

Lindis River low flow investigations

Comparison of flow regimes and fish passage at critical riffle sites using  
Lincoln Agritech Longitudinal Flow Model

26 June 2017



The following graphs depict fish passage at critical riffles along the Lindis River under four low flow regimes. The regimes were selected from the memorandum of Rekker (2017<sup>1</sup>) and reflect the longitudinal flow from his memo figures 2, 3, 4 and 5. The flows with distance downstream were derived from the spreadsheet that was distributed by Jens Rekker on 23 June 2017. The key components of these scenarios are as follows:

- Scenario 1: Model comparison of status quo abstraction (Races) and improved infrastructure (Galleries) with a 900 L/s minimum flow at the Ardgour Road flow recorder. Input flow at Lindis Peak of 2.50 cumecs.
- Scenario 2: Model comparison of status quo abstraction (Races) and improved infrastructure (Galleries) with a 550 L/s minimum flow at the Ardgour Road flow recorder. Input flow at Lindis Peak of 2.02 cumecs.
- Scenario 3: Model comparison of status quo abstraction (Races) and improved infrastructure (Galleries) with a 550 L/s minimum flow at the Ardgour Road flow recorder. Input flow at Lindis Peak of 1.308 cumecs.
- Scenario 2: Model comparison of status quo abstraction (Races) with a minimum flow of 900 L/s at Ardgour Road flow recorder and improved infrastructure (Galleries) with a 550 L/s minimum flow at the Ardgour Road flow recorder. Input flow at Lindis Peak of 1.396 cumecs.

For each scenario, flow at the approximate distance downstream coinciding with the locations of critical riffles (surveyed for fish passage between 24 February and 24 April 2017) was identified and applied to the relationship between fish passage and flow derived for each riffle. Fish passage was based on the minimum depths identified in Gabrielsson and Hay (2017<sup>2</sup>). These are tabulated on the following page. For each minimum depth for passage, contiguous passage width at the relevant minimum depth for fish life stage, under the relevant flow, was obtained and plotted for each riffle.

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<sup>1</sup> Rekker, J. 2017. (memo). Lindis River Management Flow Appeal Technical Caucusing Group: Comparison of Current Water Race Abstraction and Proposed Mid-River Galleries Using the Longitudinal Model (Updated). Lincoln Agritech.

<sup>2</sup> Gabrielsson, R. and Hay, J. 2017. Review of fish passage criteria for assessing implications of minimum flow options. Prepared for Otago Fish & Game Council. Cawthron Report No. 3014.

*Recommended minimum water depth and width criteria for maintaining salmonid passage during the late summer low flow period, based on a review of commonly adopted fish passage criteria in New Zealand and overseas. (source: Gabrielsson and Hay, 2017).*

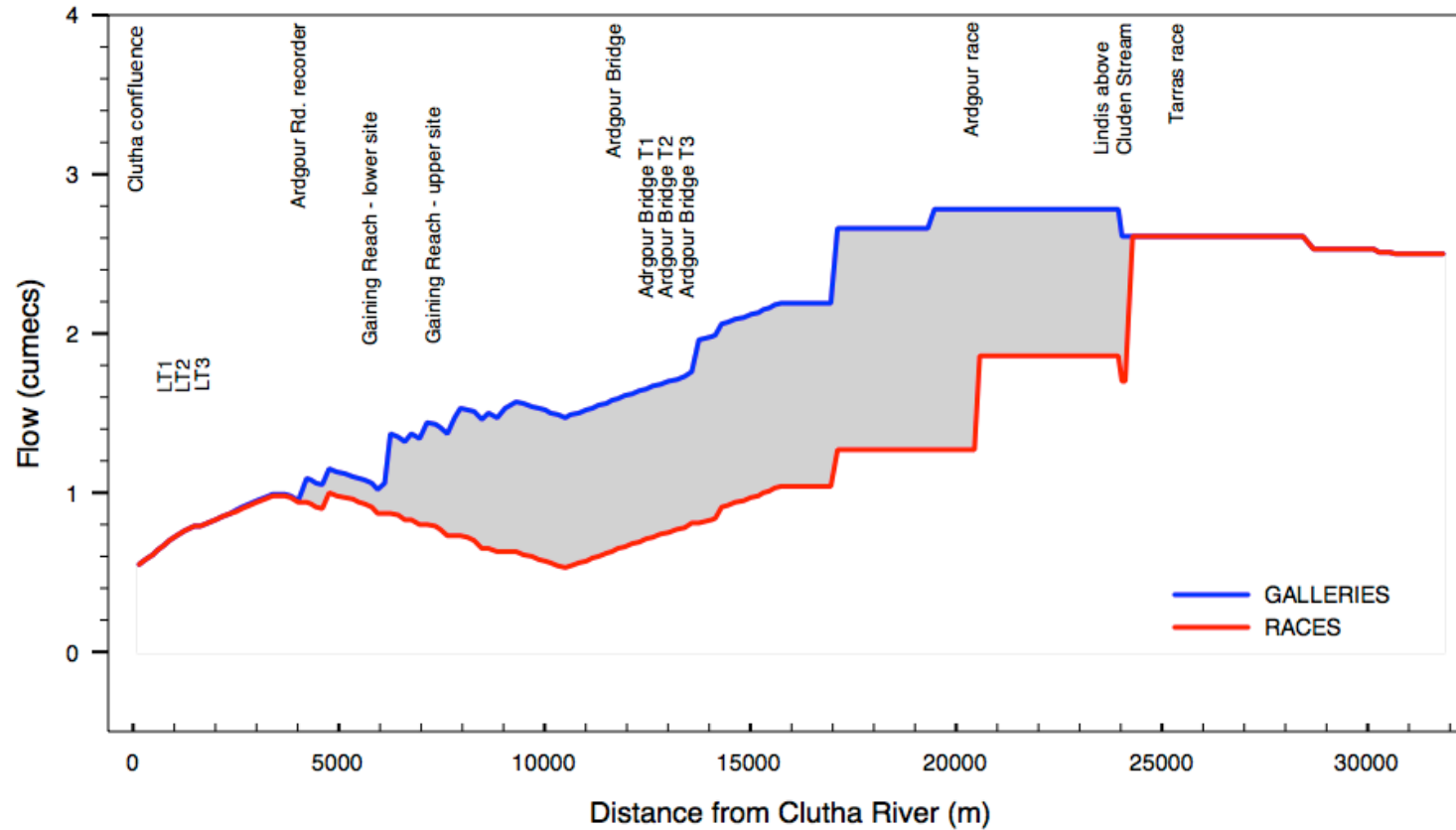
<b>Fish life stage</b>	<b>Fish length indicative size range (cm)</b>	<b>Minimum water depth for passage (m)</b>	<b>Minimum contiguous passage width (m)</b>
Young-of-the-year trout	10 – 15 *	0.10	1
Yearling trout	18 – 25 *	0.15	1
Adult trout	> 40	0.20	1
Salmon / Very large trout	> 60	0.25	1

*\* Expected size range during late summer / autumn (February – April)*

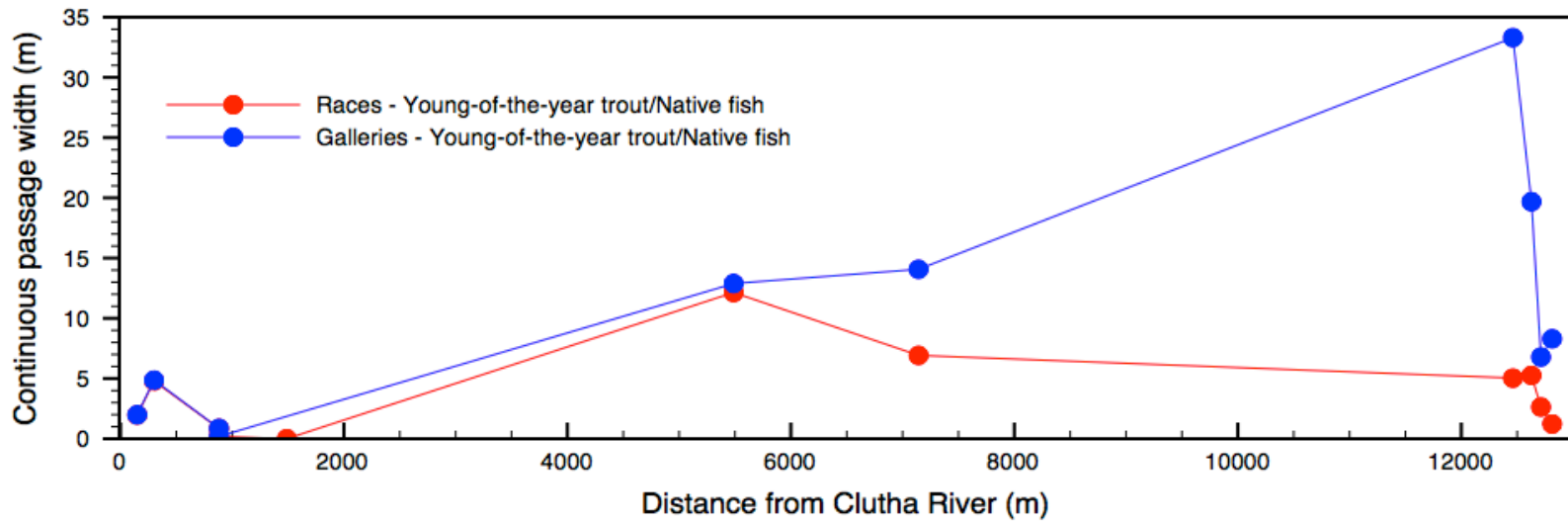
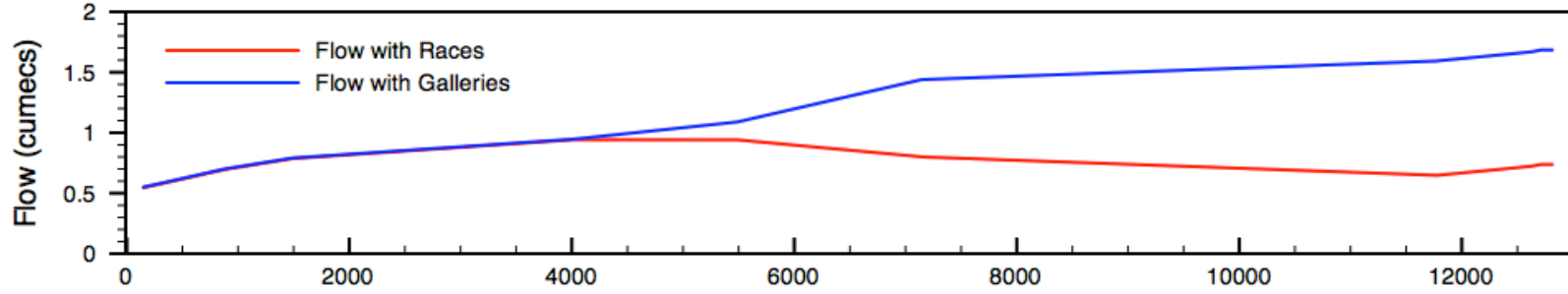
MINIMUM FLOW OF 900 L/SEC @ RECORDER:

LINDIS PEAK FLOW = 2.50 CUMECS

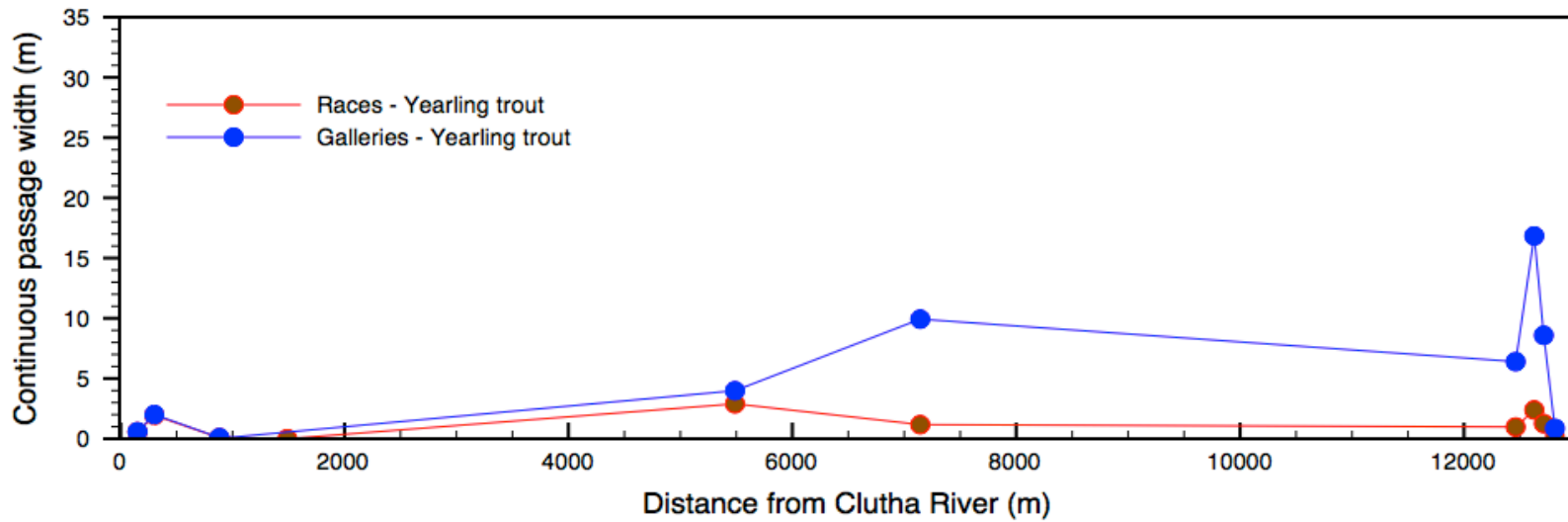
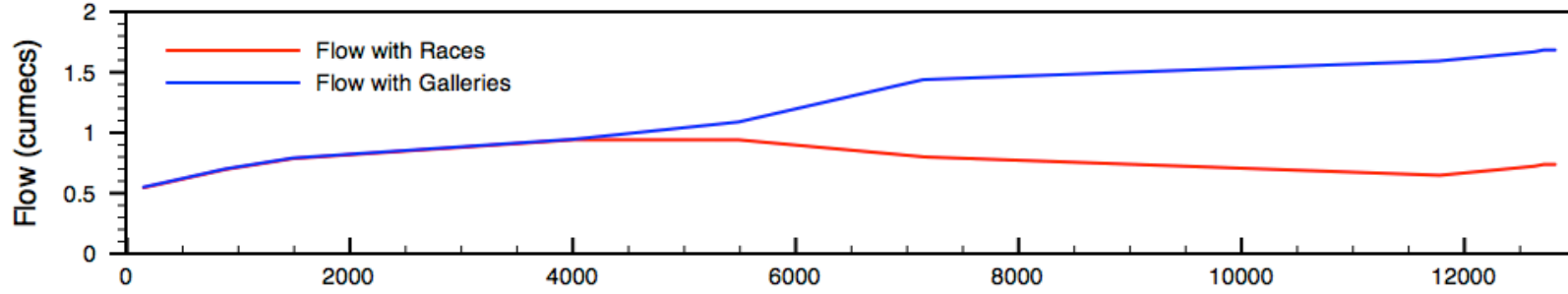
Longitudinal Flow Model  $Q_{\text{Lindis Peak}} = 2.502 \text{ m}^3/\text{sec}$ . 900 L/s min. flow for Galleries and Races

