Final Report

Correlating fruit fly with cherry production and climate

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Project Number: CY13012

CY13012

This project has been funded by Horticulture Innovation Australia Limited using funds from the cherry industry and funds from the Australian Government.

ISBN 978 0 7341 3909 2

Published and distributed by:
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Contents

1. Summary

The project reported here presents four models which can be used to predict Queensland fruit fly (Qff) proliferation post-winter throughout Australia. These models are driven by the three-way relationship between Qff maturation through its various life stages, weather conditions up to and including harvest and cherry phenology.

Funding for this project was made available by the Australian Commonwealth Government and through levies paid by the Australian cherry industry. Although this report is written from the cherry perspective the models described therein can be applied to any crop and modified to suit any pest or disease whose proliferation in the field is dependent on weather.

The models presented here are:

- Model 1: High resolution maps based on (a) published accumulated degree-day models for pest insects and published literature on temperature thresholds for Qff development and maturation or (b) maps similar to Model 1 but modified with new temperature thresholds for Qff development and maturation in cool climates identified during research carried out under this project. Temperature data used are from the Australian Bureau of Meteorology.

- Model 2: Tabulated accumulated degree-days for each cherry production centre based on data used in (a) Model 1(a) and (b) Model 1(b)).

- Model 3: Based on the first likely Qff mating date and Model 1(b).

- Model 4: This is in its early stages of development and is based on the number of days during the winter period prior to harvest at ≤1.0°C and the number of days during the summer period prior to harvest at ≥36.0°C.

The models reported here, as they apply to Qff, are new and have been constructed without the use of sophisticated modelling technologies. Although all four models matched observed, real-life, fruit fly occurrences reasonably well they need to be assessed more rigorously by experts in biological modelling science and fine tuned into one usable model.

This report recommends that these models can be used by the cherry industry (and, potentially, other horticultural production industries) in two ways.

- To assess the economic viability, based on fruit fly impact on production and exports, of new cherry production regions.

- To add weight and extra scientific evidence to submissions for area freedom status, areas of low pest prevalence, pest free production sites or pest free places of production (as described in International Standards for Phytosanitary Measures) for current and future cherry production areas.

NOTE: There are many maps and hyperlinks to other maps in this report which need to be used for prediction purposes. They are generally too large to fit into this report. These maps are available separately. Maps included in this report are simplified versions.

ALSO NOTE: The software used to create degree-day maps can readily be modified according to (a) base date; (b) minimum threshold temperatures for fruit fly development and maturation; (c) accumulated degree-days for development; (d) contours and colours; (e) which years, or range of years, of weather data are used in the calculations.

2. Keywords

Fresh cherries, export, pest free area, model, Queensland fruit fly, *Bactrocera tryoni*

3. Introduction

Background

Cherries are recognised internationally as being able to host Queensland fruit fly (Qff) (*Bactrocera tryoni*, Froggatt). Qff can, therefore, be a quarantine impediment for exports. As a result of their positive host status to Qff fresh Australian-produced cherries are banned, or at least restricted, from many desirable interstate and international markets.

Much of Australia’s cherry crop can be produced without being impacted by Qff i.e. without the need for the application of pre-harvest or post-harvest technologies for control of fruit flies. Certainly Tasmania enjoys export facilitation as it is internationally recognised as free from pest fruit flies (i.e. Tasmania is a Pest Free Area (PFA)). Internationally accepted PFAs do not exist for cherries grown on the Australian mainland. This is despite the zero to minimal impact of Qff in many cases. The fact that Qff is either endemic to, or established in, areas where cherries are grown is sufficient for market access bans or restrictions.

There are two reasons for many mainland cherries being safe from Qff and consequently, on a quarantine basis, safe for export. One is that the area in which they are grown is free from Qff due to regional management systems, terrain or climate, but without domestic and international recognition of pest freedom. The other reason is that, although there may be a sub-detectable to low population present in or near the orchard, fruit remain pest free due to the interaction of climate with fruit fly biology. That is, weather conditions at, and prior to, the time cherries are ripe for harvest preclude fruit fly infestation.

Currently there is insufficient scientifically valid evidence in support of applications for access to many desirable markets based on climatic or seasonal freedom from Qff. The project reported here carried out research that will provide scientific data which can be used to construct protocols which, when carried out, will provide assurance of quarantine security.

Queensland fruit fly as a pest

The major fruit fly pest in eastern Australia is Qff as it can attack just about all commercial fruits and many vegetables. It is also of major quarantine concern to Australian and international markets which are free from this pest. This pest is therefore a problem for both production and export.

Fruit fly control

Historically, fruit flies have been managed either by cover spraying with pesticides, such as dimethoate and fenthion, or by growing fruit in areas that are free from these pests. Currently growers are facing extra difficulties in managing fruit flies due to recently imposed restrictions on traditional usage patterns for dimethoate and fenthion and multiple fruit fly outbreaks in hitherto pest free production areas. Growers, now, need to be more aware of the biology and ecology of fruit flies so they can practice in-field management options effectively. These options include monitoring with traps, baiting with attract and kill technologies and, potentially, more targeted applications of pesticides which ensure less impact on the environment, the grower and the consumer.

Queensland fruit fly distribution

The Queensland fruit fly is endemic to much of the north and east coasts of Australia from Darwin, to the east of Darwin down to the coastal regions of the border between NSW and Victoria. South Australia, Tasmania, Western Australia and many parts of the Northern Territory and inland Queensland, Victoria and NSW are free from Queensland fruit fly. Historically, populations of fruit fly have not established in regions to the west of the Great Dividing Ranges but in recent times multiple incursions into some of these areas have occurred and some of these are regarded as not feasible to eradicate. It should be noted that areas which desire recognition of pest free status need to provide a suitable volume of supporting data and demonstrate protection from incursions, monitoring, recording, notification, incursion triggers, incursion eradication, etc.

Survival of fruit fly

The livelihood of Queensland fruit fly is heavily dependent on temperature and the availability of water as well as the presence of host fruits. Sources of protein and carbohydrates are generally not limiting in most landscapes except under extreme temperature and drought conditions. Day-degree data are often used to model expected times taken above certain biological temperature thresholds and corresponding dates for insects to become sexually mature and attack fruit. These times and dates vary from region to region and are based on average daily temperatures and related insect growth rates.

In very cold winter climates fruit flies either die out completely and new populations arise from new incursions later in the year or they find suitable overwintering sites which allow them to survive until the average daily temperatures increase. In warm winter climates flies can attack ripe fruit in winter as long as average daily temperatures are biologically suitable.

There are adverse impacts on fruit fly livelihood due to the extremes of droughts and floods but, despite anecdotal evidence, there are few usable scientific data on this.

Climate based area of low pest prevalence

There is a common rule of thumb, particularly for coastal areas south of the Central Coast of NSW and inland regions, that fruit flies are not a problem to production of fruit crops that are harvested prior to Christmas. This is generally a valid rule. Its validity is due to a negligible to small overwintering population which, if it lays eggs into early season fruit (e.g. loquats and apricots), will take four months to mature and infest fruit due to cold to cool average daily spring temperatures. The rule breaks down if spring populations are higher than normal. This situation may occur if:

- Winter and/or early spring temperatures and rainfall are higher than normal,
- Large numbers of new incursions occur
- Populations that have built up from previous seasons have not been well-managed.

Fruit flies and cherries

The list of highly attractive hosts to fruit flies includes cherries. Traditionally, multiple applications of approved pesticides have been essential to the production of good quality, pest-free cherries. With the recent restrictions imposed on the usage patterns of dimethoate and fenthion questions have been raised as to the possibility of using fewer applications of these chemicals in areas where fruit fly populations are zero to low during fruit production and at harvest. Fly populations may be zero to low because the flies are naturally not there or due to fruit fly management practices. Such practices range from trapping and baiting, systems approaches, sterile insect release, orchard hygiene to exclusion netting.

Candidate climate based areas of low pest prevalence

It is quite feasible that some southern inland cherry production areas may be able to support fewer cover spray applications to control fruit flies to below economic thresholds. This is based on low numbers of flies overwintering and a long period from winter to summer where average daily temperatures cause extended fruit fly maturation times.

The areas that are most likely to suit would most likely be those situated to the south of Sydney's latitude – or maybe Newcastle's. Elevated areas such as Bathurst and the Blue Mountains may be applicable. Orange would be marginal especially as fruit flies have been trapped there in October, 2012 – much earlier than historical data report. Young, Griffith, Leeton and Victorian cherry production areas would probably fit the model.

Export development

If growers obtain approval to designate their production area as an Area of Low Pest Prevalence (PFA) or as a Pest Free Area (PFA) they will need to ensure, and show auditable evidence of, actions taken to maintain pest freedom (in the case of the PFA) or under a certain allowed level of pest (as in an ALPP) with data to prove it. The second scenario (ALPP) can be satisfied for interstate market access by ensuring that fruit flies if trapped fall below the outbreak trigger point designated by the Queensland Fruit Fly Code of Practice. For international exports bilateral negotiations will need to be entered into.

Systems approaches as described above can only be successful when the following issues are addressed:

- Delimiting the pest free area
- Trapping
- Testing for infestation of fruits in and around target orchards
- Management of nearby alternative fruit fly host plants
- Orchard and packing house accreditation
- Orchard sanitation
- Protection of packaged product during transport through fruit fly populated areas
- Maintenance of pest freedom
- Contingency plans for outbreaks
- Plans for re-instatement of systems approach after outbreak eradication

4. Methodology

Data collection

- Daily minimum and maximum daily temperature records for all regions in Australia from the beginning of record collection. These data were supplied by the Australian Bureau of Meteorology (BOM). Averages over the last 10 years with more detailed data on weather in cherry production districts around Australia (existing and potential future areas) were extracted from the BOM files.
- Maps of cherry production districts around Australia (present and future). These were supplied by Cherry Growers Australia.
- Fruit fly activity thresholds (mainly temperature but also humidity and rainfall). These data were gathered from published literature and from unpublished laboratory studies carried out under this project.

  These laboratory studies were carried out at NSWDPI's research site at Ourimbah on the Central Coast of NSW. This facility houses a colony of Qff which is less than 12 months old having been sourced, originally, from natural field infestations of various fruit (e.g. apples, peaches, guavas and feijoa) from southern NSW, the Sydney region and the Central Coast of NSW. All flies emerging from these fruit were examined to ensure 100% purity (i.e. no other fruit fly species such as *Dirioxa pornia*, the Island fly, or *Bactrocera neohumeralis*, the Lesser Queensland fruit fly, or fruit fly parasitoids present). Flies were reared under standard conditions at a constant 26°C and 60% rh to 70% rh with a day:dusk:night:dawn period of 12h:1h:10h:1h.

  Adult flies used in cold acclimation experiments were housed under similar conditions to the standard conditions described above but at different temperatures.

  Two types of fly were used in these experiments (1) Flies reared under standard conditions and (2) Flies reared under standard condition but at 20°C.

  Adult survival at a range of temperatures from -5.0°C to 26°C was assessed to test for survival during cold winters.

  Eggs collected from 20°C reared adults were seeded onto standard fruit fly larval diet (mixture of dried and diced carrot, Torula yeast, sodium benzoate, citric acid and water) and stored at various temperatures (6°C, 7°C, 10°C, 12°C, 14°C, 16°C, 18°C, 20°C, 22°C, 24°C and 26°C). Measurements of the times taken for larval, pupal and adult development were taken. These data were used to estimate minimum maturation temperature thresholds and accumulated degree-days for each life stage. These thresholds and accumulated degree-days were used as the bases for Model 1(b) as described below.
- The presence of alternative fruit fly host material in each cherry production district before, during and after harvest. This information needs to be collected from each target area. Some centres have been, or are in the process of, drawing up locality maps showing locations of fruit fly host plants as well as host plant fruiting phenology. These will be invaluable for delimiting fruit fly presence during the year.

- Presence or absence of fruit flies in target area. Data have been obtained from NSW and, to a lesser extent, Victoria. NSW data was provided through Pestmon which is a database of fruit flies collected from the National Fruit Fly Trapping Grid. This grid traps for native and exotic fruit flies using traps placed in horticultural production areas and in and around all entry ports (i.e. airports and shipping ports). Traps are monitored once a week in warm weather and once a fortnight in cooler weather. Data for NSW go back to 1996.
- The state of fertility of female fruit flies at the start of spring in each district - based on temperature records and survivability of fruit flies under those temperature regimes. This information is unknown but can be inferred from trap captures and infestation detections reported by Pestmon and also by various interested individuals in target regions. Inferences on the state of female fertility are also made based on overwintering temperatures.
- Published degree-day calculation methods or programs. Several degree-day calculators are available in the internet. The one chosen for this project (Snyder 2005) was found to be the easiest to understand, use and incorporate into the models being developed.

  It is likely that the type of degree-day calculation used in this report is not sufficiently sophisticated. There are many others (e.g. CLIMEX and DYMEX) that could be used. We chose a simple procedure to ensure ease of use for the grower.

These data were used to construct different models to predict fruit fly proliferation.

The models that were developed for this project are as follows:

Model 1

High resolution maps showing colour-coded regions between iso-lines that correspond to accumulated degree-days starting from 1 July using minimum temperature thresholds were constructed based on:

(a) Model 1(a): Published accumulated degree-day models for pest insects and published literature on temperature thresholds for Qff development and maturation or

(b) Model 1(b): Data similar to those used in Model 1 but modified with new temperature thresholds for Qff development and maturation in cool climates identified during research carried out under this project.

Temperature data (daily minimum and maximum temperatures for all Australian weather stations from the beginning of recording to mid 2014) used were supplied by the Australian Bureau of Meteorology. These data were averaged from 2004 to 2014 and average daily temperatures were then calculated and mapped.

Maps were produced using software capable of smoothing corresponding data points (i.e. those with the same accumulated degree-day value) into iso-line map contours. The R programming environment (R Development Core Team 2012) was used to create maps. It is a free software environment for statistical computing and graphics.

The geospatial mapping packages *raster* (Hijmans & van Etten 2012), *rgdal* (Keitt *et al*. 2012), *sp* (Pebesma and Bivand 2005, Bivand et al. 2013) and *fields* (Fields development team 2006) were used for the raster calculations, thin plate smoothing and mapping. The R package *oz* (Venables & Hornick 2014) was used to plot the Australian coastline and State/ Territory boundaries.

Model 2

Model 2 is based on tabulated accumulated degree-days for each cherry production centre.

> (a) Model 2(a) [Appendix 10]: Figures in tables are based on data collected for Model 1(a) with a minimum threshold temperature of the published 13.5°C and accumulated degree-days based on laboratory data collected for Model 1(b) or
>
> (b) Model 2(b) [Appendix 11]: Figures in tables are based on data collected for Model 1(b) with a minimum threshold temperature of the published 12.405°C and accumulated degree-days based on laboratory data collected for Model 1(b).

Degree-days were calculated using the simplest method, namely:

$$\mathbf{((T_{max}-T_{min})/2)-M}$$

Where T_{max} is maximum daily temperature, T_{min} is minimum daily temperature and M is the minimum temperature threshold. If the result is ≤ 0.0°C then the degree-day reading is 0. Accumulated degree-days for each day are calculated by adding degree-day readings sequentially from 1 July.

The minimum maturation temperature threshold and accumulated degree-days required for the completion of each Qff life stage estimated by NSWDPI laboratory tests described above were used in this model.

Model 3

This model varies from the more common models described in published literature in this subject. It is based on the first likely Qff mating date after winter, instead of 1 July, and Model 1(b).

We were unable to obtain data on daily temperatures at sunset. This is the time of day that Qff mate. Estimates were made on sunset temperatures by assuming that in areas where relative humidity is, on average, less than 60% (an assumption to fit most cherry production regions in Australia) the temperature at sunset would be 70% of the maximum daily temperature. Obviously this is a gross simplification but the model will be improved with future accurate records.

Daily degree-day calculations used in Model 2 in this model but the start date of 1 July was replaced by the start date being the first day that the sunset temperature reached 16°C (the minimum mating threshold temperature).

Model 4

This model is in its early stages of development and is based on the number of days during the winter period prior to harvest at below a certain daily minimum and the number of days during the summer period prior to harvest above a certain daily maximum. Additionally winter, early spring and summer rainfall data were incorporated into the model.

Data were obtained for two seasons in two regional centres where records showed that the first season had minimal Qff outbreaks and the second year had significant Qff outbreaks. The town chosen was Shepparton.

BOM weather data for 2013/2014 and 2014/2015 were used to count the number of days in winter 2013 and 2014 where daily minimum temperatures were ≤ 1.0°C and the number of summer days (up to the end of harvest – we chose an arbitrary date of 31 December) that were ≥ 36.0°C. BOM weather data was also used to count the number of days of rain during August, September and December.

The threshold temperatures of 1.0°C and 36.0°C were estimated from weather data for each production centre by simply testing the number of days beyond various temperature ranges for the greatest difference between the two years. This process is quite simplistic but was decided as appropriate because the differences in fruit fly numbers between the two years in these centres was marked. Also male traps in the first year were able to detect the first flies of the season but traps in the second season were not. Rainfall during winter has an impact on weed growth (winter refuge for adult flies as well as a source of protein and carbohydrates) and minimum temperatures. Rainfall during summer will facilitate Qff survival during heat waves. Sustained hot and dry weather will reduce fruit fly survival.

5. Outputs

- Four draft models that describe the interaction between post-winter temperature and fruit fly activity.
- A series of maps (of Australia and of each state) with iso-lines that correlate accumulated degree-days from 1 July averaged over 30 years from 1984 to 2014 with Queensland fruit fly maturation and development.
- A series of tables of accumulated degree-days from 1 July averaged over 10 years from 2004 to 2104 for town centres from individual cherry production regions in NSW, Victoria, South Australia and Tasmania. Entries in these tables are shaded according to the correlation of accumulated degree-days with Queensland fruit fly maturation and development.
- A series of monthly weather maps of Australia showing the temperature at sunset with iso-lines and indicator arrows that correspond with fruit fly mating activity.
- Tables of daily degree-days for each regional centres of each state where cherries are produced to be used in conjunction with the above mentioned weather maps showing sunset temperatures.
- A decision making tool for use in planning for fruit fly outbreaks and for fruit fly population increases.
- A decision making tool which can be used to assess green field sites for potentially adverse fruit fly impact.
- A tool which can be fine-tuned as new information on temperature thresholds for fruit fly activities becomes available.

6. Outcomes

- A new understanding of fruit fly survival and mortality (i.e. cold acclimation) under cool to temperate conditions.

- An understanding of the potential for, and limitations of, using degree-day models to predict population fluctuations of highly variable, mobile and adaptable insect pests.

- An improved understanding of the variables that impact on the interaction between Queensland fruit fly ecology, behaviour and biology with weather and host phenology.

- An improved understanding of the correlation between climatic variations throughout Australia and survival and proliferation of Queensland fruit fly.

7. Evaluation and Discussion

At the start of spring female fruit flies:

- May carry fertile eggs which can be laid straight away if temperatures are suitable and there are host fruit around. This would occur in areas with mild winters such as in sub-tropical and warm coastal temperate regions. Coastal eastern Australia from Sydney to the north would satisfy this.
- May carry non-fertile eggs but still have sperm stored in their spermathecae as so don't need to mate - just fly, lay eggs into readily available, suitably ripe fruit. The extent of this factor in fruit fly survival over the winter is largely unstudied but it is sufficient to suggest that areas of Australia that satisfy this parameter would not be greatly different from the areas described above. It is likely that the affected area may extend a little further south but still remain coastal.
- May carry non-fertile eggs and no stored sperm and require male flies to fertilise (i.e. mate) prior to egg laying - need correct temperatures for flying and mating as well as egg laying and hosts. This is the situation that would most likely describe regions in inland NSW and coastal and inland Victoria where populations of Qff have become established. Overwintering flies need to obtain water and carbohydrates in order to survive and to fly and then would need to access protein to mature their eggs, mate, fertilise their eggs and oviposit.
- May have eclosed from overwintering larvae and/ or pupae in which case will be at a similar maturity to the above flies except that ingestion of sugar and proteinaceous material is essential before oviposition. This scenario may apply to cherry growing regions where apples and quinces are growing but the numbers of insects overwintering in this way is likely to be very small. However, again, if fruit fly populations are allowed to be very high before winter sets in the likelihood of insect survival in apples and quinces over the winter will be relatively high.
- May not be in the area and need to be brought in by human mediated means or fly in from nearby areas or on the wind. There is always a risk to any crop production region. Tourists, locals returning to their homes, transporters and others can bring in infested fruit and even adult flies from warmer climates. It would be difficult to predict when flies from these fruit would establish a population and their numbers proliferate. Depending on their origin and state of maturity they would have accumulated any number of degree-days.

Models 1(a) and 1(b) and Models 2(a) and 2(b) assume that, as from 1 July, flies are in, or nearby, the target region and carry eggs that need to progress from zero maturation to maturation after achieving required accumulated degree-days above the minimum temperature threshold for maturation. Once their eggs have matured they will be able to mate and lay eggs. Model 3 takes account of this by finding the first suitable date for mating using local daily temperature recordings or calculating them from average weather data for their area and then commencing the accumulated degree-day model (from the time of mating rather than from the beginning of egg maturation in the unmated female).

Model 4 does not use accumulated degree-days. It relies on local weather records and past fruit fly outbreak records only and uses trigger parameters to predict the likelihood, rather than the date, of Qff proliferation during the coming season.

The onset of fruit fly proliferation is very dependent not only on weather but also on the existence of, and, if present, the size of, an overwintering population of fruit flies. If the overwintering population is small then fruit fly proliferation will not become detectable to an economically damaging level until first generation adults commence oviposition. Under situations where large populations have overwintered economic detection may occur during spring and early summer due to oviposition by adults that have overwintered. In this case economically damaging levels of infestation may occur early in the season.

When using maps and tables produced in this report it is important to decide which season commencing scenario is appropriate for the region being assessed:

- High overwintering population OR
- Low overwintering population

If the overwintering population is high then the onset of the first generation after winter will have a heavy and significant impact on available host crops. High overwintering populations are created by mild, wet winters and hot, dry summers prior to harvest. This scenario is most likely to occur:

- if fruit flies were a problem in the previous season and
- there were few days where the minimum temperature was <1°C and
- there were few days prior to harvest at >36°C and
- winter and early spring received more than average rainfall

then the grower should expect to deal with economically large populations at the first generation.

Conversely, if the overwintering population is low the onset of the second generation will most likely be the more economically damaging. This will occur:

- if there were low numbers of flies going into winter due to low numbers last season (or as a result of suitable fruit fly management such as traps, baits and cover-sprays) and
- there was an average number of days <1°C prior to harvest and
- there was an average number of days >36°C prior to harvest and
- there was an average number of rainfall days during winter and early spring.

8. Recommendations

To industry

Consider:

1. Using predictive models -
   a. Model 4 to decide if the overwintering Qff population is large or small based on previous summer and winter temperature extremes and rainfall for their location and
   b. Model 3 to observe current daily records of sunset temperature post-winter to determine the first likely Qff mating date and
   c. Use degree-day tables for the target location, or nearest weather station, to predict Qff activities and Qff population proliferation after the initial mating date (Model 3) then
   d. Comparing these data with production and harvest times for each cherry cultivar grown in the target region.
2. Using Models 1 and 2 to look at overall geographically-based potential for cherry production in existing and new production areas and
3. Using Models 1 and 2 to search for existing and new cherry production areas and corresponding cherry cultivars that will assure markets of freedom from adverse impacts of Qff to imports of fresh Australian cherries
4. Using Appendix 16 as a Biosecurity Plan to assess each region/ community for future fruit fly impact.

For future research

Consider:

a) A review of the basic assumptions and model designing used in this report by expert insect and crop model designers.
b) An expansion of Model 4 to test the assumptions used there in other regional centres where fruit fly populations have varied in impact from year to year.
c) More knowledge gap filling research on the biology, ecology and behaviour of Qff in cool to cold winter temperate climates and incorporation of these data into Models 1 and 2 leading to an improvement in prediction using these models.
d) Extrapolating the models reported in this report to commodities other than cherries and pests and diseases other than Qff.

9. Scientific Refereed Publications

No scientific refereed publications generated

10.IP/Commercialisation

No commercial IP generated

11. Acknowledgements

John Archer, Technical Officer, NSW DPI, CCPIC, Ourimbah

Christine Cruickshank, Technical Assistant, NSW DPI, CCPIC, Ourimbah

David Cruickshank, Technical Assistant, NSW DPI, CCPIC, Ourimbah

Lorraine Spohr, Biometrician, NSW DPI Chief Scientific Officer Branch, Ourimbah

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John Golding, Research Horticulturist, NSW DPI, CCPIC, Ourimbah

Simon Boughey, Chief Executive Officer, Cherry Growers Australia Inc

Stuart Burgess, Industry Services Manager, Horticulture Innovation Australia Limited

Staff of the Bureau of Meteorology, Australia

12.Cherry production in Australia

Australian Cherries are produced in six states, with New South Wales, Victoria and Tasmania being the three largest producers and South Australia is the fourth largest producer.

Tasmania has had a rapid expansion in plantings and has a strong export focus, enhanced by its relative pest and disease freedom. Both Western Australia and Queensland are relatively small producers primarily focusing on their domestic markets.

Australian Cherries are available from mid/late October to late February, depending on the state and seasonal calendar due to climatic variation and growing season.

Currently up to 12,000 tonnes of Australian Cherries are produced every year with 20% exported, with this expected to rise to 15,000 tonnes and 50% exported by 2015.

Table 1. Production of cherries in Australia

PRODUCTION BY STATE - 2010							
	NSW	VIC	QLD	SA	WA	TAS	Total
Maximum Volume (X 1,000t)	4.4	4.5	0.036	1.5-1.8	0.5	4.0	15
Area Of Plantings (Ha)	800	800	20-25	590	70	560	2,845
Businesses	108	95	18	118	70	76	485

Source: Cherry Growers Australia, 2013

13.Cherry exports from Australia[1]

Data on Australia's exports, values, destinations, volumes

Table 4 shows the major export markets for Australian cherries from 2007/08 to 2011/12.

Table 2. Major Australian export markets (tonnes)

Importing country	Export year				
	2007/08	2008/09	2009/10	2010/11*	2011/12
Hong Kong	349.8	731.1	701.2	211.4	317.2
Taiwan	323.7	312.1	373.2	210.8	236.3
Thailand	198.2	278.7	248.6	161.7	193.0
Singapore	183.1	237.7	122.3	51.4	111.8
Vietnam	15.0	17.7	36.9	53.5	77.3
Indonesia	12.6	24.5	26.9	53.5	49.9
Malaysia	37.9	75.6	57.2	61.8	46.9
Others	288.4	471.4	318.2	135.3	175.0
TOTAL	1,408.8	2,148.9	1,884.5	939.3	1,207.3

Source: GTIS – ABS.
Note: * 2011/12 covers the period October 2011 to February 2012, GTIS data (for this year) provided by Cherry Growers Australia, 2013

Information on export impediments

There are several impediments to the sustainable export of fresh Australian cherries.

Some of the major impediments to trade include:

- Quarantine, SPS (sanitary, phytosanitary) issues, pests and diseases – Queensland fruit fly and Mediterranean fruit fly are not the only pest or disease based impediments to trade. The range and identities of restricted pests and diseases varies from country to country and, of course, from crop to crop.
- Pesticide use, residues – Any use of pesticides against fruit flies or any other pest or disease must be used under approved label requirements. These approvals consider pesticide use effects on the person applying the pesticide, on the environment and on the consumer. If these treated commodities are for export then the importing country/ region must also approve the pesticides used. It is notoriously time-consuming and expensive to obtain registration of new chemicals. The non-approved use of these chemicals would act as an impediment to trade.

[1] Source: Cherry Growers Australia, 2013

- Variety, style of cherry grown – Markets demand different types of fruit. Some desire very large fruit while others prefer very sweet fruit. Fruit firmness and colour are also factors that vary from market to market. Also some cherry cultivars are more prone to transit damage and so are better for close markets rather than distant ones. Others store so badly that they are never exported.
- Tariffs, exchange rates – Tariffs and other local production protection facilities along with the high value of the Australian dollar make remunerative trade difficult to a number markets. This can lead to patchy supply – good in some years and not so in others – thus creating an unstable supply to individual markets.
- Length of supply window – Some markets demand that product be supplied only during nominated market windows. This makes marketing of short season fruits such as cherries particularly difficult.
- Competition from other suppliers – Generally fresh Australian cherries have a market advantage in being seasonal to lucrative northern hemisphere markets when cherries in those northern markets are out of season. However there is serious competition from other southern hemisphere countries particularly New Zealand, Chile and Argentina.
- Costs of air freight
- Fruit quality issues following sea freight
- Volumes available for supply
- Competition/ partition between importers
- Changes in importer quarantine restriction

Information on export promotants

There are also promotants to trade in fresh Australian cherries that include:

- Supply and demand – There is a market for Australian cherries due to their being produced counter seasonally to those produced in the major production areas in the Northern Hemisphere.
- Quality
- Gift giving – Common in North Asian countries
- Religious and cultural
- Health aspects – antioxidants, Vitamin C, fibre
- Preferences for different cherry types
- Organics, pesticide-freedom
- Freedom from pests and diseases
- Fill gap in local availability

14. Cherry production areas in Australia[2]

New South Wales

- Young
- Orange
- Hillston
- Mudgee
- Wellington
- Tumut/ Batlow
- Narromine

Victoria

- NE Victoria
- Swan Hill/ Sunraysia
- Goulburn Valley
- Yarra Valley/ Dandenongs

Tasmania

- Huon/ Channel
- Derwent Valley/ Coal Valley
- Tamar Valley
- NW Coast

South Australia

- Adelaide Hills
- Riverland
- SE South Australia

Western Australia

- Donnybrook/ Manjimup
- Pemberton
- Albany/ Mt Barker
- Perth Hills

Queensland

- Stanthorpe

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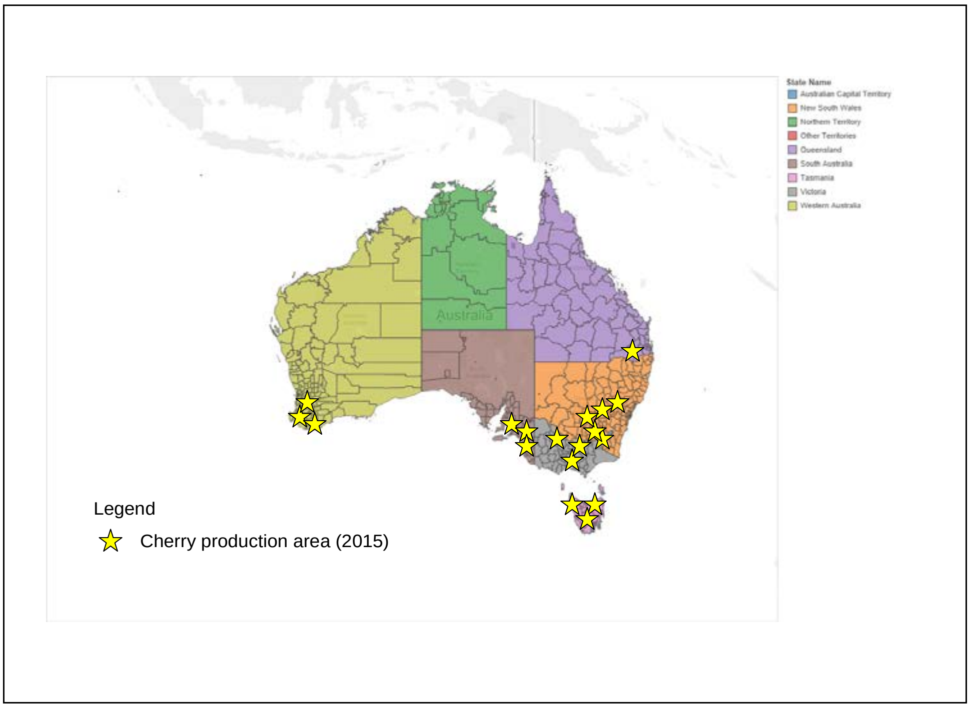
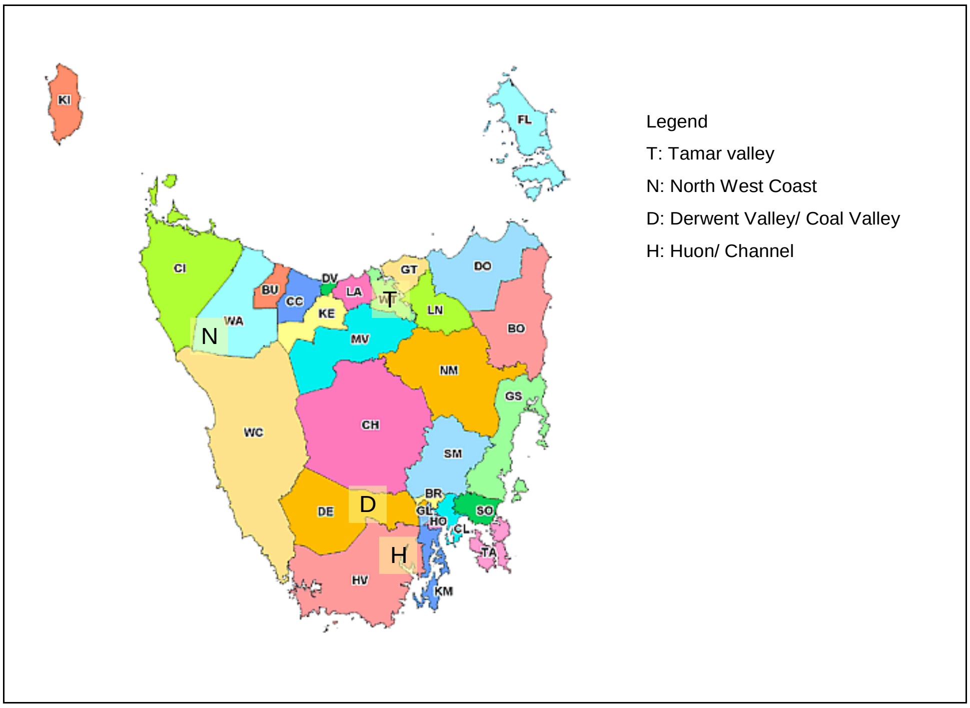
[2] Source: Cherry Growers Australia, 2013


State Name
Australian Capital Territory
New South Wales
Northern Territory
Other Territories
Queensland
South Australia
Tasmania
Victoria
Western Australia
Australia
Legend
Cherry production area (2015)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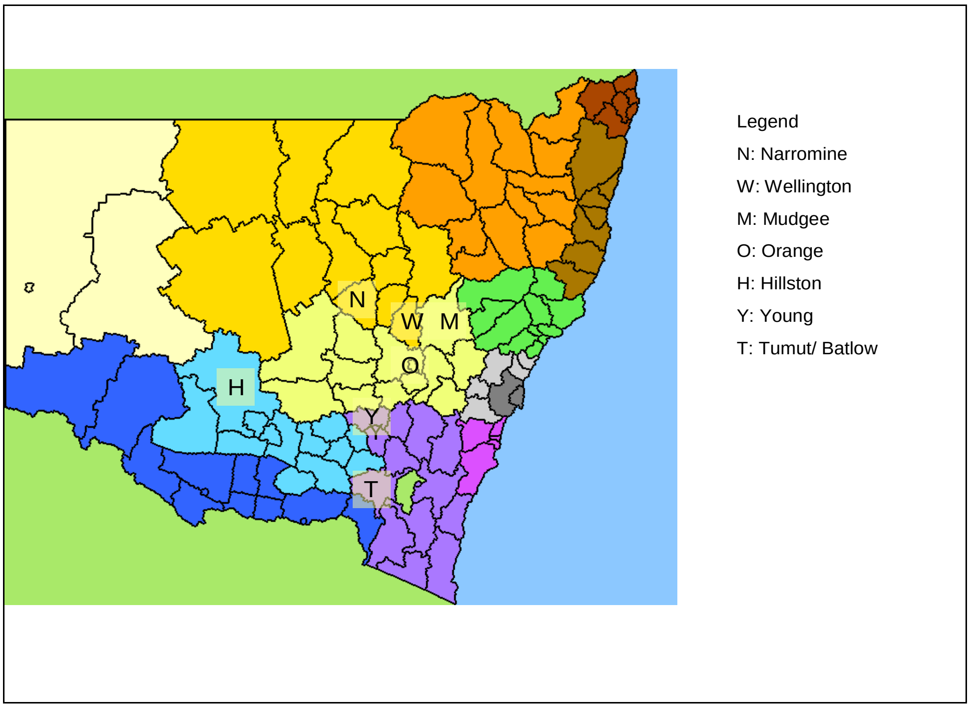
T: Tamar valley
N: North West Coast
D: Derwent Valley/ Coal Valley
H: Huon/ Channel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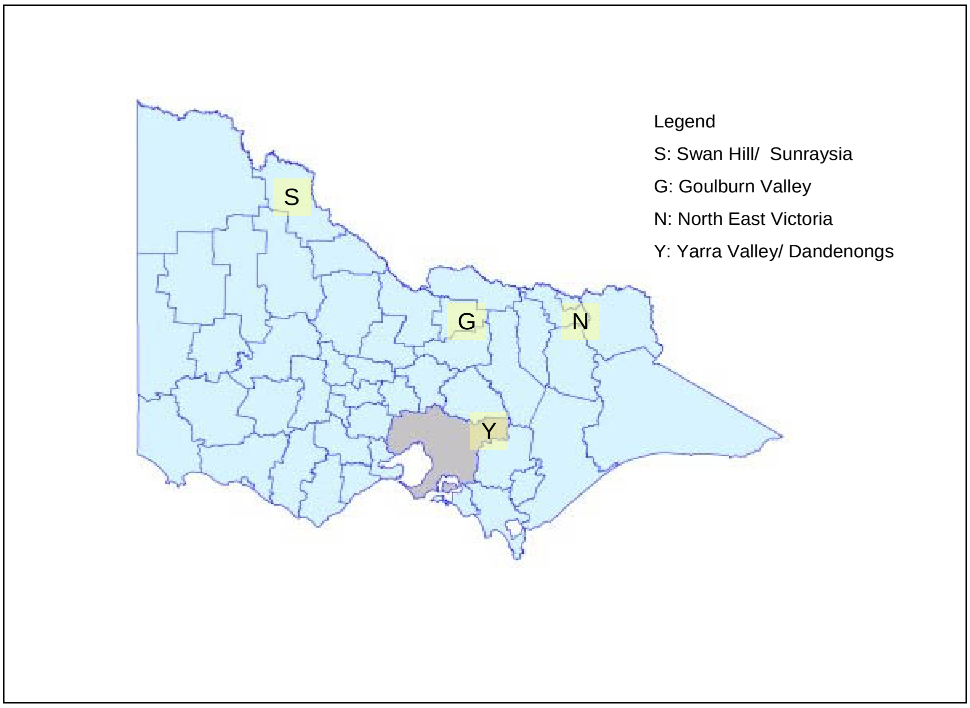
N: Narromine
W: Wellington
M: Mudgee
O: Orange
H: Hillston
Y: Young
T: Tumut/ Batlow


S
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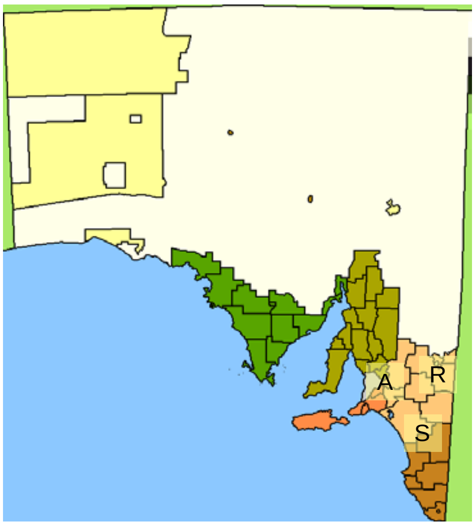
S: Swan Hill/ Sunraysia
G: Goulburn Valley
N: North East Victoria
Y: Yarra Valley/ Dandenongs

Legend

S: Stanthorpe



Legend

A: Adelaide Hills

R: Riverland

S: South East South Australia

Legend

PH: Perth Hills

D: Donnybrook/ Manjimup

P: Pemberton

A: Albany/ Mount Barker

15. Cherry cultivars grown in Australia[3]

New South Wales

The main varieties grown in the Orange cherry production region are: Ranier, Sweetheart, Simone, Lapin, Van, Merchant and Bing. The main varieties produced in the Young region include: Lapin, Stella, Ron's Seedling, Supreme, Burlat, Empress and Sweetheart.

Other varieties grown, to a lesser extent, include: Early Sweet, Earlise, Black Star, Sylvia, Simone, Chelan, Sweet Georgia, Brooks and Tulare.

Queensland

The main varieties produced in the Stanthorpe region of South East Queensland are: Bing, Stella, Lapin, Brooks and Early Sweet.

Other varieties grown include: Early Burlat, Burgsdorf, Supreme and Empress. More Australian-bred varieties are being tested and some look promising and production is likely to expand: Sir Tom, Sir Don, Dame Nancy and Dame Roma.

South Australia

The dominant varieties grown in South Australia are: Stella, Lapin, Merchant, Sweetheart and Simone.

Other varieties are: Bing, Supreme, Empress, Van, Summit, Sunburst, Kordia, Vista and Lambert. Varieties new to the region have recently been introduced and are likely to increase in popularity. These include: Black Star, Earlisweet, Sweet Georgia, Chelan, Earlise, Australise, Santinam Samba, Sylvia and Regina.

Tasmania

The main varieties are: Lapin, Simona, Sweetheart, Sylvia, Regina and Kordia. Sweet Georgia is a new variety there.

Victoria

Over 50 varieties are grown commercially in Victoria but many of the older, poorer performing varieties with short shelf life are being replaced. The main varieties planted today are: Merchant, Bing, Supreme, Empress, Stella, Lapin, Sweetheart and Van.

[3] Source: Cherry Growers Australia, 2013

The newer varieties planted include: Ferprime. Simone, Early Sweet, Royal Ranier, Sweet Georgia, Kordia, Chelan, Earlise and Australise.

Western Australia

Bing, Stella, Lapin. Sweetheart and Van are the main varieties. Some of the older varieties such as Merchant, Supreme and Empress are still grown.

Newer varieties include: Ferprime, Simone, Early Sweet, Royal Ranier, Sweet Georgia, Kordia, Chelan, Earlise and Australise. Other varieties are being tested across the region such as Sandra Rose, Samba, Index and Symphony.

16. Cherry harvest times[4]

Seasons

The Australian Cherry Season lasts just 100 days – spanning the spring and summer months.

The first cherry harvest starts in October/November in the eastern mainland states and extends through to late February with the majority of cherry crops harvested during December and January.

Queensland, New South Wales, South Australia and Victoria are the first to supply to market followed by Western Australia and Tasmania who reap their biggest returns in December and January.

Tasmania has the shortest harvest window – yet the third largest volume – at approximately eight weeks with the majority of the cherry growing states capitalising on three to four months of harvest.

Varietal diversity impacts seasonality and timing of harvest in Australia with wide-ranging premium stone fruit varying in colour, flavour and taste amongst a short supply season.

Seasonal factors such as rainfall, humidity and frost have the capacity to impact the volume and quality of cherry crops with precise care and management required by orchardists at harvest to maximise crop output.

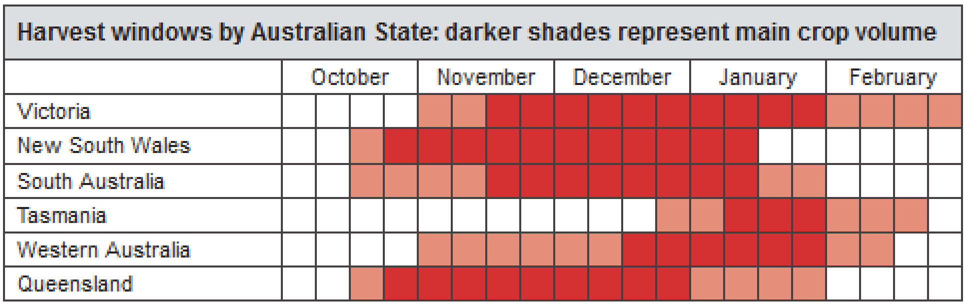


Table 3.

New South Wales

The cherry season in NSW starts around late October (Hillston and Narromine) and continues through Christmas finishing around mid January.

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[4] Source: Cherry Growers Australia, 2013

Queensland

The main production season is late October to late December, with some early varieties starting in mid October with later varieties lasting until late January.

South Australia

The main production season is mid November to mid January, with some early varieties starting in mid October (Riverland). It can last until late January with the newer later maturing varieties.

Tasmania

The Tasmanian cherry season commences mid to late December and continues through to late February.

Victoria

The main production season is mid November to late January, with some early varieties starting in early November and can last until late February with later varieties.

Western Australia

The main production season is mid December to late January, with some early varieties starting in early November and can last until February with later varieties.

17. Fruit fly species in Australia

- >270 Tephritid fruit flies in Australia (about 80 attack fruit, 8 of which are pests of commercial fruits and vegetables) [over 4,250 world wide of which 1,400 attack fruits]
- Not all of these pest fruit flies exist in all production areas in Australia e.g. no Medfly in Eastern Australia and no Queensland fruit fly in WA.

There are about eighty species of fruit fly that are native to Australia that infest mainly native fruit and vegetables but, of these, six are classed by the Horticultural Policy Council as pests of horticultural significance. They are:

- *Bactrocera tryoni* (Queensland fruit fly)
- *B. neohumeralis* (lesser Queensland fruit fly),
- *B. cucumis* (Cucumber fly),
- *B. musae* (banana fly),
- *B. jarvisi* (Jarvis's fruit fly) and
- *B. aquilonis* (Northern Territory fruit fly).

In addition to these native flies there are two exotic species which have established populations within Australia. They are:

- *Ceratitis capitata* (Mediterranean fruit fly)
- *Bactrocera frauenfeldi* (Mango fruit fly)

The Queensland fruit fly is by far the most destructive of the native Australian fruit fly species although another, non-native species, now established in parts of Western Australia and which arrived in Australia in the 1890s – the Mediterranean fruit fly (*Ceratitis capitata*) – is just as damaging and it, too, is a critical quarantine pest.

Queensland fruit fly and Mediterranean fruit fly are the two most import impediments to domestic and international trade in fresh Australian horticultural produce. They are the main reasons for trade restriction of the bulk of Australia's fruit and fruiting vegetable exports.

18.Fruit fly habits

The adult QFF is reddish brown to dark brown and more wasp-shaped than, and slightly smaller than, a house fly. It has a narrow waist between the thorax (the upper part of the fly's body where the legs are connected) and the abdomen. The thorax is decorated with two shoulder patches, two long stripes and various patches on each side. Patches and stripes can range from bright yellow through cream to, less commonly, white.

QFF is most active in warm humid conditions and after rain. QFF might be seen walking on the undersides of leaves or on maturing fruit. They readily take flight if disturbed. In the orchard the adults fly away from their overnight resting place when it is warm, and/or sunny enough to find water and food. Females start to look for a suitable fruit to lay her eggs into and males start to look for a suitable place from which to "call" or attract potential female mates to. During the middle of the day, depending on temperature and relative humidity, both males and females rest under large broad leaves. Later in the day the females travel to the males and mating may occur in the late afternoon, just before dark.

Males attract females by positioning themselves in a suitable tree. Such trees may have fruit on them or may be just large and dark, and therefore, cool, moist and safe. Often several males will pick the same tree and join in together to attract females. They do this by emitting a sex pheromone that they release from their bodies and beat with their wings to disperse it on the breeze. The sound of their wings is called "stridulation" and females will use the stridulation to home in on the males after initially detecting the scent of the sex pheromone. Once the female enters the site of the group of males – called the "lek" - the males then proceed to perform courtship dances. Quite often the male is on the topside of a well-lit leaf and the female under it. She can "see" the shadow of the male's movements through the leaf. She then chooses her mate based on the courtship dance.

Adult QFF need water which they obtain from dew, nectar and rain; sugar from nectar and other plant exudates and protein from yeasts and fungi which grow on plant surfaces, bird droppings, etc. Female flies need protein to help their eggs to mature.

QFF behaviour

Typically adult QFF:

- are most active from October to May
- are most active from dawn and the first few hours of the day and then towards late afternoon
- feed in host fruit trees
- rest in shady trees (fruit trees, ornamental trees and shrubs) during the day
- mate at dusk
- can survive throughout winter in protected sites

Typically female QFF:

- mate once or twice in a lifetime
- need to feed on a protein food source to allow her eggs to mature (males, too, need protein to become sexually mature)
- need to feed on a sugar food source (e.g honeydew, nectar) for energy
- commence egg laying one or two days after mating and continues throughout her lifetime
- lay eggs into healthy maturing and ripening fruit on the tree and sometimes into fallen fruit
- may resorb eggs during extended periods of cold weather

Seasonal development

QFF numbers tend to increase in spring when temperatures are warm and there is ready availability of suitable host fruit.

During winter months the QFF population may diminish. However, some QFF may survive the winter (overwintering) as adults by sheltering in protected places.

The livelihood of Queensland fruit fly is heavily dependant on temperature and the availability of water as well as the presence of host fruits. Sources of protein and carbohydrates are generally not limiting in most landscapes except under extreme temperature and drought conditions. Day-degree data are often used to model expected times taken above certain biological temperature thresholds and corresponding dates for insects to become sexually mature and attack fruit. These times and dates vary from region to region and are based on average daily temperatures and related insect growth rates.

In very cold winter climates fruit flies either die out completely and new populations arise from new incursions later in the year or they find suitable overwintering sites which allow them to survive until the average daily temperatures increase. In warm winter climates flies can attack ripe fruit in winter as long as average daily temperatures are biologically suitable.

There are adverse impacts on fruit fly livelihood due to the extremes of droughts and floods but, despite anecdotal evidence, there are few usable scientific data on this.

19. Fruit fly habitat ranges in Australia

Queensland fruit fly distribution

The Queensland fruit fly is endemic to much of the north and east coasts of Australia from Darwin, to the east of Darwin down to the coastal regions of the border between NSW and Victoria. South Australia, Tasmania, Western Australia and many parts of the Northern Territory and inland Queensland, Victoria and NSW are free from Queensland fruit fly. Historically populations of fruit fly have not established in regions to the west of the Great Dividing Ranges but in recent times multiple incursions into some of these areas have occurred and some of these are regarded as not feasible to eradicate. It should be noted that areas which desire recognition of pest free status need to provide a suitable volume of supporting data and demonstrate protection from incursions, monitoring, recording, notification, incursion triggers, incursion eradication, etc.

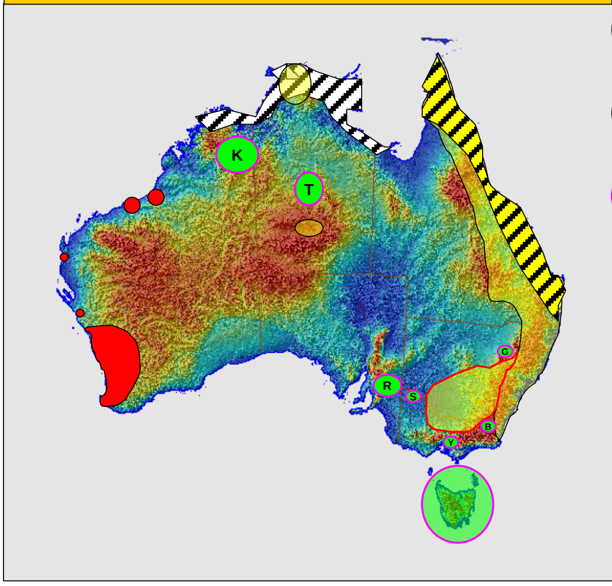
Queensland fruit fly has been an impediment to fruit production in Australia since the late 1890s in south eastern Queensland in particular. Although there are records that it has been known as far south as Kiama in NSW it is thought to have spread with the planting of new suitable hosts to which it rapidly became adapted. There is a temporal and geographic continuum of ripening to ripe fruit along the east coast of Australia, now, from north to south and the fly has acclimatised to varying climates, geographies and host plant species.

During the 1940s it was thought that Gosford on the Central Coast of NSW was the southernmost limit and that populations of Queensland fruit fly would not persist beyond the odd outbreak or two west of the Great Dividing Range. At that time it was thought highly unlikely that Queensland fruit fly populations could establish themselves in cool to temperate fruit growing regions in southern NSW and in Victoria due to the cold temperatures experienced in those regions in the winter. Since then the Queensland fruit fly has shown a remarkable ability to adapt to these areas. In the last 10 years it has spread even further into regions hitherto un-populated and has established itself there. It may be that climate change has assisted this movement and subsequent adaptation but this pest’s innate ability to adapt is significant.

