CAMEROON'S ILLEGAL WILDLIFE TRADE

An Analysis of Trafficking Supply Chains, Routes, and Actors

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Abbreviations

CITES	The Convention on the International Trade in Endangered Species of Wild Fauna and Flora
FATF	Financial Action Task Force
LAGA	The Last Great Ape Organization (a nonprofit organization that supports wildlife crime enforcement in Cameroon)
MINFOF	The Ministère des Forêts et de la Faune in Cameroon
UNODC	United Nations Office on Drugs and Crime

Abstract

The illegal wildlife trade presents a serious threat to terrestrial and marine fauna and flora; from 1999–2018, about 6,000 different species and their parts were seized as part of the illegal trade, with nearly every country in the world implicated over this period. The coastal countries around the Gulf of Guinea in West and Central Africa are emerging as hotspots for this illegal trade, but knowledge gaps remain about wildlife trafficking in the region. Additionally, network analysis is gaining traction as a method to understand the actors involved in the illegal wildlife trade, their relationships, and how they interact across time and space. As demonstrated by multiple recent studies, network analysis can be a valuable tool to better target wildlife trafficking enforcement and build evidence-based disruption tactics.

Based on the need for further research and the opportunities to replicate and adapt novel network analysis techniques, this study explores how the illegal wildlife trade operated in and through Cameroon during the study period, January 2008–December 2018. The research used open-source seizure, arrest, and prosecution data to analyze 1) the observed trafficking routes to, from, and within Cameroon; 2) where the illegal wildlife trade converges with other types of crime, e.g., drug trafficking, financial crime; 3) the roles actors in Cameroon play in illegal wildlife trade supply chains; and 4) the nodes in Cameroonian illegal wildlife trade networks that appear most key to crime disruption.

The study results indicate a significant trade involving Cameroon and Cameroonian actors, with connections to 37 other countries. Based on the features seen across the data and analysis, this study summarizes typologies of the Cameroonian wildlife trade, including frequent trade routes, issues of crime convergence, and actors' roles and connections. These typologies capture high-level commonalities observed across the study period, which may inform future enforcement and investigative efforts.

Chapter 1: Introduction

The Illegal Wildlife Trade Globally

While the novel coronavirus (COVID-19) has taken precedence in the current global perspective, the threat of biodiversity loss remains consistent and complex. The Living Planet Report 2020 noted a 68% decline in bird, amphibian, mammal, fish, and reptile populations in the past 50 years, a change that has dramatically altered the planet's ecosystems (WWF, 2020). Coinciding with these losses, the illegal wildlife trade has continued to threaten terrestrial and marine fauna and flora; from 1999–2018, about 6,000 different species and their parts were seized as part of the illegal trade, with nearly every country in the world implicated over this period (UNODC, 2020). COVID-19 itself most likely originated from the wildlife trade, highlighting the risks when such trade is unregulated or illicit (Haider *et al.*, 2020; Xiao *et al.*, 2020).

Broadly, the wildlife trade involves the sale or exchange of any wild animal species or its parts (TRAFFIC, 2021). This includes the legal trade of unprotected species, such as the many species of wild fish that are legally harvested and traded around the world for food. The illegal wildlife trade, also commonly referred to as wildlife trafficking, involves the "illegal trade, smuggling, poaching, capture, or collection of endangered species, protected wildlife*,* derivatives, or products thereof" (UNODC, 2019b).

To regulate the wildlife trade, the Convention on the International Trade in Endangered Species of Wild Fauna and Flora (CITES) provides a legally-binding framework for the trade of animals and plants to ensure protection of threatened species (CITES, n.d.). However, how CITES regulations are translated into national laws and then enforced varies widely. CITES also pertains only to international trade, not to domestic trade or poaching (UNODC, 2020). As this research and others demonstrate, there are still significant enforcement, legislative, and judicial gaps in countries, across regions, and around the globe that allow the illegal trade of protected species to persist.

It is widely acknowledged that the scope and impacts of the illegal wildlife trade are difficult to assess and quantify. To provide an overview of the complex threats associated with the illegal wildlife trade, this research categorises the impacts, broadly, as "human and societal" and "environmental," with details below. These are not intended to capture all effects of illegal wildlife trade across scales but to capture the high-level and most significant effects for which there exists a solid evidence base.

Human and Societal Impacts of the Illegal Wildlife Trade

Disease Transmission

As noted regarding COVID-19, the illegal wildlife trade has been repeatedly implicated in the spread and transmission of zoonotic diseases, threatening global health and economic stability (Karesh *et al.*, 2005; Smith *et al*., 2017; Swift *et al.*, 2007). The Centers for Disease Control and Prevention in the United States estimates that 2.7 million people die each year due to zoonotic diseases (CDC, 2020). About 70% of emerging infectious disease (EID) pathogens originate from animals, and these are associated with some of the most devastating health crises in modern history—including the Ebola virus and the severe acute respiratory viruses that comprise COVID-19 and the strain from the 2002 SARS outbreak (Haider *et al.*, 2020; Jones *et al.*, 2008). Since 2000, there have been 33,547 cases and 14,461 deaths attributable to Ebola (WHO, 2021a); 171 million cases and 3.8 million deaths attributable to COVID-19 (WHO, 2021b); and 8,098 cases and 774 deaths attributable to SARS (CDC, 2017). Though the dynamics of zoonotic and EID transmission are complex, one 2007 mathematical model uses the number of species hunted for bushmeat, the number of urban dwellers susceptible to disease, and possible rates of contact to demonstrate how the trafficking of wildlife to cities increases the likelihood of disease transmission (Swift *et al.*, 2007). Looking holistically at the wildlife trade, Karesh *et al.* estimate that "at least some multiple of 1 billion direct and indirect contacts among wildlife, humans, and domestic animals result from the wildlife trade annually" (Karesh *et al.*, 2005).

The same study from Karesh *et al.* further assesses that animal-related disease outbreaks, in 2005, had cost "hundreds of billions of dollars" in economic damages (Karesh *et al.*, 2005).

Since 2005, the 2014–2016 Ebola outbreak in West Africa created a USD 53.19 billion global economic and social burden (Huber, Finelli, and Stevens, 2018). At the time of this research, the COVID-19 pandemic is ongoing, but the global costs associated with this disease are already staggering. One economic analysis calculated a USD 16 trillion burden for the United States alone (Cutler and Summers, 2020). At the time of this writing in June 2021, the World Health Organization attributes 3,840,223 deaths to the pandemic (WHO, 2021b).

Organized Crime

The 2018 London Illegal Wildlife Trade Conference, an influential global meeting of practitioners and policymakers, emphasized the illegal wildlife trade's position as a "serious crime" (Massé *et al.*, 2020); the United Nations Office on Drugs and Crime's (UNODC) second World Wildlife Crime Report followed suit in 2020 (UNODC, 2020). Per the United Nations, a *serious crime* is "conduct constituting an offence punishable by a maximum deprivation of liberty of at least four years or a more serious penalty" (UNODC, 2004). This positioning of the illegal wildlife trade emphasizes the gravity of these crimes and encourages national policy to reflect such through the associated penalties.

The illegal wildlife trade has grown into a large-scale, transnational activity that profits criminal groups, who may perceive this trade as a *high-reward* and *low-risk* activity (FATF, 2020; Haenlein and Keatinge, 2017; UNODC, 2020). Though the illicit profits are nearly impossible to fully quantify, UNODC estimates that rhino horn and elephant ivory yielded USD 630 million to end-of-supply-chain retailers from 2016–2018 (UNODC, 2020). Another estimate assumes that the illegal trade is equal to roughly 25% of the legal trade in wildlife: This calculation places the value of the illegal wildlife trade (i.e., criminal profits) at USD 2.1 billion annually (Van Uhm, 2016).

Multiple studies note that the rise of large-scale ivory seizures and the complexity of such volumes of trade indicate the involvement of international criminal syndicates (Clarke and Babic, 2016; INTERPOL and UNEP, 2016; Titeca, 2019). While there are still significant questions about armed insurgent groups' involvement in elephant poaching and whether

poaching significantly funds these groups, Vira and Ewing (2014) found many instances of this convergence in Africa, including: national security forces funding and profiting from ivory-trading rebels in the Democratic Republic of the Congo; terrorist group al-Shabaab receiving profits from Kenyan elephant poaching; and growing interactions between East Asian organized crime and Central African elephants in Gabon and the Republic of the Congo.

Other known criminal groups with ties to the wildlife trade include the Xaysavang network of Southeast Asia, which trafficks in ivory, rhino horn, and pangolins (Bergenas and Knight, 2015; U.S. Department of State, n.d.), and the Shuidong syndicate, which trafficked three tons of ivory from Africa to China in 2017 (EIA, 2017). After detection, the Shuidong group suggested they were "just one of about 10 to 20 similar groups originating from Shuidong" (EIA, 2017).

The illegal wildlife trade's interactions with and fostering of other crimes and corruption are a critical component of the trade's impacts, and are further discussed in the section on crime convergence later in this chapter.

Environmental Impacts of the Illegal Wildlife Trade

As noted above, the 2020 World Wildlife Crime Report found that about 6,000 different species and their parts were seized as part of the illegal trade from 1999–2018 (UNODC, 2020). Including legal and illegal trade, about 24% of known terrestrial vertebrate species are part of the wildlife trade (Scheffers *et al*., 2019). A 2021 meta-analysis of the wildlife trade's impacts on 145 terrestrial species found that population abundance declined by an average 62% where trade was observed (Morton *et al.*, 2021). Declines also increased with higher threat status so species classified as endangered or critically endangered by the International Union for Conservation of Nature experienced trade-driven declines of more than 80% (Morton *et al.*, 2021).

Information about the illegal wildlife trade is most abundant for several key species: elephants, rhinoceros, and pangolins. Poaching is associated with decreasing elephant populations over the last decade, particularly in Tanzania, Gabon, the Republic of the Congo, Cameroon,

northern Mozambique, and parts of Kenya (UNODC, 2020; Wittemyer *et al.*, 2014). The global rhinoceros population has declined from about 500,000 at the beginning of the twentieth century to roughly 27,000 in 2021, with poaching widely acknowledged as one of the greatest threats (WWF, 2021). For African rhino species, poaching rose steadily from 2007–2014, with a peak in 2014, and poaching numbers from 2015–2019 remaining in the hundreds to thousands (Eikelboom *et al.*, 2020). All eight pangolin species populations are in decline, with about 800,000 whole pangolins traded from 1977–2014 (Heinrich *et al.*, 2016) and about 895,000 traded from 2000–2019 (Challender, Heinrich, Shepherd, and Katsis, 2020). From 2014–2018, pangolin scale seizures have increased ten-fold, alongside growth in seizure quantities, indicating ongoing unsustainable harvest (UNODC, 2020).

These population declines driven by trade, in turn, alter the species' roles in their habitats, shift predator-prey dynamics, and spread invasive species, with cascading global implications for ecosystem services and climate regulation (Cardinale *et al.*, 2012; IPBES, 2019; WWF, 2020). This cycle ultimately loops back to exacerbate negative impacts on humans.

The Illegal Wildlife Trade in Cameroon

Cameroon as a Research Priority

Due to historic trading routes and once-bountiful wildlife populations, most research on the illegal wildlife trade has focused on the supply from East and Southern Africa to the demand in Southeast Asia (UNODC, 2020). However, research indicates that wildlife trade actors may use both substitute species and geographies to adapt to changing circumstances, such as population declines or increased enforcement. West and Central Africa, specifically the coastal countries around the Gulf of Guinea, are emerging as hotspots for illegal trade (OECD, 2018a; UNODC, 2018; UNODC, 2020). For example, in 2016, the ivory-smuggling Shuidong Syndicate transitioned its operations from Tanzania to Lagos, Nigeria (EIA, 2020). According to an analysis of the syndicate's operations, the primary reason was a higher price in China—about USD 150 more per kilogram—for the "yellow" ivory from West and Central Africa than the "white" ivory of East and Southern Africa (EIA, 2020).

Using the aggregated seizure and prosecution data in the 2019 TRAFFIC Bulletin, preliminary research for this study assessed the scale of the illegal wildlife trade in Gulf of Guinea countries from March 1997–October 2019. Of the Gulf of Guinea countries on the continent—Angola, Benin, Cameroon, Côte d'Ivoire, the Democratic Republic of the Congo, Equatorial Guinea, Gabon, Ghana, Liberia, Nigeria, the Republic of the Congo, and Togo—Nigeria was implicated in the most incidents (n = 67) and Cameroon the second most (n = 52).

Despite these indications, the region and Cameroon have yet to be prioritized in wildlife trade research. A literature search in SCOPUS—using the words and phrases "wildlife trade," "wildlife trafficking," "wildlife crime," and Cameroon—reveals only four relevant peer-reviewed articles focusing on the wildlife trade and Cameroon. Of these, two focus on local and regional bushmeat hunting, rather than international trade, and three of the articles were published in 2014 or earlier. Four additional articles—with three of these published in 2017 or later—include global research with results implicating Cameroon as a source or transit for the illegal trade. These research gaps indicate a need for greater understanding of the crime typologies in Cameroon to establish effective interventions at multiple scales.

State of Knowledge on the Wildlife Trade and Cameroon

Cameroon is most noted as a poaching hotspot, primarily for ivory and pangolin scales (OECD, 2018a; UNODC, 2018). Regarding ivory, data from the 2015 Great Elephant Survey indicates that Cameroon had the highest proportion of observed dead elephants in surveyed countries: 83.4% (UNODC, 2020). This is more than twice the next highest proportion in Mozambique at 31.6% (UNODC, 2020). However, the challenges of viewing Cameroon's forest elephants beneath tree cover (compared to viewing the savannah-dwelling elephants of East Africa), may have influenced the results of the aerial survey (UNODC, 2020).

Research of trade in the West and Central African regions indicates that Cameroon may, broadly, serve as a source country of wildlife products transiting via Nigeria (Omifolaji *et al.*, 2020; UNODC, 2018). In 2018, for example, a Chinese national arrested in Lagos possessed more than 300 bags of pangolin scales reportedly sourced from Cameroon (UNODC, 2018).

DNA analysis has been useful in tracing seized and rescued wildlife and parts to origin locations. An analysis of rescued chimpanzee DNA found that chimp harvesting is prevalent in Cameroon in both protected and unprotected areas (Ghobrial *et al.*, 2010). A similar analysis of ivory chips from tusks transported between Cameroon and Hong Kong showed a probable origin of Gabon or the Republic of the Congo—an early indication of Cameroon being used for intermediary transit (Wasser *et al.*, 2008). A 2015 report records a group using Cameroon as a transit hub to smuggle ivory to Hong Kong (Miller, Vira, and Utermohlen, 2015), and a more recent social media analysis of the illegal African grey parrot trade found evidence of Cameroon being a source and export country (Martin, Senni, and D'Cruze, 2018).

The local and regional trade of wild meat in Cameroon is slightly better understood than other types of wildlife trade. Multiple threatened species have been observed for sale in the county's markets, including species of pangolin, gorilla, guerza, duiker, and colobus (Aguillon *et al.*, 2020; Fa *et al.*, 2014; Ingram *et al.*, 2019), and markets selling threatened species appear to align with those species' known habitat ranges in the region (Fa *et al.*, 2014).

Though the academic literature has primarily focused on the wildlife harvested in Cameroon and less on the criminals and their activities, the Cameroonian Ministère des Forêts et de la Faune (MINFOF) has prioritized operations against and investigations into the illegal wildlife trade. Since 2003, the government has collaborated with the Last Great Ape Organization (LAGA), the founding member of the EAGLE Network of nonprofit organizations combating the illegal wildlife trade in West and Central Africa (EAGLE Network, 2021). LAGA's website notes that the organization's investigations and enforcement actions lead to at least one arrest each week of a major wildlife dealer (LAGA, 2021a), and UNODC places Cameroon's total arrest rate of wildlife traffickers around 80 per year from 2013–2018 (UNODC, 2018). LAGA's many publicly available reports on its activities emphasize that the wildlife trade in Cameroon is both prominent and lacking research insights (see LAGA, 2021b). While LAGA issues in-depth reports of its activities each month—including trainings, operations, and arrests—there nonetheless exist gaps in analyzing the scope and routes of the illegal trade, how the trade

converges with other crimes, and how Cameroonian wildlife trade connects to regional and global networks.

The Illegal Wildlife Trade and Crime Convergence

As noted regarding the impacts of the wildlife trade, these crimes have been observed to overlap and converge with other types of crime. Surveys of INTERPOL member countries indicate that about 84% of all environmental crimes (including illegal logging and related trade) converge with other serious crimes, such as corruption, counterfeiting, drug trafficking, and financial crime (INTERPOL and United Nations Environment Programme, 2016). Yet the majority of illegal wildlife trade investigations begin with discovery through routine inspection and end with seizures of the trafficked goods, often without arrests or further investigations into possible convergences (Asia/Pacific Group on Money Laundering and UNODC, 2017; UNODC, 2020). INTERPOL's 2015 study of environmental crime convergence found several key areas where criminal groups involved in other serious crimes also profit from the wildlife trade. The illegal tiger trade in parts of Asia is linked to kidnapping, illegal firearms, extortion, murder, and cybercrime, and ivory trafficking is broadly linked to "fraud, tax evasion, and money laundering," as well as funding militia groups (INTERPOL, 2015). Ivory trafficking also converges with other types of profitable natural resource crime, including illegal logging and charcoal (INTERPOL, 2015).

While the United Nations and other international bodies elect not to explicitly define "corruption," a frequently used definition for policymakers is "abuse of public or private office for personal gain" (OECD, 2007). By this definition, corruption also pervades the illegal wildlife trade, particularly among state actors—such as wildlife management authorities and law enforcement officers—who choose to profit from the trade rather than curtail it (OECD, 2018b; Van Uhm and Moreto, 2017; Wyatt and Cao, 2015; Zain, 2020). Zain's brief on the issue concludes that corruption is "one of the most important facilitators of illegal wildlife trade" and details risks that include document fraud (particularly falsified CITES permits), complicity by private sector transport companies, and the theft of wildlife product stockpiles that suggest government collusion (Zain, 2020). Notably, despite recommendations to consider wildlife

crime a “serious crime,” sentences and fines for these crimes continue to be low around the world. UNODC has found that associated fines are often less than the value of the trafficked goods, which has exacerbated the perceptions of the illegal wildlife trade as a low-risk, high-reward activity (UNODC, 2019a). One analysis of wildlife crime prosecutions in the Republic of the Congo found that the most severe crimes were dismissed and that signs of corruption were “blatant,” including the random release of prisoners (WCS Congo, 2018). Such analyses demonstrate how corruption can undermine rule of law and judicial proceedings.

Crime typologies, including convergence with other serious crimes, present an important opportunity for governments to move beyond seizures and disrupt supply chains and criminal networks. As such, one aim of this research is to assess how the wildlife trade in and through Cameroon connects to other forms of criminal activity.

Network Analyses of the Illegal Wildlife Trade

In the twenty-first century, social network analysis has become an increasingly popular tool in the social sciences and in the study of organized crime (Borgatti *et al.*, 2009). These types of analyses are used to examine the properties of nodes, such as their centrality or importance in a network; network ties, such as the distribution of nodes within a network; and predictions of consequences based on network variables (Borgatti *et al.*, 2009).

Network analysis is also gaining traction as a method to understand the actors involved in the illegal wildlife trade, their relationships, and how they interact across time and space (‘t Sas-Rolfes *et al.*, 2019). For example, Arroyave *et al.* (2020), Paudel *et al.* (2020), and Indraswari *et al.* (2020) recently used network analyses to represent and study the geographic networks associated with the illegal wildlife trade in Colombia, Nepal, and Indonesia, respectively. These novel studies share replicable methods that others can apply in different contexts. Arroyave *et al.*, in particular, use their analysis to examine strategies of disruption based on different measurements of nodal centrality (2020). They conclude that using such relatively simple metrics, which require minimal investment in investigative staff skills, can be both effective and

efficient in identifying and targeting the important players in wildlife trade networks (Arroyave *et al.*, 2020).

Research on transnational environmental crime has observed that these activities are often committed by “loosely connected informal networks, or interconnected nodes, stretching across geographic boundaries that coalesce temporarily around emerging opportunities” (Gibbs, McGarrell, and Sullivan, 2015). Similarly, Costa identifies “opportunism, fluidity, flexibility, adaptability and loose structures” as the characteristics of the illegal wildlife trade (Costa, 2019). The research suggests that the social structures of individuals and their locations are a key component to ongoing and resilient illegal trade. Network analysis, as demonstrated by recent studies, can be a valuable tool to better target enforcement and build evidence-based disruption tactics.

Aims and Objectives

Based on the knowledge gaps described above and the opportunities to replicate and adapt novel network analysis techniques, this research is guided by the overarching question: How does the illegal wildlife trade operate in and through Cameroon?

To guide the research, four sub-queries were explored:

1. What are the observed trafficking routes to, from, and within Cameroon? This component of the research analyzes the source, destination, transit, and enforcement sites indicated in Cameroonian wildlife trade incidents.
2. Where does the illegal wildlife trade converge with other types of crime, e.g., drug trafficking, financial crime, corruption? This component of the research analyzes the frequency of crime convergence, types of convergence, and the locations of convergence incidents.
3. What roles do actors in Cameroon play in illegal wildlife trade supply chains, e.g., freight operators, corrupt officials? This component of the research analyzes the purported

roles of actors involved in the trade and uses network analysis to map their connections.

4. What nodes in the illegal wildlife trade networks appear most key to crime disruption? This component of the research builds on the analysis of incident locations and actors' roles and uses network statistics to ascertain which nodes exert greater network influence and whether their removal would lead to network collapse.

