CENTRAL SOUTH ISLAND REGION

2025 Hakataramea River Fish Distribution Study

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January 2025

Prepared for the Central South Island Fish and Game Council

Report number: CSI2025-025

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Background

In mid-May 2018, a program was initiated by Central South Island Fish & Game (CSIF&G) to trap and tag brown and rainbow trout during their spawning migration from the Waitaki River to the Hakataramea River. This effort was conducted in collaboration with the Waitaki Riparian Enhancement Society (WRES), which was operating the trap to collect broodstock for their salmon enhancement initiatives in the lower Waitaki Catchment. The work coincided with the Winnemem Wintu salmon rematriation project, aimed at collecting genetic samples from late-running salmon. Consequently, the trap operated during approximately half of the brown trout and nearly all the rainbow trout spawning migration period.

The aim of the project was to gain a better understanding of the Hakataramea spawning run and its contribution to the lower Waitaki River fishery. The data from tag returns provided insights into the post-spawning distribution of trout that reside in the Waitaki but spawn in the Hakataramea. This information will be valuable for informing future management strategies focused on habitat protection, particularly for migration, as well as for understanding the catch and harvest dynamics of this spawning cohort.

Methods

Trapping Method

The trap was situated on the Hakataramea River, approximately 400 meters upstream from its confluence with the Waitaki River. It effectively captured trout from the entire river (see Figure 1). During the nearly six-month trapping period, there was only one flood significant enough to necessitate the removal of the trap, which lasted for eleven days.

Figure 1: The trap in the lower Hakataramea

Data Collection

Trout that were captured in the trap were placed into a holding bucket, sedated, measured, weighed, tagged and then placed into a revival container before being released upstream of the trap. A total of 570 trout were tagged. Signage at popular access points, online videos and newsletter articles were used to promote the project and encourage anglers to detect and report their catch of tagged trout. Tagged trout caught by anglers in the Waitaki River and its tributaries were reported to the CSIF&G office. Anglers provided the tagging number, the location where the trout was caught, and the trout's weight, which were then recorded in an Excel file.

Data Analysis

The approximate GPS coordinates of all tagged fish caught were determined using Google Maps Pro and recorded in an Excel file. QGIS and PowerPoint were then used to map the locations of each tagged trout. R-Studio was then utilised to create charts that assist in the visualisation of the weight (lb) difference of trout from when they were tagged to when they were recaptured (RStudio Team 2024).

Results

Tag returns were received across the 2018/19 to 2021/22 sports fishing seasons. In the 2018/19 season 44 tag returns were received, 17 during the 2019/20 season, 0 during the 2020/21 season, and 1 during the 2021/22 season. 46.77% of the tagged trout caught by anglers were captured in the Waitaki River, 51.61% in the Hakataramea River, and 1.67% in Bells Pond (Figure 2; Figure 3; Figure 4; Figure 5). 70% of tagged trout caught in the Waitaki River were within 5 km of the confluence of the Hakataramea. Five tagged trout were caught twice, with a tendency for them to remain in the same area where they were initially caught, except for one trout.

Accessibility is shown to be a key factor influencing where fish were caught (Figure 5). In between the Duntroon Access and the State Highway 8 Bridge only two tagged fish were reported.

The time of season also tended to impact the distribution of where tagged trout were caught in the Hakataramea (Figure 6). 78.12% of the tagged trout were caught early season (November-December), and only 21.87% were caught in mid to late season (January-April). Furthermore, no trout were captured above Mt Florence Bridge in the mid to late season (January-April).

From the trout that had recorded tagging and recaptured weights, 77.42% had lost weight (Figure 7; Figure 8). Weight data also suggests that trout tend to reach a maximum size of around 5lb (Figure 7), with the average weight of fish at tagging being 4.01 lb and the average weight of recaptured tagged fish being 3.68 lb. Therefore, on average fish tended to lose around 0.33 lb from the time of tagging to recapture.

