



Mapping Terra Incognita: An Expert Elicitation of Women's Roles in Wildlife Trafficking

Helen U. Agu^{1,2}, Cydney Andrew² and Meredith L. Gore^{3*}

¹ Department of International and Comparative Law, University of Nigeria, Nsukka, Nigeria, ² Department of Fisheries and Wildlife, Michigan State University, East Lansing, MI, United States, ³ Department of Geographical Sciences, University of Maryland, College Park, MD, United States

OPEN ACCESS

Edited by:

Xingli Giam,

The University of Tennessee, Knoxville,
United States

Reviewed by:

Tanya Wyatt,

Northumbria University,

United Kingdom

Pedro Segurado,

University of Lisbon, Portugal

*Correspondence:

Meredith L. Gore

gorem@umd.edu

Specialty section:

This article was submitted to
Global Biodiversity Threats,
a section of the journal
Frontiers in Conservation Science

Received: 22 March 2021

Accepted: 18 October 2021

Published: 11 November 2021

Citation:

Agu HU, Andrew C and Gore ML
(2021) Mapping Terra Incognita: An
Expert Elicitation of Women's Roles in
Wildlife Trafficking.
Front. Conserv. Sci. 2:683979.
doi: 10.3389/fcosc.2021.683979

The gender dimensions of wildlife trafficking remain understudied even though the problem is of great socio-environmental significance. Data about the roles of women in wildlife trafficking offer critically needed indicators that can contribute to building evidence and setting targets for, and monitoring progress of, sustainable and equitable futures. We set three objectives for this research filling a major gap in conservation knowledge: (1) explore expert perceptions of primary roles that women may play in wildlife trafficking, (2) explore expert perceptions of secondary roles that women may play in wildlife trafficking, and (3) explore variability in roles for women in wildlife trafficking. We used an online survey to conduct expert elicitation in February 2020 to achieve objectives. Experts ($N = 215$) identified key assumptions associated with six primary and 32 secondary roles for women in wildlife trafficking. Results highlight the impacts of wildlife trafficking manifest in varied contexts across society, including persons harmed at local levels such as family members in general, widows and orphans. The perceived roles of women in the wildlife trafficking networks may be factored into transformative solutions to help combat wildlife trafficking and data from expert elicitation can inform future hypotheses and inferences on this topic of broad socio-environmental significance.

Keywords: corruption, environmental law, gender, gender-environment nexus, wildlife crime, sustainable development goals

INTRODUCTION

The Sustainable Development Goals (SDGs) offer an ambitious global blueprint for a sustainable future inclusive of all life on earth. Wildlife trafficking is a problem with broad socio-environmental significance and deep negative impact that undermines efforts to achieve sustainable development. The United Nations' (UN) 2019 snapshot of gender equality across the SDGs estimated that women spend three times as many hours as men each day in unpaid and domestic work (SDG 5); have a 10% higher risk of experiencing food insecurity than men (SDG 2); comprise 39% of the workforce but hold 27% of managerial positions (SDG 5); and 39% of employed women are working in agriculture, forestry, and fisheries but only 14% of landholders are women (SDGs 12-15). Further, of the USD 117 billion in official development assistance commitments received by developing countries, only 38% targeted gender equality and women's equality as a significant/secondary or primary objective (SDG 17) (United Nations Women, 2019). These data provide evidence that development cannot progress without analyzing and addressing inequality, discrimination and

exclusion affecting men and women, including in relation to the environment (e.g., biodiversity loss, conservation, invasive species, climate change) (Serrao et al., 2019).

Data disaggregation across multiple dimensions is requisite for tailoring policies and development assistance in pursuit of progress toward achieving the 2030 Sustainable Development Agenda (Serrao et al., 2019). Unsurprisingly, many countries have committed to identifying marginalized populations and reporting baseline statistics and progress among minoritized groups, particularly women. There are three strategies that UN Women offers for achieving gender-related goals using data: invest in data, gather data, and use the data (United Nations Women, 2019). Gaps in data impede progress assessment, particularly for SDGs that attend to the gender-environment nexus (e.g., wildlife trafficking, illegal fishing), or the different vulnerabilities, impacts and adaptive capacities related to climate change, disasters and use to natural resources and between men and women (Serrao et al., 2019). The lack of sex-disaggregated data in wildlife trafficking specifically or conservation in general affects the development and implementation of effective policies and programs to address the gender-environment nexus. UN Environment and the International Union for Conservation of Nature (IUCN) for example, have recommended a set of 19 indicators to measure the gender-environment nexus, many of which are identical or modified versions of SDG indicators (Serrao et al., 2019). Interestingly, data on the role of women in wildlife trafficking, part of the global criminal economy posing significant risk to animal, human, and ecosystem health with touchpoints on multiple SDGs, is grossly deficient in all three data domains which the UN Women identified are needed to “leave no one behind.” The roles of women in wildlife trafficking remain terra incognita, or “unexplored territory.” Characterizing this unknown territory is central for achieving the mission of the SDGs and conservation writ large. Here, we offer results from a global survey of experts with gender-specific indicators that can help establish gender equality baselines, support trend data essential for assessing direction and pace of progress, inform gender mainstreaming efforts, and be integrated with other gender-environment nexus measures to track progress of societal dimensions of environmental change.

WOMEN AND WILDLIFE TRAFFICKING

Wildlife trade has existed for millennia, but the depths of the illegal market has grown dramatically over the last 5 years (UNODC, 2020). Surging demand and skyrocketing retail prices have opened new floodgates for an illegal trade with an estimated retail value of USD 5 to USD 23 billion annually (May, 2017; UNODC, 2020). Global trafficking of wildlife and wildlife parts is a domain posing substantial societal problems that are globally distributed; between 1999 and 2015, nearly 7,000 species accounted for 164,000 seizures affecting 120 countries. Risks, harms, and threats associated with wildlife trafficking include violence that threatens animals and people, undermining the rule of law and sustainable development investments, removing taxable revenue from legal supply chains,

degrading cultural resources, contributing to zoonotic diseases and biological invasions, fueling corruption and other forms of criminality, and converging with other serious crimes such as drug trafficking (Kahler and Gore, 2012; Smith et al., 2017; Brito et al., 2018; Gore et al., 2019). Between 2010 and 2018, 24 international donors committed USD 2.35 billion (USD 261 million annually) to combat wildlife trafficking in Africa and Asia (World Bank Group, 2020); the World Bank Group concluded additional resources are needed. According to the online and publicly accessible database on international funding to tackle illegal wildlife trade, only three projects among 1,784 distributed across 68 countries included in the analysis explicitly mentioned gender in the program description. All were based in Nepal and funded by the US Agency for International Development through bilateral agreements (World Bank Group, 2020). These data help delineate the *terra firma* of the extant literature from the underexplored knowledge of terra incognita.

