Goulburn Murray Valley Queensland fruit fly Area-Wide Management Program

Analysis of the impact of Area-Wide Management, Sterile Insect Technique and the weather on Queensland fruit fly proliferation.

12 July 2024

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Working definition of Area-Wide Management for the Goulburn Murray Valley

The Goulburn Murray Valley (GMV) Queensland fruit fly (Qff) area-wide management (AWM) program is based on a unique operational model:

> *"Creating awareness, education and engagement in the community, industry and government to reduce the economic impact of fruit fly"*
>
> **– Instilling Ownership**

GLOSSARY

Qff
Queensland fruit fly

SIT
Sterile Insect Technique

GMV
Goulburn Murray Valley

AWM
Area-Wide Management

Statistics and key findings from analysis

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Cobram & GMV Trap Sites Map

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Statistics and key findings from analysis

In 2017, the Victorian Government introduced funding that enabled a Goulburn Murray Valley (GMV) Area Wide Management (AWM) program to be introduced to control and manage Queensland Fruit Fly (Qff).

AWM is defined as "Creating awareness, education and engagement in the community, industry and government to reduce the economic impact of fruit fly".

During the high input phase of AWM, the program removed over 90,000 host plants, while education, workshops and training programs were presented to 14,000+ attendees. The "No flies on us" message was promoted to over 32M readers, viewers and listeners via television, radio and print. Signage, electronic billboards, web and social media, including the release of information packs, flyers, posters and stickers, were also distributed throughout the GMV.

2017

95% reduction in Qff numbers in the first year of high input AWM program.

2018

Further reduction of 60% in Qff numbers in the second year of high input AWM.

The Victorian Government funded the first three years, 2017 to 2019, of the program (the first year being only for program setup) to enable a high input of AWM.

2019

Sterile Insect Technique (SIT) was introduced in Cobram and reduced Qff numbers by 83%.

When comparing other areas that have trialled SIT, none have been as successful as the GMV in achieving such a significant reduction of Qff. This demonstrates that SIT works more effectively with AWM.

Mid-2020

AWM in the GMV transitioned from a high input AWM program to a low input AWM program (due to less funding from the Victorian Government).

2020-2025

Funding decreased incrementally from 2020 onwards, (eventually by more than 60% in the program's final year 2024/2025) enabling only a low input AWM program for the 2020-2025 period. The low input phase was heavily reliant on the success that was gained through the high input AWM phase to sustain it in the short term.

The GMV's high input AWM phase (when funding was adequate), provided significantly more resources to the management and control of Qff within the GMV than the low input AWM phase. This included the hiring of up to four trained (casual) field officers who were on alert to respond to any detection of Qff. Also, support was provided to the GMV Fruit Fly Coordinator to assist in the rollout of workshops and face-to-face community education opportunities. Additionally, there was significantly more media and educational content released to train and inform the public.

Due to the reduced funding and consequent low input AWM, urban trapping (as part of the trapping grid) was decreased significantly (from 102 to 19 traps). This meant that proactive efforts to track Qff at their source were compromised. The total number of traps across the GMV reduced from 409 during the high input phase to 200 (presently) in the low input phase.

It is very likely a factor that the uncertainty regarding funding and the incremental extensions of financial support gained through extensive lobbying, (including the continued reductions in funding allocation) has impacted the momentum gained from high input AWM on Qff.

Provided is the forecast of Qff numbers should the Victorian Government not support an AWM program (as currently intended), a low input or high input AWM program beyond June 2025.

June 2025

Funding for the AWM program from the Victorian Government is scheduled to conclude as outlined in Victoria's Fruit Fly Strategy 2021-2025.

No AWM

First year

Best case: 14% expected increase in Qff numbers

Worst case: 168% expected increase in Qff numbers

By 2026

Best case: 205% expected increase in Qff numbers over current figures

Worst case: Over 600% expected increase in Qff numbers

Beyond 2026

Increases continue for both best and worst case scenarios.

Low AWM

First year

Best case: 7% expected increase in Qff numbers

Worst case: 152% expected increase in Qff numbers

By 2026

Best case: 170% expected increase in Qff numbers

Worst case: Over 500% expected increase in Qff numbers

Beyond 2026

Increases continue for both best and worst case scenarios.

High AWM

First year

Best case: 96% decrease on current (2024) Qff trap capture rates

Worst case: 91% decrease on current (2024) Qff trap capture rates

By 2026

If a high input AWM program is funded by the Victorian Government, Qff numbers are predicted to further decrease.

At times, the true success of GMV AWM has been questioned and suggested that Qff reductions experienced in the GMV are also likely weather/climate influenced. Investigations detailed within this analysis suggest that this is incorrect, that reductions are more conclusively a result of high input AWM.

There is an opportunity for other states across Australia to utilise the GMV AWM model as a guide to support their management and control of Qff, including other geographical areas within Victoria.

It is recommended for the future of horticulture and exports within Victoria that the Victorian Government continues to support AWM and increase funding to again enable a high input AWM program within the GMV. Low input AWM will not be effective in managing Qff numbers as highlighted within the forecasts for 2025 onwards.

There is an opportunity for the Australian Government to fund the rollout of SIT programs in tandem with a Victorian Government supported high input AWM program to maximise impact of Qff control.

The total estimated value of horticulture within Victoria is $3.9 billion with the GMV contributing approximately $1.6 billion. The GMV also contributes significantly to Victoria's total horticultural export value of $1.57 billion. It is pertinent that the economic impact of forecasted increases of Qff with no AWM is understood to support advocacy efforts pertaining to the AWM program within the GMV.

Author’s Biography

Andrew Jessup, Janren Consulting Pty Limited, is a consultant on controlling fruit flies to facilitate access of fresh Australian horticultural commodities to domestic and international markets and reducing the impact of fruit flies on home garden production of fresh fruits and vegetables.

He worked with NSW Department of Primary Industries from 1984 on developing post-harvest treatments based on irradiation, cold storage, fumigation, heat and modified atmospheres against fruit flies and other quarantine pests in a wide range of commodities. Many of these treatments are now approved for international trade meaning Australia has access of several horticultural commodities to interstate and overseas markets due to the work he and his team achieved.

> ***Starting in 1988, he developed mass-rearing, sterilisation, packaging and transport strategies for the sterile insect technique (SIT) against Queensland fruit fly.***

From 2008 to 2011 he worked with the International Atomic Energy Agency in Vienna, Austria to manage international fruit fly projects on SIT. He also researched mass-rearing methods for many exotic fruit fly species most of which threaten Australian biosecurity.

He was a member of the Technical Panel on Phytosanitary Treatments of the International Plant Protection Convention (IPPC) which reviews plant-based quarantine treatments for international approval.

While employed with the NSW Department of Primary Industries and since he worked on improving trap design and deployment, cover sprays and baiting for fruit fly management in commercial, community and back-yard situations.

His consultancies include working on fruit fly management in South Africa, Malaysia, Papua New Guinea, Fiji, Tonga and Palau, and with the Commonwealth Government and regions of Victoria and NSW.

Qualifications:

Bachelor of Science (Agriculture), University of Sydney

Master of Science (Food Technology), University of New South Wales

40 years of research on, and in-field application of, pest fruit fly management

www.researchgate.net/profile/Andrew_Jessup2

andrewjessup.academia.edu

Over 40
Final research project reports

Approx 70
Publications in international literature

2
Book chapters

8
Chemical registration submissions

20
Consultancy reports

15
Export trade submissions

Reduced Qff
numbers by
60%
across the
GMV

Reduced Qff
number by
83%
in Cobram
+ SIT pilot program

The GMV Qff AWM program, which commenced in mid-2017 reduced Qff populations considerably when compared with the previous five year period when there was no AWM.

High input AWM (2017 to 2019) was more effective than low input AWM (2021 to the present). There was a 60% reduction in Qff populations by the end of the second year of the high input AWM phase while, currently, during the low input AWM phase Qff populations have increased 5-fold compared with the high input AWM phase.

A pilot sterile insect technique trial in Cobram (from 2019 to 2022) resulted in a clear reduction in Qff numbers in Cobram indicating the benefits of combining AWM with SIT.

Weather patterns over the AWM program did not have a significant impact on Qff numbers.

Goulburn Murray Valley's Horticultural Economic Profile

The Goulburn Murray Valley covers 16,354km^2

From 2017 to 2020, the Goulburn Murray Valley (GMV) region included the five local governments of Greater Shepparton, Moira, Berrigan, Campaspe and Strathbogie with a population of 152,750 people and a regional economy worth $8.4 billion (FIC 2019, GMV 2019).

Horticulture plays a central role in the regional economy, generating an estimated $1.6 billion (or 20%) in Gross Regional Product. According to the 2016 Census, horticulture accounted for 13% of local jobs, however, in some parts of the region, the proportion was much higher (Table 1).

It is estimated that horticulture in the GMV region generates $1.6 Billion (or 20%) in gross regional product

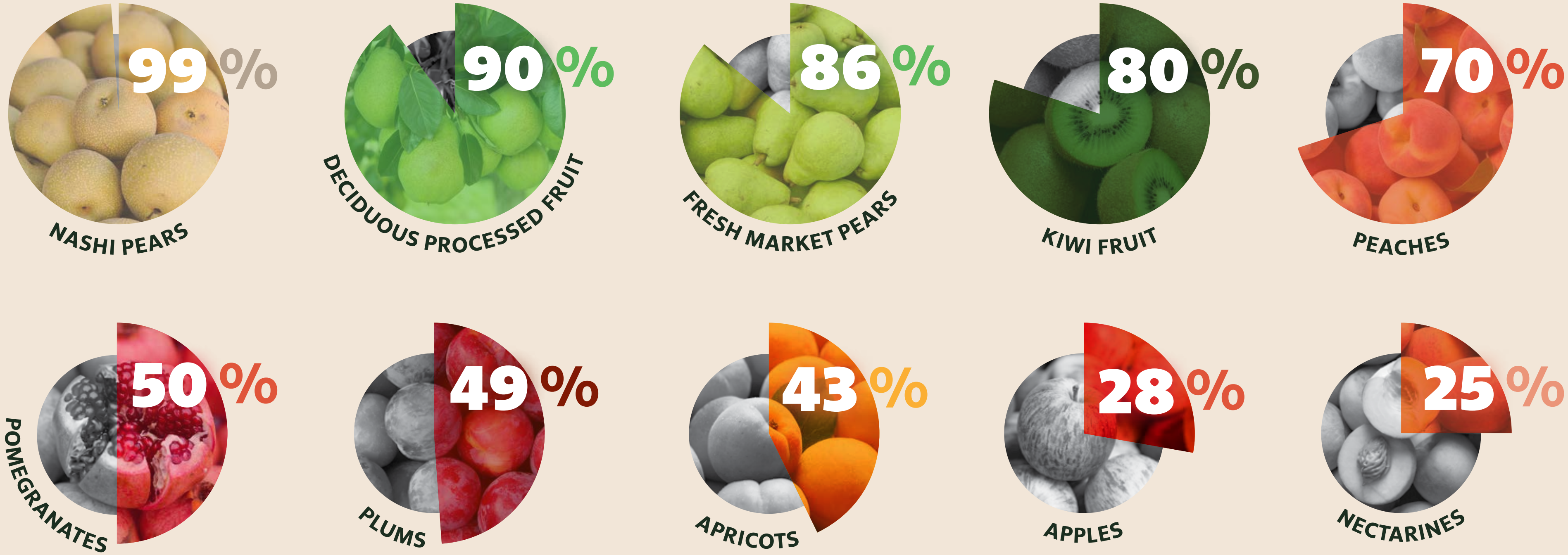
TABLE 1
Horticultural Contribution to Employment and Economy, Goulburn Murray Valley

Local Government Area	Employment in Horticulture 2016	Economic Contribution of Horticulture 2017-18
Berrigan	21%	38%
Campaspe	13%	31%
Greater Shepparton	8%	12%
Moira	19%	14%
Strathbogie	25%	28%
Region	13%	20%

Source: ABS (2017); REMPLAN (2019); ID (2019); Lucid Economics (2019)

Australian Fruit Production in the Goulburn Murray Valley Region (GMV)

The Goulburn Valley is the largest producer of canning pears in the Southern Hemisphere and the Murray Valley is the largest producer of Stone Fruit in Australia.



The GMV also contributes a significant percentage of Australia's production of vegetables, berries, table grapes and wine grapes.

Funding for the Goulburn Murray Valley's Queensland Fruit Fly Area-Wide Management Program

Up to about 1900, there were no pest fruit flies in Victoria although the risk they posed was recognised by the state government and growers. However, from about 1900 the Mediterranean fruit fly (Medfly) rapidly became established in many parts of the state. Medfly was controlled by growers with some public education provided by the state government via the media. Medfly died out from Victoria during the early 1940s. In 1946 Qff started to appear in sporadic outbreaks and by 1949 the state government took the responsibility to monitor, detect and eradicate these outbreaks wherever they occurred in Victoria, except the Gippsland area where Qff was gazetted as established.

State government responsibility for Qff monitoring and eradication continued in the GMV until 2012/13 when outbreaks there were too numerous for the state government to control by itself. A transition phase for passing the responsibility from the state government to growers commenced. While the transition was occurring no state government funds were expended on controlling Qff in the GMV apart from obligatory trapping and reporting under the National Fruit Fly area-wide and regulation of compliance for products exported from the GMV. During this period the state government provided advice to growers on Qff management if requested.

Qff populations built up throughout much of the GMV during the transition period causing much concern with commercial and domestic growers.

> ***By 2016, the state government had initiated a series of fruit fly management strategies targeting significant commercial horticultural production areas. One of these was the GMV.***

The GMV AWM program commenced with the appointment of its Regional Coordinator in mid-2017.

Funding for this program was through the state government's Managing Fruit Fly Regional Grant Program which stipulated that beneficiaries of the program should become the main contributors – both financially and in-kind. The state government funded program was, initially, for three years and then, subsequently, from successful applications to the state budget.

The first three years of the project proved to be efficacious with contributions from the state government's regional grants and from growers and the community at large resulting in significant whole-of-community awareness and participation. Section 3 of this report describes these activities. This period is described as the "high input" AWM program.

The commencement of yearly applications to the state budget resulted in decreased funding compared with the high input phase from 2017/18 to 2019/20. Program discontinuity occurred because of the gap between the end of one year's project and the application for funding for the next. This uncertainty resulted in community disengagement with the overall plan for continuous engagement and ownership of the program. Qff populations are now rising again and are higher than at any time during the high input phase. This period is described as the "low input" AWM program.

Qff populations are now rising again and are higher than at any time during the high input phase.