From the early 1900s to the early 1940s Queensland fruit fly was not the main tephritid pest of our fruit crops. The major fruit fly pest was Mediterranean fruit fly (*Ceratitis capitata*, Weidemann) which invaded Western Australia in 1896 and spread into eastern Australia some 10 years later. This pest was dominant for many years but eventually died out from eastern Australia in about 1941. Several reasons have been conjectured on how this happened – competitive displacement by Queensland fruit fly, effects of extended droughts at that time, etc.

The figure below shows the current habitats of pest fruit fly species in Australia. It also includes locations of designated fruit fly pest free areas.

Pest fruit flies and pest free areas in Australia



Mediterranean fruit fly

Queensland fruit fly

Qld fruit fly – new incursions

Tropical pest fruit fly species

Fruit Fly Pest Free Areas

Tasmania

Major pest fruit fly species:

- *Bactrocera tryoni*
- *Ceratitis capitata*
- *Bactrocera jarvisi*
- *Bactrocera neohumeralis*
- *Bactrocera frauenfeldi*
- *Bactrocera musae*
- *Bactrocera cucumis*
- *Bactrocera aquilonis*

20.Fruit fly life cycle

There are four stages in the life cycle of QFF: egg, larva (maggot), pupa and adult.

Completion of the QFF life cycle is dependent on temperature and moisture. Each stage in the life cycle may take from a few days to several weeks but under favourable conditions one generation takes about 4 weeks.

Eggs

QFF eggs are generally inconspicuous. If you cut the skin around the sting site to a depth of no more than 4mm you can see fruit fly eggs, or their egg cases, if the eggs have hatched. Eggs are smooth and white to creamy white measuring about 0.9mm to 1.2mm by about 0.4mm. They are slightly bent like a banana. Depending on the temperature around the fruit eggs will hatch in 24 to 48 hours from egg laying.

Maggots (larvae)

A small legless maggot, the larva, emerges from each egg. Larvae develop through three growth stages but look similar in each stage. Larvae grow from about 1.2mm long and 0.3mm wide up to around 8mm to 10mm long and 2mm wide. Usually they range from almost colourless when small to a creamy-white when they are large. Sometimes they have a little extra colour in a stripe down the body which is colour picked up from the fruit and swallowed into its gut.

The larva is long and tubular with a blunt end and a sharp end. In the larger larvae a pair of dark brown to black toothed mouthparts can be seen.

Many larvae can develop in each fruit. Young larvae tend to eat their way towards the centre of the fruit.

Decay begins inside the fruit while the outside of the fruit may appear intact.

When the largest larvae are mature enough to form a pupa or “cocoon” they develop a “jumping” or “hopping” habit which can easily be seen. The larva use their mouthparts to gab their backside and curl up into a circle. They build up pressure in their internal organs and then suddenly let go. If their backside is against something solid they can hop about 10 to 15cm high and long. These hops are random so hopping is a good way of avoiding predators.

Larvae live inside fruit for 6 to 20 days or more depending on temperature and what sort of fruit they are growing in. Cherries, for instance allow fruit flies to grow quickly but some apple varieties make them grow quite slowly.

Pupae

Larvae, when they are old enough, leave the fruit and burrow into the soil beneath the tree to pupate. Each larva forms a hard, brown barrel-like pupal shell from its skin. Inside this case the pupa develops into a fly. Pupae, or “cocoons”, are white through to cream to honey brown to dark brown. They measure from 2.5mm by 1mm to about

4mm by 2.5mm. They generally pupate in the soil or ground litter under fruit trees or vegetable crops. Sometimes pupae can be found in mummified peaches, apples and citrus either still in the tree or on the ground.

Pupae remain in the soil for 8 to 15 days before the adult fly breaks out, depending on the temperature. Some observers have found pupae remaining viable for a month or two in the ground in winter.

Adults

QFF adults emerge from their pupal cases in the soil and burrow towards the surface. There they inflate their wings and fly to find shelter, food and water. Usually, males and females mate at about 6 to 10 days after breaking out from their pupae. After mating the female can lay fertile eggs within a day. The female Queensland fruit fly can lay more than 2,000 eggs in her lifetime after just one mating. If the female is to survive a cool winter she may have to resorb her fertilised eggs for energy as she will not move very far in the cold. To lay more eggs, then, she will have to mate again when the weather warms up in Spring.

The female will mate one to three times during her lifetime. Males will mate many times.

Adults can live for many weeks.

The female QFF has a retractable, needle-sharp egg-laying organ (the ovipositor) at the tip of her abdomen. Using the ovipositor the female QFF digs a flask-shaped chamber about 3 mm deep in the outer layer of the fruit where 3 to 12 eggs are laid at a time.

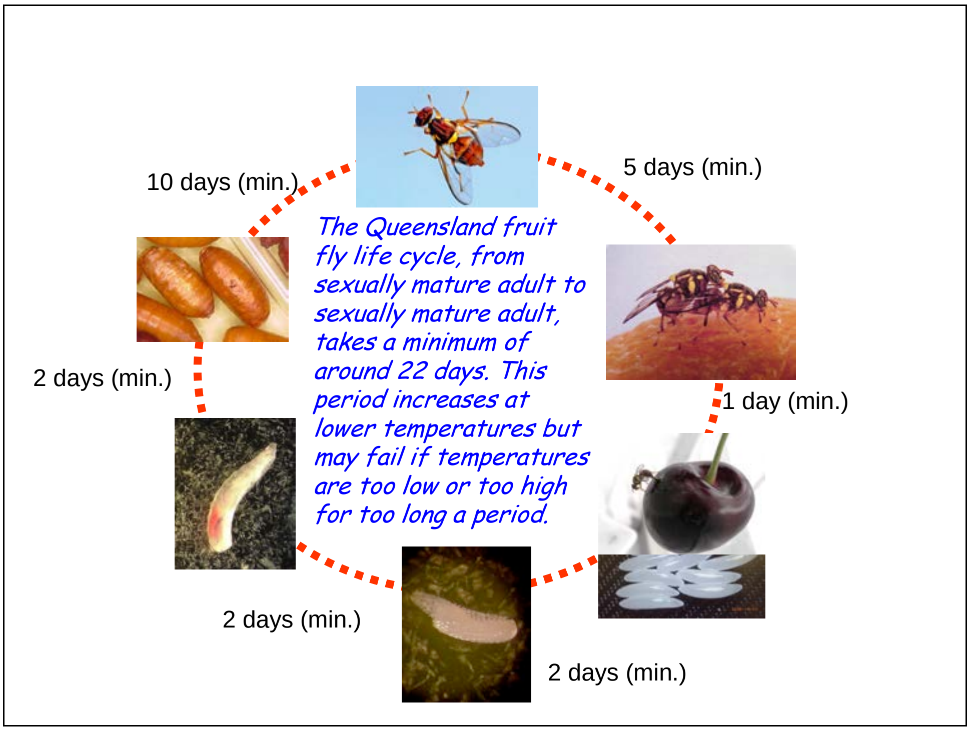
Eggs hatch within a minimum of 24 to 48 hours

Larvae grow in length from about 2mm (first larval instar [stage]), through 5mm (second larval instar) to 8 to 10mm (third larval instar) in fruit over a minimum of 7 days up to 40 days in cool weather and then jump out of the fruit.

After leaving the fruit the larvae become pupae and stay in the ground or mummified fruit – for a minimum of 10 days up to about 20 days in cool weather

After a minimum of 10 days the adult fly emerges from the pupal case. It takes one to two weeks for the flies to mature, mate and lay more eggs.

- 1 generation takes 22 to about 70 days


10 days (min.)
5 days (min.)
The Queensland fruit fly life cycle, from sexually mature adult to sexually mature adult, takes a minimum of around 22 days. This period increases at lower temperatures but may fail if temperatures are too low or too high for too long a period.
2 days (min.)
1 day (min.)
2 days (min.)
2 days (min.)

21.Fruit fly mortality relationship with temperature and humidity

Survival of fruit fly

The livelihood of Queensland fruit fly is heavily dependent on temperature and the availability of water as well as the presence of host fruits. Sources of protein and carbohydrates are generally not limiting in most landscapes except under extreme temperature and drought conditions. Day-degree data are often used to model expected times taken above certain biological temperature thresholds and corresponding dates for insects to become sexually mature and attack fruit. These times and dates vary from region to region and are based on average daily temperatures and related insect growth rates.

In very cold winter climates fruit flies either die out completely and new populations arise from new incursions later in the year or they find suitable overwintering sites which allow them to survive until the average daily temperatures increase. In warm winter climates flies can attack ripe fruit in winter as long as average daily temperatures are biologically suitable.

There are adverse impacts on fruit fly livelihood due to the extremes of droughts and floods but, despite anecdotal evidence, there are few usable scientific data on this.

Climate based area of low pest prevalence

There is a common rule of thumb, particularly for coastal areas south of the Central Coast of NSW and inland regions, that fruit flies are not a problem to production of fruit crops that are harvested prior to Christmas. This is generally a valid rule. Its validity is due to a negligible to small overwintering population which, if it lays eggs into early season fruit (e.g. loquats and apricots), will take four months to mature and infest fruit due to cold to cool average daily spring temperatures. The rule breaks down if spring populations are higher than normal. This situation may occur if:

- Winter and/or spring temperatures and rainfall are higher than normal,
- Large numbers of new incursions occur
- And/or populations that have built up from previous seasons have not been well-managed.

Fruit flies and cherries

The list of highly attractive hosts to fruit flies includes all stone fruit: apricots, peaches, nectarines, plums, hybrids, etc and cherries. Cherries are listed in official tables as able to host Queensland fruit fly (see Table 1). If cherries are grown in areas where fruit flies are endemic or established multiple applications of approved pesticides have traditionally been essential to the production of good quality, pest-free fruit. With the recent restrictions imposed on the usage patterns of dimethoate and fenthion questions have been raised as to the possibility of using fewer applications of these chemicals in areas where fruit fly populations are zero to low during fruit production and at harvest. Fly populations may be zero to low because the flies are naturally not there or due to fruit fly management practices. Such practices range from trapping and baiting, systems approaches, sterile insect release, orchard hygiene to exclusion netting.

How they come into a new area

One way is by being carried in by unwary produce transporters and the public in infested fruit and vegetables. The New South Wales Government protects the fruit fly free status of the Murrumbidgee Irrigation Area by constructing a system of signs, dump bins, random road blocks and fines on roads leading into the area. It was suggested that the Asian papaya fruit fly incursion that occurred in and around Cairns, in northern Queensland in 1995 was caused by travellers entering Australia from Asia with infested fruit.

Given favourable weather conditions and irrigation practices flies can move from one region into the next and establish there. If conditions are good in the new region the fruit fly population will increase and then spread to the next region providing there is a link between the regions that is suitable to fly survival and/or movement.

Australian weather patterns are notoriously variable. It is possible for mild winters and wet summers to occur every now and again in areas where, on average winters and cold and wet. These regions, such as the Riverina, in New South Wales, are usually fruit fly free because of the adverse winter climate. However, when there is a change, if there happen to be any flies surviving in small pockets with a favourable micro-climate, such as the compost heap or near a brick wall adjacent to a fireplace, fruit fly populations could expand. We think this happened in and around Leeton, in southern New South Wales from 1999 to 2001. Also, if people mistakenly bring in infested fruit and throw them out into the compost heap during these times then that, too, would add to the possibility of fruit flies establishing themselves.

Irrigation, water courses and rivers can act as conduits for the establishment of new fruit fly populations especially if the water ways are lined with fruit fly host plants. These host plants can be commercial plantations, backyard or hobby farm gardens or feral, self-sown hosts such as loquats and peaches.

It is possible that fruit flies can move from one region to the next as a result of winds. It has been shown that the melon fly will move from island to island near Japan and Taiwan on the wind. If enough flies arrive in the same spot within a few weeks then a new population will be able to start.

District

Fruit flies can be a pest all year round if environmental conditions allow. Parts of coastal Queensland can be warm enough for fruit flies to remain sexually active all year. The further inland or the further south you go the fewer generations of flies you get each year. Some fruit fly species are less tolerant of cool conditions and so will not move very far south. For example, the Lesser Queensland Fruit Fly, *Bactrocera neohumeralis,* will not venture much further south than Coffs Harbour on the Mid North Coast of NSW. The cucumber fly, *Bactrocera cucumis*, cannot be found further south than Brisbane in Queensland. The limiting factors, here, are temperature and relative humidity. If the temperature remains above about 20°C all day and most of the night all year then it is possible to have a fruit fly problem all year. Twelve generations of Queensland fruit fly a year are possible in these districts.

Cooler districts on coastal NSW around Sydney may allow only 5 of 6 generations of Queensland fruit fly a year while areas with even cooler winters, such as Young, a cherry production area in southern NSW, allow only 2 or 3 generations a year.

In some districts winters are so cold that all fruit flies are killed by exposure to the cold and the insect dies out. The Murrumbidgee Irrigation Area of NSW and Tasmania are examples of this sort of climate. Flies can build up again in these areas by two ways. Firstly if last winter was relatively mild then adult flies can survive and then re-mate and build up again the following spring. Alternatively new flies might come into the area in infested produce being brought in. This causes an outbreak of new flies and the start of a new population of fruit flies for that region as the weather warms up.

Time of year – winter, Christmas

As mentioned before some districts have pest populations of fruit flies all the year. Other, generally cooler, areas can get away with producing crops in the late autumn to spring. In Sydney, after a normally cool winter, tomatoes can be grown fruit fly free if planted early so that fruit ripens before Christmas. Generally cherries from Young are harvested before Christmas and, most often, do not need to be treated against fruit flies.

Weather – Rain, Humidity, Temperature

Weather cannot be predicted very accurately, especially in coastal Australia. Fruit flies do react to weather, though. Fruit fly problems will be lessened during extended droughts. Flies will regain problem status quite rapidly after rain. This implies that flies are not killed during droughts. They are just not laying eggs – they are waiting for more favourable climatic conditions in which their offspring will have a better chance for survival.

Depending on weather, availability of fruit and predation:

- 1 generation (egg to egg) takes 22 to 70 days
- The average adult fly lives from 2 to 4 months
- One mated female could produce 400 female and 400 male offspring in her life time

22.Fruit fly diurnal and seasonal activities

Night

Apart from responses due to disturbance there is minimal movement at night. If possible, i.e. if it is not below temperature thresholds for movement the fly will move to the most comfortable and safe refuge it can detect. If it is so cold that the flies are in torpor they will have placed themselves in a spot where dislodgement in unlikely. However, if they do fall to the ground they will survive overnight even if the temperature goes to at least as low as -5°C for several hours – unless preyed upon.

Mating flies may remain coupled for several hours after full dark has fallen, They then disengage. It is then likely that they spend the night close to each other and not move very far (unless disturbed).

Morning

In the morning flies start moving in response to sunshine and temperature. On cold mornings they to sunshine to “re-charge” but that cannot expose themselves in the open due to risk of predation, They can be found on the undersides of leaves (e.g. young lemon leaves) whose upper surface face the morning sun.

After recharging a little through the leaf blade the fly can then move to the exposed surface to complete its recharge before flying off in search of water, carbohydrates and amino acids.

Morning activities generally include searching for and feeding on water, sugar and protein sources. It is also at this time that male flies are attracted to parapheromones, both naturally occurring semiochemicals and synthetic ones such as those used in fruit fly traps. It is also at this time that female flies search out suitable host trees for oviposition.

If females and males have not been able to secure amino acids in their foraging or they are newly eclosed adults they will not be attracted to parapheromones (males) or oviposition sites (females). These flies will keep foraging for food and shelter.

Afternoon

As the day warms up flies will respond to potential heat stress by moving to cooler and protected refuges away from the heat and wind, and the consequent risk of desiccation, and predation.

The question here is: do males take refuge in trees where they will form leks later in the day? Or do they move from their refuge from heat stress to lek trees later in the day for mating? If the latter: how are they attracted to the lek tree? It is possible that one male’s stridulation and pheromone release in a suitable lek tree will attract other males to that site. If the fruit fly population is high a number of lek sites could form within the near vicinity. If the latter is not true then males may stay in the refuge until late in the day and use that site for setting up a lek.

Do females react similarly to males as described above? Do they purposely take refuge in a tree with suitable host fruit? The possibly do as oviposition occurs just prior to the warmest part of the day. They do protect their oviposition site for a short time after oviposition (about 1 hour???) to protect their offspring from other fruit fly ovipositions.

Females can be divided into three groups. Each group may vary from each other in their activities later in the day.

1. Immature females will maintain their foraging for food and shelter until ready to seek out males. This is when they have fed on sufficient amino acids to allow for fertilisation of their eggs.
2. Mature but unmated females will leave their refuge and search for males with whom to mate.
3. Mated, gravid females will probably maintain searching for sustenance and oviposition sites. Do they lay eggs in the afternoon? They don't need to find a male and mate for at least a couple weeks. They do need to replenish their protein status in order to fertilise new eggs after previous ovipositions. Sperm from their previous mating will be stored in the female's pair of spermathecae and let down in response to the need to fertilise new eggs. In warm weather that is suitable for fruit fly mating and oviposition it is likely that most of these females will not survive long enough to require remating.

[I have not addressed the so-called male "dispersal phase" yet. Not a lot is known about this although there have been some publications on this. This aspect of fruit fly activity needs to be addressed in more detail.]

Dusk

Mature males tend to gather together in small groups of up to about 12 flies called "leks". Just before dusk these flies commence wing fanning which makes a sound ("stridulation") and helps disperse sex pheromones. Both stridulation (sound) and pheromones (scent) act as attractants to mature, unmated females.

Effect of season

Diurnal activities will vary with season. Protein based trapping data show that, as winter approaches in the autumn and recedes in the spring, flies, both male and female forgo their urge to procreate and spend their time, at temperatures above their minimum thresholds for movement, foraging for food and shelter. At low temperatures they hardly move at all as long as they are safe from extreme cold stress, wind, desiccation and predators. Without the need to sequester a large proportion of their nutritional reserves to high energy consumptive activities such as sperm production, egg production, mating and oviposition flies can live for a much longer time in cool weather than in warm weather. In the summer flies the dominant proportion of their energy is used for procreation while in the winter flies use their energy mainly for survival over the winter. This phenomenon has important ramifications for fruit fly trapping as well as in understanding what are their overriding reasons for survival at different times of the year.

It is highly unlikely that adult flies would overwinter in deciduous crops due to exposure to the elements and to predators. It is most likely that they move to more sheltered areas not far away from oviposition sites. There have been many observations of flies moving from deciduous trees to evergreen trees as winter approaches. In particular lemon trees in house paddocks have been found to harbour flies in the winter.

This leads to the question of what eggs, larvae and pupae are doing throughout the years. Where are they in the landscape? Eggs and larvae reside, mostly, in fruit although mature third instar larvae may have left fruit and are on or in the ground just prior to pupation. Pupae are generally in the ground but some, especially in the winter, may have formed inside mummified fruit such as apples and quinces. Certainly *Ceratitis capitata* and *Bactrocera oleae* will pupate inside fruit during periods of hostile climatic conditions.

Fruit inhabited by eggs and larvae (and, possibly, pupae) may be situated intact on the tree, off the branch but still lodged in the tree or on the ground.

Eggs and larvae are very susceptible to temperature, especially eggs. Generally, temperatures within infested fruit that is still connected to the tree are tempered by respiration and transpiration even when the fruit is exposed to the sun. On the other hand, temperatures inside detached fruit which is lying in the sun can reach levels that are lethal to immatures.

Eggs, larvae and pupae in fruit or in the ground (late third instar larvae and pupae) during winter will be slower to mature than in the summer. There is plenty of evidence of the in publications and through observations. Adults react to cool weather in the same way – as described earlier.

Some fruit, especially some citrus and passionfruit, drop quite readily upon infestation with fruit fly so population reduction is feasible of these fruit are exposed to the sun during the heat of the day. Therefore, orchard floor management (e.g. weed slashing) is an important aspect of ensuring fallen fruit is exposed to the sun (as well as to frugivorous animals (e.g. sheep, cattle) and birds (e.g. fowls) and other predators.

Another potential impact on fruit flies pupae is flooding, whether for irrigation or as a result of storms. Research indicates that flooding will not ensure full eradication of pupae in the ground as even as long as seven days submersion will not kill 100% of Queensland fruit fly pupae.

What do adult flies do when it is rainy or windy? For an insect which is so successful in its incursion potential the Queensland fruit fly is remarkably affected by the presence of free water. That is, they jump into the water, their wings stick to their body and, if they can't become dry they will drown, or be preyed upon as they can't fly. Therefore, on rainy days, flies must keep out of the rain. They do this by finding refuge under leaves, in cracks in the bark of trees and other places.

Rainfall also reduces daily fluctuations in the temperature. Such tempering of low and high temperature promotes survival in the winter and the summer. It raises local relative humidity which also tempers the effects of extreme weather as well as promoting weed growth for alternative refuge and oviposition sites and growth of bacteria, fungi and yeasts over the landscape (e.g. crop, weeds, refuge areas) which serve as feed sources for flies. Increased dew levels improve adult survival and reduces desiccation effects on eggs, larvae, pupae and adults. Orchardists are less able to get into orchards to slash weeds due to inclement weather and risk of bogging. Weed proliferation, particularly in winter and early spring, and in deciduous crops, will improve the chances of overwintering flies surviving the cooler months. Flowering weeds also act as sources for carbohydrates (e.g. sugars) which are essential for the survival of newly eclosed adults and adults coming out of winter.

Information on the effects of light winds and upwind anemotaxis on fruit fly movement needs to be added here. That is, more ecological research on this should be done to assess its impacts on fly behaviour and how we can exploit it.

Impact of beating of raindrops on pupation and adult eclosion: There is evidence that adult flies eclose in response to rain by responding to the raindrop impacts. This seems a logical approach in that is ensures that the fly will emerge into moist conditions or at least high relative humidity. Similarly, when infested fruit is impacted by rain or when it falls to the ground, larvae are stimulated to leave the fruit and pupate in the soil beneath. This, too, is ecologically sensible as larvae in fruit are very susceptible to predation by frugivorous animals and birds. Also the soil will be moist and will not cause excessive desiccation of the pupating larva.

Hot weather will also impact on the survival of fruit flies. If relative humidity, during hot weather, is high then it is likely that flies will survive at quite high ambient temperatures because they will be able to move to more comfortable sites with a deceased risk of desiccation. In more inland regions where relative humidity is low (less than about 50%) high temperatures (above about 36°C) will be lethal unless flies are able to find suitable refuges. Desiccation would be a significant factor in mortality especially if it is also windy. Not only will flies avoid flying, and this includes, importantly, flying into pest monitoring traps (both male and female biased traps), heat also impacts on fruit fly behaviour. They are less likely to fly to oviposition sites, mate and lay eggs – even to find water, especially if there is no dew formation. Hot weather reduces pollination of fruit trees and results in a reduction of suitable host fruit for fruit fly oviposition. It also reduces the amount of bacteria, fungi and yeasts in the field and so reduces the availability of food sources. It can be said that similar adverse impacts on fruit fly behaviour occur during extreme low temperatures too.

23. Temperature thresholds for fruit fly activities

1. Adult mortality: 5 to 7 consecutive days at -7.0°C to -10.0°C (Fletcher 1979, Meats and Fitt 1987a, 1987b [see Muthuthantri 2008]). In areas of the former Fruit Fly Exclusion Zone it was considered that “the risk posed by overwintering adults is small” (Qff COP 1996). If nightly minima drop to <-3.0°C adults will die (Meats 1981).
2. Larval mortality: Following 5 consecutive days where average daily temperature is <11.5°C “all larvae were assumed to die” (Qff COP 1996). Eggs and larvae will not survive if daily temperature rises to 38°C (Meats 1981).
3. Egg laying: between 5°C and 38°C; pre oviposition period: egg laying commences from minimum 6d post adult eclosion (at constant 26°C) to about 14d to 21d. Under optimal weather conditions males also take this long to become sexually mature (is this pre maturity stage the dispersal phase for males?); TM_{50} (time to 50% female maturity) from 8d to 40d in field; egg laying may continue after initial mating for up to 280d in laboratory (shorter in field). Populations growth will cease (due to zero egg production) when there are 5 consecutive days where the daily maximum temperature is ≤18°C (Yonow 2004). Muthuthantri 2008 shows that flies will lay eggs at lower temperatures even when Yonow 2004 model is applied. Qff COP (1996) states that egg development ceased at 5 days where average daily temperature was <12°C. Egg development commenced from 0 following 5 consecutive days where the average daily temperature was >12°C (Qff COP 1996).
4. Egg laying to egg hatch: between 13.5°C (Pritchard 1970, Meats and Khoo 1976)), 12°C to 13°C and <38°C; between 12°C and 37°C (Meats 1989); eggs hatch in about 1.5d to 4d under optimal weather conditions
5. Larval development to pupation: 12.5°C (Fletcher 1979), 11.5°C (Qff Cop 1996), 12.405°C (Jessup, unpublished data); between 12°C and 35°C (Meats 1989); under optimal weather conditions it takes 6d to 10d from egg hatch to pupation; much longer in some fruits (e.g. quinces and some apple cvars – about 21d to 25d at constant 26°C) and in cool weather (number of days????); 18d at 18.3°C, 12d at 23.9°C, 9d at 29.4°C (in apples), longer in winter (O’Loughlin 1964).
6. Pupation to adult eclosion: between 12°C and 34°C (Meats 1989); under optimal weather conditions it takes 9d to 12d from pupation to adult eclosion; much longer in cool weather (number of days????); pupae at ≤7°C: prevention of adult eclosion; pupal duration is 26d at 18.3°C, 14d at 23.9°C, 9d at 29.4°C, longer in winter (2 months) (O’Loughlin 1964).
7. Adult maturation: between 12.5°C and 35°C to 36°C; see 1. Egg laying; adults survive 6m to 12m (O’Loughlin 1964, 1965).
8. Flight: 14°C, 15°C (Meats 1989)
9. Walking (onset of cold torpor): 2°C, 7°C (Meats 1989); 4°C to 10°C (newly eclosed adults), 2°C to 10°C (post-teneral flies)
10. Mating: 16°C; 17°C
11. Egg to adult eclosion: 315 degree-days >11.5°C (Qff COP 1996).

Flies can lay eggs at 5°C (Jessup, unpublished data) but their movement is heavily restricted at such a low temperature. Flies would be very prone to predation while in the process of oviposition. Also, few fruits would be suitable for oviposition at this time, too. This could happen only if mated females were sheltering in a tree with suitable host fruit on it at that time. It is possible that Navel oranges or other winter fruit or even winter fruiting weed species in which flies may be sheltering. It is likely that is overwintering fruit fly populations are very large flies may attempt oviposition, if they are gravid, whenever suitable host fruit are around. If this happened then it would contribute significantly to subsequent fruit fly proliferation later in the season.

24.Degree-day models for fruit fly activities

Background - The degree-day concept and introduction to different models tested in this report

Growth and maturation of many biological entities are regulated by temperature. The concept is that these entities can mature only at temperatures above a certain base or threshold. Biological growth from one stage to another occurs after a certain number of degree-days have accumulated above that threshold. This technique is used to predict timing of flowering, then fruit set and harvest for various cultivated varieties of deciduous fruit crops following winter dormancy. Each stage of growth may be based on different low temperature (and high temperature) thresholds and require variable accumulated degree-days. Also each crop type and even crop variety will have a different set of temperature thresholds and accumulated degree-days for growth. Crop producers use published data tables showing these parameters and match them with their own weather records or those of the nearest appropriate weather station.

Insect growth, maturation and onset of virulence, too, can be predicted using degree-day models. Many US universities present online degree-day calculators for several pest species. Post-winter growth of insects that undergo low temperature induced diapause is most often described in international literature and pest virulence prediction models. Generally, these models use low- and high-temperature development thresholds, accumulated degree-day data for each developmental life stage all based on an arbitrary zero development date. The zero development date is usually sometime in the mid-winter. In temperate regions of the northern hemisphere this date is usually 1 January and, correspondingly, in the southern hemisphere the start date is 1 July.

Preliminary studies on exploring climatic window options for cherries

A study was made of historical daily temperature records for four geographically and climatically diverse regional centres of cherry production (Young in southern NSW, Orange in central NSW, Omeo in Victoria and Bushy Park in Tasmania) in South Eastern Australia and one regional centre where fruit flies are endemic year-round (Gosford on the Central Coast of NSW). These records were used to fit into models for fruit fly ecology in order to predict when fruit flies become sexually active in these areas.

Each model is based on published literature that gives temperature thresholds for various fruit fly activities. The parameter tested in this report is Oviposition. The CSIRO has determined that a cumulative 66 degree-days must passed above the minimum development threshold temperature of 13.5°C (Meats and Khoo 1976).

The first model (see section “*DEGREE-DAY MODEL 1: Mapping accumulated degree days for fruit fly growth from 1 July*” for more details) used Bureau of Meteorology (BOM) data for all temperature records from the beginning of recording to mid 2014 from all meteorological stations in Australia. An algorithm that smoothed out data points relating to the threshold temperatures and corresponding degree-days for Queensland fruit fly (Meats and Khoo 1976) against BOM data averaged from

2004 to 2014 was used to create colour coded maps of accumulated degree-days above 13.5°C from 1 July.

The second model (see section "*DEGREE-DAY MODEL 2: Tabulating/ graphing accumulated degree days for fruit fly growth from 1 July*" for more details) used an internationally accepted degree-day model (Snyder et al., 2005) to estimate the first day when temperature conditions and fruit fly maturity are sufficient for a Queensland fruit fly to oviposit, providing it can find a suitable host. Summary results can be seen in Table 5.

The third model (see section "*DEGREE-DAY MODEL 3: Using local sunset temperature plus degree-day data*" for more details) is one that is still in development. It attempts to correlate temperature and relative humidity at sunset with Queensland fruit fly mating proclivity. Sunset is the time of day when Queensland fruit flies mate. Meats and Khoo (1976) state that mating will not occur at temperatures below 16°C. Estimated first mating dates are shown in Table 6 and Figure 2.

Table 4. DegDay (Snyder et al., 2005) estimates of the first date at which Queensland fruit fly has matured to be able to mate and oviposit (based on 66 degree-days above 13.5°C)

Geographical centre	Estimated date on which first eggs of the season can be laid
Gosford, NSW	27 July 2012
Young, NSW	8 October 2012
Orange, NSW	8 November 2012
Omeo, Vic	5 November 2012
Bushy Park, Tas	17 November 2012

Figure XX shows graphs of estimated sunset temperatures and a mating temperature range of 15.5°C to 16.5°C based on the 4th degree polynomial fit to the temperature at sunset estimated from daily temperature records from 2012 for the five regions.

The assumptions used in this model are that the temperature at sunset would be 80% of the temperature at 3pm if, at 3pm, RH% was >50% OR, under low ambient humidity, the temperature at sunset would be 70% of the 3pm temperature if, at 3pm, RH% was ≤ 50%. These figures are entirely arbitrary and will need to be tested for veracity.

Table 5. Model 3 (Jessup, unpublished data) estimates of the first date at which Queensland fruit fly has matured to be able to mate (based on sunset temperature reaching 16°C).

Geographical centre	Estimated date on which first eggs of the season can be laid
Gosford, NSW	5 October 2012
Young, NSW	21 October 2012
Orange, NSW	15 November 2012
Omeo, Vic	25 November 2012
Bushy Park, Tas	Never (?)

In fact, the three models should be complementary as the fly must mature to a certain level of maturity to be able to mature eggs, mate and oviposit (Model one) but they will not be able to mate actually unless sunset temperatures allow it (Model 2).

So the first matings will occur after the accumulated 66 degree days have been achieved and after sunset temperatures have reached the mating threshold of 16°C and the first oviposition of the season would be shortly after that (about 2 days).

When comparing the information in the two tables above (Tables 5 and 6) it can be seen that estimates for Young, Orange and Omeo are not widely different. However the estimates for Gosford and Bushy Park are. This is not of concern for Bushy Park as the implication is that, even if flies were there in that part of Tasmania, they would not be able to mate and therefore would die out before they became a problem.

The Gosford information seems to say that average daily temperatures during winter will give the fly sufficient thermal units (degree-days) to reach sexual maturity but local temperatures will not be amenable for egg-laying until early October. There is evidence that flies will lay their eggs in fruit in Gosford much earlier than that. Jessup (unpublished data) has recorded collection of fruit fly infested loquats from the Gosford region that were estimated to have been stung by Queensland fruit fly in the first week of July 2003. It is quite likely, though, that these flies had previously mated and had overwintered in a gravid state. Several Australian fruit fly entomologists have shown that gravid flies will overwinter in a gravid state as long as minimum temperatures are not less than about -3°C for extended periods. This is certainly not generally the case for Gosford but it is for Orange, Omeo and Bushy Park and, in most years, Young. Researchers say that if flies happen to survive these cold temperatures over the winter they will resorb their eggs and any stored sperm in their spermathecae for energy conservation purposes and will need to re-mate during the next season.

25. Locations used for Degree-day calculations in cherry growing regions in Australia

New South Wales

Location code	Location
063254	Orange (-33.3211S, 149.0828E)
073138	Young (-34.2493S, 148.2475E)
075032	Hillston (-33.4915S, 145.5249E)
065034	Wellington (-32.5635S, 148.9503E)
062101	Mudgee (-32.5628S, 149.6149E)
065070	Dubbo (-32.2206S, 148.5753E)
073141	Gundagai (-35.0479S, 148.0364E)
072043	Tumbarumba (-35.778S, 148.0122E)
072150	Wagga Wagga (-35.0517S, 147.3493E)
074037	Yanco (-34.6222S, 146.4326E)

South Australia

Location code	Location
023090	Adelaide (-34.9211S, 138.6216E)
023373	Nuriootpa (-34.4761S, 139.0056E)
023733	Mount Barker (-35.0730S, 138.8465E)
023842	Mount Lofty (-34.9784S, 138.7088E)
023878	Mount Crawford (-34.7253S, 138.9273E)
024024	Loxton (-34.4390S, 140.5978E)
025006	Karoonda (-35.0900S, 139.8972E)
025507	Keith (-36.0980S, 140.3556E)
025509	Lameroo (-35.3288S, 139.5599E)
026099	Naracoorte (-36.9813S, 140.7270E)

Tasmania

Location code	Location
091126	Devonport (-41.1701S, 146.4289E)
091291	Sheffield (-41.3886S, 146.3219E)
091311	Launceston (-41.5492S, 147.3219E)
094029	Hobart (-42.8897S, 147.2144E)
094220	Campania (-42.6867S, 147.4258E)
094220	Grove (-42.9858S, 147.0742E)
095003	Bushy Park (-42.7097S, 146.8983E)

Victoria

Location code	Location
082138	Wangaratta (-36.4206S, 146.3056E)
082042	Strathbogie (-36.847S, 145.7308E)
081123	Bendigo (-36.7395S, 144.3266E)
080023	Kerang (-35.7236S, 143.9197E)
081125	Shepparton (-36.4289S, 145.3947E)
080091	Kyabram (-36.3350S, 145.0638E)
077094	Swan Hill (-35.3766S, 143.5416E)
089002	Ballarat (-37.5127S, 143.7911E)
082139	Hunters Hill (-36.2136S, 147.5394E)
082076	Dartmouth (-36.5353S, 147.4984E)

26. Assumptions used to construct fruit fly proliferation models 1 to 4

Model 1(a)

Base date: The date from which it is assumed that eggs in fruit flies are immature - 1 July.

Minimum temperature threshold for fruit fly activity: As soon as degree-days exceed this temperature fruit flies can commence development and maturation. The first step is to mature eggs so the female is able to mate. Two minimum temperature thresholds were used in Model 1(a). They are 13.5°C (Pritchard 1970, Fletcher 1975, Meats and Khoo 1976) and 11.5°C (Qff COP 1996 cites Fletcher but there are no reference details).

Accumulated degree-days (DD) for data based on a minimum temperature thresholds of both 11.5°C and 13.5°C: Information from the Queensland fruit fly Code of Practice (Qff COP 1996) states the following: 66DD >13°C for egg maturation plus 315DD >11.5°C for development from egg to adult. In this report, however, we used 66DD plus 315DD for egg to adult plus another 66DD for adult to oviposition. That totals 447DD >11.5°C or 13.5°C from immature egg to oviposition – i.e. a full life cycle.

The two minimum threshold temperatures were tested in this report to give a range of likely responses based on published literature.

Therefore, for minimum temperature thresholds of both 11.5°C and 13.5°C: Maps given in Appendices 1 to 7 (13.5°C) and Appendix 8 (11.5°C) show colour mark-offs at:

(i) 66DD: Egg maturation
(ii) 381DD: Egg maturation to adult eclosion
(iii)447DD: Egg maturation to oviposition

Therefore the first post-winter generation of adult flies will occur at about 381DD after 1 July and the second generation of adult flies will emerge at about 828DD after 1 July.

Model 1(b)

Base date: 1 July.

Minimum temperature threshold for fruit fly activity: 12.405°C. This figure was calculated from laboratory trials on cold acclimation carried out under this project at NSW DPI, Ourimbah. It is close to the figure of 12.5°C as calculated by Fletcher (1979).

Accumulated degree-days (DD) for data based on a minimum temperature threshold of 13.5°C.

As a result of research carried out at NSW DPI, Ourimbah the following accumulated degree-days above 12.405°C were used in Model 1(b):

Box 1

(i) 82DD >12.405°C: From zero development to egg maturation
(ii) 99DD >12.405°C: From zero development through mating and oviposition to egg hatch
- *That is 17DD for oviposited egg to hatch*

(iii) 180DD >12.405°C: From zero development to larval pupation
- *That is 81DD for 1st instar larva to pupate*

(iv) 404DD >12.405°C: From zero development to adult eclosion - Emergence of the first generation of Qff adults after winter
- *That is 224DD for adult to eclose from its puparium*

(v) 486DD >12.405°C: From zero development through egg maturation and mating to oviposition
- *That is 82DD for the teneral adult to mature, mate and oviposit*

(vi) 890DD >12.405°C: From zero development to the emergence of the second generation of Qff adults after winter
- *That is 404DD from eclosion of the first generation adults to eclosion of second generation of teneral adults*

Colour cut-offs in maps presented in Appendix 9 denote the above accumulated degree-days for each developmental stage.

Model 2(a)

The same basic assumptions used in Model 1(a) as described above were used in Model 2(a). The colour cut-offs shown in the tables presented in Section 28 below reflect the same accumulated degree-days for each developmental stage used in Model 1(a).

Model 2(b)

The same basic assumptions used in Model 1(b) as described above were used in Model 2(b). The colour cut-offs shown in the tables presented in Section 28 below reflect the same accumulated degree-days for each developmental stage used in Model 1(b).

Model 3

The main assumption used in Model 3 is that flies will mate at 16°C (Meats and Fay 2000). The maps of sunset temperatures in Australia presented in Appendices 12 and 13 are based on an assumption that, in areas of relative humidity of ≤50% rh, the temperature at sunset would be 70% of the daily temperature maximum.

Model 4

It is known that fruit fly survival is affected adversely by low temperatures and by high temperatures combined with low relative humidity. Pest incident data also show that Qff proliferation, as manifested by fruit infestation, starts early in one years and later in another while yet other years are not problematic. It is understood that, in cold to temperate areas, wet winters usually correspond to milder temperatures than if the winter is dry. Also hot, dry weather in summer will affect adult survival more adversely than hot, humid weather. The assumption used in Model 4 is that weather data from “bad” fruit fly years can be compared with weather data from “good” fruit fly years and a fruit fly proliferation model can be worked out from that.

27. DEGREE-DAY MODEL 1: Mapping accumulated degree days for fruit fly growth from 1 July

One of the pivotal assumptions upon which degree-day models are based, with respect to insect pests, is that the pest is present in, or near, the target orchard in the winter (i.e. the pest insect has overwintered successfully). Such a situation is common for temperate fruit pests such as codling moth and cherry maggot and degree-days models for these pests are reasonably accurate. This may also well be the case for Queensland fruit fly in some districts of south eastern Australia where it has recently become established. However it is not certain, in all cases, that Queensland fruit fly has overwintered and has not been brought in via the wind or by human mediated means.

For example if the cherry production regions centred around Wellington and Young in NSW and Bushy Park in Tasmania are examined using the degree-day model based on accumulated degree-days over 12.405°C from 1 July it can be seen that there is a wide divergence in predicted population growth between regions (Figure XX). Figure XX predicts that the first post-winter generation of fruit flies from overwintering flies (i.e. those existing in the field from 1 July) will commence oviposition between about 26 November to 10 December in Wellington (during mid to late harvest), 7 to 19 January in Young (during late harvest) and on 7 March in Bushy Park (after completion of harvest). If overwintering populations are small then it is unlikely that eggs and larvae from these will impact on harvest. If overwintering populations are large then eggs and larvae from these flies will be noticed in infested fruit.

If adult flies come into the target orchard area from another, probably warmer site, after 1 July then it is assumed that these flies would have already accumulated a certain amount of degree-days whilst in their original habitat.

[ALSO ACCOUNT FOR FLIES THAT HAVE STORED SPERM AND/OR FERTILISED EGGS]

This makes it difficult to predict population growth using the degree-day model.

Accumulated degree-day maps were constructed, using data from the Bureau of Meteorology (BOM) for each Australian state and for Australia based on published and laboratory researched Queensland fruit fly activity parameters. Weather data used were the averages from 1 July 1983 to 31 January 2014. These maps can be accessed from Appendices 1 to 8 (Model 1(a)) and Appendix 9 (Model 1(b)), respectively. Maps hyperlinked from these appendices are very large portable document files (pdfs) and can be magnified many times without compromising resolution. This facility allows the reader to focus more closely on their region of interest. Figures XX to XX are simplified versions of a selection of these maps and are included in the main report to illustrate use of these maps.

Maps shown in Figures XX to XX and those in Appendices 1 to 9 show colour coded cut-offs within iso-lines based on the various published and laboratory Qff development parameters. For Figures XX to XX and Appendices 1 to 8 the most significant points on these maps are those bounded by the iso-lines that encompass the predicted times for the first generation Qff adult emergence and their maturation. This is the result of flies having survived the winter, have mated (if necessary) and laid their eggs in whatever hosts were available and those eggs have hatched and matured to pupae and then adults. These regions are coded in pale orange.

Cherry production areas, either existing or future, located in regions of these maps coloured pale blue or mid-blue at the time of harvest would, based on Qff development parameters used to construct these maps, be immune from fruit fly infestation. In Figure XX (NSW: 1 Jul – 29 Dec) it can be seen that if fruit flies have overwintered successfully there are very few places where this insect would not exist as first generation mature adults. Figure XX (VIC 1 Jul – 5 Jan) shows that cherries produced in the Yarra Valley may be immune from infestation while other production areas are not. Much of Tasmania is immune from Qff infestations but, by 29 January, according to Model 1(a), cherries growing in the Huon Valley area and the Tamar Valley are on the brink of fruit fly infestation.

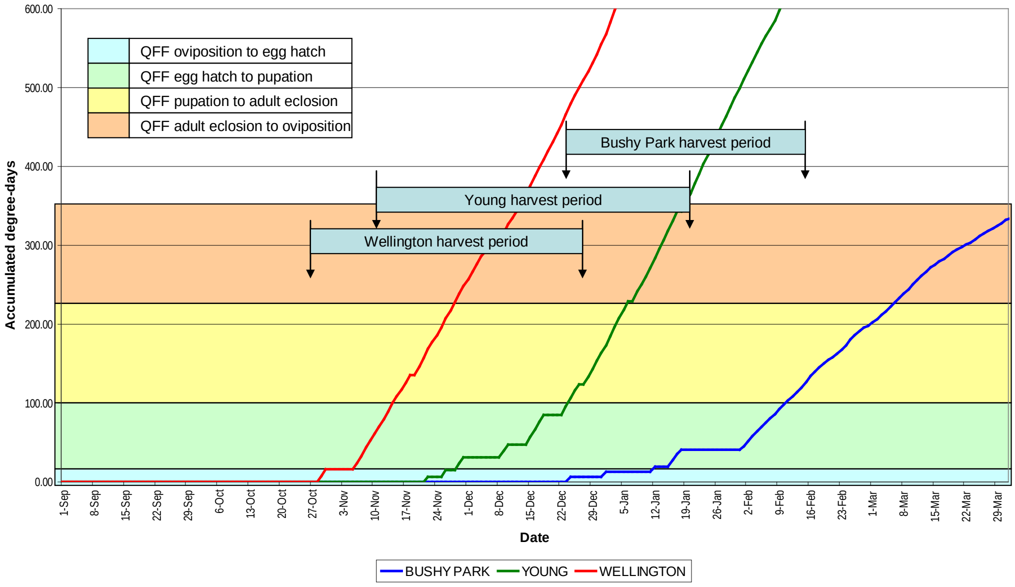
Qff is absent from Tasmania but if allowed to enter and establish it could become problematic in these areas, according to Model 1(a).

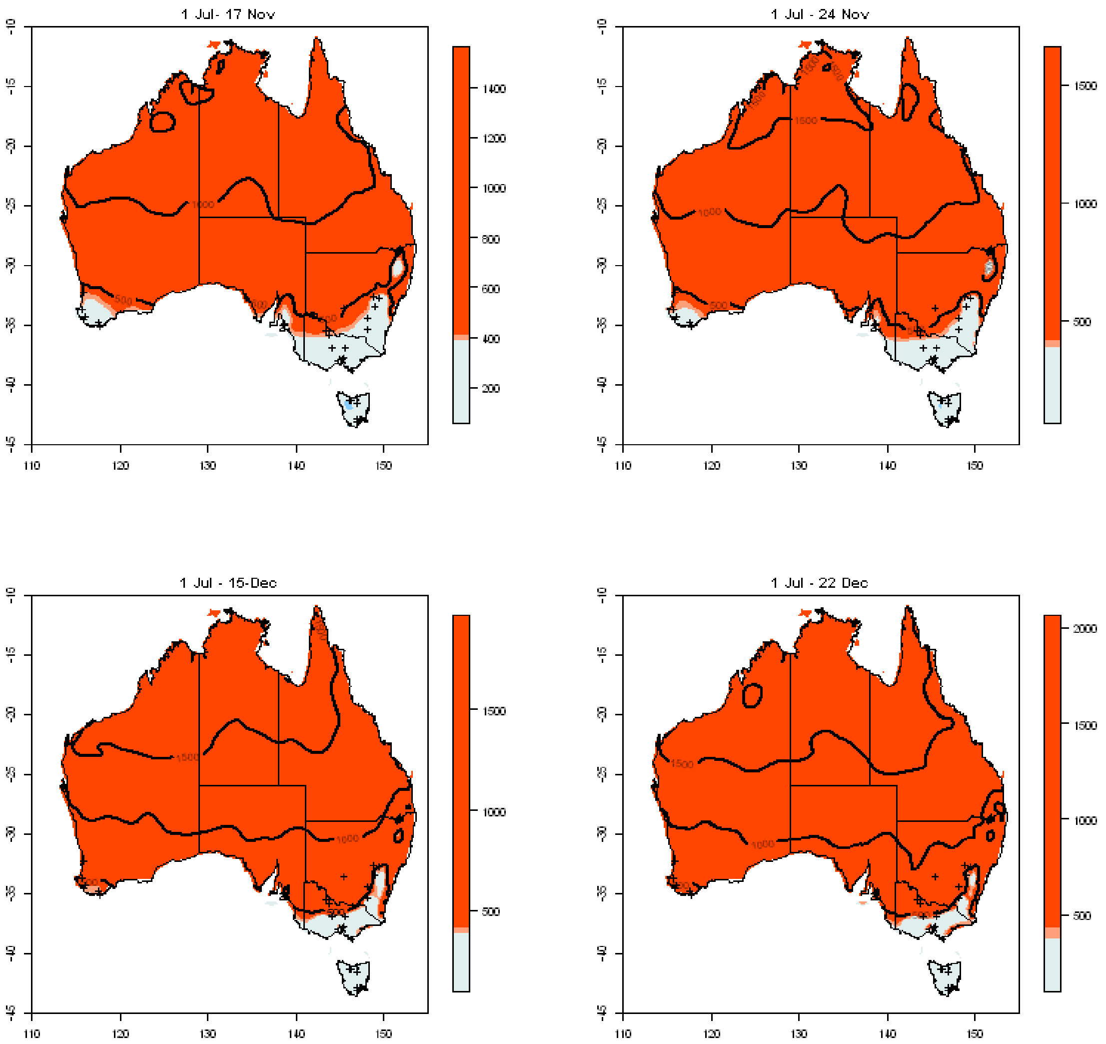
Model 1(b) differs from Model 1(a) in that its parameters are based on laboratory observations from this project. Supporting maps, similar to those constructed for Model 1(a) can be seen in Appendix 9 and Figure XX (a simplified sample of the maps from Appendix 9).

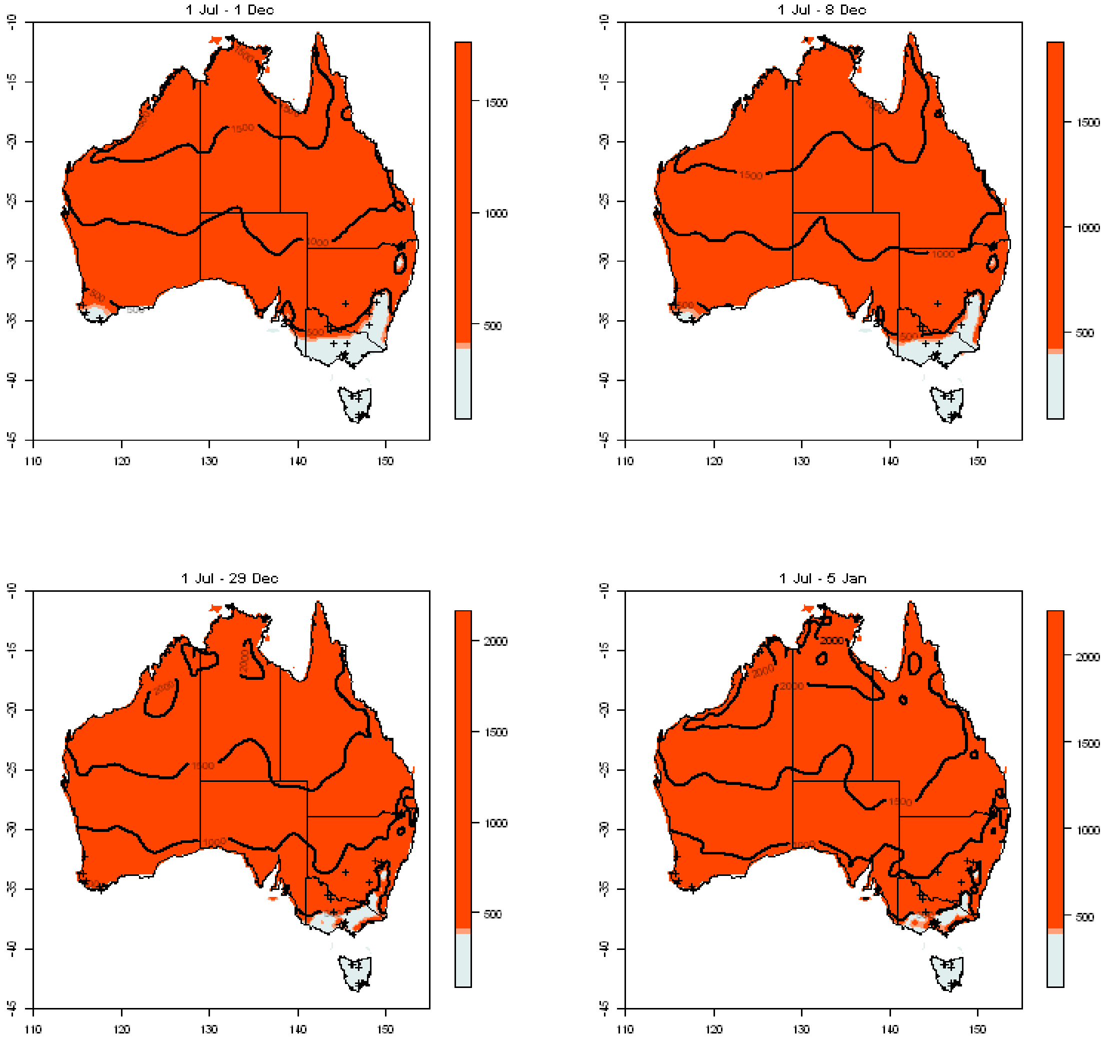
Model 1(b) maps indicate that predictions for the first generation (denoted as the dark orange band) are not markedly different from Model 1(a).

