THE THREAT OF ILLICIT DRUG TRAFFICKING IN THE MARITIME SERVICES OF COLOMBIA

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Keywords

Illegal Trafficking, Maritime Services, Maritime Security, Spatial Analysis.

Abstract

In Colombia, the General Directorate of the Sea plays the crucial role of regulating and granting commercial exploitation licenses to companies that provide maritime services. These services not only drive national development but also strengthen sovereignty in maritime spaces through various activities. However, the maritime progress of the country is threatened by the tactics of Transnational Criminal Organizations, especially concerning illicit drug trafficking by sea. This article proposes to conduct a spatial analysis of maritime service clusters in Colombia that are closest to seizures of illicit drug trafficking by sea. To enrich this perspective, a bibliometric analysis is carried out linking the search equations "maritime services" and "security." The results of this investigation are presented through geographical and bibliographic maps, shedding light on the direct connection between maritime services and the threat of illicit drug trafficking. This approach represents an original contribution to the field, as there are few works exploring the intersection of these two themes and employing geographic information systems. Additionally, the application of these findings could be extrapolated to maritime commercial route data, allowing the identification of vulnerabilities caused by Transnational Criminal Organizations. This, in turn, would provide valuable information to maritime security authorities for implementing specific strategies at identified critical points.

1 INTRODUCTION

There are numerous actors that have a direct relationship with the development and management of maritime power, including the maritime industry, providers of maritime information and communication services, maritime transport operators, maritime service providers, and security and defense institutions, such as the Colombian Navy (ARC) (Alba Rocha et al., 2022). In Colombia, the General Directorate of the Sea (DIMAR) is responsible for regulating Maritime Service Companies (AESM). However, its main role is to be the Colombian maritime authority responsible for implementing government policy in maritime jurisdictional areas, rivers, and coastal lines (Pacific and Caribbean Coasts). By Decree 1512 of 2000, the legal nature of DIMAR was established as an internal dependency of the Ministry of Defence of Colombia with administrative and financial autonomy. Together with the ARC, they ensure the development of Colombia's maritime, river, and coastal interests and combat threats such as Illicit Drug Trafficking by Sea (IDTS).

The Colombian Navy (ARC) has the Directorate Against Drugs (DICOD), which is headquartered at the Naval Cadet School Admiral Padilla (ENAP) in Cartagena de Indians, Colombia. The International Center for Research and Analysis against Maritime Drug Trafficking (CMCON) is located at ENAP. In 2008, the Republic of Colombia, through the ARC, organized the first Maritime Symposium against Drug Trafficking in the Americas. This event brought together 25 international delegations and naval authorities from at least eight countries to address the issue of maritime drug trafficking. During the symposium, the need to establish a permanent space for continuous research and analysis of this issue was highlighted, leading to the creation of CMCON (Masson Fiallos, 2021).

CMCON focuses on promoting continuous study and research of the global problem of drug trafficking from a regional perspective. It is an important effort of integration involving active participation from 9 countries in the Americas, with the collaboration of some European countries. Its main objective is to unify information in the registry of seizure events related to maritime drug trafficking. By addressing the initial approaches between maritime services and maritime security in the fight against IDTS, the functions of CMCON can be directly attributed, as they aim to achieve successful cooperation against IDTS.

"Promote cooperation between the Armies, Naval Forces, Navy, Anti-Drug Agencies, Maritime Services and Coast Guard on the American continent and the world, to contribute to the development of strategies against illicit drug trafficking by sea, through the study and investigation of the phenomenon; in order to achieve a deeper knowledge of the threat of drug trafficking in the maritime scenario."

In the National Ocean and Coastal Spaces Policy of Colombia (PNOEC), an area focused on "Economic Development" is proposed, which has as its primary objective to achieve regional leadership in the development of various areas such as the port system, transportation maritime, the naval industry, the sustainable use of marine and coastal resources, as well as maritime and recreational tourism. This initiative seeks to generate conditions conducive to the economic growth of the country. Likewise, two specific lines of action are established for this area: first, constantly improve levels of efficiency in the provision of maritime and port services; and second, promote development in sectors such as security, services, health, housing, education, as well as strengthen industry and commerce in areas near ports in order to improve the quality of life of the communities that reside in said areas. areas (González et al., 2020).

