Studii şi Cercetări Ştiinţifice
Chimie şi Inginerie Chimică, Biotehnologii, Industrie Alimentară

2025, **26** (1), pp. 093 – 110

https://doi.org/10.29081/ChIBA.2025.633

Scientific Study & Research
Chemistry & Chemical Engineering, Biotechnology, Food Industry

ISSN 1582-540X

ORIGINAL RESEARCH PAPER

THE EFFECTS OF MINERALS AGGREGATES EXTRACTION ON PROTECTED BIRD SPECIES IN THE NATURA 2000 SITE FROM PRAHOVA COUNTY: NOISE POLLUTION EVALUATION

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Received: February, 17, 2025
Accepted: March, 27, 2025

Abstract: This paper assesses the ambient noise produced by mineral aggregate extraction activities. The extractive industry is vital for people's livelihoods and significantly contributes to the economy of every state. However, it also presents several major challenges, including land use changes, erosion, air pollution from dust, disturbances to vegetation, and noise pollution, among others. This study specifically examined two areas in Prahova County, where mineral aggregate extraction takes place through dredging operations along the minor channels of the Prahova River. This region is part of the Natura 2000 network, particularly the ROSPA0152 Ialomița Corridor, which is designated for the protection of bird species. In this research the presence of characteristic bird species was evaluated and the temporary effects of noise generated by the extraction activities were observed.

Keywords: *evaluation, extraction, mineral aggregates, noise pollution, protected bird species*

INTRODUCTION

Following a systematic review of the literature, at an international level, through a study conducted in 2024 [1], the impact of anthropogenic noise on bird species was investigated.
The environmental impacts linked to the extraction of mineral aggregates (such as sand, gravel and stones) are well-documented or can be anticipated, and these effects are often temporary in nature. As the development of human civilization has largely depended on the availability of water [2], it is unfortunately impossible to provide societal needs without conducting such activities as aggregates extraction, acknowledging and accepting the derived negative effects on every environmental compartment: atmosphere, soil, or water.
Just to have a general perspective on these activities impact, theoretical models for the weathering rate of silicate minerals in the laboratory and the natural soil environment have been developed. For instance, if the weathering rate is assumed to be proportional to the exposed surface area of the mineral, the soil moisture saturation, and the chemical driving force, then the process can be defined by a kinetic expression [3].
Anthropogenic noise can impact wildlife at individual and population levels on all continents and habitats [4], affecting land wildlife [5]. It can also disrupt ecosystems through changes within populations [6], reducing the ability to reproduce [5] and interactions between species, including prey location and predator detection [6].
In 2020, the European Environment Agency published Report No. 22/2019 [7], which highlights the potential for anthropogenic noise to impact on both terrestrial and aquatic species. Impacts may be related to physiological and behavioral responses, influencing reproductive success, mortality, emigration and population density. Effects can start at low noise levels (by human definition, e.g. 40 dB(A)) for terrestrial species, such as birds, and the impacts depend on the frequency and noise source [8].
According to the IUCN's Red List of Threatened Species [9], the Birds class is the only class of animal species that was completely evaluated regarding the number of existing species and species under threat. Therefore, the Birds class is the only class that allows a correct anthropogenic impact estimation.
Studying the specialized literature, we observed that, the behavioral ecology deals with the ability of animals to reproduce and survive in their natural environment [10]. Noise can impact the behavior of birds through 'Decrease of density/ Abundance of population' [11 – 19], 'Behavioral changes/response' [20, 21] and 'Reduction of cognitive performance' [22, 23].
Also, studying the literature, we observed that, the chemical methods for analyzing the breakdown products of mineral aggregates include a wide range of techniques, from classical gravimetric and titrimetric methods to advanced techniques such as ICP-OES, ICP-MS and X-ray diffraction. The choice of methods depends on the purpose of the analysis, the desired sensitivity and the nature of the samples analyzed. These techniques are essential to understand the chemical composition and properties of mineral aggregates, providing useful information for their use in industry and environmental impact assessment. These techniques are essential to understand the disaggregation processes, their impact on the environment and to determine the optimal use of these aggregates in different industries, such as construction or material production.

Gravimetric analysis involves determining the amount of a certain compound by measuring its mass. In the case of mineral aggregates, gravimetry can be used to quantify the major components (such as silicon, calcium, iron, aluminum, etc.) in the form of oxides. This main stage involves the following:

- Sampling and collection representative samples of disaggregated material.
- Chemical dissolution or decomposition: The material is treated with acids or other solutions to dissolve the soluble components.
- Selective precipitation: The desired components are precipitated from solution and filtered.
- Drying and weighing: After drying the precipitate, it is weighed to determine the initial concentration of the analyzed element.

Atomic Absorption Spectrometry (AAS) is used to determine the concentration of metals in mineral aggregates. Atomic absorption spectrometry works on the principle of radiation absorption by free atoms in a gaseous state. The solid sample is dissolved and the solution is atomized in a flame or electrothermal atomization furnace. Radiation of specific wavelength is directed at the atomized sample and the absorption intensity is measured. This is proportional to the concentration of the metal in the sample. AAS is a sensitive and accurate method capable of detecting very low concentrations of metals such as iron, aluminum, manganese or magnesium in breakdown products.

Inductively Coupled Plasma Optical Emission Spectrometry (ICP-OES) is a modern and highly accurate technique used for multi-elemental analysis. Mineral aggregates are dissolved in solutions, then atomized and ionized in an inductively coupled plasma. In high-temperature plasma, atoms and ions emit radiation characteristic of each element.