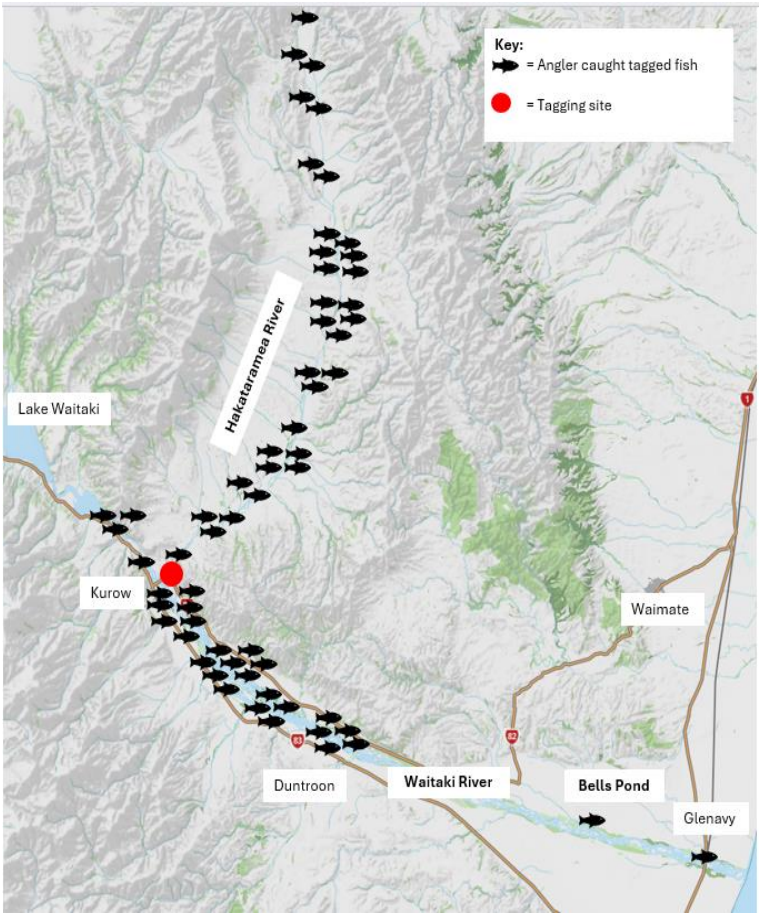

Figure 2: Location of 62 tagged trout caught by anglers in the Waitaki River, Hakateramea River, and Bells Pond between 2018-2022.

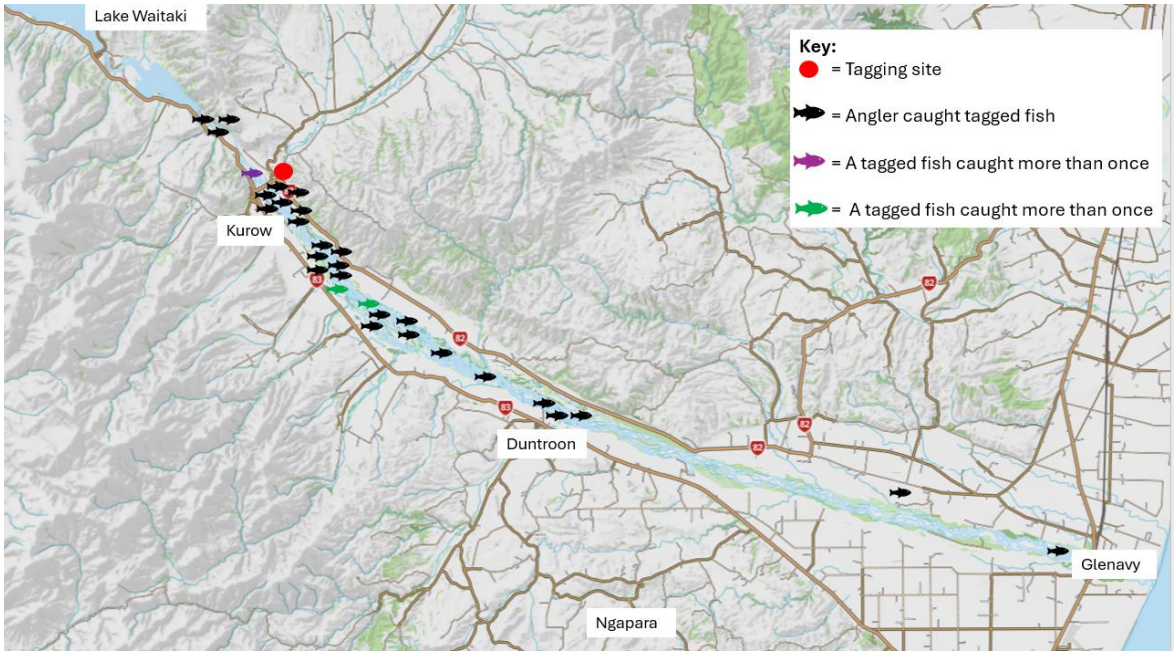

Figure 3: Location of 30 tagged trout caught by anglers in the Waitaki River and Bells Pond between 2018-2022.