The gendered-dimensions of wildlife trafficking remain understudied, even though distinct literatures on the global wildlife trade and crime long ago denoted the importance of, and an absence of, discussion of the gender dimensions of the problem (Oldfield, 2003). Different theories from criminology (e.g., deviance, recidivism) have been criticized for their gender blindness and androcentricity (e.g., Heidensohn, 1996; Naffine, 1997). Individuals and groups working across the source, transit and destination geographies of wildlife trafficking are almost never defined by their gender (Agu and Gore, 2020). Not only is gendered data largely unavailable for wildlife trafficking programs and policies, but there are also no consistent indicators available to identify trends, formulate causal associations, or make inferences valuable for mainstreaming or decision making. Review papers by criminologists on mainstream crimes indicate gendered difference in the prediction of desistance largely depend on the domain of the behavior under consideration.

Thus, the data deficient landscape of wildlife trafficking has the potential to significantly complicate efforts to understand recidivism and desistance in wildlife crime, pathways of different individuals into and out of crime. A review of literature published 2010–2019 suggested women may embody at least six primary and 35 secondary roles in the wildlife trafficking “workforce” (Agu and Gore, 2020). These workforce roles offer, at a minimum, a descriptive characterization of the diverse behaviors that could relate to recidivism and desistance. The primary roles (e.g., offender, defender, observer, influencer, person harmed, beneficiary) may not be mutually exclusive or scale across all wildlife trafficking contexts (e.g., trafficking of orchids vs. sea cucumbers vs. pangolin scales). Identifying aspects of heterogeneity in these roles offered critically needed indicators upon which to invest in building evidence, setting targets, and monitoring progress. However useful, the review of literature was retrospective by design. As with other socio-environmental contexts, when data are published on wildlife trafficking (e.g., U.S. Eradicate, Neutralize and Disrupt Wildlife Trafficking Act Annual Report to Congress), the significant time lag between data collection, analysis and publication can mean the situation has already changed from that reported in publication.

Experts can be an untapped resource of up-to-date information on wildlife trafficking and can often draw on their knowledge of published and unpublished data to give an opinion on expected future developments, something that cannot be achieved by a non-expert reviewing the literature (Washington et al., 2014). Experts' estimates represent the state of knowledge and often also represents previously unknown and undocumented information, particularly on a topic where there is uncertainty due to lack of data (Gottschalk and Gunnesdal, 2017). Expert elicitation is widely applied as a mode to source information where data are lacking, as is the case here with the roles of women in wildlife trafficking. We set three objectives for this research that build upon Agu and Gore (2020)'s review of literature: (1) explore experts' perceptions of primary roles that women may play in wildlife trafficking, (2) explore experts' perceptions of secondary roles that women may play in wildlife trafficking, and (3) reflect upon variability in roles for women in wildlife trafficking within the context of sustainable human-environment interactions.

METHODS AND ANALYSIS

Expert Elicitation

We used expert elicitation (EE), an established technique used for gathering knowledge about data-limited topics, to collect data. Expert knowledge is a highly useful resource for guiding decision making (Burgman et al., 2011) and allows for coordinated knowledge gathering across a range of geographic scales (White et al., 2005). EE helps fill the need to characterize dynamic, complex systems, limited resources to collect new empirical data, and the urgency of conservation decisions (Sutherland, 2006; Kuhnert et al., 2010). EE is well-established in the conservation social sciences (Aipanjiguly et al., 2003; Martin et al., 2012) and illegal natural resource use contexts, such as IUU fishing (Riskas et al., 2018) and white-collar crime (Gottschalk and Gunnesdal, 2017), where unlawful activities are the topic of interest and difficult to study using conventional methods. We relied on the large and mature field of EE, with its body of methods for robustly and efficiently eliciting and combining judgments from experts, for this research (Runge et al., 2011). An expert is anyone especially knowledgeable in the field and at the level of detail being elicited. Meyer and Booker (1991) distinguished between two types of expertise: substantive and normative. Substantive expertise comes from the expert's experience in the field in question. Normative expertise is knowledge related to the use of the response mode. The response mode is the form in which the expert is asked to give a judgment. We identified both types of experts based on (a) authorship of published literature and reports; (b) referrals from colleagues working throughout the study area; and (c) membership in professional societies with relevance to wildlife trafficking. Typically, 10 experts are considered the minimum sample size needed for EE (Slottje et al., 2008; Heyman and Sailors, 2016). EE is often conducted via an online survey to allow for data collection at varied geographic scales, low resource cost, social distancing for coronavirus, and without the logistical constraints of in-person interviews. To minimize psychological, motivational, implicit, and latent

biases, it is common to seek participant feedback to resolve any ambiguity surrounding the meaning of abstract concepts; for instance, perceptions of "risk" and "threats" are subject to cultural and political factors (e.g., Runge et al., 2011).

Data Collection Instrument

We used a voluntary, English-language, online survey implemented with the Qualtrics platform February 4–29, 2020 to achieve objectives about a topic accompanied by a small body of published literature (Trochim, 2020) (see **Supplemental Material** for survey instrument and informed consent script). The survey was accessible via computer and mobile device. Experts were recruited using opportunistic sampling because no single list of individuals existed at the time of research; invitations with an open weblink were distributed via authors' Twitter, Facebook, and LinkedIn accounts as well as multiple listservs (i.e., Society for Conservation Biology's Social Science Working Group, Emerging Wildlife Conservation Leadership Group, Green Criminology Working Group, Global Initiative Against Transnational Organized Crime Expert Group, Congo Forest Basin Protected Areas Group, Michigan State University Alliance for African Partnership Group). To increase the gradient of similarity and external validity of results, we focused the context of wildlife trafficking on Sub-Saharan Africa (Trochim, 2020). Survey options enabled by the Qualtrics platform included: a back button enabling respondents to change their responses, a save and continue later option, open access allowing anyone with a link to take the survey (but no forward link option), preventing ballot box stuffing, preventing indexing, securing participant files, and default survey expiration. The survey was implemented in such a format to minimize survey fatigue, be accessible to diverse respondents, and be optimized for mobile phones. The survey was designed to be completed in ~15 min. Respondents were asked to provide informed consent before commencing the survey.