This technique has the following advantages: allows the simultaneous analysis of several elements (more than 70 elements can be measured simultaneously), it is fast and offers high sensitivity and it is ideal for analyzing elements in very low concentrations (traces) in mineral aggregates.

Inductively Coupled Plasma Mass Spectrometry (ICP-MS) is another advanced technique for multi-elemental analysis that combines a plasma source with mass spectrometry. This method offers higher sensitivity than ICP-OES and is ideal for detecting very small trace metals. Within this technique, the sample is dissolved and introduced into a plasma source for atomization and ionization. The ions produced are then guided into a mass spectrometer, where they are separated by mass-to-charge ratio and quantified. ICP-MS is often used for the analysis of toxic elements such as lead, arsenic or mercury in mineral aggregates resulting from weathering.

X-ray diffraction is used to identify the crystalline phases in the breakdown products. This is essential to understand the mineralogical structure of the aggregates. The solid sample is exposed to X-rays and the resulting diffraction pattern is analyzed to determine the crystal structure of the minerals present. XRD allows identification of specific minerals (such as quartz, feldspar, calcite, dolomite, etc.) and provides information on possible structural changes as a result of weathering. XRD is extremely useful for mineral aggregates because most of them have well-defined crystal structures.

Thermogravimetric analysis (TGA) is a method of thermal analysis that measures changes in mass of a sample as it is heated. It is used to study the thermal stability and decomposition of organic and inorganic components in breakdown products. The sample is heated in a controlled environment and the weight loss is measured as a function of temperature. Volatile components such as chemically bound water or

organic carbon can be identified and quantified. TGA is useful to assess the quality of mineral aggregates and the degree of organic contamination or moisture content.
Titrimetric methods are classical methods of chemical analysis and are still used to determine the concentrations of certain substances in mineral aggregates (e.g., complexometric titrimetry for the determination of calcium and magnesium; redox titrimetry for the determination of iron or manganese; acid-base titrimetry for the analysis of carbonate content or other basic/acidic components) [24, 25].
The disintegration of minerals in mineral aggregates is a complex process. In almost all cases involves physical, chemical and biological actions at the same time, all interconnected. In the case of chemical disintegration, the chemical structure of minerals is altered under the influence of water, carbon dioxide, and any other environmental factors. This can involve reactions such as hydrolysis, oxidation, carbonation, and other kind of reactions. Some of the gaseous pollutants that influence the disintegration of minerals include sulfur dioxide (SO_2), nitrogen oxides (NO_x), carbon dioxide (CO_2) and other acidic compounds that form acid rain.
Hydrolysis is a process in which minerals react with water (H_2O), leading to the modification of the mineral structure as a result of ions dissolution. An example is the reaction of feldspars, aluminosilicate minerals ($KAlSi_3O_8$) with water, with the formation of kaolinites ($Al_2Si_2O_5(OH)_4$), by a typical reaction observed at eqn (1):

$$2KAlSi_3O_8 + 11H_2O + 2CO_2 \rightarrow Al_2Si_2O_5(OH)_4 + 4H_4SiO_4 + 2K^+ + 2HCO_3^- \quad (1)$$

In this reaction, potassium feldspar ($KAlSi_3O_8$) is altered and transformed into kaolinite (a clay mineral), while potassium ions and bicarbonates are released into the solution.
Oxidation involves the reaction of iron-containing minerals, such as pyrite (FeS_2), with oxygen and water, having as result the formation of iron compounds and sulfuric acid (H_2SO_4), as observed at eqn (2):

$$2FeS_2 + 7O_2 + 2H_2O \rightarrow 2FeSO_4 + 2H_2SO_4 \quad (2)$$

Pyrite oxidizes in the presence of oxygen and water, releasing iron ions and sulfuric acid, which can contribute to the acidification of surrounding soils and waters.
Carbonation involves the reaction of carbon dioxide (CO_2) dissolved in water with carbonate minerals, such as calcite ($CaCO_3$). This is a dissolution reaction that follows by the eqn (3):

$$CaCO_3 + CO_2 + H_2O \rightarrow Ca^{2+} + 2HCO_3^- \quad (3)$$

This reaction produces calcium and bicarbonate ions, which are soluble in water and lead to the disintegration of the mineral.
Atmospheric pollutants such as sulfur dioxide (SO_2) and nitrogen oxides (NO_x) form acids when they react with water in the atmosphere, generating acid rains. These acids precipitations accelerate the disintegration of minerals, as observed at equations (4) and (5):

$$SO_2 + H_2O \rightarrow H_2SO_3 \text{ (sulfurous acid)} \quad (4)$$

$$2NO_2 + H_2O \rightarrow HNO_3 + HNO_2 \text{ (nitric acid and nitrous acid)} \quad (5)$$

Sulfuric and nitric acids (H_2SO_3 and HNO_2) in acid rain contribute to the dissolution of carbonate and silicate minerals, accelerating the disintegration of mineral aggregates.
So, gaseous pollutants can be involved in many processes:
- Carbon dioxide (CO_2) participates in carbonation and the formation of acid precipitation.

- Sulfur dioxide (SO_2) is the primary source of sulfuric acid in the atmosphere.
- Nitrogen oxides (NO_x) contribute to the formation of nitric acid.
- Ammonia (NH_3) can contribute to the formation of ammoniacal compounds and environmental acidification.

