

LONGNOSE DACE RESPONSES TO CONTAMINANTS IN SOUTHERN ALBERTA RIVERS

Advancing Canadian Wastewater Assets (ACWA) Provides
Innovative Collaborations and Exciting Research Opportunities

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A SOCIETAL PROBLEM

Pill-popping society fouling our water, official says

Birth control pills, cancer drugs and a host of other pharmaceuticals that people flush down the drain every day are showing up in our drinking water, says Gord Miller, Ontario's environmental commissioner.

"We need to do a better job of keeping drugs out of lakes, rivers and drinking water," Miller told the Kitchener-Waterloo Record on Wednesday.

Although the drugs are not considered a threat to human health, there is evidence that they can harm wildlife.

RELATED LINK: [Antidepressant drugs found in drinking water; pharmaceuticals have now become environmental pollutants](#)

"There is no health hazard in drinking water now that has been detected in Canada, but we have detected substances in drinking water," he said, adding that the problem is likely to get worse rather than better as the population grows.

THE CHALLENGE – ARE PEOPLE SAFE?

Issues to ponder....

- Decreased sperm mobility over the last 50 years
- Increased rates of cancers under hormonal control (breast, ovarian, testicular, prostate)
- Individuals present at a younger age

A: Maybe we are; maybe we aren't.....



THE CHALLENGE – ARE PEOPLE SAFE?

Many environmental studies....

Florida Alligators

Fish downstream of wastewater effluent inputs

Turtles in Ontario wetlands

Amphibians in Illinois

Marine mammals

.... Provide abundant evidence of endocrine disruption in field populations

THE CHALLENGE – ARE PEOPLE SAFE?

The water in which these fish live.....



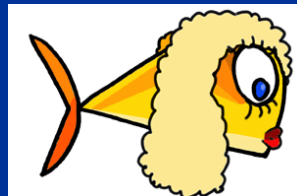
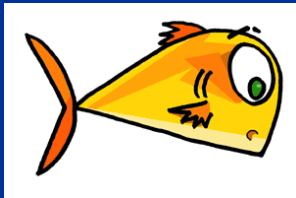
..... is the water we drink



THE CHALLENGE – ARE PEOPLE SAFE?

This presents a problem.....

For obvious reasons we can't conduct the experiments required to test hypotheses regarding human exposure to EDCs.....

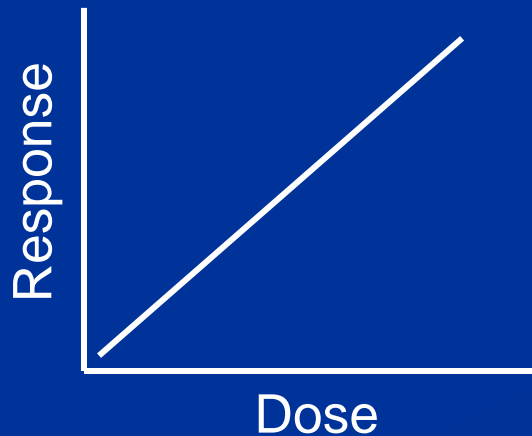
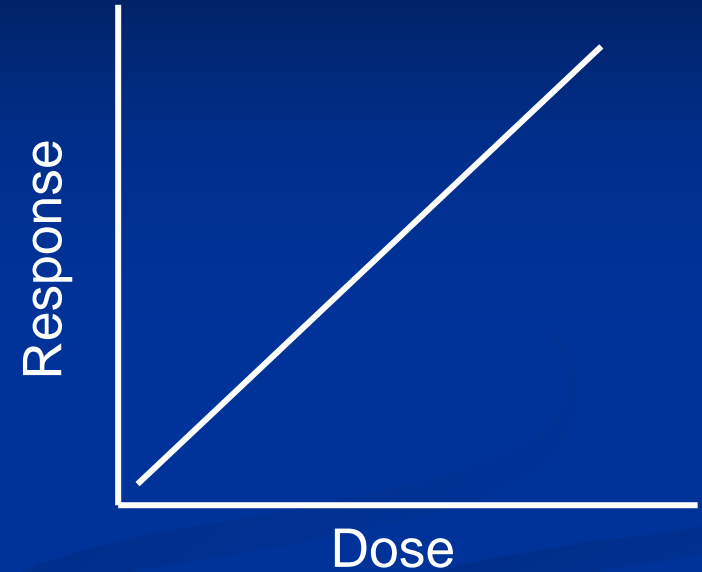


THE CHALLENGE – ARE PEOPLE SAFE?

What is the message we should take from studies on wildlife
(ie, what is our risk)?

TRADITIONAL ECOTOXICOLOGY

Contaminant
of
Concern



To the
Field



TRADITIONAL ECOTOXICOLOGY

Often we cannot predict patterns in the field....

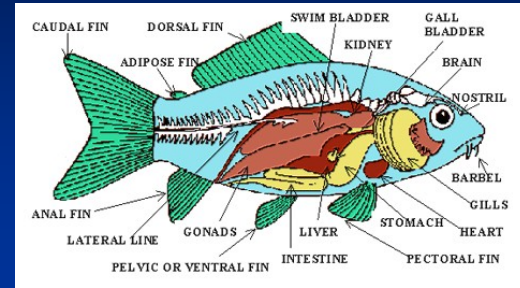
- Chemicals are not present by themselves
- Organisms experience natural stress that is unrelated to contaminants



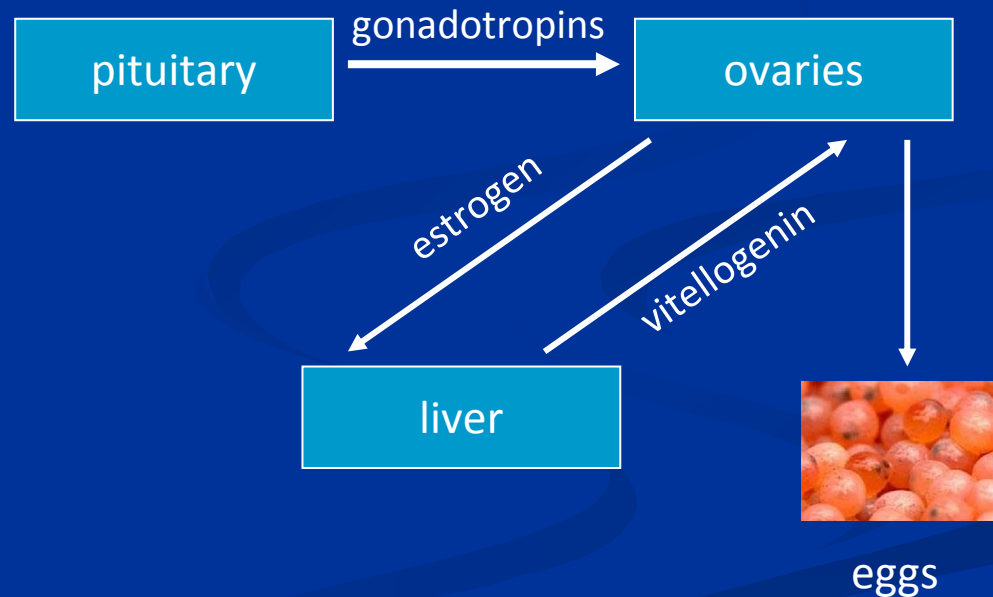
A DIFFERENT APPROACH



Ask biota to tell us where
there are problems



“Effects-based”



