



## ***How to set up a Routine Mosquito Surveillance Program***

### Table of Contents

<b>Why Routine Mosquito Surveillance is Important</b> .....	<b>1</b>
<b>Before Setting Up Surveillance</b> .....	<b>2</b>
Assessment of risk .....	2
Mapping out the 400m zone.....	2
Assemble a Mosquito Surveillance Kit .....	3
Survey the 400m area .....	4
Setting Out Routine Surveillance Traps .....	4
Surveillance of Routine Larval Sites .....	5
<b>Carrying Out Surveillance</b> .....	<b>6</b>
Frequency of Checking Traps .....	6
Frequency of Checking Larval sites.....	6
Routine Environmental Surveys and Other POE Surveys .....	7
Processing of Samples .....	7
<b>Regular Review of the Surveillance Programme</b> .....	<b>7</b>

### Why Routine Mosquito Surveillance is Important

New Zealand's mosquito fauna is small, with only sixteen species present (13 endemic and 3 introduced), and no endemic mosquito borne diseases that affect humans. The best way to guarantee this continues is to ensure that exotic mosquitoes are excluded from entering the country. One of the most effective tools we have available to monitor for the presence of exotic and unwanted mosquitoes is routine surveillance set up at Points of Entries (POE), such as seaports and airports. Routine surveillance at POE's also helps to provide information regarding the potential for New Zealand's indigenous mosquito species to be accidentally exported to other countries.

There are two pieces of legislation that necessitate the implementation of mosquito surveillance at POEs. Part IV of the Biosecurity Act 1993 relates to the surveillance and prevention of unwanted organisms and provides for the continuous monitoring of New Zealand's status in regard to unwanted organisms and pests.

The International Health Regulations (WHO 2005) also requires that, as far as practical, facilities used by travellers at point of entry are maintained in a sanitary condition and kept free of sources of infection or contamination, including vectors and reservoirs (article 22) and requires, as far as practicable, containers and container loading areas to be kept free from sources of infection or contamination, including vectors and reservoirs (article 34).

To have an effective monitoring programme, the regular surveillance should include the presence of traps that target both the larval and adult stage of a broad range of species, and the monitoring of habitats (where this cannot be removed) that is present at the POE.

## How to set up a Routine Mosquito Surveillance Program

### Before Setting Up Surveillance

#### Assessment of risk

Before traps are placed at the Point of Entry (POE), there are several things which need to be considered. The first of which is establishing where the highest risk areas of the POE are, to establish where the centre point of the 400m surveillance zone will be. Depending on the POE, there may be one high-risk area, or there may be several that need to be covered. Multiple 400m zones are common in seaports and large international airports. A high-risk area will look different depending on what the POE is. Some examples of high-risk areas are locations where passenger luggage is checked at an international airport, where charter or private flights arrive, where goods are stored after being taken off a ship, or where containers or air cans are devanned if there are transitional facilities at the POE as well.

Working with the Port Authorities is useful to help determine where and what the risks are at the location as they will have an in-depth knowledge of what is happening in each area and will be able to provide information to help with the risk assessment. This could be advice on anything from passenger numbers, the nature of goods and their volumes, and the origin of goods or people arriving at POE. They can point out any habitat that may need to be assessed such as ponds or bunding. Working closely with port authorities can also help with gaining access to areas of the POE. Information regarding the drainage systems and any other water storage systems that may be a risk can also be acquired through the port authorities.

A risk assessment tool developed to support public health units to complete a risk assessment of international ports and airports within their region can be found in Appendix 23: Point of Entry Risk Assessment Tool in Section five of the Border Health Protection Manual.

#### Mapping out the 400m zone

Once the high-risk area or areas are identified at the POE, the 400m zone around each of these points will need to be defined. This can be done using a program such as Google Earth to draw a circle with a 400m radius around the central point (Figures 1 a & b). Areas with multiple 400m zones may have some overlap between each circle, no overlap, or a mixture of both.

