

ORIGINAL RESEARCH PAPER

THE IMPACT OF NOISE POLLUTION CAUSED BY THE ACTIVITY OF EXTRACTION OF MINERALS AGGREGATES ON SOME PROTECTED BIRD SPECIES IN THE NATURA 2000 SITE FROM TELEORMAN COUNTY

**Luiza G. Crăciunică, Cristina I. Covaliu-Mierlă*,
Vlad G. Dinu, Ovidiu Gheorghiu**

*National University of Science and Technology Politehnica Bucharest,
Faculty of Biotechnical Systems Engineering, 313 Splaiul Independenței,
sector 6, 060042, Bucharest, Romania*

*Corresponding author: cristina_covaliu@yahoo.com

Received: March, 07, 2025
Accepted: September, 05, 2025

Abstract: This paper examines the environmental impact of ambient noise generated by mineral aggregate extraction activities, with particular emphasis on a site located in Teleorman County, Romania. The study area, designated as the ROSPA0024 Olt-Danube Confluence site and part of the Natura 2000 ecological network, is recognized for its high ornithological value, providing habitat for several protected bird species.

Extraction operations, primarily consisting of desilting activities along minor channels of the Olt River, were systematically monitored to assess their potential effects on local avifauna. The research documented temporary yet measurable behavioural modifications among key bird species during periods of elevated noise levels. These included alterations in feeding behaviour, nest abandonment, and increased flight responses.

The findings underscore the vulnerability of protected bird populations to industrial noise and indicate that existing mitigation measures are inadequate. This study provides empirical evidence to support the integration of stricter temporal restrictions on extraction activities, particularly during critical breeding and migration periods, as part of a broader strategy to reconcile economic development with biodiversity conservation objectives.

Keywords: *avifauna, mineral extraction, noise impact, natura 2000*

INTRODUCTION

Ambient noise pollution represents a significant environmental challenge across Europe, with documented adverse effects on both human health and biodiversity. Numerous species, particularly invertebrates, mammals, and birds, depend on acoustic cues for communication, navigation, and survival. Anthropogenic noise disrupts essential behaviours, including communication, foraging, and predator avoidance [1 – 3]. According to the European Environment Agency (2020) [4], such disturbances can induce physiological stress and behavioural changes in both terrestrial and aquatic organisms, with potential long-term consequences for reproduction, survival rates, and population stability. Notably, even relatively low noise levels, around 40 dB(A), may negatively affect wildlife, depending on the frequency and source characteristics of the noise [5].

Among vertebrates, birds have been the subject of extensive research, with the International Union for Conservation of Nature (IUCN) providing comprehensive assessments of anthropogenic threats to avian populations [6]. Numerous studies have reported declines in bird population density and abundance [7 – 15], as well as behavioural alterations [16, 17] and cognitive impairments [18, 19] linked to noise pollution. In response to these environmental concerns, the European Union adopted Directive 2002/49/EC on environmental noise, which establishes a framework for assessing noise exposure and associated health effects, informing the public, preventing and reducing noise emissions, and preserving high-quality acoustic environments [20]. These measures are designed to safeguard both human well-being and biodiversity.

In Romania, the Natura 2000 ecological network plays a vital role in the conservation of habitats and species of European interest. The ROSPA0024 Olt-Danube Confluence site, located in Teleorman County, has been designated for the protection of avifauna but faces increasing pressure from anthropogenic activities, particularly mineral aggregate extraction.

Mining operations in the area involve the use of heavy machinery, such as excavators, front loaders, and dump trucks, which generate significant levels of low-frequency noise that can disturb local bird populations. Beyond noise emissions, these activities also release atmospheric pollutants, including dust and combustion gases, contributing to environmental degradation and posing additional risks to protected bird species [21].

Effective noise mitigation strategies include the use of quieter, well-maintained machinery, the scheduling of operations outside sensitive periods, the installation of noise barriers, the optimisation of site layouts, continuous noise monitoring, and community engagement initiatives [22]. Such measures are essential for minimising environmental impacts while maintaining the economic benefits associated with mineral resource extraction.

This study investigates the short-term effects of noise pollution generated by mineral aggregate extraction within the Natura 2000 ROSPA0024 Olt-Danube Confluence site on the area's characteristic bird species. By integrating quantitative noise measurements with ecological field observations, this research provides valuable insights to support the effective management and conservation of bird populations within the Olt-Danube Confluence.

Covering approximately 20,484 hectares, the Special Protection Area (SPA) hosts 89 bird species that depend on the site for feeding, breeding, and nesting. Among these, 18 species are recognised as conservation priorities (Table 1), underscoring the ecological

significance of the site and the urgent need for responsible management of mineral extraction activities to protect local bird populations and their habitats.