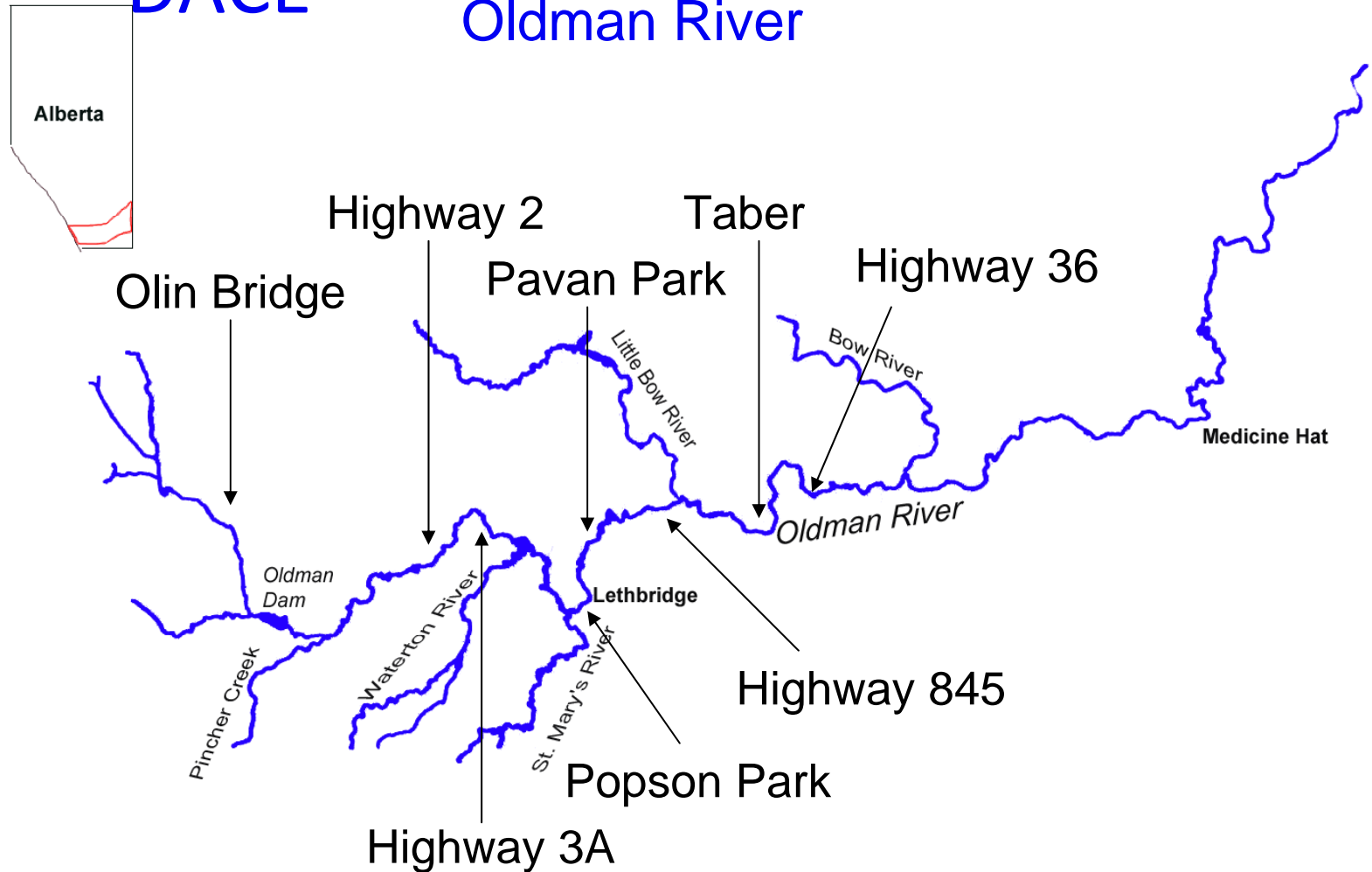
MESSAGES FROM LONGNOSE DACE



Rhinichthys cataractae

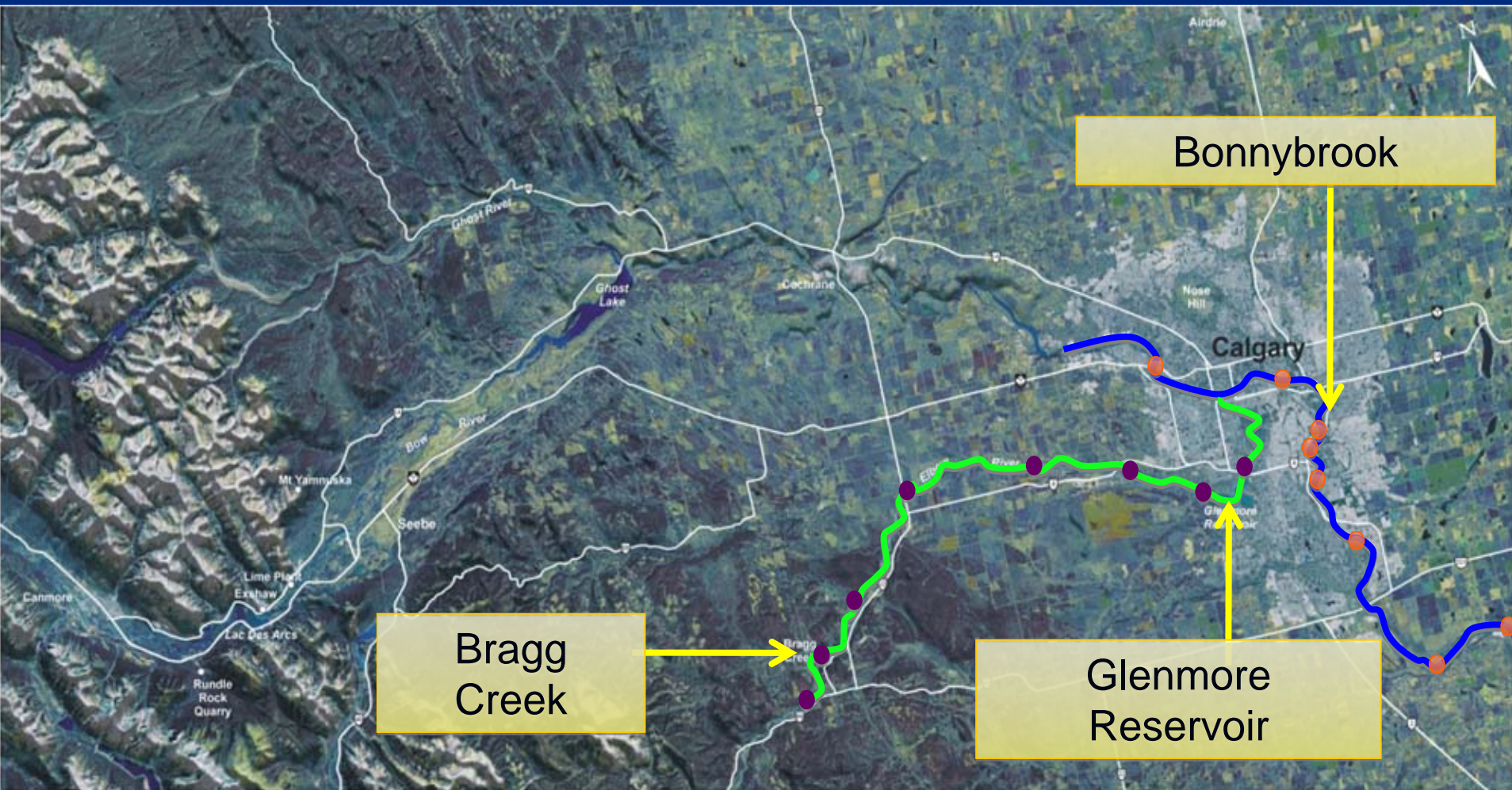
MESSAGES FROM LONGNOSE DAKE

