Hormone mimics and fish reproduction

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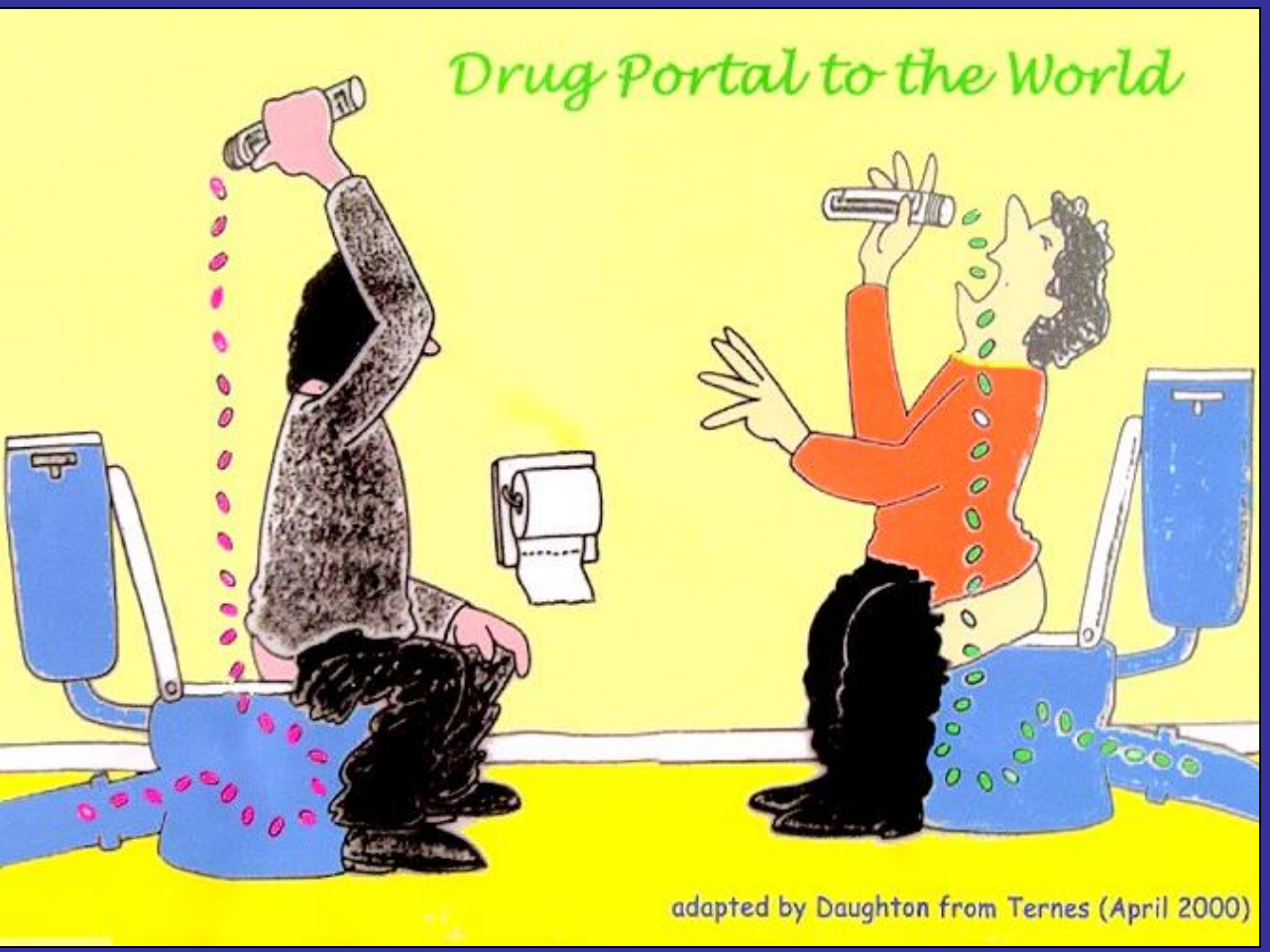
What am I going to talk about?

- Where do hormone mimics come from?
- What do they do to fish?
- How do or could they affect biodiversity?
- What ecosystems are at risk?
- What can be done?

Sewage: the Basics

- Largest single discharge to surface waters
- Problems associated with discharges include
  - Disease transmission
  - Decreases in water quality
  - Inputs of chemicals

Chemicals in Sewage



Pharmaceuticals

Fragrances

Cleaners

Detergents

Metals

Pesticides

What are we finding in surface waters?