It is a challenge for national maritime authorities to remain aligned with the imperatives of modernization, with the purpose of continually improving the services that drive the country's progress in the field of the Merchant Navy and port management. This task is fundamental for a nation that seeks to advance its economic and social development, and that aspires to generate trust among all users of its maritime and port services. It is essential to recognize that maritime transport is immersed in a dynamic commercial logistics chain that demands adaptability and efficiency. In this sense, the study carried out by Ospina (2015) according to the interviews carried out with the staff of the captain's offices of the main ports in Colombia, maritime incidents are divided into several categories, which include fires, collisions, accidents, spills, shipwrecks. and hydrocarbon spills. In addition, cases of drug trafficking stand out, where the contribution of the Maritime Vessel Traffic Management (VTM) for the surveillance and control of these illicit activities is valued. This peculiarity in the maritime

control system in Colombia has led to the construction of an independent VTM system, exclusive for the ARC, a measure uncommon elsewhere (Ospina Arias, 2015).

In these first approaches, the relationship that exists between maritime services, security and the threat of IDTS is evident. The fight against drug trafficking is not limited only to the eradication of illicit crops, but also contributes to sustainable development. The fight against IDTS must address various aspects of maritime security, including the marine environment, economic development, national security and human security. This requires the implementation of measures such as law enforcement, naval diplomacy, activities at sea, awareness of maritime jurisdiction and coordination between actors. Furthermore, it is essential to incorporate spatial analyses to geographically assess the threat in the oceans (Echeverry Andrade et al., 2023B).

The ARC deploys a variety of strategic, tactical, administrative, and academic units with the aim of contributing to the fulfilment of its institutional mission. Among these functions, the ARC makes available to various naval forces, navies, anti-drug agencies, maritime services, and coast guards in the Americas and globally, research and analysis products developed by CMCON. These products have been recognized as references by foreign entities in the formulation of strategies against IDTS (Olaya Quintero, 2022).

However, there are few studies in maritime services and spatial analyses that address the impact of the IDTS threat on maritime services. Therefore, the purpose of this study addressed two questions, the first of which is aimed at determining whether there are articles that relate maritime services to maritime security in the fight against IDTS? The second question estimates whether Colombia's maritime services clusters are spatially close to IDTS seizure events? The study was carried out in seven (7) sessions; (1) the introduction that presents the general context and structure of the work. (2) The methodology with the steps for its reproduction. (3) The results and discussions with the main findings of the bibliometric review and spatial analysis. (4) The conclusions along with recommendations for future work and finally, (5) the references.

2 METHODOLOGY

An exploratory literature review methodology was applied with the purpose of identifying articles that relate maritime services to maritime security in the fight against IDTS. The methodology was aimed at examining the chronology of the published articles, determining the countries and keywords, as well as the lines of research. To do this, a search equation was applied in the SCOPUS database that combined the keywords "maritime services" with "security". In addition, the criteria were established that these words were in the titles, summaries and keywords, that the documents obtained were of the article type, and that the articles were in English and Spanish (table 1). These logs were downloaded and analysed in the VosViewer software. (Echeverry Andrade et al., 2023A).

Table 1. Bibliometric analyzes implemented in VosViewer

Analysis type	Parameters
Co-authorship	Countries Number minimum number of documents from a country = 1 Number minimum number of citations from a country = 1
Co-occurrence	Keywords Number minimum occurrences of a keyword = 5
Languages	Spanish and English
Document type	Article
Words analyzed	Title , abstract and keywords: maritime services and security

For the spatial analysis, the names of countries with the production of articles were listed, obtained from the SCOPUS records, in order to visualize the global panorama of maritime service articles. Six (6) annual reports (2016-2021) published by CMCON were also compiled (CMCON, 2023). Seizure data were vector-georeferenced in point type using latitude and longitude coordinates and a heat map was generated to represent the magnitude of individual values within a data set as a color (Echeverry Andrade et al., 2024A). The AESM list obtained from the official DIMAR website was downloaded and georeferenced with the department name attribute. Finally, the data were cross-referenced to estimate whether Colombia's maritime services clusters are

spatially close to IDTS seizure events.

