

The impacts of oil sand operations on the development, survival and reproductive capabilities of Fathead Minnows (*Pimephales promelas*) in Alberta, Canada

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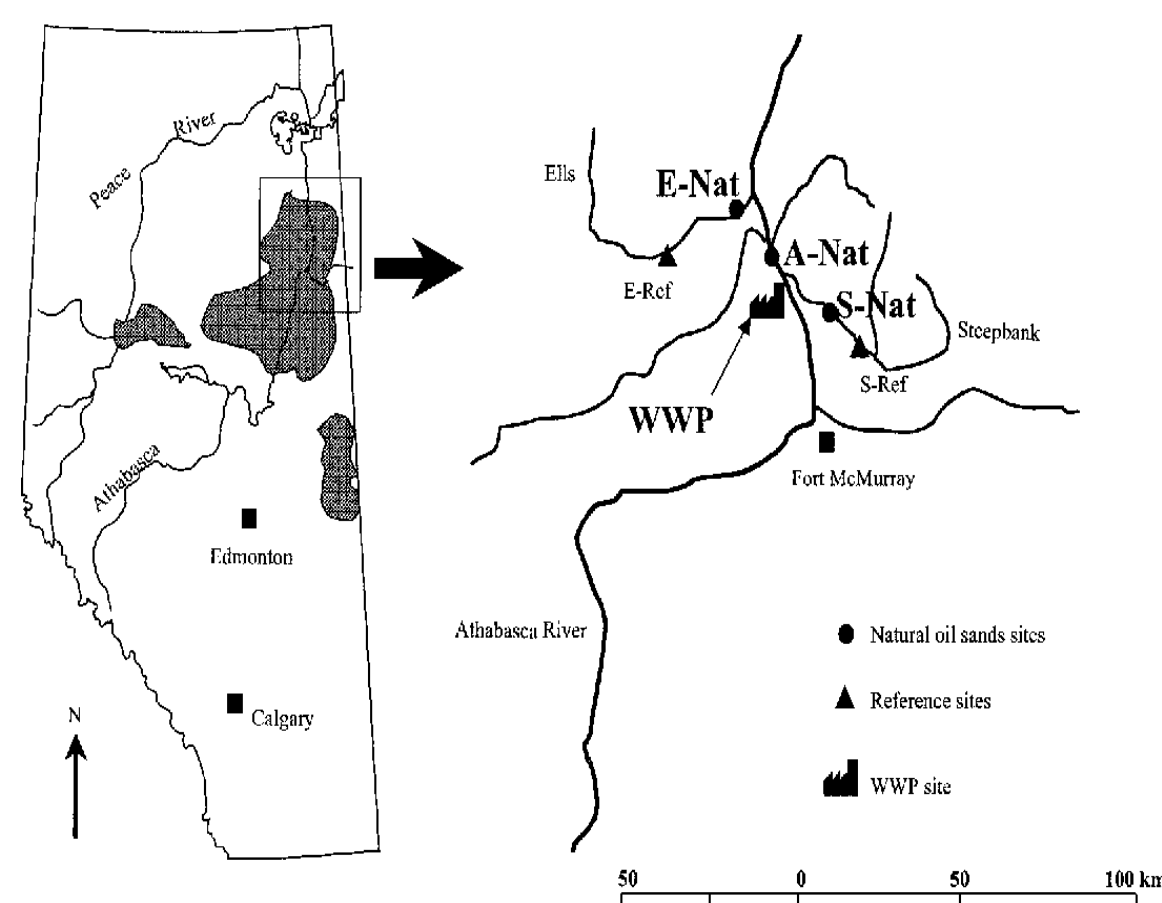


Abstract

- Purpose is to determine impacts of oil sands on development, survival and reproductive capabilities of Fathead Minnows
- Minnows are abundant and native to the oil sands region of Alberta
- Findings:
 1. Naphthenic acid fraction components (found in the wastewater) increases mortality of Minnow embryos or increases developmental abnormalities at hatch
 2. Wastewater increases hematocrit levels (ratio of red blood cells), decreases leucocrit levels (ratio of white blood cells) and circulates lymphocytes in Minnows
 3. Naphthenic acid also impairs reproductive physiology of Minnows
- Future involves establishing cause/pathway of toxicity, critical developmental periods, and implementing recuperation methodologies

