Shell Exploration & Production

Effects of Dispersed Oil with Emphasis on Cold Water Environment of Beaufort and Chukchi Seas

a workshop summary

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Acknowledgements

- The workshop “Effects of Dispersed Oil with Emphasis on Cold Water Environment of Beaufort and Chukchi Seas“ took place in Anchorage, Alaska on 26-27 of March 2008

- It was organized and moderated by Jack Q. Word of NewFields Northwest

- API and Shell provided financial support for the workshop

Workshop Objectives

- Bring stakeholders together ✓
- Review available literature on the effects of dispersed oil on Arctic marine ecosystem with emphasis on Beaufort and Chukchi Seas ✓
- Identify knowledge gaps ✓
- Design research work that would address these gaps ✓
- Form Joint Industry Project to finance this research — Ongoing
- Implement project and disseminate results — 2008-2009

Workshop participants

- USCG,
- NOAA,
- MMS,
- North Slope Borough,
- ADEC,
- University of Alaska Fairbanks,
- ExxonMobil,
- Shell,
- BP,
- Chevron,
- PWSRCAC,
- CIRCAC
- COOGER,
- AKVAPLAN-NIVA,
- SINTEF,
- OSRI,
- Alaska Clean Seas.

Workshop focus areas

- Beaufort and Chukchi Sea
- Ice-free season
- Salinity of 28-34‰
- Temperatures of 1-10ºC
- Upper 10 m of water column
- Water depths >30 m
- Beyond shelf break (>30 km offshore)
- The above parameters were selected to narrow down the range of test species and are not related to dispersant application parameters