Through this exploration, the research aims to fill a gap in the research literature and, ultimately, to provide useful data that can translate into enforcement, investigative, and policy action in Cameroon.

Chapter 2: Methods

Study Area and Law Enforcement

Cameroon is a country in western Central Africa (Figure 1), bordering the Gulf of Guinea, with a land area of 472,710 square kilometers and a population of about 28.5 million people (CIA, 2021). The country consists of 10 regions with varied geography and regional governments and law enforcement: Adamawa, Center, East, Far North, Littoral, North, Northwest, South, Southwest, and West. The county's capital and largest city, Yaoundé, is in the Center Region with a population of 4.16 million (CIA, 2021).

About 10.95% of Cameroon's land lies within 49 protected areas, including national parks, wildlife sanctuaries, and faunal reserves (UNEP-WCMC, 2021). These protected areas are primarily concentrated in the East and Far North Regions (Figure 2).

Figure 1: Map of Cameroon and its neighboring countries (Google Earth, 2021).

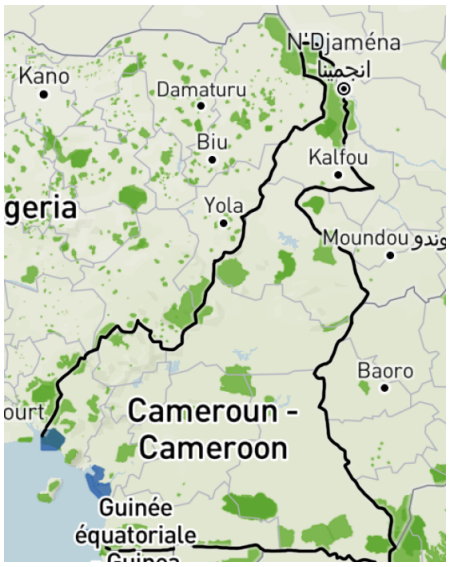


Figure 2: Map of Cameroon where green denotes protected areas. Map modified from UNEP-WCMC, 2021.

Of these protected areas, the four largest nationally-designated areas are the connected Nki and Boumba Bek National Parks in the East Region (5,491 km^2); Dja Faunal Reserve in the East

and South Regions (5,260 km^2); Mbam et Djerem National Park in the Central and Adamawa Regions (4,290 km^2); and Faro National Park in the North Region (3,500 km^2) (UNEP-WCMC, 2021). Cameroon's wildlife populations include about 900 bird and 320 mammal species (AWF, n.d.). These include populations of the critically endangered African forest elephant (*Loxodonta cyclotis*), the endangered chimpanzee (*Pan troglodytes*), the critically endangered Western gorilla (*Gorilla gorilla*), three endangered or vulnerable pangolin species (*Smutsia gigantea*, *Phataginus tricuspis*, and *Phataginus tetradactyla*), and the endangered African grey parrot (*Psittacus erithacus*) (IUCN, 2021).

Cameroon suffers from poor governance and ranks 149th out of 180 countries on Transparency International's most recent Corruption Perception Index (Transparency International, 2020). Likewise, the ENACT Organised Crime Index, which measures countries' levels of organised crime and resilience to organized criminal activity, notes Cameroon as having high criminality and low resilience; in particular, Cameroon ranked fourth on the continent for its presence and prevalence of criminal markets (ENACT, 2019).

An analysis of Cameroon's wildlife law enforcement notes that enforcement problems and conflicts between enforcing bodies are not due to the lack or clarity of legislation but rather to effective implementation of the existing laws (Nkoke, Nya, and Ononino, 2016). This includes poor understanding of legislation, lack of coordination between agencies, and unclear roles and responsibilities (Nkoke, Nya, and Ononino, 2016). The primary actors involved in enforcing wildlife trade laws in Cameroon include MINFOF agents, police and gendarmerie officers, customs officials, and other judicial personnel (Nkoke, Nya, and Ononino, 2016). Except limited special cases and some centralized customs agents, all of these actors perform their functions in designated territories, typically within regional divisions (Nkoke, Nya, and Ononino, 2016). As the law enforcement analysis explains: "The chief of the forest and hunting control post in Djoum in the South Region is only mandated to act in the district of Djoum and neighboring areas. In principle, he/she cannot exercise his/her duties in the district of Mintom or Oveng also in the South Region" (Nkoke, Nya, and Ononino, 2016). Due to this territorial division, this study includes regional analyses of the collected wildlife trade data.

Open-Source Data Collection

This research relied on publicly available illegal wildlife trade data, specifically recorded seizures, arrests, and prosecutions. The sources used are:

- TRAFFIC International's quarterly bulletins, which have compiled illegal wildlife trade data from 1997 to the present
- The Wildlife Trade Portal, the most comprehensive open-access repository of wildlife seizure data
- Data from published reports, including UNODC's 2016 and 2020 World Wildlife Crime Reports and the Environmental Investigation Agency's reports
- The Last Great Ape Organization (LAGA) reports of the enforcement network's activities
- Robin des Bois reports, which, like TRAFFIC, compile wildlife trafficking incidents from open sources, news reports, and tips
- European Union annual illegal trade reports
- CITES trade database seizure and confiscation incidents
- UNODC SHERLOC environmental crime cases
- United States Fish and Wildlife Service's Law Enforcement Management Information System (LEMIS) wildlife trade data, 2000–2014 (obtained and shared by EcoHealth Alliance through the Freedom of Information Act)

The full list of data sources is provided in Appendix I. Data collection was limited to incidents documented as occurring in the time period January 1, 2008, to December 31, 2018 (2008–2018), to provide a large enough dataset for analysis and to assess trade trends over the study period.

Data Extraction

The data were sorted and coded in spreadsheet files. When possible, the research identified and grouped the same incident when it appeared in multiple sources; this was often, but not always, possible by comparing dates, locations, and descriptions of the incidents. In total, 61.2% (n = 301) incidents appeared in multiple sources. However, in some cases, it is likely

that the sources themselves were referring to each other; for example, Robin des Bois reports aggregate incidents from various sources, including LAGA reports, and this research referred to both for collation. This study did not attempt to determine whether such incidents were merely duplicative but counts such occurrences as appearing in multiple sources. Since the style and length of incident descriptions vary by source, grouping duplicative incidents may provide a more robust picture of these incidents.

Following coding conventions from the source materials, incidents were coded by six types, including combinations: Abandoned [product]; Arrest; Attempted arrest; Observation; Poaching; and Seizure. To analyze the trafficking routes, the research disaggregated incident locations by source or supply location and transit or destination location(s), of which there were often multiple as products moved along supply chains.

The research noted incidents that appeared to converge with other crimes, though this was often based only on minimal information provided in the incident descriptions. The research elected to include "unconfirmed" convergences—in which the reporting source suggested crime convergence but the evidence or specifics were insufficient—and notes those as "unconfirmed" in all subsequent analyses. The research referred to types of convergence crimes described in multiple sources to create a set of codes that best align with the data from Cameroon (INTERPOL, 2015; Miller, Vira, Utermohlen, 2015; van Uhm and Nijman, 2020). The convergence crimes used, including combinations of these and unconfirmed incidents, are:

- Adoption fraud
- Bribery and attempted bribery
- Corruption and attempted corruption
- Cybercrime
- Drug dealing
- Drug possession
- Falsified documents and permits
- Firearms dealing

- Homicide
- Human parts smuggling
- Illegal entry/residence
- Illegal firearms
- Illegal immigration
- Kidnapping
- Laundering through legal storefront
- Other natural resource crime (e.g., mineral smuggling)
- Terrorist financing
- Theft
- Violence and resisting arrest

To allow for network analysis, the various actors, their roles, and their nationalities, when available, were coded using Phelps, Biggs, and Webb's (2016) illegal wildlife trade typologies (reproduced in Table 1).

Table 1: Typology of key actor roles along illegal wildlife trade supply chains, reproduced from Phelps, Biggs, and Webb (2016).

Harvesters	Subsistence	Non-commercial harvest for household or local use (e.g., food, cultural), usually comparatively small scale
	Specialist commercial	Harvest with an explicit commercial orientation that often involves specialist skills or technologies. Includes different harvest intensities and levels of technological investment, and is led by both self-employed and hired harvesters, as well as by local residents and non-residents.
	Opportunist	Harvest based on chance encounters and circumstances, but not as a primary objective or livelihood strategy
	Local guide	Local residents hired to guide non-resident harvesters
	Rule abuser	Knowing abuse of harvest rules, such as quotas (eg under or mis-reporting), boundaries (eg protected area), or restrictions on technology (eg certain traps, nets)
	Bycatch	Unintentional harvest of non-target species

	Recreational	Harvest for enjoyment
	Reactionary	Harvest associated with discontent or protest (eg in reaction to conservation policies or conflict with wildlife
Intermediaries	Logistician	Involved in ordering, aggregation, and transport, as well as financing and planning trade. May be directly involved in handling trade or involved at a distance
	Specialized smuggler	Transport that requires specialized actions to evade detection or negotiate access, usually across borders (eg transboundary smuggling, specialist
	Government colluder	Involved in using an official government position (eg park ranger, police officer, judge, prosecutor) to facilitate trade, whether for financial (corruption), social, or personal gain
	Third party	External services hired to support trade, but potentially unknowingly (eg bus or air transport)
	Processor	Involved in product transformation (eg skinning, medicine)
	Launderer	Involved in laundering illegal wildlife into legal markets chains (eg via captive breeding or processing operations)
	Vendor	Involved in direct sale to consumers or to other intermediaries (eg market, online platform
Consumers	Medicinal	Use associated with medicinal practices, usually traditional but some novel
	Ornamental	Use associated with ornaments and pets (eg ivory, shell, live parrots, aquarium fish)
	Cultural	Use associated with long-standing traditional practices (eg feathers, pelts, ritual harvest)
	Gift	Use as a gift, often to gain/demonstrate social standing or show respect
	Investment	Use as an investment, usually of high-value taxa
	Recreational	Use associated with the act of recreational harvest (eg game hunting, sport fishing)
	Animal food	Use as food for other animals (eg fodder, bait, small animals)
	Construction materials	Use for construction materials (eg timber, rattan)

Fuel	Use for burning for heat or cooking
Food	Use for direct consumption, ranging from luxury consumption to basic nutritional need

Notes: Categories are not mutually exclusive

To further distinguish within role groupings, this research divided the generalized Logistician and Vendor roles into sub-categories as follows:

- Logistician, financing: an individual who provides monetary funds to support the illegal wildlife trade
- Logistician, weapons: an individual who provides weapons and/or ammunition for illegal wildlife harvesting
- Logistician, storage: an individual who provides a physical space for illegal wildlife products before sales or further trafficking
- Vendor from harvesters: a vendor who collects and may order wildlife products from harvesters; often a wholesaler
- Vendor to other vendors: a vendor who sells products to other vendors or wholesalers; may also be a harvester
- Vendor to consumers: a vendor who sells products directly to consumers
- Vendor, online: an individual involved in the illegal wildlife trade on the internet

When available, actors' names were also noted in the data to assess when individuals were involved in multiple incidents and to identify specific network case studies. In total, the research collected 495 separate wildlife trafficking incidents involving Cameroon or Cameroonian nationals from 2008–2018.

Data and Network Analysis

This research uses descriptive statistics to ascertain patterns, frequency, and anomalies in the illegal wildlife trade in Cameroon. For the trafficking routes and locations, the analysis includes comparing total illegal wildlife trade enforcement incidents by location and by region of

Cameroon; types of incidents by location; and locations most frequently implicated as enforcement, source, transit, or destination sites. Within Cameroon, the percentage of incidents by each region was calculated in total and per capita. ArcGIS was used to visualize domestic trafficking routes and to plot enforcement incident points. This research also used linear regression (R^2 values) to assess the trends in enforcement incidents over the ten-year study period for each region of Cameroon.

The convergence incidents were disaggregated by type of crime and visualized by year with a color scale corresponding to the number of incidents. The percentage of convergences were also plotted over the study period, against the total incidents, and the R^2 values calculated to visualize temporal trends. Domestic convergence incidents were disaggregated by region of Cameroon, and the proportion of each convergence crime type was calculated by region, using the total of each convergence type and the total of enforcement incidents in each region.

To analyze the coded illegal wildlife trade actors, the sum and percentage of each role type and combinations, e.g., *Vendor and specialized smuggler*, was calculated for all incidents. The data was further disaggregated by domestic regions, and the regional frequencies of roles were calculated. The number and rate of arrests for each role were calculated to ascertain whether enforcement and apprehension may be more successful for certain types of actors. Actor data were also coded by nationality, and the international actors were charted both by nationality and by the role performed in the incident data.

In addition to descriptive statistics and data visualization, the research relied on network analyses to build understanding of connections between locations and between actors in Cameroon illegal wildlife trade supply chains. The research used the visualization and statistical analysis program Gephi to create the network analyses. In the location network, each node equals the location (a city or region in Cameroon or a country beyond Cameroon) of an enforcement incident, of the product source, or of a transit or destination site. When an incident involved transit between multiple locations, these movements were broken into individual connections (Paudel *et al.*, 2020). For example, a trafficking incident that travelled

from Dja Faunal Reserve to the United States with a transit connection in Douala, would be broken into two connections: one between Dja Faunal Reserve and Douala, and one between Douala and the United States.

In the location network, the edges between nodes indicate transit from one site to another; in the actor network, the edges between nodes indicate a relationship observed in the data. Measures of each node's centrality and influence were calculated in Gephi: degree (sum of edges associated with the node); in-degree (sum of edges directing to the node); out-degree (sum of edges directing from the node to another node); weighted degrees that take into account the frequency of associated edges; betweenness centrality (the number of times a node appears in the shortest path between pairs of nodes); closeness centrality (the distance between a node and the others); and eigenvector centrality (a node's influence in the total network) (Arroyave *et al.*, 2020; Indraswari *et al.*, 2020; Paudel *et al.*, 2020; Wandelt *et al.*, 2018).

Two similar networks were created using the actors' roles and international actors' nationalities, in which each role (e.g., *Harvester*) or nationality (e.g., Beninese) was made equivalent to a node. Since it was rarely possible to determine how a product moved between the actors involved in an incident, these networks' edges are undirected, and in-degree and out-degree centrality were not calculated.

For the transit and role networks, sequential attacks were implemented, following Arroyave *et al.*'s methodology (2020). In this approach, nodes are manually removed based on the common network measures of degree, betweenness centrality, and eigenvector centrality, beginning with the node of the highest value, recalculating the measure after each removal, and continuing until all nodes are disconnected. These measures were selected based on common and recommended strategies (Arroyave *et al.*, 2020; Wandelt *et al.*, 2018). Note, since betweenness centrality measures the number of times a node appears in the shortest path between pairs of nodes, as nodes are removed, betweenness values will gradually become zero, though a network may still have multiple short connections. To accommodate this, the

betweenness centrality disruption approach first sequenced node removal by betweenness value and then by closeness centrality as these values are similar in their "high ability to connect distant places" (Arroyave *et al*., 2020).

Network robustness *R* was then calculated using Schneider *et al*.'s formula:

$$R = \frac{1}{N}\sum_{Q=1}^{N} s(Q)$$

in which *N* is the network's number of nodes and *s(Q)* is the size of the network's giant component (Schneider *et al*., 2011). The giant component is the largest grouping of connected nodes; a network may include multiple components that are not all connected (Wandelt *et al.*, 2018). In this study, the relative sizes of the giant component were then plotted against the percentages of removed or "attacked" nodes to visualize the effectiveness of different node removal strategies (Wandelt *et al.*, 2018).

This approach identifies key nodes for disruption and demonstrates which network measures may be most effective at determining those nodes.

Data Limitations

There are multiple limitations to this study's data, inherent in illegal wildlife trade and criminology research. First, seizure data do not reflect the true breadth of the illegal trade. In criminology more broadly, there is always the "dark figure" of the crimes that go unreported and undetected (UNODC, 2019a). As a mixed indicator, seizure and arrest data can be misleading both about trafficking and about law enforcement efficacy (UNODC, 2020). The data may be biased toward cities, regions, and countries with stronger enforcement or more robust reporting (Ingram *et al.*, 2019). Certain types of actors may be more or less easy to identify and arrest, again biasing data toward those types of actors that are more visible, such as vendors to consumers. In particular, actors involved in the financial side of the illegal wildlife trade, including laundering the profits, are little understood and rarely caught (FATF, 2020; Haenlein and Keatinge, 2017).

This study data, in particular, is open-source and often anecdotal. As noted above, though some incidents appear in multiple sources, such duplication cannot confirm that the incident occurred exactly as described in the often informal reports. As such, this research had to rely on subjective interpretations of incidents to collate and code the data.

Chapter 3: Results

Trafficking Locations

Source, Transit, Destination, and Enforcement Sites

This review of multiple publicly-available data sources found that from 2008–2018, 196 unique locations or countries were observed or implicated in the illegal wildlife trade involving Cameroon. These locations include source, transit, and destination sites and the enforcement locations of seizures and arrests. The data include domestic incidents and transnational incidents that either implicate Cameroon as part of the supply chain or that involve Cameroonian nationals. Table 2 includes the 20 locations implicated in 10 or more incidents.

Table 2: Sites observed or implicated in 10 or more incidents, including when the site was the source, transit, or destination, or the location of enforcement action. Gray rows denote international locations.

Location	Total number of incidents	Number of enforcement incidents	Number of incidents as source, transit, or destination	Percentage of all unique incidents
Cameroon	125	7	118	25.25%
Yaoundé, Cameroon*	67	52	15	13.54%
United States	66	61	5	13.33%
Douala, Cameroon*	32	27	5	6.46%
Nigeria	30	5	25	6.06%
Gabon	28	15	13	5.66%
Djoum, Cameroon	23	17	7	4.65%
Republic of the Congo	16	7	9	3.23%
Bertoua, Cameroon*	16	12	4	3.23%
Lomie, Cameroon	15	13	2	3.03%
Dja Faunal Reserve, Cameroon	14	3	11	2.83%
Bafoussam, Cameroon*	14	13	1	2.83%
France	13	9	4	2.63%
Ebolowa, Cameroon*	12	8	4	2.42%
Belgium	12	8	4	2.42%
North Region, Cameroon	11	0	11	2.22%
Kribi, Cameroon	11	10	1	2.22%

Abong Mbang, Cameroon	11	10	1	2.22%
South Region, Cameroon	10	1	9	2.02%
East Region, Cameroon	10	1	9	2.02%
China	10	1	9	2.02%

** Capital or regional capital in Cameroon*

The capital of Cameroon, Yaoundé, was the most frequently reported site across incidents. Beyond Cameroon, the data include 37 implicated countries in Africa, Europe, North America, and Asia, and two incidents describing transit, generally, to Asia. The study also found 10 incidents of international cyber trafficking, in which the actual trade was not completed, including attempted trade to Belgium, Malaysia, the United States, the Netherlands, Canada, and Azerbaijan or Uzbekistan. These cases are potentially fraudulent, and the wildlife or wildlife products may not have actually been available to the traffickers.

The enforcement location refers to the place where the seizure, arrest or attempted arrest, poaching, or observation of illegal wildlife goods occurred. For the majority of locations, 56.6% (*n* = 111), there were more *enforcement* incidents than incidents of the location as a *source, transit, or destination* site. The most frequently implicated sites that are exceptions and that appeared in the data primarily as *source, transit, or destination* locations are: Cameroon; Nigeria; Republic of the Congo; Dja Faunal Reserve, Cameroon; North Region, Cameroon; South Region, Cameroon; East Region, Cameroon; and China. Of all documented enforcement incidents, 74.94% (*n* = 371) occurred within Cameroon's borders. Arrest and seizure incidents account for 74.8% of domestic enforcements (*n* = 279), and arrests without seizures for 10.19% incidents (*n* = 38). Comparatively, in the study period, 13.14% of domestic incidents (*n* = 49) were seizures or poaching without arrests.

Figure 3 charts the top 10 sites of enforcement and the types of enforcement incidents by percentage. Due to the country's customs procedures, only the United States documented either "abandoned" incidents, in which an illegal good was discovered as abandoned, or "seizure and reexport." As Figure 3 also shows, the dual enforcement action of an "arrest and seizure" was the most documented in these 10 locations, except in the United States. Of these 10 locations, only in Gabon was poaching documented.