Oldman River



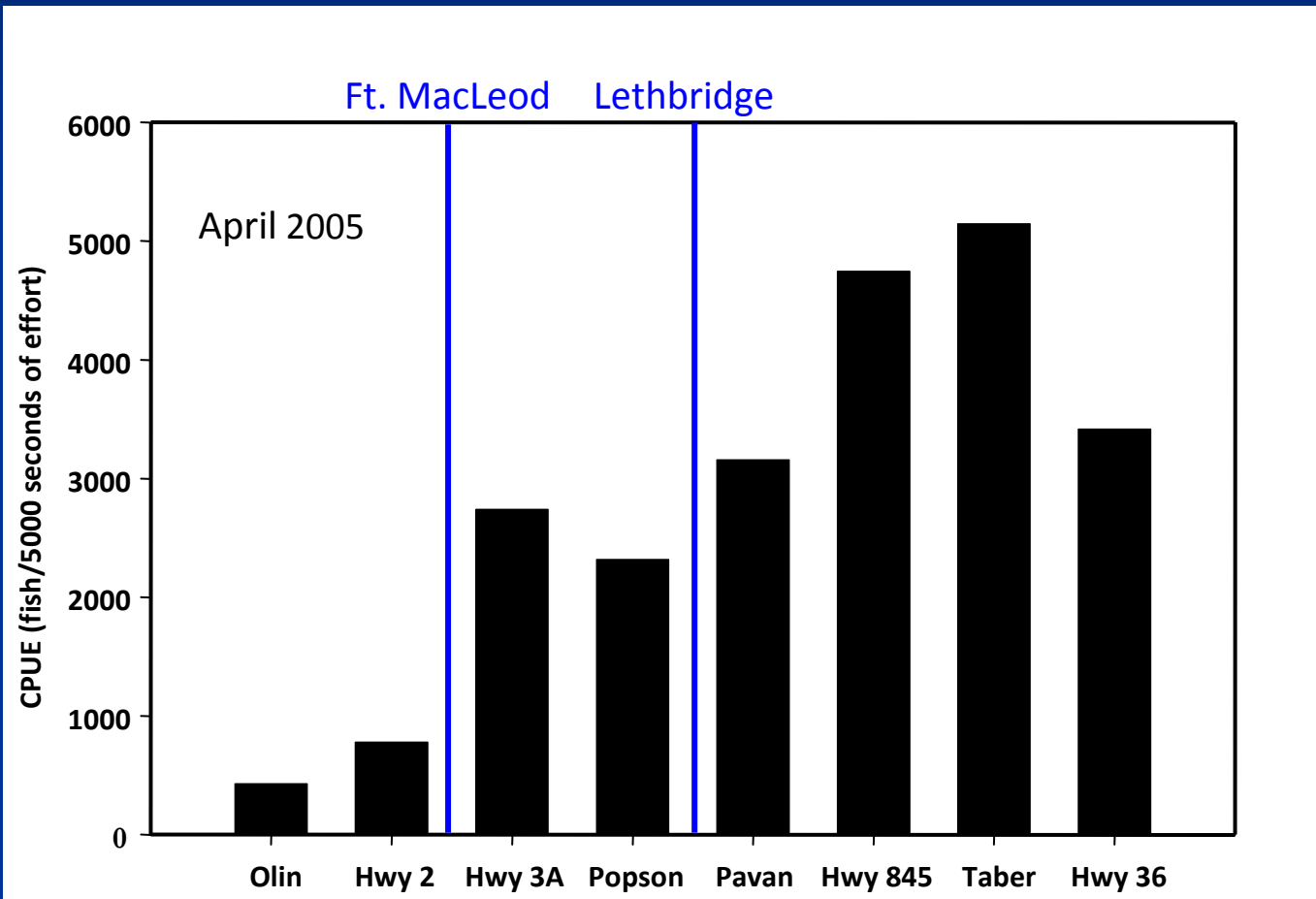
MESSAGES FROM LONGNOSE DACE

Bow River

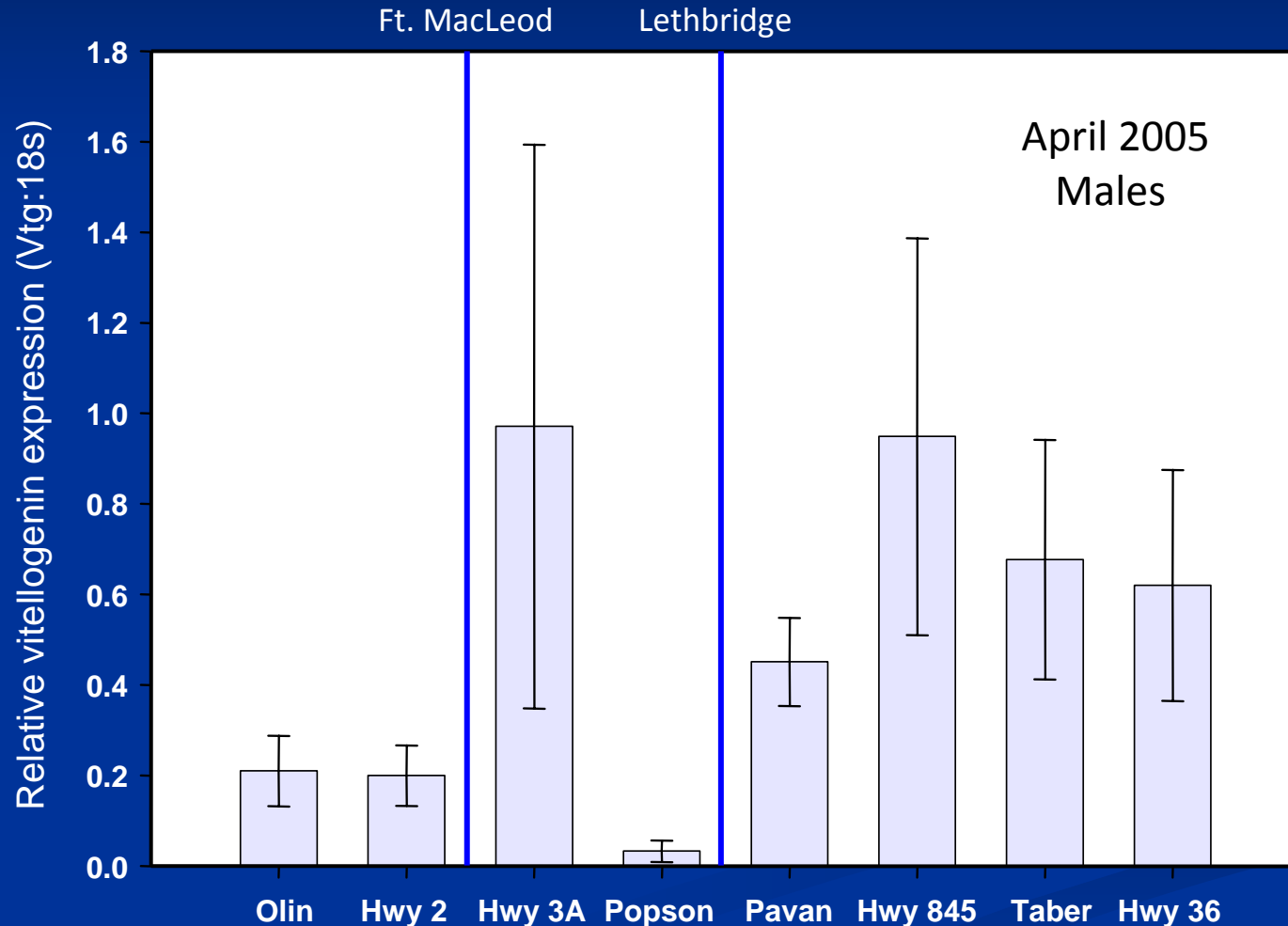