Measurement

The survey had 70 questions organized into six sections, one for each primary role for women in wildlife trafficking: offender, defender, observer, influencer, beneficiary, person harmed (**Table 1**) (Agu and Gore, 2020). This question blocking was used to minimize the cognitive burden on participants and definitions of primary and secondary roles were provided adjacent to measurement items (**Table 1**). The same question format was replicated in each section. Horizontal slider bars were used to measure perceptions about the percentage of women involved in a particular wildlife trafficking role—both the 6 primary roles and associated secondary roles. Slider bars ranged from 1 to 100 delineating 10-point grid lines. The start position for all sliders was zero and the actual value selected by the expert was indicated on the screen. One five-point Likert-type question asked how important it is to think about women in the primary role; response options ranged from extremely important (20) to not at all important (16). The Likert-type scale integers were automatically assigned by Qualtrics; it is not the value of the integer, but rather the equal distance between integers, that creates the strength of the Likert-type

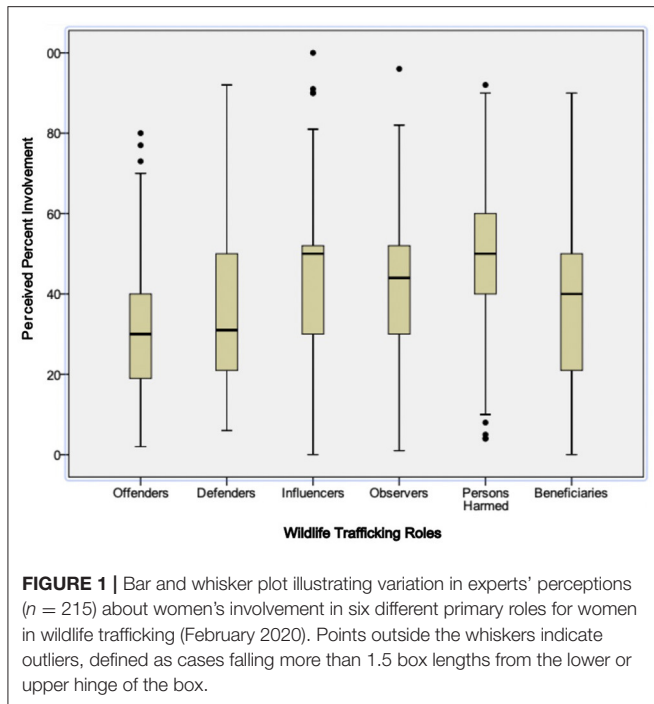
TABLE 1 | Definitions of the primary roles of women in wildlife trafficking and their corresponding secondary roles, alphabetized.

Primary role	Definition	Secondary roles
Beneficiary	Individuals or groups that derive indirect or direct benefits from wildlife trafficking.	Cultural expression
		Employment
		Empowerment/equity
		Health
		Income
		Prestige
		Recreation
Defender	The individuals or groups with formal or informal authority to guard or protect people and animals across the wildlife trafficking supply chain.	Community guardian
		Criminal justice professional
		Customs official
		Non-governmental org.
		Police/ranger/security
		Spokesperson
Influencer	The individuals or groups linked by various mechanisms of connection to wildlife trafficking and with the capacity to stimulate and suppress.	Mother/aunt/grandmother
		Religious/cultural leader
		Sibling
		Teacher/educator
		Wife/romantic partner
		Academic/researcher/scientist
Observer	The individuals or groups that are eyewitnesses to the activities of, and actors involved in, wildlife trafficking, either intentionally or unintentionally.	Media/journalist
		Donors (foundations/private)
		Consumer
Offender	The individuals or groups "performing" the criminal, harmful, or deviant behavior.	Corruptor
		Enabler
		Poacher
		Seller
		Transitor
		Immediate family member
Person(s) harmed	The human individuals or groups victimized and/or made vulnerable by wildlife trafficking.	Orphan
		Refugee
		Un(der)employed
		Widow

scale as a measurement ruler (Trochim, 2001). A text box with no character limit was provided for participants to provide examples of the primary role since 2015. All questions were forced choice, meaning there was no "not applicable" option, however participants were able to progress to the next question without answering previous questions if they so desired. Forced choice questions are commonly used in online surveys because they require respondents to deeply process each question and response option. It usually takes respondents a longer time to complete a forced response question compared to other question formats, thus reducing a primacy effect, and increasing the number of survey records with responses that are usable for analysis. The primary disadvantage of forced choice question is measurement error and respondent frustration (Lavrakas, 2008). The survey concluded with questions on participant age (radio button for 5-year ranges), gender (radio button), and country of residence (single line text box). The instrument was pretested by students in a Gender, Justice, and Environment Methods course at Michigan State University; modifications to question wording and order were implemented after the pretest and before deploying the final survey.

Analysis

Results were exported as a .svm file from Qualtrics into SPSS v 26 for analysis (IBM Corp, 2016). Crosstabs, analysis of variance and *t*-tests were used to compare results about perceptions of different roles among participants, help identify if any associations were present in the data and if so, help characterize those relationships (objectives 1 and 2). Principal components analysis (PCA) was used to achieve objective 3, because the analysis helps uncover relationships between variables, such as clusters of variables or outliers that may be conceptually peripheral or unique vis a vis other variables measured; PCA also helps transform data into fewer dimensions and summarize features, which can be useful when exploring large number of variables such as secondary role. Principal components analysis is a commonly used to explore typologies of different groups of people, such as typologies of dairy farmer perceptions toward climate change (Barnes and Toma, 2012). A principal components analysis (PCA) with varimax rotation, Kaiser normalization and eigenvalues > 1 was informed on the percent involvement variables to extract clusters comprising roles with highly correlated percent involvement values across respondents. Membership of roles in the PCA-determined clusters was then compared against the original hierarchy of primary-secondary roles to explain variation in expert perceptions based on our review of literature (Agu and Gore, 2020). The PCA generated a rotated component matrix (KMO = 0.613, Bartlett's Test of Sphericity 1,449.151, df = 595, *p* < 0.001) with 8 components with rotated sums of squared loadings explaining 76.39% of the variance in secondary roles for women in wildlife trafficking. We assigned secondary roles to components in which they loaded highest and >0.4; components with < 2 secondary roles were dropped. Thus, the secondary roles of consumers, poachers, and community guardians are absent in results because they are outliers that cannot be summarized with this analysis. The Michigan State University Human Subjects Protection Program approved the



methods and analysis for the study (STUDY00003659) as exempt under 45 CFR 46.104(d) 2(ii).