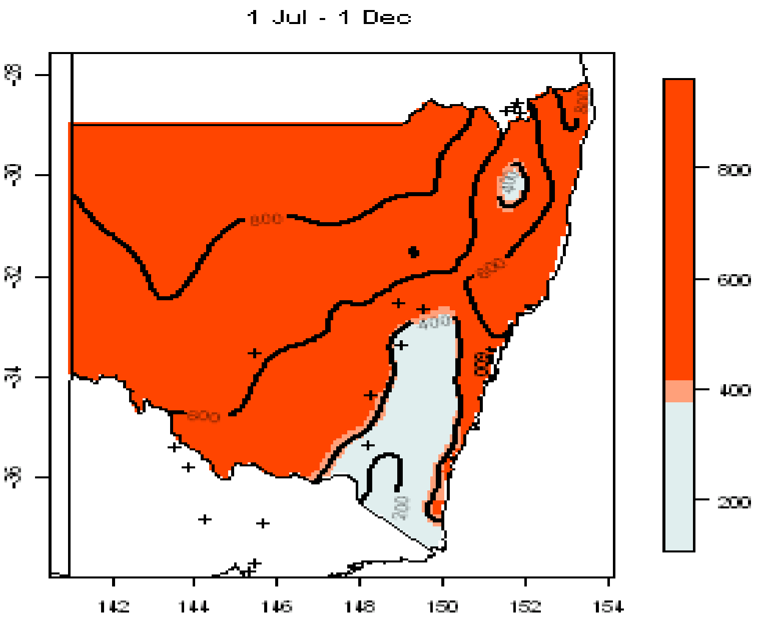
It should be remembered that, if initial overwintering populations are small, populations of first generation adult flies may not impact economically even though some males may be trapped at this time. It is likely that the second generation would be the economically damaging population resulting from surviving overwintering flies or Qff incursions from elsewhere in the country.

Degree-day model for Queensland fruit fly development in three cherry production regions in Australia - Degree-days over 12.405°C from 1 July




1 Jul- 17 Nov
1 Jul - 24 Nov
1 Jul - 15-Dec
1 Jul - 22 Dec


1 Jul - 1 Dec
1 Jul - 8 Dec
1 Jul - 29 Dec
1 Jul - 5 Jan


1 Jul - 1 Dec
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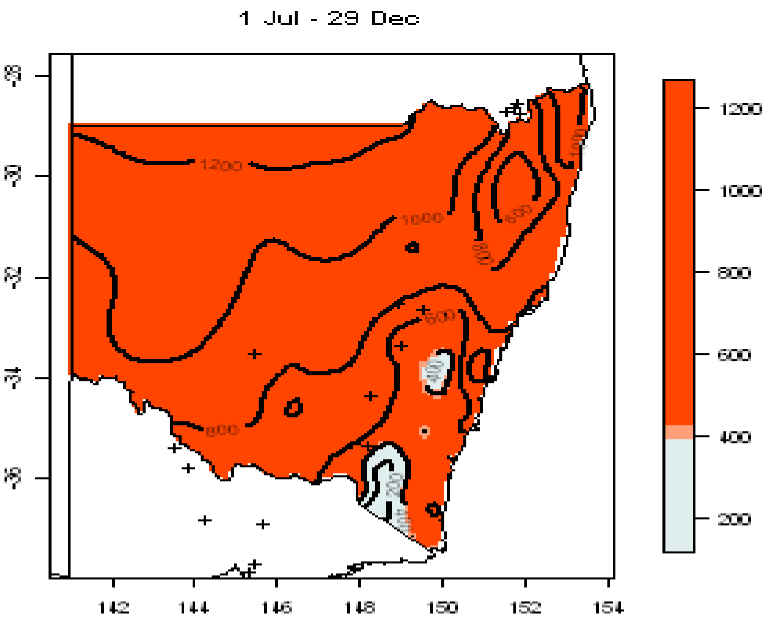
1 Jul - 29 Dec
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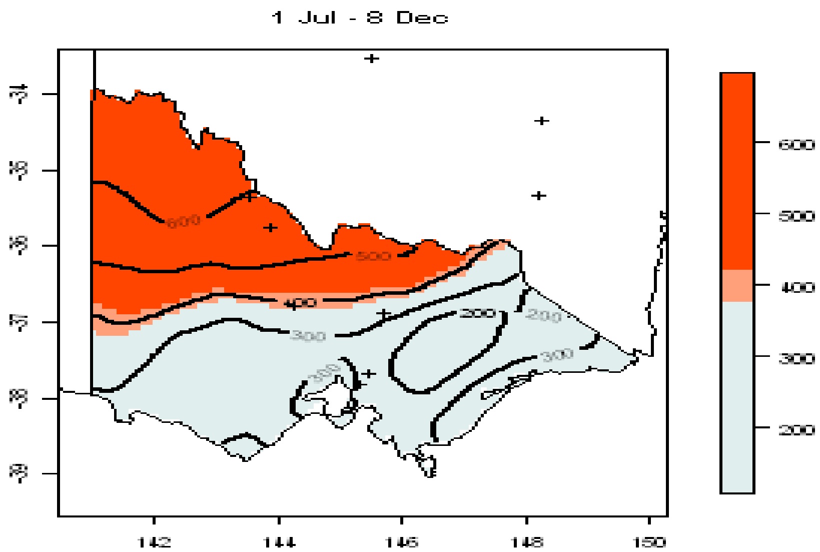
1 Jul - 8 Dec
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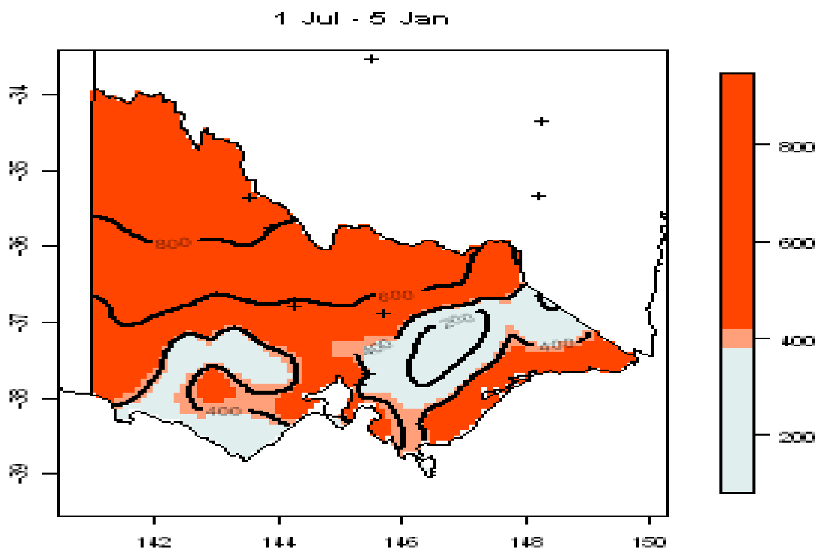
1 Jul - 5 Jan
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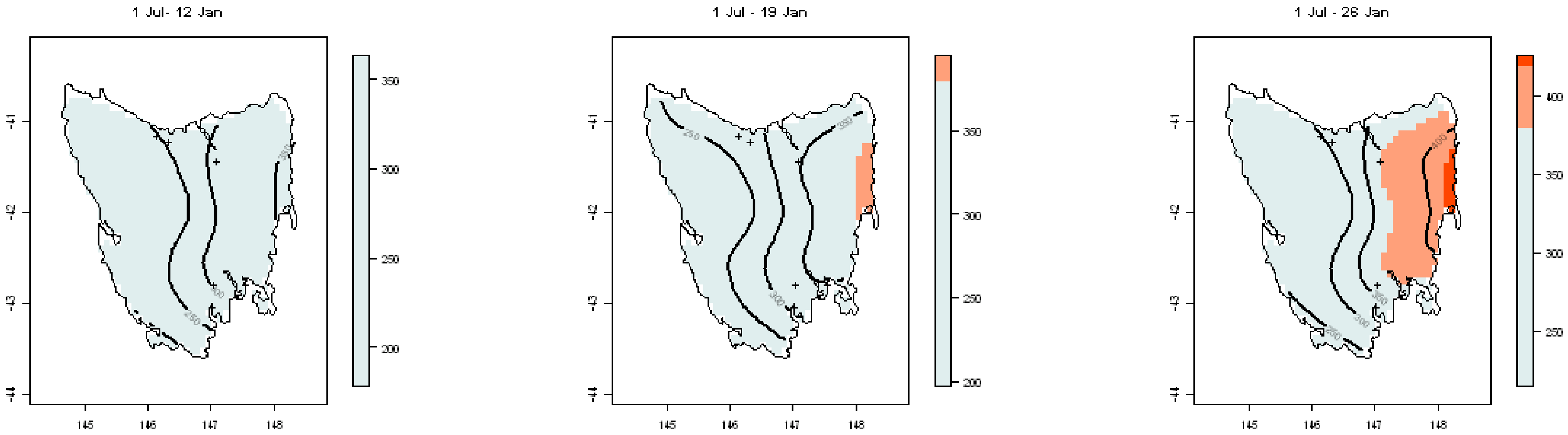
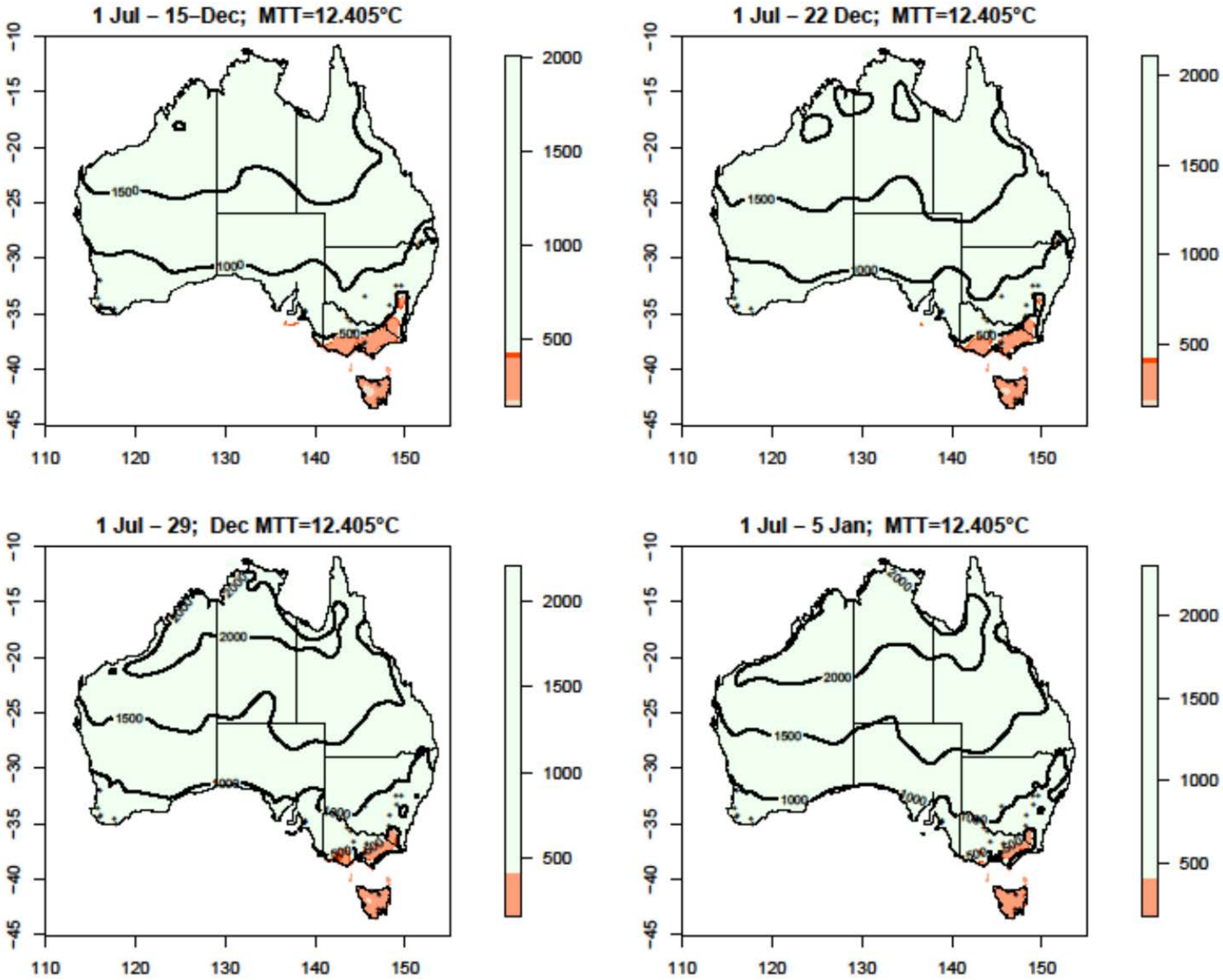

1 Jul- 12 Jan
1 Jul - 19 Jan
1 Jul - 26 Jan


1 Jul – 15–Dec; MTT=12.405°C
1 Jul – 22 Dec; MTT=12.405°C
1 Jul – 29; Dec MTT=12.405°C
1 Jul – 5 Jan; MTT=12.405°C

28.DEGREE-DAY MODEL 2: Tabulating/ graphing accumulated degree days for fruit fly growth from 1 July

Models 2(a) and 2(b) were constructed from actual Bureau of Meteorology (BOM) data for various regional centres based on cherry production areas in each cherry producing state. Models1(a) and 1(b) were constructed using the same data as Models 2(a) and 2(b). However, Models 2(a) and 2(b) were based on raw BOM data for daily maximum and minimum temperatures averaged over the years 2004 to 2014 to reflect current temperatures (to account for climate change). Degree-days were calculated and accumulated degree-days recorded in a table for the closest regional centre to each target cherry production area. Data can be seen in Appendices 10 (Model 2(a)) and 11 (Model 2(b)).

Model 2(a) is based on the published minimum temperature threshold of 13.5°C and Model 2(b) is based on the laboratory researched minimum temperature threshold of 12.405°C.

Tables XX (Model 2(a)) and XX (Model 2(B)), which are summaries of the data presented in Appendices 10 and 11, show that the 1°C difference in minimum temperature thresholds can impact on predicted timing of the onset of the first and second generations of adult flies after winter.

It is, therefore, important to fine tune the minimum threshold temperature for Qff for these predictive models.

Models 1(a) and 2(a) show similar predictions for the insect of the first generation. Similarly for Models 1(b) and 2(b). The main attraction for Model 1 is that the maps can be magnified considerably so that smaller regions in each state can be assessed. This is done by the smoothing facility of the software that creates the maps. Temperature data from points between official weather stations are interpolated using data from surrounding weather stations. This increases accuracy. Model 2, while useful in many ways is restricted by the fact that weather data from only certain towns where weather stations are located are used. There is no facility to predict the weather in orchards that are some distance away from these weather stations.

Table 6. Predictions of the emergence of adult flies from the first and second generations in various cherry production area centres using a model based on a minimum temperature threshold of 13.5°C and accumulated degree-days estimated from laboratory trials [Model 2(a)]

NEW SOUTH WALES	Hillston	Wellington	Dubbo	Mudgee	Yanco	Wagga	Gundagai	Young	Tumbarumba	Orange
Date of 1st gen. adult emergence	27-Oct	3-Nov	3-Nov	17-Nov	10-Nov	17-Nov	24-Nov	24-Nov	15-Dec	29-Dec
Date of 2nd gen. adult emergence	15-Dec	22-Dec	22-Dec	5-Jan	22-Dec	5-Jan	12-Jan	19-Jan	9-Feb	23-Feb
SOUTH AUSTRALIA	**Loxton**	**Karoonda**	**Keith**	**Lameroo**	**Adelaide**	**Nuriootpa**	**Mount Barker**	**Naracoorte**	**Mount Crawford**	**Mount Lofty**
Date of 1st gen. adult emergence	3-Nov	10-Nov	17-Nov	10-Nov	10-Nov	1-Dec	8-Dec	1-Dec	22-Dec	12-Jan
Date of 2nd gen. adult emergence	29-Dec	5-Jan	19-Jan	5-Jan	5-Jan	26-Jan	2-Feb	2-Feb	16-Feb	5-Apr
TASMANIA	**Campania**	**Hobart**	**Bushy Park**	**Grove**	**Melton Mowbray**	**Launceston**	**Cressy**	**Devonport**	**Sheffield**	**Tunnack**
Date of 1st gen. adult emergence	5-Jan	12-Jan	5-Jan	19-Jan	19-Jan	12-Jan	12-Jan	9-Feb	16-Feb	23-Feb
Date of 2nd gen. adult emergence	22-Mar	26-Apr	15-Mar	31-May	10-May	29-Mar	29-Mar	No 2nd gen	No 2nd gen	No 2nd gen
VICTORIA	**Swan Hill**	**Kerang**	**Kyabram**	**Shepparton**	**Wangaratta**	**Bendigo**	**Dartmouth**	**Ballarat**	**Strathbogie**	**Hunters Hill**
Date of 1st gen. adult emergence	10-Nov	10-Nov	24-Nov	24-Nov	1-Dec	1-Dec	8-Dec	5-Jan	29-Dec	12-Jan
Date of 2nd gen. adult emergence	29-Dec	29-Dec	12-Jan	19-Jan	19-Jan	26-Jan	2-Feb	15-Mar	23-Feb	8-Mar

Table 7. Predictions of the emergence of adult flies from the first and second generations in various cherry production area centres using a model based on a minimum temperature threshold of 12.405°C and accumulated degree-days estimated from laboratory trials [Model 2(b)]

NEW SOUTH WALES	**Hillston**	**Wellington**	**Mudgee**	**Young**	**Tumbarumba**	**Orange**				
Date of 1st gen. adult emergence	18-Oct	22-Oct	1-Nov	8-Nov	2-Dec	13-Dec				
Date of 2nd gen. adult emergence	30-Nov	8-Dec	22-Dec	23-Dec	21-Jan	3-Feb				
SOUTH AUSTRALIA	**Karoonda**	**Keith**	**Lameroo**	**Nuriootpa**	**Mt Barker**	**Naracoorte**	**Mt Crawford**	**Mt Lofty**		
Date of 1st gen. adult emergence	26-Oct	6-Nov	28-Oct	16-Nov	21-Nov	19-Nov	6-Dec	31-Dec		
Date of 2nd gen. adult emergence	18-Dec	28-Dec	18-Dec	6-Jan	16-Jan	11-Jan	27-Jan	7-Mar		
TASMANIA	**Bushy Park**	**Melton Mowbray**	**Launceston**	**Cressy**	**Sheffield**	**Tunnack**				
Date of 1st gen. adult emergence	15-Dec	1-Jan	29-Dec	28-Jan	26-Jan	31-Jan				
Date of 2nd gen. adult emergence	19-Feb	16-Mar	6-Mar	28-Feb	No 2nd gen	No 2nd gen				
VICTORIA	**Swan Hill**	**Kerang**	**Kyabram**	**Shepparton**	**Wangaratta**	**Bendigo**	**Dartmouth**	**Ballarat**	**Strathbogie**	**Hunter's Hill**
Date of 1st gen. adult emergence	29-Oct	30-Oct	11-Nov	12-Nov	15-Nov	21-Nov	25-Nov	24-Dec	18-Dec	29-Dec
Date of 2nd gen. adult emergence	15-Dec	17-Dec	30-Dec	31-Dec	2-Jan	10-Jan	14-Jan	17-Feb	6-Feb	16-Feb

29. DEGREE-DAY MODEL 3: Using local sunset temperature plus degree-day data

Prediction of fruit fly population growth

The assumption is that fruit fly population growth will not commence until eggs have been laid. Population initiating eggs can be laid by:

1. Overwintering females that still hold fertilised eggs in their ovaries.
2. Overwintering females that hold viable sperm in their spermathecae.
3. Overwintering females without fertilised eggs or viable sperm who need to find a male and mate.
4. Females who have emerged from overwintering larvae or pupae who need to find a male and mate.

Regarding points one and two above: females will lay eggs at the optimum temperature (as long as there are suitable host fruits available). Lowest egg-laying temperature is about 11°C. It is highly unlikely that these conditions will prevail in temperate cherry growing regions of Australia. This assumption needs to be addressed.

To satisfy points 3 and 4 above females will mate at a suitable temperature (about 16°C) and lay eggs, if suitable host fruit are available, within a few days.

If we calculate:

1. The first days of the season when mating can take place – that is, the first days when dusk temperatures are suitable for mating (about 16°C or maybe lower – depending on the degree of cold acclimation the population has achieved*) – or when egg-laying can be achieved if eggs are still fertilised post-winter (≥ 11°C??). Targetted orchard or township dusk temperatures should be used here – or, if these are not available then those of the nearest weather station should be used.
2. Calculate accumulated degree-days above the basal development threshold (about 12.405°C) – this figure, too, is not well-defined, depending on which publication is read). Use data from 10-year average daily maximum and minimum temperatures for the weather station that is nearest to the targetted orchard or township. Better still, actual target orchard temperatures would better account for microclimate variations.
3. Eggs will hatch at 17DD above 12.405°C. When 17DD is reached then all eggs laid at 1. will be hatched.
4. Adult flies will be on the wing at an accumulation of about 322DD (see Box 1) above 12.405°C. When this occurs this date will be the first generation offspring of the first eggs laid in the season.
5. Check for the presence of ripening or ripe fruit fly host fruit in the vicinity of the targetted orchard or township when:
    a. Dusk temperatures reach about 16°C and
    b. First generation adult flies are estimated to be on the wing.

These will be the fruit attacked by the first fruit fly population of the season.

Five year (or more?) averages of these will give figures that are normal. Anything outside of these may impact on fruit fly numbers. It is also important to realise the impact of irrigation on temperature and relative humidity in both orchards and townships.

Results and discussion

Estimated sunset temperatures are presented in Appendices 12, 13 and 14. Appendix 12 shows a sample of data for Young, NSW using average weather data for the five year period from 2009 to 2013. This table uses the Qff maturation degree-days over 12.405°C described in Box 1 and predicts Qff activity following the first day on which fruit flies can mate. Appendix 13 shows these temperatures based on the 30 year average from 1961 to 1990 while Appendix 14 shows data based on monthly averages from 2014/2015. The two sets of data (i.e. Appendices 13 and 14) can be used to check for the impact of changes in climate.

Appendix 15 gives degree-day data for several cherry production centres in each major cherry production state of Australia. These data are to be used in conjunction with the determination of the first mating capable date of the season as well as the information supplied in Box 1.

The data for Young, NSW show that the day on which flies can first mate is around 4 September (based on the average estimated sunset temperatures from 2009 to 2013).

Corresponding predictions for Qff activity are:

(i) 4 September - Overwintering adults mate for the first time in the season
(ii) 5 December – Eggs laid after first mating have hatched
(iii) 24 December – Larvae have pupated in soil beneath host crops
(iv) 16 January – First generation of Qff adults have emerged and they are able to fly
(v) 24 January – First generation Qff adults are infesting the next crop of host fruit
(vi) 4 March – The second generation of Qff adults have emerged

This model predicts that there would be no third generation of fruit flies and any eggs and larvae in fruit at this time would perish over winter. However it has to be noted that there is much variation in microclimates in and around production regions and associated urban areas which may allow some flies to overwinter. Also, it should be remembered that some fruits are able to sustain Qff eggs and larvae through winter – e.g. apples and quinces. For this reason feral apples and quinces should be identified and removed and apple and quince orchards should be cleaned up before winter.

30. MODEL 4: Using winter rainfall and summer temperature records

Relative humidity and rainfall will impact on fruit fly proliferation. If there is rain during winter and spring and temperatures are mild in winter then there will be a beneficial impact on fruit fly survival and population expansion during spring and early summer.

Results and discussion

The town of Shepparton, Victoria experienced minimal fruit fly pressure in the 2012/2013 season while there was significant impact on production (both commercial and backyard) in 2013/2014. We surveyed temperatures and periods where the most difference occurred from one year to the next. The question asked was: "What was so different in 2013/2014 from 2012/2103 that would allow fruit fly populations to explode?"

The results of the data survey show that the weather patterns to look out for are:

- Number of winter days at ≤ 1°C (often mild winter temperatures are caused by rainy days)
- Number of early summer days

Data shown in Table XX indicate that a "bad" fruit fly year is characterised by:

(a) Fewer than 6 days at ≥ 36°C during the early, current, summer
(b) Fewer than about 23 days at ≤ 1°C in the previous winter
(c) Greater than about 180mm of rainfall in the previous winter
(d) Greater than about 60mm of rainfall in the previous summer

Table 8.

SHEPPARTON AIRPORT		2012	2013	2014
TEMP	No. days >36°C: 1 Sept to 31 Dec	5	6	3
	Ave max temp: 1 Sept to 31 Dec	24.3	24.2	25.7
	No. days <1°C: 1 Apr to 31 Aug	30	23	17
	Ave min temp: 1 Apr to 31 Aug	4.3	5.5	5.9
RAIN	No. days >15mm: 1 Apr to 31 Aug	1	2	4
	Total rainfall: 1 Apr to 31 Aug	169.2	187.6	234.8
	No. days >10mm: 1 Sept to 31 Dec	2	3	6
	Total rainfall: 1 Sept to 31 Dec	62.2	100.8	124.4
SUN	No. days >15MJ/m*m: 1 Apr to 31 Aug	15	14	14
	Ave. solar exposure: 1 Apr to 31 Aug	9.5	9.5	9.1
	No. days >15MJ/m*m: 1 Sept to 31 Dec	96	92	107
	Ave. solar exposure: 1 Sept to 31 Dec	21.9	20.2	22.3

The data and corresponding model above are very preliminary in nature and need more work on their development. Pestmon data for each production district would be checked against weather data and correlations made between “good” fruit fly years and “bad” fruit fly years.

However, this information is very important for decision making on the likelihood of the size of the overwintering population. This, in turn, will decide which scenario should be used in subsequent predictions of Qff proliferation:

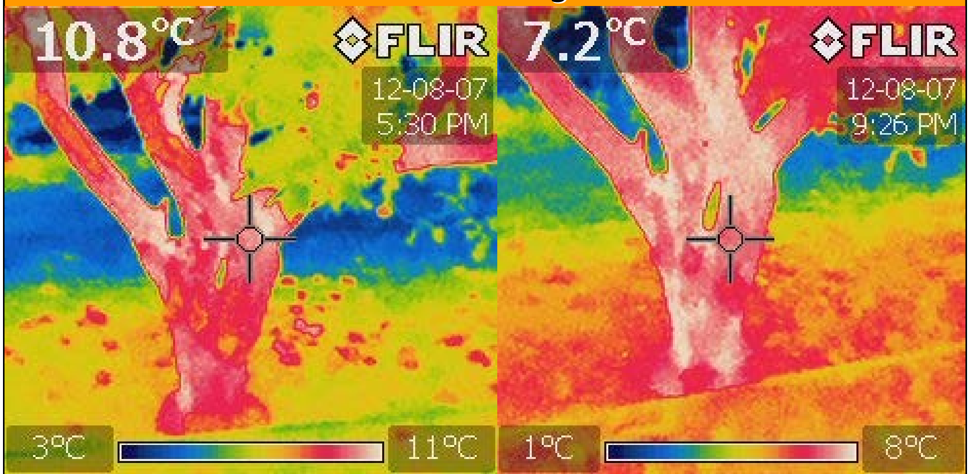
(i) The overwintering population is small and, therefore, the second generation of adults will be the more damaging populations or

(ii) The overwintering populations is large and, therefore, the first generation of adults will be seriously damaging

31. Temperature variation across the landscape – impact of microclimates

This is a simple demonstration of the high variation in temperatures and corresponding levels of relative humidity that can exist in an orchard. Figure XX below show thermal images of an orange tree in an orchard at Somersby on the Central Coast of NSW in the winter. Ambient air temperature at 5:30pm was 3°C and, at 9:26pm it was 1°C. Temperatures within the tree were much higher (up to 11°C and 8°C, respectively). If any adult flies were present in this tree they would be attracted to the warmer spots and would overnight there.

Where do fruit flies go in winter?



A winter night at Somersby: Parts of this citrus tree, in particular around exposed trunk and branches, remained warmer than the rest of the canopy and surrounding area. These sections of the tree release absorbed heat for several hours. Fruit flies would over-night here if they could find it.

32. Impact of temperature change on fruit fly habitat range

Appendices 13 and 14 can be used to check the possible impact of climate change on fruit fly activity. Appendix 13 shows the average estimated sunset temperatures from 1960 to 1991. The red arrows depict regions of Australia where sunset temperature is about 16°C. This is the lowest temperature at which Qff will mate. During the month of October the map predicts that it would not be sufficiently warm at sunset for Qff to mate in any cherry production area with the exception of north west Victoria (e.g. Mildura) and the Perth Hills. The southern most areas for Qff mating on the east coast centres around Sydney and the Lower Hunter Valley. Most of Tasmania, with the exception of the Tamar Valley, is at low risk during December.

Appendix 14 shows average sunset temperatures for 2014/2015, only. For the month of October the southernmost region of likely Qff mating occurs around Melbourne (e.g. Yarra Valley), Canberra and as far south in NSW as Bega. Most of Victoria except the highest production areas, all of South Australia and most of Western Australia are at risk. With the exception of the Tamar Valley, Tasmania remains as a low risk until January.

The two scenarios described above indicate that climate change will impact on the timing of fruit fly proliferation if a sizeable Qff population has been allowed to build up prior to winter and during spring.

33.Impact of climate change on cherry production areas

It is likely that cherry production will be modified over time due to climate change should climate change result in continued warming patterns. This change will, however, take a much longer time to occur than that of the impact of fruit flies due to climate change. Qff will respond to smaller climate changes and more rapidly than cherry trees. It is more likely that, if there are modifications to cherry production caused by climate change they will be via old, high-chill varieties being replaced by new, low-chill cultivars.

New cherry production areas could be opened up in more southern regions which, prior to climate change induced warming, were too cold for economic production. Degree-day models and fly activity models used in this report can be used to predict the potential impact of Qff on cherry production in these potential new production regions.

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Appendices

Appendix 1 – Australia: Weekly maps of accumulated degree-days over 13.5°C from 1 July

AUSmap_13_5_MTT_1.pdf

AUSmap_13_5_MTT_2.pdf

AUSmap_13_5_MTT_3.pdf

AUSmap_13_5_MTT_4.pdf

AUSmap_13_5_MTT_5.pdf

AUSmap_13_5_MTT_6.pdf

AUSmap_13_5_MTT_7.pdf

Appendix 2 - New South Wales: Weekly maps of accumulated degree-days over 13.5°C from 1 July

plotSmooth_13_5_NSW1.pdf

plotSmooth_13_5_NSW2.pdf

plotSmooth_13_5_NSW3.pdf

plotSmooth_13_5_NSW4.pdf

plotSmooth_13_5_NSW5.pdf

plotSmooth_13_5_NSW6.pdf

plotSmooth_13_5_NSW7.pdf

Appendix 3 - Victoria: Weekly maps of accumulated degree-days over 13.5°C from 1 July

plotSmoothVIC1.png

plotSmoothVIC2.png

plotSmoothVIC3.png

plotSmoothVIC4.png

Appendix 4 – South Australia: Weekly maps of accumulated degree-days over 13.5°C from 1 July

plotSmoothSA1.png

plotSmoothSA2.png

plotSmoothSA3.png

plotSmoothSA4.png

Appendix 5 - Tasmania: Weekly maps of accumulated degree-days over 13.5°C from 1 July

plotSmoothTAS1.png

plotSmoothTAS2.png

plotSmoothTAS3.png

plotSmoothTAS4.png

Appendix 6 - Queensland: Weekly maps of accumulated degree-days over 13.5°C from 1 July

plotSmoothQLD1.png

plotSmoothQLD2.png

plotSmoothQLD3.png

plotSmoothQLD4.png

Appendix 7 – Western Australia: Weekly maps of accumulated degree-days over 13.5°C from 1 July

plotSmoothWA1.png

plotSmoothWA2.png

plotSmoothWA3.png

plotSmoothWA4.png

Appendix 8 – Australia: Weekly maps of accumulated degree-days over 11.5°C from 1 July

AUSmap_11_5_MTT_1.pdf

AUSmap_11_5_MTT_2.pdf

AUSmap_11_5_MTT_3.pdf

AUSmap_11_5_MTT_4.pdf

AUSmap_11_5_MTT_5.pdf

AUSmap_11_5_MTT_6.pdf

AUSmap_11_5_MTT_7.pdf

Appendix 9 – Australia: Weekly maps of accumulated degree-days over 12.405°C from 1 July

AUSmap_12_4_MTT_1.pdf

AUSmap_12_4_MTT_2.pdf

AUSmap_12_4_MTT_3.pdf

AUSmap_12_4_MTT_4.pdf

AUSmap_12_4_MTT_5.pdf

AUSmap_12_4_MTT_6.pdf

AUSmap_12_4_MTT_7.pdf

Appendix 10 – Accumulated Degree-days ≥ 13.5°C for Queensland fruit fly - 10 years (2004-2014) average data, starting from 1 July.

New South Wales

Accumulated Degree-days ≥ 13.5°C for Queensland fruit fly in NEW SOUTH WALES - 10 years (2004-2014) average data, starting from 1 July.

(blue)	0 - 82	Zero development to egg maturation
(cyan)	82 - 99	Mature egg through mating and oviposition to egg hatch
(light green)	99 - 180	Hatched egg to larval pupation
(light orange)	180 - 404	Pupa to adult eclosion - The first generation of Qff adults after winter
(orange)	404 - 425	Eclosed adult through egg maturation and mating to oviposition
(brown)	425 - 829	The second generation of Qff eggs, larvae, pupae and adults after winter – Second generation adults emerge after 829DD

Week		Hillston	Wellington	Dubbo	Mudgee	Yanco	Wagga	Gundagai	Young	Tumbarumba	Orange
1	7-Jul	7.48	8.09	8.24	5.34	4.14	2.98	1.95	1.99	0.42	0.06
2	14-Jul	13.52	15.90	16.31	9.94	8.19	6.14	4.70	4.61	0.83	0.24
3	21-Jul	20.44	23.36	23.52	14.63	12.21	9.16	7.06	6.43	1.63	0.34
4	28-Jul	29.72	32.56	32.60	20.08	17.12	12.86	10.06	9.59	2.06	0.48
5	4-Aug	43.42	43.38	44.49	28.21	25.52	18.11	14.13	14.36	3.86	1.34
6	11-Aug	54.93	52.92	55.06	35.62	33.01	22.89	18.38	18.10	4.92	1.95
7	18-Aug	69.25	65.49	68.06	45.12	41.96	28.72	23.77	22.78	6.92	2.70
8	25-Aug	89.34	81.35	84.33	57.59	54.83	37.77	31.65	29.69	10.94	5.52
9	1-Sep	113.50	105.08	108.86	77.42	74.59	52.50	45.90	43.23	19.31	11.56
10	8-Sep	137.85	127.61	132.20	95.38	95.64	68.06	60.54	56.69	27.74	17.00
11	15-Sep	165.79	152.48	158.53	116.03	118.03	84.75	76.00	70.44	36.02	23.15
12	22-Sep	201.48	183.39	190.65	143.26	147.65	107.70	97.25	91.56	50.19	34.66
13	29-Sep	237.39	218.48	227.66	173.32	176.62	130.90	120.10	113.84	64.65	48.51
14	6-Oct	279.64	258.10	267.10	206.14	212.13	160.26	148.47	141.50	83.82	65.66
15	13-Oct	319.11	293.41	303.64	236.94	248.44	189.20	176.24	167.66	102.96	78.53
16	20-Oct	365.31	334.01	346.16	271.52	291.18	224.75	210.53	198.85	127.44	96.94
17	27-Oct	418.26	380.25	394.30	311.32	340.60	266.95	249.73	236.71	154.80	119.21
18	3-Nov	475.47	432.70	449.23	355.82	394.51	313.63	293.92	279.13	186.62	146.28

19	10-Nov	532.58	484.33	504.73	397.94	448.51	361.48	339.29	321.97	220.29	172.61
20	17-Nov	595.63	539.95	562.82	446.33	507.02	412.29	387.08	368.11	255.74	202.97
21	24-Nov	657.42	599.24	624.17	496.67	568.77	467.98	439.92	417.67	297.09	239.47
22	1-Dec	726.99	661.97	688.21	550.15	635.94	528.25	497.14	471.02	340.45	278.15
23	8-Dec	793.07	724.78	752.60	604.57	698.79	586.05	554.56	523.64	382.26	314.43
24	15-Dec	860.46	790.08	819.25	660.58	763.13	644.52	611.35	576.68	425.06	353.02
25	22-Dec	929.95	855.07	886.42	716.86	831.53	705.99	671.20	632.14	471.08	394.25
26	29-Dec	1001.36	922.84	955.76	775.49	902.33	770.87	734.60	690.77	521.14	437.32
27	5-Jan	1075.39	996.48	1030.74	839.79	981.19	842.86	804.58	755.16	577.21	486.25
28	12-Jan	1159.18	1072.47	1108.02	906.02	1062.26	917.38	876.51	821.33	637.14	538.42
29	19-Jan	1238.37	1151.96	1188.22	974.15	1145.26	993.73	951.03	890.75	698.71	593.83
30	26-Jan	1323.79	1231.66	1269.34	1043.94	1229.45	1071.84	1028.69	962.32	761.57	648.25
31	2-Feb	1411.46	1311.57	1350.60	1114.17	1316.09	1152.84	1107.35	1034.40	826.60	705.58
32	9-Feb	1486.27	1387.69	1427.54	1179.61	1393.18	1226.38	1178.57	1100.14	884.39	757.74
33	16-Feb	1557.64	1457.01	1498.68	1238.97	1464.88	1293.37	1244.31	1160.48	934.83	797.24
34	23-Feb	1635.87	1527.79	1571.63	1299.96	1541.22	1363.07	1312.29	1222.26	988.00	838.75
35	1-Mar	1712.53	1596.78	1642.65	1357.24	1614.27	1430.28	1377.89	1281.71	1039.39	877.24

South Australia

Accumulated Degree-days ≥ 13.5°C for Queensland fruit fly in SOUTH AUSTRALIA. 10 years (2004-2014) average data, starting from 1 July

(blue)	0 - 82	Zero development to egg maturation
(cyan)	82 - 99	Mature egg through mating and oviposition to egg hatch
(light green)	99 - 180	Hatched egg to larval pupation
(light orange)	180 - 404	Pupa to adult eclosion - The first generation of Qff adults after winter
(orange)	404 - 425	Eclosed adult through egg maturation and mating to oviposition
(brown)	425 - 829	The second generation of Qff eggs, larvae, pupae and adults after winter – Second generation adults emerge after 829DD

Week		Loxton	Karoonda	Keith	Lameroo	Adelaide	Nuriootpa	Mount Barker	Naracoorte	Mount Crawford	Mount Lofty
1	7-Jul	8.37	7.48	5.60	6.47	6.74	2.59	2.49	3.26	0.32	0.12
2	14-Jul	14.85	12.96	10.15	11.51	12.82	4.63	4.51	5.67	0.76	0.13
3	21-Jul	22.05	18.66	15.03	17.13	18.80	6.44	6.70	8.77	1.20	0.26
4	28-Jul	34.19	29.69	22.91	26.78	28.59	10.72	11.03	13.35	2.49	0.56
5	4-Aug	49.50	42.32	32.73	38.56	38.69	16.04	16.12	19.57	4.40	1.33
6	11-Aug	62.61	53.54	40.91	49.36	48.30	20.90	20.56	25.13	5.72	1.67
7	18-Aug	77.35	65.53	49.65	60.35	59.97	26.83	26.21	30.95	8.14	3.09
8	25-Aug	95.97	81.43	61.89	74.70	74.01	34.86	34.54	39.24	12.14	5.19
9	1-Sep	119.48	102.09	78.09	95.11	93.48	47.07	46.90	50.79	19.07	9.80
10	8-Sep	144.13	123.36	95.32	116.16	114.52	60.31	60.26	63.62	27.69	15.53
11	15-Sep	170.82	146.09	113.57	138.00	135.08	74.88	74.07	76.11	35.37	19.96
12	22-Sep	204.36	174.61	138.30	166.72	162.49	96.16	93.46	93.73	48.19	28.02
13	29-Sep	233.78	200.50	158.81	193.06	186.32	114.97	109.98	108.75	58.68	34.99
14	6-Oct	269.09	232.56	185.22	224.87	217.01	139.33	132.61	128.48	74.34	44.92
15	13-Oct	303.79	264.31	212.25	255.85	247.26	163.20	154.74	150.61	90.51	56.08
16	20-Oct	345.39	302.52	247.49	295.13	286.17	195.58	184.33	179.51	113.89	72.19
17	27-Oct	389.20	340.87	280.48	334.46	322.76	226.62	209.45	207.29	135.00	85.63
18	3-Nov	434.31	382.08	317.25	376.60	362.33	261.08	239.13	238.07	161.69	103.12
19	10-Nov	483.27	427.36	359.75	421.14	408.60	300.86	273.47	275.00	192.92	123.82
20	17-Nov	534.34	476.65	404.42	471.74	459.70	345.79	312.07	314.45	232.39	151.61
21	24-Nov	587.03	526.02	450.92	522.04	510.41	390.12	351.78	356.05	270.99	178.00

22	1-Dec	646.81	581.94	505.48	578.10	569.93	440.72	395.28	405.22	315.85	209.72
23	8-Dec	701.44	633.53	554.24	630.76	621.50	487.43	436.07	451.16	355.26	234.47
24	15-Dec	756.00	682.29	601.15	680.17	672.59	530.09	473.58	494.93	390.32	256.20
25	22-Dec	815.76	738.93	653.57	737.88	732.11	581.99	519.99	543.54	435.94	290.07
26	29-Dec	874.65	790.71	705.74	794.20	789.17	632.34	565.16	591.65	480.30	321.47
27	5-Jan	942.83	855.09	768.20	859.72	861.53	695.28	620.17	648.84	537.71	367.26
28	12-Jan	1010.20	916.83	828.39	924.57	929.40	755.24	671.59	703.87	591.11	406.64
29	19-Jan	1075.95	977.84	888.63	990.16	997.60	814.61	723.89	759.22	645.05	446.53
30	26-Jan	1146.29	1043.00	951.97	1057.79	1070.37	878.17	780.24	817.24	702.92	491.74
31	2-Feb	1217.48	1108.76	1015.26	1126.78	1146.25	943.88	835.94	875.30	762.79	537.15
32	9-Feb	1280.39	1165.16	1069.55	1186.73	1207.69	998.58	883.57	925.31	812.05	574.41
33	16-Feb	1344.93	1225.39	1128.80	1249.45	1273.62	1056.91	934.07	980.59	862.00	611.24
34	23-Feb	1409.80	1286.29	1186.35	1312.64	1340.88	1113.78	984.84	1036.34	913.34	650.00
35	1-Mar	1472.64	1345.27	1244.42	1373.93	1406.61	1169.03	1034.85	1090.82	961.90	685.92
36	8-Mar	1528.77	1399.33	1298.07	1430.47	1467.09	1220.69	1082.21	1140.96	1003.85	723.00
37	15-Mar	1588.58	1456.52	1353.10	1490.33	1530.48	1274.74	1130.99	1193.53	1054.67	763.81
38	22-Mar	1639.21	1504.05	1399.90	1539.65	1581.35	1316.92	1171.01	1237.01	1088.40	787.72
39	29-Mar	1686.30	1547.67	1441.29	1583.17	1628.15	1356.19	1207.05	1274.91	1121.20	810.16
40	5-Apr	1730.42	1589.77	1480.74	1625.92	1673.03	1392.57	1241.43	1311.05	1151.40	830.32

Tasmania

Accumulated Degree-days ≥ 13.5°C for Queensland fruit fly in TASMANIA. 10 years (2004-2014) average data, starting from 1 July		
	0 - 82	Zero development to egg maturation
	82 - 99	Mature egg through mating and oviposition to egg hatch
	99 - 180	Hatched egg to larval pupation
	180 - 404	Pupa to adult eclosion - The first generation of Qff adults after winter
	404 - 425	Eclosed adult through egg maturation and mating to oviposition
	425 - 829	The second generation of Qff eggs, larvae, pupae and adults after winter – Second generation adults emerge after 829DD

Week		Campania	Hobart	Bushy Park	Grove	Melton Mowbray	Launceston	Cressy	Devonport	Sheffield	Tunnack
1	7-Jul	1.88	1.31	1.40	1.22	0.52	0.75	0.70	1.20	0.13	0.07
2	14-Jul	3.84	2.46	2.43	2.66	1.11	0.85	1.12	1.67	0.13	0.07
3	21-Jul	6.29	4.25	4.58	4.08	2.14	1.45	1.70	2.99	0.24	0.07
4	28-Jul	9.45	6.44	6.72	6.15	3.39	2.21	2.49	4.50	0.50	0.18
5	4-Aug	13.66	10.01	10.01	9.03	5.06	3.27	3.42	5.45	0.63	0.41
6	11-Aug	16.88	12.12	12.56	10.84	6.22	3.83	4.18	6.44	0.77	0.47
7	18-Aug	20.66	15.54	16.58	13.66	7.66	5.53	5.66	8.21	1.33	0.48
8	25-Aug	27.69	22.07	23.59	19.22	11.11	8.63	8.76	10.25	2.24	1.16
9	1-Sep	37.75	31.01	32.25	27.17	17.28	12.78	12.72	12.71	3.99	3.02
10	8-Sep	47.31	40.00	41.59	35.34	22.87	18.31	17.15	15.47	5.96	4.92
11	15-Sep	56.64	48.61	50.19	42.23	28.15	23.18	21.61	19.06	8.67	6.47
12	22-Sep	68.49	59.29	61.98	51.15	35.44	31.73	29.21	24.88	11.91	8.91
13	29-Sep	79.09	69.15	72.50	58.88	41.63	38.83	35.51	29.97	15.58	11.02
14	6-Oct	91.60	81.38	85.53	68.63	50.36	48.25	44.06	35.70	19.13	15.42
15	13-Oct	107.19	96.01	101.48	81.40	61.53	59.84	55.27	43.52	25.37	21.99
16	20-Oct	125.56	112.83	119.53	96.23	75.66	74.62	69.71	51.85	33.12	30.25
17	27-Oct	144.24	128.91	139.01	111.54	91.40	91.79	86.05	62.93	41.90	39.54
18	3-Nov	163.77	145.21	161.27	127.73	108.65	111.86	105.93	77.52	54.90	50.72
19	10-Nov	186.91	164.75	186.31	146.74	128.47	133.73	128.17	91.76	68.53	63.61
20	17-Nov	210.12	183.93	210.94	164.72	148.68	155.27	150.46	107.29	82.76	76.45
21	24-Nov	237.82	207.75	239.44	187.44	173.33	180.67	177.43	126.93	101.46	92.95

22	1-Dec	265.22	230.85	270.32	210.94	199.01	209.20	206.89	147.64	121.20	110.70
23	8-Dec	294.45	257.42	299.83	234.81	224.55	237.55	236.40	168.80	139.32	128.53
24	15-Dec	325.27	284.57	331.79	259.74	252.25	266.96	267.25	190.93	158.59	147.18
25	22-Dec	357.94	312.84	364.96	287.27	280.92	298.07	299.88	213.89	180.45	167.79
26	29-Dec	391.12	341.30	398.61	313.76	310.25	330.96	334.15	239.85	203.87	188.82
27	5-Jan	431.03	376.86	437.15	345.82	346.13	369.80	374.17	268.15	231.63	215.83
28	12-Jan	470.52	412.78	476.92	379.12	382.60	409.21	415.27	298.85	261.12	243.93
29	19-Jan	512.75	449.71	519.27	415.12	421.60	452.07	459.85	331.79	294.29	275.03
30	26-Jan	554.08	485.28	562.22	451.02	460.52	494.88	504.60	363.10	326.99	306.69
31	2-Feb	597.25	521.62	606.74	487.47	501.35	539.46	549.54	398.65	362.61	340.87
32	9-Feb	635.56	554.92	646.82	519.79	535.92	579.84	590.77	431.84	393.78	367.79
33	16-Feb	671.49	585.18	687.62	551.61	569.89	619.77	632.63	463.81	424.87	394.35
34	23-Feb	709.99	620.00	727.48	584.43	604.88	662.36	675.70	498.98	457.19	421.63
35	1-Mar	744.35	650.17	765.57	614.92	636.86	703.13	717.63	532.91	489.65	446.08
36	8-Mar	777.97	678.88	800.78	644.07	667.43	739.69	754.51	562.61	516.88	469.46
37	15-Mar	817.78	713.07	840.01	678.49	703.63	779.20	794.16	593.07	546.22	498.13
38	22-Mar	847.55	739.25	870.54	704.55	729.66	810.97	825.83	620.09	569.32	517.15
39	29-Mar	874.81	763.31	896.79	726.98	751.15	836.51	851.72	643.38	587.65	532.29
40	5-Apr	899.58	784.49	919.82	747.35	770.56	858.40	872.67	663.31	601.75	545.22
41	12-Apr	923.89	805.22	942.40	766.87	790.20	878.28	892.76	682.07	615.47	558.47
42	19-Apr	942.26	820.83	960.53	781.87	804.44	895.41	909.95	699.01	627.63	567.25
43	26-Apr	956.64	832.33	973.58	793.83	814.58	907.19	921.41	712.18	634.26	572.33
44	3-May	969.51	843.86	984.43	803.55	822.73	914.74	929.25	721.54	637.90	575.50
45	10-May	981.20	853.57	993.56	812.32	830.20	922.81	937.03	731.04	642.25	578.59
46	17-May	992.97	863.50	1002.82	821.31	836.84	929.05	943.43	738.73	640.08	581.31
47	24-May	1001.90	870.78	1009.24	828.13	842.28	934.16	948.46	745.63	648.33	582.98
48	31-May	1007.45	874.97	1013.25	832.41	845.35	937.48	951.69	751.42	649.68	583.60
49	7-Jun	1011.51	977.58	1016.04	834.69	846.73	938.99	953.70	755.17	650.95	583.83
50	14-Jun	1014.61	879.32	1017.32	836.85	847.80	940.33	954.68	757.70	651.19	583.99

51	21-Jun	1016.85	880.71	1018.54	838.77	848.58	940.87	955.38	759.50	651.39	584.00
52	28-Jun	1019.70	883.14	1020.70	841.18	849.52	941.44	956.08	761.01	651.66	584.04

Victoria

Accumulated Degree-days ≥ 13.5°C for Queensland fruit fly in VICTORIA. 10 years (2004-2014) average data, starting from 1 July

	0 - 82	Zero development to egg maturation
	82 - 99	Mature egg through mating and oviposition to egg hatch
	99 - 180	Hatched egg to larval pupation
	180 - 404	Pupa to adult eclosion - The first generation of Qff adults after winter
	404 - 425	Eclosed adult through egg maturation and mating to oviposition
	425 - 829	The second generation of Qff eggs, larvae, pupae and adults after winter – Second generation adults emerge after 829DD

Week		Swan Hill	Kerang	Kyabram	Shepparton	Wangaratta	Bendigo	Dartmouth	Ballarat	Strathbogie	Hunters Hill
1	7-Jul	5.20	4.69	2.36	2.15	1.72	1.03	0.61	0.10	0.00	0.00
2	14-Jul	8.94	8.32	4.29	3.88	3.89	1.41	1.37	0.12	0.03	0.00
3	21-Jul	13.57	12.58	6.77	6.30	6.57	2.92	2.33	0.39	0.39	0.00
4	28-Jul	20.86	19.33	10.08	8.97	9.05	4.83	4.35	0.66	0.47	0.00
5	4-Aug	30.39	27.98	15.26	13.24	12.82	7.99	6.50	1.76	1.29	0.35
6	11-Aug	39.01	36.01	20.08	17.39	16.68	10.37	8.04	1.98	1.52	0.43
7	18-Aug	49.84	46.22	26.08	22.24	21.05	13.96	10.84	2.61	1.92	0.43
8	25-Aug	64.89	60.81	36.16	30.97	28.64	21.47	16.53	5.31	3.95	0.83
9	1-Sep	83.60	79.26	49.73	43.65	41.71	32.12	26.95	10.05	7.97	3.38
10	8-Sep	104.63	99.87	65.33	58.28	55.58	43.83	37.53	15.10	12.75	6.28
11	15-Sep	126.78	121.27	82.03	73.63	69.08	56.26	47.35	20.33	17.50	8.82
12	22-Sep	155.38	148.84	103.53	94.16	88.19	73.26	63.88	28.99	25.79	14.18
13	29-Sep	182.05	174.60	124.21	114.22	107.47	89.49	80.94	35.94	34.04	19.73
14	6-Oct	214.06	205.45	150.28	139.86	131.57	111.45	101.98	47.17	46.26	28.68
15	13-Oct	247.91	238.32	178.28	167.69	156.66	134.92	124.16	59.53	60.12	39.28
16	20-Oct	287.86	277.52	211.84	200.59	188.58	164.72	152.62	77.23	78.94	54.04
17	27-Oct	331.14	320.00	248.30	237.30	223.27	195.97	183.55	93.22	99.63	70.44
18	3-Nov	377.60	365.93	289.48	278.74	263.88	232.75	218.52	115.07	124.03	91.35
19	10-Nov	425.95	414.36	333.52	323.02	307.00	271.08	254.96	140.25	152.93	114.04
20	17-Nov	476.93	464.59	378.88	367.74	350.82	311.68	293.80	167.05	183.23	140.70
21	24-Nov	531.17	517.83	428.70	417.25	401.14	356.47	337.27	190.59	218.45	172.07

