

Auckland/Waikato Fish & Game Council Annual Drift Dive Monitoring Program Report 2024



Author: Dr Adam Daniel
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Auckland/Waikato Fish and Game Council
Hamilton New Zealand

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1. Executive summary

Drift dive surveys are conducted annually to ensure fish populations can sustain the current bag limits and to detect catastrophic collapses of the fish population requiring emergency closures. Events like chemical spills, large storms, slips, volcanic eruptions, droughts and heatwaves can cause trout populations to collapse. Long term monitoring also allows Fish & Game to improve the management of streams by looking at increases or declines in trout populations corresponding with land use change or management actions such as fencing and riparian planting.

Drift dive surveys were successfully conducted on the Awakino, Waihou, Waitawheta, Whakapapa and Kauaeranga Rivers. Drift dives were conducted from mid-January to early March of 2024. Rainfall was below average during January and February with the first major rain occurring after surveys were completed in early March of 2024 (Figure 1.1). There were no significant recruitment failures or other alarming findings amongst the Auckland/Waikato Streams monitored during the 2024 drift dives.

Due to nearly three years of non-lethal temperatures both the Kauaeranga and Waitawheta Rivers are sustaining trout populations after several years of poor fishing due to high summer temperatures. Fishing reports from the Waitawheta and Ohinemuri Rivers have been excellent during the past year. Water temperatures in the Ohinemuri River are normally above 19°C from early November to late March but the summer of 2022 was extremely mild with only short periods above 19°C. Fly fishing competitions in the Ohinemuri River were abandoned in 2018 due to low catch rates (mean catch of 7.8 fish per competitor) and high water temperatures. The annual Ohinemuri competition was resumed in 2024 and competitors averaged 17.3 each likely due to successful recruitment that occurred in 2022.

Multiple attempts were made to drift dive the Mangatutu River during mid-January and February that were abandoned due to low visibility. Significant earthworks (Figure 1.1) from a new farm track and felling operations with inadequate erosion control allowed moderate to large amounts of sediment into the Mangatutu River significantly reducing water clarity in the survey reach. The discharge was reported to Waikato Regional Council who investigated. Due to the site previously being forestry, the track building and subsequent runoff were classed as a forestry activity and covered by permitted activity rules. As a result, no charges were laid but “corrective instructions” were given to the new landowner. Sediment is the single most influential factor for reducing the health of wadable streams and their fish populations (Pingram et al. 2019), so it is disappointing that the incident occurred.



Figure 1.1. Tree felling and earthworks on the Mangatutu Stream January 2024.

2. Introduction

Auckland/Waikato Fish & Game is tasked with managing the region's freshwater sports fisheries for present and future generations with the goal of maintaining and improving wild, self-sustaining populations (Wilson 2021). To successfully manage the region's wild trout population staff are required to monitor populations and their trends over time. (Wilson 2021). Detecting significant changes in trout populations is important for setting bag limits and emergency closures if trout populations are significantly impacted. Drift diving is the primary tool used to monitor the Auckland/Waikato region's trout populations.

It is impractical to monitor all the region's streams, so a diverse set of representative streams that meet the criteria for drift dive monitoring are selected annually and surveys are conducted mid-summer. Drift dives also allow staff to monitor water quality, check on access, discuss issues with landowners and conduct compliance.

Drift diving is not the most precise means of monitoring fish with fish count accuracies of 21-90% (Hagen and Baxter 2005; Young and Hayes 2001). Inexperienced divers often count 50% fewer trout compared to seasoned divers, introducing significant error into counts. Water clarity is the primary factor affecting accuracy of drift dive counts. Low water clarity, similar to that found in the upper North Island (4 m), can result in fish counts that represent only 20% of the actual population; water clarity approaching 16 m can increase accuracy to nearly 90% (Hagen and Baxter 2005). However, most drift dive accuracy assessment work has been done on larger rivers where divers cover 5m lanes (Hagen and Baxter 2005) with flows of at least 2 m³ per diver. In contrast Auckland/Waikato divers cover about 2.5 m lanes with flows of about 0.7-1.6 m³ per diver.

Despite not being a total count of a river's trout population, drift dive data is very useful for monitoring long term trends in the same river. Several variables like instream habitat, depth, flow, and water clarity make comparisons between rivers dubious. But comparing the same stream reach under similar conditions in consecutive years controls for these variables,

providing a good low-cost monitoring tool. The standard error of drift diving data in water clarity below 10 m is likely to be very high ($\pm 30\%$) and thus the data should only be used to make management decisions when large shifts (40%+) in trout populations are indicated.

Water temperatures above 24°C are often lethal to trout (Huysman et al. 2020; Wismer and Christie 1987) and are a significant limiting factor for trout populations in the Northern half of the Auckland/Waikato Region. Rivers like the Ohinemuri and Waikato Rivers regularly breach the 24°C mark for extended periods during most summers (Figure 1.1 & 1.2). Rainbow and brown trout die quickly at 26°C, and only 50% survived at 25°C with prolonged periods of temperatures above 24°C causing significant mortality. Due to the mild temperatures during the summers of 2022 and 2023 adult fish counts in heat impacted streams like the Kauaeranga and Waitawheta are expected to rebound.

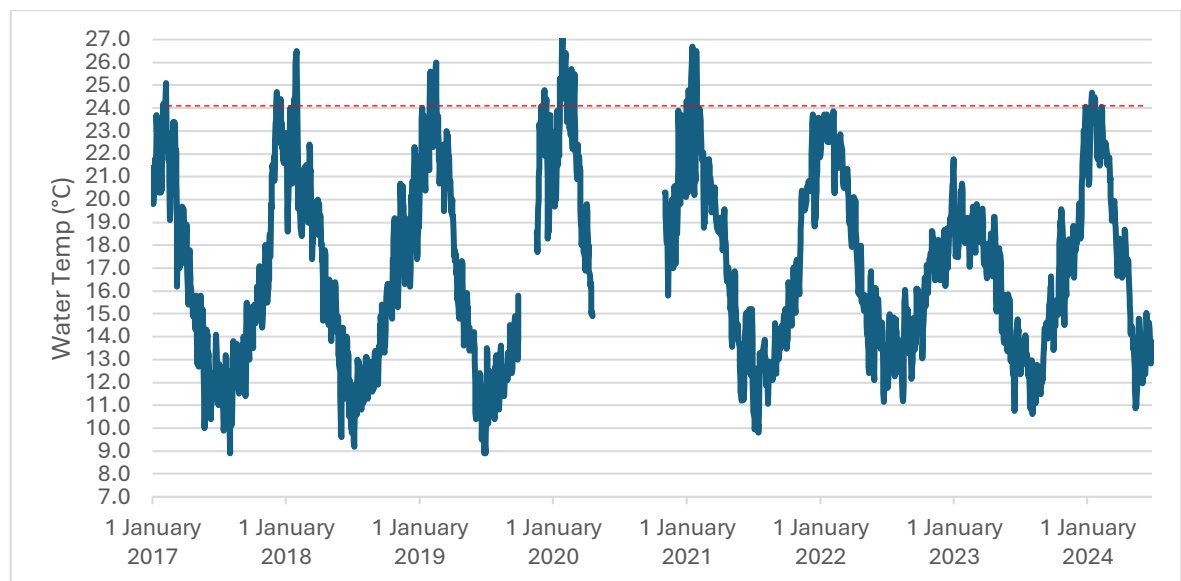


Figure 1.1. Ohinemuri River temperature from Jan of 2017 to Aug 2024. The red dotted line indicates lethal water temperature for trout.

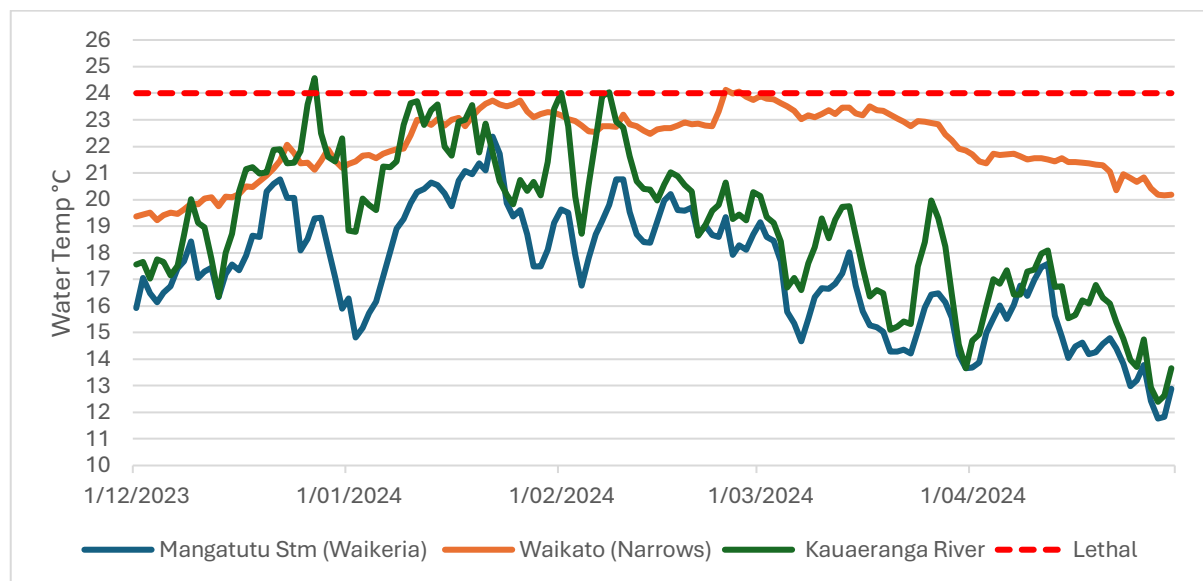


Figure 2.1. Water temperature from Jan. of 2023 to Mar of 2024 in the Mangatutu Stream (blue line), Waikato River (brown line), Kauaeranga River (green line). The red dotted line indicates lethal water temperature for trout.

