SPATIAL DISTRIBUTION OF NOISE FROM RELIGIOUS HOUSES IN RUMU-OKWACHI COMMUNITY, RIVERS STATE, NIGERIA.

Abstract

Noise from 12 religious structures was mapped in Rumu-Okwachi community. Religious noise in residential settings is a growing concern. Noise levels for daytime religious activity were monitored before, during, and after religious sessions at 15 sample sites defined by superimposing 150-by-150-meter gridlines. The findings showed that during religious activities, the highest equivalent noise level (L_{eq}) was 75.5 (dBA) at sampling point 13, whereas during religious non-activities, it was 63.3 (dBA) at point 7. A two-way analysis of variance (ANOVA) showed $p<0.05$ that the average daily noise level differed across sample sites. The highest peak noise level (L_{10}), intermediate noise level (L_{50}), and background noise level (L_{90}) were recorded on Sunday during religious events. The geographical distribution of L_{eq} values at all sample sites verified the noise map's prediction of higher L_{eq} values during religious occasions, with Sunday having the highest L_{eq} values of 69.2054 to 75.544. (dBA). The noise indices were compared to the WHO's recommended noise exposure limit, which showed that during religious events, the L_{eq} values were higher than the WHO's recommended noise standard, with the maximum noise pollution level (NPL) being 96.17 (dBA). This suggests that residents of this neighborhood may experience bothersome noise levels.

Keywords: Religious houses, Equivalent noise level, Noise, Permissible limit.

1 INTRODUCTION

Due to its potential to be detrimental to human health, communication, and social pleasure, noise exposure is widely considered as a severe environmental public health concern. Noise is any loud, unpleasant, or unexpected sound that is not sought (Mangalekar et al., 2012). Hence, pollution is defined as overly loud, uncontrolled noise that has a negative impact on the environment, public health, and welfare (Ijaiya, 2014). After air and water pollution, noise pollution is ranked by the World Health Organization as the third most dangerous kind of pollution in big cities (Khilman, 2004). According to its source and distribution characteristics, noise pollution is different from other types of pollution (Hunashal and Patil, 2012). Human activity, particularly urbanization, an increase in traffic, and industry, all cause noise. As a result, urban populations are far more affected by noise pollution than rural ones, while it also has an effect on small towns and villages that are near to highways or factories.

As a consequence of growing human population and activities like transportation, urbanization, and industry, noise levels have significantly grown throughout time (Hunashal and Patil, 2012). Despite the fact that noise pollution kills slowly and covertly, nothing has been done to address the issue. Hearing loss, high blood pressure, irregular heartbeats, insomnia, interrupted sleep, annoyance, and stress are a few effects of noise on human health and comfort that depend on its duration and volume. Examples of indirect effects on work performance include decreased productivity and erroneously interpreting what is heard (Oyedepo, 2013; Olaosun, et. al., 2009). The region is rather noisy, especially the noise coming from the places of worship. Any noise pollution that occurs from religious rites or activities is referred to as religious noise. Examples include playing music or singing during religious services, ringing bells or other noisemakers, or utilizing loudspeakers to broadcast sermons or prayers. Those who live or work near to places of worship may find this sort of noise distressing, particularly if it is excessive or happens at unsuitable times.

Nigeria has the most churches per person in the whole globe and provides a favorable environment for the development of autonomous churches (Adesanya, 2011). With little to no attempt made to lessen the excessive noise produced by their activities, religious centers continue to proliferate in practically all Nigerian cities, popping up in every nook and crevice of residential zones. Religious noise may take many different forms, and the amount of disturbance it produces can vary greatly based on a number of variables, including as the loudness, frequency, and length of the noise as well as the time of day or night when it happens. It happens sometimes that the noise is only present at certain periods of the day, as at formal occasions or religious ceremonies. The sounds may sometimes become worse if loud religious music or recorded prayers are being played. Religious noise is a problematic subject because it may be difficult to strike a compromise between people's rights to exercise their faith and their rights to live in peace (Ijaiya, 2014). For instance, although some individuals could see loudspeakers being used during religious services as a necessary part of their religious practice, others would view them as an annoyance that infringes on their right to peace and quiet. There are several areas where religious sound management is restricted by rules and regulations, including limitations on the hours of the day or loud levels. Some places, however, could not be subject to any particular rules or enforcement. The fact that individuals often may not be aware of the noise pollution they are causing and may not be able to comprehend how it affects or irritates their neighbors is another problem. People could therefore become resistant to working together to find a solution since they are uninformed of the issue. This study's objective is to map the spatial distribution of religious noise at a few key areas inside the Rumu-okwachi community in Rivers State, Nigeria. The noise map would provide illuminating details on ambient noise levels in different places and throw light on the influence of religious activities on service hours and after-service hours noise pollution levels in the area. The research would provide an in-depth knowledge of the noise generated by religious structures. The noise map would direct the government and pertinent organizations in properly regulating religious houses of worship activities for the benefit of the general populace.

2 MATERIALS AND METHODS

2.1 Study Area

The study area was Rumu-Okwachi community, located in Port Harcourt City local Government Area, Rivers State at approximately 4°52'35.5"N and 6°55'15.1"E. It is bordered in the North by

Ikwerre and Etche Local Government Areas, in the West by Emuoha Local Government Area, in the East by Omuma Local Government Area and Abia State. The map of the study area is shown in Figure 1.

