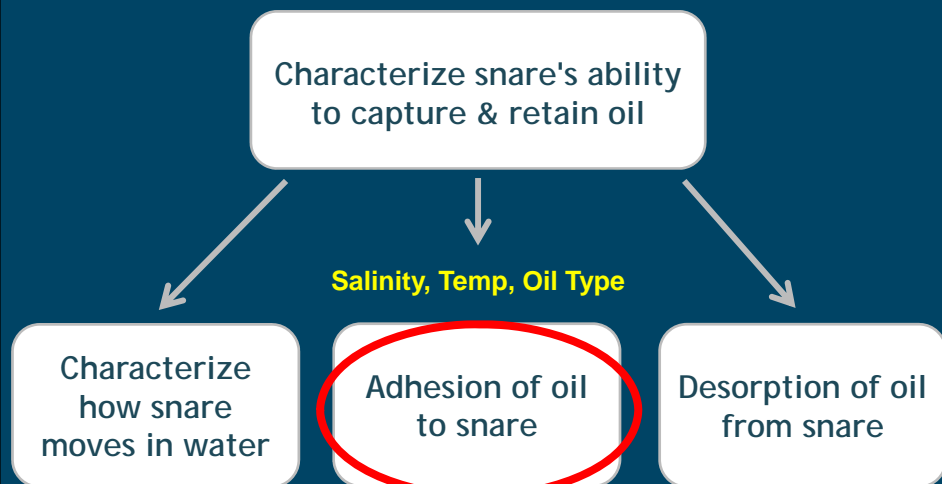
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Towing Results Summary

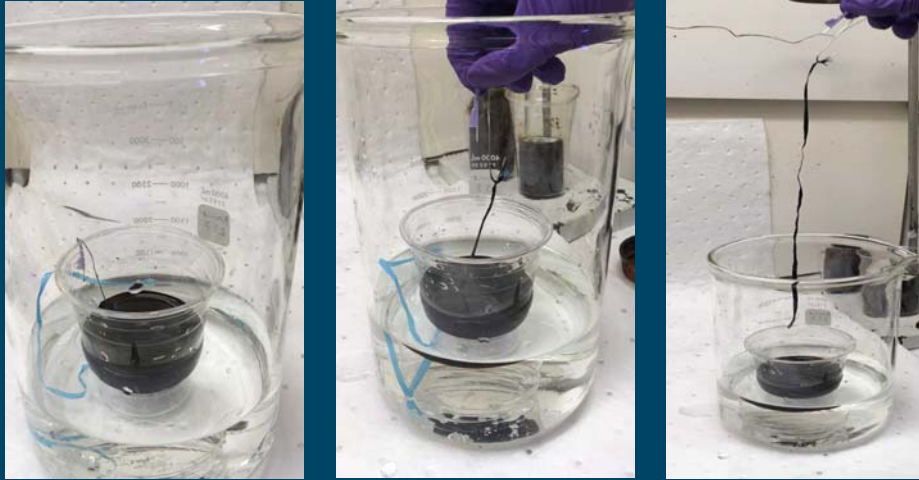
- Location in water column:
 - Velocity of tow
 - Weight chains
 - Number of snare
- Ongoing research:
 - Algorithm for responders
 - Varying configurations
 - Snare oil encounter



Research Objectives and Overview



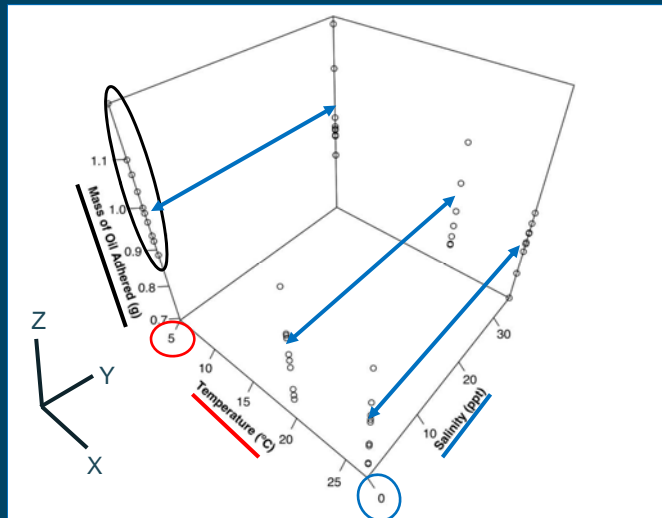
Adhesion Experiment Design



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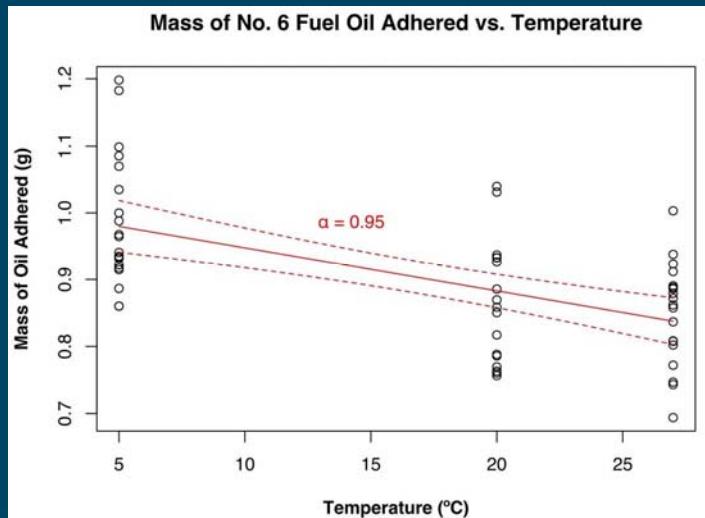
No. 6 Fuel Oil Adhesion



