International Journal of Marketing, Communication and New Media
ISSN: 2182-9306. VOL 13, Nº 25, December 2025

IJMCNM

DOI: https://doi.org/10.54663/2182-9306.2025.v.13.n.235-258

Research Paper

Social Media Intelligence and Wildlife Crime: A Quantitative Analysis.

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ABSTRACT

This paper explores the role of social media intelligence (SMI) and digital marketing—particularly data-driven analytics, social media marketing, and social media platforms—as instruments for analysing and addressing wildlife crime in online spaces, focusing on illegal animal trafficking. This is a descriptive study based on a quantitative approach. A bibliometric analysis was conducted using the Web of Science database, complemented by a quantitative analysis of data extracted from the European Union project ECO-SOLVE platform and the United Nations Office on Drugs and Crime (UNODC) platform, to identify the main patterns of action of traffickers on social networks. The results show a growing number of research studies interested in applying digital tools to track and prevent illegal animal trafficking, with a predominance of scientific publications in the areas of environmental sciences and criminology. The results also indicate the use of digital social networks by criminals, with Facebook standing out as the main platform for disseminating ads. By leveraging SMI, authorities and digital platforms can proactively identify and disrupt illegal activities, particularly on platforms like Facebook, which are frequently exploited by traffickers. The findings call for urgent, collaborative, and ethical action among institutions, law enforcement, and social media companies to enhance the effectiveness of digital tools in addressing this global issue. The Scopus database was not included in the analysis, and so the inability to access specific data may have restricted the scope of the research. The conclusion highlights that SMI is a promising approach to monitoring and combating wildlife trafficking. It emphasises originality by suggesting that maximising its effectiveness requires integrated and ethical action between institutions, authorities, and digital platforms. This study underscores the critical role of SMI in revolutionising enforcement practices and digital communication strategies to combat wildlife trafficking.

Keywords: Social media marketing, social media platforms, social media intelligence, data-driven marketing, marketing analytics, wildlife crime, illegal trafficking.

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Received on: 2025.07.21
Approved on: 2025.10.02
Evaluated by a double-blind review system

1. INTRODUCTION

The illegal wildlife trade is part of transnational organised environmental crime in a globalised context, based on sophisticated networks and highly lucrative markets. The illicit wildlife trade is one of the primary threats to global biodiversity and is driven by cultural, economic, and technological factors (Wyatt et al., 2022). In recent years, the growth of digital social networks has significantly altered the dynamics of the illegal wildlife trade, leading to an increase in crimes against fauna due to the ease with which these networks facilitate the demand for and supply of protected species. Social media platforms serve as essential digital frameworks that facilitate worldwide interaction among users, fostering settings suitable for both lawful activities and unlawful behaviours. These platforms — including Facebook, Instagram, TikTok, and WhatsApp — function as vibrant ecosystems that enable the creation, sharing, and distribution of multimodal content, while promoting the connection between supply and demand instantaneously. In the realm of illicit wildlife trafficking, their interconnectedness and worldwide scope significantly heighten the danger of encountering and utilising protected species (Huertas-García et al., 2023; Salas-Picazo et al., 2023). Traffickers make the most of digital marketing tools to expand the scope and effectiveness of their operations (Di Minin et al., 2018; Greenfield & Veríssimo, 2019; Lavorgna, 2014). The increasingly intensive use of social networks as facilitators of wildlife crime is partly due to their ability to offer anonymity, ease of access, and reach to a wider audience. Traffickers exploit these platforms to publish, in the form of photographs, and very often, alongside captivating images of the animals, are elaborate descriptions with unique hashtags, created to facilitate access to buyers (Lavorgna, 2014). In addition, features such as private groups and encrypted messages facilitate covert negotiations, making it more difficult for authorities to monitor these activities (Nijman et al., 2022). The responses of digital platforms have been considered insufficient by several experts (Di Minin et al., 2018). Despite removing posts, adding warning notices, and applying policies prohibiting the sale of protected species, the measures of these digital platforms tend to be inconsistent and ineffective, especially when applied to different languages and regions (Singh, 2021). In addition, the use of recommendation algorithms can

accidentally increase the likelihood of exposure to this type of content by users interested in these materials (Bergman et al., 2022).

To obtain relevant knowledge from digital platforms, a new field of intelligence has emerged: social media intelligence (SMI), which uses data science techniques, network analysis, and natural language processing (Berger-Wolf et al., 2017; Greenfield & Veríssimo, 2019). Examples of SMI's potential include the implementation of methodologies that make it possible to monitor, detect, and map supply patterns in near real time, enabling both the anticipation of illegal activities and the reinforcement of enforcement actions (Greenfield & Veríssimo, 2019; Shaheen, 2025). Although there are studies on animal trafficking in physical contexts, the digital market for species is still little explored (El Bizri et al., 2024; Lavorgna, 2014). The automatic recognition of animal images for commercial purposes contributes to more effective continuous surveillance of suspicious content, demonstrating the applicability of computer vision algorithms to the investigation of crimes against nature (Greenfield & Veríssimo, 2019). In this context, it becomes urgent and indispensable to endeavour to understand the interactions between SMI and wildlife crime. This understanding is essential not only for the development and improvement of automated detection tools but also for the formulation of public policies and regulations applicable to digital platforms, intending to correct legal and institutional loopholes that encourage impunity (Al Kurdi et al., 2022; Greenfield & Veríssimo, 2019).