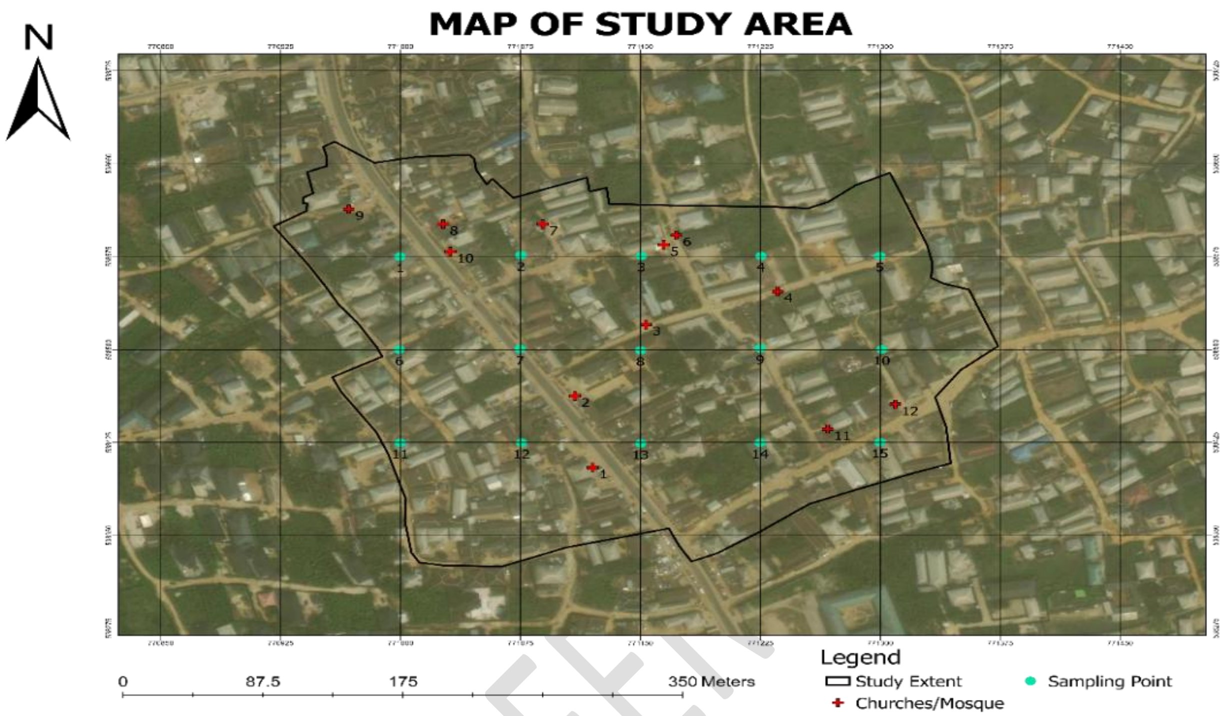

Figure 1: Study Area indicating Sampling Points and Religious Houses

2.2 Selection of Religious Houses

The churches and mosque in the area were first identified based on a purposive sampling technique and all their coordinates obtained using a GPS device (Garmin etrex20 GPS). A total of 11 churches and one mosque was selected for the study. The religious houses selected were those with permanent physical structures. This was done to ensure that during the course of this project they don't move away from their current location. The coordinates of sampling points was obtained using 150 m by 150 m gridlines on ARCGIS that was superimposed on the study area. The intersections became the sampling points. This is shown in Table 1.

Table 1: Coordinates of Sample Points and Religious Houses in Study Area

Points	Coordinates of sampling points		S/N	Coordinates of Religious Houses	
	Latitude	Longitude		Longitude(X)	Latitude(Y)
1	4.864775	6.926009	1	6.92709	4.86324
2	4.864784	6.926686	2	6.92699	4.86376
3	4.864779	6.927363	3	6.92739	4.86428
4	4.864779	6.928036	4	6.92813	4.86452

5	4.864779	6.928704	5	6.92749	4.86486
6	4.864097	6.926004	6	6.92756	4.86493
7	4.864102	6.926681	7	6.92681	4.86501
8	4.864093	6.927359	8	6.92625	4.86501
9	4.864107	6.928031	9	6.92629	4.86481
10	4.8641	6.928714	10	6.92572	4.86512
11	4.86342	6.926009	11	6.92841	4.86352
12	4.86342	6.926691	12	6.92879	4.86370
13	4.863415	6.927359			
14	4.86342	6.928031			
15	4.863425	6.928704			

2.3 Device used and Sampling Method

The defined coordinates were utilized to measure noise level using a digital sound level meter (SL-5868P). The noise level meter has an accuracy of ±1.5dB and a measurement range of 30–130dBA or 35–130dBC. It was built in accordance with IEC651 TYPE 2 and ANSI s1.4 TYPE 2 for sound meters. It includes time weighing for fast and slow as well as frequency weighting for A and C. At the various sample points, the noise level was measured at intervals of five minutes for each hour of the research. During the course of two weeks, measurements were taken both during and after religious and secular activities. The days of religious activity that were counted were Wednesday, Friday, and Sunday, and the hours of worship were from 8 am to 6 pm. Each location's noise levels were tested and noted. The measuring tool (sound level meter) was held 1.5 meters above the ground and placed at arm's length to prevent any interference from the surroundings in order to achieve precise and trustworthy findings. A windshield was also used to lessen the effect of wind on the data, and the meter response was calibrated to precisely record variations in the noise levels over time.

2.4 Analysis of Data

Microsoft Excel was used to compute and analyze the data collected from the noise measurements for efficient and consistent computation of the various noise indices, as well as the creation of meaningful and informative visual representations of the data. The relevant noise indices calculated include equivalent sound level (L_{eq}) shown as Equation (1), noise statistics (L_n) shown as Equation (2) and Noise Pollution Level (NPL) shown as Equation (3). Equivalent sound level (L_{eq}) quantifies the noise environment to a single value of sound level for any desired duration. It is the constant noise level over a given time period that produces the same amount of A-weighted energy as a fluctuating level over the same time frame (Sincero and Sincero, 2006). It is designed to represent a varying sound source over a given time as a single number. However, L_{eq} does not convey any measure of noise variation and this variation is an important factor when considering response to noise. To makeup these lapses, percentile levels (L_n) are determined. Percentile levels in noise (L_n) are a statistical measure that indicates how frequently sound level is exceeded or equaled. It can be described as noise level exceeded for N% of a stated time period (T). It reveals maximum and minimum noise levels. Most commonly used statistical percentile measures are L_{10}, L_{50} and L_{90}, indicating the level exceeded by 10, 50 and 90% of the time respectively. Thus, L_{10} is the level exceeded for 10% of the time and as such can be regarded as the peak noise level. L_{90} is the level exceeded for 90% of the time and as such can be regarded background noise. L_{50} is the level exceeded for 50% of the time and it is used to describe intermediate noise. Furthermore, noise pollution level (NPL) is used to adequately describe the degree of annoyance caused by noise. Equation (4) describes the noise climate (NC) which is the range over which the sound levels are fluctuating at a time interval.