Once these gases are released into the atmosphere, they lead to the formation of acid rains, which in turn accelerates the chemical disintegration of minerals. This process has negative effects on soils and water bodies in areas with high atmospheric pollution. However, there are practical solution to mitigate gaseous emissions into the atmosphere.
Ambient noise levels, on the other hand, are another major concern in Europe, particularly impacting biodiversity and the activities of various species including invertebrates, mammals, and especially birds. In response to this issue, the European Council has implemented noise reduction policies, such as the Environmental Ambient Noise Policy, which establishes noise limits for major sources of noise pollution. The Directive 2002/49/EC [26], enacted by the European Parliament and the Council on June 25, 2002, addresses the assessment and management of environmental noise. This directive outlines four key area of actions:

-Evaluating exposure to environmental noise and its health impacts at the level of individual dwellings.
-Providing the public with accessible information regarding environmental noise and its consequences.
- Implementing measures to prevent and mitigate environmental noise.
- Maintaining high-quality environmental noise levels in areas where they are already favorable.

Within this study were examined two areas in Prahova County, where mineral aggregate extraction takes place through dredging operations along the minor channels of the Prahova River. This region is part of the Natura 2000 network, particularly the ROSPA0152 Ialomița Corridor, for the protection of bird species.
The purpose of this research was to study and analyze the presence of characteristic bird species and to observe the temporary effects of noise generated by mineral aggregate extraction activities.

MATERIALS AND METHODS

The area studied in this article has one temporary exploitation of mineral aggregates located on the administrative territory of Tinosu Municipality, Prahova County.
The site, located in Prahova County, Tinosu municipality, is within the limits of the special avifaunistic protection area ROSPA0152 Ialomița Corridor (Figure 1). It was designated as SPA by Government Decision of 14 September 2016 on the establishment of the protected natural areas regime and the declaration of special birds protection areas as an integral part of the European ecological network Natura 2000 in Romania. Additionally, the specific conservation objectives at the site level were established in Note from the Ministry of the Environment 28537 of 2021 regarding the approval of the set of special measures for the protection and conservation of biological diversity, as well as the conservation of natural habitats, wild flora and fauna, the safety of the population and investments in ROSPA0152 Ialomita Corridor.

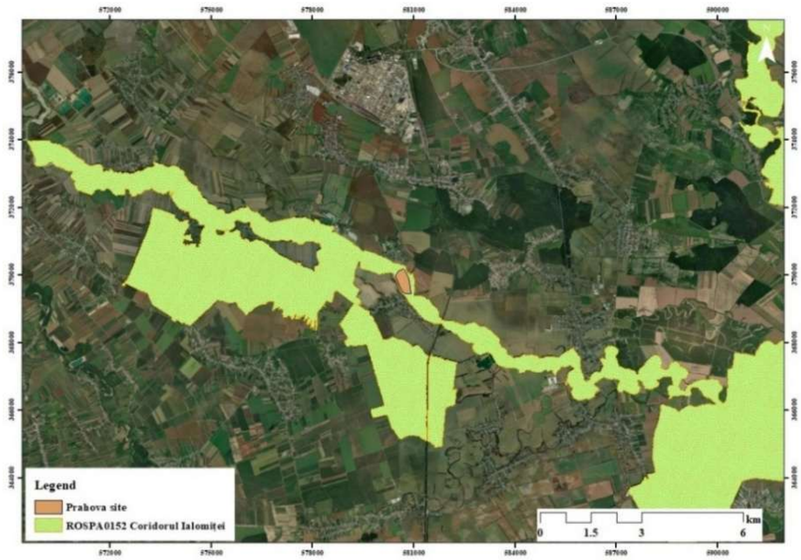

Figure 1. *Location of the studied area in relation to ROSPA0152 Ialomița Corridor*

The site, with an approximate area of 25307.90 ha, is designated for a number of 28 species of birds that use this area for feeding, breeding or nesting. According to the site's Standard Form, a number of 21 species are declared as priority (Table 1).

Table 1. *Priority species ROSPA0152 Ialomița Corridor [27]*

Name	Population in the site		Unit*
	Min	MAX	
Accipiter brevipes	3	4	P
Alcedo atthis	20	30	P
Aythya nyroca	8	12	P
Buteo rufinus	2	3	P
Ciconia nigra	50	100	I
Ciconia ciconia	1	1	P
Coracias garrulus	50	70	P
Dendrocopos medius	200	250	P
Dryocopus martius	20	35	P
Egretta garzetta	20	50	P
Emberiza hortulana	100	200	P
Falco vespertinus	200	300	I
Haliaeetus albicilla	1	1	P
Hieraaetus pennatus	1	1	P
Ixobrychus minutus	10	15	P
Lanius collurio	200	300	P
Lanius minor	80	150	P
Lullula the tree	100	150	P
Nycticorax nycticorax	30	60	P
Pernis apivorus	4	7	P
Picus canus	50	70	P
Sylvia snows	200	300	P

**P – pairs, I – individuals*

In the process of extracting mineral aggregates, noise is generated primarily by the technological equipment operating within the boundaries of the exploitation areas, including excavators, front loaders, and dump trucks. Noise generation is a common aspect of all mineral aggregate mining operations, although it can sometimes be reduced.

The main sources of noise and vibrations are the extraction machines during their operation and their transportation from the work site to the contractors with whom service agreements are in place. The noise produced by the machines operating in the exploitation area (excavators, front loaders, dump trucks) is generally low frequency, which poses a low risk of environmental impact as well as minimal effects on personnel in the exploitation area.

When all noise sources operate simultaneously, and we only consider the distance between the source and the receiver-while neglecting the attenuation effects from vegetation, terrain, and wind-the calculated noise level at the nearest receiver will be quite low.

