REVISTA HYGEIA **ISSN: 1980-1726**
https://seer.ufu.br/index.php/hygeia DOI: https://doi.org/10.14393/Hygeia2173122

ANALYSIS OF *AEDES AEGYPTI* TEMPORAL DISTRIBUTION IN THE STATE OF SANTA CATARINA, BRAZIL, FROM 2011 TO 2023

ANÁLISE DA DISTRIBUIÇÃO TEMPORAL DO *AEDES AEGYPTI* NO ESTADO DE SANTA CATARINA, BRASIL, DE 2011 A 2023

Gabriel Oscar Cremona Parma
Universidade do Sul de Santa Catarina, Programa de Pós-Graduação em Ciências da Saúde, Palhoça, SC, Brasil
gcremona@gmail.com

Josiane Somariva Prophiro
Universidade do Sul de Santa Catarina, Programa de Pós-Graduação em Ciências da Saúde, Tubarão, SC, Brasil
josiane.prophiro@hotmail.com

Millena Fernandes
Universidade do Sul de Santa Catarina, Programa de Pós-Graduação em Ciências da Saúde, Tubarão, SC, Brasil
millena.bn.f@gmail.com

Joice Guilherme de Oliveira
Universidade do Sul de Santa Catarina, Programa de Pós-Graduação em Ciências da Saúde, Tubarão, SC, Brasil
joice_o@hotmail.com

Sabrina Fernandes Cardoso
Universidade Federal de Santa Catarina, Programa de Pós-Graduação em Biologia Celular e do Desenvolvimento, Florianópolis, SC, Brasil
sabrinalogia@hotmail.com

Jefferson Traebert
Universidade do Sul de Santa Catarina, Programa de Pós-Graduação em Ciências da Saúde, Palhoça, SC, Brasil
jefferson.traebert@gmail.com

ABSTRACT

This study aimed to analyze the temporal distribution of *Aedes aegypti* in the state of Santa Catarina, Brazil, along with its health macro-regions, from January 2011 to April 2023, seeking to detect any potential trends and seasonalities. Nine health macro-regions of Santa Catarina, as well as it is state, were used as units of analysis. Data on *Ae. aegypti* outbreaks were obtained by the State's Directorate of Epidemiological Surveillance. Additive decomposition was applied to the time series data to separate them into three main components: trend, seasonality, and residuals. Autocorrelation and partial autocorrelation functions were examined. Regression graphs were generated to assess the growth model of breeding sites during specific identified months. A total of 285,009 *Ae. aegypti* outbreaks were reported in Santa Catarina during the study period. Temporal analyses revealed a seasonal pattern, with the highest number of breeding sites occurring in February and March, corresponding to the months with higher temperatures. The results underscore the necessity for more intense implementation of control and preventive measures in municipalities, especially during February and March. Furthermore, there is a call for more in-depth investigations into the factors contributing to these increases.

Keywords: Dengue. *Aedes aegypti*. Arbovirus infections. Time series studies.

RESUMO

Este estudo teve como objetivo analisar a distribuição temporal do *Aedes aegypti* no estado de Santa Catarina, Brasil, juntamente com suas macrorregiões de saúde, de janeiro de 2011 a abril de 2023, buscando detectar quaisquer tendências e sazonalidades potenciais. Nove macrorregiões de saúde de Santa Catarina, assim como seu estado, foram utilizadas como unidades de análise. Dados sobre *Ae. aegypti* foram obtidos através da Diretoria de Vigilância Epidemiológica do Estado. A decomposição aditiva foi aplicada aos dados da

Recebido em 16/04/2024
Aceito para publicação em: 25/08/2025.

série temporal para separá-los em três componentes principais: tendência, sazonalidade e resíduos. Funções de autocorrelação e autocorrelação parcial foram examinadas. Gráficos de regressão foram gerados para avaliar o modelo de crescimento dos criadouros durante meses específicos identificados. Um total de 285.009 focos de *Ae. aegypti* foram relatados em Santa Catarina durante o período do estudo. As análises temporais revelaram um padrão sazonal, com maior número de criadouros ocorrendo em fevereiro e março, correspondendo aos meses com temperaturas mais elevadas. Os resultados ressaltam a necessidade de implementação mais intensa de medidas de controle e prevenção nos municípios, especialmente durante os meses de fevereiro e março. Além disso, há um apelo a investigações mais aprofundadas sobre os fatores que contribuem para estes aumentos.

Palavras-chave: Dengue. *Aedes aegypti*. Infecções por arbovírus. Estudos de séries temporais.

INTRODUCTION

Aedes mosquitoes, such as *Aedes aegypti*, are the primary vectors of arboviruses, responsible for the transmission of DENV, ZIKV, and CHIKV (Almeida *et al*., 2021). Therefore, studies that assess the spatiotemporal distribution of vectors are important for developing planning and control strategies for these diseases (de Oliveira *et al*., 2023).

Transmission of an arbovirus is a complex process that depends on the interaction between hosts and disease vectors, which occurs when an adult mosquito feeds on an infected host. The mosquito carries infectious viral particles in its salivary glands and, on a subsequent blood meal, can transmit the virus to another host. For this process to happen, a competent vector is required, capable of infecting, transporting and transmitting viruses from one host to another (Guzmán *et al*., 2020). Dengue viruses circulate endemically in tropical and subtropical regions around the world, causing about 50 million symptomatic infections per year (World Health Organization, 2023). In Brazil, 14,859,333 dengue patients were confirmed between 2014 and June 2023, out of which 9,173 evolved to the severe form of the disease and 5,677 died (Pan American Health Organization, 2023).