This study aims to critically evaluate the SIM methodologies applied to monitoring wildlife crime in digital contexts. Through a bibliometric analysis and analysis of the ECO-SOLVE and UNODC platforms, the aim is to identify the main patterns of action of traffickers on social networks, as well as the most effective tools and methodologies for detecting and monitoring these illegal activities. The structure of this work includes a theoretical contextualisation of wildlife trafficking and the role of social networks, a description of the methodologies used, a presentation and discussion of the results obtained, and, finally, conclusions and future recommendations.

2. LITERATURE REVIEW

2.1. Illegal wildlife trafficking in the global context

The illegal wildlife trade is one of the most profitable and influential criminal activities worldwide in the environmental context (Mozer & Prost, 2023). This phenomenon, which involves the illegal capture, transport, and sale of wild species, is often associated with organised international

networks and takes place outside of legal systems and environmental protection regimes. According to Interpol (2023), the illegal trade in species generates an annual financial volume of between 7 billion and 23 billion dollars, making it one of the four main global illicit markets. This activity represents an immediate threat to the preservation of biodiversity and severely impacts the ecological sustainability of various ecosystems (UNODC 2024). In recent years, the growing demand for exotic animals, either as pets or as products valued for their ornamental, medicinal, or gastronomic characteristics, has fuelled the growth of this market (Nellemann et al., 2016). This demand is based on complex cultural, social, and economic factors, often associated with social status symbolism and the belief in unproven therapeutic properties (Wyatt et al., 2020).

Amerhauser and Cartwright (2023) and Nijman et al. (2022) point out that the globalisation of value chains related to environmental crime, combined with weak enforcement structures and institutional corruption, is one of the main factors driving the growth of this trade. In tropical regions, especially in the Amazon basin, Southeast Asia, and Central Africa, the illegal wildlife trade is strongly associated with the destruction of habitats and the clandestine exploitation of natural resources (Rosen & Smith, 2010).

In addition to the ecological consequences, the illegal wildlife trade poses major risks to public health; for example, the COVID-19 pandemic has demonstrated the link between the wildlife trade and the emergence of zoonoses (Choo et al., 2023; Shivaprakash et al., 2021). Direct contact with these trafficked species, often in morbid conditions, increases the likelihood of epidemic outbreaks that can have global repercussions. At the same time, there is growing concern about the use of digital technologies as facilitators of this type of crime.

Sellers use social media platforms, online marketplaces, and anonymous payment systems to conceal, commercialise, and distribute protected species on an international scale (Cardoso et al., 2023; Di Minin et al., 2018; Lavorgna, 2014; Salas-Picazo et al., 2023). International laws, such as the Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES), attempt to impose restrictions on trade in endangered species; however, the effectiveness of these measures depends significantly on how they are integrated into national legal systems and the ability to monitor and enforce regulations (Challender & MacMillan, 2014).

2.2. Digitalisation of wildlife trafficking

Digitalisation is significantly changing the landscape of the illegal animal trade. The shift from the physical to the digital market is not just a change of format, but a restructuring of the practices,

individuals involved, and tactics used to capture, transport, promote, and sell protected species. This technological revolution has expanded the geographical and social reach of traffickers, while dispersing and fragmenting their operations, making it difficult for the competent authorities to identify them (Hernandez-Castro & Roberts, 2015; Lavorgna, 2014).

In the first investigations into wildlife trafficking, the focus was mainly on physical locations, such as markets, specialised shops, airports, and smuggling routes (Martin & Stiles, 2000; Rosen & Smith, 2010). However, since the late 2000s, there has been a steady increase in transactions on online platforms, such as forums, auction sites, digital marketplaces, and, more recently, on social media (Alacs & Georges, 2008; Lavorgna, 2014). The convenience, anonymity, and ease of access offered by these digital environments act as drivers of supply and logistical facilitators for sellers. One of the most notable features of the digitalisation of the wildlife trade is its ability to adapt and move between different platforms. Traffickers don't limit themselves to just one medium: they often start interactions with potential buyers through public posts on social networks, then move the conversation to private or encrypted messaging apps such as WhatsApp, Telegram, or Signal (Mou et al., 2024; Wyatt et al., 2022). This behaviour, called "tactical migration", makes monitoring more difficult and requires analytical methods that cover the entire transaction cycle. In addition, the application of textual and visual masking techniques represents a significant challenge for automated surveillance systems (Mou et al., 2024). Keywords are intentionally altered, and animal images are often edited with filters, overlays, or placed in neutral contexts to evade detection by automated systems. In multilingual contexts, the situation is even more complicated, as traffickers use local jargon, dialects, or even pictographic symbols (emojis) to cover up the true intentions of the publications (Huertas-García et al., 2023; Zhu & Bhat, 2021).

