ALL YOU NEED TO KNOW ABOUT MIDGES

WHAT ARE MIDGES? Midges are small insects that do not bite or spread diseases, and are often mistaken for mosquitoes. They are usually found near water bodies and reproduce very quickly during hot weather. Midges are weak fliers and can be easily carried by the wind to nearby estates and premises. When in large numbers, swarms of midges can cause a nuisance to people who encounter them.

WHY ARE MIDGES STILL FLYING AROUND?
Midges are part of the ecosystem and it is impossible to completely remove them. New species could also emerge, which would require new measures to tackle them. We also need to balance our actions against possible impact on the ecosystem. For example, PUB only uses an environmentally-friendly larvicide at the recommended dosage so as to not adversely impact the reservoir’s water quality, while doing our best to control their numbers.

In the meantime, PUB will continue to study the midges to find more effective and sustainable mitigation methods.

TIPS FOR THE PUBLIC
• Avoid the reservoir area and close your windows until fogging is over.
• Install insect screens with mesh size less than 2mm across windows and doors.
• Switch off lights in rooms when not in use or dim the lights.
• Close windows during dusk and dawn when midges are most active.

CONTACT INFORMATION
PUB 24Hr Hotline:
1800-CALL-PUB
(1800-2255-782)
摇蚊知多少

什么是摇蚊？摇蚊（俗称蚊虫）是一种不会咬人也不会传播疾病的小昆虫，并且经常被误认为蚊子。它们在水生环境中生长，碰上炎热天气时会繁殖得更快。由于它的身型非常细小，因此容易随着风向被吹到附近的地方或住宅区。当摇蚊成群出现时，会对人们的生活造成困扰。

### 公用事业局采取哪些应对摇蚊的措施？

<table>
<thead>
<tr>
<th>摇蚊的特性</th>
<th>公用事业局采取的措施</th>
</tr>
</thead>
<tbody>
<tr>
<td>普遍在池塘、水潭及灌木地活跃</td>
<td>增加在水池及周围区域喷洒杀虫剂来减少摇蚊的数量。</td>
</tr>
<tr>
<td>摇蚊具有吸血的习性</td>
<td>每日摇蚊的数量大约400至500只。</td>
</tr>
<tr>
<td>在灌木丛中经常出现</td>
<td>使用化学喷雾剂来减少摇蚊的数量。</td>
</tr>
<tr>
<td>体表光滑，容易被风吹起，</td>
<td>在灌木丛中设置障碍物，以防止摇蚊飞到住宅区。</td>
</tr>
<tr>
<td>无法长期在水中生存</td>
<td>在水面上撒上漂浮物以防止摇蚊的繁殖。</td>
</tr>
</tbody>
</table>

### 为什么还有摇蚊飞舞？

摇蚊属于生态系统的一部分，因此要将它们完全消灭是不可能的。另外，每当下雨后摇蚊的数目会显著增加，这可能是由于雨水的积累。为了控制摇蚊的数量，公用事业局会采用各种措施，包括喷洒化学药剂和设置障碍物。

### 几点贴士：

1. 在喷洒化学药剂时，请避开池塘和水源，直接喷洒摇蚊密集的地方。
2. 在窗户和门上安装大小不超过2毫米的防蚊网。
3. 不要使用调暗的灯光。
4. 在黄昏和黎明时分，摇蚊最活跃的时候，关闭窗户。

### 联系

公用事业局24小时热线：
1800-CALL-PUB
(1800-2255-782)

新加坡
公用事业局
Frequently Asked Questions about Midges

Q1: What are midges?
Non-biting midges – also known as chironomids – are often mistaken for mosquitoes. They exist in or near water bodies, and are highly adaptable insects that have existed for centuries. There are over 5,000 recorded species worldwide.

Midges occur naturally in aquatic ecosystems, and are an important part of the food chain as they are food for animals like birds, fish and spiders. In Singapore, 57 different species of midges can be found in our reservoirs.

Midges are not dangerous to humans. They do not bite or spread diseases as they do not have a proboscis (piercing mouth part). However, as they tend to swarm in large numbers, they can pose a nuisance and cause discomfort to people who encounter them.

Q2: Where can midges be found?
Midges thrive in most water bodies, ranging from fast-flowing streams to ponds and deep lakes. They can be found throughout the world, in both temperate and tropical regions.

In reservoirs, the larvae live in the sediment and organic matter (algae) along the edges and at the bottom.

Other than Pandan and Bedok Reservoirs, there have also been emergences at Lower Seletar, Marina, Poyan, Serangoon and Tengeh Reservoirs, as well as Punggol Waterway.

Q3: What is a midge's life cycle like?
There are four stages - egg, larva, pupa and adult. In tropical countries like Singapore, this entire process typically takes approximately 3 weeks to complete. At the pupal stage, they swim to the surface and emerge as flying adults, and only live up to 2 days.

Higher temperatures will hasten the midges' life cycle, causing them to reproduce at a faster rate (around 2 - 2.5 weeks).

Q4: When do mass emergences of midges occur?
As midges are very light, the prevailing wind might blow the midges to nearby residential estates. For instance, the northeast monsoon (Dec to March) may cause an accumulation of midges south-east of Bedok Reservoir.

