NEW ZEALAND BIOSECURE

BORDER HEALTH NEWSLETTER – DECEMBER 2022

NAU MAI, HAERE MAI - WELCOME!

Kia ora koutou katoa,

We hope you all had a very Happy Christmas and a great and relaxing holiday break. This month we have produced the annual mozzie chart for you to discover the mozziest month of 2022.

In the news this month, read about the alarming increase in dengue cases in the Philippines and Bangladesh. Also some ground-breaking research results including; a study that found the highest levels of pyrethroid resistance on record in *Aedes aegypti* collected in Vietnam and Cambodia; A first-of-its-kind study that analysed mosquitoes' internal and external microbiomes for the first time. Research using 'brain in a dish' to study the effects of the Zika virus, taking research a step closer towards developing drugs to combat the infection; lastly, read about what could become the first-ever treatment against the debilitating joint pain effects caused by the Chikungunya virus.

Scroll down to check the “know your vector-borne disease” section, this month featuring dengue and severe dengue.

Happy reading!

SURVEILLANCE

During December 1331 routine samples were collected by staff from 12 PHUs (Figure 1). The samples included 152 positive larval samples and 70 positive adult samples, leading to a total of 796 adults and 5783 larvae identified over the past month (Table 1). *Aedes notoscriptus* are the dominant larval species this month, which is the same as this month last year (Table 1).

In total, nine mosquito species have been collected this month (Table 1), one more than collected last month.

Table 1. Adult and larvae sampled by the New Zealand surveillance program during December 2021 & 2022

Species (common name)	Adults		Larvae	
	Dec 22	Dec 21	Dec 22	Dec 21
Aedes antipodeus (winter mosquito)	43	35	-	-
Ae asteliae (no common name)	-	-	4	8
Ae australis (saltwater mosquito)	-	1	-	-
Ae notoscriptus (striped mosquito)	45	144	2474	3816
Ae subalbirostris (no common name)	1	-	-	-
Coquillettidia iracunda (no common name)	1	160	-	-
Coq tenuipalpis (no common name)	2	4	-	-
Culex pervigilans (vigilant mosquito)	357	1129	1599	3806
Cx quinquefasciatus (southern house mosquito)	303	846	1641	7128
Culex sp.	44	118	-	1
Opifex fuscus (rock pool mosquito)	-	-	65	190
Total	**796**	**2437**	**5783**	**14949**

Compared to this same month last year, the total number of larvae and adults have shown a decrease (61% and 67% respectively) (Table 1).

Compared to the previous month, both mosquito larval and adult numbers have shown a decrease (2% and 63% respectively).

The highest number of larvae sampled this month was obtained in Northland (2034 larvae) followed by Bay of Plenty (1672 larvae) (Figure 1).

Aedes notoscriptus larval numbers have shown an increase in six PHUs and a decrease in four PHUs from this same month last year (Figure 2). As expected, *Aedes notoscriptus* has not been recorded this month, this year, or last year in Public Health South (Figure 2).

Culex quinquefasciatus larval numbers have shown an increase in nil PHUs and a decrease in eight from this same month last year. *Culex quinquefasciatus* has not been found this month in Public Health South (Figure 2).