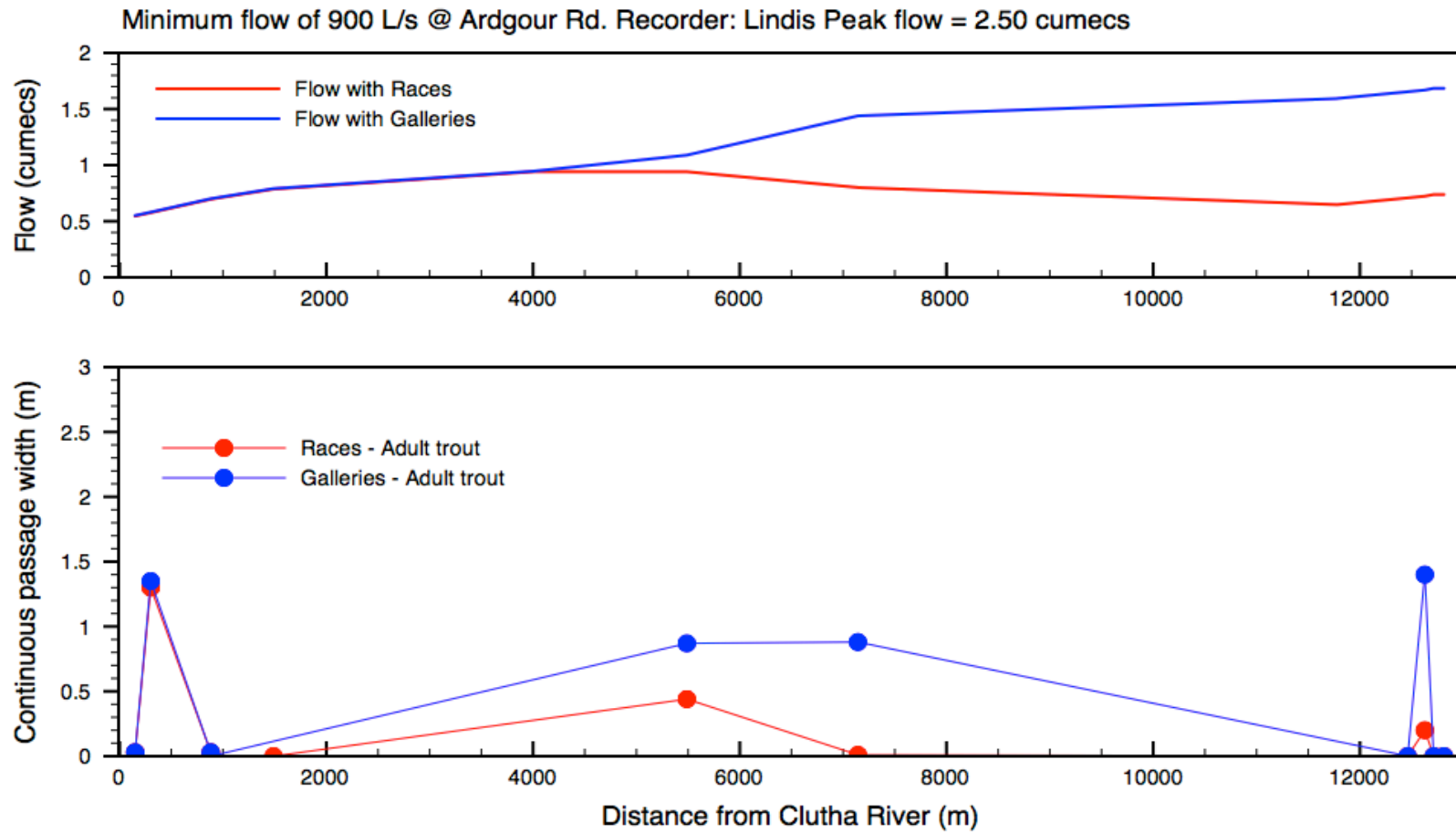


Minimum flow of 900 L/s @ Ardgour Rd. Recorder: Lindis Peak flow = 2.50 cumecs

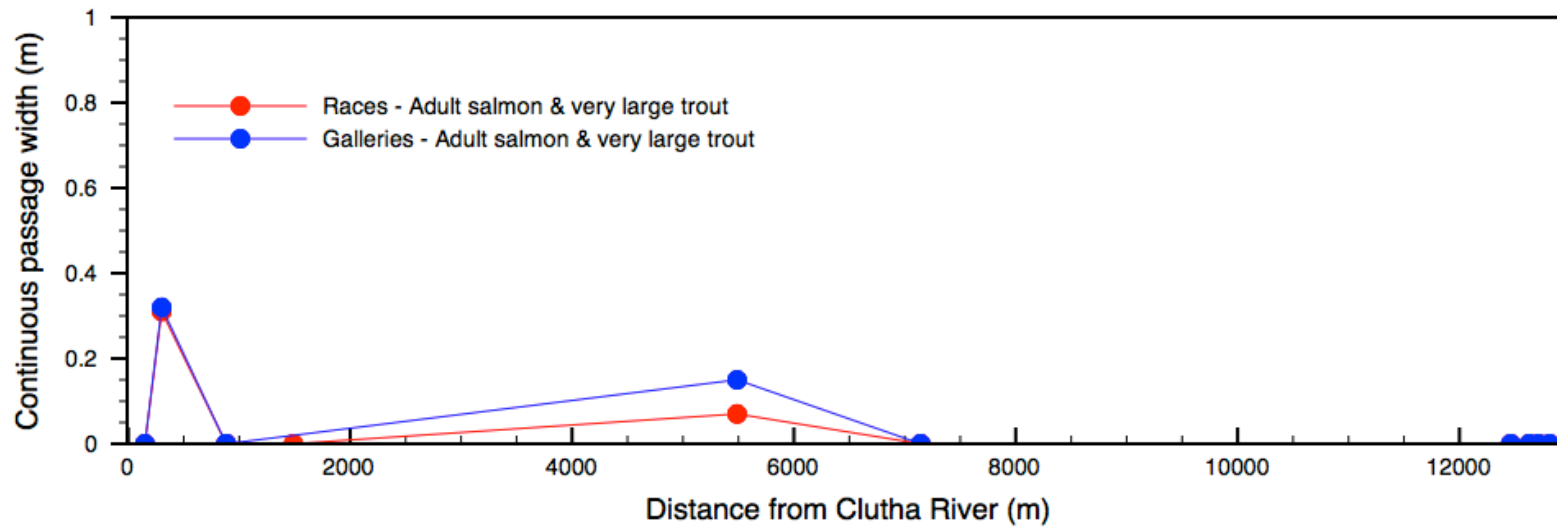
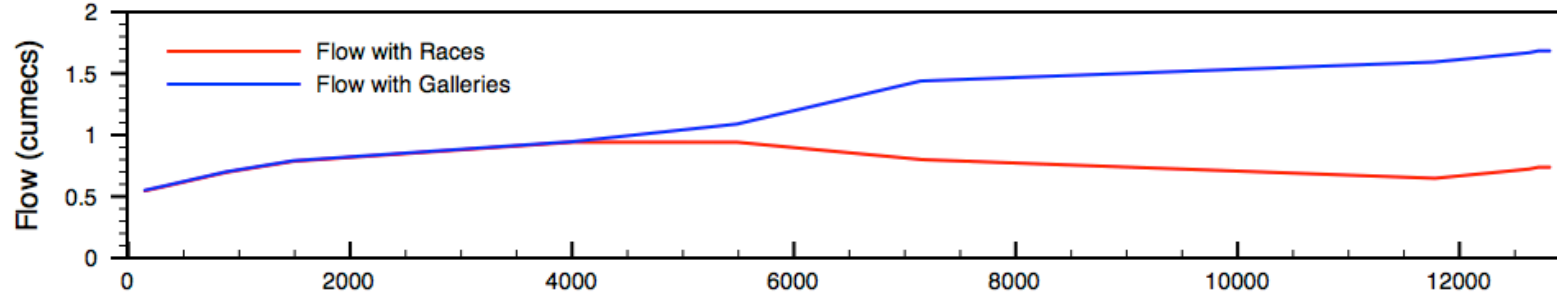


Minimum flow of 900 L/s @ Ardgour Rd. Recorder: Lindis Peak flow = 2.50 cumecs





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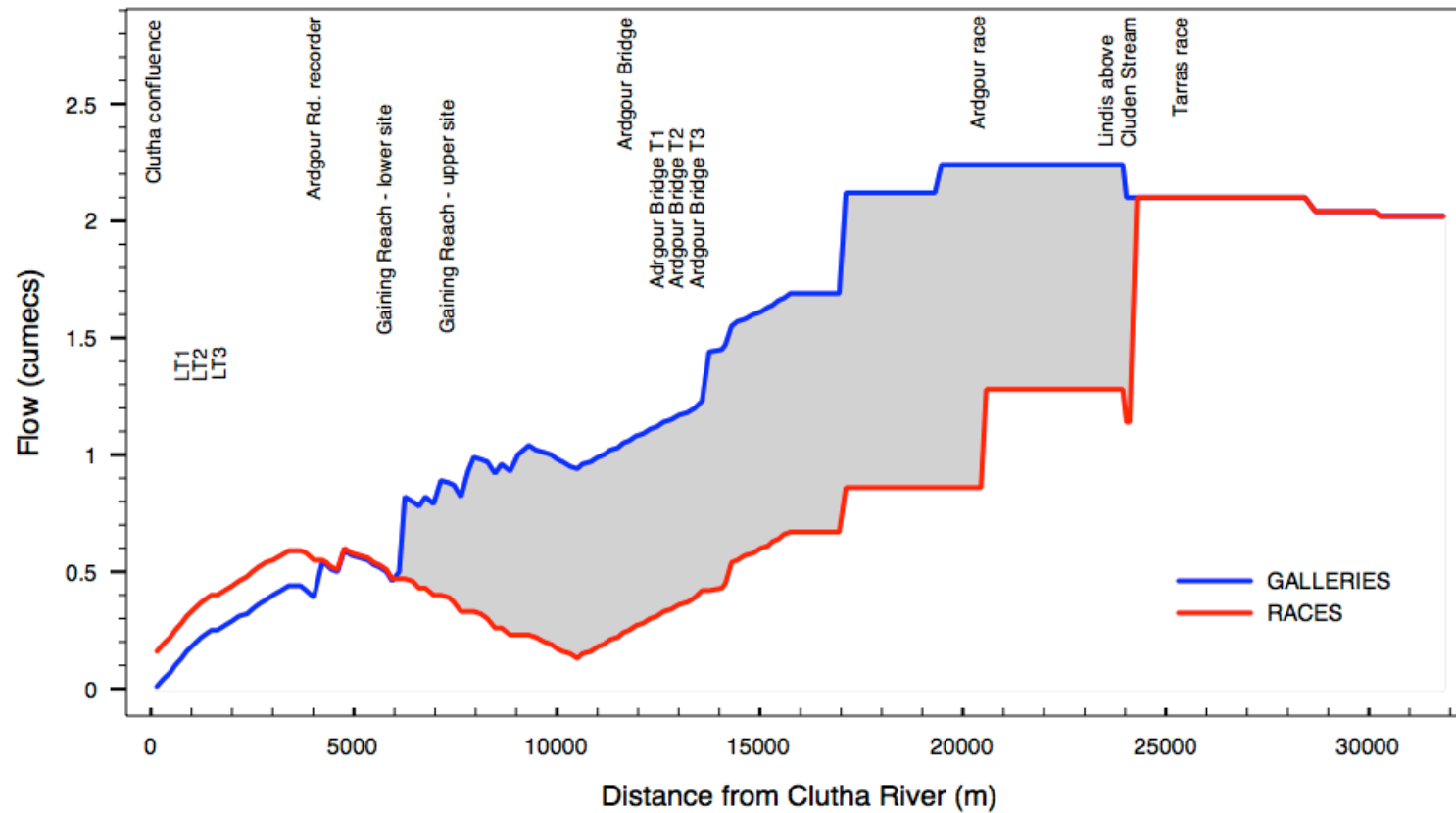




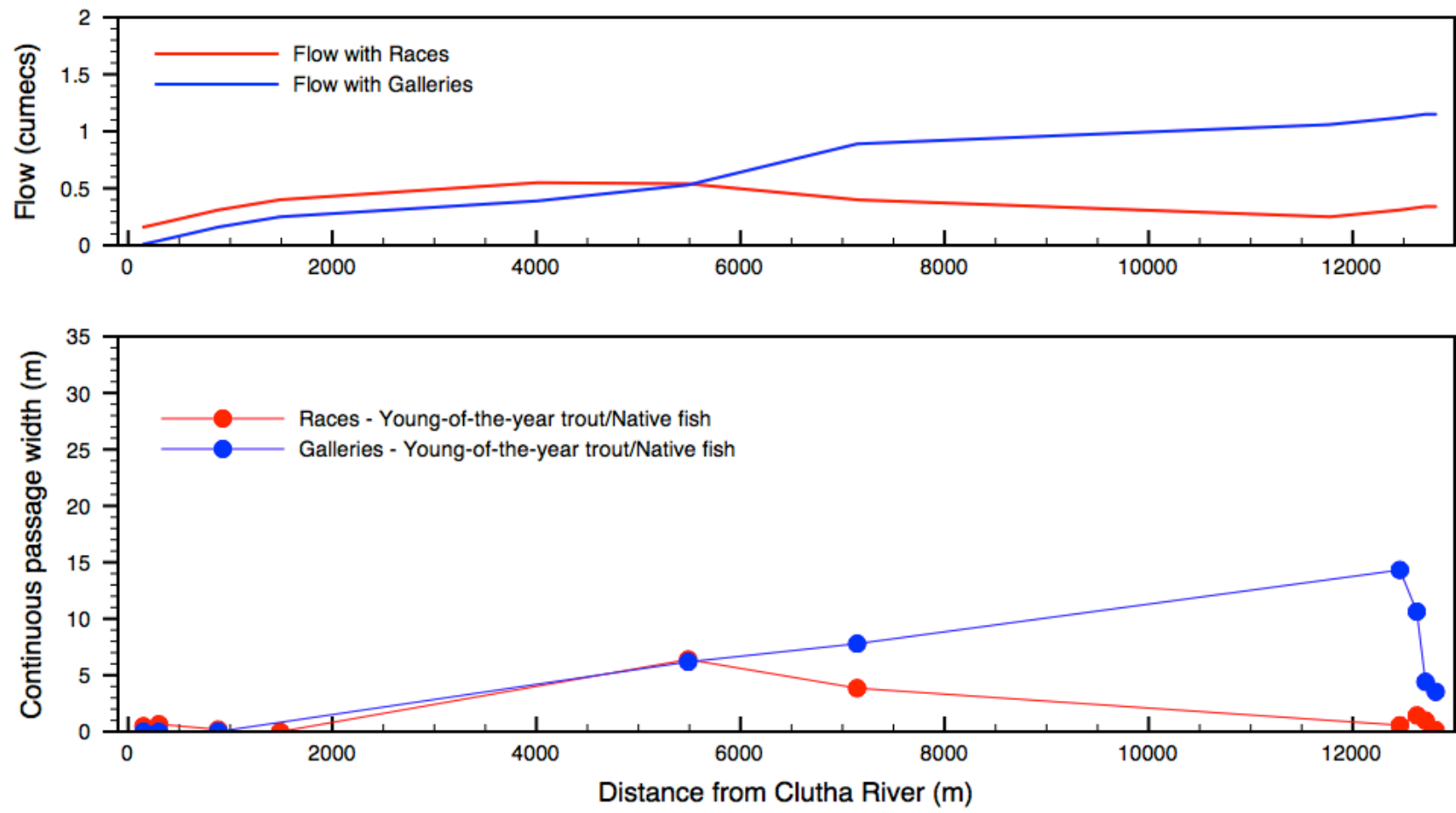
MINIMUM FLOW OF 550 L/SEC @ RECORDER:

LINDIS PEAK FLOW = 2.02 CUMECS

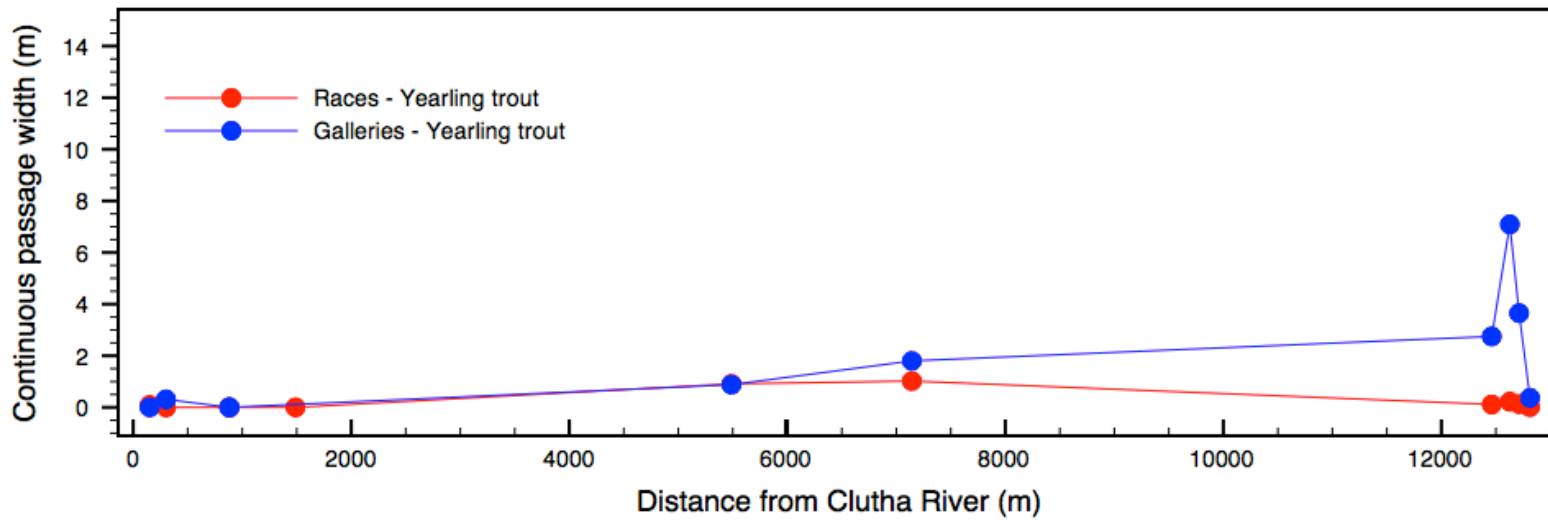
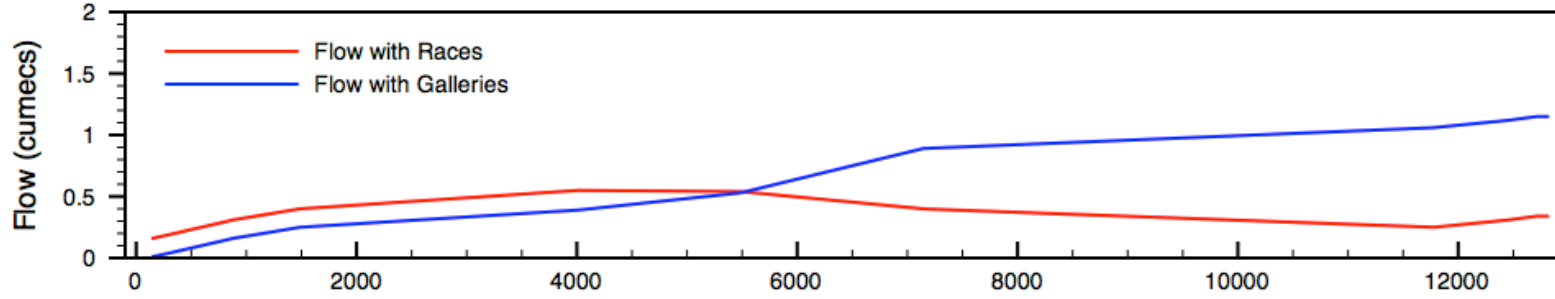
Longitudinal Flow Model  $Q_{Lindis\ Peak} = 2.015\ m^3/sec.$  550 L/s min. flow for Galleries and Races



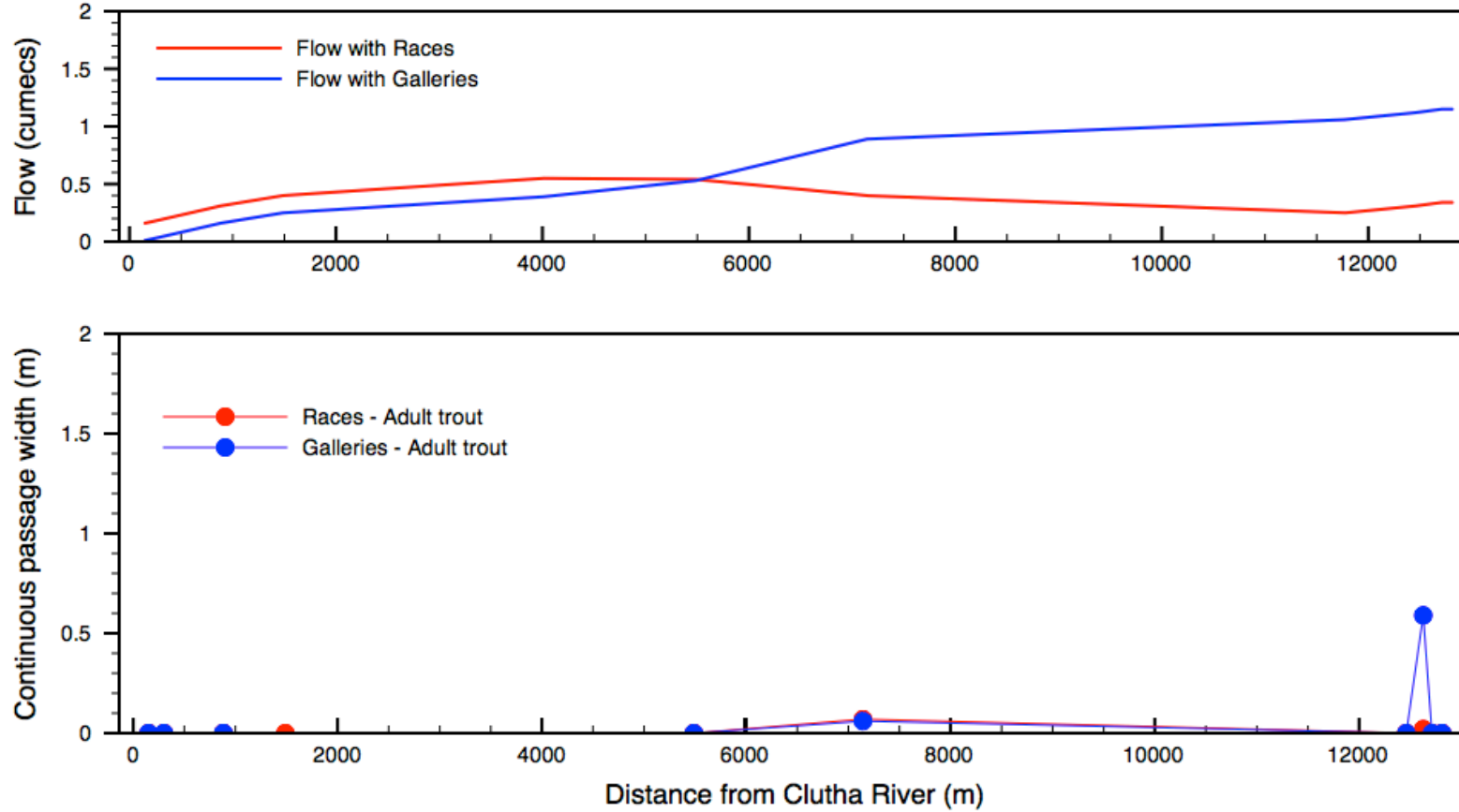
Minimum flow of 550 L/s @ Ardgour Rd. Recorder: Lindis Peak flow = 2.02 cumecs