22	1-Dec	592.41	577.38	484.34	473.04	455.87	407.47	383.84	231.57	257.47	206.90
23	8-Dec	648.72	651.92	536.54	525.20	507.37	453.40	427.84	263.34	292.36	236.63
24	15-Dec	705.06	707.81	587.90	576.60	559.52	499.19	472.70	294.34	326.76	267.42
25	22-Dec	766.70	768.76	645.02	633.25	615.07	551.43	521.51	331.95	368.54	304.29
26	29-Dec	829.26	830.67	701.67	690.52	673.38	604.21	574.02	368.51	410.43	344.57
27	5-Jan	898.76	901.10	768.01	755.52	737.35	665.48	632.74	413.78	463.03	395.14
28	12-Jan	968.26	971.02	833.55	821.30	802.13	726.85	694.09	461.25	515.57	450.57
29	19-Jan	1037.86	1041.30	899.03	887.01	868.87	788.72	756.82	509.11	568.07	506.71
30	26-Jan	1111.08	1113.77	968.66	956.93	938.01	852.99	821.10	559.12	625.23	562.82
31	2-Feb	1186.17	1188.30	1038.96	1026.84	1008.76	920.12	887.92	611.66	683.80	625.70
32	9-Feb	1254.69	1258.41	1102.42	1090.51	1071.16	979.44	948.24	656.56	734.07	676.65
33	16-Feb	1320.93	1323.92	1164.18	1152.33	1132.52	1038.11	1000.78	700.51	781.07	717.85
34	23-Feb	1390.99	1393.70	1229.89	1217.56	1193.89	1099.86	1056.55	747.43	831.30	761.98
35	1-Mar	1457.80	1459.55	1291.77	1278.65	1254.69	1156.91	1109.85	789.20	877.05	802.84
36	8-Mar	1514.80	1516.46	1344.90	1331.59	1308.28	1206.12	1159.14	827.03	916.04	837.50
37	15-Mar	1575.75	1577.42	1402.43	1388.76	1365.33	1259.83	1210.67	868.88	960.01	878.71

Appendix 11 – Selected cherry production areas: Tables of daily accumulated degree-days over 12.405°C from 1 July

New South Wales

	0 - 82	Zero development to egg maturation
	82 - 99	Mature egg through mating and oviposition to egg hatch
	99 - 180	Hatched egg to larval pupation
	180 - 404	Pupa to adult eclosion - The first generation of Qff adults after winter
	404 - 425	Eclosed adult through egg maturation and mating to oviposition
	425 - 829	The second generation of Qff eggs, larvae, pupae and adults after winter – Second generation adults emerge after 829DD

	YOUNG	TUMBARUMBA	HILLSTON	WELLINGTON	MUDGEE	ORANGE
Jul/1	0.29	0.16	1.99	1.75	1.14	0.03
Jul/2	0.86	0.36	3.81	3.21	2.26	0.05
Jul/3	1.56	0.68	5.27	4.84	3.51	0.17
Jul/4	2.36	0.85	6.62	6.87	5.03	0.33
Jul/5	3.12	1.01	8.60	8.57	6.19	0.39
Jul/6	3.70	1.14	10.22	9.76	7.02	0.39
Jul/7	4.06	1.25	11.05	11.13	7.88	0.39
Jul/8	4.53	1.31	11.75	12.64	8.68	0.39
Jul/9	5.13	1.45	12.94	14.11	9.57	0.46
Jul/10	6.01	1.63	14.32	15.51	10.51	0.53
Jul/11	6.95	1.75	15.95	17.19	11.50	0.64
Jul/12	7.44	2.08	17.14	18.91	12.76	0.68
Jul/13	8.33	2.27	18.18	20.56	14.04	0.86
Jul/14	9.09	2.45	19.26	22.02	15.08	1.04
Jul/15	9.28	2.50	20.42	22.93	15.71	1.04
Jul/16	9.76	2.71	21.76	24.10	16.51	1.04
Jul/17	10.44	2.87	22.73	25.60	17.57	1.12
Jul/18	11.07	3.12	23.84	27.11	18.86	1.18
Jul/19	11.47	3.25	25.03	28.32	19.60	1.18
Jul/20	11.97	3.50	26.90	30.33	21.11	1.19
Jul/21	12.94	3.96	29.15	32.42	22.42	1.31
Jul/22	14.06	4.35	30.97	34.55	23.80	1.44
Jul/23	14.74	4.54	33.00	36.08	24.79	1.44
Jul/24	15.73	4.84	35.42	37.83	26.00	1.58
Jul/25	16.58	5.11	37.55	39.91	27.58	1.64
Jul/26	17.40	5.18	38.95	41.85	28.73	1.69
Jul/27	18.06	5.41	40.14	43.63	29.98	1.84
Jul/28	18.87	5.58	41.54	44.84	30.90	1.87
Jul/29	19.94	5.76	43.87	46.85	32.56	2.03
Jul/30	20.91	6.02	46.38	48.78	34.01	2.16
Jul/31	22.01	6.37	49.22	51.19	35.97	2.33
Aug/1	23.19	6.94	51.87	53.35	37.75	2.66
Aug/2	24.27	7.48	54.45	55.41	39.36	3.02
Aug/3	25.61	8.04	57.23	57.54	41.14	3.34
Aug/4	26.54	8.48	59.21	59.11	42.15	3.60
Aug/5	27.59	8.84	61.32	60.90	43.51	3.77

	YOUNG	TUMBARUMBA	HILLSTON	WELLINGTON	MUDGEE	ORANGE
Aug/6	28.22	9.15	63.68	62.81	45.15	3.98
Aug/7	28.96	9.39	65.46	64.70	46.62	4.11
Aug/8	29.77	9.67	67.36	66.22	47.94	4.30
Aug/9	30.68	9.96	69.64	68.03	49.35	4.43
Aug/10	31.83	10.32	72.00	69.93	50.78	4.79
Aug/11	32.79	10.72	73.53	71.75	52.30	5.10
Aug/12	33.55	11.10	75.48	73.38	53.46	5.17
Aug/13	34.33	11.39	77.97	75.59	55.08	5.27
Aug/14	35.92	12.15	80.65	78.21	57.10	5.57
Aug/15	37.39	12.79	83.57	80.54	59.07	5.87
Aug/16	38.89	13.39	86.92	83.43	61.27	6.38
Aug/17	39.83	13.66	89.11	85.66	63.24	6.73
Aug/18	40.85	14.16	91.81	87.88	65.00	6.94
Aug/19	42.07	14.85	94.84	90.26	66.77	7.35
Aug/20	43.18	15.52	98.04	92.44	68.29	7.62
Aug/21	44.56	16.13	101.89	95.30	70.36	7.97
Aug/22	46.32	16.86	104.96	98.16	72.64	8.44
Aug/23	48.04	17.72	108.29	101.39	75.38	9.42
Aug/24	49.55	18.74	111.89	104.42	78.12	10.06
Aug/25	51.51	20.01	115.91	107.48	80.85	11.51
Aug/26	54.11	21.69	120.26	111.05	84.04	12.73
Aug/27	57.03	23.40	124.50	115.07	87.49	13.95
Aug/28	60.25	25.54	128.99	119.57	91.24	15.53
Aug/29	63.53	27.47	133.63	124.16	94.87	16.89
Aug/30	65.75	28.71	137.12	127.79	98.09	17.96
Aug/31	67.69	29.82	140.62	130.98	100.86	18.77
Sep/1	70.37	31.23	144.75	134.99	104.40	20.02
Sep/2	73.59	33.18	149.23	139.63	108.45	21.55
Sep/3	76.90	35.33	153.61	143.44	111.22	22.77
Sep/4	79.44	37.07	157.38	146.79	113.87	23.67
Sep/5	81.96	38.74	161.23	150.13	116.62	24.74
Sep/6	84.70	39.97	164.83	153.99	119.85	25.90
Sep/7	87.01	41.35	168.32	157.68	123.04	26.72
Sep/8	89.35	42.72	172.08	161.40	125.96	27.72
Sep/9	91.14	44.15	175.70	164.90	128.76	28.62
Sep/10	93.28	45.21	179.75	168.86	132.04	29.63
Sep/11	95.54	46.24	183.50	172.50	134.99	30.21
Sep/12	98.78	48.15	188.33	176.38	138.22	31.56
Sep/13	102.00	50.10	193.68	180.87	142.41	33.23
Sep/14	105.13	51.67	198.99	185.21	146.08	34.45
Sep/15	108.50	53.40	204.24	190.11	150.34	36.09
Sep/16	111.34	54.98	208.65	193.72	153.33	37.48
Sep/17	114.83	57.22	213.71	198.19	157.29	39.46
Sep/18	118.92	59.76	219.42	203.22	161.72	41.46
Sep/19	123.22	62.64	226.04	208.13	165.99	43.37
Sep/20	126.92	64.65	230.99	213.73	170.39	45.38
Sep/21	130.80	67.33	236.50	218.93	174.98	47.44
Sep/22	136.12	70.77	243.94	224.89	180.34	50.56
Sep/23	140.77	73.75	249.14	230.83	185.64	53.57
Sep/24	144.67	76.30	254.19	236.42	190.85	55.81
Sep/25	148.74	79.00	259.86	241.81	195.44	58.14

	YOUNG	TUMBARUMBA	HILLSTON	WELLINGTON	MUDGEE	ORANGE
Sep/26	152.94	81.58	265.38	247.18	199.96	60.20
Sep/27	157.76	84.76	272.08	253.36	205.18	63.27
Sep/28	162.01	87.26	278.63	259.37	210.35	65.97
Sep/29	165.11	88.65	283.37	264.11	214.39	67.69
Sep/30	169.16	90.84	289.00	268.93	218.88	69.79
Oct/1	173.63	93.79	295.77	274.08	223.84	72.34
Oct/2	179.47	97.84	303.41	280.07	229.65	75.72
Oct/3	184.43	101.40	310.26	285.62	234.26	78.42
Oct/4	189.85	105.05	317.01	291.71	239.37	81.47
Oct/5	195.69	108.73	324.31	298.55	245.44	85.31
Oct/6	200.16	111.44	330.06	304.85	251.17	88.37
Oct/7	203.50	113.68	335.00	309.26	255.35	90.11
Oct/8	207.01	115.89	339.58	313.95	259.72	91.76
Oct/9	211.22	118.79	344.92	319.27	264.00	93.75
Oct/10	216.58	122.36	351.95	325.21	269.09	96.33
Oct/11	221.34	125.43	358.86	330.63	273.87	98.41
Oct/12	226.98	129.35	367.44	336.95	279.47	101.41
Oct/13	233.59	134.15	376.99	344.30	285.83	105.07
Oct/14	238.46	137.87	384.86	350.84	291.62	108.44
Oct/15	243.12	140.61	390.76	357.26	297.17	111.19
Oct/16	247.30	143.40	395.68	362.13	301.23	113.18
Oct/17	251.81	146.55	402.22	368.17	306.17	115.60
Oct/18	258.17	151.18	410.45	374.82	311.66	118.64
Oct/19	265.10	156.65	419.02	382.02	318.09	122.86
Oct/20	272.67	162.32	428.02	389.63	324.80	127.46
Oct/21	280.11	167.30	436.47	397.07	331.75	131.72
Oct/22	286.93	171.61	445.57	404.55	337.98	135.82
Oct/23	293.93	176.31	454.48	412.74	344.88	139.97
Oct/24	300.07	180.96	463.46	419.38	350.70	143.30
Oct/25	306.72	185.08	471.84	426.69	356.95	146.91
Oct/26	313.34	189.63	480.96	433.70	362.60	150.37
Oct/27	319.52	193.85	489.09	440.78	368.85	153.86
Oct/28	325.83	198.22	496.89	448.13	375.26	157.38
Oct/29	333.16	203.17	506.21	455.96	382.05	161.45
Oct/30	340.44	207.90	514.75	464.52	388.94	165.95
Oct/31	348.52	213.84	523.97	473.43	396.48	171.04
Nov/1	356.94	219.61	534.37	482.56	404.15	176.26
Nov/2	365.36	225.30	545.93	491.48	411.66	181.17
Nov/3	372.24	230.01	554.14	499.57	418.73	185.32
Nov/4	379.00	234.34	560.56	507.23	425.23	189.17
Nov/5	386.63	239.76	568.46	514.57	431.33	192.98
Nov/6	393.86	245.36	577.81	522.10	437.10	196.70
Nov/7	401.63	250.65	587.01	530.79	444.42	201.42
Nov/8	409.64	256.77	596.39	540.15	452.00	206.67
Nov/9	417.23	262.47	607.67	548.91	459.28	211.20
Nov/10	424.78	267.99	618.44	557.43	466.31	216.07
Nov/11	432.47	273.25	629.02	566.13	473.43	220.85
Nov/12	441.70	279.81	641.66	575.46	481.49	226.61
Nov/13	449.68	285.17	653.62	584.93	489.79	231.74
Nov/14	458.32	291.15	665.52	594.82	498.64	237.52
Nov/15	466.68	296.52	675.76	604.43	507.14	242.52

	YOUNG	TUMBARUMBA	HILLSTON	WELLINGTON	MUDGEE	ORANGE
Nov/16	474.33	301.70	685.36	612.49	513.87	246.41
Nov/17	482.74	307.65	695.76	621.41	521.05	251.06
Nov/18	492.28	314.43	708.05	630.88	529.12	256.75
Nov/19	502.14	321.54	720.53	641.64	538.33	263.49
Nov/20	511.85	328.91	732.36	652.25	547.48	270.43
Nov/21	521.41	335.74	742.89	662.66	556.45	277.09
Nov/22	529.96	341.82	751.38	673.10	565.15	283.36
Nov/23	537.56	347.57	760.09	681.82	572.11	287.85
Nov/24	545.80	354.14	770.10	690.88	579.60	292.76
Nov/25	555.43	361.45	782.27	701.02	588.00	298.58
Nov/26	565.60	369.23	794.14	712.36	597.25	305.28
Nov/27	575.66	376.13	805.64	722.75	606.40	311.46
Nov/28	586.21	383.60	817.36	733.43	615.70	318.14
Nov/29	595.03	390.20	827.85	743.74	624.70	323.90
Nov/30	604.87	396.62	838.75	754.02	633.72	330.25
Dec/1	614.53	403.40	849.59	765.42	643.13	336.83
Dec/2	623.73	409.78	858.66	776.10	652.34	342.39
Dec/3	632.04	415.97	867.94	785.74	660.77	347.99
Dec/4	641.27	422.18	878.43	795.45	669.11	353.70
Dec/5	650.08	428.15	890.64	805.03	677.51	358.64
Dec/6	659.43	435.12	904.32	815.45	686.23	364.82
Dec/7	669.46	442.37	915.89	826.21	695.32	371.26
Dec/8	680.01	450.03	927.47	837.56	705.05	377.99
Dec/9	690.16	457.85	938.40	849.31	715.24	384.80
Dec/10	699.66	464.24	950.68	860.33	724.47	390.78
Dec/11	708.20	470.97	961.70	869.81	732.27	396.29
Dec/12	717.03	477.33	972.21	879.73	740.40	401.91
Dec/13	726.10	484.02	982.31	890.22	749.73	408.48
Dec/14	735.59	490.84	992.65	900.83	758.76	414.57
Dec/15	745.56	497.82	1003.44	912.07	768.45	421.34
Dec/16	755.87	505.21	1015.10	923.74	777.72	428.05
Dec/17	765.89	511.87	1026.99	934.40	786.79	434.30
Dec/18	775.73	518.23	1038.37	944.33	794.92	439.71
Dec/19	785.81	525.52	1049.68	954.92	804.11	446.13
Dec/20	795.55	532.98	1060.42	966.31	813.85	453.01
Dec/21	806.46	541.16	1072.30	977.60	823.53	460.22
Dec/22	818.05	550.15	1086.37	988.93	833.74	468.09
Dec/23	830.85	559.66	1100.21	1002.33	845.59	477.01
Dec/24	842.47	568.42	1112.68	1015.36	856.47	484.69
Dec/25	851.80	575.10	1123.96	1025.36	865.45	490.25
Dec/26	861.21	582.31	1135.82	1035.48	873.89	495.87
Dec/27	870.88	589.60	1146.29	1045.83	882.47	502.22
Dec/28	881.72	598.06	1157.96	1056.66	891.49	509.03
Dec/29	892.65	606.29	1170.73	1068.23	901.36	516.57
Dec/30	903.91	614.96	1185.17	1079.43	910.85	523.69
Dec/31	915.42	623.99	1200.33	1091.37	921.07	531.52
Jan/1	927.76	634.28	1216.97	1104.22	931.98	539.96
Jan/2	940.08	643.46	1229.93	1118.10	943.56	548.52
Jan/3	952.00	652.56	1242.65	1132.01	954.99	556.62
Jan/4	963.83	661.24	1255.81	1144.98	965.40	563.83
Jan/5	976.33	669.91	1268.96	1158.13	976.45	571.97

	YOUNG	TUMBARUMBA	HILLSTON	WELLINGTON	MUDGEE	ORANGE
Jan/6	989.11	679.31	1282.43	1170.65	987.22	580.21
Jan/7	1001.52	688.43	1296.29	1183.20	997.46	588.00
Jan/8	1014.44	697.93	1309.98	1196.58	1008.71	596.76
Jan/9	1025.47	706.79	1324.06	1208.43	1018.73	603.50
Jan/10	1037.77	716.98	1339.96	1220.58	1028.98	611.03
Jan/11	1051.47	727.36	1356.92	1234.07	1040.63	620.09
Jan/12	1066.42	739.32	1373.09	1249.41	1053.73	630.88
Jan/13	1081.24	749.52	1387.64	1264.73	1066.90	641.93
Jan/14	1095.17	760.18	1402.56	1279.35	1078.94	651.68
Jan/15	1110.24	771.94	1419.40	1293.98	1091.26	661.58
Jan/16	1123.96	782.38	1433.63	1308.01	1103.15	670.70
Jan/17	1136.03	792.42	1445.98	1320.85	1114.07	678.44
Jan/18	1147.74	802.03	1458.26	1333.08	1124.42	686.34
Jan/19	1160.50	811.13	1471.91	1346.00	1135.07	694.70
Jan/20	1174.46	820.92	1487.68	1359.63	1146.15	703.61
Jan/21	1187.54	830.45	1503.19	1373.13	1157.83	712.94
Jan/22	1201.20	841.39	1519.43	1386.69	1169.32	721.40
Jan/23	1215.00	852.53	1535.06	1401.10	1181.03	730.16
Jan/24	1228.30	862.55	1549.91	1415.23	1192.93	738.59
Jan/25	1240.60	871.67	1564.54	1428.78	1204.82	746.96
Jan/26	1253.80	882.02	1580.24	1442.79	1217.03	755.83
Jan/27	1267.69	892.24	1596.35	1456.92	1228.96	765.25
Jan/28	1281.06	902.58	1612.56	1469.99	1240.05	773.43
Jan/29	1295.25	913.78	1628.69	1483.92	1251.71	782.82
Jan/30	1309.51	924.96	1645.40	1497.99	1263.87	792.04
Jan/31	1323.70	936.12	1661.57	1512.54	1276.20	801.84
Feb/1	1338.88	947.97	1678.75	1527.59	1288.97	811.84
Feb/2	1352.43	958.67	1693.23	1541.41	1300.68	820.66
Feb/3	1365.24	968.87	1707.49	1555.31	1312.36	829.61

Victoria

	0 - 82	Zero development to egg maturation
	82 - 99	Mature egg through mating and oviposition to egg hatch
	99 - 180	Hatched egg to larval pupation
	180 - 404	Pupa to adult eclosion - The first generation of Qff adults after winter
	404 - 425	Eclosed adult through egg maturation and mating to oviposition
	425 - 829	The second generation of Qff eggs, larvae, pupae and adults after winter – Second generation adults emerge after 829DD

	HUNTER'S HILL	DARTMOUTH	BENDIGO	WANGARATTA	STRATHBOGIE	BALLARAT	KYABRAM	SWAN HILL	KERANG	SHEPPARTON
Jul/1	0.00	0.22	0.29	0.36	0.00	0.16	0.61	1.39	1.25	0.49
Jul/2	0.00	0.43	0.78	1.01	0.03	0.31	1.36	2.64	2.54	1.18
Jul/3	0.00	0.67	1.29	1.65	0.04	0.34	2.10	3.84	3.67	1.91
Jul/4	0.00	0.86	1.66	2.36	0.04	0.34	2.92	5.15	4.99	2.75
Jul/5	0.00	1.09	2.03	2.83	0.04	0.36	3.52	6.31	6.03	3.29
Jul/6	0.00	1.31	2.46	3.46	0.08	0.37	4.30	7.46	7.05	3.98
Jul/7	0.00	1.52	2.65	3.88	0.08	0.37	4.77	8.17	7.78	4.33
Jul/8	0.00	1.77	2.81	4.40	0.09	0.37	5.11	8.80	8.43	4.66
Jul/9	0.00	2.08	3.00	5.11	0.09	0.42	5.58	9.77	9.36	5.12
Jul/10	0.00	2.38	3.25	5.91	0.09	0.42	6.20	10.75	10.50	5.71
Jul/11	0.00	2.48	3.38	6.46	0.09	0.45	6.94	11.83	11.56	6.33
Jul/12	0.00	2.82	3.65	6.99	0.17	0.46	7.54	12.87	12.50	6.90
Jul/13	0.00	3.29	3.89	7.58	0.19	0.46	8.16	13.44	13.15	7.44
Jul/14	0.00	3.47	4.12	8.08	0.26	0.54	8.60	14.30	13.87	7.88
Jul/15	0.00	3.54	4.32	8.25	0.27	0.59	9.03	15.07	14.64	8.11
Jul/16	0.00	3.75	4.60	8.66	0.29	0.61	9.48	16.10	15.61	8.55
Jul/17	0.00	4.12	5.15	9.38	0.51	0.69	10.22	17.08	16.58	9.34
Jul/18	0.05	4.45	5.60	10.01	0.78	0.90	10.96	18.07	17.63	9.94
Jul/19	0.05	4.68	6.03	10.64	0.78	0.95	11.62	19.19	18.70	10.48
Jul/20	0.05	5.07	6.51	11.46	0.89	1.10	12.35	20.37	19.71	11.23
Jul/21	0.05	5.57	7.03	12.58	1.06	1.24	13.29	21.70	21.00	12.15
Jul/22	0.05	5.99	7.95	13.59	1.11	1.36	14.43	23.20	22.48	13.25
Jul/23	0.05	6.58	8.64	14.43	1.12	1.41	15.35	24.66	23.99	14.03
Jul/24	0.05	7.21	9.35	15.32	1.26	1.61	16.37	26.52	25.67	14.96
Jul/25	0.05	7.43	9.95	15.92	1.30	1.84	17.20	28.20	27.17	15.67
Jul/26	0.05	7.90	10.38	16.65	1.37	1.90	18.15	29.72	28.57	16.42
Jul/27	0.05	8.29	10.65	17.08	1.40	2.00	18.68	30.84	29.61	16.82
Jul/28	0.05	8.47	11.06	17.51	1.43	2.11	19.30	32.30	31.00	17.29
Jul/29	0.05	8.92	11.82	18.53	1.47	2.29	20.41	33.90	32.65	18.34
Jul/30	0.05	9.31	12.35	19.32	1.55	2.34	21.54	35.65	34.31	19.34
Jul/31	0.05	9.74	13.18	20.12	1.72	2.58	22.72	37.31	35.90	20.38
Aug/1	0.11	10.47	13.83	21.13	1.89	2.80	23.87	39.14	37.58	21.23
Aug/2	0.23	11.08	14.53	22.03	2.07	3.15	24.96	41.35	39.44	22.09
Aug/3	0.43	11.56	15.52	22.87	2.33	3.75	26.16	43.43	41.39	23.07
Aug/4	0.62	12.09	16.34	23.87	2.70	3.96	27.36	45.39	43.26	24.23
Aug/5	0.76	12.67	17.09	24.99	2.95	3.98	28.76	47.26	45.01	25.50
Aug/6	0.77	13.17	18.15	25.92	3.06	4.15	30.16	49.26	47.01	26.65
Aug/7	0.78	13.54	18.62	26.54	3.14	4.26	31.05	50.80	48.53	27.52
Aug/8	0.79	13.99	19.20	27.36	3.17	4.48	32.13	52.59	50.14	28.33
Aug/9	0.79	14.18	19.68	28.13	3.24	4.56	32.91	54.41	51.91	29.03
Aug/10	0.79	14.49	20.23	28.97	3.24	4.69	33.72	55.86	53.26	29.92

	HUNTER'S HILL	DARTMOUTH	BENDIGO	WANGARATTA	STRATHBOGIE	BALLARAT	KYABRAM	SWAN HILL	KERANG	SHEPPARTON
Aug/11	0.79	14.95	20.93	30.00	3.37	4.79	34.95	57.44	54.68	30.95
Aug/12	0.80	15.50	21.88	31.01	3.48	4.96	36.05	58.95	56.11	31.91
Aug/13	0.80	15.98	22.71	31.76	3.57	5.20	37.32	61.09	58.27	32.96
Aug/14	0.81	16.85	23.41	32.99	3.73	5.48	38.57	63.30	60.25	34.15
Aug/15	0.84	17.43	24.18	33.91	3.94	5.84	39.98	65.74	62.31	35.18
Aug/16	0.88	18.15	25.42	35.12	4.20	6.30	41.59	68.00	64.59	36.60
Aug/17	0.88	18.65	26.05	35.93	4.24	6.34	42.55	69.56	66.13	37.46
Aug/18	0.90	19.56	26.96	37.18	4.56	6.44	44.05	71.84	68.38	38.80
Aug/19	1.06	20.42	27.93	38.51	4.93	6.70	45.56	73.85	70.45	40.07
Aug/20	1.15	21.52	29.15	39.80	5.39	7.24	47.33	76.51	73.04	41.73
Aug/21	1.18	22.38	30.84	41.27	5.85	7.87	49.49	79.37	75.68	43.59
Aug/22	1.22	23.50	32.11	42.76	6.30	8.33	51.24	81.76	78.03	45.18
Aug/23	1.23	24.58	33.71	44.28	6.66	8.93	53.17	84.10	80.44	46.83
Aug/24	1.45	26.10	35.48	45.83	7.24	9.68	55.14	87.27	83.27	48.55
Aug/25	1.95	27.66	37.26	47.83	8.13	10.68	57.42	90.41	86.58	50.72
Aug/26	2.57	29.65	39.36	50.02	9.12	11.60	60.01	93.43	89.89	53.09
Aug/27	3.11	31.67	41.15	52.13	9.71	12.34	62.29	96.65	93.03	55.23
Aug/28	4.05	34.21	43.66	54.68	10.77	13.66	65.11	100.56	96.87	57.83
Aug/29	4.65	36.38	46.15	57.64	12.00	14.95	68.22	104.25	100.53	60.77
Aug/30	4.97	38.18	47.65	59.49	12.50	15.60	70.30	107.04	103.21	62.59
Aug/31	5.32	39.58	49.27	61.49	13.05	16.28	72.32	109.82	105.96	64.67
Sep/1	5.91	41.35	51.21	63.62	14.03	17.37	74.69	112.84	109.01	66.87
Sep/2	6.78	43.49	53.90	66.37	15.15	18.81	77.77	116.94	112.88	69.81
Sep/3	7.57	45.62	56.19	69.10	16.51	20.17	80.65	120.71	116.69	72.60
Sep/4	8.11	47.73	58.71	71.80	17.81	21.43	83.84	124.53	120.62	75.45
Sep/5	8.91	49.90	60.95	74.48	19.14	22.26	86.91	128.54	124.57	78.33
Sep/6	9.36	51.94	62.63	76.77	19.87	23.05	89.43	131.60	127.66	80.71
Sep/7	9.71	53.83	64.45	79.05	20.57	23.82	91.64	134.44	130.39	82.86
Sep/8	10.17	55.27	66.59	81.30	21.19	24.68	94.12	137.65	133.51	85.22
Sep/9	10.63	56.63	68.87	83.73	22.20	25.73	96.93	141.19	136.98	88.07
Sep/10	10.84	57.90	70.70	86.00	22.78	26.27	99.43	144.20	139.98	90.53
Sep/11	11.14	59.41	72.92	88.11	23.49	27.27	102.01	147.52	143.38	92.85
Sep/12	12.07	61.72	76.04	90.93	24.97	29.25	105.80	152.21	147.95	96.32
Sep/13	12.96	63.83	78.35	93.25	26.09	30.24	108.73	155.95	151.56	98.98
Sep/14	13.43	65.77	80.51	95.91	27.05	31.01	111.47	159.55	154.92	101.58
Sep/15	14.08	68.06	82.98	98.64	28.11	32.00	114.68	163.73	158.85	104.29
Sep/16	14.83	70.07	85.02	100.83	29.10	33.05	117.07	167.31	162.16	106.67
Sep/17	15.72	72.37	87.57	103.59	30.52	34.57	120.25	171.64	166.37	109.69
Sep/18	16.93	75.55	89.98	106.85	32.09	35.77	123.74	176.00	170.62	113.05
Sep/19	18.41	79.06	93.86	110.77	34.22	38.16	128.12	181.25	175.75	117.26
Sep/20	19.04	81.22	96.38	113.80	35.34	39.26	131.29	185.44	179.82	120.31
Sep/21	19.84	84.37	99.60	117.17	36.99	41.04	134.98	190.28	184.57	123.89
Sep/22	21.39	88.00	103.73	121.56	39.41	43.55	140.01	196.27	190.38	128.65
Sep/23	22.84	91.52	106.56	124.85	40.92	44.44	143.53	200.29	194.50	131.94
Sep/24	23.72	94.43	108.90	128.00	42.05	45.30	146.64	204.15	198.28	135.00
Sep/25	24.74	97.39	111.79	131.20	43.67	46.78	150.18	208.36	202.48	138.42
Sep/26	25.87	100.20	115.30	134.59	45.57	48.85	154.18	213.48	207.38	142.23
Sep/27	27.48	103.79	119.24	138.74	48.04	51.07	158.90	219.36	213.12	146.86
Sep/28	28.55	106.56	121.44	142.22	49.73	52.07	161.72	223.53	216.90	149.95
Sep/29	28.95	108.40	123.67	144.71	50.56	53.09	164.54	227.13	220.31	152.53
Sep/30	29.81	111.20	126.83	148.09	52.38	54.64	168.46	232.04	225.08	156.31

	HUNTER'S HILL	DARTMOUTH	BENDIGO	WANGARATTA	STRATHBOGIE	BALLARAT	KYABRAM	SWAN HILL	KERANG	SHEPPARTON
Oct/1	30.83	114.36	130.54	151.79	54.40	56.43	172.87	237.54	230.29	160.52
Oct/2	32.74	118.33	134.10	156.17	56.57	58.52	177.13	242.56	235.25	164.74
Oct/3	34.89	122.35	138.07	160.77	59.21	60.81	181.83	247.90	240.40	169.37
Oct/4	36.89	126.47	142.86	165.42	62.08	64.04	186.91	254.26	246.53	174.42
Oct/5	38.87	130.70	146.75	169.53	64.24	66.20	191.35	259.33	251.56	178.84
Oct/6	40.05	133.44	149.40	172.65	65.79	67.59	194.42	263.18	255.24	181.87
Oct/7	40.88	135.97	151.96	175.58	67.03	68.73	197.60	267.27	259.05	184.91
Oct/8	41.85	138.56	154.59	178.52	68.08	69.51	200.95	271.22	262.33	188.03
Oct/9	43.30	141.98	158.42	182.48	70.28	71.09	205.37	276.18	267.19	192.27
Oct/10	45.47	146.13	162.64	186.98	73.03	73.55	210.45	282.24	273.05	197.21
Oct/11	47.16	150.06	167.00	191.21	75.53	76.49	215.23	287.96	278.77	201.93
Oct/12	49.57	154.87	172.66	196.63	79.22	80.41	220.93	295.64	286.09	208.16
Oct/13	52.94	159.75	177.43	201.92	82.93	82.88	226.75	302.25	292.95	214.31
Oct/14	55.07	164.30	181.51	206.33	85.12	85.27	231.39	307.96	298.47	218.77
Oct/15	56.51	168.10	184.95	210.17	86.90	86.89	235.46	313.19	303.42	222.73
Oct/16	58.12	171.34	188.82	214.05	89.30	89.24	239.69	318.28	308.41	226.97
Oct/17	60.05	175.64	193.09	218.52	91.94	91.93	244.52	323.97	313.90	231.63
Oct/18	62.89	181.05	198.36	224.28	95.64	95.17	250.49	330.85	320.78	237.57
Oct/19	66.96	187.09	204.58	230.92	100.37	99.38	257.27	338.61	328.53	244.24
Oct/20	71.15	193.14	211.52	238.14	105.38	103.95	264.62	347.25	337.04	251.60
Oct/21	74.89	198.07	216.83	243.85	109.20	106.60	270.87	354.54	344.39	257.78
Oct/22	77.77	203.09	221.87	249.34	112.91	109.58	276.31	361.56	351.34	263.50
Oct/23	80.66	208.68	227.02	255.12	116.70	112.72	282.29	368.26	358.04	269.33
Oct/24	83.62	214.18	232.26	260.74	120.03	115.52	288.37	375.48	364.87	275.11
Oct/25	86.14	218.81	236.82	266.22	123.18	117.79	293.73	381.66	371.08	280.65
Oct/26	89.01	224.00	242.56	271.98	127.08	121.29	300.27	389.50	378.64	287.02
Oct/27	91.50	228.86	247.23	277.25	130.07	123.51	305.70	395.80	384.64	292.78
Oct/28	94.09	233.89	252.47	282.70	133.34	126.68	311.69	403.06	391.60	298.71
Oct/29	97.51	239.56	258.31	289.10	137.58	130.37	318.21	410.29	398.76	305.11
Oct/30	100.63	244.78	264.51	295.42	141.94	134.58	325.20	418.56	406.55	312.11
Oct/31	104.92	251.11	271.26	302.55	146.75	139.07	332.45	426.86	415.01	319.43
Nov/1	109.32	257.25	278.20	310.35	151.77	142.98	340.27	435.42	423.52	327.10
Nov/2	113.72	263.44	284.94	317.64	156.23	146.93	347.35	444.00	431.86	334.46
Nov/3	116.69	268.79	289.31	323.07	158.84	149.13	352.62	449.83	437.67	339.89
Nov/4	119.45	273.75	293.97	328.49	162.17	151.65	357.83	455.80	443.48	345.38
Nov/5	123.25	279.09	299.84	335.08	166.97	155.85	364.42	463.44	451.10	352.14
Nov/6	127.65	284.79	306.30	342.33	172.20	160.62	371.95	471.57	459.24	359.70
Nov/7	131.20	290.82	312.54	349.22	177.13	164.95	379.20	479.89	467.64	366.75
Nov/8	135.31	297.04	318.48	356.45	181.83	168.46	386.18	487.55	475.19	373.85
Nov/9	139.61	303.51	325.86	363.53	186.89	173.76	394.31	496.24	483.99	381.61
Nov/10	143.92	309.88	332.64	370.91	191.97	178.53	402.21	504.78	492.53	389.38
Nov/11	148.20	316.16	340.06	377.93	197.10	183.99	409.97	513.30	501.10	397.09
Nov/12	153.59	322.43	348.00	385.90	203.20	189.58	418.98	523.69	511.21	405.82
Nov/13	157.98	328.91	354.26	393.13	207.94	193.40	426.74	532.37	519.72	413.39
Nov/14	162.65	335.35	361.06	400.47	213.05	197.54	434.30	540.76	528.01	420.78
Nov/15	167.26	341.01	366.76	407.25	217.28	200.94	440.98	548.51	535.41	427.34
Nov/16	171.10	346.30	372.34	413.69	221.14	204.13	447.33	556.41	542.98	433.65
Nov/17	175.57	352.93	379.43	420.95	226.55	209.38	454.92	565.33	551.73	441.09
Nov/18	181.10	360.40	387.87	429.49	232.96	215.77	464.38	575.93	561.87	450.34
Nov/19	187.55	367.98	396.60	438.89	239.83	221.71	474.19	586.72	572.42	460.00

	HUNTER'S HILL	DARTMOUTH	BENDIGO	WANGARATTA	STRATHBOGIE	BALLARAT	KYABRAM	SWAN HILL	KERANG	SHEPPARTON
Nov/20	193.43	375.27	403.85	447.78	245.34	226.48	482.91	596.02	581.65	468.20
Nov/21	198.13	381.63	410.67	455.47	250.60	230.79	490.55	604.52	590.38	475.99
Nov/22	202.47	387.97	416.64	462.89	255.17	233.92	497.33	612.02	597.80	482.87
Nov/23	206.84	394.32	423.20	470.08	260.07	238.15	504.41	619.93	605.55	490.02
Nov/24	212.32	401.63	431.20	478.55	266.42	243.74	513.08	629.24	614.75	498.68
Nov/25	218.81	409.63	440.76	487.93	273.28	249.74	522.83	640.47	625.69	508.15
Nov/26	225.22	418.18	449.01	497.19	279.68	255.68	532.10	650.47	635.40	517.30
Nov/27	230.63	425.70	457.92	505.98	286.23	262.67	541.56	661.71	646.20	526.50
Nov/28	237.01	433.63	465.67	514.83	292.19	267.85	550.88	671.82	656.48	535.47
Nov/29	242.47	440.77	473.85	523.83	298.21	273.39	560.28	682.39	666.56	544.70
Nov/30	247.68	448.23	481.95	532.66	304.62	278.51	569.26	692.28	676.12	554.03
Dec/1	252.65	455.02	489.98	541.05	310.56	283.46	578.11	702.33	686.17	563.09
Dec/2	256.94	461.68	496.62	548.74	315.71	287.92	585.86	710.30	694.22	571.03
Dec/3	261.48	468.40	503.53	556.44	321.28	292.41	593.98	719.45	703.28	579.06
Dec/4	265.81	474.91	510.21	563.84	326.23	297.14	601.47	728.08	711.65	586.51
Dec/5	270.32	481.45	517.83	571.85	331.57	302.78	609.97	737.28	720.80	595.02
Dec/6	275.90	489.02	525.62	580.60	337.64	307.92	618.74	746.93	730.13	603.73
Dec/7	281.33	496.67	533.40	589.35	343.69	313.56	627.18	756.23	739.44	612.23
Dec/8	287.46	504.75	541.64	598.63	350.15	319.91	636.55	766.80	749.63	621.46
Dec/9	293.31	511.94	549.00	607.51	356.21	325.06	645.35	775.84	758.88	630.25
Dec/10	298.04	519.03	556.49	615.58	361.83	330.83	653.73	785.11	768.17	638.67
Dec/11	303.31	526.55	563.81	623.96	367.65	335.82	661.79	793.99	776.98	646.84
Dec/12	308.07	533.87	571.45	631.84	373.26	341.08	670.35	803.37	786.38	655.15
Dec/13	312.73	540.31	578.77	640.19	378.57	346.23	678.54	812.58	795.44	663.33
Dec/14	318.16	547.68	586.12	648.62	384.01	351.07	686.47	821.66	804.09	671.49
Dec/15	323.18	554.46	593.75	657.27	389.68	356.28	694.73	831.02	813.25	679.78
Dec/16	328.97	562.19	601.81	665.97	395.89	361.71	703.36	840.35	822.68	688.34
Dec/17	334.53	569.41	610.20	674.41	402.21	367.32	712.72	850.49	832.80	697.35
Dec/18	339.14	576.29	618.65	683.04	408.58	373.81	721.71	860.64	842.74	706.20
Dec/19	345.06	583.67	627.13	692.24	414.71	379.34	731.04	871.77	853.39	715.50
Dec/20	350.65	591.64	635.43	701.41	421.48	385.61	740.24	881.89	863.30	724.80
Dec/21	357.65	600.61	644.22	711.68	428.73	391.49	750.46	892.63	874.03	734.99
Dec/22	365.29	609.96	654.04	722.27	436.75	399.05	761.18	904.65	885.91	745.91
Dec/23	373.15	619.53	664.18	732.78	444.08	405.77	771.71	916.68	897.92	756.31
Dec/24	379.93	629.00	673.58	743.38	451.67	411.91	782.13	927.78	909.01	767.29
Dec/25	384.70	636.25	681.13	751.73	457.02	417.34	790.25	937.58	918.59	775.54
Dec/26	390.82	644.23	689.40	760.78	463.42	422.47	799.16	947.83	928.64	784.57
Dec/27	396.65	651.88	697.66	769.65	469.64	428.22	808.11	958.03	938.63	793.55
Dec/28	403.92	660.28	706.61	779.63	476.91	434.61	817.96	968.43	949.11	803.19
Dec/29	411.27	669.04	715.30	789.51	483.88	440.62	827.42	978.69	959.64	812.50
Dec/30	419.52	678.60	725.97	800.23	492.24	448.83	838.74	991.16	972.17	823.02
Dec/31	428.39	688.74	738.52	811.80	502.55	459.32	851.97	1006.03	986.76	835.12
Jan/1	437.89	699.09	749.50	824.05	512.09	466.02	864.44	1020.09	1000.51	847.91
Jan/2	445.08	709.60	758.26	834.13	519.32	471.99	874.31	1030.29	1010.67	857.76
Jan/3	452.76	719.10	768.12	844.58	527.06	479.19	884.98	1041.71	1022.23	868.35
Jan/4	460.46	728.58	778.13	855.31	535.29	487.22	895.89	1053.31	1033.51	879.22
Jan/5	468.55	738.56	788.39	866.51	544.13	493.98	907.28	1065.89	1045.97	890.83
Jan/6	477.39	748.77	797.60	877.32	551.98	500.53	917.60	1077.20	1057.31	901.44
Jan/7	485.58	758.73	807.23	888.18	559.79	507.31	928.16	1088.83	1068.77	912.23
Jan/8	493.89	768.51	817.49	898.86	567.86	514.96	939.22	1100.75	1080.72	923.09

	HUNTER'S HILL	DARTMOUTH	BENDIGO	WANGARATTA	STRATHBOGIE	BALLARAT	KYABRAM	SWAN HILL	KERANG	SHEPPARTON
Jan/9	501.74	778.07	827.48	909.59	575.82	522.87	950.04	1112.31	1092.39	933.69
Jan/10	511.17	788.76	839.65	921.50	585.69	532.50	962.67	1126.31	1106.27	946.10
Jan/11	520.73	799.40	851.78	934.03	595.39	541.80	975.95	1140.86	1120.52	959.13
Jan/12	531.11	811.20	862.24	946.38	604.48	548.92	987.51	1153.25	1133.42	971.20
Jan/13	540.06	821.64	871.45	956.89	611.71	555.78	997.26	1164.15	1144.20	981.07
Jan/14	549.80	832.24	882.34	968.43	620.71	564.35	1009.15	1176.65	1156.96	992.70
Jan/15	560.60	844.18	892.74	980.73	629.69	572.43	1020.68	1189.19	1169.99	1004.34
Jan/16	570.08	855.48	904.47	993.29	639.04	580.97	1033.02	1202.43	1183.23	1016.69
Jan/17	578.92	865.93	915.90	1005.47	647.88	590.00	1045.06	1215.30	1196.32	1028.80
Jan/18	587.15	875.56	926.51	1016.41	656.86	597.40	1056.23	1227.66	1208.49	1040.07
Jan/19	595.31	885.55	936.23	1027.81	665.00	604.60	1066.96	1239.82	1220.23	1051.05
Jan/20	603.77	895.72	947.47	1039.86	674.69	612.74	1079.29	1252.65	1232.81	1063.20
Jan/21	612.18	905.97	957.88	1052.02	683.59	620.78	1091.03	1265.31	1245.42	1075.12
Jan/22	621.85	917.29	969.78	1064.88	693.60	629.80	1104.32	1279.13	1259.04	1088.16
Jan/23	631.68	928.79	979.85	1077.06	702.54	637.85	1115.78	1291.51	1270.92	1099.61
Jan/24	640.10	939.22	989.69	1088.22	710.50	644.72	1126.76	1303.28	1282.69	1110.58
Jan/25	648.53	949.10	1000.05	1099.41	719.29	653.24	1138.25	1315.91	1295.17	1121.96
Jan/26	658.46	959.95	1011.18	1112.20	728.87	661.44	1150.74	1329.46	1308.63	1134.61
Jan/27	668.20	971.17	1022.08	1123.99	737.64	669.99	1162.78	1342.95	1321.92	1146.30
Jan/28	678.32	982.59	1034.47	1136.65	747.85	679.61	1176.08	1357.31	1335.98	1159.54
Jan/29	688.94	994.34	1046.54	1149.87	758.49	688.58	1189.13	1371.32	1350.11	1172.51
Jan/30	699.03	1005.94	1058.11	1162.87	768.27	697.78	1201.52	1385.03	1363.72	1185.01
Jan/31	709.63	1017.91	1070.14	1175.94	778.12	706.63	1214.33	1398.64	1377.47	1197.66
Feb/1	720.96	1029.82	1082.31	1189.54	788.65	715.30	1227.15	1412.53	1391.21	1210.59
Feb/2	730.20	1040.40	1093.47	1201.53	797.44	723.73	1238.79	1425.29	1403.39	1222.28
Feb/3	739.44	1050.56	1105.64	1213.31	806.76	732.39	1250.87	1438.98	1416.86	1234.45
Feb/4	748.11	1060.51	1116.41	1224.45	815.18	740.40	1262.34	1451.85	1429.51	1245.97
Feb/5	755.95	1070.62	1127.11	1235.44	823.94	747.88	1273.90	1465.05	1442.58	1257.60
Feb/6	763.74	1079.45	1135.73	1245.50	830.85	754.07	1283.26	1475.76	1453.59	1267.18
Feb/7	771.95	1089.20	1146.02	1256.31	839.31	762.25	1294.57	1487.96	1466.02	1278.42
Feb/8	781.01	1099.78	1155.73	1267.97	847.97	769.12	1305.36	1499.44	1477.91	1289.45
Feb/9	788.50	1108.76	1164.98	1278.05	856.04	776.04	1316.04	1510.43	1488.90	1300.22
Feb/10	795.85	1117.60	1173.52	1287.82	862.63	782.19	1325.30	1520.46	1498.90	1309.60
Feb/11	802.31	1126.35	1182.51	1297.71	870.20	788.17	1335.17	1531.24	1509.50	1319.38
Feb/12	808.69	1135.04	1191.08	1307.34	877.05	793.78	1344.24	1541.50	1519.50	1328.59
Feb/13	815.14	1143.69	1199.88	1316.98	884.16	800.30	1353.31	1551.87	1529.55	1337.97
Feb/14	822.21	1152.79	1210.07	1327.32	892.45	808.73	1364.00	1562.92	1541.09	1348.58
Feb/15	828.90	1161.32	1221.10	1337.47	900.29	817.01	1375.13	1575.32	1552.80	1359.65
Feb/16	835.60	1170.04	1231.61	1347.56	908.28	825.65	1386.44	1587.61	1565.18	1370.59
Feb/17	842.92	1179.25	1242.33	1358.00	916.99	834.73	1397.86	1600.16	1577.71	1381.84

South Australia

	0 - 82	Zero development to egg maturation
	82 - 99	Mature egg through mating and oviposition to egg hatch
	99 - 180	Hatched egg to larval pupation
	180 - 404	Pupa to adult eclosion - The first generation of Qff adults after winter
	404 - 425	Eclosed adult through egg maturation and mating to oviposition
	425 - 829	The second generation of Qff eggs, larvae, pupae and adults after winter – Second generation adults emerge after 829DD

	LAMEROO	KAROONDA	NARACOORTE	MT CRAWFORD	MT LOFTY	KEITH	MT BARKER	NURIOOTPA
Jul/1	1.76	1.94	1.18	0.27	0.17	1.55	0.83	1.04
Jul/2	3.63	3.88	2.02	0.53	0.18	2.91	1.67	2.04
Jul/3	5.33	5.82	3.24	0.56	0.21	4.69	2.57	2.96
Jul/4	6.62	7.34	3.91	0.6	0.21	5.77	3.13	3.43
Jul/5	7.83	8.6	4.62	0.7	0.21	6.66	3.65	3.86
Jul/6	9.08	10.14	5.34	0.7	0.21	7.85	4.17	4.35
Jul/7	10.12	11.1	5.91	0.72	0.21	8.76	4.47	4.63
Jul/8	11.12	11.9	6.51	0.8	0.21	9.58	5.03	4.95
Jul/9	12.23	13.25	7.23	0.92	0.21	10.82	5.63	5.36
Jul/10	13.83	14.95	8.09	1.22	0.22	12.17	6.41	6.24
Jul/11	15.2	16.35	8.95	1.35	0.28	13.24	6.93	6.84
Jul/12	16.01	17.2	9.48	1.54	0.34	14.06	7.56	7.39
Jul/13	17.13	18.57	10.19	1.76	0.39	15.16	8.2	8.02
Jul/14	18.26	19.7	10.74	1.76	0.39	16.27	8.34	8.22
Jul/15	19.45	20.96	11.58	1.77	0.39	17.24	8.69	8.45
Jul/16	20.58	22.08	12.37	1.81	0.39	18.29	9.03	8.83
Jul/17	21.75	23.43	13.32	1.98	0.51	19.44	9.53	9.46
Jul/18	22.8	24.38	13.97	1.98	0.51	20.48	9.76	9.96
Jul/19	24.02	25.72	14.61	2.14	0.51	21.49	10.36	10.38
Jul/20	25.57	27.13	15.61	2.36	0.62	22.91	11.13	10.9
Jul/21	27.05	28.58	16.56	2.65	0.69	24.22	12.28	11.7
Jul/22	28.64	30.23	17.32	2.96	0.75	25.43	12.98	12.7
Jul/23	30.25	31.94	17.91	3.47	0.88	26.53	14.16	13.7
Jul/24	32.22	33.94	19.15	3.81	1.01	28.4	15.13	14.7
Jul/25	34.44	36.24	20.48	3.94	1.01	30.26	16	15.6
Jul/26	36.21	38.01	21.58	4.07	1.02	31.72	16.81	16.3
Jul/27	37.76	39.69	22.81	4.38	1.18	33.22	17.61	17.06
Jul/28	40.29	42.22	24.66	5.01	1.37	35.52	19.09	18.57
Jul/29	42.09	44.06	25.76	5.26	1.48	37.12	20.1	19.46
Jul/30	44.37	46.43	27.38	5.65	1.51	39.33	21.29	20.65
Jul/31	46.52	48.79	28.92	6.12	1.68	41.21	22.53	21.82
Aug/1	48.88	51.11	30.05	6.62	1.86	43.05	23.58	22.96
Aug/2	51.36	53.69	31.59	7.22	2.19	45.17	24.73	24.33
Aug/3	53.98	56.46	33.18	8.03	2.54	47.5	26.12	25.85
Aug/4	55.67	58.34	34.2	8.07	2.54	48.87	26.65	26.54
Aug/5	58	60.76	35.6	8.55	2.67	50.66	27.89	27.82
Aug/6	60.32	63.22	37.05	8.88	2.9	52.68	28.87	28.92
Aug/7	62.1	65.26	38.39	9.19	3.04	54.35	29.98	29.85