RESULTS

Descriptive Statistics

Two hundred fifteen surveys were returned, and 96 experts identified themselves as being male or female (17 and 27% of total respondents, respectively); they ranged across age categories from 18 to 22 to 63+; 16% of respondents were 33–37 years old and 15% were 43–47 years old. Internet protocol addresses (i.e., the location where the survey was completed) were geotagged to 39 different countries and 98 respondents self-reported being residents of 25 countries. Of the respondents who identified their country of residence, the majority were residents of the United States ($n = 31$, female = 23), South Africa ($n = 17$, female 11), and Germany ($n = 5$, female = 4). Australia, Cameroon, Canada, Kenya, and Nigeria were all countries of residence for 4 respondents each with 3, 0, 1, 3, and 3 females, respectively. Across the six primary roles for women in wildlife trafficking, experts assessed persons harmed as having the highest perceived involvement (mean perceived involvement, or $x = 47.64$), followed by influencers ($x = 43.02$), observers ($x = 42.62$), beneficiaries ($x = 37.79$), defenders ($x = 36.28$), and offenders ($x = 31.21$). Somewhat differently, across the six primary roles for women in wildlife trafficking experts assessed offenders ($x = 17.29$) as being the most important, followed by beneficiaries ($x = 17.24$), persons harmed ($x = 17.05$), observers ($x = 16.99$), influencers ($x = 16.90$) and defenders ($x = 16.83$).

Our first objective was to investigate experts' perception of primary roles that women may play in wildlife trafficking—which roles women were involved in and the nature of their involvement in different aspects of the illegal supply chain. Thus, we compared mean associated with role types. Offender-type roles were perceived as being the most important to think about, but persons harmed-type roles were perceived as being the most prevalent roles for involvement (Figure 1). Respondents that self-identified as being male or female differed in their mean perception of women's involvement across the six different primary roles, and the difference was statistically significant: offenders (male $x = 31.42$, female $x = 29.27$, $t = 19.841$, $p < 0.000$), defenders (male $x = 34.38$, female $x = 39.17$, $t = 18.365$, $p < 0.000$), influencers (male $x = 41.97$, female $x = 43.74$, $t = 18.252$, $p < 0.000$), observers (male $x = 42.08$, female $x = 42.75$, $t = 20.915$, $p < 0.000$), individuals harmed (male $x = 47.38$, female $x = 48.71$, $t = 22.049$, $p < 0.000$), and beneficiaries (male $x = 40.70$, female $x = 35.95$, $t = 18.059$, $p < 0.000$). Female and male respondents also differed in their mean perception of how important the primary and perceptions were significantly different: offenders (male $x = 17.44$, female $x = 17.25$, $t = 183.904$, $p < 0.000$), defenders (male $x = 17.11$, female $x = 16.67$, $t = 202.310$, $p < 0.000$), influencers (male $x = 17.05$, female $x = 16.84$, $t = 187.528$, $p < 0.000$), observers (male $x = 17.11$, female $x = 23,116.91$, $F = 0.899$, $p = 0.346$), individuals harmed (male $x = 17.34$, female $x = 16.86$, $t = 173.656$, $p < 0.000$), and beneficiaries (male $x = 17.32$, female $x = 17.18$, $t = 160.777$, $p < 0.000$).

Our second objective was to explore experts' perceptions of secondary roles that women may play in wildlife trafficking. Results indicated heterogeneity in perceptions of the 35 roles, with consumers perceived as having the highest mean involvement in wildlife trafficking. Recreation was perceived as having the lowest mean involvement (Table 2). Experts identified a range of other roles that could be explored further, such as informants that enable wildlife trafficking by passing along information or spy on behalf of the offenders (not always on their own volition or by their own agency); supporters that provide safe houses, hide contraband, weapons, and people in their homes; wildlife rehabilitation specialists that care for injured wildlife; and political activists focused on land tenure.

The final objective was to explore variability across roles for women in wildlife trafficking. The PCA identified 6 components explaining 67.1% of the total variance of 35 secondary roles for women in wildlife trafficking. The 6 components computed during the PCA overwhelmingly mapped onto the six primary roles discussed in the literature with two exceptions (Table 3). Together, the observer and beneficiary roles explained the most variance in the analysis, which is consistent with objective 1 and 2 results noting these are roles that were not perceived as being the most prevalent or important to the problem. This result helps signpost a topic for future research and confirmatory analysis. How, when, and why do women perform in observer and beneficiary roles? Two secondary roles, corruptor, and spokesperson, were grouped into components that did not match their original conception based on the literature. Again, future

TABLE 2 | Online survey respondents ($n = 215$) perceived varying involvement of women across 35 secondary roles in wildlife trafficking (February 2020).

Primary role	Secondary role	Mean perceived % involvement
Offender	Consumer	50.19
	Seller	46.17
	Enabler	36.13
	Transitor	28.59
	Corruptor	23.14
	Poacher	15.38
Defender	NGO personnel	43.25
	Community guardian	40.91
	Spokesperson	29.43
	Criminal justice professionals	25.51
	Customs official	23.46
Influencer	Police/ranger	21.22
	Mother/parent/ aunt	43.78
	Wife/romantic partner	39.83
	Siblings/sister	32.20
	Teachers/educator	29.58
Observer	Spiritualleader	24.17
	Scientist/researcher	43.92
	Media/journalist	41.16
	Donor	39.06
Persons Harmed	Foundation	36.38
	Private donor	31.30
	Parastatal	30.61
	Family member	47.45
	Widow	46.66
Beneficiary	Orphan	38.03
	Unemployed	33.78
	Refugee	33.72
	Income	41.30
	Employment	31.79
	Culture	27.75
	Prestige	25.68
Empowerment	23.79	
	Health	22.45
	Recreation	14.83

research could equivocate results and more deeply explore these roles for women in wildlife trafficking.