Phase	Qff Management Phase	Phase Period	Total	Change in yearly funding since 2018/19
1	No pest fruit fly species present in Victoria	Prior to 1900	No State Government funding	N/A
2	Sporadic detections of Medfly; no detections of Qff	1900 to 1949	Funds spent by State Government on low key media	N/A
3	Eradication of Qff outbreaks by Victorian State Government	1949 to 2012/13^	State Government funding as needed	N/A
4	No state govt funded AWM program in the GMV	2012/13^ to 2017	No State Government funding for AWM	N/A
5	**High input AWM program**	**2017/18**	**$412,082**	**AWM program setup**
		2018/19	**$859,920**	**-**
		2019/20	**$785,530**	**-8.7%**
6	**Low input AWM program**	**2020/21**	**$706,050**	**-17.9%**
		2021/22	**$503,819**	**-41.4%**
		2022/23	**$521,598**	**-39.3%**
		2023/24	**$422,869**	**-50.8%**
		2024/25	**$322,316**	**-62.5%**

TABLE 2
Funds allocated from the Victorian State Government for the Goulburn Murray Valley Qff AWM program

^ The Victorian State Government removed the GMV from the Fruit Fly Exclusion Zone in 2012 and deregulated Qff management in the rest of Victoria (except the Greater Sunraysia Pest Fruit Fly area) on 1 July 2013.

Activities from 2017 to 2020

Funding provided by the Victorian Government's Fruit Fly Grants Program enabled the support and coordination of the GMV FFAWM Project resulting in reduced Qff numbers in the region by 60% across the GMV and 83% in Cobram where a sterile insect technique pilot program was carried out.

The project was also awarded:

- **Victorian Achiever of the Year Award (2019)**
- **Victorian Agriculture Innovation Award (2019)**

Reduced Qff numbers by 60% across the GMV

Reduced Qff numbers by 83% in Cobram + SIT pilot program

Trapping grid and monitoring of Qff

Set up and managed by staff and volunteers who also collect, identify and record trapped insects. Data are analysed and monthly reports (or sooner if necessary) are produced which:

- Alert growers, the community and the government to new Qff outbreaks
- Show when and where the worst outbreaks ("hot spots") are occurring
- Alert AWM project staff and volunteers when and where they should deploy AWM activities
- Predict place and timing of hot spots
- Identify areas where Qff is not present or are at very low population levels
- Assess and evaluate the AWM project
- Assess and evaluate the SITplus sterile insect release program

The analysis and interpretation of the data gained from the GMV trapping grid established that numbers in the region had been reduced by 60% and a reduction in Cobram of 83%. This reduction in Qff has the potential benefit of improving exports of fresh horticultural products from Victoria.

Host tree/plant removal/eradication

Through community and grower consultation, information packs and the media, over 90,000 host plants have been removed necessitating coordination between property owners (residential, commercial, horticultural, council and Crown), legal issues, green waste disposal, complaints, data management, etc.

Education workshops and programs

Presented to over 14,000 attendees covering a broad range of groups (i.e. grower organisations, government departments, Landcare networks, gardening clubs, schools, Rotary, Lions, Probus, Men's Sheds, farmers markets, community markets, agricultural field days and special events) in several regional cities, towns and villages.

Research/trials

A better understanding of Qff in the GMV and its management has been achieved under the AWM project via the SITplus Consortium's choice of the Cobram as a component of their sterile insect technique (SIT) program against Qff.

This resulted from the GMV's extensive fruit fly trapping grid set up under the GMV AWM project. A combination of successful FFAWM and SITplus has contributed to the significant decrease in Qff in Cobram. The GMV fruit fly AWM project hosted the 7th Australian Biology of Tephritid Fruit Flies Conference in Shepparton, and the project coordinator was invited to participate in a horticultural study tour of the USA and Canada.

The Western Australian Dept. of Primary Industries and Regional Development requested the project coordinator to assist with Medfly AWM in Carnarvon and subsequently requested permission to use the GMV Action Plan and Communications Plan. These benchmarks were promoted and reported extensively by the media.

Marketing, events and promotions

Promoted the "No flies on us!" message and the project FFAWM strategy to over 32 million readers, viewers and listeners via television, radio, print, signage, electronic billboards, web/social media and information packs/flyers/posters/stickers.

Fruit fly trapping in the GMV

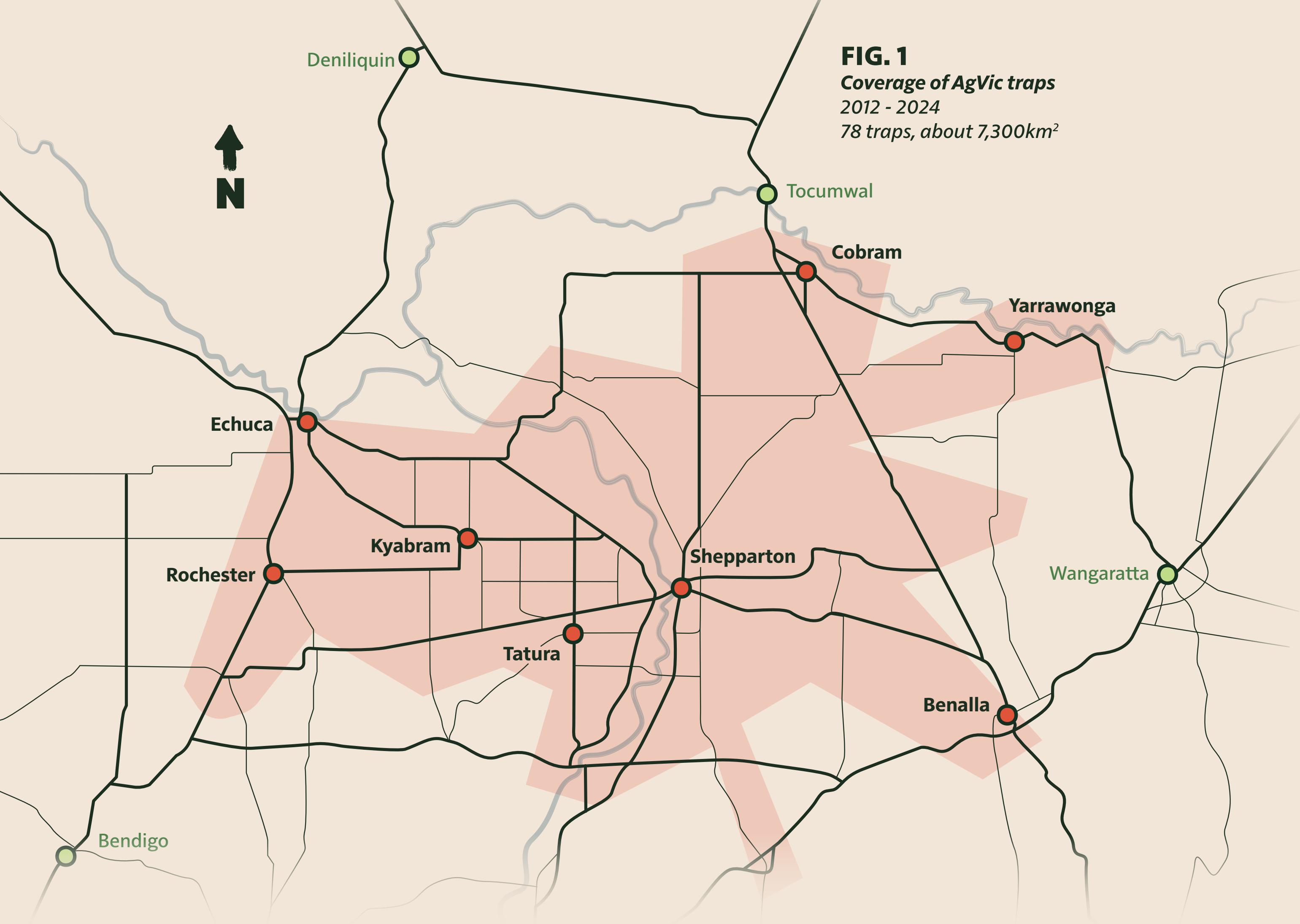


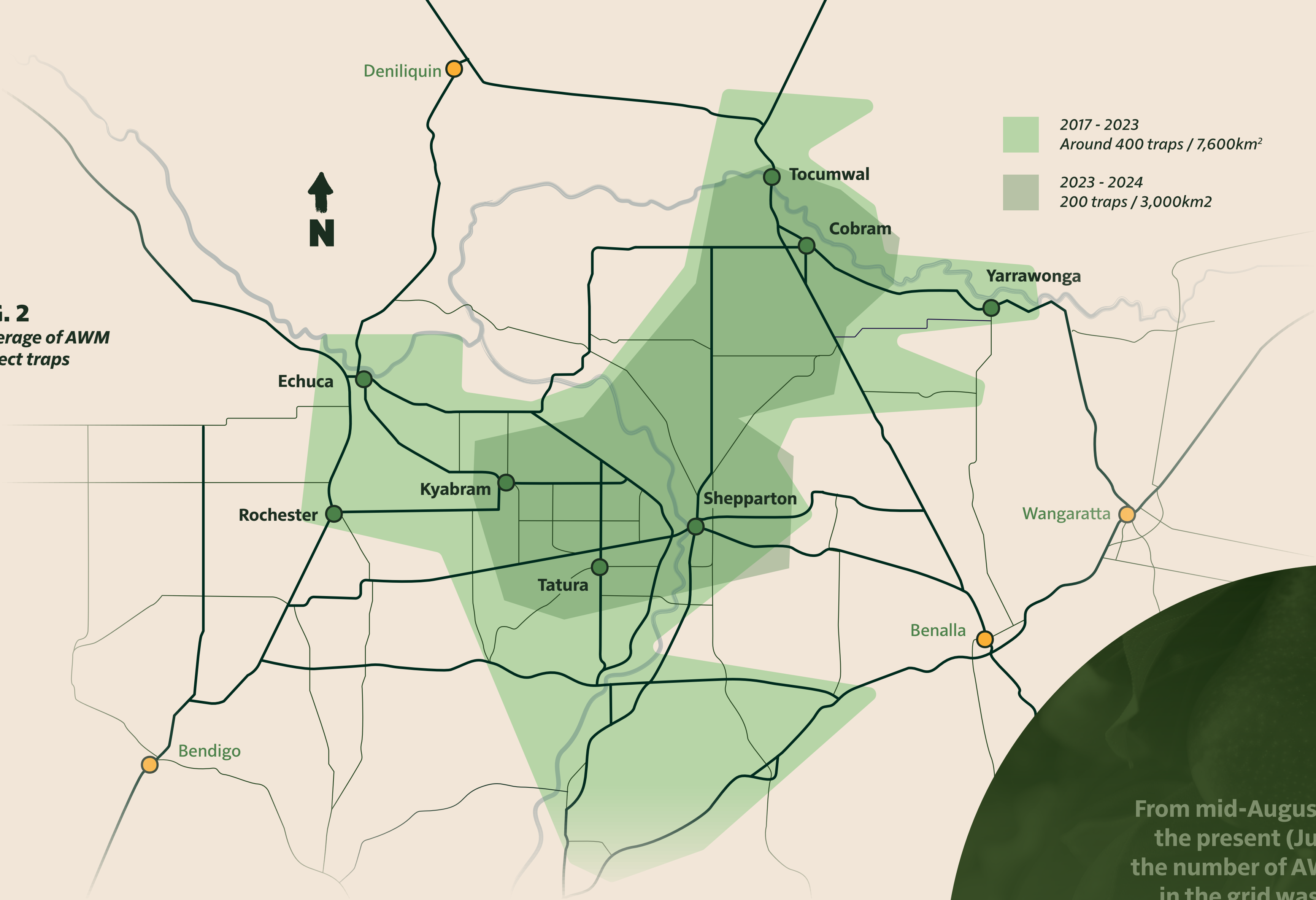
FIG. 1
Coverage of AgVic traps
2012 - 2024
78 traps, about 7,300km²

AgVic Traps

From 2012, when AgVic installed Queensland fruit fly traps across the state, 78 traps were deployed in the Goulburn Murray Valley region as part of the National Fruit Fly Trapping Grid.

Trap coverage with the AgVic trapping grid was 78 traps over 7,300km² (Fig. 1) or about 45% of the total GMV. These traps are still in place to date (June 2024).

FIG. 2
Coverage of AWM project traps



AWM Traps

From 1 July 2017 to the end of June 2023 up to 409 traps were deployed (the AWM trapping grid) as a component of the GMV Qff area-wide management (AWM) project. This gives a maximum of 409 traps over 7,600km² (Fig. 2) or approx. 46.5% of the GMV.

The combined AgVic and AWM traps of 487 traps covers about 10,000km² of the GMV or about 61% of the GMV.

From mid-August 2023 to the present (June 2024) the number of AWM traps in the grid was reduced to 200 along with the area covering approx. 3,000km² (Fig. 2) which is approx. 18% of the GMV.

Over the period from 2012 to the present, changes were made in the scale of input into the GMV AWM program (Fig. 3).

Prior to mid-September 2017 there were no dedicated AWM programs in the GMV. Then a dedicated three year AWM project was funded through the Victorian Government's Managing Fruit Fly Regional Grants and in-kind contributions from communities within the GMV. This project ended in September 2020.

> ***It is described as a high input AWM program because sufficient funding was available to employ staff to set up and manage a full program of fruit fly control, education and public awareness across most of the Qff-affected area of the GMV.***

This achieved reductions in Qff populations over the GMV (Fig. 3), installation of road signage, removal of unwanted Qff host plants, public education and awareness, face-to-face meetings with affected individuals and groups, among other strategies.