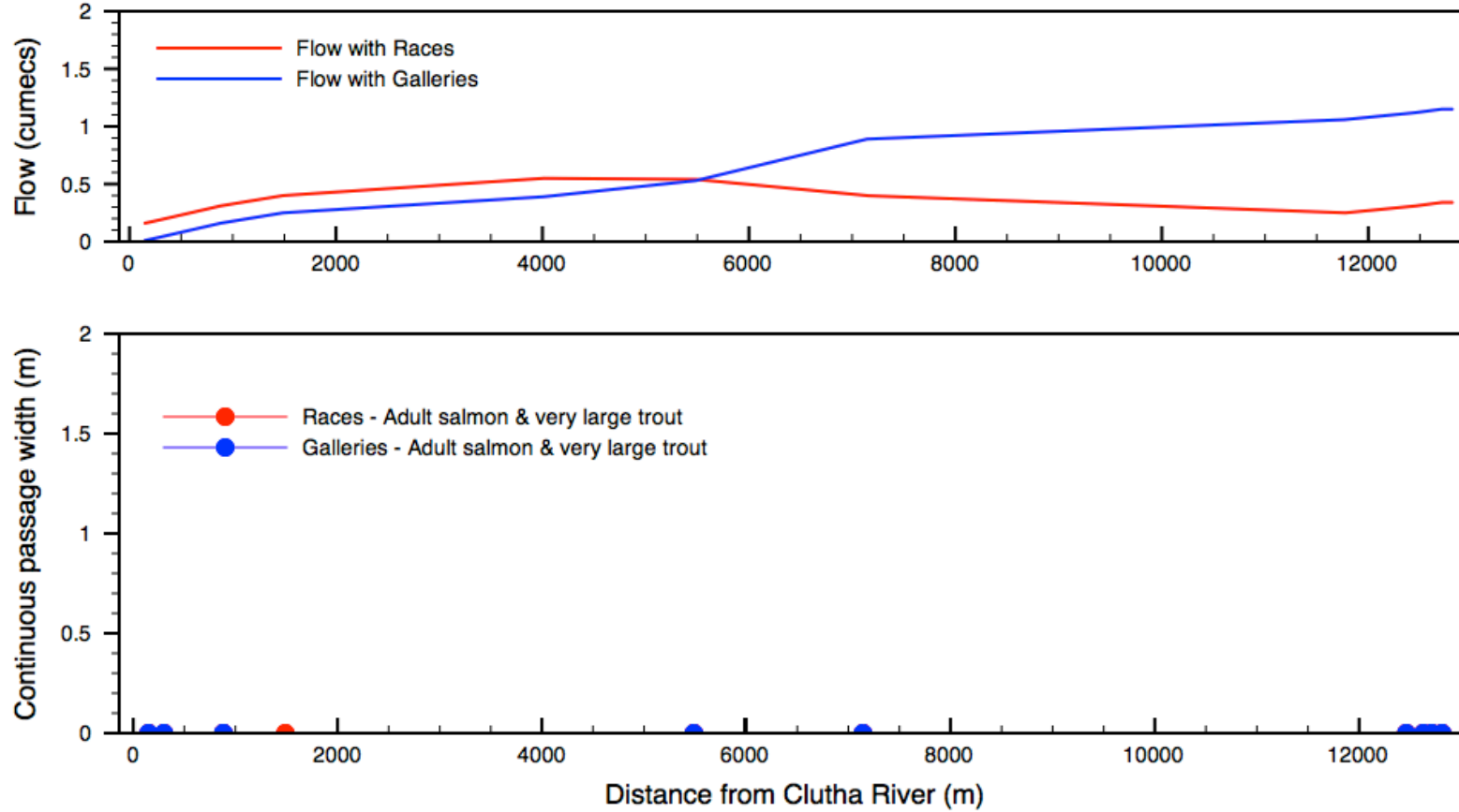
Minimum flow of 550 L/s @ Ardgour Rd. Recorder: Lindis Peak flow = 2.02 cumecs



Minimum flow of 550 L/s @ Ardgour Rd. Recorder: Lindis Peak flow = 2.02 cumecs



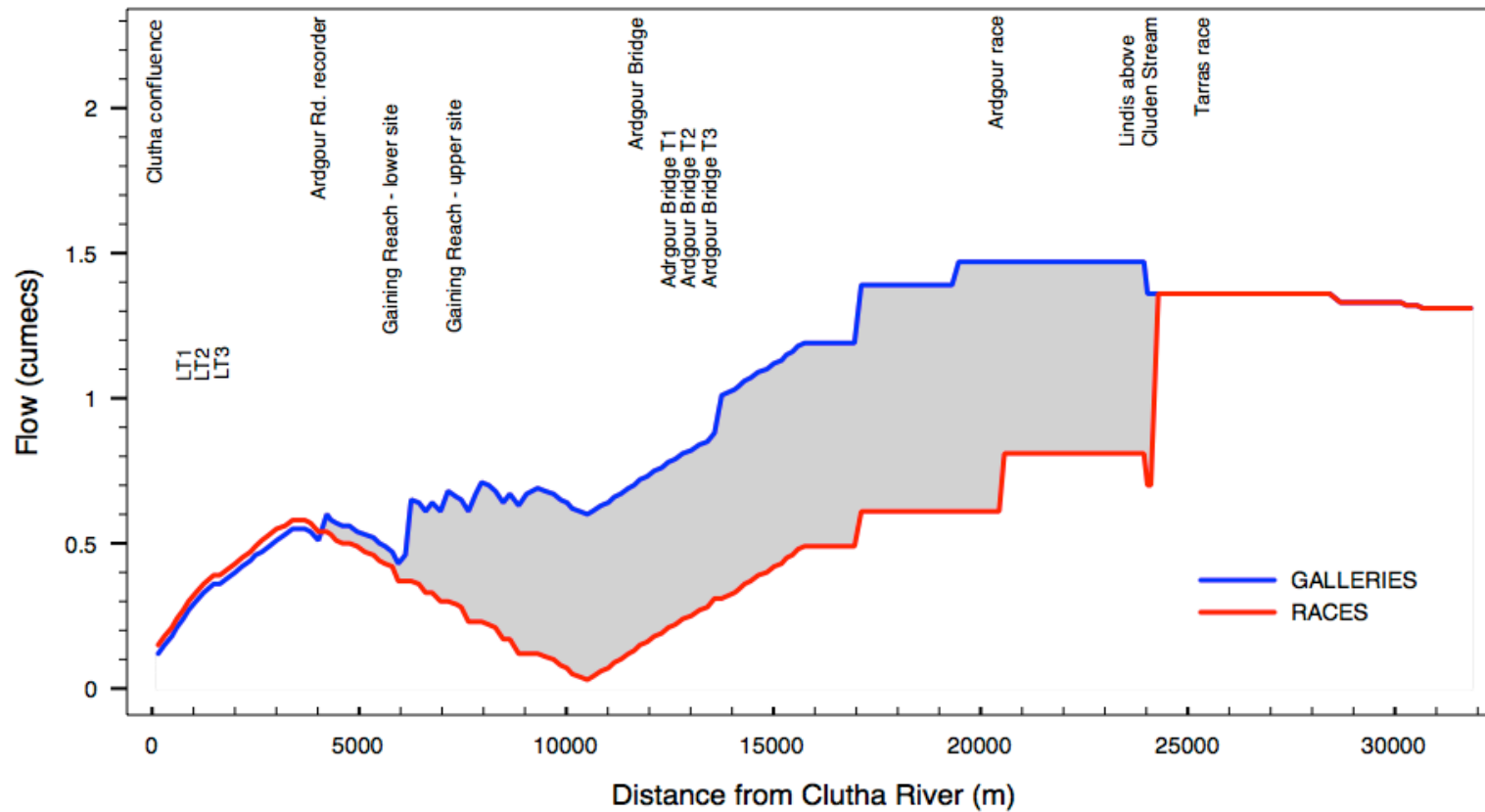
Minimum flow of 550 L/s @ Ardgour Rd. Recorder: Lindis Peak flow = 2.02 cumecs



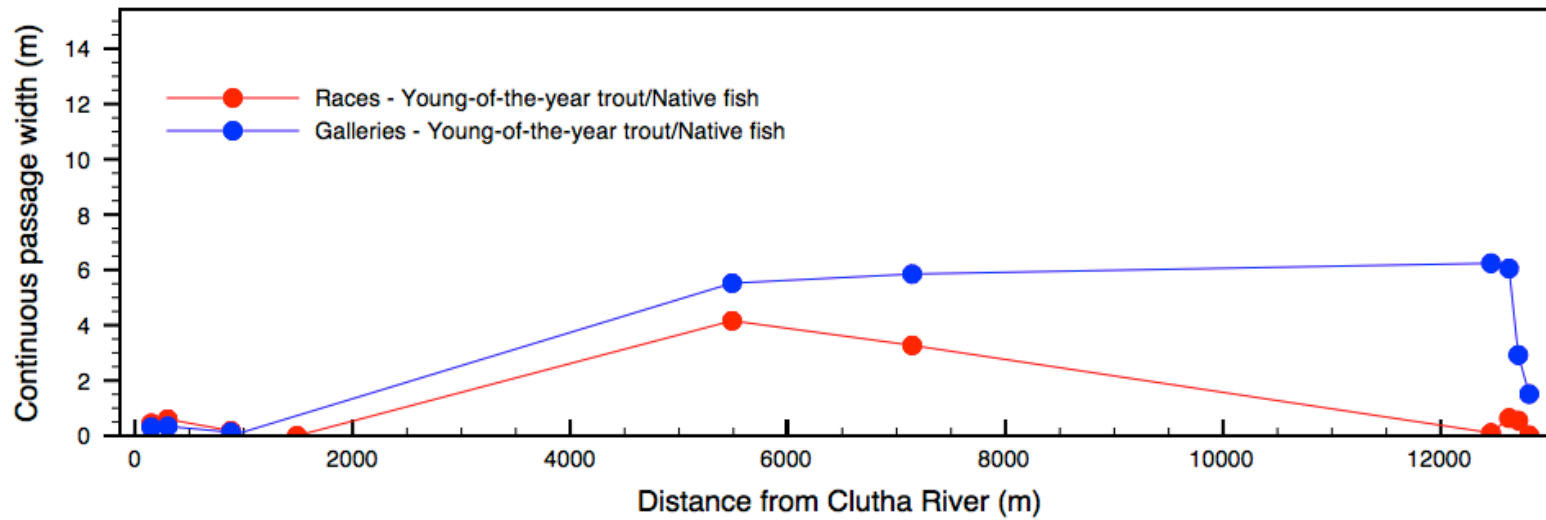
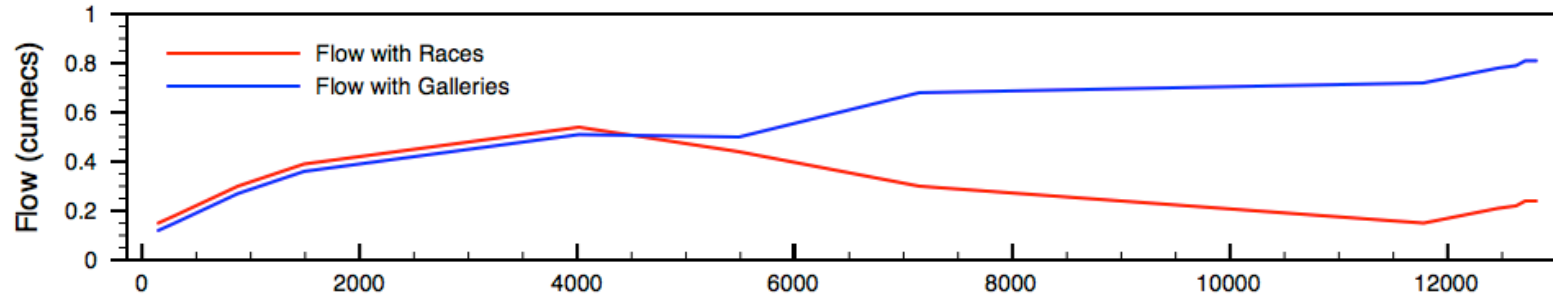
MINIMUM FLOW OF 550 L/SEC @ RECORDER:

LINDIS PEAK FLOW = 1.31 CUMECS

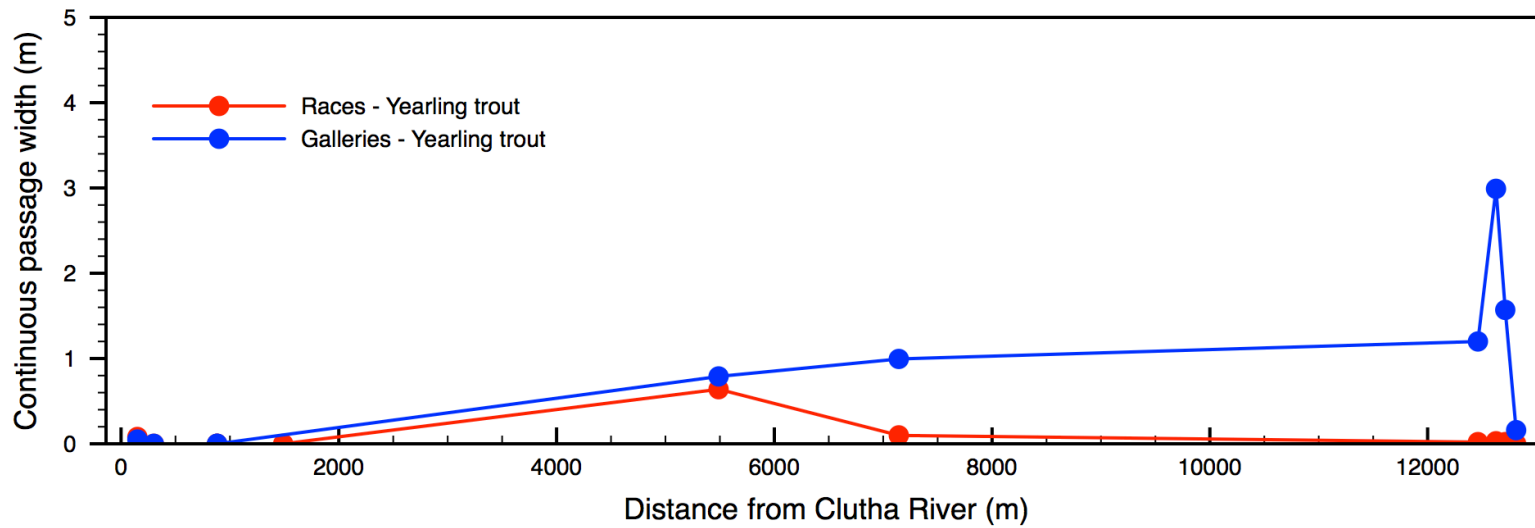
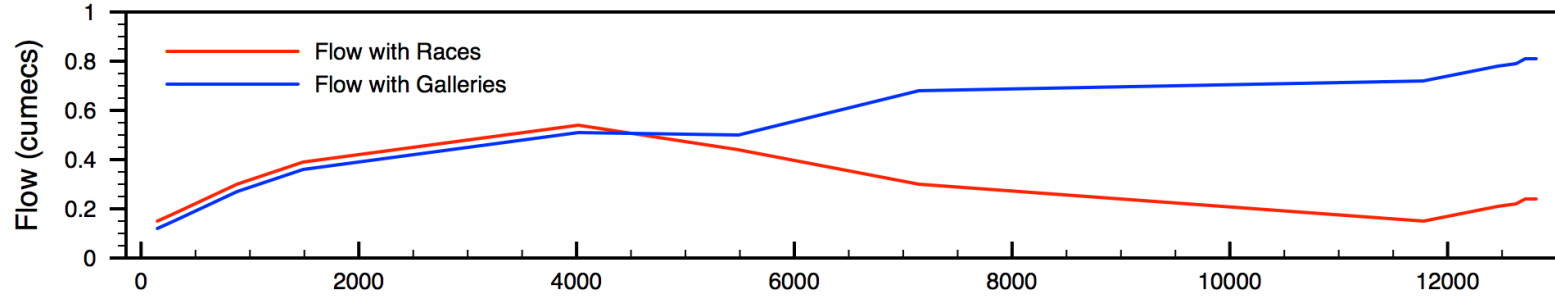
Longitudinal Flow Model  $Q_{Lindis\ Peak} = 1.308\ m^3/sec.$  550 L/s min. flow for Galleries and Races



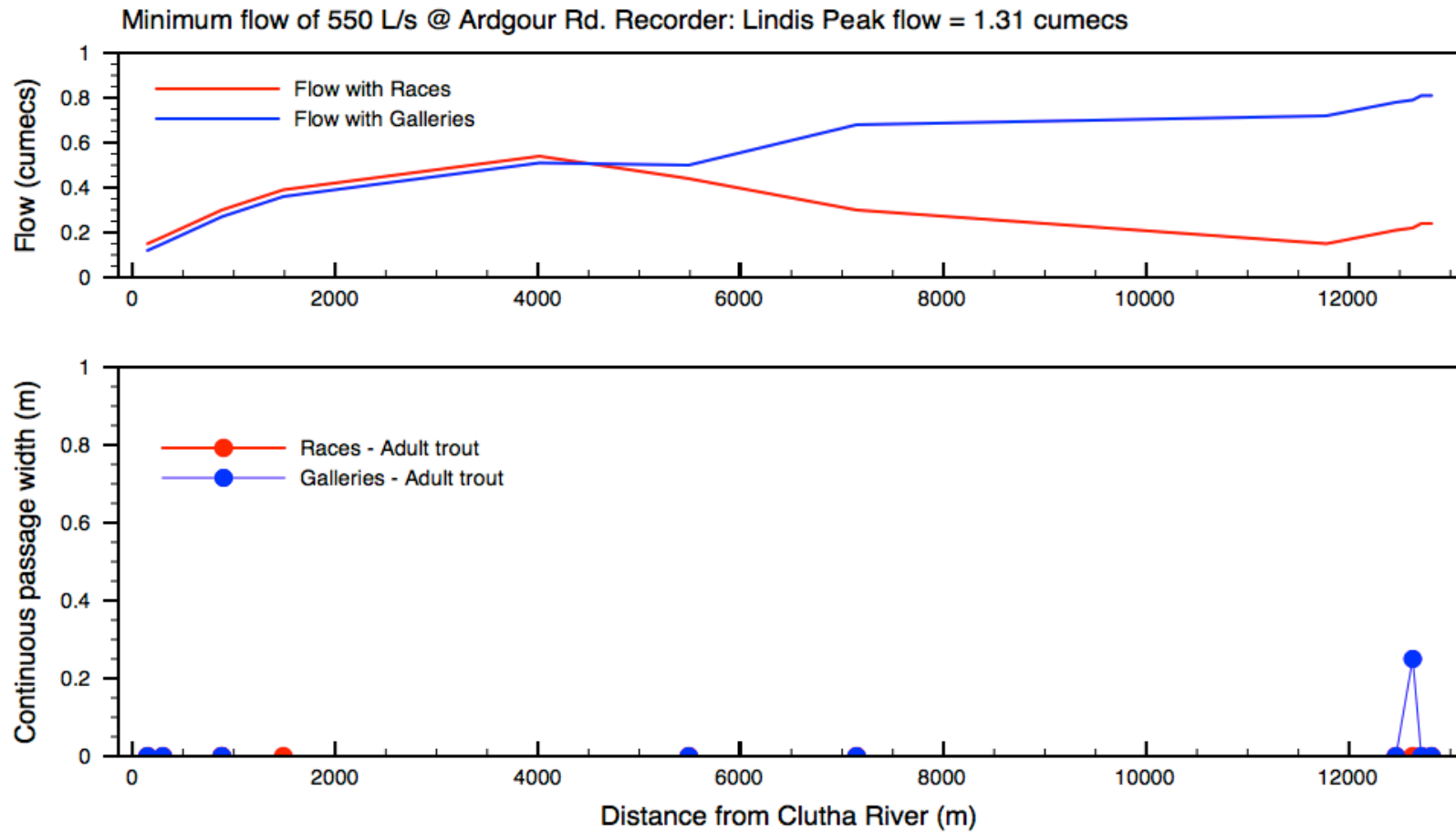
Minimum flow of 550 L/s @ Ardgour Rd. Recorder: Lindis Peak flow = 1.31 cumecs