	LAMEROO	KAROONDA	NARACOORTE	MT CRAWFORD	MT LOFTY	KEITH	MT BARKER	NURIOOTPA
Aug/8	64.38	67.58	39.97	9.48	3.11	56.31	30.8	31.01
Aug/9	66.3	69.68	41.07	9.86	3.31	57.93	31.65	32.01
Aug/10	68.24	71.45	42.06	10.15	3.34	59.08	32.7	32.94
Aug/11	69.95	73.11	43.16	10.36	3.4	60.52	33.45	34.03
Aug/12	71.94	75.05	44.38	10.63	3.47	62.07	34.37	35.03
Aug/13	74.09	77.45	45.83	11.1	3.68	63.97	35.72	36.51
Aug/14	76.13	79.65	47.08	11.69	4.08	65.77	37.1	37.69
Aug/15	78.45	82.09	48.62	12.4	4.6	67.64	38.25	38.98
Aug/16	80.54	84.33	50.05	13.06	4.97	69.55	39.5	40.26
Aug/17	82.32	86.2	50.99	13.25	5.11	70.86	40.42	40.98
Aug/18	84.75	88.89	52.2	13.97	5.55	72.88	41.79	42.47
Aug/19	86.59	91.59	53.44	14.41	5.66	74.8	43	43.56
Aug/20	89.25	94.44	55.42	15.36	6.13	77.19	44.71	45.32
Aug/21	91.84	96.98	57.21	15.89	6.29	79.35	46	46.52
Aug/22	94.24	99.66	58.86	16.71	6.66	81.67	47.59	48.27
Aug/23	96.71	102.38	60.38	17.72	7.19	83.7	49.21	49.76
Aug/24	99.81	105.47	61.96	18.75	7.81	85.97	51.03	51.5
Aug/25	102.74	108.42	63.68	19.72	8.53	88.62	52.75	53.3
Aug/26	105.69	111.57	65.48	20.73	9.46	91.19	54.6	55.14
Aug/27	109.15	115.01	67.62	21.83	10.18	94.08	56.99	57.2
Aug/28	113.15	119.16	70.47	23.77	11.42	97.46	60.02	60.05
Aug/29	117.11	123.3	73.17	25.28	12.39	100.94	62.55	62.63
Aug/30	120.31	126.56	74.93	26.17	12.86	103.3	64.2	64.17
Aug/31	123.46	129.67	76.8	27.34	13.66	105.81	66.25	66.17
Sep/1	127	133.15	78.98	29.04	14.86	108.85	68.49	68.48
Sep/2	131.48	137.55	81.82	31.41	16.58	112.63	71.69	71.51
Sep/3	135.1	141.21	84.36	33.13	18.13	115.74	74.23	73.89
Sep/4	139.05	144.97	87.07	35.02	19.53	119	76.74	76.37
Sep/5	142.67	149.2	89.46	36.24	19.81	122.08	78.87	78.71
Sep/6	145.7	152.56	91.45	37.37	20.36	124.74	80.91	80.96
Sep/7	148.64	155.61	93.75	38.45	21.13	127.4	83.04	83.05
Sep/8	151.81	158.83	95.73	40.15	22.27	130.14	85.57	85.49
Sep/9	155.25	162.32	97.85	41.35	23.02	133.04	87.7	87.59
Sep/10	158.45	165.63	99.84	42.15	23.56	135.74	89.67	89.28
Sep/11	162.09	169.42	102.26	43.95	24.76	138.99	92.41	92.1
Sep/12	166.64	174.04	105.41	45.99	25.96	143.03	95.45	95.42
Sep/13	170.48	178.24	107.86	47.59	26.86	146.44	98.23	98.45
Sep/14	173.82	181.44	109.86	48.41	27.12	149.13	100.07	100.64
Sep/15	177.5	185.41	111.94	50.2	28.35	152.12	102.85	103.64
Sep/16	181.41	189.24	114.41	51.79	29.49	155.28	105.67	106.31
Sep/17	185.87	193.82	117.54	54.14	31.3	159.46	108.91	109.67
Sep/18	190.62	198.4	120.3	56.65	32.93	163.78	112.21	113.15
Sep/19	195.49	203.24	123.52	58.82	34.1	168.04	115.58	116.77
Sep/20	199.64	207.28	126.15	60.43	35.01	171.33	118.54	120.03
Sep/21	205.08	212.99	129.68	63.66	37.09	176.14	122.5	124.5
Sep/22	210.37	218.16	133.44	66.22	38.54	181.22	126.24	128.84
Sep/23	214.12	221.82	135.8	67.48	39.62	184.06	128.38	131.62

	LAMEROO	KAROONDA	NARACOORTE	MT CRAWFORD	MT LOFTY	KEITH	MT BARKER	NURIOOTPA
Sep/24	217.75	225.68	138.01	69.13	40.74	187.09	130.92	134.64
Sep/25	221.71	229.65	140.6	70.79	41.76	190.46	133.48	137.29
Sep/26	226.92	235.07	144.29	73.93	43.77	195.24	137.57	141.58
Sep/27	232.08	240.52	147.74	77.23	46.23	199.81	141.64	145.89
Sep/28	236.59	244.21	149.66	78.26	46.45	202.58	143.78	148.66
Sep/29	240.67	248.06	152.07	79.6	47.13	205.57	146.38	151.23
Sep/30	245.39	253.21	154.79	82.23	48.91	209.52	150.02	155.01
Oct/1	250.65	258.49	158.56	85.06	50.88	214.18	153.83	159.2
Oct/2	255.42	263.59	161.73	87.27	52.23	218.38	157.09	162.85
Oct/3	260.52	268.55	165.29	89.87	54.06	222.68	160.77	166.9
Oct/4	267.11	275.28	170.18	94.26	57.23	228.79	165.97	172.54
Oct/5	272.21	279.93	173.13	96.79	58.54	232.83	169.71	176.4
Oct/6	276.75	284.42	175.94	98.74	59.57	236.29	172.96	179.81
Oct/7	280.54	288.52	178.51	100.25	60.28	239.57	175.47	182.58
Oct/8	284.18	292.37	180.95	101.81	61.38	242.75	178.14	185.47
Oct/9	289.5	297.72	184.69	104.68	63.36	247.39	182.37	189.82
Oct/10	294.5	302.95	188.57	107.23	65.21	252.05	186.12	193.82
Oct/11	300.35	309.23	193.2	111.04	68.14	257.54	190.66	198.65
Oct/12	307.29	316.35	198.85	114.04	72.15	264.31	195.93	204.43
Oct/13	312.53	321.42	202.25	116.27	73.28	268.39	199.33	208.22
Oct/14	317.76	326.4	206.22	118.84	74.81	273.13	202.86	212.27
Oct/15	322.26	330.7	208.97	121.04	75.8	276.95	206.11	215.92
Oct/16	327.66	336.03	212.79	124.1	78.09	281.74	210.28	220.31
Oct/17	333.74	342.2	217.68	128.37	80.94	287.41	215.18	225.72
Oct/18	340.63	349.02	223.07	132.72	84.26	293.69	220.55	231.3
Oct/19	348.38	356.42	229.27	137.89	87.94	300.73	226.28	237.76
Oct/20	357.08	365.24	235.47	144.16	92.56	308.56	232.87	245.12
Oct/21	363.74	372.74	239.65	147.2	94.39	313.76	236.59	249.98
Oct/22	370.39	379.36	244.39	151.22	97.34	319.34	241.29	255.35
Oct/23	376.6	385.5	249.34	154.84	99.91	325.11	245.72	260.56
Oct/24	383.33	392.07	254.05	159.46	102.91	331.04	250.29	266.7
Oct/25	389.39	398.33	258.19	163.41	105.55	336.3	254.52	271.67
Oct/26	395.88	404.48	263.13	166.98	107.4	341.98	258.51	276.65
Oct/27	401.19	409.72	266.86	169.67	109.12	346.46	262.14	280.74
Oct/28	407.63	416.29	271.31	173.64	111.78	352.41	267.07	286.23
Oct/29	414.48	423.1	276.69	177.94	114.62	358.8	271.73	291.65
Oct/30	422.14	430.76	282.7	183.25	118.4	365.69	277.1	297.88
Oct/31	429.71	437.84	287.94	188.41	121.99	372.08	282.3	303.93
Nov/1	437.28	445.46	293.27	193.06	125.38	378.41	287.55	310.04
Nov/2	444.62	452.61	298.69	198.34	129.11	384.92	293.04	316.32
Nov/3	449.88	457.3	302.18	200.74	130.2	389.05	296.18	320.18
Nov/4	455.84	463.38	306.86	204.86	132.93	394.65	301.12	325.53
Nov/5	462.89	471.09	312.82	209.93	136.36	401.8	307.01	331.96
Nov/6	470.78	479.3	319.52	215.4	140.19	409.5	313.28	338.87
Nov/7	478.19	486.53	325.51	219.67	142.74	416.47	318.18	345.37
Nov/8	484.93	493.6	331.21	224.43	145.93	422.9	323.11	351.34
Nov/9	493.08	501.83	338.26	230.33	150.19	430.74	329.4	358.46

	LAMEROO	KAROONDA	NARACOORTE	MT CRAWFORD	MT LOFTY	KEITH	MT BARKER	NURIOOTPA
Nov/10	500.79	509.48	344.77	236.56	154.77	437.92	335.45	365.59
Nov/11	509.79	518.35	352.3	243.73	160.31	446.22	342.5	373.86
Nov/12	519.43	528.41	359.99	251.31	165.99	455.22	349.75	382.56
Nov/13	528.3	536.75	366.35	257.44	170.47	462.61	355.79	389.7
Nov/14	536.5	544.58	372.09	263.44	174.63	469.13	361.91	396.58
Nov/15	544	551.79	377.51	269.34	178.58	475.22	367.32	403.28
Nov/16	551.57	558.9	382.85	274.73	182.02	481.89	372.67	409.75
Nov/17	560.21	567.8	390.2	281.53	187.23	489.88	379.94	417.65
Nov/18	570.58	577.91	398.78	289.6	192.96	499.45	387.93	426.64
Nov/19	580.39	586.98	406.16	297.28	198.54	507.85	394.78	434.87
Nov/20	589.03	595.29	413.06	303.75	203.02	515.85	401.48	442.11
Nov/21	596.01	602.21	418.28	308.89	206.19	522.22	406.82	448.71
Nov/22	602.43	608.37	423.6	313.17	208.84	528.08	411.41	454.22
Nov/23	610.05	615.87	430.48	319	212.9	535.61	417.71	461.28
Nov/24	619.32	625.12	438.69	326.1	218.21	544.65	425.23	469.54
Nov/25	628.97	634.68	446.69	334.24	224.7	553.89	432.85	478.5
Nov/26	639.29	644.48	455.37	342.12	230.37	563.11	440.4	487.38
Nov/27	650.22	655.57	464.17	351.17	237	573.37	448.68	497.45
Nov/28	659.56	664.68	471.23	357.75	241.45	581.96	455.16	505.48
Nov/29	668.62	673.67	478.95	364.88	246.55	590.68	462.13	513.61
Nov/30	678.48	683.3	487.42	371.97	251.44	600.37	469.79	521.98
Dec/1	687.08	691.56	494.87	377.04	254.59	608.34	475.03	528.05
Dec/2	694.58	698.64	501.35	382.24	257.41	614.88	480.35	533.94
Dec/3	702.02	705.84	507.64	387.68	260.93	621.62	486.21	540.48
Dec/4	710.12	714.05	514.85	393.65	264.87	629.56	492.46	547.52
Dec/5	719.35	723.36	523.5	400.69	270.11	638.47	499.73	555.56
Dec/6	728.45	731.93	531.23	406.73	273.92	646.42	506.41	563.2
Dec/7	737.66	741.25	539.05	413.96	278.94	655.24	513.93	571.87
Dec/8	747.05	750.37	547.46	421.2	283.71	664.35	521.01	580.43
Dec/9	755.25	758.39	555.14	426.75	287.39	672.49	527.1	587.59
Dec/10	763.17	766.25	562.18	431.89	290.74	679.94	533.09	594.12
Dec/11	770.98	774.34	569.42	437.08	294.07	687.6	539.11	601.1
Dec/12	779.52	782.48	576.56	442.81	297.75	695.65	545.4	608.33
Dec/13	788.36	790.77	584.68	449.54	302.49	704.22	552.51	615.82
Dec/14	796.5	798.39	591.08	455.18	306.54	711.55	558.51	622.48
Dec/15	804.78	806.83	598.23	460.97	310.37	719.14	564.77	629.58
Dec/16	813.75	815.83	606.13	468.05	315.62	727.63	571.99	637.33
Dec/17	822.93	824.59	613.74	474.55	320.49	736.25	578.9	645.29
Dec/18	833.05	834.65	623.05	482.43	326.27	745.96	586.65	654.01
Dec/19	843.31	844.35	631.3	490.46	331.98	754.69	594.63	662.77
Dec/20	853.49	853.86	638.77	498.69	338.07	763.41	602.69	671.83
Dec/21	863.73	863.62	646.94	506.44	343.6	772.44	610.59	681.1
Dec/22	873.64	873.54	655.04	513.77	349.3	781.49	618.4	690.16
Dec/23	884.37	884.38	664.47	522.79	355.34	791.95	626.63	699.94
Dec/24	893.92	893.09	672.13	529.18	359.84	800.34	633.59	707.86
Dec/25	902.36	901.23	679.64	535.59	364.34	808.29	640.36	715.11
Dec/26	911.86	909.96	686.86	542.15	368.77	816.44	646.78	723.1

	LAMEROO	KAROONDA	NARACOORTE	MT CRAWFORD	MT LOFTY	KEITH	MT BARKER	NURIOOTPA
Dec/27	920.79	918.71	694.58	549.28	373.82	824.5	654.05	731.4
Dec/28	930.42	928.21	702.49	556.7	379	833.3	661.43	739.77
Dec/29	940.56	938.08	710.95	564.81	385.42	842.54	669.4	749.04
Dec/30	953.24	950.72	722.38	576	394.42	854.73	680.21	761.25
Dec/31	968.71	965.83	735.32	589.74	405.89	868.75	691.8	774.93
Jan/1	980.52	976.88	744.01	599.03	412.52	879.12	701	786.36
Jan/2	989.82	986.38	752.45	606.63	418.37	888.37	708.7	795.03
Jan/3	1000.7	997.41	762.37	615.5	425.18	899.14	717.96	805.46
Jan/4	1012.1	1008.72	772.73	624.93	432.56	910.37	727.5	816.04
Jan/5	1022.6	1018.63	781.34	632.5	437.8	919.61	735.58	825.72
Jan/6	1032.49	1028.61	789.96	640.18	443.45	928.78	743.49	835.24
Jan/7	1043.35	1039.24	799.28	648.43	449.43	938.76	751.98	845.33
Jan/8	1054.31	1049.47	808.22	657.28	455.88	948.74	760.6	855.31
Jan/9	1065.89	1060.75	817.99	666.97	463.43	959.82	769.89	865.87
Jan/10	1078.95	1073.32	828.9	678.46	471.92	972.14	779.96	878.24
Jan/11	1091.87	1085.42	839.15	688.19	478.94	983.96	789.3	889.4
Jan/12	1102.03	1095.09	847.35	694.93	483.5	992.85	796.65	898.04
Jan/13	1112.23	1104.77	856.25	702.31	488.85	1002.1	804.37	907.32
Jan/14	1123.14	1115.23	865.29	711.2	494.96	1012.13	812.63	917.31
Jan/15	1134.01	1126.18	875.13	719.66	501.04	1022.66	821.71	927.18
Jan/16	1145.57	1137.6	885.36	730.1	508.39	1034.02	831.52	938.06
Jan/17	1158.49	1149.41	895.78	740.89	516.99	1045.66	841.9	949.2
Jan/18	1169.81	1160.36	904.97	749.2	522.72	1055.95	850.45	959.18
Jan/19	1181.12	1171.23	914.25	758.17	528.94	1066.2	858.78	969.43
Jan/20	1192.81	1182.52	924.23	767.82	536.15	1077.17	867.99	980.32
Jan/21	1203.94	1193.1	933.48	776.48	542.58	1087.36	876.81	990.49
Jan/22	1215.92	1205.14	944.07	786.63	550.37	1098.89	886.94	1001.5
Jan/23	1227	1216.02	953.08	795.04	556.61	1109.12	895.88	1011.72
Jan/24	1238.26	1227.08	962.77	804.04	563.53	1119.76	905.08	1021.96
Jan/25	1250.22	1238.21	972.3	813.94	570.78	1130.57	914.69	1033.58
Jan/26	1261.67	1249.91	982.28	823.84	579.14	1141.26	924.4	1044.75
Jan/27	1273.29	1261.23	992.49	833.67	586.7	1152.35	933.6	1055.6
Jan/28	1285.74	1273.05	1003.48	844.61	595.79	1163.65	943.94	1067.53
Jan/29	1298.03	1284.66	1014.23	854.62	603.41	1175.51	953.98	1079.11
Jan/30	1310.99	1297.2	1024.75	864.82	610.41	1187.28	964.61	1091.19
Jan/31	1323.26	1309.37	1034.32	875.35	617.89	1198.32	974.46	1102.69
Feb/1	1335.35	1321.11	1043.61	885.42	625.50	1208.93	983.89	1113.98
Feb/2	1348.14	1333.19	1053.97	895.49	633.34	1220.38	993.94	1125.70
Feb/3	1360.18	1344.29	1063.54	905.01	640.76	1230.85	1002.83	1136.89
Feb/4	1371.17	1354.60	1072.99	913.77	647.48	1241.03	1011.55	1147.17
Feb/5	1381.19	1363.83	1081.15	921.88	653.60	1250.07	1019.12	1156.17
Feb/6	1390.92	1373.19	1089.26	930.05	659.68	1258.94	1027.07	1165.20
Feb/7	1401.11	1383.14	1097.91	938.68	666.13	1268.40	1035.24	1174.41
Feb/8	1411.69	1393.13	1106.49	946.60	671.64	1277.88	1043.48	1183.63
Feb/9	1421.00	1401.71	1113.80	953.50	676.33	1285.94	1051.00	1191.81
Feb/10	1430.02	1410.71	1122.05	960.53	681.34	1294.85	1058.32	1199.95
Feb/11	1438.99	1419.37	1129.43	967.16	685.86	1303.27	1065.09	1208.63

	LAMEROO	KAROONDA	NARACOORTE	MT CRAWFORD	MT LOFTY	KEITH	MT BARKER	NURIOOTPA
Feb/12	1448.58	1428.64	1137.32	974.08	690.59	1311.92	1072.43	1216.90
Feb/13	1459.22	1438.36	1146.22	981.61	696.05	1321.49	1080.40	1225.61
Feb/14	1470.41	1448.97	1156.05	990.15	702.60	1332.44	1089.44	1235.58
Feb/15	1482.99	1460.82	1167.28	999.99	710.32	1344.62	1099.60	1247.52
Feb/16	1495.47	1472.78	1178.44	1010.50	718.72	1356.49	1109.82	1259.08
Feb/17	1507.88	1485.09	1190.03	1021.33	727.29	1368.37	1120.59	1270.73
Feb/18	1520.61	1497.64	1201.79	1032.32	736.02	1380.93	1131.53	1282.27
Feb/19	1531.25	1507.66	1210.04	1039.60	741.18	1390.19	1139.13	1291.46
Feb/20	1540.27	1516.33	1218.40	1046.80	746.12	1399.00	1145.92	1300.02
Feb/21	1548.93	1524.60	1225.71	1052.84	750.10	1406.94	1152.67	1307.84
Feb/22	1558.54	1533.96	1233.85	1060.20	755.45	1415.74	1160.53	1316.33
Feb/23	1570.03	1545.07	1243.87	1069.25	762.82	1426.55	1169.88	1326.21
Feb/24	1581.40	1555.85	1253.91	1078.33	769.53	1437.46	1179.26	1336.41
Feb/25	1591.68	1565.98	1263.02	1087.27	776.41	1446.89	1188.09	1345.96
Feb/26	1602.39	1576.38	1272.73	1096.43	783.35	1457.09	1197.49	1356.15
Feb/27	1612.82	1586.57	1281.64	1103.89	788.61	1466.73	1205.55	1365.44
Feb/28	1621.73	1594.85	1288.84	1109.96	792.89	1475.10	1212.23	1372.92
Mar/1	1629.79	1602.69	1296.19	1116.16	797.35	1482.94	1218.62	1380.02
Mar/2	1639.16	1611.60	1304.47	1123.24	802.97	1491.84	1226.01	1388.52
Mar/3	1649.19	1621.30	1313.77	1131.18	809.27	1501.32	1234.27	1397.40
Mar/4	1658.85	1630.78	1322.32	1139.23	815.78	1510.74	1242.41	1406.13
Mar/5	1668.21	1639.88	1330.51	1146.17	821.00	1519.74	1249.67	1414.25
Mar/6	1677.19	1648.47	1337.90	1152.77	826.02	1527.87	1256.40	1421.49
Mar/7	1686.51	1657.37	1346.01	1160.48	831.75	1536.70	1264.03	1429.82

Tasmania

	0 - 82	Zero development to egg maturation
	82 - 99	Mature egg through mating and oviposition to egg hatch
	99 - 180	Hatched egg to larval pupation
	180 - 404	Pupa to adult eclosion - The first generation of Qff adults after winter
	404 - 425	Eclosed adult through egg maturation and mating to oviposition
	425 - 829	The second generation of Qff eggs, larvae, pupae and adults after winter – Second generation adults emerge after 829DD

	BUSHY PARK	TUNNACK	LAUNCESTON	SHEFFIELD	MELTON MOWBRAY	CRESSY
Jul/1	0.46	0.12	0.22	0.09	0.29	0.34
Jul/2	0.78	0.12	0.65	0.22	0.42	0.79
Jul/3	1.19	0.12	0.90	0.33	0.60	1.05
Jul/4	1.58	0.12	0.97	0.33	0.69	1.07
Jul/5	2.04	0.13	1.08	0.33	0.93	1.14
Jul/6	2.51	0.22	1.32	0.46	1.22	1.36
Jul/7	2.63	0.23	1.59	0.46	1.28	1.49
Jul/8	2.89	0.25	1.68	0.46	1.29	1.79
Jul/9	2.97	0.25	1.72	0.46	1.38	1.80
Jul/10	3.29	0.25	1.83	0.49	1.64	1.93
Jul/11	3.65	0.25	1.88	0.53	1.94	2.09
Jul/12	4.31	0.28	2.18	0.58	2.40	2.39
Jul/13	4.60	0.28	2.35	0.64	2.49	2.60
Jul/14	4.71	0.28	2.42	0.65	2.52	2.68
Jul/15	5.02	0.30	2.55	0.72	2.78	2.89
Jul/16	5.67	0.30	2.73	0.86	3.04	3.10
Jul/17	6.32	0.35	2.90	0.93	3.52	3.25
Jul/18	6.73	0.40	3.24	1.03	3.71	3.48
Jul/19	7.42	0.42	3.54	1.20	4.12	3.82
Jul/20	7.97	0.44	3.71	1.26	4.36	4.08
Jul/21	8.49	0.44	3.85	1.29	4.52	4.17
Jul/22	9.01	0.51	4.21	1.46	4.94	4.44
Jul/23	9.57	0.67	4.43	1.60	5.25	4.74
Jul/24	10.15	0.67	4.76	1.73	5.61	4.97
Jul/25	10.72	0.73	5.06	1.80	6.00	5.31
Jul/26	11.17	0.75	5.35	1.96	6.29	5.71
Jul/27	11.49	0.75	5.68	2.20	6.47	6.03
Jul/28	12.20	0.89	5.97	2.30	7.00	6.42
Jul/29	12.99	1.09	6.54	2.46	7.56	6.95
Jul/30	13.48	1.09	6.93	2.54	7.96	7.24
Jul/31	14.33	1.27	7.26	2.60	8.36	7.61
Aug/1	15.29	1.31	7.59	2.69	8.67	7.92
Aug/2	16.11	1.31	7.90	2.81	9.12	8.15
Aug/3	16.85	1.51	8.33	2.87	9.62	8.52
Aug/4	17.49	1.60	8.71	2.98	10.03	8.97
Aug/5	18.43	1.65	9.07	3.14	10.51	9.28
Aug/6	19.17	1.65	9.31	3.20	10.88	9.50
Aug/7	19.86	1.79	9.55	3.27	11.28	9.75
Aug/8	20.32	1.84	9.63	3.31	11.74	9.98
Aug/9	21.02	1.85	9.92	3.41	12.01	10.35
Aug/10	21.20	1.85	10.08	3.44	12.07	10.65

	BUSHY PARK	TUNNACK	LAUNCESTON	SHEFFIELD	MELTON MOWBRAY	CRESSY
Aug/11	21.90	1.95	10.49	3.67	12.43	11.02
Aug/12	22.42	1.95	11.00	4.12	12.52	11.56
Aug/13	23.01	1.96	11.52	4.40	12.85	11.99
Aug/14	23.65	1.96	11.97	4.49	13.10	12.47
Aug/15	24.75	2.02	12.29	4.58	13.78	12.73
Aug/16	26.63	2.05	13.02	4.78	14.42	13.31
Aug/17	27.55	2.05	13.48	4.84	14.73	13.75
Aug/18	28.59	2.16	14.18	5.13	15.35	14.38
Aug/19	30.09	2.36	14.78	5.36	16.19	15.08
Aug/20	31.13	2.52	15.37	5.56	16.88	15.67
Aug/21	31.93	2.55	15.86	5.64	17.16	16.15
Aug/22	32.98	2.68	16.37	5.69	17.72	16.61
Aug/23	34.84	3.01	17.42	6.07	18.78	17.66
Aug/24	36.90	3.38	18.48	6.72	19.90	18.80
Aug/25	38.58	3.78	19.53	7.19	20.97	19.75
Aug/26	40.11	4.25	20.62	7.72	22.04	20.60
Aug/27	41.55	4.59	21.50	8.15	23.08	21.50
Aug/28	43.36	5.21	22.54	8.75	24.59	22.56
Aug/29	45.53	5.96	23.85	9.36	26.33	23.65
Aug/30	46.92	6.16	24.53	9.57	27.45	24.44
Aug/31	48.43	6.66	25.18	10.00	28.69	25.15
Sep/1	49.94	7.11	26.25	10.64	29.63	26.30
Sep/2	51.48	7.49	27.19	11.01	30.62	27.04
Sep/3	53.07	8.06	28.37	11.78	31.85	28.14
Sep/4	55.00	8.68	29.64	12.15	33.19	29.02
Sep/5	57.52	9.28	31.07	12.59	34.75	30.21
Sep/6	59.69	9.91	32.46	13.08	36.23	31.61
Sep/7	61.22	10.22	33.62	13.44	37.07	32.65
Sep/8	62.55	10.55	34.83	13.84	37.74	33.66
Sep/9	63.61	10.90	35.67	14.33	38.65	34.39
Sep/10	65.22	11.20	36.83	14.85	39.49	35.66
Sep/11	66.81	11.61	37.92	15.41	40.58	36.67
Sep/12	69.26	12.21	39.20	15.91	42.27	37.76
Sep/13	71.39	12.88	40.46	16.42	43.80	38.89
Sep/14	73.12	13.24	41.77	16.88	44.70	40.21
Sep/15	74.43	13.58	42.56	17.19	45.54	40.91
Sep/16	76.07	13.96	44.11	17.82	46.55	42.28
Sep/17	78.08	14.25	45.13	18.05	47.89	43.13
Sep/18	80.40	14.79	46.96	18.99	49.34	44.93
Sep/19	83.36	15.83	49.18	20.09	51.43	46.93
Sep/20	85.45	16.29	51.08	20.88	52.66	48.70
Sep/21	87.74	17.13	52.81	22.01	54.19	50.41
Sep/22	89.80	17.84	54.50	23.00	55.83	51.89
Sep/23	91.30	18.10	56.04	23.67	56.79	53.15
Sep/24	93.07	18.70	57.56	24.75	57.87	54.66
Sep/25	95.37	19.34	59.04	25.32	59.36	56.10
Sep/26	97.72	20.13	60.34	25.68	61.09	57.36
Sep/27	100.13	20.85	62.19	26.61	62.69	58.92
Sep/28	102.19	21.46	63.45	27.36	63.89	60.21
Sep/29	103.65	21.77	64.87	28.01	64.67	61.46
Sep/30	105.53	22.38	66.46	28.61	65.80	63.03

	BUSHY PARK	TUNNACK	LAUNCESTON	SHEFFIELD	MELTON MOWBRAY	CRESSY
Oct/1	108.05	23.00	68.24	29.37	67.54	64.77
Oct/2	110.48	23.86	70.15	30.40	69.17	66.69
Oct/3	113.21	25.04	72.28	31.51	71.24	68.62
Oct/4	116.59	26.46	74.50	32.48	73.65	70.63
Oct/5	118.72	27.52	76.51	33.49	75.27	72.49
Oct/6	120.21	27.87	77.91	34.02	76.13	73.63
Oct/7	122.28	28.03	79.30	34.82	77.10	74.95
Oct/8	124.24	28.57	80.96	35.69	78.16	76.68
Oct/9	126.60	29.73	83.18	36.91	79.90	78.82
Oct/10	129.96	31.32	85.16	37.99	82.49	80.78
Oct/11	133.19	32.80	87.61	39.39	84.72	83.09
Oct/12	137.20	35.18	90.42	41.45	88.48	85.92
Oct/13	139.64	36.45	93.12	42.95	90.44	88.41
Oct/14	142.06	37.58	95.30	44.20	91.99	90.64
Oct/15	144.02	38.36	97.17	45.03	93.55	92.34
Oct/16	146.18	39.37	98.92	45.93	95.36	94.04
Oct/17	148.94	40.49	101.52	47.35	97.32	96.45
Oct/18	152.47	42.22	104.37	48.92	100.20	99.18
Oct/19	157.29	45.03	108.03	51.32	104.08	102.85
Oct/20	161.51	47.54	111.61	53.77	107.79	106.49
Oct/21	164.31	48.65	114.60	55.41	109.70	109.41
Oct/22	167.74	50.53	117.73	57.23	112.64	112.60
Oct/23	171.64	52.68	121.21	59.36	116.00	115.91
Oct/24	175.24	54.67	124.13	61.28	118.98	118.58
Oct/25	177.96	55.97	126.56	62.96	121.00	121.03
Oct/26	181.63	57.84	129.53	64.37	124.03	123.81
Oct/27	184.65	59.84	132.47	66.05	126.91	126.60
Oct/28	187.69	61.01	135.14	67.75	129.18	129.11
Oct/29	191.12	62.92	138.01	69.87	131.86	132.01
Oct/30	195.18	65.32	141.56	72.23	135.16	135.67
Oct/31	199.74	67.79	145.84	75.39	138.91	139.91
Nov/1	203.69	70.52	149.77	78.12	142.30	143.80
Nov/2	207.62	72.89	153.53	80.84	145.57	147.49
Nov/3	210.80	74.20	156.57	82.83	147.75	150.38
Nov/4	213.42	75.48	159.69	84.78	149.86	153.61
Nov/5	217.46	77.63	163.17	87.06	153.12	157.26
Nov/6	222.42	80.14	167.31	89.87	157.11	161.37
Nov/7	226.65	82.31	171.00	92.23	160.25	164.90
Nov/8	230.69	84.57	174.61	94.79	163.69	168.52
Nov/9	235.72	87.76	178.35	97.37	168.02	172.40
Nov/10	239.84	90.40	182.37	100.32	171.32	176.55
Nov/11	244.47	93.30	186.27	102.94	175.28	180.53
Nov/12	248.71	95.75	190.33	105.67	179.10	184.65
Nov/13	253.02	97.99	194.00	108.22	182.57	188.45
Nov/14	256.83	99.87	197.49	110.74	185.37	192.00
Nov/15	260.12	101.84	200.61	112.89	188.08	195.18
Nov/16	263.18	103.62	203.96	115.66	190.56	198.74
Nov/17	268.31	106.61	207.92	118.16	195.14	202.87
Nov/18	273.84	110.02	212.16	120.90	200.07	207.18
Nov/19	278.80	113.36	217.25	124.80	204.76	212.46
Nov/20	283.55	115.82	220.94	127.71	208.49	216.46

	BUSHY PARK	TUNNACK	LAUNCESTON	SHEFFIELD	MELTON MOWBRAY	CRESSY
Nov/21	287.34	118.16	224.61	130.30	211.80	220.28
Nov/22	291.04	120.35	228.43	133.24	214.95	224.32
Nov/23	295.62	123.10	232.86	137.11	218.93	229.09
Nov/24	301.04	126.62	237.34	140.60	223.67	233.83
Nov/25	306.49	130.11	242.48	144.57	228.41	239.38
Nov/26	311.71	133.19	246.80	147.22	232.99	243.73
Nov/27	316.87	136.78	251.99	151.05	237.52	249.13
Nov/28	321.29	139.37	256.74	154.99	241.10	254.19
Nov/29	325.98	141.93	260.97	158.30	244.75	258.38
Nov/30	331.41	145.30	265.32	161.72	249.21	263.06
Dec/1	336.45	148.00	269.96	164.67	253.37	267.53
Dec/2	341.57	151.32	274.95	168.02	257.84	272.39
Dec/3	346.07	154.37	279.80	171.26	261.68	277.79
Dec/4	350.28	157.30	283.98	174.24	265.47	282.40
Dec/5	354.48	159.69	288.11	177.02	268.80	286.58
Dec/6	359.76	163.04	292.69	180.15	273.41	291.28
Dec/7	364.41	166.06	297.17	183.28	277.62	296.00
Dec/8	370.17	169.77	302.43	186.76	282.99	301.36
Dec/9	376.08	173.47	307.26	190.00	288.04	306.42
Dec/10	381.15	176.88	312.09	193.22	292.44	311.33
Dec/11	386.36	179.93	317.00	196.41	297.08	316.37
Dec/12	391.68	183.44	321.88	199.93	301.87	321.55
Dec/13	396.73	186.18	326.41	203.18	306.08	326.35
Dec/14	401.29	188.88	331.14	206.66	310.23	331.34
Dec/15	406.69	192.28	336.27	210.31	315.01	336.70
Dec/16	412.10	195.93	341.51	213.95	319.79	342.31
Dec/17	416.89	198.98	346.23	217.25	323.90	347.20
Dec/18	422.29	202.58	350.84	220.50	328.67	352.18
Dec/19	427.78	205.84	355.73	224.19	333.64	356.99
Dec/20	433.18	208.97	361.25	228.50	338.02	362.47
Dec/21	439.02	212.77	366.39	232.33	343.01	367.98
Dec/22	444.54	216.90	371.69	236.29	348.37	373.53
Dec/23	450.00	220.20	377.26	240.28	353.16	379.09
Dec/24	455.98	224.03	382.65	244.25	358.32	384.73
Dec/25	460.85	227.35	387.43	248.11	362.65	389.81
Dec/26	465.92	230.67	392.31	251.66	366.98	394.82
Dec/27	471.65	234.21	397.57	255.35	372.05	400.09
Dec/28	477.43	238.48	403.48	259.64	377.59	406.15
Dec/29	482.52	241.67	409.06	263.78	382.07	412.06
Dec/30	489.28	246.31	415.22	268.29	388.26	418.45
Dec/31	496.03	251.12	422.25	273.36	394.79	425.75
Jan/1	501.71	254.72	428.48	277.64	399.86	432.17
Jan/2	506.71	257.94	433.96	281.35	404.28	437.75
Jan/3	512.97	262.95	440.08	285.95	410.56	444.16
Jan/4	519.52	268.22	446.26	290.67	417.40	450.60
Jan/5	526.03	273.30	452.64	295.99	423.70	457.37
Jan/6	531.21	277.32	458.36	300.43	428.76	463.44
Jan/7	537.80	281.81	464.41	305.57	434.66	469.94
Jan/8	544.55	286.25	470.85	310.56	441.00	476.60
Jan/9	550.53	290.48	477.24	315.06	446.61	483.13
Jan/10	557.25	295.32	483.32	319.56	452.72	489.45

	BUSHY PARK	TUNNACK	LAUNCESTON	SHEFFIELD	MELTON MOWBRAY	CRESSY
Jan/11	564.69	300.43	490.10	324.80	459.38	496.32
Jan/12	571.06	305.41	496.83	329.97	465.61	503.47
Jan/13	577.50	310.16	502.87	334.43	471.59	509.67
Jan/14	584.71	315.90	510.32	340.50	478.72	517.43
Jan/15	591.89	321.77	517.21	345.93	485.63	524.54
Jan/16	599.40	327.23	524.44	351.46	492.26	532.01
Jan/17	607.08	332.75	532.03	357.29	499.35	539.66
Jan/18	613.32	337.03	538.98	362.76	504.81	546.94
Jan/19	619.69	341.42	545.30	367.85	510.39	553.69
Jan/20	626.26	345.83	552.26	373.35	516.22	560.80
Jan/21	633.28	350.91	558.91	378.66	522.41	567.92
Jan/22	640.47	356.39	565.70	383.92	529.21	575.06
Jan/23	647.54	361.40	572.08	389.02	535.62	581.72
Jan/24	653.85	366.32	578.48	393.93	541.35	588.38
Jan/25	660.70	371.51	585.14	398.95	547.51	595.30
Jan/26	668.23	377.45	592.72	405.13	554.30	603.21
Jan/27	675.77	383.17	600.01	410.92	560.79	610.85
Jan/28	684.25	389.72	608.03	417.20	568.62	618.62
Jan/29	691.91	395.79	616.31	423.82	575.68	626.69
Jan/30	699.51	402.30	624.16	430.27	583.23	634.73
Jan/31	705.93	406.98	630.79	435.73	589.10	641.54
Feb/1	712.50	411.63	637.18	440.90	594.90	648.47
Feb/2	719.40	416.27	643.64	446.21	600.80	654.75
Feb/3	726.04	420.94	650.80	452.22	606.38	661.97
Feb/4	733.69	426.14	657.65	457.48	612.99	668.95
Feb/5	740.72	430.95	664.78	463.23	618.89	676.52
Feb/6	745.96	434.62	670.28	467.46	623.65	682.09
Feb/7	751.94	439.22	676.34	472.09	629.52	688.38
Feb/8	757.84	443.21	682.51	476.90	634.39	694.67
Feb/9	764.36	447.53	688.99	481.98	640.03	701.06
Feb/10	769.85	451.13	694.43	486.56	644.70	706.99
Feb/11	775.48	455.06	700.21	491.40	649.42	713.29
Feb/12	780.77	458.05	705.53	495.64	653.60	718.53
Feb/13	787.00	462.16	711.69	500.34	658.74	725.05
Feb/14	794.28	466.84	719.12	506.16	664.63	732.71
Feb/15	802.20	472.61	726.27	511.97	671.31	740.26
Feb/16	810.00	478.29	733.65	518.00	678.41	747.90
Feb/17	817.10	483.98	741.36	524.31	685.00	755.60
Feb/18	825.08	489.50	748.26	529.42	692.22	762.77
Feb/19	831.05	493.53	755.29	535.31	697.32	769.97
Feb/20	836.79	497.39	761.85	540.13	702.40	776.49
Feb/21	842.64	501.37	768.27	545.03	707.36	782.98
Feb/22	848.68	505.02	774.61	549.98	712.32	789.38
Feb/23	855.63	509.97	781.37	555.17	718.42	796.26
Feb/24	862.76	514.58	788.27	560.56	724.55	802.93
Feb/25	870.29	520.01	795.92	567.00	731.15	810.93
Feb/26	876.42	524.48	802.61	572.19	736.50	817.56
Feb/27	882.21	528.40	808.79	577.46	741.37	824.05
Feb/28	887.55	531.51	814.31	582.02	745.81	829.78
Mar/1	892.25	534.45	819.91	586.44	749.57	835.59
Mar/2	897.71	538.11	825.93	591.42	754.32	841.82

	BUSHY PARK	TUNNACK	LAUNCESTON	SHEFFIELD	MELTON MOWBRAY	CRESSY
Mar/3	904.35	543.03	832.30	596.34	760.44	848.29
Mar/4	909.69	546.72	837.77	600.64	765.15	854.02
Mar/5	915.07	550.28	843.06	604.74	769.43	859.33
Mar/6	920.77	554.08	849.07	609.54	774.19	865.58
Mar/7	926.15	557.68	855.20	614.12	779.10	871.48
Mar/8	931.89	561.06	861.16	618.66	783.83	877.46
Mar/9	937.70	565.29	867.26	623.40	789.19	883.46
Mar/10	943.95	570.01	874.24	629.26	794.79	890.40
Mar/11	950.58	574.81	880.80	634.13	800.87	896.99
Mar/12	957.40	579.73	887.07	639.09	807.33	903.21
Mar/13	964.33	585.17	893.86	644.52	814.10	910.13
Mar/14	970.77	590.50	900.10	649.09	820.22	916.30
Mar/15	976.82	595.01	906.09	653.40	825.97	922.34
Mar/16	982.25	598.98	911.73	657.70	830.75	928.18
Mar/17	987.37	602.75	917.55	662.41	835.34	934.07
Mar/18	992.24	606.19	922.87	666.65	839.45	939.36
Mar/19	997.37	609.76	928.04	670.40	844.09	944.62
Mar/20	1002.86	613.20	933.01	673.99	848.70	949.60
Mar/21	1007.96	616.58	938.33	677.88	853.31	954.81
Mar/22	1012.95	619.88	943.77	681.63	857.83	960.13
Mar/23	1017.58	622.71	948.97	685.56	861.77	965.20
Mar/24	1021.61	624.98	953.00	689.04	864.95	969.37
Mar/25	1026.48	628.05	957.25	692.56	868.75	973.69
Mar/26	1030.90	630.93	961.65	695.77	872.79	978.06
Mar/27	1034.98	633.24	965.76	699.03	875.97	982.09
Mar/28	1039.09	635.85	969.91	702.27	879.58	986.25
Mar/29	1043.51	638.39	973.82	704.98	883.31	990.32
Mar/30	1047.40	640.73	977.89	707.90	886.38	994.42
Mar/31	1051.11	642.77	981.71	710.35	889.48	997.95
Apr/1	1056.32	646.56	986.17	713.71	894.08	1002.41
Apr/2	1060.26	648.86	990.23	716.51	897.43	1006.16
Apr/3	1063.16	650.49	993.32	718.81	900.05	1009.19
Apr/4	1066.89	652.81	996.88	721.45	903.16	1012.79
Apr/5	1070.47	654.98	1000.42	724.08	906.38	1016.29
Apr/6	1074.25	657.00	1003.94	726.48	909.33	1019.69
Apr/7	1078.17	659.43	1007.39	728.93	912.77	1023.08
Apr/8	1081.63	661.65	1011.02	731.30	916.03	1026.51
Apr/9	1086.37	664.74	1015.04	734.17	920.43	1030.52
Apr/10	1090.12	667.42	1018.67	736.97	924.11	1034.05
Apr/11	1093.01	668.88	1021.52	739.25	926.23	1037.10
Apr/12	1096.28	670.76	1024.80	741.71	928.89	1040.40
Apr/13	1100.40	673.11	1027.80	743.93	932.40	1043.71
Apr/14	1104.02	674.94	1031.00	746.53	935.22	1047.07
Apr/15	1107.01	676.38	1033.82	748.78	937.27	1049.83
Apr/16	1110.44	678.19	1036.54	751.09	940.02	1052.80
Apr/17	1113.55	679.94	1039.92	753.47	942.86	1055.98
Apr/18	1116.56	681.65	1042.99	755.75	945.32	1058.91
Apr/19	1119.69	683.37	1045.86	757.92	947.84	1061.96
Apr/20	1122.65	685.15	1048.55	759.76	950.28	1064.67
Apr/21	1125.48	686.90	1051.43	761.84	952.79	1067.61
Apr/22	1128.07	688.38	1054.23	763.69	955.00	1070.41

	BUSHY PARK	TUNNACK	LAUNCESTON	SHEFFIELD	MELTON MOWBRAY	CRESSY
Apr/23	1130.41	689.31	1056.30	764.93	956.84	1072.57
Apr/24	1132.59	690.22	1058.66	766.15	958.69	1074.60
Apr/25	1134.87	690.93	1060.71	767.35	960.50	1076.57
Apr/26	1137.06	691.98	1062.70	768.76	962.21	1078.54
Apr/27	1139.45	693.13	1064.51	770.10	964.02	1080.36
Apr/28	1141.84	694.28	1066.31	771.21	965.93	1082.20
Apr/29	1143.31	694.80	1068.12	772.08	967.36	1083.92
Apr/30	1144.93	695.60	1069.86	773.04	968.64	1085.73
May/1	1146.73	695.93	1070.99	773.57	969.84	1086.98
May/2	1148.91	696.57	1072.55	774.51	971.54	1088.62
May/3	1151.26	697.35	1073.92	775.52	973.27	1090.03
May/4	1153.75	698.21	1075.70	776.60	975.03	1091.89
May/5	1155.00	698.53	1076.99	777.24	975.84	1093.16
May/6	1156.64	698.79	1078.44	777.96	976.79	1094.53
May/7	1158.15	699.04	1079.85	778.97	977.68	1095.91
May/8	1160.12	699.76	1081.43	779.99	979.15	1097.41
May/9	1162.35	700.86	1083.68	781.40	980.90	1099.63
May/10	1164.39	702.03	1085.53	782.71	982.94	1101.49
May/11	1166.16	702.93	1087.25	783.80	984.35	1103.21
May/12	1167.94	703.70	1088.37	784.72	985.73	1104.29
May/13	1169.50	704.51	1089.65	785.49	987.23	1105.73
May/14	1170.84	705.12	1090.53	786.12	988.56	1106.69
May/15	1173.24	706.01	1092.00	787.40	990.44	1108.24
May/16	1175.17	706.58	1093.61	788.52	991.51	1109.82
May/17	1177.46	707.41	1095.44	789.74	993.19	1111.52
May/18	1178.49	707.69	1096.28	790.32	993.92	1112.46
May/19	1180.29	708.46	1097.97	791.35	995.62	1114.03
May/20	1181.27	708.90	1099.15	791.90	996.49	1115.20
May/21	1182.36	709.27	1100.23	792.62	997.68	1116.30
May/22	1183.81	709.65	1101.28	793.15	998.84	1117.33
May/23	1185.30	710.17	1102.51	793.93	1000.01	1118.61
May/24	1186.15	710.58	1103.40	794.44	1001.02	1119.49
May/25	1187.44	710.85	1104.42	794.72	1001.80	1120.45
May/26	1188.56	711.30	1105.47	795.26	1002.60	1121.43
May/27	1189.10	711.48	1106.25	795.61	1003.34	1122.40
May/28	1189.94	711.73	1106.95	795.98	1004.08	1123.07
May/29	1191.15	712.06	1107.93	796.31	1004.99	1124.07
May/30	1192.64	712.24	1108.63	796.94	1005.83	1124.77
Jun/31	1193.30	712.41	1109.36	797.43	1006.32	1125.45
Jun/1	1193.96	712.63	1110.42	798.17	1007.04	1126.44
Jun/2	1194.79	712.94	1111.48	798.93	1007.83	1127.68
Jun/3	1195.64	713.06	1112.04	799.49	1008.32	1128.38
Jun/4	1196.45	713.31	1112.86	799.91	1008.86	1129.27
Jun/5	1197.19	713.36	1113.17	800.24	1009.23	1129.52
Jun/6	1198.09	713.46	1113.29	800.46	1009.70	1129.71
Jun/7	1198.31	713.46	1113.42	800.66	1009.80	1129.81
Jun/8	1198.61	713.54	1113.58	800.87	1009.96	1129.97
Jun/9	1199.07	713.54	1113.76	800.99	1010.26	1130.20
Jun/10	1199.57	713.73	1114.35	801.25	1010.85	1130.66
Jun/11	1200.17	713.88	1114.86	801.56	1011.36	1131.20
Jun/12	1200.32	713.88	1115.16	801.64	1011.60	1131.56

	BUSHY PARK	TUNNACK	LAUNCESTON	SHEFFIELD	MELTON MOWBRAY	CRESSY
Jun/13	1200.52	713.95	1115.59	801.76	1011.76	1131.95
Jun/14	1201.15	713.95	1116.06	801.95	1012.01	1132.37
Jun/15	1201.31	713.95	1116.35	801.99	1012.14	1132.62
Jun/16	1201.33	713.95	1116.38	801.99	1012.14	1132.63
Jun/17	1201.70	713.95	1116.63	802.09	1012.30	1132.99
Jun/18	1202.23	713.97	1117.05	802.29	1012.78	1133.46
Jun/19	1202.57	714.04	1117.13	802.50	1013.11	1133.55
Jun/20	1203.36	714.05	1117.47	802.67	1013.53	1133.87
Jun/21	1203.37	714.08	1117.67	802.74	1013.73	1134.03
Jun/22	1203.64	714.08	1117.84	802.87	1013.86	1134.43
Jun/23	1204.20	714.08	1117.93	802.91	1014.00	1134.45
Jun/24	1204.58	714.15	1118.12	803.06	1014.35	1134.74
Jun/25	1205.05	714.23	1118.31	803.16	1014.73	1135.03
Jun/26	1205.28	714.23	1118.31	803.16	1014.82	1135.15
Jun/27	1205.73	714.23	1118.85	803.22	1015.13	1135.71
Jun/28	1206.11	714.23	1119.01	803.42	1015.35	1135.89
Jun/29	1207.03	714.29	1119.38	803.63	1015.99	1136.10
Jun/30	1207.96	714.31	1119.93	803.83	1016.56	1136.59

Appendix 12 – Queensland Fruit fly activity predictions for Young, NSW based on mating time and degree days above 12.405°C

YOUNG AIRPORT - DATA: 5 YEAR AVERAGES FROM 2009 TO 2013				
DATE	AVE TEMP AT SUNSET (°C)	DEGDAY >12.4054°C	ACCUMULATED DEGDAY >12.4054°C	FLY ACTIVITY
1-Jul	10.272	0		
2-Jul	9.712	0		
3-Jul	10.016	0		
4-Jul	10.16	0		
5-Jul	9.616	0		
6-Jul	8.72	0		
7-Jul	10.064	0		
8-Jul	10.512	0		
9-Jul	10.672	0		
10-Jul	10.944	0		
11-Jul	10.832	0		
12-Jul	11.024	0		
13-Jul	11.36	0		
14-Jul	9.872	0		
15-Jul	8.688	0		
16-Jul	10.752	0		
17-Jul	11.632	0		
18-Jul	11.168	0		EGGS ARE MATURING (PRE-MATING)
19-Jul	10.224	0		
20-Jul	10.368	0		

YOUNG AIRPORT - DATA: 5 YEAR AVERAGES FROM 2009 TO 2013				
DATE	AVE TEMP AT SUNSET (°C)	DEGDAY >12.4054°C	ACCUMULATED DEGDAY >12.4054°C	FLY ACTIVITY
21-Jul	11.056	0		
22-Jul	11.216	0		
23-Jul	9.728	0		
24-Jul	10.864	0		
25-Jul	11.072	0		
26-Jul	10.64	0		
27-Jul	10.48	0		
28-Jul	11.44	0		
29-Jul	11.84	0		
30-Jul	11.52	0		
31-Jul	11.408	0		
1-Aug	11.344	0		
2-Aug	11.616	0		
3-Aug	12.4	0		
4-Aug	11.936	0		
5-Aug	12.112	0		
6-Aug	10.096	0		
7-Aug	10.896	0		
8-Aug	10.352	0		
9-Aug	10.128	0		EGGS ARE MATURING (PRE-MATING)
10-Aug	11.84	0		
11-Aug	11.584	0		
12-Aug	11.344	0		
13-Aug	11.28	0		

YOUNG AIRPORT - DATA: 5 YEAR AVERAGES FROM 2009 TO 2013				
DATE	AVE TEMP AT SUNSET (°C)	DEGDAY >12.4054°C	ACCUMULATED DEGDAY >12.4054°C	FLY ACTIVITY
14-Aug	12.736	0		
15-Aug	12.592	0		
16-Aug	12.528	0		
17-Aug	10.016	0		
18-Aug	10.176	0		
19-Aug	11.488	0		
20-Aug	10.896	0		
21-Aug	11.376	0		
22-Aug	12.592	0		
23-Aug	12.224	0		
24-Aug	11.296	0		
25-Aug	11.008	0		
26-Aug	11.472	0		
27-Aug	12.96	0		
28-Aug	14.128	0		
29-Aug	14.704	0		EGGS ARE MATURING (PRE-MATING)
30-Aug	11.776	0		
31-Aug	12.144	0		
1-Sep	13.936	0		
2-Sep	15.184	0		
3-Sep	16.32	0	0	FLIES MATE AND LAY EGGS 1 OR 2 DAYS LATER
4-Sep	15.632	0	0	
5-Sep	14.848	0	0	
6-Sep	14.736	0	0	

