The Poaching Diaries

Crime Scripting for Wilderness Problems

Edited by A.M. Lemieux

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Center for Problem-Oriented Policing

nscr Netherlands Institute for the Study of Crime and Law Enforcement

The Poaching Diaries is an edited collection of contributions on wildlife crime prevention and wilderness problems. It is an outlet for practitioners, policy makers, and academics to tell stories that facilitate problem-solving.

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Proto crime scripting for identifying gaps in knowledge: an example for bushmeat poaching

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Redwood Burl Poaching in the Redwood State & National Parks, California, USA

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Trade and trafficking in small-clawed otters for the exotic pet market in Indonesia, Japan and Thailand

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Large carnivore poaching using steel wire snares by Vietnamese poaching groups in tropical forests of Peninsular Malaysia

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Introduction and Appendix

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The Poaching Diaries

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Andrew M. Lemieux is a researcher at the Netherlands Institute for the Study of Crime and Law Enforcement (NSCR). He coordinates the NSCR's Wildlife Crime theme and is a member of the Spatial and Temporal Crime Patterns theme. Over the last decade, Andrew has worked with numerous wildlife-protection agencies in Africa and Asia including governmental, non-governmental, and private entities. His work revolves around the collection and use of data for decision-making, with an emphasis on problem solving and situational crime prevention. He has spent considerable time in the field with rangers on the front line of protection efforts and with managers looking for innovative ways to protect their ecosystem. These experiences are what led Andrew to promote the use of problem-oriented wildlife protection as a way to find holistic solutions that are mutually beneficial to wildlife and people.

I
Introduction

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The aim of *The Poaching Diaries* is to present ideas that help governments and civil society diversify their approach to wildlife protection to achieve lasting impacts. The focus of this volume is crime scripting, a useful process for unpacking problems and designing clever solutions. Crime scripts are generated by developing detailed, step-by-step accounts of very specific crimes, in the specific contexts and environments where they take place. These scripts capture the full process of committing a crime, including steps taken before and after the criminal act itself. This is useful for identifying weak points in the chain of events to focus prevention strategies. For example, a subway pickpocketing event is part of a larger process, in which the offender has many decisions to make and actions to complete; one of these actions could be loitering on platforms to find victims. Looking at this stage in the crime script, a disruption strategy might focus on limiting access to subway stations for individuals without a valid ticket. This would make it harder, or at least more expensive, for pickpockets to work and therefore a less attractive environment for crime.

Over the last year, we have worked with practitioners and academics from around the world to create a collection of scripts for specific wildlife crimes and wilderness problems. The contributions in this volume walk the reader through a criminal event from the preparation stage where tools and supplies are gathered, through the aftermath when the wildlife product is sold or used. To help guide prevention efforts, the contributions include suggestions on how to make each stage in the chain of events difficult, risky, or unattractive. This provides a more holistic view of prevention options, many of which do not focus or rely on catching someone 'red handed'. For example, controlling the sale of commercially available poison used to kill lions or having strong systems in place to deal with damage caused by lions, are both ways to intervene at the preparation stage of a lion poaching event. Neither intervention targets the actual activity of killing a lion, but both are aimed at keeping lions alive.

Our goal in compiling this volume of *The Poaching Diaries* was to create a collection of scripts that is not only useful to the contributors, but to a wider audience of readers interested in wildlife protection, like yourself. This introduction gives a brief overview of the crime scripting process and how it was used here, reflects on three lessons we learned, and discusses how crime scripting might be used for ongoing and future wildlife protection work.

A brief overview of crime scripting

Crime scripting was first proposed as a tool for crime prevention by Derek Cornish in the early 1990s.[1] Drawing from research in cognitive science that used 'scripts' to unpack human behavior and decision making, he explained how the scripting process helps those interested in crime prevention get specific about the problems they deal with. Scripting helps build a more complete picture of the tools or materials required, locations used by offenders, people they interact with, and conditions that enable crime. This makes it easier to identify weak points and develop tailored interventions that target these specific people, places, or behaviors. Cornish argued crime scripting is a useful companion to Situational Crime Prevention[2] because it helps get to the level of detail needed to understand and change opportunity structures that facilitate crime. His idea was well received by the crime prevention community, and since then scripting has been used to unpack various types of offending including cybercrime, corruption and fraud, robbery and theft, drug offenses, violent crime, sexual offenses and even environmental crime, including poaching.[3]

On the topic of wildlife crime specifically, crime scripting has been used to examine: illegal coral harvesting [4]; illegal hunting, poaching and illegal wildlife trade [5]; illegal ivory market [6]; illegal, unreported and unregulated fishing [7]; illegal waste dumping [8]; internet-mediated wildlife trafficking

[9]; jaguar paste production [10]; rhino horn and live pet trafficking [11]; rhino poaching [12] and waste crime.[13] The current collection of crime scripts builds from this foundation, adding additional settings, crime types, and contributors to the literature.

The current collection

This inaugural volume of The Poaching Diaries was envisioned by the editor in response to growing interest in crime scripting from practitioners and academics working in wildlife protection. More and more people were talking about this 'tool' but many did not have any experience or reference material for developing their own script. In collaboration with the Center for Problem-Oriented Policing (POP Center), it was decided that compiling an edited, open-access collection of scripts would be a useful exercise for those involved, but also beneficial to those who could use the collection as reference material. In May 2019, a call for contributions was posted on the Wilderness Problems portal of the POP Center website and circulated via the editor's network.

In the months that followed, a list of interested parties was compiled, as was an instructional overview on how to develop crime scripts. In most cases, the contributor(s) participated in an intake session, usually a virtual meeting or call. Here we would explain our vision for the collection and answer questions about data sources and how to develop scripts, eventually agreeing on a strategy for writing the first draft. This was the beginning of a back and forth process where we provided feedback and support as needed until a final version was agreed upon.

An updated version of the instructional material provided to contributors can be found in the appendix to this volume. This contains more detail on the science behind crime scripting and how scripts can be developed. For this reason, we encourage you to read the appendix, especially if you are thinking about writing a script yourself.

A key element of this collection is that most of the information used was already available to the contributors, either in project reports, expertise within the organization, or as open-source material. As such, this was not a project that relied on new data collection or research, but rather one employing a framework to structure old data into new knowledge. A great deal of our work was continual questioning of details, which helped add depth to the scripts as well as identify knowledge gaps that need to be filled. We gave contributors flexibility in the length of their contribution as some felt they needed extra space to describe the context of the problem, but did our best to maintain focus on the script.

In the end, we ended up with a total of 12 scripts from 5 continents (see Table 1). Most of the contributions are actor-based crime scripts that focus on a specific wildlife crime and the activities of one or more individuals. The leopard poaching script from Zambia (#2) is an exception because it uses a product-based approach that details how leopard skins are harvested, traded, and eventually used. Similarly, the script on trade and trafficking of otters (#10) contains both an actor-based script describing poaching, and a product-based script describing trafficking. The rhino poaching script from South Africa (#6) is also unique because it unpacks a single, well-documented incident event after it happened. The final exception is the generic bushmeat poaching script (#7), that emphasizes the utility of crime scripting as methodology for identifying information gaps. We hope the mixture of scripts in this collection helps you understand the versatility of this tool for aiding wildlife protection efforts. In the next section, we reflect on three important lessons we learned from working with this diverse set of contributors and wilderness problems.

Table 1. Overview of the collection

Continent	#	Problem	Brief description	Contributor(s)	Country
Africa	II	Leopard poaching	Leopards are killed for skins used in traditional ceremonies.	G. Whittington-Jones, Senior Chief I. Yeta, V. Naude, M. Lishandu, D. Chibeya, T. Dickerson, J. Dunnink	Zambia
	III	Parrot poaching	Africa grey parrots are harvested for international trade	N. Bruschi	DRC
	IV	Lion poaching	Lions are target for local/international trade and in retaliation for cattle kills	K. Everatt	South Africa Mozambique
	V	Hippo poaching	Hippos are killed to supply local bushmeat markets	I. Ashaba	Uganda
	VI	Rhino poaching	Rhinos are killed for international trade	N. van Doormaal	South Africa
	VII	Bushmeat poaching	Antelopes are targeted for the bushmeat trade	J. Hill	Not specific
N. America	VIII	Redwood burl poaching	Burls are removed from redwood trees, for trade on domestic and international markets	S.F. Pires, N. Marteache, B. Silver, S. Troy	USA
	IX	Saguaro poaching	Saguaro cacti are stolen for local use in landscaping	S.C. McFann, S.F. Pires, R. O'Neil	USA
Asia	X	Otter trade	Otters are harvested for commercial pet markets	A. Parker, L. Slattery	Indonesia Thailand Japan
	XI	Large mammal snaring	Large mammals are targeted for international trade.	W.Y. Lam, Z.A. Mat	Malaysia
Europe	XII	Amber mining	Amber is illegally mined for international export	S.C. McFann	Ukraine
Oceania	XIII	Recreational fishing	No-take zones are violated by recreational fishermen	D. Weekers	Australia

Lessons learned

We thought it would be important to briefly describe three lessons we learned from putting this collection together. These relate to the utility of crime scripting for wildlife protection, the adaptability of the process to different problems and data sources, and the accessibility of the method to people who have not used it before. In this section we reflect on these lessons to provide a foundation for future work. We draw from our own experiences, but also from feedback provided to us by the contributors.

Lesson 1 *Crime scripting is an adaptable process that can be applied to many different contexts and data sources to produce a more detailed view of a problem*

At the beginning of this project, it was unclear who would participate, how many scripts would be written, and what problems would be included. As we began the intake process with contributors, it was immediately clear that they would be writing about a wide variety of problems, in different contexts, using different data sets. In other words, it would be difficult to standardize how the scripts would be developed, especially if similar sources of information across contributors was required to do so. A major advantage of standardizing the crime type and preparation procedure of crime scripts is that it enables you to compare scripts to one another to find generalizations about specific wildlife crimes. Moreover, if we had used a standard way to capture data and put it into a script, it would be much easier for readers like yourself to replicate what was done here.

So why not standardize? The simple answer is that this volume would not have been possible without a significant amount of additional resources to facilitate the training and data collection needed for standardization. Moreover, we believed standardization would have been a barrier to us recruiting contributors who may have seen the project as consuming more time and resources than it was worth. As noted above, there was already considerable interest in crime scripting, and this was an opportunity to test the waters.