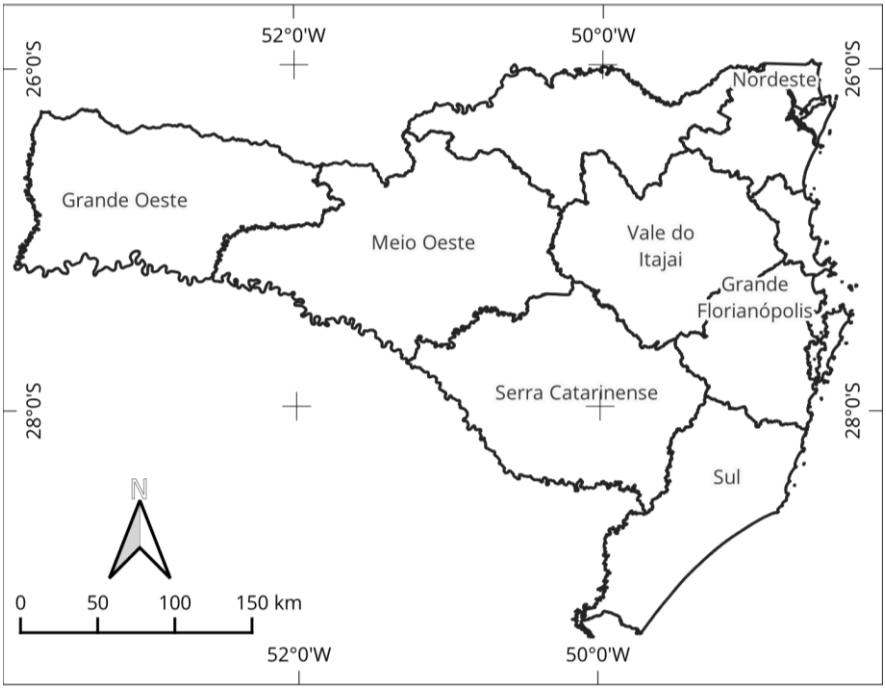
The southern region of Brazil was known for having climatic barriers that hindered the transmission of arboviruses, such as DENV, because seasonal temperatures include cold temperatures which interfere with the life cycle of *Ae. aegypti* and, consequently, hinder efficient viruses transmission (Barcellos; Lowe, 2014). Between 2000 and 2018, a study was carried out demonstrating that the southern region of the country had the lowest incidence of dengue cases (de Azevedo; Lorenz; Chiaravalloti-neto, 2020). However, in recent years, a change in this scenario has been observed. During the year 2022, when Brazil recorded over 1,423,614 probable cases of dengue (incidence rate of 667.4 cases per 100,000 inhabitants), the Southern region was the second with the highest incidence (1,047.5 cases/100,000 inhabitants), second only to the Midwest region (2,043.7 cases/100,000 inhabitants) (Ministério da Saúde, 2022). In a recent study that reviewed the entomological survey of *Ae. aegypti* and vector infestation using the Home Infestation Index (HII), an increase in the number of infested municipalities in the South region was observed between 2017 and 2021, as well as an increase in the annual average of the HII in the municipalities of the Southern region (de Oliveira *et al*., 2023). In the State of Santa Catarina, in the year 2022, 83,276 cases of dengue and more than 67,000 outbreaks of *Ae. aegypti* in 233 of the 295 municipalities in Santa Catarina were reported. Out of these, 142 municipalities were considered infested by the vector, an increase of 20.3% compared to the same period in 2021, which recorded 118 municipalities in this condition (Governo do Estado de Santa Catarina *et al*., 2022a).

Elucidating the impact of the vector is aided by understanding the population dynamics of *Ae. aegypti*. Furthermore, the transmission of arboviruses depends, with rare exceptions, on the presence of competent mosquitoes such as *Ae. aegypti*. It should be emphasized that the mosquito is present in several parts of the world, including all of Brazil, a country with tropical and subtropical climate conditions favorable to the development of the species. Therefore, understanding the distribution of this vector is essential for developing vector control strategies. Thus, the aim of this study was to analyze the temporal distribution of *Ae. aegypti* outbreaks in the State of Santa Catarina and its health macro-regions, from January 2011 to April 2023, aiming to detect any potential trends and seasonality. With the purpose of addressing this gap identified in Santa Catarina.

METHODS

An exploratory time-series epidemiological study was carried out using the health macro-regions of Santa Catarina, Brazil, as units of analysis, in addition to the state of Santa Catarina as a whole. The health macro-regions included were: Grande Oeste, Meio Oeste, Planalto Norte, Nordeste, Vale do Itajaí, Foz do Rio Itajaí, Serra Catarinense, Sul and Grande Florianópolis (Figure 1). Santa Catarina has 95,730.690 km2 surface area and a population of 7,609,601 inhabitants (Instituto Brasileiro de Geografia e Estatística - IBGE, 2023). The climate is humid subtropical, with temperatures ranging from 13 to 25ºC, with well-defined seasons (Governo do Estado de Santa Catarina *et al*., 2024).

Figure 1 – Health macro-regions of Santa Catarina, 2024



Source: IBGE, 2024. Prepared by the authors, 2025.

Data from outbreaks of *Ae. aegypti* were collected from information provided by the Directorate of Epidemiological Surveillance (DIVE) of the State Department of Health of Santa Catarina (Governo do Estado de Santa Catarina *et al*., 2024).

According to the operational strategy for dengue, chikungunya and zika prevention and control in the State of Santa Catarina, all the municipalities should have active *Ae. aegypti* Surveillance and Control Programs, with the aim of identifying and monitoring vectors, with the periodic performance of the following activities: inspection of larvitrampa-type traps, which inspection takes place every seven days; visit every 14 days to sites with great deals on preferential sites for *Ae. aegypti*, the so-called strategic points; investigation of complaints coming from the population and the Levantamento de Índice Rápido (LIRA, Quick Index Survey), which is carried out twice a year (March and November). Other activities for the identification of outbreaks, such as those carried out due to the detection of an existing outbreak, are: focus delimitation (FD), characterized by house-to-house visits within a radius of 300 meters from the generating focus, with inspection of sites to detect immature vector forms and finally search for the winged vector; Survey of Index plus Treatment (Si+T), characterized by an inspection carried out two months after the FD, in the same area already visited to review activities and Special Vector Search (SVS) which consists in the search for *Ae. aegypti* due to the notification of a suspected case of diseases transmitted by the *Ae. aegypti* (Governo do Estado de Santa Catarina *et al*., 2022b).

Based on *Ae. aegypti* outbreaks data, time series analyses over a period of 148 months, that is, from January 2011 to April 2023 were described. Descriptive analysis of the series of each macro-region and of

the State was carried out with the elaboration of histograms together with probability distribution curves. In addition, box-plots were used to identify the occurrence of outliers. To assess the normality of the data, the QQ plot and the Shapiro-Wilk test were used. Then, additive breakdown was applied to each time series to separate them into three main components: trend, which indicated the direction of the disease outbreaks over time; seasonality, which identified seasonal patterns at fixed intervals; and residuals, which implied variations not explained by the trend and seasonality. Afterwards, a seasonality analysis was carried out to identify the month in the historical series with the highest number of outbreaks in each macro-region. Next, the autocorrelation and partial autocorrelation functions were reviewed to assess the temporal dependence of the cases, which allowed the identification of the delays (lags) in which the past values significantly influenced the present values to better understand the temporal structure of the data that helped in the selection of appropriate models. An analysis of the residuals, obtained in the additive breakdown stage, was carried out at once by the automatic ARIMA (Auto Regressive Integrated Moving Average) method, to identify if there were still patterns or structures not captured by the models previously used. Finally, with the use of the previously identified seasonality data, the months with the highest number of *Ae. aegypti* outbreaks were detected. Then, regression charts were generated to evaluate the outbreaks growth model in those specific months. In addition, 95% confidence intervals were calculated for the average of each region in the months with the highest seasonal disease occurrence. The confidence interval was determined using the t-student test, since the sample number in the months reviewed was less than 30 (Larson; Farber, 2016; Morettin; Toloi, 2018; Walpole *et al*., 2016).

As it is an aggregated database that is in the public domain, it was not necessary to submit for review the research project to the Ethics Committee for Research with Human Beings. However, all the ethical prerogatives of Resolution nº 466/2012, of the National Health Council, were strictly followed.