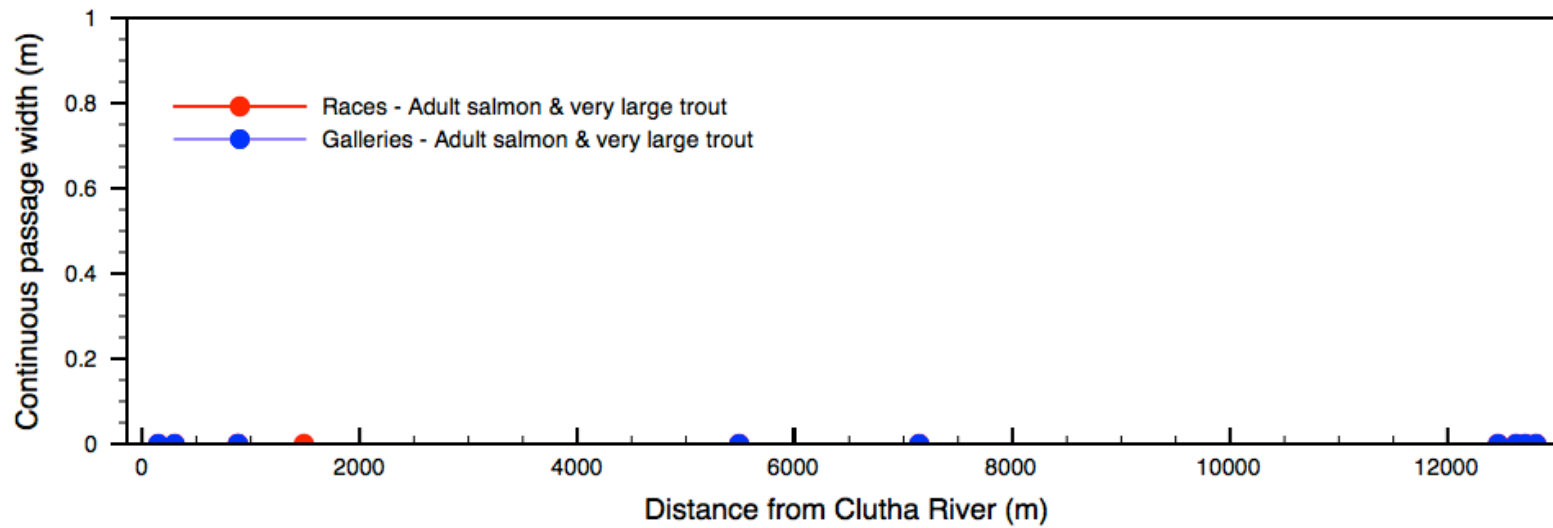
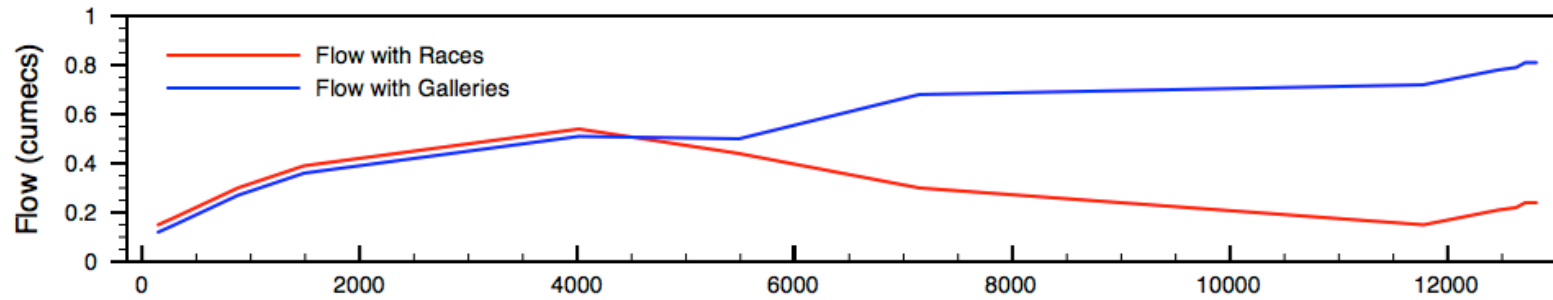
Minimum flow of 550 L/s @ Ardgour Rd. Recorder: Lindis Peak flow = 1.31 cumecs



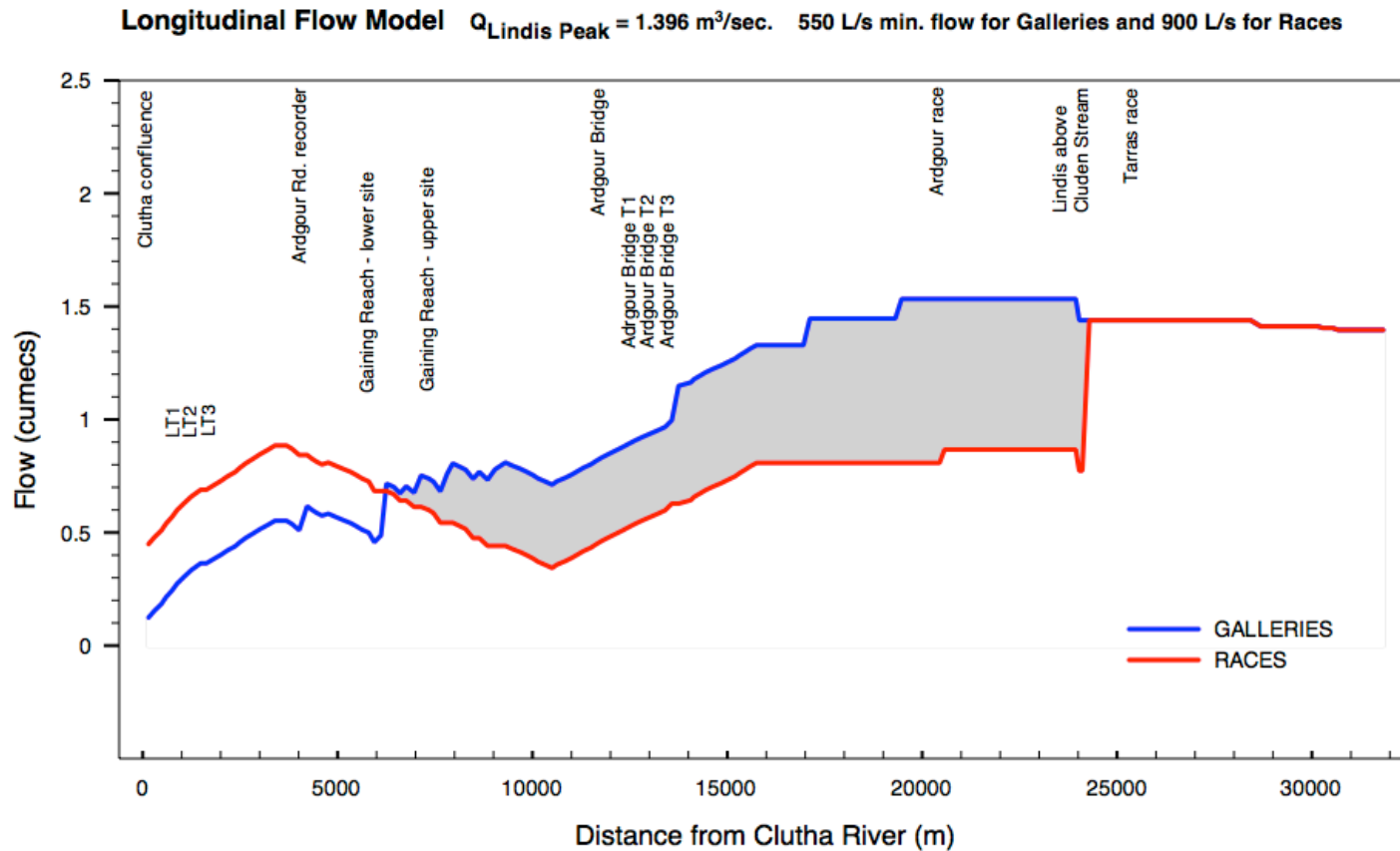




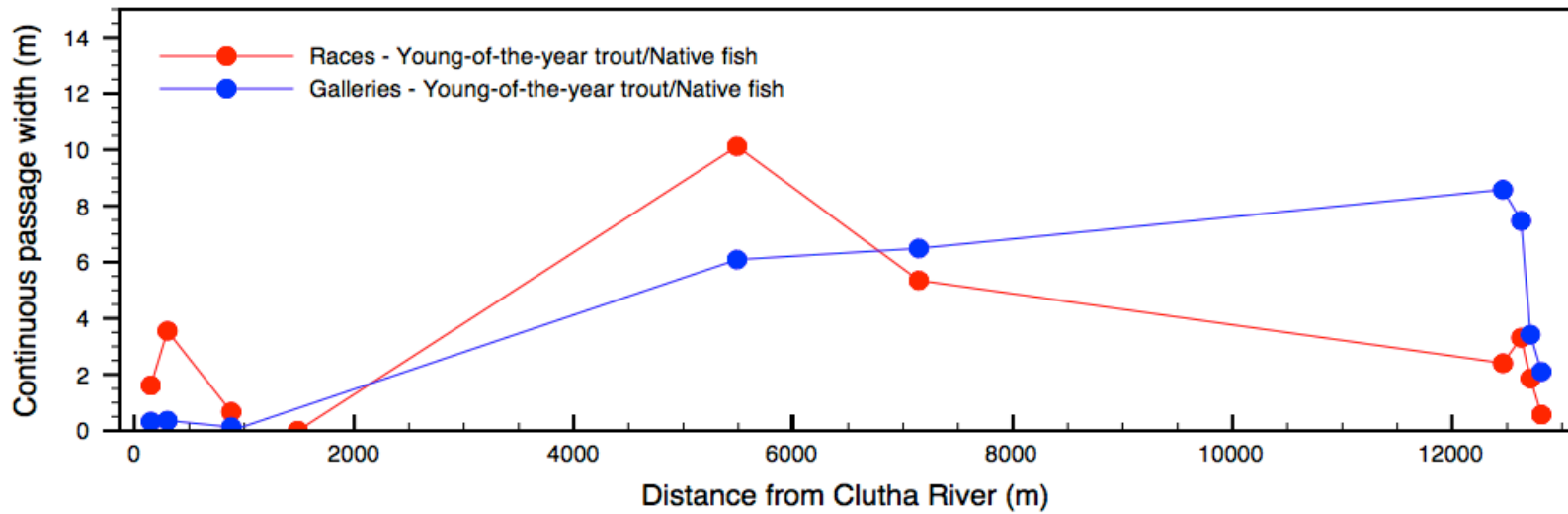
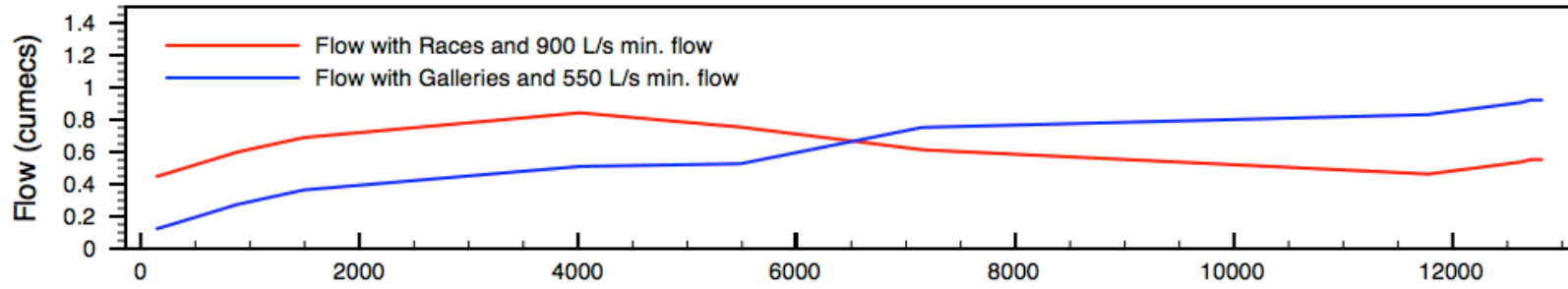
Minimum flow of 550 L/s @ Ardgour Rd. Recorder: Lindis Peak flow = 1.31 cumecs