Recent scientific reviews of crime scripting support our approach, noting that without evidence of improvement from a standardized method, so called 'back-of-the-envelope' scripting may very well be good enough and contribute to crime reduction.[3] Importantly, the authors of that study noted that logically, crime scripting has been in use for a long time, before it was made explicit by Cornish. People working in security fields, for example a detective investigating a murder case, will always have dealt with the questions made explicit in scripts: describing in fine detail who does what, when, how, and why. With this in mind, our objective was to create a comfortable learning environment for the contributors, many of whom had never done this before, to develop scripts that might contribute to crime reduction.

To cater for the diverse problems and data the contributors wanted to write about, we provided a blank table that could be used to structure the script. In the table, contributors were asked to describe the actions that happen during preparation, pre-activity, activity, and aftermath stages of the wildlife crime they chose. We also asked them to include details about when and where the activity happened, and who was involved. For more information see the appendix and the crime script table in each contribution. We found this approach worked well and ultimately was adaptable enough for all of the data sources available to construct the scripts presented here.

Lesson 2 *Crime scripting is useful for thinking about prevention more broadly and for identifying knowledge gaps*

As contributors built their crime script using the template we provided, they were asked to think about interventions that could be used to disrupt different stages of the script, as well as to identify knowledge gaps for these same stages. For example, it might be clear how a lion is baited and killed (activity stage), but the details of how those lion products make it to market might be less clear (aftermath stage). This is an information gap that if filled, would make the script even more complete for guiding prevention work. You may for instance ask what shops poison originates from or what scrapyard is targeted to steal material for wire snares. A number of contributors indicated scripting had helped them identify such gaps and design ways to fill them, improving the focus of their ongoing work. Based on our personal experiences, and the feedback we received from contributors, with a crime event laid out in detail, it was much easier to think about how each activity within the script could be disrupted or discouraged. It was also easier to think about how intervening at a

specific stage would affect the process as a whole because the relationship between steps was easier to visualize.

We found that crime scripting also helped our contributors, many of whom work with or are themselves law enforcement officers, see how non-enforcement interventions could be used to complement and support standard models that rely arrests to deter crime. This is especially important for government authorities mandated to protect wildlife as they commonly work with NGOs and civil society to solve problems. Crime scripting is a good way to map out how partnerships can be used to target multiple stages in a script, leveraging the skills, resources, and mandates of different organizations and agencies. This is useful for proactive policing models such as Problem-Oriented Policing,[14] which strives to prevent crime through partnerships and innovative interventions that do not necessarily rely on the criminal justice system.

Given the link between crime scripting and Situational Crime Prevention (SCP), we looked for ways to incorporate the 25 Techniques of SCP into our discussions about interventions with contributors. For readers unfamiliar with the 25 Techniques, Table 2 gives hypothetical examples of how these techniques can be used to address urban and wilderness problems. We encourage you to refer back to this table when reading the scripts to help link the ideas of SCP to some of the interventions suggested by the contributors.

Lesson 3 *Crime scripting is a user-friendly process that can be integrated into ongoing projects to help guide strategy development and operations*

In the final stages of this project, we sent a feedback form to our contributors to see what they thought about the crime scripting process, if our approach to helping them build crime scripts was beneficial, and if they would recommend or use crime scripting in the future. Seeing as this was the first time most of the contributors had written a crime script, it was important to understand and learn from their experience. In general, contributors thought the crime scripting process was relatively easy to learn and apply, and had been a useful way to structure knowledge about a specific problem. They believed the training manual provided, combined with the intake session, gave them a strong foundation to start from, but the mentorship model used here, i.e. follow up calls and document review from beginning to end, was useful for helping the process move along and maintain focus. Overall, crime scripting was seen as a readily accessible tool for contributors from diverse backgrounds, many of whom had no formal training in crime science or criminology. Most contributors told us they would recommend crime scripting to others and would use it again themselves as needed.

Given the utility of crime scripting for developing strategies and operations, some of the contributors commented on the value of using the process internally, rather than for publication in an open-access outlet such as *The Poaching Diaries*. Their point was simple. Sometimes you will not want to publicize your intervention because it might dilute the effect. We completely agree and should note here that some contributors redacted interventions from their final scripts because they were ongoing or under development as a result of this process. The main message here is that crime scripting can be used for internal and external purposes to refine thinking about problems and solutions. One contributor indicated they were using a hybrid version of this, where crime scripting was used internally to plan operations, and externally to communicate with partners dealing with a similar problem in different locations. We have also heard of scripting being used to guide real-time operations, for example after a rhino poaching event, to disrupt the aftermath stage and seize the horn before it changes hands too many times. Our advice is to choose a model that works best you, while emphasizing the importance of sharing your experiences when possible so others can learn.

Table 2. The 25 techniques of situational crime prevention with examples for urban (●) and wilderness (★) problems

Increase effort	Increase risk	Reduce rewards	Reduce provocations	Remove excuses
Target harden ● Bullet-proof glass between taxi drivers and passengers ★ Reinforced store room for seized wildlife products and weapons/traps	*Extend guardianship* ● Leave light on at home when away ★ Use technology to monitor location of vulnerable animals	*Conceal targets* ● Pull jewellery from display cases and put in safe at night ★ Buffer zone around core areas	*Reduce frustrations/stress* ● Regular updates for passengers on delayed public transport ★ Community involvement in protected area management	*Set rules* ● Clear limits for liquids in carry-on baggage ★ Collaborative agreements for wildlife harvesting and use
Control access to facilities ● Visitor registration at office buildings ★ Vehicle tracking of contractors working within the reserve	*Assist natural surveillance* ● Encourage and support whistleblowers ★ Hotline for visitors to report suspicious activity	*Remove targets* ● Cashless payments ★ Destroy ivory stockpile	*Avoid disputes* ● Staggered closing time for bars ★ Rapid response teams for wildlife damage	*Post instructions* ● 'No smoking' signs ★ Signs with clear harvest regulations near offtake zones
Screen exits ● Ticket checks to exit public transport ★ Vehicle checks when exiting protected area	*Reduce anonymity* ● Driver name, photo, and permit number posted in taxi ★ Public hearings and media coverage of major arrests	*Identify property* ● 'DNA' spray on property ★ RHODIS DNA database for rhinos	*Reduce temptation/arousal* ● Zero-tolerance of racist chants at football matches ★ Support services for victims of wildlife attacks	*Alert conscience* ● Navigation device with speeding notification ★ 'No Trespassing' signs along reserve boundary
Deflect offenders ● Metal detectors at entrance of large shopping areas ★ Dog detection units at major transportation hubs	*Use place managers* ● Pressure building owners to fix broken fences, locks, and lights ★ Work with restaurant owners to discourage the sale of bushmeat	*Disrupt markets* ● Closure of dark web marketplaces ★ Demand reduction campaigns for wildlife products	*Neutralize peer pressure* ● Media campaigns such as 'Stop bullying now!' ★ Wildlife clubs for children and adults	*Assist compliance* ● Free plastic bags for liquids in carry-on luggage ★ Immediate compensation programs for wildlife damage
Control tools/weapons ● Limit access to medicines used to make methamphetamine ★ Limit public sale of pesticides commonly used to poison animals	*Strengthen formal surveillance* ● Traffic cameras ★ New outposts in areas with low patrol effort	*Deny benefits* ● Dye packages in bags with stolen money ★ Asset forfeiture of items purchased with wildlife crime profits	*Discourage imitation* ● Ban videos of dangerous 'challenges' on YouTube ★ Ban videos of exotic animals kept as pets or as tourist attractions on YouTube	*Control drugs/alcohol* ● Train bartenders to avoid overserving ★ Zero-tolerance policy for drinking on duty

*Note: for more information about Situational Crime Prevention, see recommended readings at the Center for Problem-Oriented Policing.

Future research

We hope this collection inspires people like yourself to use crime scripting as a part of wildlife and wilderness protection in the future. It is by no means a silver bullet, but it is a useful tool for one's crime prevention toolbox. As you read the scripts that follow, we encourage you to ask yourself questions such as: How is this problem similar to one you deal with or know about? How is it different? Have you tried any of the suggested interventions? Did any of them work? Can you think of additional ones? And most importantly…Could you build your own script for a specific problem?

As noted above, this collection shows integrating crime scripting into ongoing and future wildlife protection work is possible and beneficial. If you are planning to write your own script, read the appendix to this volume and the recommended readings listed there to learn more about the process and how to do it properly. Crime scripts are only as reliable as the information they are generated from, and they evolve over time, important points to keep in mind before rolling out an intervention based on poor or incomplete information.

Drawing from the lessons learned here, we believe future work should focus on building comparable crime scripts for similar problems. For example, a problem such as the targeted killing of lions for body parts could be scripted for different protected areas, to help develop a coordinated strategy based on common weak points in the script. Additionally, crimes related to lion poaching, such as the subsequent trafficking of products or money laundering, could be scripted to identify intervention points that are much farther downstream from the poacher. A crucial topic for future research is the rigorous evaluation of interventions used to disrupt stages of a crime script, so those working in or supporting wildlife protection can develop evidence-based strategies.

In closing, we would like to personally thank all of the contributors for their hard work and dedication. We believe this has been a good learning experience for everyone involved, including ourselves. To the reader, we hope you enjoy the stories and ideas that follow, and critically reflect on how they might help you solve your own wildlife protection problems.

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II

Product-based crime script of targeted leopard poaching for skin use in ceremonial attire by the Lozi People of Western Zambia

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Problem description

Leopards (*Panthera pardus*) are considered the world's most persecuted large cat and it is estimated that they have been eradicated from more than two-thirds of their historic African range.[1] Despite this, leopards are often deemed to warrant low conservation priority.[2] Their wide geographic range and ability to persist in regions where other large carnivores have disappeared has given rise to a widespread assumption that their long-term persistence is assured. Consequently, much attention has been given to other charismatic wildlife in Africa, while until recently, the conservation needs of leopards have largely been overlooked.[3]

The primary threat to leopards in southern Africa is the demand for their skins for use in ceremonial attire by numerous cultural groups. Notable groups that wear leopard skins as symbols of power, prestige, courage, grace, stealth and fierceness include Zulu royalty,[4] the growing Nazareth Baptist 'Shembe' Church of South Africa,[5] and the Lozi and Ngoni Peoples of Zambia. While the use of leopard skins stems from a deep cultural reverence for the species, local demand for skins and high levels of illicit harvesting for trade is likely putting tremendous pressure on regional populations. With growing human populations and dwindling leopard populations, what was once a sustainable use for ceremonial purposes has become unsustainable. Put in context, monitoring of large Shembe gatherings (>50,000 followers) conducted by Panthera since 2013 suggests that there are up to 14,600 (± 2,400 SE) skins in circulation among Shembe followers, with over 800 leopards harvested annually to supply this demand (Panthera unpublished data). Recent DNA-based geographic assignment of leopard skins indicates that Shembe-driven trade is transnational and syndicated, with some leopards harvested in South Africa, while the majority originate from Zimbabwe, southern Mozambique and to a lesser extent western Zambia.[6] While demand for leopard skins among the Lozi People is estimated to be far less than that of the Shembe Church followers, it nevertheless provides an interesting case study.

