

Bow River Fish Population Assessments

Bearspaw Dam to Bassano Dam, 1999 – 2023

Background

Fish population assessments have been completed on the Bow River since the late 1990s, using standardized one-pass and multi-pass mark and recapture electrofishing techniques (ABMI and ASRD 2014, ESRD 2013; Table 1). The primary study reach of the Bow River is between Bearspaw Dam and Bassano Dam (Figure 1), with a focus on naturalized populations of rainbow trout and brown trout, and native populations of mountain whitefish. A detailed population analysis by the University of Calgary showed a population level decline in rainbow trout from 2003-2013 (Cahill et al., 2018) and highlighted the need for a comprehensive analysis of fish abundance and population trends.



TABLE 1 SUMMARY OF BOW RIVER FISH POPULATION ASSESSMENTS

Bearspaw Dam to Bassano Dam, 1999 - 2023

| Year | Assessment Type | Location Description |
|------|-------------------------|--|
| 1999 | Mark-recapture | Downstream of Policeman's Flats, 4-km site |
| 2000 | Mark-recapture | Downstream of Policeman's Flats, 4-km site |
| 2001 | One-pass electrofishing | Bearspaw Dam to Bassano, 177 x 1-km site |
| | Mark-recapture | Downstream of Fish Creek to Carseland Weir, 48-km |
| 2003 | Mark-recapture | Downstream of Policeman's Flats, 4-km site |
| 2005 | Mark-recapture | Downstream of Policeman's Flats, 4-km site |
| 2007 | Mark-recapture | Downstream of Policeman's Flats, 4-km site |
| 2008 | Mark-recapture | Downstream of Policeman's Flats, 4-km site |
| 2011 | Mark-recapture | Harvie Passage to Highwood River, 4 x 1-km sites |
| 2012 | Mark-recapture | Downstream of Carseland Weir, 4 x 1-km sites |
| 2013 | Mark-recapture | Harvie Passage to downstream of McKinnon Flats, 8 x 1-km sites |
| 2017 | One-pass electrofishing | Bearspaw Dam to downstream of Highwood River, 6 x 2-km sites |
| | Mark-recapture | Downstream of Policeman's Flats, 4-km site |
| 2018 | One-pass electrofishing | Bearspaw Dam to Carseland Weir, 12 x 2-km sites |
| | One-pass electrofishing | Bearspaw Dam to Carseland Weir, 13 x 2-km sites |
| 2019 | One-pass electrofishing | Bearspaw Dam to Carseland Weir, 13 x 2-km sites |
| 2020 | One-pass electrofishing | Bearspaw Dam to Carseland Weir, 13 x 2-km sites |
| 2021 | Mark-recapture | Downstream of Policeman's Flats, 4-km site |
| 2023 | Mark-recapture | Downstream of Policeman's Flats, 4-km site |
| | One-pass electrofishing | Bearspaw Dam to Carseland Weir, 12 x 2-km sites |