$$L_{eq} = 10\log_{10}\left[\frac{1}{T}\sum_{i=t}^{i=n} 10^{\frac{L}{10}} t\right] \quad (1)$$

Where T is total sampling time, L is recorded noise level in decibels, t is fraction of total sample time and n is the number of samples

$$\text{Percentile} = \frac{2m-1}{2n}\ x\ 100 \quad (2)$$

Where m is the rank number and n is the number of samples.

$$NPL = L_{50} + L_{10} - L_{90} + \frac{(L10 - L90)\,\mathbf{2}}{60} \quad (3)$$

Where L_{10}, L_{50} and L_{90} are noise levels equaled or exceeded, 10 %, 50 % and 90 % of the time respectively.

$$NC = L_{10} - L_{90} \quad (4)$$

2.4.1 Geostatistics Analysis

A type of statistics known as "geo statistics" is used to examine and forecast the values connected to geographical or spatiotemporal occurrences. When determining whether a pollution level threatens human health or the environment and necessitates cleanup, environmental scientists utilize it. For geographical and spatiotemporal analysis, inverse distance weighing (IDW) was used. IDW is an interpolation technique that calculates cell values by averaging sample data points near each processing cell. A point's effect or weight on the average calculation increases with distance from the estimated cell's center. This approach makes the assumption that the effect of the variable being mapped diminishes with distance from the sample site.

2.4.2 Analysis of Variance (ANOVA)

To determine if there is a significant difference between the sample days and the sampling locations, a two-way analysis of variance (ANOVA) was employed to compare the various sampling points. ANOVA is used in inferential statistics to identify the noteworthy differences in noise levels across residential areas.

3 RESULTS

3.1 Equivalent Noise Level (L_{eq})

The results of equivalent noise level (L_{eq}) calculated using the measured noise level for the various days at the given period of time for religious non-activity period (non-service) and religious activity period (service time) are shown in Table 2.

Table 2: L_{eq} for Non-Service Time and Service Time

	Non-Service Time				Service Time			
Points	**L_{eq} Wed**	**L_{eq} Fri**	**L_{eq} Sun**	**Ave L_{eq}**	**L_{eq} Wed**	**L_{eq} Fri**	**L_{eq} Sun**	**Ave L_{eq}**
1	58.0	57.2	57.1	57.5	66.3	68.7	70.1	68.6
2	43.9	41.0	40.8	42.1	51.7	53.5	65.5	61.1
3	41.4	37.5	33.5	38.6	70.1	69.9	73.4	71.4
4	38.0	33.9	33.7	35.7	60.9	60.8	66.8	63.8
5	36.6	38.5	38.3	37.9	41.3	46.4	52.9	49.2
6	50.7	51.5	55.9	53.3	51.6	52.2	56.9	54.2
7	63.3	61.6	61.4	62.2	66.5	64.3	68.6	66.8
8	43.2	42.2	44.8	43.6	60.4	58.7	63.6	61.4
9	48.8	48.6	48.8	48.7	52.1	52.2	54.9	53.3
10	39.1	38.1	38.9	38.7	59.0	57.1	64.4	61.3
11	35.2	37.1	33.9	35.6	39.5	42.2	41.4	41.2
12	45.9	46.0	44.5	45.5	59.6	57.6	64.1	61.3
13	58.7	59.2	62.5	60.5	72.6	74.3	75.5	74.3
14	52.5	50.8	51.0	51.5	65.2	64.9	63.2	64.5
15	49.0	49.3	49.5	49.3	68.7	71.1	70.5	70.2

The results of the L_{eq} presented in Table 2 ranged from 33.5 – 63.3 (dBA) with an average L_{eq} value of 54.2 (dBA) during non-service time while the L_{eq} during the service time ranged (39.5 – 75.5dBA) with an average L_{eq} value of 72.95 (dBA). A maximum L_{eq} value of 63.3 (dBA) was recorded at point 7 during religious non-activities time. This could be due to fact that point 7 fell close a road where there is light vehicular traffic. A maximum L_{eq} value of 75.5 (dBA) was recorded during religious activities time at point 13. This could also have been worsened because this point fell close to road where there was vehicular traffic. Points 1, 3 and 15 which were close to religious buildings and free from vehicular traffic recorded sound levels above 70 (dBA) on a Sunday. A similar high noise level of 84.30 dBA was observed from religious centres as reported by Nwankwo et. al (2016). On the average, points 3 and 15 had sound levels exceeding 70 dBA. During service time, point 11 which was the farthest away from any religious center recorded the lowest sound level of 41.4 dBA on a Sunday.

3.2 Two-Way Analysis of Variance (ANOVA)

A two-way analysis of variance was done to determine if there is any significant difference in the L_{eq} values between the days of sampling and the sampling locations. Results of the ANOVA analysis are shown as Table 3.

Table 3: Two-way ANOVA for different Days of Sampling and Sampling Locations

ANOVA						
Source of Variation	*SS*	*df*	*MS*	*F*	*P-value*	*F crit*
Sample locations	5220.095	14	372.8639	13.27546	1.4E-14	1.835683
Sample days	4720.975	5	944.1949	33.61715	2.45E-17	2.345586
Error	1966.069	70	28.0867			
Total	11907.14	89				

For comparison between the sampling locations, the F_{cal} value (13.27546) in Table 3 is greater than F_{crit} value (1.835683). This implies that there is significant variation between the average daily noise level measured on different days. Comparing the sampling days, the F_{cal} value (33.61715) is greater than F_{crit} (2.345586). This implies that there is significant variation between the average daily noise level measured among selected points. This result is expected because on service days, not all locations are close to religious buildings and so they experience lesser religious noise. Also not all religious buildings have activities on the same days. So depending on the religious building and day, a receptor may experience varying noise levels.