Digitalisation not only increases the channels of communication between sellers and buyers but also transforms the exchange of information. Social networks such as Facebook, Instagram, or TikTok act not only as places for direct sales but also as platforms for educating the market. Dealers produce content that teaches consumers how to acquire, transport, and care for exotic animals, often using video tutorials, buyer testimonials, and care instructions - methods that resemble legitimate content marketing strategies (Cardoso et al., 2023; Mou et al., 2024). The rise of unlawful species trading in online spaces shows similarities to authentic social media marketing tactics, as traffickers utilise engaging visual material, compelling stories, and targeted hashtags to lure prospective buyers and enhance the prominence of their promotions. These techniques,

commonly utilised in digital marketing campaigns, illustrate the use of promotional methods characteristic of legitimate markets for illegal purposes (Shaheen, 2025). Moreover, this phenomenon is a component of a data-oriented marketing strategy, where the structured application of behavioural and interaction data on digital platforms enables enhanced audience segmentation and increased message effectiveness. When utilised in wildlife trafficking, this data-centric model enhances the complexity of criminal activities and their capacity to adjust to various sociocultural environments (Cardoso et al., 2023). In addition to social networks, digital marketplaces have played an important role in this online environment. Websites such as eBay, Alibaba, Mercado Livre, and OLX have often been cited as places where wildlife products such as ivory, scales, skins, and bones are sold, often under the classification of "collectable" items, "ethnic art" or "natural remedies" (Huertas-García et al., 2023; Zhu & Bhat, 2021). Although some of these websites have created rules to prohibit the sale of protected species, the application of these rules is inconsistent, depending on the jurisdiction, language, and moderation resources available.

Another factor to consider when digitising animal trafficking is the financial aspect. The use of digital payment methods, such as virtual wallets, cryptocurrencies, and fast transfers, has considerably increased the speed and secrecy of transactions (Greenfield & Veríssimo, 2019). The use of cryptocurrencies such as Bitcoin or Monero has been reported in rare species trafficking networks, especially in high-value international transactions. These new technologies create additional layers of complexity for investigations, as they make financial tracing and criminal accountability more difficult (Nijman et al., 2022).

With digitalisation, the profiles of traffickers and buyers have also changed. Many dealers now act as small digital entrepreneurs, with a presence on various platforms, using personal branding strategically, responding quickly to customers, and even managing their online reputation (Weston & Greenfield, 2024). These individuals use informal communication that gets closer to the consumer and apply online influence strategies, including fake reviews, promotion bots, and algorithmic manipulation (Bergman et al., 2022). The professionalisation of these activities challenges traditional crime paradigms and aligns with what authors, such as Lavorgna (2014) characterised as informal business crime.

2.3. Social media intelligence and the detection and monitoring of environmental crime

In recent decades, SMI has established itself as a vital component in the assessment and monitoring of digital platforms, making it possible to collect, analyse, and understand large amounts of data for various strategic purposes (Sadiku et al., 2021). SMI, a subfield of Open-Source Intelligence (OSINT), focuses exclusively on data from digital social networks and has emerged as an indispensable resource, enabling the evaluation of the information obtained to recognise and prevent actions (Chauhan & Panda, 2015). SMI refers to the collection, analysis, and interpretation of publicly accessible data on social networks to facilitate tactical decision-making in corporate and institutional environments (Clarke, 2025; Söilen, 2018). In the context of environmental crime, SMI makes it possible to identify dubious behavioural patterns, monitor smuggling networks, and uncover illegal advertisements for the sale of protected species. For example, the ECO-SOLVE project, funded by the European Union, is coordinated by the Global Initiative Against Transnational Organised Crime (GI-TOC) and uses artificial intelligence technology to monitor illegal wildlife markets on digital platforms, connecting data centres in strategic nations such as Brazil, Colombia, Thailand, Indonesia, Nigeria, and South Africa (Siggia, 2025). This system has already detected thousands of illegal publications, covering the sale of live animals and products made from them, such as lion skins and whale teeth. By analysing textual information, artificial intelligence (AI) can recognise the elements that impact changes in users' feelings and opinions, which allows organisations to predict trends and adapt their communication strategies more efficiently (Alattar & Shaalan, 2021). This in-depth knowledge strengthens the relevance of SMI as a crucial tool for deciphering digital behaviour and improving interaction between brands, organisations, and the public (Alattar & Shaalan, 2021).

The implementation of SMI in the identification of environmental crimes can be carried out through a variety of approaches, such as data mining, machine learning, and social network analysis. These approaches make it possible to collect and analyse large amounts of data, helping to detect suspicious actions and understand the dynamics of trafficking networks. Integrating marketing analytics techniques into the examination of illegal wildlife trade enables the quantification and tracking of supply and demand trends, while also providing insight into the relational dynamics among traffickers, intermediaries, and consumers. These methods consist of data mining techniques, sentiment analysis, and network modelling, allowing for the identification of questionable content and the prediction of upcoming trends. Their use in environmental crime

scenarios illustrates how tools created for commercial reasons can be modified to oversee and deter illegal actions (Mozer & Prost, 2023; Cardoso et al., 2023).

