

Assessing Hydrocarbon Sensitivity and Establishing Current CYP1A Baselines in Arctic Marine Birds and Waterfowl

Ann E. Riddle^{1,2}, Tuula E. Hollmén^{1,2}, Robert Suydam³, Robert Sarren³, Raphaela Stimmelmayer³

¹School of Fisheries and Ocean Sciences, University of Alaska Fairbanks, Fairbanks, AK.

²Alaska SeaLife Center, Seward, AK.

³Department of Wildlife Management, North Slope Borough, Barrow, AK.

aeriddleberntsen@alaska.edu



Objective

Measure current P450 activity and assess sensitivity of selected Arctic birds to hydrocarbon exposure

Introduction

Potential increases in development of oil and gas resources and commercial shipping in the Chukchi and Beaufort Seas and adjacent lands in northern Alaska.

Current exposure baselines and potential sensitivity to hydrocarbons have not been determined for marine birds and waterfowl in the Arctic.

Cytochrome P450 (CYP1A) enzyme induction is widely used as a biomarker of hydrocarbon exposure from oil and is measured using liver 7-ethoxyresorufin-*O*-deethylase (EROD) enzyme activity.

Establishing Baseline P450 Activity and Validating Field Techniques

Methods:

- Collect bird livers during spring and autumn near Barrow by direct take or opportunistically from hunters
- Target three species: common and king eider, and greater white-fronted goose
- Freeze liver samples at several time points post mortem: 10mins-24hrs
- Measure liver EROD enzyme activity using a fluorescent microplate reader
- Determine post mortem enzyme activity degradation rate to refine liver sample collection protocol

Current Progress:

- Liver sample collections completed: common eider (n=11), king eider (n=22), greater white fronted goose (n=42)
- On gross examination sampled birds were apparently healthy
- Preliminary results show enzyme activity throughout post mortem time series samples, including samples frozen 24hrs after death
- Data analysis and laboratory work to be finished in 2016



King eider (*Somateria spectabilis*), common eider (*Somateria mollissima*), spectacled eider (*Somateria fischeri*), Steller's eider (*Polysticta stelleri*), long-tailed duck (*Clangula hyemalis*), greater white-fronted goose (*Anser albifrons*), black brant (*Branta bernicla*), common murre (*Uria aalge*), tufted puffin (*Fratercula cirrhata*), horned puffin (*Fratercula corniculata*), mallard (*Anas platyrhynchos*)

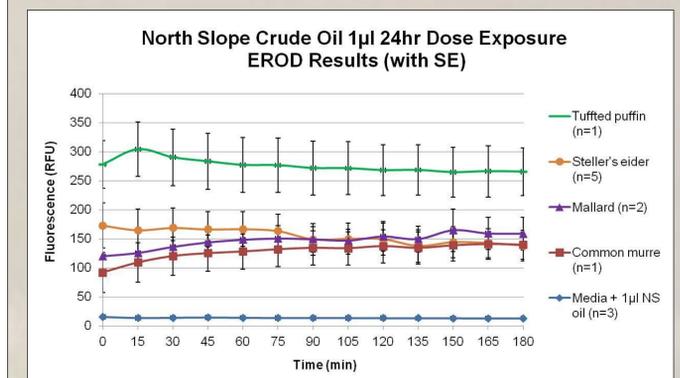
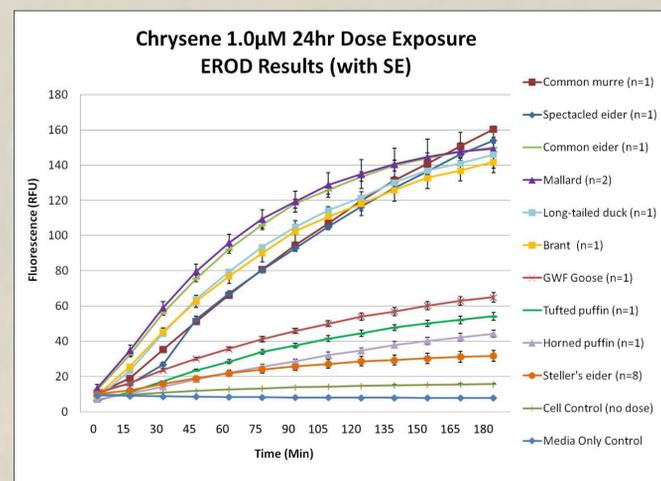
Assessing Hydrocarbon Sensitivity

Methods:

- Use species-specific embryonic liver cell culture
- Broad selection of marine birds: Steller's, spectacled, common and king eiders, long-tailed duck, black brant, greater white-fronted goose, common murre, tufted puffin, horned puffin, and control species mallard
- Dose cells with positive control reagents representing hydrocarbons in crude oil (e.g. chrysene) and Alaska North Slope Crude Oil (NS oil)
- Measure liver EROD activity using a fluorescent microplate reader after 12-72 hr dose exposure
- Monitor cells for cytopathic effects using light microscopy

Current Progress:

- Measured EROD baseline response with 24hr exposure to 1.0µM chrysene
- Measured EROD response with 24hr exposure to NS oil
- Preliminary results indicate differences in species responses to single hydrocarbons and crude oil.
- Data analysis to be finished in 2016.



Once complete, cell culture sensitivity and liver baseline P450 results from this project will provide valuable methods for monitoring Arctic bird populations and information for future Natural Resources Damage Assessment in the event of an oil spill

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