The Deepwater Horizon Oil Spill: Impacts on Gulf of Mexico Fisheries

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Texas Sea Grant
at Texas A&M University

Gulf of Mexico Fishery Management Council Meeting
Austin, TX
April 6th 2016

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Sea Grant – GoMRI partnership

$500 Million, 10-year investment

Study how oil and dispersants:
• Move around and interact
• Impact people, wildlife, and the environment

Dispatches From The Gulf - video short

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Sea Grant – GoMRI partnership

Mission: Enhance the practical use and conservation of coastal, marine and Great Lakes resources in order to create a sustainable economy and environment

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Oil Spill outreach Specialists

Chris Hale

Emily Maung-Douglass

Larissa Graham

Monica Wilson

Texas

Louisiana

Mississippi

Florida

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Outreach Team outputs

Sharing peer-reviewed, published science

– Science outreach publications
  • Focused on science topics identified by our audiences

– Science seminars & input sessions
  • Presentations by experts
  • Continue to identify needs of coastal audiences

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Ecosystem Impacts

POTENTIAL OIL IMPACT

Wetlands
Oilied, degraded or eroded marsh may reduce productivity*

Nearshore Benthos
Tarmats and oil may reduce productivity in these shallow coastal areas

Photic Zone
In this sunlight zone, surface and dispersed oil may affect the base of the food webs, particularly sensitive larval fish

Top Predators
Predators may be affected by degradation of food webs, and by direct health effects from oiling

Deep Benthos
The destruction of long-lived corals on the deep benthos (sea floor) may reduce productivity and biological processes

*refer to glossary

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Understanding fisheries impacts from oil spills: 3 level approach

How do oil spills impact many different kinds of living things in an area or habitat?

How do oil spills impact a group of living things of the same species?

How do oil spills impact individuals?

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Individual fish impacts

**FISH are good at breaking down the bad stuff in oil!**
- Oil metabolizing gene (CYP1A) triggers production of proteins that will breakdown PAHs in fish
- Animals without CYP1A bioaccumulate
- CYP1A is a biomarker for oil exposure in fish

**BUT chemicals in oil can cause:**
- Decreased swimming speed
- Decreased size
- Deformities
  (Sensitivity and impact varies by life stage)

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Individual fish impacts

Swimming speed Mahi mahi

<table>
<thead>
<tr>
<th>PAH exposure levels (ppb)</th>
<th>Control</th>
<th>4.2</th>
<th>17</th>
<th>30</th>
<th>1.2</th>
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<tr>
<td>$U_{\text{crit}}$ (BL s$^{-1}$)</td>
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<td>Control</td>
<td><img src="gulfseagrant.org/oilspilloutreach" alt="Bar chart" /></td>
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<td>Exposed only as juveniles</td>
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<td>Hatched from exposed eggs</td>
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Mager et al. (2014)

[Image of Mahi mahi fish]
Population impacts: fishery – dependent research

Shrimp in the Gulf of Mexico: Commercial Landings (pounds), 1991-2013

Other factors?
- Environmental changes
- Climatic changes

Fishery closure?

Events:
- Hurricane Andrew
- Hurricanes Rita & Katrina
- Hurricanes Gustav & Ike
- Deepwater Horizon oil spill

Year

Pounds landed
0 20,000,000 40,000,000 60,000,000 80,000,000 100,000,000 120,000,000 140,000,000 160,000,000
Population impacts: fishery – independent research

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van der Ham & der Mutsert 2014
Blue crab pop. modeling study

- larval dispersal & settlement
- blue crab larvae virtually exposed to DWH oil
- species specific & location specific results: MS River Delta

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Community Impacts

• Pre-spill normal:
  – shrimp, crabs, squid but also a 15 – 20% zooplankton

• Post-spill diet shift attributed to DWH
  – more fish & crustaceans and less zooplankton

Tarnecki & Patterson 2015

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Community Impacts

- Deep sea fish are exposed to PAHs in different ways
- Fish habitat and fish behavior play a key role in exposure
- Golden tilefish had significantly higher levels of PAH for a few years after the oil spill

[Link: gulfseagrant.org/oilspilloutreach]
Ecosystem Impacts: Populations & Communities

1. Physiological & developmental consequences
2. Potential mortality, especially during larval & juvenile stages
3. Habitat loss, degradation, or alteration
4. Changes in base of food chain
5. Fishery closures

Established negative effects of oil
Effects of oil are unclear
Indicates direct effects of oil
Indicates indirect effects of oil

Adapted from Fodrie et al. 2014

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Science Social TONIGHT!

Learn more while you eat and have a drink on us 😊

5:30 pm in the DeWitt Room

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