3.3 Probability of Exceedence (L_n)

The probability of exceedance (L_n) for each day for religious activity time and religious non-activity time were determined. To obtain the statistical measure "L_n" for each day, the L_{eq} for each point was ranked from largest to smallest and given rank numbers from 1 to 15. The probability of exceedance was obtained using Hazen William's method and the percentile was plotted against the ranked noise levels. The results of the calculated percentiles are shown in Tables 4 and 5 while the probability curves are presented in Figures 2 and 3.

Table 4: Probability of Exceedence during Religious Activity Time (Service Time)

Rank	Wednesday		Friday		Sunday	
	Noise Level (dB)	$P = \frac{2m-1}{2n} \times 100$	Noise Level (dB)	$P = \frac{2m-1}{2n} \times 100$	Noise Level (dB)	$P = \frac{2m-1}{2n} \times 100$
1	72.6	3.33	74.3	3.33	75.5	3.33
2	70.1	10.00	71.1	10.00	73.4	10.00
3	68.7	16.67	69.9	16.67	70.5	16.67
4	66.5	23.33	68.7	23.33	70.1	23.33
5	66.3	30.00	64.9	30.00	68.6	30.00
6	65.2	36.67	64.3	36.67	66.8	36.67
7	60.9	43.33	60.8	43.33	65.5	43.33
8	60.4	50.00	58.7	50.00	64.4	50.00
9	59.6	56.67	57.6	56.67	64.1	56.67
10	59.0	63.33	57.1	63.33	63.6	63.33
11	52.1	70.00	53.5	70.00	63.2	70.00
12	51.7	76.67	52.2	76.67	56.9	76.67
13	51.6	83.33	52.2	83.33	54.9	83.33
14	41.3	90.00	46.4	90.00	52.9	90.00
15	39.5	96.67	42.2	96.67	41.4	96.67

Table 5: Probability of Exceedence during Non-Religious Activity Time (Non-Service Time)

Rank	Wednesday		Friday		Sunday	
	Noise Level (dB)	$P = \frac{2m-1}{2n} \times 100$	Noise Level (dB)	$P = \frac{2m-1}{2n} \times 100$	Noise Level (dB)	$P = \frac{2m-1}{2n} \times 100$
1	63.3	3.33	61.6	3.33	62.5	3.33
2	58.7	10.00	59.2	10.00	61.4	10.00
3	58.0	16.67	57.2	16.67	57.1	16.67
4	52.5	23.33	51.5	23.33	55.9	23.33
5	50.7	30.00	50.8	30.00	51.0	30.00
6	49.0	36.67	49.3	36.67	49.5	36.67
7	48.8	43.33	48.6	43.33	48.8	43.33
8	45.9	50.00	46.0	50.00	44.8	50.00
9	43.9	56.67	42.2	56.67	44.5	56.67
10	43.2	63.33	41.0	63.33	40.8	63.33
11	41.4	70.00	38.5	70.00	38.9	70.00
12	39.1	76.67	38.1	76.67	38.3	76.67
13	38.0	83.33	37.5	83.33	33.9	83.33
14	36.6	90.00	37.1	90.00	33.7	90.00
15	35.2	96.67	33.9	96.67	33.5	96.67

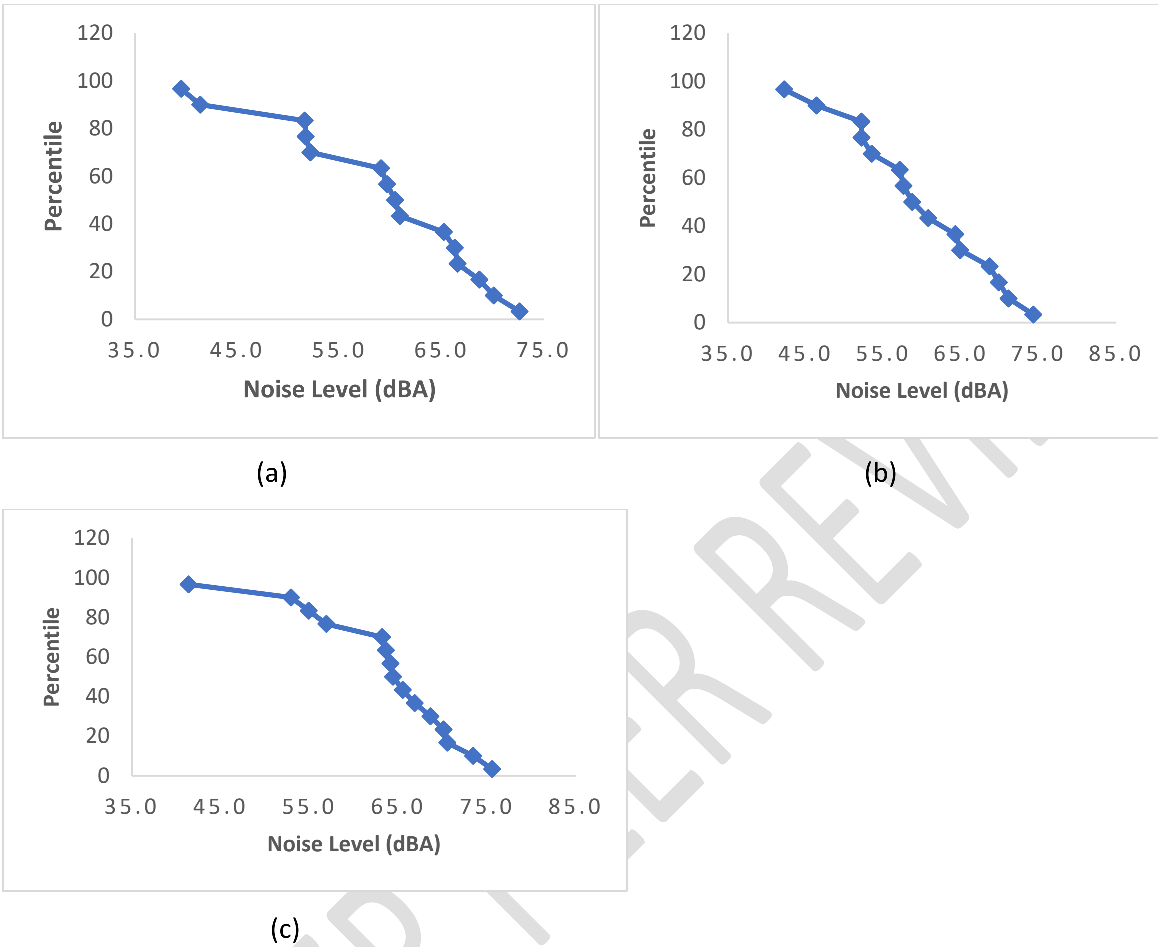

Figure 2: Probability Curve during religious activity time for (a) Wednesday (b) Friday (c) Sunday