The Lozi use leopard skins for several of their key cultural events, the most prominent of which is the annual Kuomboka ceremony. Kuomboka is a Silozi word that translated means "to get out of the water". Nowadays, it refers to a traditional ceremonial regatta that takes place when the upper Zambezi River floods the plains of Zambia's Western Province after its wet season. The festival celebrates the passage of the King of the Lozi – the Litunga – from his palace in Lealui Royal Village on the floodplain to his palace in Limulunga Royal Village on higher ground. It is during this ceremony that paddlers on the King's barge are adorned in red berets with a lion (*Panthera leo*) mane trim (or synthetic equivalent) and animal skin skirts, known as *Lipatelo*. The *Lipatelo* sometimes comprise full skins of a single species (in such cases, usually leopard or serval (*Leptailurus serval*)), but more often they are made up of skins from several species including leopard, serval, civet (*Civettictis civetta*), genet (*Genetta* species), Cape clawless otter (*Aonyx capensis*) and various species of antelope. In rare cases, cheetah (*Acinonyx jubatus*) skins may be worn.

Recognizing the potential for ceremonial use of skins to adversely impact key wildlife populations of cultural significance, the Barotse Royal Establishment (BRE) of the Lozi People took the initiative to mitigate this issue. Following the successful implementation of the Furs for Life demand-reduction project in partnership with the Shembe Church in South Africa (https://www.panthera.org/furs-for-life), in 2017 the BRE sought to join forces with Panthera to launch a similar initiative - the Saving Spots Project. Their conservation initiative across western Zambia seeks to protect declining wild cat

populations while simultaneously preserving cultural heritage through the provision of highly realistic synthetic leopard, serval and lion furs, known as “Heritage Furs”. These “Heritage Furs” were used by Lozi paddlers for the first time during a Kupuwana ceremony in September 2019 to much acclaim (watch video). Additionally, the BRE hierarchy has taken a bold approach, declaring that hereafter, no authentic skins will be worn on the King’s barge at the Kuomboka or during other ceremonial events. “Heritage Furs” are to be stored centrally at the Royal Palace, distributed to the selected participants before the ceremonies and then reclaimed and taken back to storage, thus elevating the prestige of these garments, extending their longevity and enhancing the sustainability of the Saving Spots Project.

This wildlife crime script focuses on the targeted poaching of leopards and illegal trade of their skins for ceremonial attire in western Zambia. It identifies possible intervention strategies and knowledge gaps to address this threat to wild cat populations across the region.

Information sources

Following Lemieux & Bruschi[7] a product-based approach was adopted to develop a wildlife crime script using a combination of participant observations and structured or semi-structured interviews conducted as part of the Saving Spots Project (see details below). After the project’s inception, Panthera staff were invited to attend the 2018 Kuomboka to gather information on the scale of the event, details regarding the use of skins and the traditional values underpinning the ceremony. Data were collected through direct observation and ad hoc interactions with participants or spectators.

Information relating to the hunting and trafficking of cat skins, particularly leopard, was obtained through a semi-structured interview conducted in 2019 with an interviewee who has a well-established knowledge of the relevant customs and traditions of the Lozi (n = 1). Structured interviews (n = 16) were then conducted with Lozi paddlers to understand the use and process of acquiring skins prior to the Kuomboka ceremony. Data included skin cost (if purchased), the number of skins owned by paddlers, the longevity of skins, methods for storing skins when not in use, the geographic origin of the skins, the participants knowledge of conservation laws in Zambia, their perception of the population status of leopard, lion, serval and cheetah in Zambia and their opinion of the Saving Spots demand reduction project and its effectiveness in curbing demand for authentic skins.

Crime process and Script

During the 2018 Kuomboka visit, it was estimated that the roughly 200 paddlers on the King’s barge were wearing skins of approximately 150 leopard and 800 serval. While many skins appeared fresh, curing and tailoring were rudimentary, and paddlers confirmed that they needed to be replaced frequently. Based on subsequent structured interviews with Lozi paddlers in 2019 the average longevity of skins is estimated to be 2.6 ± 0.95 (SE) years. Moreover, between 600–1,000 Lozi men will acquire skins in anticipation of being chosen to fill approximately 200 paddling positions on the King’s barge annually. All 16 paddlers indicated that they owned multiple leopard skins (range: 2-4), however at this stage it is unclear whether those refer to whole skins or parts thereof. Additionally, all interviewees stated that they obtained their leopard skins from traders as opposed to hunting themselves or acquiring them legally through the Department of National Parks and Wildlife. Fifteen paddlers indicated that they had purchased their skins in Mongu while the remaining individual reported having acquired his skins in Sioma. No interviewees were able to purport the geographic origins of the skins that they purchased.

Information obtained during the semi-structured interview indicates that prospective paddlers would approach trusted contacts living in small towns or villages close to National Parks (NPs) or Game Management Areas (GMAs) to request a leopard skin up to six months before the Kuomboka. These contacts may be Lozi or from another cultural group — the key consideration is that they are trusted.

These contacts serve as middlemen and make enquiries with known poachers in the area in an effort to source a skin. If the poachers do not already have a skin they will enter a NP or GMA in an effort to harvest a leopard. Overton *et al*. 2017 have suggested that, given the low population densities of leopard and other large carnivores in the Greater Kafue Ecosystem, it may not be economical to target these species alone but rather, they are opportunistically poached while also harvesting bushmeat. Conversely, some approaches to hunting leopards, such as the use of trained dogs, can make hunting leopards effective even at low leopard densities.

Semi-structured interview data suggests that poaching parties may range in size from a single hunter to four individuals. Methods of hunting also vary and include baiting leopards which are then shot with a firearm or trapping them with wire neck- or foot-snares (which may also be baited). Leopard may also be hunted effectively using dogs, but the degree to which this method is important in western Zambia is not well understood.

Once the animal has been killed and the skin removed, it is transported to a safe location in the bush away from the poaching site but close to the hunter's home. The skin is then processed by drying it on a rack and is cured using salt, sand, ash or a combination thereof. Processing takes approximately ten days to complete depending on the prevailing weather conditions. Once this rudimentary curing is complete, the hunter contacts the middleman who will purchase the skin. In some cases, the middleman will then transport the skin to the end-user directly or will make contact, advising him to collect the skin. Semi-structured interview data suggest that the former is the more common practice. Middlemen purportedly charge a 10-20% markup when selling skins to end-users though prices may vary according to the quality and size of the skin as well as the urgency of demand.

All 16 participants in the structured interviews were aware that it is illegal to own a leopard skin without a permit and perceived populations of all wild cat species in Zambia to be decreasing. Opinions regarding the Saving Spots Project among paddlers were mixed. All respondents agreed it was a worthwhile initiative, but 37.5% of interviewees still preferred authentic skins to synthetic alternatives. Nevertheless, all interviewees indicated that they would follow the instructions of the BRE leadership and wear the synthetic "Heritage Furs", rather than authentic skins if chosen to participate in future ceremonies.

The product-based crime script below summarizes the sourcing and use of leopard skins, suggests interventions at each stage, and highlights knowledge gaps to consider.

Product-based crime script on targeted poaching of leopard skins for the use in ceremonial attire by the Lozi people of Western Zambia						
Stage	**Steps**	**Location**	**Actor**	**Product status**	**Interventions**	**Knowledge gaps**
Broker	● End-user contacts a trusted middleman to source a skin ahead of the annual Kuomboka ceremony that takes place in March/April. Acquisition of new skins typically commences from October.	● End-user or Middleman's community (small urban area). ● Middleman's community likely to be close to a National Park (NP) or Game Management Area (GMA).	● End-user ● Middleman	N/A	● Demand-reduction project led by cultural leadership to provide, alternative - highly realistic, synthetic "Heritage Furs". Behavioral change campaign to promote the project, sensitize paddlers and wider Lozi community to the use of "Heritage Furs", highlight the plight of leopards and the importance of conserving cultural and natural heritage. ● Increase deterrent for procuring/owning an authentic leopard skin without a permit.[8]	● How often do end-users bypass a middleman and contact known hunters directly? ● How do end-users identify an appropriate middleman and what is the level of repeat business? ● Are middlemen typically Lozi, or might they belong to different tribal groups? ● How often do end-users bypass other actors and harvest skins themselves? ● What factors influence whether end-users harvest skins themselves or use other actors?
Broker (2)	●The middleman contacts poacher(s) to place an order for a skin. May either be poached to order or sold from stock.	●The community near hunting site (e.g., NP or GMA).	●Middleman ●Poacher	N/A	● The promotion of alternative livelihoods, incentive-oriented schemes and community-based natural resource management programs in communities bordering protected areas that highlight the value of wildlife and reduce the enticement to poach. ● Increase deterrent for killing leopards and trading in skins without a permit.[8]	● How do middlemen identify appropriate poachers? ● Do hunters generally hunt to fulfil specific orders; do they harvest skins in anticipation of being able to sell them or do they harvest them opportunistically/as a by-product of bushmeat poaching or a combination? ● Are the actors that supply the Lozi demand Lozi themselves, or might they be from other tribal groups? ● What is the motivation of actors involved in the trade – financial, maintenance of cultural practices or both? ● Is there an annual spike in poaching activity, e.g. between October and April?
Procure	● Poacher(s) finds and kills leopard.	● NP or protected area (PA), GMA adjacent to NP or PA, Community land adjacent to NP, PA or GMA.	● Poacher(s)	● Whole carcass	● Identification of targeted leopard populations (e.g., through interviews and DNA-based assignment of leopard skin samples). ● Increased presence of wildlife law enforcement teams in key habitats during critical times of year.	● What methods are most commonly used? ● Do poachers employ multiple methods or have a preferred method? ● How long to poachers typically need to hunt to harvest a leopard and how does this vary between different methods?