Table 1. Priority bird species within the ROSPA0024 Olt-Danube Confluence site [23]

Name	Population in the site		Unit
	Min	MAX	
<i>Alcedo atthis</i>	4	6	Pairs
<i>Aythya nyroca</i>	25	28	Pairs
<i>Burhinus oedicnemus</i>	4	10	Pairs
<i>Chlidonias hybridus</i>	80	150	Individuals
<i>Chlidonias niger</i>	50	100	Individuals
<i>Coracias garrulus</i>	16	20	Pairs
<i>Cygnus cygnus</i>	1	5	Individuals
<i>Dendrocopos medius</i>	6	10	Pairs
<i>Falco vespertinus</i>	15	25	Pairs
<i>Hymantopus hymantopus</i>	2	10	Individuals
<i>Nycticorax nycticorax</i>	12	20	Pairs
<i>Pelecanus crispus</i>	20	60	Individuals
<i>Phalacrocorax pygmaeus</i>	350	450	Pairs
<i>Picus canus</i>	6	10	Pairs
<i>Platalea leucorodia</i>	30	60	Individuals
<i>Sterna albifrons</i>	70	140	Individuals
<i>Sterna hirundo</i>	200	400	Individuals
<i>Tringa glareola</i>	500	1000	Individuals

MATERIALS AND METHODS

This study focuses on a temporary mineral aggregate extraction site located within the administrative boundaries of Islaz Municipality, Teleorman County, Romania. The site is situated within the ROSPA0024 Olt-Danube Confluence, a designated Special Protection Area (SPA) of high ecological importance, particularly due to its role in supporting avian biodiversity.

The potential environmental impact of the extraction activities was assessed using criteria based on the severity of damage and the likelihood of occurrence, following the methodology outlined in [24].

Bird monitoring was conducted using the linear transect method, whereby observers systematically walked along predefined straight lines across the study area. At fixed intervals, all birds detected either visually or acoustically within a specified distance from the transect line were recorded. This widely used method in ecological research provides a structured and repeatable approach for assessing species distribution, habitat preferences, and population dynamics over time.

Noise levels generated by the machinery employed at the two extraction sites were measured as follows:

- Bulldozer: 115 dB(A)
- Front loader: 112 dB(A)
- Excavator: 117 dB(A)

- Tipper truck: 107 dB(A)

These values indicate that heavy machinery used in the extraction process produces high-intensity noise, which may pose a risk to the local avifauna, particularly in sensitive areas within the SPA.

The equivalent continuous sound level at the nearest receptor can be estimated using a specific formula, as presented in Equation (1), which allows for the calculation of noise levels at a given distance from the source:

$$L_p = L_w - 10 * \log(r^2) - 8 = L_w - 20 * \log(r^2) - 8(1) [24] \quad (1)$$

where: L_p = sound pressure level at the receiver location (dB);

L_w – sound power level of the source at distance r (dB);

r = distance from the noise source, without considering topographical variations (m).

Noise measurements were conducted in collaboration with a qualified representative of the Territorial Environmental Protection Authority. Measurements were taken at representative locations under normal operating conditions, in accordance with the guidelines specified in the SR ISO 1996-1:2016 standard [25].

Noise measurements were performed using a calibrated Bruel & Kjaer Type 2250 Light Class 1 sound level meter (Denmark), in accordance with the SR 10009/2017 standard. The device was equipped with a Type 4950 microphone with wind protection, and a Type 4231 acoustic calibrator. Pre-calibration acoustic data indicated a sensitivity of 43.06 mV/Pa with a deviation of 0.13 dB, while post-calibration measurements showed a sensitivity of 43.56 mV/Pa with a deviation of 0.03 dB.

The sound level meter was positioned in an open-field configuration, 3 meters from the site boundary and 1.5 meters above ground level.

Measurements were carried out in June 2022 and July 2024, between 08:00 and 16:30, under the environmental conditions specified in Table 2.

Table 2. *Environmental conditions under which the investigations were conducted*

Environment conditions		Point 1	Point 2
Medium temperature	°C	28.5	29
Barometric pressure	hPa	1016.1	1018.9
Average atmospheric humidity	%	49.2	58
Wind speed	km/h	4	3
The direction of the wind	-	south-south-east	south-south-east

Based on the average noise levels generated by specific machinery used in the extractive industry, a noise propagation model was developed prior to the field survey using the Predictor LimA software package (developed by Brüel & Kjær). This predictive modelling allowed for the estimation of noise dispersion patterns in the study area, providing valuable information for assessing potential environmental impacts.

RESULTS AND DISCUSSION

The noise level generated by industrial activities varies significantly depending on the propagation environment and local conditions, such as the presence of obstacles. Understanding this variability is essential, as it directly affects the accuracy of noise

impact assessments at various distances from the source. Key factors influencing noise propagation include wind characteristics, air absorption (which depends on atmospheric pressure and temperature), local topography, and vegetation cover. Acknowledging these factors is crucial for designing effective noise monitoring programmes and implementing appropriate mitigation measures in the study area.

According to the SR 10009/2017 standard on Acoustics, with subsequent amendments and additions introduced in 2020, the admissible ambient noise limit for industrial premises is set at 65 dB(A).

In scenarios where all noise sources operate simultaneously, and considering only the distance between the source and the receiver-while neglecting attenuation effects from vegetation, terrain, and wind-the calculated noise level at the nearest receptor was found to be low. Specifically, at measurement point code Z-C-TR 0002/02.06.2022, the equivalent continuous sound level (LAeq) was recorded at 42.2 dB(A).

