The Toxicity of Chemically dispersed crude oil to herring embryos

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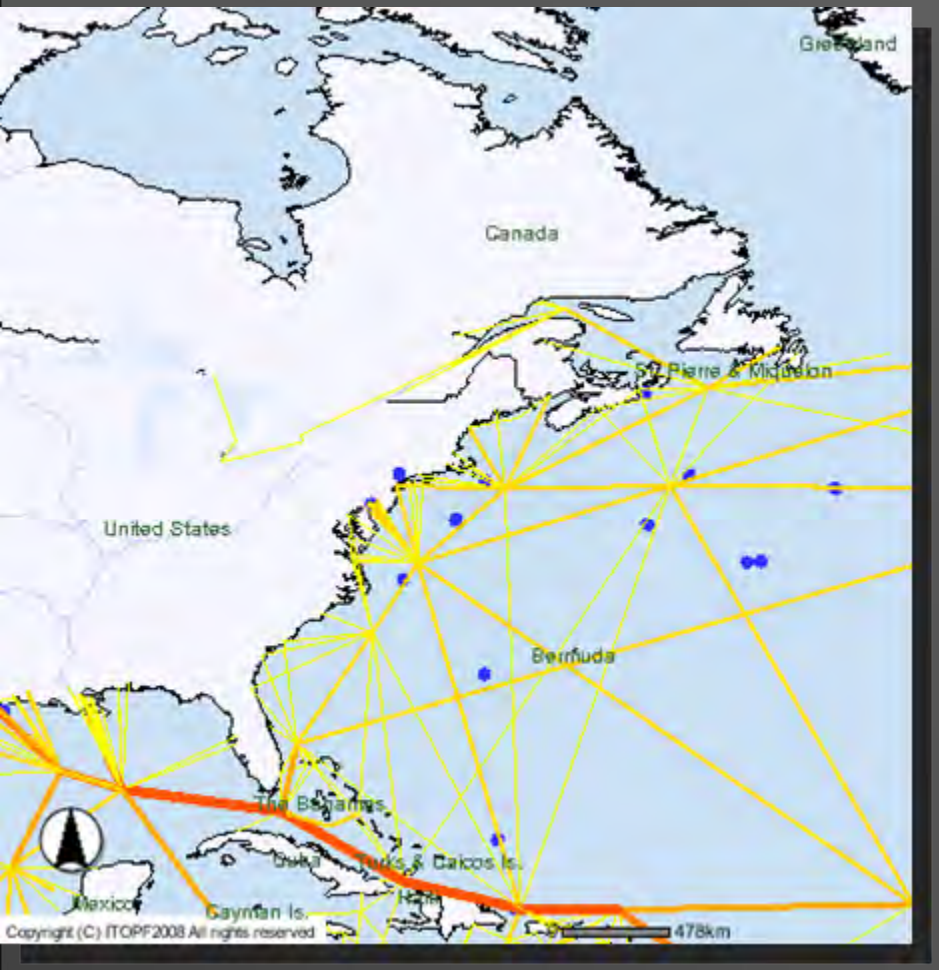
Queen's University

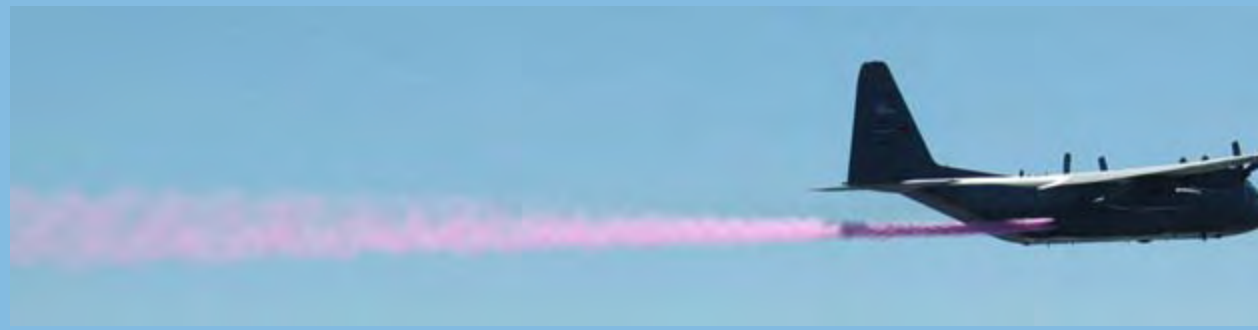
Exxon Valdez Oil Spill and Pacific Herring

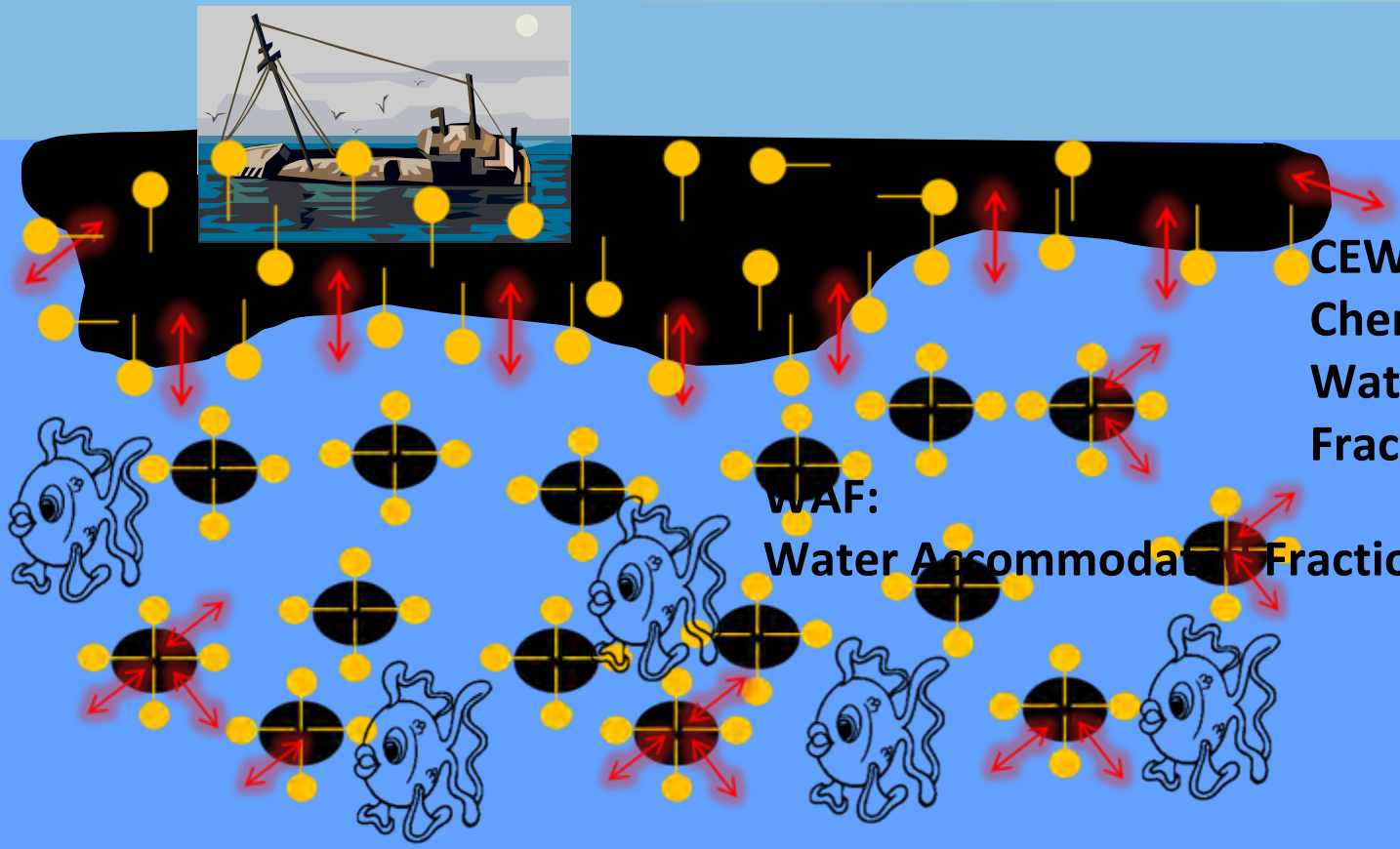
Risk Of Oil Exposure to Atlantic Herring