For Pandan Reservoir, emergences occur throughout the year. However, they usually cause a nuisance from June to October, which coincides with the southwest monsoon period as the prevailing winds carry midges into the residential estates north of the reservoir.

Midges in Singapore have been observed to exhibit more active behaviour during the cooler periods of the day, such as the early mornings and late evenings.

Q5: How does PUB monitor midge emergences at our reservoirs?
PUB monitors and conducts frequent checks on the midge adult and larvae count at the various reservoirs. At Pandan and Bedok, daily checks are conducted - reservoir bed sediment samples are
collected from 11 locations at Pandan, which are then checked for the number of midge larvae. In Bedok, adult midges trapped on oily boards at 8 locations are counted daily.

Q6: Which midge species have been found in Bedok and Pandan Reservoirs?

While there are 57 different species of midges in Singapore, only a few species are involved in mass emergence events. At Bedok, there is only one species that consistently appears in mass emergences - *Tanytarsus oscillans*, small green-coloured insects with average body lengths of about 2mm. They are usually found in waters with lower organic matter and high dissolved oxygen.

Over at Pandan, the situation is more complicated - over the last decade, a different dominant species has been recorded each time a notable emergence occurs. Currently, the dominant species is *Tanytarsus formosanus*, which is brown in colour and about 2mm in size. This species has been found to require high dissolved oxygen at the larval stage. They also emit an unpleasant odor when they die.

During major emergences at Pandan in 2012 and 2016, the dominant species were *Polypedilum nubifer* and *Chironomus circumdatus* respectively.

Q7: What are the measures taken to manage the midge problem at Bedok and Pandan?

At both locations, PUB carries out mitigation measures throughout the year to suppress the midge population. Once an up trend in larvae or adult count is detected, PUB immediately steps up our measures. These include:

- Increasing the frequency of fogging operations from 2-3 times a week to twice daily, to kill adult midges at the reservoir dykes, surrounding vegetation and drains near residential estates
- Increasing the daily dosage of biological larvicide, *Bacillus thuringiensis israelensis* (Bti), applied directly to the bottom of the reservoir to kill midge larvae
- Strong spotlights at the reservoirs' pumping stations are turned on from 7pm to 7am daily, which helps attract adult midges
- Regular inspection and removal of midge eggs from the reservoirs' floating structures
- Installing 3m-high netting along the edges of the reservoir, which acts as a barrier to prevent the wind from blowing adult midges into the nearby residential estates

Q8: Is the chemical used in PUB's fogging operations harmful to human health?

PUB closely monitors the midge situation and adjusts our fogging activities accordingly. We conduct thermal fogging in the early morning and late evening to target adult midges more effectively.

Permethrin, the pesticide used, has been certified safe and suitable for use by the World Health Organization (WHO). The concentration of permethrin used in fogging is also diluted to a sufficiently low level that poses minimal risk to the environment. Only properly licensed and trained pest control personnel are allowed to undertake fogging operations.

PUB puts up fogging notices along the reservoir dyke to update residents on the fogging schedule.

Q9: Does using Bti have any negative impact on the reservoir's water quality?

Bti is an environmentally safe biological larvicide - more specifically, it is a naturally occurring soil bacterium which produces spores that are only toxic for the digestive system of midge larvae. As a preferred biological control option, it has been proven to have no ill effects on the environment, wildlife or humans.
For maximum effect, Bti is applied at areas where midge larvae feed, killing them before they can reach adulthood. It is also commonly used to kill mosquito larvae.

PUB monitors the water quality at all our reservoirs regularly as part of our regular monitoring regime. Our analysis of the water quality in Bedok and Pandan have shown that there is no difference in the quality of reservoir water after the application of Bti. Moreover, all raw water is treated at our waterworks to WHO drinking water standards before being supplied to customers.

Q10: What additional measures have PUB employed this year to manage the midge situation at Pandan?

As the current dominant species, *Tanytarsus formosanus*, has been found to swarm in drains (a behaviour not exhibited by previous dominant species at Pandan), PUB currently carries out daily greasing of the drain walls near residential estates to trap adult midges.

In addition, we have experimented with sticking oily paper within the drains to trap and capture rate of the midges. This has been found to be effective so far.

For Pandan, PUB recently extended the existing 0.5km of 3m-high netting (first installed in 2016) by another 1km.

Q11: Despite PUB’s measures, why are there still midges in the residential estates?

As midges cannot be repelled or avoided directly, PUB tries its best to reduce the size of midge swarms. Midge emergences are a natural phenomenon that affect people who live very close to the reservoir.

Adults midges would much prefer to be near the water to breed. But as they are weak flyers, the prevailing winds can easily carry them to the nearby residential estates.

Q12: Is it possible to completely remove midges?

This is not possible as they are a natural part of aquatic ecosystems. Drastic measures, such as applying massive amounts of environmentally unsafe larvicide, could eliminate the majority of the midge population, but also risks killing other organisms in the water. This would upset the natural balance of the reservoir's ecosystem and disrupt the life cycle of other aquatic animals. It could also adversely affect the water quality in the reservoir.