MESSAGES FROM LONGNOSE DACE

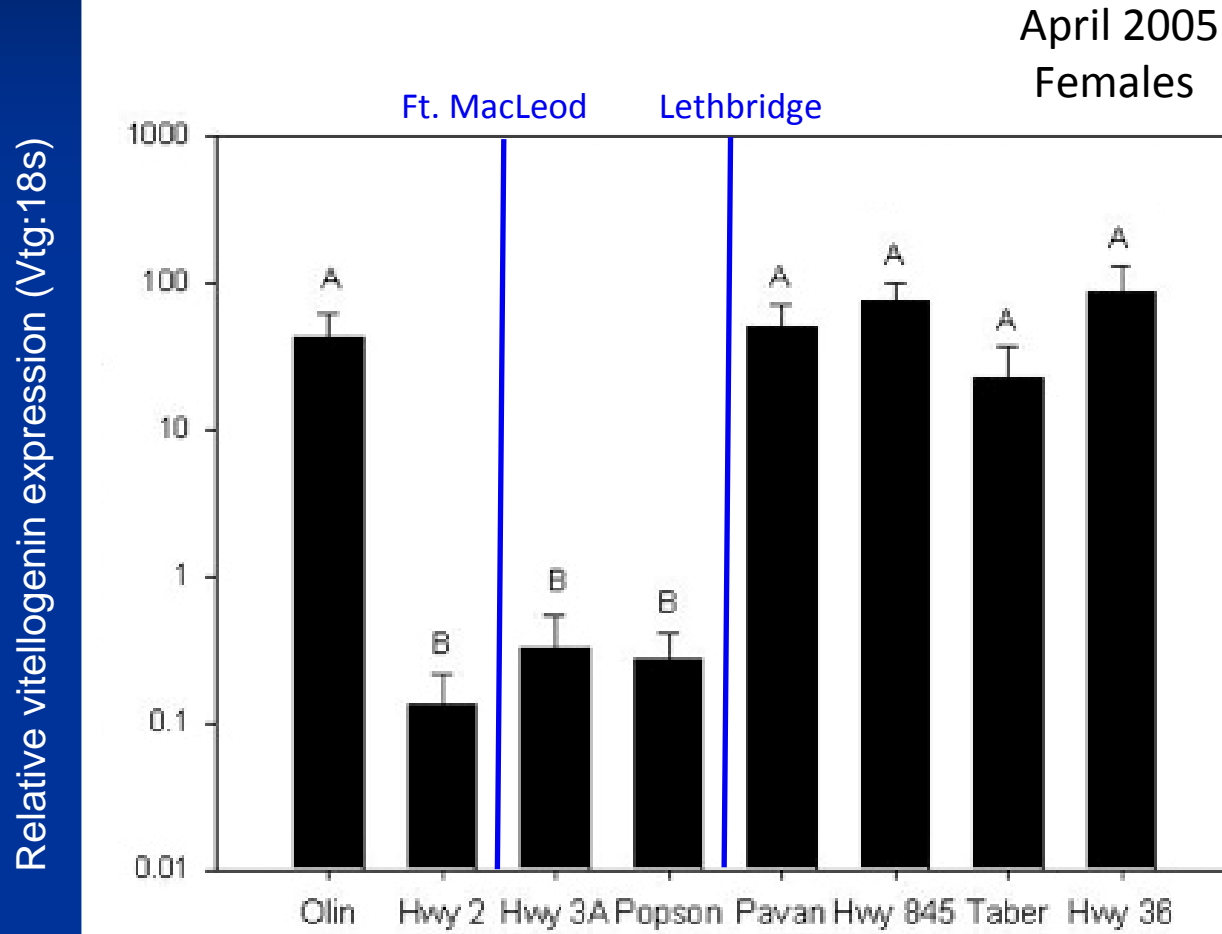
Oldman River



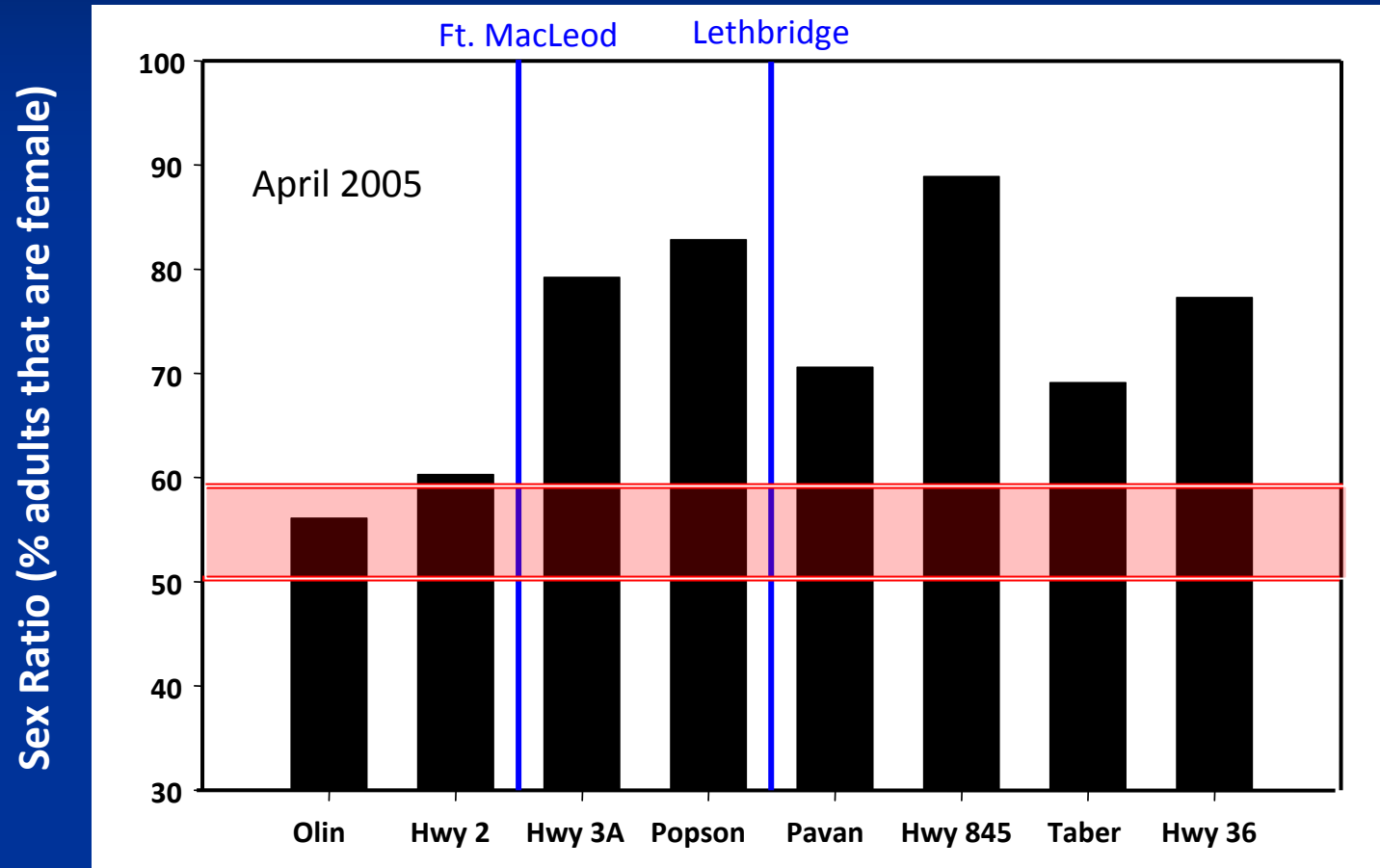
MESSAGES FROM LONGNOSE DACE Oldman River