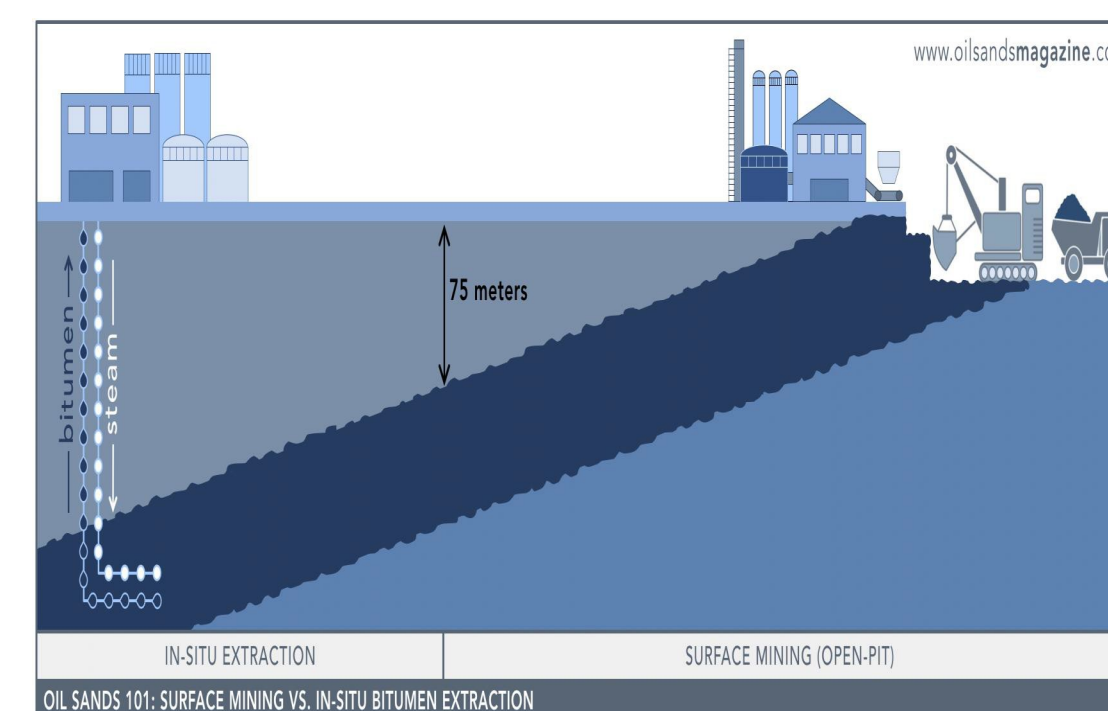
Introduction

- Oil sands possess collections of sand, clay, water, covered by a thick petroleum layer (i.e. bitumen)
- Bitumen is extracted through mining or by thermal heating, and is used for fuel
- Fathead Minnows are freshwater fish found in temperate regions of North America
- Minnows are tolerant of turbid waters with low-oxygen levels, making good indicator species
- Goal is to determine how bitumen affects development, survival and reproductive capabilities of fathead minnows



Methodology

1. Searched Web of Science for 10 papers published in past 20 years (1998-2018) using the key search terms: Fathead Minnows, oil sands, development, survival, reproduction
2. Gathered key information on impacts of oil sands on Fathead Minnow development, survival and reproduction
3. Scanned for similarities between papers to find a consensus
4. Recorded findings and offered potential future actions



Results

Effects on Fathead Minnow Reproduction:

- Lead to embryonic death or increased developmental irregularities at hatch

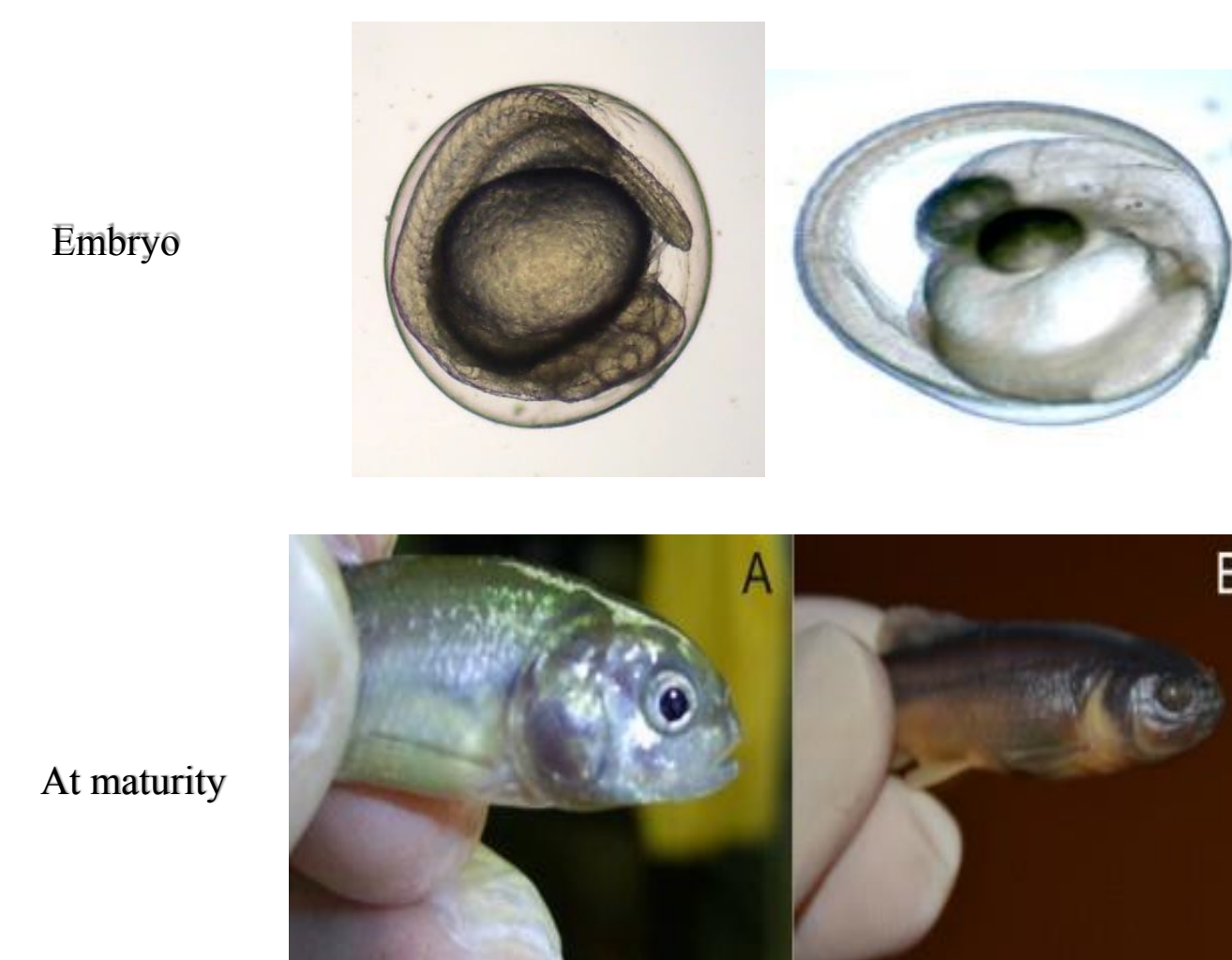
Effects on Fathead Minnow Survival:

- In control site Minnows lived up to 28 days and hematocrit levels, leucocrit levels, and gill morphologies were equivalent to those seen after only 96 hours of exposure to wastewaters

Effects on Fathead Minnow Reproductive Physiology:

- Destructively alters reproductive physiology of fathead minnows

Before vs. After Exposure



Conclusion

- Naphthenic acid (found in bitumen) cause embryonic death or intensify developmental irregularities at hatch.
- Wastewater decrease Minnow survival by increasing hematocrit levels, decreasing leucocrit levels and circulating lymphocytes in blood
- Accumulating naphthenic acid impairs reproductive physiology of fathead minnows
- Need to establish cause/pathway of toxicity, critical developmental periods, and begin implementing recuperation methodologies to reach water quality circumstances that are optimal for fish success.



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