While noise generation is an inherent aspect of all mineral aggregate mining operations, there are opportunities to mitigate its impact.

In a scenario where an earthmoving machine and two dump trucks are operating simultaneously in the exploitation area, the noise level is expected to remain below the permissible limit of 65 dB (A) at the boundary of industrial premises, as specified by SR 10009:2017 [28].

The method of measuring the ambient noise level complies with the indications mentioned in the SR ISO 1996-1:2016 standard [29].

According to specialized literature, the noise levels associated with the machines used in operations at both sites are as follows: Bulldozer 115 dB (A); Cup charger 112 dB (A);

Excavator 117 dB (A); Tipper 107 dB (A).

The equivalent noise level at the nearest receiver. To find out the noise level at a certain distance from the source, the formula can be applied [9], as observed at eqn (6):

$$L_p = L_w - 10 * \log(r^2) - 8 = L_w - 20 * \log(r^2) - 8(1) \tag{6}$$

where: L_p - noise level; L_w - acoustic power at distance r from the source; r - the distance from the noise source without taking into account the relief (it is used in the case of noise propagation from a point source on flat ground).

The noise level can vary significantly based on the surrounding environment, particularly local conditions and obstacles. As the distance between the receiver and the noise source increases, various factors come into play that can alter how sound propagates, including wind characteristics, air absorption influenced by pressure and temperature, local topography, and the type of vegetation present.

According to SR 10009/2017 on Acoustics, the permissible limit for ambient noise levels in industrial areas is set at 65 dB(A) [28]. SR 10009/2017 is a statute that refers to the methods of measuring noise levels in the environment. This is part of a wider set of standards that address issues related to noise pollution and noise protection, with the aim of establishing uniform procedures for the assessment of acoustic impact in different environments.

The norm includes details on the equipment required for measurements, the conditions under which they must be performed, as well as how to interpret the results obtained.

Also, SR 10009/2017 can be used by authorities, engineers, architects and other acoustic specialists to assess and manage noise levels, thus helping to create a healthier and more pleasant environment for communities.

A thorough evaluation of the impact of mineral aggregate extraction on protected bird species in the Natura 2000 site located in Prahova County is necessary. The type and extent of environmental impacts can differ greatly from one site to another due to various factors, so assessments must be conducted on a case-by-case basis.

To gauge the potential impact on the Natura 2000 site ROSPA0152 Ialomița Corridor, an impact assessment matrix was created. This matrix considers the consequences and likelihood of impacts related to the extraction activities, considering the degree of damage and the probability of occurrence [30].

The software programs Predictor LimAType7810-B and ArcGIS Pro 3.2 were used in this study.

RESULTS AND DISCUSSION

In the beginning, the lithosphere was made up of primary, solid minerals and rocks, which, under the influence of atmospheric agents and water, were subjected to a process of fragmentation and disintegration. The process of breaking up minerals and rocks, after which fragments of various sizes are obtained, but which preserve the mineral and structural composition of the original material, is known as disaggregation. This phenomenon is determined by the action of the physical and biological organism.

Disaggregation caused by physical agents

The physical agents responsible for breaking down minerals and rocks include daily temperature variations, freezing and thawing, water, wind, and gravity.

a) Disaggregation caused by daily temperature variations: Temperature changes during the day lead to expansions and contractions in the mass of minerals and rocks, thus causing them to fragment.

b) Disaggregation by freezing and thawing: Rocks contain small spaces inside, where water can infiltrate. When water freezes, its volume increases, exerting pressure that causes rock layers to peel away. On thawing, rocks break apart due to these internal stresses.

c) Disaggregation by the action of water: Flowing waters strike and erode the rocks, detaching them, transporting them and depositing them in the form of alluvial deposits.

d) Disaggregation caused by wind: The moving air, loaded with fine particles, erodes the rocks, detaching and transporting the fragments, which are later deposited as aeolian deposits.

Disaggregation caused by biological agents

Plants and living organisms in the soil also contribute to the process of rock breakdown. The roots of the plants penetrate the cracks of the rocks, exerting a pressure of 30 - 50 $kg \cdot cm^{-2}$, which leads to their shredding. Soil animals, by digging galleries and nests, facilitate the fragmentation and mixing of rocks, contributing to their disaggregation [31, 32].

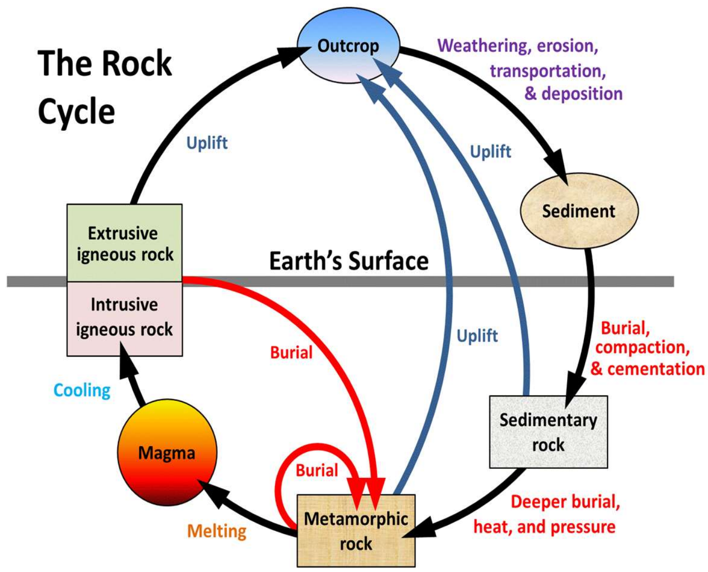

Figure 2. *A schematic view of the rock cycle [33]*

The results obtained regarding the measurements of the noise level generated by the activity of extracting mineral aggregates presented in Table 2 and Table 3 show the environmental conditions in which the measurements were made.