3. Methods

Drift dives in the Auckland/Waikato Fish & Game Region (A/W) are conducted in streams with at least 3.5 m of visual clarity and depth of at least 300mm. Poor water clarity excludes most streams in the region from being monitored. Dive reaches are 0.9 to 2 km long and are surveyed for obstructions and dangerous rapids prior to each dive. Although it is preferable to survey multiple reaches of a river, poor visual clarity, high water temperatures, low water or limited access restrict most river surveys to one or two reaches.

Drift dives are conducted with two to four divers drifting in a parallel line downstream equipped with wetsuit, mask, snorkel, and wrist-mounted recording slates. Divers maintain a parallel line perpendicular to the bank, spaced so they can see the banks and their adjacent diver or divers. The number of divers needed to survey a river is dependent on their ability to see the bottom of the river and their corresponding diver. To avoid double counting fish, divers only count fish passing in the upstream direction. Dive teams stop at the end of each pool or reach to tally fish numbers and compare notes. Fish are sorted into species and size classes (<10 cm, 10-20 cm, 20-30 cm, 30-40 cm and 40+ cm) by each team member during each stop. Data is recorded by each individual diver on slates attached to their arm and then combined on a data sheet by the team leader at the end of each dive.

Prior to diving, water clarity is measured using a 20 cm black disc. The disk is walked backwards as it is observed using an underwater viewer. When the black disk just disappears, the distance to the viewer is recorded. Water temperature is recorded, and dive surveys only preceded in reaches with water temperatures of <19°C as fish commonly migrate out of warmer areas.

4. Awakino River

4.1. Awakino River introduction

Awakino River use has dropped from 840 angler days in 2001/2002 to 380 in 2014/15 (Unwin and Rouse, 2016) but stabilized at 420 angler days in the 2020/21 survey (Stoffels and Unwin 2023a). The drop in angler use corresponds with the recovery of the Whakapapa River after the 1992 eruptions and mirrors other popular fisheries like Lake Arapuni. One possible explanation for the drop in angler use is that anglers bypass the Awakino for the Whakapapa. The Awakino is easily accessible and still considered a nationally significant trout stream with exceptional scenic values and easy access.

The Awakino River is well studied with an established relationship between high winter/spring flows and failed or reduced recruitment (Figure 4.1; Wilson 2009). Recruitment is drastically reduced when winter/spring flow events exceed 50 times base flow. The occurrence of a high flow event (>200 cubic meters per second between July and September) has consistently resulted in failed trout recruitment. In addition to high flow related reductions in recruitment, the Awakino River also has a reduction of adult fish during low flow years as observed in 2013-2014. Since 2015 no major floods have been recorded in Awakino, although summer temperatures are still a threat.

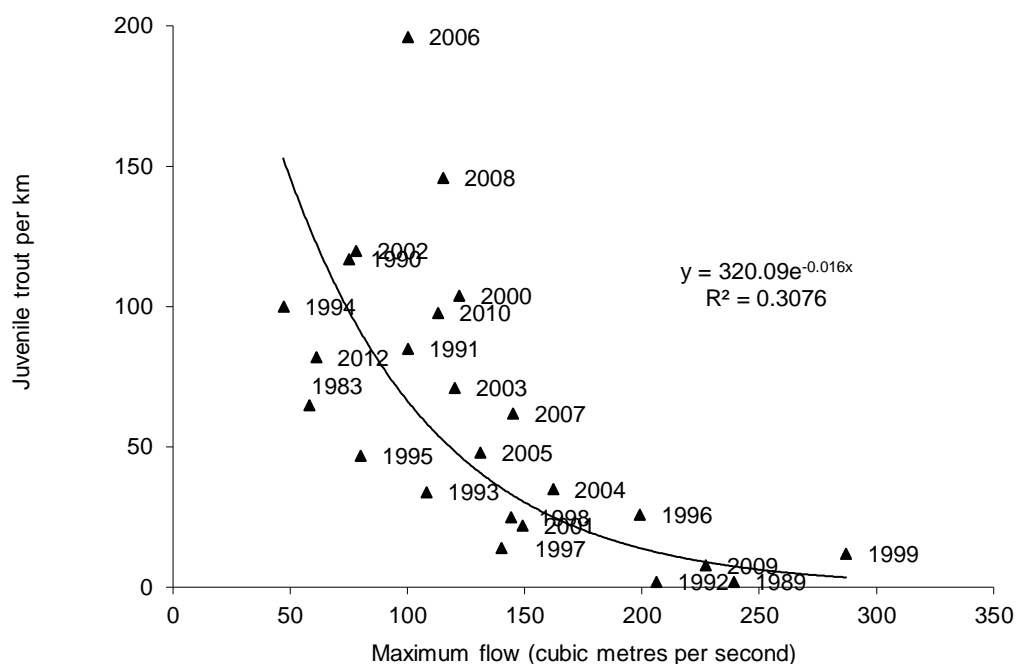


Figure 4.1. The number of juvenile trout counted in the summer drift dive survey of the Awakino River versus the maximum river flow during the previous July-September. The curve provides a model for the relationship between the maximum flow and juvenile trout recruitment (Wilson 2009).

Water quality in the upper reaches of the Awakino River is generally high but gradually deteriorates downstream as the river flows through pastoral land. There is a noticeable decline in water quality immediately downstream of the confluence with the Mangaorongo Stream. The Mangaorongo Stream is largely unfenced and areas like the Puketiti Station present significant opportunities for improving water quality in the catchment. The Awakino is one of many hill country areas that would have substantially benefited from mandatory fencing rules.

Rainbow and brown trout reproduce naturally in the Awakino River, so there is no artificial supplementation of the trout population even in years of recruitment failure. Brown trout contribute less than 2% of the historic angler catch and drift dive count.

4.2. Awakino River study area

The Awakino River has a catchment area of 226 km² in the steep rolling hill country of the Herangi Ranges on the west coast of the North Island. In the upper reaches, upstream from the village of Mahoenui, the Awakino River meanders through mixed podocarp hardwood forest and pastoral land, providing a procession of runs and pools over a riverbed of gravel, cobble, and small boulders. River flow is measured by the Waikato Regional Council at Rauroa Farm Bridge (NZTM:1754098, - 5725781). Minimum flows are about 2.5 m³/s, mean flows about 13 m³/s, and maximum flows can be over 300 m³/s. Two reaches of the Awakino River have previously been surveyed, the traditional long term monitoring site (upper site) and a reach approximately 2 km past Mahoenui (lower

reach). Due to high water temperatures and low fish numbers monitoring of the lower reach was abandoned in 2020.

4.3. Awakino River methods

The upper Gribbon Road drift dive (Figure 4.2; Appendix A) was conducted in 2024. Results of the dive were adjusted to fish per kilometer for comparison to previous surveys and other catchments. The drift dive survey was conducted with two experienced divers.

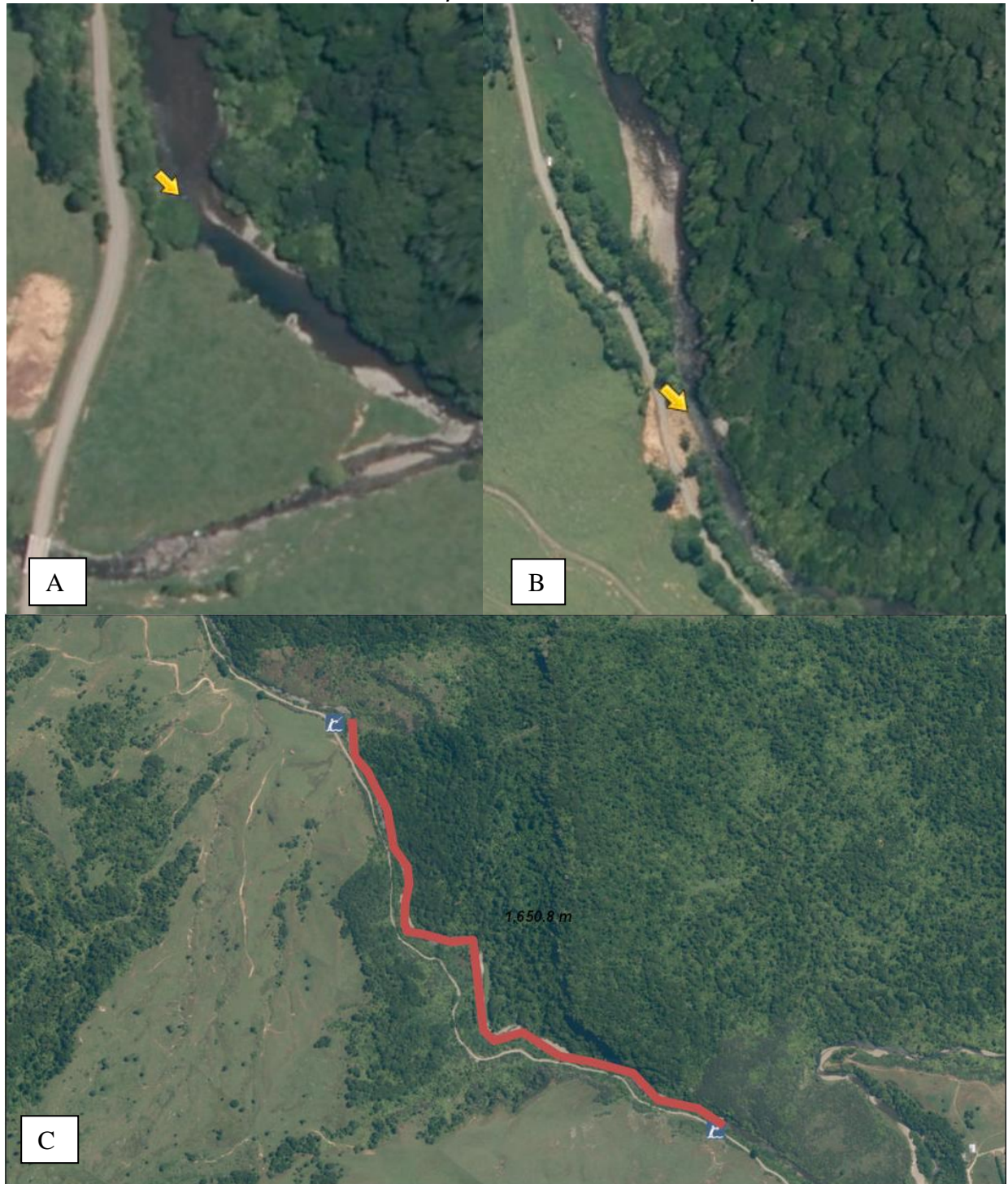


Figure 4.2. Map of the 2024 upper Awakino drift dive start “A”, finish “B” and total monitoring reach “C”.