FIG. 3

Average Qff/trap for each month across the GMV from August 2012 to June 2024

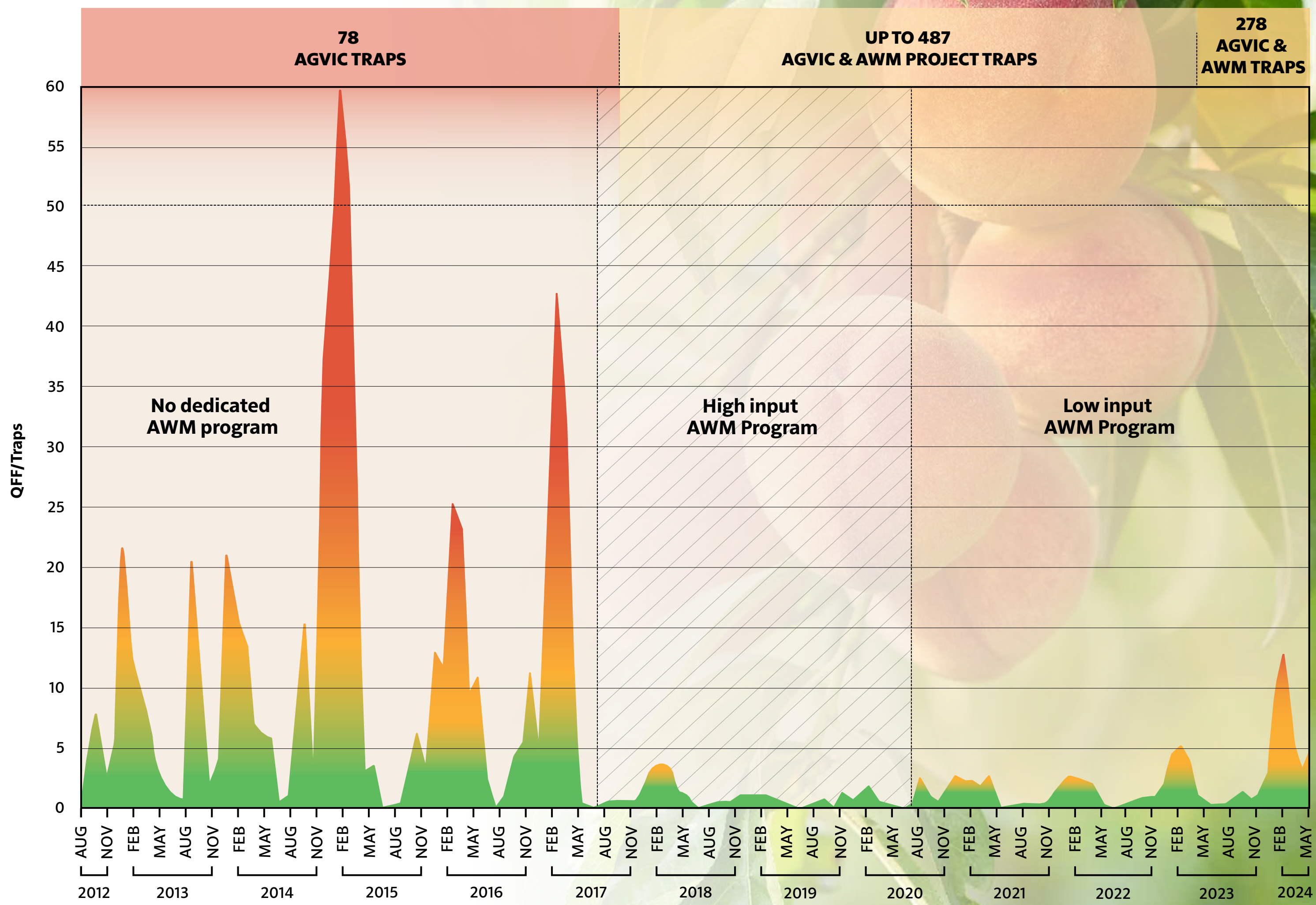
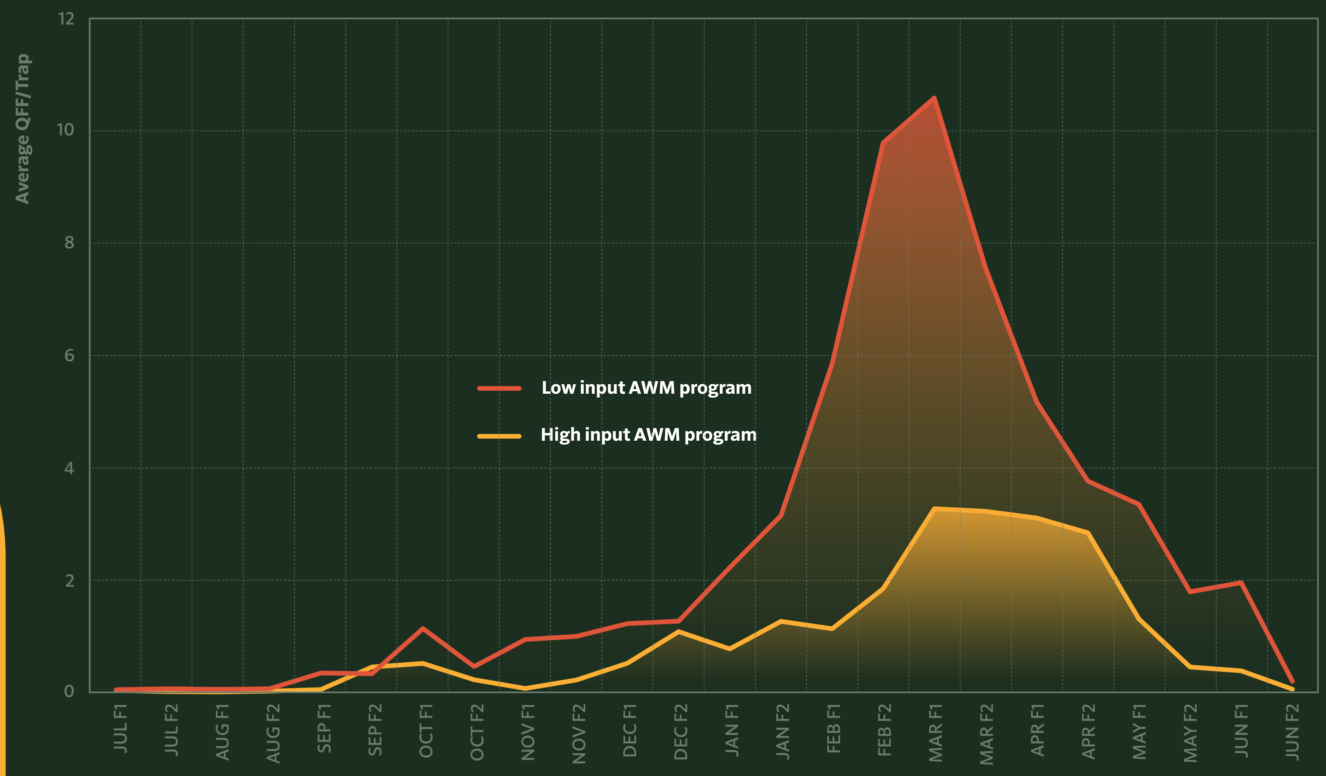


FIG. 4
Comparison of average Qff/trap/fortnight between a high input (July 2017 to June 2020) and a low input AWM program (July 2020 to Jun 2024) across the GMV



Average Qff activity per year:

High input AWM
22.8 Qff/trap/month

Low input period
62.2 Qff/trap/month
nearly 3 x more active

An interruption occurred at the end of the three year project while new funding was sought from the Victorian State Budget. Funding was obtained but it was much less than that needed for a high input program. The resulting hiatus, particularly as it coincided with the period of the year where Qff populations typically build up, caused a significant loss in momentum. Because this project was short term, the budget seeking process had to be carried out repeatedly to enable continuation of the AWM project.

There was a delay each time between the end of one project and commencement of the next. Reductions in funding and consequent reduced staffing and less interaction with the community resulted in a high level of public disengagement. The lack of long term funding commitments by the Government post 2020 and ad hoc reduced short term funding announcements being made after existing funding had ceased caused confusion, uncertainty and disengagement among program employees, stakeholders and volunteers going forward. Qff populations started to rise again at this time (Fig. 3).

Fig. 3 shows that monthly Qff populations, as measured by average numbers of Qff trapped per assessed trap in each month, varied considerably. The lowest populations occurred during the high input AWM program phase. If Qff populations are measured in a different way (Fig. 4), average numbers of Qff trapped per fortnight for the same period during the two phases, high input and low input, similar improvements in Qff population suppression were observed in the former compared with the latter phase.

FIG 5

GMV monthly percentage of trap numbers capturing equal to or more than 20 Qff/trap each month from August 2012 to June 2024

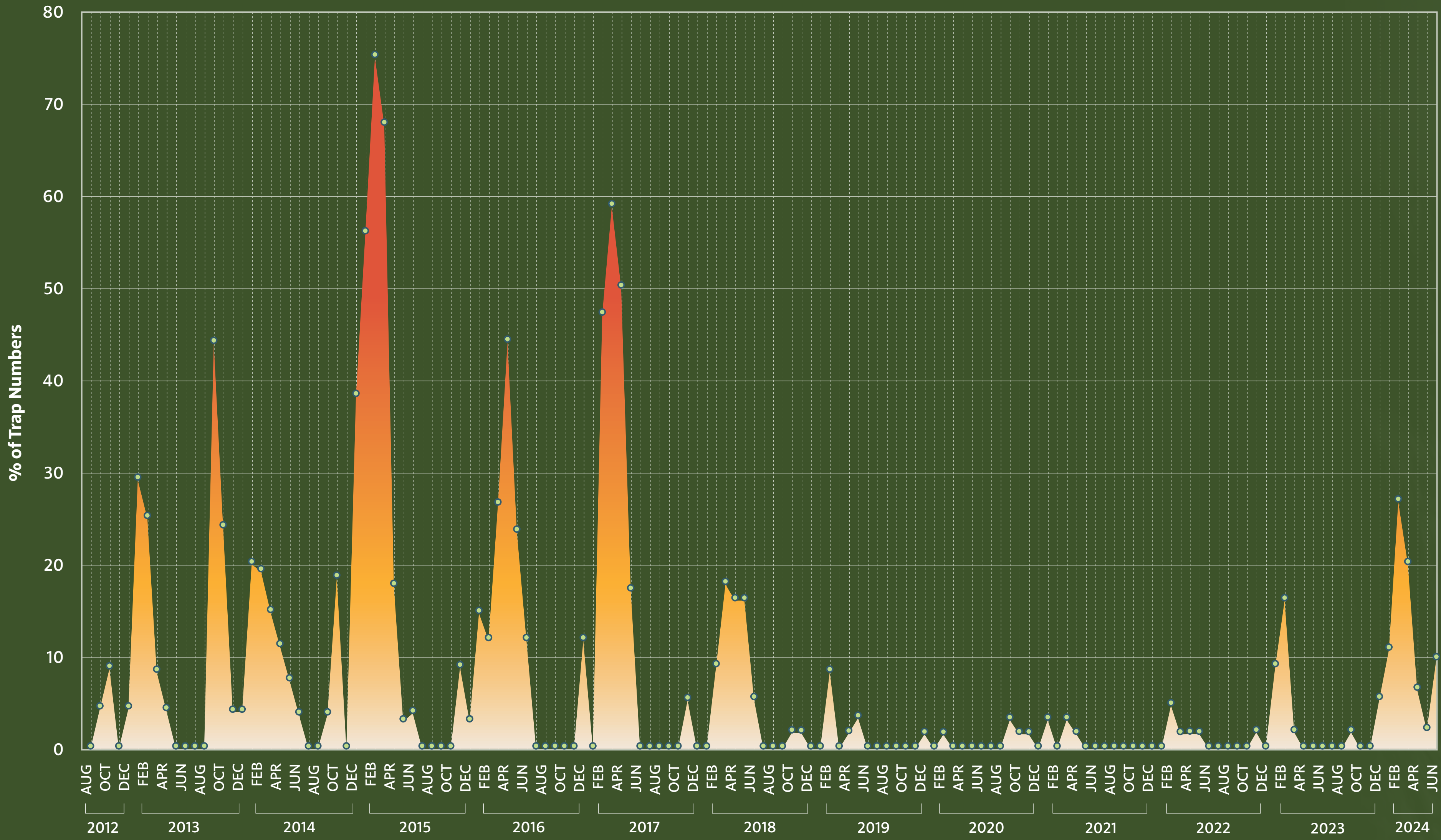


Fig. 5 looks at it another way – comparing the percentage number of traps with ≥20 Qff/trap each month. This measure gives an indication of the severity of Qff at each trap site and over the whole region. The more Qff/trap the more severe the Qff population at the site and the more traps reading high numbers of Qff (i.e. high-threat sites) the greater the severity of Qff over the whole region. Figure 5 shows that the number of high-threat trapping sites decreased during the high-input AWM phase and started to rise again during the low input phase. High-threat Qff activity at the end of the period with no dedicated AWM (i.e. 2012/13 to 2016/17) was 27.9 Qff/trap. month while it was only 0.5, a 98% reduction, by the end of the high input AWM period (i.e. 2017/18 to 2019/20). High-threat Qff activity had risen to 11.5 Qff/trap.month by the end of the low input period (2020/21 to the current date).

Table 3 shows that Qff populations declined during the two periods with AWM compared with the period with no dedicated AWM. Qff activity was over 123 at the end of the low input AWM phase, a significant increase over the Qff activity seen at the end of the high input phase (just over 41). This indicates a deterioration in Qff management during the low input period."

Results

High Qff populations present during the pre-AWM project phase were suppressed during both subsequent high input AWM and low input AWM phases. However, Qff populations started to increase during the low-input period.

Conclusions

Once initiated, the AWM project led to reduced Qff populations across the GMV. Qff proliferation was lowest during the high-input AWM phase.

TABLE 3
Qff activity during peak activity periods (November to April) each year in the whole of the GMV (including Cobram) (Qff/trap.wk) from 2012/13 to 2023/24

Qff Management Program	Peak Qff Season	Qff Activity
No dedicated AWM program	2012/13	206.78
	2013/14	122.12
	2014/15	538.88
	2015/16	178.74
	2016/17	190.60
High input AWM program	2017/18	147.06
	2018/19	103.15
	2019/20	41.66
Low input AWM program	2020/21	97.01
	2021/22	50.22
	2022/23	78.60
	2023/24	123.32

Impact of urban locations on Qff populations throughout the GMV

Qff overwinter as adults in the GMV in areas where there is warmth and shelter. Urban areas supply Qff with relatively warm solid surfaces, closely spaced heated buildings with nearby evergreen plants. These locations also supply a continuation of ripening and ripe fruits for Qff from late winter to early summer for Qff population expansion. Data from the GMV trapping grid, collected during the high input AWM phase show that Qff move out of urban areas, through peri-urban sites and into rural orchards just prior to harvest and then return to urban areas in the late autumn after harvest.

Urban locations are winter/spring Qff reservoirs for the whole of the GMV for the rest of the year

When the low input AWM phase commenced, many of the urban traps were removed leaving most of the traps on the grid in rural locations. The lack of urban-based traps meant that early detection of Qff build-up in urban areas could not be managed before they moved on into the rural locations.

TABLE 4
Changes in trap locations during the transition from high input AWM to low input AWM (not including the 78 AgVic traps)

Landuse Type	Number of Traps in each Landuse Type	
	High Input AWM Phase	Low Input AWM
Urban	102	19
Rural	232	142
Peri-Urban	75	39
Total	**409**	**200**

Data from urban traps are used to predict time and place of likely incursions into areas of commercial horticulture – resulting in improved allocation of Qff management resources. This enabled a more proactive approach to AWM during the high input phase.