Stage	Steps and options	Spatial	Temporal	People	Interventions	Knowledge gaps
Procure (cont)					● Encourage citizens to report carcasses, particularly in areas associated with wildlife-linked poverty alleviation programs (e.g., alternative livelihoods and/or incentive oriented schemes and community-based natural resource management projects).	● Does the prevailing method change geographically? ● Where are the historic harvesting areas for leopard skins to supply Lozi demand? ● Do poachers also target and harvest other products (e.g., bushmeat while hunting leopard)? ● Do poachers who supply Lozi demand also supply other (commercial) demand or are these different actors ? ● What are the costs involved with poaching leopard?
Process	● Poacher(s) skins leopard	● NP, PA or GMA adjacent to NP or PA, Community land adjacent to NP, PA or GMA.	● Poacher(s)	● Skinned carcass ● Skin	● Increased wildlife law enforcement patrols and surveillance (human or technical) along known/possible routes between settlements and PAs/NPs. ● Encourage citizens to report carcasses, particularly in areas associated with wildlife-linked poverty alleviation programs. ● Investigations to identify the hunter/ processor identity.	● Are carcasses skinned at the kill site? ● What happens to the rest of the carcass? ● Are any other parts of the leopard harvested for sale to other markets? ● If so what parts and what market(s)?
Transport	● Poacher(s) moves skin from hunting site to processing location.	● Unknown	● Poacher(s)	● Skin	● Increased wildlife law enforcement patrols and surveillance (human or technical) along known/possible routes between settlements and PAs/NPs. ● If vehicles are used to transport product, set up random and/or information-led roadblocks, potentially utilizing conservation working dogs, along key routes. ● Combination of overt/covert checks to identify cars turning around before check-points. ● Establish list of suspicious vehicles involved in wildlife product movement.	● What mode of transport does the poacher(s) use? ● Foot, bicycle/vehicle or a combination? ● Is the poacher supported by other actors?

Stage	Steps and options	Spatial	Temporal	People	Interventions	Knowledge gaps
Process (2)	● Poacher(s) processes skin by drying it on a rack and using salt, sand or ash.	● Safe location in the bush close to home but away from hunting site. May take up to 10 days.	● Poacher(s)	● Skin	● Encourage citizens to report drying racks, particularly in areas associated with wildlife-linked poverty alleviation programmes. ● Investigations to identify the hunter/ processor identity.	● Further information about the longevity of skins that have been cured using these rudimentary techniques. ● What is the typical distance away from the home that this is conducted? ● What factors influence where the processing takes place? ● How long, how and where will the hunter store the skin after it is cured?
Storage (optional)	● If the skin is poached to order it will be handed over as quickly as possible. Otherwise, it may be stored while finding a buyer.	● Personal facilities	● Poacher	● Processed skin	● Monitor the skins for sale, and encourage citizens to report illegal trade - particularly in areas associated with wildlife-based poverty alleviation programs.	● How long do poachers typically have to wait before selling a skin? ● Does the waiting period vary at different times of the year? ● How and where do poachers store skins? ● How are they treated to protect against damage?
Sell	● Poacher(s) sells cured skin to a middle man.	● Unknown but expected to be either hunter's or middleman's community.	● Poacher(s), ● Middleman	● Processed Skin	● Encourage citizens to report trade in skins or offers of illicit material, particularly in areas associated with wildlife-linked poverty alleviation programs. ● Investigations to identify the trader/buyer identity.	● Where do the sales typically take place? ● What factor(s) influence the sale location? ● How much do middlemen pay for skins and what factors influence that?
Transport (2)	● Middleman transports skin to the end-user.	● From purchase location to community of middleman or end-user.	● Middleman	● Processed Skin	● If vehicles are used to transport product set up random roadblocks, potentially using conservation working dogs along key routes, particularly during periods of high demand. ● Combination of overt/covert checks to identify cars turning around before check-points. ● Establish list of suspicious vehicles involved in wildlife product movement.	● What factors influence the sale location? ● What modes of transport are used? ● Are skins transported at particular times of the day? ● Do they bypass main roads? ● How are they typically contained?

Stage	Steps and options	Spatial	Temporal	People	Interventions	Knowledge gaps
Sell (2)	● Middleman sells skin to end-user.	● Unknown could be poacher's, middleman's or end-user's community. Money may be sent before the skin is transferred, or middleman and consumer meet to finalise the transaction.	● Middleman, ● End-user	● Processed Skin	● Demand-reduction program led by cultural leadership to provide alternative - highly realistic synthetic furs. Behavioral change campaign to promote the project and highlight the plight of leopards and the importance of conserving culture and natural heritage. ● Increase deterrent for selling/procuring an authentic leopard skin without a permit –including awareness campaigns highlighting successful convictions.	● How much do end-users pay for skins? ● What factors influence the price? ● Will the elimination of a market (i.e., the Lozi) reduce targeted poaching or will poachers and middlemen find alternative markets? ● What impact will the demand-reduction programme have on the price of skins?
Wear	● Final consumer wears fur in Kuomboka and other traditional ceremonies.	● Zambezi flood plains	● End-user	● Processed Skin	● Support cultural leadership in their efforts to encourage the use of "Heritage Furs" and discourage, limit or prohibit the use of authentic skins at ceremonies (e.g., through behavioral change campaigns). ● Support cultural leadership to make the paddler selection process less reliant on applicants needing to possess their own wild cat skins. ● Regular monitoring of authentic skins displayed in public ceremonies.	● What can be done to make the "Heritage Furs" more desirable to paddlers?
Store	● Final consumer stores fur until it is used again.	● Final consumer's home	● End-user	● Processed Skin	● Work with owners of authentic skins that are permitted to wear them in public to improve storage methods to increase their longevity. ● Centralized storage of "Heritage Furs" to ensure the safekeeping of garments. ● Improve storage methods and facilities to increase longevity and sustainability of the "Heritage Furs" intervention.	● How long do authentic skins typically last? How are they cured? ● How and where are they stored? ● How many authentic skins to paddlers own? ● Would a tan-cure assist with increasing their longevity?

Discussion

It is hoped that the pioneering conservation role played by both the Barotse Royal Establishment in Zambia and the Shembe Church in South Africa in actively seeking innovative solutions to address declining wild cat populations will significantly reduce demand for leopard, serval, cheetah and lion skins amongst their Peoples. Moreover, it is hoped that the actions of these cultural ambassadors catalyze other groups of wild cat skin users to pursue similar approaches. The introduction of "Heritage Furs" in 2019 and the subsequent public announcement by the Lozi hierarchy that only synthetic skins will be worn during future ceremonies is a profound development for conservation in Zambia. It also represents a proactive, sustainable and culturally sensitive approach to crime prevention in landscapes which are often financially impoverished and where law enforcement resources are limited.[9] Although initial interviews with Lozi paddlers were generally positive concerning the introduction of the new garments, many stated that they still prefer authentic skins to synthetic alternatives. It is anticipated that: 1) improvements in garment design made in response to feedback from the interviews and further consultation with the Lozi hierarchy, coupled with 2) comprehensive sensitization and awareness campaigns and 3) the declaration by the Lozi hierarchy concerning the use of "Heritage Furs", will significantly reduce the desirability of, and demand for, authentic wild cat skins. What remains to be seen is whether this intervention and concomitant reduction in demand for skins among the Lozi reduces pressure on source populations or whether poachers that have historically supplied the Lozi will continue to harvest leopard skins (either through targeted means or opportunistically) and seek alternative markets, either locally or internationally, to sell their products.

Preliminary data collected to date indicates that the demand for leopard skins among the Lozi, although not comparable with that of the Shembe, is nevertheless significant and has the potential to have serious consequences for regional leopard populations. This wildlife crime script is based on preliminary research that is limited by a small sample size. As such considerable research still needs to be conducted, including interviews with poachers and traders, to fill our knowledge gaps. These include our understanding of the modus operandi of poachers and trafficking networks, the structure of trafficking networks, identification of key leopard source populations (e.g. through DNA assignment techniques) and trafficking routes, the motivation of and opportunities available to actors involved in the trade (e.g., economic drivers or maintenance of cultural values) and market dynamics (e.g., pricing structures of illicit wild cat products).

The efforts to tackle the issue outlined above have focused primarily on reducing the demand for leopard skins. In appropriate circumstances, demand-reduction can be an effective tool in mitigating the unsustainable and illegal poaching and trafficking of wildlife.[10] Not only does it have the potential to address the key drivers of trade, but it can facilitate more effective implementation of other approaches by reducing illegal behavior to manageable levels.[10] By filling key information gaps identified through the wildlife crime scripting process, conservation practitioners can develop complementary interventions that disrupt other stages of the wildlife crime chain not specifically targeted or impacted by the demand-reduction component. Complementary approaches implemented at scale to help reduce reliance on the illicit wildlife trade economy may include community-based natural resource management (CBNRM) projects, targeted alternative livelihood projects and incentive-oriented schemes that help to alleviate poverty in local rural areas by providing payments linked to conservation outcomes.[11] Deterrent mechanisms may also be employed to target particular stages of the criminal process.[7] These mechanisms may include improved information-led law enforcement targeting the poaching modus operandi at key source sites, improved conviction and sentencing of actors who continue to engage in illicit activities (e.g., those supplying alternative markets) and behavioral change campaigns highlighting the importance of wildlife and the risks associated with involvement in the illegal wildlife trade.

Developing and implementing effective interventions to prevent wildlife crime are typically predicated on having an in-depth knowledge of the offender's modus operandi and the drivers behind the illegal activity, including the demand for particular wildlife products. The poaching of an animal, in this case a leopard, is just one event in a series of steps involved in the illegal trade of a wildlife product. Through the process of wildlife crime scripting, we have conducted a preliminary analysis of the trade in leopard skins for use in ceremonial attire by Lozi paddlers in Zambia in an effort towards developing a holistic strategy to disrupt the entire criminal process by removing opportunity, motivation and incentive.