The impact assessment incorporated four key considerations: (1) the ecological characteristics of the ROSPA0024 Olt-Danube Confluence site, notably its wetland habitats that support species of Community interest; (2) the technical profile of the mineral extraction activity, which involves heavy machinery generating average noise levels between 65 and 75 dB(A); (3) The reversibility of the impacts, particularly in the context of potential habitat restoration following the cessation of extraction activities; (4) Direct field observations, which documented species-specific behavioural responses to noise exposure during the breeding season.

Based on this analysis, which accounted for both the likelihood and severity of potential negative effects, the overall impact was classified as *minor negative* [26].

To estimate the potential impact of mineral aggregate extraction activities on the Natura 2000 ROSPA0024 Olt-Danube Confluence site, an impact assessment matrix was developed. This matrix incorporated both the severity of consequences and the probability of occurrence, based on the degree of ecological damage and the likelihood of such impacts materialising.

The impact was calculated using the following formula:

$$\text{Impact} = \text{Probability} \times \text{Consequence} \quad (2)$$

The probability categories and the calculated consequences are given in Tables 3 and 4.

Table 3. Probability categories

Probability	Value	Observations
Inevitable	5	The effect is certain to occur
Very likely	4	The effect will occur frequently
Probably	3	The effect will occur with low frequency
Improbable	2	The effect will occur occasionally
Very unlikely	1	The effect will occur accidentally

Table 4. Description of consequences

Degree of impairment	Value	Description
Disastrous	5	Reduction of local populations by 81%-100%
Very important	4	Reduction of local populations by 61%-80%
Important	3	Reduction of local populations by 41%-60%
Moderate	2	Reduction of local populations by 21%-40%
Insignificant	1	Reduction of local populations by 0%-20%

The impact matrix (Table 5) was developed by combining the probability of occurrence with the maximum foreseeable consequences of the assessed impact.

Table 5. *Impact levels of mineral aggregate extraction activities*

Value	Impact level
15-25	Significant negative
5-15	Moderately negative
1-5	Negative insignificant

The results obtained (Table 6) indicate that the impact level of mineral aggregate extraction activities on the bird species present in the study area is classified as minor negative.

Table 6. *Impact matrix of mineral aggregate extraction activities on bird species of community interest within the ROSPA0024 Olt-Danube Confluence Site*

Impact	<i>Cygnus cygnus</i>	<i>Phalacrocorax pygmaeus</i>	<i>Falco vespertinus</i>	<i>Alcedo atthis</i>	<i>Anas crecca</i>
15-25	0	0	0	0	0
5-15	0	0	0	0	0
1-5	4	1	1	1	1

The extraction of mineral aggregates within the ROSPA0024 Olt-Danube Confluence area has the potential to affect bird species by generating noise and disturbing their habitat. To assess this hypothesis, noise levels were measured at two different time points and subsequently analysed to determine the potential effects on bird populations.

Table 7 presents the results of noise level measurements recorded during mineral aggregate extraction activities.

Table 7. *Results of noise level measurements generated by mineral aggregate extraction activities within the ROSPA0024 Olt-Danube Confluence, Islaz Municipality, Teleorman County*

Crt. no.	Measurement point code	LAeq dB(A)	LAeq corrected dB(A)	Maximum allowed limit, according to STAS 10009:2017	Description of the measurement	Geographic coordinates
1	Z-C-TR 0001/02.06.2022	57.9	-	65	3 m from the boundary of the site with activity	480134.81 254131.16
2	Z-C-TR 0002/02.06.2022	44.2	-	65	3 m from the boundary of the site without activity	480134.80 254127.71
3	Z-C-TR 0003/02.06.2022	-	57.71	65	Residual noise correction was applied	

Crt. no.	Measurement point code	LAeq dB(A)	LAeq corrected dB(A)	Maximum allowed limit, according to STAS 10009:2017	Description of the measurement	Geographic coordinates
					because the residual noise pressure level is below the measured sound pressure level	
4	Z-C-TR-0004/16.07.2024	42.2	65	65	10 m from the limit of the noise source-inactive source	480272.21 254065.96
5	Z-C-TR-0005/16.07.2024	78.3	65	65	10 m from the limit of the noise source	480272.21 254065.96
6	Z-C-TR-0006/16.07.2024	77.6	65	65	20 m from the limit of the noise source	480269.99 254056.65
7	Z-C-TR-0007/16.07.2024	76.8	65	65	30 m from the limit of the noise source	480267.60 254046.73
8	Z-C-TR-0008/16.07.2024	75.9	65	65	40 m from the limit of the noise source	480265.30 254036.96
9	Z-C-TR-0009/16.07.2024	74.7	65	65	50 m from the limit of the noise source	480263.00 254027.28
10	Z-C-TR-00010/16.07.2024	72.9	65	65	60 m from the limit of the noise source	480260.69 254017.56
11	Z-C-TR-00011/16.07.2024	69,7	65	65	70 m from the limit of the noise source	480258.30 254007.74
12	Z-C-TR-00012/16.07.2024	67.6	65	65	90 m from the limit of the noise source	480253.68 253988.20
13	Z-C-TR-00013/16.07.2024	65.2	65	65	110 m from the limit of the noise source	480249.01 253968.73
14	Z-C-TR-00014/16.07.2024	61.8	65	65	140 m from the limit of the noise source	480242.02 253939.49
15	Z-C-TR-00015/16.07.2024	59.0	65	65	180 m from the limit of the noise source	480232.77 253900.59