AWM works better when combined with SIT

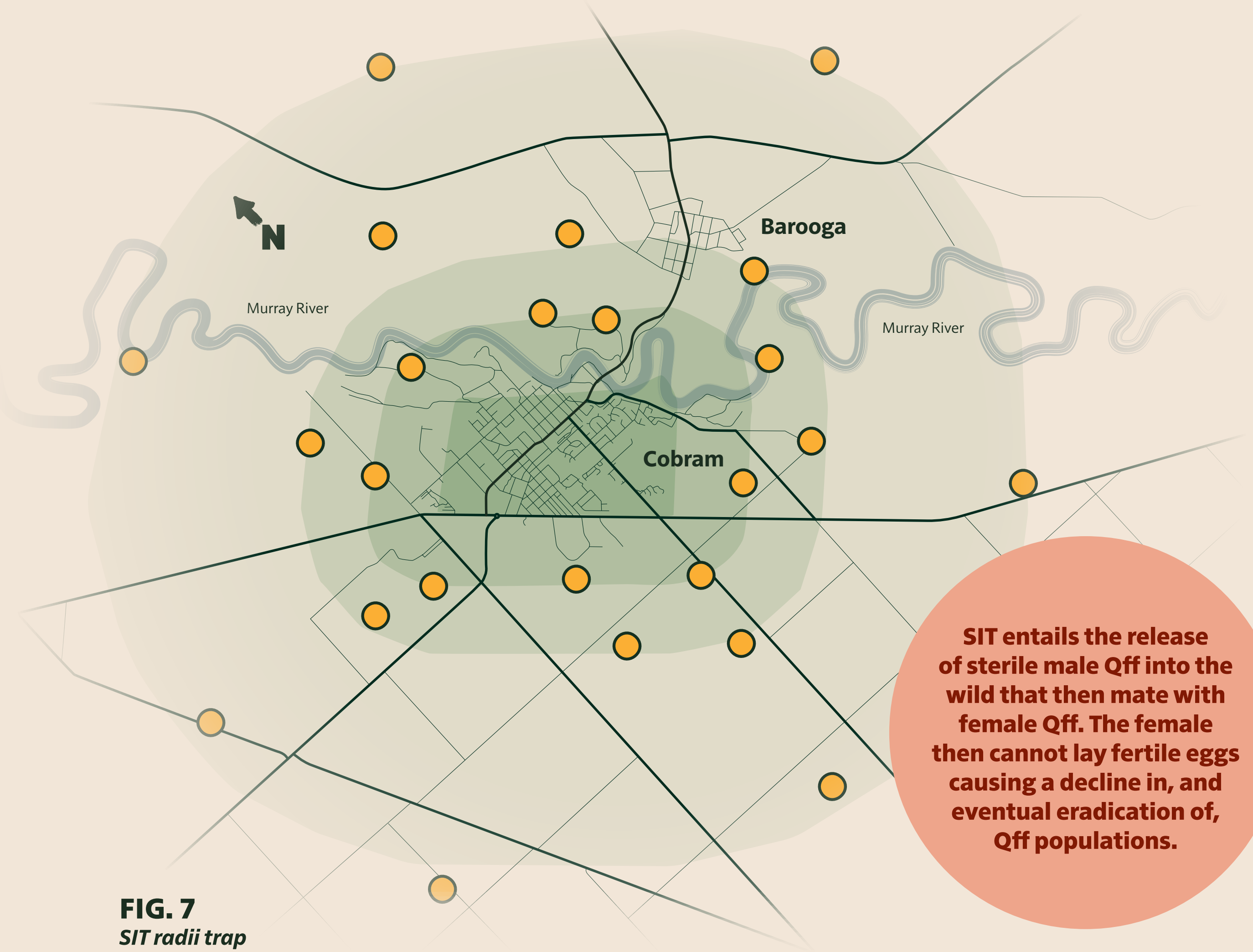


FIG. 7
SIT radii trap locations outside the SIT drop zone

SIT drop zone *1km from edge of SIT drop zone* *2km from edge of SIT drop zone* *5km from edge of SIT drop zone*

SIT entails the release of sterile male Qff into the wild that then mate with female Qff. The female then cannot lay fertile eggs causing a decline in, and eventual eradication of, Qff populations.

Synergy between the SITplus SIT program and the GMV AWM project in controlling Qff in southern Australia was observed.

During 2020/21 and later, Qff populations in the GMV, with the exception of Cobram (Tables 5 and 6, Figs 10 and 11), expanded (although nowhere near those from 2012 to 2017) (Table 6, Figs 3, 10 and 11), compared with the previous two years, probably due to favourable weather patterns associated with La Niña and the concurrent catastrophe of commercial fruit falling to the ground unharvested due to a lack of pickers (because of COVID). Together, these resulted in high fruit production, excess of wastage, increased Qff survival, enhanced Qff damage and a larger number of Qff.

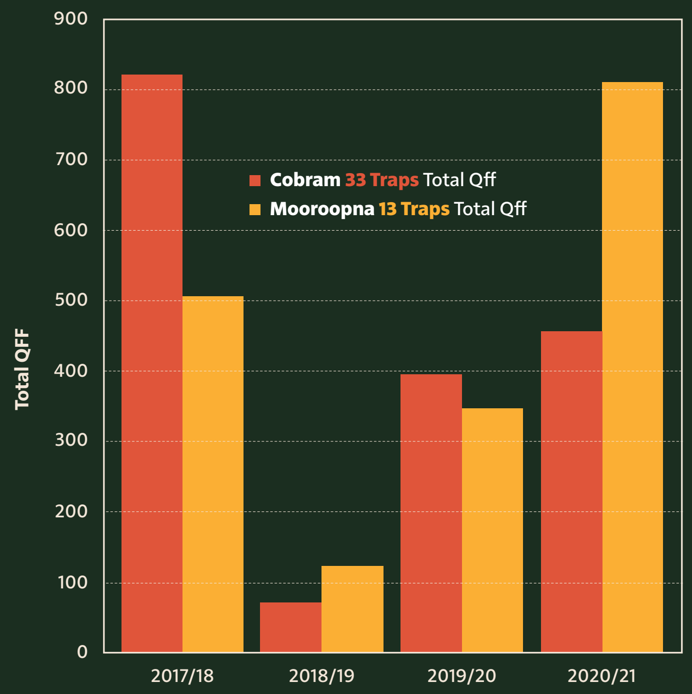
Two SIT pilot projects were conducted over three-year trial periods: aerial application of SIT against Qff in a) Cobram, Victoria (Figs 6 to 9) and b) Hillston, NSW. These trials commenced in September 2019. They were set up as "replicates" so that SIT was implemented identically in each of the two towns. Mooroopna, Vic, (+AWM/-SIT) was identified as the "control town" for comparison against Cobram.

Sterile Qff were released by air each week during three SIT release periods lasting from September to April/May each year for three years. A drop zone covering the main township of Cobram was designated and used for each drop of steriles. Sterile flies were then trapped in the AgVic National Trapping Grid (GMV-portion), the GMV AWM project traps (Figs 6 and 8) and extra SIT traps placed on certain distances from the nearest edge of the drop zone (i.e. 1, 2 and 5km) (Fig. 7).

This grid monitored the wind-drift, dispersal and concentrations of released steriles. Together with a SIT awareness campaign, concentrations of steriles were communicated weekly to community, industry and government stakeholders for dissemination to the wider community. This awareness and education informed the community that any false positives they might find in their private traps were steriles and that no fruit fly mitigation actions were needed.

TABLE 5

Number of Qff trapped in 33 traps deployed in Cobram (town) and in 13 traps deployed in Mooroopna (town) over a 15 week period from 1 November each year for 4 years.



Results

Sterile Qff were trapped outside of the SIT drop zone – some as far as nearly 10km (Table 7 and Fig 9 and 10 on the following spreads).

Qff management in the two towns (Cobram and Hillston) varied. Cobram had implemented a whole-of-community AWM program since mid-2017, while a lower scale version was in place in Hillston.

Despite the very high Qff populations present in SE Australia at that time there was only a minor increase in Qff being trapped in and around Cobram – at a much lesser rate (Qff/trap/fortnight) than the rest of the GMV. Fewer Qff were trapped in Cobram than in similar areas nearby, such as Mooroopna where Qff numbers increased (see Table 5).

Result

There is a significant reduction in Qff numbers in Cobram when compared with the rest of the GMV. This is most likely due to the implementation of the three-year SIT pilot release project over the urban section of Cobram.

TABLE 6

Qff Trapping Rates in Cobram compared with the rest of the GMV from the beginning of the Area-Wide Management Project (1 July 2017) to 30 June 2022

Locality	Measure	Date from 1 July - 30 June each season					2021/22 compared to 2017/18
		2017/18 High Input AWM	2018/19 High Input AWM	2019/20 High Input AWM	2020/21* Low Input AWM	2021/22* Low Input AWM	
Cobram (94 urban + rural traps)	Total number of Qff trapped	2406	1004	281	471	558	**76.81% REDUCTION in Qff**
	Number of traps deployed	94	94	94	94	94	
	Average	2.13	0.89	0.25	0.42	0.50	
GMV (excl. Cobram; ~300 traps)	Total number of Qff trapped	15394	5791	9855	19078	16015	**4.03% INCREASE in Qff**
	Number of traps deployed	296	296	315	300	300	
	Average	52.01	19.56	31.29	63.59	53.38	

**NOTE: The 2020/21 and 2021/22 seasons were particularly bad years for Qff as evidenced by multiple outbreaks in many parts of SE Australia hitherto free from Qff (such as the Yarra Valley and SA's Riverland and Adelaide and Perth in WA). This was as a result of the combined effects of a La Niña weather pattern, which favoured the proliferation of fruits and Qff, and COVID-19 restrictions/implications resulting in non-harvesting of Qff host fruit.*

TABLE 7
Wild and sterile Qff trapped in and around the SITplus drop zone including distances from drop zone

Total numbers from 30/12/19 to 30/06/20

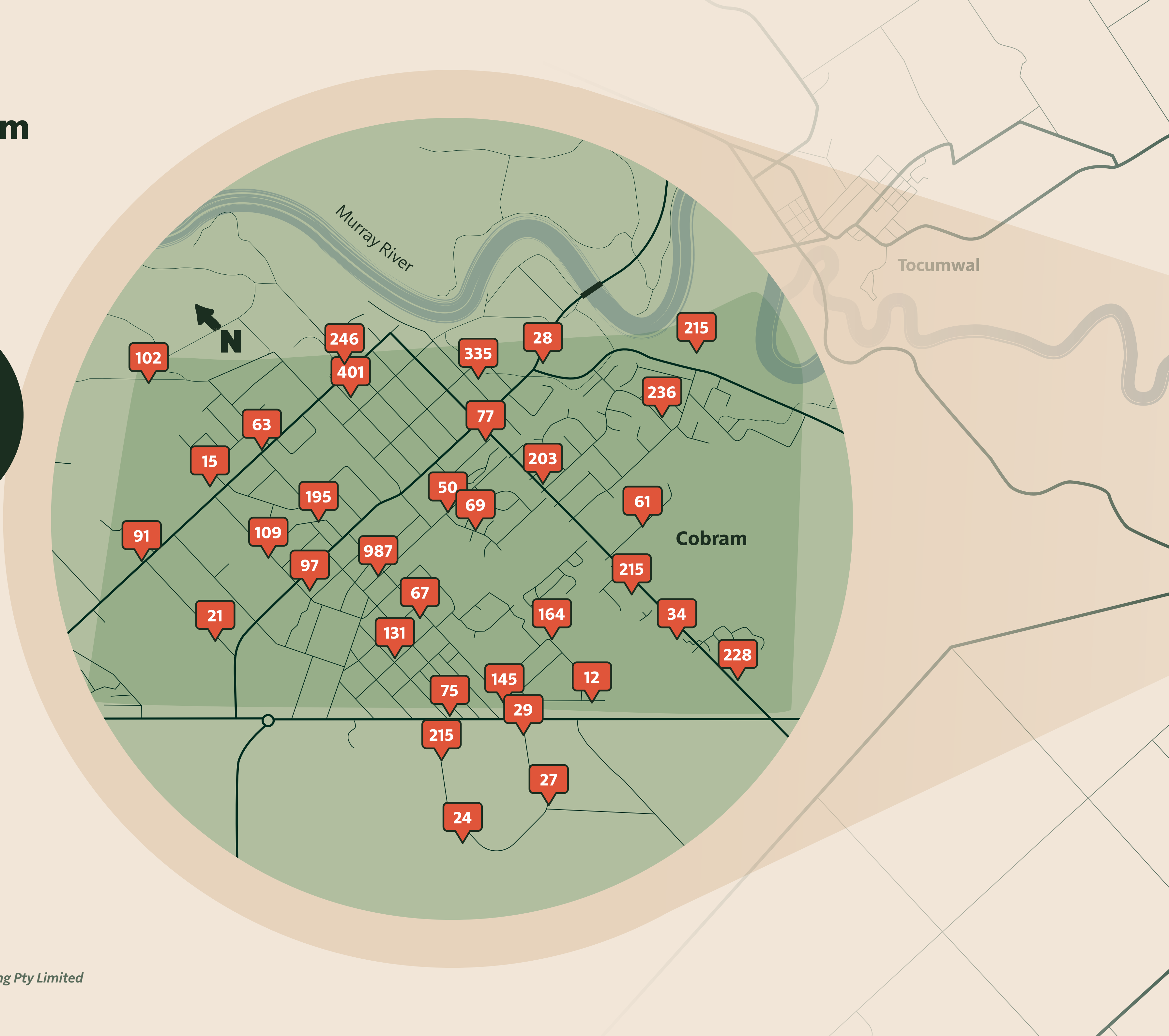
Distance (m) ^	Trap Site	Location Type	Total # of Wild Qff	Total # of Sterile Qff
Inside	M021	PERI-URBAN	2	352
Inside	M073	URBAN	0	328
Inside	M075	PERI-URBAN	1	572
Inside	M076	URBAN	0	658
Inside	M077	URBAN	2	112
Inside	M078	URBAN	6	431
Inside	M079	URBAN	3	554
Inside	M080	URBAN	6	341
Inside	M081	URBAN	14	1142
Inside	M086	URBAN	10	255
Inside	M087	URBAN	3	581
Inside	M088	URBAN	4	2565
Inside	M089	URBAN	3	197
Inside	M090	URBAN	4	289
Inside	M091	URBAN	10	383
Inside	M092	URBAN	1	714
Inside	M093	URBAN	5	670
Inside	M094	URBAN	5	87
Inside	M095	URBAN	3	544
Inside	M096	URBAN	2	71
Inside	M097	URBAN	1	517
Inside	M098	URBAN	0	205
Inside	M099	URBAN	5	547
Inside	M100	URBAN	9	273
Inside	M101	URBAN	50	58
Inside	M102	URBAN	11	487
Inside	M103	URBAN	0	102
Inside	M104	URBAN	9	670
Inside	M105	URBAN	19	519
19	M072	RURAL	3	192
47	M106	RURAL	2	9
76	M070	RURAL	0	62
106	M085	PERI-URBAN	1	466
220	M082	PERI-URBAN	4	425
223	M027	RURAL	0	264
439	M084	PERI-URBAN	8	39
628	M083	PERI-URBAN	4	149
719	M028	RURAL	4	11
929	M069	RURAL	0	0
991	M020	RURAL	1	380
991	M071	RURAL	0	6
1000	1-1	RURAL	10	15
1000	1-2	RURAL	71	91
1000	1-3	RURAL	0	3
1000	1-4	RURAL	21	32
1000	1-5	RURAL	0	0
1000	1-6	RURAL	2	1
1000	1-7	RURAL	1	4
1000	1-8	RURAL	20	20

