2	**SUBJECT:**	2018/19 Mosquito Management Annual Report
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Summary

This annual report provides an overview of mosquito management activities, with a specific focus on the City of Mandurah during the 2018/19 season and seeks Council endorsement of the recommendations of the report.

Mosquito management undertaken by the City and in conjunction with the Peel Mosquito Management Group (PMMG) and Department of Health during the 2018/19 season was far less intense than recent seasons in relation to number of aerial treatments required and the overall number of hectares treated.

The combination of environmental conditions that presented throughout the season limited inundation and hatching events and in general made managing mosquito populations for the City and program much easier than recent years.

Thirteen aerial larviciding treatments were undertaken between July 2018 and June 2019. These treatments covered a total of 1438.4 hectares.

Currently the outlook for the remainder of 2019 is ENSO – neutral. The continuation of a positive Indian Ocean Dipole (IOD) is likely to bring below average winter–spring rainfall to southern and central Australia. Based on this outlook, an average season is expected although the need for intervention by the program is likely to be more frequent and broader than season 2018/19. The program will continue to closely monitor environmental conditions and respond accordingly to manage mosquito populations appropriately.

Disclosure of Interest

Nil

Previous Relevant Documentation

• CC.3/10/18	09 October 2012	Mosquito Management Program 2017/18 Annual Report
• G12/1/18	30 January 2018	Mosquito Management Program 2016/17 Annual Report
• G.21/10/16	25 October 2016	Mosquito Management Program 2015/16 Annual Report
• G.11/10/15	13 October 2015	Mosquito Management Program 2014/15: Annual Report
• G.32/9/11	27 September 2011	Mosquito Management Annual Report 2010/11: Peer Review of Mosquito Management Program
• G.37/3/11	22 March 2011	Council resolved to invite a peer review of the City's Mosquito Management Program

Background

The PMMG includes representatives from the City of Mandurah, Shire of Murray, City of Rockingham and Shire of Waroona. The PMMG has a long history working in collaboration together to ensure the successful management of mosquito populations across the Peel region.

The purpose of this report is to provide a review of mosquito management operations during the 2018/19 season, the environmental drivers of mosquito breeding cycles and the prevalence of mosquito-borne disease. The report also includes analysis of the season's environmental conditions, tidal events, aerial larviciding treatments, adult mosquito abundance and community education initiatives.

Mosquitoes pose significant public health and amenity impacts to millions of people worldwide. Within the Peel region, the greatest health risk and nuisance factor to residents and visitors is from saltmarsh mosquitoes. The majority of the City's residential suburbs and recreational facilities are within the established flight range of saltmarsh mosquitoes which poses an increase risk to the community and challenge for the program.

Mosquito management in the Peel Region requires a coordinated and collaborative approach and is undertaken in partnership with the Department of Health (DoH) and the contracted helicopter provider. This alliance is essential given the regional disease risk, extensive breeding habitat (estimated to be up to 600Ha), prolific mosquito breeding cycles and urbanisation within the Peel region.

The program's primary focus is to reduce mosquito-borne disease via the targeted reduction of saltmarsh mosquito populations. It also aims to reduce the impact of nuisance saltmarsh mosquitoes on the City's residents and broader community.

The PMMG's main method for the reduction of saltmarsh mosquitoes is through aerial larviciding treatments via helicopter to target mosquito larval populations. This technique has the ability to successfully remove a high percentage of mosquito larvae that if untreated would emerge as adult mosquitoes and pose a greater risk of disease transmission within the community. The extent of larval and adult saltmarsh mosquito abundance at any given time is heavily influenced by environmental conditions throughout the season.

Comment

Climate influences

Historically the El Niño Southern Oscillation Index (ENSO) has provided an indication of the potential intensity of local environmental conditions that are likely to drive mosquito breeding cycles. In the past El Niño events have coincided with seasons of lower mosquito abundance. Neutral seasons generally provide moderate conditions whereas La Niña seasons have seen the most challenging conditions for mosquito management in the Peel region.

The 2018/19 season commenced with the Australian Bureau of Meteorology's (BoM) July 2018 ENSO update reporting climate models were indicating an ENSO neutral state, trending towards a likely spring El Niño. Predictions indicated a drier than average August – October 2018 with warmer days and nights favoured. Summer 2018/19 saw a number of swings between El Niño watch and El Niño alert and by May 2019, the ENSO outlook remained at watch status indicating a 50% chance of El Niño developing again.

As in past years when El Niño like conditions have persisted, environmental conditions have played a "natural" management role in the seasons events.

Along with ENSO events, other climate drivers closer to us such as the Indian Ocean Dipole (IOD), Southern Annular Mode (SAM) and Sub tropical ridge all play an important role in our regional weather drivers and influence how each season plays out.