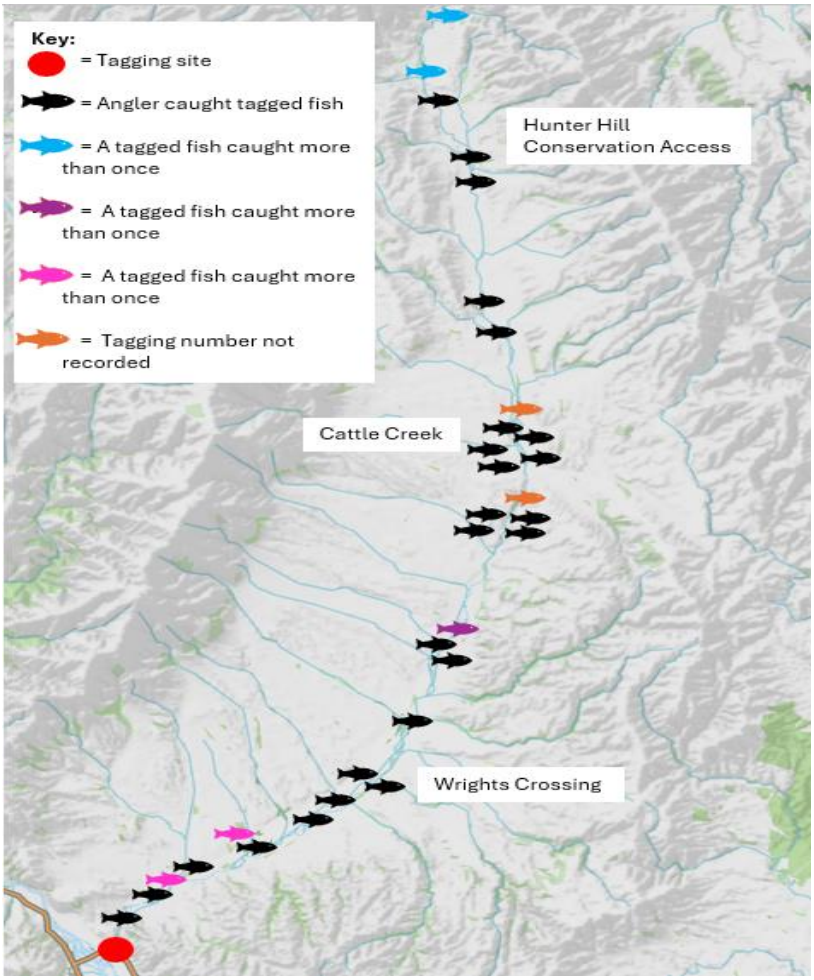

Figure 4: Location of 32 tagged trout caught by anglers in the Hakataramea River between 2018-2022.

