Upland game bird hunter expectations and experiences following a sub-tropical cyclone

Report to the Hawke's Bay Fish & Game Council: March 2024

By Dr Humphrey Walker PhD

Vision Thinking

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Humphrey Walker

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Author information

Dr Humphrey Walker PhD (Natural Resource Management)
E: humphrey@visionthinking.nz

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Structure and content of this report

This report summarises a survey of upland game bird hunters regarding their perceptions of harvest expectations and experiences following the 2023 sub-tropical Cyclone Gabrielle. The report's scope is limited to data gathering, analysis, and discussion of the results. Recommendations for an operational response and for future research are also given.

Although some data are gathered from all aspects of upland gamebird hunting, this report focuses on hunters who rough-shoot public river berms. Rough shooting is a type of walk-up bird shooting where target species are stalked, flushed and shot. Rough shooting is most frequently undertaken with the use of hunting dogs.

The report is structured to present key points from the research in a brief readable format. The executive summary is followed by the introduction, project definition, approach, method and methodology, and results. The final sections contain a brief discussion, conclusion, recommendations, and a statement of limitations.

Executive Summary

In February of 2023, rainfall from Cyclone Gabrielle caused widespread flooding in Hawke's Bay. Stop banks were breached, extensively damaging the surrounding productive and urban landscape. Visually, the impact of extreme flows on river channels was severe. The effect of storm damage on the season's upland game bird prospects was unknown, but many hunters feared the worst. This study quantifies hunter expectations and experiences of the 2023 season. It focuses on those who hunted the public river berms of the Tutaekuri, Ngaruroro, and Tukituki/Waipawa River systems. The study refers to them as *River Hunters* (*RH*).

The research deployed a targeted survey to capture hunter expectations and experiences of the 2023 game bird season across variables representing four hunting attributes. These were *Pheasant numbers, Quail numbers, Cover vegetation,* and *Hunter numbers*. Additional survey questions captured aspects of the hunter's character, behaviour, and intentions.

The survey had 101 upland game hunter responses, and 67 of them were *RHs*. The results showed that most *RHs* expected all attributes to be somewhat below or far below what they considered normal for all the river systems. In general, *RH* experiences were worse than their expectations, with the Tukituki/Waipawa system being the least worst. Inferential analysis showed positive associations between mean hunter expectations and experiences of the Ngaruroro and Tukituki/Waipawa river systems but not of the Tutaekuri. Analysis of individual systems showed associations between bird numbers, cover vegetation, and hunter numbers that reflected logic or reasonable explanation.

River Hunters hunted regularly, approximately half hunting twice a week or more. Of those that hunted cock pheasant, 52% felt their harvest was less than half of normal, and of those that hunted quail, 69% felt their harvest was less than half of normal. Most *RHs* (60%) attributed their reduced harvest to flood damage. Habit was the most likely reason a RH did not hunt a particular river system, and travel was a barrier for only 3%-7% of *RHs*, depending on the river system. Most (75%) *RHs* attributed their choice of hunt location to their own thoughts and observations, with a further 10% influenced by friends and family - only 7.5% attributed location choice to Hawke's Bay Fish and Game Council's (HBFGC) emails and their website. Most *RHs* (71%) felt it was either unlikely or very unlikely that future severe weather events would make them reconsider purchasing a licence. Of those that chose to hunt outside of Hawke's Bay, 38% did so while travelling for other reasons, while 43% were seeking better bird numbers or better hunting conditions. Upland game bird hunters had an elevated environmental orientation. Of the total 101 respondents, 41% had donated time or money to an environmental organisation in the past 24 months. This figure remained consistent in *RHs*, with 40% doing the same.

The results have equipped the HBFGC with empirical data regarding upland game bird hunter expectations and experiences for the season following Cyclone Gabrielle. To the best of the author's understanding, it is unique in New Zealand and fills a gap in knowledge that will be relevant to other Fish & Game regions. The clarity of the results demonstrates that the collective knowledge of hunters should be considered a valuable resource. Given a large-scale biological field study would be costly and time-consuming, the most cost-effective means of assessing bird populations and hunting conditions will continue to be surveying hunters. In

light of this, HBFGC should take a considered approach to the number of surveys deployed to avoid hunter survey fatigue.

I recommend that a follow-up study be undertaken following the 2024 season to quantify *River Hunter* perceptions of any recovery in habitat and harvest. The 2023 and 2024 studies combined will help guide future HBFGC severe weather response programmes. HBFGC should establish a targeted hunter-relations programme. The programme should focus on disseminating the value of hunter contributions to research, an acknowledgement of the 2023 hunter experience, and a commitment to monitoring recovery. HBFGC should also consider hosting an upland game bird focus group as part of the hunter-relations engagement strategy. The focus group should represent a cross-section of upland game bird hunters, including those with an elevated identity in the hunting or wildlife management sphere. Those involved should be comfortable with the promotion of the focus group activity.

Keywords: Upland Game Birds, River Hunters, Sub-tropical Cyclone, Expectations, Experiences.

Introduction

Upland game bird hunting is a recreational pursuit supported within New Zealand's countryside, administered by Fish & Game Councils, and undertaken seasonally by licenced hunters. Although increasingly under threat from cycleway development and pastoral expansion, Hawke's Bay rivers still offer public access to upland game bird hunting that reflects the egalitarian ideal that underpinned the formation of acclimatisation societies in 1861 (McDowell, 1994).

In February of 2023, Cyclone Gabrielle caused flood damage to Hawke's Bay streams, rivers, and their catchments, including extensive land movement (HBRC, 2024a). The National Institute of Water and Atmospheric Research (NIWA) has classified the event as extreme (Lane, 2024). NIWA's subsequent modelling found that at 13 of 20 monitored sites, the flooding was the worst on record (Lane, 2024). They also revised the Annual Recurrence Interval from 1:1000 to a 1:550 year event for one site (Lane, 2024).

Flood flows, heavy siltation, and debris have negatively impacted instream ecology, including sports fish populations (Newshub, 2023, August 08). Some of the worst affected rivers were the Ngaruroro, Tutaekuri, Esk, and Mangaone (Lane, 2024). Following the cyclone, the Tutaekuri suffered long periods of poor water quality due to siltation from existing slips.

River berms that typically provide habitat for upland game bird species (pheasant and quail) were submerged and, in some places, destroyed. Stopbanks designed to channelise rivers and protect valuable agricultural land and housing were breached, damaging housing, farmland, vineyards, and orchards (HBRC, 2024a). The orchards and vineyards provided additional food sources for upland gamebird populations (NZFGC, 2024). Anecdotal evidence suggests the past 2023 upland game bird season was poor compared to recent years, although waterfowl populations appeared unaffected by the cyclone.

Extreme weather events are predicted to become more frequent (HBRC, 2024b). Despite being a Crown entity under Schedule 4 of the Crown Entities Act (2004), the current funding model means almost 90% of funding for the Hawke's Bay Fish and Game Council (HBFGC) comes from the sale of sports fish and game licences (HBFGC, 2023). Fish licence sales provide approximately twice the income of game licences (HBFGC, 2023).

Problem statement

The financial importance of angling licence sales have naturally focussed Fish & Game post-cyclone discussion on trout populations and instream ecology. Upland game species are discussed less, at least in Fish & Game publications, and the cyclone's impact seems more difficult to assess (Hayes, 2023). Fish & Game are required to manage upland game bird hunting, and ultimately, any reduction in licence sales has a negative effect on HBFGC's ability to fund its statutory responsibilities under the Conservation Act (1987).