Crt. no.	Measurement point code	LAeq dB(A)	LAeq corrected dB(A)	Maximum allowed limit, according to STAS 10009:2017	Description of the measurement	Geographic coordinates
16	Z-C-TR-00016/16.07.2024	57.5	65	65	230 m from the limit of the noise source	480221.07 253851.96
17	Z-C-TR-00017/16.07.2024	55.1	65	65	330 m from the limit of the noise source	480197.90 253754.53

*The hourly measurement intervals were 08.00 - 16.30

Noise levels measured in the vicinity of the mineral aggregate extraction site frequently exceeded the maximum permissible limit of 65 dB(A), particularly at short distances of up to 30 meters from the noise source. As the distance from the source increased, the noise levels gradually decreased below the admissible threshold. These results indicate a significant, yet highly localized, acoustic impact, with the potential to negatively affect bird species present in the immediate vicinity of the extraction activities. It is estimated that, in the scenario where one earthmoving machine and two dump trucks operate simultaneously within the extraction area, the noise level at the boundary of the industrial premises will not exceed the admissible limit of 65 dB(A), in accordance with SR 10009:2017 [27].

Atmospheric conditions and air pollution levels were also monitored over a 24 hour period, given their potential variability and influence on environmental quality [28].

In May 2022, bird species monitoring was conducted within the extraction site area located in Islaz Municipality, Teleorman County. The linear transect method was employed, with transects ranging from 1 to 5 km in length. During these surveys, the following bird species of conservation interest were observed: *Cygnus cygnus* - 3 adults; *Falco vespertinus* - 3 adults; *Phalacrocorax pygmaeus* - 7 adults; *Alcedo atthis* - 10 adults; *Anas crecca* - 20 adults.

These observations provide valuable data for assessing the potential impact of mineral extraction activities on avifauna within the ROSPA0024 Olt-Danube Confluence site.

Figure 1 illustrates the presence and spatial distribution of priority bird species observed within the ROSPA0024 Olt-Danube Confluence area during May 2022. This information is critical for identifying sensitive zones that may be potentially affected by noise generated by mineral aggregate extraction activities.

According to the scientific literature, elevated noise levels generally lead to the displacement of fauna from affected areas. For example, Foreman *et al.* (1998) report a decline in bird presence when constant equivalent noise levels exceed 48 dB(A) [29].

For the current study, the worst-case scenario was defined as the simultaneous operation of an earthmoving machine and two dump trucks, under the assumption that this combination represents the highest typical noise output generated during mineral aggregate extraction activities. This scenario was considered the most critical due to the cumulative noise emissions produced by multiple heavy-duty machines operating in close proximity and under continuous working conditions. It reflects the maximum anticipated acoustic impact on the surrounding environment under normal operational conditions.

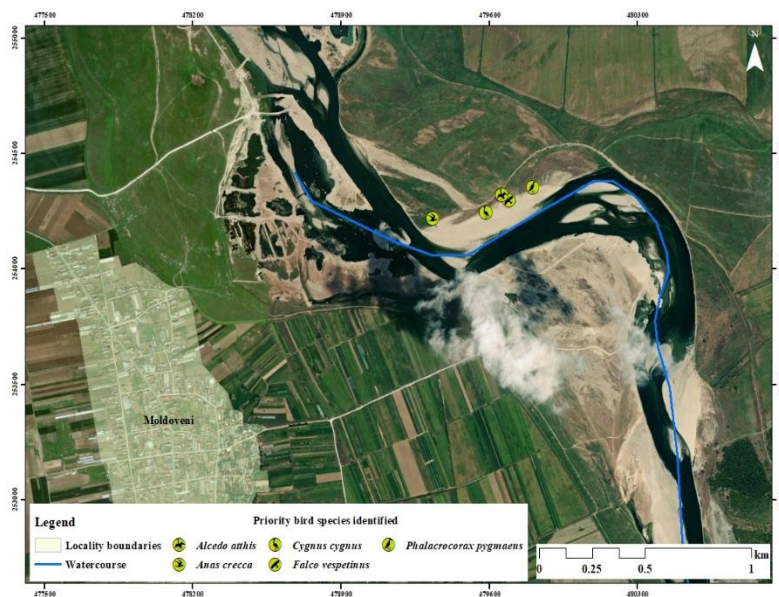


Figure 1. Presence of priority bird species within the ROSPA0024 Olt-Danube Confluence Site – May 2022

In this context, for localized mineral aggregate extraction sites, it is estimated that the 48 dB(A) noise contour extends between approximately 150 and 330 meters from the work fronts, depending on operational intensity and specific site conditions.

The assessment suggests that, at present, the ecological integrity of key migratory routes and habitats within the study area remains largely intact, allowing bird species to migrate, forage, and rest without significant disturbance. Nevertheless, ongoing monitoring and the implementation of responsible management practices are essential to maintaining these conditions and ensuring the long-term protection of avian populations.