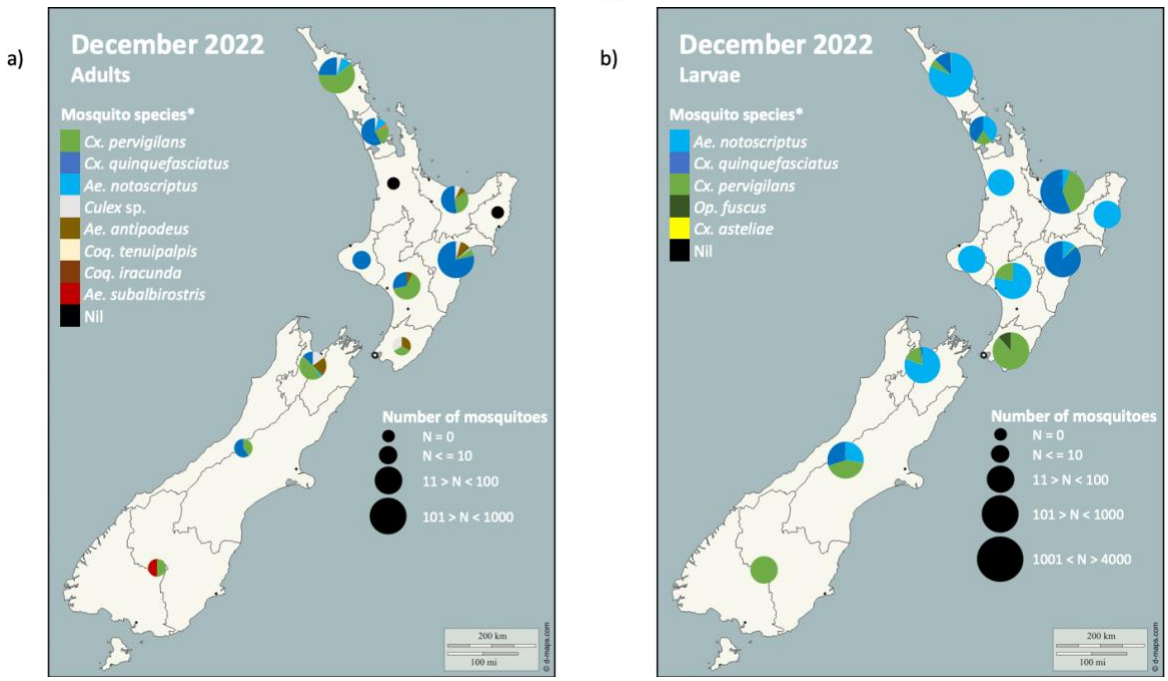


Figure 1. Total mosquito adults (a) and larvae (b) sampled in New Zealand during the December 2022 surveillance period. Please note that the markers represent the PHUs and not the specific sites where the samples have been taken.
* The mosquito species are listed in order from the most abundant to the least abundant.

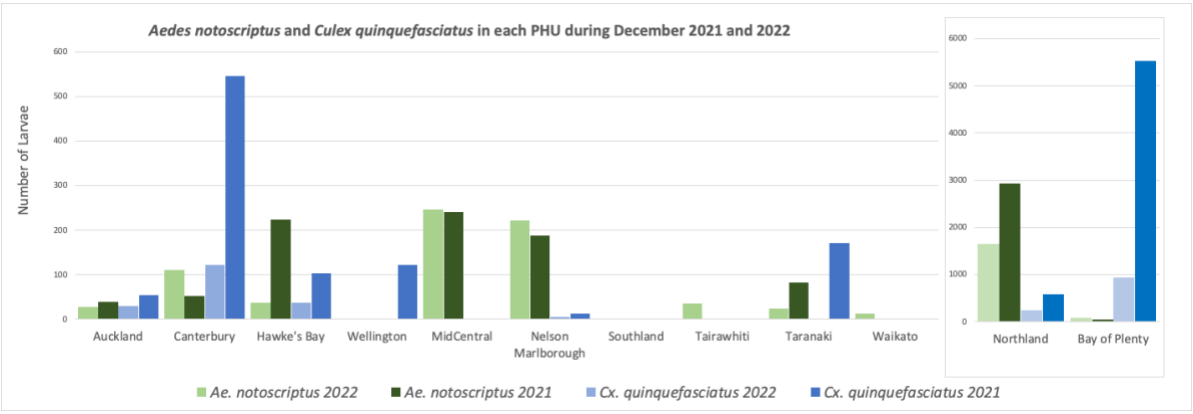


Figure 2. Comparison between introduced mosquito species sampled in each PHU during December 2021 and 2022.
*Please note the different scale for the number of larvae present in Northland and Bay of Plenty in comparison to the other PHUs.

MOZZIE NUMBERS FOR THE YEAR 2022

During 2022, a total of 103,986 larvae (Figure 3) and 15,254 adults (Figure 4) were collected by Public Health Units and identified in the NZ BioSecure Entomology Laboratory, that is 21% less larvae and 1% less adults than last year.

A total of 11 locally occurring species of mosquitoes were collected this year (2 less than last year) with *Culex quinquefasciatus* the best represented with 63% of the larvae and 53% of the adults, followed by *Aedes notoscriptus* with 24% of the larvae, and *Culex pervigilans* with

16% of the adults. The least represented mosquito was the endemic *Aedes subalbirostris* with 2 larvae and 1 adult.