Distance (m) ^	Trap Site	Location Type	Total # of Wild Qff	Total # of Sterile Qff
1000	1-9	RURAL	9	3
1034	M026	RURAL	3	2
1534	M033	RURAL	0	2
1666	M018	RURAL	0	28
1745	M031	RURAL	0	0
1953	M066	RURAL	0	1
2000	2-1	RURAL	0	0
2000	2-2	RURAL	0	1
2000	2-3	RURAL	0	0
2000	2-4	RURAL	0	5
2000	2-5	RURAL	75	4
2000	2-6	RURAL	10	3
2000	2-7	RURAL	7	3
2000	2-8	RURAL	1	1
2211	M032	RURAL	0	0
2239	M068	RURAL	1	1
2373	M067	RURAL	0	2
2509	M065	RURAL	0	3
2596	M029	RURAL	0	0
2676	M019	RURAL	2	0
2992	M056	RURAL	0	0
3029	M064	RURAL	1	12
3058	M055	RURAL	0	0
3165	M057	RURAL	0	0
3303	M030	RURAL	0	0
3640	M058	RURAL	0	0
3672	M025	RURAL	0	1
3717	M062	RURAL	0	0
3720	M054	RURAL	1	0
3869	M107	RURAL	0	0
3898	M053	RURAL	1	2
4142	M024	RURAL	3	4
4183	M017	RURAL	0	1
4233	M036	RURAL	0	0
4273	M052	RURAL	2	3
4536	M059	RURAL	0	0
4667	M034	RURAL	0	0
4671	M038	RURAL	0	1
4703	M063	RURAL	0	0
4858	M051	RURAL	0	0
4899	M035	RURAL	0	26
5000	5-1	RURAL	2	0
5000	5-2	RURAL	0	0
5000	5-3	RURAL	0	0
5000	5-4	RURAL	0	0
5000	5-5	RURAL	0	0
5000	5-6	RURAL	0	0
5000	5-7	RURAL	19	1
5285	M050	RURAL	0	0
5371	M016	RURAL	2	1
5385	M046	RURAL	0	0
5513	M045	RURAL	0	0
5552	M037	RURAL	0	0
5959	M039	RURAL	1	0
6110	M047	RURAL	0	0
6203	M041	RURAL	0	1
6450	M040	RURAL	0	0
6453	M015	RURAL	0	0
6503	M044	RURAL	1	307
6725	M049	RURAL	0	0
6778	M060	RURAL	1	0
6793	M022	RURAL	0	1
7162	M048	RURAL	8	0
7373	M023	RURAL	0	0
7386	M042	RURAL	8	13
7545	M061	RURAL	0	0
9424	M043	RURAL	0	0
9947	M074	RURAL	0	198

^ from nearest edge of SIT Drop Zone

Urban Cobram
trap sites

FIG. 9
Urban Cobram trap sites which captured sterile Qff



Numbers indicate total number of sterile Qff trapped

SIT drop zone

1km from edge of SIT drop zone

2km from edge of SIT drop zone

5km from edge of SIT drop zone

Rural and peri-urban trap sites

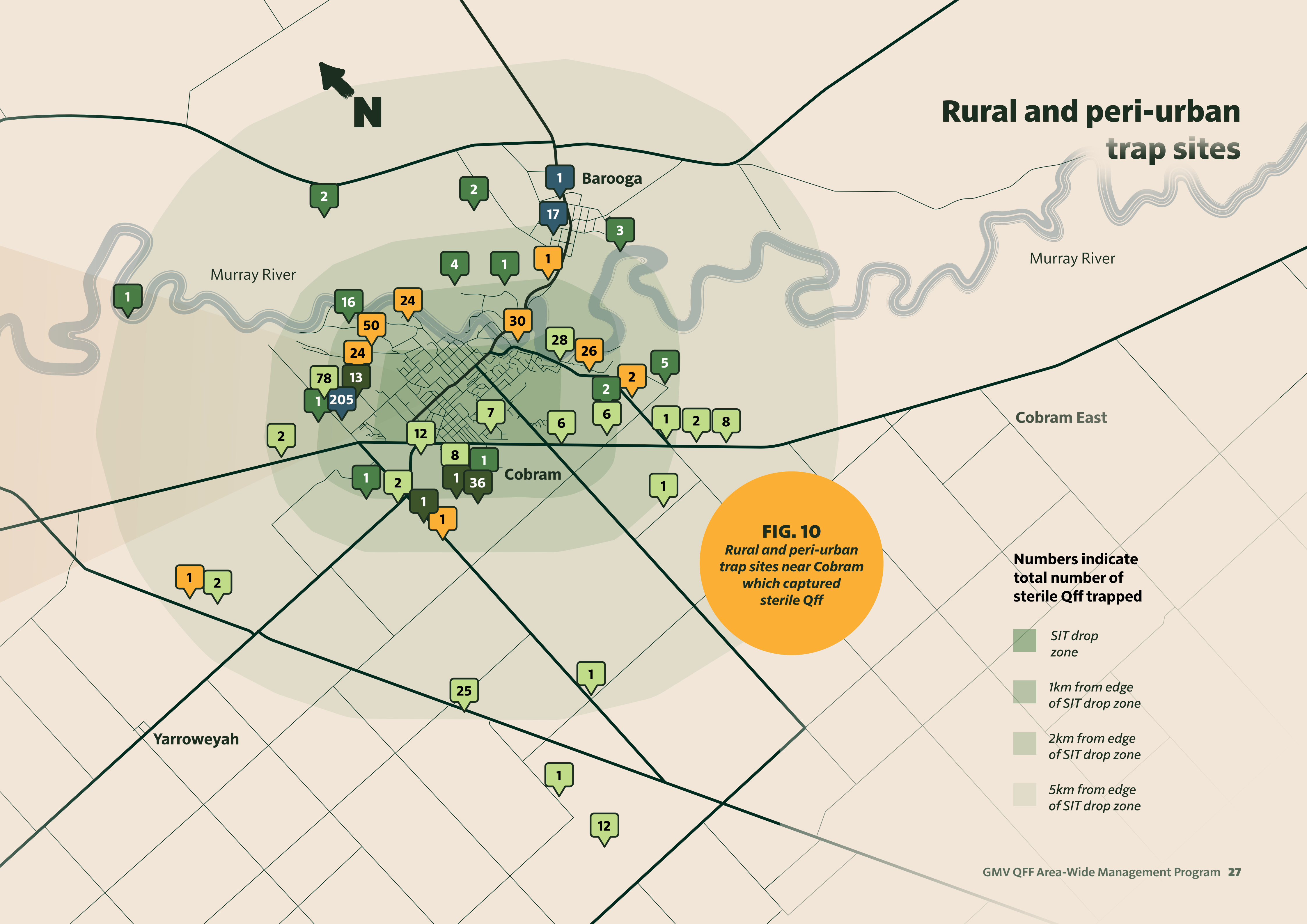
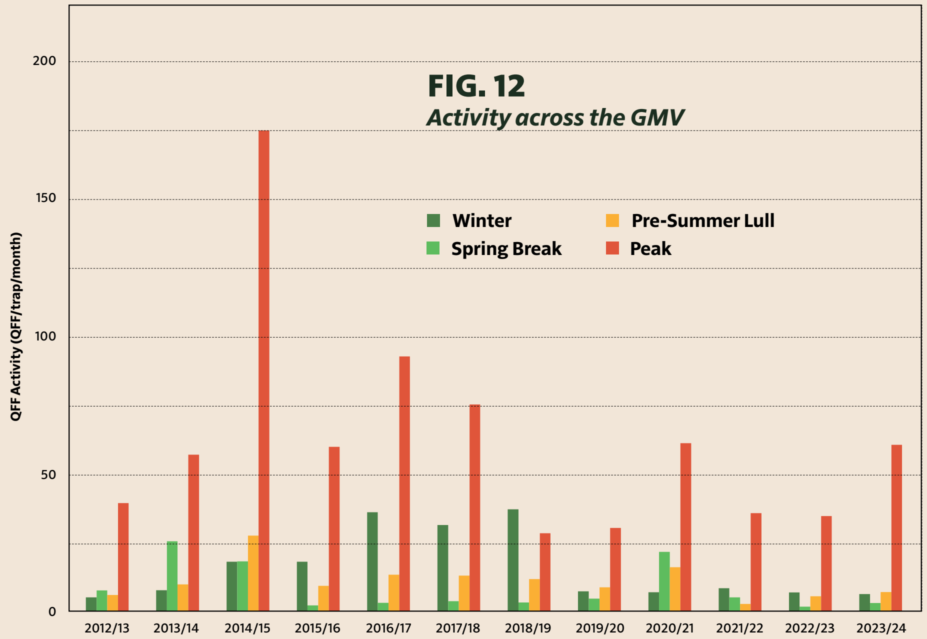
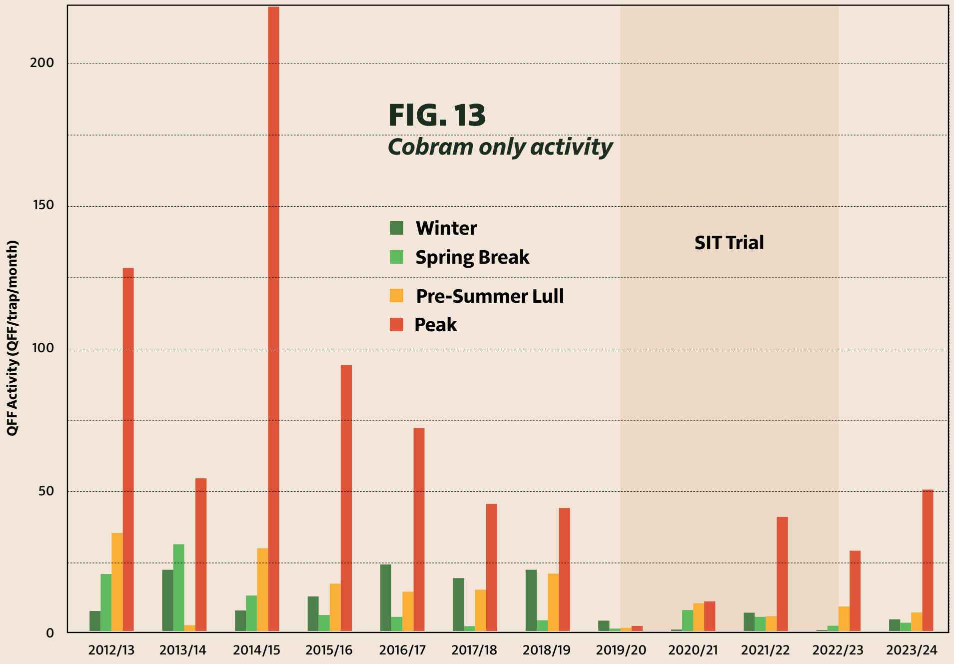


FIG. 10
Rural and peri-urban trap sites near Cobram which captured sterile Qff

Figs 12 and 13 show Qff activity (measured as the seasonal activity of Qff: area under the curve) in the GMV (without Cobram data) and Cobram. Data for these graphs were only from the 78 traps in the GMV portion of the AgVic National Fruit Fly Trapping Grid. These traps are independent of the GMV AWM traps, so they show an unbiased account of Qff population trends.