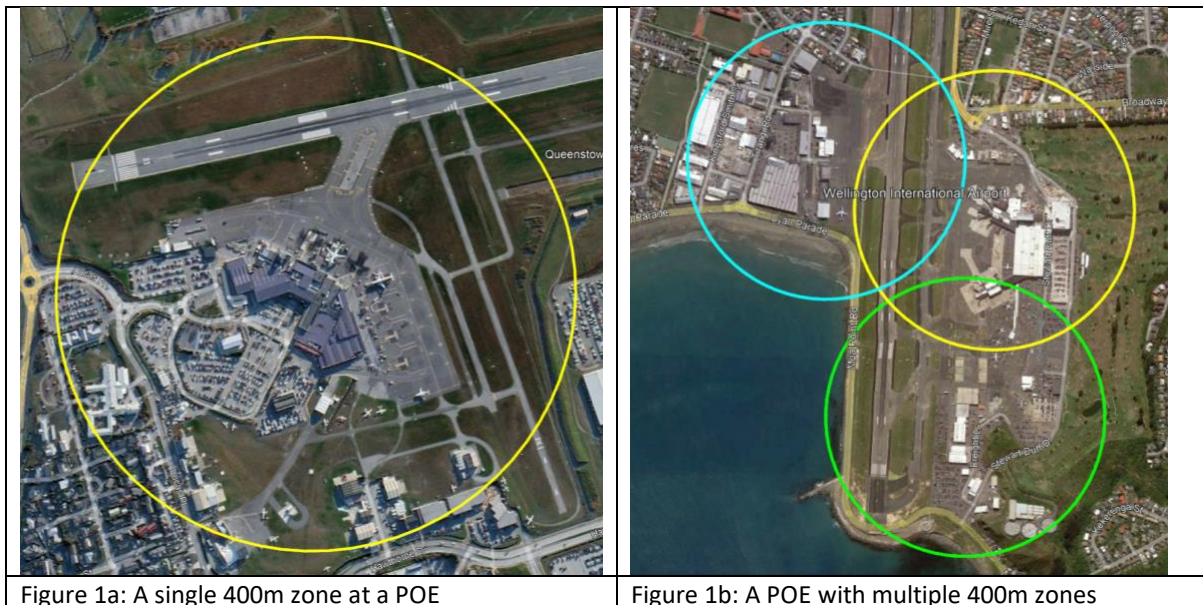


Figure 1a: A single 400m zone at a POE

Figure 1b: A POE with multiple 400m zones

## How to set up a Routine Mosquito Surveillance Program

Once a 400m area is defined, the map can be used as a starting point to assess where suitable trap locations might be, by looking at the locations of buildings or vegetation in the area, and to get a general idea of what the area is used for (e.g. is some of the 400m area residential or does a portion of the 400m zone cover the apron area at an airport). The map can also be used to assess if there are any obvious ponds or potential habitat in the 400m zone before going into the field. This can be used to put together a plan for how the area will be surveyed and to determine any areas that may require extra steps to enter (e.g. if there will be work occurring near a railway or in an area that requires escorts to access).

A second map can also be made at this time with a radius of 1km. This area does not need to be surveyed while setting up the surveillance, however it will provide insight into the surrounds and if there are any high-risk locations, groundwater sites, or facilities such as schools and hospitals that will need to be considered in the event that a species with a long flight range is intercepted at the POE. Maps showing useful facilities such as drainage systems, where filtrations ponds are, and any water storage can also be requested from the POE authority. Knowing the locations of these in advance can help with planning how these may be included in the routine surveillance plan early.

### Assemble a Mosquito Surveillance Kit

There is a selection of equipment that will be required each time routine surveillance is carried out, both for the collection of adults and larvae. Some of the equipment will be provided by the NZ BioSecure Laboratory, and the rest will need to be sourced by the PHS (Table 1).