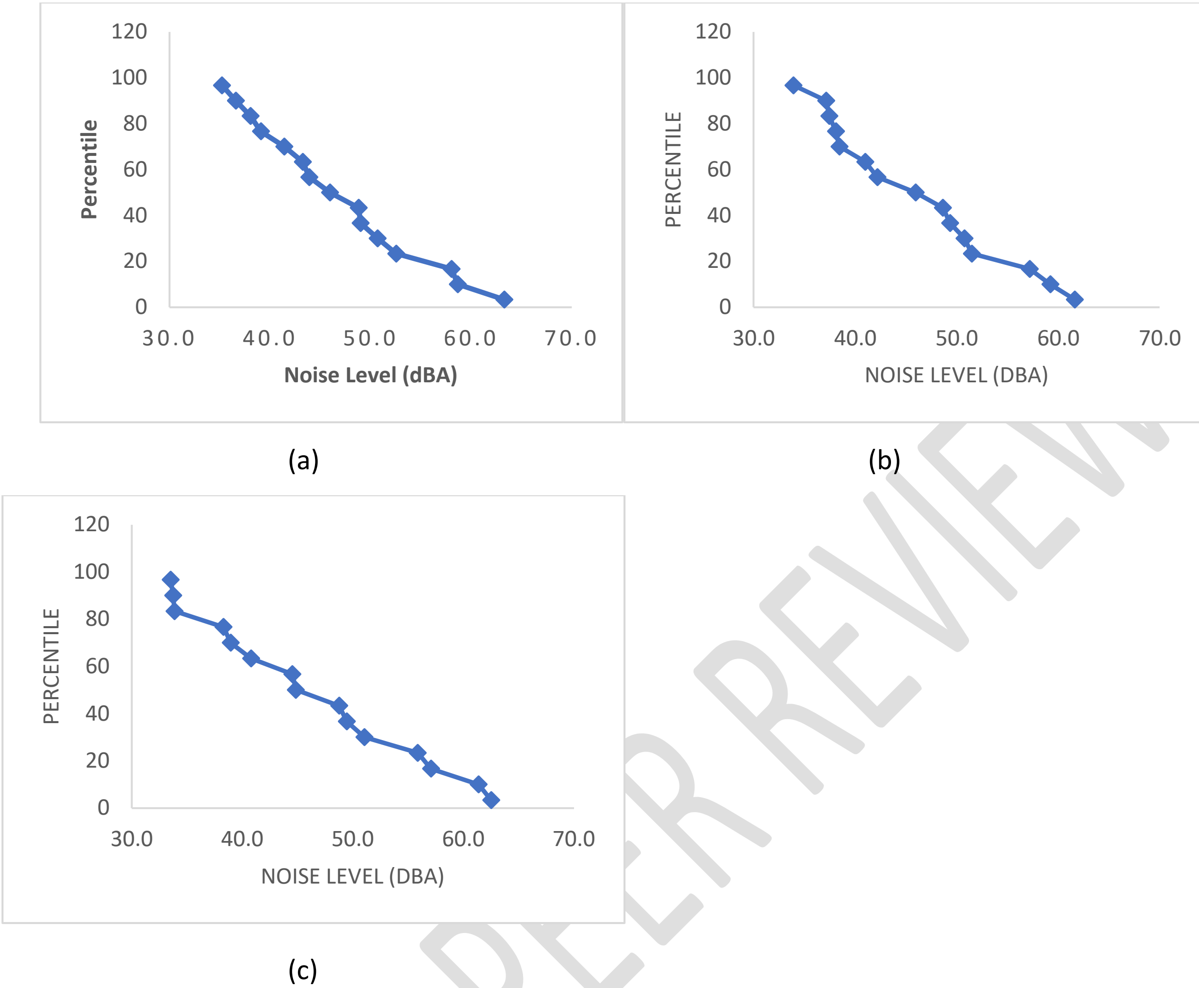

Figure 3: Probability curve during non-activity time for (a) Wednesday (b) Friday (c) Sunday

A summary of the noise indices calculated for the religious activities time and religious non-activities time in the study area is presented in Table 6.

Table 6: Summary of Noise Indices for Religious Activities Time and Non-Religious Activities Time

Noise Index	During Service Time			During Non-Service Time		
	Wed	Fri	Sun	Wed	Fri	Sun
L_{10}	72.00	72.01	74.53	58.26	57.72	59.45
L_{50}	59.03	59.60	63.44	46.96	46.17	46.31
L_{90}	46.06	47.18	52.35	35.66	34.62	33.17
NPL	96.17	94.71	93.80	78.07	78.16	84.10
NC	25.93	24.83	22.17	22.60	23.10	26.28

The peak noise level (L_{10}) presented in Table 6 ranged from 57.72 – 59.45 dBA during non-activity time and 72.0 - 74.5 dBA during activity time. The maximum L_{10} value 74.5 dBA was recorded on Sunday during service time. This means that for 10 % of the measurement time, the receptors were exposed to noise levels that equaled and exceeded 74.5 dBA. Noise levels above 60 dBA have been known to cause speech interference and above 70 dBA, it becomes annoying. The intermediate noise level (L_{50}) as presented in Table 6 ranged from 46.2 - 47.0 dBA during non-activity time and 59.0 - 63.4 dBA during activity time. The maximum L_{50} value 63.4 dBA was recorded on Sunday during service time. The background noise level (L_{90}) presented in Table 6 ranged from 33.2 - 35.7 dBA during non-service time and 46.1 - 52.4 dBA during service time. The maximum L_{90} value 52.4 dBA was recorded on Sunday during service time. NPL noise value ranged between 78.1 - 84.1 dBA during non-service time and 93.8 - 96.17 dBA) during service time. The maximum NPL value 96.17 dBA was recorded on Wednesday during service time.