3 RESULTS AND DISCUSSIONS

Bibliometric analysis: The search equation applied in the Scopus database returned 222 article records. The resulting 222 records were inspected to ensure there were no repetitions. In addition, those records that did not include a summary were discarded. Obtaining as a result 204 article records to analyse.

Figure 1 shows the chronological trend of the published articles. The results obtained from the Scopus database indicate that the first publication related to "maritime services" occurred in 1944. It is observed that the first six (6) decades from 1944 have little diffusion, it is not until the beginning since 2000, there is a small increase. However, by 2016, maritime services studies acquired greater interest, reaching their maximum peak in 2021 with 17 publications.

Figure 1. Published articles "Maritime Services"

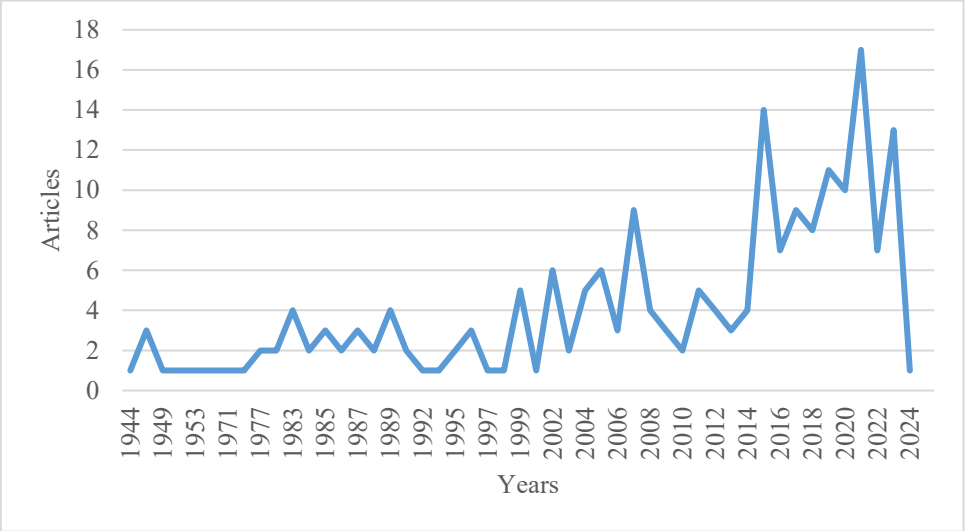


Table 2 presents the 5 most influential countries according to the number of articles published related to maritime services. The group is led by the USA with 29 published documents, 123 citations and 9 collaborations with other countries. Followed by China with 15 documents, 289 citations and 11 collaborations. In third place is Australia with 15 documents, 142 citations and 11 collaborations. In fourth place is Spain with 12 documents, 42 citations and 5 collaborations. In fifth place is the United Kingdom with 9 documents, 187 citations and 3 collaborations.

Table 2. Top 5 most influential countries

Position	Countries	Documents	Citations	Link
1	USA	29	123	9
2	China	15	289	11
3	Australia	15	142	8
4	Spain	12	42	5
5	UK	9	187	3

Figure 2 shows the 42 countries that have contributed to the maritime services research field. It is important to note that, although Colombia did not appear as a contributing country according to the search equation applied in Scopus, the next sections will present relevant data about Colombia and the threat it faces from IDTS.