Table 2. *The results obtained regarding the measurements of the noise level generated by the activity of extracting mineral aggregates in ROSPA0152 Ialomița Corridor, Tinosu Municipality, Prahova County*

No.	Measurement point code	LAeq [dB(A)]	LAeq corrected [dB(A)]	Maximum allowed limit, according to STAS 10009:2017	Compliance decisions	Description of the measurement*	Geographic coordinates**
1.	Z-C-PH 0001 / 08.06.2023	51.7	-	65	Yes	3 m from the boundary of the site with activity	579574.80 370448.48
2.	Z-C-PH 0002 / 08.06.2023	42.7	-	65	Yes	3 m from the boundary of the site without activity	579582.71 370448.58
3.	Z-C-PH 0003 / 08.06.2023	-	56.29	65	Yes	Residual noise correction was applied because the residual noise pressure level is below the measured sound pressure level	579582.71 370448.58

No.	Measurement point code	LAeq [dB(A)]	LAeq corrected [dB(A)]	Maximum allowed limit, according to STAS 10009:2017	Compliance decisions	Description of the measurement*	Geographic coordinates**
4.	Z-M-PH-0004 / 17.07.2024	42.7	-	65	Yes	10 m from the limit of the noise source- inactive source	579506.16 370471.56
5.	Z-M-PH-0005 / 17.07.2024	77.7	-	65	Yes	10 m from the limit of the noise source	579506.16 370471.56
6.	Z-M-PH-0006 / 17.07.2024	77.4	-	65	Yes	20 m from the limit of the noise source	579516.08 370472.91
7.	Z-M-PH-0007 / 17.07.2024	76.9	-	65	Yes	30 m from the limit of the noise source	579526.08 370474.26
8.	Z-M-PH-0008 / 17.07.2024	76.2	-	65	Yes	40 m from the limit of the noise source	579535.94 370475.42
9.	Z-M-PH-0009 / 17.07.2024	75.5	-	65	Yes	50 m from the limit of the noise source	579545.84 370476.73
10.	Z-M-PH-00010 / 17.07.2024	73.9	-	65	Yes	60 m from the limit of the noise source	579555.78 370477.94
11.	Z-M-PH-00011 / 17.07.2024	69.6	-	65	Yes	70 m from the limit of the noise source	579565.69 370479.23
12.	Z-M-PH-00012 / 17.07.2024	67.8	-	65	Yes	90 m from the limit of the noise source	579585.54 370481.77
13.	Z-M-PH-00013 / 17.07.2024	65.2	-	65	Yes	110 m from the limit of the noise source	579605.36 370484.30
14.	Z-M-PH-00014 / 17.07.2024	62.6	-	65	Yes	140 m from the limit of the noise source	579635.11 370488.00
15.	Z-M-PH-00015 / 17.07.2024	60.6	-	65	Yes	180 m from the limit of the noise source	579674.82 370493.21
16.	Z-M-PH-00016 / 17.07.2024	57.2	-	65	Yes	230 m from the limit of the noise source	579724.41 370499.58
17.	Z-M-PH-00017 / 17.07.2024	54.8	-	65	Yes	330 m from the limit of the noise source	579823.39 370512.33

*The hourly measurement intervals were 08.00 - 16.30
**ArcGIS Pro 3.2 software

Table 3. *Environmental conditions in 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 [$km \cdot h^{-1}$]	4	3
The direction of the wind	south-south-east	south-south-east

In May 2023, monitoring of bird species was carried out in the area of the site related to the Tinosu Municipality, Prahova County using the linear transect method as a monitoring method on areas 1 to 5 km long. Following these visits, 5 bird species were observed such as: *Egretta garzetta* – 20 adults, *Falco vespertinus* – 10 adults, *Nycticorax nycticora x*– 4 adults, *Alcedo atthis* – 4 adults and *Ixobrychus minutus* – 3 adults.

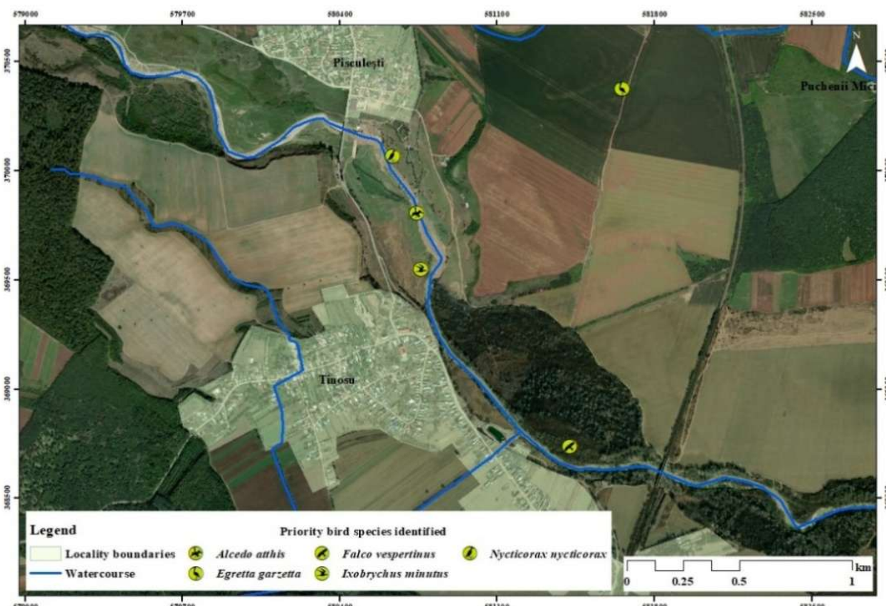

Figure 3. *The presence of priority bird species at the level of ROSPA0152 Ialomița Corridor – May 2023*

