Sustainable Farming Fund Project L06/061.
Measuring grape damage as an indicator of bird pressure.

Final report on damage to grapes in conjunction with the Falcons for Grapes Project.

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This is the final report from a 3 year grape damage survey SFF project L06-61

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Contents: Page

Executive Summary:

The Falcons for Grapes project was originally funded by SFF and NZ Winegrowers with joint objectives of conservation and of establishing falcons in vineyards where they would provide some bird control.

In conjunction with the Falcons for Grapes project, Sustainable Farmign Fund (SFF) funded the development of a robust method for surveying bird damage to grapes, (L05-036) followed by funding for a 3 year survey of grapes where falcons were established (L06-061).

This is the final report from that 3 year project.

In 2005 the method was developed (Saxton, 2007) and a survey of proposed falcon sites was conducted. As the Falcons project developed it was found that environmental factors, including electrocution on transformers, were a significant problem. Safety of the birds was paramount so there was a period of review and adjustment. At this period (2007) seminars were conducted in Hawkes Bay and in Blenheim, (in conjunction with Focus Vineyards) each attended by 40-50 vineyard personnel. The survey method was explained and the nature of bird control discussed with stakeholders. This complied with the technology transfer contract with SFF. Although vineyard personnel undertook to conduct surveys themselves in 2007 this did not happen. No surveys were conducted in 2007.

In 2008 falcons were established in vineyards in the Southern Valleys and some on the east side of Blenheim. Seven vineyards were surveyed; 1420 bunches were sampled. Data from the grape damage survey in 2008 indicated that there was virtually no damage at all within 100m of falcon feeding trays (potentially approx 4Ha), less than 2% for a radius of 300m (23Ha) and capped at 5% up to 600m (113Ha).

In 2009 some of the same vineyards were surveyed, and some new ones. Nine vineyards were surveyed; 1760 bunches were sampled. Results showed that Sauvignon blanc suffered less damage overall than Pinot noir or Pinot gris, and that damage levels overall in 2009 were heavier than in 2008. Brancott vineyard (no falcons) was surveyed in each year (06, 08 and 09) as a control, and these data showed that damage levels were heavier in 2009 than in 2008, This was possibly due to seasonal factors such as weather.

In 2009 damage to Sauvignon blanc was approximately 2% up to 300m from the falcon feeding trays, and less than 5% up to 1km away. Damage to Pinot noir and Pinot gris was heavier, being 5% up to 100m and 10% up to 300m (slightly lower for Pinot gris).

In conclusion, in both years presence of falcons correlated highly significantly with reduced bird damage to grapes. The potential for use of a predator bird to reduce bird damage outright, or in conjunction with other bird control methods to reduce overall costs of bird control appears to be a no-brainer.

Introduction

The Falcons for Grapes project began in late 2005 when the first nestlings were translocated from nests in the hills of the Waihopai Valley to artificial nests in mussel barrels in vineyards. The first nest was located in the pine forest adjacent to the Winegrowers of Ara (Waihopai) vineyard, and one on the border of the (Marris) Wither Hills and the Nobilo-Valleyfield vineyards. These two nests hosted the first four chicks. A feeding station was located beside the nest tree in the Wither Hills vineyard (now The Ned), and another was progressively moved across the paddock from the pine forest to within the Winegrowers of Ara vineyard. In addition to these sites, four other prospective sites were surveyed for bird damage in 2006 but these sites were abandoned for falcon establishment, following electrocutions of falcons in 2007, because they had uninsulated transformers that were considered a danger.

2006 and 2007 surveys

In the second year of the project 16 more nestlings were translocated from the wild to artificial nests in four more vineyards. Due to deaths particularly through electrocution of some birds, many birds were moved mid-season and settled at one site until nest sites could be found that had a minimum risk of electrocution. Due to the uncertainty of the falcon establishment, 2007 was used to comply with the SFF technology transfer contract. In conjunction with the Focus Vineyards project seminars on grape damage surveying methods were run in Hawkes Bay and in Marlborough. These were each attended by more than 40 vineyard personnel. Vineyard staff at all the vineyards where the falcons were in 2007 gave an undertaking to survey and attended workshops.

Data collection by vineyard workers did not happen in the face of pressure of harvest, so no data were obtained in 2007. Aspects of technology transfer are discussed later in this report.

In the third year of the falcons project (2008 vintage) birds were established at seven sites with a mimimum of objective danger.

