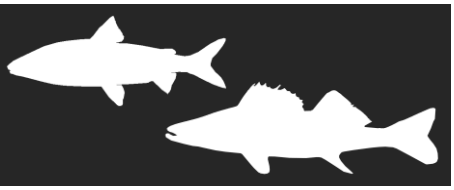
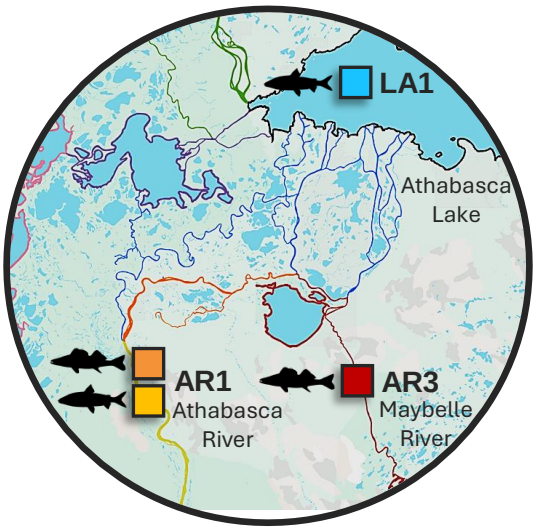
Genetic stock assessment of Lake Whitefish and Walleye in the Peace-Athabasca delta



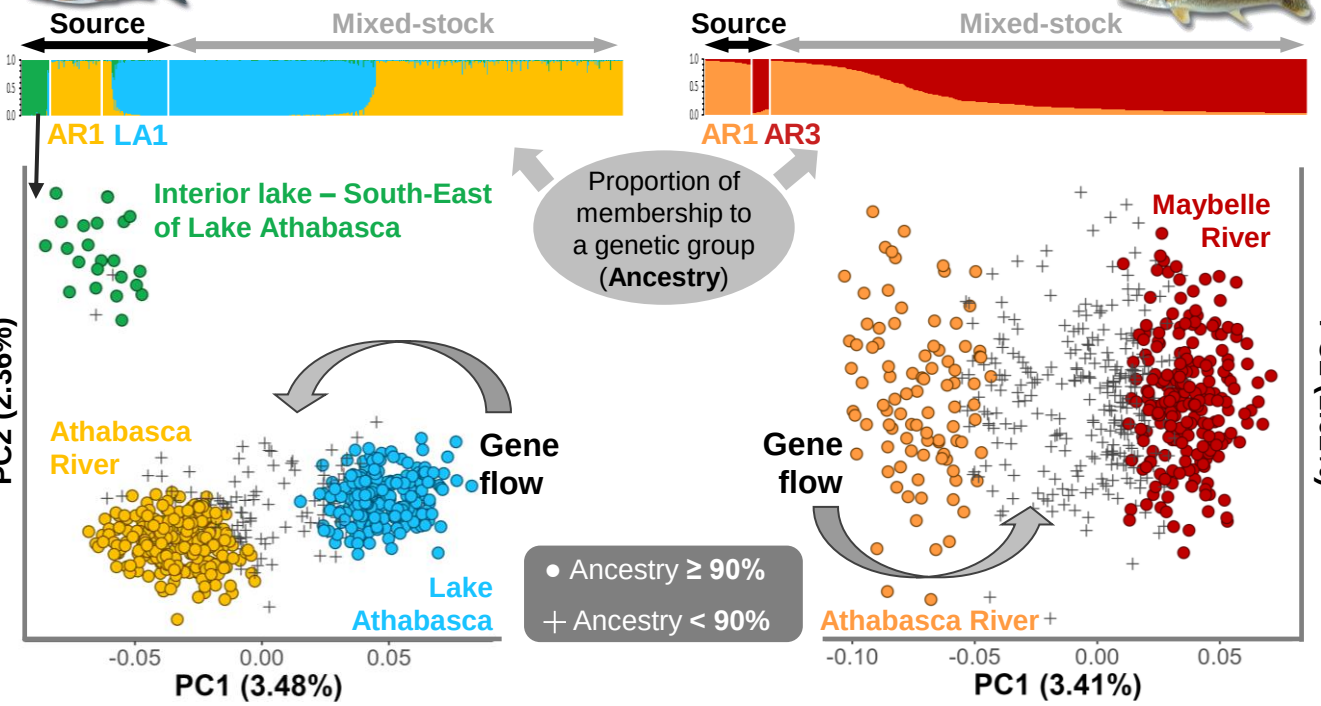
How many genetically distinct fish stock?

How much do they contribute to the harvest?



We can answer these questions using variations in the DNA.