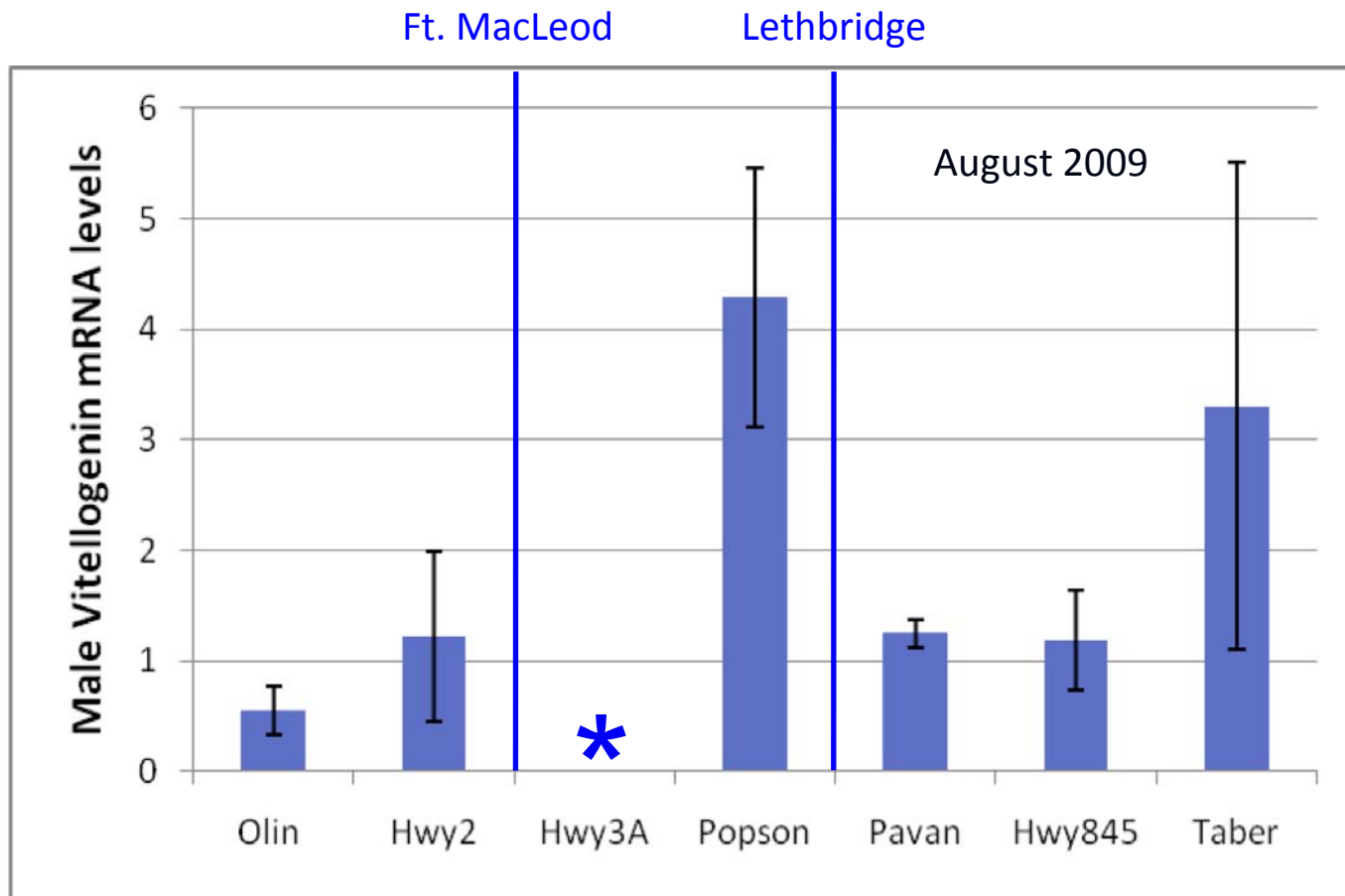
MESSAGES FROM LONGNOSE DACE Oldman River



MESSAGES FROM LONGNOSE DACE Oldman River



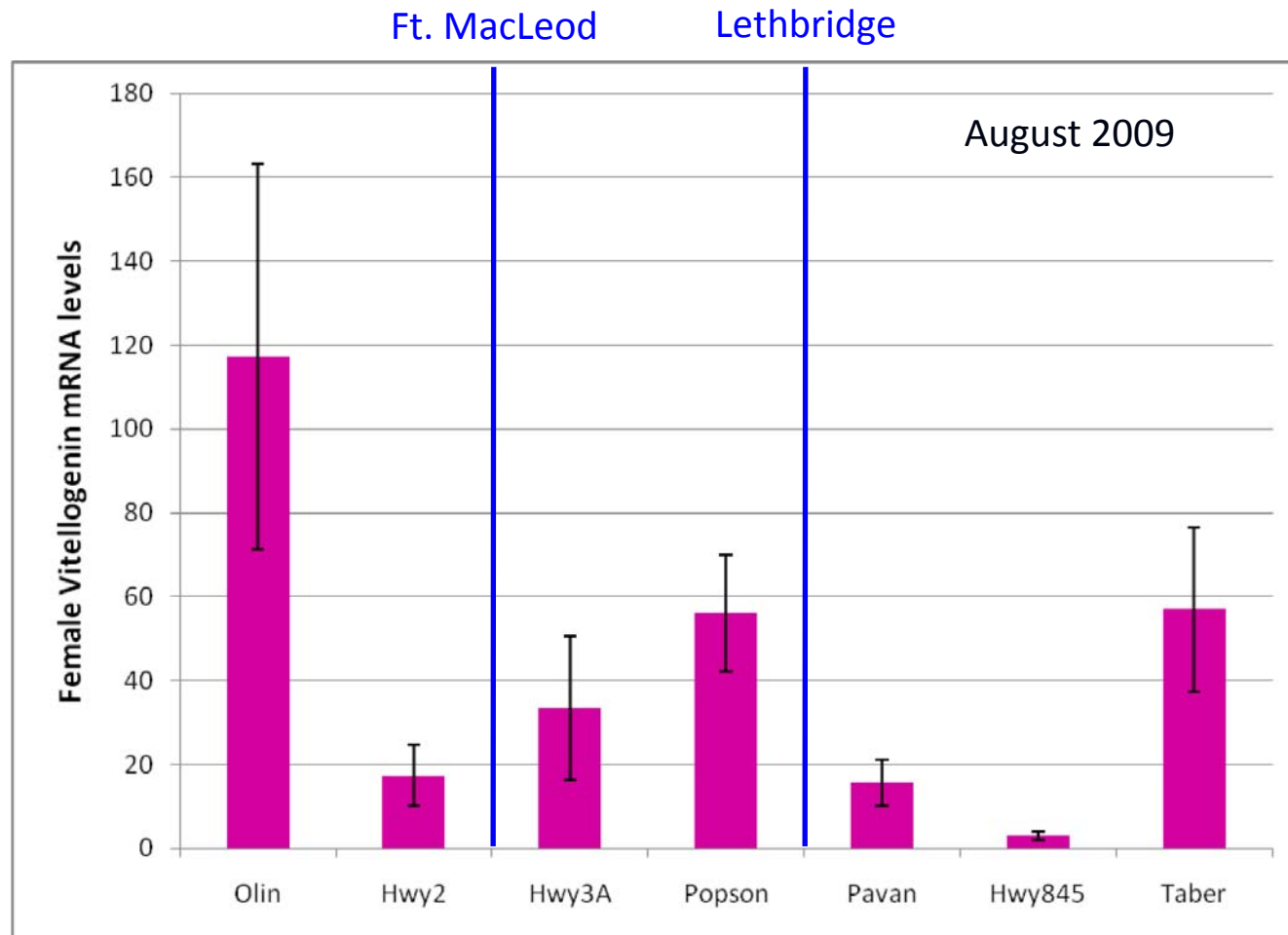
MESSAGES FROM LONGNOSE DACE Oldman River