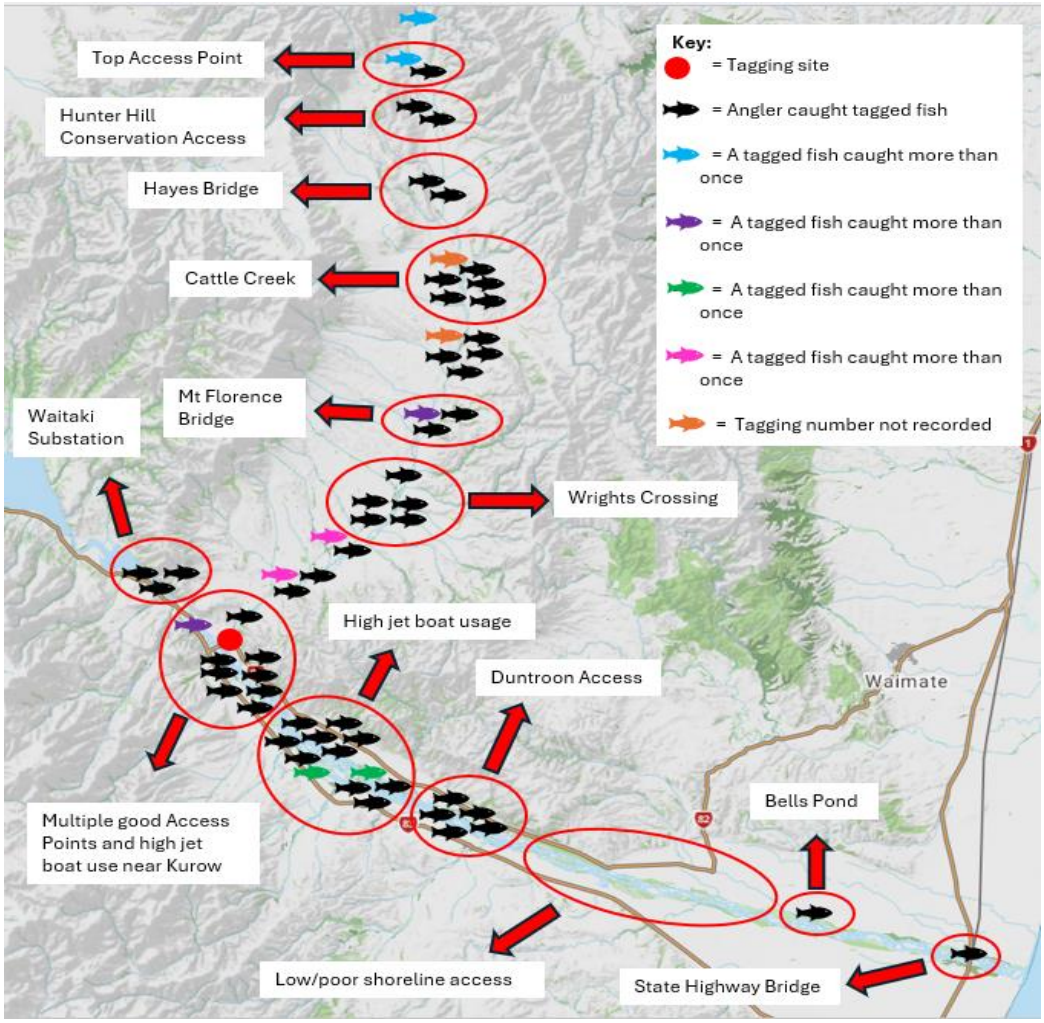

Figure 5: Location of 62 tagged trout caught by anglers in the Waitaki River, Hakataramea River and Bells Pond between 2018-2022 in relation to popular access points.

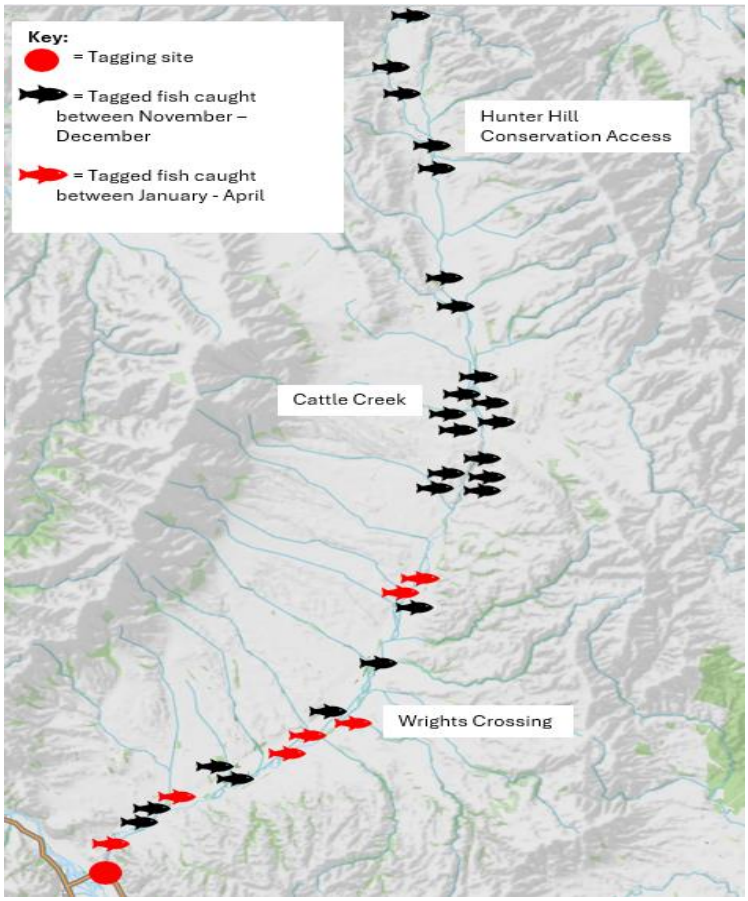

Figure 6: Location of 32 tagged trout caught by anglers in the Hakateramea River in relation to the time of season.