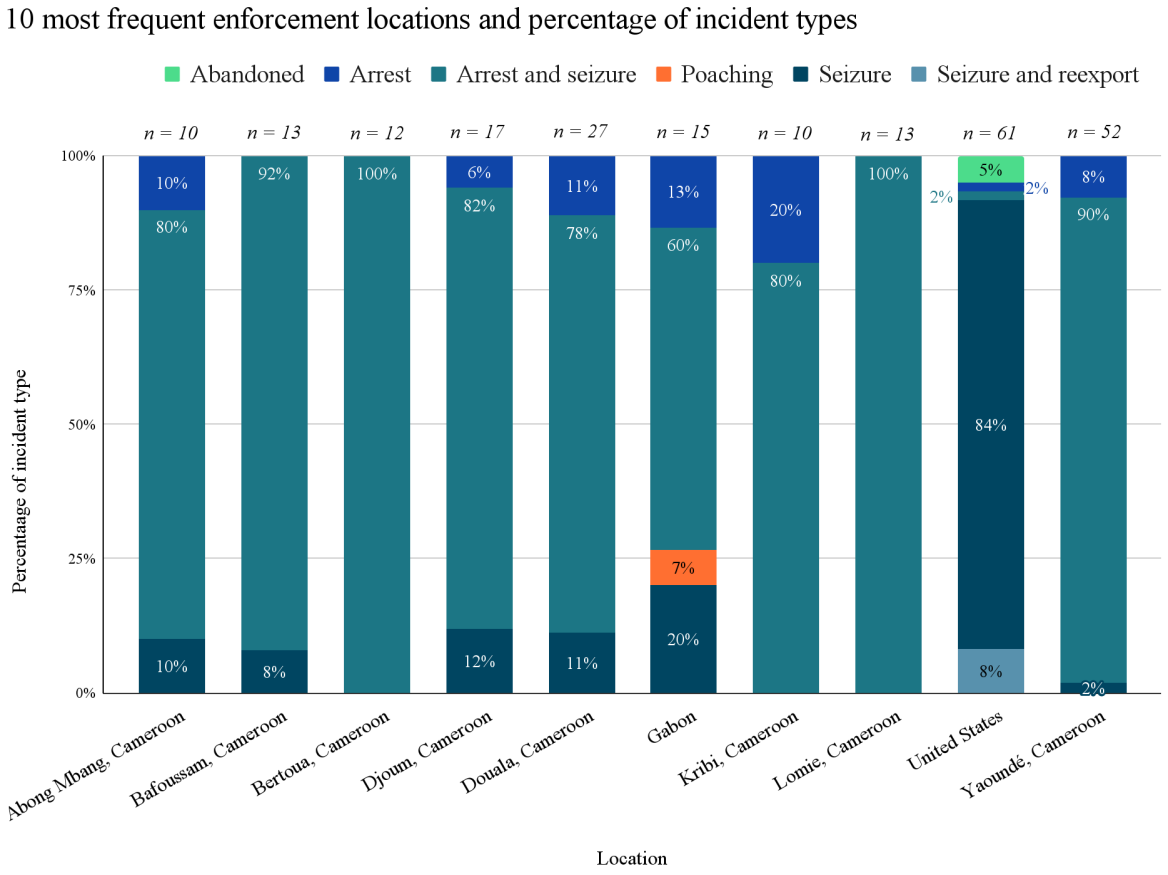


Figure 3 : The 10 locations with the most wildlife trafficking enforcement incidents involving Cameroon, 2008–2018, and the percentage of enforcement incident types documented at these locations across the study period.

When looking at all locations (including source, transit, and destination sites) the 10 most frequently-implicated locations shift slightly (Figure 4). This shift reflects the differences between where *enforcement* more frequently occurred and where wildlife goods were *sourced* or *transited*. In Figure 3, four of the locations are international, versus only two in Figure 3. For two of these countries (Nigeria and the Republic of the Congo), the majority of incidents implicated them as source, transit, or destination sites. The United States and Gabon, conversely, were documented to have a greater proportion of enforcement incidents. Within Cameroon, confirming the data shown in Figure 3, the most frequent type of incident is again the enforcement action of "arrest and seizure."

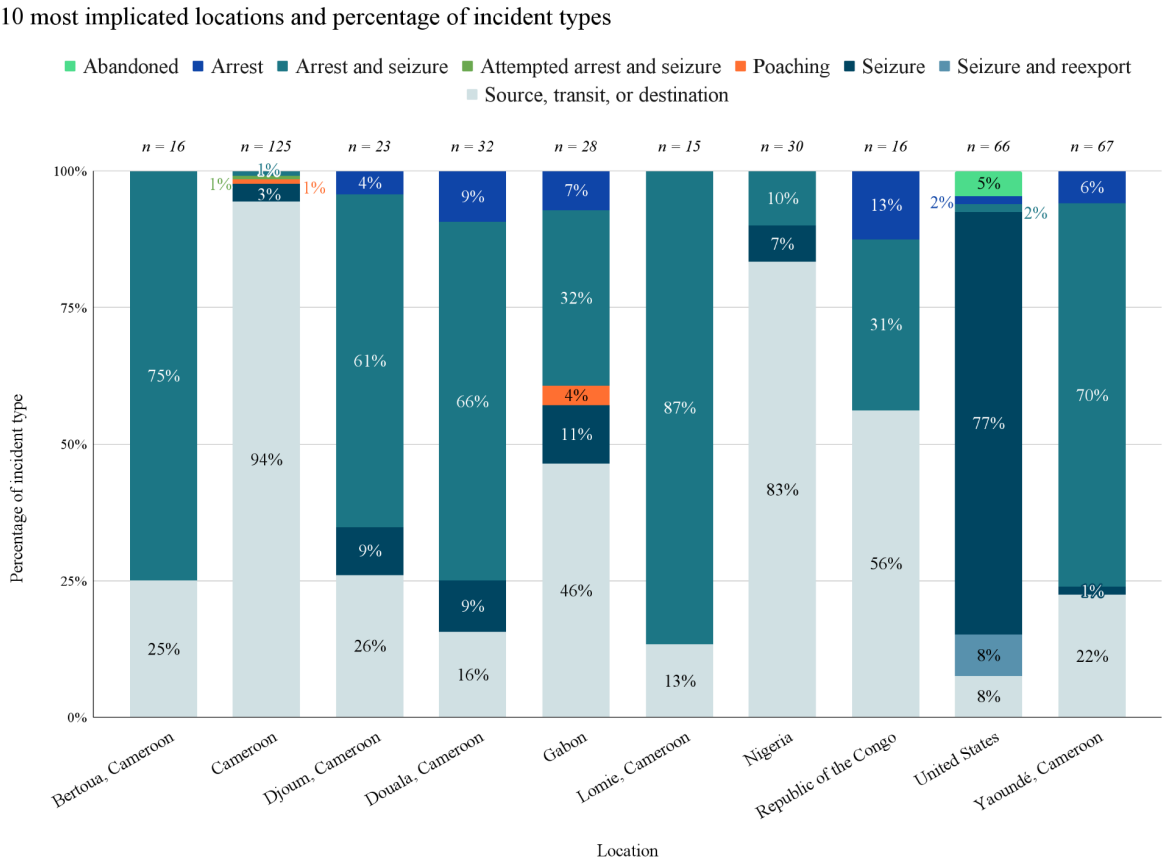


Figure 4: The 10 locations most implicated in wildlife trafficking involving Cameroon, 2008–2018, including enforcement, source, transit, and destination locations, and the percentage of incident types documented at these locations across the study period.

Regions of Cameroon

As noted in the research methodology, Cameroon is divided into 10 distinct regions of varying sizes and features, with protected areas largely concentrated in the North and East. Law enforcement is also structured regionally, making regional data about enforcement actions particularly significant. Figure 5 shows a heat map of the enforcement incidents per region (total n = 367), with regional capitals marked for reference. The total number of enforcement incidents by regions ranges from a minimum of 5 in the Far North and Adamawa Regions to a maximum of 87 in the East Region.

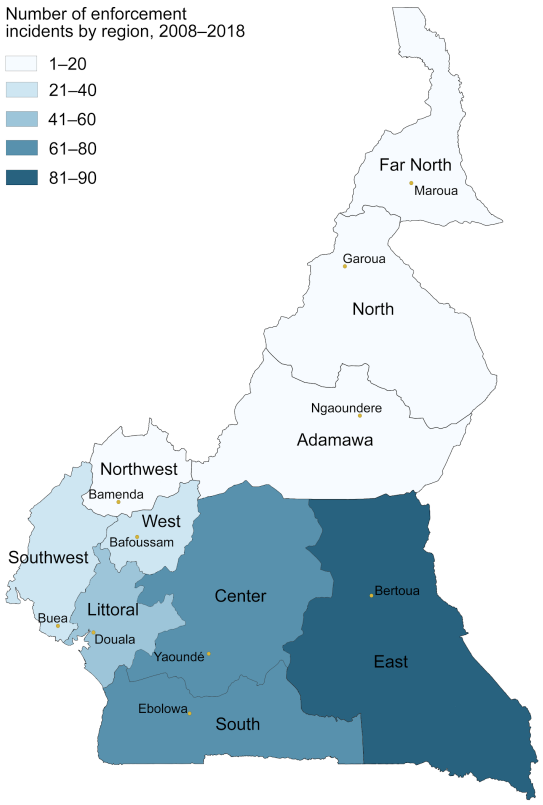


Figure 5: Heat map of total enforcement incidents by region of Cameroon, 2008–2018.

When considering the regional crimes per capita, the 2014 population numbers are the most recently available from the National Statistic Office of Cameroon and represent roughly the mid-way point in the data collection period. These population values were thus used for a per

capita average over the study period. By this calculation, the East Region experienced the highest number of incidents and the most per capita (Table 3). By both measures, the three northernmost regions (North, Adamawa, and Far North) had the fewest documented incidents in this time period. The East, Center, South, and West Regions were ranked in the top five both by total incidents and by incidents per capita, though the Center Region's position in the ranking shifted the most of all regions (three places). These data may suggest stronger enforcement in areas with more incidents per capita, more prevalent wildlife trade in these regions, or a combination of these.

Table 3: Regions of Cameroon ranked by number of enforcement incidents and enforcement incidents per capita, 2008–2018. Gray rows denote the four regions that are ranked in the top five by both measures. Population data: National Statistic Office of Cameroon, 2014.

Rank by # of incidents	Rank by incidents per capita	Region	Enforcement incidents	% of domestic enforcements	Incidents per capita (*population in 2014*)
1	1 (=)	East	87	23.45%	0.00010481 (*830,039*)
2	5 (*-3*)	Center	77	20.75%	0.00001907 (*4,038,347*)
3	2 (*+1*)	South	61	16.44%	0.00008236 (*740,671*)
4	6 (*-2*)	Littoral	46	12.4%	0.00001409 (*3,264,328*)
5	3 (*+2*)	West	37	9.97%	0.00001955 (*1,892,545*)
6	4 (*+2*)	Southwest	29	7.82%	0.00001913 (*1,515,888*)
7	7 (=)	Northwest	12	3.23%	0.00000621 (*1,933,358*)
8	9 (*-1*)	North	8	2.16%	0.00000336 (*2,378,489*)
9	8 (*+1*)	Adamawa	5	1.35%	0.00000429 (*1,166,246*)
10	10 (=)	Far North	5	1.35%	0.00000128 (*3,897,577*)

The types of incidents by region also vary in frequency, as charted in Figure 6. Only “arrests and seizures” were documented in all 10 regions. Poaching was only documented in four of the 10 regions: East, Far North, North, and Southwest. Within these, poaching was most frequent in the North Region, accounting for 37.5% of incidents (including incidents recorded as “poaching and seizure”). Attempted arrests, in which perpetrators of the illegal wildlife trade were observed but not successfully apprehended, also only occurred in the North Region.

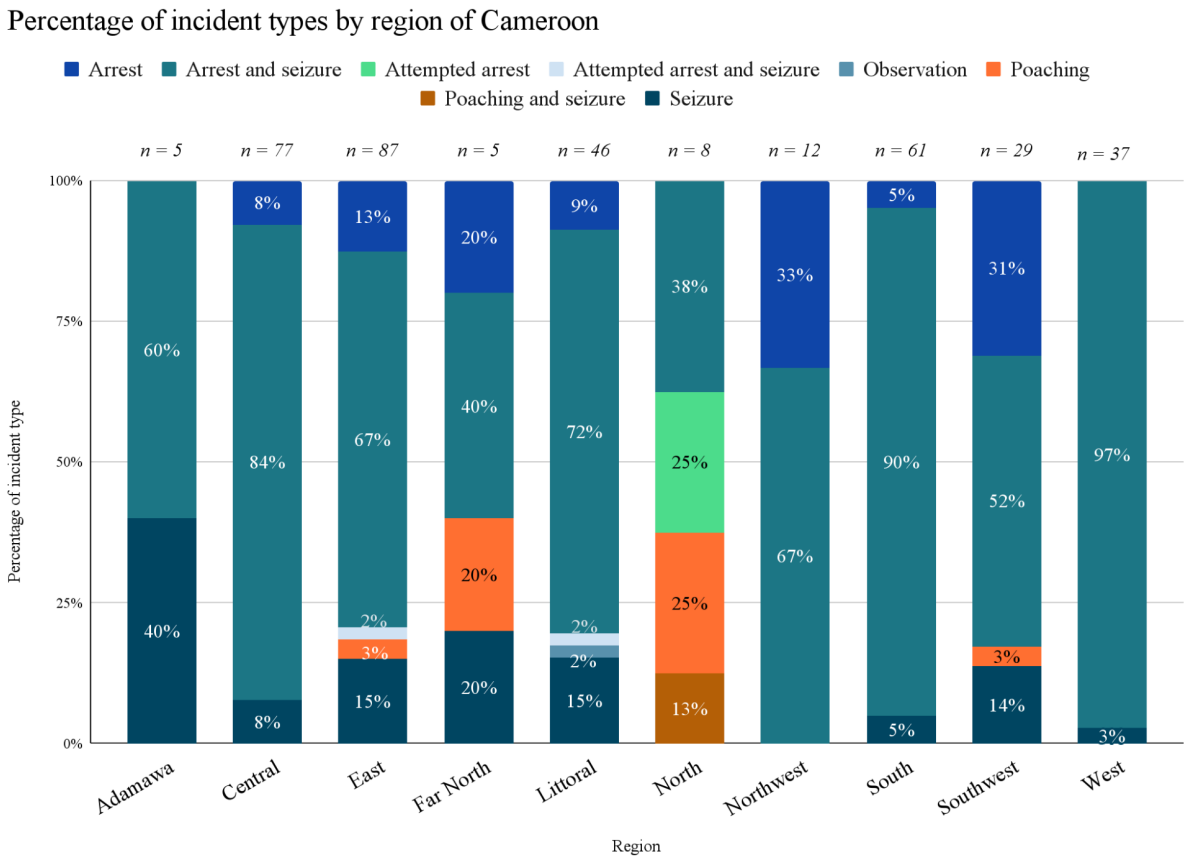


Figure 6: Percentage of each enforcement incident type observed in the study period by region of Cameroon, 2008–2018.

To assess whether enforcement incident rates were changing over time in each region, the annual enforcement incidents were plotted for the six regions with the most incidents. The four regions with the least number of incidents were not plotted over time since multiple years

lacked data. Across the six regions, as shown in Figure 7, the strongest decreasing trend lines occurred in the South and West Regions (R^2 = 0.421 and = 0.341, respectively). Enforcement incidents over the study period most increased in the Littoral Region (R^2 = 0.666).

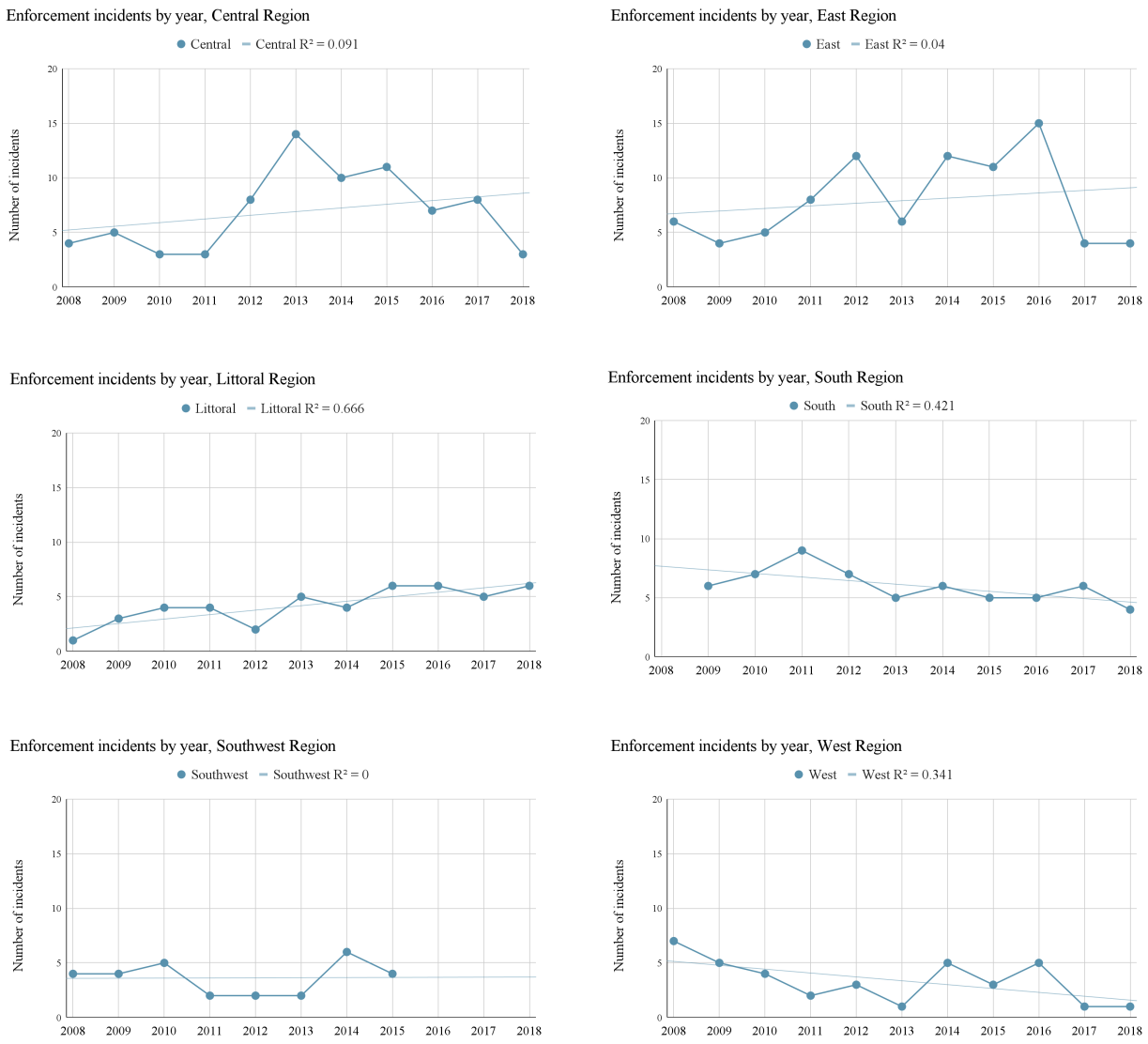


Figure 7: Enforcement incidents by year, 2008–2018, in the six regions with the most available data across years: Central, East, Littoral, South, Southwest, and West.

Trafficking Routes

Of 495 total documented incidents, 58.38% (*n* = 289) involved or implicated more than one location, i.e., the reporting source suggested transit to or from at least one other location. In the other 41.62% of incidents (*n* = 206), the data either did not capture information regarding transit or the incidents did not involve transit, e.g., in the seizure of an illegal pet with no known source. Of the 289 incidents that included trafficking between multiple locations, there were 262 unique domestic and international routes consisting of 161 unique locations. Of these, 50 routes were observed or implicated more than once, and 54% of these (*n* = 27) involved transit across international borders (Table 4).

Table 4: Trafficking routes involving Cameroon that were observed or implicated in multiple incidents in the data and study period, 2008–2018. Gray rows denote transit across international borders.

Rank	Source (starting location)	Target (transit or destination location)	Route occurrences
1	Cameroon	United States	47
2	Cameroon	France	12
3	Cameroon	Belgium	11
4	France	United States	5
5	Cameroon	England	4
6	Djoum, Cameroon	Yaoundé, Cameroon	4
7	West Region, Cameroon	Bafoussam, Cameroon	3
8	East Region, Cameroon	Douala, Cameroon	3
9	East Region, Cameroon	Yaoundé, Cameroon	3
10	Limbe, Cameroon	Nigeria	3
11	Campo, Cameroon	Kribi, Cameroon	3
12	Lomie, Cameroon	Yaoundé, Cameroon	3
13	Djoum, Cameroon	Sangmelima, Cameroon	3
14	Abong Mbang, Cameroon	Yaoundé, Cameroon	3
15	Mintom, Cameroon	Djoum, Cameroon	3
16	Sangmelima, Cameroon	Yaoundé, Cameroon	3
17	Belgium	Hong Kong	3
18	Republic of the Congo	Yaoundé, Cameroon	3
19	Belgium	United States	3

20	Cameroon	Viet Nam	3
21	Douala, Cameroon	Nigeria	3
22	Cameroon	Canada	2
23	Canada	United States	2
24	Bafoussam, Cameroon	West Region, Cameroon	2
25	North Region, Cameroon	Bafoussam, Cameroon	2
26	North Region, Cameroon	Bertoua, Cameroon	2
27	East Region, Cameroon	Bertoua, Cameroon	2
28	Dja Faunal Reserve, Cameroon	Bengbis, Cameroon	2
29	Cameroon	Switzerland	2
30	Switzerland	United States	2
31	Buea, Cameroon	Netherlands	2
32	South Region, Cameroon	Yaoundé, Cameroon	2
33	Douala International Airport, Cameroon	Bahrain	2
34	Dja Faunal Reserve, Cameroon	Lomie, Cameroon	2
35	Messamena, Cameroon	Yaoundé, Cameroon	2
36	Douala, Cameroon	China	2
37	Dja Faunal Reserve, Cameroon	Mintom, Cameroon	2
38	Tonga, Cameroon	Yaoundé, Cameroon	2
39	Gabon	Sangmelima, Cameroon	2
40	Kenya	China	2
41	Cameroon	Gabon	2
42	Yaoundé International Airport, Cameroon	Hong Kong	2
43	Garoua, Cameroon	Nigeria	2
44	Waza National Park, Cameroon	Maroua, Cameroon	2
45	Korup National Park, Cameroon	Mundemba, Cameroon	2
46	South Region, Cameroon	Gabon	2
47	Gabon	Yaoundé, Cameroon	2
48	Garoua, Cameroon	Meiganga, Cameroon	2
49	Cameroon	Kenya	2
50	Gabon	Cameroon	2

Within Cameroon, this research documented 161 unique routes and 23 routes observed more than once (Figure 8). The majority of this trafficking flows from the East and South Regions to Yaoundé. Yaoundé was observed to be a destination or transit location in 18% of unique domestic routes and 11% of all unique routes.