Figure 2. Countries with scientific contribution in maritime services

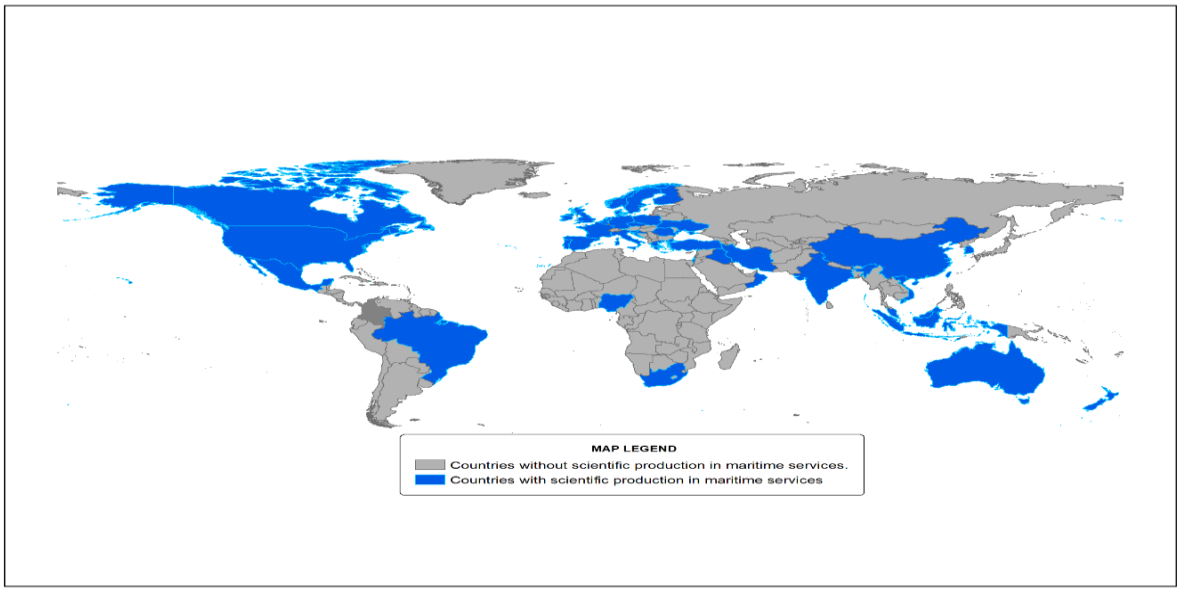


Figure 3 presents the co-authorship by country, the variety of colours shows the research clusters. The largest nodes represent the most influential countries. The connecting lines represent research collaborations between countries. The 42 countries turned out to be grouped into 27 clusters, however 19 clusters are made up of a single country, these are located on the periphery and correspond to the countries that did not collaborate on their articles.