YOUNG AIRPORT - DATA: 5 YEAR AVERAGES FROM 2009 TO 2013				
DATE	AVE TEMP AT SUNSET (°C)	DEGDAY >12.4054°C	ACCUMULATED DEGDAY >12.4054°C	FLY ACTIVITY
7-Sep	12.976	0	0	
8-Sep	12.56	0	0	
9-Sep	12.4	0	0	
10-Sep	13.152	0	0	
11-Sep	13.264	0	0	
12-Sep	15.424	0	0	FLIES ARE LAYING EGGS. EGGS ARE HATCHING.
13-Sep	14.88	0	0	
14-Sep	14.56	0	0	
15-Sep	14.048	0	0	
16-Sep	14.96	0	0	
17-Sep	15.856	0	0	
18-Sep	15.504	0	0	
19-Sep	15.76	0	0	
20-Sep	15.184	0	0	
21-Sep	15.216	0	0	
22-Sep	17.44	0	0	
23-Sep	16.656	0	0	
24-Sep	14.56	0	0	
25-Sep	16.144	0	0	
26-Sep	14.976	0	0	
27-Sep	15.632	0	0	
28-Sep	13.76	0	0	
29-Sep	12.32	0	0	
30-Sep	14.896	0	0	

YOUNG AIRPORT - DATA: 5 YEAR AVERAGES FROM 2009 TO 2013				
DATE	AVE TEMP AT SUNSET (°C)	DEGDAY >12.4054°C	ACCUMULATED DEGDAY >12.4054°C	FLY ACTIVITY
1-Oct	15.072	0	0	
2-Oct	16.032	0	0	
3-Oct	14.368	0	0	FLIES ARE LAYING EGGS. EGGS ARE HATCHING.
4-Oct	16.784	0	0	
5-Oct	17.968	0	0	
6-Oct	16.768	0	0	
7-Oct	13.584	0	0	
8-Oct	15.152	0	0	
9-Oct	16.176	0	0	
10-Oct	17.216	0	0	
11-Oct	15.104	0	0	
12-Oct	16.784	0	0	
13-Oct	17.072	0	0	
14-Oct	15.296	0	0	
15-Oct	16.496	0	0	
16-Oct	15.568	0	0	
17-Oct	15.168	0	0	
18-Oct	17.392	0	0	
19-Oct	19.904	0	0	
20-Oct	21.136	0	0	
21-Oct	22.72	0	0	
22-Oct	20.832	0	0	
23-Oct	19.664	0	0	
24-Oct	18.512	0	0	

YOUNG AIRPORT - DATA: 5 YEAR AVERAGES FROM 2009 TO 2013				
DATE	AVE TEMP AT SUNSET (°C)	DEGDAY >12.4054°C	ACCUMULATED DEGDAY >12.4054°C	FLY ACTIVITY
25-Oct	17.968	0	0	
26-Oct	16.416	0	0	
27-Oct	17.888	0	0	
28-Oct	20.352	0	0	
29-Oct	20.752	0	0	
30-Oct	19.712	0	0	
31-Oct	21.456	0	0	FLIES ARE LAYING EGGS. EGGS ARE HATCHING.
1-Nov	20.464	0	0	
2-Nov	21.44	0	0	
3-Nov	20.16	0	0	
4-Nov	19.4	0	0	
5-Nov	21.24	0	0	
6-Nov	20.992	0	0	
7-Nov	21.872	0	0	
8-Nov	23.232	0	0	
9-Nov	21.504	0	0	
10-Nov	19.6	0	0	
11-Nov	21.296	0	0	
12-Nov	23.568	0	0	
13-Nov	22.224	0	0	
14-Nov	21.84	0	0	
15-Nov	23.12	0	0	
16-Nov	21.3	0	0	
17-Nov	22.1	0	0	

YOUNG AIRPORT - DATA: 5 YEAR AVERAGES FROM 2009 TO 2013				
DATE	AVE TEMP AT SUNSET (°C)	DEGDAY >12.4054°C	ACCUMULATED DEGDAY >12.4054°C	FLY ACTIVITY
18-Nov	23.34	0	0	FLIES ARE LAYING EGGS. EGGS ARE HATCHING.
19-Nov	24.176	0	0	
20-Nov	23.44	0	0	
21-Nov	23.856	0	0	
22-Nov	20.72	6.825	6.825	
23-Nov	20.112	0	6.825	
24-Nov	20.816	0	6.825	
25-Nov	23.008	0	6.825	
26-Nov	23.584	8.755	15.58	
27-Nov	22.912	0	15.58	
28-Nov	23.424	0	15.58	EGGS HAVE HATCHED INTO FIRST INSTAR LARVAE
29-Nov	21.248	7.825	23.405	
30-Nov	20.368	7.585	30.99	NEONATE LARVAE ARE DEVELOPING INTO MATURE THIRD INSTARS.
1-Dec	20.8	0	30.99	
2-Dec	21.68	0	30.99	
3-Dec	22.464	0	30.99	
4-Dec	22.592	0	30.99	
5-Dec	18.544	0	30.99	
6-Dec	20.096	0	30.99	
7-Dec	22.656	0	30.99	
8-Dec	24.624	0	30.99	
9-Dec	23.312	8.435	39.425	
10-Dec	21.216	7.675	47.1	
11-Dec	20.096	0	47.1	

YOUNG AIRPORT - DATA: 5 YEAR AVERAGES FROM 2009 TO 2013				
DATE	AVE TEMP AT SUNSET (°C)	DEGDAY >12.4054°C	ACCUMULATED DEGDAY >12.4054°C	FLY ACTIVITY
12-Dec	22.256	0	47.1	
13-Dec	23.376	0	47.1	
14-Dec	24.672	0	47.1	
15-Dec	23.856	9.645	56.745	
16-Dec	24.912	9.955	66.7	NEONATE LARVAE ARE DEVELOPING INTO MATURE THIRD INSTARS
17-Dec	25.008	9.665	76.365	
18-Dec	22.448	8.315	84.68	
19-Dec	24.064	0	84.68	
20-Dec	23.088	0	84.68	
21-Dec	24.848	0	84.68	
22-Dec	26.192	0	84.68	
23-Dec	25.744	11.005	95.685	NEONATE LARVAE HAVE MATURED TO PUPATION
24-Dec	25.6	10.885	106.57	
25-Dec	21.792	9.175	115.745	
26-Dec	21.008	8.025	123.77	
27-Dec	23.04	0	123.77	
28-Dec	24.096	9.655	133.425	
29-Dec	24.96	10.015	143.44	
30-Dec	25.296	10.015	153.455	
31-Dec	25.744	9.945	163.4	PUPAE ARE IN THE SOIL AND MATURING
1-Jan	25.552	9.805	173.205	
2-Jan	25.888	11.775	184.98	
3-Jan	26.336	11.415	196.395	
4-Jan	25.168	10.805	207.2	

YOUNG AIRPORT - DATA: 5 YEAR AVERAGES FROM 2009 TO 2013				
DATE	AVE TEMP AT SUNSET (°C)	DEGDAY >12.4054°C	ACCUMULATED DEGDAY >12.4054°C	FLY ACTIVITY
5-Jan	26.72	11.065	218.265	PUPAE ARE IN THE SOIL AND MATURING
6-Jan	25.36	10.655	228.92	
7-Jan	25.968	0	228.92	
8-Jan	26.128	12.575	241.495	
9-Jan	22.448	9.285	250.78	
10-Jan	25.168	9.635	260.415	
11-Jan	26.032	11.035	271.45	
12-Jan	27.728	11.905	283.355	
13-Jan	26.352	12.455	295.81	
14-Jan	25.008	10.405	306.215	
15-Jan	26.336	12.095	318.31	FIRST GENERATION ADULTS HAVE EMERGED FROM THEIR PUPARIA AND ARE FLYING AROUND SEEKING FOOD, WATER, SHELTER AND MATES
16-Jan	27.728	12.965	331.275	
17-Jan	26.528	11.275	342.55	
18-Jan	26.608	0	342.55	
19-Jan	25.936	11.155	353.705	
20-Jan	26.8	12.125	365.83	
21-Jan	27.392	12.145	377.975	
22-Jan	27.56	12.82	390.795	
23-Jan	26.84	12.545	403.34	FIRST GENERATION ADULTS HAVE MATED AND ARE INFESTING THE NEXT FRUIT (OR HOST) CROP
24-Jan	25.22	11.7825	415.1225	
25-Jan	25.7	11.295	426.4175	
26-Jan	26.32	12.6825	439.1	
27-Jan	26.448	13.0625	452.1625	
28-Jan	25.6	11.045	463.2075	

YOUNG AIRPORT - DATA: 5 YEAR AVERAGES FROM 2009 TO 2013				
DATE	AVE TEMP AT SUNSET (°C)	DEGDAY >12.4054°C	ACCUMULATED DEGDAY >12.4054°C	FLY ACTIVITY
29-Jan	26.592	11.835	475.0425	
30-Jan	26.672	11.825	486.8675	
31-Jan	27.52	11.585	498.4525	
1-Feb	26.688	12.475	510.9275	
2-Feb	23.536	10.955	521.8825	
3-Feb	24.4	10.695	532.5775	
4-Feb	25.616	12.575	545.1525	
5-Feb	24.576	10.915	556.0675	
6-Feb	22.256	9.385	565.4525	
7-Feb	24.576	9.255	574.7075	
8-Feb	25.072	10.595	585.3025	
9-Feb	25.904	12.025	597.3275	
10-Feb	26.8	11.925	609.2525	
11-Feb	26.272	12.275	621.5275	
12-Feb	25.072	11.865	633.3925	
13-Feb	23.408	10.535	643.9275	
14-Feb	22.432	9.695	653.6225	
15-Feb	22.096	9.595	663.2175	
16-Feb	22.368	9.735	672.9525	
17-Feb	24	10.065	683.0175	
18-Feb	24.016	10.065	693.0825	
19-Feb	24.176	10.205	703.2875	
20-Feb	21.68	8.355	711.6425	
21-Feb	22.08	7.745	719.3875	

YOUNG AIRPORT - DATA: 5 YEAR AVERAGES FROM 2009 TO 2013				
DATE	AVE TEMP AT SUNSET (°C)	DEGDAY >12.4054°C	ACCUMULATED DEGDAY >12.4054°C	FLY ACTIVITY
22-Feb	22.784	8.565	727.9525	
23-Feb	21.536	7.805	735.7575	
24-Feb	22.512	7.795662	743.5532	
25-Feb	24.656	9.545	753.0982	
26-Feb	21.936	9.325	762.4232	
27-Feb	21.84	9.335	771.7582	
28-Feb	19.664	8.815	780.5732	
29-Feb	16.8	6.065	786.6382	
1-Mar	19.14	6.7075	793.3457	
2-Mar	20.208	7.125	800.4707	
3-Mar	21.104	7.045	807.5157	SECOND GENERATION ADULTS HAVE EMERGED FROM THEIR PUPARIA AND ARE FLYING AROUND SEEKING FOOD, WATER, SHELTER AND MATES
4-Mar	19.712	6.675	814.1907	
5-Mar	21.872	7.775	821.9657	
6-Mar	22.176	7.695	829.6607	
7-Mar	21.296	7.115	836.7757	
8-Mar	20.464	6.565077	843.3407	
9-Mar	20.256	6.535	849.8757	
10-Mar	21.728	7.765	857.6407	
11-Mar	21.664	7.865	865.5057	
12-Mar	22.784	8.025019	873.5308	
13-Mar	22.432	8.585	882.1158	
14-Mar	21.6	7.495	889.6108	
15-Mar	21.152	6.68186	896.2926	
16-Mar	20.8	5.775751	902.0684	

YOUNG AIRPORT - DATA: 5 YEAR AVERAGES FROM 2009 TO 2013				
DATE	AVE TEMP AT SUNSET (°C)	DEGDAY >12.4054°C	ACCUMULATED DEGDAY >12.4054°C	FLY ACTIVITY
17-Mar	21.056	6.166472	908.2348	
18-Mar	21.504	6.758891	914.9937	
19-Mar	21.968	7.685	922.6787	
20-Mar	21.216	7.565	930.2437	
21-Mar	21.52	7.205248	937.449	
22-Mar	19.84	5.204472	942.6535	
23-Mar	18.256	3.689531	946.343	
24-Mar	19.2	4.314635	950.6576	
25-Mar	20.32	5.019918	955.6775	
26-Mar	21.04	5.879142	961.5567	
27-Mar	20.048	6.685	968.2417	
28-Mar	18.4	5.255338	973.497	
29-Mar	19.696	5.209715	978.7067	
30-Mar	19.056	4.87658	983.5833	
31-Mar	20.224	4.915944	988.4993	
1-Apr	19.616	4.271631	992.7709	
2-Apr	19.488	4.483125	997.254	
3-Apr	18.816	4.781085	1002.035	
4-Apr	19.408	5.331602	1007.367	
5-Apr	19.472	4.838459	1012.205	
6-Apr	19.008	5.207432	1017.413	
7-Apr	18.688	4.658852	1022.071	
8-Apr	19.088	3.7924	1025.864	
9-Apr	16.288	2.676905	1028.541	

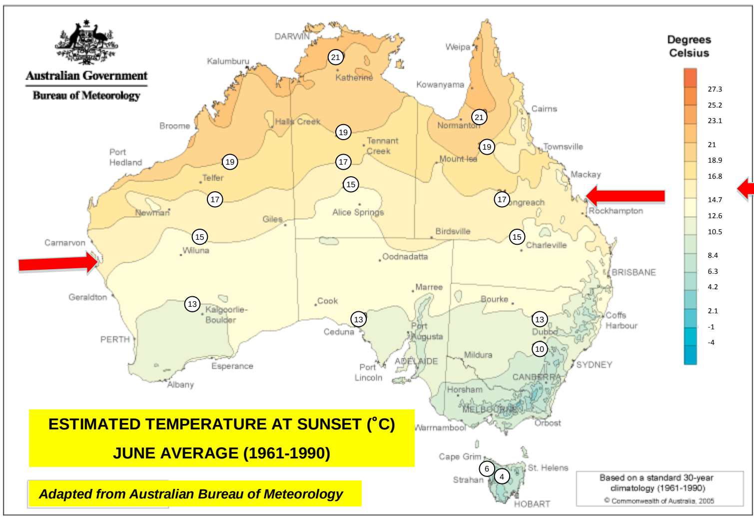
YOUNG AIRPORT - DATA: 5 YEAR AVERAGES FROM 2009 TO 2013				
DATE	AVE TEMP AT SUNSET (°C)	DEGDAY >12.4054°C	ACCUMULATED DEGDAY >12.4054°C	FLY ACTIVITY
10-Apr	16.032	2.331729	1030.872	
11-Apr	15.728	1.830147	1032.703	
12-Apr	17.12	2.357518	1035.06	
13-Apr	18.24	2.920433	1037.981	
14-Apr	17.536	2.839875	1040.82	
15-Apr	17.856	3.49599	1044.316	
16-Apr	18.16	3.34978	1047.666	
17-Apr	18.16	2.963843	1050.63	
18-Apr	16.944	2.640625	1053.271	
19-Apr	16.688	2.348457	1055.619	
20-Apr	17.408	2.564948	1058.184	
21-Apr	17.536	3.050378	1061.234	
22-Apr	17.808	2.700807	1063.935	
23-Apr	16.432	2.121097	1066.056	
24-Apr	15.888	1.932442	1067.989	
25-Apr	15.232	1.657501	1069.646	
26-Apr	15.408	1.618148	1071.264	
27-Apr	17.616	2.42519	1073.69	
28-Apr	17.552	2.533897	1076.224	
29-Apr	16.928	2.665161	1078.889	
30-Apr	16.608	2.115334	1081.004	
1-May	14.88	1.196322	1082.2	
2-May	14.448	1.135619	1083.336	
3-May	14.896	1.306706	1084.643	

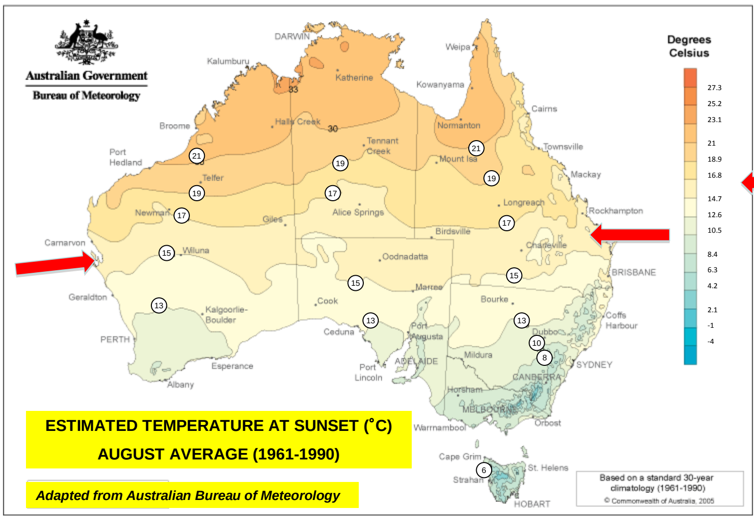
YOUNG AIRPORT - DATA: 5 YEAR AVERAGES FROM 2009 TO 2013				
DATE	AVE TEMP AT SUNSET (°C)	DEGDAY >12.4054°C	ACCUMULATED DEGDAY >12.4054°C	FLY ACTIVITY
4-May	12.528	0.403159	1085.046	
5-May	13.392	0.608557	1085.654	
6-May	13.76	0.666049	1086.32	
7-May	14.256	0.944659	1087.265	
8-May	15.808	1.414645	1088.68	
9-May	16.096	1.67571	1090.355	
10-May	14.912	1.199853	1091.555	
11-May	14.176	0.900804	1092.456	
12-May	12.416	0.373201	1092.829	
13-May	12.272	0.291021	1093.12	
14-May	12.832	0.373677	1093.494	
15-May	13.264	0.526923	1094.021	
16-May	13.408	0.598675	1094.62	
17-May	14.432	0.875227	1095.495	
18-May	14.944	1.122452	1096.617	
19-May	14.864	1.000279	1097.618	
20-May	15.264	1.233544	1098.851	
21-May	14.4	0.907889	1099.759	
22-May	13.824	0.818376	1100.577	
23-May	14.08	0.99075	1101.568	
24-May	13.392	0.715077	1102.283	
25-May	12.416	0.397673	1102.681	
26-May	12.736	0.511392	1103.192	
27-May	13.376	0.727313	1103.92	

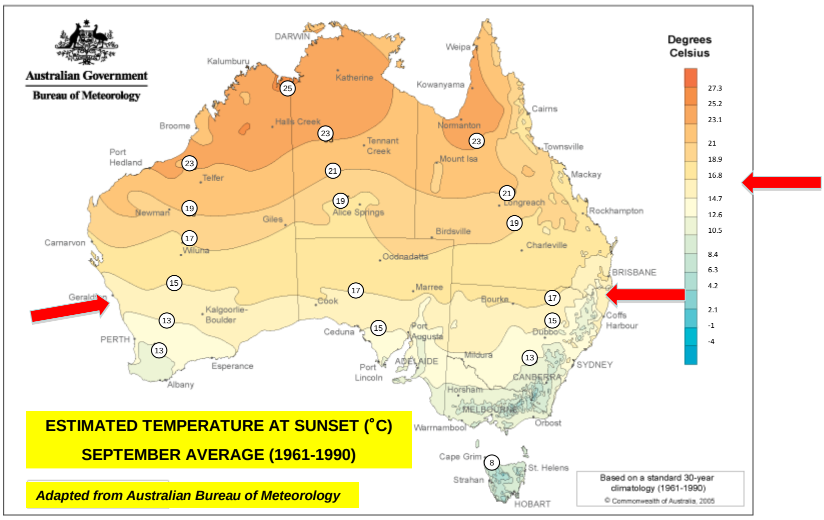
YOUNG AIRPORT - DATA: 5 YEAR AVERAGES FROM 2009 TO 2013				
DATE	AVE TEMP AT SUNSET (°C)	DEGDAY >12.4054°C	ACCUMULATED DEGDAY >12.4054°C	FLY ACTIVITY
28-May	12.96	0.549696	1104.469	
29-May	13.552	0.880403	1105.35	
30-May	14.8	1.394483	1106.744	
31-May	12.912	0.675883	1107.42	
1-Jun	13.168	0.752886	1108.173	
2-Jun	11.584	0.187201	1108.36	
3-Jun	12.192	0.403475	1108.764	
4-Jun	11.792	0.243838	1109.007	
5-Jun	10.704	0.054013	1109.061	
6-Jun	10.976	0.062024	1109.123	
7-Jun	10.368	0.011112	1109.135	
8-Jun	10.176	0.003736	1109.138	
9-Jun	10.96	0.066129	1109.204	
10-Jun	12	0.218354	1109.423	
11-Jun	11.728	0.210473	1109.633	
12-Jun	11.344	0.15003	1109.783	
13-Jun	11.776	0.245836	1110.029	
14-Jun	12.256	0.361892	1110.391	
15-Jun	12.032	0.276843	1110.668	
16-Jun	9.52	0	1110.668	
17-Jun	9.664	0	1110.668	
18-Jun	10.592	0.030105	1110.698	
19-Jun	11.68	0.220202	1110.918	
20-Jun	11.04	0.071862	1110.99	

YOUNG AIRPORT - DATA: 5 YEAR AVERAGES FROM 2009 TO 2013				
DATE	AVE TEMP AT SUNSET (°C)	DEGDAY >12.4054°C	ACCUMULATED DEGDAY >12.4054°C	FLY ACTIVITY
21-Jun	11.12	0.083396	1111.073	
22-Jun	10.576	0.037654	1111.111	
23-Jun	9.744	0	1111.111	
24-Jun	11.296	0.146768	1111.258	
25-Jun	10.688	0.0479	1111.306	NO THIRD GENERATION (NEEDS 1212DD>12.405°C) – EGGS AND LARVAE IN FRUIT AT THIS TIME WILL PERISH OVER WINTER UNLESS IN FRUIT THAT CAN SUSTAIN EGGS AND LARVAE OVER WINTER (E.G. APPLES AND QUINCES) OR ARE IN A PROTECTED MICROCLIMATE
26-Jun	11.072	0.076952	1111.383	
27-Jun	10.528	0.023362	1111.406	
28-Jun	10.24	0.007724	1111.414	
29-Jun	11.008	0.073795	1111.488	

Appendix 13 – Australia: Monthly maps of estimated temperature at sunset (average from 1961 to 1990)



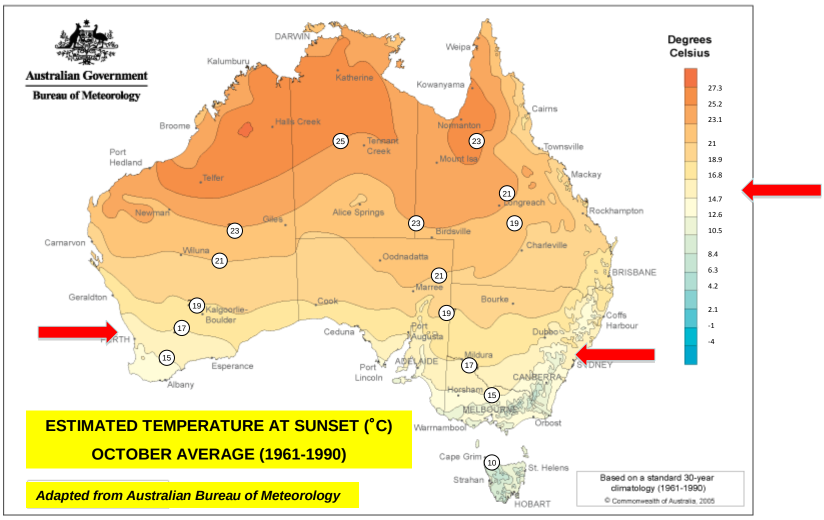




ESTIMATED TEMPERATURE AT SUNSET (°C)

SEPTEMBER AVERAGE (1961-1990)

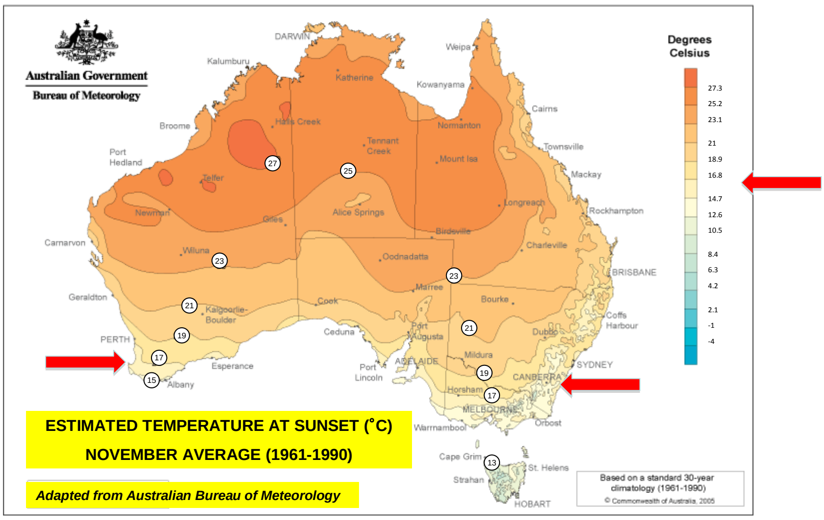
Adapted from Australian Bureau of Meteorology



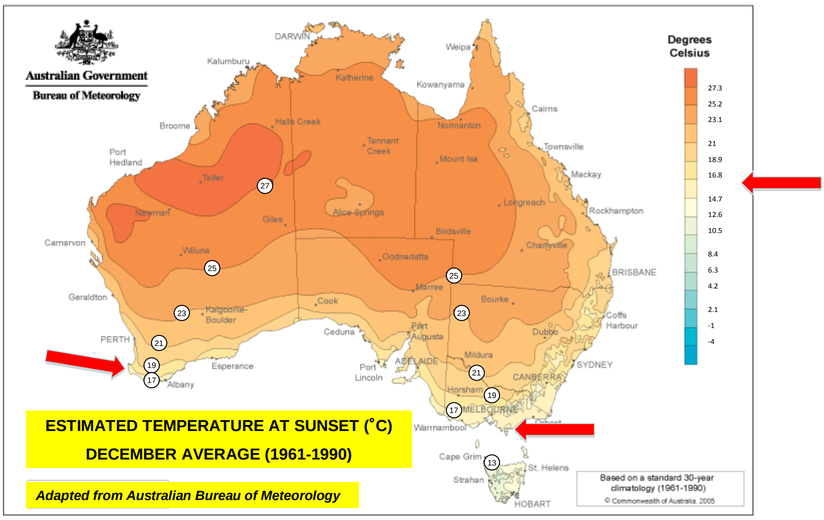
ESTIMATED TEMPERATURE AT SUNSET (°C)

OCTOBER AVERAGE (1961-1990)

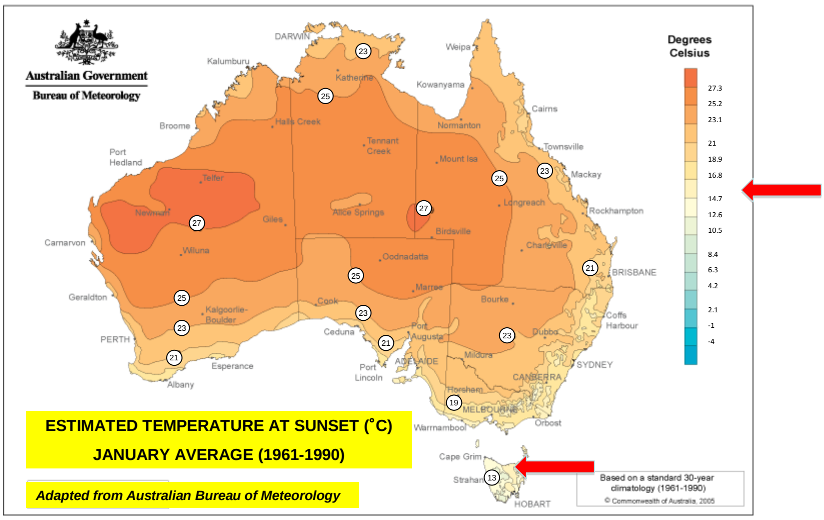
Adapted from Australian Bureau of Meteorology



ESTIMATED TEMPERATURE AT SUNSET (°C)
NOVEMBER AVERAGE (1961-1990)

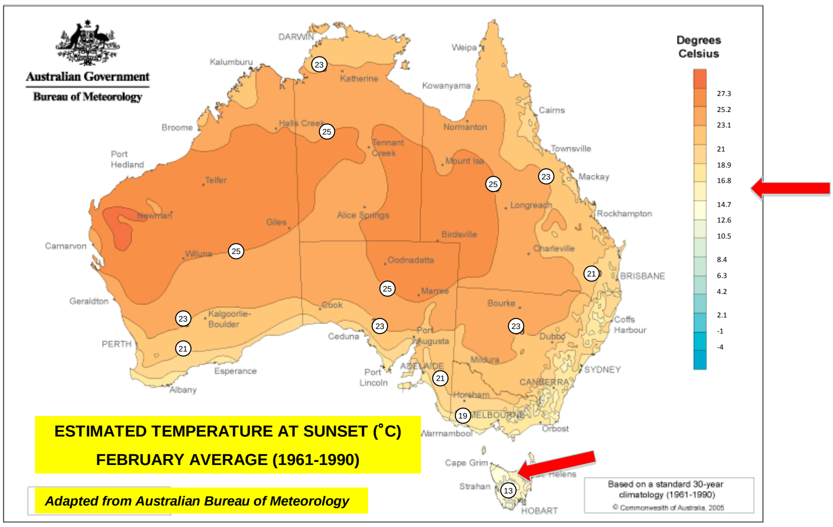


ESTIMATED TEMPERATURE AT SUNSET (°C)
DECEMBER AVERAGE (1961-1990)



ESTIMATED TEMPERATURE AT SUNSET (°C)
JANUARY AVERAGE (1961-1990)

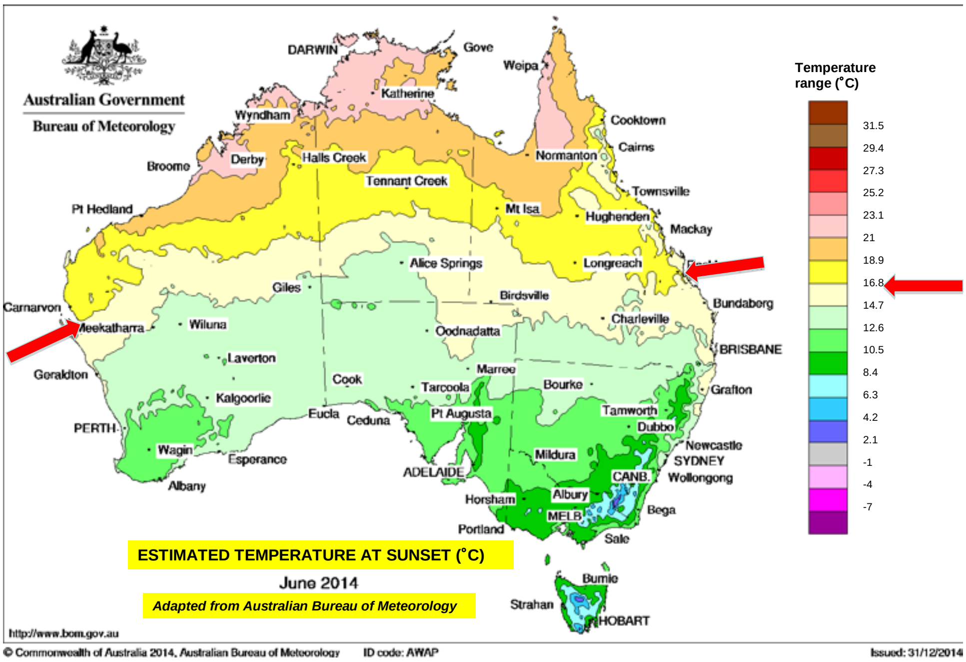
Adapted from Australian Bureau of Meteorology

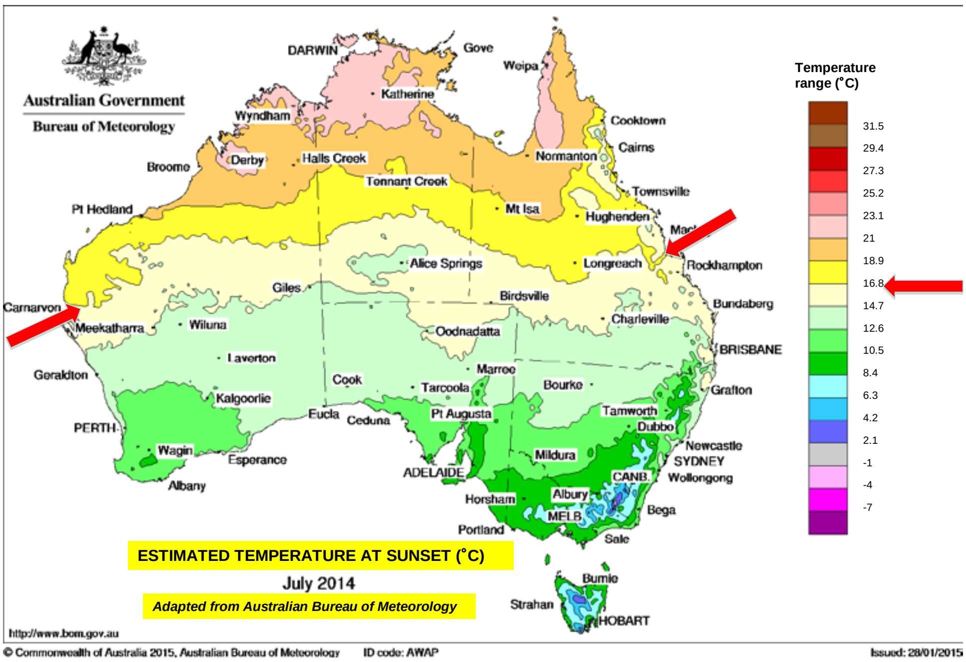


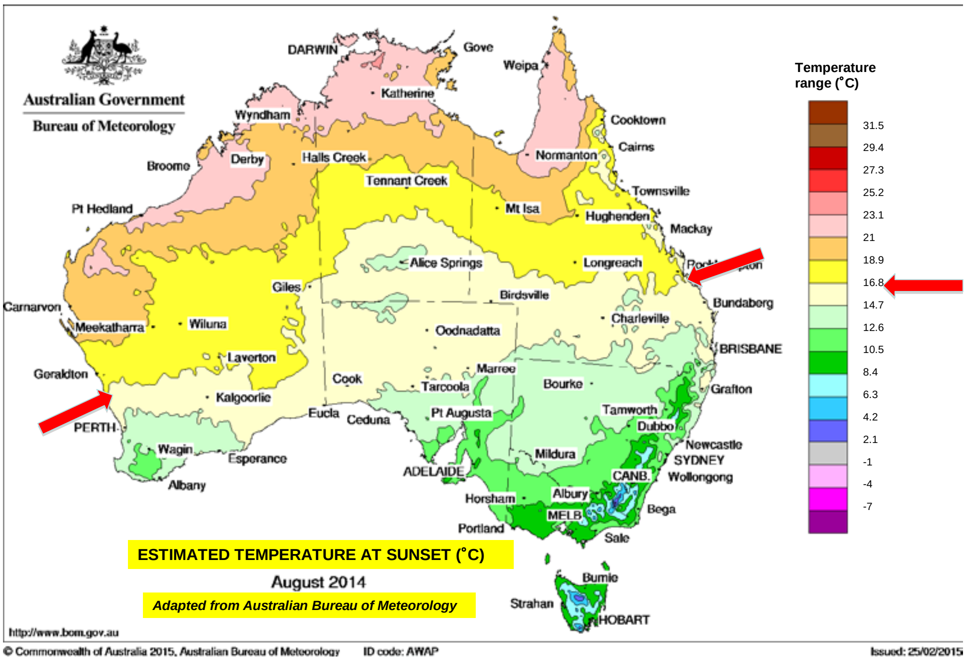
ESTIMATED TEMPERATURE AT SUNSET (°C)
FEBRUARY AVERAGE (1961-1990)

Adapted from Australian Bureau of Meteorology

Appendix 14 - Australia: Monthly maps of estimated temperature at sunset (2014-2015)






Australian Government
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HOBART
ESTIMATED TEMPERATURE AT SUNSET (˚C)
August 2014
Adapted from Australian Bureau of Meteorology
http://www.bom.gov.au
© Commonwealth of Australia 2015, Australian Bureau of Meteorology
ID code: AWAP
Issued: 25/02/2015
Temperature range (˚C)
31.5
29.4
27.3
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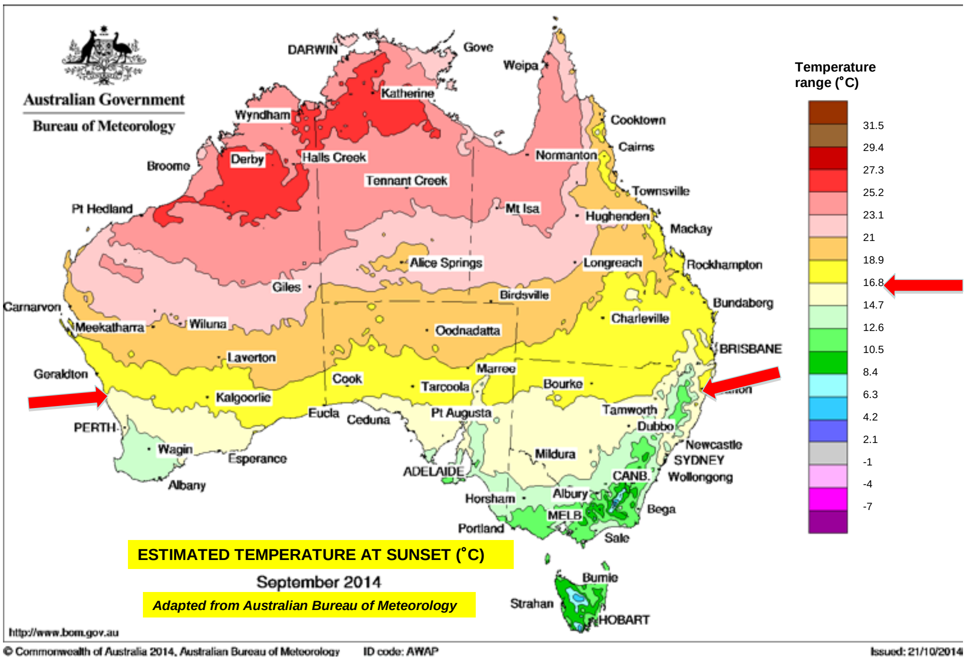
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ESTIMATED TEMPERATURE AT SUNSET (˚C)
September 2014
Adapted from Australian Bureau of Meteorology
http://www.bom.gov.au
© Commonwealth of Australia 2014, Australian Bureau of Meteorology
ID code: AWAP
Issued: 21/10/2014
Temperature range (˚C)
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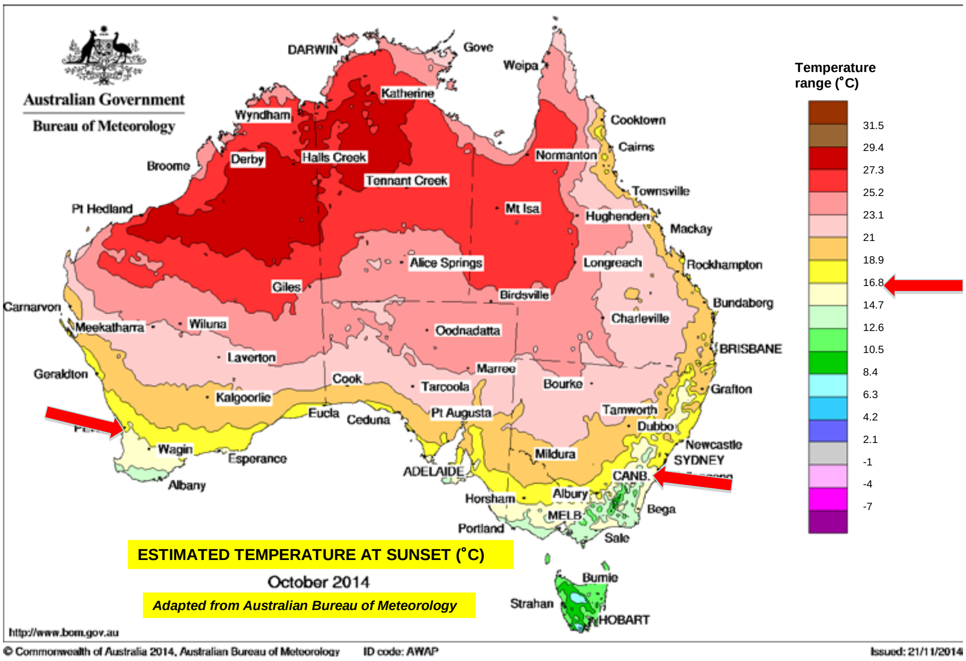
Australian Government
Bureau of Meteorology
Temperature range (˚C)
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ESTIMATED TEMPERATURE AT SUNSET (˚C)
October 2014
Adapted from Australian Bureau of Meteorology
Burnie
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HOBART
http://www.bom.gov.au
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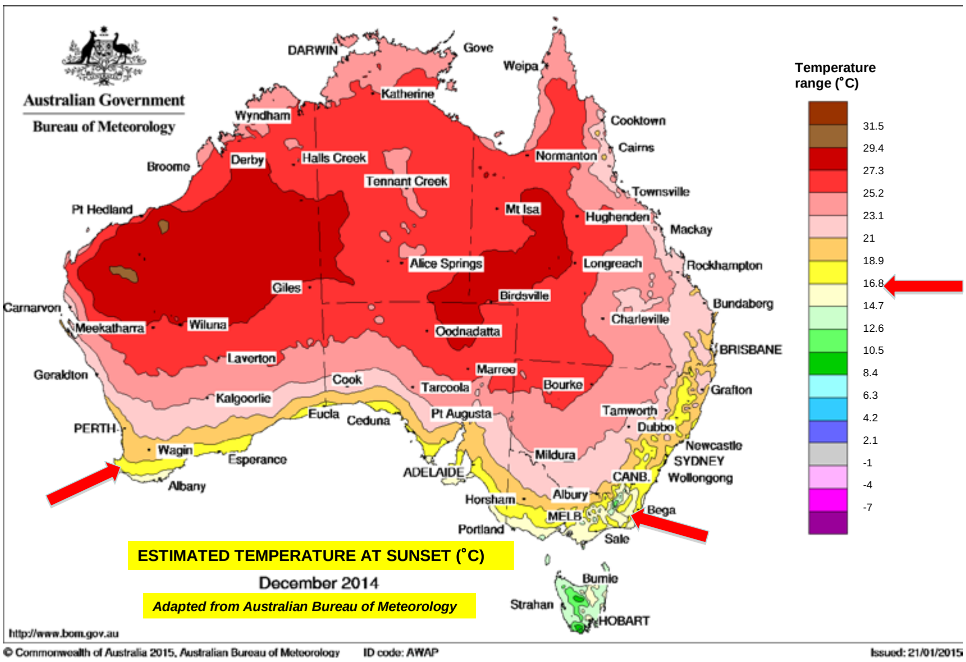
ID code: AWAP
Issued: 21/11/2014


Australian Government
Bureau of Meteorology
Temperature range (˚C)
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ESTIMATED TEMPERATURE AT SUNSET (˚C)
December 2014
Adapted from Australian Bureau of Meteorology
Burnie
Strahan
HOBART
http://www.bom.gov.au
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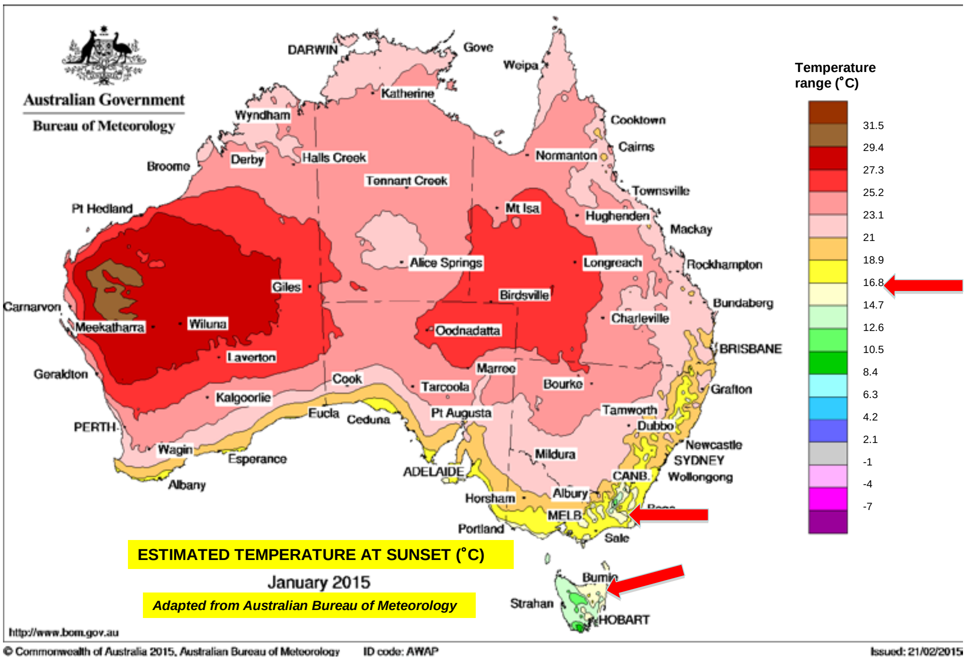
ID code: AWAP
Issued: 21/01/2015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ESTIMATED TEMPERATURE AT SUNSET (°C)
January 2015
Adapted from Australian Bureau of Meteorology
http://www.bom.gov.au
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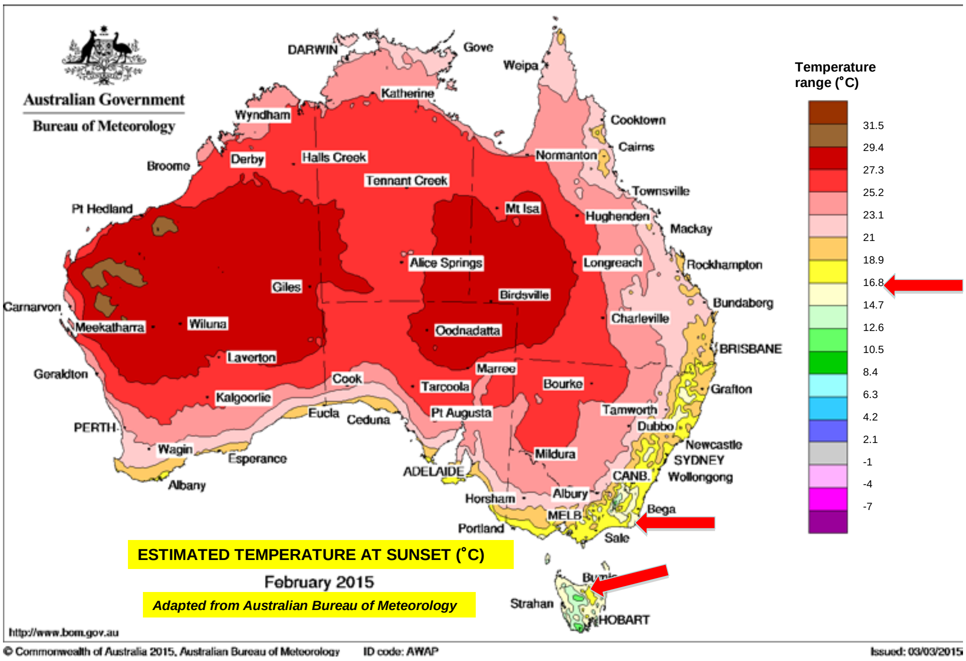
ID code: AWAP
Issued: 21/02/2015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ESTIMATED TEMPERATURE AT SUNSET (°C)
February 2015
Adapted from Australian Bureau of Meteorology
http://www.bom.gov.au
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ID code: AWAP
Issued: 03/03/2015

Appendix 15 – Selected cherry production areas: Tables of daily degree-days over 12.405°C to be used with Model 3

New South Wales

Month	Day	YOUNG	TUMBARUMBA	HILLSTON	WELLINGTON	MUDGEE	ORANGE
7	1	0.292778	0.1595	1.985	1.7525	1.14325	0.0295
7	2	0.565278	0.20425	1.823125	1.453	1.11325	0.01975
7	3	0.704167	0.314	1.460625	1.633	1.253	0.1245
7	4	0.792778	0.16925	1.35375	2.028	1.523	0.15425
7	5	0.765	0.15925	1.97875	1.70775	1.15325	0.05925
7	6	0.576667	0.13475	1.61625	1.18775	0.83325	0.00475
7	7	0.359722	0.1045	0.835313	1.368	0.8635	0
7	8	0.475833	0.0645	0.698125	1.50775	0.79325	0
7	9	0.598333	0.14425	1.191875	1.468	0.89325	0.0695
7	10	0.876111	0.174	1.379063	1.403	0.93825	0.0695
7	11	0.948056	0.119	1.629063	1.678	0.9885	0.10425
7	12	0.482222	0.334	1.191563	1.72275	1.263	0.04475
7	13	0.893056	0.18925	1.035625	1.6535	1.27825	0.18425
7	14	0.76	0.17925	1.085313	1.45775	1.043	0.1745
7	15	0.1875	0.05475	1.160313	0.9135	0.634	0
7	16	0.481944	0.2095	1.335	1.1685	0.7935	0
7	17	0.681944	0.1545	0.973125	1.498	1.06325	0.08475
7	18	0.626667	0.2495	1.104063	1.508	1.288	0.05975
7	19	0.398611	0.1295	1.197813	1.20775	0.743	0
7	20	0.498333	0.249	1.86625	2.0125	1.5075	0.00475
7	21	0.975833	0.4635	2.2475	2.0875	1.313	0.1245
7	22	1.12	0.3885	1.8225	2.1325	1.3825	0.12925
7	23	0.675833	0.19375	2.029063	1.52825	0.98825	0
7	24	0.998056	0.299	2.416563	1.74775	1.208	0.13425
7	25	0.842222	0.269	2.135	2.0875	1.57775	0.06475
7	26	0.820556	0.07425	1.397813	1.93275	1.148	0.0495
7	27	0.665556	0.22875	1.191563	1.78775	1.2575	0.1495
7	28	0.804167	0.164	1.397813	1.208	0.91825	0.0345
7	29	1.070278	0.17875	2.32875	2.0075	1.6525	0.15425
7	30	0.975833	0.264	2.51625	1.9325	1.4575	0.134
7	31	1.098056	0.349	2.835	2.4075	1.9575	0.164
8	1	1.176111	0.57375	2.6475	2.16275	1.78275	0.334
8	2	1.081667	0.534	2.585	2.063	1.6085	0.36425
8	3	1.337222	0.56425	2.778438	2.12775	1.77775	0.3195
8	4	0.937222	0.4395	1.979063	1.57275	1.008	0.25475
8	5	1.048333	0.3595	2.11625	1.78275	1.358	0.16925
8	6	0.631944	0.309	2.35375	1.90775	1.643	0.21425
8	7	0.7375	0.23925	1.785313	1.89775	1.473	0.12925
8	8	0.809444	0.28425	1.898125	1.518	1.31825	0.1895
8	9	0.904167	0.289	2.27875	1.81275	1.413	0.129
8	10	1.159444	0.35925	2.360313	1.898	1.4285	0.36425
8	11	0.959444	0.3985	1.529375	1.818	1.52325	0.304
8	12	0.753611	0.38425	1.95375	1.628	1.15325	0.0745
8	13	0.786944	0.28375	2.49125	2.2125	1.6225	0.09925
8	14	1.581111	0.76325	2.67875	2.6175	2.02275	0.29325
8	15	1.47	0.644	2.91625	2.33275	1.96275	0.304
8	16	1.503611	0.599	3.3475	2.8925	2.203	0.51375