Regional and local weather influences

Environmental drivers of local weather patterns and conditions play an important role in the ability for saltmarsh mosquitoes to sustain their breeding cycles in the Peel Region. Weather influences such low and high pressure systems, approaching cold fronts and wind forces, west coast troughs, tropical cyclones reaching the mid-west and rainfall inflow into regional river systems, either individually or as a combination can have significant impacts on local tide and water level behaviour within the Peel Harvey Estuary.

Temperature also plays a critical role by influencing the speed of larvae development with warmer water temperatures promoting the egg to adult cycle in as quickly as four days.

Water level observations.

The breeding cycles and seasonal abundance of saltmarsh mosquitoes in the Peel region are fundamentally driven by the frequency and intensity of water level changes and wetland flooding within the Peel Harvey waterways.

Whilst typical tidal amplitude within the Peel Harvey system is less than 30cm, water levels fluctuate greatly from tide predictors. Barometric tides linked to the continuous changes in atmospheric pressure result in significant tidal variations from the predicted tide patterns and are associated with local and broader weather events.

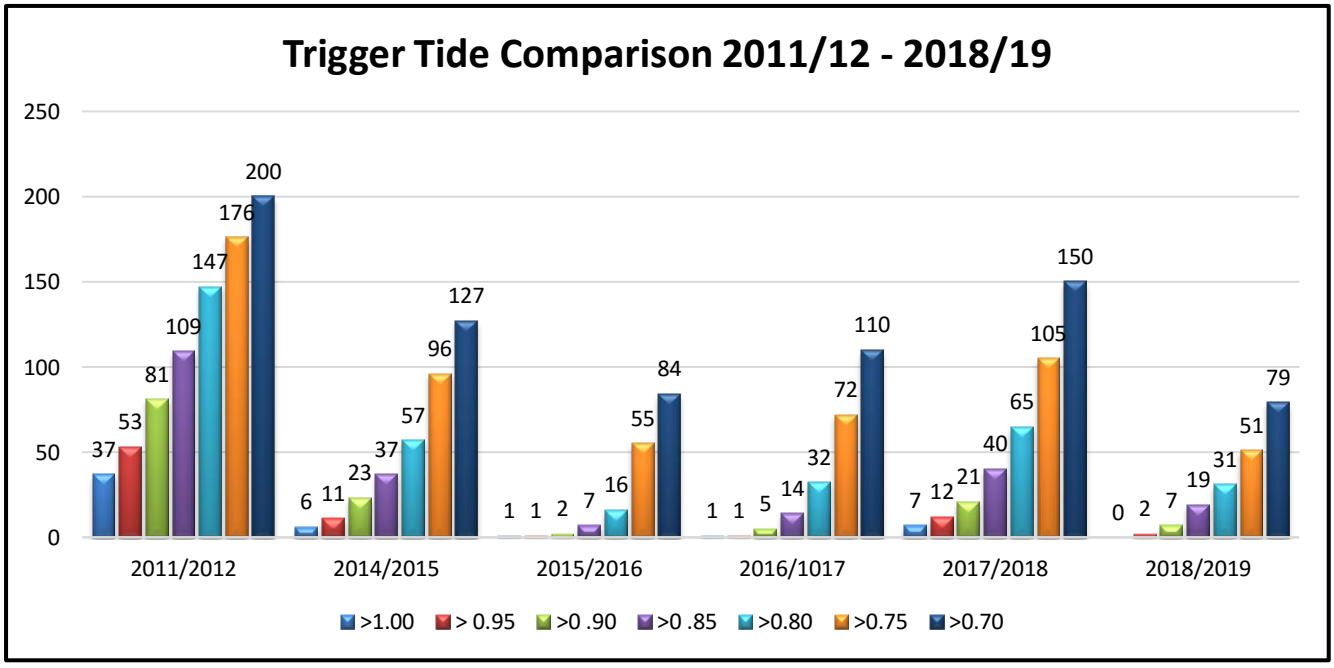
Tidal surges of 40cm above predicted peak heights are a regular occurrence within the Peel-Harvey estuary. These tides known as storm surge tides are not always linked with a storm front, rainfall event or even an obvious change in our local weather. Most storm surges are generated by the cold fronts and the low pressure system that either cross or pass below the southwest corner of the state.

Storm surges can inundate vast areas of breeding habitat and initiate the hatching of mosquito eggs in their millions. Hatching may occur as a single event or repeatedly over a number of days. The eggs of saltmarsh mosquitoes have the ability to remain in a dormant state over weeks, months and even years. This see's the build-up of egg bank loading over long periods and allows breeding cycles to be sustained endlessly.

During season 2018/19 tidal inundation was generally infrequent and of minor to moderate intensity. In general those tides that did result in wetland breeding sites being flooding were limited in number and did not peak at heights that resulted in widespread flooding or water levels remaining for more than 24 – 48hrs.

Of note was the period of extended negative residual tidal movements from November 2018 – February 2019 which led to the wetland breeding sites drying out and remaining dry throughout this period.
The highest tide of 1.37m was recorded on 7 June 2019 and peaked 0.46m above the predicted high tide. Lowest tide was 0.40m recorded on 19 September 2018 (-0.22 residual), and 26 January 2019 (-0.37 residual).