Figure 3. Co-authorship in maritime services publications by country

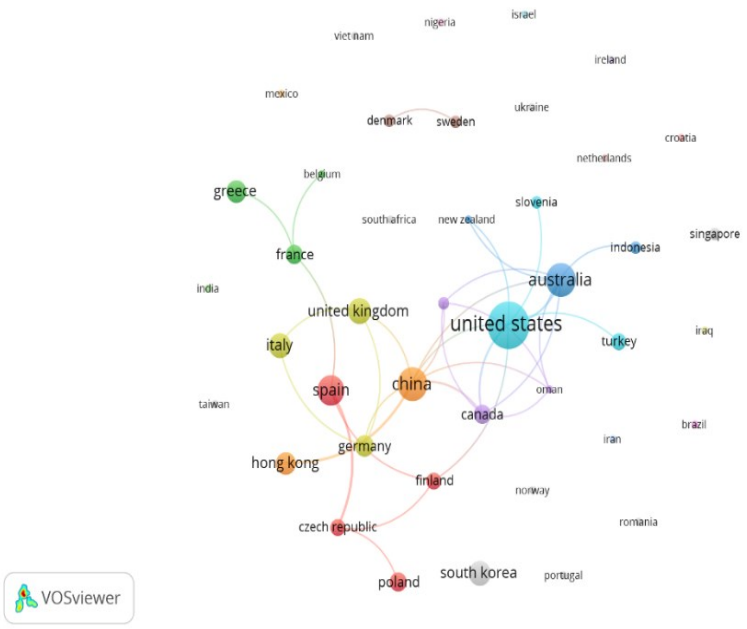


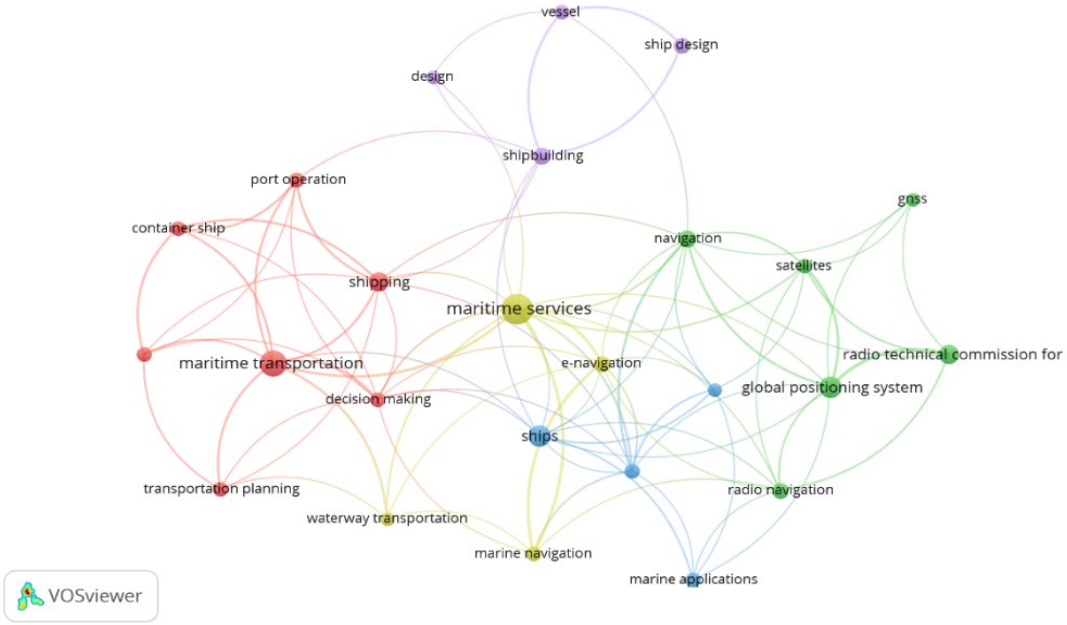
Table 3 presents the 10 most used keywords related to maritime services. The group is led by the keyword Maritime services with 24 occurrences and 35 links to other words. Followed by Maritime transportation with 17 occurrences and 35 links, in third place is Global positioning system with 12 occurrences and 22 links.

Table 3. Top 10 most used keywords in maritime services articles

Position	Countries	Occurrences	Link
1	Maritime services	24	35
2	Maritime transportation	17	35
3	global positioning system	12	22
4	Ships	12	16
5	Radio technical commission	10	13
6	Shipping	10	19
7	Navigation	8	19
8	Shipbuilding	8	13
9	E-navigation	7	17
10	radio navigation	7	11

Figure 4 presents the results of the most used keywords in maritime services articles, considering a threshold of 5 repetitions. A total of 1,361 keywords were identified in the records, however, only 25 met the threshold, being grouped into 5 clusters.

Figure 4. Keyword co-occurrence



Articles relating to maritime services and maritime safety: The abstracts of the 204 article records collected from SCOPUS were reviewed. to explore the connection between maritime services and maritime security in the fight against IDTS. IDTS is a significant challenge to maritime security and maritime services as it affects stability and security in national and international waters. Despite not having found an article directly related to these two topics in the review carried out, it is important to highlight their relevance in the context of maritime security and maritime services.

Risk factors and threats: It is clear that illicit drug trafficking represents a threat to maritime security, as it can involve the use of vessels to smuggle prohibited substances, which can put the safety of waters and coastal communities at risk. One study identifies disruption factors in maritime supply chains and highlights associated security risks, such as accidents, piracy and terrorist attacks (Saut Gurning et al., 2011).

Maritime Domain Awareness and Communication Systems: Fighting IDTS requires the use of advanced technology and efficient surveillance systems. Improving detection and tracking systems, such as the use of drones and satellite surveillance systems, can help combat these types of illegal activities and improve overall maritime security. The importance of electronic navigation in global maritime communications is highlighted (Oh et al., 2015). While presenting cases of use of navigation systems to improve maritime domain knowledge and security (Jacobs et al., 2015); (Du et al., 2016). An encryption-based security system is also proposed to mitigate threats to drones used in maritime applications (Jomaa et al., 2023). In this sense, it is important to improve satellite navigation systems to guarantee safety in maritime traffic (Williams et al., 2023). Therefore, policy reform is necessary to increase the effectiveness of operations with these vehicles in a constantly evolving international context (Johansson et al., 2021).