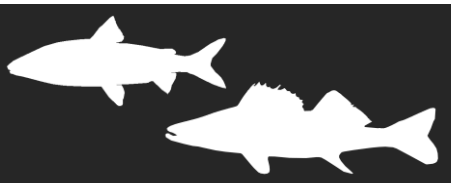
Samples from spawning fish (Source) can help identifying genetic stocks

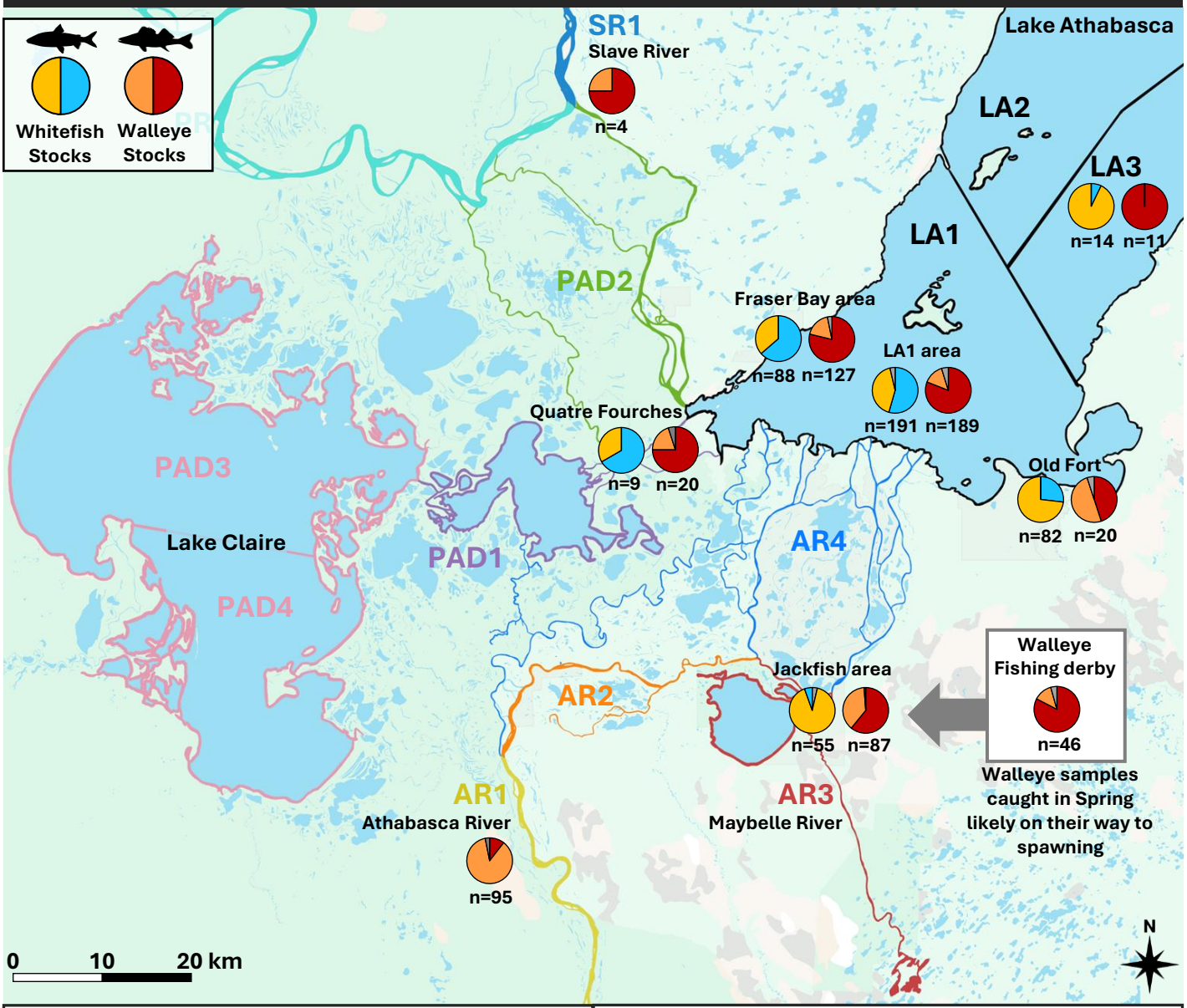


- **Lake Whitefish** populations (genetic stock) are moderately differentiated and exchange genes.
- **Source samples from the Peace-Athabasca delta** were collected during spawning season in the **Athabasca River (AR1)** and in **Lake Athabasca (LA1)**.
- Samples **collected from an interior lake** (presumably geographically isolated) are clearly differentiated.