2008 Survey

Grape damage surveys were conducted in March 2008 according to the methodology developed in SFF project L05-036 (Saxton, 2007). Damage needed to be surveyed as late as possible before harvest, but without inconvenience to vineyard harvest operations. Close liaison with the Falcons for Grapes project and with vineyard management (established on a previous visit in January 2008) pinpointed the weekend before Easter and Easter weekend itself as optimal for 2008. Altogether 13th, 14th and 15th of March and 20th, 21st and 22nd of March were dedicated to the surveys.

Seven vineyards were surveyed, each of them several times at varying distances from the falcons' feeding trays. The distances measured depended on the vineyard layout, and were between 20m and 2km from the trays. At each location 20 sample bunches were selected using a rod and string with a latin square type progression to objectively select a bunch without bias, according to the method developed by Saxton (2006). Bunch damage was estimated visually. Calibration of the visual estimates was by collecting every 20th bunch and later counting missing and damaged berries and comparing with the estimate. All estimates were then adjusted according to the averaged discrepancy. (See Saxton, 2006 for details of calibration method and correction calculation).

A total of 1420 bunches were sampled and damage estimated. Data were classified into two categories – interior vines (that generally do not sustain much damage) and edge vines that are vulnerable and generally sustain the worst damage. Both categories were further classified

into five distances from the falcon feeder trays: less than 100m, 100-300m, 300-600m, 600-1000m, 1000-2000m. A non-parametric Kruskall-Wallis ANOVA was run on the data groups (Genstat 10).

2009 survey
The survey was conducted on 19th, 20th and 21st March. Nine vineyards were surveyed – eight where falcons were established and one as an annual control for year to year variation in general bird damage. Overall 1760 bunches were sampled for bird damage. These were almost entirely from edge vines and most of the vines were unnetted.

In some cases the feeding trays for the young falcons had been moved from the original nesting sites. Consequently the areas protected by falcons had moved within the vineyard from 2008 to 2009. In addition the most frequent reason for this move was to make feeding less trouble, so the trays were located right beside the workers sheds where there was already a lot of human activity.

In 2009 a difference in damage levels was noted between cultivars, so in addition to the pooled data for all cultivars, Pinot noir and Pinot gris were analysed separately from the major variety Sauvignon blanc. Because the newer vineyard in the hills surrounding the southern valleys are Pinot noir, there are more data from Pinot noir than from Sauvignon blanc.

At all stages, selection of which vines to survey was influenced by layout of the individual vineyard. Blocks were of varying sizes, and especially in the hill blocks of varying shapes, so the main factor was to find accessible preferably un-netted edge vines at specific distances from the falcon feeding trays.

Results

2008
Edge vines:
Mean damage to bunches less than 100m from the falcon feeding tray was 0.15% (Figure 1, median 0%, n = 90), between 100 and 300m 1.4% (median 0%, n = 200), between 300 and 600m 5.25% (median 0%, n = 400), between 600 and 1000m 24.5% (median 15%, n = 40) and between 1000 and 2000m 20.5% (median 3.5%, n = 220). There was a significant difference at the p = 0.01 1evel (H = 130.1, df = 4).

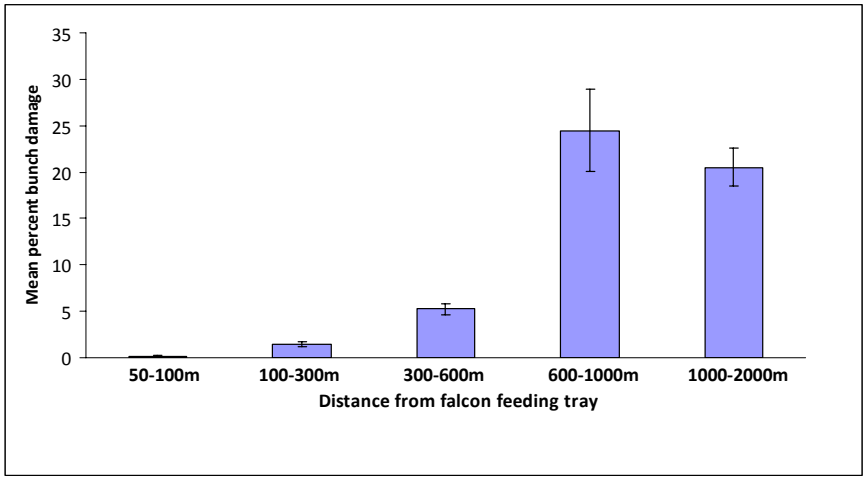

Figure 1: Mean damage per bunch to all varieties with SE bars (edge vines, n = 900)

Interior vines:
Mean damage to interior vines was 1.9% (Figure 2, median 0%, n = 180). There was no significant difference to damage levels of interior vines at varying distances from the falcon feeding trays.