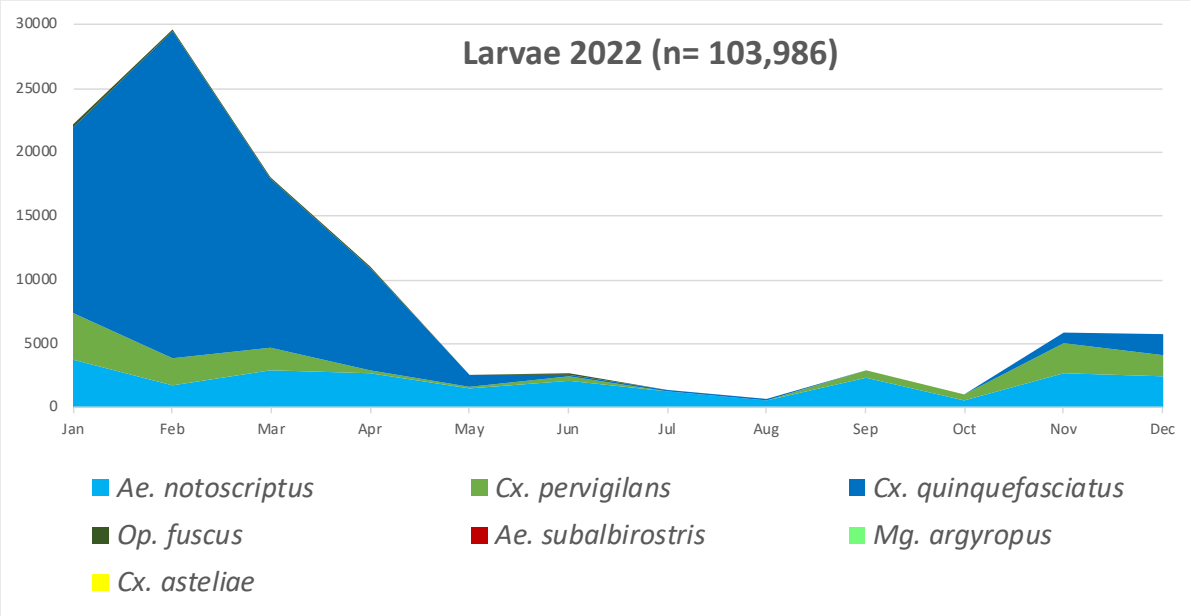


Figure 3. Variation in total mosquito larvae numbers throughout 2022.

The highest number of mosquitoes collected (larvae plus adults) in 2022 was in February (33,861) followed by January (24,341) while in 2021 the highest number was in February (43,131) followed by January (32,159). For 2022 the highest number of species was recorded in March and December (9 species) and the least was recorded in July (4 species, that is one more than last year on the same month).

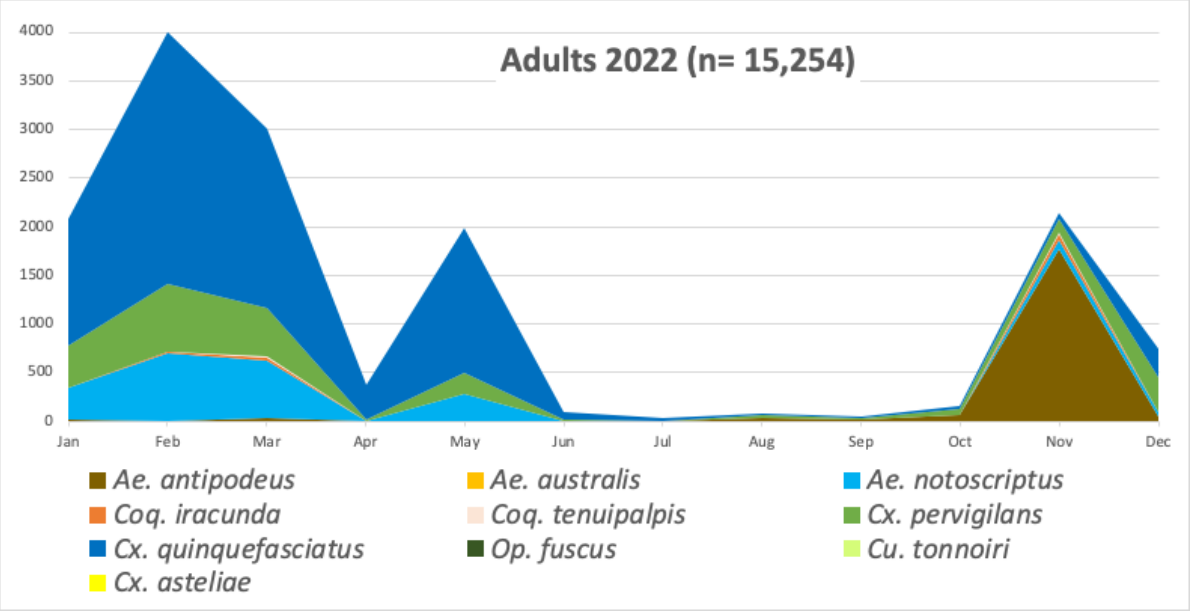


Figure 4. Variation in total mosquito adult numbers throughout 2022.