- **Walleye** populations (genetic stock) are moderately differentiated and exchange genes.
- **Representative samples ("source samples")** were identified among samples collected in the **Athabasca River (AR1)** and at the **fishing derby in AR3.**

Genetic stock assessment of Lake Whitefish and Walleye in the Peace-Athabasca delta



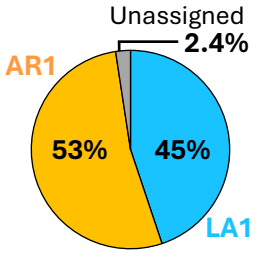


Lake Whitefish

Two genetically distinct stocks contribute approximately equally to the mixed harvest

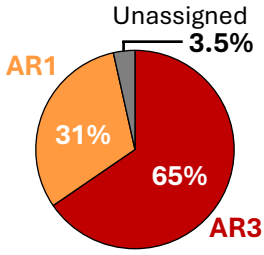
The two stocks spawn in the **Athabasca River** (AR1) and **Lake Athabasca** (LA1)

Samples from spawning sites (n=140), used as source samples for population assignments, are **not included** in the pie charts



Mixed Stock (n=457)

Walleye



TOTAL (n=599)

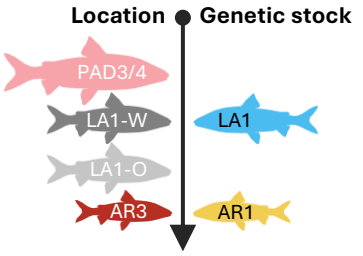
Two genetically distinct stocks with **one contributing more** to the mixed harvest

The two stocks spawn in the **Athabasca River** (AR1) and the **Maybelle River** (AR3)

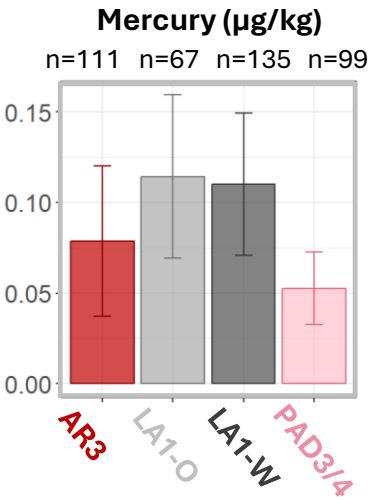
For population assignment, we used genetically representative samples collected close to spawning time (fishing derby, n=16; AR1, n=46)

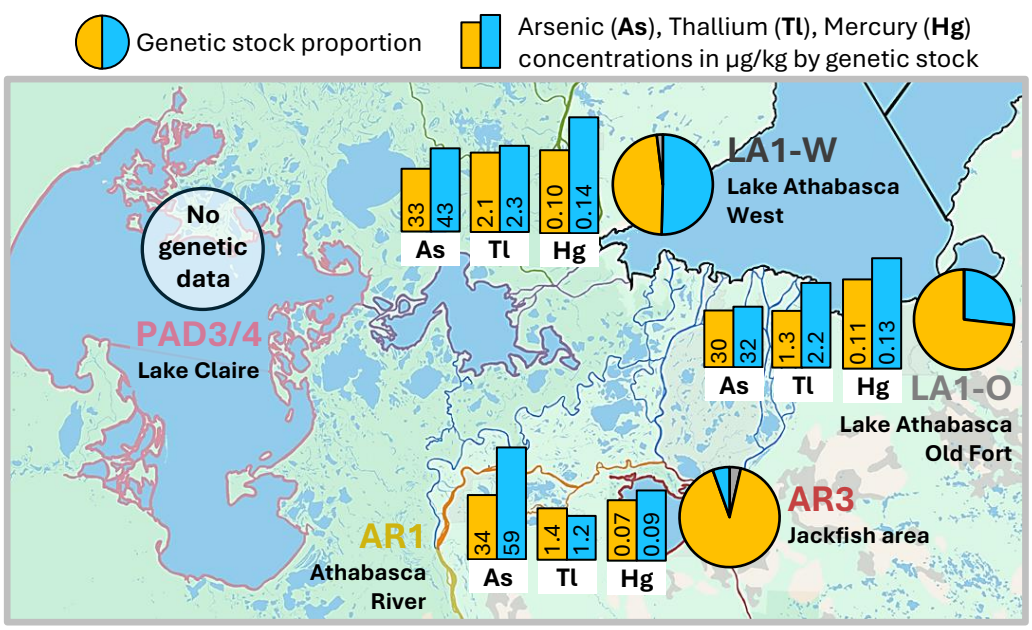
What influences contaminant levels in Lake Whitefish of the Peace-Athabasca delta?