Figure 1 - comparison of tidal activity between 1 September and 1 May (2011 – 2019). Data sourced Department of Transport.



Season 2018/19 Aerial Larviciding

Aerial larviciding via helicopter is the main technique that the program employs to achieve targeted and effective management of saltmarsh mosquito populations on a regional scale. The speed of this technique is the most efficient and effective method available to apply different larvicide products in various weather conditions when applied in line with favourable water levels and mosquito larvae development stages.

Aerial larviciding also allows application to the regions sensitive wetlands and saltmarsh habitats in an unobtrusive manner with minimal environmental impact.

There may only be a short window of opportunity of one day for an effective aerial treatment to occur and in these situations, it is vital that swift information gathering and decisions regarding product selection are made to have the greatest impact on mosquito populations. In addition, it is crucial the timing of the treatment is carefully considered and includes factors such as weather conditions, fluctuating water levels, larval densities and instar growth rate are all considered.

The two active ingredients used are S - methoprene and *Bti,* (Bacillus thuringiensis israelensis) and are the most environmentally appropriate products available for mosquito control and are utilised across the world. Both of these larvicides have been approved for use by the Australian Pesticides and Veterinary Medicines Authority and are certified for the management of mosquitoes in natural and urban environments.

Season 2018/19 ended with thirteen (13) aerial larvicide treatments being completed and a total of 1438.4 hectares being treated. The first aerial treatment for the season took place in mid-August and was followed by a further three applications in September and October 2018. Aerial treatments were not required again until January 2019 due to the absence of inundation to the wetland breeding sites, however during March (3), April (2) ,May (2) and June (1) 2019, the program was very active in responding to inundation and hatching events. This period resulted in the season's largest individual treatment of 200 hectares being completed on 24 April 2019.

As in previous years, granular larvicides were predominately the most used formulation due to their suitability for local breeding site and weather conditions. The targeted use of these larvicides resulted in high mortality rates and consistent reduction in larval populations which successfully reduced adult mosquito abundance.

The key outcomes of the season's aerial treatments were:

- 13 aerial larviciding treatments undertaken between 1 July 2018 and 30 June 2019.
- A total of 1438.40 hectares treated
- Average aerial treatment size for the 2018/19 season was 110 hectares
- Largest individual treatment was 200 hectares
- 2220kg of Prolink® Prosand applied.
- 7209kg of Corn Cob Bti - Barmac® 200GR applied.
- 396kg of Corn Cob Bti / S methoprene - VectoPrime® applied.