INCURSIONS AND INTERCEPTIONS

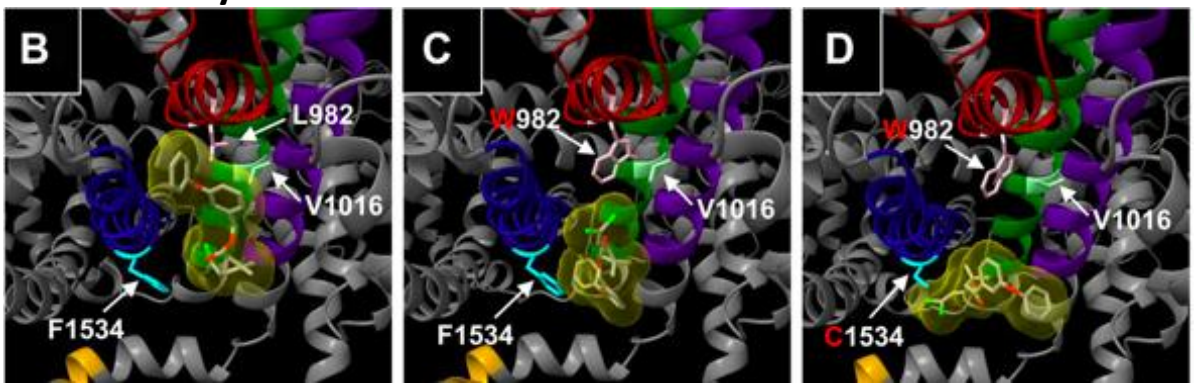
During December, HPOs responded to one suspected interception (Table 2).

Table 2. Suspected interception during December 2022

Date	Species	Location	Circumstances
07.12.2022	1 non-mosquito	Lyttelton port	Found floating in a container holding standing water on a ship during an inspection.

NEWS ARTICLES FROM AROUND THE WORLD

'Super' mosquitoes have now mutated to withstand insecticides, scientists say



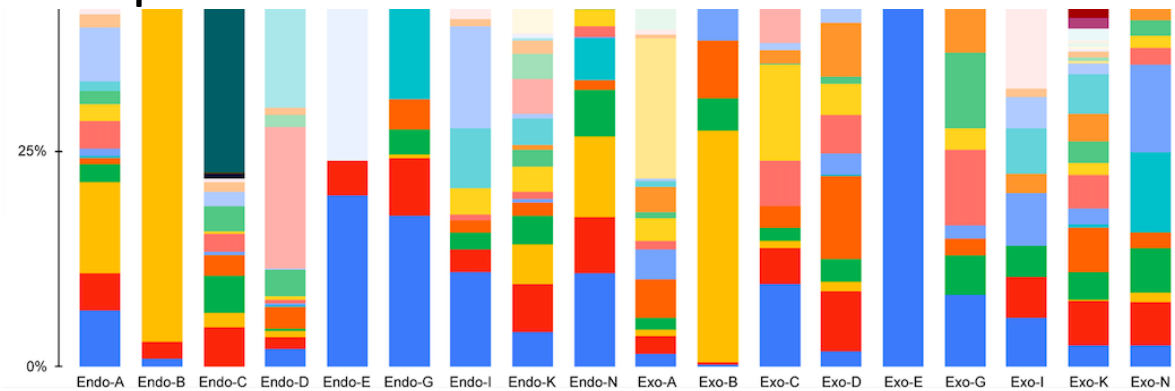
According to new research, mosquitoes have evolved to withstand insecticides, and the most "sobering" finding is the high rate in which a species known for carrying disease has developed mutations. Researchers at the National Institute of Infectious Diseases in Japan studied mosquitoes in dengue-endemic areas in Vietnam and Cambodia and found that they harbour mutations that endow them with strong resistance to common insecticides. One of the most concerning mutations appeared in about 78% in collected specimens of *Aedes aegypti* -- one of the most infamous species of mosquito and a major vector of dengue, yellow fever and Zika virus. The findings could pose a serious threat to infectious disease control and eradication programs, as the mutation is some of the highest insecticide resistance seen in a field population of mosquitoes, the researchers said. Read more. Access original article.