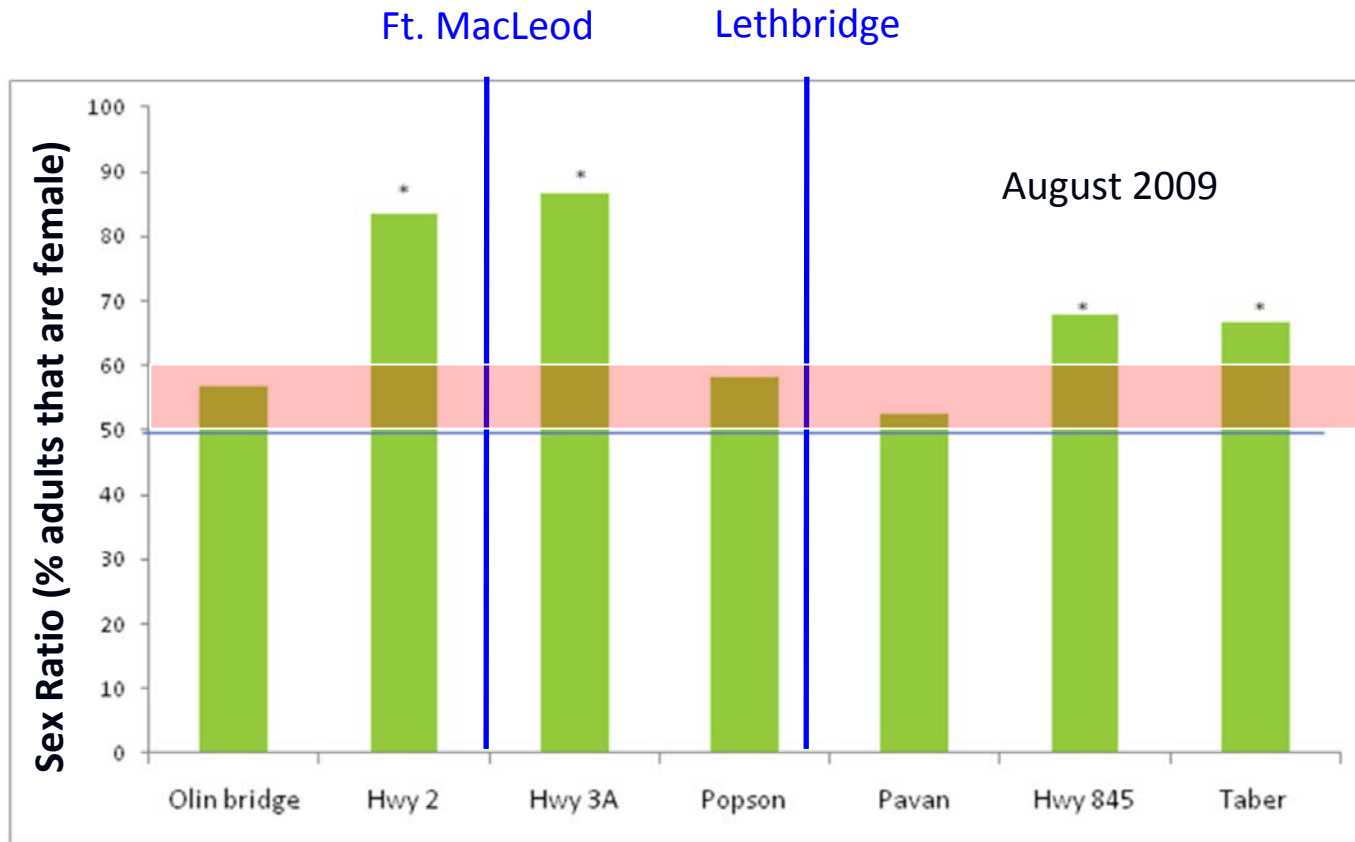
* no data

From: JS MacNeil, BSc Thesis, in progress

MESSAGES FROM LONGNOSE DACE Oldman River



MESSAGES FROM LONGNOSE DACE Oldman River

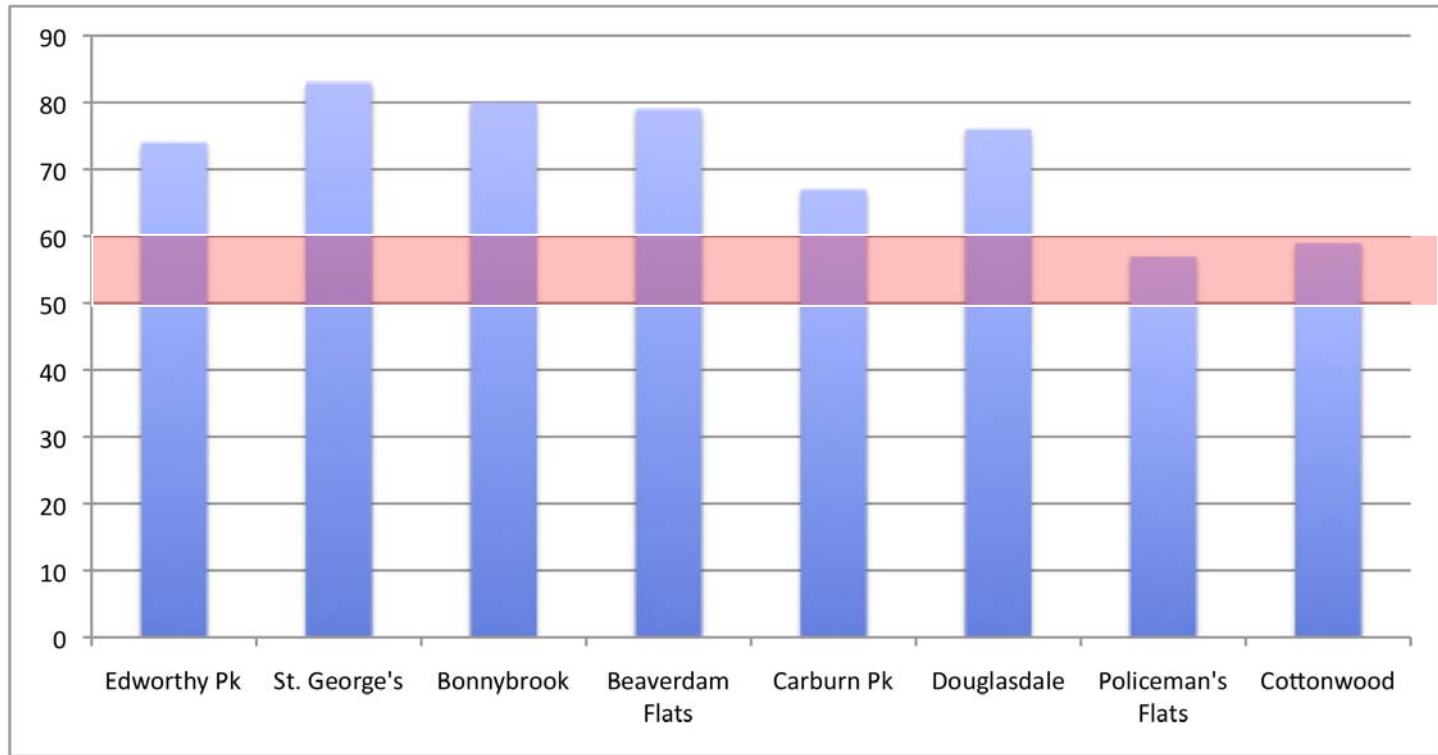


MESSAGES FROM LONGNOSE DACE

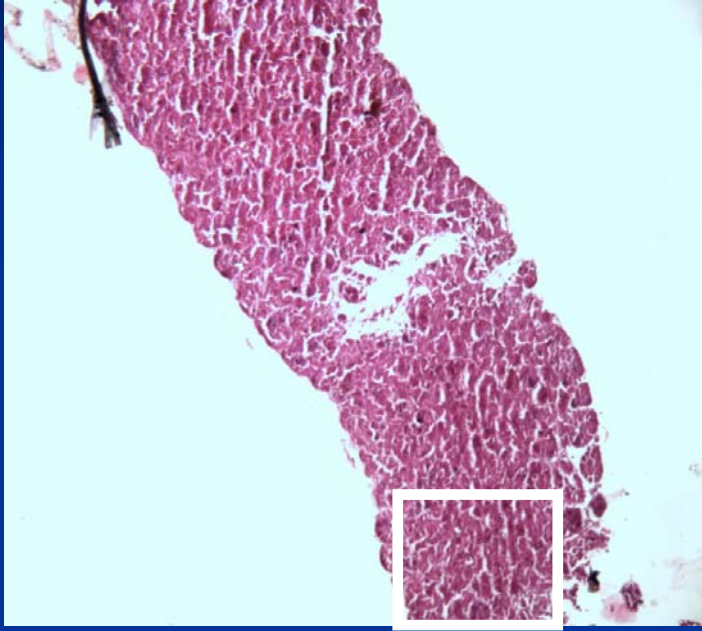
Bow River

September 2009

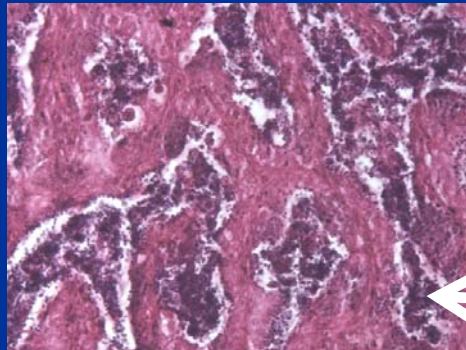
Sex Ratio (% adults that are female)