DISCUSSION

The 2030 Sustainable Development Agenda and 17 Sustainable Development Goals both call for mainstreaming the gender-environment nexus, yet full operationalization of this objective has not yet been realized. In many places in the world, women remain highly minoritized and vulnerable across environmental problems, such as land use change and biodiversity loss, climate change and disasters, sustainable consumption, health, and sanitation (Serrao et al., 2019). Minoritized groups experience

ambient social, economic, and development insecurities that allow environmental vulnerabilities to perpetuate. As new efforts emerge to map unknown spaces in conservation and human behavior, it is prescient to ask who gets to say what the problems are with the human-environment nexus and, what are the solutions? Answers to these questions and overcoming obstacles associated with the gender-environment-nexus requires, at least, baseline data upon which to anchor gender-based indicators and assess trends. Wildlife trafficking is one of the most prescient environment issues today. Assumptions about heterogeneity, trends, and outliers for women's roles in wildlife trafficking leave little room for understanding patterns of access and responses to the illicit networks (Howson, 2012), recidivism, and desistance.

Expert elicitation is one early methodological step that can help inform downstream statistical inferences, guide parameter estimation, model articulation, and reduce uncertainty (Runge et al., 2011). Expert judgments herein help provide information that can inform model parameters and generate hypotheses associated with the role of women in wildlife trafficking, however experts and non-experts are known to have divergent perceptions about wildlife crime (e.g., Gore et al., 2016) and thus future research is warranted. Results did not indicate significant distinctions between male and female participants. An enhanced data landscape provides an extraordinary opportunity to advance scientific understanding about the causes, consequences, connections, and opportunities for collaboration that enable sustainable solutions. Results from this EE advance insight about variation in the types of behavioral conduct women, and men, may engage in vis á vis wildlife trafficking. This heterogeneity in data supports the UN Women's declaration to invest in data, gather data, and use data. Nuances in data have implications for stakeholders working to help women exit from deviant roles (e.g., offenders); strategies and tactics that work for one role in wildlife trafficking may not work for others. The implications for research here are tautological—with baseline knowledge of the roles of women in wildlife trafficking, new questions can be asked to assess support for programs focusing on the reward side of the economic ledger, perceived risk of criminal sanctions, or marital attachments and intimate relationships. How and why should women be considered in a strategy to combat wildlife trafficking at local, regional, national, or transboundary scales? Importantly, the geographic context of where experts live, and work is very important to their perceptions and lived experiences. We did not explicitly assess the positionality of experts vis á vis their knowledge about women in wildlife trafficking, but such insight would have helped interpret results. Results herein help advance current understanding about the variety of roles for women in wildlife trafficking, although we did not explore pathways into or out of these roles and geographic variation is likely. The perceived roles of women in the wildlife trafficking networks can inform data collection, aggregation and disaggregation, analysis of trends and causal association strategies to combat wildlife trafficking. Data about these roles help create new touchpoints for sustainable development solutions, deepen insight about vulnerability that may undermine solutions, and provoke thinking about how women are “using their landscape” in meaningful ways.

TABLE 3 | Principal components analysis of thirty-five secondary roles for women in wildlife trafficking, according to online survey participants ($n = 215$) in February 2020.

Primary Role	Secondary Role	Component 1 (Observer)	Component 2 (Beneficiary)	Component 3 (Offender)	Component 4 (Influencer)	Component 5 (Persons Harmed)	Component 6 (Defender/mixed)
Observer	Private donor	0.852					
Observer	Scientist	0.824					
Observer	Media	0.821					
Observer	Donor	0.816					
Observer	Foundation	0.774					
Observer	Parastatal	0.700					
Beneficiary	Culture		0.702				
Beneficiary	Employment		0.765				
Beneficiary	Empowerment		0.778				
Beneficiary	Health		0.706				
Beneficiary	Income		0.706				
Beneficiary	Prestige		0.761				
Beneficiary	Recreation		0.727				
Offender	Enabler			0.773			
Offender	Seller			0.849			
Offender	Transitor			0.766			
Offender	Corruptor				0.429		
Influencer	Mother				0.777		
Influencer	Spirit leader				0.497		
Influencer	Sibling				0.858		
Influencer	Teacher				0.829		
Influencer	Wife				0.670		
Harmed	Family					0.726	
Harmed	Orphan					0.815	
Harmed	Refugee					0.747	
Harmed	Unemployed					0.567	
Harmed	Widow					0.766	
Observer	Spokesperson						0.596
Defender	Criminal justice						0.676
Defender	Customs						0.852
Defender	NGO						0.534
Defender	Police						0.801

Thirty-two secondary roles loaded into components with eigenvalues > 1 and factor loading scores > 0.4. The components computed overwhelmingly mapped onto the conceptual framework of 6 primary roles for women in wildlife trafficking adapted from the literature (Agu and Gore, 2020). The shading corresponds to components in the PCA.

This may be particularly relevant for emerging wildlife trafficking networks (e.g., those existing in virtual or online ecosystems), where there is less competition from male-dominated routes. Uggen and Kruttschnitt explored this scenario for drug markets, paying careful attention to the explanatory power of social position and gender in desistance from crime. Due to the nature in which gender is informed by other sociodemographics such as race, culture, ethnicity, and class, the results in this paper may not be generalized to other wildlife markets or geographic locations. However, our methods may be replicated to help expose the roles in which women play in wildlife crime in other contexts.