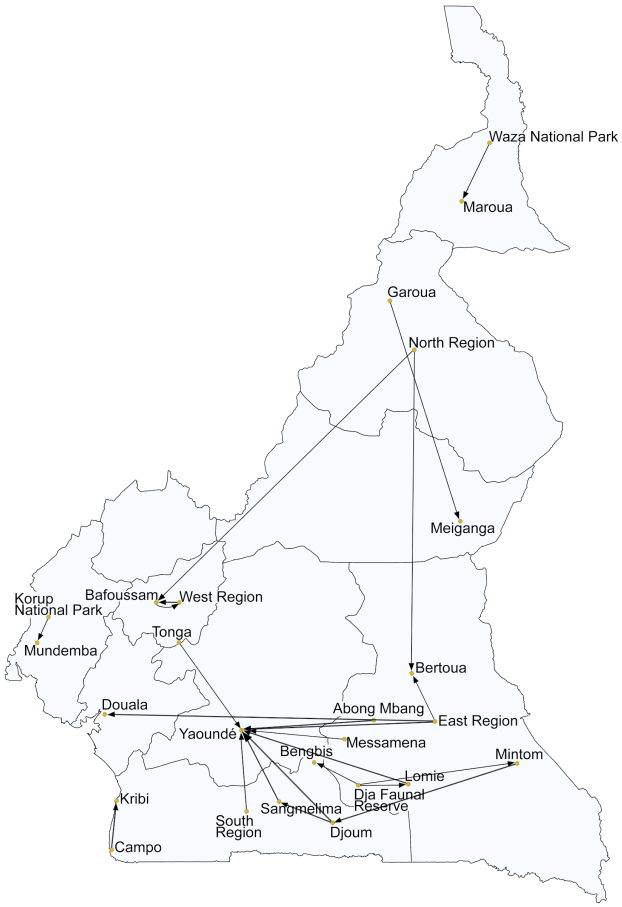


Figure 8: Domestic trafficking routes observed or implicated in multiple incidents, 2008–2018. The line weight denotes the number of incidents (minimum = 2, maximum = 4).

The trafficking network (Figure 9) visualizes the trade routes where locations are represented by “nodes” and the transit between locations by “edges.” The network provides an overview of the Cameroonian trafficking flows, with nodes scaled by total degree, i.e., the sum of edges, regardless of direction of transit. The edges are weighted by the frequency of occurrence, e.g., the weight of Cameroon to the United States = 47, per Table 4.

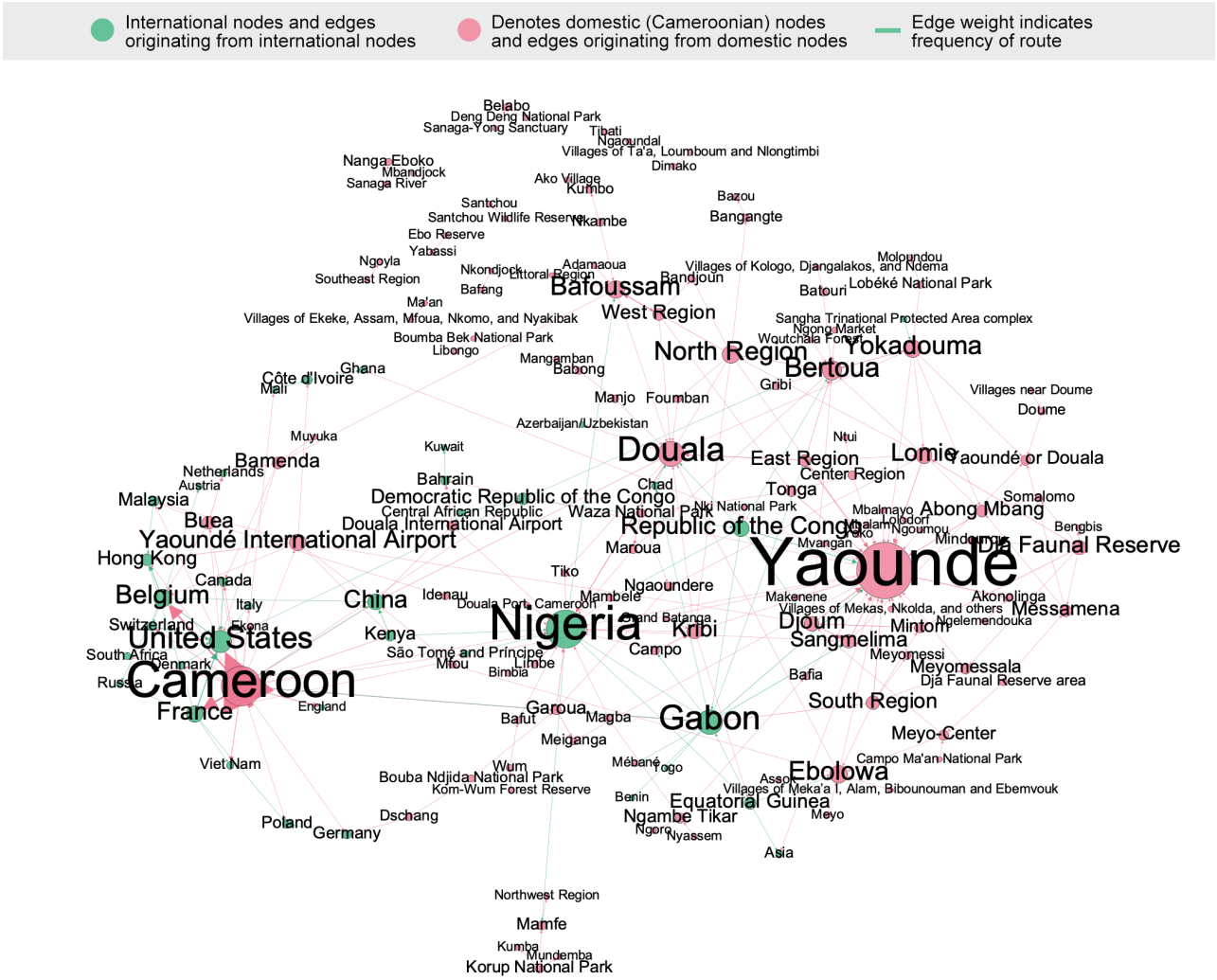


Figure 9: Network of all trafficking incident locations involving Cameroon, 2008–2018. Nodes are scaled by total degree, and the edges and corresponding arrows are weighted by the frequency of occurrence

Table 5 details the nodes with the 20 highest degree values; the full trafficking node data are available in Appendix II. Eigenvector centrality, or influence in the network, was highest for Nigeria, Yaoundé, and Gabon. The five cities in Cameroon with the highest eigenvector values are Yaoundé (Central Region), Douala (Littoral Region), Bafoussam (West Region), Bertoua (East Region), and Ebolowa (South Region); these are each the capitals of their respective regions. Internationally, Nigeria and the United States were the country nodes with the highest weighted in-degree values, indicating more edges (or trafficking) directing into these countries than into other nodes. Both the United States and China had out-degrees of 0, with no observed trade exiting from either country.

Table 5: Wildlife trafficking nodes with 20 highest degree rankings, 2008–2018. Gray rows denote international nodes. Degree is the sum of edges associated with the node. In-degree is the sum of edges (routes) directing to the node. Out-degree is the sum of edges directing from the node to another node. Weighted degrees take into account the frequency of associated edges. Betweenness centrality is the number of times a node appears in the shortest path between pairs of nodes. Closeness centrality measures the distance between a node and the others. Eigenvector centrality measures a node's influence in the total network.

Node (Location)	Degree	Weighted Degree	In-Degree	Weighted In-Degree	Out-Degree	Weighted Out-Degree	Betweenness Centrality	Closeness Centrality	Eigenvector Centrality
Yaoundé, Cameroon*	35	52	29	46	6	6	2347.760714	0.274725	0.735394
Cameroon	24	101	1	2	23	99	2218.766667	0.416667	0.193272
Nigeria	23	28	19	24	4	4	4964.441667	0.326087	1
Gabon	14	19	5	7	9	12	3951.666667	0.380711	0.591254
Douala, Cameroon*	14	19	10	12	4	7	0	0.248366	0.48486
United States	12	66	12	66	0	0	0	0	0.477967
Bertoua, Cameroon*	10	12	9	11	1	1	381	0.201613	0.194266

Bafoussam, Cameroon*	9	13	5	8	4	5	949.5	0.225225	0.451944
Ebolowa, Cameroon*	9	9	6	6	3	3	389.416667	0.226586	0.164048
Belgium	9	23	3	13	6	10	113.916667	1	0.116363
North Region, Cameroon	9	11	1	1	8	10	337.77381	0.308642	0.036293
Yokadouma, Cameroon	9	9	3	3	6	6	234.5	0.265018	0.020357
China	8	10	8	10	0	0	0	0	0.526945
France	8	23	2	13	6	10	288.333333	1	0.380111
Yaoundé International Airport, Cameroon	8	9	2	2	6	7	94.583333	0.223881	0.088106
Lomie, Cameroon	8	11	3	4	5	7	640.872619	0.264085	0.081929
Republic of the Congo	8	10	2	2	6	8	293.25	0.328947	0.025309
Kribi, Cameroon	7	9	3	5	4	4	96.725	0.275735	0.081946
Djoum, Cameroon	7	14	3	5	4	9	129.75	0.246711	0.040105
Dja Faunal Reserve, Cameroon	7	10	0	0	7	10	0	0.206897	0

** Capital or regional capital in Cameroon*

To assess potential route disruption strategies, node removals or “attacks” were implemented, sequenced in order by the node with the highest 1) eigenvector centrality value, 2) degree value, and 3) betweenness centrality value. As described in Chapter 2, the betweenness centrality approach sequenced node removal first by betweenness value and then by closeness centrality value until all nodes were disconnected. When sequencing by eigenvector centrality, the total network robustness *R* was 21.55; by degree, *R* = 10.4; and by betweenness centrality, *R* = 12.25 (Figure 10). The network was thus most effectively dismantled when removing nodes by highest degree value. For this route network, eigenvector value was the least effective dismantling approach. Across approaches, the nodes that consistently disrupted the giant component to the greatest degree were Yaoundé, Cameroon (by all three measures), Nigeria (by all three measures), and Messamena, Cameroon, a town in the East Region (by degree and betweenness).

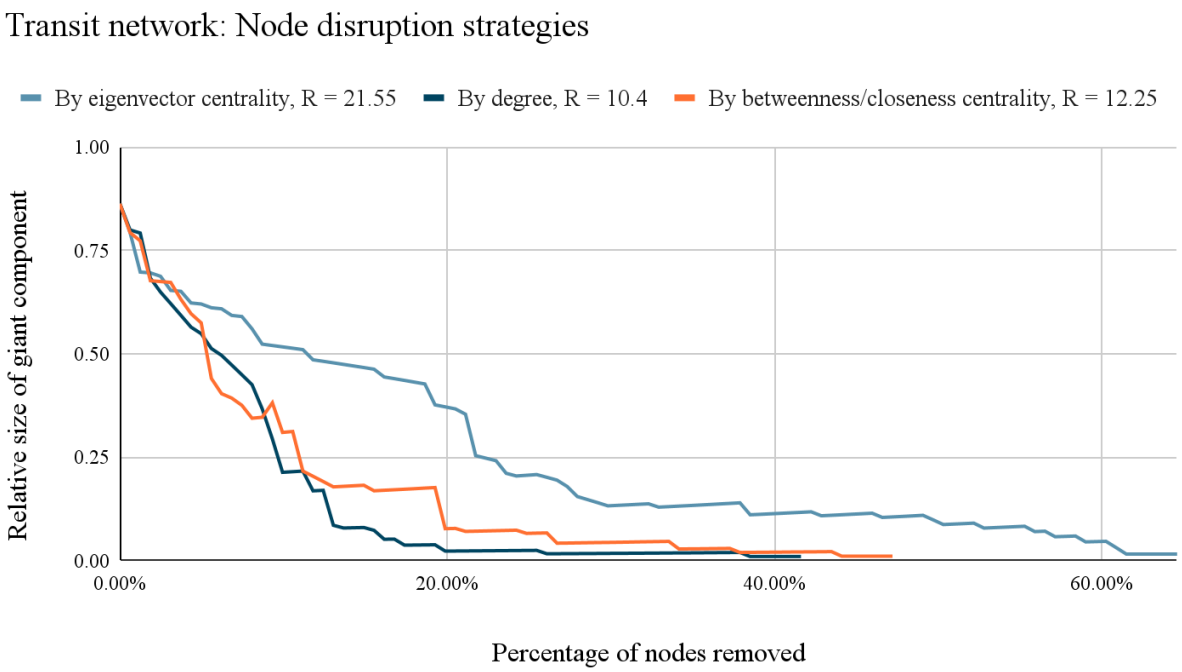


Figure 10: The robustness curves of the observed Cameroonian wildlife trade transit network (2008–2018) based on three measures of node disruption. The robustness value *R* (see equation in Chapter 2) ranges from 10.4 to 21.55.

Crime Convergence

Of the 495 unique incidents documented in this study, 34.14% (*n* = 169 incidents) appear to converge with other forms of crime (Table 6). This includes crimes suggested in incident descriptions, which were coded as “unconfirmed” convergences. Excluding unconfirmed convergences, 30.7% of all incidents (*n* = 152 incidents) converge with other crimes. The vast majority of these convergence incidents (*n* = 158) took place within Cameroon.

Table 6: All observed crime convergences, including unconfirmed incidents. The color scale (light to dark) corresponds to the number of incidents, which ranges from 0 to a maximum of 6.

Crime convergence	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	Total
Adoption fraud (unconfirmed)	0	2	0	0	0	0	0	0	0	0	0	2
Bribery	0	0	0	0	0	0	1	0	0	0	1	2
Bribery (attempted)	0	0	3	3	4	4	0	0	0	0	0	14
Bribery (unconfirmed)	0	0	0	1	0	0	0	0	0	0	0	1
Corruption	1	5	3	6	5	4	3	0	5	2	3	37
Corruption (attempted)	0	0	0	0	0	0	0	0	2	0	0	2
Corruption (unconfirmed)	0	0	0	0	2	2	0	1	0	1	0	6
Cybercrime	2	4	1	1	0	0	0	0	1	1	1	11
Drug dealing (unconfirmed)	0	0	0	0	0	0	1	0	0	0	0	1
Drug possession	0	0	0	0	1	0	1	0	0	0	0	2
Falsified documents and permits	2	6	3	1	0	3	0	0	1	1	0	17
Firearms dealing	0	0	0	0	0	0	0	0	0	1	0	1
Homicide	0	0	0	0	0	0	0	0	2	0	1	3
Human parts smuggling	0	0	0	0	1	0	0	0	0	0	0	1

Illegal entry/residence	0	1	0	1	1	1	0	0	0	0	0	4
Illegal firearms	2	1	0	0	0	0	0	2	2	1	0	8
Illegal firearms (unconfirmed)	0	0	0	3	0	0	1	0	0	0	0	4
Illegal immigration (unconfirmed)	0	2	0	0	0	0	0	0	0	0	0	2
Kidnapping	0	0	0	1	0	0	0	0	0	0	0	1
Laundering through legal storefront	6	2	3	0	0	3	0	0	3	0	1	18
Other natural resource crime	0	0	0	0	0	0	0	0	0	0	1	1
Terrorist financing (unconfirmed)	0	0	0	0	0	0	0	0	0	1	0	1
Theft	0	0	0	0	0	2	1	0	1	0	0	4
Violence and resisting arrest	2	3	2	4	5	3	1	1	4	0	1	26
										Total incidents		169
										Excluding unconfirmed		152

Looking across the surveyed timeframe, convergence incidents occur less frequently in the data beginning in 2014, with one small surge of incidents in 2016 (*n* = 21) (Figure 11).

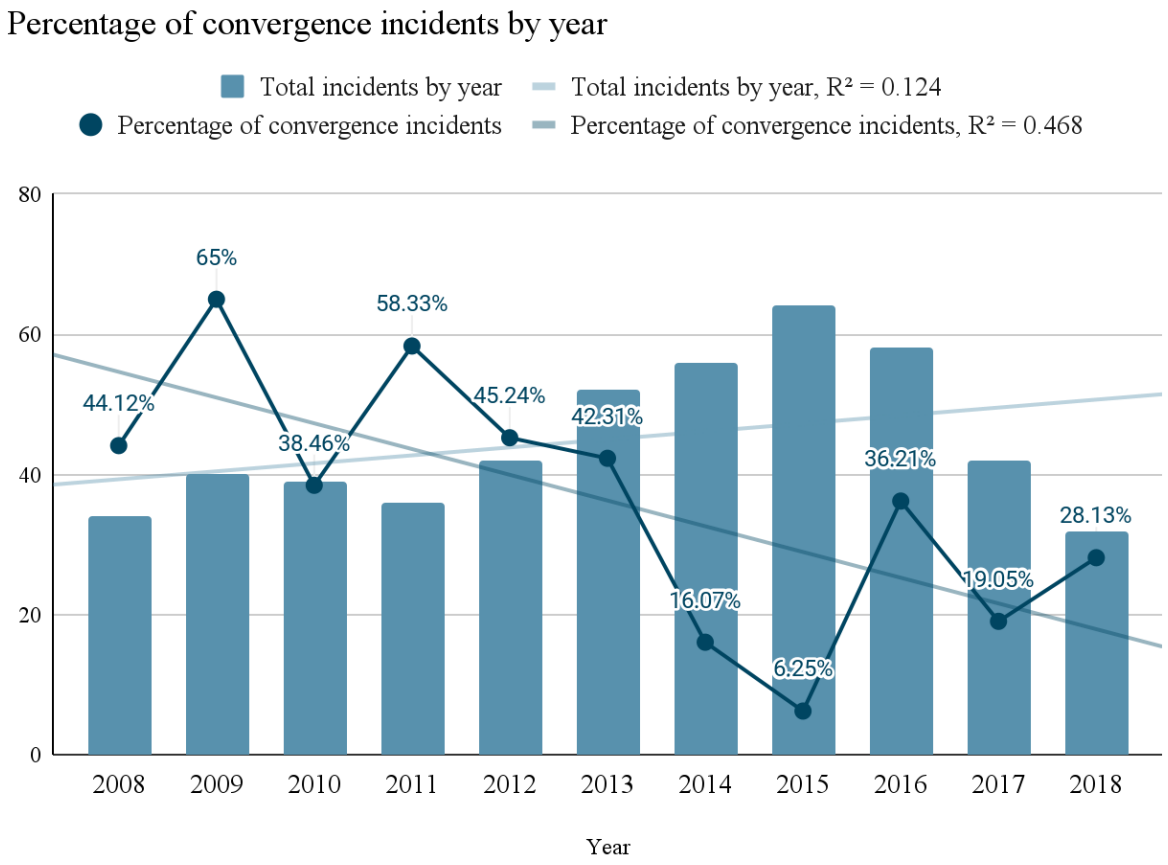


Figure 11: Bars represent the total incidents documented in each year of the study period; dark blue points represent the percentage of total incidents that converged with other crimes each year. The percentage of convergence incidents shows a decreasing trendline (R^2 = 0.468) compared against an increasing trendline of all enforcement incidents (R^2 = 0.124).

Across the time period, the average proportion of convergence incidents among all incidents is 35.5%, with the years 2014, 2015, 2017, and 2018 falling below that average. In Figure 11, the total incidents by year are also plotted, showing that overall enforcement incidents increased over the study period while the proportion of convergence incidents decreased.
Cross-referencing this data with the types of convergences in Table 6 shows that the two most common convergences—"corruption" and "violence and resisting arrest"—slightly peaked in

2011 and 2012, respectively, but were observed consistently through the study period. While most types of convergence were observed more frequently before 2014, there are a few exceptions. Both firearms dealing and suspected terrorist financing were first observed in 2017. Homicide was observed in three incidents from 2016–2018. And the only observed convergence with other types of natural resource crime—specifically, gold smuggling—was documented in this study in 2018.

The percentage frequency of each convergence crime type was then calculated by region, using the total of each convergence crime type and the total enforcement incidents in each region (Figure 12).