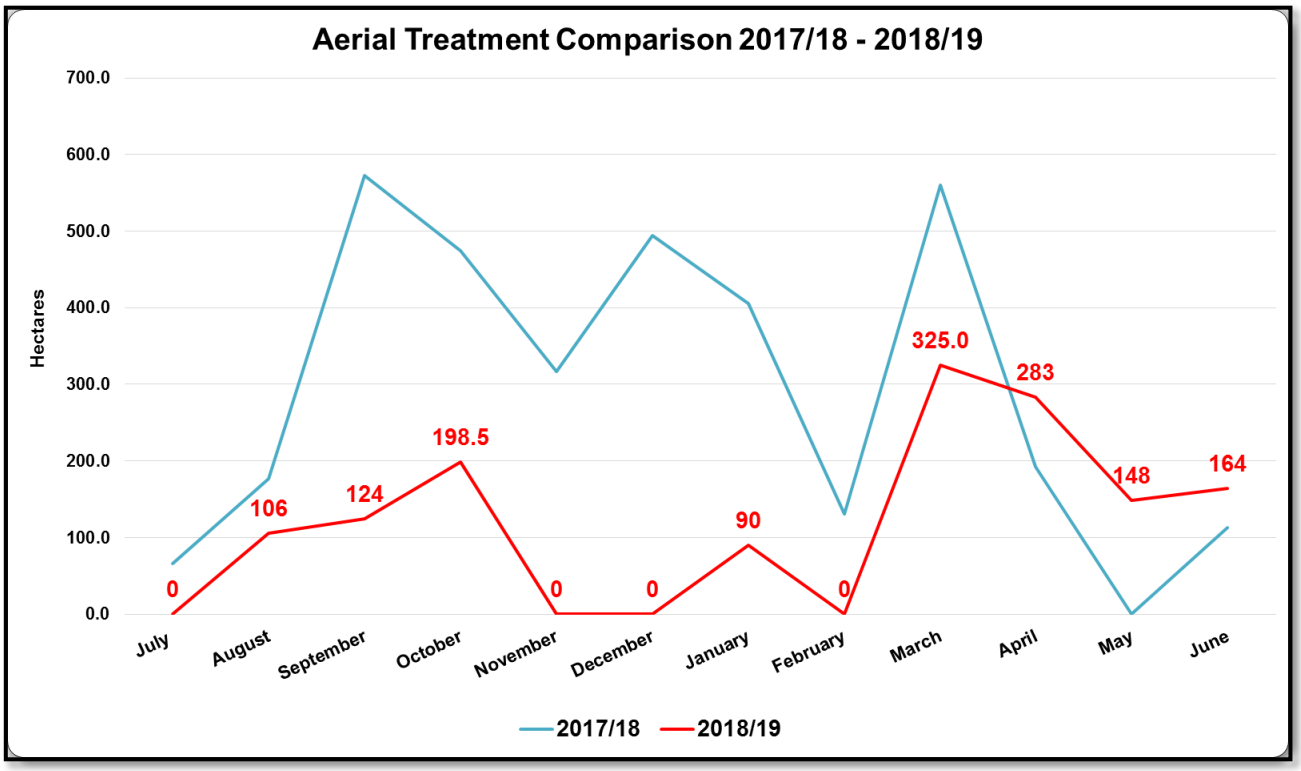


Figure 2 – Comparison of hectares treated 2017/18 – 2018/19.

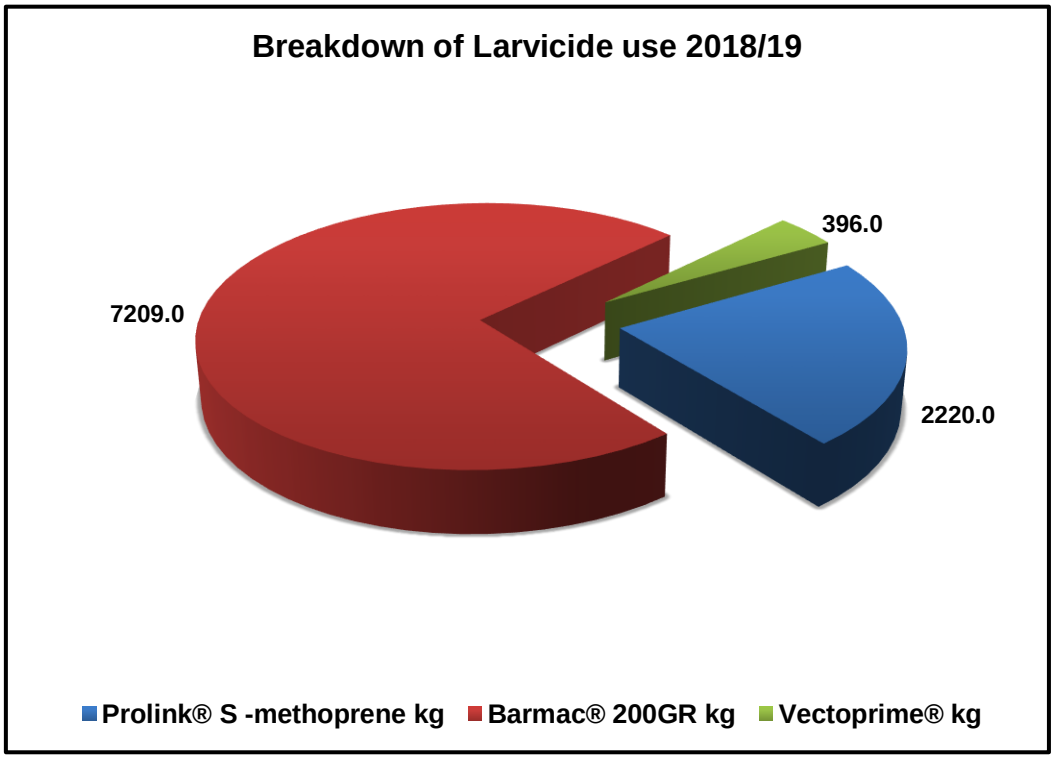


Figure 3 - Breakdown of larvicide 2018/19.

Helicopter Services – Winter Treatments

The City and PMMG continued to proactively utilise the access to helicopter treatments leading into the 2018/19 season with the last treatment of the 2017/18 season completed in June 2018, however no treatments were undertaken in July 2018 due to unfavourable weather conditions.

During season 2018/19, the WA Department of Health funded a Murdoch University research study that attempted to observe the effects of winter mosquito treatments on the egg bank (EB) and in particular, on the EB present in Spring when RRV frequencies are at their highest in the mosquito population.

The aim of the 2018/19 experiment was to test whether fewer larvae hatched from the egg bank in areas treated with larvicide compared to untreated areas, and whether this effect persisted into late spring

Findings from the study reported that the field experiment, combined with laboratory inundation trials, provided evidence that applications of larvicide may have a persistent negative effect on *Ae. camptorhynchus* egg banks. Further studies of spatial and temporal patterns in *Ae. camptorhynchus* egg banks, repetition of the experiment across a wider range of sites and weather conditions, and the oviposition behaviour of this species, may be required to develop a control strategy that could be effective under a wide range of environmental conditions.

Whilst the study undertaken by Murdoch University will hopefully prove useful, the City and PMMG will continue to advocate for the access to winter treatments based on the long term statistical data records including the recent data collected since 2013 when winter treatments were initiated at the request of the PMMG.