The gender-environment nexus involving wildlife trafficking aligns with concepts of vulnerability and security. Most people want to transition out of vulnerable situations and

change their conditions of insecurity (e.g.). Security was originally conceptualized as relating only to nations (where the state was securing national/political security of their sovereignty and territorial integrity from other states or sub-state actors), but the concept of security has evolved and expanded over time. Møller (2003) tracked the concept as expanding to human security (where individuals were securing survival, quality of life and cultural integrity from the state, globalization, poverty, and nature). The evolution then advanced to environmental or natural security (where ecosystems were securing sustainability from nature and humankind) and then gender security (where minoritized individuals secured equity and identity from patriarchal and totalitarian institutions and intolerance). Although there is a slowly growing body of extant literature on gender and environmental security as well as crime in the environment vs. crime on the

environment (e.g., Brisman, 2007), critical analytical questions remain ignored, including the possibility that wildlife trafficking impacts men and women differently and that gender mediates access to opportunities for accumulating benefits from wildlife trafficking and efforts to combat it (see Goetz, 2007). It is not possible to begin producing answers to these questions without parameterizing the primary and secondary roles of women in wildlife trafficking. Additional insight about concepts of crime orientation (i.e., an individual's stance in relation to crime) (Byrne and Trew, 2008) can be built upon gendered nature of pathways into and out of wildlife trafficking including positive evaluations of crime (e.g., crime being a good way of making money or solving financial difficulties). A gendered data landscape provides an extraordinary opportunity to take a problem-oriented approach to solving the problems of wildlife trafficking (e.g., reducing the problem at its source, for instance, by decreasing incentives to participate); rather than a disciplinary one (e.g., examining theoretical perspectives, empirical and methodological developments). Results also help contribute insight about problems known to be associated with wildlife trafficking, such as corruption. Corruption is a phenomenon widely acknowledged within the context of biodiversity conservation and wildlife trafficking (e.g., Robbins, 2000; Gore et al., 2013). Some literature on the gendered nature of corruption relates findings about the purported tendency of women to be more averse to corrupt practices than men, for example, taking bribes to illegally secure paper to cross an international border (see Dollar et al., 1999; Swamy et al., 2001). This assumption is echoed in conversations about the potential of including more women in male dominated legacy roles such as policing, while failing to elucidate the practical dynamics of corruption (e.g., Goetz, 2007). Results about perceived (low) involvement of women in defender roles such as police, rangers and private security guards speak to this point; the idea of simply "adding more" women in defender roles may not result in intended positive outcomes if the gendered dimensions of power, access, earning, and investment are ignored. Results about mean perceived low involvement of women as corrupt offender roles in wildlife trafficking further illustrate this point. We know from other illicit networks (e.g., drug trafficking) that there exist conflicting but symbiotic relationships between traders, transporters, and officers (e.g., Curtis and Karacan, 2002). Thus, individual relationships are in a constant state of flux between contestation, competition, negotiation, and cooperation (Curtis and Karacan, 2002). Advanced understanding about the nature and dynamics of these relationships within the context of wildlife trafficking could help answer a variety of questions, including how does gender influence corruption in wildlife trafficking within both offender and defender roles? What are the different ways in which men and women invest in and compete for access to wildlife trafficking networks? How does gender mediate opportunities for corruption accumulation (Howson, 2012) across different roles in wildlife trafficking? The assumption that corruption and smuggling represent a neatly defined illegality is reflected in the tendency to place both in the discourse of criminalization (Howson, 2012). Some argue the criminalization thesis (i.e., reforming laws to increasingly criminalize behavior

results in dangerous consequences) rests on a refusal to raise relevant analytical questions about the distinction between indigenous trading networks and organized crime (Meagher, 2003). This distinction is hugely relevant to the context of wildlife trafficking, as a number of political ecologists and criminologists have explained using the terminology of risk and militarization (e.g., Duffy, 2015; Hübschle, 2016; Massé et al., 2017). Indeed, wildlife trafficking impacts may manifest on persons harmed at local levels such as family members in general, widows and orphans. Losing a family member to death or jail creates new stressors on family budgets, psychological well-being, attachment and relationships. There are also important local-level (vs. high level organized crime) considerations when influencers are considered, such as mothers, parents, aunts, and grandmothers. Many of these individuals are engaged in subsistence livelihood activities at the local level, including providing food for children and managing household budgets. Family-based influencers may knowingly or unknowingly pressure family members to provide remittances from wildlife trafficking activities, reinforce cultural norms of emasculation if partners are unable to provide resources for family members (e.g., Massé et al., 2017), and dominate household purchasing and consumption decisions (e.g., Mbetete et al., 2011). Influencers may also be positioned outside the family yet still help reinforce or attenuate wildlife trafficking in a particular community. In Vietnam's Pu Mat National Park, local Women's Unions have been known to help suppress illegal snare hunting by talking with local hunters before they commence hunting for Tết Nguyên Đán, or the Lunar New Year.

Women can clearly be involved in different types of offending roles in wildlife trafficking; results suggest perceptions of higher involvement of women in consumer, seller and enabler-type roles compared to lower perceived involvement as poachers and transitors. A possible factor in women's limited involvement in certain wildlife trafficking roles may be their exclusion from or limited access to networks, although there is no research on how gender mediates access to networks for illicit earning, let alone the lack of explicit documentation about how such networks function. It is also possible that women are more centrally involved in wildlife trafficking roles, yet expert assumptions about gender roles preclude them from searching for women in offender roles. Future research could help explicate answers and add empirical data to generate inferences. Gendered access to illicit networks may be reflected in the ways that women depend on collaboration with men throughout the process of supply acquisition, transit, and sales. Access to opportunities for illicit accumulation may depend on men's support in a way that conditions women's maneuverability in pushing the boundaries of gender norms (Howson, 2012). For men in positions of power, the pressure to engage in corruption, for example, can be deeply connected to notions of masculine generosity and more generalized norms of cooperative social behavior (Howson, 2012). Interestingly, male cross-border traders for other (non-wildlife) commodities tend to smuggle in higher volumes than women, thus they are often perceived as being more important targets for seizure. Because women trade in smaller quantities, some officers refer to them as being non-threatening, indicating that officers may be less likely to target

them (Howson, 2012). One woman, when arrested for attempting to smuggle 10 baby otters out of Thailand to Japan by placing them in a basket in her carry-on luggage, claimed “she did so out of sympathy with the animals” (Bangkok Post, 2017). Future research could help explore these perceptions among women in wildlife trafficking roles and consider how issues of occupational identity represent important sources of inclusion across different roles.