Project definition

This report is part one of a two-part study. The full study aims to quantify anglers' and upland game bird hunters' perceptions of cyclone damage on their recreational prospects.

Objective 1 – Report 1

To quantify upland gamebird hunter expectations and experiences of rough shooting public river berms following a sub-tropical cyclone.

Approach

The research approach outlined in this report centred on surveying Hawke's Bay upland gamebird hunters regarding their expectations and experiences of the 2023 hunting season[1]. The target population was those who had hunted the public river berms of three main river systems. They were the Tutaekuri River, Ngaruroro River, and Tukituki/Waipawa Rivers. A river system was defined as being the main river and its tributaries. It was acknowledged to hunters that there can be a difference between the main river and its tributaries and they were asked to answer considering river systems as a whole. The survey was constructed and hosted on Survey Monkey Premier and the data was analysed using SPSS V29.

Contribution

Insights from this study objective should help guide efforts to engage, support, and retain licensees following future flood events. It should help guide the post-flood narrative among upland game bird hunters and be relevant to all Fish & Game councils.

[1] The 2023 upland game bird hunting season ran from the first weekend of May to the last weekend of August. Target species in Hawke's Bay were Cock pheasant - 2 per day and California quail - 10 per day (New Zealand Gazette, 2023).

► Method and methodology

Following pre-testing and feedback from the HBFGC, a survey of upland game bird hunters was undertaken. The survey was anonymous and ran from the 9th- 29th February 2024. An electronic link was delivered directly to 2023 game bird licence holders via the usual HBFGC administrative email channel. Survey delivery was accompanied by a HBFGC Facebook post and a paid 'boost'. The potential to enter the draw for a $250 voucher to a local sports retailer was used as an incentive. Respondents were required to be 18 years or older.

The survey logic filtered out any respondents who did not hunt upland game bird species and separated those who had not hunted public river berms. Survey logic allowed some useful superficial data to be gathered from all upland game hunter respondents and more detailed data from the target population. The survey was designed in five blocks. The first block filtered respondents and gathered demographic and descriptive data. This was followed by a block of questions for each of the three target river systems. These three blocks were randomised in the survey to avoid any order effects. Each block contained eight 5-point Likert questions. Half of the questions regarded hunter expectations of four key hunt variables. These were i) Pheasant numbers, ii) Quail numbers, iii) Cover vegetation, and iv) Hunter numbers. The other half regarded their experience with the same variables.

The final block gathered data on hunter perceptions of their total season harvest, the main reason for the outcome, and the impact of severe weather events on licence purchasing intentions and behaviour. Respondents were then given the choice of relinquishing their anonymity and providing an email contact to enter the draw for a $250 sports shop voucher. The winner was chosen randomly, and following successful contact, all emails were deleted.

Historically, categorical and ordinal Likert data analysis has had some controversy over the appropriate statistical methodology used to report central tendency, data variability, data associations, and group comparisons (Jamieson, 2004). This has centred around whether or not parametric or non-parametric analysis is appropriate for the ordinal data gathered using Likert-type questions. It is now agreed that when Likert-type questions are grouped and closely related in topic and framing, a 'scale' can be said to have been formed (Harpe, 2015; Norman, 2010). As such, the use of parametric reporting using means for central tendency and standard deviations for data variability is appropriate. It is also appropriate to use parametric tests for data associations, such as Pearson's *r*, and a t-test, analysis of variance or regression for inferential statistics (Carifio & Perla, 2008; Harpe, 2015; Norman, 2010). Where Likert-type questions do not meet the described requirements for a 'scale', they should be treated as non-parametric data. In the case of non-parametric analysis, median or mode should be used for central tendency, frequencies for data variability, and Kendall tau B or C for data associations. Non-parametric tests should be applied for inferential statistics such as chi-square, Spearman's ρ or the Mann-Whitney U-test (Jamieson, 2004). The research in this report has applied this approach.

Results

Given that the effects of Cyclone Gabrielle were not homogenous across all catchments, and in the interests of providing river system-specific data, the bulk of analysis has been separated for each river system.

Descriptive analysis

The survey ran from 9th - 29th February 2024. There were a total of 214 responses, with 192 completing the survey for a 90% completion rate. Ninety-one respondents did not hunt upland Game bird species in Hawke's Bay, which left 101 respondents. Of those, ninety-eight percent were male, with ages moderately skewed towards the older age brackets. Eighty-five percent had held a game bird licence each of the last five years, and 49% rated themselves as very experienced hunters. Most hunters (96%) hunted at least once a week, and 79% hunted over one or more dogs. Twenty-four percent were a member of a clay target club.

There are a range of upland game bird hunting activities available in Hawke's Bay. Respondents were given the opportunity to select the activities they engaged in and were able to select more than one activity. Sixty-two percent had rough shot private land, 17% engaged in driven shooting on a game preserve/private syndicate, and 12% in walk-up shooting on a game preserve/private syndicate. Forty-one percent had donated money or time to an environmental organisation in the past two years. Sixty-six percent had participated in rough shooting of public river berms (*River Hunters* n=67), and they represent this study's target population.

River Hunters (*RH*) were all male, and 87% had held a game bird licence each year for the past five years. Forty percent had donated time or money to an environmental organisation in the past 24 months, and 27% were members of a clay target club. Respondent ages were fairly evenly distributed across the age ranges, with a mild skew towards the older age brackets.

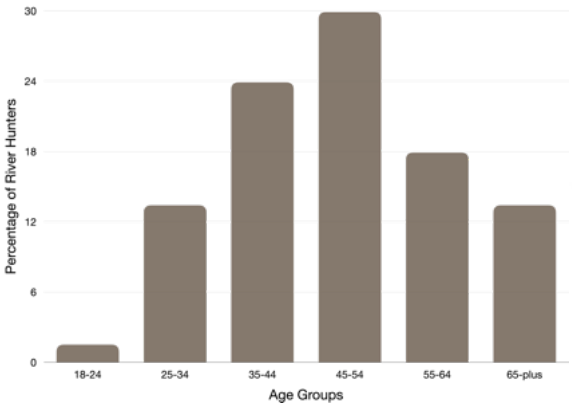

Figure 1 Age Distribution of River Hunters

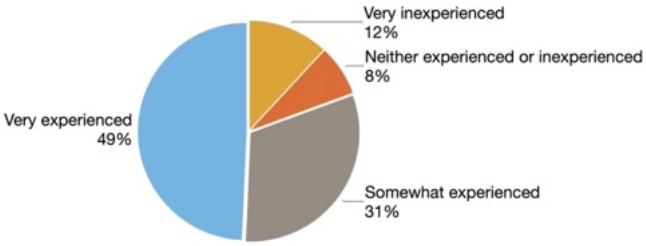

Figure 2 Self-assessed River Hunter Experience

Most *RH* considered themselves very experienced hunters, hunted regularly, and 84% hunted over dogs. Most *RHs* also enjoyed rough shooting private land (52%), with a minority (10%) engaging in game preserve/private syndicate shooting. They were geographically dispersed across the region from Bay View to Takapau. The bulk of *RHs* identified Hastings (37%), Napier (15%), Taradale (10%), and Waipukurau (10%) as their closest town.