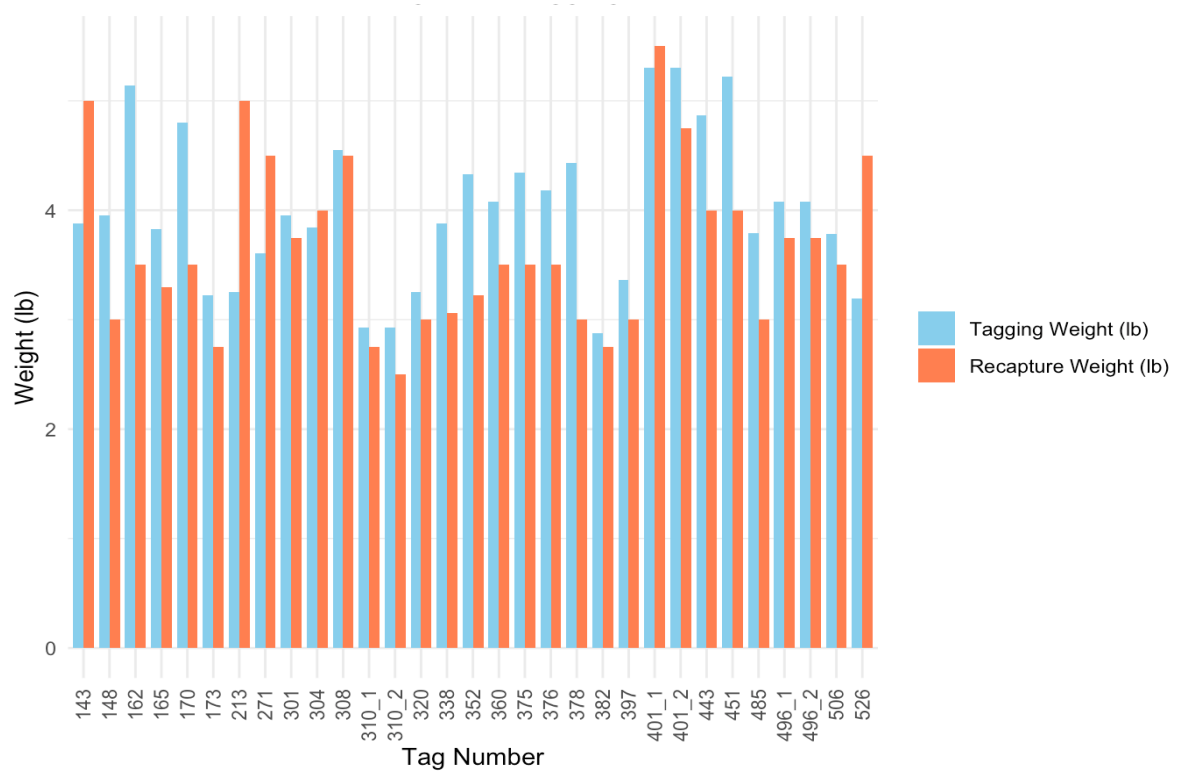

Figure 7: Comparison of trout weights at the time of tagging and recapture. The blue bars represent the weights at tagging, and the orange bars represent the weights at recapture (n=31).

