Galaxias "Teviot" (Teviot flathead galaxias) habitat description

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Cover: *Galaxias* "Teviot" habitat, Teviot River tributary. Photo by Nicholas Dunn

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Abstract

Galaxias "Teviot" occupy habitats typified by slow-flowing runs with few pools, and fast-flowing chutes and pools over bedrock in small-order hillslope streams with ribbon wetland and tussock riparian vegetation. These habitats are vulnerable to channelisation, intensive grazing and the potential for increased water levels in Lake Onslow which would flood their habitats.

1. Introduction

Figure 1. *Galaxias* "Teviot" (Teviot flathead galaxias). Photo by Rod Morris.

Galaxias "Teviot" (Teviot flathead galaxias; Figure 1) is an iteroparous, spring spawning, non-diadromous taxon endemic to Otago on South Island. *Galaxias* "Teviot" has a fragmented distribution, within wetland and stream habitat types in the Taieri and Clutha river catchments (Figure 2). *Galaxias* "Teviot" has a conservation status of Threatened: Nationally Critical (Dunn et al. 2018).

Qualitative habitat descriptions based on field observations and measurements are given for *Galaxias* "Teviot", complimenting quantitative descriptions following Instream Flow Incremental Methodology (IFIM) assessments of Daly et al. (2022). Descriptions are designed to typify the range of instream habitat conditions adult *Galaxias* "Teviot" occur in, at a mesohabitat scale.

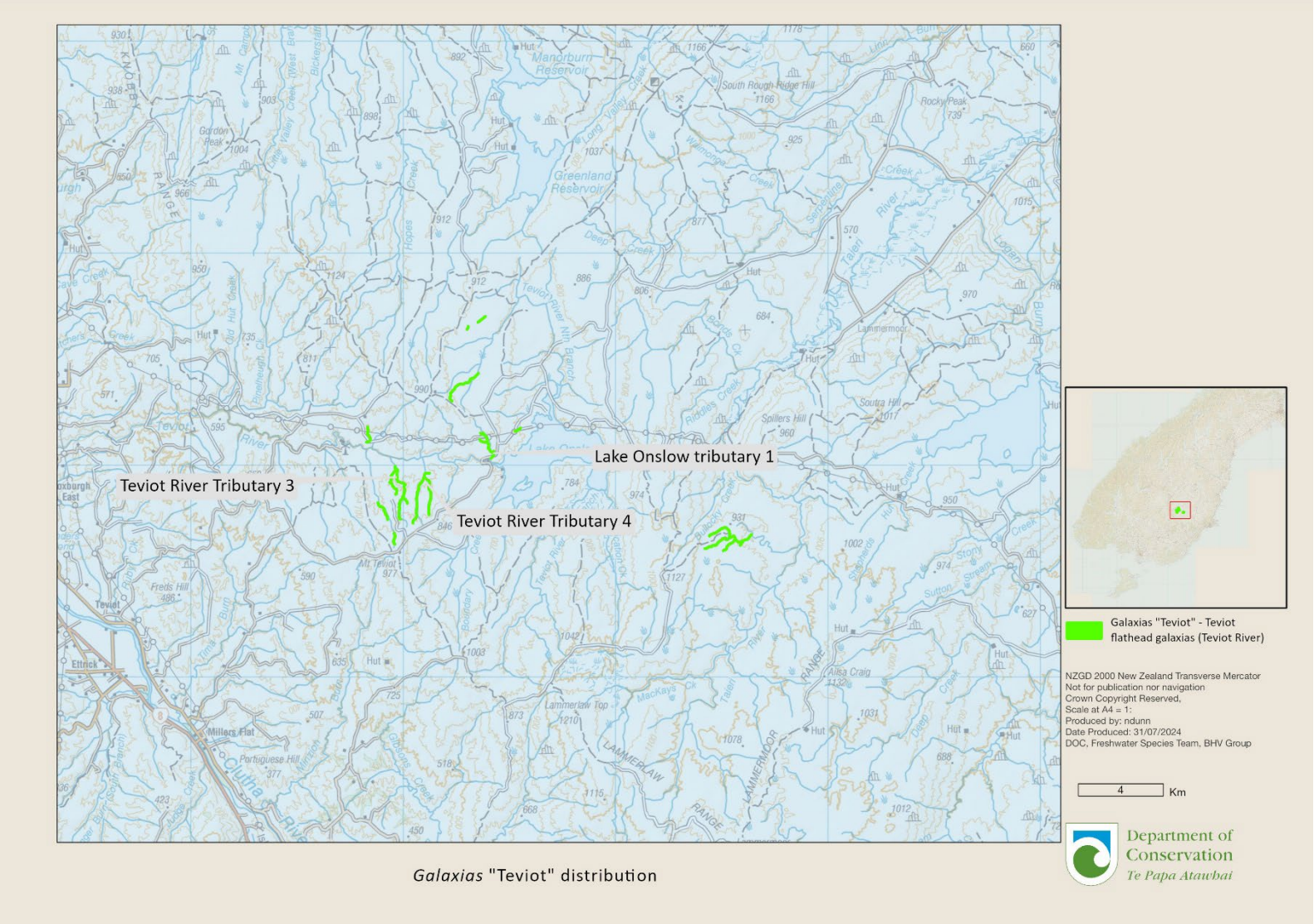

Figure 2. Known *Galaxias* "Teviot" habitat fragment distribution with sites included in the current study indicated.