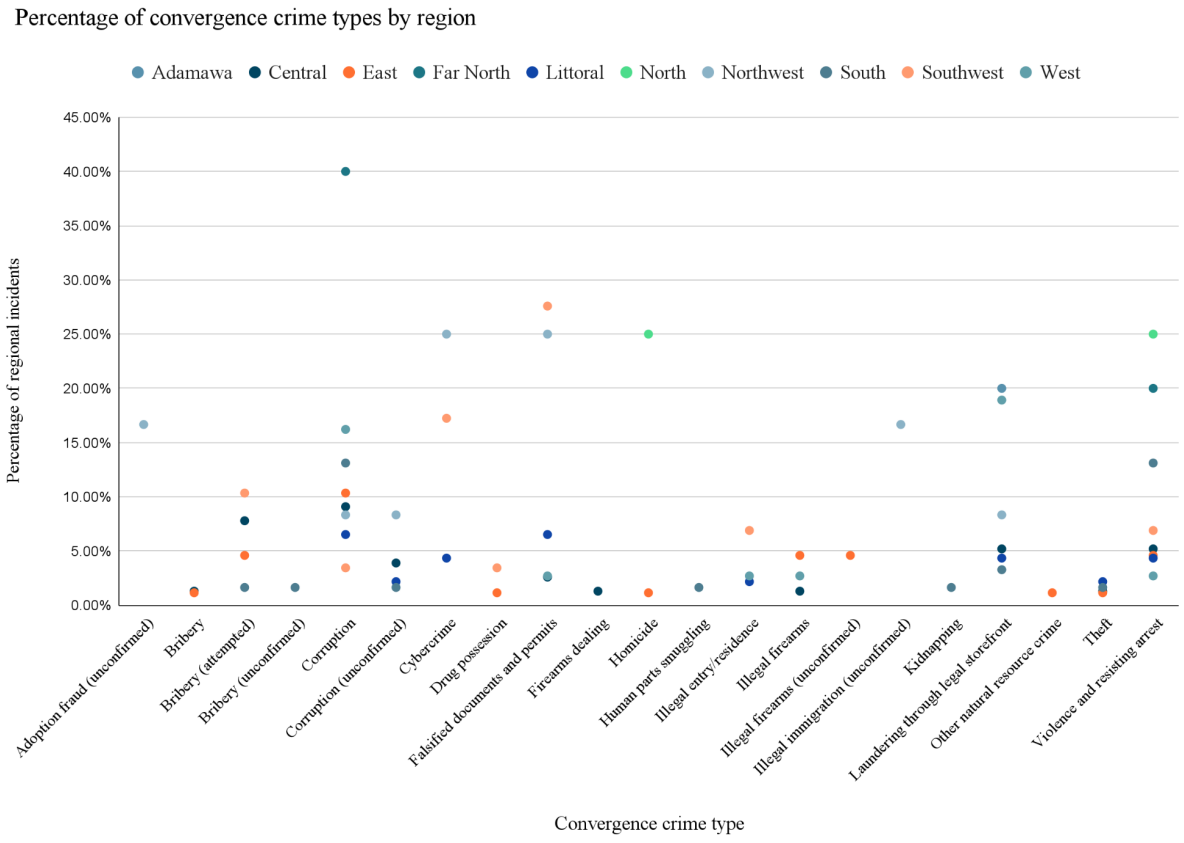


Figure 12: Dots represent the percentage that a type of convergence crime was observed within each Cameroonian region's total enforcement incidents, 2008–2018.

The resulting percentages indicate that the most frequent crime convergence for the study period was “corruption” in the Far North (40%), followed by “falsified documents and permits” in the Southwest (27.59%), “cybercrime” in the Northwest (25%), “falsified documents and permits” in the Northwest (25%), “homicide” in the North (25%), and “violence and resisting arrest” in the North (25%).

Actors and Roles

In total, the research identified 696 actors and their roles in 363 of all incidents (including known duplicates of named actors involved in multiple incidents). Of these, 25.4% of actors (*n* = 177) were identified as acting in more than one role in the given incident, e.g., both *Government colluder* and *Logistician, weapons* (see Chapter 2 for role definitions).

Nineteen roles (or groupings of roles when the actor held more than one) occurred in at least 1% of the collected incidents over the study period, as outlined in Table 7. The most specific role was assigned whenever possible; in some cases, such as with the 74 general *Intermediary* actors, the incident reports did not include sufficient information for more specific coding.

Table 7. The actor roles (or groupings of roles when the actor held more than one) occurring in at least 1% of the data (e.g., at least seven times). The most common region indicates the region where a role was most observed in the data, as a proportion of a region’s total incidents. Number of arrests corresponds to the incident’s enforcement type and includes both “arrest” and “arrest and seizure.”

Roles	Number of actors	Percentage of total actors (*n* = 696)	Most common region (*percentage of role in regional incidents*)	Number of arrests (*rate of arrest*)
Vendor	95	13.65%	North (*33.3%*)	88 (*92.6%*)
Specialized smuggler	88	12.64%	Littoral (*18.5%*)	70 (*79.5%*)
Vendor to consumers	74	10.63%	West (*21.6%*)	70 (*94.6%*)
Intermediary (general)	73	10.49%	Adamawa (*45.5%*)	59 (*80.8%*)
Harvester (general)	50	7.18%	Far North (*75.0%*)	21 (*42%*)
Vendor from harvesters and to consumers (wholesaler)	41	5.89%	West (*11.8%*)	41 (*100%*)

Logistician (general)	28	4.02%	Littoral (*6.5%*)	23 (*82.1%*)
Harvester, specialized commercial	23	3.30%	North (*16.7%*)	21 (*91.3%*)
Vendor from harvesters	18	2.59%	South (*4.3%*)	16 (*88.9%*)
Vendor, online	13	1.87%	Northwest (*19.1%*)	13 (*100.0%*)
Harvester, specialized commercial and vendor (general)	12	1.72%	Northwest (*9.5%*)	12 (*100.0%*)
Logistician (general) and vendor (general)	12	1.72%	Northwest (*4.7%*)	12 (*100.0%*)
Harvester (general) and vendor (general)	11	1.58%	Northwest (*14.3%*)	10 (*90.9%*)
Vendor to other vendors	11	1.58%	Adamawa (*9.1%*)	7 (*63.6%*)
Launderer and vendor to consumers	10	1.44%	Northwest (*9.6%*)	10 (*100.0%*)
Government colluder	9	1.29%	East (*2.6%*)	4 (*44.4%*)
Logistician, storage	8	1.15%	South (*2.6%*)	5 (*62.5%*)
Specialized smuggler and vendor	8	1.15%	Southwest (*1.8%*)	8 (*100.0%*)
Logistician, weapons	7	1.01%	East (*2.6%*)	5 (*71.4%*)

When actors appeared to hold more than one role, the most frequent pairing was *Vendor from harvesters* and *Vendor to consumers*, of which there were 41 identified actors (5.89% of all actors). This particular pairing may also be called a “wholesaler”: These actors frequently purchase wildlife goods from multiple harvesters, often in rural areas, and then resell the products directly to consumers, often in urban areas (LAGA, 2014; LAGA, 2017).

Out of the 696 coded actors, 628 were involved in domestic incidents in specified regions of Cameroon. In seven incidents, the location was identified generally as “Cameroon” so no region could be specified. The roles occurring most frequently in specified regions were *Harvester* in the Far North (75% of actors implicated in the region); *Intermediary* in Adamawa (45.5% of actors in the region); and *Vendor* in the North (33.3% of actors in the region). Actors were also analyzed against the enforcement incident type (seizure, arrest, etc.) to better understand which role were most or least apprehended over the study period. In total, the data

identified 587 arrested actors out of 696 total actors (84.33%). The types of actors that were apprehended the least during the study period were *Harvester (general)* (42% of identified actors arrested); *Government colluder* (44.4%); *Logistician, storage* (62.5%); *Vendor to other vendors* (63.6%); and *Logistician, weapons* (71.4%). Across the remaining roles that occurred in at least 1% of the data, the large majority of the identified actors (75% or more) were arrested in the study period.

To visualize how actors interact, two network maps were created using Gephi (Figures 13 and 14). The network in Figure 13 reflects each coded actor and their specific role, including combinations of roles, with 58 unique nodes. To simplify this complex network, Figure 14 visualizes connections between each individual role typology, removing the combinations of roles observed in the data, with 23 unique nodes. The one combined role retained in Figure 14 is *Vendor from harvesters and to consumers (wholesaler)* since this pairing was observed most frequently in the data and may be considered a unique typology, as discussed in the subsequent chapter. While the full network (Figure 13) provides more specificity of the observed actors and their combined roles, the simplified version (Figure 14) provides a more concise snapshot of how role types connect in Cameroonian illegal wildlife trade networks.

Each network node and its label are scaled to the corresponding degree. Even without the numeric data, one can see that *Specialized smuggler*, *Vendor to consumers*, *Logistician*, *Vendor*, and *Harvester, specialized commercial* stand out as having the most edges, or connections, to other actors. In the actor network, unlike the route network, it is possible for nodes to include self-loops, indicating that multiple actors performing the same role were implicated in a single incident and no other actor types were involved.

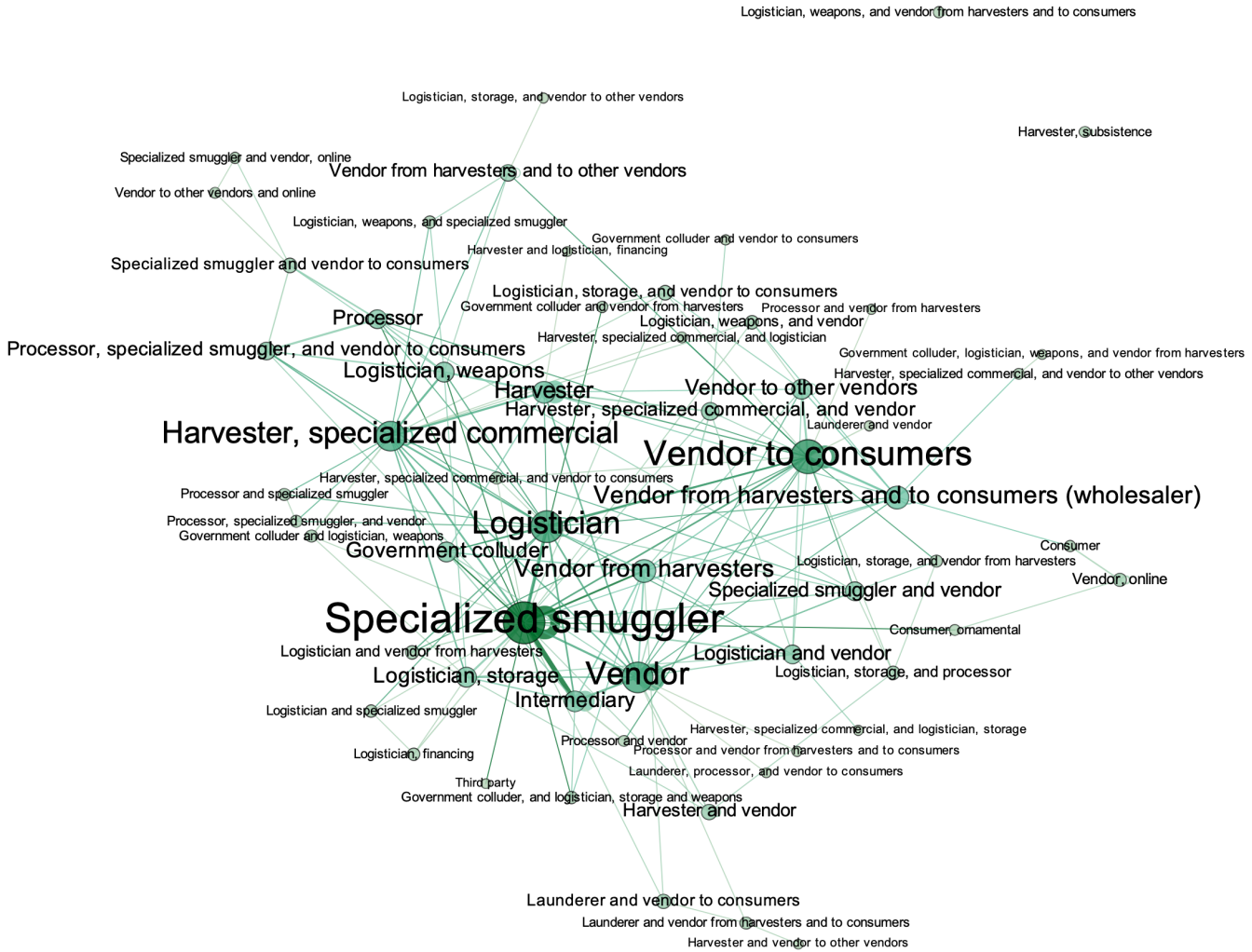


Figure 13: The network of connected actors' roles based on Cameroonian wildlife trade data, 2008–2018.

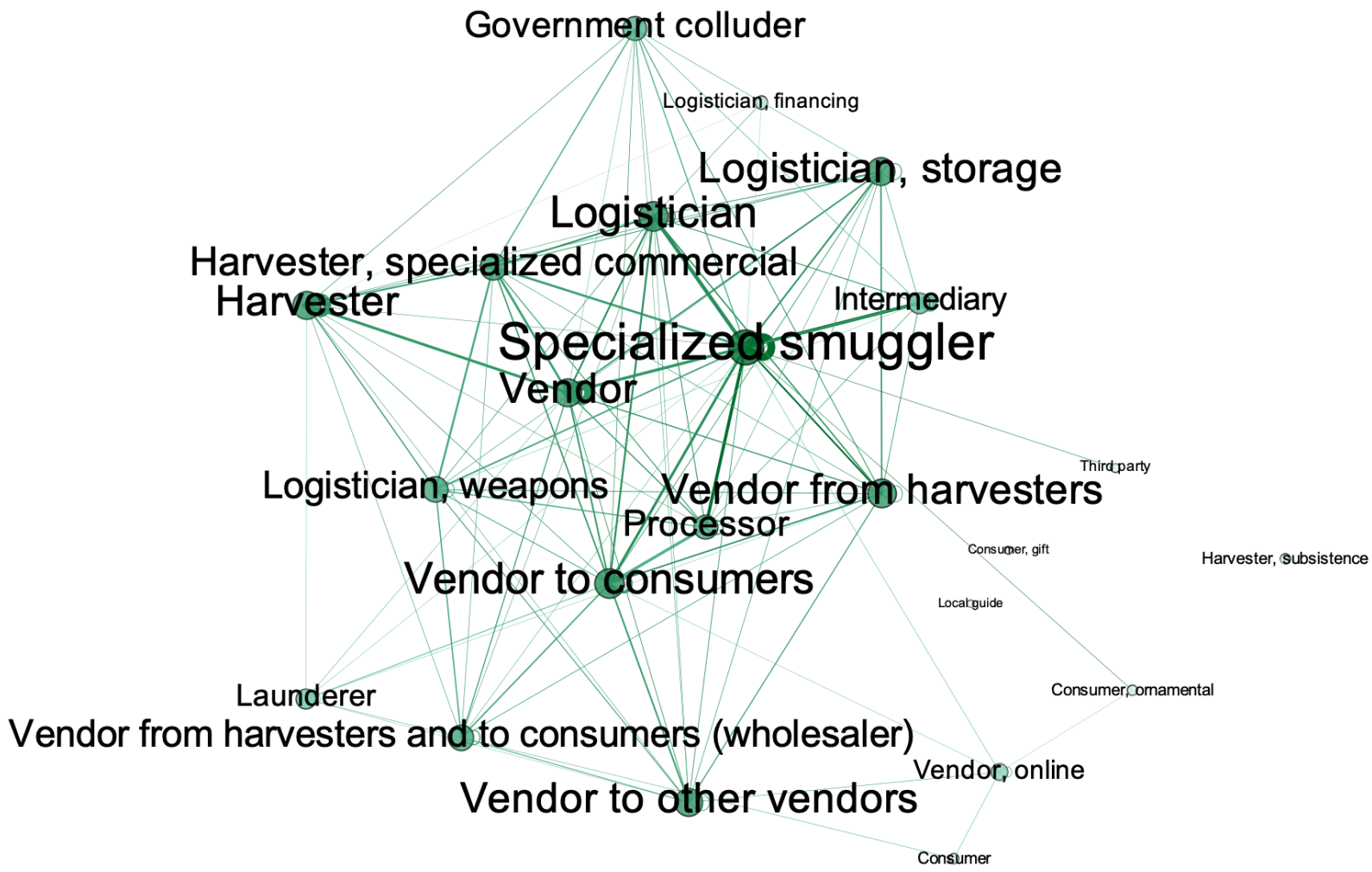


Figure 14: The condensed network of unique actor role typologies based on Cameroonian wildlife trade data, 2008–2018.

As for the route network, additional statistics of the network of actors were calculated in the Gephi application and are provided for the 20 highest-degree nodes, sorted by degree (Table 8). The percentage of the role among all actors, from Table 7, is also provided for comparison. The full actor node data is provided in Appendix III.

Table 8: Wildlife trafficking actor roles with 20 highest degree rankings, 2008–2018. Degree is the sum of edges associated with the node. Weighted degree takes into account the frequency of associated edges. Betweenness centrality is the number of times a node appears in the shortest path between pairs of nodes. Closeness centrality measures the distance between a node and the others. Eigenvector centrality measures a node's influence in the total network.

Node (Actor/Role)	Percentage of role	Degree	Weighted Degree	Betweenness Centrality	Closeness Centrality	Eigenvector Centrality
Specialized smuggler	12.64%	30	175	470.753354	0.625	1
Vendor to consumers	10.63%	23	69	314.530601	0.578947	0.785273
Logistician	4.02%	21	53	147.456085	0.561224	0.854708
Vendor	13.65%	20	129	240.226354	0.55	0.811997
Harvester, specialized commercial	3.30%	19	53	144.590442	0.518868	0.649622
Vendor from harvesters	2.59%	13	32	28.571616	0.495495	0.593722
Vendor from harvesters and to consumers (wholesaler)	5.89%	13	26	180.403145	0.509259	0.539231
Harvester	7.18%	12	121	77.587967	0.486726	0.513644
Intermediary	10.49%	11	123	20.236671	0.45082	0.473986
Government colluder	1.29%	10	16	4.687812	0.474138	0.542721
Logistician, weapons	1.01%	10	25	90.681859	0.470085	0.402554
Logistician, storage	1.15%	10	20	30.51017	0.482456	0.406137
Vendor to other vendors	1.58%	10	16	11.958989	0.454545	0.401045
Processor	0.86%	9	23	59.688815	0.470085	0.380515
Logistician and vendor	1.72%	9	13	62.394701	0.478261	0.456587
Specialized smuggler and vendor	1.15%	9	11	33.558356	0.486726	0.458457
Harvester, specialized commercial, and vendor	1.72%	8	14	57.292322	0.443548	0.321902

Processor, specialized smuggler, and vendor to consumers	0.43%	8	18	32.764286	0.443548	0.328842
Vendor from harvesters and to other vendors	0.72%	7	7	61.673846	0.416667	0.193965
Harvester and vendor	1.58%	6	13	6.745707	0.423077	0.228222

In particular, though there were a high number of *Intermediary* actors (accounting for 10.49% of all actors), this role type has relatively low degree, eigenvector, and betweenness values, indicating that the type may occur frequently but is less influential and connected in the network. Conversely, while *Logistician* and *Vendor from harvesters* occurred less frequently across the data (accounting for 4.02% and 2.59% of all actors, respectively), these types rank third and sixth by degree value and second and sixth by eigenvector centrality, suggesting they exert key influence in the network. Figure 15 plots the top 10 roles' percentage frequencies versus their degree values to visualize which roles appear better connected to other nodes despite appearing less in the data.

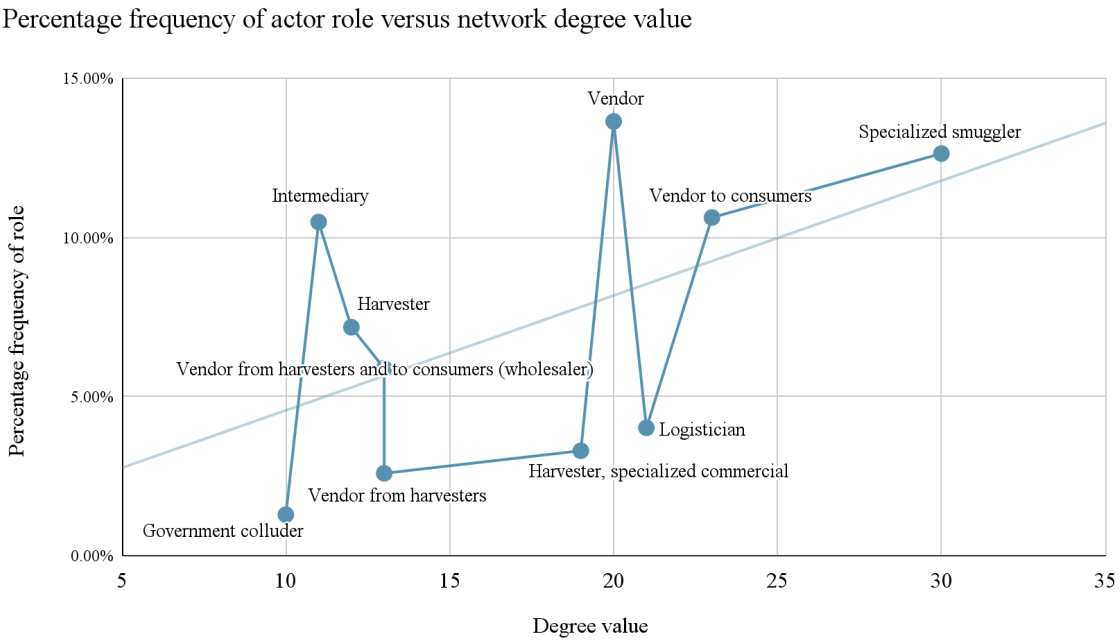
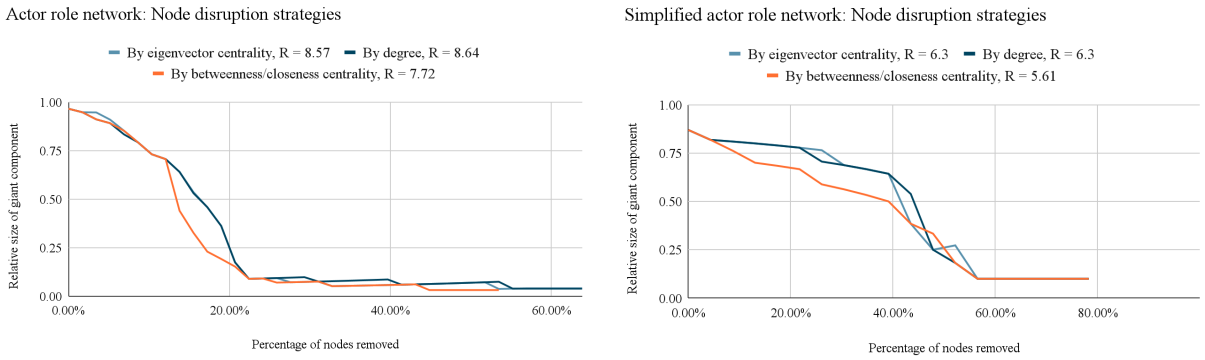


Figure 15: The 10 most frequent roles observed in the data versus their network degree value, visualizing which roles appear better connected to other nodes despite appearing less in the data.