Regulation and governance: Cooperation and coordination between countries and international organizations are essential to address IDTS effectively. Information and intelligence exchange between the maritime authorities of different countries are key to detecting and preventing drug smuggling on the high seas. Lack of clear regulations and insufficient data protection are prominent challenges. The IMO Maritime Safety Committee adopted Resolution MSC.467(101) to harmonize maritime services and improve the exchange of information in the context of electronic navigation, contributing to greater safety at sea (Weintrit, 2020). The impact of privatization on maritime security is analyzed and the importance of regional cooperation to address security challenges is highlighted (Liss, 2014). On the other hand, the adoption of a single command is suggested to improve the coordination and effectiveness of maritime operations, which would contribute to greater security at sea (Franco García, 2017).

Literary review in maritime services: Finally, two studies were found that applied the literature review in their methodology; The first of them focuses on the study of the disputability of the interior of the port and the definition of the zone of influence. It combined the statistics published in the EUROSAT databases and surveys applied to manufacturing companies located in Germany and Austria to know the current panorama of port expansion, subsequently carried out a bibliographic review to identify the market and its determinants in logistics decision making (Acciaro et al., 2017). The second article that uses a systematic review of the literature to establish the relationship between ports and the formation of clusters of other maritime sectors, was carried out in London and Hong Kong. The literature review was applied to identify changes over time in each maritime sector. The findings suggest that to establish competitive and sustainable maritime clusters there must be a wide range of sectors involved, which requires adequate planning and policy formulation so that both ports and maritime services grow and remain safe (Zhang & Lee Lam, 2017).

Spatial analysis - Colombian maritime services in relation to illicit drug trafficking: In Colombia, the DIMAR Maritime Services Companies Area is in charge of registering and granting Commercial Exploitation Licenses (LEC) for the AESM in accordance with Resolution 0759/2020, the DIMAR is also in charge of carrying out inspections of control and renewal of licenses. With resolution 0759/2020, six (6) maritime services groups were established, represented as of December 31, 2023 by 965 companies, 47.25% of the companies belong to group I; 26.94% to group II; 8.29% to group III; 7.56% to group IV; 5.59% to group V and 4.35% to group VI (table 4).

Table 4. Maritime services in Colombia

Cluster	AESM	Description
I. Supplies and services to the maritime sector	456	Companies that have as activity the delivery , receipt of supplies , materials or the provision of services , for the performance of activities maritime .
II. Transportation support _ maritime	260	Companies providers of services associated with transportation maritime .
III. Recreation and sports nautical	80	Companies that provide character services _ recreational and/or sports at sea, whether they use ships, devices naval or any other team , so such as facilities for the provision of services to recreational or sports vessels .
IV. Research , exploitation of	73	Companies with activities related to research technical – scientific in any discipline , development of infrastructure construction work or its _ _ suitability , in the sea, soil or subsoil Marine .

resources and infrastructure at sea		
V. Naval industry	54	Shipyards Naval , whose companies are dedicated to the design, construction, conversion, modernization, scrapping, maintenance, repair and/or scrapping of ships, naval devices, platforms or marine structures, as well as the installation, maintenance and repair of the different main and auxiliary systems of this type of units and naval repair workshops that are companies suitable for carrying out repairs to systems, equipment or parts of ships or naval devices.
VI. Delegation	42	Companies delegates by DIMAR to perform as Organizations Recognized (RO) or Recognized Protection Organizations (RPO).

Source: own elaboration based on resolution 0759 of November 9, 2020, DIMAR.

The 965 AESM are present in 16 of the 32 departments of Colombia, most of them with access to the sea, except for inland departments such as Amazonas, Caldas, Cundinamarca and Meta, in turn they are present in 30 municipalities (table 5).