Despite the potential of social media in identifying environmental crime, there are several challenges and limitations that complicate its application. One of the main barriers is the use of camouflage techniques employed by traffickers, who adopt codes, emojis, and different variations of language to evade automatic detection (Nijman et al., 2022). In addition, data collection on social networks can be restricted by limitations on access to interfaces that enable communication between systems (Application Programming Interfaces - APIs) and by concerns related to user privacy. Another important challenge is the distinction between legal and illegal wildlife trade. Ads often don't provide enough information to assess the legality of the transaction, which requires more detailed analysis and, on some occasions, the intervention of experts in the field. Furthermore, the effectiveness of social media analysis tools depends on the quality and timeliness of the data available, which can vary significantly between different platforms and sites. Despite advances in forensic technologies for identifying species and tracing illegal products, the scarcity of investigations focused on identifying the human culprits makes it difficult to hold criminal networks legally accountable and efficiently dismantle them (Rosen & Smith, 2010; Thomas et al., 2023). Thomas et al. (2023) emphasise the importance of integrating approaches that combine biological analysis with social intelligence and criminal investigation techniques to strengthen the fight against trafficking.

3. METHODOLOGY

This descriptive study, based on a two-phase quantitative approach, aims to identify the main patterns of action of traffickers on social networks, as well as the most effective tools and methodologies for detecting and monitoring these illegal activities. To this end, a first phase was carried out with a bibliometric analysis, drawing on the existing literature, which is in line with the literature review approach developed by Snyder (2019). Consequently, the academic database Web of Science was searched using combinations of keywords such as "wildlife trafficking", "wildlife crimes", "social media", and "intelligence". The analysis was limited to articles published in English between 2014 and 2024. The final selection prioritised recent, high-impact studies and seminal theoretical works. While not a fully systematic review, this approach ensured transparency, reproducibility, and analytical rigor, enabling a comprehensive synthesis of current

knowledge expressed through our conceptual framework. Excel and VOSviewer tools were used to analyse the database. A second phase included the collection and analysis of secondary data from specialised databases and online content monitoring platforms, ECO-SOLVE and UNODC, which monitor illegal trade on various social networks and digital marketplaces. This data is organised into categories by animal group (mammals, birds, reptiles, amphibians, among others), by digital platform (Facebook, OLX, Instagram, etc.), and by geographical location of the ads (countries where the activity is most significant). This methodological procedure allows for a multidimensional approach to the phenomenon, combining empirical evidence from online monitoring with academic insights on the subject, contributing to the development of more effective strategies for monitoring and preserving biodiversity.

4. RESULTS AND DISCUSSION

4.1. Bibliometric analysis

Based on Moher et al. (2015), a bibliometric analysis was carried out and follows the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) flowchart. The research consisted of articles published in the Web of Science (WoS) online data repository with the terms "wildlife trafficking", "wildlife crimes", "social media", and "intelligence". The first filter found 2,385 documents. Of this total, the search was limited to the years 2014 to 2024, making a total of 1,712, limiting the search to only published articles (1,519), in English (1,502), and in open access, which filtered the database to 952 articles. Published articles related to SIM and wildlife crime have undergone various changes in volume over time, as can be seen in Fig. 1.

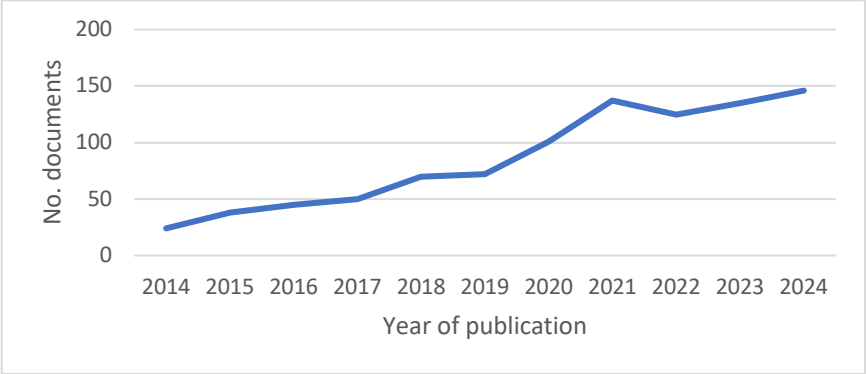

Fig. 1. Annual trend in the number of articles published

Between 2014 and 2024, there was a consistent increase in the number of scientific publications related to the subject under study. In 2014, 24 articles were identified, a number that increased over the years, with some significant increases, particularly from 2019 onwards. In 2020, there were 101 publications, a figure that continued to rise, reaching 137 articles in 2021. Despite a slight decrease in 2022 (125 articles), the general trend continued upwards, with 135 articles in 2023 and a new high of 146 articles in 2024. This steady increase reflects the scientific community's growing interest in the subject of wildlife crime and the role of social media and intelligence in preventing and combating it. The most relevant articles were then identified based on the number of citations, making it possible to highlight the themes and approaches that have attracted the most attention and impact in academic research. Table 1 shows the five most-cited articles according to the Web of Science database.