Month	Day	YOUNG	TUMBARUMBA	HILLSTON	WELLINGTON	MUDGEE	ORANGE
8	17	0.942778	0.26925	2.19125	2.2225	1.9675	0.34425
8	18	1.020278	0.499	2.6975	2.22275	1.768	0.209
8	19	1.22	0.684	3.035	2.3825	1.7625	0.414
8	20	1.103611	0.679	3.20375	2.18275	1.523	0.26925
8	21	1.381389	0.60875	3.84125	2.8525	2.0725	0.34875
8	22	1.759167	0.72875	3.07875	2.8625	2.2825	0.474
8	23	1.72	0.85375	3.322813	3.23275	2.73775	0.9735
8	24	1.514167	1.02825	3.603438	3.03225	2.7375	0.6485
8	25	1.958889	1.2685	4.01625	3.0575	2.7325	1.4485
8	26	2.603056	1.67825	4.35375	3.57275	3.19275	1.21325
8	27	2.919722	1.713	4.235	4.0175	3.44275	1.22775
8	28	3.219444	2.13275	4.49125	4.5025	3.7475	1.573
8	29	3.280556	1.93275	4.6475	4.5875	3.6375	1.36775
8	30	2.214167	1.23825	3.484688	3.6275	3.2175	1.0635
8	31	1.947778	1.1135	3.497188	3.18725	2.7675	0.81375
9	1	2.680556	1.413	4.12875	4.0175	3.5375	1.248
9	2	3.213889	1.94775	4.485	4.6375	4.0575	1.53325
9	3	3.314167	2.148	4.378438	3.80725	2.76275	1.2135
9	4	2.541944	1.73775	3.772188	3.35225	2.65275	0.9035
9	5	2.52	1.673	3.85375	3.3375	2.74775	1.0735
9	6	2.730556	1.22825	3.597188	3.8575	3.2325	1.15325
9	7	2.319444	1.38275	3.484688	3.6975	3.1925	0.81825
9	8	2.330278	1.37275	3.76	3.71725	2.9175	1.0085
9	9	1.797222	1.42825	3.621875	3.4975	2.80275	0.89375
9	10	2.141389	1.05325	4.053438	3.95725	3.2775	1.0135
9	11	2.258333	1.0385	3.7475	3.6425	2.9475	0.5785
9	12	3.236667	1.903	4.828438	3.878	3.233	1.34825
9	13	3.225278	1.953	5.353438	4.4975	4.1875	1.67325
9	14	3.130556	1.573	5.309688	4.33725	3.67725	1.2235
9	15	3.363889	1.728	5.25375	4.89725	4.25725	1.63275
9	16	2.836667	1.5785	4.41	3.61275	2.98775	1.38875
9	17	3.4975	2.238	5.05375	4.4725	3.95775	1.98825
9	18	4.091667	2.53775	5.71625	5.0275	4.43225	1.993
9	19	4.297222	2.88775	6.615938	4.9075	4.2675	1.913
9	20	3.702778	2.003	4.947188	5.602	4.4	2.01275
9	21	3.880556	2.6825	5.51625	5.2025	4.5975	2.0525
9	22	5.319167	3.4375	7.434375	5.9575	5.3525	3.1225
9	23	4.647222	2.9825	5.196875	5.937	5.30225	3.008
9	24	3.897222	2.54725	5.05375	5.5975	5.2125	2.2475
9	25	4.069444	2.7025	5.6725	5.3875	4.5925	2.32775
9	26	4.1975	2.57775	5.515938	5.37225	4.51225	2.06275
9	27	4.825278	3.18275	6.703125	6.1775	5.2275	3.0625
9	28	4.246944	2.5025	6.552813	6.01175	5.16225	2.70275
9	29	3.1025	1.3835	4.740938	4.73175	4.047	1.71825
9	30	4.047222	2.198	5.62875	4.82725	4.4875	2.098
10	1	4.475278	2.9425	6.765938	5.14725	4.96275	2.553
10	2	5.836111	4.0525	7.640313	5.9925	5.8075	3.38275
10	3	4.958333	3.55775	6.853438	5.547	4.6125	2.6975
10	4	5.419167	3.65225	6.747188	6.087	5.112	3.04725
10	5	5.841667	3.6825	7.3025	6.84225	6.06225	3.84725
10	6	4.469167	2.7125	5.74625	6.302	5.73225	3.05725

Month	Day	YOUNG	TUMBARUMBA	HILLSTON	WELLINGTON	MUDGEE	ORANGE
10	7	3.341667	2.233	4.940938	4.41225	4.1825	1.743
10	8	3.513889	2.21275	4.57875	4.68725	4.3725	1.64825
10	9	4.202778	2.89775	5.34125	5.3175	4.2775	1.99275
10	10	5.369444	3.5725	7.035	5.9475	5.0925	2.5725
10	11	4.752778	3.07275	6.909688	5.41225	4.77225	2.0825
10	12	5.641667	3.9175	8.570938	6.3275	5.6075	2.99775
10	13	6.613611	4.802	9.55875	7.34725	6.3525	3.662
10	14	4.869444	3.7225	7.865313	6.53625	5.7965	3.37275
10	15	4.652778	2.73775	5.896563	6.42675	5.55175	2.74775
10	16	4.180833	2.78775	4.9225	4.86275	4.0575	1.99325
10	17	4.513889	3.1525	6.54125	6.04725	4.94225	2.41775
10	18	6.363611	4.63225	8.227813	6.64725	5.48725	3.0425
10	19	6.930556	5.4675	8.571563	7.20225	6.4325	4.21725
10	20	7.569167	5.667	9.002188	7.6015	6.702	4.59675
10	21	7.436111	4.97725	8.446875	7.447	6.957	4.26725
10	22	6.818889	4.31225	9.102188	7.47225	6.22225	4.09225
10	23	6.996944	4.69725	8.908438	8.1915	6.90225	4.157
10	24	6.141111	4.65175	8.9775	6.64175	5.82175	3.32225
10	25	6.657778	4.12725	8.384063	7.312	6.24725	3.612
10	26	6.613889	4.54225	9.121563	7.012	5.6525	3.45775
10	27	6.180556	4.2275	8.1275	7.07675	6.2475	3.497
10	28	6.313611	4.3675	7.796563	7.35175	6.41225	3.5175
10	29	7.33	4.95225	9.3275	7.82625	6.79175	4.072
10	30	7.279722	4.722	8.53375	8.561	6.8915	4.50225
10	31	8.079722	5.947	9.227188	8.911	7.5415	5.08675
11	1	8.418889	5.7715	10.39594	9.12625	7.66675	5.21675
11	2	8.418333	5.6865	11.56438	8.926	7.50675	4.9165
11	3	6.879444	4.707	8.202188	8.08625	7.07125	4.142
11	4	6.763333	4.3325	6.422188	7.66675	6.50175	3.85225
11	5	7.63	5.4175	7.896563	7.3315	6.09675	3.80725
11	6	7.23	5.597	9.352188	7.53625	5.77675	3.72725
11	7	7.768611	5.292	9.201875	8.69125	7.31675	4.712
11	8	8.0075	6.12625	9.383125	9.3555	7.576	5.2565
11	9	7.591667	5.69225	11.27719	8.76075	7.28075	4.532
11	10	7.552222	5.527	10.77063	8.5215	7.03175	4.86175
11	11	7.685833	5.2525	10.58375	8.69625	7.117	4.7825
11	12	9.235833	6.562	12.63313	9.33125	8.06175	5.76675
11	13	7.980278	5.36225	11.96438	9.471	8.3015	5.12175
11	14	8.635833	5.98175	11.89594	9.886	8.8515	5.78675
11	15	8.363333	5.36725	10.23938	9.6115	8.5015	4.9965
11	16	7.652222	5.18225	9.602188	8.066	6.73125	3.892
11	17	8.4025	5.95225	10.4025	8.91625	7.1715	4.65225
11	18	9.546667	6.77725	12.28313	9.471	8.0765	5.682
11	19	9.851667	7.1115	12.48906	10.76125	9.20625	6.7465
11	20	9.712778	7.3715	11.82656	10.60625	9.151	6.93675
11	21	9.557778	6.8315	10.52719	10.41575	8.97125	6.6565
11	22	8.551667	6.07225	8.495625	10.43575	8.701	6.27675
11	23	7.601944	5.7575	8.702188	8.7255	6.95575	4.48725
11	24	8.240833	6.56225	10.01438	9.05575	7.49625	4.91225
11	25	9.629722	7.31675	12.17031	10.14075	8.396	5.82175
11	26	10.17389	7.77575	11.87	11.3355	9.251	6.69125

Month	Day	YOUNG	TUMBARUMBA	HILLSTON	WELLINGTON	MUDGEE	ORANGE
11	27	10.05167	6.902	11.49531	10.39575	9.15125	6.187
11	28	10.55639	7.471	11.72656	10.6755	9.296	6.681
11	29	8.817222	6.601	10.48281	10.31525	9.00525	5.76025
11	30	9.840278	6.4215	10.90188	10.281	9.01625	6.34175
12	1	9.6625	6.77675	10.84531	11.391	9.416	6.58675
12	2	9.195833	6.37625	9.065	10.68575	9.20625	5.55675
12	3	8.313333	6.192	9.283438	9.64125	8.42625	5.60175
12	4	9.224167	6.207	10.48969	9.71125	8.3465	5.71175
12	5	8.812778	5.97725	12.20781	9.5805	8.396	4.937
12	6	9.351667	6.962	13.6825	10.411	8.716	6.1765
12	7	10.03472	7.25675	11.57	10.7605	9.0905	6.44125
12	8	10.54639	7.662	11.57656	11.3505	9.7305	6.7365
12	9	10.15167	7.8165	10.93313	11.7505	10.1905	6.811
12	10	9.501111	6.3865	12.2825	11.02025	9.23025	5.97625
12	11	8.540556	6.73175	11.01438	9.48575	7.80625	5.507
12	12	8.823611	6.357	10.50813	9.91575	8.13075	5.62675
12	13	9.074167	6.69175	10.10813	10.49075	9.32125	6.567
12	14	9.485278	6.82175	10.33313	10.61075	9.03075	6.0865
12	15	9.967778	6.9815	10.78938	11.24075	9.69075	6.7715
12	16	10.31806	7.39175	11.66438	11.67025	9.27075	6.70625
12	17	10.01278	6.65725	11.88906	10.66025	9.07575	6.252
12	18	9.845278	6.35675	11.37656	9.93	8.131	5.417
12	19	10.07389	7.2915	11.31375	10.5855	9.181	6.41625
12	20	9.740278	7.4565	10.73969	11.39075	9.746	6.87675
12	21	10.91861	8.182	11.87688	11.29075	9.68075	7.21175
12	22	11.58444	8.9915	14.07063	11.336	10.211	7.871
12	23	12.80083	9.511	13.83906	13.395	11.85	8.916
12	24	11.61722	8.7615	12.47688	13.03525	10.88025	7.686
12	25	9.328889	6.67625	11.27688	9.99525	8.98025	5.5615
12	26	9.412222	7.2115	11.85781	10.1155	8.4405	5.61625
12	27	9.674167	7.2865	10.47656	10.3555	8.576	6.35175
12	28	10.83472	8.461	11.67063	10.83025	9.02125	6.8115
12	29	10.93444	8.23675	12.76406	11.57025	9.87075	7.53625
12	30	11.2625	8.667	14.445	11.20075	9.4855	7.12175
12	31	11.50667	9.02675	15.1575	11.94075	10.221	7.83125
1	1	12.34028	10.291	16.63875	12.85025	10.91075	8.441
1	2	12.32278	9.1855	12.95813	13.87525	11.58075	8.56025
1	3	11.91222	9.0965	12.72656	13.915	11.4255	8.09575
1	4	11.83361	8.68175	13.15813	12.97	10.41	7.206
1	5	12.50056	8.66575	13.15156	13.14525	11.05025	8.14575
1	6	12.78444	9.401	13.46406	12.52	10.77575	8.23575
1	7	12.40111	9.1265	13.86375	12.5505	10.23575	7.796
1	8	12.92833	9.49125	13.68281	13.38525	11.25525	8.7555
1	9	11.02778	8.86125	14.08281	11.85	10.015	6.741
1	10	12.29528	10.1915	15.90125	12.145	10.251	7.5315
1	11	13.70583	10.38125	16.96375	13.49025	11.65025	9.056
1	12	14.945	11.9555	16.16406	15.34525	13.1055	10.79525
1	13	14.8225	10.20675	14.5575	15.32025	13.16025	11.05025
1	14	13.93389	10.65575	14.91375	14.615	12.04	9.7455
1	15	15.06139	11.7605	16.83875	14.635	12.325	9.9055
1	16	13.72278	10.44575	14.23281	14.025	11.885	9.12

Month	Day	YOUNG	TUMBARUMBA	HILLSTON	WELLINGTON	MUDGEE	ORANGE
1	17	12.06722	10.031	12.35125	12.84	10.925	7.73575
1	18	11.71778	9.616	12.27656	12.2305	10.34575	7.90125
1	19	12.75611	9.1015	13.65125	12.92025	10.65525	8.356
1	20	13.95583	9.786	15.77031	13.63025	11.08025	8.91025
1	21	13.08944	9.53075	15.51375	13.5	11.67525	9.3305
1	22	13.65583	10.93575	16.23875	13.555	11.49025	8.46075
1	23	13.80056	11.141	15.6325	14.41	11.71525	8.7655
1	24	13.30028	10.02575	14.845	14.135	11.9	8.42575
1	25	12.29472	9.122	14.6325	13.545	11.89	8.36575
1	26	13.20611	10.34175	15.695	14.015	12.21	8.87575
1	27	13.88917	10.22575	16.11375	14.125	11.925	9.41525
1	28	13.37278	10.336	16.2075	13.07525	11.09025	8.18075
1	29	14.18917	11.20575	16.1325	13.93025	11.66025	9.3955
1	30	14.25639	11.1805	16.7075	14.065	12.16025	9.22075
1	31	14.19472	11.15575	16.17625	14.555	12.3355	9.8
2	1	15.17806	11.85075	17.17656	15.045	12.77	10
2	2	13.54444	10.69575	14.47625	13.825	11.705	8.8155
2	3	12.81167	10.20075	14.26406	13.8955	11.6805	8.95575
2	4	13.795	10.3205	15.14531	13.85525	11.69525	8.72575
2	5	12.65611	9.10075	15.37625	13.26525	11.30525	7.866
2	6	12.01167	8.836	12.08281	12.76025	11.0055	8.481
2	7	11.735	9.2765	11.50188	12.50525	10.64075	7.9115
2	8	12.38917	10.7465	12.70156	12.77525	10.716	8.536
2	9	12.67222	9.061	11.62063	13.40525	10.7955	8.58575
2	10	11.60611	8.65125	11.47	12.60525	10.85525	7.37125
2	11	11.58417	7.9415	11.91469	11.76025	10.21525	7.14075
2	12	11.55083	7.7865	10.81406	11.8755	10.5005	6.81125
2	13	10.645	7.62175	10.32031	11.19525	9.30525	6.2565
2	14	10.08917	8.4565	11.23281	10.1355	8.40525	5.96175
2	15	11.06139	7.90675	13.32625	11.17025	9.2805	6.2715
2	16	10.40028	7.86625	12.91375	10.715	9.1	5.41125
2	17	10.72806	8.38675	13.40781	10.585	9.00525	6.051
2	18	11.69472	9.371	14.47	11.865	10.17	7.02675
2	19	12.06694	9.171	14.47	12.44	10.5755	7.806
2	20	11.06167	7.94575	13.445	12.105	10.51525	6.7655
2	21	10.93389	8.19125	12.8075	11.54525	9.99025	6.661
2	22	10.7675	7.58175	12.63906	11.16	9.105	6.23675
2	23	10.70083	8.0865	13.00125	11.11525	9.4655	6.45625
2	24	10.86806	8.4615	12.8325	11.8255	10.1055	7.21625
2	25	11.64028	9.0415	12.31406	12.33025	9.9205	7.24125
2	26	11.00083	8.02625	12.92	11.365	9.585	6.91075
2	27	10.84472	7.77625	12.9825	11.035	9.1105	6.361
2	28	10.30611	7.80075	13.29531	10.78025	9.1255	6.056

South Australia

Month	Day	LAMEROO	KAROONDA	NARACOORTE	MT CRAWFORD	MT LOFTY	KEITH	MT BARKER	NURIOOTPA
7	1	1.7575	1.9425	1.1775	0.27425	0.17475	1.5525	0.8285	1.03825
7	2	1.8725	1.9325	0.838	0.25925	0.00975	1.35775	0.83825	1.00325
7	3	1.7025	1.9425	1.22775	0.0295	0.02475	1.7775	0.90275	0.92275
7	4	1.28275	1.5175	0.6685	0.03975	0	1.0825	0.558	0.468
7	5	1.2175	1.2625	0.708	0.0945	0	0.88775	0.51875	0.424
7	6	1.24275	1.54275	0.71775	0.00475	0	1.1925	0.52375	0.49825
7	7	1.04275	0.96275	0.56825	0.01475	0	0.90775	0.30425	0.274
7	8	1.00275	0.79775	0.603	0.08475	0	0.818	0.55875	0.324
7	9	1.1125	1.3525	0.71775	0.1145	0	1.2475	0.59825	0.4085
7	10	1.59775	1.6925	0.86825	0.30425	0.01475	1.348	0.78325	0.8835
7	11	1.36775	1.40775	0.85275	0.12925	0.05975	1.07275	0.5135	0.5985
7	12	0.81325	0.848	0.53375	0.19425	0.0595	0.81825	0.6335	0.54375
7	13	1.11275	1.368	0.70825	0.21925	0.04975	1.09275	0.6385	0.62875
7	14	1.13275	1.13275	0.54775	0	0	1.11275	0.139	0.20425
7	15	1.19275	1.25775	0.84275	0.00475	0	0.97275	0.35375	0.23425
7	16	1.128	1.123	0.788	0.04475	0	1.053	0.334	0.379
7	17	1.17325	1.34275	0.94825	0.1695	0.11475	1.14825	0.50375	0.6235
7	18	1.05275	0.95775	0.6585	0	0	1.038	0.229	0.5
7	19	1.2125	1.3375	0.63775	0.1595	0	1.00775	0.6035	0.424
7	20	1.55275	1.40775	0.99775	0.2195	0.10975	1.423	0.76875	0.524
7	21	1.4775	1.4475	0.95275	0.28925	0.07475	1.3125	1.148	0.79775
7	22	1.5975	1.6575	0.75325	0.31425	0.05975	1.20775	0.6985	0.993
7	23	1.60275	1.70275	0.59375	0.50875	0.12425	1.10325	1.18325	1.0085
7	24	1.96775	2	1.2425	0.3345	0.1295	1.8675	0.97325	0.99275
7	25	2.2275	2.3025	1.3275	0.1295	0	1.8625	0.863	0.9075
7	26	1.7625	1.7725	1.09775	0.1345	0.01475	1.4525	0.813	0.69775
7	27	1.5575	1.6825	1.23275	0.30925	0.15975	1.5025	0.798	0.75825
7	28	2.5225	2.5225	1.8475	0.6285	0.18925	2.3025	1.47775	1.51275
7	29	1.80775	1.84775	1.10275	0.2495	0.11475	1.60275	1.01325	0.883
7	30	2.2725	2.3675	1.6225	0.3935	0.02975	2.2025	1.193	1.19825
7	31	2.15775	2.36275	1.5375	0.469	0.16475	1.87775	1.233	1.16775
8	1	2.3525	2.31775	1.12825	0.49925	0.18425	1.843	1.05325	1.138
8	2	2.4875	2.5825	1.53775	0.59925	0.3245	2.1225	1.153	1.368
8	3	2.6175	2.76275	1.59775	0.814	0.3495	2.3275	1.38825	1.518
8	4	1.6925	1.8775	1.0175	0.03475	0	1.3675	0.53325	0.69325
8	5	2.32275	2.42775	1.40275	0.484	0.1345	1.7975	1.233	1.27825
8	6	2.3225	2.4525	1.44775	0.32925	0.2245	2.0175	0.98825	1.10325
8	7	1.7825	2.0425	1.3375	0.3095	0.1445	1.6675	1.103	0.92825
8	8	2.28275	2.3175	1.5825	0.284	0.06975	1.9575	0.81825	1.163
8	9	1.91275	2.1025	1.098	0.389	0.1995	1.6275	0.85825	0.9985
8	10	1.943	1.768	0.99325	0.284	0.02975	1.143	1.048	0.933
8	11	1.7075	1.6625	1.093	0.20925	0.06475	1.4475	0.748	1.08325
8	12	1.9975	1.9375	1.2275	0.27425	0.06475	1.5425	0.91775	1.00825
8	13	2.1425	2.4075	1.44275	0.4685	0.20925	1.90275	1.3525	1.47775
8	14	2.0475	2.1975	1.25775	0.594	0.39925	1.7975	1.383	1.173
8	15	2.3125	2.4425	1.53275	0.704	0.5245	1.8775	1.14825	1.2985
8	16	2.09725	2.23225	1.4275	0.659	0.36425	1.9025	1.25275	1.273
8	17	1.7725	1.8775	0.94775	0.19475	0.13975	1.3175	0.91325	0.723
8	18	2.4325	2.6875	1.2075	0.714	0.4395	2.0175	1.373	1.488
8	19	1.8425	2.7	1.24275	0.444	0.11475	1.9175	1.213	1.088
8	20	2.6575	2.8475	1.9725	0.94875	0.474	2.3925	1.703	1.763
8	21	2.5875	2.53725	1.79275	0.534	0.1595	2.16275	1.28825	1.203
8	22	2.4025	2.6875	1.64775	0.8135	0.36375	2.3125	1.59775	1.74775

Month	Day	LAMEROO	KAROONDA	NARACOORTE	MT CRAWFORD	MT LOFTY	KEITH	MT BARKER	NURIOOTPA
8	23	2.4725	2.7125	1.523	1.01375	0.534	2.03275	1.61825	1.48825
8	24	3.0975	3.0925	1.58275	1.034	0.61925	2.2675	1.82325	1.73775
8	25	2.92775	2.94775	1.71775	0.96375	0.7195	2.65225	1.71825	1.80275
8	26	2.95725	3.15725	1.80225	1.0085	0.934	2.57225	1.8425	1.8425
8	27	3.4575	3.4375	2.1425	1.0985	0.71875	2.8875	2.3925	2.0625
8	28	3.9975	4.1525	2.8425	1.94775	1.2335	3.37725	3.03225	2.84225
8	29	3.95725	4.142	2.70725	1.50775	0.974	3.48725	2.5275	2.58225
8	30	3.20225	3.25225	1.7575	0.8935	0.469	2.35725	1.653	1.538
8	31	3.1525	3.1175	1.87275	1.16375	0.804	2.5075	2.04775	2.00275
9	1	3.5425	3.4775	2.17725	1.703	1.1935	3.04225	2.24275	2.30825
9	2	4.4775	4.3975	2.8425	2.368	1.71825	3.7775	3.2025	3.028
9	3	3.6175	3.66275	2.5325	1.723	1.5535	3.1075	2.5375	2.3875
9	4	3.9475	3.76225	2.71225	1.88775	1.399	3.26725	2.5075	2.47775
9	5	3.627	4.222	2.38725	1.21775	0.27925	3.082	2.13225	2.34225
9	6	3.0225	3.3675	1.9975	1.1285	0.55375	2.6525	2.0425	2.2475
9	7	2.9425	3.0475	2.2975	1.08375	0.76425	2.66725	2.123	2.08775
9	8	3.1725	3.21725	1.97725	1.703	1.1435	2.732	2.532	2.43725
9	9	3.4375	3.49225	2.1175	1.1985	0.7485	2.9025	2.1325	2.10725
9	10	3.2025	3.3075	1.9975	0.794	0.53925	2.6975	1.9725	1.6875
9	11	3.64275	3.79275	2.413	1.8085	1.2085	3.25275	2.733	2.823
9	12	4.5425	4.6175	3.1525	2.038	1.198	4.0425	3.0475	3.318
9	13	3.8425	4.20225	2.4525	1.60275	0.894	3.41225	2.7725	3.0275
9	14	3.3425	3.1975	2.0025	0.81825	0.26425	2.6825	1.84775	2.18775
9	15	3.6775	3.9725	2.0725	1.78325	1.23375	2.9975	2.77775	3.00775
9	16	3.9125	3.8275	2.47725	1.598	1.13425	3.1525	2.8225	2.668
9	17	4.46225	4.577	3.12725	2.34775	1.81325	4.18175	3.2375	3.35725
9	18	4.747	4.582	2.7625	2.51275	1.6285	4.317	3.29725	3.4825
9	19	4.86725	4.84225	3.21225	2.1625	1.16825	4.262	3.36725	3.617
9	20	4.1525	4.0375	2.6325	1.61275	0.91375	3.2975	2.9675	3.25775
9	21	5.4375	5.7175	3.5325	3.2275	2.073	4.8075	3.9575	4.4775
9	22	5.29725	5.1665	3.75725	2.5675	1.45875	5.07625	3.742	4.332
9	23	3.74725	3.6575	2.3625	1.2585	1.079	2.8375	2.133	2.7825
9	24	3.6325	3.8625	2.2075	1.64825	1.119	3.0325	2.5475	3.0225
9	25	3.9575	3.9675	2.5925	1.663	1.0135	3.3725	2.5525	2.65275
9	26	5.2075	5.4225	3.6925	3.1375	2.013	4.7775	4.09725	4.28225
9	27	5.1625	5.44725	3.44275	3.29725	2.46325	4.57225	4.0625	4.3175
9	28	4.5075	3.69225	1.9225	1.033	0.21425	2.77225	2.1475	2.7675
9	29	4.0825	3.8525	2.4125	1.33325	0.68425	2.9875	2.59275	2.5725
9	30	4.72225	5.14225	2.72225	2.6325	1.783	3.94725	3.64225	3.77225
10	1	5.2575	5.2825	3.7625	2.83325	1.96325	4.6575	3.8125	4.1975
10	2	4.7725	5.1025	3.1775	2.21275	1.3535	4.20725	3.26275	3.64725
10	3	5.0975	4.9625	3.5525	2.59775	1.83325	4.2975	3.6775	4.0525
10	4	6.59225	6.72725	4.897	4.392	3.16775	6.112	5.19725	5.63725
10	5	5.0975	4.652	2.95225	2.5275	1.3085	4.037	3.73725	3.8575
10	6	4.54225	4.48725	2.8025	1.94775	1.0335	3.45725	3.2525	3.4125
10	7	3.78725	4.09725	2.57225	1.51325	0.70375	3.28225	2.51225	2.76725
10	8	3.6375	3.8525	2.4375	1.56275	1.09875	3.1825	2.66775	2.88775
10	9	5.32225	5.35225	3.7425	2.86725	1.988	4.64225	4.227	4.35225
10	10	5.00225	5.22725	3.87775	2.543	1.8485	4.65725	3.7525	4.00725
10	11	5.842	6.27725	4.637	3.81225	2.9225	5.48675	4.5375	4.82225
10	12	6.9415	7.12675	5.647	3	4.01225	6.777	5.272	5.78225
10	13	5.247	5.067	3.40225	2.2325	1.1285	4.07225	3.40725	3.78725
10	14	5.2225	4.9775	3.9675	2.57275	1.5385	4.74725	3.52225	4.05225
10	15	4.5075	4.30725	2.74775	2.193	0.984	3.81225	3.2525	3.6525

Month	Day	LAMEROO	KAROONDA	NARACOORTE	MT CRAWFORD	MT LOFTY	KEITH	MT BARKER	NURIOOTPA
10	16	5.3925	5.3225	3.8175	3.063	2.288	4.7925	4.1725	4.3875
10	17	6.0875	6.1725	4.8925	4.27225	2.853	5.6675	4.8975	5.40725
10	18	6.887	6.822	5.38725	4.352	3.3175	6.28225	5.37225	5.58725
10	19	7.74675	7.402	6.20175	5.167	3.687	7.04675	5.727	6.45225
10	20	8.7015	8.821	6.20175	6.2665	4.617	7.82625	6.58675	7.367
10	21	6.66125	7.5	4.18175	3.04675	1.83275	5.19625	3.72675	4.85625
10	22	6.65125	6.6165	4.7425	4.01725	2.94725	5.582	4.70225	5.36675
10	23	6.20675	6.14175	4.94725	3.61725	2.56825	5.7665	4.4225	5.21725
10	24	6.732	6.56675	4.71225	4.62675	3.002	5.932	4.572	6.13675
10	25	6.05675	6.257	4.1325	3.94725	2.64325	5.26675	4.2325	4.9725
10	26	6.49225	6.152	4.94225	3.57175	1.84275	5.677	3.98725	4.97725
10	27	5.312	5.2375	3.7325	2.6825	1.7185	4.48225	3.6275	4.0875
10	28	6.43725	6.57725	4.44725	3.97225	2.66275	5.942	4.93725	5.497
10	29	6.84675	6.80175	5.38225	4.30175	2.842	6.39675	4.65725	5.41175
10	30	7.6665	7.66675	6.007	5.312	3.77725	6.892	5.372	6.232
10	31	7.5715	7.08175	5.2465	5.157	3.5875	6.38125	5.20225	6.052
11	1	7.562	7.61175	5.327	4.64725	3.39725	6.33175	5.2475	6.11175
11	2	7.34625	7.15125	5.41675	5.2865	3.7275	6.5115	5.49175	6.28175
11	3	5.262	4.69175	3.49725	2.39275	1.0935	4.127	3.1325	3.8525
11	4	5.95725	6.08225	4.67725	4.12725	2.72275	5.602	4.9475	5.35225
11	5	7.05175	7.70675	5.957	5.06725	3.43725	7.15175	5.887	6.432
11	6	7.88675	8.21175	6.69675	5.46675	3.82725	7.6965	6.267	6.90675
11	7	7.40625	7.22675	5.9965	4.27175	2.548	6.9765	4.90175	6.5065
11	8	6.74675	7.07675	5.702	4.757	3.19225	6.43175	4.932	5.9665
11	9	8.1465	8.23175	7.04675	5.90175	4.262	7.83175	6.29175	7.117
11	10	7.70675	7.642	6.512	6.2365	4.57675	7.18675	6.042	7.1315
11	11	9.00675	8.872	7.532	7.16175	5.53675	8.30175	7.05725	8.27175
11	12	9.63625	10.06125	7.6815	7.58075	5.6815	8.99625	7.24625	8.701
11	13	8.8715	8.33625	6.362	6.13175	4.48225	7.38675	6.04175	7.14125
11	14	8.20175	7.837	5.74225	6.002	4.1625	6.522	6.11725	6.87725
11	15	7.502	7.207	5.4225	5.902	3.95225	6.087	5.41225	6.702
11	16	7.567	7.112	5.342	5.392	3.43725	6.677	5.352	6.472
11	17	8.642	8.90225	7.3425	6.79725	5.21225	7.987	7.26725	7.89725
11	18	10.37075	10.10125	8.58675	8.06625	5.72175	9.571	7.9915	8.991
11	19	9.80575	9.07075	7.37175	7.68625	5.5865	8.40125	6.85175	8.22625
11	20	8.6415	8.31625	6.907	6.46175	4.48225	8.0015	6.69675	7.2465
11	21	6.97675	6.92175	5.217	5.14675	3.16225	6.36675	5.337	6.59175
11	22	6.4215	6.15675	5.32175	4.27725	2.6525	5.85675	4.5925	5.517
11	23	7.62225	7.5	6.877	5.83225	4.06225	7.52725	6.30225	7.057
11	24	9.26675	9.252	8.212	7.097	5.312	9.047	7.522	8.2615
11	25	9.65125	9.5615	8.00225	8.1365	6.4815	9.242	7.61225	8.95625
11	26	10.32075	9.79575	8.67675	7.881	5.67675	9.21125	7.55625	8.8855
11	27	10.9305	11.0855	8.796	9.056	6.63125	10.26075	8.27625	10.066
11	28	9.3405	9.1155	7.06675	6.57625	4.44225	8.5915	6.48675	8.03125
11	29	9.06125	8.98625	7.722	7.1315	5.10175	8.72125	6.967	8.13175
11	30	9.861	9.6365	8.46675	7.0915	4.897	9.6865	7.66175	8.3665
12	1	8.60125	8.261	7.4515	5.067	3.1475	7.97125	5.2365	6.07125
12	2	7.4915	7.07175	6.48175	5.202	2.8175	6.54175	5.317	5.887
12	3	7.44675	7.20675	6.28175	5.44175	3.517	6.73675	5.86225	6.547
12	4	8.09675	8.20175	7.21675	5.972	3.94225	7.94175	6.252	7.0365
12	5	9.2315	9.31175	8.64675	7.0315	5.23725	8.91675	7.272	8.037
12	6	9.09625	8.5765	7.73125	6.04175	3.812	7.951	6.6815	7.64125
12	7	9.2115	9.31675	7.82175	7.23175	5.02675	8.81675	7.51725	8.66675
12	8	9.39075	9.1165	8.4115	7.241	4.76125	9.1055	7.08175	8.56075

Month	Day	LAMEROO	KAROONDA	NARACOORTE	MT CRAWFORD	MT LOFTY	KEITH	MT BARKER	NURIOOTPA
12	9	8.201	8.02625	7.6715	5.54625	3.682	8.14625	6.0815	7.161
12	10	7.92175	7.8615	7.04175	5.14675	3.357	7.44175	5.99175	6.53675
12	11	7.811	8.08125	7.24725	5.182	3.32225	7.6615	6.02225	6.976
12	12	8.54125	8.14125	7.13625	5.73125	3.6865	8.056	6.2915	7.23125
12	13	8.836	8.29125	8.1215	6.737	4.73225	8.57125	7.10675	7.4865
12	14	8.14125	7.6215	6.39675	5.63175	4.05725	7.3215	6.0015	6.66625
12	15	8.28125	8.436	7.152	5.79175	3.827	7.59175	6.262	7.09625
12	16	8.96675	9.00675	7.89675	7.082	5.25225	8.49175	7.222	7.75175
12	17	9.17625	8.75625	7.61675	6.4965	4.867	8.626	6.9065	7.96125
12	18	10.12625	10.06625	9.30675	7.88075	5.78125	9.701	7.74675	8.716
12	19	10.25575	9.691	8.25125	8.0365	5.70675	8.731	7.98625	8.76575
12	20	10.18625	9.5165	7.472	8.2315	6.09675	8.7215	8.06175	9.0565
12	21	10.231	9.7565	8.1615	7.74125	5.5215	9.03625	7.89175	9.26575
12	22	9.9165	9.9215	8.10175	7.336	5.7	9.0465	7.81675	9.06575
12	23	10.726	10.8405	9.4315	9.01625	6.0465	10.46075	8.2315	9.7755
12	24	9.551	8.7065	7.65675	6.39175	4.50225	8.39125	6.95175	7.92075
12	25	8.4415	8.142	7.517	6.40675	4.492	7.947	6.77225	7.25125
12	26	9.50175	8.7315	7.21225	6.56175	4.432	8.1465	6.4265	7.9915
12	27	8.9265	8.75175	7.72225	7.1315	5.04675	8.067	7.26675	8.30175
12	28	9.636	9.49625	7.91675	7.4165	5.18175	8.82625	7.37675	8.3665
12	29	10.1365	9.86625	8.45225	8.11175	6.42725	9.212	7.9725	9.2665
12	30	12.6755	12.64125	11.4365	11.19625	8.9965	12.18625	10.80625	12.2155
12	31	15.47075	15.11075	12.94075	13.73575	11.46575	14.0255	11.59625	13.676
1	1	11.81525	11.05525	8.6855	9.29025	6.631	10.36525	9.2005	11.43025
1	2	9.29625	9.4965	8.43675	7.597	5.857	9.24625	7.69175	8.671
1	3	10.886	11.03075	9.92625	8.87125	6.80175	10.771	9.261	10.431
1	4	11.3905	11.306	10.3615	9.43125	7.3865	11.23125	9.54125	10.581
1	5	10.50625	9.91125	8.60675	7.5665	5.23675	9.2465	8.08175	9.681
1	6	9.887	9.982	8.622	7.68675	5.64725	9.167	7.912	9.51625
1	7	10.861	10.631	9.3165	8.246	5.98675	9.97625	8.48625	10.09575
1	8	10.95625	10.23125	8.93675	8.85625	6.4465	9.98625	8.62675	9.976
1	9	11.586	11.27625	9.7715	9.68125	7.54675	11.076	9.2865	10.5565
1	10	13.0605	12.5705	10.91625	11.49075	8.49575	12.3255	10.071	12.37575
1	11	12.9155	12.1005	10.25075	9.73575	7.01575	11.8155	9.34075	11.1605
1	12	10.1655	9.6755	8.19675	6.7365	4.562	8.886	7.34625	8.63575
1	13	10.201	9.676	8.8965	7.3765	5.35175	9.251	7.72125	9.28075
1	14	10.90625	10.46125	9.04675	8.89125	6.1115	10.0365	8.2565	9.986
1	15	10.87075	10.95075	9.832	8.4665	6.07675	10.53075	9.0865	9.871
1	16	11.556	11.42075	10.232	10.43575	7.3515	11.35625	9.80675	10.88625
1	17	12.92575	11.8055	10.426	10.791	8.59625	11.6405	10.37625	11.136
1	18	11.32075	10.9555	9.18575	8.30575	5.73125	10.29075	8.55575	9.9805
1	19	11.3055	10.86575	9.2765	8.976	6.21675	10.25125	8.33125	10.25075
1	20	11.69575	11.29125	9.98175	9.64575	7.21175	10.96625	9.2065	10.8905
1	21	11.12075	10.576	9.25175	8.66675	6.43225	10.18625	8.8205	10.1655
1	22	11.986	12.046	10.58675	10.1465	7.7865	11.53125	10.1315	11.016
1	23	11.0805	10.87625	9.017	8.4065	6.24175	10.2315	8.9415	10.22075
1	24	11.2555	11.06575	9.6815	9.00075	6.92175	10.64575	9.201	10.241
1	25	11.96625	11.12125	9.5315	9.9065	7.2515	10.8065	9.60625	11.62075
1	26	11.45075	11.70075	9.98725	9.896	8.35625	10.686	9.70575	11.16525
1	27	11.6105	11.32025	10.20675	9.831	7.56125	11.0905	9.20125	10.8505
1	28	12.4555	11.82575	10.98625	10.941	9.09075	11.30625	10.341	11.9255
1	29	12.2855	11.606	10.75075	10.01075	7.616	11.85575	10.04075	11.5805
1	30	12.9655	12.5405	10.521	10.2	7.001	11.77075	10.631	12.0805
1	31	12.2705	12.1705	9.57125	10.52625	7.4865	11.04075	9.851	11.50075

Month	Day	LAMEROO	KAROONDA	NARACOORTE	MT CRAWFORD	MT LOFTY	KEITH	MT BARKER	NURIOOTPA
2	1	12.0855	11.7405	9.28675	10.07075	7.6115	10.61125	9.43125	11.296
2	2	12.79575	12.076	10.3665	10.066	7.83175	11.451	10.04625	11.72075
2	3	12.0405	11.10025	9.56625	9.526	7.42625	10.47025	8.89075	11.18575
2	4	10.9905	10.31575	9.4465	8.75625	6.72175	10.1805	8.721	10.281
2	5	10.02025	9.2305	8.16125	8.1115	6.117	9.036	7.56625	8.9955
2	6	9.7265	9.36125	8.11725	8.1715	6.08175	8.866	7.95225	9.03175
2	7	10.19125	9.94125	8.6415	8.6315	6.4465	9.461	8.1665	9.2115
2	8	10.57625	9.99125	8.581	7.9165	5.507	9.4815	8.24175	9.22125
2	9	9.31625	8.58625	7.3115	6.90175	4.697	8.0665	7.52175	8.17575
2	10	9.01675	8.99675	8.247	7.032	5.00725	8.90175	7.317	8.1465
2	11	8.96675	8.66125	7.3815	6.62675	4.52225	8.42625	6.7765	8.676
2	12	9.5915	9.2665	7.8965	6.92175	4.727	8.64625	7.3415	8.26625
2	13	10.63625	9.7265	8.892	7.5265	5.46175	9.5665	7.96675	8.71625
2	14	11.1905	10.606	9.83175	8.54075	6.54675	10.951	9.03675	9.9705
2	15	12.58	11.85525	11.23025	9.845	7.721	12.18	10.16575	11.94
2	16	12.48025	11.9555	11.16075	10.5055	8.39575	11.8755	10.21575	11.55525
2	17	12.41575	12.30575	11.591	10.82575	8.576	11.8755	10.771	11.6555
2	18	12.73025	12.55	11.75575	10.9905	8.731	12.56525	10.9405	11.54025
2	19	10.6405	10.02525	8.25575	7.28075	5.15675	9.2605	7.601	9.18525
2	20	9.02125	8.67125	8.35625	7.2015	4.93675	8.81125	6.786	8.56075
2	21	8.656	8.2665	7.3115	6.04175	3.987	7.931	6.75625	7.821
2	22	9.60625	9.36175	8.13675	7.36175	5.347	8.80675	7.8565	8.486
2	23	11.49125	11.106	10.02675	9.051	7.36625	10.8065	9.35125	9.886
2	24	11.371	10.78125	10.0415	9.076	6.7115	10.916	9.37625	10.20075
2	25	10.281	10.136	9.1065	8.94125	6.88625	9.4215	8.83625	9.55075
2	26	10.7065	10.39125	9.71125	9.16125	6.93125	10.201	9.39675	10.191
2	27	10.436	10.191	8.911	7.46125	5.2665	9.641	8.0615	9.281
2	28	8.9065	8.2865	7.19675	6.0665	4.2815	8.3715	6.6815	7.48625

Victoria

Month	Day	HUNTER'S HILL	DARTMOUTH	BENDIGO	WANGARATTA	STRATHBOGIE	BALLARAT	KYABRAM	SWAN HILL	KERANG	SHEPPARTON
7	1	0	0.21925	0.289	0.3635	0	0.1645	0.613	1.39275	1.253	0.493
7	2	0	0.20925	0.49375	0.648	0.03475	0.14425	0.748	1.2485	1.28275	0.683
7	3	0	0.24425	0.503	0.64325	0.00475	0.03475	0.73825	1.20275	1.13275	0.73825
7	4	0	0.184	0.378	0.708	0	0	0.823	1.30275	1.3175	0.833
7	5	0	0.23425	0.364	0.46875	0	0.01975	0.598	1.16775	1.04275	0.54325
7	6	0	0.21925	0.43375	0.6235	0.04475	0.00475	0.783	1.148	1.01775	0.6935
7	7	0	0.20925	0.189	0.4285	0	0	0.468	0.70275	0.738	0.3435
7	8	0	0.25375	0.16375	0.5135	0.00475	0	0.339	0.63825	0.6485	0.329
7	9	0	0.309	0.18875	0.70825	0	0.05475	0.46875	0.96825	0.9285	0.45875
7	10	0	0.299	0.249	0.80325	0	0	0.61775	0.9775	1.1425	0.598
7	11	0	0.0995	0.12425	0.5535	0	0.02475	0.7385	1.078	1.05275	0.6185
7	12	0	0.33925	0.26925	0.52875	0.0845	0.00975	0.6035	1.04375	0.94375	0.5685
7	13	0	0.46875	0.249	0.5935	0.01475	0	0.6185	0.568	0.6485	0.5385
7	14	0	0.1845	0.224	0.49875	0.07475	0.07975	0.44375	0.85825	0.723	0.44375
7	15	0	0.0645	0.20475	0.164	0.00475	0.05475	0.4335	0.768	0.7675	0.22875
7	16	0	0.20875	0.27875	0.414	0.01975	0.01475	0.44275	1.03275	0.973	0.43375
7	17	0	0.369	0.549	0.72375	0.2245	0.08475	0.74375	0.98325	0.96825	0.79375
7	18	0.04975	0.33425	0.44425	0.62875	0.26475	0.20975	0.73825	0.98825	1.05325	0.599
7	19	0	0.229	0.43375	0.62275	0	0.0495	0.6575	1.123	1.0675	0.53775
7	20	0	0.3935	0.479	0.82325	0.11425	0.1495	0.7285	1.173	1.013	0.7585
7	21	0.00475	0.4985	0.5185	1.11825	0.169	0.14425	0.94325	1.33775	1.28275	0.91825
7	22	0	0.41825	0.92325	1.01275	0.0495	0.11475	1.14325	1.49775	1.47775	1.093
7	23	0	0.59275	0.68825	0.843	0.00975	0.04925	0.91325	1.46275	1.51275	0.78825
7	24	0	0.62825	0.70825	0.8835	0.14425	0.1995	1.02775	1.85275	1.67775	0.923
7	25	0	0.22375	0.60825	0.59825	0.03975	0.234	0.82775	1.6825	1.5075	0.71775
7	26	0	0.4635	0.423	0.73325	0.0645	0.05475	0.948	1.51775	1.39775	0.748
7	27	0	0.394	0.2685	0.42825	0.0345	0.1045	0.52825	1.12775	1.04275	0.398
7	28	0	0.1745	0.41375	0.4285	0.02475	0.1045	0.61825	1.458	1.383	0.4685
7	29	0	0.458	0.758	1.0225	0.0445	0.18925	1.118	1.5925	1.6575	1.053
7	30	0	0.38375	0.53325	0.788	0.07475	0.04475	1.1275	1.7575	1.6575	0.998
7	31	0	0.429	0.833	0.803	0.1695	0.24425	1.1825	1.6575	1.5875	1.0375
8	1	0.05975	0.73375	0.6435	1.00825	0.1695	0.2145	1.1425	1.83275	1.67775	0.848
8	2	0.11475	0.614	0.69875	0.9035	0.17975	0.3545	1.0925	2.2025	1.8625	0.86825
8	3	0.19975	0.479	0.99325	0.83825	0.2695	0.59425	1.20275	2.08775	1.95275	0.978
8	4	0.18975	0.52925	0.8185	0.99825	0.36475	0.2095	1.20325	1.95225	1.8675	1.15825
8	5	0.13975	0.57875	0.753	1.118	0.2495	0.02475	1.3925	1.8725	1.7475	1.2725
8	6	0.00975	0.4985	1.058	0.93325	0.1145	0.16425	1.40775	2.0025	2.0075	1.148
8	7	0.00975	0.36875	0.4735	0.62325	0.07475	0.1145	0.88825	1.5375	1.5125	0.86825
8	8	0.00975	0.44875	0.578	0.818	0.02975	0.2195	1.0725	1.78775	1.6175	0.80775
8	9	0	0.19425	0.484	0.76875	0.0695	0.08475	0.78825	1.8225	1.76775	0.699
8	10	0	0.309	0.54375	0.8435	0	0.1245	0.8035	1.453	1.348	0.89325
8	11	0	0.46375	0.6985	1.0235	0.1295	0.1045	1.233	1.5825	1.418	1.02825
8	12	0.01475	0.54375	0.94825	1.018	0.114	0.16425	1.098	1.5075	1.42775	0.96275
8	13	0	0.47825	0.838	0.74325	0.089	0.24425	1.27275	2.1375	2.1675	1.05275
8	14	0.00475	0.873	0.69375	1.233	0.16425	0.279	1.248	2.20775	1.97275	1.18275
8	15	0.03475	0.57875	0.77325	0.92325	0.20925	0.359	1.4125	2.4425	2.0675	1.03775
8	16	0.03975	0.7185	1.243	1.20775	0.25425	0.46375	1.61275	2.2575	2.2775	1.41775
8	17	0	0.50375	0.62325	0.808	0.0395	0.03975	0.958	1.5625	1.54275	0.8635
8	18	0.01475	0.90825	0.91325	1.253	0.319	0.09925	1.498	2.2775	2.2425	1.333
8	19	0.1645	0.86325	0.968	1.33275	0.374	0.25925	1.508	2.01725	2.0725	1.27775
8	20	0.08925	1.098	1.21825	1.28825	0.46375	0.53375	1.768	2.6525	2.5875	1.653
8	21	0.03475	0.858	1.693	1.468	0.4535	0.639	2.1625	2.8625	2.64775	1.85775

Month	Day	HUNTER'S HILL	DARTMOUTH	BENDIGO	WANGARATTA	STRATHBOGIE	BALLARAT	KYABRAM	SWAN HILL	KERANG	SHEPPARTON
8	22	0.03975	1.118	1.26775	1.4925	0.44875	0.45875	1.7475	2.3925	2.3425	1.5925
8	23	0.00975	1.08825	1.60775	1.5175	0.364	0.5935	1.9325	2.33775	2.4125	1.6525
8	24	0.21925	1.51325	1.763	1.548	0.579	0.75375	1.9675	3.1675	2.8275	1.72275
8	25	0.494	1.5585	1.7785	1.998	0.89375	0.99875	2.28275	3.14275	3.3175	2.168
8	26	0.619	1.993	2.10775	2.19775	0.98325	0.92375	2.58775	3.0225	3.3075	2.37275
8	27	0.539	2.01775	1.78275	2.1025	0.59875	0.7385	2.2875	3.2175	3.1375	2.1325
8	28	0.9485	2.5475	2.5175	2.5575	1.05275	1.318	2.8175	3.9125	3.8425	2.6075
8	29	0.59375	2.16775	2.4825	2.9525	1.233	1.29325	3.1125	3.6875	3.6625	2.9325
8	30	0.319	1.798	1.50275	1.85275	0.5035	0.64375	2.0725	2.78725	2.67225	1.82725
8	31	0.34925	1.3985	1.61775	2	0.5445	0.68375	2.0275	2.7825	2.7575	2.0725
9	1	0.58925	1.7725	1.943	2.1275	0.97875	1.0935	2.36775	3.0175	3.0425	2.20775
9	2	0.87925	2.13775	2.6925	2.7575	1.12325	1.43825	3.0775	4.1075	3.8775	2.9375
9	3	0.784	2.1325	2.28775	2.7225	1.363	1.3585	2.8775	3.7675	3.8075	2.7875
9	4	0.53875	2.10775	2.5175	2.7075	1.298	1.25825	3.1925	3.8225	3.93225	2.8525
9	5	0.79875	2.1725	2.24225	2.6725	1.32775	0.82775	3.07225	4.007	3.94225	2.88225
9	6	0.449	2.0375	1.67775	2.2925	0.72825	0.7935	2.5225	3.0625	3.0925	2.3775
9	7	0.35425	1.88775	1.81775	2.2825	0.7035	0.7685	2.2025	2.8325	2.7275	2.1475
9	8	0.45925	1.4425	2.1475	2.2525	0.6185	0.85875	2.4875	3.2125	3.1275	2.3575
9	9	0.4595	1.358	2.27725	2.42725	1.0085	1.0485	2.80225	3.53725	3.4675	2.85725
9	10	0.2145	1.27325	1.83225	2.26725	0.5835	0.54875	2.50725	3.0175	3.00225	2.45225
9	11	0.299	1.51275	2.21275	2.1075	0.7085	0.99825	2.5725	3.31275	3.3925	2.32275
9	12	0.92375	2.308	3.12775	2.82775	1.47875	1.9735	3.7975	4.69225	4.5775	3.4675
9	13	0.89425	2.113	2.30775	2.3175	1.12325	0.994	2.9275	3.7425	3.6025	2.66775
9	14	0.46875	1.93275	2.1625	2.65725	0.958	0.768	2.74225	3.6025	3.36725	2.59225
9	15	0.6535	2.2975	2.4625	2.7275	1.05825	0.9935	3.2075	4.1725	3.9275	2.7125
9	16	0.74925	2.003	2.0475	2.1975	0.989	1.0485	2.3875	3.58225	3.31225	2.3825
9	17	0.889	2.29775	2.5425	2.7525	1.423	1.523	3.1775	4.33225	4.20225	3.0225
9	18	1.2085	3.1875	2.4125	3.2625	1.5725	1.193	3.4975	4.3625	4.25725	3.3575
9	19	1.478	3.50275	3.8775	3.9175	2.12825	2.393	4.3775	5.25225	5.13225	4.2125
9	20	0.63375	2.16275	2.5225	3.0325	1.1225	1.103	3.1675	4.1825	4.0675	3.0475
9	21	0.80325	3.1525	3.2225	3.3675	1.6475	1.77775	3.6875	4.8425	4.7475	3.5825
9	22	1.54775	3.6325	4.1325	4.3925	2.4175	2.51275	5.0325	5.9925	5.8075	4.7525
9	23	1.448	3.5125	2.8225	3.2875	1.50775	0.88825	3.5175	4.0225	4.1225	3.2975
9	24	0.87825	2.9175	2.3425	3.1525	1.13775	0.8585	3.1175	3.85725	3.7775	3.0575
9	25	1.023	2.9525	2.8875	3.2025	1.613	1.478	3.53225	4.2125	4.20725	3.4175
9	26	1.12825	2.81275	3.51775	3.3875	1.898	2.068	4.0025	5.1175	4.8925	3.8125
9	27	1.613	3.59275	3.9375	4.15225	2.478	2.228	4.7225	5.88175	5.742	4.62725
9	28	1.068	2.7675	2.2025	3.477	1.688	0.99325	2.8175	4.162	3.782	3.0875
9	29	0.39925	1.838	2.2225	2.49225	0.8335	1.0185	2.8225	3.6025	3.4125	2.5875
9	30	0.859	2.8075	3.1625	3.3825	1.813	1.55275	3.9225	4.91225	4.76725	3.7775
10	1	1.0185	3.1525	3.7125	3.69225	2.0225	1.788	4.4075	5.49725	5.20725	4.2075
10	2	1.918	3.9775	3.5625	4.3875	2.173	2.09775	4.2625	5.0225	4.96225	4.2225
10	3	2.143	4.0125	3.9675	4.5975	2.63775	2.2875	4.6975	5.3425	5.1475	4.6325
10	4	1.99775	4.12725	4.79225	4.65225	2.8675	3.2325	5.0825	6.35225	6.13725	5.0475
10	5	1.98725	4.2275	3.8875	4.1075	2.1575	2.1575	4.43225	5.07225	5.02225	4.42225
10	6	1.17875	2.738	2.64775	3.12275	1.55825	1.38825	3.07775	3.8525	3.6825	3.02275
10	7	0.82375	2.53275	2.55775	2.9275	1.23875	1.13875	3.17775	4.0925	3.81275	3.04275
10	8	0.97375	2.59275	2.6325	2.9375	1.04775	0.7835	3.3525	3.9525	3.27275	3.1225
10	9	1.44825	3.4125	3.8275	3.9625	2.1975	1.57775	4.4175	4.9525	4.8675	4.2375
10	10	2.17325	4.1525	4.2275	4.4975	2.74775	2.46275	5.07725	6.06225	5.85725	4.93725
10	11	1.69325	3.93275	4.3575	4.2325	2.508	2.933	4.7775	5.7175	5.7225	4.7225
10	12	2.40775	4.8075	5.65725	5.4225	3.68175	3.92775	5.702	7.68175	7.32175	6.232
10	13	3.372	4.88225	4.7715	5.29175	3.712	2.46725	5.82175	6.6065	6.8565	6.1515