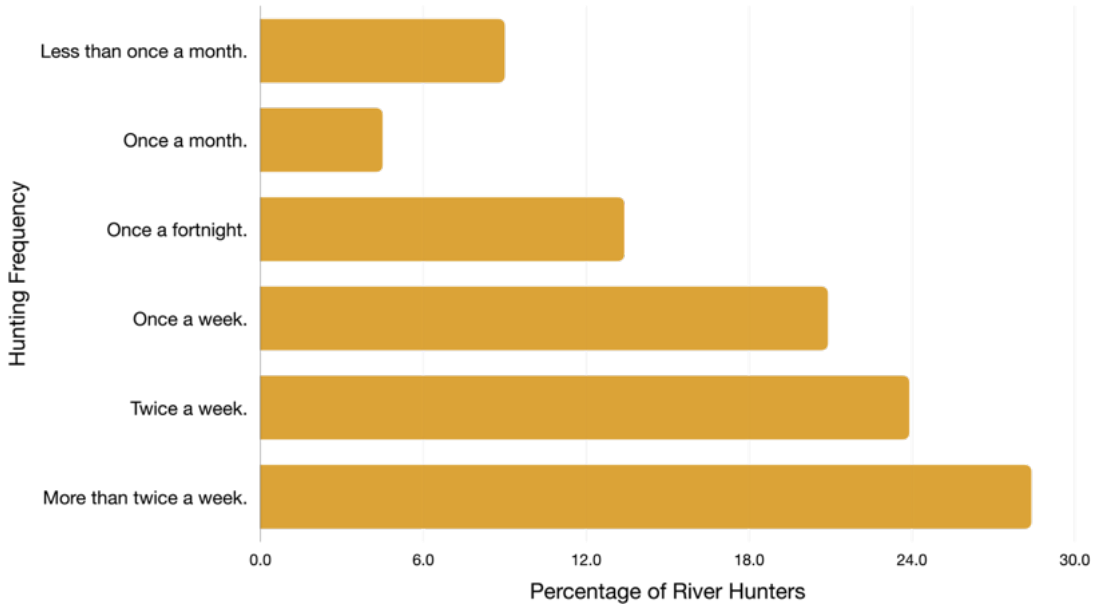

Figure 3 River Hunter Hunting Frequency

Hunter's expectations and experiences were elicited using 5-point Likert items reflecting variation around the respondent's perception of what was normal for each variable for each river system. Items ranged from 1 = Far below what you consider normal, 2 = Somewhat below what you consider normal, 3 = What you consider normal, 4 = Somewhat above what you consider normal, 5 = Far above what you consider normal.

Tutaekuri River

Forty-two percent of *RH's* had hunted, or walked with the intention of hunting the Tutaekuri River berms, including tributaries. Most expected pheasant (68%) and quail (71%) numbers to be below what they considered normal for that river system, and 71% expected cover vegetation to be either somewhat below or far below normal. Most (64%) expected hunter numbers to be either normal or somewhat below normal.

River Hunter's experience of bird populations was more negative than their expectations. Seventy-nine percent found pheasant numbers to be somewhat below or far below what they consider normal, and 82% found quail numbers to be somewhat below or far below normal. Vegetation cover and hunter numbers were also less than *RH's* expected, with 79% finding vegetation somewhat below of far below normal and 71% finding hunter numbers somewhat below or far below normal. Of those who did not hunt this system, only 23% identified cyclone damage as the main reason. This suggests a core of *RH's* were committed to the system regardless of its condition.

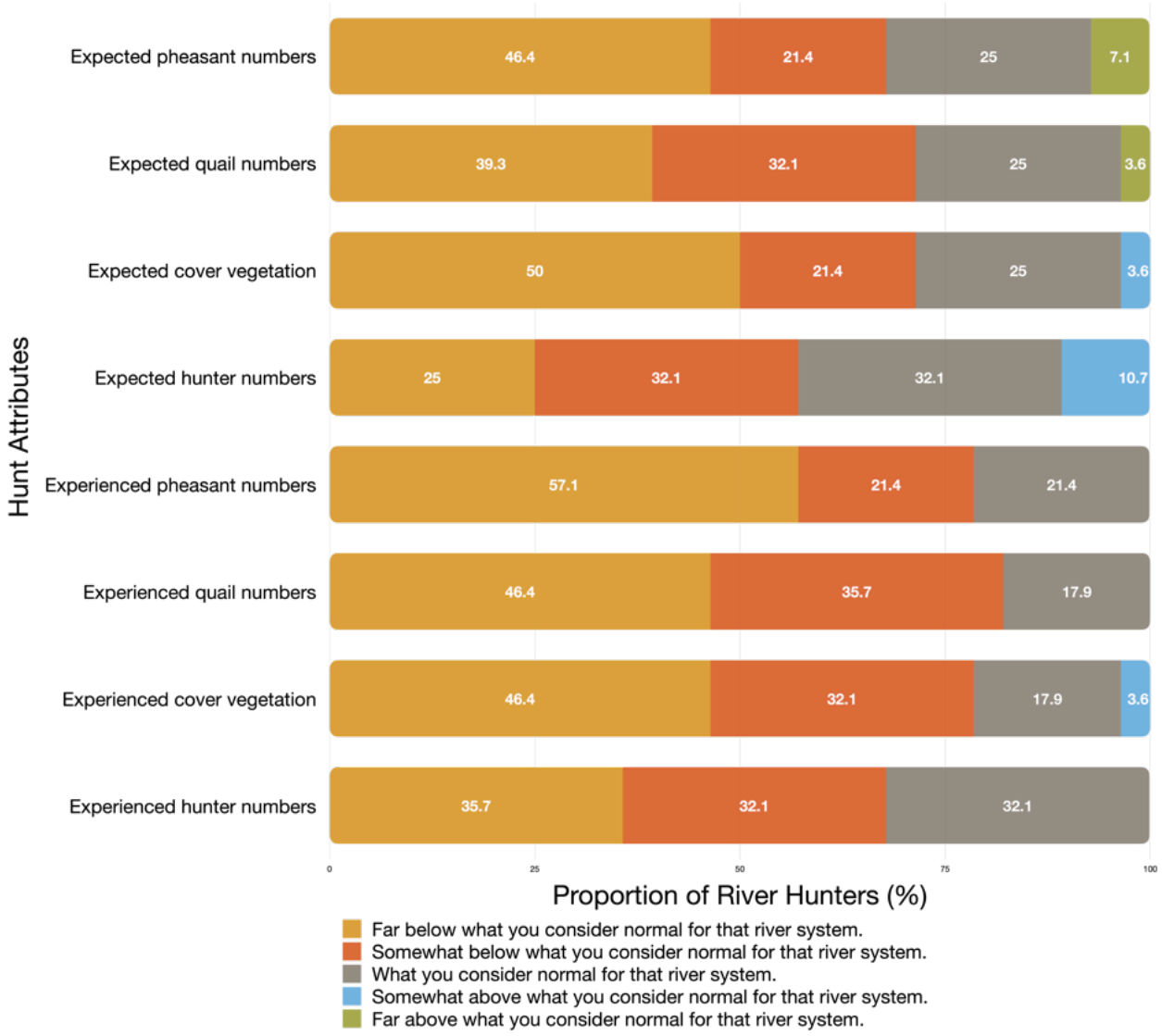

Figure 4 Hunter Expectations and Experiences of the Tutaekuri River System

Ngaruroro River

Sixty percent of *RH's* had hunted or walked with the intention of hunting the Ngaruroro River berms, including tributaries. Most (82%) expected both pheasant and quail numbers to be below what they consider normal for that system, and 70% expected cover vegetation to be below normal. Three quarters of *RH's* expected hunter numbers to be either normal or somewhat below normal.