Pharmaceuticals

- antidepressants, cholesterol regulators, antiepileptics, pain killers, chemotherapy agents, and hormones

Personal Care Products

- fragrances, sunscreen agents, antibacterials, surfactants

Others

- metals, pesticides, solvents, oil

Where Do the Chemicals Go?

- Some break down quickly in rivers
- Others persist in waters for days, months, years
- Some accumulate in fish (drugs, pesticides, metals)
- Some interfere with fish reproduction because mimic hormones

- Estrogens excreted naturally and from use of birth control pill
- Highest in effluents, diluted downstream
- Persist for days to weeks in water
- <u>But</u> constant discharge

Feminized male fish living downstream of municipal wastewaters

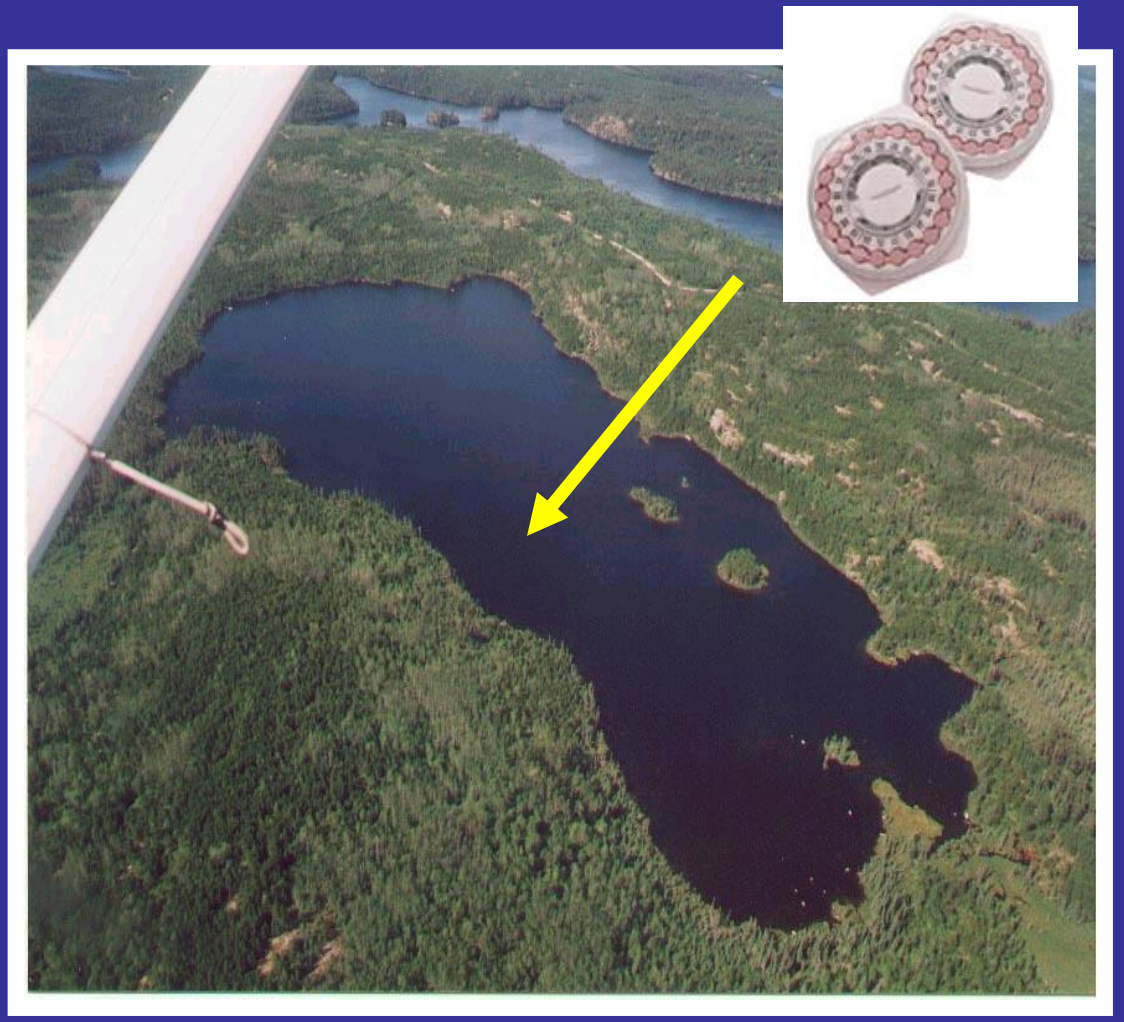
Photo courtesy of J. Parrott

- Male fish very sensitive to estrogens
- Low levels (parts per trillion) for short time (days to weeks) causes males to produce egg yolk
- Feminized males found in
  - St. Lawrence River near Montreal
  - Grand River, southern Ontario
  - South Saskatchewan River, Alberta

Is it a problem to have feminized males?