The justification for winter treatments also presents within the findings of the Report on the Mosquito Eradication Campaign 1988 by A.E Wright, Medical Entomologist Health Department of W.A., being the programs foundation reference document that clearly describes the winter breeding cycles of *Ae camptorhynchus* and the abundance of this species in the spring months.

Further to the ongoing discussions between the PMMG and the Department of Health along with correspondence between the Hon Roger Cook MLA Minister for Health and the City of Mandurah Mayor Rhys Williams during 2018 –19 no ongoing commitment to winter larviciding treatments has been provided.

The City is confident that a cost-effective arrangement will be reached to ensure operational opportunities can further enhance the public health and amenity outcomes that the Peel and southwest local government mosquito management programs deliver to their communities and the wider public. The continuation of winter treatments is considered essential by the PMMG.

Mosquito Surveillance

As in previous years, the City of Mandurah and the DoH completed 23 adult mosquito trapping rounds throughout the season. A total of nine carbon dioxide (CO2) static traps were utilised. Peel region trapping data is vital to the mosquito management program as it monitors adult mosquito populations, allows species identification and mosquito-borne disease detection and provides evidence of the effectiveness of aerial treatments undertaken.

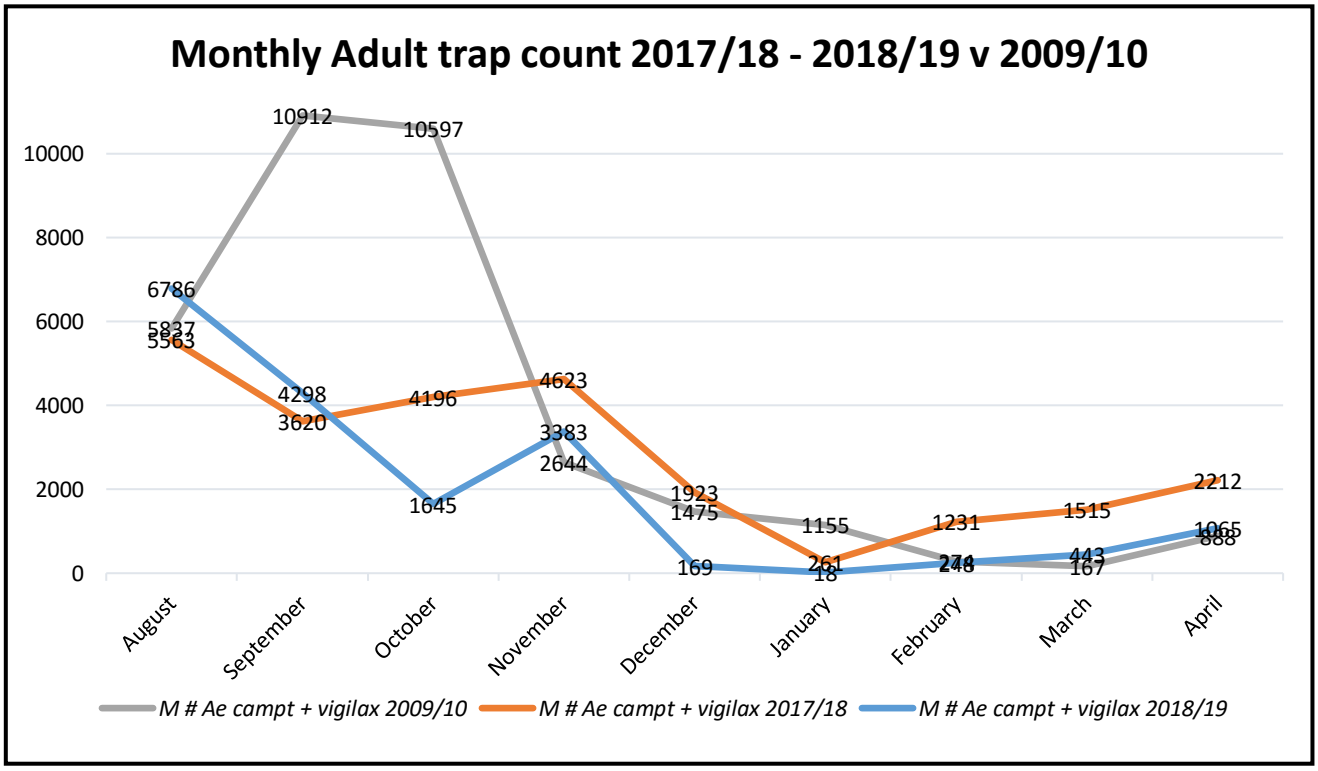
In comparing monthly trap counts across the season, figure 4 details saltmarsh mosquito (*Aedes camptorhynchus*) abundance was at its highest in August and September with a spike again in November. Populations then declined with the onset of summer before increasing again in March and April. *Aedes vigilax* populations were again very low through summer as has been the case for the last few seasons.