Atlantic Herring vs Pacific Herring

Atlantic Herring	Pacific Herring
• *Clupea harengus*	• *Clupea pallasi*
• Spawn in range of depths	• Shallow intertidal and subtidal
• Substrate spawner	• Substrate spawner
• Spring and Fall spawn	• Spring and Winter spawn
• Newfoundland to North Carolina	• California to Alaska
•14 d embryonic development time at 10˚ C	• 21 d embryonic development time at 10˚ C



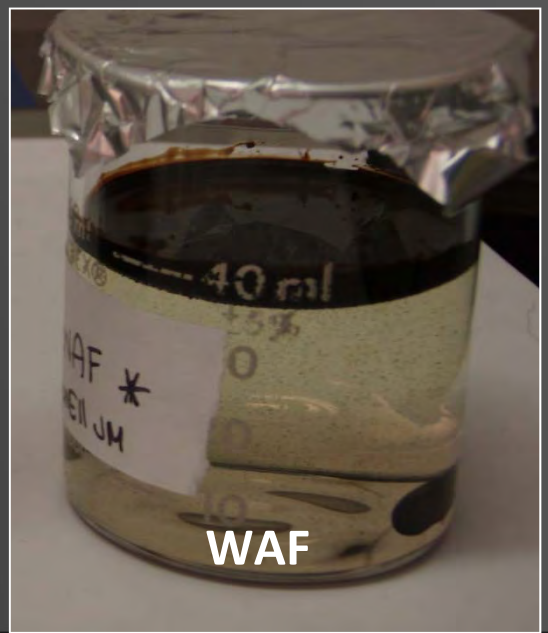


CEWAF:
Chemically-Enhanced Water Accommodated Fraction

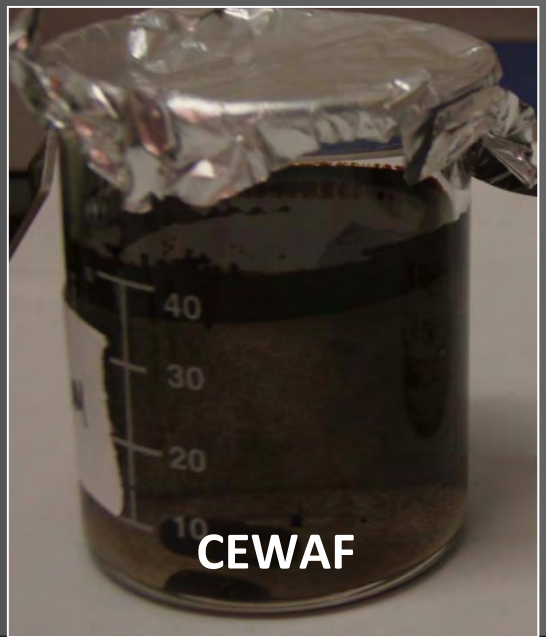
WAF:
Water Accommodated Fraction

Polycyclic Aromatic Hydrocarbons (PAHs)