River Hunter's experience of bird populations on the Ngaruroro system was more negative than their expectations. Ninety-three percent found pheasant numbers to be below what they consider normal and 88% found quail numbers to be below normal. Consistent with these findings, most *RH's* found cover vegetation and hunter numbers to be below normal. Of those who did not hunt this system, only 8% identified cyclone damage as the main reason.

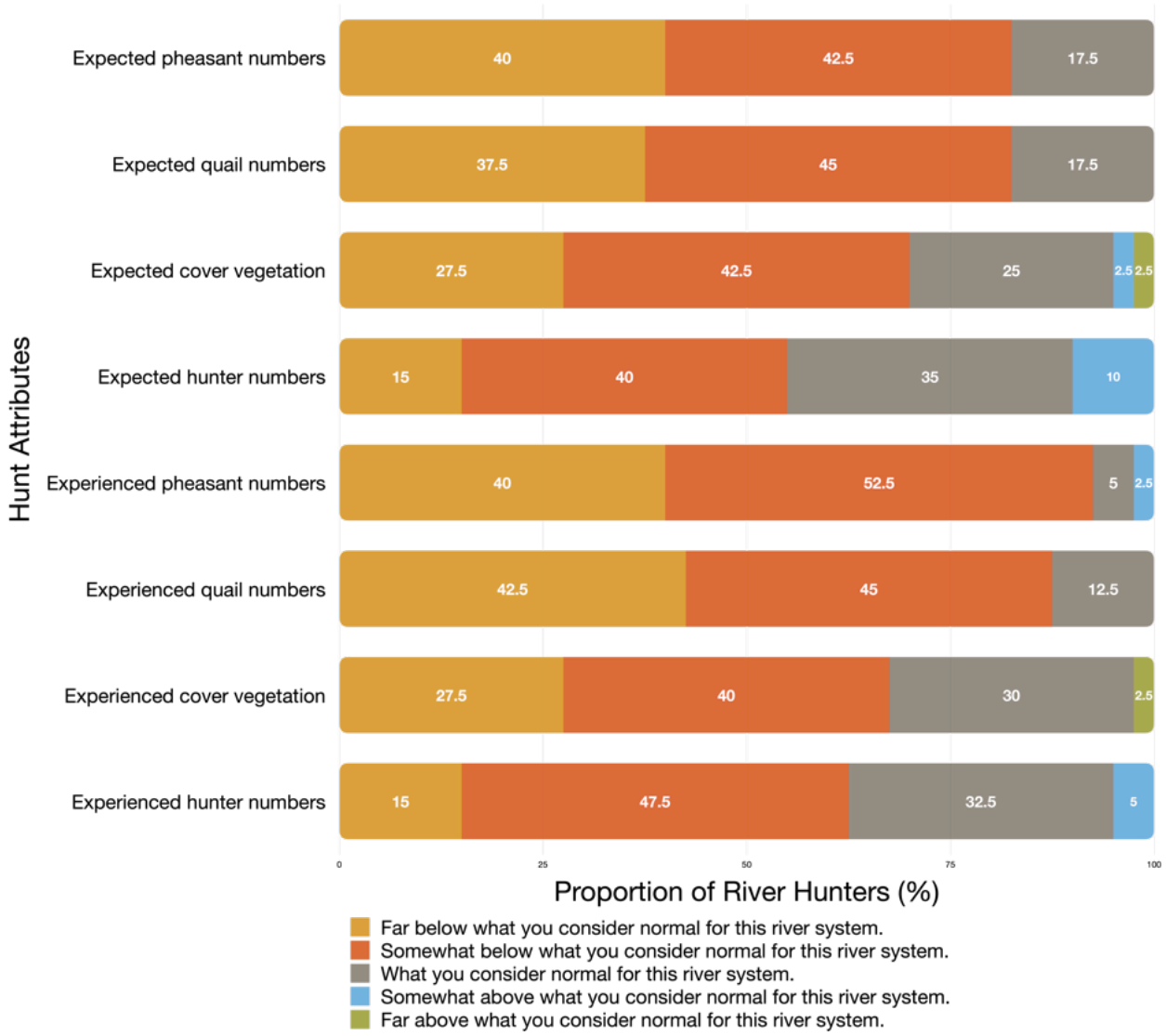

Figure 5 Hunter Expectations and Experiences of the Ngaruroro River System

Tukituki/Waipawa

Forty-nine percent of *RH's* had hunted or walked with the intention of hunting the Tukituki/Waipawa River system, or its tributaries. Expectations of pheasant and quail numbers were still mostly negative, however the proportion of *RH's* expecting a normal number of birds (Pheasants 36%, Quail 39%) was the largest of the three river systems.

The proportion of *RH's* expecting cover vegetation and the number of other hunters to be normal was also the largest of the three river systems. The less pessimistic expectation of the Tukituki/Waipawa River system by *RH's* may have reflected its distance from the more publicised epicentre of cyclone damage.

While *RH's* experience of cover vegetation and the number of other hunters accurately reflected their expectations, overall, their experience of bird numbers was less than they expected. A consistent proportion of *RH's* expected and experienced very low bird numbers.

Overall, *RH's* experience of cover vegetation was consistent with their expectation, however, experience moderated their sentiment. Of those who did not hunt this system, only 3% cited cyclone damage as the main reason.