Researchers seek to reduce Chikungunya virus-caused joint pain with new drug

Oregon Health & Science University researchers and partners are developing what could become the first-ever treatment against the debilitating joint pain that can last months or years after becoming infected with the emerging Chikungunya virus. The mosquito species whose bites spread the virus live in warmer climates. Chikungunya virus was first identified in Africa in 1952, but can now also be found in Asia, the Indian subcontinent, the Americas

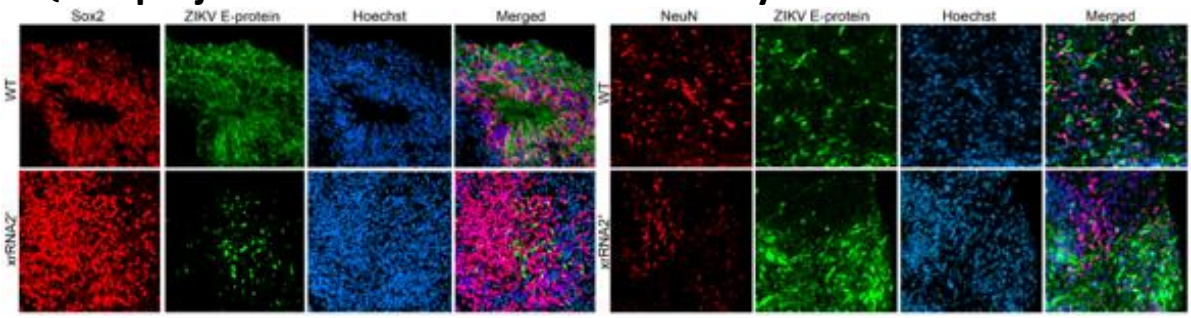
and Europe. An initial bout with Chikungunya can cause fever, joint and muscle pain, a rash and other symptom for one to two weeks. While most people fully recover, about 30 to 40% will experience persistent joint pain, known as chronic Chikungunya arthritis, for months or even years. Similar to the COVID drug Paxlovid, the experimental Chikungunya antiviral compound is designed to reduce the total amount virus, or viral load. Read more.

Study examines both the exterior surface and interior microbiome of mosquitoes



This first-of-its-kind study, published in PLOS ONE, examines both the exterior surface and interior microbiome of mosquitoes found in homes in Africa's Cote d'Ivoire – the Ivory Coast. "When you're exposed to mosquitoes, you worry about blood feeding," said R. Michael Roe, William Neal Reynolds Distinguished Professor of Entomology at NC State, and co-corresponding author of the study. "Our hypothesis is that mosquitoes can physically transfer bacteria by landing on you or by defecating on household surfaces, like flies do." Some of the findings were surprising. Researchers found large amounts of *Staphylococcus* and two variants of *Rickettsia*, the genus of these bacteria are associated with human and animal diseases. See story here. Access original article.

UQ-led project uses 'brain in a dish' to study effects of the Zika virus



The mosquito-borne Zika virus is found in 89 countries and can penetrate the placenta of a pregnant mother to infect her baby, causing severe brain abnormalities. A University of Queensland-led project has used a 'brain in a dish' to study the effects of the Zika virus, taking research a step closer towards developing drugs to combat the infection. "It's a little like something out of a science fiction movie – we're growing an artificial and microscopic

human brain in a petri dish and testing the effect of the virus on its cells." Says Dr Andrii Slonchak of UQ's School of Chemistry and Molecular Biosciences. Read more here. Access full article.

Modulation of insect immunity to control vector-borne diseases

A recent review published in PLOS Pathogens discussed the current research on the role of molecular mechanisms in mediating immune priming in insects and regulating vector-borne disease transmission. Although insecticides reduce the spread of insect-borne diseases in some regions of the world, increasing resistance to insecticides in natural insect populations indicates the need for alternate strategies to limit the transmission of these diseases. One of the areas gaining attention is immune priming to reduce the transmission of a disease. The competence of the vector, which is the ability of the vector to transmit the pathogen, depends on its immune response. Studies have provided evidence of immune priming in insects, where exposure to pathogens brings about a sustained change in cells that enhances the immune response during subsequent infections. Continue reading. Find the original article here.