The permissible noise level values used to assess environmental conditions from an acoustic perspective at the boundaries of mineral aggregate extraction activities are outlined in SR 10009:2017, Urban Acoustics, with the reference indicator being the LAeq, which represents the equivalent continuous A-weighted acoustic pressure level.
Specialized literature indicates that high noise levels generally lead to the displacement of fauna from affected areas. For instance, Forman *et al*. (1998) noted that bird populations decline when the equivalent noise level exceeds 48 dB(A) [34].
To better illustrate the expected noise levels in the two site areas, noise level modeling was conducted using Predictor LimAType7810-B software, developed by Bruel & Kjaer. This software allows for the calculation of noise contours for large models across various methods. This advanced software is designed for environmental noise

assessment and is widely used in various fields, including urban planning, transportation, and industrial noise control.

The key features of the Predictor LimAType7810-B software include:

- Sound Propagation Modeling: The software utilizes algorithms to simulate how sound travels through different environments, taking into account factors such as terrain, buildings, and vegetation. This allows for accurate predictions of noise levels at various locations.
- Data Input Flexibility: Users can input a variety of data, including source characteristics (e.g., type of noise source, sound power levels), meteorological conditions (e.g., wind speed, temperature, humidity), and topographical information, to refine the noise predictions.
- Assessment of Noise Impact: The software can evaluate the potential impact of noise on different receptors, such as residential areas, schools, and parks. This is essential for compliance with regulatory standards and for informing stakeholders about potential noise issues.
- Visualization Tools: Predictor LimAType7810-B provides visualization tools, such as contour maps and 3D models, which help users to easily interpret the noise level results and communicate findings to non-technical audiences.
- Scenario Analysis: The software allows users to create and compare multiple scenarios, which is useful for assessing the effectiveness of proposed noise mitigation measures, such as barriers or changes in land use.
- Reporting Capabilities: The software includes features for generating comprehensive reports that summarize the modeling process, assumptions, and findings, which can be essential for regulatory submissions and stakeholder communications.

Overall, Predictor LimAType7810-B is a powerful tool that aids in the systematic assessment and management of noise levels in various contexts, ensuring that noise pollution is effectively addressed in planning and development processes.

Thus, knowing the average value of the noise level generated by certain machines used in the extractive industry, by using the dedicated software Predictor LimAType7810-B, a prediction model was made regarding the propagation of the noise level noise, model shown in Figure 4, Figure 5, Figure 6 and Figure 7.

The worst-case scenario was analyzed, involving the simultaneous operation of an earthmoving machine and two dump trucks. In areas designated for mineral aggregate extraction, where activities are concentrated in a single location, it is estimated that the noise isoline of 48 dB(A) is observed at distances of approximately 150 to 330 meters from the work fronts, depending on the intensity of the operations and field conditions. The nature of the activities conducted in the analyzed areas, along with their specific locations, does not appear to disrupt the migration routes or important resting areas for bird species.

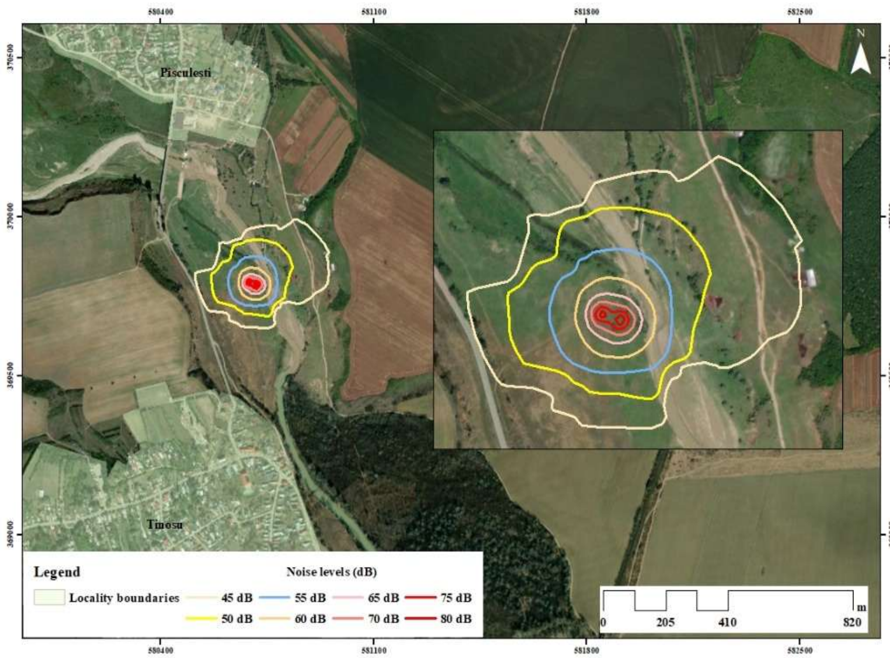

Figure 4. *The expected level of noise at the level of the location in the area of the Tinosu Municipality, Prahova County, in 2020*