Results from season 2009/10 have also been provided in figure 4 to provide a comparison to seasons 2018/19 and 2017/18.

As background, season 2009/10 was dominated by a strong El Niño event and only saw seven aerial treatments completed with just 1046 hectares being treated. The first treatment of the 2009/10 season wasn't completed until the 22 September which by this time adult populations were established. Following three further aerial treatments in November adult populations further declined.

For the program the results particularly achieved in season 2017/18 (20 @ 3504 ha) and again in 2018/19 (13@ 1403 ha) provide confirmation that the work that has been done over many years and the changes that have been pursued is paying off.

Figure 4 - DoH monthly *Aedes camptorhynchus* and *Aedes vigilax* trap counts August 2018 to April 2019 - 2009/10.



Virus Surveillance – Ross River virus (RRV) and Barmah Forrest virus (BFV)

Mosquito- borne virus surveillance is undertaken by the DoH Medical Entomology section with the aim of identifying arbovirus activity (viruses transmitted by mosquitoes).

Polymerase Chain Reaction (PCR) testing is utilised to isolate arbovirus from samples of mosquitoes that are trapped in the nine Peel region traps along with 12 others traps extending southwards from Harvey to Busselton. Upon detection of arboviruses, the DoH notifies local governments and issues media statements and warnings to the general public to ensure residents and travellers take precautions to avoid mosquito bites. During season 2018/19, 6 virus isolations of RRV and 0 virus isolations of BFV were detected in the Peel region. The DoH released a media statement to the public and local authorities in November 2018 warning the public to be vigilant against mosquito bites following the first detection of RRV in the south-west of Western Australia for the 2018/19 season

Human cases of mosquito borne disease – notifiable and laboratory reported

Mosquito borne disease surveillance is undertaken state-wide by the DoH via initial patient presentation to general practitioners and subsequent blood tests that return a positive diagnosis. Notifications are then forwarded to local government officers to follow up case details. This information is then passed back to the DoH, Medical Entomology for data collation and analysis.

Season 2018/19 recorded slightly lower numbers of reported cases in Mandurah on previous years which is consistent across the Peel region and WA. The 2018/19 Ross River / Barmah Forrest Virus case statistics are as follows:

- Confirmed human cases across the State - 402 RRV - 19 BFV
- Confirmed human cases across the Peel Region - 106 RRV - 2 BFV
- Confirmed human cases across Mandurah - 52 RRV - 1 BFV

Community engagement

The City continued to utilise quarterly email updates to provide subscribers with information on mosquito abundance, mosquito-borne disease and mosquito management activities. The email network includes residents, schools, sporting clubs and community organisations. The program also utilised social media outlets such as the City's Facebook page to provide updates on the programs activities such as posts timed with aerial treatments and reminders about personal protection.

Local radio advertising was again utilised between 4 January 2019 and 3 February 2019 to remind the public about mosquito activity and how best to protect themselves and their family against mosquito bites and mosquito borne - disease. The timing of these radio alerts is aimed to align and serve as a reminder to public that partake in the many outdoor, recreational, sporting and social activities that peak at this time of year and during the summer school holiday break.

Face to Face community engagement with the public at City supported events continued to be a focus with City officers attending and providing interactive displays and fun activities for both children and adults. The aim of connecting with community members at these events is to educate them on mosquitoes and mosquito - borne disease, promote the City's and PMMG program and communicate the Fight The Bite message to encourage the public to take measures to limit the impact mosquitoes and mosquito borne disease can have on their health and quality of lifestyle.

At all events the Department of Health's Fight the Bite campaign is promoted and branded merchandise such as reusable shopping bags and water bottles, personal repellent and informational brochures were made available. The "mozzie marquee" has proven very popular at all events particularly at the Mandurah Children's Festival.

Community enquiries and education

- Nine community enquiries were recorded in comparison to 61 in 2017/18.
- Three community email updates were sent.
- Campaign of Facebook and radio advertisements over summer school holidays and Easter.
- A series of PMMG educational videos made available on YouTube and linked to the City's website.
- New PMMG brochures in-line with Fight the Bite campaign produced.
- Fight the Bite public education campaign continued to be supported in the Peel region by the DoH and PMMG which included the use of a range of media and merchandise.
- Successful public engagement events were provided by City officers and included;
  - National Tree Day 2018
  - Lakelands Library – STEAM, national science week 2018
  - Mandurah Children's Festival 2018
  - 2018 My Park Grooves, 11, 18 and 25 November
  - University Third Age - information session

Figure 7 - National Tree day 2018 Frasers Landing.

Figure 8 - 2018 My Park Grooves – Village Beach, Wannanup.

Research and development

Following on from the reported field trials completed in November 2016, the dual active VectoPrime® formulation gained Australian Pesticides and Veterinary Medicines Authority (APVMA) registration in June 2018. Since then City officers have been assessing the formulations use and its performance for ground and aerial application. During season 2018/19 aerial calibration work was also completed to ensure accurate and label appropriate quantities were applied.