Table 1: Equipment list for larval and adult sampling and who is responsible for supply

Provided by NZ BioSecure	
Adult Sampling:	Larval Sampling:
<ul style="list-style-type: none"> <li>• CO<sub>2</sub> Baited Light Trap</li> <li>• CO<sub>2</sub> regulator</li> <li>• Catch cups</li> <li>• Stockings</li> <li>• Light bulbs</li> <li>• Octenol</li> <li>• BG Sentinel Trap</li> <li>• BG catch bags</li> <li>• BG lures</li> <li>• GAT</li> </ul>	<ul style="list-style-type: none"> <li>• Dippers (no handle)</li> <li>• Plastic Pasteur pipettes</li> <li>• Lucerne based rabbit pallets (for tyre traps)</li> <li>• S-Methoprene (for tyres traps)</li> <li>• <i>Bti</i> dunks</li> </ul>
PHS Responsibility	
Adult Sampling:	Larval Sampling:
<ul style="list-style-type: none"> <li>• Spanner</li> <li>• CO<sub>2</sub> cylinder</li> <li>• Trap batteries</li> <li>• Toothbrush/paint brush (cleaning light trap fans)</li> <li>• Residual spray for GAT surfaces</li> <li>• GAT sticky cards</li> </ul>	<ul style="list-style-type: none"> <li>• Tyre with drilled hole in the side (small aviation/go-kart/car tyres)</li> <li>• White tray or bowl</li> <li>• Scrubbing brush (dish brushes work well)</li> <li>• Small soup ladle (white is best)</li> <li>• Large pipette (turkey baster)</li> <li>• Container to carry aged water</li> </ul>

Along with the equipment specifically for the collection of adult and larval specimens, there is some general equipment that is used for both. This includes sample tubes (supplied by lab) and labels for the tubes, a device or way to collect GPS coordinates, a device or way to take photos, and a notebook or sample sheet to record information or observations while sampling, and any personal PPE and access cards required for the area being sampled. The GPS coordinates and photos can be done with a smartphone. Signage for the traps is to be organised by the PHS.

## ***How to set up a Routine Mosquito Surveillance Program***

### **Survey the 400m area**

Once the 400m area/s around the high-risk sites at the POE has been defined and mapped, the entire 400m area/s will need to be surveyed. The results of the survey will provide a picture of what habitat is in the area, what the local mosquito fauna is and where they are breeding, as well as location suitable for traps, and if there are any housekeeping issues that will need to be addressed such as rubbish accumulating or scrap piles. The survey needs to be thorough to ensure a clear picture of the area is created.

Mosquito sampling equipment will need to be taken to the site, along with the maps of the 400m zone/s prepared and information gathered from the POE authorities. Contact information of any people who are responsible for areas that are being entered will also need to be taken. The mosquito sampling equipment required for the survey will include dippers, sample tubes and labels, pencil, pipettes, a turkey baster, something to take GPS coordinates and photos (this can be done using a smartphone or dedicated devices), a white tray, and a notebook or way to record information. Treatment for larval sites (*Bti* and S-Methoprene) should also be taken to treat any habitat found (see the document [Bti vs S-Methoprene](#) to understand where and how to use these products). Personal PPE should also be taken, along with any access/ID cards required.

Larval habitat or potential larval habitat should be photographed, and GPS coordinates taken and recorded. Where possible, the habitat should be sampled, including drains, ponds, artificial containers, and any other habitat that is identified. Removal of habitats such as artificial containers like tyres, buckets, or rubbish or groundwater ponds that can be filled in should be coordinated with the appropriate port authorities. Habitat that cannot be removed, such as filtration ponds and drains, will need to be included as monitoring sites in the routine surveillance plan. All sites identified whether positive or negative for larvae need be entered into the Online National Mosquito Surveillance Database.

Another purpose of a preliminary survey of the 400m zone is to determine appropriate locations to set up traps. Each POE needs to have a minimum of one of each of the following traps set out: tyre trap and a BG sentinel trap or Gravid *Aedes* Trap (GAT) to target container breeding species such as most *Aedes* spp. and some *Culex* spp., and a CO<sub>2</sub> baited light trap (with octenol) to target groundwater breeding species such as *Anopheles* spp., most *Culex* spp., and floodwater *Aedes* spp.. Having each of these traps ensures that a wide range of mosquito species are targeted and gives the best chance of any exotic mosquito being caught. To learn more about each trap, look at the “Checklist” for processing the different traps documents and the demonstration videos on the [NZBEL – SMSL website](#).