Table 1. Most cited top 5 articles

Ranking	Article Title	Authors	Year	Citations
1	Isolation of SARS-CoV-2-related coronavirus from Malayan pangolins	Xiao et al.	2020	453
2	Capillary cell-type specialisation in the alveolus	Gillich, et al.	2020	263
3	Why must we question the militarisation of conservation	Duffy et al.	2019	224
4	How Effective Is Road Mitigation at Reducing Road-Kill? A Meta-Analysis	Rytwinski et al.	2016	211
5	A phantom road experiment reveals that traffic noise is an invisible source of habitat degradation.	Ware et al.	2015	186

The article with the highest number of citations is "Isolation of SARS-CoV-2-related coronavirus from Malayan pangolins", published in Nature in 2020, with a total of 453 citations, standing out from the rest. In second place is the article "Capillary cell-type specialisation in the alveolus", also published in Nature in 2020, with 263 citations. This was followed by the article "Why we must question the militarisation of conservation", published in the journal Biological Conservation in 2019, with a total of 224 citations. In fourth place is the article "How Effective Is Road Mitigation at Reducing Road-Kill? A Meta-Analysis", published in PLOS One in 2016, with 211 citations. Finally, "A phantom road experiment reveals traffic noise is an invisible source of habitat

degradation", published in Proceedings of the National Academy of Sciences (PNAS) in 2015, with 186 citations. This ranking highlights the studies with the greatest impact on the scientific community, serving as essential references for research into wildlife crime and related topics such as zoonotic diseases, conservation, and human impact on biodiversity. Table 2 shows the authors with the highest number of publications in this area, highlighting five researchers with the highest identified scientific output.

Table 2. Top 5 authors with the most published articles

No. Publications	**Names Authors**
10	Vincent Nijman
8	Jackie Dawson
7	Chris R. Shepherd
7	Clinton D. Francis
6	Richard Andrasik

Analysing the authors with the highest number of publications in the area, Vincent Nijman stands out, with a total of 10 articles, assuming a position of clear quantitative leadership in scientific production on the subject. He is followed by Jackie Dawson, with eight publications, and then by Clinton D. Francis and Chris R. Shepherd, both with seven publications, and Richard Andrasik with six articles. These authors are key references in the field and could be relevant starting points for future literature reviews, identification of research trends, and possible academic collaborations. In continuity, it is also important to highlight the Top 5 journals with the highest concentration of relevant production in the area (Table 3).

Table 3. Top 5 journals with the most articles published

Journal	No. Articles
PLOS ONE	48
Global Ecology and Conservation	46
Biological Conservation	33
Animals (Basel)	24
Scientific Reports	23

With regard to the scientific journals with the highest volume of publications on this subject, PLOS One stands out, with a total of 48 articles published, positioning itself as the main source of dissemination of research related to wildlife trafficking, environmental crime, and the role of social networks and intelligence in combating it. This was followed by Global Ecology and Conservation, with 46 publications, also showing a strong contribution to this area of study. In third place is Biological Conservation, with 33 published articles, consolidating its important role in the scientific literature dedicated to wildlife conservation. The journals Animals (Basel), with 24 articles, and Scientific Reports, with 23 publications, were less representative but still significant. This panorama reflects a strong interest and growing scientific production, spread across various impact journals, with a special emphasis on open-access and multidisciplinary journals, which favour wide dissemination and international debate on the challenges and strategies in combating wildlife crime. Analysing the thematic distribution of articles reveals a clear predominance of areas linked to environmental and ecological sciences, as well as criminology, as shown in Fig. 2.

Fig. 2. Thematic analysis

The category with the highest number of publications is Environmental Studies, with 111 articles, followed by Ecology (99 articles), Environmental Sciences (86 articles), and Biodiversity Conservation (67 articles). This pattern suggests that the issue of wildlife trafficking is largely dealt with from an ecological and conservation perspective, highlighting researchers' concern with environmental impacts and the preservation of global biodiversity. Also noteworthy is the significant presence of the area of Criminology and Penology, with 42 articles, which demonstrates the growing attention paid to the criminal, legal, and punitive components associated with these phenomena. This intersection between environmental sciences and criminology reflects the complex and multifaceted nature of species trafficking, which involves both ecological damage and organised criminal networks. Other relevant areas appear with less, but not insignificant, expression. For example, Transport (31 articles) analyses the means and routes used in the illicit movement of fauna and flora. Zoology (29 articles) focuses on the species affected, while Geography (36 articles), Physical Geography (21 articles), and Urban Studies (21 articles) indicate an interest in the spatial and territorial dimension of these crimes, as well as the role of urban areas as places where illegal products are transacted, stored, or finalised. These results show that wildlife trafficking is a transdisciplinary phenomenon with environmental, criminal, logistical, territorial, and social implications. Analysing the geographical origin of the 446 articles identified in the Web of Science reveals a global distribution of research on the subject (Fig. 3).