2. Methods

Three unnamed tributaries of the Teviot River and Lake Onslow were sampled in January 2022 (Table 1), being the same sites as those reported on by Daly et al. (2022). Site selection was based on *Galaxias* "Teviot" being previously known at these locations, with timing designed to coincide with the summer low flow period, and to not interfere with spawning and larvae/post-larval/juvenile rearing periods.

Table 1: Location of study streams for *Galaxias* "Teviot" in the Teviot River catchment. Coordinates are for the midpoint of sampled sites.

Stream	NZTM Easting	NZTM Northing
Lake Onslow Tributary 1	1334261	4950573
Teviot River Tributary 3	1329627	4949893
Teviot River Tributary 4	1330985	4949421

In each stream a sampling reach containing a variety of instream habitat types was selected. Starting at the downstream end of reaches, transects were marked at 3.0 m intervals. Within each transect a 0.75 m x 0.75 m quadrat was carefully placed within the stream to cover the dominant flow, water depth and substrata conditions. A 1.0 m wide push net was placed along the downstream edge of the quadrat and three-pass electrofishing of the quadrat was conducted using a Kainga EFM 300 backpack electrofishing machine (NIWA Instrument Systems, Christchurch). While electrofishing was used in this study, it is becoming increasingly recognised that Gee's minnow trapping is more effective in the habitats occupied by *Galaxias* "Teviot". Each pass consisted of 5 seconds of electrofishing time in a downstream direction, stopping for a minimum of 5 seconds between passes. Captured fish were identified to taxon and measured to the nearest 0.5 mm, then placed in an aerated bucket of water to recover before being released.

Locations of quadrats were recorded by GPS and water depth and velocity measured at the centre points of quadrats. Water velocity was measured at 0.6 x depth using a Marsh McBirney Flo-Mate 2000 electromagnetic current meter. Percentage substrata composition was estimated within the quadrat using modified Wentworth scale size classes: bedrock (>4096 mm), boulder (256-4096 mm), cobble (64-256 mm), large gravel (8-64 mm), fine gravel (2-8 mm), sand (0.06-2 mm) and silt (0.0063 mm). Percentages of algal and macrophyte cover within the quadrat were also estimated.

Figure 2. *Galaxias* "Teviot" habitat. (A) cobble-boulder riffle. (B) bedrock run. (C) narrow cobble-boulder riffle-run habitats. (D) wetland pool-swale. (E) bedrock run in incised valley. (F) wetland habitat position in landscape.

3. Results

A total of 137 quadrats were sampled across the three tributary sites, with *Galaxias* "Teviot" captured in 46 of these, spread similarly (13-18) across the three streams. Characteristics of the sites *Galaxias* "Teviot" were present at are summarised in Table 2.

Galaxias "Teviot" showed a strong preference for low water velocities (Daly et al. 2022, Table 2) and was found more commonly amongst smaller substrata sizes (silt), likely associated with low water velocities. *Galaxias* "Teviot" were predominantly captured in slow run and pool habitat types and were found in locations ranging from open water to areas with dense macrophyte and algal cover.

Table 2. Habitat attributes measured within the 46 quadrats where *Galaxias* "Teviot" were present. Units are as presented, and percentages were visually estimated.

Attribute	Mean	Range (min – max)
Stream width (m)	1.53	0.46 - 3.45
Flow velocity (ms^{-1})	0.09	0 – 0.52
Substrata size class (mm)	<0.0063[1]	<0.0063 - >4096[2]
Water depth (cm)	18.3	4.5 - 57
Riffle habitat (%)	5.1	0 - 90
Run habitat (%)	47.5	0 - 100
Pool habitat (%)	53.8	5 - 100
Macrophytes (%)	9.7	0 - 100
Algae (%)	20.1	0 - 80

[1] Silt
[2] Silt - bedrock

4. Discussion

Based on field measurements and observations, *Galaxias* "Teviot" typically occur in habitats characterised by narrower, naturally irregularly meandering channels with lower water velocities. Channel form is dominated by deeper, slow-flowing swale-run habitat and few pools, although shallower, faster, steeper chutes in bedrock dominated reaches with scattered large cobble/small boulder creating interstitial refugia, can also be occupied. Channel form is influenced by valley form, ranging from deep box shaped with undercut, and at times, slumping banks in areas of incised and confined valleys, to shallow V shaped, wider, flatter wetted channels in areas of lower gradient, with indiscrete margins grading into riparian ribbon wetland.

Substrata are dominated by silts that overlie larger particles and bedrock in slower reaches, but finer particles are absent in faster reaches. Aquatic macrophytes within and adjacent channels also create structure and can limit open water areas; instream surfaces are often coated in medium depth films of brown algae.

The habitats occupied by *Galaxias* "Teviot" occur within an agricultural landscape, and given the habitats small size, they are prone to channel modification, with straightening and pugging increasing water velocity and sedimentation rates respectively, and riparian vegetation degradation and removal. The restricted distribution also makes *Galaxias* "Teviot" prone to adverse weather events, particularly intense precipitation that can cause localised flooding. Such events can also jeopardise the integrity of natural and built barriers that are currently hindering *Salmo trutta* (brown trout) from invading *Galaxias* "Teviot" habitat. A further potential threat is the currently shelved proposal to raise the water level in Falls Dam. Should this project proceed at some point in the future both current habitat and potential translocation sites within the catchment would be inundated.

5. Acknowledgements

We wish to thank Susanna Blakely (then DOC) for assistance in the field, Daniel Jack (DOC) for discussions on *Galaxias* "Teviot", and the owners of Minzion Station for allowing access to their land on which the sampled streams are located.

6. References

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