Figure 2 presents an acoustic propagation map for the year 2020, illustrating estimated noise levels based on the spatial distribution of active industrial sources within the study area. The red and orange zones represent areas where sound levels exceed 65 dB(A), located in close proximity to the operating equipment. Yellow and light green zones indicate progressively lower noise levels as the distance from the source increases.

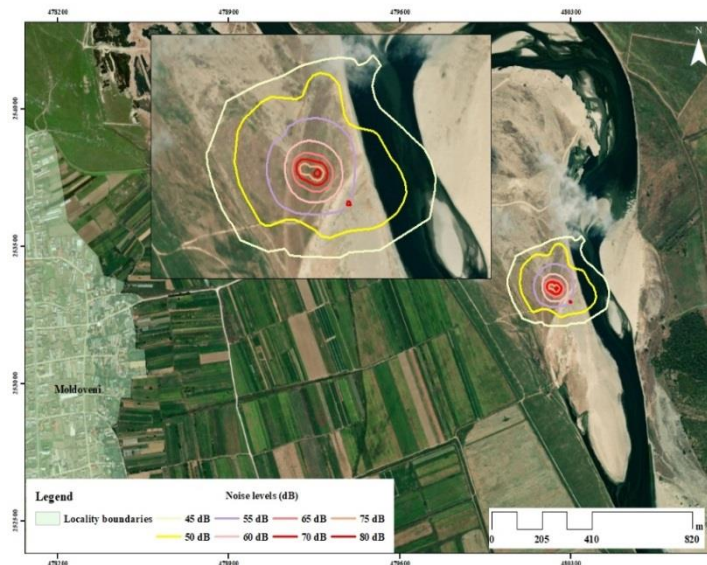


Figure 2. Predicted noise levels for the extraction site within the Islaz Municipality Area, Teleorman County, in 2020

The 48 dB(A) noise contour is clearly visible, extending approximately 300 meters from the source. This contour is particularly relevant, as noise levels exceeding this threshold are considered to have the potential to negatively affect local fauna, especially bird species, according to established scientific literature.

Figures 3 and 4 illustrate a noise distribution pattern that is nearly identical to that of the previous assessment, indicating the continuity of mineral extraction activities without significant changes in equipment type or operational location. Minor variations may occur as a result of the weather conditions included in the modelling process; however, the overall spatial distribution and intensity of noise emissions remain consistent.

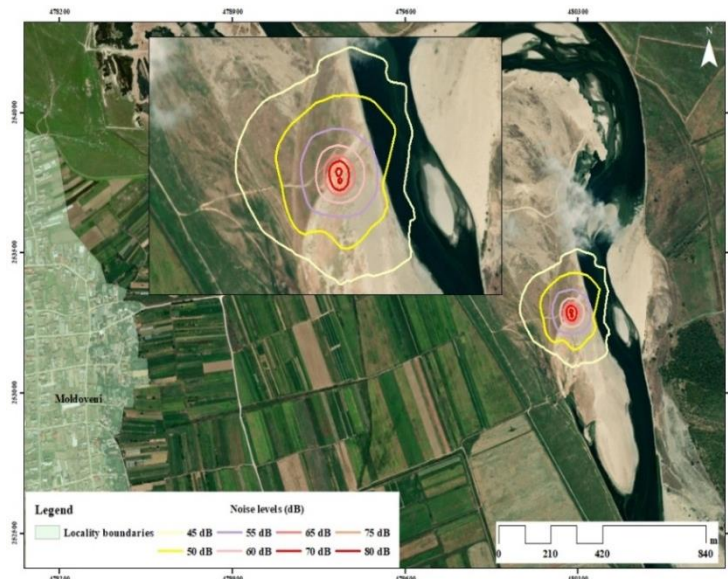


Figure 3. Predicted noise levels for the extraction site within the Islaz Municipality Area, Teleorman County, in 2021

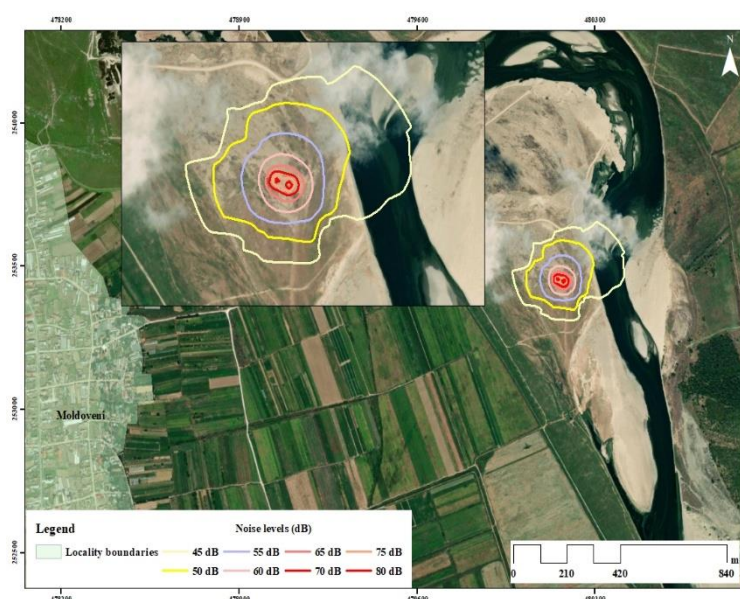


Figure 4. Predicted noise levels for the extraction site within the Islaz Municipality Area, Teleorman County, in 2022

The 2022 noise propagation model most likely incorporates real measurement data collected during that year. A strong correlation was observed between the modelled noise levels and the values recorded in the field, confirming the accuracy of the simulation. The results indicate that significant noise emissions do not extend beyond the immediate vicinity of the extraction activities, remaining below a distance of approximately 330 m from the operational fronts.