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III
African grey parrot poaching and trafficking, Democratic Republic of the Congo

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Problem description

African Grey Parrots (AGPs) (*Psittacus erithacus*) are native to 21 African countries.[1] This includes the Democratic Republic of the Congo (DRC), which had been the primary exporter of this species when international trade was legal.[1,2] AGPs were one of the most traded bird species on Appendix II of the Convention on International Trade in Endangered Species (CITES), with net exports of 1,335,822 wild sourced Psittacus parrots between 1975 and 2016.[3,a] However, with an estimated mortality rate of 40-60% from capture to export, the number of birds taken from the wild may have been as high as 2 million.[4] That figure could be exceeded when accounting for the misreporting of wild specimens as captive bred, unreported illegal trade, and domestic demand.[1]

Due to fears of population decline and local extinctions across its range, in 2016 at the Seventeenth meeting of the Conference of the Parties to CITES (CoP17) the grey parrot was uplisted to Appendix I, effective as of 2nd January 2017, which prohibits all of the commercial trade in wild specimens.[5,6] However, an investigation by World Animal Protection conducted from 2017 to 2018 demonstrated how criminals continued to source AGPs from eastern DRC for international clients. The grey parrots were laundered via legal consignments of green parrots and exported using global airlines.[7] The poor welfare suffered by such highly sentient animals was also documented in detail, from stressful and potentially injurious capture to storage and export in cramped aviaries and crates.[8] This script outlines this prohibited *international* trade and identifies tangible points of intervention in an illegal supply chain that spans a difficult operating environment.[9,b]

A note on legality and terminology

Researchers were told that in the DRC, AGPs in restricted areas can be caught legally for domestic consumption provided there is a permit and it is the hunting season. No permits had however been requested of the relevant authorities. It was therefore unclear – if not unlikely - whether the trappers in the script had the necessary paperwork, or if quotas were respected given information that large numbers of AGPs were being sourced. The permit system itself remains unclear, being both seasonal and regional, and with permits required for capture, registration of origin (within 15 days from capture), ownership, approval to trade and CITES export (inapplicable due to the suspension talked about below). Additionally, trappers stated that the AGPs were sourced for international clients or at least for onward sale to Kinshasa.

Furthermore, while the international export of wild-sourced AGPs out of the DRC is non-compliant with CITES, it may not be illegal in the countries that make up the supply chain, such as the DRC, if they have not passed legislation that is consistent with the implementation of the convention. Following the CITES Appendix I listing, uncertainty arose over the DRC's reservation to the listing. Exporters were unsure if the pre-existing suspension on trade in AGPs with the DRC would remain in effect, or how this was affected by the reservation. In response, the CITES Secretariat issued a notification reminding Parties that the suspension on AGP exports from the DRC, implemented prior to their listing on Appendix I, remained effective.[10] The notification also informs Parties that the DRC announced that it will not implement its reservation on the listing of the species on Appendix I.

Given the complex local laws, unlikelihood that all required permits were obtained and uncertainty over applicable legal terminology, this script will refer to the practices documented as being part of the illegal wildlife trade (IWT). This, as Phelps et al. have stated, is "characterized by actions that contravene stated environmental regulations, including government legislation, rules governing private/community resource- holder rights, and/or international agreements (e.g. CITES)".[9] While collection may be legal (hunting) or illegal (poaching) depending on the documentation and non-compliance with CITES is not by definition in contravention of national law, the international commercial trade in AGPs contravenes DRC's commitment to CITES. More generally, crime scripts will inherently include non-illegal acts that may nevertheless provide effective intervention points that do not necessarily include law enforcement.

[a] This figure likely includes re-exports from non-range states.

[b] This paper does not focus on AGP harvesting for domestic consumption within the DRC, some of which is permitted according to DRC regulations.

Information sources

These crime scripts were developed from semi-structured interviews and participant observations conducted between May to December 2018. Attempting to follow the AGP's (the 'product' in this crime script) from collection to export, researchers first began remote scoping in the region around Walikale town, North Kivu Province, which laid the groundwork for field trips in June, August and September 2018 to interview parrot hunters.

From September 2018 onwards, trips focused on two DRC trading hubs:

- Firstly, Kisangani, in the country's east, where middlemen collect parrots from hunters in the surrounding villages, such as Ubundu, and as far afield as Walikale, according to local conservation organizations. They then send them across the DRC to its capital, Kinshasa. Field trips were conducted in Kisangani in September, October and November 2018.
- Secondly, Kinshasa itself, is where exporters and officials hold and export parrots. As a network of sources had been built across the region for previous projects, this was used to identify individuals in Kinshasa who order parrots from Eastern Congo and illegally export them to international clients, with fieldwork following in September and December 2018.

To capture information on the supply and demand dynamics of the trade, enquiries focused on the methods used to hunt or poach, hold and transport African grey parrots across the DRC, and smuggle them to global clients. Interviews were conducted with hunters and their associates (n = 4), middlemen and traffickers (n = 5), and government and enforcement officials (n = 5).

The sample was identified through various methods. Broadly, researchers were guided by recommendations from sources and partners in the region, and when in the field researchers proactively identified further sources through participant observation. From this followed snowball sampling. Researchers then assessed the reliability of the sources and triangulated the information that had been divulged, attempting to corroborate information acquired across the different stages of the supply chain.

Crime process and scripts

The crime process described here, captures the wildlife crime continuum from collection to international trafficking. This is a highly interdependent process, especially since it is facilitated by middlemen maintaining close relationships with all the other actors involved. Moreover, parrots are mostly thought to be "caught to order", so that the hunter is effectively sprung into action as a customer places an order with the middleman. For the sake of presentation, the description of this continuum is split into two separate scripts. A hunting or poaching script describes the actions of the trappers in extracting parrots from the wild. The second script describes the actions of the middlemen, when going from an incoming order to international trafficking from Kinshasa airport. Since the route from poaching site to Kinshasa airport involves multiple legs and holding sites, this script is split into three sections. This includes a general section applicable to both the main holding cities of Kisangani and Kinshasa, as well as individual sections relating specifically to either Kisangani and Kinshasa – based on available knowledge.

Trapping

Trapping may be a legal hunt or illegal poaching activity resulting in the capture of live parrots. The people collecting them are largely local to the area, living in the rural communities. Operations are often set up around swampy areas called Idos, which allegedly attract parrots. Families owning the land on which Ido's are situated are often involved in the trapping process, either directly as hunters or indirectly by accepting money from hunters. Hunting parties vary in size but may consist of four to five people, including men, women and children of a family – with climbing skills being an important requirement. It is reported these groups may disguise themselves as firewood collection parties.

The parrots are caught to order, with requests coming in through traffickers based in Kinshasa and Kisangani acting as middlemen between trapper and buyer (see second script). Sources stated that the hunting season closes in August for three months and re-opens in October or November. However, the capture of AGP's appears to be most common at the end of July and start of September, and trappers claim to collect the ordered stock within two weeks of the order saying they can obtain 100 to 300 birds a week (a number dependent on the season). Adult or near-adult birds are thought to be the main target, and it is believed that this at least partly determines the trapping (poaching) seasons as younger parrots are mature enough by September.[c] Birds that are too young suffer too great a risk of dying. Middlemen may process or hold any number of parrots - ranging from 100 to 800 at a time, but according to testimony gathered in this investigation international exports are thought to carry around 200 birds per flight.

To collect AGP's, trappers first acquire or make a natural glue produced from local herbs.[d] Decoy birds, bait, wire snares or ground nets may also be used, but glue or a variant thereof appears to be the most common method, not only for AGP's but also other bird species being targeted. The glue is at times prepared at night just before the operation starts. The product needs to be boiled over a fire to function as an adhesive. It is then applied, possibly with feathers, to branches of trees that parrots flock to, or to broomsticks brought by the trappers. These flocks are attracted using food or by tying a live parrot to the glue trap, knowing that AGP's are highly social and will come to investigate distress calls that this parrot will emit given high stress levels, rough handling and potential injury.[e] The entire activity may take between one to five hours depending on the size of the trees, which determines the difficulty of setting up the operations. This is also why strong climbers are required, as parrots look for tall trees.

Such trapping sites are prepared at night, possibly well in advance of parrots becoming active. Hunters can either remain on site or return in the morning as parrots become active between 6AM and 10AM, when they will warm up in the sun. This is when hunters will try to trap them: incoming birds will get stuck to the trap or fall to the ground because of it. Hunters retrieve parrots from the tree or collect them off the ground, pulling the glued sticks from their wings and cleaning their feathers before putting them in baskets. For trade, the parrots must be healthy and without defect to their eyes, beaks or claws but unfit birds can be used as lures, for meat, traditional belief-based use, or onward sale. At this point the birds are taken back to the village in baskets, where they are held until transport to the intermediate location (see second script).

Trappers and middlemen train other trappers in these methods in the forest, and researchers were informed even buyers – serving as middlemen in the eastern regions - may organize for experienced hunters to train locals. Opportunistic hunting of AGP's also occurs as by-catch of for example green doves, which are caught using the same methods but are eaten and not sold for the pet trade.

When the birds are being transported or held in holding facilities, trappers and middlemen can be targeted by police for not having the correct permits, but bribes can help avoid arrest or secure a quick release. The permit system in question is not entirely clear and may involve regional permits for capture and keeping of the parrots. The legality of the trapping not only rests on having a permit, but also on whether it is the correct one for the season, region, time of day, methods used and number of animals taken, etc. This needs to be understood by enforcement officials to be able to act,

[c] In other areas, chicks are also targeted in the nest.

[d] There was one reference to the glue being produced from local herbs acting like "a hevea rubber". It is therefore unclear whether the glue is something akin to Hevea brasiliensis Latex, a liquid secreted by a rubber tree which may be present in the DRC, or if it is a substance with similar properties. http://www.factfish.com/statistic-country/congo%2C%20democratic%20republic%20of%20the/natural%20rubber%2C%20production%20quantity

[e] It is likely that this lure bird will be used in this way repeatedly, with a significant negative impact on its welfare.

and the legality of acquisition is also relevant to CITES. Fraudulent export permits to facilitate international export that is illegal under all circumstances may also be involved. This indicates that corruption plays an important role, and domestic protection status is unclear.

Trafficking

Middlemen are responsible for either moving birds across locations in the DRC or exporting them out of the country. They liaise between (inter)national buyers and the local trappers, actively preventing direct contact between the two to secure their own position in the process, but also because of the difficulty of accessing trappers in remote areas. These contacts rely strongly on local reputation and established relationships between hunters and middlemen as well as middlemen and security and airport personnel. Through these built relationships, the involved actors know where to find each other – both in rural communities and in specific areas in cities like Kisangani, including markets and places of worship. Orders for AGP's, or any other animal, are placed with the middleman who then contacts the trapper to relay the order.