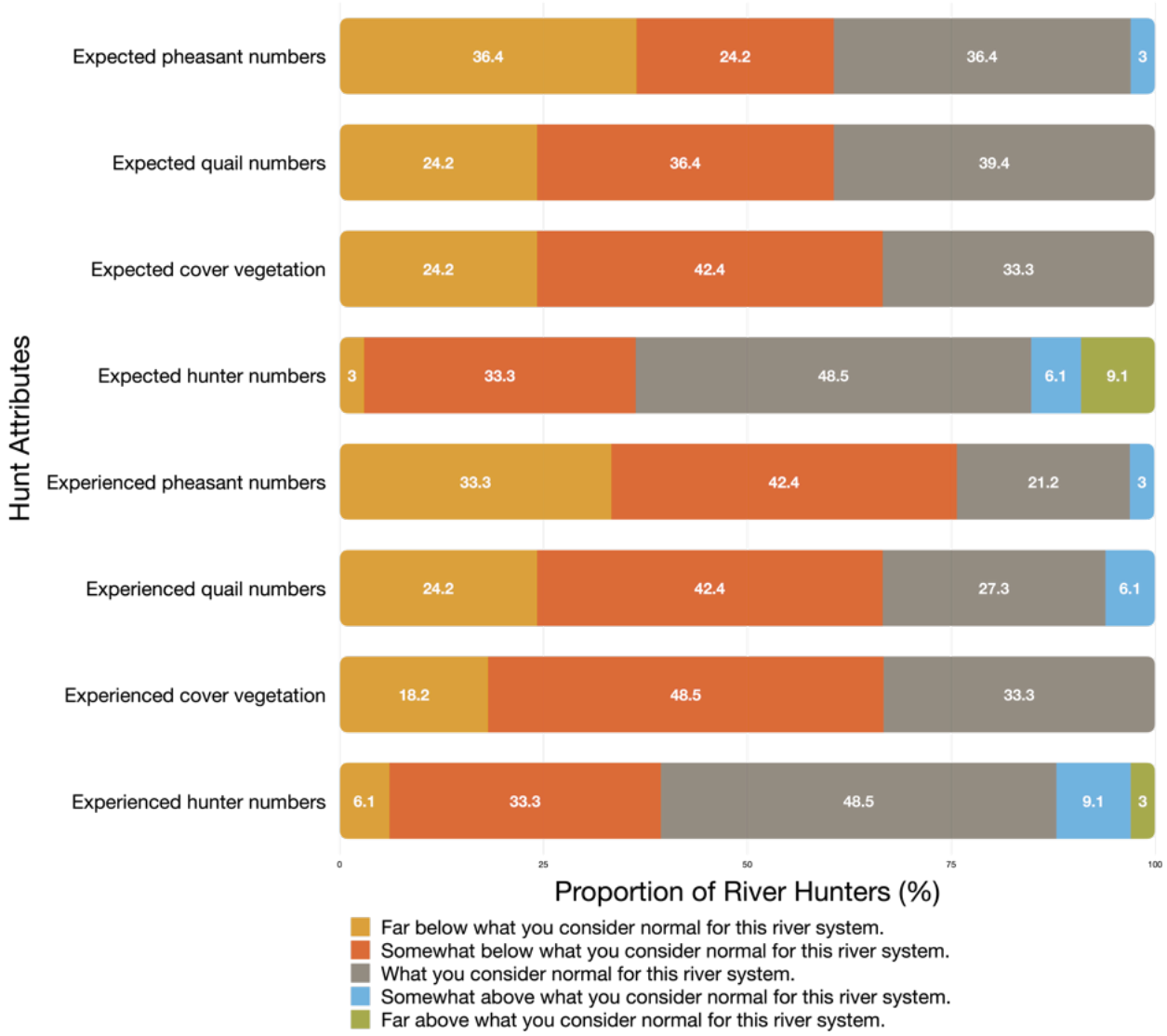

Figure 6 Hunter Expectations and Experiences of the Tukituki/Waipawa River System

Location choice

Choice of river system was largely governed by hunter habit. This accounted for 59% of respondents who did not hunt the Tutaekuri, 52% who did not hunt the Ngaruroro, and 56% who did not hunt the Tukituki/Waipawa river systems. Travel distance was only a barrier to 3% of *RHs* for the Tutaekuri River, 7% for the Ngaruroro River, and 3% for the Tukituki/Waipawa River. Most *RH's* (75%) attributed their choice of hunting location to their own thoughts and observations, with another 10% being influenced by friends and family.

Table 1 *Main Source of Information Used to Determine Which River Systems to Hunt in 2023*

Main Source of Information	***River Hunters* (%)**
Fish & Game emails or website.	7.5
Advice from an outdoors/hunting shop or club.	1.5
Friends or family.	10.4
Your own thoughts and observations.	74.6
Other	6
Total	100

Thirty-one percent of *RH's* hunted outside Hawke's Bay during the 2023 season. Auckland/Waikato, Eastern, and Wellington Fish & Game regions were the most frequented, with 10% of respondents hunting in each. Of those *RH's* that hunted outside of Hawke's Bay, the most frequent reason was it coincided with other travel.

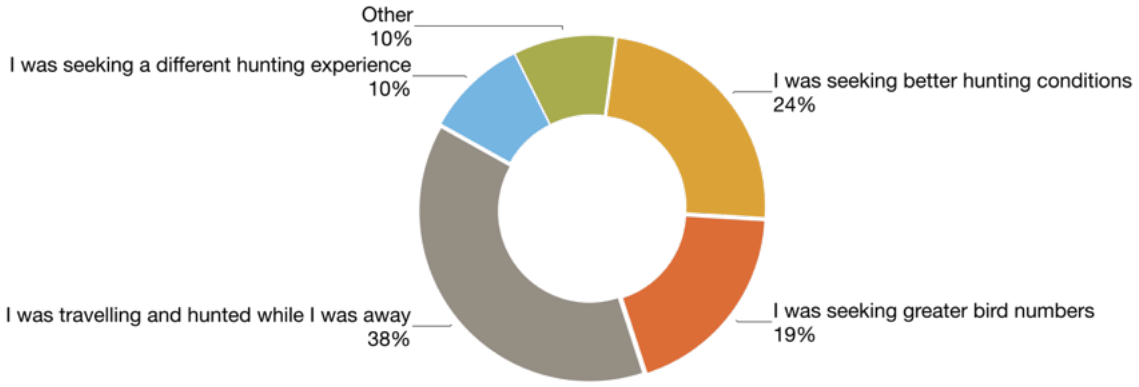

Figure 7 Reasons River Hunters Hunted Outside of Hawke's Bay

Harvest perceptions

Table 2 summarises *RH's* harvest perceptions and hunting preferences. Of the sixty-three *RH's* that hunted pheasant, only 22% assessed their harvest to be the number normally expect. Twenty-one percent felt their harvest was half normal expectations, while 52% thought it was less than half. Only 54% of respondents hunted quail, of those, most (69%) felt their harvest was less than half of normal.

Table 2 *River Hunter Harvest Perceptions and Preferences*

	***River Hunters* (%)**	
Perceptions of the 2023 season's harvest	**Pheasants**	**Quail**
The number you would normally expect	20.9	9.0
Three quarters the number you would normally expect	4.5	4.5
Half the number you would normally expect	19.4	3.0
Less than half the number you would normally expect	49.3	37.3
I did not hunt cock pheasant	6.0	-
I did not hunt quail	-	46.3
Total	100	100

Table 3 summarises *RH's* perceived reasons for a reduced bird harvest and respondents were able to select more than one answer. Most *RH's* identified flood damage as the main cause of a reduced bird harvest. A wetter than normal spring was the second most identified cause of

reduced bird numbers. A fault in the survey logic meant that those who felt their harvest was *'normal'* also faced this question. This may account for a proportion of *'Other'* responses.

Table 3 *River Hunter Perceived Reason for Reduced Bird Harvest*

Perceived reason for reduced bird harvest[†]	***River Hunters (%)***
Flood damage from severe weather events.	59.7
Normal seasonal variation in bird numbers.	4.5
The effects of a wetter than normal spring on nesting and chick survival.	19.0
Predation of birds and eggs.	12.0
Normal seasonal variation in opportunity and/or hunter performance.	9.0
Other	22.4

[†]Multiple responses were allowed.

Effects of weather on licence purchase intentions

Of the total 101 upland game bird respondents, 18% considered not purchasing a licence this season based on the effects of flood damage and 32% had friends or family that did not purchase a licence for those reasons. Seventeen percent felt flooding from future severe weather events would make them reconsider purchasing a hunting licence.

Twenty-one percent of *RH's* considered not purchasing a licence for the 2023 season based on the effects of flood damage. Thirty-one percent stated they had friends or family that did not purchase a licence due to the effects of flooding. It is unknown if the reason for not purchasing was based on a perception of poor hunting prospects or financial stress from storm damage. Only 15% felt it was either likely or very likely that such an event would stop them from purchasing a licence in the future.

Table 4 Effects of Future Severe Weather Events on Licence Purchase

	***River Hunters* (%)**				
	Very Unlikely	Unlikely	Neither likely nor unlikely	Likely	Very likely
How likely is it that flooding caused by future severe weather events in Hawke's Bay would make you reconsider purchasing a hunting licence?	50.7	20.9	13.4	7.5	7.5

Inferential analysis

The inferential analysis was undertaken using bivariate correlation. Correlation is not the same as causation. Although the analysis shows if two variables are related and 'move together,' we don't know if one variable causes the other to occur. A pairwise case exclusion rule was applied to the correlation analysis. The variables were nominal and ordinal, and the transformed mean hunt variables were largely correlated with nominal and ordinal variables. Therefore, bivariate correlations were undertaken using Spearman's ρ.