Results from VectoPrime® treatments have been very encouraging to date and City officers are confident its unique dual larvicide action will provide a solution to situations when multiple larval stages are developing at different growth rates as well as when weather and tidal influences impact the timing of aerial larvicide treatments

A funding increase for the use of VectoPrime® for larger scale aerial treatments by the PMMG has been approved by the Department of Health for season 2019/20.

Waterwatch sensors

As part of the City's Smart City Strategy and Corporate Business Plan 2018 – 2012, officers have been working with the City's Systems and Technology team to expand the City's utilisation of IOT technology.

New Zealand based company Tussock Innovation manufacture internet connected hardware and software products focussed on monitoring and management of water. Of interest to the City was their LS1 remote surface water level sensor designed for a number of applications such as flood warning. City officers saw the potential for the use of the LS1 for monitoring flood and water level fluctuations on the City's saltmarsh wetlands that support mosquito breeding. Officers also became aware of the use of these devices by Redlands council in QLD for monitoring offshore mosquito breeding wetlands.

Following a meeting with Tussock Innovation representatives in May 2019, the City committed funds to purchase four (4) of the water monitoring sensors. The devices have been in operation since August 2019 and are proving a valuable, more accurate and tailored information on the tidal flooding and movement of water within the City's and regions wetlands. The data feed has been incorporated into the Data Storytelling project being managed by the City's Systems and Technology team.

A further expansion of the sensor network is likely to go ahead with further units being installed by the Shire of Murray and City of Rockingham to collect and provide the same data from with wetland breeding sites within their boundaries.

Outlook for season 2019/20

The outlook for the remainder of 2019 is ENSO - neutral. The neutral phase is also likely to continue into early 2020 as depicted in figure 9. A positive Indian Ocean Dipole (IOD) is forecasted for the remainder of winter and spring which is likely to result in below average rainfall to much of central and southern Australia. The lower than average rainfall may also result in fewer tidal events presenting during the remainder of winter and into spring.

Based on past season experiences, ENSO neutral events typically result in an average season in terms of tidal inundation, hatching events and intervention required by the program. Season 2019/20 is likely to be more active in terms of treatment frequency and scope.

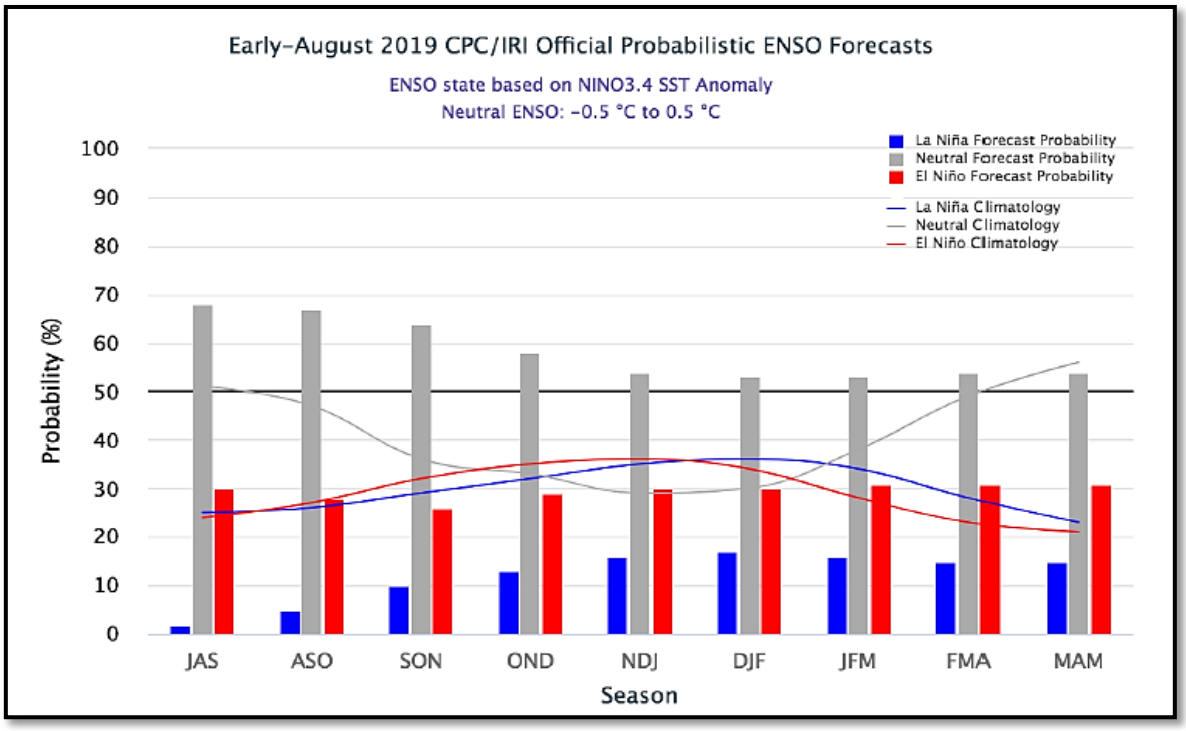


Figure 9 – August 2019 Probabilistic ENSO outlook issued by 'Climate Prediction Centre' /National Centres for Environmental Protection USA.