DISPERSION

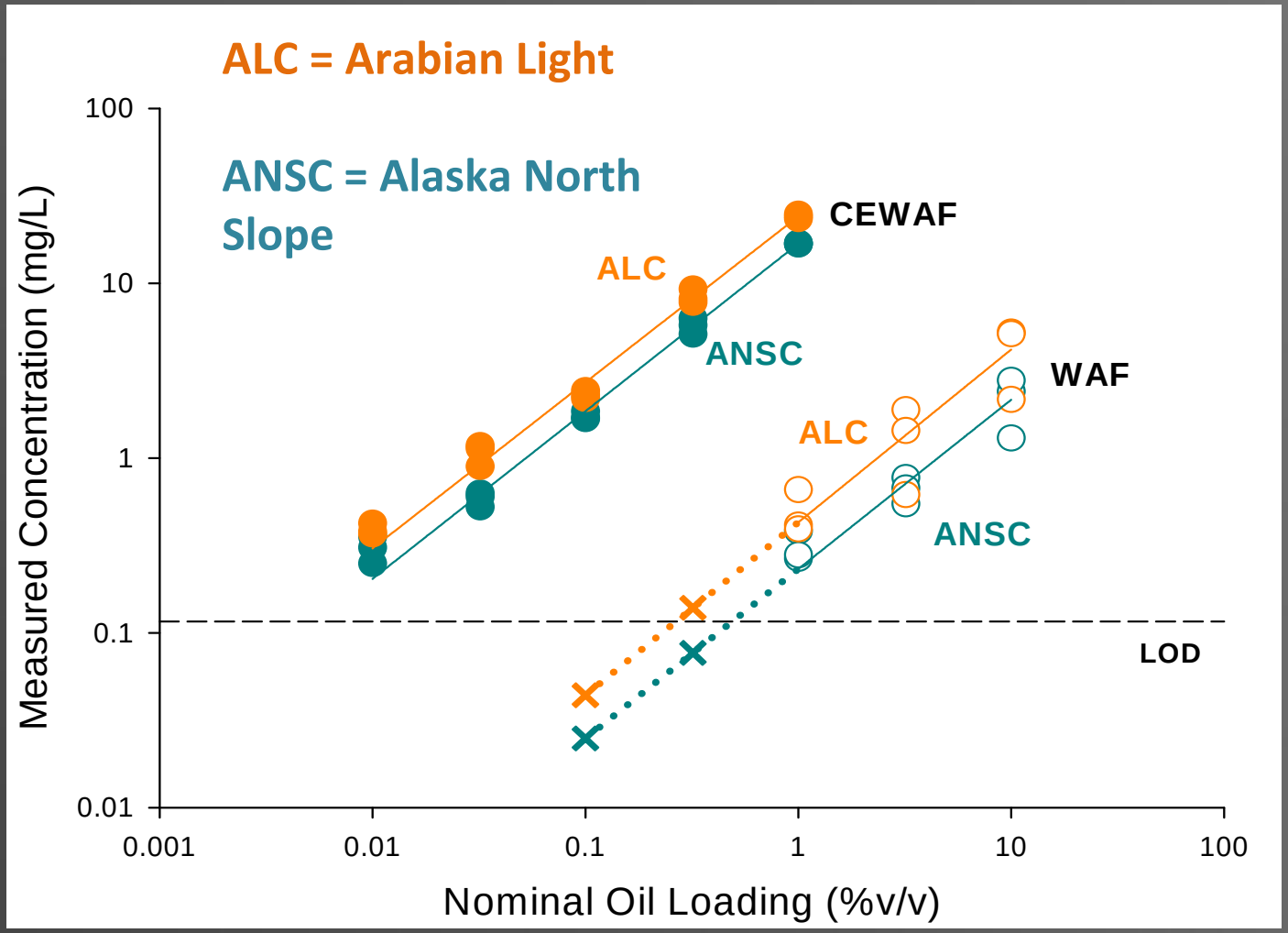


WAF



CEWAF

Chemical dispersion increases the concentration of fluorescent compounds within the water



Blue Sac Disease (BSD)

Measurements:

- % mortality
- % normal
- pathologies
- swimming ability

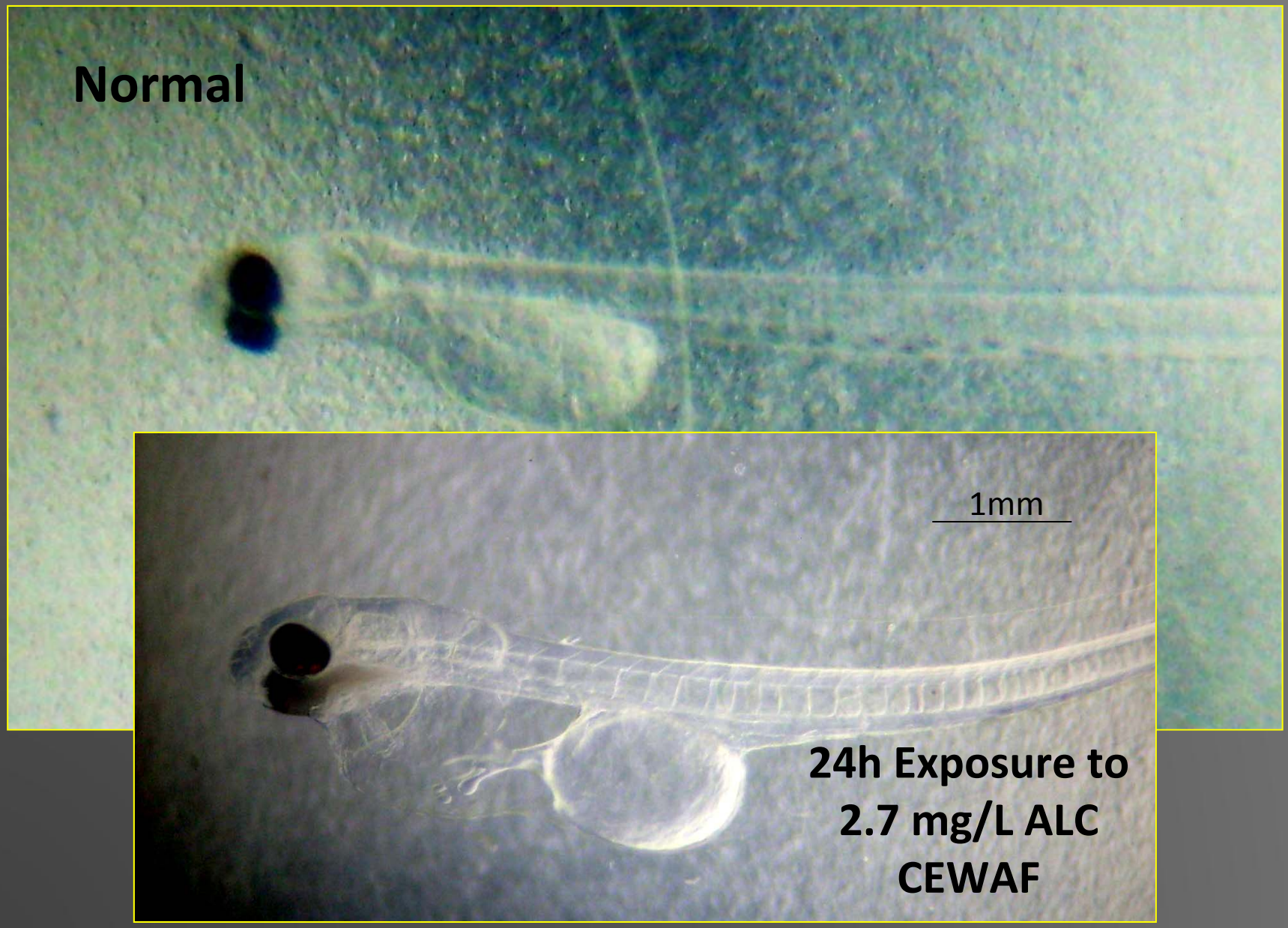
Research Questions

1. Are data interchangeable between species of herring?
2. Are all oils equally toxic or does toxicity vary with chemical composition?
3. Can toxicity occur within brief periods of an oil spill?
4. Are standard lab preparations of dispersed oil suitable for judging oil exposure and toxicity under more “natural” conditions?