3.4.1 Spatial Interpolation Map

Spatial interpolation was done using Inverse Distance Weighting (IDW). The L_{eq} values from the different sampling points were plotted in the ARCGIS to establish temporal and spatial variation. The l_{eq} values were represented by six (6) colour classes, with the blue indicating region with lowest noise level and the red region the highest noise level. These are shown as Figures 4 to 6.

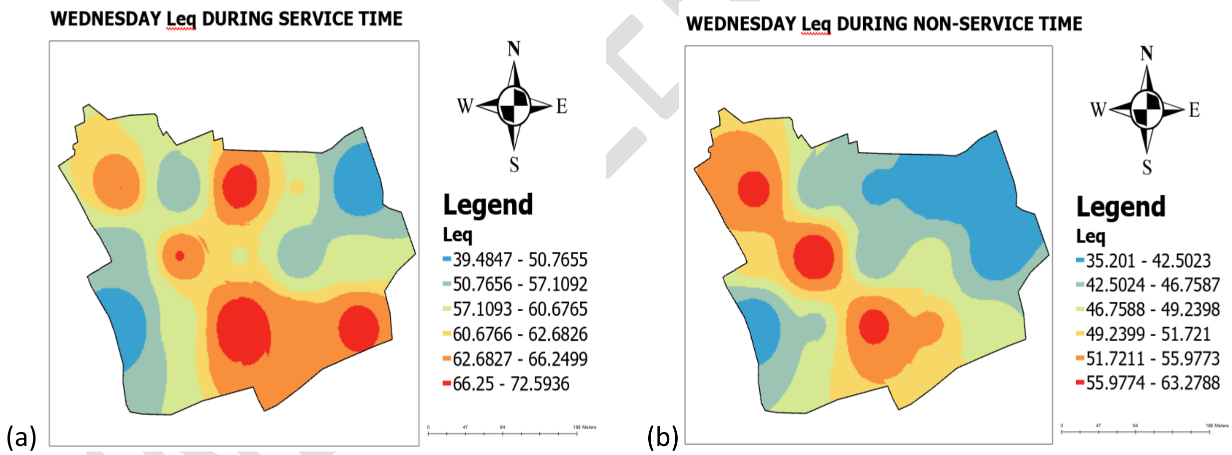

Figure 4: Noise Interpolation Map for Wednesday L_{eq} during (a) activity time and (b) Non-activity Time.

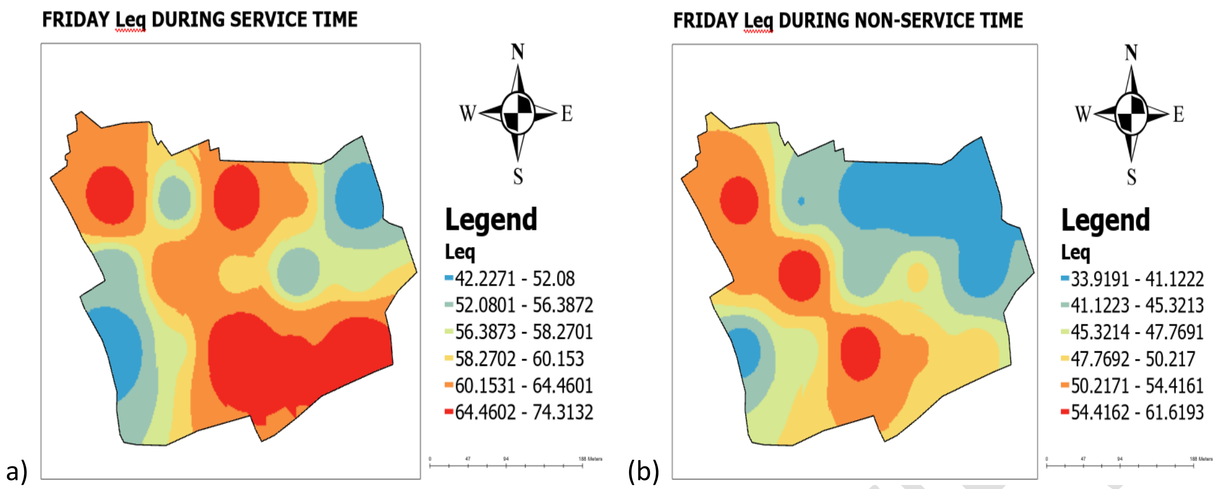

Figure 5: Noise Interpolation Map for Friday L_{eq} during (a) activity time and (b) Non-activity time.