Lake whitefish contaminant levels linked to sampling locations, age, size and genetic stock



Lake Whitefish differ in size, age and growth across locations: fish caught and/or spawning in LA1 are **older, slow-growing, larger and heavier** compared to fish caught in AR3 and/or spawning in AR1.



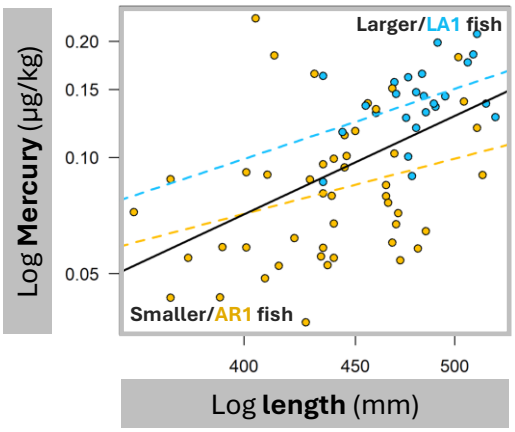


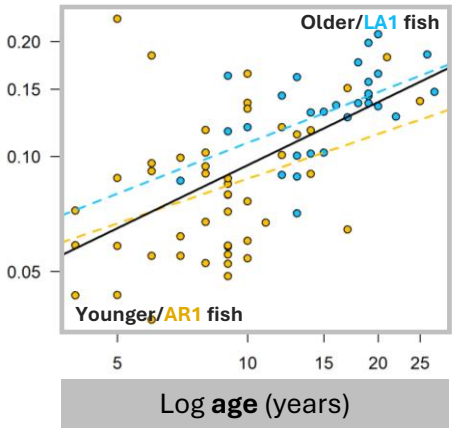
Mercury levels are mainly explained by age (older), location (LA1-O/W), and genetic stock (51% more in LA1 stock). **In addition, mercury is higher in larger, heavier, slow-growing fish, suggesting bioaccumulation over time as the main factor.**

Thallium levels are mainly explained by liver size (smaller relative to body size), location (LA1-W) and genetic stock (50% more in LA1 stock). Thallium can damage liver tissue, suggesting involvement in fish health.

Arsenic levels are higher in fish that are in better condition (higher Weight/Length^3 ratio).

Lead levels are higher in fish caught in LA1-W (64-74% more than other locations in the full dataset).



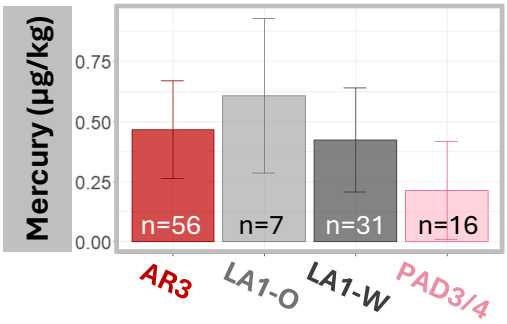


Overlap between fish traits, genetic group and location

For instance, mercury is **high <u>in both</u> older/larger and LA1 fish**

What influences mercury levels in Walleye of the Peace-Athabasca delta?

Few differences in age, condition and mercury between locations – except for Lake Claire

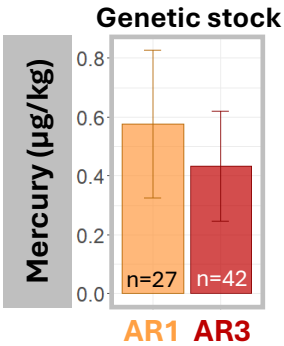


No significant differences in mercury levels among **AR3**, **LA1-O** and **LA1-W**.

Walleye caught in Lake Claire (PAD3/4) had **lower mercury levels** and were in better condition (estimated as condition factor: Weight/Length^3).

Walleye caught in the Jackfish area (AR3) were older than those caught in Lake Athabasca West (**LA1-W**) or Lake Claire (**PAD3/4**).

Mercury levels in walleye were mainly explained by age and genetic stock



i) Walleye spawning in the **Athabasca River (AR1)** (0.43 ±0.19 µg/kg) have 33% more mercury than walleye spawning in the **Maybelle River** in **AR3** (0.58 ±0.25 µg/kg).

ii) Older walleye have higher mercury levels.

The average mercury concentration in Walleye (0.43 ±0.23 µg/kg) is **almost five times** that of concentrations recorded in Lake Whitefish (0.09 ±0.05 µg/kg).

Larger and heavier walleye have higher mercury levels, likely due to bioaccumulation over time. However, walleye in poor condition (low ratio Weight/Length^3) have higher mercury levels, suggesting an impact on fish health.