4.4. Awakino River results

The Awakino drift dive survey began at 12:00 pm on the 7th of March 2024. Water clarity was low for the Awakino River at 3.7 m (mean 4.5 m; range 3.7-6.4 m) likely resulting in undercounting. The water temperature was about 3°C below the normal summer temperature at 14.9°C (mean 17.7 °C; range 14.9-19.0 °C) due to consistently cloudy weather. Flows were slightly elevated at 5.3 m³. No large floods were recorded during the winter of 2023, with only moderate floods occurring in July 2022 (Figure 4.3) that were about half of what would be required to pose a risk to recruitment.

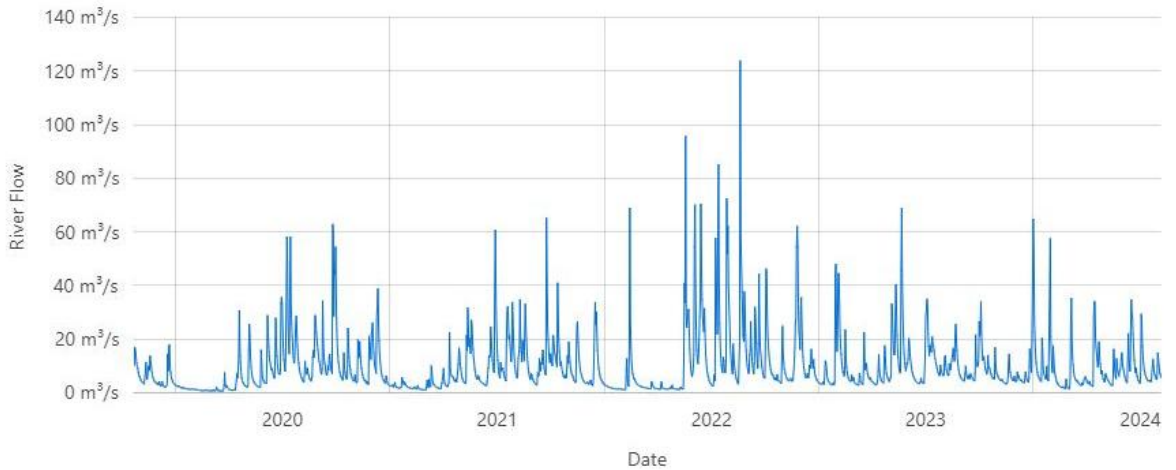


Figure 4.3. Awakino River hydro graph from the Waikato Regional Council website June to Dec 2019 to Aug 2024.

Despite the cool weather and moderate visibility there were good numbers of 40+ cm adult rainbow trout observed in 2024. It is likely that similar to 2023, fish were not concentrated in the monitoring area due to cool water allowing trout to survive further downstream, spreading out the population and reducing the count. The number of medium and age zero fish were a positive sign, indicating a relatively healthy fishery (Table 4.1 and Figure 4.4). All size classes were within the normal expected range for the Awakino River during a year with low to moderate spring flooding and very cool water temperatures.

Table 4.1. The size, frequency and species of trout seen in the upper Awakino River on the 2022-2024 drift dive surveys. Trout less than 20 cm in length were not identified to the species level. Trout identified as rainbow trout (R), or brown trout (B) are labelled as such.

Year	<10 cm	10-20 cm	20-30 cm	30-40 cm	40+ cm
2022	3	11R	9 R	6 R	30 R 0 B
2023	21	27R	7R	4R	6R 3B
2024	18	139R	36R	9R	19R 4B

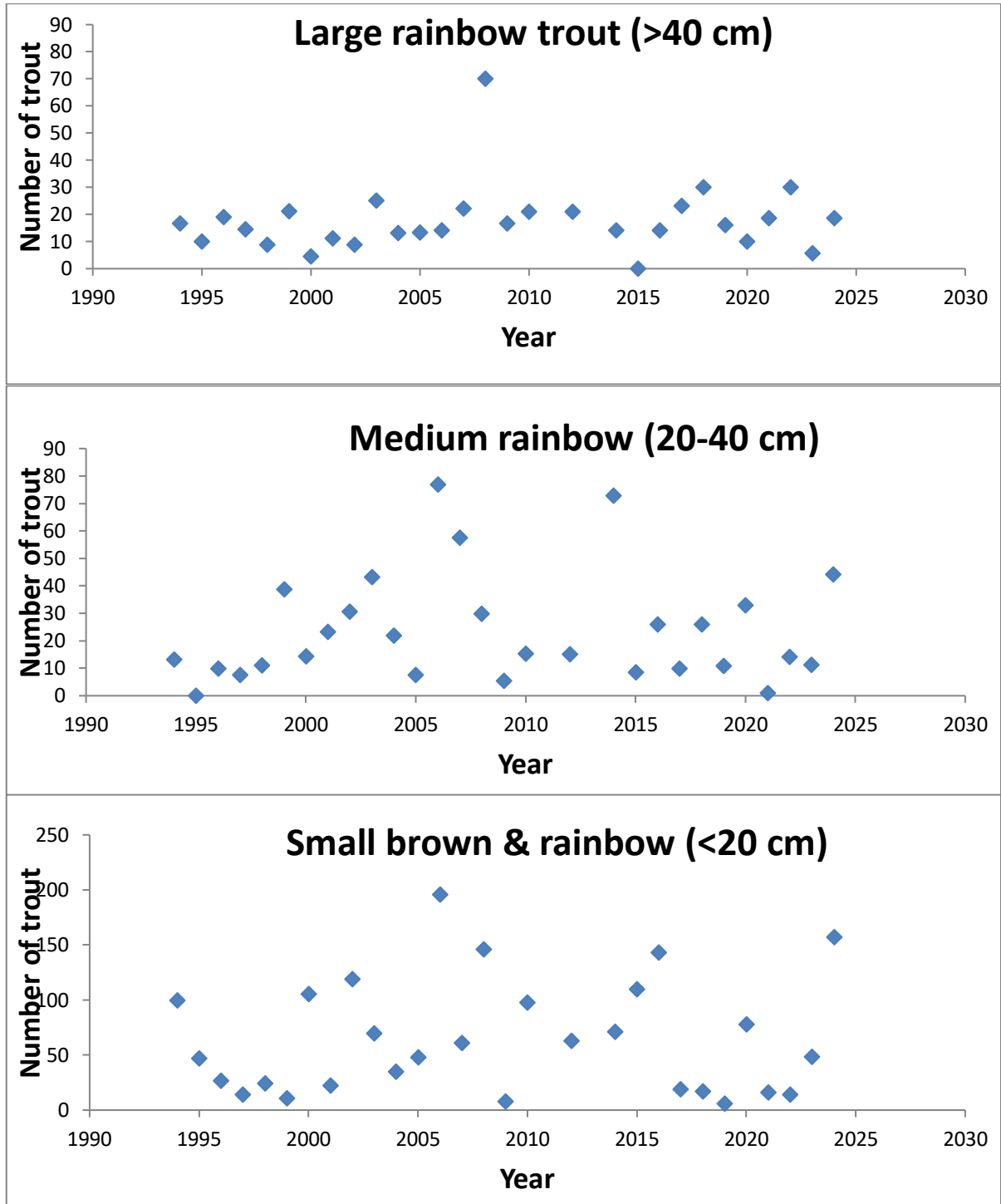


FIGURE 4.4. Large, medium, and small rainbow trout per km (blue squares) counted from 1994 to 2024 during the Awakino River drift dives.

4.5. Awakino River discussion

As discussed in previous reports, the magnitude of floods during the July-September period is the main but not the only environmental factor controlling trout numbers as low annual rainfall with high river temperatures can also impact the upper Awakino River. The lack of significant flooding and cool water has increased the survival of age 0 and 1 fish over the last two years. Adult fish numbers in the upper reaches of the river were likely low due to the low water temperature allowing fish to occupy a much larger area, reducing the number of trout forced upstream into the drift dive survey area.