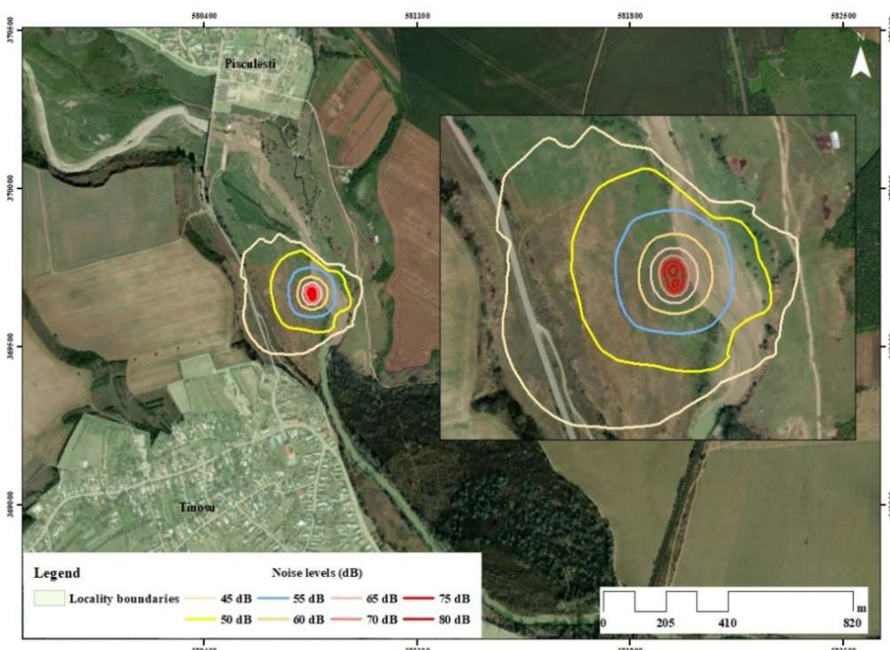

Figure 5. *The expected level of noise at the level of the location in the area of the Tinosu Municipality, Prahova County, in 2021*

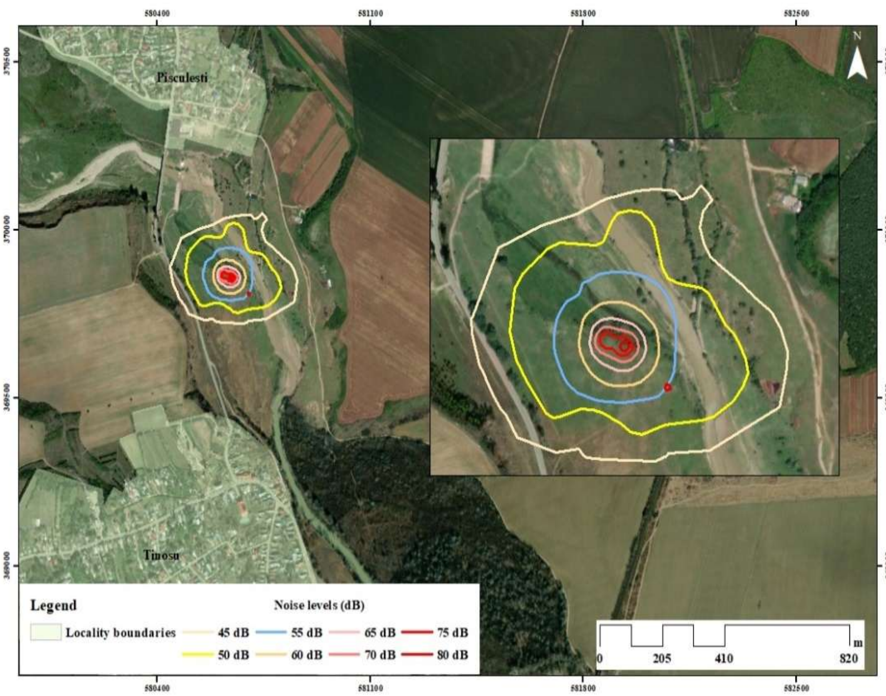

Figure 6. *The expected level of noise at the level of the location in the area of the Tinosu Municipality, Prahova County, in 2022*

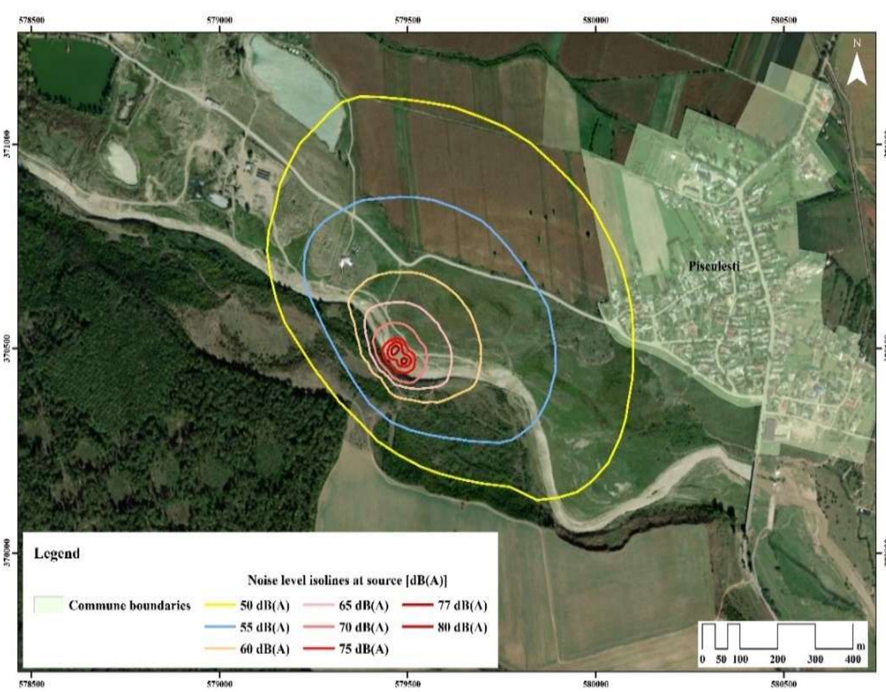

Figure 7. *The expected level of noise at the level of the location in the area of the Tinosu Municipality, Prahova County, in 2024*