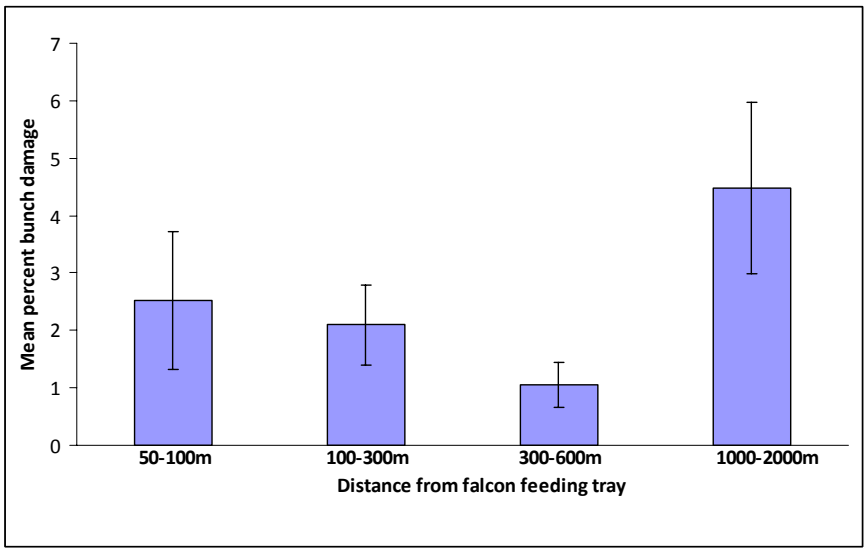

Figure 2: Mean damage per bunch to all varieties 2008 with SE bars (interior vines, n = 260)

2009

Edge vines:
Mean damage to bunches less than 50m from the falcon feeding tray was 3.6% (Figure 3, median 0%, n = 270), between 50m and 100m was 4.0% (median 0%, n = 160), between 100 and 200m 8.1%, median 4.5%, n = 160), between 200m and 300m 8.2% (median 2.9%, n = 130), between 300 and 600m 18% (median 9.7%, n = 230), between 600 and 1000m 19.0% (median 19%, n = 320) and between 1000 and 2000m 25.8% (median 15.6%, n = 100). There was a significant difference at the p = 0.001 1evel (H = 197.1, df = 6).

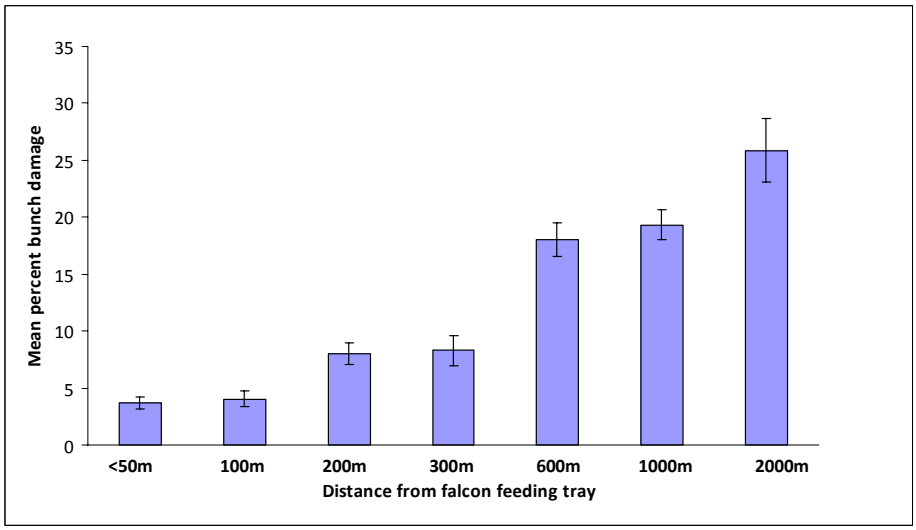

Figure 3:Mean percent bunch damage to all grape varieties 2009 with se bars (n = 1370)

Sauvignon blanc

Mean damage to bunches less than 100m from the falcon feeding tray was 2.14% (Figure 4, median 0%, n = 200), between 100 and 300m 4.4% (median 0%, n = 130), between 300 and 600m 3.9% (median 0%, n = 70), and between 600 and 1000m 11.2% (median 5.2%, n = 140) There was a significant difference at the p = 0.001 1evel (H = 64.3, df = 3).