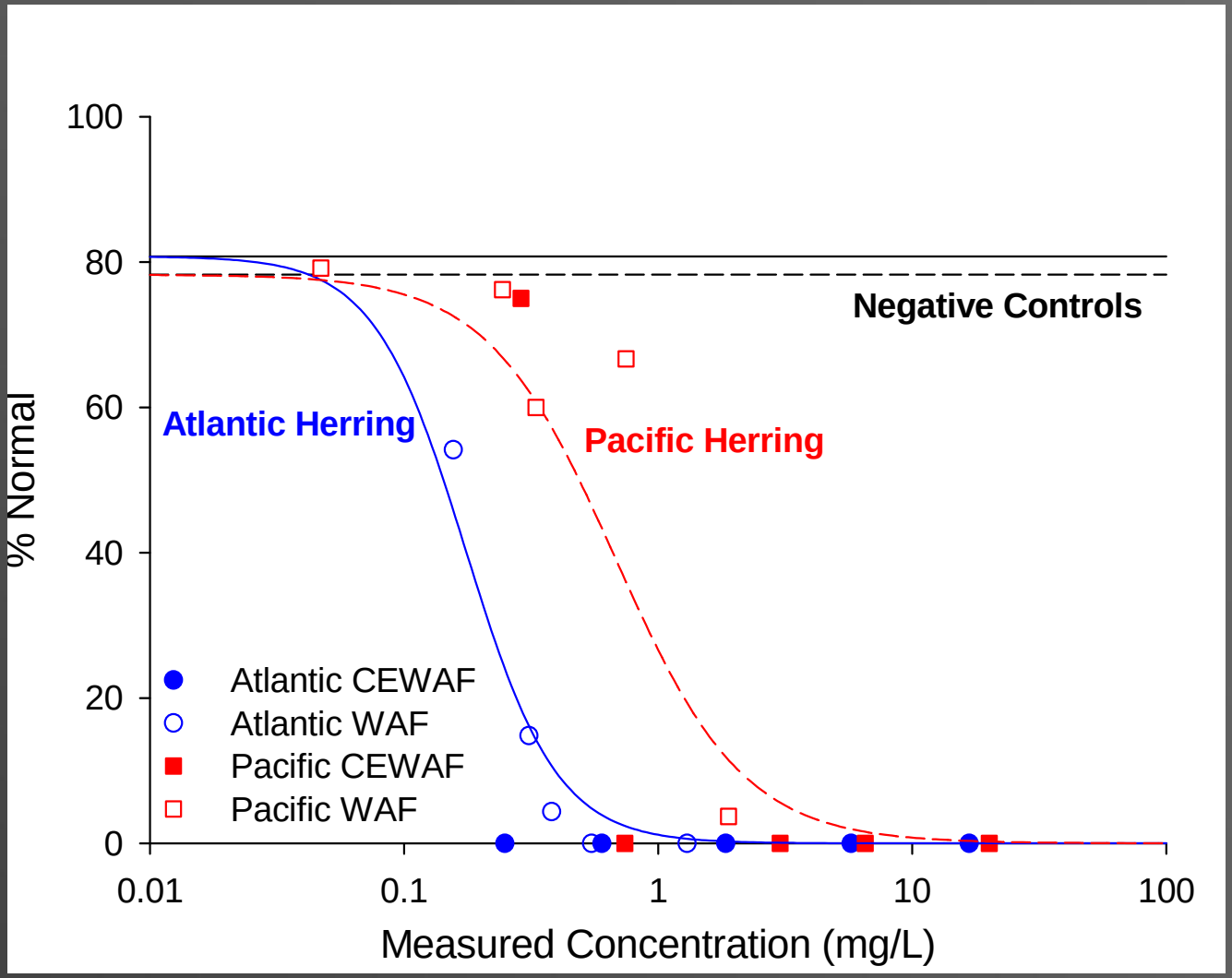
Methods

Methods

- Crude Oils: Medium South American (MESA), Alaska North Slope (ANSC), Arabian Light (ALC)
- Dispersant: Corexit 9500A
- Wave Tank
- Exposure - Time Response
- Controls
- Chemical Analysis
- Responses


Normal
1mm
24h Exposure to
2.7 mg/L ALC
CEWAF

1. Are data interchangeable between species of herring?



ANSC

- Exposed from fertilization to hatch (Atlantic = 14d; Pacific = 21 d)
- Daily static renewal of test solutions
- Scored for pathologies upon hatch

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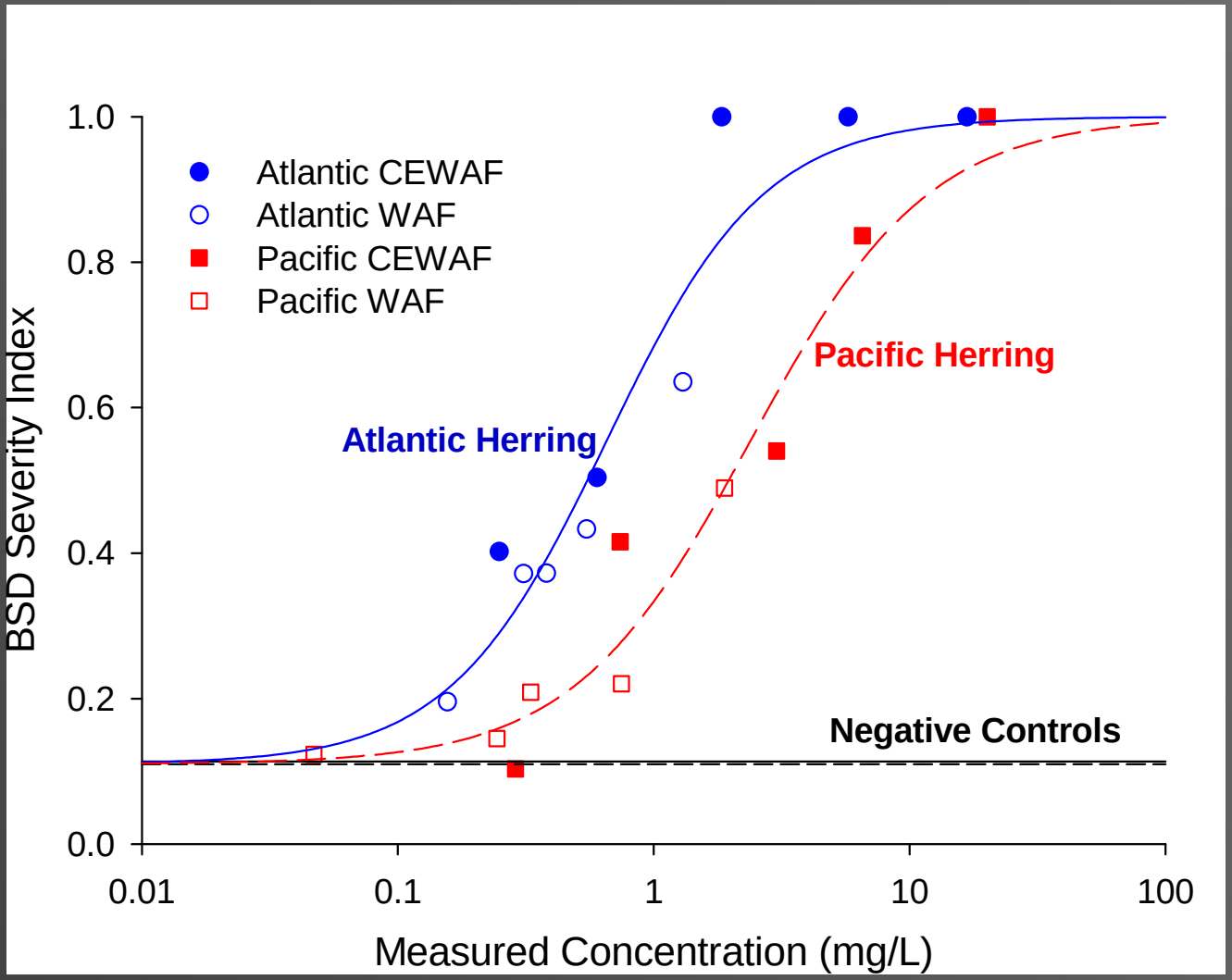