5. Whakapapa River

5.1. Whakapapa River introduction

The Whakapapa River is the only major fishery in the region that has had a steady increase in angler use over time (Figure 5.1), as it has recovered from the devastating Mount Ruapehu eruption in 1995. At 3772 angler days the Whakapapa River has similar angler use to Lake Arapuni, the Auckland/Waikato Regions most popular fishery. Fish & Game's management objective for the upper Whakapapa River is to maintain a trophy trout fishery. Increasing access to the Whakapapa has also been identified as important to maintaining quality fishing as angler use grows. Since 2011, trophy trout numbers have leveled off at what may be the carrying capacity for the Whakapapa River under the current flow regime, but angler use is still climbing. New fees imposed by iwi in the Taupō fishery have increased use by guides and YouTube influencers, boosting publicity and use of the Whakapapa fishery.

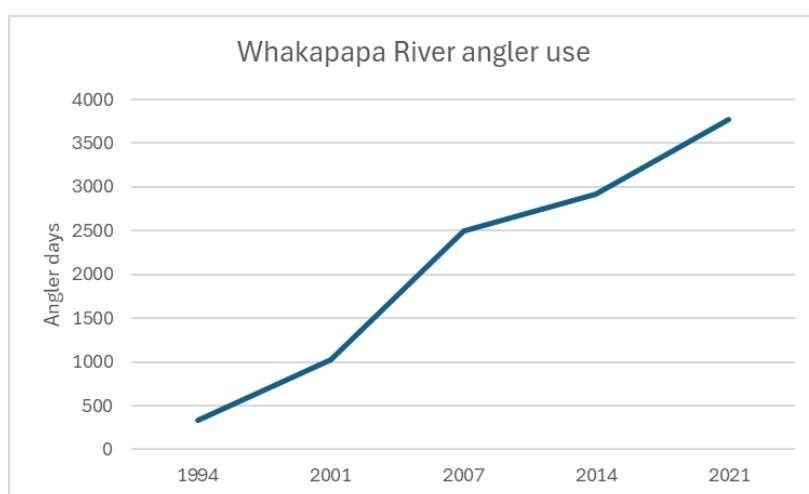


Figure 5.1. Angler use (angler days) 1994 -2021 derived from Stoffels and Unwin (2023).

The Whakapapa & Whanganui River Angler Use Monitoring Study completed in 2016 (Daniel 2017) confirmed that limited access above Owhango has led to low angler use and improvements to angler access in the upper river are still required. The closure of the Whakapapa Intake Road has exacerbated the issue and reopening the road is a high priority for staff. The overall angler use (>0.5 km from parking areas) of the upper Whakapapa in 2014 and 2015 was very low at only 2 anglers per month on average (Daniel 2017) due to the lack of public access. The successful purchase of 1.2 km of the lower river just upstream from the Kakahi landing in 2019 helped spread out anglers but the limited access available is becoming overcrowded.

5.2. Whakapapa River study area

The Whakapapa River is formed by the joining of the Whakapapa-nui and Whakapapa-iti Streams. Both streams drain small glaciers and snowfields on the western slopes of Mt. Ruapehu and are cold, swift and clear. The only major nutrient or sediment inputs in the upper Whakapapa River are runoff and wastewater discharge from the Whakapapa Village. DOC has proposed upgrades to the wastewater treatment plant that should increase consistency of the discharge and reduce the overall impact to the Whakapapa River but have been held up in the RMA process for nearly a decade. In addition, there is also seasonal disturbance from the Whakapapa Ski fields and corresponding access roads.

The Whakapapa Intake of the Tongariro Power Scheme is located about two kilometers downstream from the confluence of the Whakapapanui and Whakapapaiti streams. The Whakapapa Intake structure is a major impediment to the river's trout population as it blocks significant spawning and critical summer habitat for fish that move upstream to avoid the extreme summer heat in the Whanganui River below Taumarunui. Although there is good access to the Whakapapanui and Whakapapaiti, the Whakapapa intake structure isolates this population limiting fish density.

Below the intake, the Whakapapa is a turbulent river alternating between steep rapids and short deep pools. Here the river is quite narrow, generally about 10 to 20 m wide. Access to the intake is via the Whakapapa Intake Road through the Taurewa Station and was closed to the public in 2019. The gauging foot bridge is the starting point for the traditional upper river drift dive, and it is located about 1 km below the Whakapapa Intake structure. Unfortunately, the legal access to the upriver site is no longer accessible to staff.

The Owhango Bridge site is located 20 km downstream from the intake and is the first publicly accessible section of the river below the Whakapapa Intake Road. The Owhango Bridge site is easily accessible and heavily fished. This reach has high numbers of rainbow trout likely due to predominantly catch and release fishing documented in the Whakapapa & Whanganui River Angler Use Monitoring Study, where less than 1% of anglers were recorded with dead fish (Daniel 2017).

5.3. Whakapapa River methods

Only one reach of the Whakapapa River was surveyed in 2024 as the foot bridge drift dive survey was not conducted due to the closure of the Whakapapa Intake Road. The Owhango Bridge monitoring reach begins 1 km upstream from the Whakapapa Bush Road bridge and ends approximately 50 m upstream from the bridge (Figure 5.2).

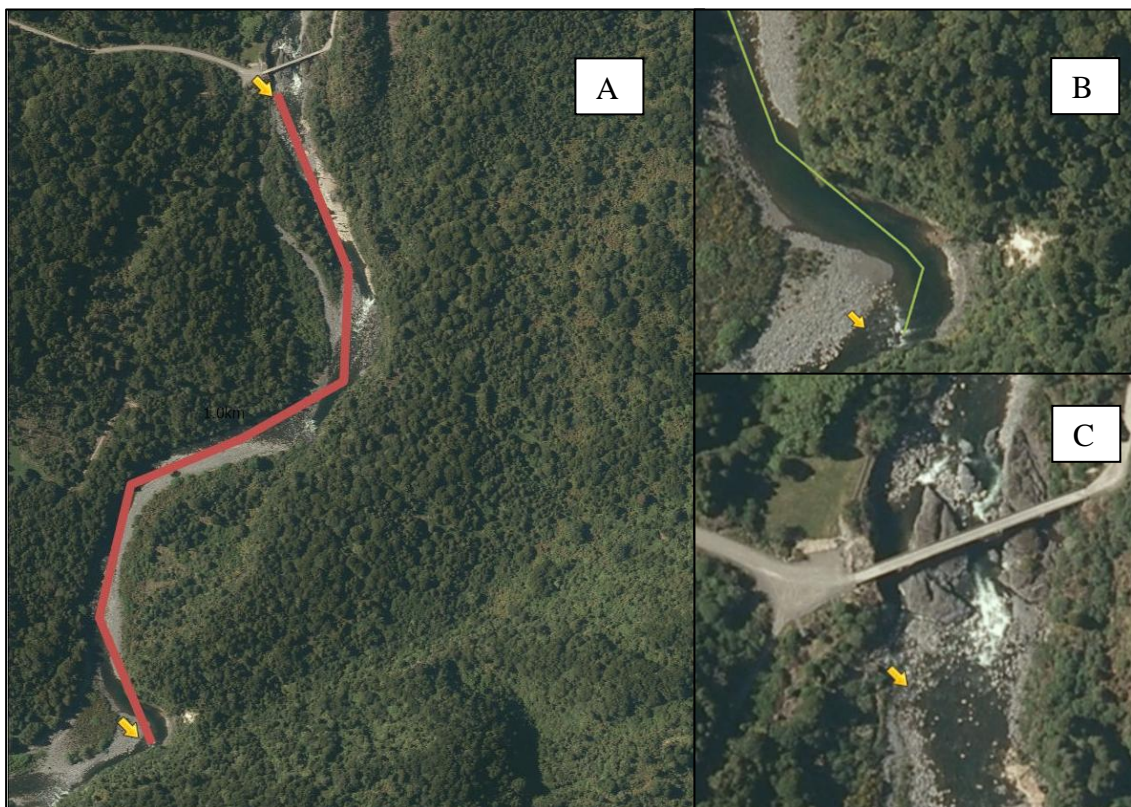


Figure 5.2. Owhango drift dive monitoring area (A), put in site (B) and take out location (C).

Rapids are a safety risk to divers so only pools and riffles were surveyed. As a result, very little habitat suitable for small fish was investigated.

5.4. Whakapapa River results

The Owango dive survey started at 12:00 pm on the 25th of February 2024. Water clarity was 4.0 m with a temperature of 16.1°C. The Owango reach had one of the highest counts of large fish (40+ cm) on record (Figure 5.3; Table 5.1). Brown trout were seen in low numbers similar to previous counts (Figure 5.3; Table 5.1). Age 0 fish were spotted in shallow pools above the takeout indicating successful spawning in 2023.

