

Atlantic salmon and sturgeon wastewater impacts investigation

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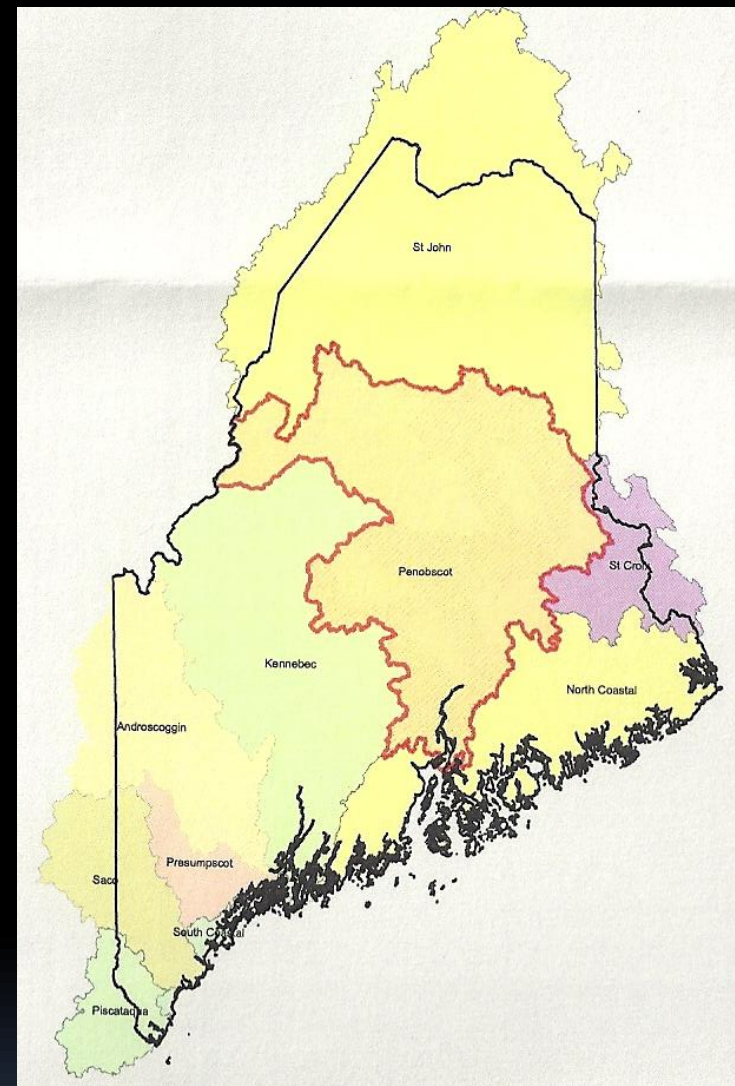
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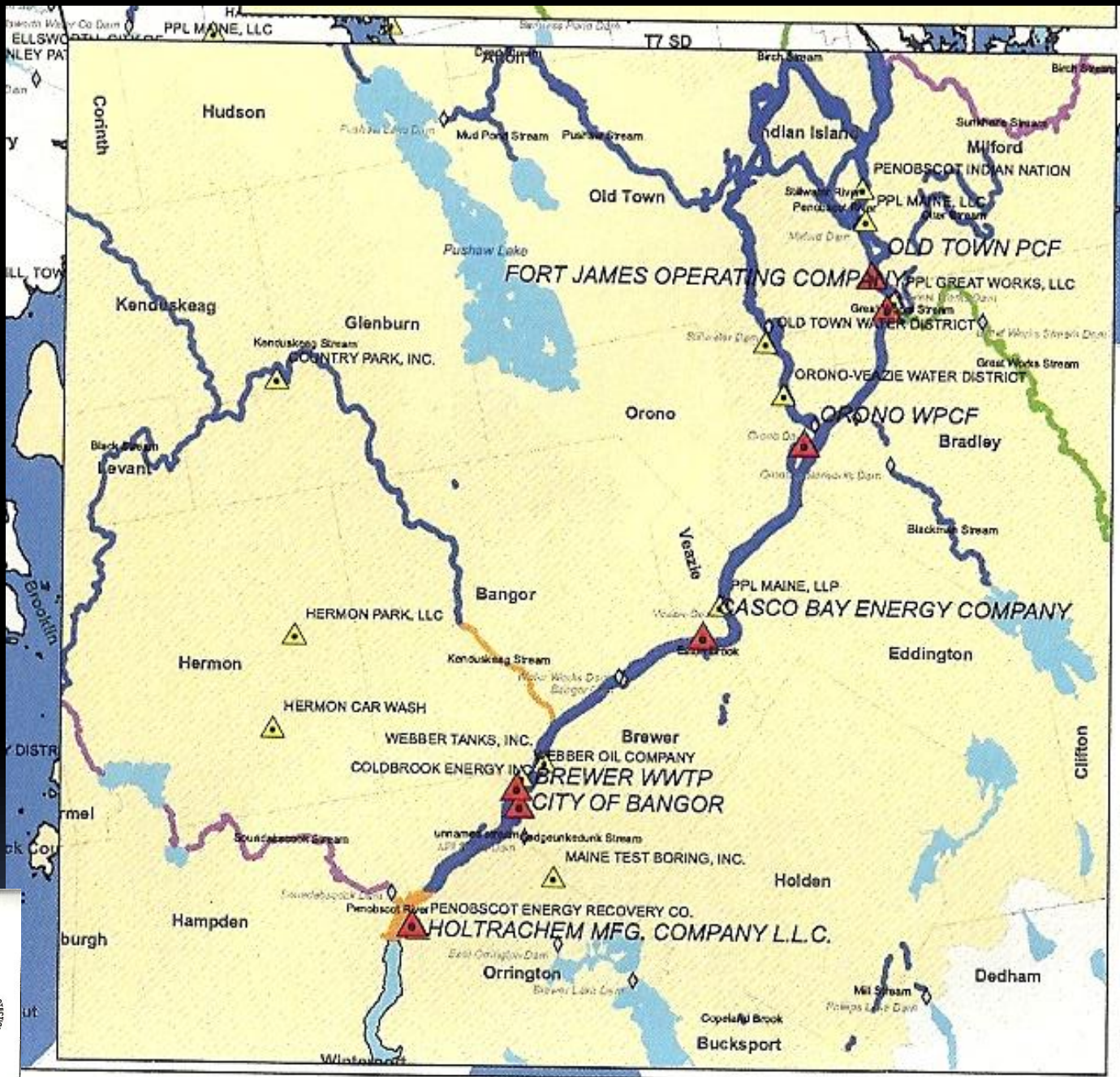
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Funded by NOAA Fisheries