For the location Tinosu Municipality, in Prahova County, on July, field trips were carried out, where the mineral aggregate extraction works were observed, recording the level of noise generated at the source, linearly, at different distances from the generating sources, at predetermined coordinates before moving into the field. The location of the measurement points, respectively the values recorded sound level meter, are presented in Figure 8.

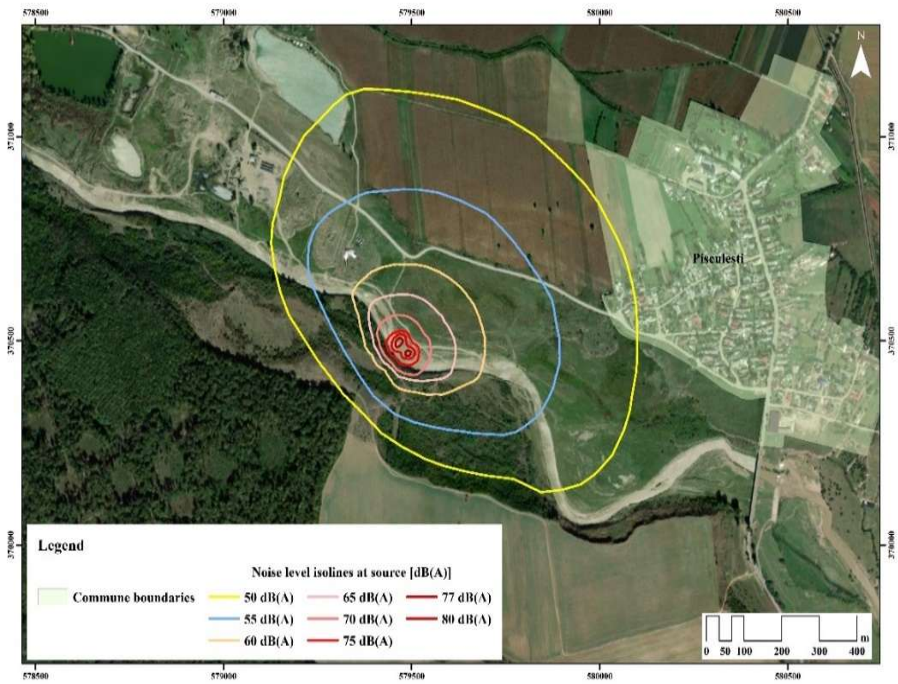

Figure 8. *The measurement points of the noise level and acoustics recorded at the site level within the radius of Tinosu Municipality, Prahova County, in 2024*

Prior to the field visit, a prediction model was made regarding the propagation of the noise level noise, model shown in Figure 7. It could be observed that, by comparison with the values obtained in the field with the help of the sound level meter (Figure 8), that the prediction model made shows a generally increased accuracy.

Considering the information regarding the topographic elevations, terrain characteristics, landscape values, and sound power levels at the source, it can be concluded that the use of the LimAType7810-B Predictor software allows to estimate the potential impact on environmental factors and sensitive receptors. It can be applied to analyze and predict the effects generated by extractive activities on the Prahova River, thus providing relevant data for risk management and the development of environmental protection measures. The activity of fauna species, especially bird species, will be temporarily disturbed during the operation period due to the increase in human presence and the noise produced by the operation of the machines and the performance of the works, the negative effects generated being able to be felt on a small area, of maximum 330 m from the limit of the working fronts [35].

Both analyzed natural areas present very large feeding, nesting and resting areas for bird species, so that during the operating period they will have available surfaces for carrying out the activity.
The high number of priority birds determined following the monitoring of the two analyzed areas, shows that in the case of both locations there is no major impact on their activity.

CONCLUSIONS

Based on the analysis of the noise level measurements from mineral aggregate extraction activities in the Natura 2000 site ROSPA0152 Ialomița Corridor in Tinosu Municipality, Prahova County-along with monitoring of bird species in both areas, we can conclude that the noise generated by mining activities does not significantly affect the behavior of the characteristics of the bird species in either location. There is no major impact on their activity. To better illustrate the expected noise levels in the two site areas, noise level modeling was conducted using Predictor LimAType7810-B software, developed by Bruel&Kjaer. This software allows for the calculation of noise contours for large models across various methods.
To assess the impact of mineral aggregate extraction on the identified bird species, noise level measurements were conducted during the extraction activities. Additionally, several field visits were undertaken to identify the bird species present in the studied areas. To provide a clearer representation of the analyzed elements, maps were created using ArcGIS Pro 3.2 software.
The analysis of the level of impact of mineral aggregates extraction activity on bird species of Community interest from the site ROSPA0152 Ialomița Corridor considered the consequences and probability of negative effects considering the particularities of the area, the technical characteristics of the project, the degree of reversibility of the effects produced and the observations made in the field. The outcome is defined as the level of impact, the impact being considered moderately negative.

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