Table 5. Maritime services in Colombian departments and cities

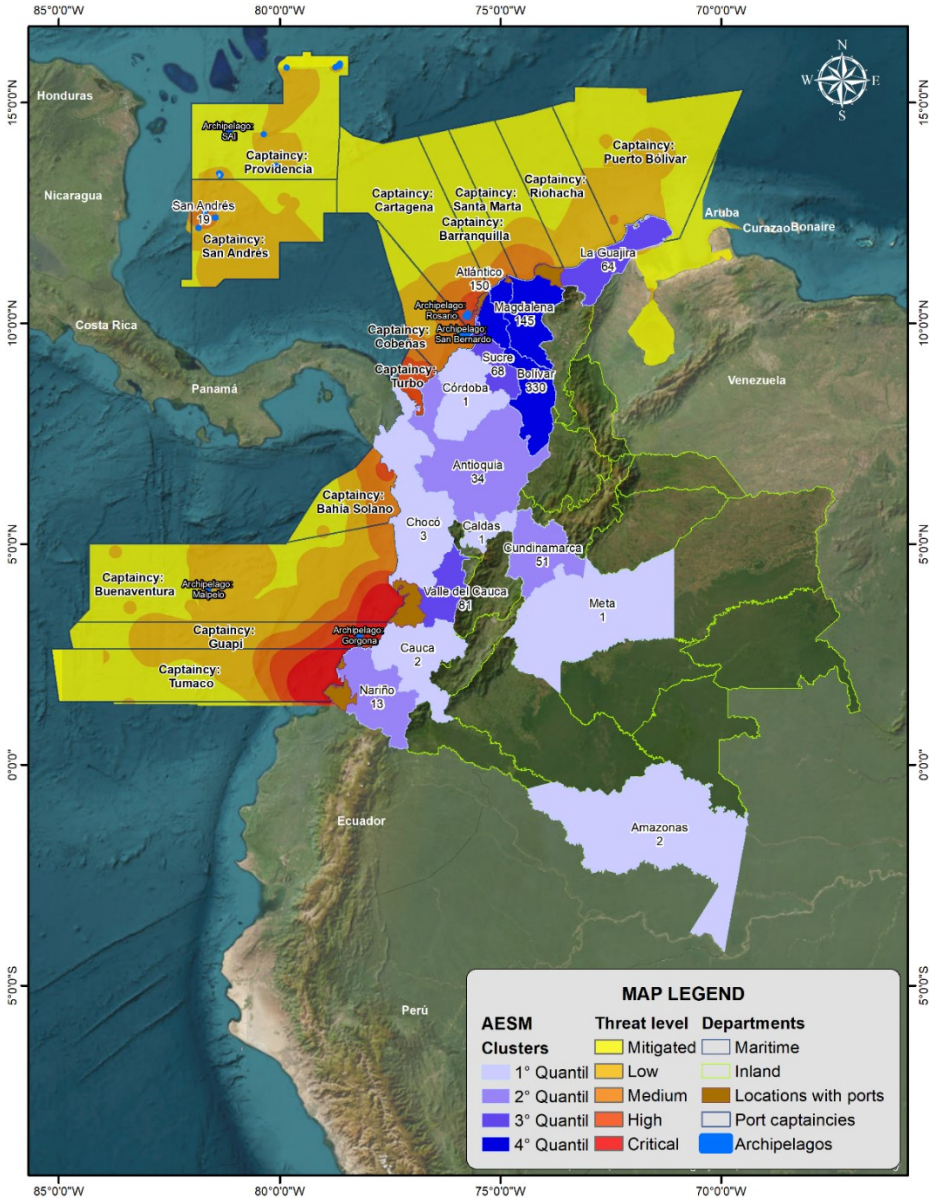
Region	Department	Municipality	AESM
Inside	Cundinamarca	Bogotá	51
	Amazonas	Leticia	2
	Caldas	Manizales	1
	Meta	Acacias	1
		Arboleda	1
		Copacabana	1
		Envigado	1
		Girardota	1
	Antioquia	Itagüí	1
		Medellín	2
		Necoclí	2
		Rionegro	1
		Turbo	24
Atlantic (Caribbean Sea)	Atlántico	Barranquilla	149
		Puerto Colombia	1
	Bolívar	Cartagena	330
	Córdova	Saint Antero	1
	Guajira	Puerto Bolívar	24
		Riohacha	40
	Magdalena	Santa Marta	145
	San Andrés	Providence	1
		Saint Andrés	18
	Sucre	Coveñas	66
		Tolú	2
Pacific	Valle del Cauca	Buenaventura	77
		Cali	3
		Candelaria	1
	Nariño	Tumaco	13
	Choco	Solano Bay	3
	Cauca	Guapi	2

The five departments with the greatest presence of AESM in Colombia are: Bolívar (330 AESM), Atlántico (150 AESM), Magdalena (143 AESM), Valle (81 AESM) and Sucre (68 AESM). Of this group, Valle is the only one located in the Pacific Ocean, while the other four are in the Caribbean Sea (Atlantic Ocean). Together with the department of La Guajira (61 AESM), they form an important conglomerate of companies that offer maritime services. Among the interior departments, Cundinamarca stands out, because it is home to the

country's capital, Bogotá, with 51 AESM. The other interior departments, such as Amazonas (2 AESM), Caldas and Meta (1 AESM each), have a smaller presence of AESM.