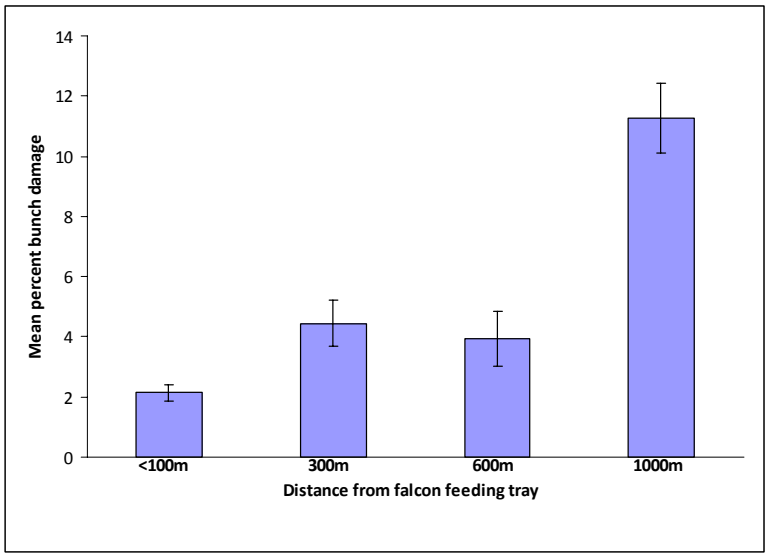

Figure 4: Mean percent bunch damage to Sauvignon blanc 2009 with se bars (n = 540)

Pinot noir

Mean damage to bunches less than 100m from the falcon feeding tray was 2.14% (Figure 5, median 0%, n = 200), between 100 and 300m 4.4% (median 0%, n = 130), between 300 and 600m 3.9% (median 0%, n = 70), and between 600 and 1000m 11.2% (median 5.2%, n = 140) There was a significant difference at the p = 0.001 1evel (H = 64.3, df = 3).

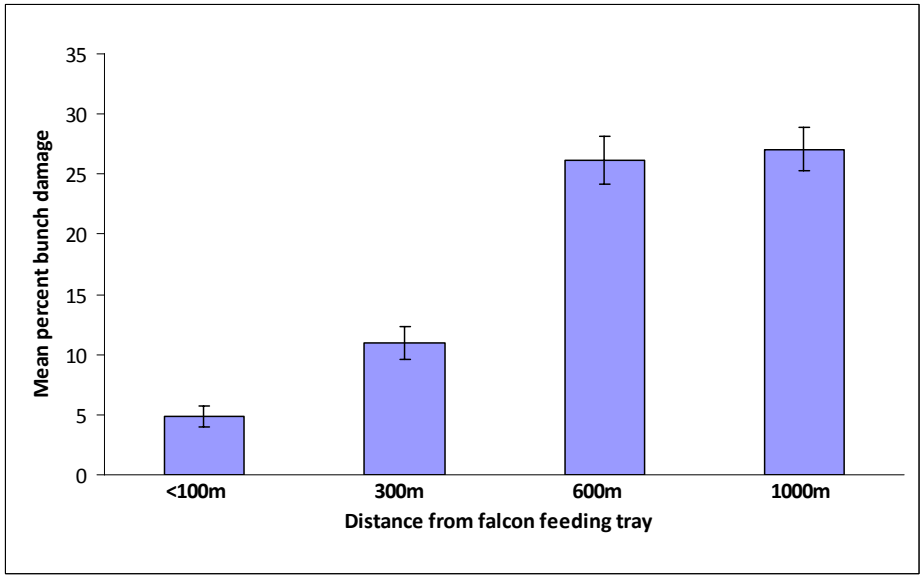

Figure 5: Bird damage to Pinot noir grapes 2009 with se bars (n = 670)

Pinot gris

Mean damage to bunches less than 100m from the falcon feeding tray was 4.7% (Figure 4, median 4.5%, n = 40), between 100 and 300m 606% (median 202%, n = 60), between 300 and 600m 7.4% (median 4.6%, n = 30), and between 600 and 1000m 21.5% (median 13.6%, n = 40) There was a significant difference at the p = 0.001 1evel (H = 20.7, df = 3).

