Electronic Supplementary Material (ESI) for Journal of Environmental Monitoring

Supporting information

Fish biology

Yellow walleye (*Sander vitreus*) is a warm water fish found in lakes and rivers throughout much of central Canada and the United States; its range extends along the Mackenzie River basin to the Mackenzie delta. As an adult it is a piscivore. It reaches lengths of 750 mm and generally lives for 8-12 years although in northern Canada where growth rates are slower, fish can live 20 years or more. [1] The Regional Aquatic Monitoring Program (RAMP) for the areas upstream and downstream of the oil sands developments has a walleye tagging program as part of its fish inventory studies. This program has found that some walleye remain resident in an area whereas others may migrate substantial distances to the Athabasca delta. [2]

Northern pike (*Esox lucius*) has a slightly larger range distribution than walleye and also is piscivorous. It prefers slow flowing and weedy waters [1]. It can attain lengths > 1,000 mm, lives for ca. 10-12 years in much of its range although in northern Canada they can live 25 years or more. Pike, in large measure, remain resident in areas where they have been captured from Athabasca River.[3]

Lake trout (*Salvelinus namaycush*) is a cold water stenotherm found only in lakes that retain a well-oxygenated hypolimnion in summer; these lakes tend to be deep.[1]. The lake trout's geographic range is similar to that of northern pike. Lake trout are facultative piscivores, preying on fish when they are present but consuming invertebrates if lakes lack such prey. Lake trout attain lengths of >1000 mm and reach sexual maturity at age 6 or 7 in the southern part of their range but not until 13 years or more in northern Canada. In northern Canada, lake trout, walleye and northern pike generally reach an average mercury concentration of 0.5 µg/g once they reach ca. 10-12 years. [4]

Lake whitefish (*Coregonus clupeaformis*) have a similar range as northern pike and are found in lakes and rivers and at a broad range of depths. [1] They reach lengths of >600 mm and live to ca. 10 years in the southern part of their range but in northern Canada can attain ages of 20 years and more. They are bottom feeders consuming aquatic insects, mollusks and amphipods but may also consume zooplankton, and, on occasion small fish. Mercury concentrations are low in whitefish because they feed at a lower trophic level than piscivorous fish such as walleye, lake trout and northern pike.

Suncor wastewater release rate

Suncor's wastewater stream historically consisted of water from two coke settling ponds, wastewater from the upgraders, industrial runoff, runoff from the flue gas desuphurisation pond and from the ash pond; the ash pond source was recently eliminated.[5] Suncor's wastewater release rate has declined from 0.028-0.037 km3/y over the late 1990s to 0.003-0.007 km3/y over 2009-2011 (Fig. S1).

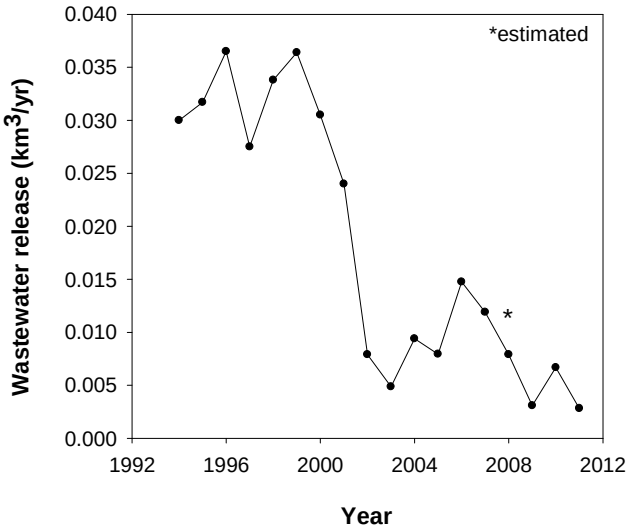

Fig S1. Wastewater release rate from Suncor, 1993-2011. The rate for 2008 is estimated by extrapolation from a figure.

References

1. W. B. Scott and E. J. Crossman, *Freshwater Fishes of Canada. Bulletin 184*, Ottawa, ON, 1973.
2. Regional Aquatics Monitoring Program, *2009 Technical Report*, 2010.
3. Regional Aquatics Monitoring Program, *2010 Technical Report*, 2011.
4. M. S. Evans, W. L. Lockhart, L. Doetzel, G. Low, D. Muir, K. Kidd, G. Stephens and J. Delaronde, *Science of the Total Environment*, 2005, **351-352**, 479-500.
5. R. Hazelwinkel, *Alberta Environment*, Personal communication.