The map presented in Figure 5 illustrates the worst-case operating scenario, involving the simultaneous use of a bulldozer and two dump trucks, generating maximum noise levels. Zones with noise intensities exceeding 70 dB(A) are confined to the first few tens of meters from the source. The 48 dB(A) contour remains the ecologically significant threshold for assessing potential impacts on bird species. The model reconfirms that noise emissions only marginally affect sensitive habitats, with the most critical areas remaining outside the zone of significant acoustic influence.

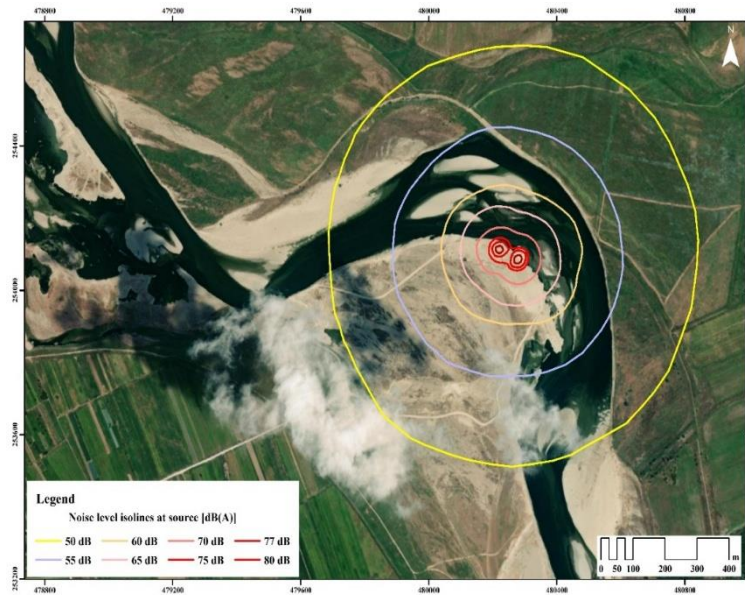


Figure 5. Predicted noise levels for the extraction site within the Islaz Municipality Area, Teleorman County, in 2024

Figure 6 illustrates the precise geographical location of the 17 measurement points established within the study area. The strategic placement of these points at varying distances from the noise source (ranging from 3 meters to 330 meters) allowed for a gradual assessment of noise attenuation over distance. The data obtained from these measurements were used to validate the acoustic propagation model presented in the previous figures.

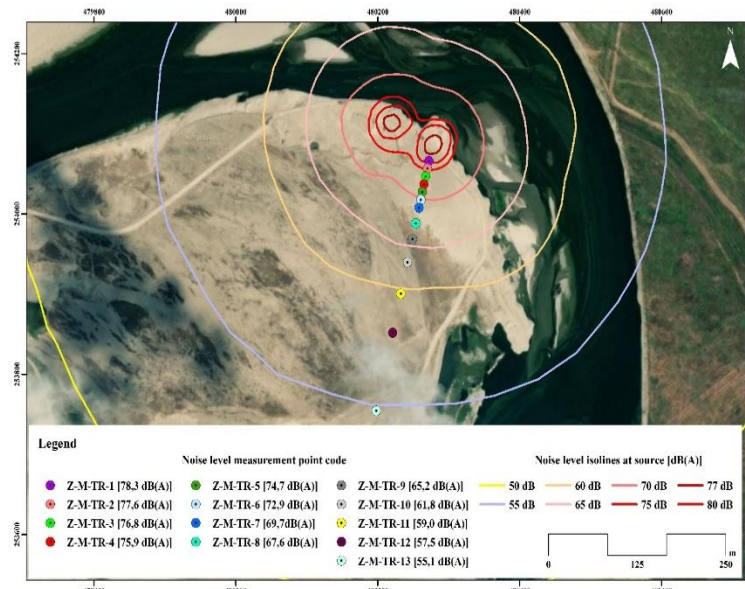


Figure 6. Noise level and acoustic measurements conducted at the site within the administrative boundaries of Islaz Municipality, Teleorman County, in 2024

The measurement results confirmed that beyond distances of approximately 90 to 100 meters from the noise source, sound levels decreased below the critical threshold for avifauna, defined as 48 dB(A).

The assessment of the potential environmental impact of mineral aggregate extraction activities along the Olt River was carried out using the LimA Type 7810-B Predictor software, which integrates detailed information on topography, terrain characteristics, landscape features, and the acoustic power of noise sources.