RESULTS

A total of 285,009 *Ae. aegypti* outbreaks were reported in Santa Catarina, Brazil, from January 2011 to April 2023. Table 1 shows data from the time series of outbreaks by health macro-regions and in the State.

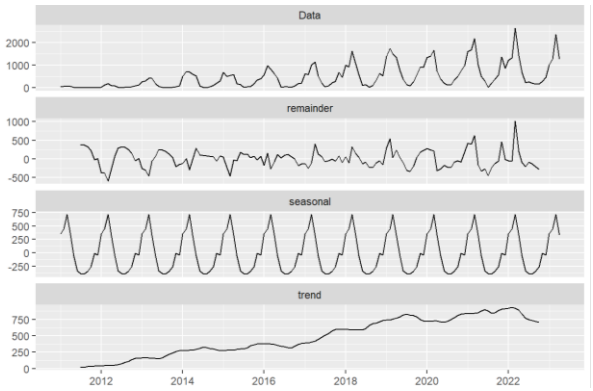
The additive decomposition analysis of time series by health macro-region showed well-defined outbreak notification seasonality in all regions, with random components without set patterns. In the same breakdown of the regional series, increasing trends were found over the years, although the speed of this increase varied in each location analyzed. Such information can be observed in Figure 2, in which, in each macro-region, the original series, the trend, the seasonality and the residuals are shown sequentially.

From the trend analysis, we could identify that, as of 2012, only the Grande Oeste health macro-region showed a significant increase in *Ae. aegypti* outbreaks. In 2014, the beginning of the trend towards an increase in confirmed outbreaks was seen at the Foz do Rio Itajaí. As of 2018, an increase in outbreaks was seen in the Meio Oeste, Nordeste, Grande Florianópolis and Sul macro-regions. As of 2019, the Vale do Itajaí also showed a trend towards an increase in outbreaks. Particular situations were observed in the Planalto Norte, with few outbreaks and a very small and irregular increase trend as of 2015. Serra Catarinense, which had very few outbreaks throughout the analysis period, did not show any trend.

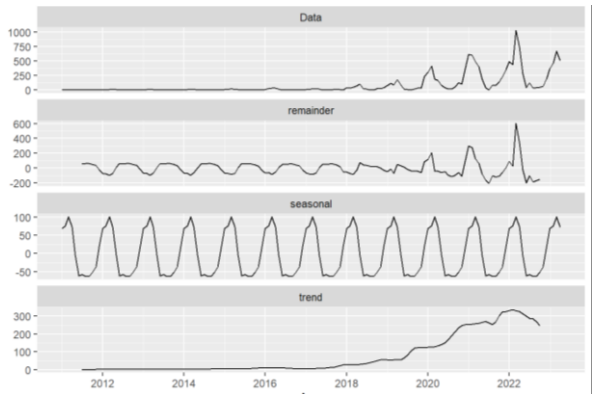
The autocorrelation analysis, that is, values of outbreaks in a month in relation to the previous month, showed, in general, a strong autocorrelation. However, once again due to the low number of cases recorded, in Serra Catarinense there was no such autocorrelation and in Planalto Norte, it was minimal.

Figure 2 – Additive breakdown analysis of the *Ae. aegypti* time series of outbreaks by health macro-region in Santa Catarina from January 2011 to April 2023