With the heat map generated from the seizure points, two (2) critical zones were estimated. The first and most affected are the maritime spaces of the Pacific Ocean in the departments of Chocó, Valle del Cauca (Port of Buenaventura), Cauca, and Nariño (Port of Tumaco), which together form a conglomerate of 99 AESM, with Valle del Cauca being the most affected by the presence of IDTS seizures. A second critical zone is observed in the Caribbean Sea, with the departments of Sucre, Bolívar (Port of Cartagena), Atlántico (Port of Barranquilla), and Magdalena (Port of Santa Marta) being the most vulnerable to the presence of IDTS. These four (4) departments have a conglomerate of 607 AESM (Figure 5). It is worth noting the presence of five (5) ports in these critical zones.

Figure 5. Maritime services in Colombia



Seizure operations at sea, carried out individually or in collaboration by navies and maritime services, remain one of the most employed and efficient methods to combat this illicit activity, whether drugs are hidden in speedboats, semi-submersibles, or large-tonnage cargo ships (Echeverry Andrade et al., 2023A). Moreover, the

largest drug seizures typically occur predominantly at sea or in ports when considering volume. However, this requires the ability to monitor the maritime environment in real-time, intelligence work, and resources to maintain effective presence. It is crucial to identify areas where a fragile state and vessels converge. Navies or maritime services will need to make efforts to address the threats present in these areas, but they will not be able to definitively resolve them if there are underlying governance and development issues (Toro Vargas, 2020).

4 CONCLUSIONS

This article proposes an empirical method that combines bibliometric analyses with geographic information systems analysis. It is based on a search equation on maritime services, considering an important aspect such as maritime security. The results obtained from the bibliometric analysis did not yield any studies related to the Caribbean or Colombia, however, the analysis was complemented with the information and list published by DIMAR on EMSAs in Colombia. As do the CMCON reports that contain valuable spatial information on IDTS seizures. Which gave rise to being able to apply spatial analyses to visualize the critical areas affected by IDTS and associate it with a department in order to show which maritime services may be affected.

In the context of maritime services and maritime security, articles that relate to these two (2) themes address the topics of (1) risk factors and threats: in the sense that authors employ methodologies to identify these factors in maritime services. (2) Communication systems and maritime domain awareness: the use of technologies in maritime spaces is vital, this due to the spatial characteristics of seas and oceans, whose access and difficult communication require advanced systems. (3) Regulation and governance; Information and intelligence exchange among maritime authorities from different countries are key to preventing IDTS, so some authors analyse cooperation frameworks to achieve coordination among multiple agencies. Finally, some articles oriented towards (4) Literature review in maritime services are presented: as it is a recommended methodology to cover and analyse broad fields of research, which allows obtaining data from articles, countries, and the current state of the researched topic.

The importance of research examining communication systems is highlighted, given their close connection to cartography development. The use of drones, satellite images, and GPS devices enables the collection of data, which can subsequently be mapped to identify both critical threat points and available resources to address them. This integration of technologies provides a more comprehensive and detailed perspective for effective maritime security management. The AESM clusters affected by IDTS turned out to be two (2), one in the Pacific Ocean and another in the Caribbean Sea. While the Pacific Ocean area turns out to be the most affected by the presence of IDTS and affects 99 EMSA, the Caribbean Sea area has the greatest presence of EMSA with a total of 607 that can be affected by IDTS.

It is convenient for future research to expand the search spectrum in more search engines other than Scopus. Review other Latin American sources, which include the participation of South American and Caribbean countries. Regarding spatial analysis, one could think of a bivariate or multivariate correlation analysis, which relates the variables of continental spaces (AESM) with maritime spaces (seizures).

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