Singapore records 2nd highest dengue tally in 2022

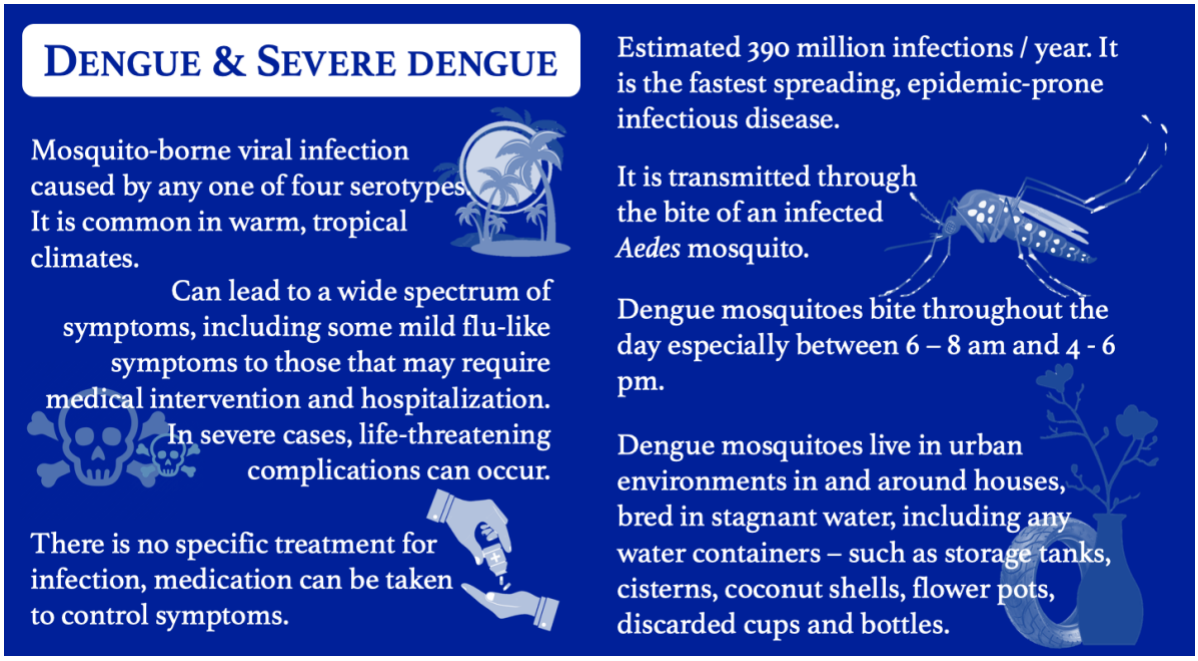
Through the end of week 52, 2022, the Singapore National Environmental Agency (NEA) reported 32,097 total dengue fever cases. This is the second most cases reported in Singapore in a single year. This is more than a 500 percent increase in cases compared to the same period in 2021 (5,258). Earlier in the year, the NEA said the increase in dengue cases in 2022 was due to the high *Aedes aegypti* mosquito population, together with circulation of the previously uncommon DENV-3 that the public had little immunity. Click on the photo to watch the "Dengue in the Philippines 2022" video.

Bangladesh reports record dengue deaths in 2022

The Bangladesh Directorate General of Health Services (DGHS) ended 2022 reporting 281 total dengue related deaths, easily breaking the previous record for fatalities in 2019 when 179 deaths were recorded. 260 of the deaths were recorded from September through December alone with more than 100 seen in November. DGHS numbers show that 173 of the deaths (61%) were in Dhaka while 108 were outside of Dhaka. After Dhaka, Chattgoram division recorded 69 of deaths. Officials saw 62,382 dengue cases requiring hospitalization,

the second most since records were kept starting in 2000. 39,220 cases of this total, or 63%, were reported in Dhaka. In 2019, Bangladesh saw well more than 100,000 dengue hospitalizations, a record that stands to this day. Read more.

KNOW YOUR VECTOR-BORNE DISEASE



RISK MAPS

Dengue Map – Centres for Disease Control and Prevention
Zika Map – Centres for Disease Control and Prevention
Malaria – Centres for Disease Control and Prevention
Malaria – World Health Organisation

DISEASE OUTBREAKS

To find out where the latest disease outbreaks have occurred visit:

Epidemic and emerging disease alerts in the Pacific region - Produced by the Pacific Community (SPC) for the Pacific Public Health Surveillance Network (PPHSN).

Disease Outbreak News - World Health Organization.

Public Health Surveillance - Institute of Environmental Science and Research (ESR) - Information for New Zealand Public Health Action.

Communicable disease threats report - European Centre for Disease Prevention and Control