The two natural areas analysed within the ROSPA0024 Olt-Danube Confluence site provide extensive feeding, nesting, and resting habitats for bird species. Consequently, even during active extraction phases, these species are expected to retain access to sufficient undisturbed habitat to support their ecological needs.

The monitoring activities identified a substantial number of priority bird species within both surveyed locations. This observation suggests that the impact of extraction operations on bird populations is likely to be minimal. Although temporary disturbances may occur in the immediate vicinity of active extraction sites, the availability of alternative habitats and the limited spatial extent of the noise-affected areas indicate that local bird populations can continue to thrive during the operational period.

Moreover, despite the proximity of extractive activities to natural habitats, field observations and spatial analyses confirm that these operations do not intersect key migratory routes or essential resting areas used by bird species. Therefore, the likelihood of direct disruption to migratory behaviour is considered low [30].

CONCLUSIONS

In order to evaluate the impact of mineral aggregate extraction activities conducted within the ROSPA0024 Olt-Danube Confluence Natura 2000 site, located in Teleorman County, Romania, noise level measurements were performed during extraction operations. In parallel, field surveys were carried out to identify the bird species from the study area.

The results indicate that noise levels recorded near the operational fronts frequently exceeded the legal threshold of 65 dB(A); however, the direct impact on avifauna was generally low. According to the impact assessment matrix, the effect on the five priority species monitored - *Cygnus cygnus*, *Phalacrocorax pygmaeus*, *Falco vespertinus*, *Alcedo atthis*, and *Anas crecca*-was classified as negligible negative.

Predictive modelling confirmed that noise levels exceeding the critical threshold of 48 dB(A) can extend up to 330 meters from the source. Nevertheless, field observations demonstrated that key nesting and foraging habitats for bird species do not overlap with these impacted zones. Furthermore, it was observed that sufficient alternative habitats are available within the boundaries of the ROSPA0024 Olt-Danube Confluence site.

In conclusion, although mineral aggregate extraction activities generate localized acoustic disturbances, the effects on bird species of community interest remain limited and reversible, provided that continuous monitoring and responsible management practices are maintained.

REFERENCES

1. Blickley, J.L., Patricelli, G.L.: Impacts of Anthropogenic Noise on Wildlife: Research Priorities for the Development of Standards and Mitigation, *Journal of International Wildlife Law & Policy*, **2010**, 13 (4), 274-292, <https://doi.org/10.1080/13880292.2010.524564>;
2. European Environment Agency: *Noise. Does noise stress animals too?* EEA, **2024**, accessed at: [https://www.eea.europa.eu/en/topics/indepth/noise#:~:text=Noise%20negatively%20impacts%20wildlife%2C%20both,other%2C%20especially%20during%20mating%20season](https://www.eea.europa.eu/en/topics/indepth/noise#:~:text=Noise%20negatively%20impacts%20wildlife%2C%20both,other%2C%20especially%20during%20mating%20season;);
3. U.S. Environmental Protection Agency: *USEPA Report No. NTID 300.5, Effects of noise on wildlife and other animals*. Washington, DC, USA, **1971**, accessed at: <https://nepis.epa.gov>;
4. European Environment Agency: *Environmental noise in Europe, 2020*, Publications Office, **2020**, <https://data.europa.eu/doi/10.2800/686249>;
5. Shannon, G., McKenna, M.F., Angeloni, L.M., Crooks, K.R., Fristrup, K.M., Brown, E., Warner, K.A., Nelson, M.D., White, C., Briggs, J., McFarland, S., Wittemyer, G.: A Synthesis of Two Decades of Research Documenting the Effects of Noise on Wildlife, *Biological Reviews*, **2016**, 91 (4), 982-1005, <https://doi.org/10.1111/brv.12207>;
6. International Union for Conservation of Nature: *The IUCN Red List of Threatened Species*, **2023**, accessed at: <https://www.iucnredlist.org/resources/summary-statistics#Summary%20Tables>;
7. Rottenborn, S.C.: Predicting the Impacts of Urbanization on Riparian Bird Communities, *Biological Conservation*, **1999**, 88 (3), 289-299, [https://doi.org/10.1016/S0006-3207\(98\)00128-1](https://doi.org/10.1016/S0006-3207(98)00128-1);
8. Seiler, A., Helldin, J.-O., Seiler, A.: Road Mortality in Swedish Mammals: Results of a Drivers' Questionnaire, *Wildlife Biology*, **2004**, 10 (3), 225-233;
9. Gunnarsson, G., Elmberg, J., Sjöberg, K., Pöysä, H., Nummi, P.: Experimental Evidence for Density-Dependent Survival in Mallard (*Anas platyrhynchos*) Ducklings, *Oecologia*, **2006**, 149, 203-213, <https://doi.org/10.1007/s00442-006-0446-8>;
10. Patón, D., Romero, F., Cuenca, J., Escudero, J.C.: Tolerance to Noise in 91 Bird Species from 27 Urban Gardens of Iberian Peninsula, *Landscape and Urban Planning*, **2012**, 104 (1), 1-8, <https://doi.org/10.1016/j.landurbplan.2011.09.002>;
11. Barron, D.G., Brawn, J.D., Butler, L.K., Romero, L.M., Weatherhead, P.J.: Effects of Military Activity on Breeding Birds, *The Journal of Wildlife Management*, **2012**, 76 (5), 911-918, <https://doi.org/10.1002/jwmg.355>;
12. Watson, K.A., Simpson, T.R.: Relationship of Vehicular Traffic Flow and Roadside Raptor and Vulture Abundance in South-Central Texas, *Bulletin of the Texas Ornithological Society*, **2014**, 47 (1-2), 17-23;
13. Uebel, K., Marselle, M., Dean, A.J., Rhodes, J.R., Bonn, A.: Urban Green Space Soundscapes and Their Perceived Restorativeness, *People and Nature*, **2021**, 3 (3), 756-769, <https://doi.org/10.1002/pan3.10215>;
14. Wang, J., Liu, W., Lin, Q., Hou, J.: Effects of Flight Disturbance on Bird Communities at Airports: Predatory Birds Rise to the Challenge, *Pakistan Journal of Zoology*, **2022**, 56 (2), 845-852, <https://dx.doi.org/10.17582/journal.pjz/20220913080930>;
15. Rodríguez-Casanova, A.J., Zuria, I., Hernández-Silva, D.A.: Effect of Firework Festivities on Bird Richness and Abundance at a Natural Protected Wetland in Central Mexico, *Waterbirds*, **2023**, 45 (3), 277-286, <https://doi.org/10.1675/063.045.0307>;
16. Vas, E., Lescroël, A., Duriez, O., Boguszewski, G., Grémillet, D.: Approaching Birds with Drones: First Experiments and Ethical Guidelines, *Biology Letters*, **2015**, 11 (2), 20140754, <https://doi.org/10.1098/rsbl.2014.0754>;
17. Eddajjani, A., Hanane, S., Kandry, A.E., Qninba, A.: The Association Strength of Landscape Composition and Spatial Structure Governs Occurrence of Invasive Eurasian Collared-Doves and Expanding Woodpigeons in a Mediterranean Urban Environment, *Landscape Ecology*, **2022**, 37 (8), 2007-2024, <https://doi.org/10.1007/s10980-022-01462-4>;
18. Lima, S.L.: Predators and the Breeding Bird: Behavioral and Reproductive Flexibility Under the Risk of Predation, *Biological Reviews*, **2009**, 84 (3), 485-513, <https://doi.org/10.1111/j.1469-185X.2009.00085.x>;
19. Daria, C., Slevin, M.C., Anderson, R.C.: Effects of Anthropogenic Noise on Cognition, Bill Color, And Growth in the Zebra Finch (*Taeniopygia guttata*), *Acta Ethologica*, **2023**, 26 (3), 185-199, <https://doi.org/10.1007/s10211-022-00406-0>;