After the hunting or poaching events, parrots are initially held in the trapper's village. Because of high costs associated with care of the birds, which need a diet of raw groundnuts, seeds, palm, sugarcane, maize and peanuts, they are kept in these villages for as short a time as possible. From the village, the AGPs endure a stressful journey of up to 75 km to rural holding facilities such as Ubundu, transported by hunters in packed wooden crates, boxes or baskets. If they survive, they then go via motor boats (called pirogues) and motorbikes to Kisangani, either to holding facilities or directly to the airport to be forwarded on to Kinshasa, from where international trade is conducted. The middlemen are generally responsible for the transports, even collecting them from the trapper's villages. Wild birds are loud and conspicuous especially when in noisy surroundings, so during these ground transports bribes may need to be paid at checkpoints - for instance to the security forces guarding embarkation locations along the river. Transports mostly take place just after midnight. Once in a holding facility, security forces may also target the middlemen to extort bribes.

The rural holding facilities in places like Ubundu may keep up to a thousand birds, but again because of expenses and attention these wild birds will attract they are held only for a short time, which is why they are poached and held to order. In Kisangani, different numbers of AGPs are said to be kept in wooden infrastructures, some in homes, with thirty, sixty and a hundred being referenced. Unhealthy birds may be kept in quarantine areas. An important note here is the figures: one would expect holding facilities in Kisangani to in fact have larger parrot stocks as they are further along the trafficking chain.

From Kisangani, birds are commonly sold and transported to Kinshasa, to a local buyer or en-route to an international buyer. Trial runs with smaller numbers of parrots may be conducted to show to the buyer that the middleman can be trusted. Transport from Kisangani to Kinshasa is by plane, and allegedly facilitated by corruption to help board the parrots onto planes. Birds are transported in cases with 100, 300 or 500 individuals at a time. Specific aviation companies, especially cargo transporters, are allegedly involved. At the time of research, cargo airliners had irregular flights and no set schedule. While luggage needs to be checked, extreme certainty about illegal cargo is needed for Kisangani airport chiefs to ground a plane.

In Kinshasa the parrots are kept in large holding facilities, with aviaries known to have housed 700 birds. Many other animals are kept in these facilities as well, under very poor conditions. From here the birds are shipped to international buyers, possibly similar to the domestic flight, in 30cm x 45cm x 80cm crates, each total shipment around 200 birds. Traffickers hide AGP's among green parrots which are legally traded and use green gauze or mesh in the crates to make greys appear green and

thus AGP's harder to distinguish. Paperwork is provided with the shipment to fraudulently claim that it consists solely of green parrots.[f]

It is not fully clear what the wildlife exporters in Kinshasa, who are responsible for ordering AGPs from the bush and holding them in Kinshasa, are responsible for in the illegal export of the parrots, nor what is included in the price they charge their customers. The exporter would take care of the paperwork like permits and veterinary checks, but cages, transportation and "formalities" with customs would be extra or the client's responsibility. However, like allegedly corrupt security officials, legal exporters made it clear they had established and useful relationships with customs and air cargo staff. One, for example, had a son in the military who helped in overcoming any barriers to his operations.

Military or security personnel at the airport are bribed to facilitate the illegal international transport of AGPs. They volunteer to meet with customs and airline staff and, crucially, freight handlers who are known by name. The birds are either boarded under the cover of a legal shipment (like the green parrots), or smuggled onto the plane at an opportune time, when airport personnel are either absent or bribed. Airline staff must also be co-opted.

In all situations, the process relies strongly on established relationships of the middlemen/exporters with customs, airport, security and airline staff, and customers are largely responsible for arrangements in the receiving country.

A popular destination from Kinshasa is Istanbul, because traffickers prefer direct flights to keep down costs and reduce scrutiny from customs, and at the time of research allegedly had infrastructure in place regarding a major airline on this route. However, multiple airlines were referenced by subjects as possible to use for export. Given the general importance of the Middle East as a transit and consumer region, airlines serving it as well as those with extensive operations in Africa were most vulnerable to being exploited by traffickers. There is also mention of buyers retrieving the parrots from the middlemen themselves in Kinshasa, as their being late was a noted reason for parrots dying at this stage in the process.

[f] The DRC quota for P gulielmi, the green parrot, was reduced in 2019 down to 450 from 3000 in 2017. As a result, this 'loophole' may now be harder to utilise. It is still likely that traffickers will exploit confusion and lack of awareness in this area on the part of customs officials. https://speciesplus.net/#/taxon_concepts/3893/legal

SCRIPT 1: African Grey Parrot hunting and poaching, Democratic Republic of the Congo					
Stage	**Steps and options**	**Spatial**	**Temporal**	**People**	**Interventions**
Preparation	● Trapper receives order from middleman. ● Recruit co-offenders. ● Secure storage cage ● Make or acquire natural glue through boiling, requires ingredients, pot and fire on site. ● Procure lure bird, or bird statue. ● Acquire food for parrots (maize, peanuts). ● Acquire holding basket, (broom)sticks and quiver, rope, and head/large torches. ● Identify suitable location.	● Trappers are locals in rural communities. ● Middlemen are generally based in cities. ● Trapping groups are families or friends. Parties of around 5 people, including children. ● Glue made in the village. ● Feed purchased locally. ● Lure birds kept locally or in village. ● Trapping sites include Idos, tall trees.	● Caught to order, no fixed schedule (but more common July-September) ● Glue boiled at night before poaching.	● Trapper (aka hunter or poacher). ● Wider family / co-offenders ● Middleman ● Buyer who contacted middle man (see script 2) ● Shop keepers / market sellers	● Identify grey parrot feathers, food, sounds, storage cages and other signs of their being kept, in village. ● Identify individuals going into bush with parrot catching equipment, or as firewood collection groups, set up systems of legal firewood collection or alternative firewood sources. Law enforcement to address illegal firewood collection (broken windows). ● Identify equipment kept in village huts. ● Map distribution of grey parrot attractants (e.g. idos). ● Map access points to trapping sites. ● Cooperate with landowners to prevent access to attractants like Idos: information campaign about parrots and consequences of hunting and poaching, set up alternative livelihood programs to disincentivize trapping or accepting money from poaching groups, receive information about poachers who approach these landowners in return. ● Contact potential suspects of poaching in a “eyes on you” campaign ● Information campaigns around bushmeat and green dove poaching, to prevent bycatch. Provide alternative meat sources. ● Set up hotline for people to report holding facilities. ● Focus law enforcement patrols to parrot attractants, access points and holding locations in villages. ● Monitor access points and attractants using wildlife cameras or ambush patrols.
					Information gaps ● Investigate the glue and equipment needed to make it. ● Investigate where ingredients/sources of glue are to be found. ● Investigate where complex parrot diet is sourced from. ● Understand how birds are cleaned and what is used.
Pre-activity	● Await suitable time for trapping. ● Walk to capture site. ● Make & set trap: smear glue, place food, set up lure bird, install snare or nets. ● Take positions and wait for birds to stick. ● Cause lure bird to make noises.	● Trapping site (privately owned land with poorly defined ownership rights). ● Wait in or around tree.	● Traps prepared around midnight.	● Trapper ● Accomplices	● Address men and families (women and children) loitering in the vicinity of potential trapping sites, and those around existing traps. ● Identify men exiting and entering the village at the designated times. ● Identify trees used by trappers, as traps and climbers may be visible and some trunks have ropes attached. ● Identify well-worn paths used to go into forest. ●Focus law enforcement patrols at evening and morning times when traps are set up and when parrots become active. ● Identify and respond to distress calls of AGP’s.

Stage	Steps and options	Spatial	Temporal	People	Interventions
Activity	● Collect birds from tree or ground, or send them down by rope to ground level. ● Remove sticks / glue from feathers. ● Store birds in baskets.	● Trapping site	● Trapping between 6AM and 10AM	● Trapper ● Accomplices	● Identify and respond to distress calls of AGP's. ● Identify and respond to noticeable flocks of birds descending. ● Identify ropes used to send birds and sticks back down to ground level. ● Identify baskets. ● Look out for men and families (women and children) in the vicinity. of the traps, with baskets, handling birds and removing glued-up sticks.
Post-activity	● Exit from area. ● Pay landowner, amount depends on catch. ● Bribes in case of arrest. ● Carry birds back to village. ● Place and keep in storage cage. ● Contact middle man. ● Provide to middle man.	● Trapping site access route ● Local village	● Exit after 10am	● Trapper ● Wider accomplices ● Landowner ● Police ● Middleman	● Identify individuals with equipment, feathers, food, basket and parrots (possibly noisy). ● Identify outsiders in village, talk to village elders. ● Identify holding structure / storage cage.

SCRIPT 2: Middleman actions and international trafficking of AGP's from Democratic Republic of the Congo					
General					
Stages	**Steps and options**	**Spatial**	**Temporal**	**People**	**Interventions**
Preparation	● Receive order and money from customer. ● Identify and approach trappers. ● Arrange the order with the trappers.	● Poachers based in rural areas, meeting can take place in Kisangani markets or places of worship. ● All locations need holding facilities: rural towns, Kisangani, Kinshasa.	● As orders come in.	● Customer ● Middlemen ● Trapper ● Reps of customer ● 'Associates' connecting middlemen & trappers	● Understand middlemen and financial incentives, set up information campaigns and alternative livelihood programs. ● Potentially turn associates into source network, to notify counter-trafficking actors when an order is made. This can then determine when trapping and export might happen to give greater direction to enforcement.
Pre-activity	● Secure holding facilities ● Acquire food for parrots ● Identify and confirm cooperation of customs / security staff (see Kinshasa section). ● Select domestic and international flights. ● Bribe relevant customs chief at the airports. ● Organize permits: veterinary status, regional collection, taxes and green parrot international trade permit. ● Obtain and prepare crates with green gauze to hold parrots during flights.	● Local markets ● Cooperation and bribes needed for domestic (Kisangani) and international (Kinshasa) flights.		● Middlemen ● Airlines, airport and customs personnel. ● Permits organized with regional and national governmental agencies.	● Identify holding facilities in rural towns, Kisangani and Kinshasa through structures, people's behavior patterns and noise of large number of parrots. Many other animals are held here as well. ● Recruit market salesmen as informants. ● Rotate airport personnel to avoid establishing corrupt relationships. ● Information campaign targeting government workers to disrupt 'green parrot' and other relevant loopholes / concealment methods. ● Set up hotline for people to report holding facilities. ● Require certified personnel to be present at packing sites to confirm AGPs are not being laundered into shipments of other products or species. ● Work with zoning bodies to revoke license of building being misused for wildlife storage/trade.