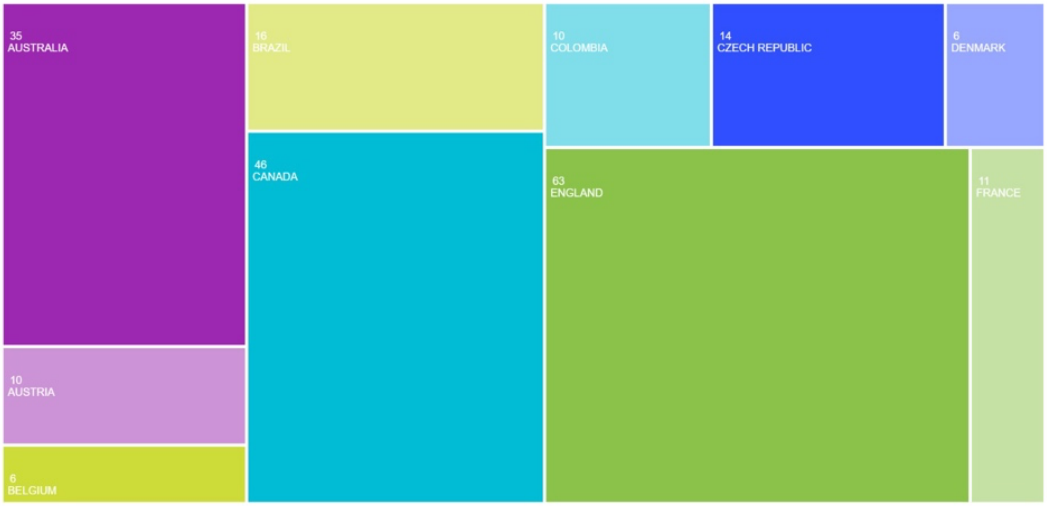

Fig. 3. Analysis of geographical distribution

The results show a strong concentration of scientific production in countries in the northern hemisphere, with England leading the way with 63 publications (Figure 3). This number reflects the country's commitment to research in environmental conservation, criminology, and monitoring technologies applied to biodiversity protection. Canada comes second with 46 articles, also indicating an active role in combating wildlife trafficking, namely through the integration of digital intelligence tools and environmental monitoring strategies. Australia, with 35 publications, is in the third position, as a country with high biodiversity and vulnerable to illegal trafficking of species, which justifies its significant involvement in research on the subject. Brazil, with 16 publications, represents Latin America in this global discussion. Its rich biodiversity and the challenges faced in combating the trafficking of fauna and flora justify the growing academic and institutional attention the topic has received in the country. Other countries with relevant contributions include France (11), Austria (10), Colombia (10), Denmark (6), Belgium (6), and the Czech Republic (6), revealing a dispersed but significant interest in the subject. These data suggest that wildlife trafficking is recognised as a global and transdisciplinary problem, arousing attention both in countries directly affected by this type of crime and in international research centres interested in its ecological, legal, and technological dimensions. Using VOSviewer software, a co-occurrence analysis of keywords associated with wildlife trafficking was carried out. The map generated makes it possible to visualise the thematic interconnection between different areas of research and the most relevant topics (Fig. 4).

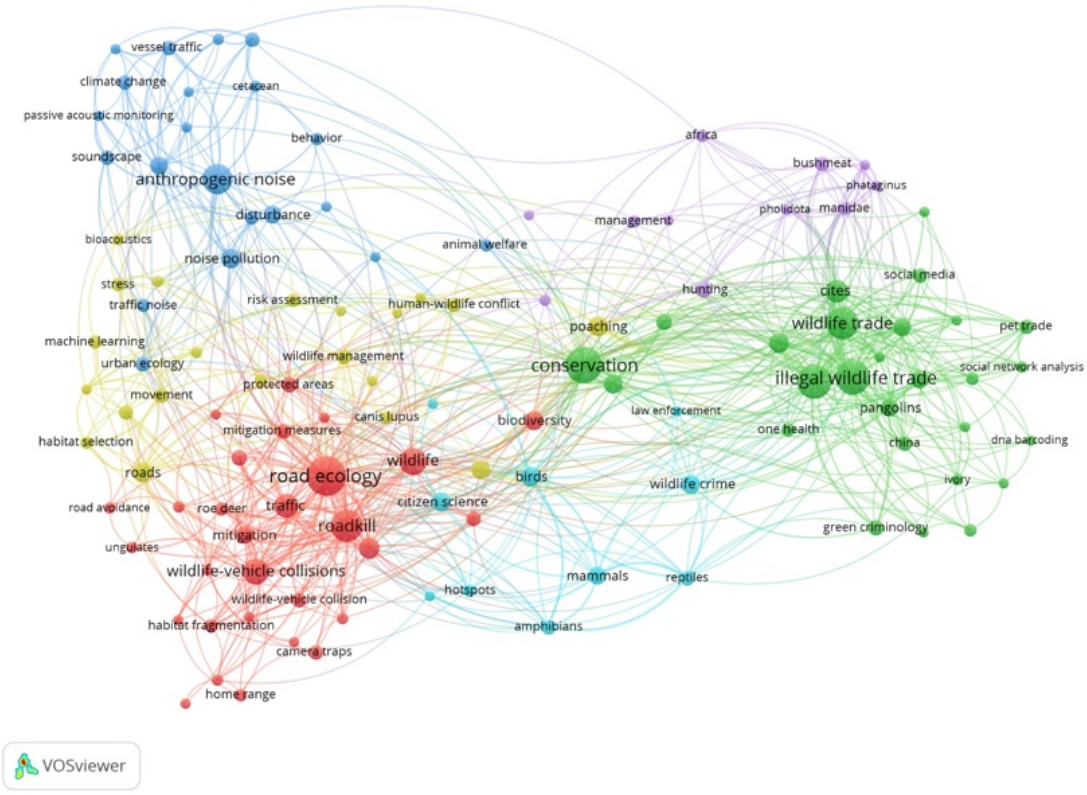

Fig. 4. Keyword co-occurrence analysis

The image shows the centrality of the concepts "wildlife trafficking", "wildlife trade" and "conservation", reflecting the close link between species trafficking and the challenges of preserving biodiversity. These terms are at the centre of a dense green cluster, where notions such as "green criminology" and "ecosystem services" also stand out, highlighting both the ecological impact and the criminological approach to studying these phenomena. The red cluster, identified as "road ecology", points to the role of human infrastructure in habitat degradation, with special emphasis on terms such as "wildlife-vehicle collisions", "traffic noise", and "urbanisation", revealing the direct threats of urban development to wildlife. The blue section highlights anthropogenic disturbance factors, such as "anthropogenic noise", "human disturbance", and "animal welfare", illustrating the constant pressure of human activities on natural ecosystems. Finally, there is a growing technologization of research, visible through the presence of terms such as "machine learning", "satellite tracking", "DNA barcoding", and "bioacoustics", demonstrating the adoption of advanced tools to monitor and combat trafficking and its impacts on wildlife. The

network of concepts thus shows a multidisciplinary approach that integrates biology, criminology, ecology, and technology, which is essential for tackling the complexity of wildlife trafficking and its environmental impacts.