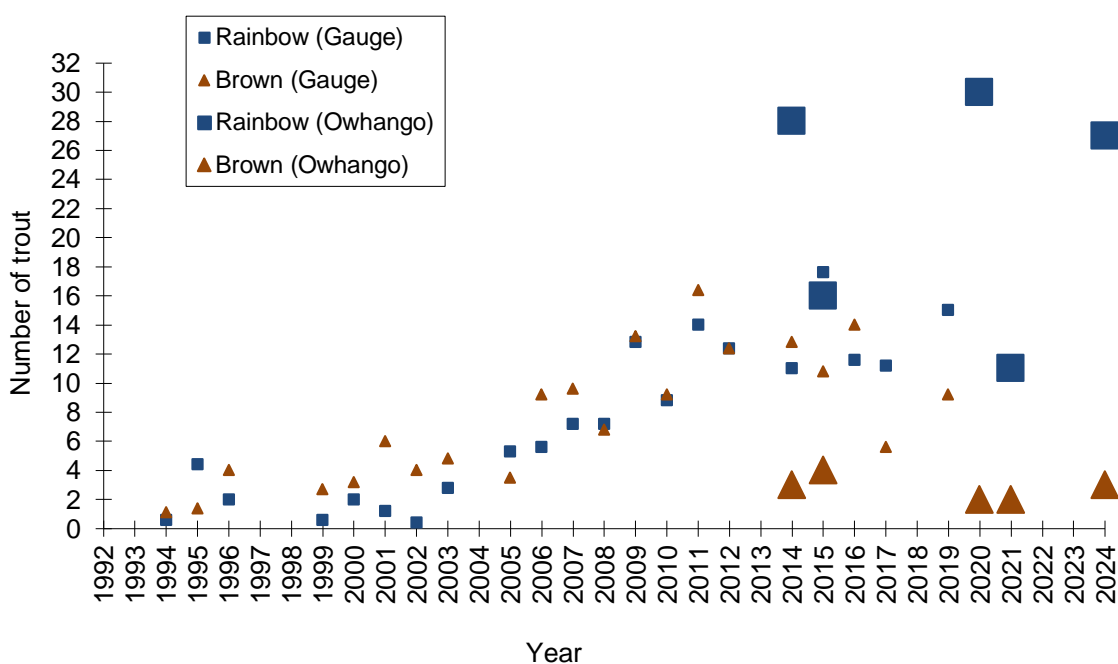


Figure 5.3. Number of large (≥ 40 cm) trout per km of the upper Whakapapa River at the gauging station bridge (gauge; small symbols) and above the Owango Bush Road (Owango; large symbols) 1994-2024.

Table 5.1. Number of fish counted during each of the last three Whakapapa River drift dives 2020, 2021 and 2024.

Year	<10 cm	10-20 cm	20-30 cm	30-40 cm	40+ cm
2020	8	9R	4R	11R	30R
		0B	0B	2B	0 B
2021	0	2R	0R	0R	11R
		0 B	0 B	0 B	3B
2024	14	41R	15R	6R	27R
		0 B	0 B	0 B	4B

5.5. Whakapapa River discussion

Overall, the Whakapapa fishery has moderate to high numbers of large (40+ cm) rainbows and brown trout. Water clarity during the 2024 survey at Owhango was normal at 4 m. The clarity is significantly reduced due to the influence of the Piopotea Stream. The rainbow trout population has been stable for over a decade and has not been significantly affected by increased angler use (Stoffels and Unwin 2023b).

The influence of the Piopotea catchment combined with loss of water and habitat to the Tongariro Power Scheme are the biggest anthropogenic limitations to the Whakapapa River trout population. Volcanic activity, such as the 1992 eruption that devastated the Whakapapa River trout population, could also reoccur.

Flows in the upper river are substantially modified by the intake weir operated by Genesis Energy, which maintains a minimum flow of 3 m³/s and can divert up to 40 m³/s. The intake weir reduces the magnitude of floods such that moderate rainfall usually has negligible effect on flows resulting in dramatic increases and decreases in flows rather than rain induced spikes, followed by a gradual reduction in flow. Although such a dramatic hydrograph could cause mass stranding of fish, the steep channelized morphology of the Whakapapa riverbed does not allow for lateral flooding that would likely strand fish. But the sudden spikes likely wash most of the small fish downstream, leading to the very large population of mostly 40+ cm fish.

. In terms of long-term management, the Whakapapa and Whanganui Rivers will be a key focus area for Auckland Waikato Fish & Game due to the high quality of the fisheries. Angling pressure is currently low to moderate on the upper Whanganui River and improving fish quality on the Whanganui will ultimately take pressure off the Whakapapa (Daniel 2017).

6. Waihou River

6.1. Waihou River introduction

The upper Waihou has easy access and abundant small fish making it a great location for beginners and experienced anglers. The Whites Road section of the Waihou River is well developed with walking paths in the riparian zone that extend for over four kilometers upriver of the car park and include a composting toilet. The location, water clarity, fish numbers and ease of access make the Waihou a priority asset in terms of the Auckland/Waikato regions current fisheries.

The Waihou is a large spring-fed river near Putāruru and is one of the most popular fishing waters in the Auckland/Waikato region, with angler usage in the 2021-22 season estimated at 1018 angler days, a significant drop from 1930 angler days during the 2013-14 season (Unwin and Rouse 2016). This decline is highly suspicious as the Waimakariri Stream is listed as having higher use at 1394 (Stoffels and Unwin 2023a) and is far less popular with anglers. Most of the angling pressure occurs immediately above the Whites Road bridge near the Blue Spring where the water is clear. Water quality rapidly declines as the river flows through several intensive dairy farms.

6.2. *Waihou River study area*

The Waihou River starts as small streams that wind through scrub and plantation pine forest on the Mamaku Plateau. Near Putāruru, land use transitions to dairy and flow is increased by a series of large springs.

Immediately downstream from the Blue Springs, water clarity is high with visibility exceeding 10 m. Most of New Zealand's bottled water is sourced from the Waihou River near the study site. However, water quality quickly deteriorates and 2 km downstream from the springs at the end of the drift dive survey reach, water clarity is typically less than 6 m. Water quality continues to deteriorate and was measured at less than 3.5 m at the confluence of the Waimakariri Stream just 3.8 km downstream from the walkway.

A 4.7 km walkway extends from Whites Road to the Blue Springs upper parking lot. During the past decade most of the upper Waihou has been fenced. However, buffer widths are far too narrow and critical source areas on neighboring farms still deposit fine sediment into the stream at an alarming rate. Despite much of the river being fenced and planted, water quality still deteriorates quickly, likely due to the intensive agriculture throughout the catchment. The lower Waihou is among the dirtiest rivers in the North Island with significantly elevated nutrient levels and heavy sediment loads.

6.3. *Waihou River methods*

The drift dive was 1.7 km and the GPS positions for the start and end points are listed in Appendix A and shown in Figure 6.1.





Figure 6.1. Maps of the reaches covered in the 2024 drift dive surveys of the upper Waihou River including: “A” Waihou survey reach, “B” end point, “C” start point.

6.4. Waihou River results

The 2024 Waihou drift dive was conducted on the 10th of January at 10:00 am. Water clarity on the Waihou was low for the study reach at only 5.5 m and clarity did diminish during the dive due to diver interaction with the substrate. As in previous years only rainbow trout were observed on the dive. The size and frequency of rainbow trout observed on the last three drift dives (2020-2024) are summarized in Table 6.1. The Waihou River had lower fish numbers compared to 2023 with a low number of large 40+ cm fish (Table 6.1 & Figure 6.2).

Table 6.1. The size and frequency of rainbow trout seen per kilometre in the Waihou River during the 2021-2024 drift dive surveys.

Year	Size and frequency of rainbow trout per kilometre of river			
	<20 cm	20-30 cm	30-40 cm	>40+ cm
2022	58	27	24	14
2023	71	74	42	17
2024	7	44	23	6

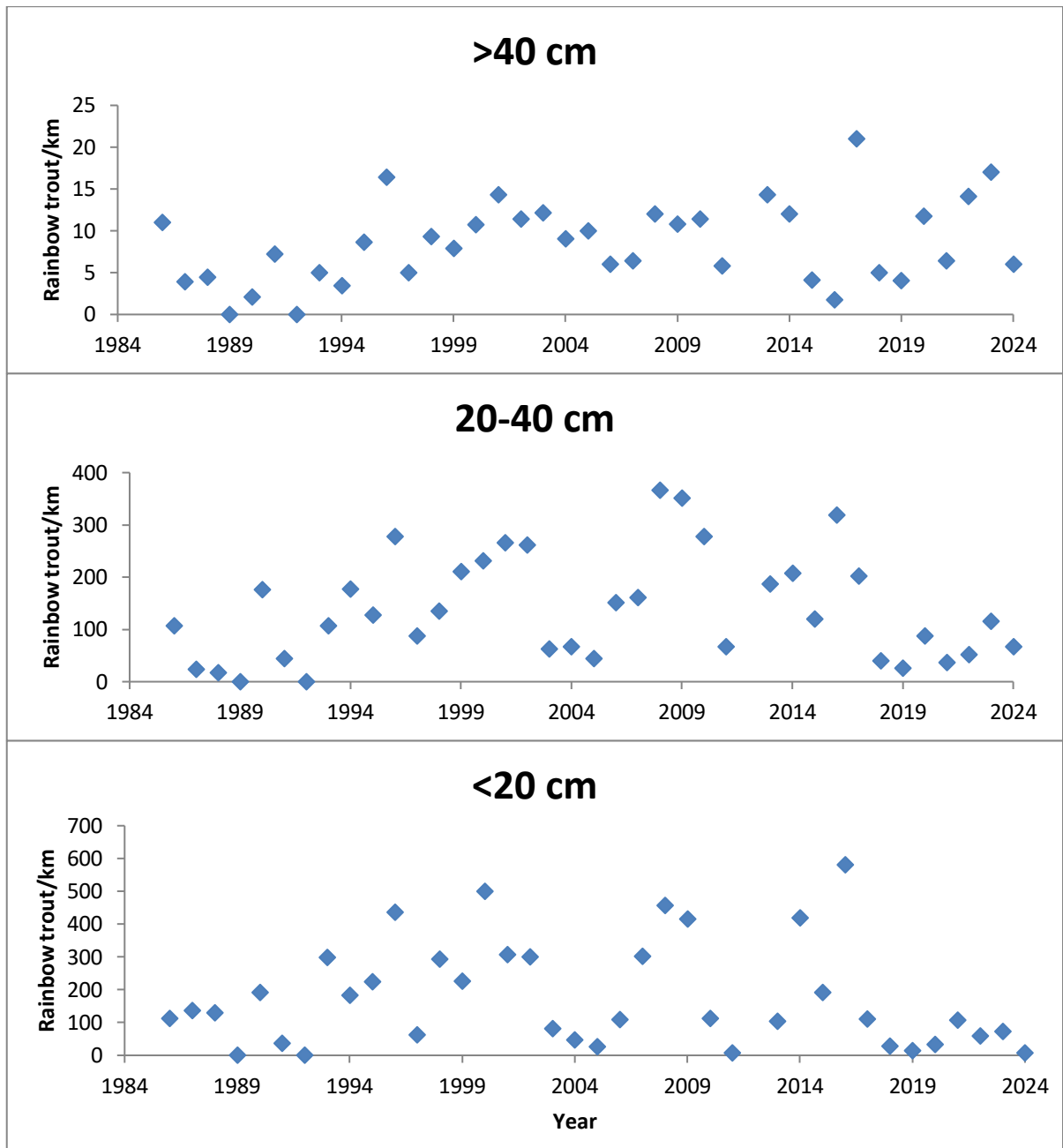


Figure 6.2. Number of rainbow trout per kilometre of the Waihou River above Whites Road as observed on drift dive surveys undertaken since 1986. Fish are grouped into small (<20), medium (20-40 cm) and large (>40 cm) categories.