Added estrogen used in birth control pill to lake for 3 years

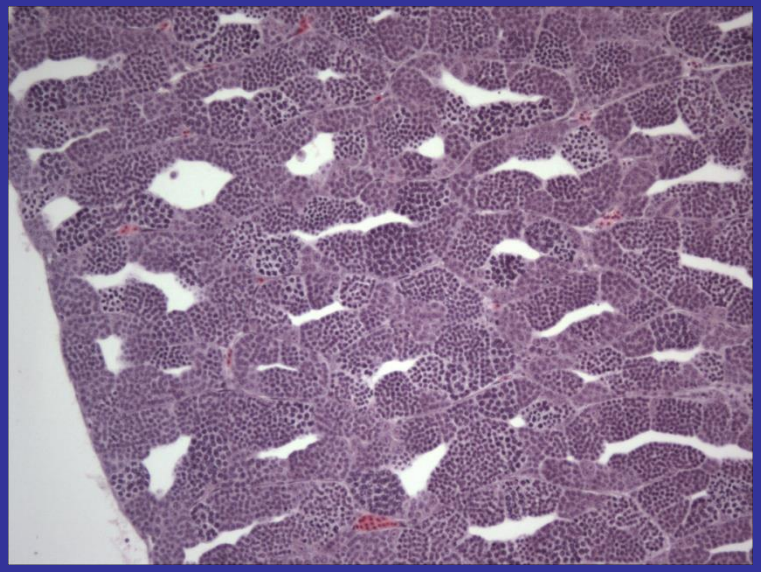
Monitored affects on fish health and numbers, as well as main food of fish



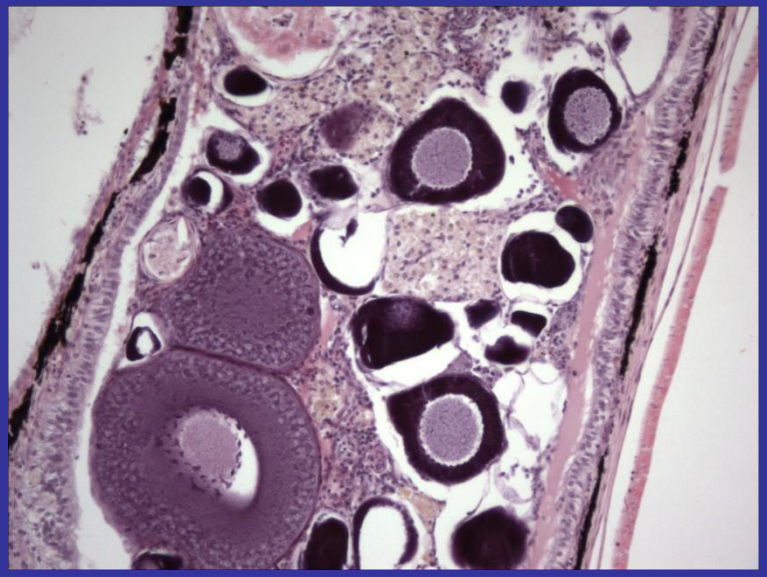
Research lake, Experimental Lakes Area Northwestern Ontario

What happened to the fish?

Cross section of normal testes



Cross section of testes from male exposed to estrogen



What else happened when we dosed the whole lake?

- No changes in algae or algae-eaters
- Dramatic declines in smallest fish, lost >98% of this species
- Fewer of other two species of fish

Is the birth control pill an effective form of contraception for wild fish?

Yes!

Stops reproduction in fish

Wild fish affected by estrogen “soup” from municipal wastewaters

What else can hormone mimics do?

- Interfere with spawning behaviour of both males and females
- Decreases male defence of nests
- Decreases their external “maleness”

How could hormone mimics affect the diversity of fish?

- Reduce the abundance of individuals of a species through effects on reproduction
  - Small fish seem to be more susceptible than larger fish
- Reduce the genetic diversity of fish because of effects on spawning success of individuals

What ecosystems are at risk?

Risk depends on

- Dilution of effluent in receiving waters
- Water quality
- Presence of other stressors
- Refugia from exposure
- Climate
- Life history characteristics of fish (lifespan, spawning)
- Ability for immigration from other locations

Is feminization of male fish the only concern?

Does this mean that women should stop taking the birth control pill (or peeing)?

- No!
- Answer is better wastewater treatment and management

and natural estrogens