4.2. Online content monitoring platforms: ECO-SOLVE and UNODC

This section analyses data from the European Union project ECO-SOLVE and the United Nations Office on Drugs and Crime (UNODC), databases specialised in monitoring illegal activities related to wildlife trafficking in digital environments. Regarding the ECO-SOLVE database, the data analysed covers the period between 1 January 2022 and 23 May 2025, the date of the last update used in this study. This database gathers information collected automatically using algorithms to detect language associated with illegal trafficking on digital platforms. The UNODC's database includes records from international and national operations to combat trafficking in species, with systematised data from 2019 to May 2025. This source combines historical data with regular updates, allowing for a more longitudinal and institutional analysis of the phenomenon. This ensures a complementary approach: on the one hand, ECO-SOLVE offers a more dynamic and real-time perspective of online activity; on the other, UNODC provides a structured and legally consolidated view of the offences reported by the authorities over the last few years. Table 4 illustrates the number of suspicious ads related to illegal trade identified on various social networks, categorised by animal group. We can see that mammals represent the category with the highest number of suspicious adverts, with over 5.500 records, making them the most targeted group. This is followed by birds, with around 2.000 occurrences, and reptiles, with approximately 1.300 adverts.

Table 4. Suspicious ads about animal groups based on ECO-SOLVE

Group of animals	No. of suspicious ads
Mammals	5671
Birds	2163
Reptiles	1241
Amphibians	726
Ivory	685
Dart frogs	7

The categories of amphibians, dart frogs, and ivory registered significantly lower figures, all below 1.000 suspicious adverts. This distribution shows that mammals are the main targets of monitored online trafficking, and it is crucial to strengthen surveillance and measures to combat illegal trade in this category on digital platforms.

Table 5 shows the countries where suspicious ads related to wildlife trafficking on digital platforms have been identified. In geographical terms, Thailand (6,166), South Africa (1,411) and Brazil (1,292) are the countries with the highest number of suspicious ads.

Table 5. Suspicious ads by country based on ECO-SOLVE

Country	**No. of suspicious ads**
Thailand	6166
South Africa	1411
Brazil	1292
India	221
Indonesia	177
Colombia	111
Jordan	74
Saudi Arabia	35
Bangladesh	33
Kuwait	15
United Arab Emirates	7
Oman	2

This geographical distribution highlights the prevalence of illegal wildlife trade in specific regions, mainly in Southeast Asia, Africa, and Latin America, and emphasises the need to strengthen monitoring mechanisms and international cooperation to combat this type of environmental crime. Analysing the data also reveals that the species most affected by animal trafficking are, to a large extent, those with body parts that are highly valued on the illegal market (Table 6). Table 6 shows that the rhinoceros is the most targeted species, mainly for its horn, with 29% of the cases recorded. This is followed by pangolins, whose scales are highly sought after in traditional Asian medicine,

accounting for 28% of the incidents. Elephants, targeted for the ivory of their tusks, accounted for 15% of the species affected, reinforcing the persistent demand for animal products considered exotic or luxury. Eels and crocodiles account for 5% each, which may be related to their gastronomic value and the use of their skin, respectively. On the other hand, species such as parrots, cockatoos, carnivores (e.g., tigers, lions, leopards), turtles, terrapins, snakes, and seahorses register lower percentages (around 2% each), but are still relevant, mainly due to trafficking for the exotic animal market, medicinal or ornamental use.

Table 6. Most affected species based on data from Unodc.org. 2015-2021

Species most affected	**Percentage**
Rhinoceros (horn)	29%
Pangolins (scales)	28%
Elephants (ivory)	15%
Eels	5%
Crocodiles	5%
Parrots and cockatoos	2%
Carnivores (such as tigers, lions, leopards...)	2%
Turtles and terrapins	2%
Snakes	2%
Seahorses	2%
Others	8%

This pattern shows that species trafficking is mainly motivated by commercial interests associated with the use of animal parts, with worrying consequences for biodiversity conservation. With regard to the distribution of the number of adverts suspected of illegal trafficking on the different digital platforms, Facebook (9,244) stands out as the main platform used to publicise these ads (Table 7). The data in Table 7 also shows that the OLX platform has 243 adverts, and Line has 119. Other platforms such as Tokopedia (73), YouTube (59), and Instagram (28) also register suspicious activity, albeit on a smaller scale. Finally, platforms such as Opensooq, Mercado Livre, WhatsApp, Amazon, and eBay show residual numbers, with less than 20 ads each.