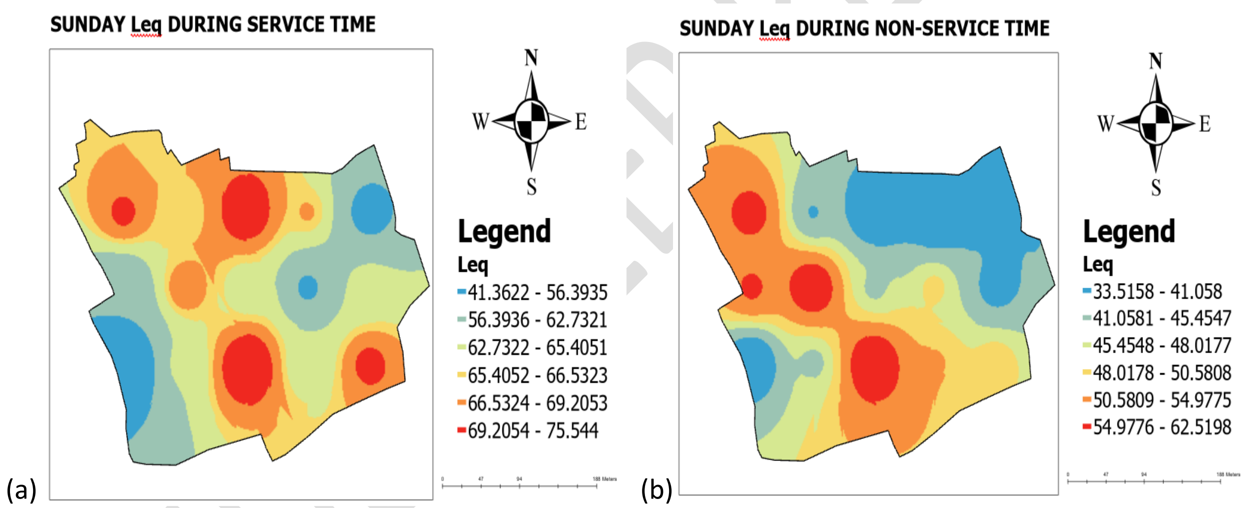

Figure 6: Noise Interpolation Map for Sunday L_{eq} during (a) activity time and (b) Non-activity Time

From the noise map shown in Figure 4, it could be seen that the religious activities time in some sampling points on Wednesday recorded very high L_{eq} values ranging from 66.25 dBA to 72.6 dBA as indicated by red region. This noise level is above World Health Organization 55 dBA recommended noise exposure limit for day time in residential area (WHO, 2010). It is also above the maximum permissible noise level 60 dBA for day time at area of worship, entertainment or public announcement system set up by National Environmental (Noise standard and control) Regulations 2009. However, the L_{eq} values which ranged 55.98 – 63.28 dBA in some sampling points as indicated by red region were slightly above exposure limits and maximum permissible noise level during religious non-activities time.

Figures 5 and 6 revealed that during the religious activities time, L_{eq} values ranged from 64.46 – 74.31 dBA and 69.21 – 75.54 dBA for Friday and Sunday respectively, in some locations as indicated by red region. These values were above WHO exposure limit for day time residential area and also above the maximum permissible noise level for day time at area of worship, entertainment or public announcement system set up National Environmental (Noise standard and control) Regulations standards. However, during non-religious period, the L_{eq} values ranged from 54.42 – 61.62 dBA and 54.98 – 62.52 dBA for Friday and Sunday respectively, in some areas as indicated by red region. This shows that during religious activities time, the noise pollution levels in this area were above maximum permissible noise level and may be a source of annoyance to the residents of this community.

Furthermore, the average L_{eq} during the religious activities time and religious non-activities time was also mapped in the ARCGIS as shown in Figure 7. Results still indicated that average L_{eq} values during religious activities time ranges from 68.01 dBA to 74.3 dBA indicating high noise pollution level.

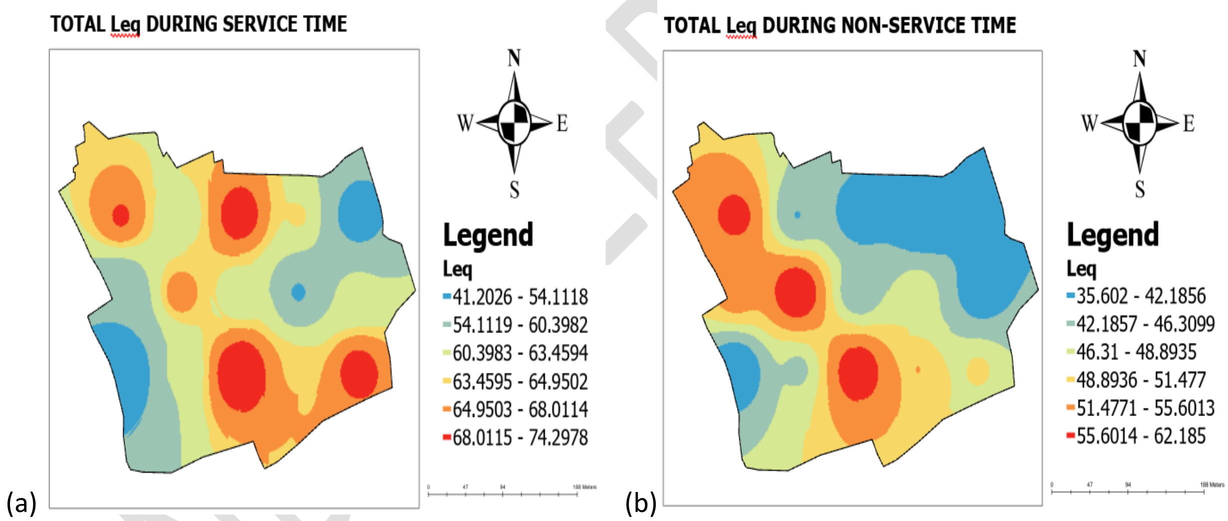

Figure 7: Noise Interpolation Map for mean L_{eq} during (a) service time (b) Non-service time

Noise indices, L_{10}, L_{50}, L_{90}, NPL, NC on various days during religious activities time and non-religious time were compared and presented in Figure 8. It could be seen that all the noise indices during the religious activity time were higher than the noise indices during religious non-activity time with highest NPL value of 96.17 dBA on Wednesday during religious activities time. This is expected because on this day, the difference between the peak and background noise is larger than all other days and NPL takes into account this fluctuation in sound levels.