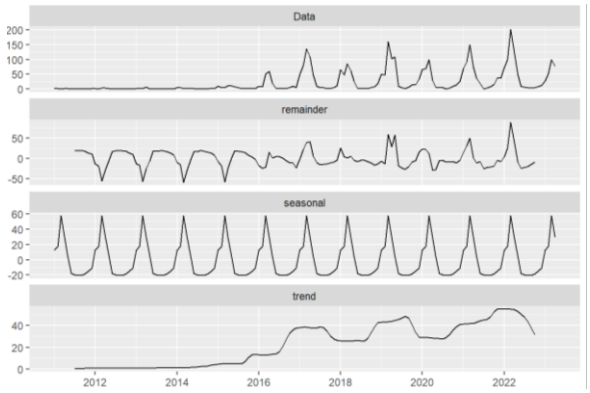
Grande Oeste



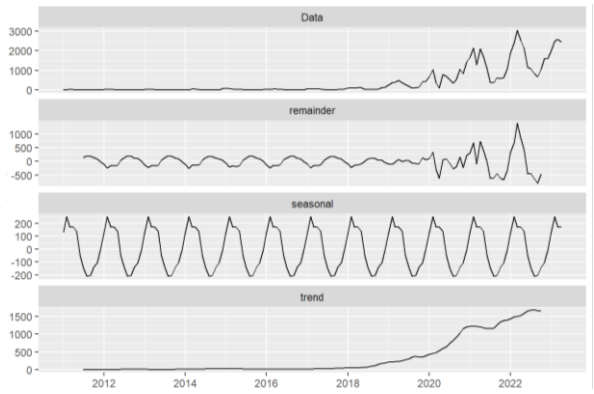
Meio Oeste



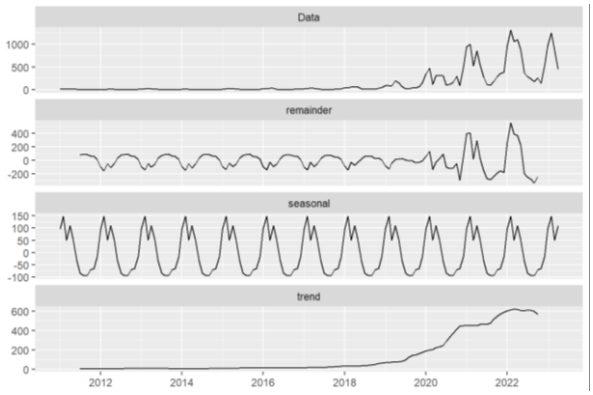
Planalto Norte



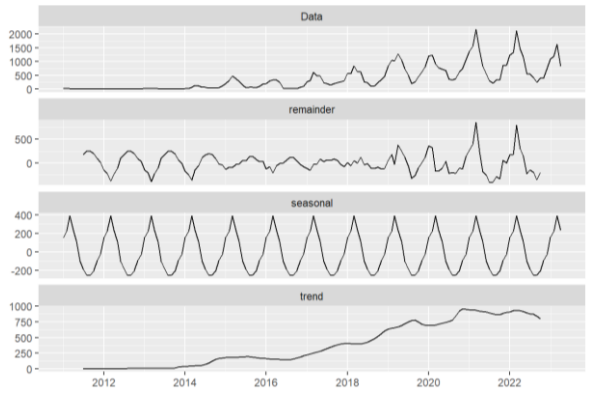
Nordeste

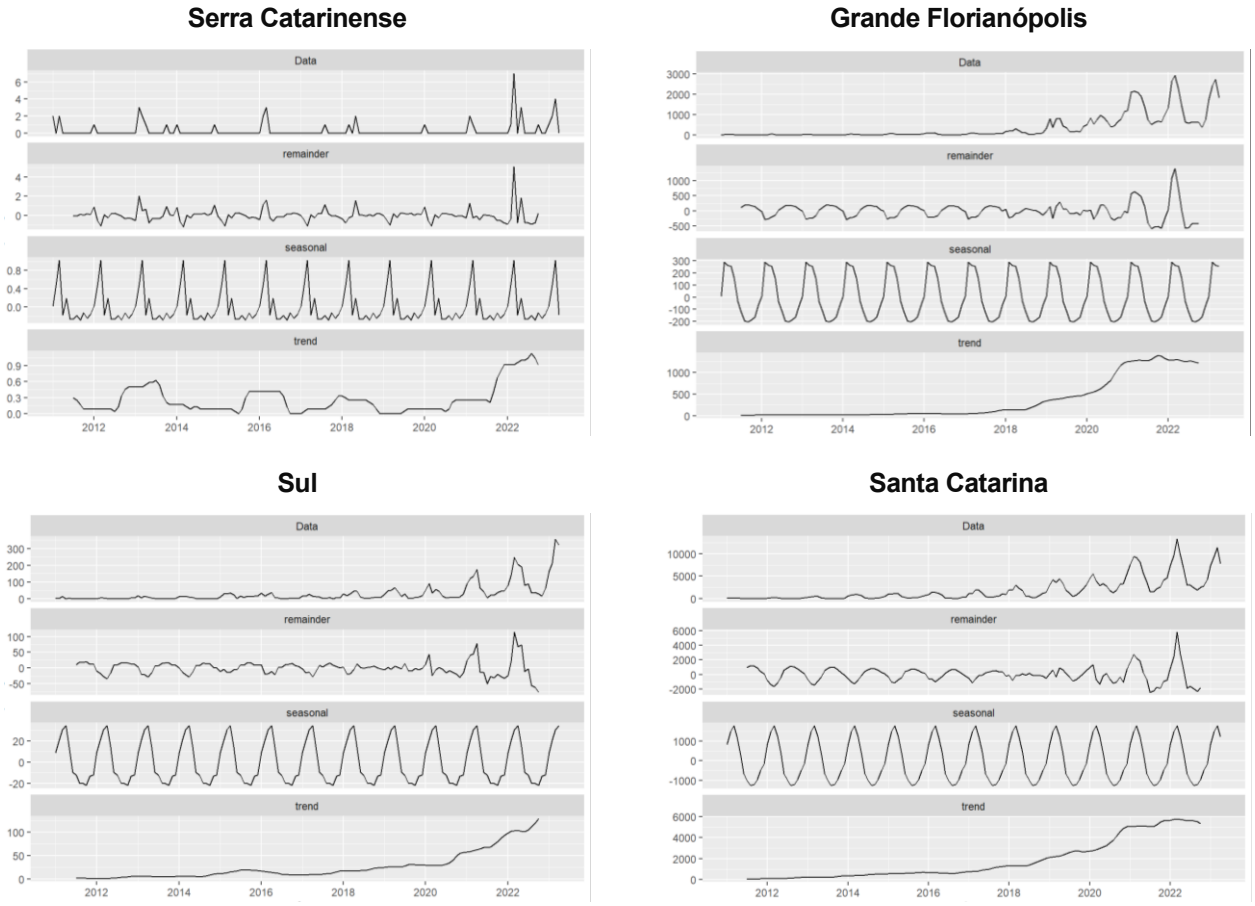


Vale do Itajaí



Foz do Rio Itajaí

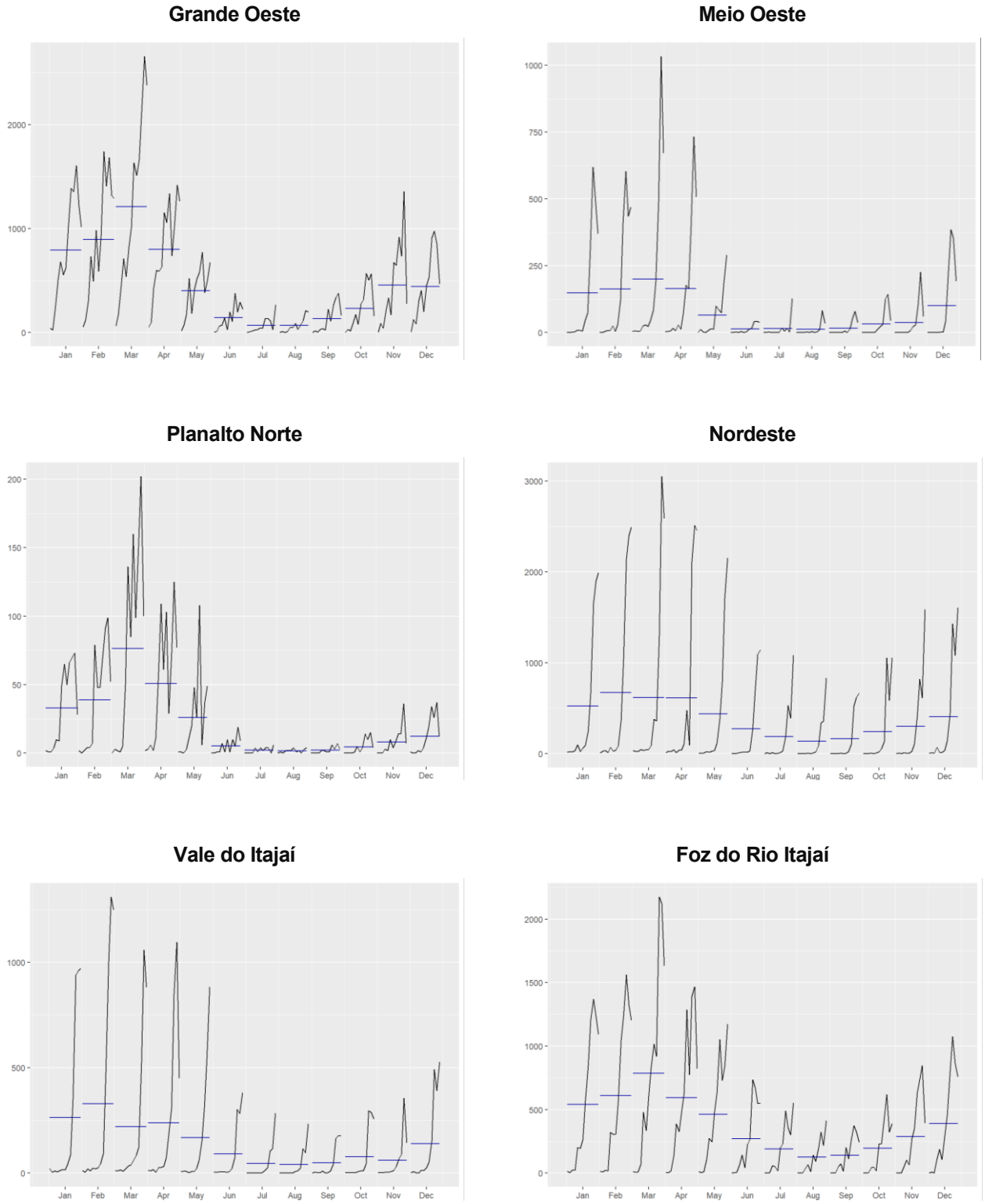


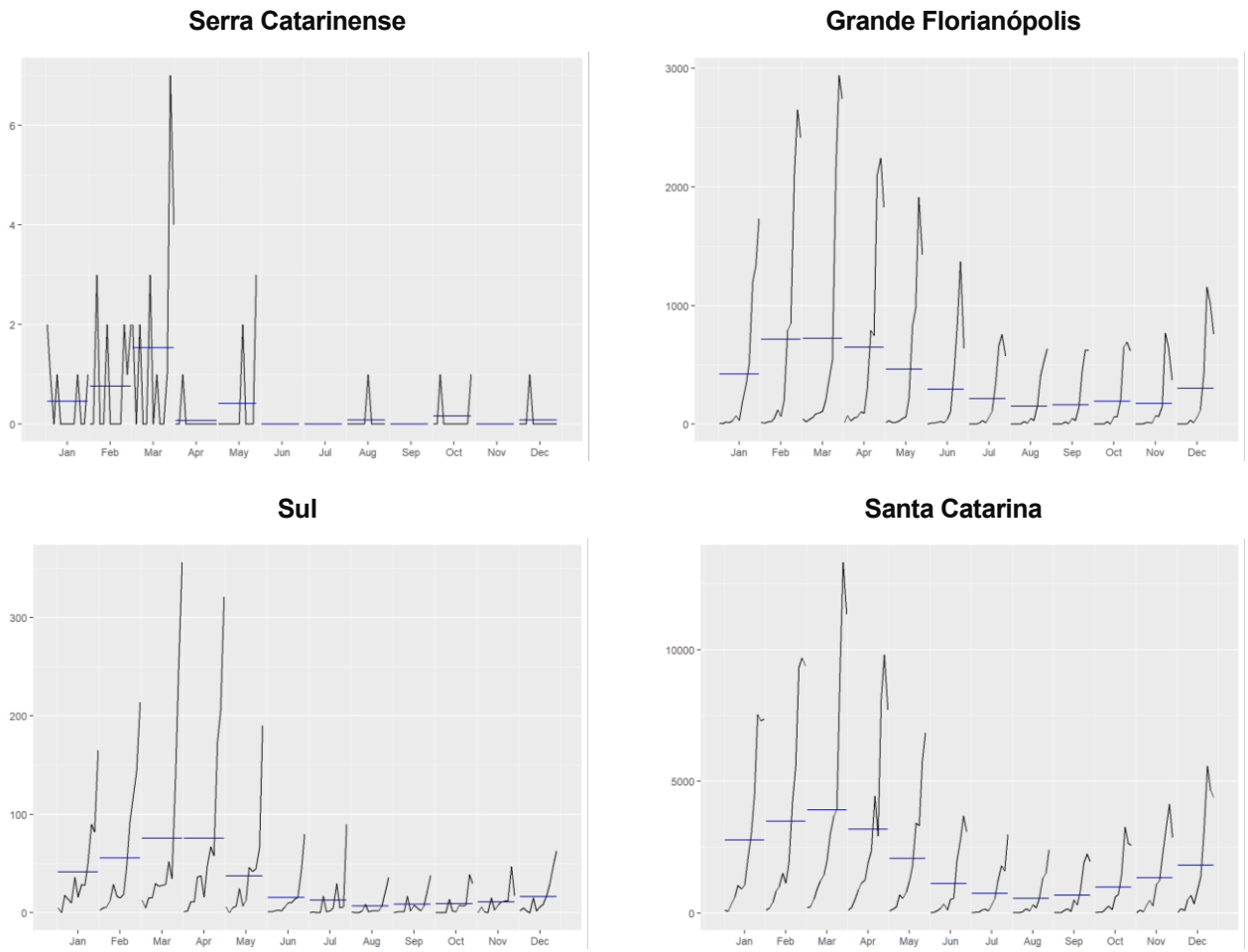


Source: Governo do Estado de Santa Catarina *et al.*, 2024. Prepared by the authors, 2025.

The seasonality analysis (Figure 3) indicated that, in general, the maximum number of *Ae. aegypti* outbreaks occurred in the month of March. However, in the Nordeste and Vale do Itajaí the outbreaks occurred in February. Also, in those same months, there was a greater range of outbreaks during the period under review. It is important to emphasize that the macro-regions of the Planalto Norte and Serra Catarinense, although they had the highest incidence of outbreaks in March, presented significantly lower numbers compared to the other macro-regions analyzed. It should also be noted that in the winter quarter, that is, during the months of June, July and August, the lowest number of outbreaks were observed in the historical series reviewed.

Figure 3 – Seasonality analysis of *Ae. aegypti* outbreaks by health macro-region in Santa Catarina from January 2011 to April 2023