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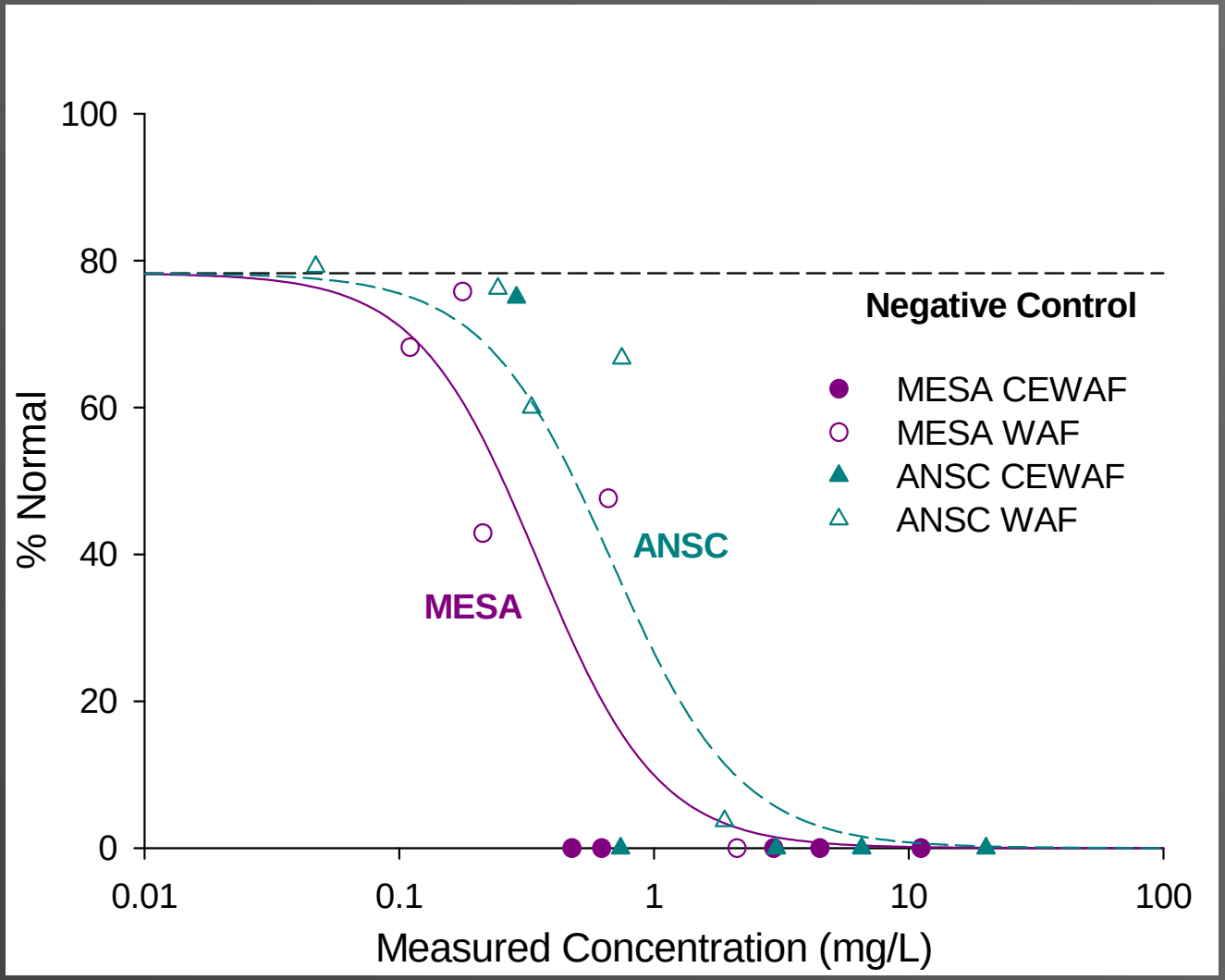

Pacific herring

- Exposed from fertilization to hatch (21 d)
- Daily static renewal of test solutions
- Scored for pathologies upon hatch

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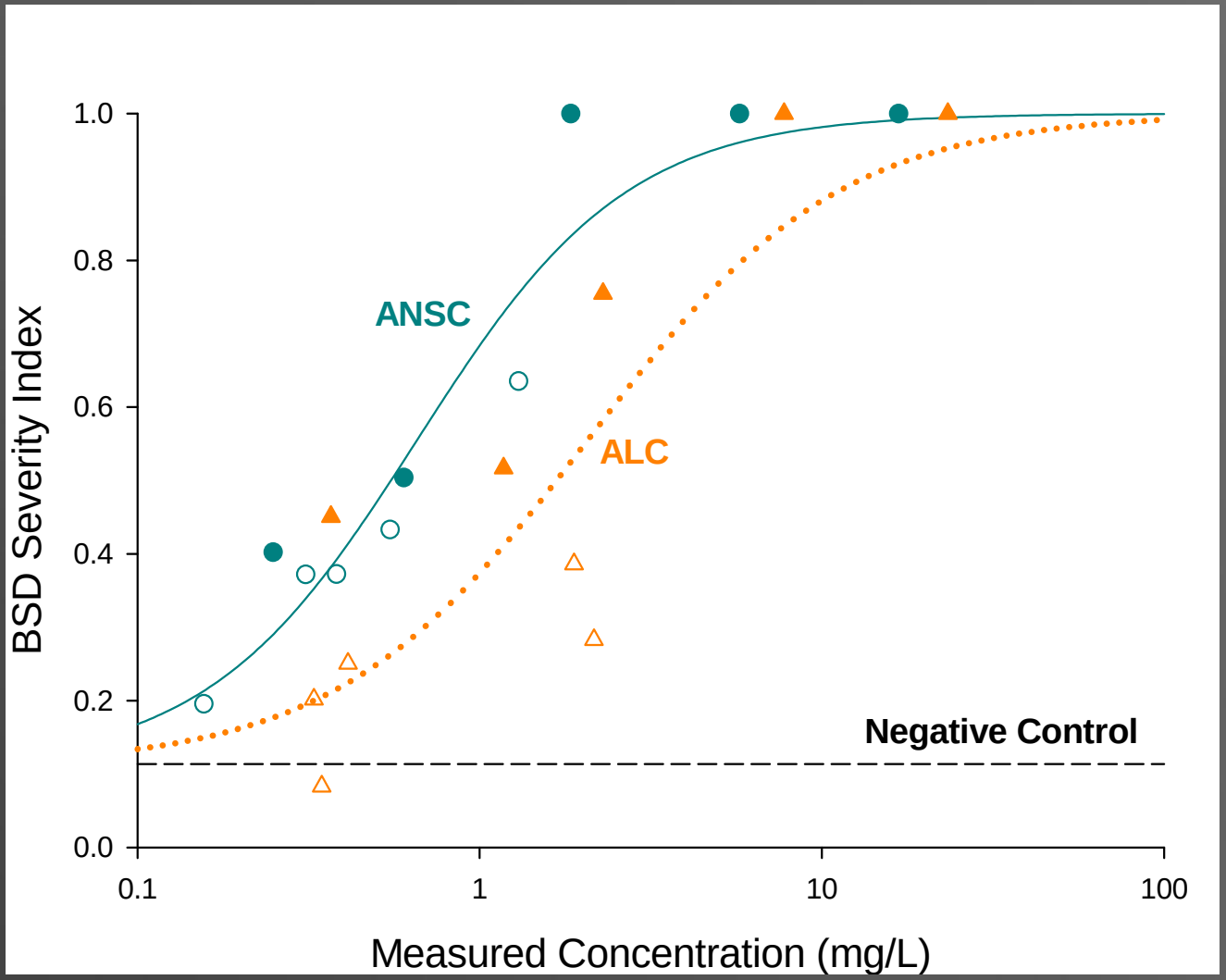