6.5. *Waihou River discussion*

The Waihou fish counts were low in 2024 but within the range seen in the river during historic counts. The boom-and-bust cycle of the Waihou population is not unusual and the 66 medium size fish (20-40cm) would be considered high in most other rivers. The closure of the walkway has cut off most of the fishing in the upper Waihou so it will be interesting to see if the number of large fish rebounds during the 2025 drift dive.

7. Waitawheta River

7.1. Waitawheta River introduction

The Waitawheta River rises on the eastern slopes of Mt Aroha in the Kaimai-Mamaku State Forest and then flows for about 20 km northward before entering the Ohinemuri River opposite the township of Karangahake. The Waitawheta is a critical spawning tributary and thermal refuge for the once productive Ohinemuri River. The historic Masonry Dam near the town of Waihi prevents fish passage to the upper reaches of the Ohinemuri River that would provide both thermal refuge and spawning habitat making the Waitawheta a critical spawning tributary and thermal refuge. Although high summer water temperature and fish passage limits trout production during most summers, the catchment is still a popular destination due to the proximity to Auckland. Extensive fencing and planting upstream could improve conditions for trout in the Ohinemuri but ultimately climate change is working against restoration efforts. The Ohinemuri and Waitawheta trout populations do bounce back during years of cool conditions similar to the conditions observed in 2024.

7.2. Waitawheta River study area

The drift dive survey occurs in the upper reaches of the Waitawheta River on the boundary of the State Forest at the end of Franklin Road. Here the river consists of a series of long deep pools separated by short turbulent runs/rapids. Although the river was modified for logging and mining the upper catchment is nearly pristine aside from the DOC tracks.

7.3. Waitawheta River methods

The drift dive was 1.2 km and the dive reach and GPS positions for the start and end points are displayed in Figure 7.1 A and B in addition to Appendix A.

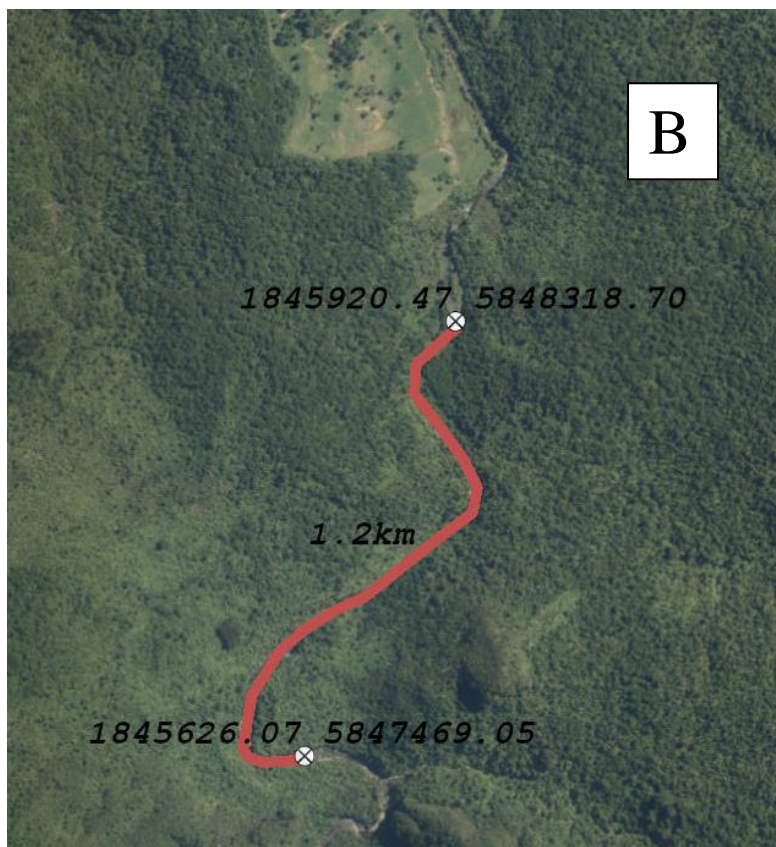
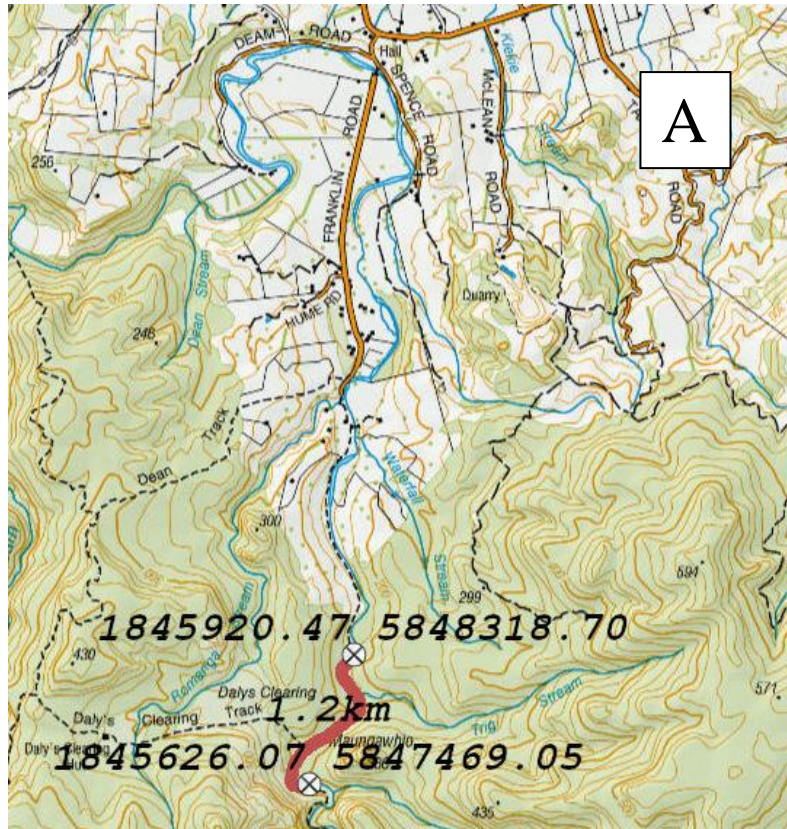


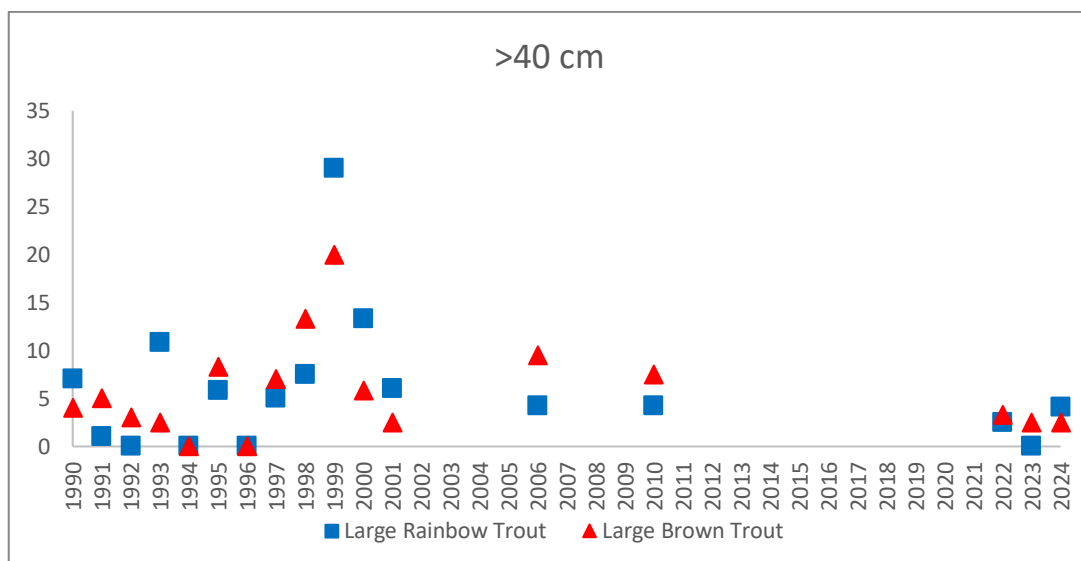
Figure 7.1. (A) Drift dive location showing Franklin Road (B) photo of the drift dive area with GPS points in NZTM for the start and stop locations.