Descriptive variable bivariate correlations are shown in Table 5. The sample was homogenous by gender, leaving age as the only relevant demographic variable. Age was positively associated with the number of times a hunter held a licence in the past five years. As you may

expect, past licence tenure had a positive relationship with the self-assessed level of hunting experience. This lends some credibility to respondents' self-assessment of their hunting experience and to viewing past licence tenure as an independent metric of hunter experience.

Considering not purchasing a licence for the 2023 season had a moderate positive association with having friends or family that did not purchase a licence due to flood damage. There was, however, a negative association between considering not purchasing a licence in 2023 and the likelihood of not purchasing a licence due to weather events in the future. Having friends or family that did not purchase a licence due to flood damage also had a negative association with not purchasing a licence due to future weather events. This suggests that, despite reservations and close associates foregoing a licence, *RH's* have a reluctance to forego hunting opportunities due to weather damage.

A new variable was created using the mean of hunter expectations and experience scores for each river system. The variables for expected and experienced number of other hunters were re-coded with inverse scores. Re-coding represented high numbers of other hunters as a less desirable hunt characteristic than low numbers. Descriptive and mean hunt variable correlations are shown in Table 5.

River Hunter's mean expectations of the Ngaruroro and Tukituki/Waipawa River systems had a strong positive relationship with their subsequent mean experience of those respective systems. There were also some positive associations across river systems. Expectations and experiences of the Ngaruroro and Tutaekuri each had a positive association across both variables with the Tukituki/Waipawa. These correlations support the view that *RH* perceptions of these systems following a severe weather event are a credible assessment of likely hunting prospects. Some singular cross-variable associations were also noted between river systems.

In contrast, there was no statistically significant correlation between the mean expectation and experience of the Tutaekuri River system. There was also a negative association with hunter expectations of the Tutaekuri River system and being a member of a clay target club. This may relate to sentiment stemming from the destruction of the Kennels Gun Club, which was located adjacent to the Tutaekuri River.

The number of past seasons a hunter had held a licence had a positive relationship with the mean hunter experience on both the Ngaruroro and Tukituki/Waipawa. This infers that more established hunters fared better on these systems, whereas there was no relationship between hunter licence tenure and how they fared on the Tutaekuri. Hunter expectations and experience of the Tukituki/Waipawa had a negative relationship with the likelihood of not purchasing a licence due to the effects of future severe weather events, which suggests those that hunted the Tukituki/Waipawa may have considered it less affected and/or more resilient.

Table 5 *Bivariate Correlation Coefficients (Spearman's ρ) for Descriptive and Mean Hunt Variables*

Variables	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
1. Age															
2. Licence time	.269*														
3. Enviro	-.078	-.060													
4. Target Club	.073	.182	.051												
5. Experience	.058	.258*	-.247*	.143											
6. Hunt Frequency	.100	.148	-.180	-.081	.008										
7. Dogs	-.154	-.295*	.200	-.004	-.259*	-.219									
8. Consider non-purchase	-.025	.218	-.123	-.063	.104	.004	.030								
9. Friends or family	-.150	-.081	.035	.026	-.122	-.142	.213	.532**							
10. Future Licence	-.044	-.171	.292*	.121	.009	-.134	.116	-.592**	-.449**						
11. Tutaekuri_Expt	-.069	-.142	-.031	-.411*	-.338	-.020	.370	.212	.506**	-.102					
12. Tutaekuri_Experi	-.010	.236	.000	.204	-.144	.206	.307	.322	.273	-.194	.370				
13. Nrarururoro_Expt	.180	.209	.073	-.152	.001	.040	-.067	.203	.198	-.152	.364	.487*			
14. Ngarururoro_Experi	.219	.425**	.160	-.047	-.225	.014	.094	.236	.335*	-.253	.543**	.667**	.628**		
15. TukiWaipawa_Expt	-.080	.256	.115	-.059	-.017	-.200	.156	.104	.209	-.207	.652**	.340	.746**	.861**	
16. TukitWaipawa_Experi	-.052	.450**	-.092	-.076	.131	-.063	.021	.258	.063	-.305	.353	.747*	.570*	.560*	.761**

*The correlation was significant at the p<.05 level, ** at the p<.01 level

2. Licence time = Over the past 5 seasons, how many times have you held a game bird licence? 3. Enviro = In the past 2 years, have you donated money or time to an environmental organisation? 4. Target Club = Are you a member of a clay target club? 5. Experience = How would you rate your level of game bird hunting experience? 6. Hunt Frequency = how frequently do you usually hunt? 7. Dogs = do you hunt over one or more dogs? 8. Consider non-purchase = Did you consider not purchasing a hunting licence this season based on the effects of flood damage in Hawke's Bay. 9. Friends or family = Do you have friends or family that did not purchase a game bird licence this season due to flooding caused by severe weather events? 10. Future Licence = How likely is it that flooding caused by future severe weather events in Hawke's Bay would make you reconsider purchasing a hunting licence? 11. Tutaekuri_Expect = The mean hunter expectation of the Tutaekuri River system including tributaries. 12. Tutaekuri_Experi = The mean hunter experience of the Tutaekuri River system including tributaries. 13. Ngarururoro_Expect = The mean hunter expectation of the Ngarururoro River system including tributaries. 14. Ngarururoro_Experi = The mean hunter experience of the Ngarururoro River system including tributaries. 15. TukiWaipawa_Expect = The mean hunter expectation of the Tukituki/Waipawa River system including tributaries. 16. TukiWaipawa_Experi = The mean hunter experience of the Tukituki/Waipawa River system including tributaries.

Bivariate correlations for each river system are shown in Table 6, Table 7, and Table 8 in the Appendix. For those interested, they offer a more detailed insight into the relationship between hunt variables for each system. In the interest of readability, the following is a very brief outline of these correlations.

Tutaekuri River

In the Tutaekuri system, the self-rated level of hunting experience had a negative association with the expectation of pheasant numbers and quail numbers, with expected numbers of other hunters. A positive relationship was found between *RH* expectations of pheasant numbers, their expectations of quail numbers, and their expectations of cover vegetation. Similarly, there was a positive relationship between the experience of pheasant numbers in the Tutaekuri, the experience of quail numbers, and the experience of cover vegetation. It is reasonable to expect better cover vegetation to be associated with better bird numbers and this association lends credibility to the data. The experience of hunter numbers also had a positive relationship with the experience of cover vegetation, pheasant numbers, and quail numbers. It is logical that a good hunting spot would attract more hunters.

Ngaruroro River

Expected pheasant numbers had a positive relationship with all other hunt variables for this river system, suggesting that when pheasant numbers are good *RH* consider all else is likely to be good. Experiences tended to reflect expectations, with expected quail numbers having a positive association with the amount of quail experienced, expected cover vegetation having a positive association with the level of cover experienced, and expected hunter numbers having a positive association with numbers experienced. This adds credibility to *RH's* ability to assess hunt conditions on the Ngaruroro system.

The self-rated level of hunting experience had a negative relationship with the experience of pheasant numbers. In the first instance, this appears to be a perverse relationship. However, it may be that more experienced hunters had higher expectations of what they consider *normal* bird numbers.

Tukituki/Waipawa River

Each hunt variable in the Tukituki/Waipawa system had a positive association with their respective expectations and experiences. The number of seasons a *RH* had held a licence in the past five years had a positive relationship with experienced quail and pheasant numbers in the Tukituki/Waipawa system, which suggests, once again, that more experienced hunters may have fared better on this system. As with the other river systems, there were several positive associations between bird numbers, cover vegetation, and hunter numbers. Expected pheasant numbers had a positive association with expected and experienced quail numbers, and experienced pheasant numbers had a positive association with experienced quail numbers.