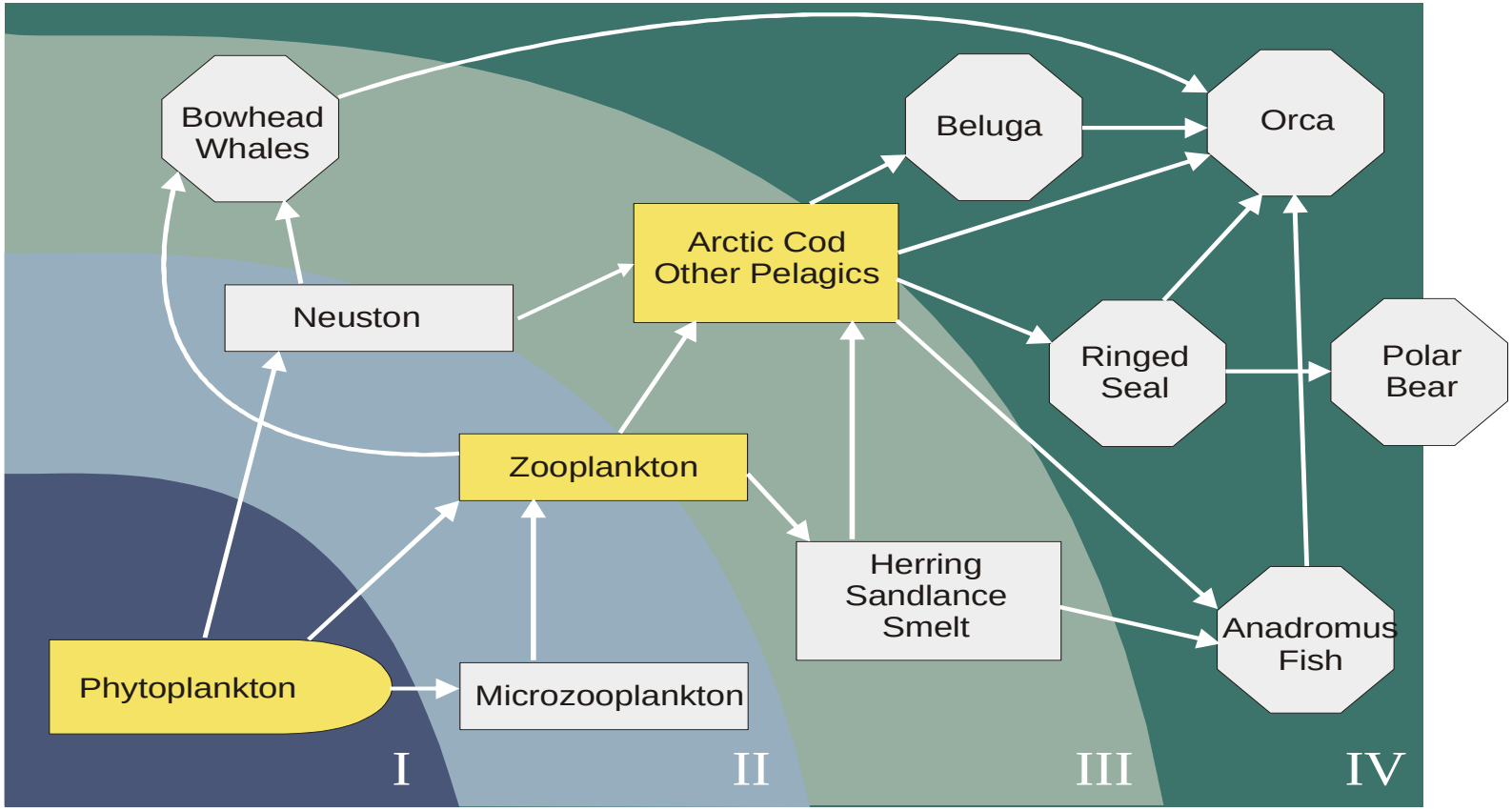
Why more research is needed

- Arctic marine environment is different from the more temperate regions in a number of ways
  - Lower solubility of hydrocarbons at low temperatures
  - Slower uptake by organisms
  - Sensitivity of arctic species
  - Shorter food chain
  - Biodegradation rates
- Toxic effects as well as the effect of mechanical smothering should be evaluated
  - Toxicity tests
  - Tests of dispersed/undispersed oil stickiness/fouling with baleen and skin of marine mammals
- Baseline data are needed

Topics discussed at the workshop

- Circulation patterns in the Beaufort and Chukchi Seas;
- Trophic food web structure;
- Earlier relevant toxicity tests;
- Fate and behavior of dispersed oil in the environment;
- Test parameters for appropriate evaluation of the effects of dispersed oil;
- Biodegradation of dispersed and undispersed petroleum;
- Type of information required to improve our understanding of the effects of dispersed oil.

Beaufort and Chukchi Seas food web



Recommended research parameters

Test Parameters	Conditions
Test Species	Arctic cod; Calanus glacialis
Temperature	4 to 5°C
Salinity	28 to 32 ppt
Exposure Regime	Initial spiked then declining over time as per CROSERF recommendation
Open or closed test chamber	Open as per NRC 2005
Light	Natural rather than UV (UV can be added as a special adjunct)
Duration	4 days and also longer 7 to 10 days
Oil Weathering	Fresh
Oil to dispersant ratio	20 to 1
Oil to water ratio	1 to 200
Mixing energy and time	20 to 25% vortex for 18 hours, followed by settling for 6 hours per Clark et al 2001
Test concentration	Serial dilution per Barron 2003
Analytical chemistry	Broad suite including VOA, and THC (GC/MS)
Droplet size	Target <20 microns (measure)

Recommended research parameters

Test Parameters	Conditions
Life stage	Most appropriate for marine water column evaluation
Feeding	Follow ASTM protocols
Endpoint	Lethal and sublethal effects at 4 days and up to 10 days. Calanus reproduction can be evaluated over a 10 to 14 day exposure
Bioaccumulation	Broad suite including VOA, and THC (GC/MS); consider metabolite measurements and triglycerides
Bioremediation and Biodegradation	Ensure use of indigenous arctic populations
Petroleum Fouling	Needs assessment for toxicity test as well as potential for sticking to marine mammal skin and baleen
Food Web Contamination	Determine baseline contaminant and triglyceride levels for marine wildlife – develop food web model concepts for ERA
Behavioral observations in test chambers and the environment	Need to be made relative to response to dispersed or undispersed petroleum

Conclusions

- The workshop goals were achieved
- Knowledge gaps and ways to close them were identified
- Test protocol was developed
- Joint Industry Project will be formed to implement workshop recommendations
- The project will be conducted in collaboration with University of Alaska Fairbanks, local stakeholders and international researchers

Deliverables

- Literature review (111 pages)
- Searchable literature database
- Workshop presentations
- Workshop proceeding

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