Table 7. Suspicious ads on the different platforms based on ECO-SOLVE

Platforms	**No. of ads**
Facebook	9244
OLX	243
Line	119
Tokopedia	73
Youtube	59
Instagram	28
Opensooq	20
Mercado Livre	10
Whatsapp	9
Amazon	3
Ebay	1

4.3. The role of marketing professionals in combating wildlife trafficking

In addition to the technological and criminological approaches analysed, it is important to highlight the contribution that marketing professionals can make in addressing the challenges of wildlife trafficking in digital environments. Given their expertise in digital communication, market segmentation, and data analysis, these professionals are well-positioned to act on multiple fronts. Firstly, the application of marketing analytics techniques enables the identification of behavioural patterns, demand trends, and suspicious interactions on social media and digital marketplaces. By employing tools for large-scale data collection and analysis, marketing professionals can support the construction of predictive models that anticipate the dynamics of illicit networks. In this sense, SMI, supported by AI innovations and human-machine cooperation methodologies, is becoming a powerful resource for analysing, monitoring, and managing content on social networks, with applications ranging from internet security to strategic communication (Alattar & Shaalan, 2021; Mehta & Passi, 2022; Sadiku et al., 2021; Yang et al., 2023). Secondly, strategies traditionally used in social media marketing can be adapted to implement counter-narratives that discourage the consumption of products derived from illegal wildlife trade. Through campaigns based on storytelling, digital influencers, and targeted advertising, it is possible to deconstruct cultural beliefs that attribute ornamental, medicinal, or gastronomic value to protected species. Another

relevant contribution lies in the data-driven marketing approach, which allows the use of real-time information to direct awareness campaigns and optimise the allocation of resources in monitoring and prevention actions. This evidence-based perspective strengthens institutional communication and expands the effectiveness of initiatives by NGOs and government agencies. Additionally, marketing professionals can contribute to the design of policies and moderation practices in partnership with social media platforms, given their knowledge of recommendation algorithms, SEO strategies, and digital engagement mechanisms that are often exploited by traffickers. This expertise is fundamental for creating technical solutions that limit the visibility of illegal content and strengthen the accountability of digital intermediaries. Finally, in the corporate sphere, marketing can support the promotion of transparent and sustainable supply chains, reinforce reputational strategies, and develop trust seals that guarantee that products are free from links to wildlife trafficking. This dimension aligns conservation objectives with market practices, making it possible to integrate social responsibility into business positioning.

Marketing professionals can contribute by acting as a bridge between actors, data science, strategic communication, and public policy, considering that collaboration between criminal authorities, environmental agencies, and international partners is crucial for the detection, investigation, and prosecution of trafficking (Stein et al., 2024).

5. CONCLUSION

This study highlights the dual role of digital social networks in wildlife trafficking: as enablers of illegal activities and as tools for combating them through SMI. Social networks facilitate global reach and transactions using sophisticated concealment tactics like emojis, hashtags, and visual codes. Bibliometric and quantitative analyses revealed thematic trends, key terms (e.g., wildlife trafficking, digital conservation), and recurring patterns of traffickers' camouflage techniques and adaptive strategies, particularly on Facebook.

The analysis indicates that the very tools facilitating the digital transformation of markets — data-driven marketing, marketing analytics, social media marketing, and social media platforms — are likewise being utilised by criminal organisations to enhance and strengthen the illegal wildlife trade. This comparison between lawful and unlawful applications highlights the necessity for creating regulatory and technological approaches that can address the emerging digital dynamics of environmental crime (El Bizri et al., 2024; Salas-Picazo et al., 2023).

The findings underscore the need for AI-driven tools to detect and prevent these practices in real time, alongside updated legal frameworks and coordinated efforts among digital platforms, authorities, and environmental organisations. Addressing wildlife trafficking in the digital age demands a global, interdisciplinary approach to dismantle networks, reduce impunity, and protect biodiversity.

The findings have significant practical implications for digital communication and enforcement practices, offering actionable insights for policymakers, law enforcement agencies, and digital platforms, calling for urgent, collaborative, and ethical action among these to enhance the effectiveness of digital tools in addressing this global issue.

This study faces several limitations, including its reliance on the Web of Science database and English-language publications, which may exclude relevant research from other sources and languages. The focus on the 2014–2024 timeframe could overlook earlier foundational studies or emerging trends. Secondary data from ECO-SOLVE and UNODC platforms is subject to potential biases and gaps, while the emphasis on platforms like Facebook, OLX, and Instagram may not capture trafficking on less monitored or emerging platforms. These limitations highlight the need for more comprehensive, adaptive, and real-time methodologies to tackle the evolving challenges of wildlife trafficking in digital spaces.

These limitations highlight the need for ongoing research, the inclusion of diverse data sources, and the development of more advanced and adaptive methodologies to address the complex and dynamic nature of wildlife trafficking in digital environments. Future research should also combine multidisciplinary approaches linking areas such as criminology, ecology, data science, and public policy.

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How to cite this article:

Santos, L.; Lopes, L.; & Correia; M. (2025). Social Media Intelligence and Wildlife Crime: A Quantitative Analysis. *International Journal of Marketing, Communication and New Media*, *Vol 13, Nº 25*, pp. 235-258. https://doi.org/10.54663/2182-9306.2025.v.13.n.235-258