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No. 6 Fuel Oil Adhesion

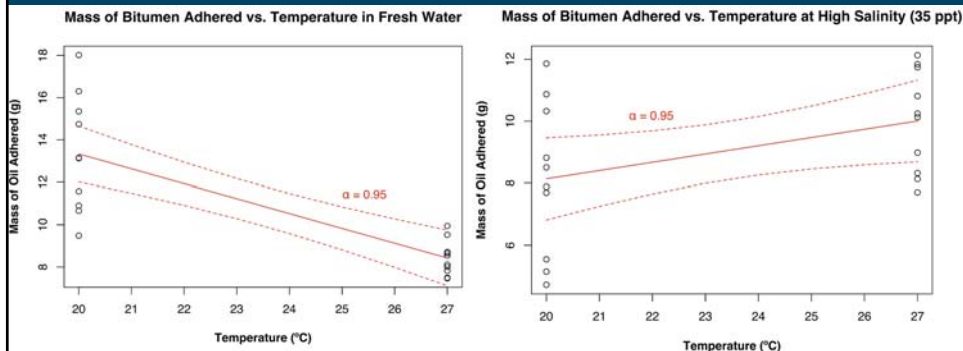


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Bitumen Adhesion

Fresh Water

Salt Water



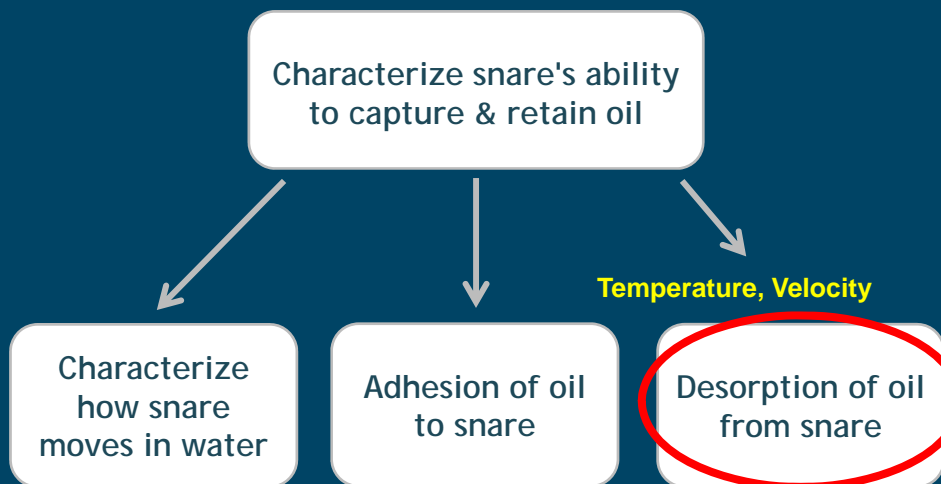
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Adhesion Results Summary

- Temperature is significant driver for No. 6 fuel oil adherence
- Salinity and temperature are both drivers of bitumen adherence
- Ongoing research:
 - more oil types
 - experiments to explore trends



Research Objectives and Overview



Desorption Experiment Design



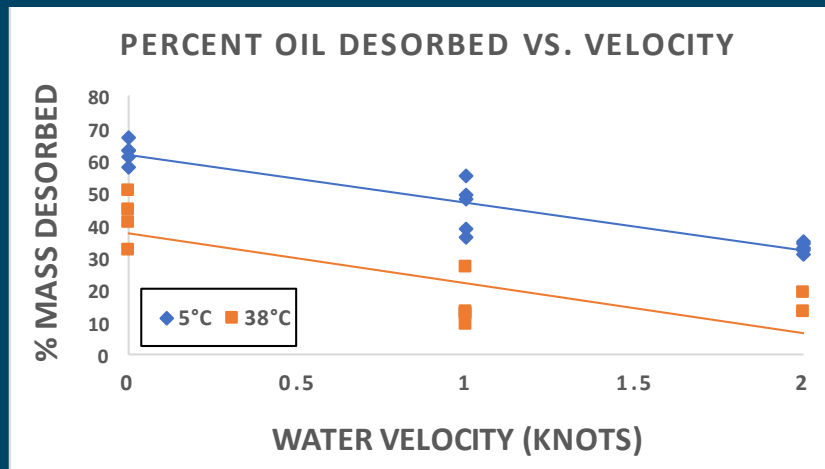
Independent Variables: Temperature and Velocity



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Desorption Results: No. 6 Fuel Oil



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Desorption Results Summary

- More oil desorbed at lower velocities
- More oil desorbed at lower temperatures
- **Note:** Cold temperatures increased both adherence and desorption
- Ongoing research:
 - More oil types
 - Higher velocities



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Application to Response

- Getting snare to the oil
- Height in water column
 - Velocity of tow
 - Weight of chains
 - Number of snare
- Oil type
- Environmental conditions
 - Temperature
 - Salinity



(US Army Corp of Engineers, 2008)



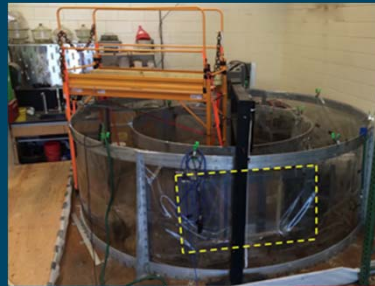
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Thank you. Questions?

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- Student Research Groups



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