7.4. Waitawheta River results

The Waitawheta drift dive was conducted 3 January 2024 at 10:00am. The Waitawheta River does not have a river gauge, but the river was at base flow during the dive. Water temperature was 15.2°C with water clarity at 4.0 m due to heavy periphyton and low water. Two divers conducted the dive searching all accessible water. Several shallow runs were skipped due to low water and the heavy algal growth. The largest number of Age 0 fish ever recorded were seen on the dive indicating successful recruitment during the winter of 2023 (Table 7.1 & Figure 7.2). However low numbers of adult trout were detected, and no large rainbow trout were spotted on the dive (Table 7.1 & Figure 7.2). It is possible that the large rainbows that normally seek thermal refuge in the park were downstream due to low water temperatures.

Table 7.1. Trout per kilometre for the last three drift dives in the Waitawheta River.

Year	<10 cm	10-20 cm	20-30 cm	30-40 cm	40+ cm
2022	13.3	75	2.5	1.6	2.5 3.3 B
2021	7	12	5	0	0 2.5 B
2024	36	118	7	4	4 2.5B



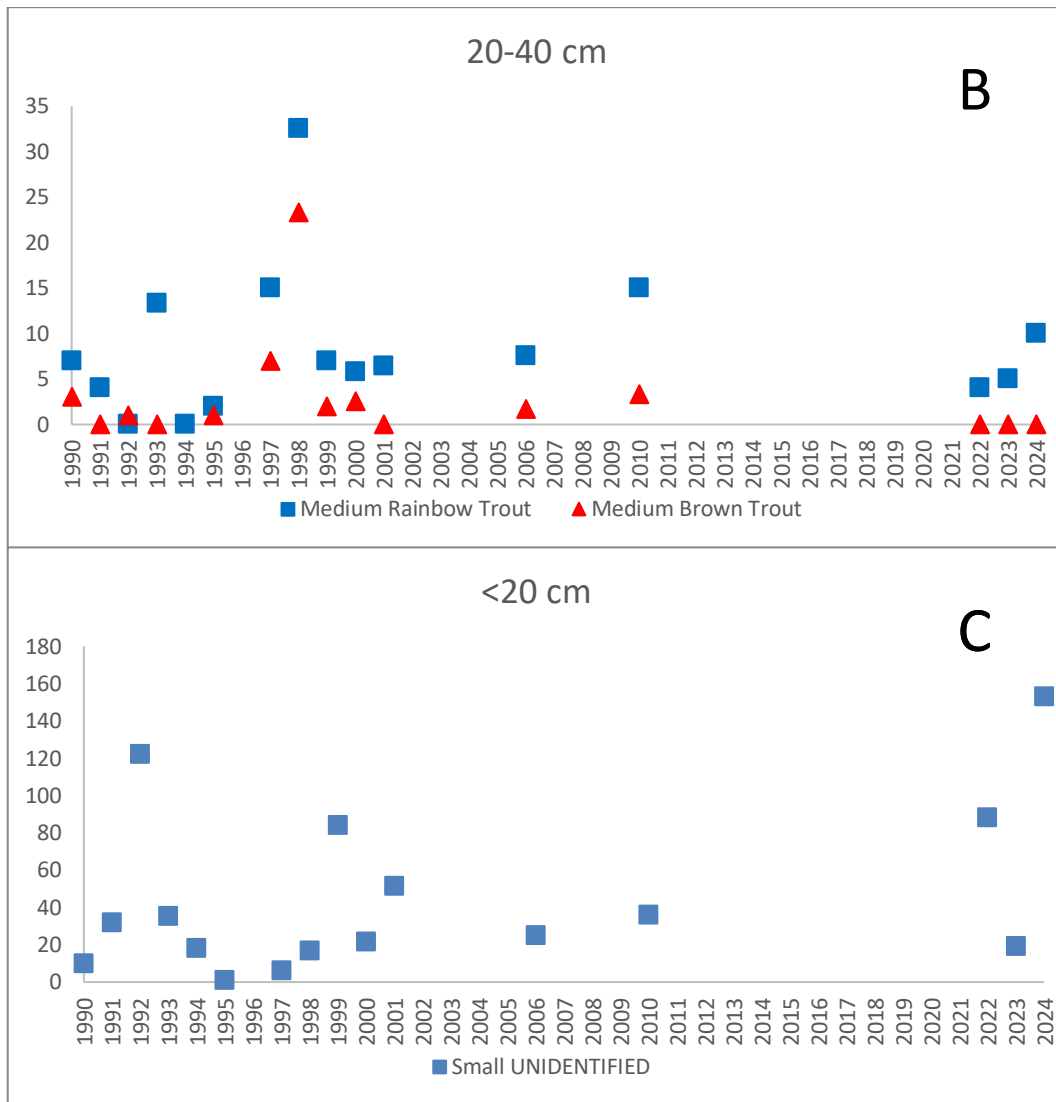


Figure 7.2. Number of large (≥ 40 cm; A), medium (20-40cm; B) and small < 20 cm; C) trout per km of the Waitawheta River 1990-2024. Red triangles represent brown trout, and blue squares represent rainbow trout counted during the drift dive survey.

7.5. Waitawheta River discussion

A summary of drift diving results for the Waitawheta River since 1990 (Figure 7.2 A-C) indicates the reach monitored only occasionally holds high numbers of large trout. The consistent cool weather and large cohort of small fish in 2022 should translate into increased numbers of large fish during the 2025 survey. Fishing reports from the area indicate exceptional survival that should repopulate the river until the next major drought.

8. Kauaeranga River

8.1. Kauaeranga River intro

Fish & Game management objective for the Kauaeranga River is to maintain a wild trout population that will provide a satisfactory fishing experience for anglers. However, climate change will make this goal increasingly difficult, and it is likely that fishing will only be “satisfactory” during periods with multiple back-to-back cool summers.

8.2. *Kauaeranga River study area*

The Kauaeranga River rises in the Coromandel Range and flows in a southwesterly direction for about 32 km before entering the Thames estuary at Thames. The catchment area of about 121 km² is generally steep with regenerating native bush and scrub in the upper reaches, and exotic pine plantation, native scrub and pastoral land in the middle and lower reaches.

For much of the year, the Kauaeranga River can be described as a stream flowing over the bed of a large river. The wide riverbed does not allow for shading, increasing the daily peak water temperature. Although base flows in the Kauaeranga are low (mean annual 7-day low flow of 0.62 m³/s), massive floods are not uncommon as the Coromandel Range is often subjected to torrential rain from northerly storms and the remnants of tropical cyclones. These massive floods have gorged out long deep pools and created broad shallow runs. Bed materials in the upper/middle reaches consist of boulders, cobbles, and hard gravels. Further downstream below the Coromandel Forest Park there are increasing quantities of mud and silt.

A large part of the Kauaeranga catchment is in the Coromandel State Forest Park, and here the river is visited by many people, especially in the summer. A metal road with numerous DOC camping areas follows the river valley for some 25 km.

8.3. *Kauaeranga River methods*

The drift dive covered 1.2 km and the dive reach and GPS positions for the start and end points are displayed in Figure 8.1 A and B in addition to Appendix A. The drift dive involved two divers floating downstream using snorkeling equipment and counting trout as they became visible. Inexperienced drift divers were used for the survey potentially influencing the data collection and making comparisons between years less reliable. The wide riverbed and low water created thousands of pools making it very difficult to cover all of the available water. If there was an impact on data collection it would likely result in the undercounting of fish making the estimate a minimum.