There were no statistically significant correlations between the age or frequency of hunting and any of the hunt variables for any of the river systems. This infers that age and frequency did not play a significant part, on their own, with *RH* expectations and experiences of the post cyclone game bird season. Therefore, the expectations and experiences of even unpractised and infrequent *RH's* form an integral part of the season's barometer of success.

Discussion

This study gathered individual hunter perceptions and judgements relative to what they consider *normal* bird numbers, cover vegetation, and hunter numbers for the Hawke's Bay Fish & Game Council (HBFGC). The data portray a cohesive and logical picture of post-cyclone expectations and the season's hunting experience. Overall, the inferential analysis lent further credibility to the Likert data. Most statistically significant correlations inferred relationships between variables that followed logic or reasonable explanation, lending confidence in the hunt attributes applied and the methodology.

The study's primary results were that *RH's* had relatively low expectations of their prospects for the 2023 season. Their reality was slightly worse than their expectations, and most considered severe weather as the root cause of a harvest that was reduced by 50% or more. There is little or no past data with which to compare this result. Anecdotally, the reduced harvest reported was in line with the authors river-side conversations with hunters during the season.

Most upland game bird hunters and *RH's* were very regular hunters, loyal licence holders, and unlikely to be put off purchasing a licence due to severe weather events. This should give HBFGC some confidence in revenue from *RH's*. However, the potential lost income from those likely not to purchase may give some pause, given the low marginal cost of additional licence sales.

Most *RH's* were self-contained when it came to hunt location choice, with a very low proportion of River Hunters relying on HBFGC emails or their website. This should not be taken wholly as a negative reflection on that information channel, as the survey question's framing for information channels was based on reliance and not engagement. The initial survey response rate is a positive indicator of the engagement attained by a well-constructed email.

A robust environmental orientation in the total sample of 101 upland gamebird hunters was unexpected. It highlights the environmental dimension of hunting. The proportion of the general public that donates to environmental organisations is unclear; however, the proportion of total upland game bird hunters (41%) and of *River Hunters* (40%) is high. In the New Zealand Environmental Perceptions report, Hughey et al (2019) used extensive questioning regarding the environmental orientation of respondents, and found rates varied between 10% and 30%, depending on collection method.

The results have equipped the Hawke's Bay Fish & Game Council with empirical data regarding upland game bird hunter expectations and experiences for the season following Cyclone Gabrielle. To the best of the author's understanding, it is unique in New Zealand and fills a knowledge gap relevant to other Fish & Game regions. The collective knowledge of hunters should be considered a valuable resource. Given a large-scale biological field study would be costly and time-consuming, the most cost-effective means of assessing bird populations and hunting conditions will continue to be surveying hunters. In light of this, HBFGC should take a considered approach to the number of surveys deployed to avoid hunter survey fatigue.

Conclusions

1. Post Cyclone Gabrielle, the 2023 season's upland game bird harvest was half or less than half the number normally expected by those who hunt public river berms.

2. Mostly, hunter expectations and experiences of pheasant and quail numbers, cover vegetation, and hunter numbers were less than normal across all three river systems.

3. In general, hunter experiences were worse than their expectations, and experiences had a significant positive relationship with expectations across all hunt attributes.

4. Experiences were the least worst in the Tukituki/Waipawa River system.

5. Bird numbers, amount of cover, and hunter numbers tend to have a positive relationship with each other, reflecting logic or reasonable explanation.

6. *River Hunters* are primarily self-contained concerning decisions regarding hunt location and are mainly dedicated yearly licence purchasers.

7. A small percentage of *River Hunters* are more likely to forego licence purchase due to the effects of severe weather.

8. Upland game bird hunters have an elevated environmental dimension to their demographic.

Recommendations

There are anecdotal theories regarding upland game bird behaviour during and after flood events. These 'on-the-ground' experiences have a vital role in management. However, they are a far less defensible basis for planning and decision-making than empirical data. Recommendations are:

1. A follow-up study should be undertaken following the 2024 season to quantify *River Hunter* perceptions of any recovery in habitat and harvest. This will guide future HBFGC severe weather response programmes.

2. A targeted hunter-relations programme should be established. This should focus on disseminating the value of hunter contributions to research, an acknowledgement of the of the 2023 hunter experience, and a commitment to monitor the recovery.

3. HBFGC should consider hosting an upland game bird focus group as part of the hunter-relations engagement strategy. This should represent a cross-section of upland game bird hunters, including those with an elevated identity in the hunting or wildlife management sphere. Those involved should be comfortable with publicising the focus group.

Assumptions and limitations

The electronic delivery and Facebook boosting campaign meant that some self-selection bias was unavoidable. Aside from this, the sample was fairly representative of general game bird licence purchasers.

The behavioural motive of those friends and family that did not purchase a licence is left unexplored. This means accurate interpretation is impossible and, therefore, offers no clear guidance for future management.

It is unclear if those who *did not hunt pheasants* or *did not hunt quail* did not hunt them by intentional exclusion or did not encounter those species on the outings they undertook.

The term *severe weather event* was used in the survey to avoid any bias associated with the name Cyclone Gabrielle. Since the survey was collected, the official NIWA report on Cyclone Gabrielle has been released. In that report, the cyclone was labelled an *extreme weather event*. It is unlikely this has made a material difference in the results. However, it should be noted as a limitation.

The survey was delivered six months after the end of the season. This may have impacted *RH's* recollection of the season; however, the atypical nature of the season and the dedication of *RHs* meant recollections were more likely to be reliable. There may also have been a degree of confirmation bias where *RH's* expectation scores were influenced by their subsequent experience.

Final Comment

I have intentionally omitted any discussion regarding the often inevitable call to stock river systems with birds, although I understand this has been done at least once in the past. This is outside my expertise and there are HBFGC Councillors who are experts in the requirements of reared birds and the efficacy of their release.

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Appendix

Table 6 *Bivariate Correlations (Spearman's ρ) of Descriptive and Hunt Variables for the Tutaekuri River System*

Variable	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
1. Age															
2. Licence time	.269*														
3. Enviro	-.078	-.060													
4. Target Club	.073	.182	.051												
5. Experience	.058	.258*	-.247*	.143											
6. Hunt Frequency	.100	.148	-.180	-.081	.008										
7. Dogs	-.154	-.295*	.200	-.004	-.259*	-.219									
8. Future Licence	-.025	.218	-.123	-.063	.104	.004	.030								
9. Pheasant_Expt	-.115	-.274	-.038	-.434*	-.475*	.116	.328	.295							
10. Quail_Expt	-.162	.037	.211	-.228	-.440*	-.308	.468*	.146	.427*						
11. Veg_Expt	-.196	-.129	.072	-.249	-.305	.041	.514**	.360	.555**	.409*					
12. Hunt_Expt	-.011	.045	.125	-.112	-.409*	.147	.214	.346	.306	.299	.222				
13. Pheasant_Experi	-.047	.168	.050	.285	-.323	.091	.314	.355	.377*	.264	.582**	.352			
14. Quail_Experi	-.145	.181	.130	.149	-.336	-.064	.275	.199	.285	.421*	.442*	.383*	.619**		
15. Veg_Experi	.048	.172	.033	-.137	-.321	.276	.360	.456*	.505**	.398*	.794*	.513**	.719**	.606*	
16. Hunt_Experi	-.094	-.018	.221	-.125	-.541**	-.108	.234	.276	.297	.493**	.292	.658**	.409*	.551**	.460*