Both the complex and the simplified networks of wildlife trade actors' roles demonstrated fairly consistent robustness for the three network disruption approaches (by eigenvector, degree, and betweenness values). In the full complex network, node attacks sequenced by eigenvector and by degree yielded similar *R* values: 8.57 and 8.64, respectively (Figure 16). For this network, dismantling nodes by the betweenness values was most effective at decreasing network robustness, with *R* = 7.72. In the simplified network, betweenness centrality again was the most effective approach for network disruption, with *R* = 5.61 (Figure 17). Sequenced node removal by eigenvector and degree value both yielded *R* = 6.3. While the robustness of the full and complex networks is similar, the full network has a higher average *R* value: 8.31 average versus 6.07 for the condensed network. In other words, the complex network of illegal wildlife trade actors documented in this study is more difficult to dismantle than a simplified version.



Figures 16 (left) and 17 (right): The robustness curves of the full observed Cameroonian wildlife trade actor network (L) and the condensed network (R). The robustness value R ranges from 7.72–8.57 in the full network and from 5.61–6.3 in the condensed network.

Across approaches, the nodes that disrupted the giant component to the greatest degree were *Logistician, storage* (by all three measures); *Vendor from harvesters and to consumers (wholesaler)* (by all three measures); *Processor* (by eigenvector and degree); *Vendor to other vendors* (by eigenvector and degree); and *Logistician, weapons* (by degree and betweenness).

To further elucidate connections within Cameroonian wildlife trade networks, actor data were coded by nationality, as possible. In total, this study identified the nationalities of 622 actors (out of 696 total actors). Of these, 87.1% of actors were Cameroonian, including one

naturalized citizen (*n* = 542). Of the 80 international actors, there were 23 unique nationalities, including one actor identified in the data source as, generally, "Asian." The most common nationalities were Chinese (*n* = 14), Nigerian (*n* = 13), Ghanaian (*n* = 10), Congolese (*n* = 9), and Gabonese (*n* = 6). Three of these nationalities implicate countries that share borders with Cameroon (Nigeria, the Republic of the Congo, and Gabon).

Table 9 disaggregates the international actors by nationality and by the role performed in the incident data. In total, the most frequent roles international actors performed in this study's data are *Specialized smuggler* (*n* = 19), general *Intermediary* (*n* = 16), *Logistician* (*n* = 10), and *Harvester* (*n* = 9).

Table 9: International actors implicated in the Cameroonian illegal wildlife trade by nationality and by role, 2008–2018.

Nationality	Role	Actors	Total actors
American	Vendor, online	1	2
	Specialized smuggler and vendor	1	
"Asian"	Logistician	1	1
Belgian	Consumer, ornamental	1	1
Beninese	Vendor from harvesters and to consumers (wholesaler)	1	1
British	Logistician and specialized smuggler	1	1
Canadian	Consumer	1	2
	Specialized smuggler	1	
Central African	Intermediary	1	1
Chadian	Intermediary	1	2
	Specialized smuggler	1	
Chinese	Intermediary	6	14
	Specialized smuggler	4	
	Logistician	3	
	Consumer	1	
Congolese	Harvester	4	9
	Harvester, specialized commercial, and vendor	2	

	Intermediary	2	
	Specialized smuggler	1	
Dutch	Consumer	2	2
Egyptian	Vendor to other vendors	1	1
French	Consumer	1	1
Gabonese	Harvester	3	5
	Logistician and specialized smuggler	1	
	Vendor to other vendors	1	
Ghanaian	Intermediary	4	9
	Specialized smuggler	3	
	Logistician, financing	1	
	Logistician, storage	1	
Greek	Intermediary	1	1
Guinean	Specialized smuggler	1	1
Italian	Vendor from harvesters	1	1
Malaysian	Intermediary	1	2
	Specialized smuggler and vendor to consumers	1	
Malian	Launderer and vendor from harvesters and to consumers (wholesaler)	1	4
	Specialized smuggler	1	
	Harvester	1	
	Vendor from harvesters	1	
Nigerian	Specialized smuggler	3	10
	Logistician	2	
	Vendor to consumers	2	
	Harvester and vendor to consumers	1	
	Logistician, storage, and processor	1	
	Vendor	1	
Sudanese	Harvester, specialized commercial	1	1
Vietnamese	Logistician	2	2
	Total actors with identified roles and nationalities		74

The data were further simplified to visualize relationships between the actors' home continents and their roles. As shown in Figure 18, the roles of international actors were most varied in Africa, which included the most implicated countries. International *Harvesters* and *Processors*, in particular, only acted on the African continent in the surveyed data. *Consumers* primarily came from Europe and North America, while the greatest share of *Logisticians—including* financiers and other types of logistical support—were identified as Asian.

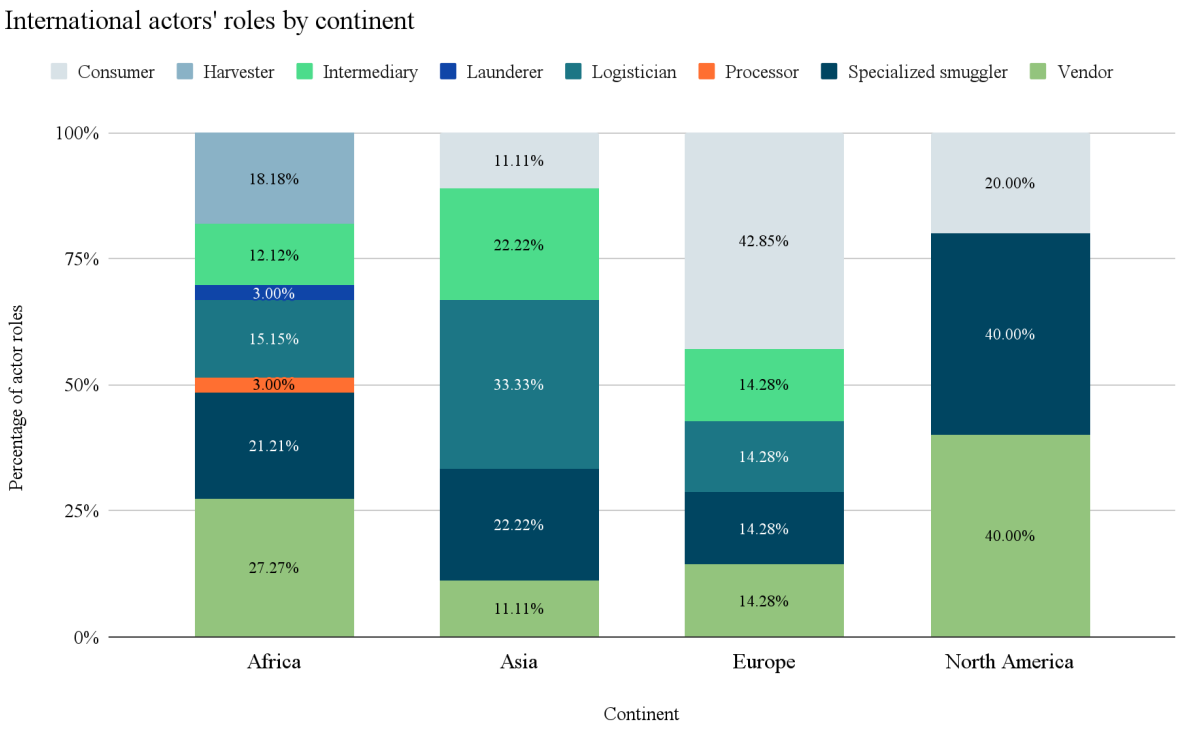


Figure 18: International actors' roles by percentage in the study data and by home continent, 2008–2018.

The connections between international actors was visualized in a network using Gephi software (Figure 19). The network contains 18 unique nodes, with Cameroonian actors connected to 16 of these. Of 80 documented edges in the network, 66.25% (n = 54) involve the Cameroonian actor node. Of the remaining 33.75% of edges (n = 27) not connected to the Cameroonian node, 81.48% of these (n = 22) are self-looping edges that connect actors of the same

nationality. These data highlight two features of the network: the involvement of Cameroonian actors and the connections between actors from the same home country.

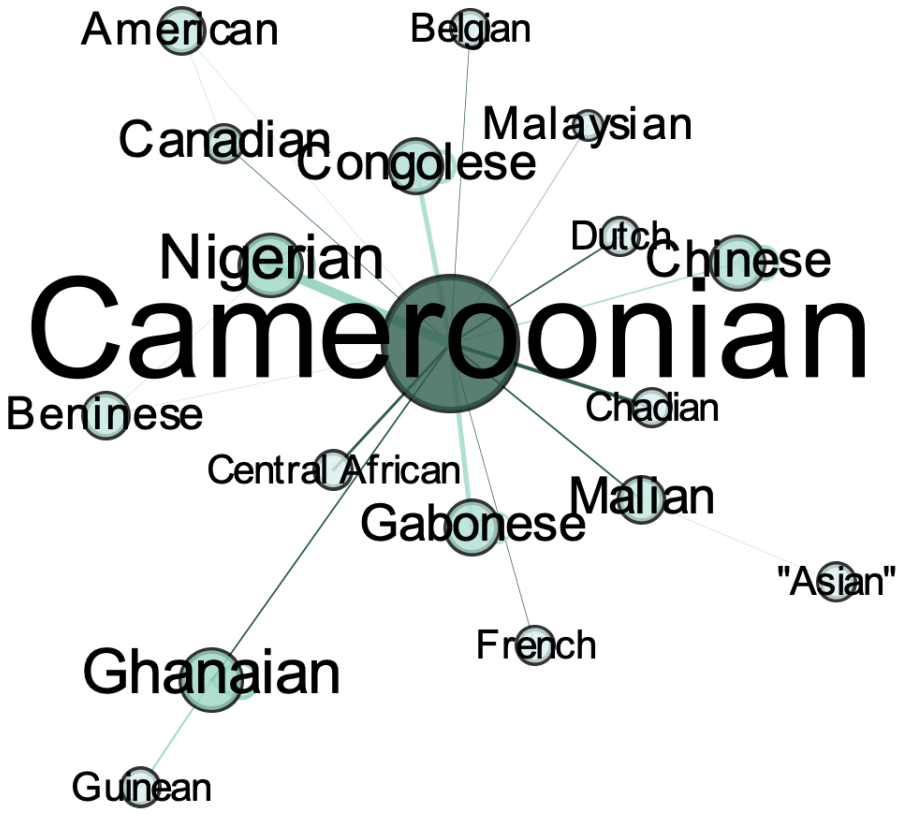


Figure 19: The network of connected international actors based on Cameroonian wildlife trade data, 2008–2018.

Chapter 4: Discussion

What are the Observed Trafficking Routes To, From, and Within Cameroon?

Cameroon's Role in International Trade

The data from this research emphasize the breadth of Cameroon's involvement in the global wildlife trade, with 37 other countries implicated over the study period. With Cameroon as a case study, the data concur with and build on evidence that countries in Central Africa act as both sources of and transit sites for the illegal wildlife trade (UNODC, 2018). While the United States was the international location involved in the most documented incidents (n = 66), it is worth noting that U.S. seizure data is well-tracked in the Fish and Wildlife Service LEMIS database, with records from 2000–2014 available to this study. Conversely, such comprehensive data is not available from Nigeria (for example), and this study recognizes the inherent bias toward countries like the United States with strong reporting procedures (Ingram *et al.*, 2019).

With this bias acknowledged, the United States nonetheless appears to be a frequent destination for wildlife products sourced from or transiting through Cameroon. This is suggested both by the number of enforcement incidents with seizures (n = 60) and by the trafficking network, in which the United States has an out-degree of 0, indicating no trade leaving it for further destinations.

Internationally, after the United States, Cameroon's neighbors of Nigeria, Gabon, and the Republic of the Congo were most implicated in this study's data. Nigeria and the Republic of the Congo were implicated most frequently as *source, transit, or destination* locations (83.3% of incidents in Nigeria and 56.25% in the Congo versus 46.43% in Gabon). Gabon was observed to have a greater percentage of *enforcement* incidents (53.57% versus 16.7% in Nigeria and 43.75% in the Congo). Gabon also appears in the top 10 enforcement sites across all locations, with 15 enforcement incidents. These figures may be interpreted several ways: First, since its observed enforcement incidents are higher, Gabon may have a stronger law enforcement capacity than other regional countries. Second, since this study focused only on

Cameroonian actors and trade involving Cameroon, cooperation between Cameroon and Gabon officials may be better—thus increasing the apprehension rate of Cameroonian nationals in Gabon and the seizure of products moving between the two countries. Third, Nigeria and the Republic of the Congo may be more common source and transit locations; for Nigeria, this interpretation aligns with existing findings about the country's growing role as an exporter of illegal wildlife products (EIA, 2020; UNODC, 2020; UNODC, 2018). As discussed later in this chapter, a regional study could be a valuable addition to understanding these connections.

Despite a general belief that wildlife trade primarily flows from Africa to Asia (see UNODC, 2020), the most implicated Asian country in this study, China, was involved in only 2.02% of incidents. Again, this may indicate a lack of available data, poor reporting, and/or poor enforcement in Asia, rather than minimal trade. It is also possible that trade routes between East Africa and China are more common and resilient than flows from or through Cameroon. Rather than flows to Asia, this study found that France and Belgium were more common destinations for illegal wildlife trade involving Cameroon; together, these countries were implicated in 5.05% of recorded incidents. As both France and Belgium share the French language with Cameroon and France was once the colonial power in the country, there is historic, linguistic, and cultural precedent for these connections. The Cameroonian population is estimated at 76,000 individuals in France and 25,000 in Belgium (African Union Commission, 2019). This diaspora, creating transnational links between families, friends, and business associates, likely contributes to the prominence of France and Belgium in the study data. While such connections are not well researched, particularly for wildlife trade routes, many studies suggest that diaspora communities are facilitating various types of transnational crime (Costa, 2019; INTERPOL, 2018; UNODC, 2010). In this study, the incidents involving France and Belgium were primarily airport seizures and did not include arrests so there remains a gap in understanding the actors involved in this supply chain.

Based on the study data, Cameroon appears to experience a high percentage of wildlife trafficking arrests. As noted in Chapter 3, the vast majority of enforcement incidents in Cameroon included an arrest (84.99%), often of more than one offender, and only 13.14% of incidents recorded seizures or poaching without arrests. The total arrests documented for the study period were 587, or about 53 per year—this is less than the 80 arrests per year estimated by UNODC and comparable to the 52 arrests that LAGA estimates from its activities (LAGA, 2021a; UNODC, 2018). For comparison, a search in the online Wildlife Trade Portal yields 9,940 total global seizure or poaching incidents for the study period and only 350 enforcement or prosecution incidents (TRAFFIC International, n.d.). While this study does not specifically assess LAGA's role in Cameroonian wildlife crime enforcement, it is possible that LAGA's added support to national officials, particularly for investigative work, contributes to the high proportion of arrests. Additional research or an evaluation of LAGA's role over time would build this understanding and quantify the potential value of similar government–NGO collaboration in other contexts.

Cameroon's largest cities, and particularly the regional capitals, were frequently implicated in the study data, including Yaoundé, Douala, and Bertoua. One possible factor related to this data is that enforcement may be stronger in cities with sizable populations and more law enforcement personnel. Another factor suggested by the data is that wildlife products harvested from other areas—both within Cameroon and from neighboring countries—flow into the markets of these cities. This finding concurs with research about the bushmeat trade's prominence in Douala (Aguillon *et al.*, 2020; Fa *et al.*, 2014) and with findings in other countries that capital cities are often wildlife trade hotspots (Paudel *et al.*, 2020; Ingram *et al.*, 2019; Indraswari *et al.*, 2020). The study's documented incidents frequently refer to "suppliers" in rural areas who provide products to logisticians, vendors, and smugglers who then bring the products to market (see LAGA, 2008; LAGA, 2014; TRAFFIC, 2019). For example, a group of three actors was arrested in Yaoundé in 2009 with connections to suppliers from the East, South, and Central Regions; from them, officials seized bushmeat of multiple species including giant pangolin and gorilla. Additionally, Cameroon's larger cities are gateways for trade to

international destinations, particularly the airports in Yaoundé and Douala and the coastal ports of Douala and Limbe. For example, from these latter two ports, the study found six incidents of trade transiting to Nigeria.

Regionally, the East of Cameroon was observed to have the most enforcement incidents and the most enforcements per capita during the study period, suggesting a strong regional force combating the illegal wildlife trade and/or a high level of trade. These results may be encouraging since 94.25% of enforcement incidents in the East Region included arrests. Notably, the East Region also contains several of Cameroon's largest protected areas; proximity to the biodiversity of these areas likely enables trade. As shown in the heat map in Figure 5, Chapter 3, the other highly-biodiverse regions with protected areas—specifically the North and Far North—appear less effective at targeted enforcement. These areas were observed to experience larger percentages of poaching without arrests, and the North Region was the only region where attempted but unsuccessful arrests without seizures occurred in the study period (see Figure 6). Notably, the Far North and North are the second (n = 3,897,577) and fourth (n = 2,378,489) most populous regions in Cameroon, respectively (see Table 3). As shown in Figure 8, Chapter 3, there is evidence that some trade flows from the North Region to at least three other regions of Cameroon; poor enforcement within the North Region itself thus perpetuates trade across the country. The low arrest rates in the North and Farth North, despite observations of poaching and illegal wildlife trade flows, suggest a need for more targeted investigations, a focus on regional cooperation, and possibly increased staffing to better understand and address the gap.

Cameroon's Trafficking Network

The data suggest strong resilience in the trafficking network, with robustness values of 10.4–21.55 based on three common network disruption strategies. In other words, if certain nodes are removed, by increased law enforcement, for example, it is likely that there are already substitute routes in place that can be repurposed and bolstered. For the trafficking network, sequencing disruption by each node's degree appears most effective, yielding the lowest robustness value of 10.4 (compared to 21.55 by eigenvector centrality and 12.25 by

betweenness centrality). As such, increasing enforcement in the nodes (locations) that have the most connections to other nodes may be an effective strategy for reducing trafficking.

This study found that removal of Yaoundé in the Central Region, Nigeria, and Messamena in the East Region disrupted the network's giant component to the greatest degree. Though Messamena is not a regional capital and its degree value is relatively low (n = 5), this result suggests that the city may be a critical node in the flow of trafficking throughout the network. In two recorded incidents, wildlife products were observed to be harvested in the East Region's Dja Faunal Reserve and then to transit through Messamena. The city's proximity to this reserve (see Figure 8) may increase its significance in the network if it acts as a gateway between source locations and markets. Additionally, as already suggested regarding Nigeria, further research about supply chains transiting between Cameroon and its northern neighbor would also improve understanding and inform effective action.

Where Does Illegal Wildlife Trade Converge with Other Types of Crime?

This study contributes more evidence that corruption converges with and contributes to the illegal wildlife trade. Including incidents of observed, attempted, and suspected corruption in the data, corruption accounted for 26.6% of all convergences. The types of corruption most commonly observed were military officers providing funding, weapons, uniforms, and other support; government officials providing immunity or logistical support to traffickers; and unprocedural actions after arrests, including suspicious releases of individuals in custody. For example, in 2010, a known parrot trafficker was arrested in Kribi in the South Region. LAGA's records note that after his arrest, MINFOF officials removed the offender from the gendarmerie brigade, released him, and refused to sign the complaint report for a warrant of arrest. While Cameroon is recognized as suffering from endemic corruption—ranking 149th out of 180 countries on Transparency International's Corruption Perception Index (Transparency International, 2020)—this study is one of the first to document the prevalence of corruption associated with the illegal wildlife trade in the country.

The data indicate that the Cameroonian wildlife trade most frequently converges with logistical or reactionary crimes such as corruption (*n* = 45), falsified documents (*n* = 17), violence and resisting arrest (*n* = 26), and laundering illegal wildlife products through storefronts (*n* = 18) (see Table 6). There was little observed convergence with other types of transactional crime: one unconfirmed incident of drug dealing, one incident of firearms dealing, and one incident of gold smuggling. These data suggest that the illegal wildlife trade in and through Cameroon may be highly specialized. One potential reason for this specialization is the view, introduced in Chapter 1, of wildlife trade as a low-risk, high-reward criminal activity as compared to other types of crime; thus, the networks involved in the wildlife trade may be averse to the risks of criminal diversification. This study's findings related to wildlife trade specialization would be complemented by an assessment of wildlife crime prosecution rates in Cameroon to better understand if penalties are disincentivizing or possibly encouraging the trade. This suggestion is discussed further in the upcoming section on future studies.

Regionally, convergence incidents accounted for an average of 36.76% of domestic enforcement incidents, ranging from a low of 20.0% in the Adamawa Region to a high of 60.0% in the Far North. As shown in Figure 12 in Chapter 3, corruption in the Far North occurred in 40.0% of the region's incidents, a far higher rate than in any other region. Also of note, homicide and violence were both observed in 25.0% of the North Region's documented incidents, associated with poaching in protected areas. This study's observed incidents in the North Region suggest two points: Adequate protection of protected areas and their wildlife continues to be a challenge in Cameroon, and porous borders near protected areas create opportunities for transnational poachers and traffickers.