To and from Kisangani					
Stages	**Steps and options**	**Spatial**	**Temporal**	**People**	**Interventions**
Activity	● Collect or receive parrots from trapper's village or rural holdings. ● Pay bribes along the route, show regional collection permits. ● Hold parrots in Kisangani or transport directly to Kisangani airport. ● Board AGP's on domestic flight from Kisangani to Kinshasa (using bribes and/or permits for green parrots or other useful product).	● Rural villages, travelling by motorbike and boat. ● Kisangani holding facilities. ● Kisangani airport	● One group confirmed transport between midnight and 1AM. ● Parrots held as briefly as possible.	● Trapper ● Middlemen ● Security staff (e.g. boat docks) ● Kisangani airport/airline staff.	● Rotate security personnel to avoid establishing corrupt relationships. ● Focus law enforcement on travel routes between known villages and Kisangani, targeting roads and river crossings. ● Brief customs personnel on methods used to conceal AGP's. ● Inspect all or random selection of green parrot freights. ● Cancel export permits, and blacklist those who are caught laundering.
To and from Kinshasa					
Pre-activity	● Collect or receive AGP's and green parrots from Kinshasa airport staff of domestic flight. ● Directly liaise with, or have associates approach, security, customs and airline staff, and freight handlers at airport to negotiate smuggling birds through airport. ● Bribe relevant people. ● Select airline flight with direct connection. ● Hold AGP's in Kinshasa facilities. ● Move at night, at opportune time.	● Kinshasa airport ● Kinshasa holding facilities.		● Relies on well established relationships with all officials involved. ● Middlemen ● Airline, airport, customs personnel. ● Worker in holding facility to feed parrots (may be children). ● Local personnel live in compound. ● Airline freight handlers, who pay bribes to relevant customs, including 'Customs Chief'. ● Chief of freight, or cargo manager. ● Military or security personnel.	● Identify holding facilities within city (corrugated iron, wire mesh, wooden frame, aviaries, slightly separated from other buildings), where lots of animals are held which means various conspicuous identifiers may be present. Possibly request information on building permits and legal wildlife traders to identify potential facilities.[g] ● Rotate airport and security staff to prevent establishing corrupt relationships. ● Change enforcement protocols, to not depend on strong suspicion to ground a plane, but instead allow crates to be removed/held back from a flight when mild suspicion arises.

[g] For more information on relevant actors, i.e. legal wildlife traders and government agencies, please contact author.

Stages	Steps and options	Spatial	Temporal	People	Interventions
Activity	● Meet facilitators at the airport. ● Undergo potential cargo checks (relies partly on green parrots and partly on corrupt relations). ● Board AGP's on international flight from Kinshasa to destination (using bribes and/or green parrot permits).	● Kinshasa airport ● Kinshasa holding facilities.	● ~ Two weeks after order initially placed. ● Timed with international flights, Istanbul as common destination. ● Move contraband at specific times, i.e. when custom officials are on break.	● Middlemen ● Airport staff ● Airline staff ● Customs personnel ● Freight handlers ● Security/military personnel	● Brief customs personnel on methods used to conceal AGP's (i.e. green parrots). ● Check flight cargo. ● Inspect all legal green parrot, or alternative, freights for presence of AGP's (given a reduction in this loophole's use, a replacement may have been found as part of displacement activity). ● Assess International Air Transport Association (IATA) guidelines and other welfare legislation, including at the national level, for breaches that would prevent the shipment. ● Request information on green parrot permits being granted and green parrot freights being boarded from relevant authorities. Triangulate information with green parrot numbers in the wild, green parrot import numbers from demand countries and green parrot demand on open markets.
General					
Post-activity	● Finalize deal with recipient (customer or illegal trader) ● Share gains	● Online ● Kinshasa		● Poachers ● Customers ● Middlemen	● Attempt to determine the route taken by AGPs and to identify customers, either through sources or online monitoring in case social media is used. Liaise with relevant international enforcement and keep intelligence for future interventions.

Discussion

Due to the difficult operating environment in the DRC, questions about various steps in the crime process remain. To better understand the dynamics of both collection and trade, it is important to understand how markets have or have not changed in response to the CITES uplisting of AGPs. Questions to answer include whether demand for wild-caught animals has changed in various historic demand markets, whether some of the poaching opportunities are new phenomena in response to the ban and how formerly legal sellers have dealt with these changes. Further, the wider context of the trapping sites needs to be better understood. The ownership and access rights, whether mostly privately owned or including national parks or otherwise protected areas, are important determinants of what actions can realistically be taken.

More specifically, the numbers of parrots held at different points of the illegal supply chain may be looked at, to better understand the crime facilitators at each stage. Ubundu, one of the first stops, seemingly has more poached birds in holding facilities than later stages in Kisangani and Kinshasa. This is counter-intuitive, as one would expect stock size to increase at each stage of the supply chain. It is unknown whether this is because it is less risky to have large numbers of parrots in rural areas, or whether it is easier and necessary to hide smaller numbers spread across multiple facilities in cities.

The potential for legal domestic capture of AGPs, and what is and is not permitted by season and region is not entirely clear and may cause ambiguity on the ground, which can be exploited. Similarly, how bribes may facilitate the collection and by extension (inter)national trafficking process is at least partly dependent on the permit system. A diffuse and ambiguous system may create many loopholes to be exploited, either knowingly or unknowingly. From trapping sites to transit locations and finally Kinshasa, references from multiple sources were made to enforcement insisting on payments to allow parrot stock to proceed on its way. This would at times be predicated on traders and hunters not carrying the right documentation, though what documentation is referenced remains uncertain. This, as well as either the lack of adequate welfare legislation or information on its existence, is the greatest gap in our knowledge.

There are also questions at the Kinshasa stage. More information is needed on what the middleman is responsible for, though it is the author's belief that this will depend on negotiations with each customer and is left deliberately vague. Additionally, how the birds are transported to and from the airport and holding facilities, and by who, is largely unknown. How deals between exporters and their airport connections are made, in particular where and when they meet and conduct payments, also requires further explanation.

The scope of the research was limited to the DRC. This means that future work should focus on how the Kinshasa-based exporters are approached by and conduct business with global clients. Using the estimates given by interviewees of how long it takes from an order being made to AGPs being sourced and sent to the capital, a potential timeline of illicit activity could be plotted. This would better direct and sequence counter-trafficking activity at the trapping and export stages. Interventions in the DRC are difficult to implement because the conservation and welfare of parrots will be a low priority. The sheer impracticability of enforcing regulations in remote, rural areas where there is a lack of visibility is an obstacle, and their implementation by agencies with low paid, poorly motivated and insufficiently monitored staff is another. Corruption in enforcement and customs agencies is a major block to effectively countering grey parrot trafficking.

In such an environment, one possible intervention is to identify and support those individuals and departments, in public sector and civil society actors, who are trying to do their job even when having to contend with colluding elements in their own organizations. Ground sources have confirmed that such individuals can indeed be found in select Congolese government institutions whose work in environmental protection is reported to have improved. Given the decentralization of

government in the DRC, engaging at the provincial level may prove more effective when addressing legislation and enforcement issues. Improving national and provincial legislation to prohibit trapping and make for a more unambiguous process would allow for better enforcement options. In fact, one province in the DRC instituted a ban on trapping and transporting AGPs within the province – after being made aware of the number of parrots moving through their airport and the trapping taking place in their area. Evidence suggests that the airport in question is no longer used as a major hub, but geographic displacement of crime is possible until more such steps are taken.2,11

Non-governmental organizations based in-country with a wealth of local knowledge and contacts can also be engaged. Interventions that they could assist in implementing are those surrounding the socio-economic and awareness factors, as well as the need for improved policy and legislation. Situational crime prevention tactics, e.g. to disrupt corrupt networks and improve security operations, requires well-intended individuals in possibly harder to reach organizations.[h]
A focus should be to stop AGP's being loaded on to international flights as, due to poor welfare and potentially high mortality rates in transit and the difficulties of repatriation, it is often too late for them once they have left the DRC. Improved intelligence gathering and sharing between interested parties must be coordinated with more rigorous shipment inspection. As above, given the complexity of the process, close collaboration would be necessary between airlines, airport authorities, government ministries, customs, enforcement and security agencies, civil society and the designated CITES Management Authority. This also ensures that no individual stakeholder can easily avoid their responsibilities given commitments to their partners.

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[h] For more information on relevant actors to work with on the ground, i.e. non-government organisations, please contact author.

IV

Bushmeat Hunting with Wheel Traps and Wire Snares in Rubirizi, Queen Elizabeth National Park, Uganda

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Problem description

Queen Elizabeth National Park (QENP), covering a total area of 1978 km^2 is one of Uganda's ten national parks and home to a wide variety of wildlife. A large number of species are targeted for bushmeat inside the park, including the hippopotamus (hereafter hippo), buffalo, antelope, kob, warthog, giant forest hog and reedbuck. Bushmeat is defined as meat from wild animals that have been hunted illegally, either for personal consumption or commercial trade.[1] Wildlife is also targeted for non-food uses such as traditional medicine, household raw materials for making ornaments, cultural practices such as witchcraft, skins for traditionalists, and to protect people's gardens from damage.

QENP park spans the districts of Rubirizi, Kasese, Rukingiri, and Kamwenge in Uganda. This script focuses on bushmeat poaching using wheel traps and wire snares in Rubirizi, a thriving practice and one of the main threats to wildlife in QENP. Other threats include a rapidly growing human population which can also lead to human-wildlife conflicts as well as the effects of climate change on protected areas, evidenced from the ten villages in which the study was conducted.

Information sources

The crime script was developed from information collected through interviews and focus group discussions across 10 villages in Rubirizi District (see Figure 1). These are: Kicwamba, Rwandaro, Magambo, Musumba, Kafuro, Kyenzaza, Bwegiragye, Kikumbo, Nyakarambi, and Ryamatumba. A number of different actors participated, including active hunters (N=6), former hunters (N=18), conservation officials of the Uganda Wildlife Authority (N=2), local leaders (N=3), elders (N=2), retired game guards (N=2), a former licensed hunter (N=1), and a local author (N=1). The information was collected in January - February 2018 and July - August 2018 as part of a project looking at culture, organizational structure, and hierarchy in bushmeat hunting. Additionally, information from personal observations, informal conversations, and communication with several community leaders and locals living close to the protected area was part of the information gathering. These data sources were combined and triangulated to create the actor-based crime script below.