MESSAGES FROM LONGNOSE DACE Oldman River

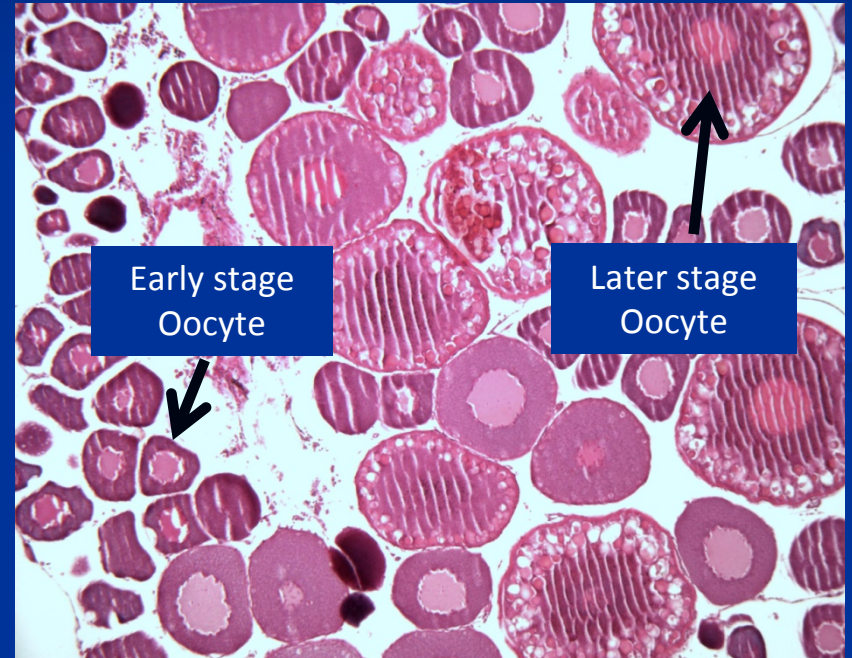


Normal Testis



Spermatozoa

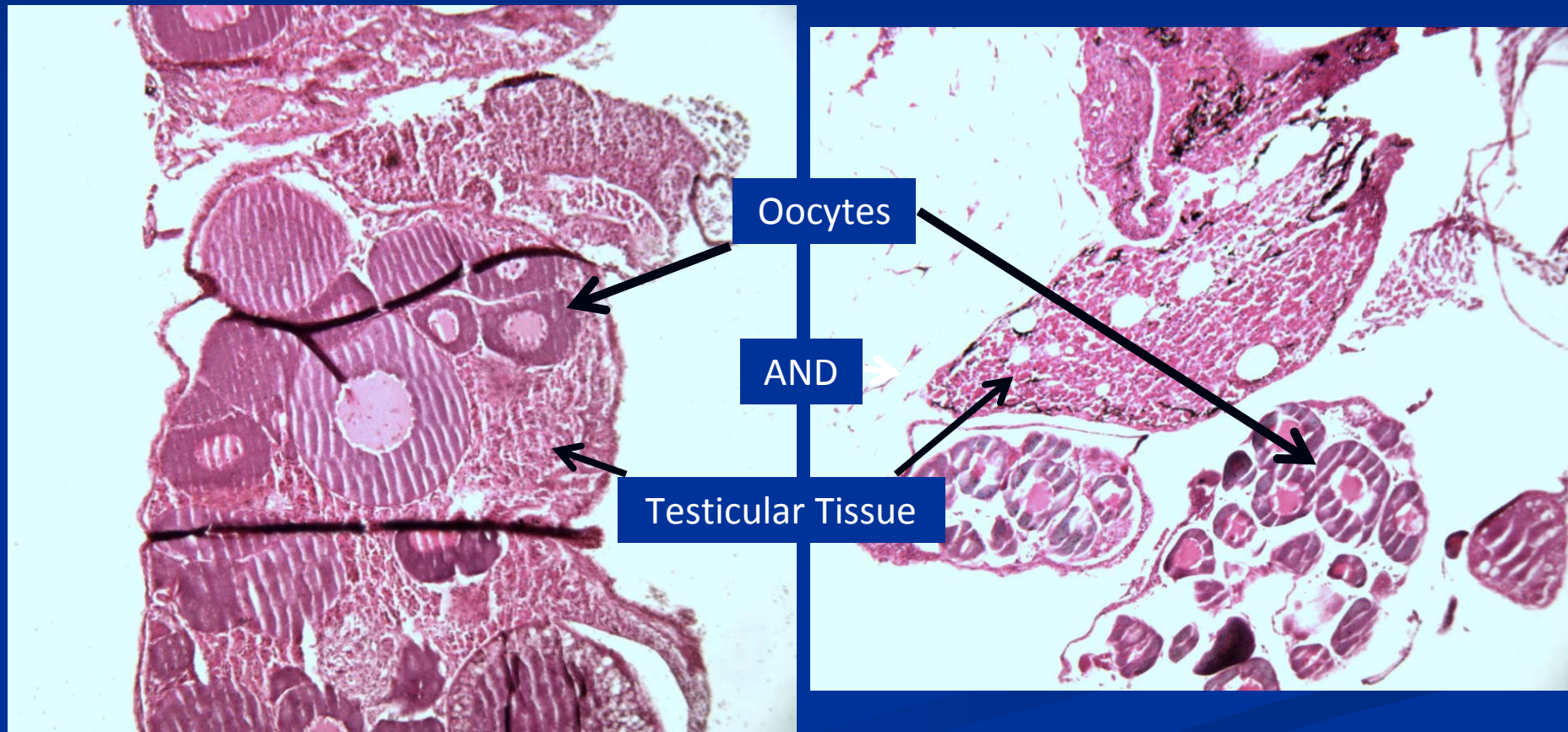
Normal Ovary



Early stage
Oocyte

Later stage
Oocyte

MESSAGES FROM LONGNOSE DACE Oldman River



MESSAGES FROM LONGNOSE DACE

Oldman River

- Male dace vitellogenin upregulated throughout basin
- Evidence exists for downregulation of female vitellogenin
- Female-biased sex ratios exist at a number of sites
- Patterns are consistent through time

Bow River

- Male dace vitellogenin upregulated throughout basin
- Evidence exists for downregulation of female vitellogenin
- Female-biased sex ratios exist at a number of sites
- Temporal pattern unknown (except male vitellogenin)

BROAD PATTERNS LOOK SIMILAR

THE CHALLENGE – ARE PEOPLE SAFE?

SAFE AND SECURE
WATER SUPPLY → PUBLIC
HEALTH

GLOBAL ISSUES

LOCAL OPPORTUNITIES →

“INTERNATIONAL CLASS” SOLUTIONS

ADVANCING CANADIAN WASTEWATER ASSETS RESEARCH FACILITY