What Roles Do Actors in Cameroon Play in Illegal Wildlife Trade Supply Chains?

This study found that the types of roles actors assume in Cameroonian illegal wildlife trade networks align with existing typologies (Phelps, Biggs, and Webb, 2016). However, further delineation of types—specifically vendors and logisticians—allowed for more thorough analysis and understanding of the connections between actors and how enforcement actions may be skewed toward certain roles. Of these study-specific vendor and logistician types, this research

identified that enforcement incidents most frequently encountered *Vendors to consumers* (*n* = 74, 10.63% of all identified actors) and *Vendors from harvesters and to consumers (wholesalers)* (*n* = 41, 5.89% of all identified actors). Vendors earlier in the supply chain—those that purchase products from harvesters and those that supply wholesalers—were observed less frequently in the data. *Vendors to other vendors* were also observed to experience a much lower arrest rate: 63.6% versus 94.6% for *Vendors to consumers* and 100% for *Wholesalers*. These results may indicate a gap in enforcement, in which vendors earlier in the supply chain and further from consumer markets elude detection and proper legal proceedings.

Likewise, *Harvesters* were observed to experience a low arrest rate, 42.0%, despite being the fifth most common role observed in the data. As noted earlier, one reason for this may be the violence associated with poaching and the difficulties of apprehending actors who are often armed (UNODC, 2018). As recent analyses suggest, anti-poaching efforts can lead to improved protections and reduce trade, but this approach is not sufficiently comprehensive to combat the many drivers of wildlife trafficking (Lynch, Stretesky, and Long, 2017; Moneron, Armstrong, and Newton, 2020). Past enforcement efforts, particularly in Africa, have overly focused on the harvesters rather than addressing the consumer demand or financial incentives for logisticians. For example, interviews with convicted wildlife offenders in South Africa revealed that harvesters were overwhelmingly represented, with few convicted actors who filled higher roles in supply chains (Moneron, Armstrong, and Newton, 2020). As such, the high arrest rate of vendors and smugglers suggest a robust enforcement network in Cameroon that is investigating across wildlife supply chains.

Regionally, the Far North was observed to have the highest frequency of any single role: *Harvesters* accounted for 75% of observed actors in this region. This finding aligns with the fact that the Far North also holds a significant portion of the country's protected areas (see Figure 2, Chapter 2). Despite this, the study found few incidents of wildlife or wildlife products flowing from the Far North to other destinations. Only one route involving the Far North was observed more than once in all surveyed incidents, and this route is between two locations within the Far North: from Waza National Park to the regional capital, Maroua. As visualized in

Figure 8, this study observed few domestic flows of wildlife products from regions farthest from the capital Yaoundé, such as the Far North. The complex movement along supply chains from harvest to market could obfuscate products' origins, or products from the Far North may be flowing to markets with less enforcement and thus less data available to this study. Broadly, the prevalence of observed harvesters in the Far North suggests products from this region are supplying markets, and this flow could be explored more in targeted research in the field.

Additionally, the most common role across all data, *Vendor*, accounted for the highest percentage of actors in the North Region (33.3%). The North Region accounted for only 2.16% of enforcement incidents over the survey period but was observed to be part of trafficking flows into three other regions (Adamawa, East, and West). Despite this role as part of supply chains and having the fourth largest regional population, the region's low rate of enforcement incidents suggest a need for increased investigation. Given the high frequency of vendors in the region, further exploration of the region's markets, particularly in the regional capital of Maroua, would benefit targeted enforcement efforts.

The actor networks visualized in Chapter 3 (Figures 13 and 14) further emphasize the need to understand vendors as central figures in Cameroonian wildlife supply chains. Of the 10 roles with the highest degree values (or connections to other actors) in this study, types of vendors accounted for four (see Table 8). In addition to the degree values, these vendor roles accounted for three of the five highest betweenness centrality values: *Vendor to consumers* at 314.530601; *Vendor* at 240.226354; and *Vendor from harvesters and to consumers (wholesaler)* at 180.403145. The exception is the *Vendor from harvesters'* betweenness centrality (28.571616); this relatively low value suggests that these actors were largely observed to be an end node, connecting to 13 other nodes but not lying *between* many connected nodes. However, this should not be interpreted as a lack of influence in the network, particularly since the role nonetheless shows a high eigenvector value (0.593722, sixth highest of all calculated values). Given the very definition of the role, *Vendors from harvesters* may function as gatekeepers between harvesters and other types of vendors. As shown throughout the data in the combined *Wholesaler* role that constitutes 5.89% of observed actors, *Vendors from*

harvesters frequently perform this dual role, both collecting products from harvesters and then supplying to consumers.

Also of note are the roles for which frequency deviates from degree, which is one indicator of a role's connectedness in a network. In particular, as introduced in Figure 15 in Chapter 3, the *Logistician* role, though infrequently observed (4.02% of observed actors), exerts a disproportionately high influence in the network, particularly by degree (21) and by eigenvector value (0.854708). Returning to the role definitions, a generalized *Logistician* is "involved in ordering, aggregation, and transport, as well as financing and planning trade" (Phelps, Biggs, and Webb, 2016). Given the expansiveness of this role, these actors appear to frequently engage with other types of actors in the supply chain, with the strongest connection to *Specialized smugglers*. In this study, general *Logisticians* (which excludes logisticians identified as providing finance, storage, and weapons) were observed to be decision makers or leaders, often described as directing harvesting and trade. For example, a 2011 arrest of a group of poachers and ivory traffickers in the East Region identified one individual as the leader who planned when and where to kill elephants. Similarly, a Cameroonian logistician arrested in Yaoundé in 2013 was described as driving the illegal trade of ivory from the Republic of the Congo into Cameroon and other countries.

We also see the significance of the *Logistician* role in the involvement of other nationalities: A third of Asian actors identified in the data performed a type of logistical function. The role of Asian nationals aligns with other analyses of illicit wildlife trade in the Central and West African regions, which suggest that Chinese expatriates facilitate trade between the region and markets in Asia (OECD, 2018a; UNODC, 2018). This research found evidence of 14 Chinese individuals acting as *Intermediaries*, *Logisticians*, and *Specialized smugglers*, as well as four Vietnamese or Malaysian actors involved in the trade (see Table 9, Chapter 3).

The actor network disruption strategies in Chapter 3 showed that attacks based on betweenness centrality were most effective at dismantling Cameroonian trade networks, yielding the lowest robustness values at 7.72 for the full network and 5.61 for the condensed

network (Figures 16 and 17). This outcome aligns with Wandelt *et al.*'s finding that betweenness is the most consistently effective of common disruption strategies (2018). However, the full, complex network—which included actors performing combined roles as observed in the data—yielded higher robustness values across the three disruption techniques than the values yielded by a simplified version (Figures 16 and 17). This finding suggests that when actors perform multiple roles, a trade network is more difficult to disrupt or break apart: For example, a single actor who is both a vendor and a logistician is both more adaptable and creates more diversity of connections within a whole network.

Case Study: The Sama–Wei Network

Several documented incidents provide a valuable case study into a subset of the complex, international network of Cameroonian wildlife trade actors: specifically, the ties between Chinese national Wei Tao and Cameroonian Jonathan Sama. Per LAGA's public reports, Jonathan Aneng Sama was first arrested in 2007 while trying to illegally export 720 African grey parrots to Bahrain. Though no details are publicly available, corruption within MINFOF is suggested in the report. The case study is further complicated by unclear regulations around African grey parrot trade from Cameroon: The country had an export quota of 12,000 from 1994–2006, but CITES instituted a moratorium on trade in 2007 (CITES, 2006; Tamungang and Cheke, 2012). A new quota was allowable after two years if a population survey was completed and a National Management Plan in place, but these requirements were not completed until 2012 (CITES, 2006; Tamungang and Cheke, 2012). Thus, Sama's first 2007 arrest was shortly after the beginning of the trade moratorium. In the 2012 survey and management plan report, Sama is noted as the president of the nonprofit SNEFCAM (Syndicat national des exploitants de la faune vivante) and described as a "parrot exporter," though exportation was still under moratorium (Tamungang and Cheke, 2012). During the moratorium, Sama was again arrested in Yaoundé after further investigation into his role in illicit trade, but his case was not tried until 2015. In the interim, there is evidence that he continued supporting the illegal wildlife trade by supplying falsified permits to others and possibly by directing the trafficking. In April 2013, three traffickers were arrested at a port in Limbe, Cameroon, attempting to smuggle pangolin scales to Nigeria: Chinese national Wei Tao and two Cameroonians, Harrison Azie and Elvis

Thezuo Ngamgoue. Per LAGA's reporting, Wei Tao had a falsified export permit from Sama. The Cameroonian accomplices acted as logisticians and smugglers, helping with translation and transport of the pangolin scales. Reports also note that Wei Tao attempted to bribe officials upon apprehension. The following August, based on Wei Tao's claim that he was working for Sama, Sama was again arrested for his role in supplying falsified permits. As a result, both Sama and Wei Tao were convicted and charged to pay 80,000 Cameroonian francs (about USD 160 at 2013 exchange rates); Sama received three months in prison and Wei Tao six months. For his earlier infraction in 2007, Sama was acquitted in 2015.

This case study highlights several common features seen in this study's data. First, the trade frequently involved multiple international destinations—here, this includes Bahrain, China, and Nigeria. The Sama–Wei case also illustrates the insidiousness of corruption, which is often suggested but very difficult to confirm. In particular, Sama's repeated releases and minimal sentencing point to possible collusion with law enforcement. In addition to corruption, these incidents include two other crime conversions commonly observed in the study period: attempted bribery and falsified documents and permits. Finally, we see in this example how actors' connections in Cameroonian wildlife trade may function within and across individual incidents of trafficking. Across incidents, Sama acted as a logistician and smuggler who manipulated his role as a sometimes-legal exporter. His and Wei Tao's positions as logisticians were supplemented by Azie and Ngamgoue, who were described as more directly negotiating and facilitating the pangolin scale smuggling in 2013.

Cameroonian Wildlife Trade Typologies

Based on the features seen across the data and analysis, this study summarizes typologies of the Cameroonian illegal wildlife trade, including frequent trade routes, issues of crime convergence, and actors' roles and connections. These typologies capture high-level commonalities observed across the study period, which may inform future enforcement and investigative efforts.

1. **Demand beyond Asia**: The five most frequent trade routes observed in this dataset included four international destinations: the United States, France, Belgium, and England. With network out-degrees of zero, the United States and England appear to be final destinations for products. France and Belgium were observed to be both final destinations and transit hubs to other locations, including Switzerland, Russia, Viet Nam, and Hong Kong. These results underscore a growing understanding that demand for illegal wildlife products in Asia does not represent a comprehensive global picture. Consumers of wildlife products from Cameroon and Central Africa, broadly, exist in both Europe and North America and drive trade to these regions.

   Example: In 2009, in one of Cameroon's first arrests for wildlife trafficking on the internet, officials apprehended a local dealer attempting to sell primate skulls to a store in the United States. The investigation revealed that he had conducted such sales about 22 times over at least four years; he was able to do so undetected due to a falsified CITES permit.

2. **Flows from the East and South Regions**: Domestic trafficking in Cameroon appears to flow significantly from sources in the South and East to Yaoundé (Figure 8, Chapter 3). Messamena, a town in the East Region, was found to be a key node for network disruption. The most common source location observed in the study period was the Dja Faunal Reserve, a protected area of 5,260 km^2 that extends between the East and South Regions. With a degree value of 7, the Reserve was the only protected area appearing in the top 20 location nodes ranked by degree (Table 5, Chapter 3).

   Example: In 2010, a female bushmeat dealer was arrested in Meyomessala, a town in the South Region on the western edge of the Dja Faunal Reserve. Her proximity to the reserve aided her business, and she was found with a freezer of illegal bushmeat, including meat from chimpanzees and giant pangolins. Per LAGA's report on her arrest, she supplied the bushmeat to markets in Yaoundé.

3. **Nigeria's connections**: Nigeria emerged from the data with strong ties to Cameroonian wildlife trade networks. In the trafficking network, the Nigeria node disrupted the giant component more than any node other than Yaoundé. We also see that Nigeria had the highest eigenvector centrality value, exerting significant influence in the network (Table 5). Trafficking was observed to flow into Nigeria from 23 unique locations across the study period. Moreover, Nigerian nationals were the second most frequently-implicated international actors in the documented incidents (second to Chinese nationals; see Table 9). In particular, as shown in the network in Figure 19, Nigerian nationals appear to have strong ties to Cameroonian actors involved in the wildlife trade.

   Example: In 2014, two traffickers were arrested in Magba, West Region, Cameroon, who specialized in the chimpanzee trade. They operated near the border between the West and Adamawa Regions and revealed that Nigerian counterparts frequently crossed the border in this area to buy ape parts. The traffickers were reported to be actively engaged in supplying chimpanzee trophies as part of this cross-border trade.

Crime convergence

4. **The prevalence of corruption**: Corruption appears to be the most common crime converging with the illegal wildlife trade in Cameroon. This primarily takes the form of collusion by government and military officials, who were observed in the data to financially and logistically support the illegal wildlife trade and to limit the consequences of arrests. In particular, 40% of incidents in the Far North Region were reported to include corruption. This study separated bribery as a unique type of crime convergence, but, based on different definitions, it may also be considered corruption, further amplifying the findings of corruption in the study period.

   Example: A trafficker was arrested trying to sell gorilla skins in 2012 in the Northwest Region. In one of the more blatant incidents of corruption documented in this study, LAGA noted that the dealer was allowed to freely leave the police station but was reported as having "escaped."

5. **Violence in the North**: Of the convergence incidents documented in the North Region during the study period, half included a form of violent crime, either violence and resisting arrest or homicide. Notably, 25% of enforcement incidents in the North were documented as attempted arrests, which may be a result of this violence or the threat of violence. Both of the reported homicides resulted from encounters with poachers in protected areas late in the study period: 2016 and 2018. Though the overall rate of convergence incidents appears to be decreasing in Cameroon, the apparent rise of violent outcomes of poaching should be further investigated.

   Example: In 2018, civilian park rangers and military defense personnel encountered a group of poachers in Bouba Ndjida National Park, North Region, Cameroon. The poachers were reported to have entered from Chad via the park's northern edge and were heavily armed. As a result of the encounter, six Cameroonian soldiers and two rangers were killed.

Actors

6. **The role of wholesalers**: Wildlife wholesalers in Cameroon purchase illegal wildlife and products from vendors, often in large quantities, and re-sell products directly to consumers. These actors were observed across Cameroon's regions, most frequently in the West (accounting for 11.8% of documented actors). Across the three network disruption strategies used in this study, the removal of the wholesaler node consistently disrupted the network giant component more than other nodes except *Logistician, storage.* Targeted investigation and apprehension of these actors may be an effective strategy for disrupting product flows between harvesters and markets.

   Example: In 2009, two traffickers were arrested in the capital of the West Region, Baffoussam, with leopard skins. Based on reports from LAGA and TRAFFIC, they collected products from suppliers in the West Region and re-sold them in the Littoral Region. One of the actors—a vendor from other vendors—was responsible for collection and would alert his partner—the wholesaler—when he had a "reasonable quantity" of product for supply.

7. **Actors' adaptable roles**: About a quarter of the actors analyzed in this study appeared to perform multiple roles in the trade network, such as *Logistician* and *Specialized smuggler*. This finding aligns with the "fuzzy" or "fluid" roles often seen in criminal operations (Arroyave, 2020; Van Uhm and Nijman, 2020). As such, the full network of actors is more difficult to disrupt than a simplified version, as shown in Chapter 3, as actors' connections across the network are more diverse and often redundant within smaller groups of actors.

   Example: A group of four traffickers arrested in 2010 show the adaptability and possible redundancy in their roles: One man named Victorien Ntima acted as poacher and supplier to others in the network, primarily Belos Mende. Mende was also a poacher and maintained connections with vendors, including Herve Ambassa. In addition to finding clients, Ambassa also supplied ammunition. To further facilitate operations, the fourth member, Guy Ambol, supplied a weapon and transported products to clients.

8. **International actors**: Though Cameroonian nationals are the majority of actors involved, many international actors were implicated in the study data, from harvesters to consumers. These actors were most commonly observed to act as *Specialized smugglers* and *Logisticians*, often facilitating the trade between Cameroon and their home countries. This finding aligns with understanding about the role of the diaspora and expatriates in criminal networks (Costa, 2019; UNODC, 2018).

   Example: In 2016, three sources reported a Nigerian trafficker's arrest with pangolin scales and ivory tusks in Bertoua, East Region, Cameroon. As a wholesaler, his network provided him with products sourced from the East Region, which he would sell to buyers. Furthering the international scope, reports also indicated that he had connections to Chinese buyers.

Future Studies

As suggested throughout this study, these findings present some of the first academic research about Cameroon's role in the illegal wildlife trade. As such, the study yields many new questions and avenues for research. This research relied heavily on LAGA's public reports, and, as previously noted, arrest rates for wildlife traffickers in Cameroon appear higher than expected based on global data. An evaluation of LAGA's role over time would build understanding of its contribution to these rates of enforcement and quantify the potential value of similar government–NGO collaboration in other contexts.

As a macro-overview of Cameroon's trade flows, this research highlights but does not fully assess criminal connections between Cameroon and its neighboring countries. This study found significant evidence of cross-border trade and actor relationships between Cameroon, Nigeria, Gabon, and the Republic of the Congo. A regional study could be a valuable addition to understanding these connections, including where porous borders may be facilitating illegal trade.

Corruption is a significant problem that affects efforts to combat wildlife trade across countries and contexts (OECD, 2018b; Van Uhm and Moreto, 2017; Wyatt and Cao, 2015; Zain, 2020); as shown in this study's findings, Cameroon's acknowledged poor governance and accountability translate to challenges in enforcing wildlife crime laws. As part of a growing body of evidence about corruption in natural resource management, a political ecology study would better reveal the power structures and political drivers behind Cameroon's illegal trade and the role of corruption (Nash, 2020).

As mentioned through this study, there is research pointing to a perception of wildlife crime as a low-risk criminal activity for relatively high rewards. A study of court cases and prosecution rates for illegal wildlife trade criminals would build understanding of this perception in the Cameroonian context. If prosecution rates and penalties are low in Cameroon's courts, this finding would point to the need to strengthen judicial proceedings and standardize penalties with international recommendations—in effect, raising the risk of these crimes. Existing studies

in other countries, such as the example implemented in the Republic of the Congo mentioned in Chapter 1, provide useful precedence for such research (WCS Congo, 2018).

Additionally, there are limitations to this quantitative, desk-based study, which does not fully account for the real experiences and perspectives of actors in Cameroon. The COVID-19 pandemic limited this study's opportunities for fieldwork, but a complementary qualitative study, with key informant interviews, would provide an important dimension to understanding the reality on-the-ground in Cameroon. Such research would also provide an opportunity to validate the typologies put forth in this study, as done in a recent study on typologies of urban wildlife traffickers and sellers (Gore *et al.*, 2021).

Chapter 5: Conclusions

The illegal wildlife trade has recently been established as a serious crime (Massé et al., 2020; UNODC, 2020), and many reports from academics, think tanks, and governments emphasize the trade's prevalence and its impacts on global well-being. To advance understanding of a subset of the illegal wildlife trade, this study analyzed open-source data about Cameroon's role in wildlife trafficking from 2008–2018. Specifically, the research aimed to build evidence about the observed trafficking routes to, from, and within Cameroon; how Cameroon's illegal wildlife trade converges with other types of crime; the roles actors in Cameroon play in illegal wildlife trade supply chains; and which nodes in the illegal wildlife trade networks appear most key to crime disruption.

The study results indicate a significant trade involving Cameroon or Cameroonian actors, with connections to 37 other countries. In particular, trade from or through Cameroon was shown to flow to the United States and to francophone countries in Europe. There is also evidence of strong ties between Cameroonian and Nigerian traffickers, who exploit the countries' shared border to facilitate trade. In the analyzed trade network, the Nigeria node exerted the most influence and significantly disrupted the network when removed. It is recommended that further research explores the Cameroon–Nigeria connections, particularly drivers and facilitators of cross-border trade.

Within Cameroon, enforcement rates were highest in the East, South, and Central Regions, with observed trade flowing from the former two to the capital Yaoundé in the Central Region. Messamena in the East Region emerged as a key node for disruption in the trade network, and the Dja Faunal Reserve appears to be a common source location, supplying trade that moves through the East and South. Both enforcement rates and observed trade were comparatively low in or from the northern regions, despite the regions' biodiverse protected areas, suggesting a possible gap in enforcement or investigations. The convergence of the illegal wildlife trade with violence and homicide in the North Region—where 25% of incidents were failed arrests—may be limiting appropriate levels of enforcement.

Convergence with other crimes occurred in 34.14% of the study's incidents. In particular, corruption was the most common convergence crime observed in Cameroon. Though the overall rate of convergence showed a decreasing trend over the study period, corruption was observed consistently in time and across the country. This finding emphasizes the need for a more in-depth political ecology study of Cameroon's governance structures and power dynamics as they relate to the illegal wildlife trade.