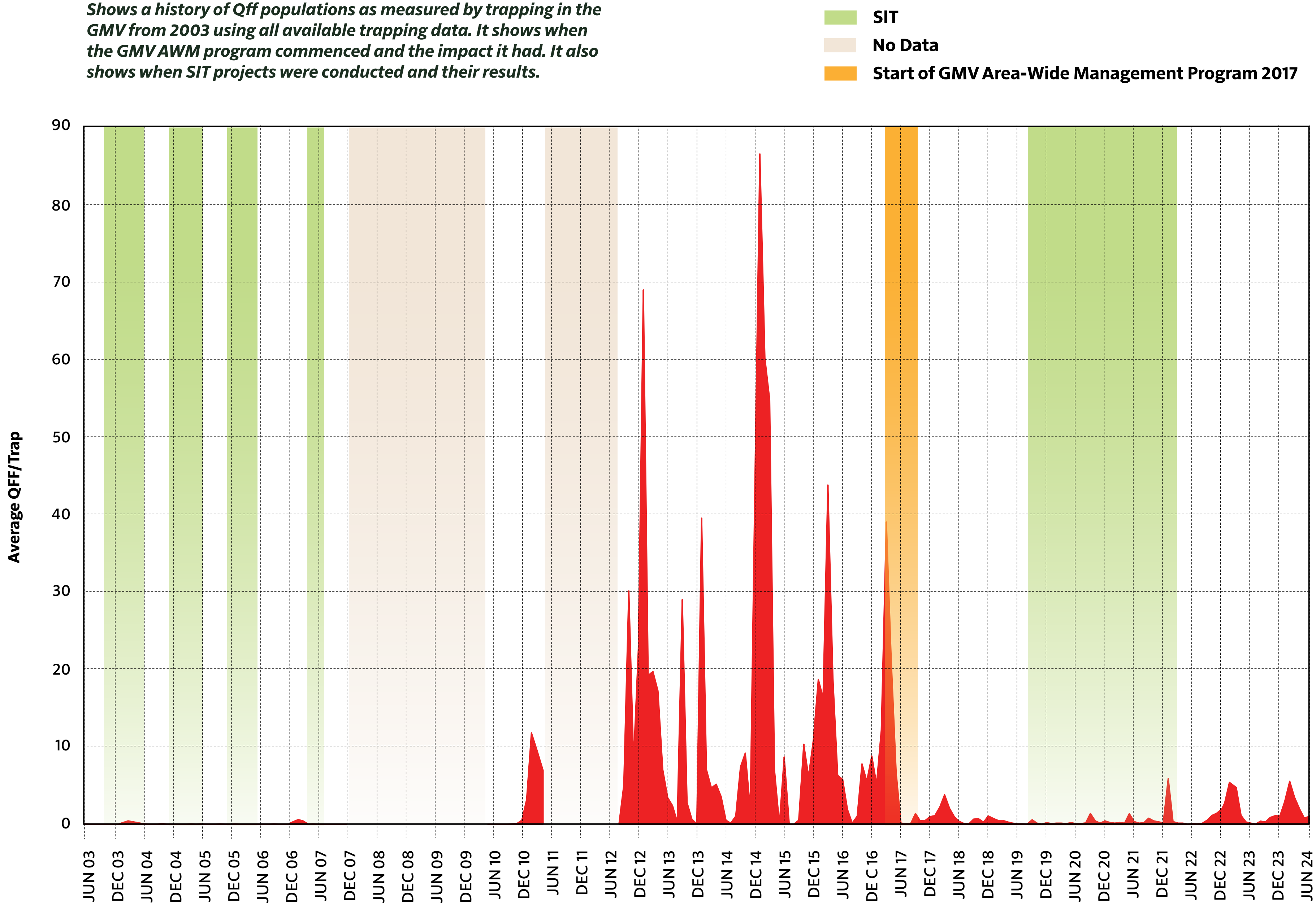


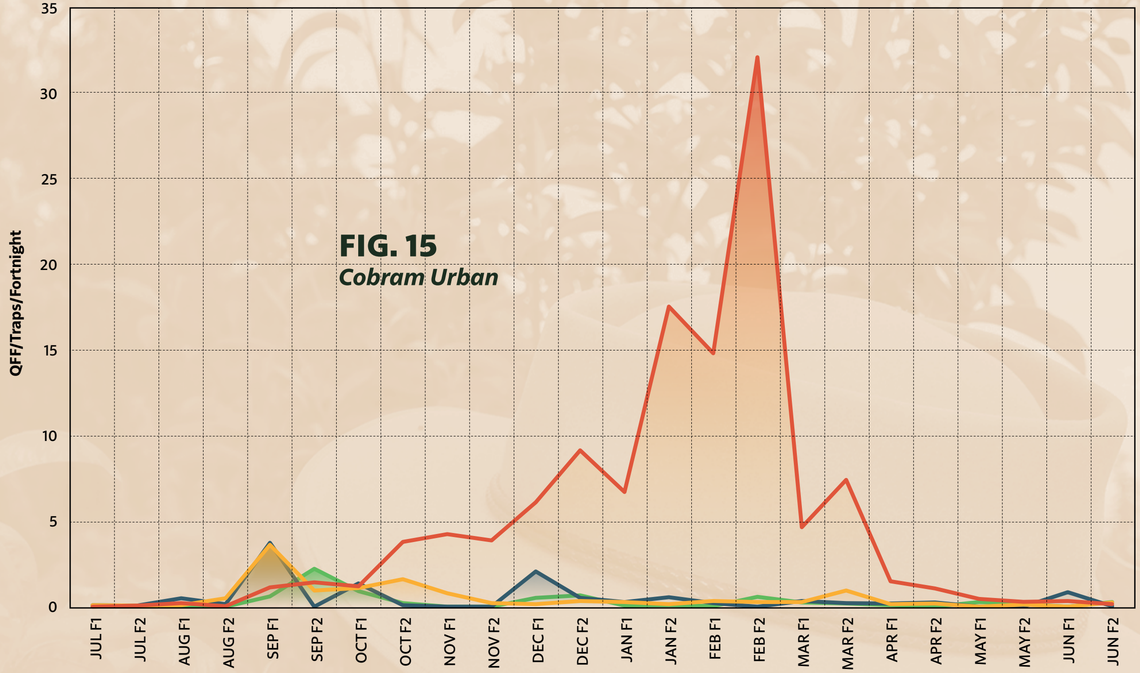


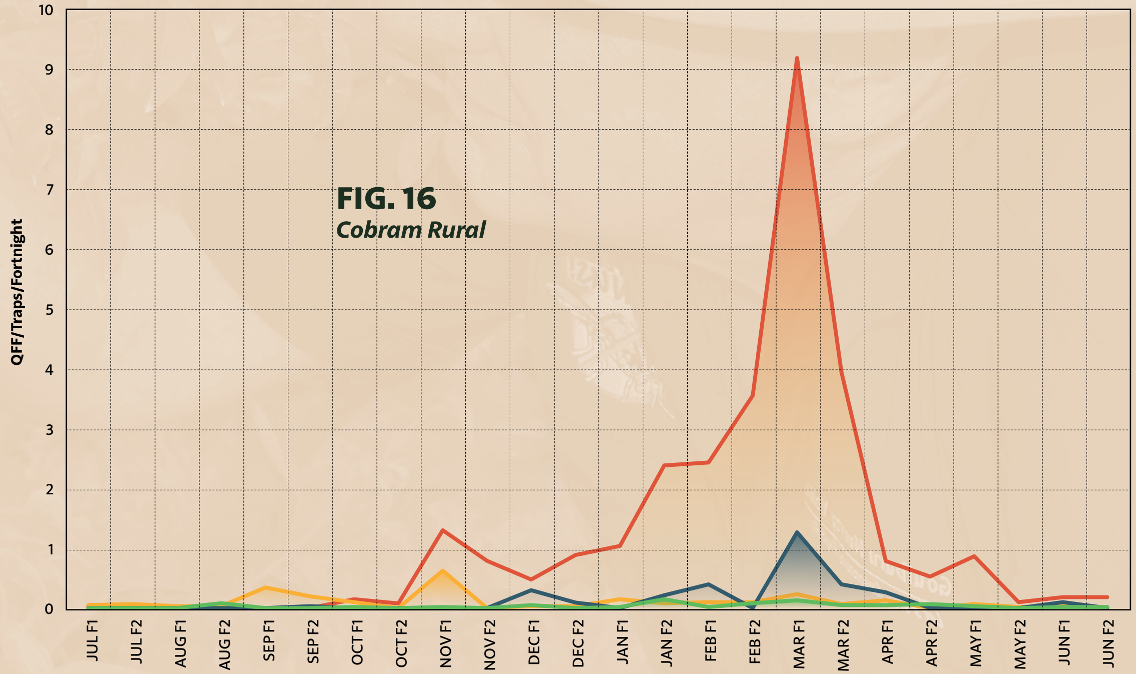
Data show that Qff numbers declined, in all seasons, during the SIT program in Cobram except in the summer (peak Qff season) of the third year. The cause for this peak was the release of poor quality, sub-optimal steriles which failed to impact the local wild population. This problem was soon remedied and Qff declines returned during late summer and autumn 2022 when the project concluded.

FIG. 14

Shows a history of Qff populations as measured by trapping in the GMV from 2003 using all available trapping data. It shows when the GMV AWM program commenced and the impact it had. It also shows when SIT projects were conducted and their results.







Qff traps each fortnight during activity season

Figs 15 and 16 show the impact of SIT on Cobram urban and Cobram rural trapping sites, respectively.

SIT had an impact on rural sites which were not in the direct drop zone of steriles. The suggestion is that movement of steriles from the drop zone were also effective in reducing Qff numbers outside the actual sterile insect release areas.

The hypothesis that Cobram's AWM program, in combination with SIT, is the base cause for the significant reduction in Qff numbers trapped in the years during the SIT pilot in Cobram is supported by the fact that most other trapping sites within the GMV and many other sites throughout southeastern Australia - for example, the Riverland in South Australia and the Sunraysia region in northwestern Victoria - experienced increased Qff population levels at that time.

No other GMV town centre with similarly high Qff populations (e.g. Mooroopna, Shepparton, Kyabram, Tatura) showed a similar decrease in Qff numbers than Cobram at that time.

SIT without AWM (-AWM/+SIT) was tested in Hillston, NSW. Some Hillston traps captured 34 Qff in a two-week period, a threat level not seen in Cobram (+AWM/+SIT), suggesting that SIT without AWM is less successful that SIT with AWM.

Observation #1

AWM works better when combined with SIT when Cobram (+AWM/+SIT) is compared with Mooroopna (+AWM/-SIT).

Observation #2

AWM works better when combined with SIT when Cobram (+AWM/+SIT) is compared with Hillston (-AWM/+SIT).

Observation #3

SIT impact can spread outwards from sterile insect release areas.

Conclusions

1. Qff capture rates declined significantly (by 95%) in the first year of high input AWM (Fig. 3) and then by another 60% in the second year
2. Qff activity was less severe under high input AWM than under low input AWM. Currently, under low input AWM, the GMV is experiencing a 5-fold increase (96%) in Qff activity compared with high input AWM
3. There is a beneficial synergism between the AWM project and the SIT program
4. Victoria as well as NSW, and now South Australia would benefit significantly from a high input AWM program in combination with SIT
5. SIT benefits can spread outside of the immediate sterile insect release areas
6. There was a significant reduction in Qff numbers in Cobram when compared with the rest of the GMV. This is most likely due to the implementation of the three-year sit pilot release project over the urban section of Cobram

Impacts of weather on Qff proliferation

It has been suggested from time to time that some, if not all, the beneficial impacts seen during the GMV AWM program on lowering Qff populations were due to weather effects. A study of weather patterns in Tatura, located within the GMV, from 1899 revealed a small increase in maximum and minimum daily temperatures and a small decrease in rainfall (Fig. 17) from then until the present. This variation depends heavily on the base date chosen for comparison (Table 6) and reflects the cyclical nature of weather patterns in Australia.

Heavy rainfall from 2010 to 2012 marks the onset of the building up of Qff populations in Victoria and elsewhere in southeastern Australia.

Medium to low Qff numbers (population status) were apparent during early 2018 and 2019 with coinciding low rainfall and higher daily average temperatures. However, low Qff numbers were present during the next two years, 2020 and 2021 when rainfall was higher and average temperatures were lower. There seems to be little correlation between overall adverse weather and low Qff numbers.

Interestingly, there was very low rainfall from 1938 to 1946. This period coincides with the time when Mediterranean fruit fly disappeared from eastern Australia.

Conclusions

Qff numbers decrease during hot, dry spells but that, it is suggested, is due to their going into refuge until the adverse weather improves for them. Longer periods of hot, dry weather are likely to reduce the number of flies surviving in fruit at immature stages especially if this weather caused fruit drop or reduces fruit set. It is unlikely that such periods would persist long enough to impact the total Qff populations because of the ability of Qff to infest remaining fruit in very great numbers that would then emerge in the autumn when weather conditions are more suitable for Qff and when much of the GMV's crops are ripening or ripe.

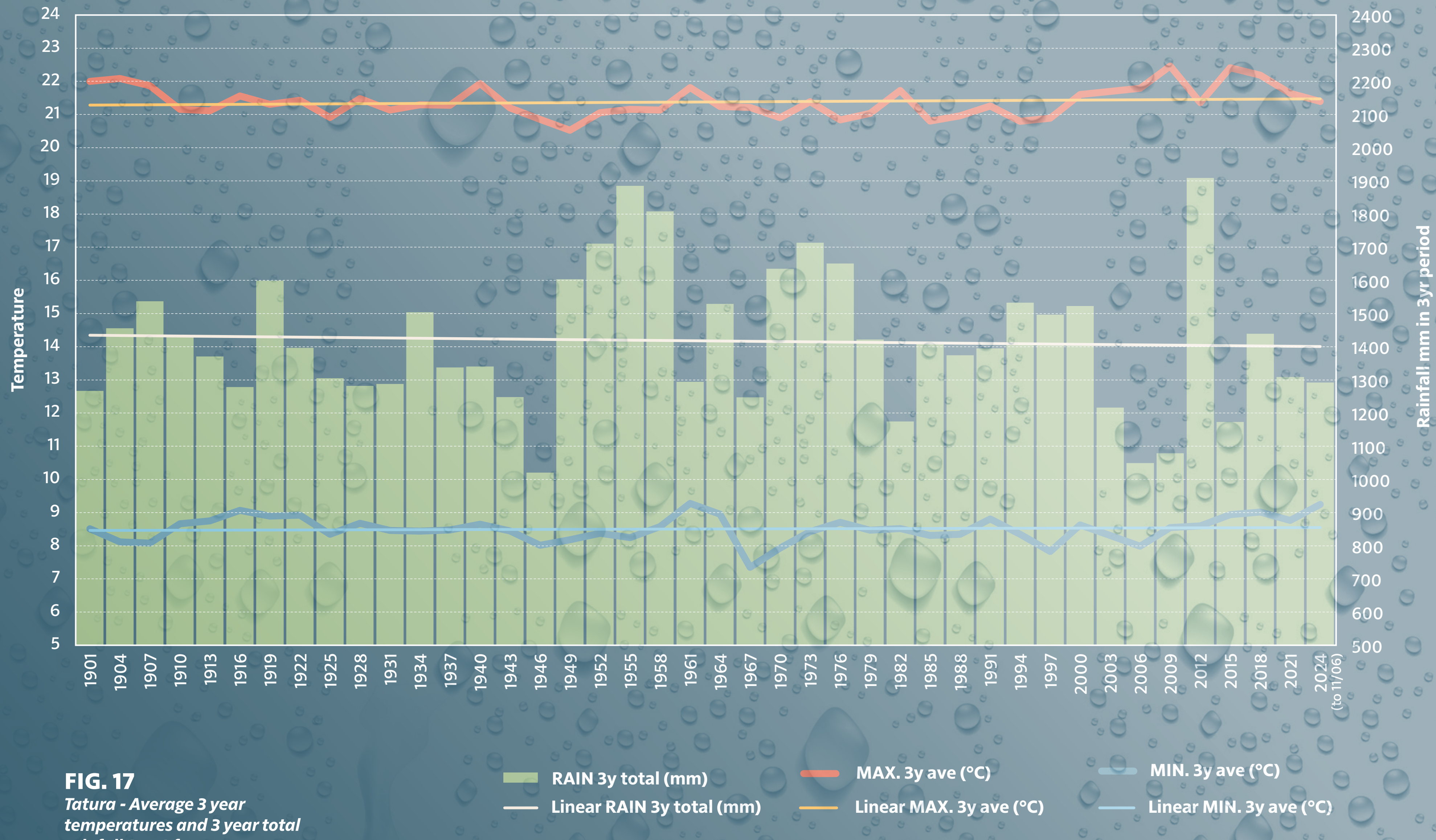


FIG. 17

Tatura - Average 3 year temperatures and 3 year total rainfall (mm) from 1899 to 2023

Changes in Qff populations

Estimating changes in Queensland fruit fly populations in the Goulburn Murray Valley with varying degrees of input into area-wide management

Queensland fruit fly (Qff) populations are predicted to increase significantly over the next few years in the Goulburn Murray Valley (GMV) without dedicated AWM programs or if low input AWM programs are continued as they are currently. Implementation of a high input AWM program, similar to that deployed from 2017 to 2020, is predicted to suppress Qff populations to a low level. Methods used to predict future Qff populations, the results and their conclusions are discussed in this report.

Background

The existence and proliferation of future populations of Queensland fruit fly (Qff) depend on:

- Future weather patterns
- Size and extent of previous Qff populations
- Success or otherwise of area-wide management (AWM) programs
- Temporal and spatial availability of host fruit
- Adaptability/resistance of Qff to changes in weather, host plants and AWM strategies

Research rationale

Qff populations, as measured by the numbers of Qff captured in male-targeting traps, vary during their activity season.

Numbers of Qff trapped in July are negligible, mainly because Qff are not responsive to parapheromone lures in the cold weather.

As adult Qff emerge from their winter refuges numbers in traps build up to a 'spring peak' in September/October. These flies die off after mating and laying eggs into any available fruit and numbers in traps decline while the new generation matures to emerge in December/January creating a 'summer peak'.

Hot weather in January/February will reduce the numbers of Qff entering traps and will kill off some eggs and larvae in fruit that are exposed to the sun. However the summer peak does not occur when La Niña weather events bring milder, wetter summers to the region.

After this, the highest peak, labelled the 'autumn peak' in trapped Qff occurs. This coincides with commercial harvesting of fruit in the GMV.

The size of each of these peaks varies according to previous Qff activity, weather patterns and AWM implementation.

Autumn peak

- **The size of the summer Qff population**
- **Weather during the previous summer**
- **Volume of available fruit during summer and early autumn**

Spring peak

- **The size of the previous autumn Qff population**
- **Weather patterns in the previous winter and autumn**

Summer peak

- **The size of the previous spring peak**
- **Weather during the previous spring**
- **Volume of available host fruit during spring and early summer**

Winter peak

The size of the winter population is not measurable by trapping due to the inhibitory effects of cold weather on the response of Qff to lures in male-targeting traps. It is therefore highly likely that Qff populations in the sinter are higher than that indicated by winter trapping data.