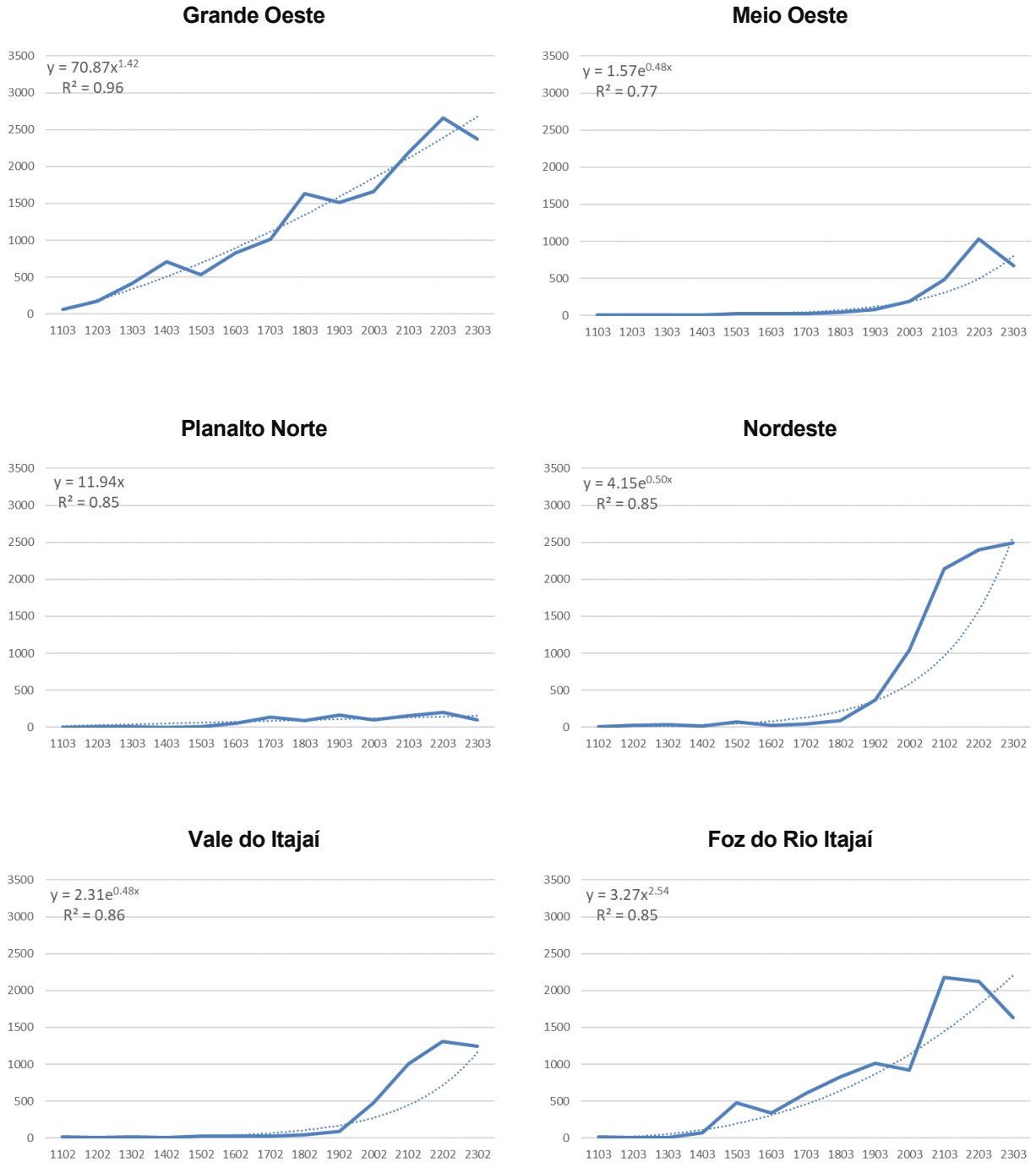


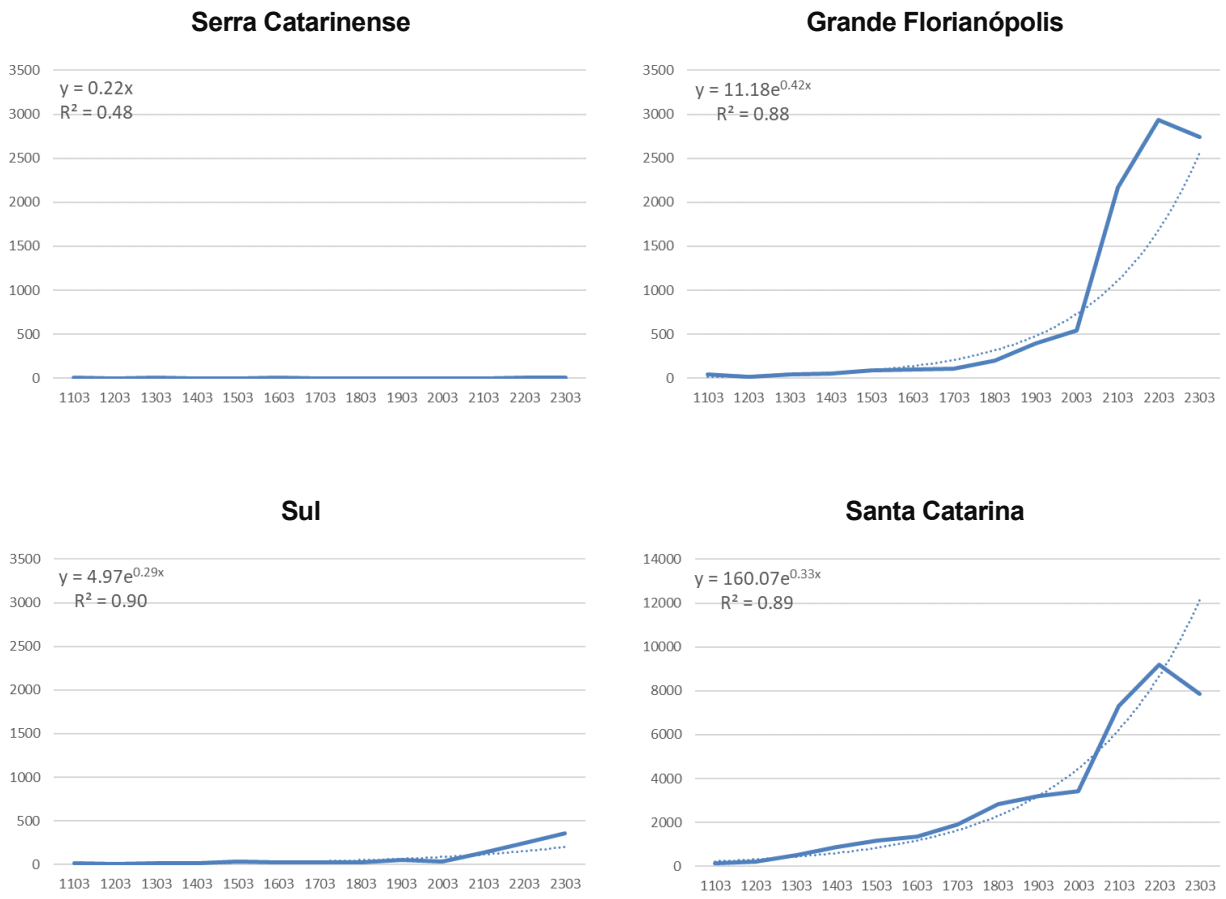


Source: Governo do Estado de Santa Catarina *et al.*, 2024. Prepared by the authors, 2025.

In the analysis of the outbreak growth models, it was possible to observe that the macro-regions of the Meio Oeste, Nordeste, Vale do Itajaí, Grande Florianópolis and Sul and in the State as a whole, adjusted to exponential models with high coefficients of determination (R2). The determination coefficients were R2= 0.77 in the Meio Oeste, R2= 0.85 in the Nordeste, R2= 0.86 in Vale do Itajaí, R2= 0.88 in Grande Florianópolis, R2= 0.90 in the Sul and R2= 0.89 in the State as a whole. The Grande Oeste (R2= 0.96) and Foz do Rio Itajaí (R2= 0.85) macro-regions showed the best fit for potential models. In turn, Planalto Norte (R2= 0.85) and Serra Catarinense (R2= 0.48) fitted linear models. In Figure 4, in addition to the regression charts, one can observe the fit models in each case.

Figure 4 – Analysis of *Ae. aegypti* outbreaks growth models by health macro-regions in Santa Catarina from January 2011 to April 2023





Source: Governo do Estado de Santa Catarina *et al.*, 2024. Prepared by the authors, 2025.