### **Setting Out Routine Surveillance Traps**

Ideal locations vary between trap types, though all traps should ideally be placed in shaded areas close to vegetation (where possible) and where they are unlikely to be disturbed or damaged by the routine activities in the area. To find a breakdown on how to select a good location for setting up traps, use the [“Where to set up traps”](#) document. When placing traps, it should be ensured that the entirety of the 400m zone is well covered by both adult traps and larval traps. If it is not possible to set adult traps throughout the full 400m zone, then focus should be on the centre point of the area to target the highest risk area.

When setting out adult traps, consideration should also be given to how the trap is going to be powered. As the trap will be set under cover or inside, it may be possible to have a power point installed specifically to run the trap. This will help ensure that the trap is able to run continuously and will prevent the need to carry batteries when doing routine surveillance. Talk to the POE authority to see if this is a possibility.

## How to set up a Routine Mosquito Surveillance Program

Once ideal locations for traps have been identified during the preliminary survey, then it is time to place them in the field. When each of the traps have been placed, the GPS coordinates and a photo should be taken of the location. This information will then be used to create a site reference in the Online Mosquito Database. It is important to ensure that a site reference is created for each of the sites, even if it is a tyre trap and an adult trap set up beside each other (Figure 2). Instructions on how to create a site reference in the Online National Mosquito Database can be found in the [Database guidelines V8](#). A map of the trap locations should be made to ensure that all staff who will be carrying out the surveillance know where they are placed. The map, photos and GPS coordinates should be added into the Surveillance Plan document and be available for all HPOs.

The screenshot shows a web form titled 'Home / Create Site Reference'. The form contains the following fields and options:

- Health Board: Auckland Regional Public Health Service (dropdown)
- Site Reference No.: Site Reference (text input)
- GPS East: i.e. Longitude 000 00 00 000 E (text input)
- GPS North: i.e. Latitude 00 00 00 000 S (text input)
- Trap Type: Select Trap Type (dropdown)
- Reason for Sampling: Select Sample Reason (dropdown)
- Attractants: Select Attractant (dropdown)
- Trap: Yes (dropdown)
- Habitat Category: Select Habitat Category (dropdown)
- Sample Type: Select Sample Type (dropdown)
- Salinity: Salinity (text input)
- Sample Location: Select Location (dropdown)
- Control / Treat: Select Control / Treat (dropdown)

At the bottom of the form, there are two buttons: a green 'Save' button and a 'Back to Main List' button.

Figure 2: Creating a new site reference in the Online Database

Additional adult traps can be supplied by the NZ BioSecure Lab where required however it is the responsibility of each PHU to supply tyre traps. Conversion between battery connection and wall power can also be done where required by the NZ BioSecure Lab for CO<sub>2</sub> baited light traps.

If the CO<sub>2</sub> baited light traps and regulators that are being set out for a new surveillance zone have been in storage for a long period, these should be sent to NZ BioSecure for servicing before they are placed in the field. This will help ensure that they are working correctly and that the flow of CO<sub>2</sub> is set to the appropriate value. This servicing will need to be repeated on a yearly basis to ensure that traps continue to function correctly, and this should be included in the surveillance plan to ensure coverage is able to be maintained while regulators and traps are being serviced.

All traps that are deployed in the field should have clear and sturdy signage stating what the trap is and its purpose, and the appropriate contact information. Tyre traps must also show the HAZCHEM sign indicating that it contains a hazardous substance that is hazardous to the aquatic environment and the words "The site contains a hazardous substance that is hazardous to the aquatic environment".

### Surveillance of Routine Larval Sites

Along with the traps set out, there may be non-trap sites that need to be included in the routine surveillance programme. These can be sites such as filtration or catchment ponds, drainage sumps, bunding, or other bodies of water than cannot be removed (Figure 3 for examples of this). These sites should have a database site reference assigned to them included in the map of routine sites. For large bodies of water, a standardised method of sampling will need to be devised to ensure that a) the area is sufficiently sampled, and b) that the samples are taken the same way each time, even if different

## How to set up a Routine Mosquito Surveillance Program

people are sampling. A brief explanation on how this method may look can be found in the [SMS website](#).



Figure 3: Examples of non-trap habitat that may be included in a surveillance plan.