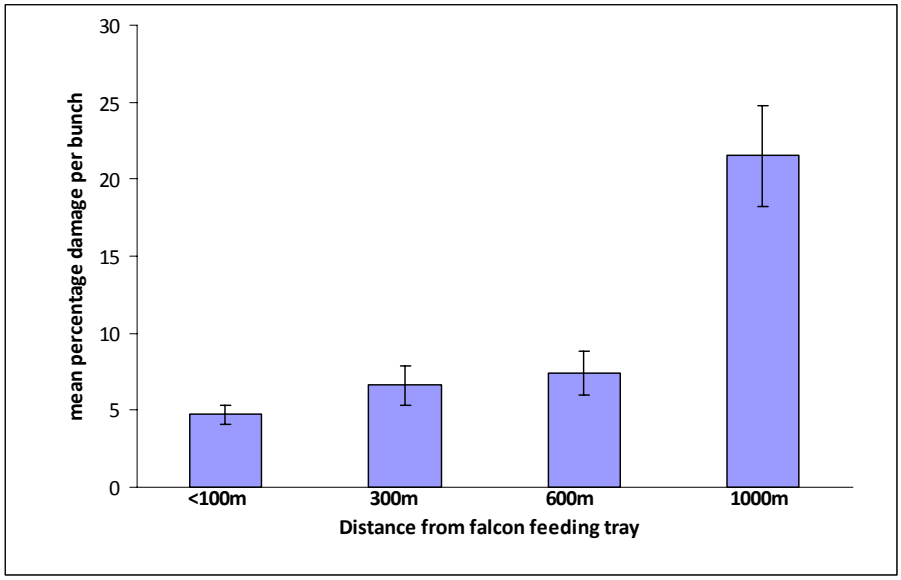

Figure 6: Bird damage to Pinot gris grapes 2009 with se bars (n = 170)

Interior vines 2009.

Interior vines (more than 50m into the vineyard) were surveyed but no significant effect of distance from falcon feeding tray was found. Mean percent bunch damage to interior vines was 7.1% in 2009 at Brancott, and 3.2% in 2008.

Brancott Vineyard

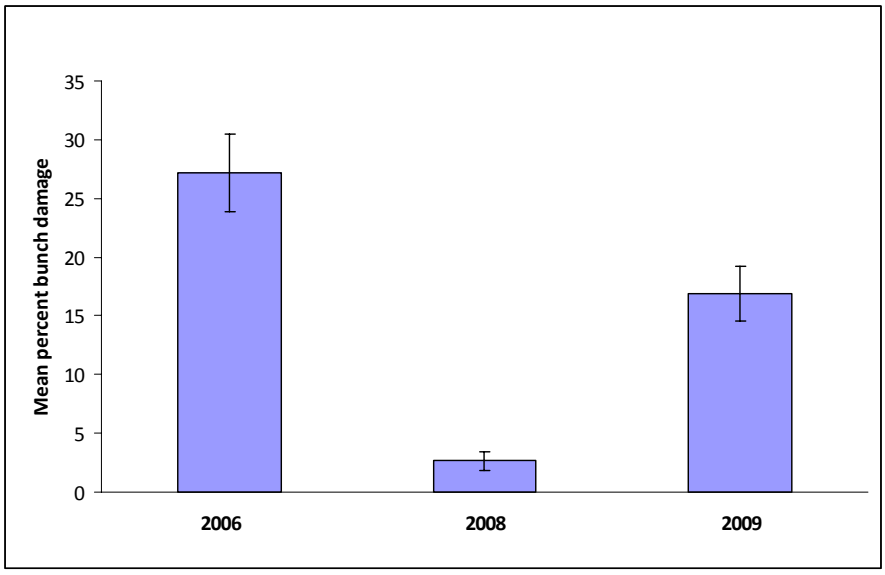

Figure 7: Mean bunch damage recorded on Pinot noir at Brancott Vineyard in 2006, 2008 and 2009 (p=0.001, n = 220)

Discussion

Data from both years show that bird damage to grapes was reduced closer to the falcon feeding trays. This effect was highly significant in both years; damage scored was higher in 2009 than in 2008.

A highly significant vintage variation was noted between 2008 and 2009. Damage was higher in 2009 than in 2008. Reasons for this include firstly actual vintage variability as measured in the Brancott vineyard where damage was surveyed as a control over 3 vintages to monitor vintage differences. Figure 7 indicates that damage in a vineyard without falcons was greater in 2009 than in 2008. It is anecdotally known that weather affects bird behaviour in vineyards; a dry late summer will correlate with heavier damage, possibly because there is less water/fruit available for birds generally. It is possible that winter conditions will also impact on bird numbers because in a mild winter more juveniles survive to nest next spring.