Based on the data of the months of maximum frequency of *Ae. aegypti* outbreaks, i.e., March and February, it was possible to determine the months with the number of cases greater than this limit as shown in Table 1. Thus, the results of the analysis of the time series indicated that the number of outbreaks observed in the regions indicated was above the upper limit of 95% of the established confidence interval. This means that the number of outbreaks was statistically greater than would be expected fortuitously, considering the natural variability of *Ae. aegypti* outbreaks records. Thus, all macro-regions were, at some time, in a situation of higher than expected number of outbreaks, considering the upper limits of the confidence intervals of the seasonal averages of each month. Due to the low number of notifications of outbreaks, the macro-regions of Serra Catarinense and Planalto Norte were excluded from this review. It could be observed that in 2018, the macro-region of the Grande Oeste presented an occurrence of outbreaks above the expected limit for the month of March. In 2019, the upper limits were observed in three macro-regions: Grande Oeste, Planalto Norte and Foz do Rio Itajaí, in addition to the State of Santa Catarina as a whole. As of 2020, occurrences of outbreaks above the expected limit were found in all macro-regions included in the review, in addition to the State as a whole (Table 1).

Table 1 – Data from the time series of *Ae. aegypti* outbreaks by health macro-regions and in the State of Santa Catarina from January 2011 to April 2023

Health Macro-region	Average	Standard Error	Maximum Value	Maximum Expected Value	Year/Month of Beyond Expectation
Grande Oeste	438.1	537.5	2,645	1,498	2018/March 2019/February and March 2020/February 2021/January 2022/March 2023/March
Meio Oeste	83.2	2.170,5	1,033	310	2020/February and December 2021/January to April and December 2022/January to April 2023/January to April
Nordeste	388.4	683.9	3,050	1,006	2020/February, October and December 2021/January to June and December 2022/January to July 2023/January to April
Vale do Itajaí	147.3	280.6	1,311	500	2021/January to May 2022/January to May and December 2023/January to March
Foz do Rio Itajaí	389.8	460.3	2,174	1,044	2019/February, April and May 2020/January, February and December 2021/January to April 2022/January to May 2023/January to March
Sul	31.6	57.2	356	112	2021/February to April 2022/February to May 2023/January to April
Grande Florianópolis	379.5	633.9	2,239	1,093	2020/December 2021/January to June 2022/January to May 2023/January to April
Planalto Norte	22.5	37.5	202	100	-
Serra Catarinense	0.3	0.9	7	2	-
Santa Catarina	1,925.7	2,633.9	13,313	4,112	2019/February and April 2020/January, February and December 2021/January to May, November and December 2022/January to May 2023/January to April

Source: Governo do Estado de Santa Catarina *et al.*, 2024. Prepared by the authors, 2025.

DISCUSSION

In Santa Catarina, until 2010, there were only records of imported dengue cases (Governo do Estado de Santa Catarina *et al.*, 2023). Considerable changes in the entomo-epidemiological scenario of the State

have been observed in recent years, especially in 2011, when the first autochthonous cases of the disease were detected (Governo do Estado de Santa Catarina *et al*., 2023). The first dengue outbreaks were reported in the West region and Vale do Itajaí in 2013. In addition, the first dengue epidemic was recorded in 2015 in the municipality of Itajaí, located in the macro-region of Foz do Itajaí, and in 2016 the disease spread to 27 municipalities, including cases in the West region, with the occurrence of the first fatal case (Governo do Estado de Santa Catarina *et al*., 2023). Such data corroborate the results of the present study, which showed a trend towards an increase in the number of *Ae. aegypti* outbreaks in the aforementioned regions and periods. In a recent study that assessed the *Ae. aegypti* house infestation index (HII) in southern Brazil, an increase in the number of municipalities infested by the vector was detected in the State of Santa Catarina, between the years 2017 - 2021. According to the study, the mesoregions that presented the highest HII average were the West of Santa Catarina (1.31) and Vale do Itajaí (0.61) (de Oliveira *et al*., 2023).

In 2022, a new change in the pattern of the epidemiological profile of Santa Catarina was evidenced, resulting from the dissemination of the vector, which caused many cases of dengue in several municipalities, including deaths (Governo do Estado de Santa Catarina *et al*., 2023). Therefore, the identification of the number of *Ae. aegypti* outbreaks that are statistically significant deviant highlights the need to implement more intense control and prevention measures in the municipalities of the regions, as well as the need for a deeper investigation of the reasons for such increases.

The control of vectors and arboviruses can be understood using data that address the concept of One Health (Leandro *et al*., 2021). As an interdisciplinary approach, it involves several areas related to global health, with the different interactions that may exist between human health, animal health and the environment, understood as a joint and non-fragmented work (Ryu *et al*., 2017). It is urgent to consider new multidisciplinary strategies for the control and prevention of arboviruses, requiring joint efforts by public, private, non-governmental sectors, the scientific community, and the population in general to control the *Ae. aegypti*'s vector.

Important points to be mentioned are those possibly related to the quantity and quality of field actions carried out by the municipalities, since the increase detected shows insufficiency, contributing to the worsening of the current situation. The possible deficit in the number of Agentes de Combate às Endemias (ACE, Endemic Diseases Combat Agents), who carry out surveillance and vector control activities, may be the cause of actions not being properly performed. The lack of Health Education actions, which results in a lack of awareness among the population regarding inspection, cleaning, and other care to prevent the proliferation of *Ae. aegypti* may also be contributing to the situation detected (Governo do Estado de Santa Catarina *et al*., 2022b).

Time series analyses show that *Ae. aegypti* outbreaks followed a seasonal pattern, causing a greater number of outbreaks in February and March, which correspond to the months with higher temperatures in Santa Catarina (Universidade Federal de Santa Catarina ; Centro Universitário de Estudos e Pesquisas sobre Desastres, 2013; Herrmann, 2006), while in the coldest months, June, July and August, there was a decline in the number of disease outbreaks. Similar seasonal models have been reported in other Brazilian states (Ferreira; Neto; Mondini, 2018; Xavier *et al*., 2017). This can be explained by the effect of the climatic conditions of these months on the life cycle of the insect. At low temperatures and food shortages, the 4th larval stage can last for a longer period before transforming into a pupa (Ministério da Saúde, 2001). Low temperatures can also alter *Ae. aegypti* flight capacity, which can be a limiting factor for copulation and, therefore, for fertilization (Simoy; Simoy; Canziani, 2015). In addition, other factors, in combination with temperature, can affect the rate of development of these vectors, such as the house conditions, food in breeding sites and rainfall intensity in some regions (de Oliveira *et al*., 2023).

CONCLUSIONS

The outcome of our study showed a trend towards an increase in the *Ae. aegypti* population in the State of Santa Catarina involving most of the health macro-regions, but with important differences in the year of onset, and the insect population growth speed. Seasonality analysis indicated that, in general, the maximum *Ae. aegypti* outbreaks occurred in the months of March and February, possibly associated with the climatic factors such as temperature and precipitation existing during that period.