Month	Day	HUNTER'S HILL	DARTMOUTH	BENDIGO	WANGARATTA	STRATHBOGIE	BALLARAT	KYABRAM	SWAN HILL	KERANG	SHEPPARTON
10	14	2.12775	4.55175	4.08225	4.407	2.19275	2.38775	4.63725	5.712	5.51725	4.45725
10	15	1.44325	3.7975	3.43725	3.83725	1.7775	1.62325	4.07225	5.23225	4.95225	3.96225
10	16	1.60825	3.24275	3.8675	3.8775	2.40275	2.34775	4.2275	5.0925	4.9925	4.2375
10	17	1.928	4.2975	4.2775	4.4775	2.638	2.69275	4.8325	5.6875	5.4875	4.6575
10	18	2.83775	5.40725	5.267	5.75725	3.70225	3.23775	5.972	6.88175	6.87675	5.947
10	19	4.06725	6.0425	6.2175	6.6425	4.73225	4.2075	6.7825	7.75675	7.757	6.6625
10	20	4.19175	6.05225	6.942	7.21225	5.007	4.57225	7.34725	8.64675	8.5065	7.36725
10	21	3.7465	4.9225	5.30675	5.7125	3.822	2.647	6.25125	7.2865	7.346	6.17675
10	22	2.87675	5.02225	5.042	5.48675	3.7125	2.9825	5.437	7.02175	6.9565	5.72175
10	23	2.89275	5.5875	5.14725	5.782	3.7825	3.1375	5.98225	6.69225	6.69225	5.832
10	24	2.9575	5.50175	5.24725	5.62175	3.3325	2.80775	6.07725	7.22225	6.83725	5.772
10	25	2.5225	4.63225	4.552	5.482	3.15225	2.26275	5.36225	6.182	6.20675	5.547
10	26	2.86725	5.1925	5.74225	5.7625	3.89725	3.50225	6.542	7.842	7.562	6.37225
10	27	2.48725	4.86225	4.667	5.26725	2.9925	2.223	5.432	6.29675	6.00175	5.757
10	28	2.58775	5.0225	5.24225	5.4525	3.26775	3.1725	5.98225	7.262	6.962	5.92725
10	29	3.42225	5.6775	5.84175	6.392	4.237	3.68725	6.52175	7.2315	7.15175	6.402
10	30	3.12675	5.212	6.1965	6.327	4.36175	4.21225	6.9965	8.27125	7.7965	6.9965
10	31	4.28675	6.33675	6.75625	7.1315	4.81175	4.4825	7.24175	8.2965	8.456	7.3215
11	1	4.39675	6.132	6.93675	7.7915	5.01675	3.9175	7.8215	8.5615	8.5065	7.67125
11	2	4.4065	6.19175	6.7415	7.2965	4.46675	3.947	7.08675	8.5765	8.3415	7.3565
11	3	2.96225	5.35175	4.36675	5.42675	2.6075	2.2025	5.2615	5.8315	5.8165	5.4365
11	4	2.7675	4.95725	4.6675	5.4225	3.3275	2.5175	5.2125	5.9725	5.8075	5.4875
11	5	3.79225	5.34725	5.86225	6.5925	4.80225	4.20225	6.58725	7.64225	7.62225	6.76225
11	6	4.40725	5.7	6.462	7.24725	5.23225	4.76225	7.537	8.127	8.132	7.552
11	7	3.5415	6.0215	6.237	6.88675	4.927	4.33725	7.2465	8.31575	8.40075	7.05175
11	8	4.11175	6.22675	5.9415	7.23625	4.6965	3.512	6.9765	7.6665	7.5565	7.10625
11	9	4.30175	6.467	7.382	7.072	5.06725	5.292	8.1315	8.68675	8.7965	7.76175
11	10	4.307	6.37175	6.77675	7.387	5.0775	4.777	7.90675	8.53675	8.5365	7.7665
11	11	4.28175	6.2825	7.427	7.022	5.132	5.457	7.757	8.52175	8.57625	7.712
11	12	5.39125	6.26675	7.94125	7.96175	6.10175	5.587	9.00625	10.39125	10.11125	8.7265
11	13	4.39225	6.47675	6.25175	7.2315	4.73225	3.8225	7.76125	8.676	8.506	7.56625
11	14	4.66625	6.44175	6.802	7.34675	5.11725	4.1375	7.562	8.39625	8.29125	7.3915
11	15	4.612	5.657	5.70225	6.77675	4.2225	3.39775	6.677	7.752	7.402	6.567
11	16	3.842	5.29175	5.582	6.44225	3.8675	3.197	6.35175	7.8965	7.57175	6.30675
11	17	4.47225	6.632	7.087	7.25725	5.40725	5.25225	7.59225	8.92225	8.74225	7.43725
11	18	5.52175	7.47225	8.437	8.537	6.41225	6.3865	9.46175	10.60125	10.14125	9.25175
11	19	6.4515	7.57625	8.7315	9.401	6.86675	5.93675	9.806	10.79075	10.5555	9.656
11	20	5.88625	7.291	7.25125	8.89175	5.50725	4.77225	8.716	9.291	9.231	8.20625
11	21	4.6965	6.36175	6.8165	7.69175	5.262	4.31225	7.6415	8.5065	8.72625	7.79175
11	22	4.342	6.342	5.97175	7.42175	4.572	3.12775	6.78675	7.5015	7.4165	6.87675
11	23	4.36675	6.352	6.56725	7.1825	4.89725	4.23225	7.07225	7.90225	7.75725	7.15225
11	24	5.4815	7.3015	7.997	8.472	6.35225	5.59225	8.67675	9.31175	9.19125	8.65175
11	25	6.48625	8.001	9.55625	9.38125	6.86225	5.992	9.746	11.231	10.941	9.476
11	26	6.41575	8.55075	8.256	9.256	6.39175	5.947	9.27525	10.0005	9.7105	9.1455
11	27	5.406	7.52625	8.90575	8.7965	6.551	6.98625	9.46075	11.2455	10.8005	9.20075
11	28	6.38075	7.931	7.746	8.84625	5.96175	5.177	9.31075	10.1055	10.28025	8.97575
11	29	5.46125	7.13575	8.1815	9.00625	6.02175	5.547	9.40075	10.566	10.0855	9.23125
11	30	5.2065	7.45625	8.1065	8.82125	6.40675	5.117	8.98625	9.89125	9.55625	9.321
12	1	4.97675	6.7965	8.026	8.396	5.94625	4.95175	8.84625	10.056	10.051	9.06575
12	2	4.291	6.6565	6.6365	7.68625	5.1465	4.4615	7.7515	7.9665	8.04625	7.93625
12	3	4.5325	6.72175	6.912	7.7065	5.567	4.482	8.12175	9.14675	9.0615	8.032
12	4	4.33675	6.5065	6.682	7.397	4.957	4.737	7.49175	8.6315	8.3765	7.44675
12	5	4.50725	6.54675	7.6215	8.01175	5.33725	5.63225	8.49675	9.20675	9.1415	8.51675

Month	Day	HUNTER'S HILL	DARTMOUTH	BENDIGO	WANGARATTA	STRATHBOGIE	BALLARAT	KYABRAM	SWAN HILL	KERANG	SHEPPARTON
12	6	5.58125	7.567	7.79175	8.74675	6.07175	5.1465	8.771	9.641	9.33575	8.71125
12	7	5.426	7.647	7.77175	8.75175	6.047	5.637	8.44175	9.306	9.306	8.4965
12	8	6.136	8.081	8.24625	9.28175	6.46175	6.35175	9.37075	10.56575	10.19075	9.2265
12	9	5.84125	7.192	7.3565	8.8765	6.0565	5.15175	8.79125	9.041	9.25575	8.79625
12	10	4.73675	7.09125	7.4965	8.07125	5.622	5.77175	8.38625	9.2715	9.281	8.42125
12	11	5.26725	7.52125	7.3115	8.38125	5.82175	4.982	8.0615	8.881	8.816	8.1615
12	12	4.76225	7.31175	7.64625	7.87675	5.6075	5.26225	8.55625	9.376	9.401	8.316
12	13	4.6615	6.4415	7.3215	8.3465	5.3115	5.1515	8.18625	9.2165	9.061	8.1815
12	14	5.42675	7.372	7.3465	8.43175	5.44225	4.83675	7.9315	9.0765	8.64625	8.1565
12	15	5.0215	6.77675	7.63175	8.65175	5.67225	5.217	8.26175	9.3615	9.1615	8.29175
12	16	5.78625	7.736	8.0565	8.702	6.202	5.42225	8.62625	9.32625	9.42625	8.5615
12	17	5.562	7.222	8.39625	8.43725	6.32225	5.612	9.36625	10.14575	10.12075	9.0115
12	18	4.612	6.87625	8.44125	8.63125	6.37175	6.487	8.9865	10.14625	9.946	8.8465
12	19	5.9165	7.38125	8.486	9.19625	6.13175	5.5365	9.331	11.1305	10.6505	9.30075
12	20	5.592	7.96625	8.30175	9.1765	6.77175	6.267	9.1965	10.11675	9.901	9.29625
12	21	6.99625	8.9715	8.78675	10.2715	7.24175	5.87725	10.22625	10.7415	10.73125	10.19125
12	22	7.6405	9.3465	9.82125	10.586	8.0265	7.56675	10.72075	12.0205	11.8855	10.92125
12	23	7.86575	9.57575	10.1355	10.51125	7.3265	6.71675	10.52575	12.03525	12.00525	10.396
12	24	6.77625	9.46575	9.40125	10.6015	7.5915	6.1365	10.42625	11.09125	11.09625	10.98625
12	25	4.77125	7.25075	7.5565	8.3515	5.347	5.43725	8.11175	9.80625	9.57125	8.2515
12	26	6.12125	7.986	8.26175	9.0465	6.402	5.12225	8.91125	10.24625	10.05625	9.0265
12	27	5.82625	7.64625	8.267	8.86625	6.21725	5.7575	8.951	10.206	9.986	8.976
12	28	7.271	8.3965	8.9415	9.9865	7.277	6.392	9.85625	10.396	10.481	9.64625
12	29	7.3565	8.766	8.697	9.8765	6.96225	6.0075	9.4565	10.261	10.536	9.3065
12	30	8.24125	9.561	10.66575	10.722	8.36225	8.20675	11.31575	12.47075	12.5255	10.51625
12	31	8.87075	10.136	12.55575	11.56625	10.3115	10.49125	13.23575	14.87075	14.5905	12.106
1	1	9.50025	10.346	10.9755	12.251	9.53625	6.696	12.4655	14.055	13.75	12.79025
1	2	7.19575	10.5105	8.75625	10.07575	7.23625	5.977	9.87075	10.20525	10.15575	9.84575
1	3	7.676	9.50575	9.86625	10.45625	7.742	7.19175	10.66625	11.416	11.561	10.596
1	4	7.6965	9.47625	10.01125	10.72625	8.22125	8.03125	10.91125	11.601	11.28125	10.86625
1	5	8.09125	9.98575	10.2615	11.201	8.8415	6.76175	11.3965	12.57575	12.4605	11.61125
1	6	8.841	10.2055	9.2015	10.8065	7.852	6.55225	10.31575	11.316	11.34575	10.60575
1	7	8.19075	9.96125	9.631	10.86125	7.80675	6.7765	10.561	11.6305	11.45075	10.79125
1	8	8.311	9.77575	10.261	10.686	8.0765	7.652	11.056	11.916	11.951	10.861
1	9	7.8465	9.5605	9.99625	10.726	7.95675	7.90675	10.82625	11.566	11.67125	10.60125
1	10	9.436	10.691	12.16575	11.91125	9.8715	9.631	12.63075	14.0005	13.88525	12.41125
1	11	9.56025	10.641	12.12525	12.526	9.70125	9.30075	13.28	14.545	14.245	13.025
1	12	10.38025	11.8055	10.46575	12.35525	9.09125	7.122	11.5605	12.39025	12.90525	12.07025
1	13	8.9455	10.4305	9.21075	10.511	7.22225	6.862	9.74575	10.9005	10.78025	9.8705
1	14	9.74075	10.6055	10.89125	11.54175	9.00175	8.56675	11.89125	12.501	12.76125	11.63625
1	15	10.8005	11.93525	10.39575	12.2955	8.981	8.082	11.5305	12.5355	13.0205	11.64075
1	16	9.48575	11.30575	11.73075	12.56525	9.35625	8.54175	12.34025	13.2405	13.24025	12.34525
1	17	8.83075	10.44525	11.42575	12.17075	8.8365	9.02625	12.0405	12.8755	13.0905	12.1055
1	18	8.236	9.6355	10.61075	10.946	8.97625	7.40125	11.16575	12.3555	12.1705	11.27575
1	19	8.156	9.98575	9.726	11.396	8.14675	7.197	10.73075	12.16025	11.74025	10.9805
1	20	8.4655	10.17525	11.241	12.0505	9.68625	8.1415	12.3305	12.83075	12.58575	12.15075
1	21	8.40575	10.2455	10.41025	12.1605	8.90125	8.0415	11.74	12.66	12.605	11.92
1	22	9.6705	11.32525	11.90025	12.86025	10.00625	9.0165	13.29	13.82	13.62	13.04
1	23	9.83025	11.495	10.0705	12.18075	8.9415	8.0515	11.46075	12.38525	11.88525	11.446
1	24	8.425	10.43525	9.8405	11.16025	7.9615	6.872	10.9805	11.76525	11.76525	10.97025
1	25	8.43025	9.87525	10.3515	11.186	8.78675	8.5215	11.49125	12.62575	12.48025	11.38125
1	26	9.92525	10.8455	11.13075	12.79575	9.5815	8.20175	12.49075	13.5555	13.46525	12.64575
1	27	9.7355	11.22525	10.9005	11.79075	8.76625	8.5465	12.04075	13.49025	13.29025	11.69025

Month	Day	HUNTER'S HILL	DARTMOUTH	BENDIGO	WANGARATTA	STRATHBOGIE	BALLARAT	KYABRAM	SWAN HILL	KERANG	SHEPPARTON
1	28	10.12525	11.42025	12.396	12.66075	10.21125	9.62125	13.3005	14.35525	14.05525	13.2455
1	29	10.62025	11.7505	12.0705	13.2155	10.6405	8.97075	13.0455	14.01525	14.13	12.9705
1	30	10.08525	11.5955	11.57075	13.0055	9.7815	9.20125	12.39025	13.70525	13.61025	12.49525
1	31	10.60525	11.97025	12.021	13.0655	9.8515	8.8515	12.8105	13.61025	13.755	12.6505
2	1	11.32525	11.91025	12.171	13.60075	10.526	8.66175	12.82575	13.89575	13.74075	12.936
2	2	9.2455	10.58525	11.16075	11.9855	8.79125	8.4365	11.6355	12.7555	12.17575	11.6855
2	3	9.241	10.161	12.17025	11.78075	9.32125	8.656	12.07525	13.69025	13.46525	12.17025
2	4	8.67075	9.95025	10.77025	11.14525	8.42625	8.0115	11.47025	12.87525	12.65025	11.52525
2	5	7.8355	10.10525	10.7055	10.986	8.7515	7.47625	11.5655	13.19525	13.07525	11.6255
2	6	7.78575	8.83125	8.61625	10.06075	6.912	6.192	9.36125	10.71075	11.0105	9.576
2	7	8.21625	9.7465	10.28625	10.81625	8.46625	8.187	11.311	12.19625	12.426	11.24625
2	8	9.056	10.58575	9.71075	11.656	8.65625	6.86675	10.791	11.48625	11.891	11.02575
2	9	7.496	8.98075	9.2515	10.07575	8.06675	6.922	10.67575	10.991	10.99075	10.77575
2	10	7.35125	8.83625	8.54125	9.7715	6.5965	6.142	9.261	10.02575	9.996	9.376
2	11	6.4515	8.74625	8.991	9.8915	7.56175	5.98675	9.866	10.781	10.606	9.781
2	12	6.38625	8.69525	8.57075	9.63075	6.857	5.6115	9.0705	10.261	10.00025	9.21075
2	13	6.446	8.6455	8.796	9.641	7.112	6.5115	9.07575	10.36575	10.05075	9.38075
2	14	7.076	9.106	10.19575	10.34125	8.2865	8.4365	10.69075	11.05575	11.5405	10.611
2	15	6.6855	8.5305	11.025	10.15075	7.8365	8.276	11.125	12.395	11.71	11.0705
2	16	6.70075	8.71575	10.5105	10.086	7.99075	8.6455	11.31525	12.29025	12.38025	10.94025
2	17	7.321	9.21125	10.72575	10.43625	8.71125	9.08075	11.4155	12.5505	12.52525	11.24575
2	18	8.15025	9.88575	11.1355	11.01025	9.01625	9.37075	11.89025	12.82525	12.66	11.70525
2	19	8.115	9.66075	10.76525	10.7355	8.23575	6.761	11.45	13.055	12.83	11.585
2	20	6.58025	8.41025	9.05575	9.4705	7.08675	5.99175	10.18025	11.0005	10.8705	10.22025
2	21	6.81575	8.7905	9.62625	9.511	7.50125	6.726	10.4555	10.93075	10.88575	10.5855
2	22	6.391	8.326	9.176	9.6565	7.49125	6.8465	9.96575	10.971	10.89575	9.93575
2	23	7.28575	8.65625	10.181	9.78675	7.87225	8.19675	10.406	11.63075	11.64075	10.126
2	24	7.5105	9.55125	10.766	10.46125	8.22675	8.4465	11.106	11.91075	11.73075	10.81075
2	25	8.1105	9.24075	10.46075	10.621	8.33125	8.21625	11.54025	12.5855	12.16075	11.1855
2	26	6.93525	8.2605	9.53075	9.83575	7.292	7.59175	10.85025	11.3505	10.8855	10.0855
2	27	5.771	7.80525	9.186	9.10625	6.9665	6.311	9.9005	11.496	11.516	9.496
2	28	5.80025	8.10075	7.53575	9.011	5.92675	4.932	8.321	9.71075	9.36575	8.686

Tasmania

Month	Day	BUSHY PARK	TUNNACK	LAUNCESTON	SHEFFIELD	MELTON MOWBRAY	CRESSY
7	1	0.459	0.11975	0.21925	0.0945	0.28925	0.33925
7	2	0.32375	0	0.43375	0.12425	0.134	0.45375
7	3	0.4085	0	0.24425	0.10925	0.17425	0.25925
7	4	0.38925	0	0.0695	0	0.08975	0.01975
7	5	0.46425	0.01475	0.11475	0	0.23925	0.06975
7	6	0.464	0.0845	0.2345	0.1345	0.29425	0.2195
7	7	0.11925	0.01475	0.269	0	0.05475	0.1295
7	8	0.2645	0.01975	0.0945	0	0.00975	0.29425
7	9	0.07475	0	0.04475	0	0.0945	0.01475
7	10	0.319	0	0.10925	0.02475	0.2595	0.1295
7	11	0.3645	0	0.04425	0.0395	0.304	0.15925
7	12	0.6585	0.02475	0.29875	0.0495	0.454	0.30375
7	13	0.2885	0	0.174	0.0595	0.08975	0.209
7	14	0.1095	0	0.0645	0.00975	0.02975	0.07475
7	15	0.309	0.02475	0.13925	0.0745	0.26425	0.214
7	16	0.65375	0	0.1795	0.1445	0.25875	0.2145
7	17	0.649	0.0495	0.16425	0.0645	0.48425	0.14925
7	18	0.409	0.0445	0.34425	0.1045	0.18475	0.22925
7	19	0.68825	0.02475	0.29425	0.16925	0.414	0.334
7	20	0.5535	0.01475	0.17425	0.05975	0.2345	0.264
7	21	0.524	0	0.139	0.02975	0.1595	0.08425
7	22	0.51425	0.06975	0.3585	0.1645	0.4235	0.274
7	23	0.559	0.1595	0.22375	0.1445	0.31425	0.30375
7	24	0.58375	0	0.32425	0.12425	0.35425	0.229
7	25	0.5735	0.05975	0.29875	0.07925	0.39375	0.334
7	26	0.4485	0.02475	0.294	0.15425	0.289	0.40375
7	27	0.31875	0	0.3335	0.24375	0.174	0.32375
7	28	0.70375	0.1445	0.28875	0.09425	0.53875	0.38325
7	29	0.7935	0.199	0.5685	0.1595	0.55875	0.52875
7	30	0.4935	0	0.3885	0.07975	0.3985	0.29375
7	31	0.84325	0.17425	0.33375	0.05925	0.399	0.36875
8	1	0.96325	0.04475	0.32925	0.094	0.3095	0.309
8	2	0.81875	0	0.30375	0.1195	0.449	0.234
8	3	0.74325	0.1995	0.43875	0.0595	0.49875	0.373
8	4	0.64325	0.08975	0.378	0.10925	0.409	0.443
8	5	0.93325	0.0495	0.359	0.164	0.4835	0.31425
8	6	0.73875	0	0.24375	0.0545	0.374	0.214
8	7	0.69375	0.1395	0.2335	0.0695	0.394	0.254
8	8	0.4635	0.04475	0.07925	0.03975	0.46375	0.23425
8	9	0.69375	0.01475	0.29375	0.10925	0.26875	0.36375
8	10	0.17925	0	0.15425	0.02475	0.05475	0.29875
8	11	0.7035	0.0995	0.41875	0.2295	0.36425	0.37875
8	12	0.519	0	0.50875	0.454	0.08925	0.53325
8	13	0.5885	0.00975	0.51375	0.274	0.32875	0.434
8	14	0.64375	0	0.4535	0.09475	0.254	0.4735
8	15	1.098	0.0595	0.3235	0.08425	0.6785	0.26875
8	16	1.87825	0.02975	0.7235	0.199	0.6435	0.5735
8	17	0.923	0	0.46375	0.0695	0.30925	0.43875
8	18	1.043	0.11425	0.698	0.28875	0.61875	0.6325
8	19	1.498	0.19925	0.5985	0.224	0.83825	0.6985
8	20	1.03825	0.159	0.59325	0.19925	0.6885	0.59325
8	21	0.803	0.02975	0.49375	0.0845	0.284	0.48375

Month	Day	BUSHY PARK	TUNNACK	LAUNCESTON	SHEFFIELD	MELTON MOWBRAY	CRESSY
8	22	1.0485	0.129	0.5035	0.0495	0.559	0.45375
8	23	1.8625	0.32925	1.0525	0.3785	1.05825	1.0525
8	24	2.0575	0.369	1.05825	0.6535	1.123	1.14325
8	25	1.6775	0.399	1.0535	0.464	1.06325	0.94375
8	26	1.52825	0.46925	1.088	0.52875	1.07325	0.84875
8	27	1.443	0.34375	0.883	0.4335	1.038	0.90775
8	28	1.81275	0.61825	1.038	0.59825	1.50825	1.05275
8	29	2.163	0.75375	1.31325	0.61375	1.743	1.09325
8	30	1.398	0.199	0.67325	0.20425	1.12325	0.79275
8	31	1.50825	0.499	0.64825	0.43375	1.2335	0.7085
9	1	1.513	0.44925	1.07325	0.6385	0.94375	1.153
9	2	1.538	0.37925	0.94275	0.37375	0.99325	0.733
9	3	1.5875	0.56875	1.17775	0.76875	1.223	1.09825
9	4	1.92775	0.624	1.27275	0.369	1.34825	0.88825
9	5	2.5225	0.59825	1.4275	0.44325	1.55275	1.1875
9	6	2.1725	0.63325	1.39275	0.48825	1.48775	1.39775
9	7	1.5225	0.309	1.158	0.36375	0.8335	1.03775
9	8	1.338	0.3295	1.20775	0.399	0.66875	1.013
9	9	1.05325	0.34925	0.844	0.489	0.91825	0.73375
9	10	1.6125	0.294	1.1625	0.52	0.83775	1.2675
9	11	1.588	0.41875	1.08775	0.5535	1.0835	1.01325
9	12	2.453	0.5985	1.273	0.5035	1.69325	1.08325
9	13	2.12825	0.66875	1.2675	0.50875	1.5335	1.12775
9	14	1.7275	0.354	1.3075	0.46325	0.89275	1.3275
9	15	1.313	0.344	0.79325	0.30925	0.84325	0.69325
9	16	1.638	0.379	1.5475	0.63325	1.008	1.373
9	17	2.0175	0.294	1.01775	0.22875	1.34325	0.84775
9	18	2.3125	0.53875	1.8275	0.93775	1.44775	1.8025
9	19	2.9675	1.03825	2.2275	1.09775	2.0925	2.00275
9	20	2.0875	0.45875	1.8975	0.78825	1.22775	1.7725
9	21	2.2875	0.83875	1.7275	1.1325	1.5275	1.7075
9	22	2.05775	0.7085	1.688	0.98825	1.64275	1.478
9	23	1.50275	0.269	1.5425	0.6685	0.963	1.26275
9	24	1.768	0.594	1.51775	1.083	1.08325	1.50275
9	25	2.3025	0.64325	1.47775	0.573	1.48275	1.4425
9	26	2.3525	0.788	1.30275	0.36325	1.728	1.26275
9	27	2.4025	0.72375	1.853	0.92375	1.603	1.558
9	28	2.06275	0.6085	1.25775	0.7535	1.198	1.293
9	29	1.46325	0.309	1.423	0.6435	0.78875	1.243
9	30	1.8825	0.609	1.5875	0.6085	1.12875	1.5725
10	1	2.5175	0.6235	1.7775	0.75275	1.73275	1.7425
10	2	2.42775	0.85825	1.91275	1.038	1.633	1.91775
10	3	2.7275	1.1835	2.1275	1.10875	2.07325	1.9325
10	4	3.3825	1.4135	2.2275	0.968	2.4025	2.0125
10	5	2.1325	1.058	2.0075	1.00775	1.62775	1.8525
10	6	1.48825	0.3545	1.398	0.5285	0.85375	1.148
10	7	2.0675	0.15875	1.3925	0.8035	0.97325	1.3175
10	8	1.963	0.53875	1.65775	0.873	1.05825	1.7325
10	9	2.3575	1.1585	2.2175	1.21275	1.743	2.1325
10	10	3.3575	1.59275	1.97775	1.08275	2.5925	1.96275
10	11	3.2325	1.4785	2.4575	1.40325	2.228	2.3075
10	12	4.0075	2.383	2.8075	2.05275	3.762	2.8375
10	13	2.4475	1.268	2.7025	1.503	1.95275	2.4875
10	14	2.4175	1.133	2.1775	1.2525	1.55775	2.2275

Month	Day	BUSHY PARK	TUNNACK	LAUNCESTON	SHEFFIELD	MELTON MOWBRAY	CRESSY
10	15	1.95825	0.7735	1.87275	0.8285	1.5585	1.69775
10	16	2.163	1.01375	1.74775	0.8985	1.80325	1.70275
10	17	2.7625	1.12275	2.6025	1.418	1.96775	2.4125
10	18	3.5225	1.73275	2.8475	1.5775	2.87775	2.7275
10	19	4.8225	2.8025	3.6625	2.3925	3.8825	3.6725
10	20	4.2175	2.51275	3.5775	2.4575	3.70725	3.6375
10	21	2.8025	1.113	2.9925	1.63275	1.90775	2.92225
10	22	3.43225	1.87275	3.1225	1.8225	2.93775	3.18725
10	23	3.8975	2.1575	3.4825	2.1325	3.3625	3.3125
10	24	3.59775	1.98275	2.9175	1.918	2.97775	2.6725
10	25	2.7225	1.303	2.43775	1.68225	2.028	2.4475
10	26	3.66725	1.868	2.9675	1.41275	3.0225	2.7825
10	27	3.02275	1.998	2.94275	1.6775	2.87775	2.78775
10	28	3.03775	1.178	2.6675	1.70275	2.27275	2.5125
10	29	3.4325	1.90275	2.8725	2.1125	2.68275	2.8975
10	30	4.0625	2.40275	3.5425	2.36775	3.30275	3.6575
10	31	4.56225	2.467	4.28225	3.15725	3.747	4.24225
11	1	3.9475	2.73275	3.93225	2.7275	3.38775	3.88725
11	2	3.9325	2.3675	3.762	2.72225	3.2725	3.69225
11	3	3.172	1.3135	3.03225	1.9925	2.18275	2.88725
11	4	2.6275	1.283	3.1225	1.9475	2.1025	3.2325
11	5	4.0325	2.14275	3.4775	2.2825	3.2675	3.6525
11	6	4.96225	2.51775	4.14725	2.80725	3.9825	4.10225
11	7	4.2325	2.16325	3.6925	2.3575	3.1475	3.5325
11	8	4.0425	2.26775	3.6075	2.5625	3.4325	3.6225
11	9	5.02725	3.18775	3.73725	2.5825	4.3325	3.87725
11	10	4.117	2.63725	4.0175	2.9475	3.29725	4.1575
11	11	4.63225	2.90275	3.9025	2.6225	3.9625	3.9725
11	12	4.2375	2.44775	4.0625	2.7275	3.8175	4.12225
11	13	4.3125	2.238	3.66725	2.5475	3.4725	3.79725
11	14	3.80725	1.883	3.48725	2.51775	2.79725	3.557
11	15	3.2925	1.968	3.1225	2.15775	2.713	3.1725
11	16	3.0575	1.7775	3.3475	2.7675	2.4775	3.56225
11	17	5.1375	2.9925	3.9675	2.5025	4.5825	4.1275
11	18	5.5225	3.4075	4.2375	2.7325	4.932	4.3175
11	19	4.962	3.34225	5.092	3.9075	4.68725	5.27225
11	20	4.747	2.46275	3.682	2.90775	3.73725	4.00725
11	21	3.7975	2.34275	3.6775	2.5925	3.30775	3.8175
11	22	3.6975	2.18775	3.8125	2.9325	3.15225	4.0375
11	23	4.582	2.748	4.43225	3.8725	3.9725	4.7675
11	24	5.41725	3.51775	4.48225	3.49225	4.7475	4.74725
11	25	5.452	3.49225	5.13725	3.97225	4.73175	5.547
11	26	5.2125	3.0825	4.3225	2.6475	4.5825	4.3475
11	27	5.16175	3.58775	5.19225	3.83225	4.52725	5.402
11	28	4.42175	2.5925	4.75225	3.93225	3.58225	5.05725
11	29	4.6925	2.558	4.2225	3.3125	3.653	4.19725
11	30	5.42625	3.37225	4.35675	3.417	4.462	4.6715
12	1	5.0475	2.69275	4.632	2.95225	4.1525	4.47225
12	2	5.112	3.32225	4.99225	3.352	4.47225	4.86225
12	3	4.502	3.057	4.857	3.237	3.837	5.402
12	4	4.207	2.92275	4.17225	2.98725	3.7925	4.612
12	5	4.2025	2.3925	4.1375	2.7775	3.3275	4.1725
12	6	5.27725	3.35225	4.57725	3.13225	4.61725	4.7075
12	7	4.6525	3.0175	4.4775	3.1225	4.2025	4.7175

Month	Day	BUSHY PARK	TUNNACK	LAUNCESTON	SHEFFIELD	MELTON MOWBRAY	CRESSY
12	8	5.762	3.70725	5.26225	3.4875	5.37225	5.35675
12	9	5.90725	3.7025	4.82725	3.2325	5.05225	5.06225
12	10	5.07725	3.4075	4.82725	3.22725	4.40225	4.907
12	11	5.20175	3.05675	4.91675	3.18175	4.64175	5.047
12	12	5.3275	3.5025	4.87225	3.52225	4.7825	5.1725
12	13	5.042	2.7425	4.537	3.25675	4.21725	4.807
12	14	4.56225	2.7025	4.73175	3.472	4.147	4.982
12	15	5.40225	3.3975	5.12725	3.65225	4.78225	5.36725
12	16	5.41225	3.6525	5.23725	3.6375	4.78225	5.6075
12	17	4.787	3.05225	4.717	3.307	4.10225	4.887
12	18	5.39725	3.5925	4.61225	3.2425	4.77225	4.98725
12	19	5.497	3.262	4.89675	3.692	4.96675	4.802
12	20	5.39175	3.13725	5.512	4.30725	4.382	5.48725
12	21	5.84225	3.79225	5.14725	3.83725	4.992	5.50225
12	22	5.5225	4.13725	5.29225	3.96225	5.35725	5.5525
12	23	5.462	3.29225	5.57175	3.9875	4.79225	5.557
12	24	5.9765	3.837	5.39675	3.96675	5.1565	5.64675
12	25	4.86725	3.31275	4.77725	3.8625	4.33225	5.0775
12	26	5.07225	3.3275	4.8825	3.5525	4.332	5.0075
12	27	5.7325	3.5375	5.25725	3.6825	5.0675	5.27225
12	28	5.782	4.2675	5.9065	4.297	5.542	6.05675
12	29	5.08725	3.1925	5.587	4.13725	4.47675	5.917
12	30	6.75725	4.63725	6.152	4.51225	6.19725	6.387
12	31	6.7525	4.807	7.03725	5.06225	6.52225	7.302
1	1	5.68125	3.607	6.22625	4.28175	5.07625	6.41625
1	2	4.997	3.22225	5.48175	3.712	4.42175	5.57675
1	3	6.26225	5.00225	6.11725	4.602	6.27725	6.412
1	4	6.547	5.27175	6.17675	4.717	6.8365	6.442
1	5	6.51675	5.08175	6.38675	5.32675	6.30675	6.76675
1	6	5.1725	4.01775	5.717	4.437	5.05225	6.077
1	7	6.5975	4.4875	6.047	5.13725	5.90225	6.497
1	8	6.74175	4.44725	6.44675	4.99175	6.33675	6.662
1	9	5.982	4.2275	6.382	4.497	5.61675	6.5265
1	10	6.72225	4.837	6.08175	4.50675	6.11225	6.31675
1	11	7.43675	5.11725	6.78175	5.23175	6.6565	6.8715
1	12	6.37675	4.972	6.72675	5.172	6.2265	7.15675
1	13	6.432	4.75725	6.04725	4.46225	5.987	6.192
1	14	7.217	5.732	7.4515	6.06725	7.12675	7.76675
1	15	7.1815	5.872	6.882	5.43675	6.90675	7.11175
1	16	7.5015	5.4575	7.232	5.527	6.627	7.462
1	17	7.68625	5.522	7.5915	5.8315	7.0965	7.6515
1	18	6.24125	4.28675	6.94625	5.4715	5.46125	7.28125
1	19	6.3715	4.382	6.32675	5.087	5.572	6.7465
1	20	6.567	4.41725	6.9615	5.4965	5.837	7.11675
1	21	7.017	5.072	6.6415	5.3165	6.187	7.1165
1	22	7.18675	5.48225	6.7925	5.252	6.802	7.142
1	23	7.07675	5.01225	6.38225	5.10225	6.41225	6.662
1	24	6.3075	4.91725	6.39675	4.90675	5.72225	6.66175
1	25	6.852	5.19225	6.662	5.027	6.1625	6.912
1	26	7.53175	5.942	7.5815	6.18175	6.79175	7.91675
1	27	7.532	5.717	7.29175	5.78175	6.49175	7.6365
1	28	8.48675	6.5475	8.022	6.287	7.8265	7.767
1	29	7.66125	6.0715	8.27625	6.6165	7.06625	8.0765
1	30	7.5965	6.512	7.851	6.44625	7.54675	8.04075

Month	Day	BUSHY PARK	TUNNACK	LAUNCESTON	SHEFFIELD	MELTON MOWBRAY	CRESSY
1	31	6.422	4.6825	6.6315	5.46175	5.87175	6.8065
2	1	6.572	4.647	6.38675	5.172	5.802	6.93125
2	2	6.892	4.63775	6.45675	5.307	5.89225	6.28175
2	3	6.64675	4.677	7.1615	6.01675	5.58725	7.21175
2	4	7.64675	5.19725	6.85125	5.2615	6.60675	6.9815
2	5	7.02675	4.81175	7.12625	5.7465	5.89675	7.571
2	6	5.24725	3.6675	5.50225	4.23225	4.7575	5.577
2	7	5.9775	4.60225	6.05725	4.6275	5.877	6.287
2	8	5.90225	3.98725	6.17175	4.812	4.872	6.28675
2	9	6.5165	4.32225	6.48125	5.0765	5.632	6.39125
2	10	5.48725	3.5975	5.437	4.582	4.67225	5.93175
2	11	5.637	3.932	5.78175	4.84175	4.71675	6.3015
2	12	5.282	2.9925	5.322	4.237	4.1825	5.23225
2	13	6.237	4.1025	6.15675	4.7015	5.13725	6.52675
2	14	7.28175	4.682	7.43125	5.8215	5.89725	7.6565
2	15	7.917	5.77225	7.152	5.81175	6.682	7.5465
2	16	7.79675	5.677	7.38125	6.02625	7.09175	7.6415
2	17	7.097	5.6965	7.711	6.306	6.59675	7.701
2	18	7.98675	5.517	6.89725	5.11175	7.2165	7.17675
2	19	5.96625	4.02725	7.03125	5.8865	5.10125	7.19625
2	20	5.73725	3.8575	6.5615	4.8215	5.077	6.52175
2	21	5.85175	3.982	6.417	4.90675	4.96725	6.4915
2	22	6.0415	3.64725	6.342	4.942	4.95175	6.392
2	23	6.947	4.957	6.75625	5.192	6.10725	6.88175
2	24	7.13175	4.61175	6.90175	5.39675	6.12175	6.677
2	25	7.53175	5.42675	7.65175	6.43675	6.607	7.99125
2	26	6.132	4.472	6.68625	5.1865	5.35175	6.63675
2	27	5.79175	3.91675	6.18125	5.2765	4.86675	6.49125
2	28	5.337	3.1125	5.522	4.552	4.44225	5.727

Appendix 16 – Discussion paper on a Biosecurity Plan quantifying potential impacts of changes in climate and fruit production on fruit fly proliferation

Blueprint for:

A Review of the 2010/11 Fruit Fly Outbreaks in NSW and Victorian Portions of the Fruit Fly Exclusion Zone

Regarding:

- What was different in 2010/11 compared with the previous 5 years?
- Did these differences "cause" the current explosion of Qff outbreaks?
- Can timely and cost-effective predictions and management procedures be set up before Qff becomes a trade problem?

Current situation

Since 2000 there have been relatively few Qff outbreaks in the FFEZ. Up until now, that is. Although Victorian outbreaks in 2009/10 were more numerous than previous years the 2010/11 season surpassed that significantly.

The main reason for the upsurge of Qff outbreaks in this region is that the region experienced a prolonged mild and wet winter in 2010 and that this "caused" or facilitated Qff population explosions.

The rapidity and extent of outbreaks throughout the entire region raises the question: "Where did the originating propagules come from?" There are several theories and these need to be discussed strenuously with an agreement in how to test these. These theories include:

a) Qff eggs and larvae came into the region in infested fruit
b) Qff adults came in as "hitchhikers" in vehicles
c) Qff adults were blown in on the wind
d) Qff adults dispersed from outbreak sites using time, flight distance and orchards in a "stepping stone" or "ripple" effect
e) Qff adults exist all over the region in sub-detectable but "simmering" populations which exploded due to changed environmental and/or human-based conditions
f) Combinations of the above

Of these, the most concerning is point e). There has been discussion on this and publications (e.g. Maelzer, 2004, who rejected the possibility of low level populations persisting in South Australia) but should we dismiss this summarily or should we consider it in a scientific add dispassionate way and develop FFEZ-consistent tests to prove or disprove it's possibility? And if it is likely what plan of action can be devised to manage it?

The number and severity of the outbreaks, as monitored through male parapheromone lures (cuelure) in traps (Lynfield type), throughout the region has reached unprecedented levels with outbreaks having been gazetted in just about all fruit production areas within the NSW and Victorian portions of the FFEZ.

These outbreaks are causing severe restrictions to international and domestic trade in fresh horticultural produce out of this region. These outbreaks also result in the need for more extensive use of synthetic pesticides both pre- and post-harvest, the post-harvest use of cold disinfestation, the non-harvest of some fruit, or send their produce to markets that are not sensitive to Qff. These factors are costly, time-consuming (especially for highly perishable products and with regards to market access timing), they may impact on future fruit fly populations in the region (if abandoned crops are not managed correctly) and may cause an oversupply and consequent returns to the grower in the rather more narrow non fruit fly sensitive market.

This Blueprint

The discussion paper presented here is to be used as a template for a scientific review on the situation reported and described above. It basically asks the questions: “What’s happening this year that didn’t happen in previous fruit fly free years?” and “What can we do to stop it from happening again?”

To do this it is recommended to carry out the following review process:

1. List all actions, activities, environmental conditions, technologies, crop types and volumes, practices that exist in fruit fly management and may impact on fruit fly survival in the FFEZ

2. Assess each of the abovementioned issues for changes between 2010/11 and the previous 5 years

3. Determine if each issue has actually impacted, or can impact, on fruit fly presence and survival

4. Determine what can be done, if anything, to predict and forestall each of the impactful issues before there are Qff population explosions

5. Set up an action plan to address each impactful issue

6. Predict “ball park” costs for others to consider

Table 1:

DRAFT BLUEPRINT FOR REVIEW ON CURRENT FRUIT FLY EXCLUSION ZONE QUEENSLAND FRUIT FLY OUTBREAK SITUATION

Note: To be completed during Review, I've just added some themes and inputs to make a start

ISSUE	IMPACT ON QFF INCREASE? HOW DOES IT IMPACT?	CAN IMPACTFUL ISSUE BE PREDICTED? HOW IS IT PREDICTED?	CAN THE IMPACTFUL ISSUE BE NEGATED? HOW CAN IT BE NEGATED OR MANAGED?
Warm winter – records for temperature (max., min., no. of days, no. of frosts, other issues)	If a warm, wet winter does have a positive impact on fruit fly survival then it means that flies are either overwintering in the region or flies invade from outside of the FFEZ in winter / early spring and are able to survive to maturity under favourable conditions.	Yes, through weather records and possibly through weather forecasts.	Reduction of overwintering populations if they exist. Early mitigation programs e.g. baiting, cover spraying, feral host removal, weed reduction, application of fungicides, removal of fallen fruit and treatment of abandoned orchards / crops.
Wind	It is possible that strong winds will carry adults from one area to another (e.g. *B. cucurbitae* between Taiwan and Okinawa) but flies need to be in large numbers in the first place, correct sex ratio and not dispersed too much in the new area so that they can find each other as well as find food, water and shelter. In the	Can be predicted – but probably not an issue in this context.	Be aware of low-distance spread within towns or between neighbouring orchards.

ISSUE	IMPACT ON QFF INCREASE? HOW DOES IT IMPACT?	CAN IMPACTFUL ISSUE BE PREDICTED? HOW IS IT PREDICTED?	CAN THE IMPACTFUL ISSUE BE NEGATED? HOW CAN IT BE NEGATED OR MANAGED?
	FFEZ this likelihood is – and this needs to discussed further – low. Low strength winds may also aid the dispersal of fruit flies by allowing them to follow vapour trails (protein, ammonia, fruit volatiles, etc). But the distances flies would travel under these conditions are likely to be too small (100s rather than 1,000s of metres) for widespread regional dispersal (papers by Meats, Dominiak, etc).		
Rain and dew	The presence of rain and dew gives flies access to drinking water and may assist in build-up of fruit fly populations. Heavy rain is detrimental to fruit fly survival especially at the pupal in-ground stage. Rain also causes softening and splitting in fruits and can make even normally non-host fruits attractive as oviposition sites (e.g. Qff infestations in Hunter Valley wine	Predictable through weather forecasting and reporting.	If farmers can get into their orchards – reduce weed growth (fruit fly refuges) and fruiting in feral and weed hosts. Reduce fungal growth.

ISSUE	IMPACT ON QFF INCREASE? HOW DOES IT IMPACT?	CAN IMPACTFUL ISSUE BE PREDICTED? HOW IS IT PREDICTED?	CAN THE IMPACTFUL ISSUE BE NEGATED? HOW CAN IT BE NEGATED OR MANAGED?
	grapes). Rain will also allow the growth and fruiting of feral and weed host plants which will ensure persistence of populations.		
Humidity	High humidity favours fruit fly survival. It improves fly flight and mating, reduces dehydration, improves finding, recognizing and alignment to food reserves (e.g. yeast, bacteria and fungal volatiles) and oviposition sites. Also affects fruit integrity as to ease of fruit fly oviposition. Also favours proliferation of yeasts, bacteria and fungi which are Qff food resources.	Predictable through weather forecasting and reporting and the fact that humidity often remains high while soil moisture levels are high and pan evaporation values are low.	Monitor fruit softening / splitting. Reduce fruiting in feral and weed hosts. Reduce fungal growth.
Changes in the number of feral hosts, abandoned orchards, abandoned crops	Has there been an increase in weeds (fruit fly refuges), weed hosts, etc that may act as fruit fly reservoirs? Check feijoas, loquats, quinces, persimmons and apples – as some of the worst early and late season fruit fly reservoirs.	Yes – by survey and mapping.	Cull unwanted and feral fruit fly hosts. Create laws making the unsupervised production of significant fruit fly reservoir crops illegal.
Chemical usage	Has there been a reduction in the		

ISSUE	IMPACT ON QFF INCREASE? HOW DOES IT IMPACT?	CAN IMPACTFUL ISSUE BE PREDICTED? HOW IS IT PREDICTED?	CAN THE IMPACTFUL ISSUE BE NEGATED? HOW CAN IT BE NEGATED OR MANAGED?
	use of chemicals in the region? Amount of chemicals / ha? New and different active ingredients? New methods of application of these chemicals?		
Volume of organic production			
Changes in backyard production			
Changes in cover spray usage			
Cover spray active ingredients			
Cover spray dosage			
Baits			
Standard protein / malathion			
Spinosad			
New cuelure products			
New cuelure suppliers			
Traps			
Trap type			
Change in number of traps deployed			
Trap recharging rates / intervals			
Trap replacement rates / intervals			
Code of Practice			
Where did the fruit flies come from and how?			
Presence of sub-detectable			

ISSUE	IMPACT ON QFF INCREASE? HOW DOES IT IMPACT?	CAN IMPACTFUL ISSUE BE PREDICTED? HOW IS IT PREDICTED?	CAN THE IMPACTFUL ISSUE BE NEGATED? HOW CAN IT BE NEGATED OR MANAGED?
populations			
Improved survival of overwintering Qff populations			
Road blocks			
Community awareness programs			
Feral host removal			
Change in host weed populations			
Change in fly refuge populations			
Traveller numbers			
Commercial transport movements			
Nitrogenous fertilizer usage			
Personnel			
Numbers of personnel			
Delays in implementation of risk mitigation activities			
Sterile insect release			
Risk Reduction Zone management			
Crop types			
Crop production volumes			
Change in host ability of crops			
Natural enemies			
Other issues			
Other issues			
Other issues			

Impactful issues identified

List each issue that can impact on fruit fly survival and population expansion.

Action plan devised

Against each impactful issue list a set of actions that can be undertaken to mitigate its effect on fruit fly survival and population expansion.

Discussion on costs

List some of the costs considered to be essential for each activity within the action plan and present to Industry, policy-makers, Governments, etc.

Basic discussion on benefit:cost ratio

Address this with reference to the various Commonwealth- and State-initiated fruit fly reviews from over the last 30 years or so.

Recommendations

A list of recommendations for immediate, short term and long term fruit fly risk mitigation activities including when they should be initiated and for how long (i.e. what triggers activity implementation and cessation e.g. winter temperatures, number of flies in traps, etc)

Appendix 17 – Suggested yearly plan

Results derived from this project, and also from HAL Project No. HG10066 "High density mass Queensland fruit fly trapping", have been assessed and the following basic yearly schedule is recommended to growers and communities within regions that are susceptible to fruit fly impact.

MAY	• Clear weeds in and around orchards • Clear or treat (Permit 13589, see below) fallen and unwanted unharvested fruit left hanging • Consider clearing (or treating) alternative host and refuge plants within 100m of the orchard perimeter with special attention to plants in the house block
JUNE	• Continue with activities commenced in May. • Consult temperature records from previous summer. The more days <36.0°C the more flies will still be alive going into winter. These flies will be the parents of the next fruit fly population next spring/ summer. • Start recording rainfall and minimum and maximum daily temperatures. The more rainfall and days where the temperature is >1.0°C the more flies will be able to survive all winter.
JULY	• Continue previous activities. • Commence recording daily sunset temperatures.
AUGUST	• Continue previous activities. • Purchase traps, baits and cover sprays approved for fruit fly management/ control for the coming season. • Assess rainfall and the minimum daily temperatures in conjunction with the degree of severity of previous years' fruit fly populations to predict the likelihood of early build-up of fruit fly populations.
SEPT- EMBER	• Continue previous activities. • Set out traps[5] for a) Monitoring – Male traps only - spaced around the orchard perimeter at 100m intervals and within the orchard at 4 traps/ha. b) Mass trapping – Male and female traps – spaced around the orchard perimeter with male traps every 100m and female traps between the male traps every 20m and, internally 4 male traps/ha and 100 female traps/ha. • Monitor traps fortnightly.
SEPT- EMBER TO	• Sunset temperature will reach 16°C during this time indicating that flies, if present will mate and fruit infestation will take place soon thereafter. • Monitor traps weekly after first flies found. • If fly numbers build up to an uncomfortable[6] level start baiting once a fortnight.

[5] Numbers of traps/ha presented here differ from the standard Queensland fruit fly Code of Practice (COP) (Qff COP 1996). This project deals with situations where fruit flies have become established whereas the COP is concerned with maintaining area freedom from Qff.
[6] The action triggers for baiting, increased baiting and cover spray application/s should be determined by the grower in conjunction with an experienced advisor.

HARVEST	• If fly numbers continue to increase bait weekly or up to twice weekly. • If fly numbers continue to build up use a registered cover spray. • Commence checking fruit for fruit fly sting marks and also for fruit infestation (some fruit do not show sting marks). • If there are sting marks and/or fruit infestations apply a registered cover spray. • Maintain temperature and rainfall records for use in fruit fly prediction models • Maintain fruit fly trapping records and remember to keep note of zero trap captures. These are essential in future applications for recognition of an Area of Low Pest Prevalence, or Pest Free Area.
AFTER HARVEST	• Maintain traps to assist in clearing out remaining flies. • If baiting was commenced keep baiting once a week for three weeks after harvest to assist in clearing out remaining flies. • If fruit fly populations were very high and required the application of twice-weekly baits or cover sprays consider using dimethoate (e.g. Rogor) as an after harvest clean up treatment (see APVMA Permit 13859 which is in force to 31 July 2024). • Carry out May activities as described above. • Evaluate year's work and fine tune plans for next year.