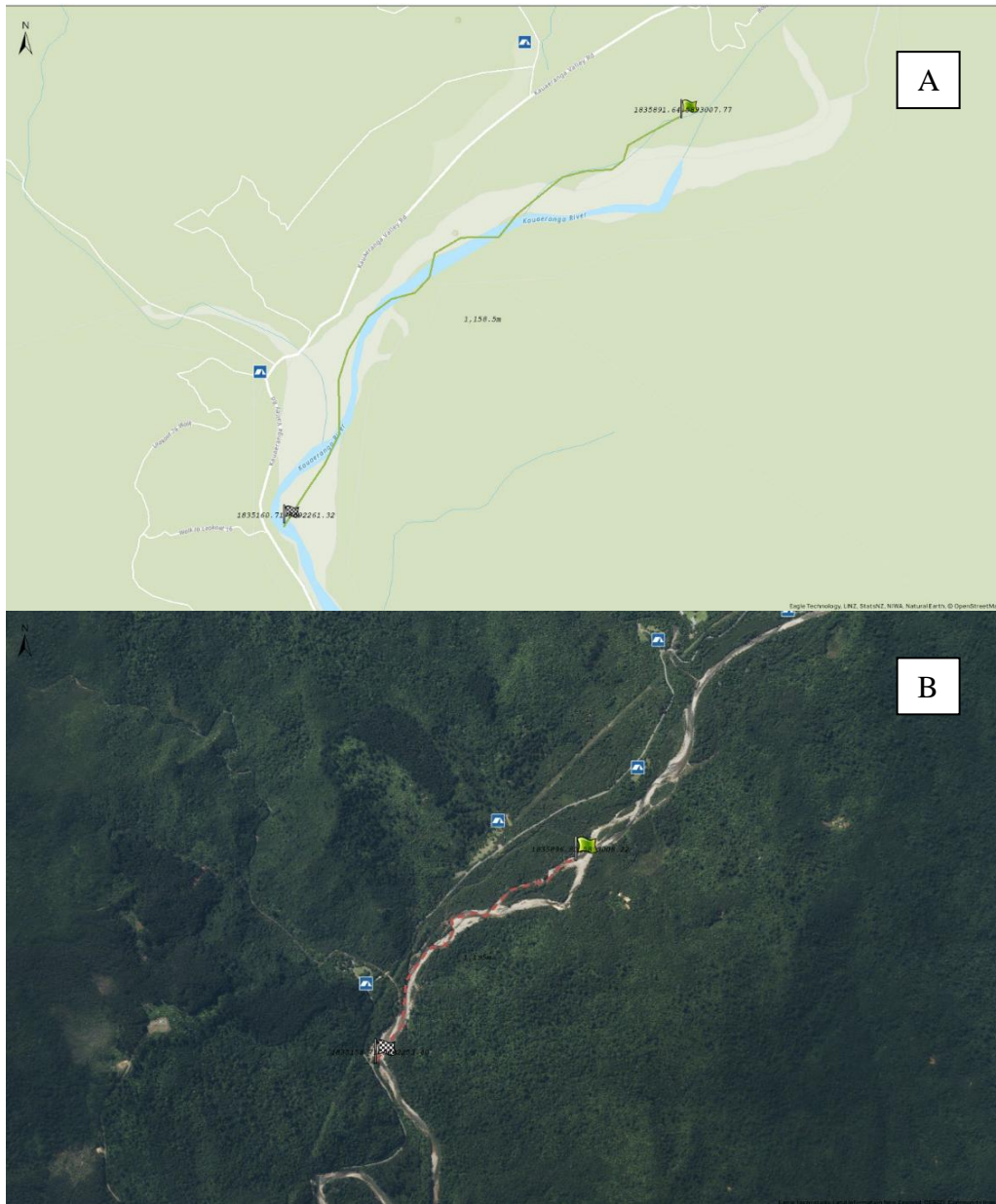


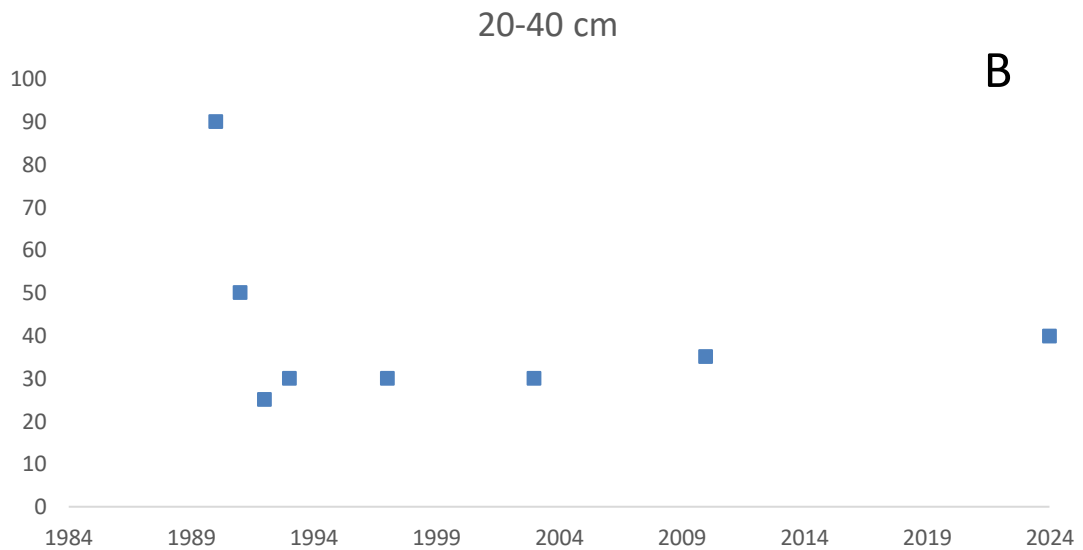
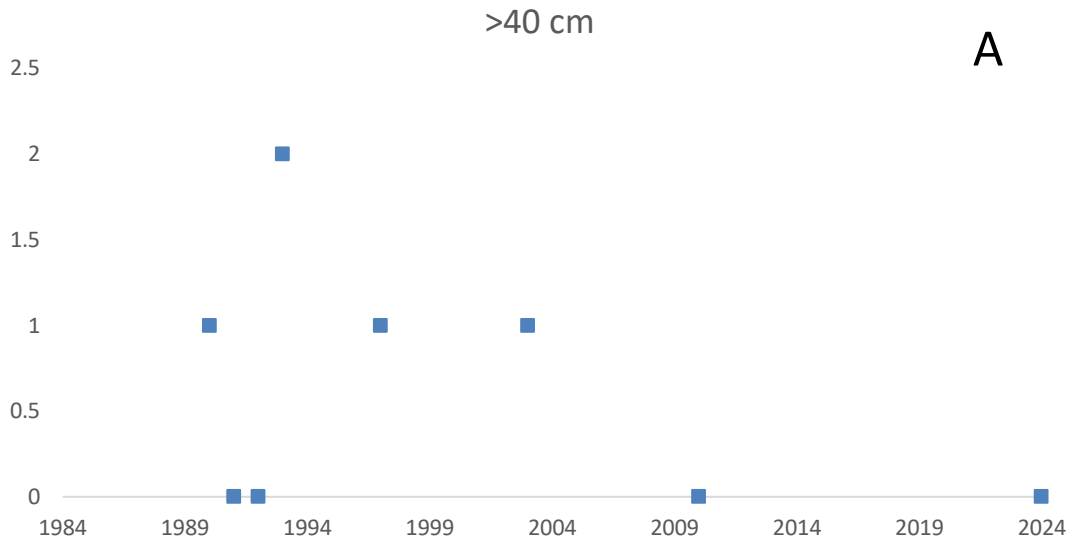
Figure 8.1. (A) Drift dive location showing the put in (green flag) and take out (checkered flag). (B) Photo of the drift dive area with GPS points in NZTM for the start (green flag) and stop location (checkered flag).

8.4. *Kauaeranga River results*

The Kauaeranga River Drift dive started at the top end of the Boom Flat Island at 1:00pm on February 18th, 2024, with 10.2 m visibility and water temperature of 21 C°. Although the water temperature was extremely high there was a noticeable influence of groundwater in many pools creating thermal refuges far below the surface temperature. The number of native fish was remarkable with hundreds of smelt in some pools. Although trout numbers were low there were positive signs for the population with relatively high numbers of small fish (Table 8.1; Figure 8.2).

Table 8.1. The size and frequency of rainbow trout seen in the Kauaeranga River on the last three drift dive surveys (2003, 2010 and 2024).

Year	< 10 cm	10-20 cm	20-30 cm	30-40 cm	40+ cm
2003	12	19	23	7	1
2010	3	0	30	5	0
2024	9	31	8	3	0



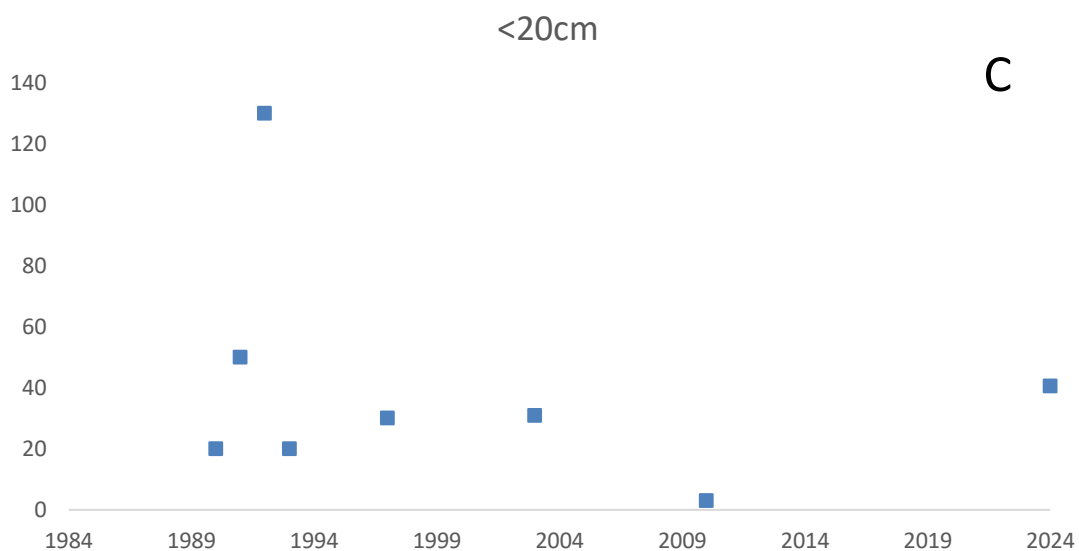


Figure 8.2. Number of large (≥ 40 cm; A), medium (20-40cm; B) and small <20 cm; C) rainbow trout per km of the Kauaeranga River (1990-2024). Only years surveys were conducted are listed.

8.5. *Kauaeranga River discussion*

Although the Kauaeranga River has low trout numbers it is an exceptionally scenic location with popular DOC campgrounds. The river has a wide stream bed with limited shading in the main channel due to frequent high intensity floods. High summer temperatures limit recruitment during hot summers making the Kauaeranga River an intermittent fishery. The last significant recruitment of trout was in 1992 when there were similar cool conditions that facilitated spikes in the trout population in both the Kauaeranga River and Waitawheta Rivers. There are no practical management interventions that could improve conditions as the upper catchment is already a forest park. However, the river is worth monitoring to inform anglers when fish are present.

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10. Appendix A Dive locations

River	Reach	Start		Stop		Distance (km)
		X NZTM	Y NZTM	X NZTM	Y NZTM	
Awakino	Upper Gribbon	1757293	5734677	1757491	5734051	0.75
Whakapapa	Owhango	1807552	560061	1807709	5680870	1.0
Waihou	Blue springs	1847743	5787062	1847057	5787905	1.7
Waitawheta	Park boundary	1845628	5847472	1845905	5848404	1.2
Kauaeranga	Booms Flat	1835891	5893007	1835163	5892258	1.2

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