- **The size of the Qff population during the previous late autumn**
- **Availability of sufficient warm, moist refuges**

The GMV winter is not cold enough to kill adult Qff, but it is cold enough to kill off eggs and larvae in fruit and pupae in the soil.

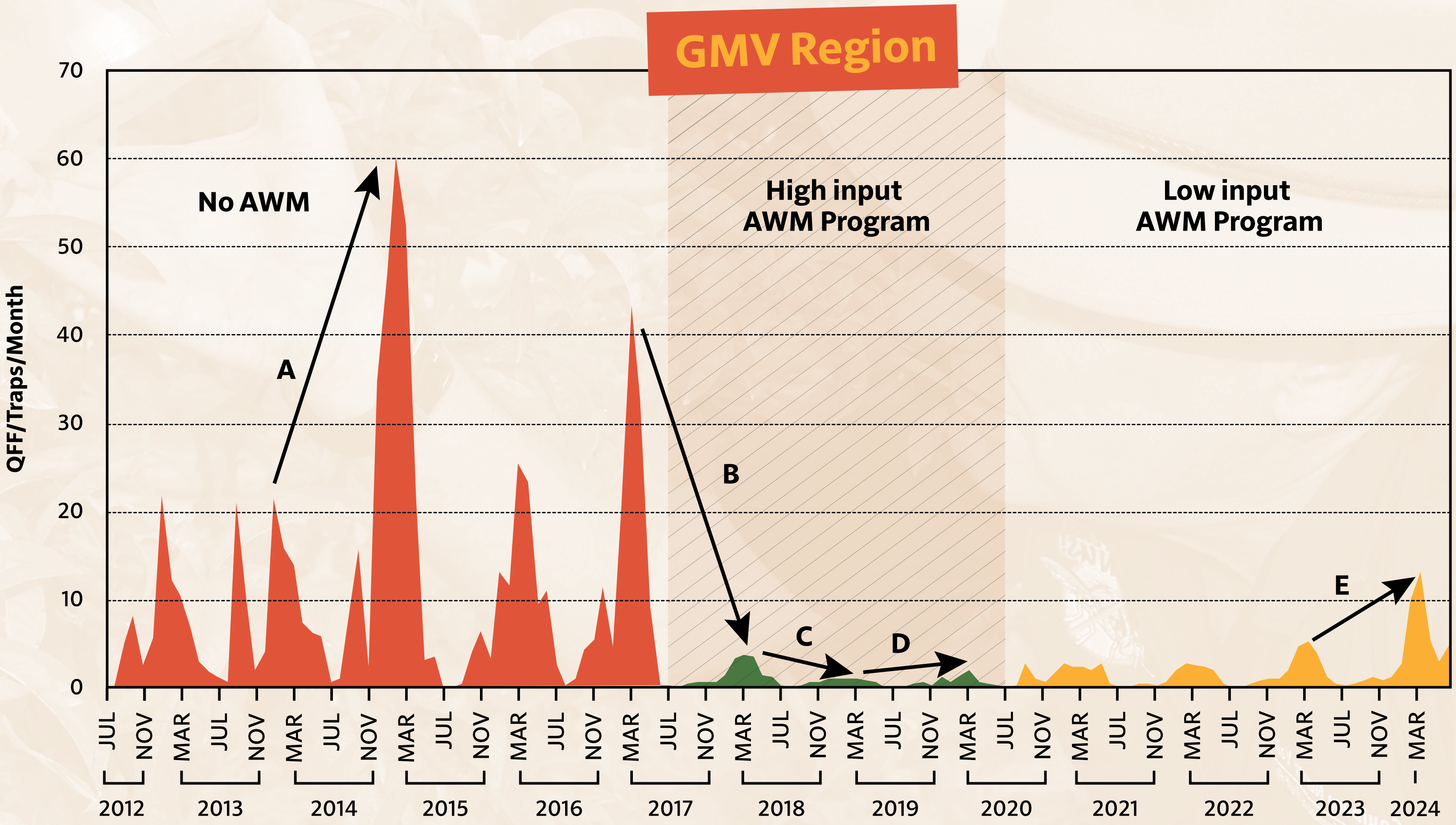
Methods

Estimates were based on previous Qff trapping from traps within the GMV (Fig. 18) which are on the National Fruit Fly Trapping Grid (labelled as 'AgVic' traps) and traps used in the AWM project in the GMV which commenced in mid-2016 (labelled as 'IKC' traps, RapidAIM traps, 'supplementary' traps and 'SIT radii' traps).

Trapping data were divided into the following operational periods:

- **No dedicated AWM program (No AWM) – from 2012 to 2017**
- **High input AWM program – from 2017 to 2020**
- **Low input AWM program – from 2020 to 2024**

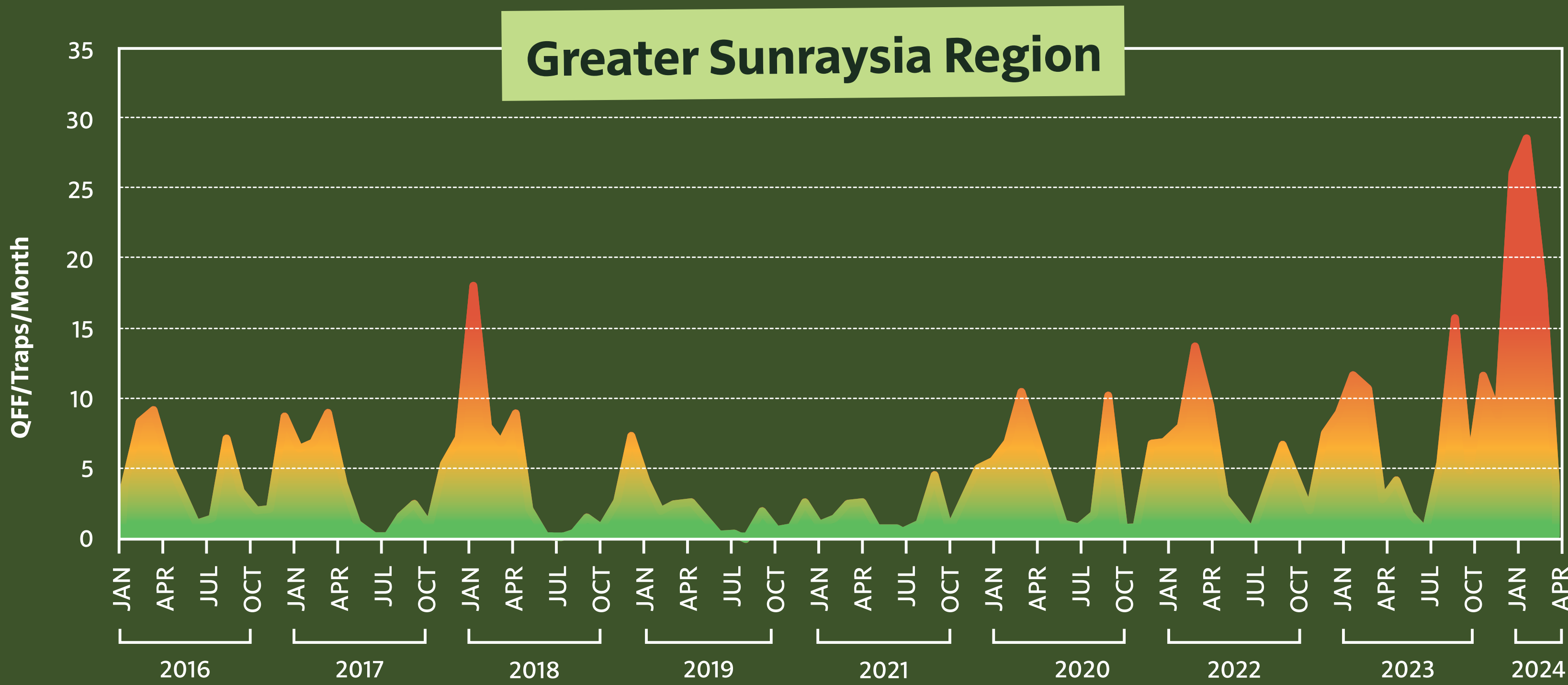
FIG. 18
Monthly Qff trap capture rates in the GMV comparing three AWM types



Data collected from more than 1,150 traps deployed throughout the Greater Sunraysia region (Figure 19) were also referenced to obtain trends from another, separate region of Victoria for comparison with the GMV.

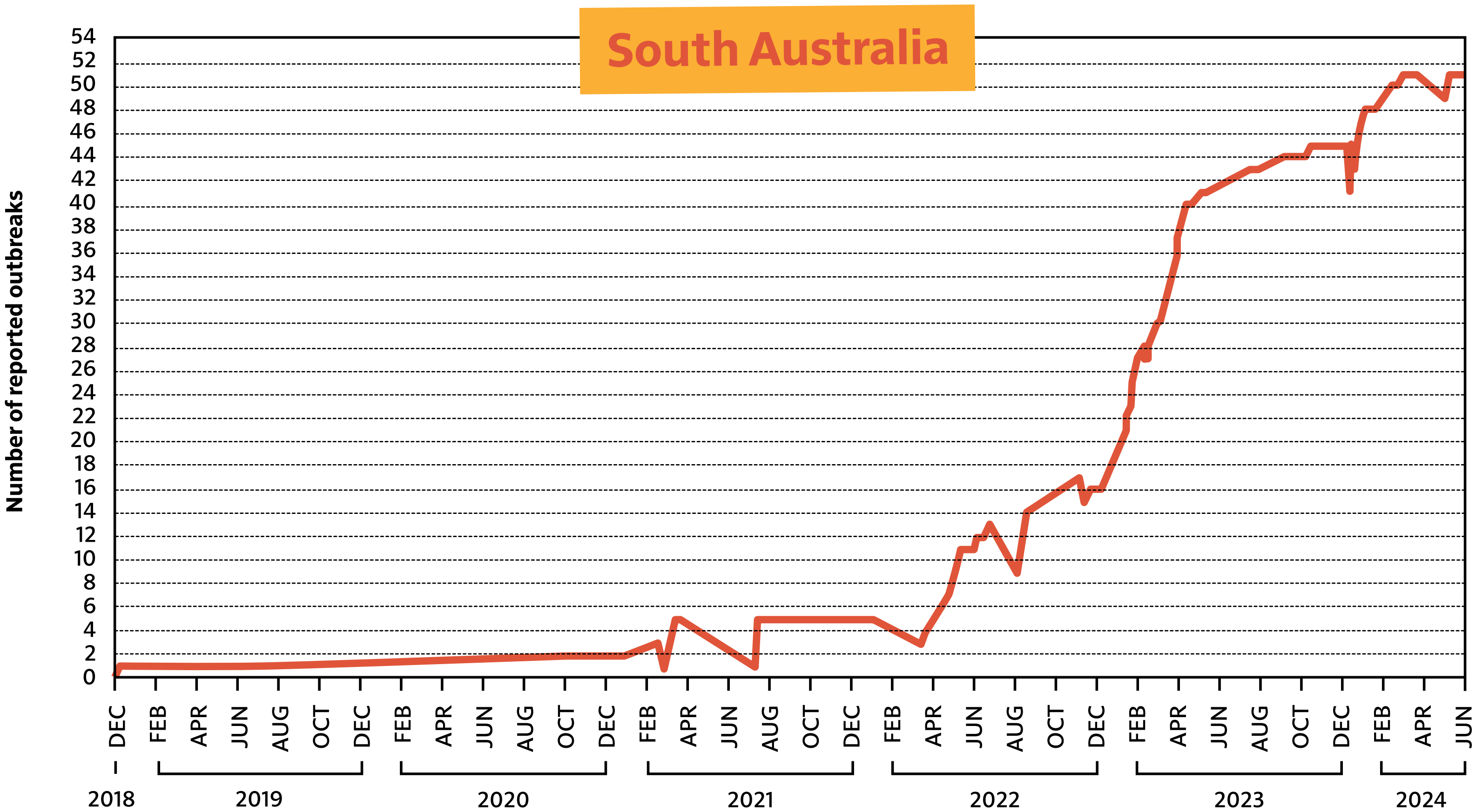
Figure 19 shows that recent Qff populations, as measured by trapping data, started to escalate in size from about September 2020 with a sizable peak in February 2024. This shows that the Sunraysia region has been under considerable threat from Qff populations especially in the last 3 years and particularly in the 7 months to April 2024.

FIG. 19
Average numbers of Qff trapped in the Sunraysia region per month from January 2016 to April 2024 (partial)



South Australia is another area of SE Australia that is currently battling with Qff outbreaks (Figure 20). Data for Figure 20 were extracted from newspaper articles and South Australian Government media releases on the number of outbreaks periodically from December 2018 to June 2024. Figure 20 shows that the number of Qff outbreaks in South Australia increased dramatically from April 2022 (with 3 outbreaks) to July 2024 with 51 outbreaks. This represents an unprecedented increase in Qff populations in South Australia during the period covered by the AWM program in the GMV.

FIG. 20
Number of outbreaks of Qff reported in South Australia from 1 Dec 2018 to 2024



Hourly weather data for Shepparton from 1 July 2012 to the present (Table 8) were obtained from Visual Crossing:

www.visualcrossing.com/weather/weather-data-services

The conclusion that SE Australia is currently under unprecedented pressure from expanding Qff populations is supported by Qff trapping and outbreak data from the Sunraysia region of Victoria (Fig 19) and from South Australia (Fig 20). This situation can be extrapolated to the GMV region and this suggestion is also supported by the latest trapping data (Fig 18).

These data were used to calculate potential Qff activity each year. Qff activity was measured by accumulated degree-days above the minimum maturation threshold of Qff, 12.405°C, and under the maximum developmental threshold for Qff, 34°C, commencing on 1 July 2014/15, with a high Qff activity rating, was a bad year for Qff but 2018/19, with a similar activity was not. This occurred during the high input AWM phase.

Refer to the following references:

www.horticulture.com.au/globalassets/laserfiche/assets/project-reports/cy13012/cy13012-final-report-465.pdf

Snyder RL (2005) DegDay Version 1.01 written March 2002, revised April 10, 2005. © 2002 Regents of the University of California

TABLE 8

Comparison of seasonal (i.e. July to June) Qff activity

As measured by accumulated degree-days above the minimum maturation threshold of Qff, 12.405°C, and under the maximum developmental threshold for Qff, 34°C, commencing on 1 July.

Shepparton

Qff activity season	Accumulated degree-days above 12.4°C
2012/13	1,610
2013/14	1,795
2014/15	1,953
2016/17	1,585
2017/18	1,837
2018/19	1,936
2019/20	1,637
2020/21	1,583
2021/22	1,649
2022/23	1,449
2023/24	1,759

Scenarios

Forecast Qff capture rates were based after the latest data received (2023/24 season) on percentage changes in maximum monthly trap capture rates within historical data (Figure 18) from each of the three trapping periods (No AWM, High Input AWM and Low Input AWM) which were applied to the latest maximum monthly capture rate.