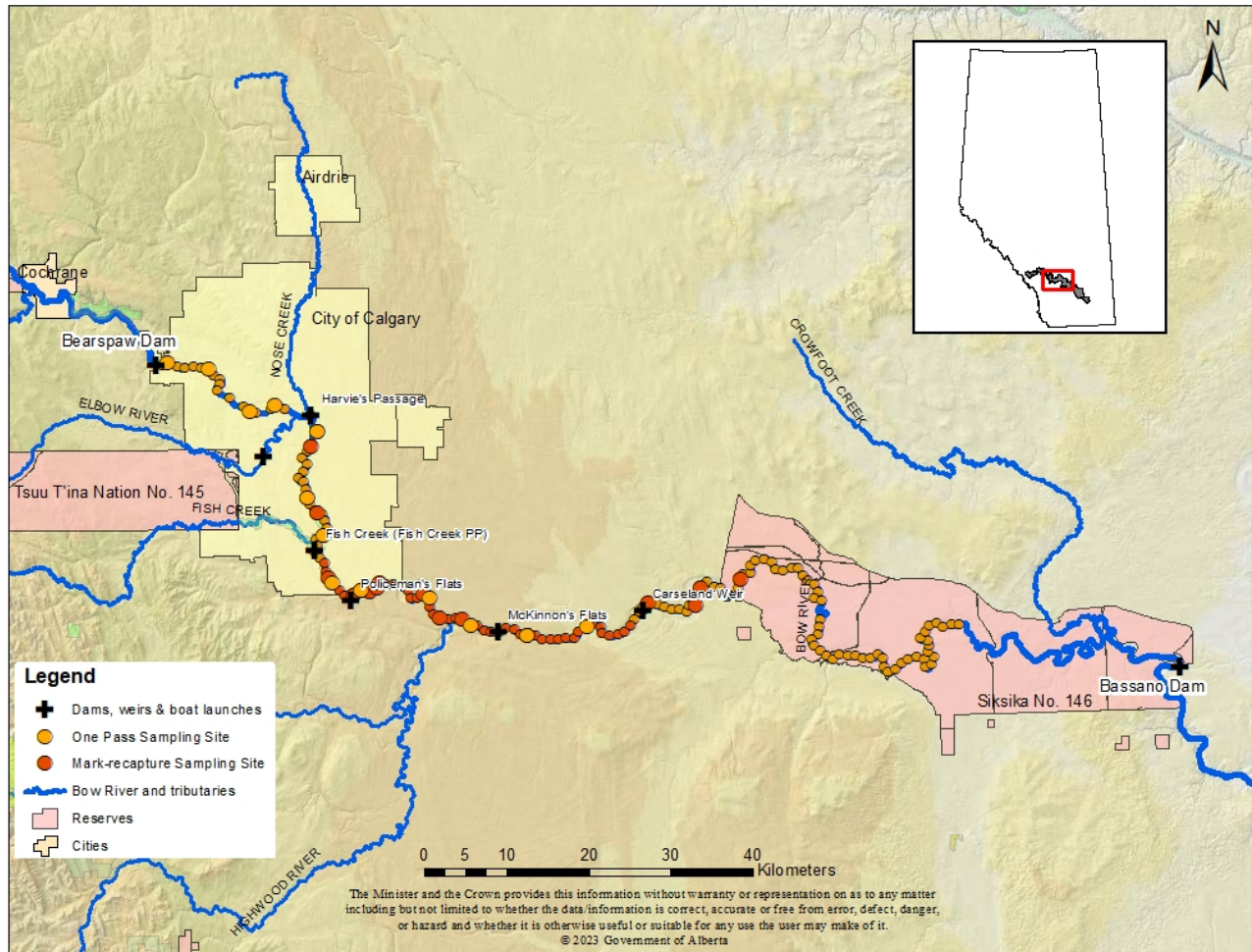


Figure 1 Fish Population Sampling Sites on the Bow River, Bears paw Dam to Bassano Dam (1999 – 2023)

Population Analysis and Modelling, 1999 – 2023

In 2022, Alberta Environment and Protected Areas contracted a third-party fisheries scientist to assess long term trends in the population abundance and size structure between 1999-2023. This analysis and the accompanying Bayesian modelling framework integrates data from both mark-recapture and one-pass electrofishing sampling sites across all years to estimate annual abundance. Abundance estimates for mountain whitefish could not be reliably estimated in this analysis, owing to the very low number of recaptured fish during mark-recapture sampling.

An overview summary of the population analysis is presented below. Detailed methodology and additional analyses, including length-at-age modelling, abundance estimates by age class and relative condition factor, can be found in the full third-party report: [Bow River Fish Population Assessment: 1990 – 2023 Final Report](#).

Key Results

Annual Abundance Estimates

The average of size-aggregated abundance estimates across years was 929 fish/km for rainbow trout (Fig. 2a) and 392 fish/km for brown trout (Fig. 2b).