A UNIQUE FACILITY TO
UNDERTAKE LEADING
WASTEWATER RESEARCH



UNIVERSITY OF
CALGARY



THE CITY OF
CALGARY



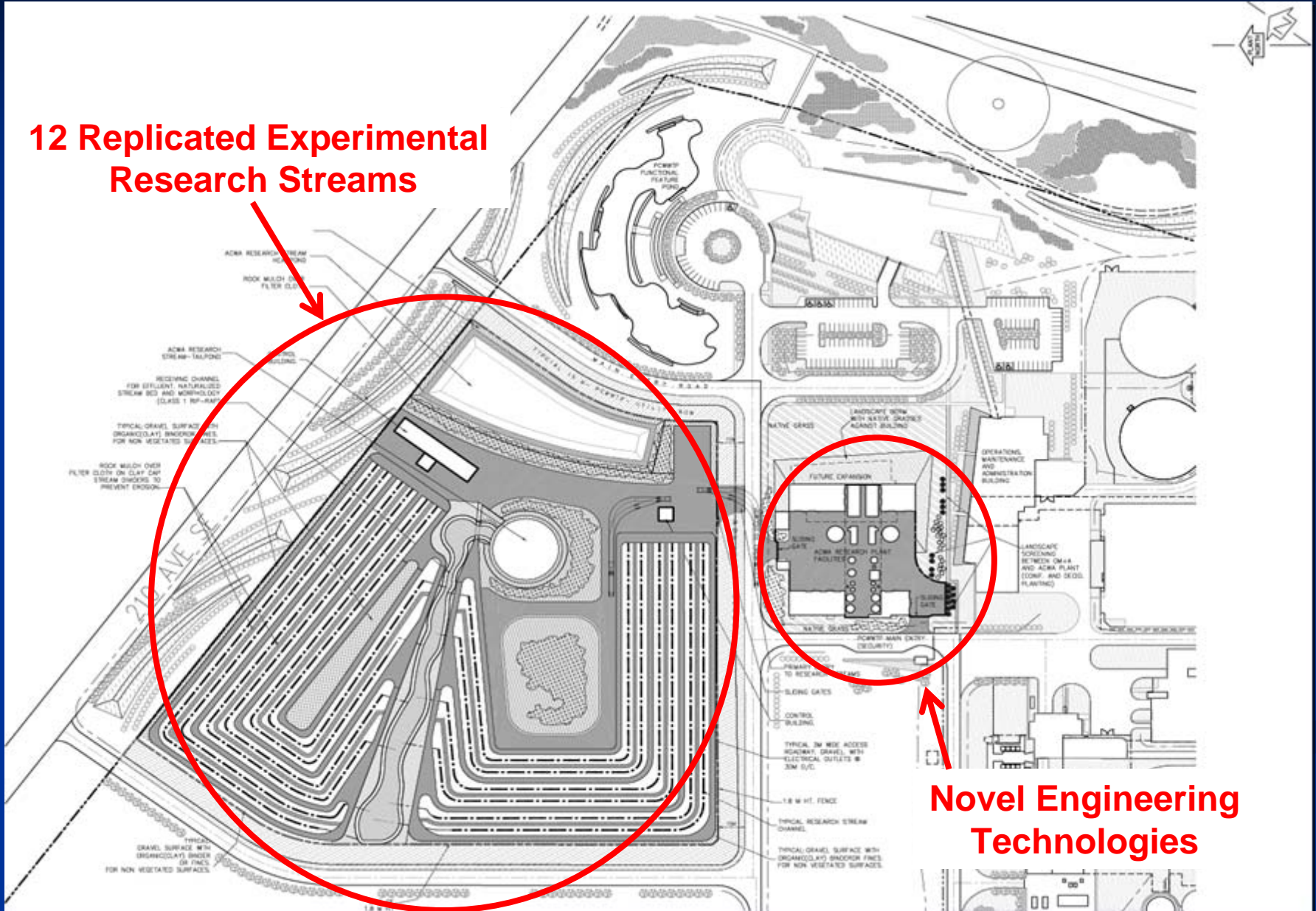
Western Economic
Diversification Canada

Diversification de l'économie
de l'Ouest Canada

Canada 

ACWA Facility

12 Replicated Experimental Research Streams



ACWA Facility

Engineering Modules:

- Two, parallel, 0.25 mega litre/day lines
- Test advanced wastewater treatment (filtration, oxidation)
to improve efficiency and remove contaminants
- Can be pushed to failure
- Will feed experimental streams

Experimental Research Streams:

- Can receive Bow River water
- Can receive engineering module effluent
- ~ 325 x 1.5 m with 10 pool/riffle combinations
- 12 streams provides true experimental replication
- emerging contaminants can be dosed via headworks
- water can be retreated through Pine Ck plant
- will be “seeded” with native species and experimental populations



SAFE & SECURE WATER SUPPLY → PUBLIC HEALTH