Atlantic herring

- Exposed from fertilization to hatch (14 d)
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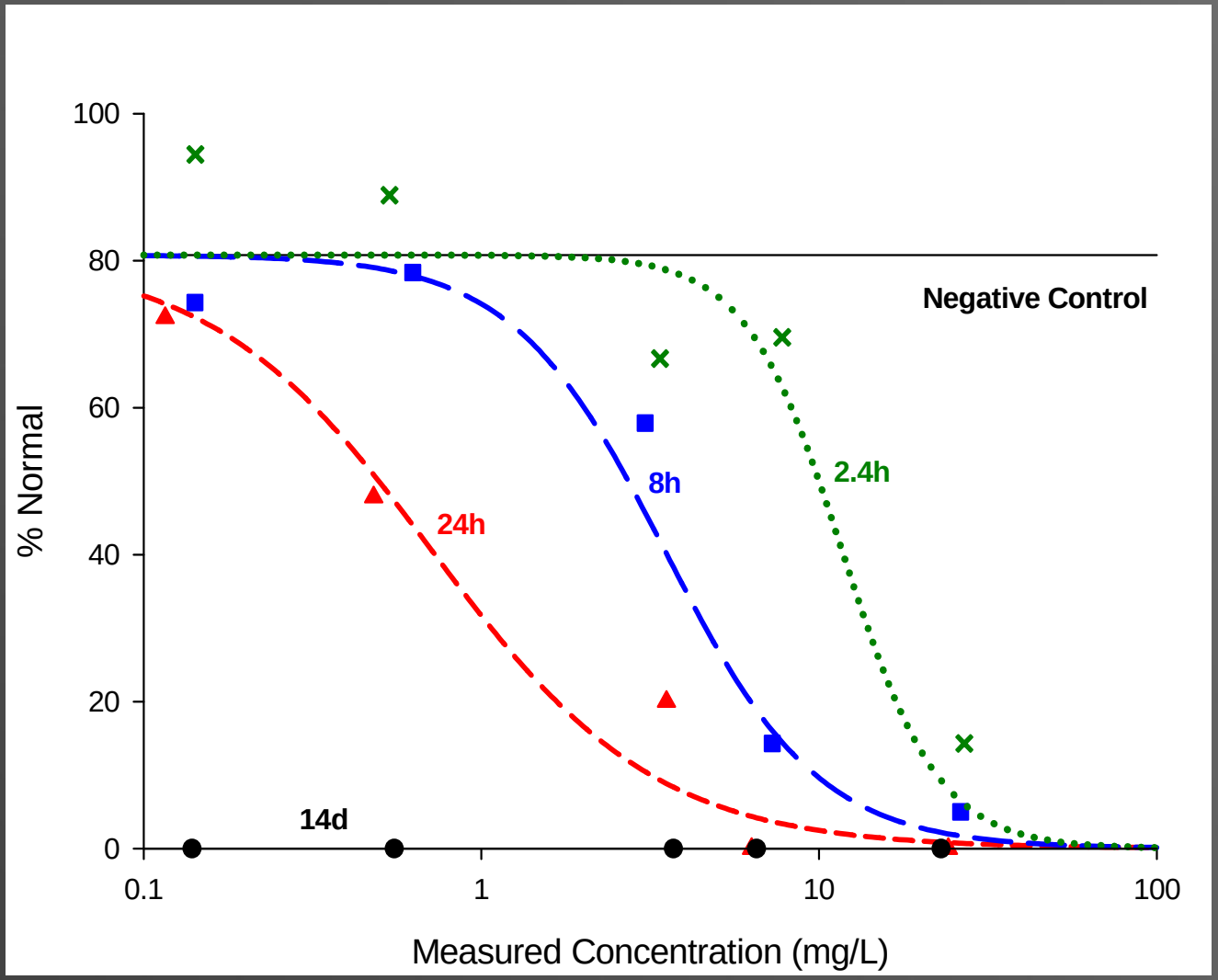
3. Can toxicity occur within briefs periods of an oil spill?



ANSC

- Exposed immediately after fertilization for 2.4 h – 14 d
- Transferred to clean water after exposure
- Scored for pathologies upon hatch