## Carrying Out Surveillance

### Frequency of Checking Traps

Once the traps are placed, and permanent larval habitats are located, the frequency of the surveillance will need to be determined. It is recommended that routine surveillance occurs on a weekly basis, with all traps being checked every seven days. Adult traps can be checked more frequently to change the CO<sub>2</sub> cylinder and any batteries being used. Depending on the POE, larval sampling can be shifted to a fortnightly period during the colder winter months. Adult traps will still need to be checked at least weekly. This can be discussed with the NZB Lab to determine what is appropriate for the POE if needed. How to check the various traps can be found in the SMS website.

### Frequency of Checking Larval sites

Frequency of checking of larval sites that were identified during the preliminary survey will depend on what the site is and can be worked around access to the site. Ponds and other bodies of water within the 400m zone should be scheduled to be sampled with the larval traps (once a week or fortnightly during cold months), however if the pond is in a hard to access area (e.g. in an area where an escort is required), the frequency can be fortnightly rather than weekly.

Sampling of sumps will depend on ability to access to each area, and how many sumps exist in the POE. A way to spread the sampling of sumps is to divide the 400m area into zones and sample a

selection of sumps in each zone each week. Sumps closest to the centre of the 400m zone can even be sampled on a weekly basis when the traps are checked.

### **Routine Environmental Surveys and Other POE Surveys**

Each time surveillance is conducted, an environmental check should be completed as well. This means that along with checking the traps and any non-trap habitat, the general POE environment should be checked for potential mosquito breeding sites that may be present. These sites could include blocked drains/guttering, tyres or other rubbish that has been dumped, or bins and other containers that are collecting water. POE authorities should be advised of this habitat to allow them to mitigate it.

At least once a year a larger scale 400m or mega survey should be completed. A 400m survey is similar to the preliminary survey where the entirety of the 400m zone is thoroughly checked for potential mosquito breeding habitat. A mega survey is the same as a 400m survey, however it encompasses sites with multiple 400m zones, such as a large international airport. These surveys provide insight into changes that may have occurred since the previous survey and may identify new habitat that will need to be included in the routine surveillance. These surveys should be planned to occur at approximately the same time each year. Before the start of the mosquito season, around October or November is a good time for these to occur as it allows risks to be mitigated or sites to be added into the routine plan before the season starts.

A 1 to 5 km survey is recommended to be carried out every 2-3 years. This survey is a combination of a desktop exercise, with some field work, and involves identifying high-risk sites within 1 to 5 km of the POE. These include sites such as transitional facilities, large bodies of water, and sites such as schools, kindergartens, cemeteries, community gardens, and hospitals. Having an idea of where these sites are located is useful in the event of the interception of a species with a longer flight range, such as many Anopheline species. Ponds and other bodies of water can be visited and sampled to get a picture of the local mosquito fauna, and visits can be made to some, or all of the sites identified as being a risk.

### **Processing of Samples**

Positive samples collected during routine surveillance should be processed and sent to the NZ BioSecure Lab for identification on the day that they are collected. How to process samples can be found in the recourses for HPOs section on the [SMSL website](#). All samples that are collected during routine surveillance from traps and any habitat found, need to be entered into the Online National Mosquito Database, including negatives. This should be done on the day that the samples are collected.

### **Regular Review of the Surveillance Programme**

The surveillance plan should be reviewed routinely to assess its effectiveness, and the time of this review should be added into the plan when it is created. When reviewing a surveillance plan, the high-risk areas should also be reviewed to check that those identified as high risk still are, that no high-risk area has moved, and that no new high-risk areas have emerged.

This should be done yearly and should also include looking at the catch rate of each trap and reviewing trap placement to ensure that the 400m zone still has sufficient coverage of traps. The catch rate of each trap will show how effective each trap is by how often it is positive. Traps that are always negative should be reviewed to determine if there may be a more suitable location nearby, such as a more sheltered location. As POE are often very dynamic, and often traps may need to be removed or the locations changed as areas change or become inaccessible. Reviewing the coverage ensures that when traps are moved or removed, gaps do not appear in the surveillance coverage.