Real data were assessed against the following scenarios that may apply to future Qff management:

No AWM
No dedicated AWM program, as used pre-2017

The forecast for the 'No AWM' scenario was based on the percentage increase in the worst case scenario of data from 2013/14 to 2014/15 (refer to arrow A in Figure 18) and applied to the latest (2023/24) max. monthly capture rate. Estimates for 2025/26 and 2026/27 were based on the same percentage change but added to the forecasts for 2024/25 and 2025/26, respectively.

Low Input AWM
As used post-2020

The forecast for the 'Low Input AWM' was based solely on the percentage change of the maximum trap capture rates between 2022/23 and 2023/24 (arrow E in Figure 18).

High Input AWM
As deployed from 2017 to 2020

The forecast for 2024/25 for the 'High Input AWM' was based on the percentage change between maximum trap capture rates for 2016/17 and 2017/18 (arrow B in Figure 18) and applied to the latest (2023/24) max monthly capture rate. This represented the effect of the first year of the High Input AWM on the last year of the No AWM period. The forecast capture rate for 2024/25 was then estimated by applying the percentage change seen at arrow B to the maximum monthly capture rate for 2023/24. The forecast for 2025/26 was based on the change between maximum rates from 2017/18 and 2018/19 (arrow C and arrow D, respectively, in Figure 18).

Basically, calculated percentage changes during the No AWM, High Input AWM and Low Input AWM phases were applied to the latest maximum monthly Qff capture rate (in the 2023/24 season) to estimate future Qff trapping rates under the three Qff management types (No AWM, High Input AWM and Low Input AWM).

Data review
Future weather patterns

Degree-days above the minimum maturation threshold for Qff (12.4°C) over the past 12 years were calculated. Accumulated degree-days (ADD) for the Qff activity season (1 July to 30 June) each year showed some variation. ADD can be used as a measure of total seasonal Qff activity.

With a mean of 1707ADD (median 1669ADD) and a range of 1449ADD to 1953ADD from 12 years of data covering periods with La Niña, El Niño and neutral it is safe to suggest that the average degree days will describe near-future Qff activity.

Climate change, in the medium to long-term future may necessitate modification to the degree day model.

Size and extent of previous Qff populations

Qff populations will expand rapidly from low to high given suitable weather, fruit availability and the amount of human-mediated control (e.g. AWM but also traditional pesticide application and removal of windfalls and fruit still in-tree after harvest).

Figure 21 shows how monthly trapping rates of Qff varied during the three phases of Qff management since 2012. When no AWM was being carried out there were considerably more Qff/trap in each month from 78 traps across the GMV than during the high input and low input phases.

> ***During the high input phase Qff trapping rates declined dramatically during the first year of the phase with a very slight increase by the end of its three year period.***

Trapping rates started to increase immediately following the transition to the low input phase and continued to increase each season up to the present time (June 2024).

Qff populations also vary across the Qff activity season from month-to-month. Figure 4 shows this and compares Qff activity during the season between the three levels of AWM input. Qff activity was higher when under no AWM for all months than low and high input AWM when averaged over the period under which each AWM operation was carried out. High input AWM was lower than low input AWM over the summer and autumn months.

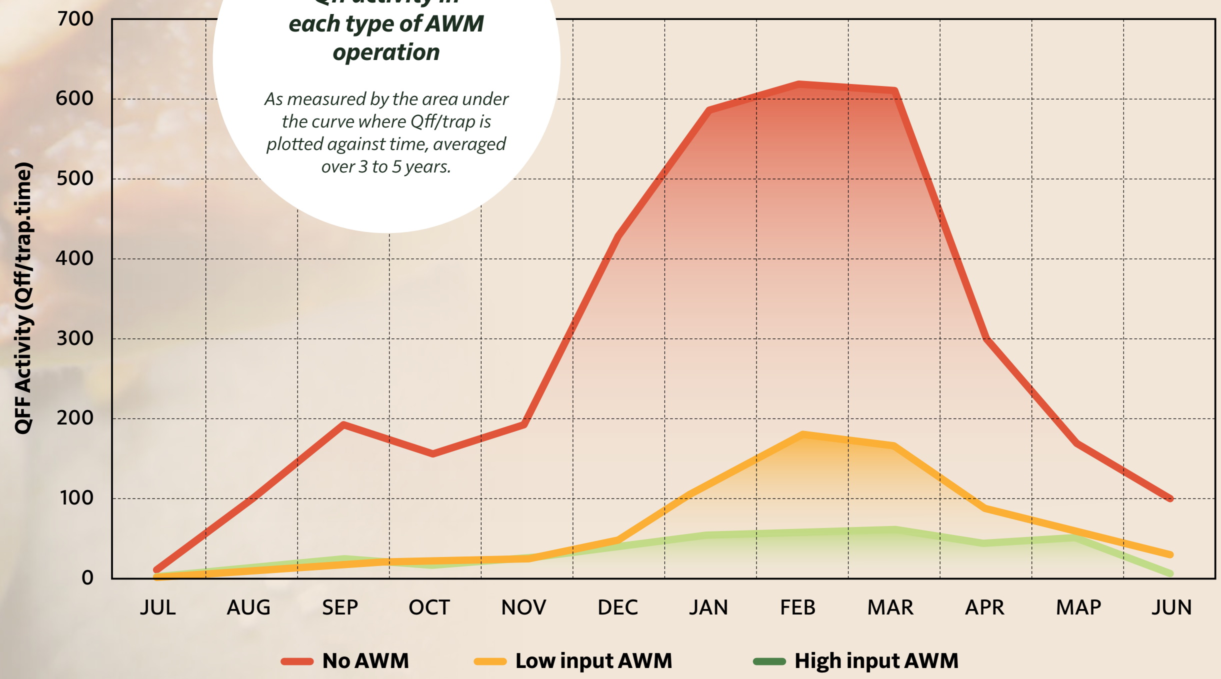


FIG 21
Qff activity in each type of AWM operation

As measured by the area under the curve where Qff/trap is plotted against time, averaged over 3 to 5 years.

Temporal and spatial availability of host fruit

Qff populations can build up to very high numbers causing serious damage to crops when ripening or ripe Qff host fruit is present all year round. This situation is generally presented in urban areas, particularly in older parts of town where it is traditional to plant fruiting crops in the backyard and, sometimes, front yards. The resulting concentration of evergreen plants and suitable host fruit over many months offers Qff both winter refuge and breeding opportunities. Feral and abandoned host fruit on the outskirts of urban areas and into rural areas with commercial horticulture facilitate the spread of Qff from urban to rural areas especially when commercial crops begin to ripen.

Host plant removal programs, a major component of high input AWM programs, create breakages in temporal availability, with removals of host fruit from urban blocks, and in spatial availability of host fruit in feral plants in the corridor between urban and rural crops.

Conclusions and discussion

Qff numbers are predicted to expand significantly under both the No AWM and, to a slightly lesser extent, the Low Input AWM scenarios.

The No AWM Input predictions were based on adding the percentage change in the historical worst case season (from 2013/14 at 22.4 Qff/trap to 2014/15 at 60.0 Qff/trap) to the 2023/24 trapping rate (13.0 Qff/trap) and then to each year after that. This may be over-estimating the prediction but, if the change from the last season of the No AWM phase was used instead, predictions for future Qff expansion would be less than those for a Low Input phase. The Low Input predictions were based on the latest trend (from 2022/23; 5.1 Qff/trap to 2023/24; 13.0 Qff/trap) which suggests a rapid expansion in Qff in the future. It is likely that these predictions will be moderated by weather and human-mediated Qff control outside a formal AWM program and, consequently, Table 9 represents worst case scenarios.

TABLE 9
Historical and predicted maximum Qff trap capture rates during the three operational phases of Qff management in the GMV under OPTIMAL weather conditions for Qff survival and proliferation

Operation	Season	No AWM	High AWM	Low AWM
No AWM	2012/13	21.7		
	2013/14	22.4		
	2014/15	60.0		
	2015/16	25.4		
	2016/17	43.1		
High AWM	2017/18		3.7	
	2018/19		1.1	
	2019/20		1.9	
Low AWM	2020/21			2.7
	2021/22			2.7
	2022/23			5.1
	2023/24			13.0
Forecast Max Monthly Capture Rate	2024/25	34.9	1.1	32.8
	2025/26	93.6	0.3	82.9
	2026/27	251.2	0.6	209.5
	2027/28	674.4	0.6	529.4

The percentage change from 2014/15 (60.0 Qff/trap) to 2015/16 (25.4 Qff/trap) was used to estimate the impact of weather on Qff populations (refer to Table 10). The reason for choosing these data is that Qff populations decreased markedly between these two dates whilst the GMV was in the No AWM phase. The most likely cause of this decline was the weather, meaning that 2014/15 was optimal for Qff survival and subsequent proliferation while the next season, 2015/16, was more likely to be a weather pattern less likely to be supportive of significant Qff population expansion. This is supported by the fact that Qff populations within the No AWM phase for the two years before and one year after 2014/15 were at similar levels.

Under normal weather conditions, which are generally less suitable for Qff, populations are predicted to build up over the coming years although to a much lesser extent than if perfect Qff weather persisted over this time.

TABLE 10

Predicted maximum Qff trap capture rates during the three operational phases of Qff management in the GMV based on weather impact

OPERATION	SEASON	NO AWM	HIGH INPUT AWM	LOW INPUT AWM
Forecast max monthly trap capture rate each season	2024/25	14.8	0.5	13.9
	2025/26	39.6	0.1	35.1
	2026/27	106.4	0.2	88.7
	2027/28	285.5	0.2	224.1

Figure 22 shows how different the situations are predicted to be if No AWM, Low Input AWM and High Input AWM were carried out from now onwards under two different weather patterns:

1. **Optimal (worst case) – when weather patterns persist over the next four seasons that are the best conditions for Qff survival and subsequent proliferation.**

2. **Normal case – where normal weather patterns prevail in the GMV for the next four season.**

Data points for High Input AWM do not show up on the Figure 22 because they are too small when compared with data points from No AWM and Low Input AWM. Figure 5 demonstrates that High Input AWM is likely to confer a significant benefit in alleviating GMV's Qff problems.

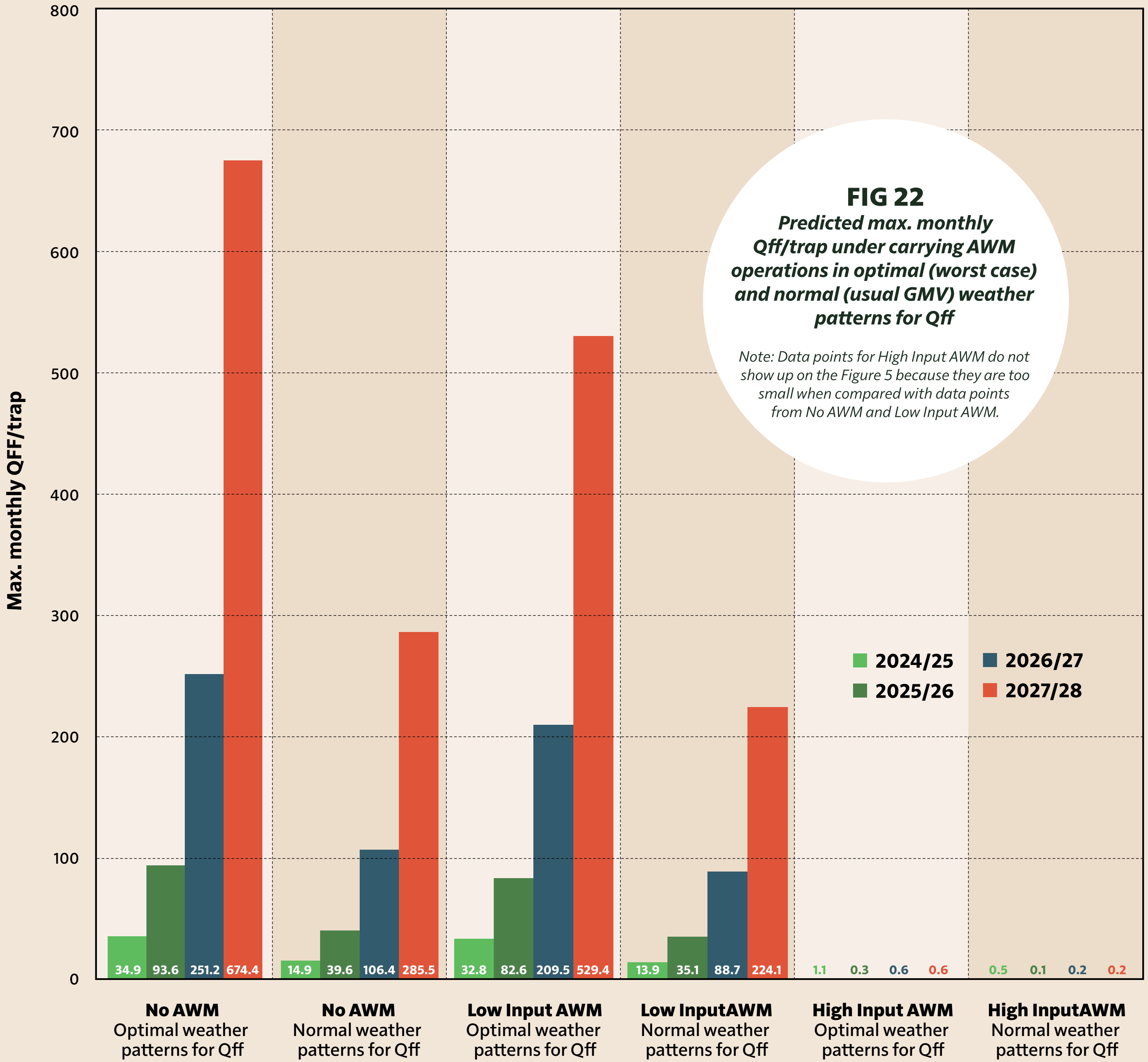


FIG 22

Predicted max. monthly Qff/trap under carrying AWM operations in optimal (worst case) and normal (usual GMV) weather patterns for Qff

Note: Data points for High Input AWM do not show up on the Figure 5 because they are too small when compared with data points from No AWM and Low Input AWM.

The similarity between predictions for the No AWM and Low Input AWM is concerning. The data suggest that the Low Input AWM strategy confers only slight benefits when compared with not having any AWM at all.

Data and predictions under a High Input AWM strategy show very low-level increases in Qff populations. It is anticipated that if High Input AWM strategies were put in place now, in 2024/25, there would be a sizable initial decrease in Qff. This situation occurred in the first year of the historical High Input AWM phase when Qff/trap dropped from 43.1 to 3.7. It is likely that similar suppression of Qff would occur over the next few years under a High Input AWM scenario.

Goulburn Murray Valley
Queensland Fruit Fly
Area-Wide Management Program

Analysis of the impact of Area-Wide Management, Sterile Insect Technique and the weather on Queensland fruit fly proliferation.

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