These global events can evolve and change quickly and although they are a useful guide, our local and regional environmental conditions have an even greater influence on the program's operations and performance. It is important to note that conditions may not present as predicted which is an essential consideration when monitoring these drivers and operating an effective mosquito management program.

Consultation

Nil

Statutory Environment

Nil

Policy Implications

Nil

Economic implications

Mosquito-borne diseases such as RRV and BFV are estimated to cost approximately $5,000 per case in medical expenses and loss of earnings. The number of cases in the City would greatly increase if there was no program in place to manage mosquito populations.

The cost on the reputation and branding of Mandurah and the Peel region is difficult to assess but the management of mosquitoes is a vital service in ensuring an acceptable amenity and environment for residents and visitors to enjoy.

The administration of the PMMG is an essential partnership to ensure the successful management of mosquitoes in the region. The group met on four occasions during the 2018/19 mosquito management season as well as attending regional meetings relating to mosquito management matters.

These meetings were attended by local government officers and elected members from each PMMG local government as well as representatives from the DoH and allow for ongoing collaboration between the PMMG to ensure the identification and implementation of improvements within the program. Examples of key discussions during 2018/19 include:

- Mosquito - borne Disease notification updates
- Mosquito abundance and disease isolation updates
- Local government reports on mosquito breeding and treatments
- Environmental conditions
- Treatment updates
- Budget reviews
- Research Studies
- Season events and outlooks
- Public education strategies
- New technologies and products

A total of $157,040.00 was allocated for the procurement of larvicides by the PMMG during season 2018/19 inclusive of negative carryover funds from season 2017/18.

A total of $124,442.99 was expended in 2018/19 resulting in a balance of $32,597.01 being carried into the 2019/20 budget calculation. The following contributions to the 2018/19 budget were made by PMMG members. The total income excludes the Shire of Waroona contribution and the value of carry over stock from 2017/18.

Table 1 outlines the PMMG larviciding operating budget excluding the DoH funding for all costs associated with the helicopter services. This service is provided throughout the southwest of the state with the Peel region being the primary user. Without this financial assistance the PMMG would require substantial increases in budget allocation to manage the programs activities.

Agency	2018/2019 Contribution
Department of Health	**$83,041.25**
City of Mandurah	**$44,193.92**
Shire of Murray	**$26,548.73**
Shire of Waroona	**$1,000.00***
City of Rockingham	**$10,198.60**
Total Income for 2018/19 **Excludes Shire of Waroona*	**$163,982.50**

Table 1 - Peel Mosquito Management Group Larvicide / Operations Budget - 2018/19 (Excluding GST)

Further to the allocation for larvicide costs, the City of Mandurah contributed an estimated $275,000 in labour, vehicles, equipment and resources for public education during the course of the 2018/19 season.

Strategic Implications

The following strategies from the *City of Mandurah Strategic Community Plan 2013 – 2033* are relevant to this report:

Environment:
- Protect and ensure the health of the natural environment and waterways.
- Increase scientific understanding and knowledge of the marine and estuarine environment.

Social:
- Ensure the provision of quality health services and facilities.

Conclusion

As somewhat foreseen and aligned with the predicted environmental conditions, the 2018/19 season was one of limited tidal activity and mosquito reproduction. This resulted in a significant reduction in the area treated when compared to season 2017/18.

Whilst the season was of a subdued nature, officers successfully completed the thirteen aerial treatments during the season in an effort to reduce the public health risk from mosquito - borne disease and nuisance impact on the community across the City and Peel region.

Note: Subject to Committee's consent, The City's Senior Mosquito Management Officer will make a presentation on this item at the meeting.

RECOMMENDATION

That Council:

1. **Receives the City of Mandurah Mosquito Management Program: 2018/19 Annual Report.**

2. **Approves the release of these reports to the following key stakeholders:**
   - **Residents of the City of Mandurah via access at Administration Centre and Library, website and media releases**
   - **Department of Health**
   - **The Minister for Health and local Parliamentary Representatives**
   - **Peel Mosquito Management Group member local governments**

- **Peel Development Commission**
- **Department of Water Environment and Regulation**
- **Residents and Progress Associations**
- **Mandurah Environmental Advisory Group**

3. Notes the City's support for the Department of Health Fight the Bite Campaign.

4. Acknowledges the support provided by the Department of Health in the implementation of improvements in the Peel Mosquito Management Program.

5. Supports ongoing efforts to improve the aerial larviciding capacity of the mosquito management program including the ongoing provision of winter treatments.

6. **Acknowledges the importance of the State Government's ongoing commitment to the annual programs, and in accordance with the Dawesville Channel Environmental Review and Management Program.**