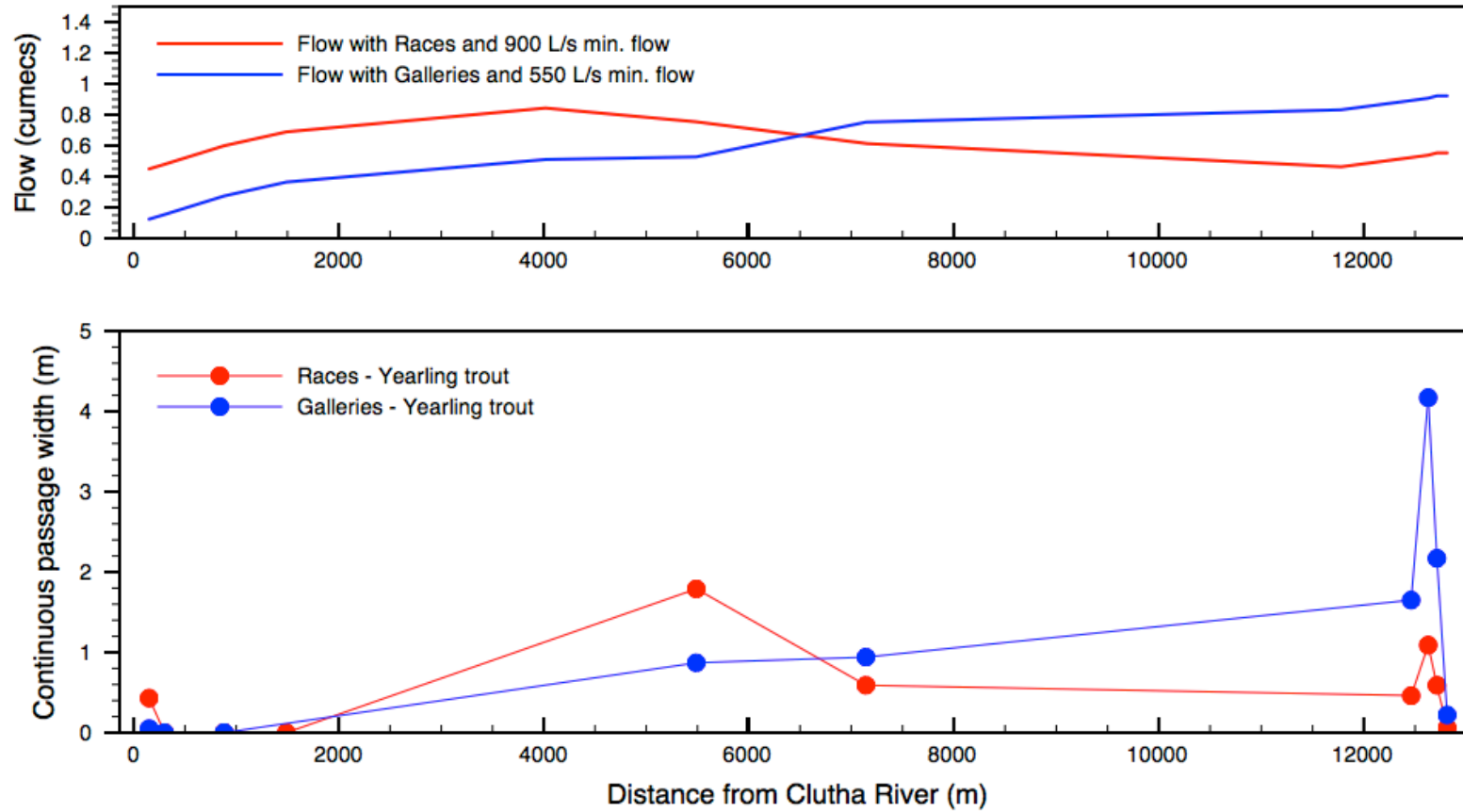
**MINIMUM FLOW OF 550 L/SEC @ RECORDER FOR GALLERIES & 900 L/SEC FOR RACES:  
LINDIS PEAK FLOW = 1.396 CUMECS**



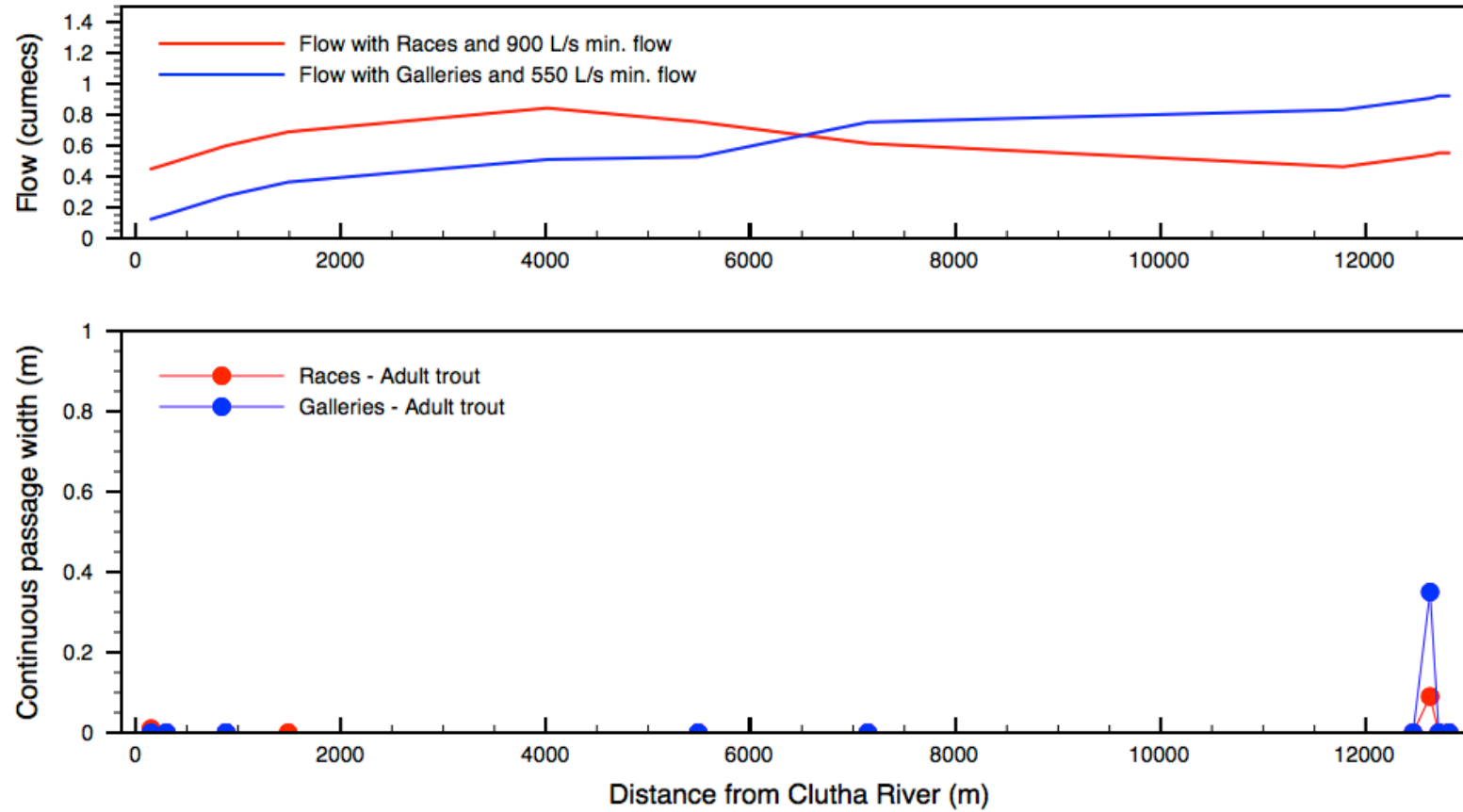
Minimum flow of 550 L/s for Galleries and 900 L/s for Races: Lindis Peak flow = 1.396 cumecs



Minimum flow of 550 L/s for Galleries and 900 L/s for Races: Lindis Peak flow = 1.396 cumecs



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