The increase in the recording of autochthonous dengue cases in locations that were previously known to have climatic barriers that hindered the transmission of the arbovirus, as has been happening in the state of

Santa Catarina, is of concern. This fact may be associated with the increase and expansion of the vector distribution and infestation in the state.

In this connection, the results of this survey can contribute to the planning of control actions of this mosquito, targeting the most affected areas and in the months prior to the most critical periods besides providing understanding about the distribution of *Ae. aegypti* in the State of Santa Catarina.

ACKNOWLEDGMENTS

This study was financed in part by the Coordenação de Aperfeiçoamento de Pessoal de Nível Superior - Brasil (CAPES) - Finance Code 001, and from Anima Institute. In addition, Dr. Jefferson Traebert is a Research Productivity fellow - CNPq Call No. 09/2023 - CNPq/Brazil (311402/2023-2).

REFERENCES

ALMEIDA, J. P. P. et al. The virome of vector mosquitoes. **Current Opinion in Virology**, v. 49, p. 7-12, 2021 https://doi.org/10.1016/j.coviro.2021.04.002

BARCELLOS, C.; LOWE, R. Expansion of the dengue transmission area in Brazil: the role of climate and cities. **Tropical Medicine & International Health**, v. 19, n. 2, p. 159-168, 2014. https://doi.org/10.1111/tmi.12227

DE AZEVEDO, T. S.; LORENZ, C.; CHIARAVALLOTI-NETO, F. Spatiotemporal evolution of dengue outbreaks in Brazil. **Transactions of The Royal Society of Tropical Medicine and Hygiene**, v. 114, n. 8, p. 593-602, 2020. https://doi.org/10.1093/trstmh/traa030

DE OLIVEIRA, J. G. et al. Aedes aegypti in Southern Brazil: Spatiotemporal Distribution Dynamics and Association with Climate and Environmental Factors. **Tropical Medicine and Infectious Disease**, v. 8, n. 2, p. 77, 1 fev. 2023. https://doi.org/10.3390/tropicalmed8020077

FERREIRA, A. C.; NETO, F. C.; MONDINI, A. Dengue in Araraquara, state of São Paulo: epidemiology, climate and Aedes aegypti infestation. **Revista de Saúde Pública**, v. 52, 2018. https://doi.org/10.11606/S1518-8787.2018052000414

GOVERNO DO ESTADO DE SANTA CATARINA et al. **Dengue**. Available at: https://dive.sc.gov.br/index.php/dengue. Accessed on: Apr.15, 2024.

GOVERNO DO ESTADO DE SANTA CATARINA. **Geografia de Santa Catarina: SC é o menor Estado em território do Sul do país**. Available at: https://estado.sc.gov.br/conheca-sc/geografia/. Accessed on: Apr.15, 2024.

GOVERNO DO ESTADO DE SANTA CATARINA et al. **Estratégia operacional para a prevenção e controle da dengue, chikungunya e Zika no estado de Santa Catarina**. Florianópolis, dez. 2022b.

GOVERNO DO ESTADO DE SANTA CATARINA et al. **Informe epidemiológico n°31/2022 vigilância entomológica do Aedes aegypti e situação epidemiológica de dengue, chikungunya e zika em Santa Catarina**. 2022, 2022.a

GOVERNO DO ESTADO DE SANTA CATARINA et al. **Plano de contingência para o enfrentamento da dengue, chikungunya e zika no estado de Santa Catarina**. Florianópolis, 2023.

GUZMÁN, C. et al. Ecoepidemiology of Alphaviruses and Flaviviruses. Em: Emerging and Reemerging Viral Pathogens: Volume 1: Fundamental and Basic Virology Aspects of Human, Animal and Plant Pathogens. **Elsevier**, 2020. p. 101-125. https://doi.org/10.1016/B978-0-12-819400-3.00006-5

HERRMANN, M. L. DE P. **Atlas de Desastres Naturais do Estado de Santa Catarina**. 1. ed. Florianópolis: IOESC, 2006.

INSTITUTO BRASILEIRO DE GEOGRAFIA E ESTATÍSTICA - IBGE. Brasil | Cidades e Estados | IBGE. Available at: https://cidades.ibge.gov.br/. Accessed on: Aug.9, 2023.

LARSON, R.; FARBER, E. **Estatística aplicada**. 6. ed. São Paulo: Pearson Prentice Hall, 2016.

LEANDRO, A. DE S. et al. The adoption of the One Health approach to improve surveillance of venomous animal injury, vector-borne and zoonotic diseases in Foz do Iguaçu, Brazil. **PLoS Neglected Tropical Diseases**, v. 15, n. 2, 2021.https://doi.org/10.1371/journal.pntd.0009109

MINISTÉRIO DA SAÚDE. **Dengue, Instruções para Pessoal de Combate ao Vetor, Manual de Normas Técnicas**, 2001.

MINISTÉRIO DA SAÚDE. Monitoramento dos casos de arboviroses até a semana epidemiológica 51 de 2022. **Secretaria de Vigilância em Saúde/ Ministério da Saúde Brasília**, 30 dez. 2022.

MORETTIN, P.; TOLOI, C. **Análise de séries temporais**. 3. ed. São Paulo: Blucher, 2018. v. 1

PAN AMERICAN HEALTH ORGANIZATION. PLISA Health Information Platform for the Americas, Core Indicators Portal. Available at: https://www3.paho.org/data/index.php/en/mnu-topics/indicadores-dengue-en/dengue-nacional-en/252-dengue-pais-ano-en.html. Accessed on: Aug.14, 2023.

RYU, S. et al. One Health Perspectives on Emerging Public Health Threats. **Journal of Preventive Medicine and Public Health**, v. 50, n. 6, p. 411-414, 2017. https://doi.org/10.3961/jpmph.17.097

SIMOY, M. I.; SIMOY, M. V.; CANZIANI, G. A. The effect of temperature on the population dynamics of Aedes aegypti. **Ecological Modelling**, v. 314, p. 100-110, 2015. https://doi.org/10.1016/j.ecolmodel.2015.07.007

UNIVERSIDADE FEDERAL DE SANTA CATARINA; CENTRO UNIVERSITÁRIO DE ESTUDOS E PESQUISAS SOBRE DESASTRES. Atlas brasileiro de desastres naturais 1991 a 2012. 2. ed. Florianópolis: UFSC, 2013.

WALPOLE, E. et al. **Probability e Statistics for Enginners e Scientists**. 9. ed. United States of America.: Prentice Hall, 2016.

WORLD HEALTH ORGANIZATION. Ten threats to global health in 2019. Available at: https://www.who.int/news-room/spotlight/ten-threats-to-global-health-in-2019. Accessed on: Aug.14, 2023.

XAVIER, D. R. et al. Spatial-temporal diffusion of dengue in the municipality of Rio de Janeiro, Brazil, 2000-2013. **Caderno de Saúde Pública**, 2017. https://doi.org/10.1590/0102-311X00186615