a) Rainbow trout

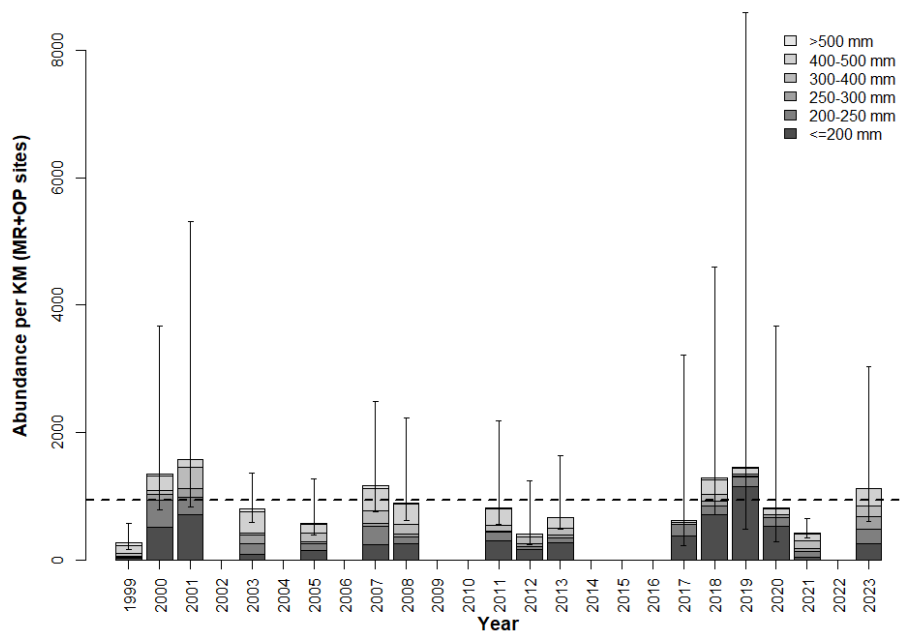
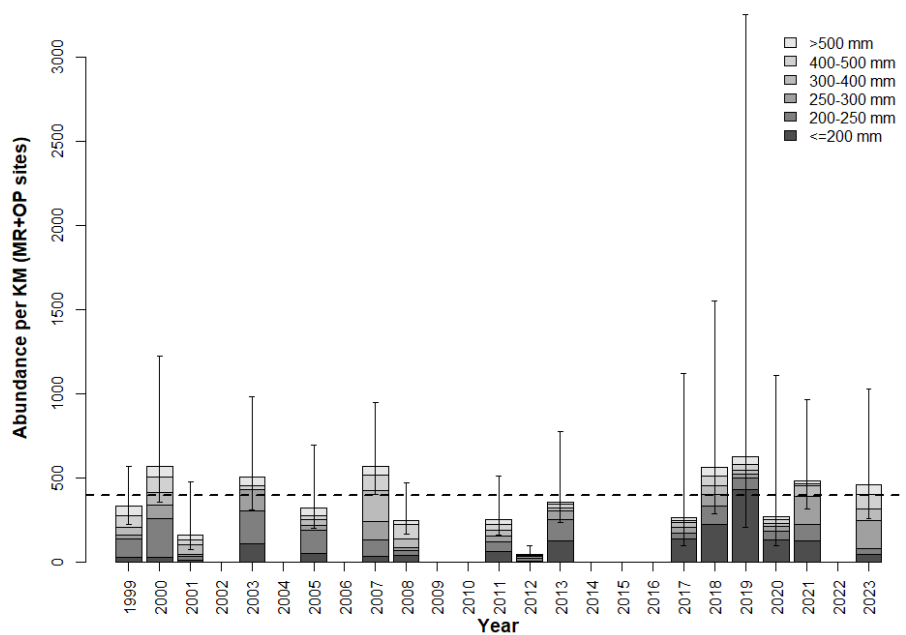


Figure 2 Annual abundance estimates for a) rainbow trout and b) brown trout based on all available data for each year (mark-recapture (MR) only, one-pass (OP) only, or mark-recapture and one-pass, see Table 1). The height of each bar and the error bars represent the median and 95% credible interval of the total abundance across size classes. Shaded bars show the median abundance of each size class. The dashed horizontal line represents the interannual mean of size-aggregated annual abundance estimates.

b) Brown trout



Abundance Trends

There was a very slight negative trend in the abundance of rainbow trout ≥ 250 mm over the study period (median trend = $-2.3\%/yr$ with 95% credible intervals of $-5.7\%/yr$ and $1.0\%/yr$, respectively (Fig. 3a). There was a similar very slight declining trend in abundance for brown trout >250 mm (median trend of $-0.7\%/yr$ with 95% credible intervals of $-5.7\%/yr$ and $4.1\%/yr$, respectively, Fig 3b). However, there is substantive year-to-year variation in abundance around the declining trend.