In our effort to leverage EE to help clarify thinking about the range of possible roles, and thus participation, of women in wildlife trafficking, experts have raised more questions than produced answers. These questions help focus our lack of awareness on an extremely important socio-environmental issue impacting individuals, local people, and the global community. We cannot interpret experts’ information in a general inference manner in conjunction with any assumptions or other information elements available. The limited ability to infer does not mean that expert judgments are not valid data (Runge et al., 2011). Expert judgments are indeed valid data in that it must be carefully gathered, analyzed, and interpreted (Meyer and Booker, 1991). Results herein should not be overgeneralized. However, as the multisectoral communities (vested in overcoming challenges to sustainable development, gender equity and wildlife trafficking) work to achieve objectives, they can be more fully aware that disregarding gendered variance in the consideration of workforce and workplace may result in false positives and unintended policy failures. Data herein can be adapted and applied in pursuit of future empirical analyses that help control for such errors and missteps, particularly those that exclude gender as a variable.

REFERENCES

- Agu, H., and Gore, M. L. (2020). Women in wildlife trafficking in Africa: a synthesis of literature. *Glob. Ecol. Conserv.* 23:e01166. doi: 10.1016/j.gecco.2020.e01166
- Aipanijiguly, S., Jacobson, S. K., and Flamm, R. (2003). Conserving manatees: knowledge, attitudes, and intentions of boaters in Tampa Bay, Florida. *Conserv. Biol.* 17, 1098–1105. doi: 10.1046/j.1523-1739.2003.01452.x
- Bangkok Post (2017). *Japanese Women Arrested for Baby Otter Smuggling*. Available online at: shorturl.at/InvO8 (accessed January 8, 2021).
- Barnes, A. P., and Toma, L. (2012). A typology of dairy farmer perceptions towards climate change. *Clim. Change* 112, 507–522. doi: 10.1007/s10584-011-0226-2
- Brisman, A. (2007). Crime-environment relationships and environmental justice. *Seattle J. Soc. Just.* 6:27. Available online at: <https://digitalcommons.law.seattleu.edu/sjsj/vol6/iss2/6/>
- Brito, J. C., Durant, S. M., Pettorelli, N., Newby, J., Canney, S., Algadafi, W., et al. (2018). Armed conflicts and wildlife decline: challenges and recommendations for effective conservation policy in the Sahara-Sahel. *Conserv. Lett.* 11:e12446. doi: 10.1111/conl.12446
- Burgman, M., Carr, A., Godden, L., Gregory, R., McBride, M., Flander, L., et al. (2011). Redefining expertise and improving ecological judgment. *Conserv. Lett.* 4, 81–87. doi: 10.1111/j.1755-263X.2011.00165.x
- Byrne, C. F., and Trew, K. J. (2008). Pathways through crime: The development of crime and desistance in the accounts of men and women offenders. *Howard Journal of Criminal Justice*, 47, 238–258. doi: 10.1111/j.1468-2311.2008.00520.x
- Curtis, G. E., and Karacan, T. (2002). *The Nexus Among Terrorists, Narcotics Traffickers, Weapons Proliferators, and Organized Crime Networks in Western Europe*. Washington, DC: U.S. Library of Congress, Federal Research Division.

DATA AVAILABILITY STATEMENT

The raw data supporting the conclusions of this article will be made available by the authors, without undue reservation.

ETHICS STATEMENT

The studies involving human participants were reviewed and approved by Michigan State University Human Research Protection Program. The patients/participants provided their written informed consent to participate in this study.

AUTHOR CONTRIBUTIONS

MG and HA: conceived of research questions and sampling protocol. CA: led survey implementation. MG: led analysis. HA, CA, and MG: wrote manuscript. All authors contributed to the article and approved the submitted version.

FUNDING

This research was supported by the Michigan State University Alliance for African Partnership Program and the Department of Fisheries and Wildlife.

SUPPLEMENTARY MATERIAL

The Supplementary Material for this article can be found online at: <https://www.frontiersin.org/articles/10.3389/fcsc.2021.683979/full#supplementary-material>

- Dollar, D., Fisman, R., and Gatti, R. (1999). Are women really the “fairer” sex? Corruption and women in government. *J. Econ. Behav. Org.* 46, 423–429. doi: 10.1016/S0167-2681(01)00169-X
- Duffy, R. (2015). War, by conservation. *Geoforum* 69, 238–248. doi: 10.1016/j.geoforum.2015.09.014
- Goetz, A. M. (2007). Political cleaners: women as the new anti-corruption force? *Dev. Change* 38, 87–105. doi: 10.1111/j.1467-7660.2007.00404.x
- Gore, M. L., Braszak, P., Brown, J., Cassey, P., Duffy, R., Fisher, J., et al. (2019). Transnational environmental crime threatens sustainable development. *Nat. Sustain.* 2, 784–786. doi: 10.1038/s41893-019-0363-6
- Gore, M. L., Lute, M. L., Ratsimbazafy, J. H., and Rajaonson, A. (2016). Local Perspectives on Environmental Insecurity and Its Influence on Illegal Biodiversity Exploitation. *PLOS ONE*, 11, e0150337. doi: 10.1371/journal.pone.0150337
- Gore, M. L., Ratsimbazafy, J., and Lute, M. L. (2013). Rethinking corruption in conservation crime: insights from Madagascar. *Conserv. Lett.* 6, 430–438. doi: 10.1111/conl.12032
- Gottschalk, P., and Gunnesdal, L. (2017). Expert elicitation to estimate the size of an iceberg based on the tip: some methodological challenges in determining the magnitude of white-collar crime. *Int. J. Crim. Just. Sci.* 12, 224–236. doi: 10.5281/zenodo.1034666
- Heidensohn, F. (1996). *Women and Crime*. Macmillan Education UK.
- Heyman, J., and Sailors, J. (2016). A respondent-friendly method of ranking long lists. *Int. J. Market Res.* 58, 693–710. doi: 10.2501/IJMR-2016-001
- Howson, C. (2012). *Women Smuggling and the Men Who Help Them: Gender, Corruption and Illicit Networks in Senegal*. Cynthia: SIAS Faculty Publications. 19p.