*The correlation was significant at the p<.05 level, ** at the p<.01 level

Licence time = Over the past 5 seasons, how many times have you held a game bird licence? Enviro = In the past 2 years, have you donated money or time to an environmental organisation? Target Club = Are you a member of a clay target club? Experience = How would you rate your level of game bird hunting experience? Hunt Frequency = how frequently do you usually hunt? Dogs = do you hunt over one or more dogs? Future Licence = How likely is it that flooding caused by future severe weather events in Hawke's Bay would make you reconsider purchasing a hunting licence? Pheasant_Expt = Overall were you expecting pheasant numbers in the Tutaekuri River system, including tributaries, to be? Quail_Expt = Overall were you expecting quail numbers in the Tutaekuri River system, including tributaries, to be? Veg_Expt = Overall were you expecting cover vegetation on the Tutaekuri River system, including tributaries, to be? Hunt_Expt = Overall were you expecting the number of hunters on the Tutaekuri River system, including tributaries, to be? Pheasant_Experi = Based on your overall experience of hunting the Tutaekuri River system, including tributaries, were pheasant numbers? Quail_Experi = Based on your overall experience of hunting the Tutaekuri River system, including tributaries, were quail numbers? Veg_Experi = Based on your overall experience of hunting the Tutaekuri River system, including tributaries, was cover vegetation? Hunt_Experi = Based on your overall experience of hunting the Tutaekuri River system, including tributaries, was the number of other hunters?

Table 7 *Bivariate Correlations (Spearman's ρ) of Descriptive and Hunt Variables for the Ngaruroro River System*

Variable	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
1. Age															
2. Licence time	.269*														
3. Enviro	-.078	-.060													
4. Target Club	.073	.182	.051												
5. Experience	.058	.258*	-.247*	.143											
6. Hunt Frequency	.100	.148	-.180	-.081	.008										
7. Dogs	-.154	-.295*	.200	-.004	-.259*	-.219									
8. Future Licence	-.025	.218	-.123	-.063	.104	.004	.030								
9. Pheasant_Expt	-.115	-.274	-.038	-.434*	-.084	-.073	.011	.203							
10. Quail_Expt	-.162	.037	.211	-.228	-.116	-.041	-.092	.252	.500**						
11. Veg_Expt	-.196	-.129	.072	-.249	-.152	.042	.073	.077	.423**	.250					
12. Hunt_Expt	-.011	.045	.125	-.112	-.130	-.181	.090	.117	.479**	.263	.502*				
13. Pheasant_Experi	-.047	.168	.050	.285	-.333*	-.092	.063	.259	.701**	.327*	.424**	.420**			
14. Quail_Experi	-.145	.181	.130	.149	-.216	-.091	-.036	.151	.350*	.752**	.208	.175	.349*		
15. Veg_Experi	.048	.172	.033	-.137	-.075	.132	-.028	.265	.482**	.324*	.859*	.469**	.533**	.220	
16. Hunt_Experi	-.094	-.018	.221	-.125	.011	.013	-.312	.119	.480**	.210	.193	.489**	.280	.211	.207

*The correlation was significant at the p<.05 level, ** at the p<.01 level

Licence time = Over the past 5 seasons, how many times have you held a game bird licence? Enviro = In the past 2 years, have you donated money or time to an environmental organisation? Target Club = Are you a member of a clay target club? Experience = How would you rate your level of game bird hunting experience? Hunt Frequency = how frequently do you usually hunt? Dogs = do you hunt over one or more dogs? Future Licence = How likely is it that flooding caused by future severe weather events in Hawke's Bay would make you reconsider purchasing a hunting licence? Pheasant_Expt = Overall were you expecting pheasant numbers in the Ngaruroro River system, including tributaries, to be? Quail_Expt = Overall were you expecting quail numbers in the Ngaruroro River system, including tributaries, to be? Veg_Expt = Overall were you expecting cover vegetation on the Ngaruroro River system, including tributaries, to be? Hunt_Expt = Overall were you expecting the number of hunters on the Ngaruroro River system, including tributaries, to be? Pheasant_Experi = Based on your overall experience of hunting the Ngaruroro River system, including tributaries, were pheasant numbers? Quail_Experi = Based on your overall experience of hunting the Ngaruroro River system, including tributaries, were quail numbers? Veg_Experi = Based on your overall experience of hunting the Ngaruroro River system, including tributaries, was cover vegetation? Hunt_Experi = Based on your overall experience of hunting the Ngaruroro River system, including tributaries, was the number of other hunters?

Table 8 *Bivariate Correlation (Spearman's ρ) of Descriptive and Hunt Variables for the Tukituki/Waipawa River System*

Variable	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
1. Age															
2. Licence time	.269*														
3. Enviro	-.078	-.060													
4. Target Club	.073	.182	.051												
5. Experience	.058	.258*	-.247*	.143											
6. Hunt Frequency	.100	.148	-.180	-.081	.008										
7. Dogs	-.154	-.295*	.200	-.004	-.259*	-.219									
8. Future Licence	-.025	.218	-.123	-.063	.104	.975	.030								
9. Pheasant_Expt	.004	.316	-.020	.182	.027	-.050	.061	-.071							
10. Quail_Expt	-.239	.270	.172	-.018	.002	-.095	.110	.095	.516**						
11. Veg_Expt	-.152	.058	.179	-.083	-.020	-.063	.141	.280	.241	.111					
12. Hunt_Expt	-.198	.151	.122	.227	.094	.118	-.054	.193	.207	.220	.187				
13. Pheasant_Experi	-.043	.391*	-.175	-.076	-.066	-.026	-.066	.166	.574**	.428*	.235	.178			
14. Quail_Experi	-.124	.489**	-.024	.029	.185	.073	-.070	.066	.655**	.692**	.158	.090	.612**		
15. Veg_Experi	-.117	.213	.175	.147	.244	-.161	-.112	.440*	.321	.091	.685**	.409*	.155	.299	
16. Hunt_Experi	-.088	.196	.199	.308	.111	.079	-.300	.145	.169	.115	-.024	.801**	.203	.203	.352*

*The correlation was significant at the p<.05 level, ** at the p<.01 level

Licence time = Over the past 5 seasons, how many times have you held a game bird licence? Enviro = In the past 2 years, have you donated money or time to an environmental organisation? Target Club = Are you a member of a clay target club? Experience = How would you rate your level of game bird hunting experience? Hunt Frequency = how frequently do you usually hunt? Dogs = do you hunt over one or more dogs? Future Licence = How likely is it that flooding caused by future severe weather events in Hawke's Bay would make you reconsider purchasing a hunting licence? Pheasant_Expt = Overall were you expecting pheasant numbers in the Tukituki/Waipawa River system, including tributaries, to be? Quail_Expt = Overall were you expecting quail numbers in the Tukituki/Waipawa River system, including tributaries, to be? Veg_Expt = Overall were you expecting cover vegetation on the Tukituki/Waipawa River system, including tributaries, to be? Hunt_Expt = Overall were you expecting the number of hunters on the Tukituki/Waipawa River system, including tributaries, to be? Pheasant_Experi = Based on your overall experience of hunting the Tukituki/Waipawa River system, including tributaries, were pheasant numbers? Quail_Experi = Based on your overall experience of hunting the Tukituki/Waipawa River system, including tributaries, were quail numbers? Veg_Experi = Based on your overall experience of hunting the Tukituki/Waipawa River system, including tributaries, was cover vegetation? Hunt_Experi = Based on your overall experience of hunting the Tukituki/Waipawa River system, including tributaries, was the number of other hunters?