a) Rainbow trout

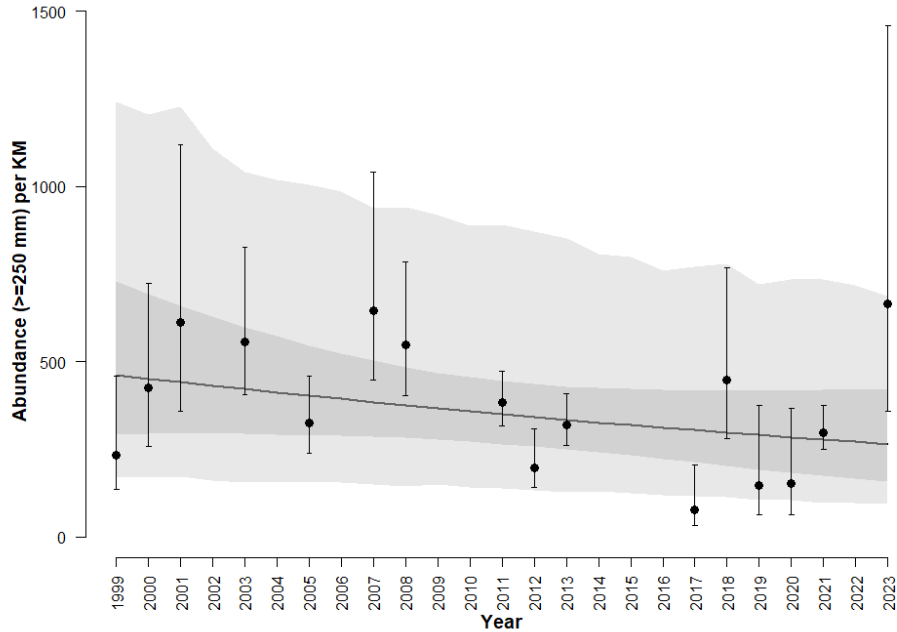
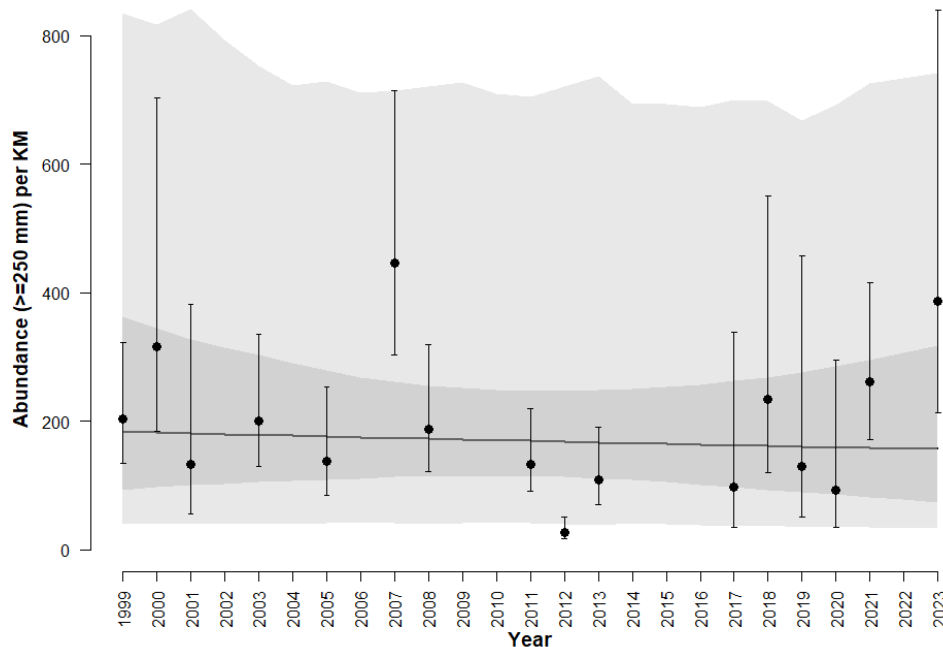


Figure 3 Trend in abundance for a) rainbow trout >250 mm and b) brown trout ≥ 250 mm. Points and error bars show the median and 95% credible intervals of abundance estimates from the closed population model. The solid sloping line is the median estimate of the abundance trend. The dark gray shaded area represents the 95% credible interval of the trend based on uncertainty in its parameters. The light gray band represents the 95% credible interval that accounts for both parameter uncertainty in the trend and process error (true year-to-year variation in abundance around the trend line).

b) Brown trout



Summary

There was a slight declining trend in abundance between 1999 – 2023 for both rainbow trout and brown trout (>250 mm). Over longer periods of time, the low annual rate of decline can lead to substantive reductions in expected abundance. For example, the annual rate predicts that abundance in 2033 will be ~ 80% of the trend-based prediction in 2023. However, given the uncertainty in the trend, and more importantly, the extensive year-to-year variation around it, predictions of future abundance should be considered highly uncertain.

While this analysis blends both mark recapture and one pass estimates into a single statistic that represents sampling at a broad spatial scale, readers should be cautioned from making inferences and projections of population trends from these plots alone, particularly since combined mark recapture and one pass estimates have far greater uncertainty than mark recapture only plots. Further detailed analyses and plots can be found in in the full Bow River abundance report, which provides very detailed information and analyses about the Bow River fish population.

The Bow River trout population will be periodically monitored in the future, using both mark recapture and one pass sampling, and analysis will be conducted with the modelling tools developed during this analysis.

Key Outcomes and Next Steps

- Results from this population analyses are incorporated into cumulative effects models, which seek to understand key drivers to Bow River fish populations.
- Key drivers that have been assessed by cumulative effects modelling include environmental flows, avian predation, angling, and threats of low flows/warm water temperatures.
- Entrainment into irrigation canals is an additional driver that will be assessed through cumulative effects, and is informed by these population results and population modelling.
- Changes to the future management of the Bow River fishery is informed by population assessment results, and is provided to decision makers when considering future angling regulations.
- The Bow River will be periodically monitored to understand the current status of fish populations, and to help understand potential emerging threats like whirling disease and extreme drought.

Literature

Alberta Biodiversity Monitoring Institute and Alberta Sustainable Resource Development (ABMI and ASRD). 2014. Fish Survey Methods for Rivers: ABMI and ASRD Collaboration. Written by Jim Schiek and edited by M.G. Sullivan. Prepared for Alberta Biodiversity Monitoring Institute and Alberta Sustainable Resource Development. 20 pp.

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