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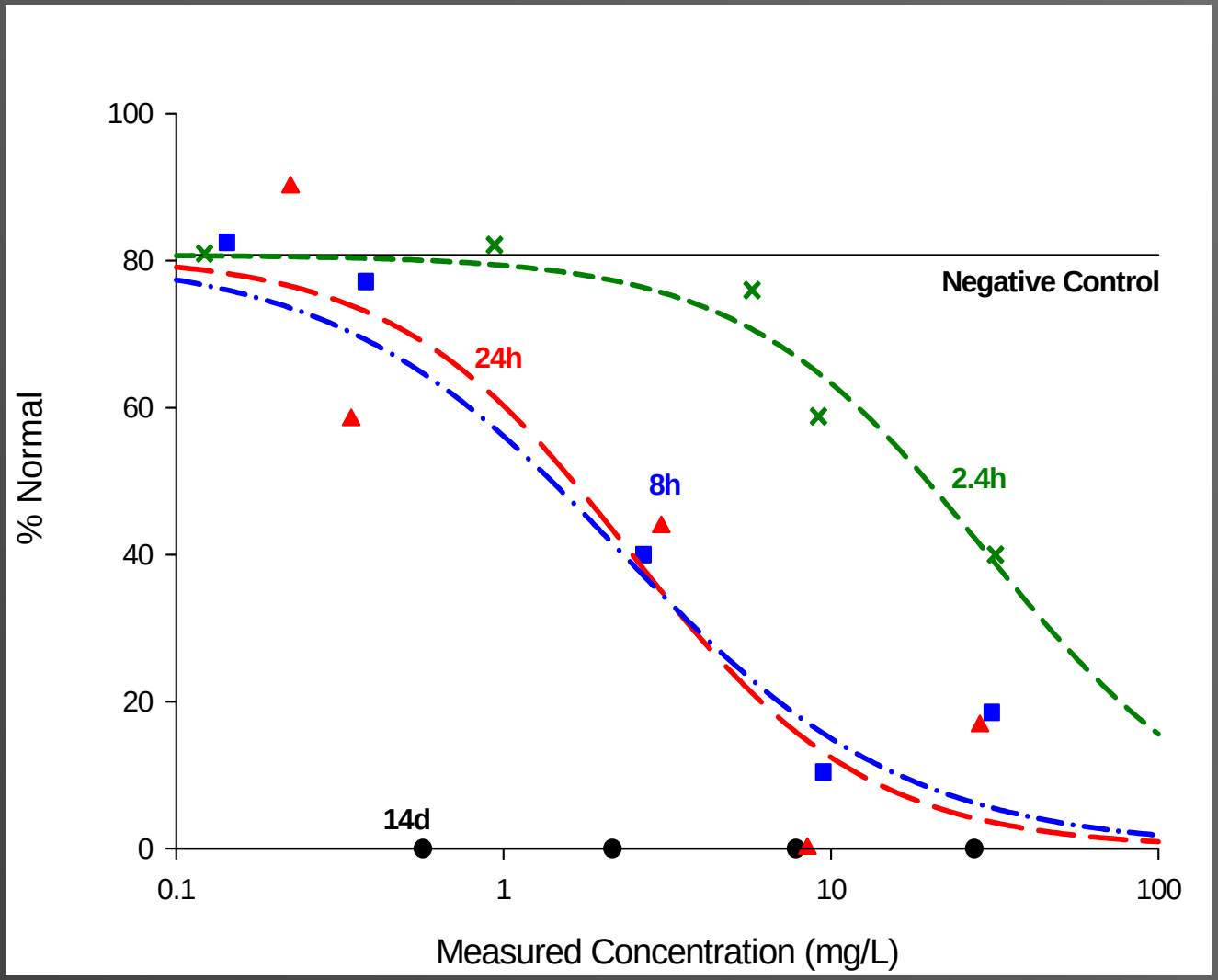

ALC

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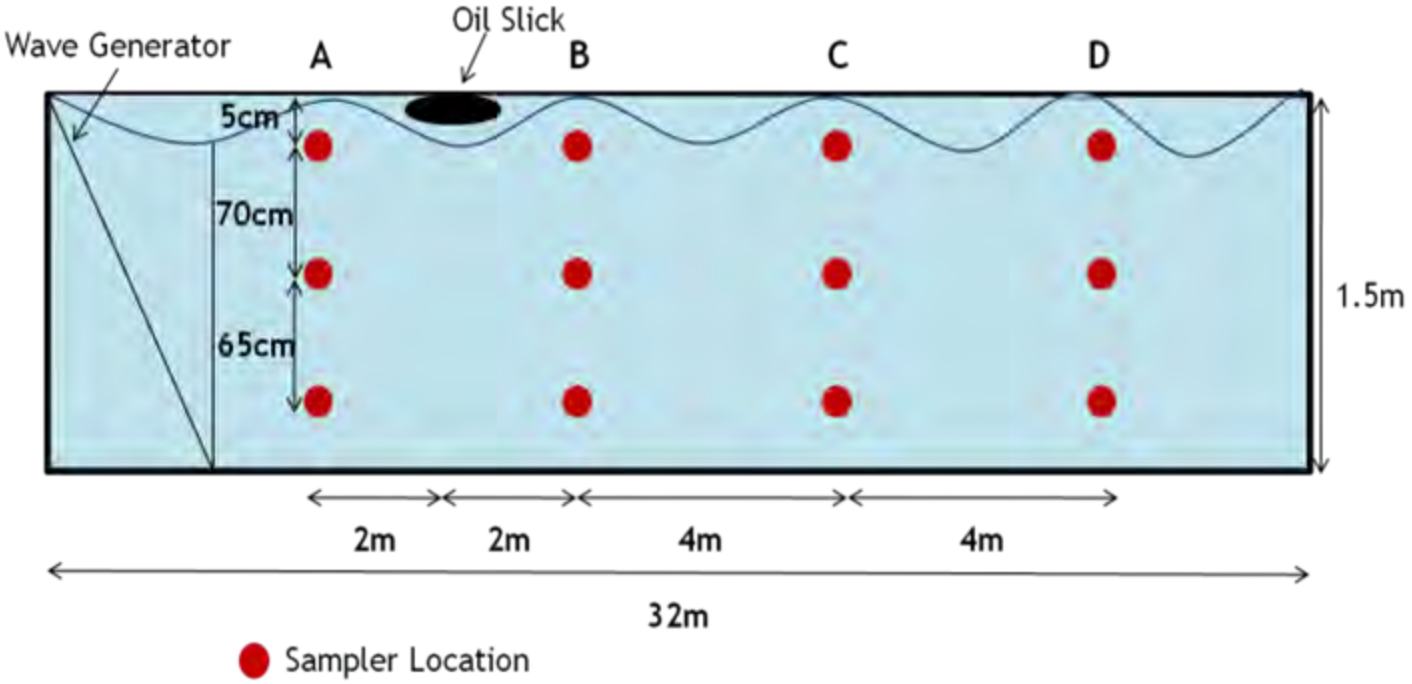
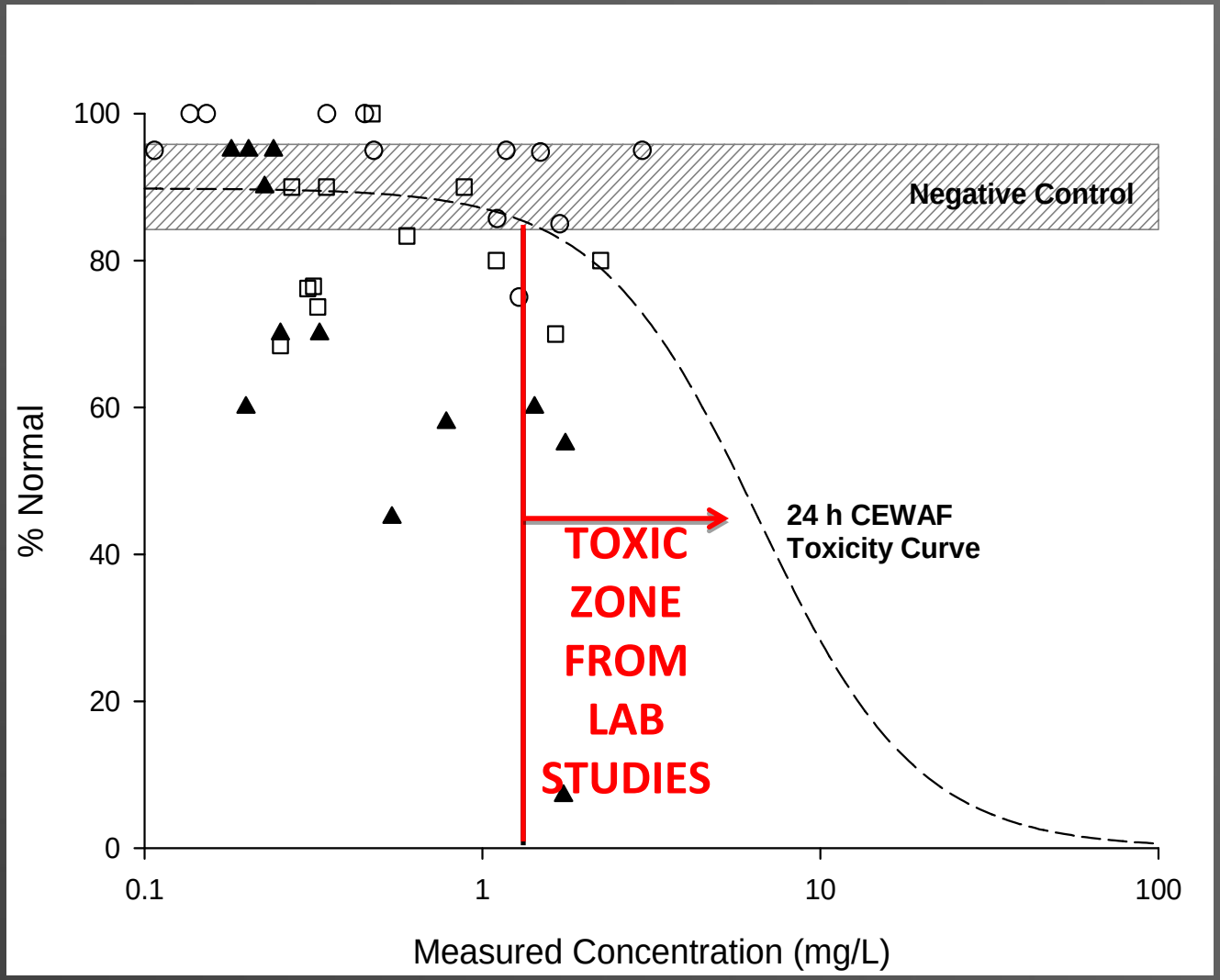