Cameroonian actors' roles in this study generally aligned with existing wildlife trade typologies, but this research found unique types of logisticians and vendors common over the study period and thus disaggregated these as: logisticians who supply financing, weapons, or storage for products; vendors who sell to other vendors, buy from harvesters, sell directly to consumers, or who sell online. This specificity of roles allowed for the creation of a more comprehensive trade network. Among the vendor types, wholesalers who buy from harvesters and sell to consumers emerged as a common typology; these actors were also observed to be a key node for network disruption. This study found that about a quarter of actors involved in the Cameroonian wildlife trade perform two or more roles, with wholesaler being the most common combined role. By documenting these role combinations, based on descriptions in the available incident reports, the analysis found a trade network more resilient to node disruption than a network that does not account for actors' combined and flexible roles.

The study used sequential node removal to assess strategies for network disruption of the trade routes and actors. The route network was found to be best dismantled when removing nodes by degree value, e.g., removing locations based on the number of connections to other locations. In the actor network, sequencing node attacks by betweenness centrality value was most effective, e.g., removing actors that are most frequently on a path between other actors. These strategies provide potential insight for Cameroonian law enforcement to use in targeting efforts to combat the illegal wildlife trade.

This study was limited to open-source data and relied on quantitative analysis. To further these findings, complementary future studies should include qualitative data from key informants,

which may validate the typologies put forth in this research. The network analyses conducted in this research provide a novel and relatively simple approach that may be reproduced by enforcement agencies with minimal training, as Arroyave *et al.* also suggested in their network analysis (2020). As one the first academic studies focused exclusively on the illegal wildlife trade in Cameroon, this study is a critical starting point to drive future inquiries, particularly on cross-border trade and corruption in the region. Overall, this study further debunks notions that the illegal wildlife trade flows from sources in East and Southern Africa to demand in Asia, and presents data that raises the urgency of studying and responding to wildlife trade in the Gulf of Guinea, including Cameroon.

Appendices

Appendix I: Data Sources

CITES (2020) ‘Trade database’ [online]. Available from: https://trade.cites.org (Last accessed 21 Jan 2021)

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Appendix II: All Trafficking Nodes and Network Statistics, Sorted Alphabetically

Node (Location)	Node Type	Degree	Weighted Degree	In-Degree	Weighted In-Degree	Out-Degree	Weighted Out-Degree	Betweenness Centrality	Closeness Centrality	Eigenvector Centrality
Abong Mbang, Cameroon	Domestic	5	7	4	4	1	3	75	0.218659	0.074692
Adamaoua, Cameroon	Domestic	1	1	0	0	1	1	0	0.185819	0
Ako Village, Cameroon	Domestic	1	1	0	0	1	1	0	1	0
Akonolinga, Cameroon	Domestic	2	2	1	1	1	1	76	0.217765	0.003836
Asia	International	2	2	2	2	0	0	0	0	0.457868
Assok, Cameroon	Domestic	1	1	0	0	1	1	0	0.186732	0
Austria	International	1	1	1	1	0	0	0	0	0.044201
Azerbaijan/Uzbekistan	International	1	1	1	1	0	0	0	0	0.175467
Babong, Cameroon	Domestic	2	2	1	1	1	1	77	0.17226	0.003836
Bafang, Cameroon	Domestic	1	1	1	1	0	0	0	0	0.003836
Bafia, Cameroon	Domestic	2	2	1	1	1	1	39	0.217765	0.011735
Bafoussam, Cameroon	Domestic	9	13	5	8	4	5	949.5	0.225225	0.451944
Bafut, Cameroon	Domestic	2	2	1	1	1	1	152	0.248366	0.007785
Bahrain	International	3	4	2	3	1	1	88	1	0.331876
Bamenda, Cameroon	Domestic	5	5	1	1	4	4	232	1	0.155729
Bandjoun, Cameroon	Domestic	2	2	2	2	0	0	0	0	0.069675
Bangangte, Cameroon	Domestic	2	2	1	1	1	1	88	1	0.018897
Batouri, Cameroon	Domestic	2	2	1	1	1	1	76	0.169643	0.003836
Bazou, Cameroon	Domestic	1	1	1	1	0	0	0	0	0.012842
Belabo, Cameroon	Domestic	2	2	2	2	0	0	0	0	0.007671
Belgium	International	9	23	3	13	6	10	113.916667	1	0.116363
Bengbis, Cameroon	Domestic	1	2	1	2	0	0	0	0	0.003836

Benin	International	1	1	1	1	0	0	0	0	0.193272
Bertoua, Cameroon	Domestic	10	12	9	11	1	1	381	0.201613	0.194266
Bimbia, Cameroon	Domestic	1	1	0	0	1	1	0	0.201044	0
Bouba Ndjida National Park, Cameroon	Domestic	2	2	0	0	2	2	0	0.208672	0
Boumba Bek National Park, Cameroon	Domestic	1	1	0	0	1	1	0	1	0
Buea, Cameroon	Domestic	6	7	1	1	5	6	93	0.221239	0.059214
Cameroon	Domestic	24	101	1	2	23	99	2218.766667	0.416667	0.193272
Campo Ma'an National Park, Cameroon	Domestic	1	1	0	0	1	1	81.95	0.259516	0
Campo, Cameroon	Domestic	3	5	1	1	2	4	0	0.175	0.193272
Canada	International	3	5	2	3	1	2	0	1	0.109992
Center Region, Cameroon	Domestic	3	3	0	0	3	3	0	0.222543	0
Central African Republic	International	2	2	1	1	1	1	90.5	0.207756	0.021474
Chad	International	2	2	1	1	1	1	2.25	0.204918	0.193272
China	International	8	10	8	10	0	0	0	0	0.526945
Côte d'Ivoire	International	3	3	2	2	1	1	2.666667	1	0.057149
Democratic Republic of the Congo	International	5	5	1	1	4	4	589.25	0.277778	0.059214
Deng Deng National Park, Cameroon	Domestic	1	1	0	0	1	1	0	1	0
Denmark	International	2	2	1	1	1	1	0	1	0.059214
Dimako, Cameroon	Domestic	1	1	1	1	0	0	0	0	0.003836
Dja Faunal Reserve area, Cameroon	Domestic	2	2	0	0	2	2	0	0.242604	0

Dja Faunal Reserve, Cameroon	Domestic	7	10	0	0	7	10	0	0.206897	0
Djoum, Cameroon	Domestic	7	14	3	5	4	9	129.75	0.246711	0.040105
Douala International Airport, Cameroon	Domestic	4	5	1	1	3	4	1035.916667	0.255102	0.012686
Douala Port, Cameroon	Domestic	1	1	0	0	1	1	78.5	0.257732	0
Douala, Cameroon	Domestic	14	19	10	12	4	7	0	0.248366	0.48486
Doume, Cameroon	Domestic	2	2	1	1	1	1	1	1	0.003836
Dschang, Cameroon	Domestic	2	2	1	1	1	1	2	0.666667	0.003836
East Region, Cameroon	Domestic	5	10	1	1	4	9	759.75	0.257732	0.193272
Ebo Reserve, Cameroon	Domestic	1	1	0	0	1	1	0	1	0
Ebolowa, Cameroon	Domestic	9	9	6	6	3	3	389.416667	0.226586	0.164048
Ekona, Cameroon	Domestic	1	1	0	0	1	1	0	1	0
England	International	1	4	1	4	0	0	0	0	0.059214
Equatorial Guinea	International	5	5	2	2	3	3	238.333333	0.292969	0.409028
Foumban, Cameroon	Domestic	2	2	1	1	1	1	3.25	0.206612	0.018897
France	International	8	23	2	13	6	10	288.333333	1	0.380111
Gabon	International	14	19	5	7	9	12	3951.666667	0.380711	0.591254
Garoua, Cameroon	Domestic	4	6	2	2	2	4	147.5	0.252525	0.026682
Germany	International	3	3	2	2	1	1	2	1	0.066999
Ghana	International	2	2	2	2	0	0	0	0	0.34746
Grand Batanga, Cameroon	Domestic	1	1	0	0	1	1	0	0.218391	0
Gribi, Cameroon	Domestic	2	2	1	1	1	1	94.5	0.213068	0.021474
Hong Kong	International	5	8	5	8	0	0	0	0	0.320273
Idenau, Cameroon	Domestic	2	2	1	1	1	1	65	0.249169	0.021474
Italy	International	2	2	1	1	1	1	0	1	0.059214

Kenya	International	4	6	2	3	2	3	64	0.250836	0.094889
Kom-Wum Forest Reserve, Cameroon	Domestic	1	1	0	0	1	1	0	0.169197	0
Korup National Park, Cameroon	Domestic	3	4	0	0	3	4	0	0.8	0
Kribi, Cameroon	Domestic	7	9	3	5	4	4	96.725	0.275735	0.081946
Kumba, Cameroon	Domestic	1	1	1	1	0	0	0	0	0.003836
Kumbo, Cameroon	Domestic	2	2	2	2	0	0	0	0	0.007671
Kuwait	International	1	1	1	1	0	0	0	0	0.126207
Libongo, Cameroon	Domestic	1	1	1	1	0	0	0	0	0.003836
Limbe, Cameroon	Domestic	2	4	1	1	1	3	76	0.248366	0.003836
Littoral Region, Cameroon	Domestic	1	1	1	1	0	0	0	0	0.155729
Lobéké National Park, Cameroon	Domestic	2	2	0	0	2	2	0	0.213889	0
Lolodorf, Cameroon	Domestic	1	1	0	0	1	1	0	0.217765	0
Lomie, Cameroon	Domestic	8	11	3	4	5	7	640.872619	0.264085	0.081929
Ma'an, Cameroon	Domestic	1	1	1	1	0	0	0	0	0.003836
Magba, Cameroon	Domestic	2	2	1	1	1	1	189	0.248366	0.011735
Makenene, Cameroon	Domestic	1	1	0	0	1	1	0	0.217765	0
Malaysia	International	4	4	3	3	1	1	0.5	1	0.116363
Mali	International	2	2	1	1	1	1	39.166667	0.666667	0.059214
Mambele, Cameroon	Domestic	2	2	1	1	1	1	11.5	0.25	0.016635
Mamfe, Cameroon	Domestic	3	3	2	2	1	1	89	1	0.378434
Mangamban, Cameroon	Domestic	1	1	0	0	1	1	0	0.148571	0
Manjo, Cameroon	Domestic	2	2	1	1	1	1	152	0.205405	0.007785
Maroua, Cameroon	Domestic	3	4	2	3	1	1	429	0.249169	0.097446

Mbalam, Cameroon	Domestic	1	1	0	0	1	1	0	0.217765	0
Mbalmayo, Cameroon	Domestic	1	1	0	0	1	1	0	0.217765	0
Mbandjock, Cameroon	Domestic	1	1	1	1	0	0	0	0	0.007785
Mébané, Cameroon	Domestic	1	1	1	1	0	0	0	0	0.193272
Meiganga, Cameroon	Domestic	2	3	2	3	0	0	0	0	0.339691
Messamena, Cameroon	Domestic	5	6	2	2	3	4	66.84881	0.223529	0.007671
Meyo-Center, Cameroon	Domestic	4	4	2	2	2	2	0	0.186732	0.007671
Meyo, Cameroon	Domestic	1	1	0	0	1	1	93.25	0.209366	0
Meyomessala, Cameroon	Domestic	4	4	2	2	2	2	12.997619	0.221574	0.007671
Meyomessi, Cameroon	Domestic	2	2	1	1	1	1	0	0.217765	0.003836
Mfou, Cameroon	Domestic	2	2	1	1	1	1	3.5	1	0.067351
Mindourou, Cameroon	Domestic	2	2	1	1	1	1	6.765476	0.217765	0.003836
Mintom, Cameroon	Domestic	4	7	2	3	2	4	17.932143	0.238994	0.007671
Moloundou, Cameroon	Domestic	1	1	1	1	0	0	0	0	0.003836
Mundemba, Cameroon	Domestic	1	2	1	2	0	0	0	0	0.003836
Muyuka, Cameroon	Domestic	1	1	1	1	0	0	0	0	0.050778
Mvangan, Cameroon	Domestic	1	1	0	0	1	1	0	0.217765	0
Nanga Eboko, Cameroon	Domestic	2	2	1	1	1	1	1	1	0.003836
Netherlands	International	2	3	2	3	0	0	0	0	0.072252
Ngambe Tikar, Cameroon	Domestic	4	4	2	2	2	2	156	0.214286	0.007671
Ngaoundal, Cameroon	Domestic	1	1	1	1	0	0	0	0	0.003836
Ngaoundere, Cameroon	Domestic	3	3	2	2	1	1	85.5	0.20436	0.040128
Ngelemendouka, Cameroon	Domestic	1	1	0	0	1	1	0	0.180751	0
Ngong Market, Cameroon	Domestic	1	1	0	0	1	1	0	0.169643	0
Ngoro, Cameroon	Domestic	1	1	0	0	1	1	0	0.17833	0

Ngoumou, Cameroon	Domestic	1	1	0	0	1	1	0	0.217765	0
Ngoyla, Cameroon	Domestic	1	1	1	1	0	0	0	0	0.003836
Nigeria	International	23	28	19	24	4	4	4964.441667	0.326087	1
Nkambe, Cameroon	Domestic	2	2	0	0	2	2	0	0.187805	0
Nki National Park, Cameroon	Domestic	1	1	0	0	1	1	0	0.25	0
Nkondjock, Cameroon	Domestic	1	1	0	0	1	1	0	1	0
North Region, Cameroon	Domestic	9	11	1	1	8	10	337.77381	0.308642	0.036293
Northwest Region, Cameroon	Domestic	1	1	1	1	0	0	0	0	0.126725
Ntui, Cameroon	Domestic	1	1	1	1	0	0	0	0	0.003836
Nyassem, Cameroon	Domestic	1	1	0	0	1	1	0	0.17833	0
Poland	International	3	3	3	3	0	0	0	0	0.223621
Republic of the Congo	International	8	10	2	2	6	8	293.25	0.328947	0.025309
Russia	International	2	2	2	2	0	0	0	0	0.181182
Sanaga River, Cameroon	Domestic	1	1	0	0	1	1	0	0.666667	0
Sanaga-Yong Sanctuary, Cameroon	Domestic	1	1	0	0	1	1	0	1	0
Sangha Trinational Protected Area complex	International	1	1	0	0	1	1	0	0.211699	0
Sangmelima, Cameroon	Domestic	6	11	3	6	3	5	166.582143	0.267857	0.233898
Santchou Wildlife Reserve, Cameroon	Domestic	1	1	0	0	1	1	0	0	0
Santchou, Cameroon	Domestic	1	1	1	1	0	0	0	1	0.003836
São Tomé and Príncipe	International	2	2	1	1	1	1	0	0.248344	0.059214
Somalomo, Cameroon	Domestic	2	2	1	1	1	1	0.333333	0.181384	0.003836

South Africa	International	2	2	1	1	1	1	0	1	0.059214
South Region, Cameroon	Domestic	6	8	0	0	6	8	0	0.32377	0
Southeast Region, Cameroon	Domestic	1	1	0	0	1	1	0	1	0
Switzerland	International	3	5	2	3	1	2	0	1	0.103415
Tibati, Cameroon	Domestic	1	1	0	0	1	1	0	1	0
Tiko, Cameroon	Domestic	2	2	1	1	1	1	0	0.248344	0.175467
Togo	International	1	1	1	1	0	0	0	0	0.193272
Tonga, Cameroon	Domestic	4	5	3	3	1	2	50.5	0.218023	0.058449
United States	International	12	66	12	66	0	0	0	0	0.477967
Viet Nam	International	2	4	2	4	0	0	0	0	0.196195
Villages near Doume, Cameroon	Domestic	1	1	0	0	1	1	0	0.666667	0
Villages of Ekeke, Assam, Mfoua, Nkomo, and Nyakibak, Cameroon	Domestic	1	1	0	0	1	1	0	1	0
Villages of Kologo, Djangalakos, and Ndema, Cameroon	Domestic	1	1	0	0	1	1	0	0.146667	0
Villages of Meka’a I, Alam, Bibounouman and Ebemvouk, Cameroon	Domestic	1	1	0	0	1	1	0	0.186732	0
Villages of Mekas, Nkolda, and others, Cameroon	Domestic	1	1	0	0	1	1	0	0.217765	0
Villages of Ta'a, Loumboum and Nlongtimbi, Cameroon	Domestic	1	1	0	0	1	1	0	1	0
Waza National Park, Cameroon	Domestic	3	4	0	0	3	4	0	0.221574	0

West Region, Cameroon	Domestic	5	8	1	2	4	6	186	0.230061	0.155729
Woutchala Forest, Cameroon	Domestic	1	1	0	0	1	1	0	0.169643	0
Wum, Cameroon	Domestic	2	2	1	1	1	1	77	0.201044	0.003836
Yabassi, Cameroon	Domestic	1	1	1	1	0	0	0	0	0.003836
Yaoundé International Airport, Cameroon	Domestic	8	9	2	2	6	7	94.583333	0.223881	0.088106
Yaoundé or Douala, Cameroon	Domestic	4	4	4	4	0	0	0	0	0.11977
Yaoundé, Cameroon	Domestic	35	52	29	46	6	6	2347.760714	0.274725	0.735394
Yokadouma, Cameroon	Domestic	9	9	3	3	6	6	234.5	0.265018	0.020357
Yoko, Cameroon	Domestic	1	1	0	0	1	1	0	0.217765	0

Appendix III: All Actor Nodes and Network Statistics, Sorted Alphabetically

Node (Actor Role)	Degree	Weighted Degree	Betweenness Centrality	Closeness Centrality	Eigenvector Centrality
Consumer	2	4	14.583333	0.345912	0.050271
Consumer, ornamental	2	2	38.416667	0.395683	0.091054
Government colluder	10	16	4.687812	0.474138	0.542721
Government colluder and logistician, weapons	3	5	0	0.416667	0.181301
Government colluder and vendor from harvesters	2	2	0	0.392857	0.111115
Government colluder and vendor to consumers	1	1	0	0.308989	0.028434
Government colluder, and logistician, storage and weapons	3	3	0	0.398551	0.18034
Government colluder, logistician, weapons, and vendor from harvesters	1	1	0	0.257009	0.005288
Harvester	12	121	77.587967	0.486726	0.513644
Harvester and logistician, financing	1	1	0	0.329341	0.044725
Harvester and vendor	6	13	6.745707	0.423077	0.228222
Harvester and vendor to other vendors	1	1	0	0.269608	0.008653
Harvester, specialized commercial	19	53	144.590442	0.518868	0.649622
Harvester, specialized commercial, and logistician	2	3	0.4	0.395683	0.126419
Harvester, specialized commercial, and logistician, storage	1	1	0	0.325444	0.039798
Harvester, specialized commercial, and vendor	8	14	57.292322	0.443548	0.321902
Harvester, specialized commercial, and vendor to consumers	3	3	0	0.433071	0.231001
Harvester, specialized commercial, and vendor to other vendors	2	2	54	0.34375	0.048698
Harvester, subsistence	2	2	0	0	0.001258

Intermediary	11	123	20.236671	0.45082	0.473986
Launderer and vendor	1	2	0	0.369128	0.069
Launderer and vendor from harvesters and to consumers	3	3	55.133333	0.366667	0.087415
Launderer and vendor to consumers	5	5	12.433333	0.404412	0.162884
Launderer, processor, and vendor to consumers	1	1	0	0.357143	0.070528
Logistician	21	53	147.456085	0.561224	0.854708
Logistician and specialized smuggler	3	3	1.166667	0.404412	0.174945
Logistician and vendor	9	13	62.394701	0.478261	0.456587
Logistician and vendor from harvesters	4	6	1.003968	0.436508	0.266977
Logistician, financing	3	4	0.5	0.392857	0.139642
Logistician, storage	10	20	30.51017	0.482456	0.406137
Logistician, storage, and processor	4	4	3.027778	0.387324	0.141165
Logistician, storage, and vendor from harvesters	3	3	0	0.381944	0.122331
Logistician, storage, and vendor to consumers	5	5	8.654503	0.443548	0.259817
Logistician, storage, and vendor to other vendors	1	1	0	0.295699	0.018214
Logistician, weapons	10	25	90.681859	0.470085	0.402554
Logistician, weapons, and specialized smuggler	3	3	0	0.369128	0.111577
Logistician, weapons, and vendor	4	4	2.736826	0.433071	0.227535
Logistician, weapons, and vendor from harvesters and to consumers	2	6	0	0	0.001258
Processor	9	23	59.688815	0.470085	0.380515
Processor and specialized smuggler	3	3	0	0.387324	0.14479
Processor and vendor	2	4	0.630495	0.37931	0.110146
Processor and vendor from harvesters	1	1	0	0.369128	0.069

Processor and vendor from harvesters and to consumers	1	1	0	0.357143	0.070528
Processor, specialized smuggler, and vendor	3	3	0	0.387324	0.14479
Processor, specialized smuggler, and vendor to consumers	8	18	32.764286	0.443548	0.328842
Specialized smuggler	30	175	470.753354	0.625	1
Specialized smuggler and vendor	9	11	33.558356	0.486726	0.458457
Specialized smuggler and vendor to consumers	5	9	106	0.348101	0.103977
Specialized smuggler and vendor, online	2	2	0	0.260664	0.013157
Third party	1	1	0	0.387324	0.087905
Vendor	20	129	240.226354	0.55	0.811997
Vendor from harvesters	13	32	28.571616	0.495495	0.593722
Vendor from harvesters and to consumers (wholesaler)	13	26	180.403145	0.509259	0.539231
Vendor from harvesters and to other vendors	7	7	61.673846	0.416667	0.193965
Vendor to consumers	23	69	314.530601	0.578947	0.785273
Vendor to other vendors	10	16	11.958989	0.454545	0.401045
Vendor to other vendors and online	2	2	0	0.260664	0.013157
Vendor, online	4	14	1	0.297297	0.017519

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