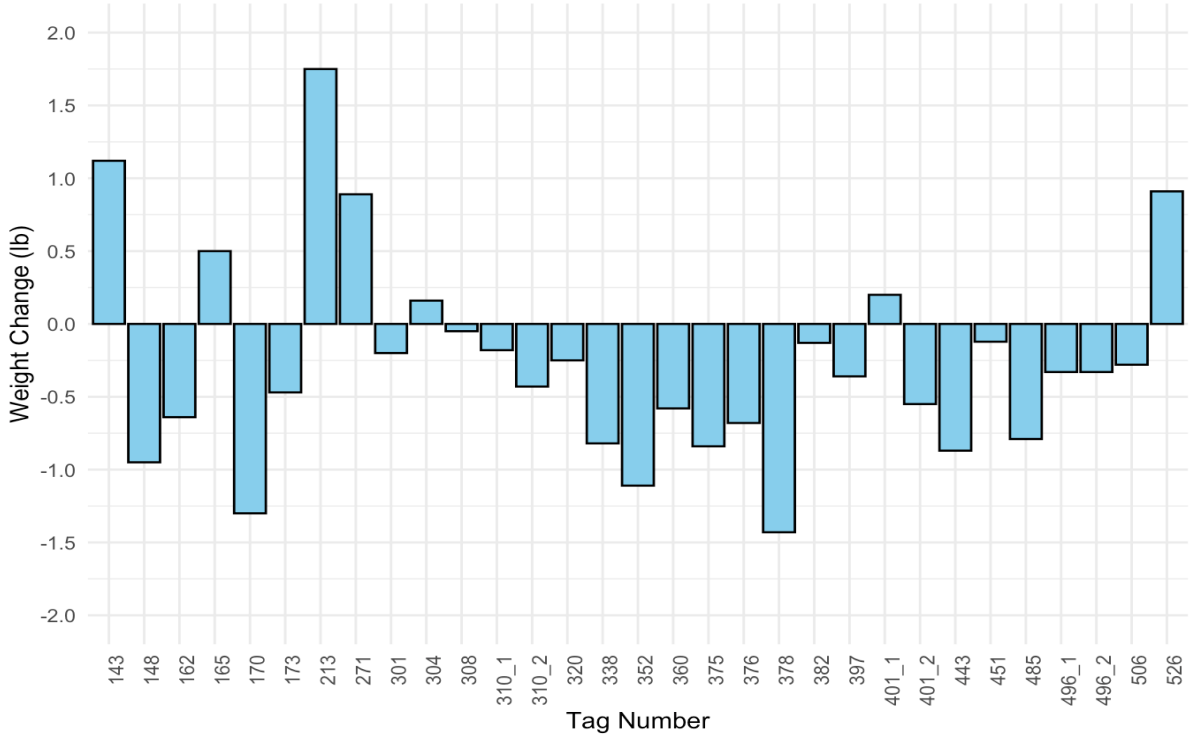

Figure 8: Weight changes (lb) for individual tagged trout, showing the difference in weight from the time of tagging to recapture. Each trout is identified by its Tag Number. Positive values indicate weight gain since tagging, while negative values indicate weight loss (n=31).

Discussion

The results suggest that the spawning run in the Hakataramea River contributes significantly to the Waitaki fishery by serving as a key source of recruitment. Of the tagged trout caught by anglers, 46.77% were captured in the Waitaki River, 51.61% in the Hakataramea River, and 1.61% in Bell's Pond. This near-equal distribution of tagged trout between the Waitaki and Hakataramea Rivers highlights the movement and connectivity of trout populations within the system. Although only 62 of the 570 tagged trout were recaptured (and/or reported), the data indicate that a considerable proportion of the trout involved in the Hakataramea spawning run may originate from, and later return to the Waitaki River fishery. This aligns with previous research conducted on salmonids, where it is suggested that they often return to their natal stream (Zwollo, 2012). Notably, 70% of the tagged trout caught in the Waitaki River were located within 5 km of the confluence with the Hakataramea, suggesting that these fish predominantly utilise the mid-upper reaches of the Waitaki River post-spawning. The distribution of fish caught within the Hakataramea and Waitaki catchment also reflects fishing access and fishability. However, it would appear that trout migrate and occupy the full lengths of the Hakataramea and Waitaki rivers post spawning and when flows allow.

Accessibility appears to be a crucial factor influencing where trout are caught, as demonstrated in Figure 5. Areas that are more easily accessible to anglers likely experience higher fishing pressure, which result in a higher number of trout being caught in these areas. As shown in Figure 5, only 3.23% of the total number of tagged trout caught were captured between the Duntroon Access and the State Highway 8 Bridge, which may be partly attributed to limited accessibility for on foot anglers. Additionally, jet boat users represent a significant portion of the fishing effort on the Waitaki River, primarily due to the enhanced accessibility they provide. The Kurow and Duntroon boat ramp facilitates this increased usage, leading to many jet boat anglers to concentrate their fishing efforts between the Duntroon Access and the Kurow Bridge. Therefore, this concentration of fishing activity may influence the number of tagged fish caught in these areas. However, trout are often found feeding around tributary inflows due to an abundant food supply being washed downstream and often more favourable flow and clarity conditions. This indicates that while accessibility may have influenced the catch rates, the proximity to tributary confluences likely plays a significant role in where trout are found and caught. Consequently, it is essential to consider both accessibility and habitat quality when evaluating fishing effort and developing management strategies for the Waitaki River fishery accordingly.