- Hübschle, A. (2016). *A Game of Horns: Transnational Flows of Rhino Horn* (PhD Thesis), Universität Köln, Köln.
- IBM Corp (2016). *IBM SPSS Statistics for Windows, Version 26.0*. Armonk, NY: IBM Corp.
- Kahler, J. S., and Gore, M. L. (2012). Beyond the cooking pot and pocket book: factors influencing noncompliance with wildlife poaching rules. *Int. J. Comp. Appl. Crim. Justice* 35, 1–18. doi: 10.1080/01924036.2012.669913
- Kuhnert, P. M., Martin, T. G., and Griffiths, S. P. (2010). A guide to eliciting and using expert knowledge in Bayesian ecological models. *Ecol. Lett.* 13, 900–914. doi: 10.1111/j.1461-0248.2010.01477.x
- Lavrakas, P.J. (2008). *Encyclopedia of Survey Research Methods*. Thousand Oaks, CA: Sage Publications.
- Martin, T. G., Burgman, M. A., Fidler, F., Kuhnert, P.M., Low-Choy, S., McBride, M., et al. (2012). Eliciting expert knowledge in conservation science. *Conserv. Biol.* 26, 29–38. doi: 10.1111/j.1523-1739.2011.01806.x
- Massé, F., Lunstrum, E., and Holterman, D. (2017). Linking green militarization and critical military studies. *Crit. Milit. Stud.* 4, 201–221. doi: 10.1080/23337486.2017.1412925
- May, C. (2017). *Transnational Crime and the Developing World*. Washington, DC: Global Financial Integrity.
- Mbete, R. A., Banga-Mbokolo, H., Racey, P., Mfoukou-Ntsakala, A., Nganga, I., Vermeulen, C., et al. (2011). Household bushmeat consumption in Brazzaville, the Republic of the Congo.
- Meagher, K. (2003). A back door to globalisation? Structural adjustment, globalisation & transborder trade in West Africa. *Rev. Afr. Political Econ.* 30, 57–75. doi: 10.1080/03056240308374
- Meyer, M., and Booker, J. (1991). *Eliciting and Analyzing Expert Judgment: A Practical Guide*. New York, NY: Academic Press.
- Møller, B. (2003). “National, societal and human security: discussion — case study of the Israel Palestine conflict,” in *Security and Environment in the Mediterranean. Hexagon Series on Human and Environmental Security and Peace*, eds H. G. Brauch, P. H. Liotta, A. Marquina, P. F. Rogers, and M. E. S. Selim. Vol. 1 (Berlin, Heidelberg: Springer).
- Naffine, N. (1997). *Feminism and Criminology*. Cambridge: Polity Press.
- Oldfield, S. (2003). *The Trade in Wildlife: Regulation for Conservation*. Available online at: <https://tinyurl.com/yx64yzlb> (accessed November 14, 2019).
- Riskas, K. A., Tobin, R. C., Fuentes, M.M.P.B., and Hamann, M. (2018). Evaluating the threat of IUU fishing to sea turtles in the Indian Ocean and Southeast Asia using expert elicitation. *Biol. Conserv.* 217, 232–239. doi: 10.1016/j.biocon.2017.10.011
- Robbins, P. (2000). The rotten institution: corruption in natural resource management. *Polit. Geogr.* 19, 423–443. doi: 10.1016/S0962-6298(99)00087-6
- Runge, M.C., Converse, S. J., and Lyons, J.E. (2011). Which uncertainty? Using expert elicitation and Expected value of information to design an adaptive program. *Biol. Conserv.* 144, 1214–1223. doi: 10.1016/j.biocon.2010.12.020
- Serrao, S., Valero, S.D., Campell, J., and Gilligan, M. (2019). *Mainstreaming Gender in Environment Statistics for the SDGs and Beyond: Identifying Priorities in Asia and the Pacific*. Bangkok, Thailand: United Nations Economic and Social Commission for Asia and the Pacific.
- Slottje, P., Sluijs, J. P., and Knol, A. B. (2008). “Expert elicitation: methodological suggestions for its use in environmental health impact assessments,” in *RIVM Letter report*. National Institute for Public Health and the Environment, the Netherlands
- Smith, K.M., Zambrana-Torrel, C., White, A., Asmussen, M., Machalaba, C., Kennedy, S., et al. (2017). Summarizing US wildlife trade with an eye toward assessing the risk of infectious disease introduction. *Ecohealth* 14, 29–39. doi: 10.1007/s10393-017-1211-7
- Sutherland, W. J. (2006). Predicting the ecological consequences of environmental change: A review of the methods*. *J. Appl. Ecol.* 43, 599–616. doi: 10.1111/j.1365-2664.2006.01182.x
- Swamy, A., Knack, S., Lee, Y., and Azfar, O. (2001). Gender and corruption. *J. Dev. Econom.* 64, 25–55.
- Trochim, W. (2020). *Qualitative Validity*. Available online at: <https://conjontly.com/kb/qualitative-validity/>
- Trochim, W. M. K. (2001). Research methods knowledge base. *Atomic Dog Pub.*
- United Nations Women (2019). *Progress on the Sustainable Development Goals. The Gender Snapshot 2019*. United Nations Department of Economic and Social Affairs, Statistics Division, New York.
- UNODC (2020). *United Nations Office on Drugs and Crime World Wildlife Crime Report: Tracking in Protected Species*. Vienna: United Nations.
- Washington, H., Baillie, J., Waterman, C., and and, E. J., Milner-Gulland (2014). A framework for evaluating the effectiveness of conservation attention at the species level. *Oryx* 49, 481–491. doi: 10.1017/S0030605314000763
- White, P. C. L., Jennings, N. V., Renwick, A. R., and Barker, N. H. L. (2005). REVIEW: Questionnaires in ecology: a review of past use and recommendations for best practice. *J. Appl. Ecol.* 42, 421–430. doi: 10.1111/j.1365-2664.2005.01032.x
- World Bank Group (2020). *Analysis of International Funding to Tackle Illegal Wildlife Trade (2010–2018)*. Available online at: <https://www.appslutelydigital.com/WildLife/cover.html> (accessed March 22, 2020).

Conflict of Interest: The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

The reviewer TW declared a past co-authorship with one of the authors MG to the handling editor.

Publisher's Note: All claims expressed in this article are solely those of the authors and do not necessarily represent those of their affiliated organizations, or those of the publisher, the editors and the reviewers. Any product that may be evaluated in this article, or claim that may be made by its manufacturer, is not guaranteed or endorsed by the publisher.

Copyright © 2021 Agu, Andrew and Gore. This is an open-access article distributed under the terms of the Creative Commons Attribution License (CC BY). The use, distribution or reproduction in other forums is permitted, provided the original author(s) and the copyright owner(s) are credited and that the original publication in this journal is cited, in accordance with accepted academic practice. No use, distribution or reproduction is permitted which does not comply with these terms.