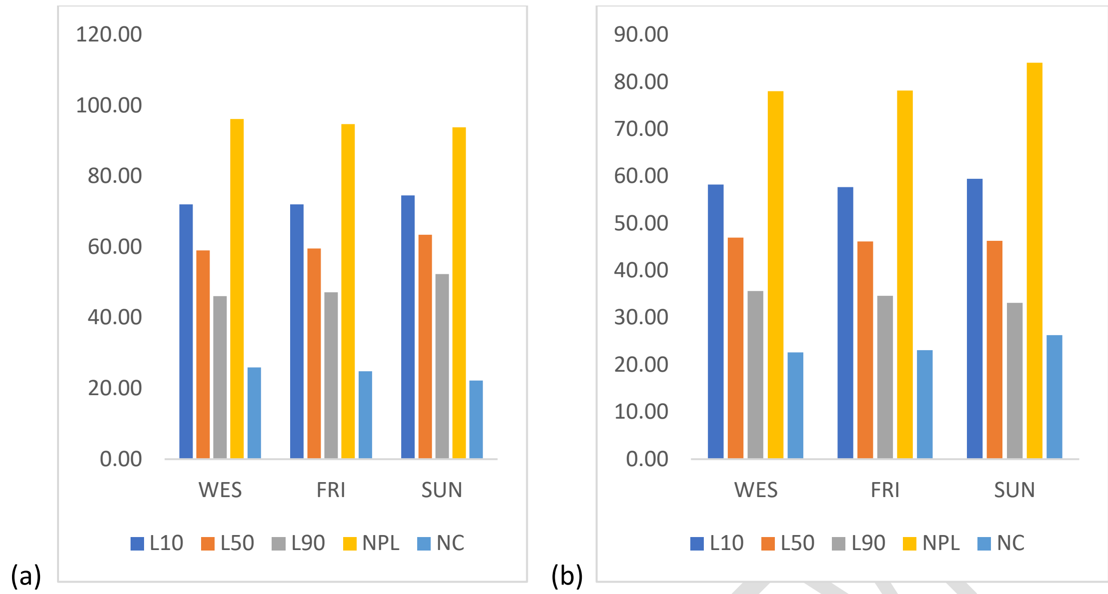

Figure 8: Comparison of Noise Indices during Service Time (a) and Non-Service Time (b)

Furthermore, comparison of average L_{eq} values against WHO standards as presented in Figure 9 showed that almost all the average L_{eq} values during religious activities time were above WHO noise level standard for all the sampling points covered except for points 5, 9 and 11 which were below WHO recommended noise exposure limit with average L_{eq} values of 49.2, 53.3 and 41.2 (dBA) respectively with point 13 recording the highest average L_{eq} level of 74.3 dBA. Similar report was observed by Shittu and Remi-Easn, (2019) who recorded highest equivalent noise level of 73.9 dBA 10 meters away from a religious house. These high noise levels recorded could be due to the fact that speakers in the religious houses are located outside the buildings and these speakers are also highly elevated. This could possibly push the sound levels farther away to much greater distances.

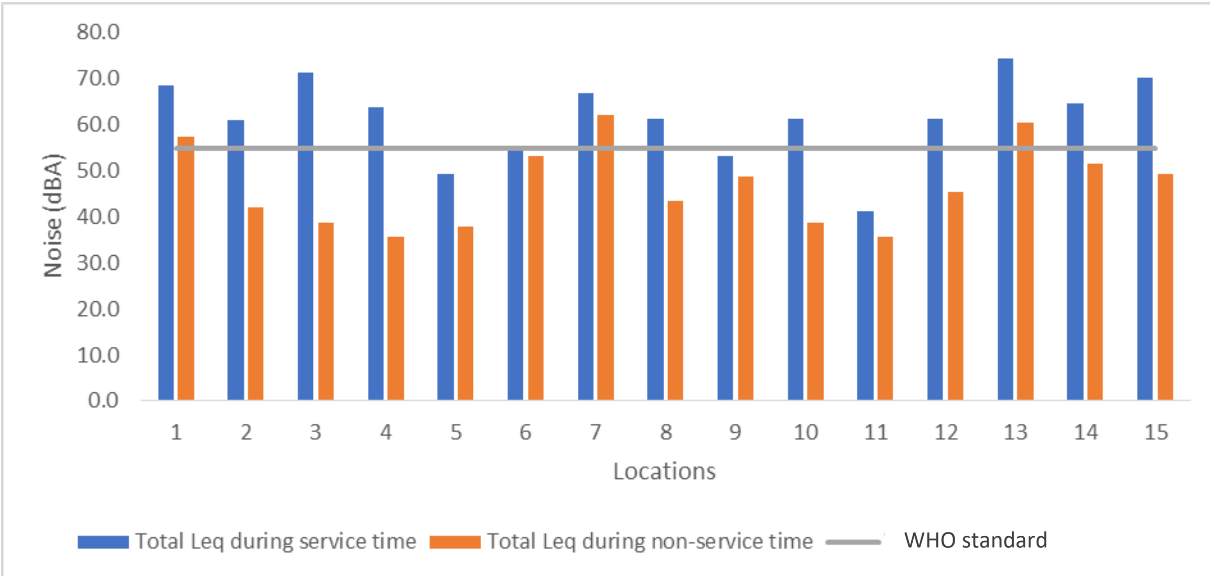

Figure 9: Comparison of Average L_{eq} values against WHO Standards

4 CONCLUSION

It can be seen from the study that the activities of religious houses in Rumu-Okwachi community, Obio/Akpor Local Government Area, Rivers State, generate noise levels which are above WHO recommended noise exposure limit and maximum permissible noise level for place/area of worship, entertainment or public announcement system. It was observed that some sampling points in the study area recorded average L_{eq} values as high as 74.3 dBA during religious activities time. It was also observed that the noise indices during religious activities period were all higher than the noise indices during religious non-activities period. The highest NPL value of 96.17 dBA was recorded on Wednesday during a time of religious activity. This indicates that residents near these religious houses may be exposed to loud noise levels and may cause various health issues on the resident. Exposure to excessive noise levels may cause physiological and mental effects, sleep disturbances, stress, cardiovascular problems, hearing impairment, interference with communication and other noise related deformation or irregularities after long exposure. However, these health effects may differ from person to person due to other factors. Since noise pollution has become a major environmental challenge, the study recommend that worshippers should perform their religious activities without disturbing the peace of residents in the area. Religious houses should be located outside residential areas and when otherwise, the use of loudspeakers should be restricted to indoor use only. The study also recommend that sound limiters should be attached to sound systems to reduce noise intensity and religious buildings should be designed to be sound proof to avoid the sound from disturbing the resident community. Government agencies responsible for noise control should ensure that religious leaders conform to permissible limit of noise in their environments.

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