Another factor that may be influencing where trout are caught may be fishability and the subsequent ecological conditions. The lower stretches of rivers, such as the lower Waitaki River, are often prone to increased erosion, flooding, and discolouration due to several interrelated factors. Their flat floodplain topography makes these areas more susceptible to flooding (Nepal et al., 2014). Additionally, as water travels downstream it accumulates greater flow volumes and sediments loads from upstream erosion and runoff (Nepal et al., 2014). This increased sediment load can contribute to water discolouration (Morrison et al., 2009). These combined factors can create unstable and turbid conditions in the lower reaches, reducing habitat quality. Subsequently, these conditions may not only deter anglers, but they can also lead to a decrease in invertebrate biomass due to poorer habitat quality and stability (Ryan, 1991; Scrimgeour & Winterbourn, 1989; Suren & Jowett, 2006). Considering invertebrates are a key food source for trout (Townsend, 1996), fish may opt to reside in habitats with high food

availability after spawning. More stable tributaries, such as the mid-upper reaches of the Waitaki River, offer better water and habitat quality (Suren & Jowett, 2006), which may support higher invertebrate populations, providing trout with abundant feeding opportunities. These favourable ecological conditions in the mid-upper reaches of the Waitaki River likely support larger trout populations and contribute to the higher recapture rates of tagged trout in these areas.

The findings from this research align with a previous study conducted by Central South Island Fish & Game, which examined fish harvest in the Waitaki River during the 2018/19 sports fishing season. Notably, results from that study suggested that the section of the river between Borton's Pond and Ferry Road had the lowest number of fish caught throughout the entire river. This section, located between the Duntroon Access and Bell's Pond (Figure 5), supports the notion that poor accessibility for on foot anglers and the subsequent reduced fishability of the lower river section contribute to fewer trout being caught in this area.

The months in which tagged trout were recaptured indicate that trout typically inhabit the full length of the Hakataramea River during November-December (Figure 6). However, by January results suggest that trout numbers significantly decrease in the upper reaches of the Hakataramea River. It is known that during peak summer and dry conditions, a de-watering pinch point at Wrights Crossing may prevent trout from migrating back down to the lower reaches of the Hakataramea River and the Waitaki River (pers. comm Central South Island Fish & Game). Additionally, the likely increase in water temperature in peak summer, combined with low flows, likely forces most trout to retreat downstream in search of deeper and cooler waters prior to the de-watering pinch point at Wrights Crossing. However, it is possible that some trout that are inhabiting the upper reaches of the Hakataramea in December may not retreat downstream in time and become confined to the upper reaches. If so, some of these trout may die due to low flows and the subsequent increase in water temperature. Furthermore, trout that are down stream of Wrights Crossing may not be able to migrate upstream due to low or disconnected flows and may opt to remain in the Waitaki River or the lower reaches of the Hakataramea River from January to April, where conditions such as cooler, deeper water are more favourable.

Trout may have lost weight after tagging due to the timing of spawning, as all the fish were caught and tagged during approximately half of the brown trout and nearly all the rainbow trout spawning migration period. Given that the trap was positioned 400 meters upstream from the confluence of the Hakataramea and Waitaki rivers, it is likely that most of the trout captured and tagged were in their pre-spawning phase, preparing to continue further upriver to reach their spawning grounds. During the pre-spawning period, trout increase their energy reserves by accumulating fat and developing gonadal tissues, including eggs in females and milt in males (Adriaenssens & Johnsson, 2010). This period is crucial as these energy stores support both the metabolic demands of migration to spawning sites and the reproductive process itself. Therefore, these trout would have been tagged and weighed when their energy stores and body weights were higher than usual. Conversely, post-spawning often results in weight loss as their energy stores and gonad tissues are depleted. Consequently, this pre-spawning phase may explain the observed weight losses in recaptured tagged trout. However, since some trout were recaptured one to two years after tagging, natural growth over time and access to adequate food sources may have enabled some individuals to gain weight, offsetting the metabolic demands of spawning (Dedual, 2021; Jones & Closs, 2017). This variability highlights how both

reproductive timing and individual growth patterns contribute to the differences observed in tagged fish weight changes. Furthermore, recaptured trout had an average weight of 3.68 lb, ranging from a minimum of 2.5 lb to a maximum of 5.5 lb. The relatively high minimum weight of tagged trout may be attributed to their pre-spawning phase, as trout typically only begin spawning once they reach sexual maturity, which is usually around 3 years of age (Dedual, 2021). This suggests that most of the tagged trout were mature adults preparing for spawning, aligning with their increased body size and weight at the time of tagging. Furthermore, the average size and maximum weight of 5.5 lb among these trout may be largely explained by the habitat and available food resources, which support growth up to this threshold. While the habitat provides sufficient resources for trout to reach this size, it may also present limitations, such as space and resource competition that prevent further growth (Parra et al., 2010). This suggests that, while the environment enables trout to reach a moderate size, factors within the habitat may impose an upper limit on growth potential.