Federally endangered
Atlantic salmon and
shortnose sturgeon are two
species that use portions of
river systems in Maine
where pollutant discharges
occur.





Legend

- Major Wastewater Facilities
- Minor Wastewater Facilities
- Dams of Interest
- Rivers Class AA
- Rivers Class A
- Rivers Class B
- Rivers Class C
- GOM DPS Atlantic Salmon Critical Habitat

DEPARTMENT OF ENVIRONMENTAL PROTECTION

 STATE OF MAINE

Map prepared by Lisa Hirsch

 Maine DEP

 Division of Water Quality

 December 2010

- Atlantic salmon pass through and are only exposed to pollutant discharge for a short time period (a few days); they are considered to be less at risk of detrimental effects from pollutant exposure.

- However, data suggest that Atl. & shortnose sturgeon are particularly sensitive to contaminants (Dwyer et al. 2000; Dwyer et al. 2005a). Sensitivity is magnified by habitat use and life strategies of the two sturgeon species:

- long-lived,
- late maturing,
- benthic feeders that spawn, mature, and feed in large river systems,
- many of which suffer from degraded water quality (ASSRT 2007).


MEPDES Permit Requirements

- Water Quality Monitoring
- WET Testing (Whole Effluent Toxicity)
 - To characterize and measure the aggregate toxicity of an effluent or ambient waters
 - WET testing tests surrogate species (fathead minnow, brook trout and rainbow trout) to determine impact.



NMFS water quality concerns

WET testing does not sufficiently indicate whether take is occurring:

- WET testing does not answer questions about bioaccumulation/long-term impacts
 - In limited toxicology studies, it appears that SNS and ASN are among the most sensitive species that have been tested (Dwyer et al. 2000)
 - Dwyer et al. (2005) recommends testing the listed species itself, when available
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PROJECT PURPOSE

Further research is required to improve our understanding of how impaired water quality, and in particular wastewater discharge, may impact endangered Atlantic salmon, Atlantic sturgeon, and endangered shortnose sturgeon. Three primary objectives:

1. Provide information as to whether pollutants commonly discharged into U.S. rivers that contain Atlantic sturgeon, shortnose sturgeon, and Atlantic salmon, and identified by NMFS as biologically relevant (e.g. endocrine disruptors), can negatively affect the species, and if possible, at what concentrations and exposure durations this occurs.
2. Investigate the most vulnerable life stages of Atlantic and shortnose sturgeon.
3. Provide information as to whether test species commonly used for WET testing (e.g., fathead minnow (*Pimephales promelas*), brook trout (*Salvelinus fontinalis*), rainbow trout (*Oncorhynchus mykiss*)) are suitable surrogates for Atlantic sturgeon, shortnose sturgeon, and Atlantic salmon.

Contaminants of interest:

Endocrine disrupting compounds (EDCs) are common constituents of wastewater effluent (pointsources, mixed effluent or single compound toxicity).

1. 17β -Estradiol (E₂)

Five concentrations: 1 solvent control (0 ng/l), 1 high dose/positive control (1,000 ng/l), with 3 doses mimicking mild to highly urbanized portions of river (1 and 10 ng/l) and a concentration of E₂ seen in wastewater effluent (100 ng/l).

2. Ethinylestradiol (EE₂)

Five concentrations: 0, 0.1, 1, 10, 100 ng/l (EE₂ is often 10-50 times more potent than E₂, and smaller concentrations may elicit a larger response. Therefore, 100 ng/l should be a high enough concentration to elicit a positive response to EE₂).

3. Nonylphenol ethoxylates (NP)

Four concentrations: 1 solvent control (0 ug/l), 1 high dose/positive control (100 ug/l), and 2 environmentally relevant doses, characteristic of urbanized portions of U.S. rivers (1 and 10 ug/l). Choice of concentrations are based on previous exposures of Atlantic salmon to NP in USGS' Conte Physiology lab.

Year One Life Stages

- Test three EDCs for short-term, 4-day (96-hour) exposures at various concentrations on different life stages of Atlantic salmon and shortnose sturgeon:
 - embryos,
 - newly hatched yolk-sac larvae,
 - juveniles immediately following yolk-sac absorption
 - older juvenile stage (1+ years)

So that's 15 treatments (chemical conc.) on 4 life stages of two-three species. May only do salmon and SSN.



RESULTS

- Three Year Project (Sept 2010-Aug 2013):
 - Some initial results in late 2011?? Short term (96 hr) exposure results may be available.
 - Long term results in late 2012- 2013.
 - Final results in late 2013.
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