20. <https://eur-lex.europa.eu/RO/legal-content/summary/assessment-and-management-of-environmental-noise.html>, accessed December 11, **2024**;
21. Hoha, G.V., Nistor, C.E, Elefteriu, C., Băcilă, V., Çagiltay, F., Păsărin, B.: Assessment of Water Quality from Accumulation Stâncă-Costești, *Scientific Papers. Series D. Animal Science*, **2020**, **LXIII** (2), 464-469;
22. Sverdrup, H., Warfvinge, P.: Weathering of Primary Silicate Minerals in the Natural Soil Environment in Relation to a Chemical Weathering Model, *Water, Air, and Soil Pollution*, **1988**, **38** (3-4), 387-408, <https://doi.org/10.1007/BF00280768>;
23. <https://natura2000.eea.europa.eu/Natura2000/SDF.aspx?site=ROSPA0024>, accessed December 21, **2023**;
24. <https://dgmsoftware.com/products/inoise/>, iNoise database, accessed at December 21, **2023**;
25. ***: SR ISO 1996-1:2016 – Acoustics. Description, measurement and evaluation of ambient noise. Part 1: Fundamental quantities and valuation methods [in Romanian];
26. Crăciunică, L.G., Covaliu-Mierlă, C.I.: Identification of Potential Effects of Mineral Aggregates Extraction Activity Following an Adequate Impact Assessment on Protected Bird Species in Two Natura 2000 Sites from Teleorman and Prahova Counties, *Scientific Papers, Series D, Animal Science*, **2024**, **LXVII** (1), 644-650;
27. ***: SR 10009:2017 - Acoustics. Admissible limits of the noise level in the ambient environment [in Romanian];
28. Nagacevschi V., Macoveanu M., Model Matematic pentru Calculul Dispersiei unui Poluant Emis din Surse Multiple [in Romanian], *Scientific Study and Research- Chemistry and Chemical Engineering, Biotechnology, Food Industry*, **2000**, **1**;
29. Forman, R.T.T., Alexander, L.E.: Roads and Their Major Ecological Effects, *Annual Review of Ecology, Evolution, and Systematics*, **1998**, **29**, 207-231, <https://doi.org/10.1146/annurev.ecolsys.29.1.207>;
30. Ozunu, A., Anghel, C.I.: *Evaluarea Riscului Tehnologic și Securitatea Mediului* [in Romanian], Accent Publishing House, Cluj-Napoca, **2007**, 191-203.