Future Directions

Given the Hakataramea River's significant contribution to the broader Waitaki fishery, it is essential to prioritise the preservation and enhancement of its spawning habitat. Key factors in sustaining suitable spawning grounds include maintaining appropriate water flow/depth, temperature and substrate, as these directly influence trout's energy expenditure, migration success, and reproductive efficiency (Fenkes et al., 2016). Water flow, for instance, can affect both the accessibility and quality of spawning grounds by shaping sediment composition and oxygen levels in redds, which are essential for egg development (Kondolf, 2000). Furthermore, low or completely dry water levels can prevent trout from reaching their preferred spawning grounds, which may limit reproductive success and reduce population recruitment in affected areas. Temperature, meanwhile affects metabolic rates, with higher temperatures increasing the energetic demands on migrating trout (Elliott & Elliott, 2010). Lastly, substrate quality is crucial for trout, as they prefer coarse and intermediate substrates for successful redd construction and egg survival (Hayes, 1987; Taylor et al., 2019). Excessive fine sediment can reduce oxygen flow to the eggs, while large boulders can hinder trout's ability to build redds. Therefore, management efforts should focus on ensuring optimal flow regimes, monitoring temperature variations, and maintaining high substrate quality, especially during peak spawning periods. This comprehensive approach will support not only the health of individual trout but also the long-term viability of both the Hakataramea spawning population and the broader Waitaki fishery.

Limitations

One of the limitations from this research is that of the 570 trout that were tagged only 62 were recaptured (and/or reported), making it challenging to draw definitive conclusions about trout's movement's post-spawning. It is also important to note that the locations and weights of recaptured trout provided by anglers may not always be accurate. Anglers might estimate the locations where they caught the trout and guess their weights if they did not have scales to weigh them. This reliance on estimation can lead to inconsistencies in data collection. Furthermore, drawing conclusions about fishing pressure in relation to accessibility is challenging due to the lack of quantifiable data on where jet boat users spend most of their fishing activity. Without specific information on usage patterns, it is difficult to assess the impact of accessibility on fishing pressure. Consequently, the correlation between accessibility and where fish were caught needs to be interpreted with caution.

Research Design Recommendations

Based on the limitations identified in the study, there are several recommendations for future research that could provide a more comprehensive understanding of trout movement and habitat use in the Waitaki River system. For instance, expanding the study to include additional tributaries of the Waitaki River (e.g., Maerewhenua River and Otekaieke River) could help clarify the broader contribution of these tributaries to the overall fishery and provide a more complete representation of trout movement. Furthermore, incorporating more detailed data on fishing effort, such as the use of jet boats and the specific locations of fishing activities, would enable a more robust analysis of how accessibility influences catch rates. Additionally, incorporating habitat-specific variables, such as water quality, water temperature, flow regimes, and substrate conditions in different tributaries, would provide more insights into the factors influencing trout behaviour and habitat preference. By expanding the scope of the study and including these variables, future research could result in more reliable data, enhancing confidence in conclusions drawn for managing the Waitaki fishery effectively.

Conclusion

In summary, the findings of this study highlight the vital role of the Hakataramea River in supporting the Waitaki trout fishery, emphasising the significant movement of both brown and rainbow trout between these water systems. The near 50/50 distribution of tagged trout caught in both rivers suggests that a substantial proportion of the spawning run returns to the Waitaki River, particularly within the mid-upper reaches near the confluence of the Waitaki and Hakataramea rivers, where accessibility, fishability and habitat quality may influence catch rates. This emphasises the need for fisheries management strategies that consider not only angler accessibility but also the influence of habitat quality throughout a river system. The observed weight changes in tagged trout provide insight into the physiological impacts of spawning and subsequent growth patterns, reinforcing the notion that individual trout experience varying outcomes based on timing, energy reserves, and habitat conditions. The maintenance of healthy spawning habitats in the Hakataramea River is crucial for sustaining trout populations in the Waitaki fishery. Future management efforts must prioritise maintaining optimal water flow, the resulting regulation of water temperature, and substrate quality to ensure successful spawning and recruitment, ultimately supporting the long-term viability of this important fishery. By addressing these ecological factors, we can enhance a resilient and productive trout population that benefits recreational anglers.

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