- Oil dispersed in wave tank to simulate natural conditions
- Drew samples over time and space
- Compared oil concentrations to 24 h toxicity

4. Are standard lab preparations of dispersed oil suitable for judging oil exposure and toxicity under more "natural" conditions?



ANSC

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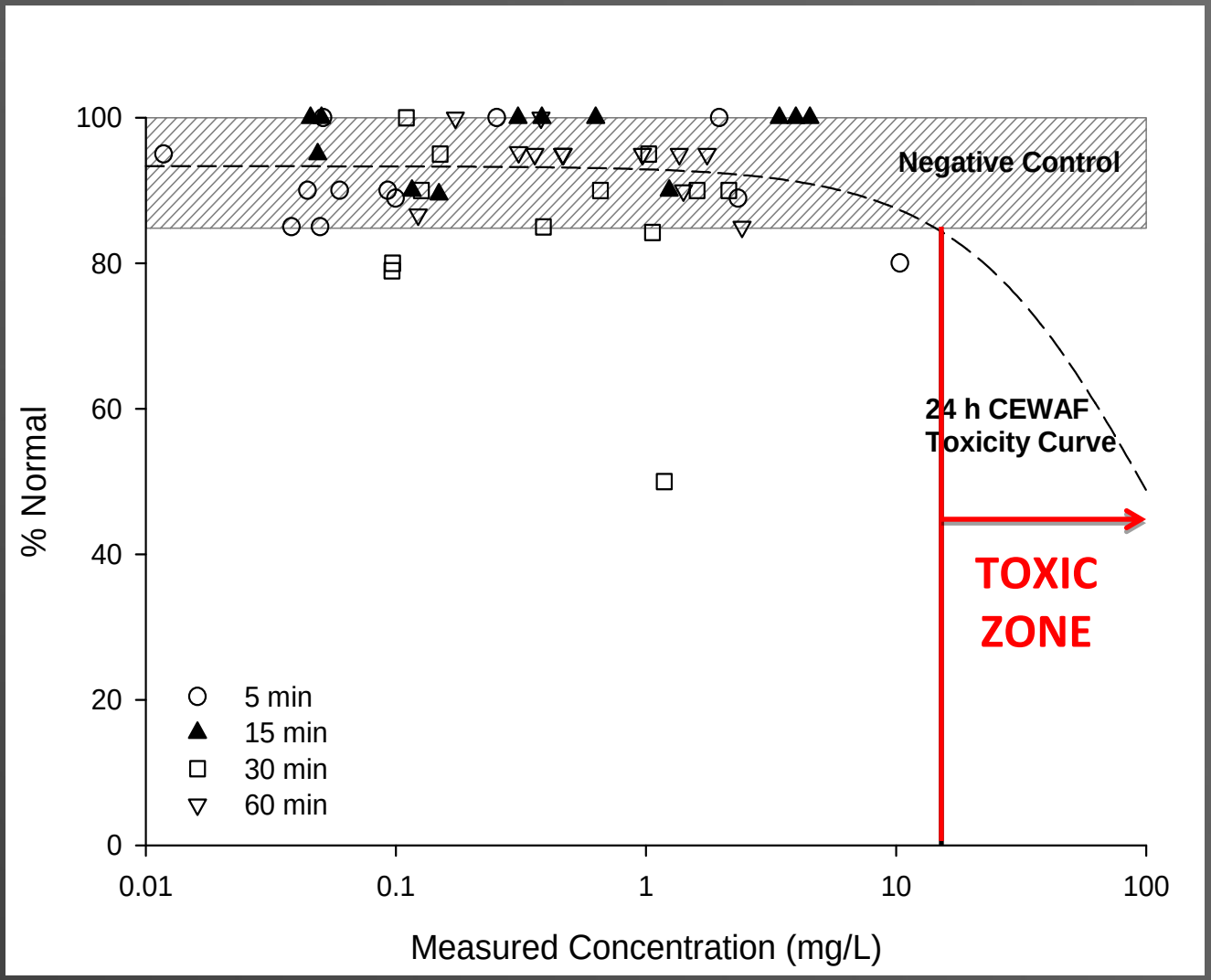

ALC

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Summary

1. Chemical dispersion (CEWAF) increases the concentration of fluorescing hydrocarbons in water relative to WAF
2. The difference in sensitivity to oil between Atlantic and Pacific herring was sufficiently small that data can be interchanged between the two species
3. Oil toxicity to herring embryos reflects the chemical composition (concentrations of PAH?)
4. Toxicity was observed following exposure times typical of an oil spill (<24 h)
5. Methods of preparing dispersed oil in the laboratory appear suitable for estimating toxicity in the field

Thank You!!

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