Secondly there is a clear difference between the three varieties surveyed. Sauvignon blanc suffers less bird damage than Pinot noir or Pinot gris. The vineyards that were surveyed in 2008 grew more Sauvignon blanc, while in 2009 more Pinot noir vines were surveyed than Sauvignon blanc. Thus damage to all varieties (Figure 3) appeared higher in 2009 because a higher proportion of the vines were Pinot noir, and the Pinot noir vines were more damaged than Sauvignon blanc.

Reasons why Sauvignon blanc is less attacked might include a lower ^{o}Brix level at harvest (typically 22^{o} rather than for Pinot noir and Pinot gris which are both likely to be 24-25^{o}Brix). Blackbirds particularly prefer high sugar content (Saxton et al.,2004).

A second reason may be colour. Research has shown that birds use colour as an indictor of ripeness which usually correlates with high sugar concentration in fruit generally.

In 2009 is that there was quite a lot of botrytis damage. Mostly it appeared that this rot had been caused by initial bird damage, but sometimes it was hard to tell, so botrytis damage may have been included as bird damage.

It is clear that the falcon presence reduced bird damage closer to the feeding trays. That there is economic value of this protection is also self-evident. Implementation of falcons as a reliable method of bird control spans however a spectrum of factors, from availability and care of the birds themselves to grower propensity for adopting innovative practice, and philosophical questions of sustainable use of nature's ecosystem services. Netting is expensive but nets are controllable and predictable. Shooting is not such a sustainable practice and could perhaps be less used as a bird control method where falcons are present.

Because Pinot noir grapes make a more expensive wine, the value of these grapes is enhanced. Therefore protection offered by falcons is more valuable for the area of those grapes that can be protected. In Marlborough current practice sees Sauvignon blanc only minimally protected – often with side netting and in many cases only of outside rows, and not infrequently without nets but still with a shooter. Therefore the cost of protection of Sauvignon blanc is relatively low. Pinot noir and Pinot gris need more expensive protection, often of multirow netting. Both netting cost and value of grapes saved are higher for Pinot noir and Pinot gris. At an economic threshold of 5%, Sauvignon blanc grapes can be protected up to a kilometre from the feeding tray, while Pinot noir and Pinot gris can be protected for 100m (4 hectares). This means a large area of low cost protection (Sauvignon blanc) or a small area of high cost protection. The overall conclusion is that falcons reduce bird pressure but do not eliminate it altogether in highly attractive grapes, except for a small area.

The human factor in innovation adoption in rural communities has been researched in many areas of agriculture. A survey of Marlborough grape growers in 2009 in conjunction with this survey (Kean, 2009, data not presented) indicated that growers knew of the falcon project, in general supported it, and regarded it primarily as a conservation project that should be supported by groups other than grape growers. In answer to questions about whether they themselves would have a falcon on their vineyard 94% said they would have a falcon on their vineyard if offered. 51% said they would not be prepared to pay more than $1000 annually for a falcon and 45% said they would only have a falcon if it were partly subsidised. But 86% thought that falcons were moderately to very successful at reducing bird damage and 90% thought the project should expand in Marlborough. Lack of clear leadership within the industry was identified as a primary obstacle to progress with expansion of falcons as bird control (ibid).

Attitudes to bird damage clearly play a part in perception of whether falcons offer a viable bird control option. 41% of respondents perceived bird damage to be currently minimal or tolerable, and 44% saw it as only moderate. Asked which varieties they perceived as sustaining most damage 25% said Sauvignon blanc (ibid.), which is possibly explained by the fact that 50% of them grew mainly Sauvignon blanc.

Only 16% knew of the 2008 survey results from this project that were published at the Romeo Bragato conference 2008 (ibid.). The 2008 results appear in Figure 1.

Conclusion

The conservation objective of the falcons for Grapes project has been successful. The methodology of nesting barrels and successful establishment and feeding of nestlings within a vineyard has been proven. This has been followed by continuous frequenting, presence and patrolling by falcons of vineyards, successful breeding and nesting, loyalty to feeding trays and the pleasure given to people concerned has been considerable. Media coverage so far has focussed on these aspects. It has taken time to prove the efficacy of falcons as a protection for grapes from bird damage. These results may contribute to a confidence that this is a viable option for reduction of bird control costs.

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