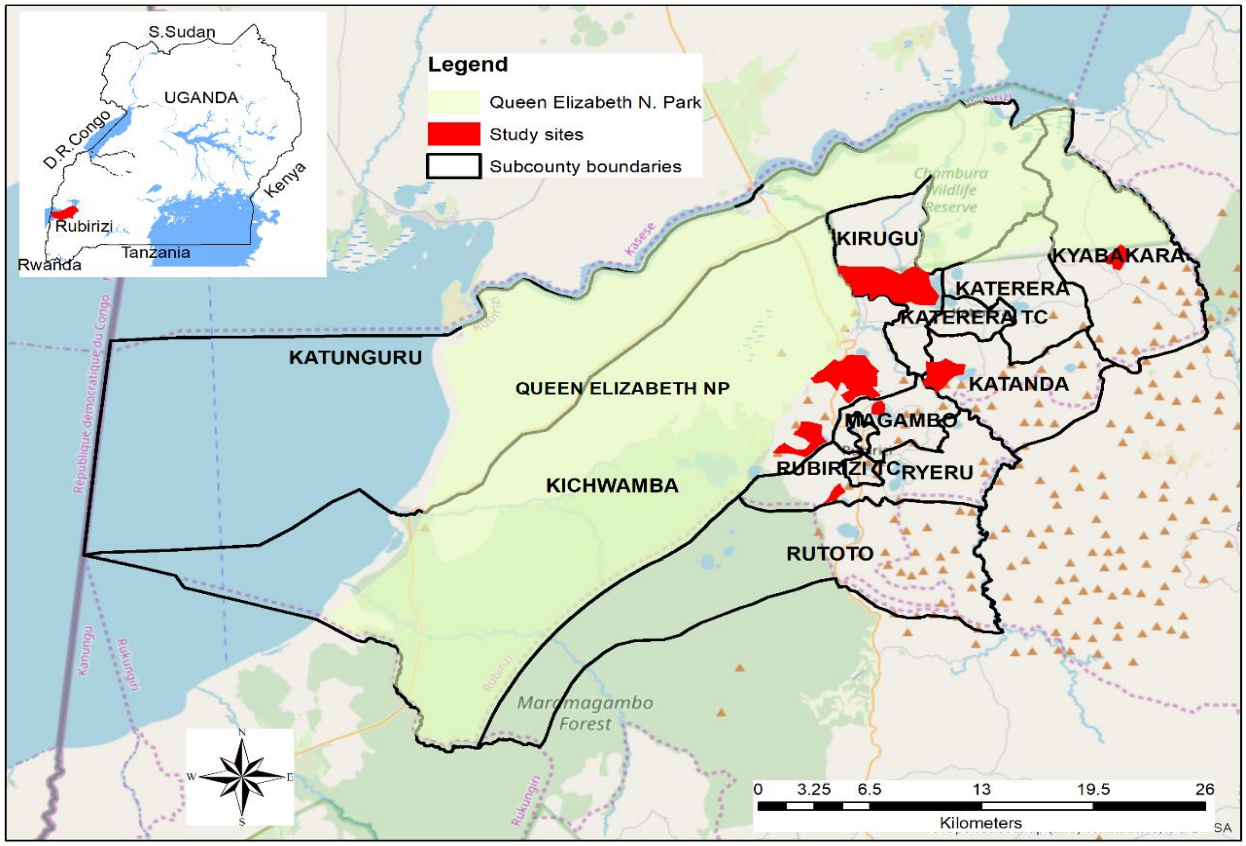

Figure 1. Map of Rubirizi district showing QENP and the study villages.

Crime process and script

The Banyaruguru were identified as the main bushmeat hunters in Rubirizi although other ethnic groups live in the district and can be interested in bushmeat. These are the Banyankore, Bakonzo, Batoro, Bakiga and Banyarwanda. Besides resource dependency, spiritual and divine factors were also identified as a driver of bushmeat hunting. Traditionally, the Banyaruguru like other ethnic groups in Uganda did not have a monotheistic religion. They believed in gods and deities such as *Muhima, Endyoka, Murari, Nyabingi, Nyaburezi, Karisa,* and *Kisokye* which they sought for peace, good harvests, rain, and child birth. Specifically, the hunting deity among the Banyaruguru is popularly referred to as *Kayigi* (among the Bakonjo, another ethnic group in Kasese and close to the park, the hunting god is called *Nyabibwya*[2]). According to respondents, these deities can be inherited (passed from one generation to another) or purchased through a process that involves certain ritual practices. For those possessing the hunting deity, before a hunter enters the park a deity is consulted and briefed on the intended mission in order to get guidance, blessings and protection. As one hunter stated: '*You inform the deity of the reasons why you are going to the park, pick your hunting materials and set off. When you return, you have to inform the gods and thank them'.* There are views that the deity is believed to push those who possess it to hunt, guides hunters on how to enter the park, paths to follow, how to avoid detection, and sends signals in case of danger.

Cultural factors also emerged as drivers of bushmeat hunting according to respondents. Beliefs around bushmeat taste, increasing energy and boosting fertility among women were also common in the study area. Hippo meat is a delicacy and nicknamed *kinywani kya bwita*, meaning 'companion of millet/cassava bread'. Respondents opined that bushmeat is savory, organic and healthy. The hippo and buffalo, according to respondent accounts, have bitter offals rumored to be medicinal since these animals feed on natural shrubs. Respondents mentioned that wild animals by nature are not vaccinated but survive in the wild, feeding on medicinal shrubs such as *omubirizi, orutonzi* and *ikombo*. Thus, eating such meat is believed to be medicinal. According to respondents, wild animals

are born in the wild, eat wild shrubs, drink from natural waterholes and therefore have pure meat. As one conservation officer explained: '*There are many Ugandans who believe that bushmeat is sweeter. As a result, others have placed themselves in a position to supply and meet this demand'.* Non-food uses for wildlife were also described when respondents for example mentioned lion skins worn as amulets and animal parts used for local surgery and treatment of ailments.

Three types of actors can be identified in the area, namely hunters, transporters and those in support roles that facilitate hunting and trading. Hunters track, trap, kill, skin, and carry bushmeat up to exit points. Transporters can be family members or friends that meet hunters at agreed park exit points to help carry the meat (a practice traditionally known as *okuchamiliza*) or motorcycle/car drivers that transport bushmeat to the villages. Finally, support roles are filled by women who have indirect roles that reinforce the practice of hunting, for example preparing food (*entanda*) for the poachers and in the distribution or sale of meat mostly via word of mouth.

A hunting party starts with a lead hunter who initiates the idea, pitches it to others in his loose network via word of mouth and recruits co-offenders in most cases friends and peers. Based on the years spent hunting, seniority, or for example knowledge of the park, tasks are divided. The lead hunter of a group of 4-8 is usually experienced, understands the park well and can lead others. Others in the group include those skilled at setting wheel traps and wire snares, those good at spearing and blowing a sudden death and those skilled at skinning animals. All hunters are usually locals living in close proximity to the park, predominantly male, illiterate or semi-literate and in the age range of 16-45. Although there was no specific hunting season, there were concurring views that festive seasons (Easter and Christmas) were good for hunting since it is assumed that locals have money.

To enter the park, hunters agree on a meeting point which can be near the home of one of the group members, or in coffee or banana plantations near the protected area. Blurred park boundaries allow them to sneak into the park. The cover of night and early morning hours before dawn were identified by respondents as the best time to enter and vacate the park. Hunting areas are selected based on the animals targeted. Hunters demonstrated local knowledge of understanding animal behavior including the vegetation animals like. Once inside the park, hunters start to make measurements, digging holes/ditches, cutting sticks and setting traps. Respondents noted that setting a successful trap is rewarded with special animal meat. Hunting duration varies and is decided upon by the group. For example, they can set wheel traps and wire snares, camp inside the park for 2-5 days regularly checking on the traps. Besides hunting materials, hunting groups also carry basics into the park such as tobacco, food, safety pins, and matchsticks. Besides camping and waiting inside the park, hunters can also set the traps, exit the park and return after 2 or 3 days to check on the traps.

The interviews, observations and personal communication suggest that bushmeat hunters have agency that allows them to circumvent challenges put in their way by wildlife officials in QENP. First is their understanding of local ecology and park dynamics. Those interviewed indicated hunting has strong familial connections whereby training and induction is passed on from forefathers to children. The Banyaruguru have a long history and tradition as bushmeat hunters that dates back to pre-colonial days. In Banyaruguru culture, when a male child grew up and got married, the father, uncle or grandfather would hand them a spear, a practice locally called *okucimbira icumu*. Over the years, hunters learn how to monitor animal movement and behavior patterns by following footmarks, droppings and water sources. As a result, mature and practiced hunters are able to track, trap and kill animals with ease. Moreover, they develop skills such as using moonlight to navigate to park exit points at night, estimating the wind direction to avoid alerting animals to their presence, knowing where cellular network is available for calling transport when exiting the park, and stalking vultures to steal from predators. Trapping is done with wheel traps (mainly for hippos and buffalos) and wire snares; animals caught in these traps are killed with spears, arrows and pangas.

Secondly, the interviews also indicated disguise and concealment is crucial to successful hunting. This involves the use of codes or pseudo names to avoid detection. Common pseudo names for bushmeat identified are; '*kinywani kya bwita*' and '*kimbo mpango*' for the hippo, '*kimbo nk(y)e*' for buffalo, '*kabyoya*' for the giant forest hog, '*aka speedi*' or '*brandina*' for the warthog. Other pseudo names for bushmeat generally are '*ekinyangwe*', '*selebo*' and '*ebitekyele*'. These pseudo names are used mostly to avoid detection by wildlife informants in the villages and thus change with time. The use of codes or pseudo names is reported in other regions. For example, bushmeat extracted from Murchison Falls National Park and sold along the Kafu-Gulu highway towards northern Uganda is code named 'charcoal'. Concealment can also take place when entering and exiting the park, for example by walking in a zigzag style to disguise hunter footsteps to look as those of animals. Disguise also happens when communicating with car/motorcycle owners on the phone to conceal exit points.

Even though bushmeat hunting in Rubirizi lacks criminal sophistication, there is evidence of organizational structure and planning that includes an informal hierarchy and the negotiation of power. A level or organization is demonstrated through the ability to thrive in bushmeat hunting, concealment, disguise and evading park rangers. Hunter demonstration of how they enter the park, trace, trap, kill, skin and exit while avoiding law enforcement and dangerous animals also demonstrates this. Important to note in the hierarchical structure is the head of the hunting party/mission who forms the group and mobilizes others, owners of wire snares, those who spear trapped animals efficiently, and those who understand park dynamics and can lead others. This hierarchy is also reflected in the distribution of bushmeat and who takes special animal parts. Respondents identified this special meat to be the tongue, heart, liver, kidney, meat around the chest and neck. Although competition is not common among bushmeat hunters, disagreements around tactics to be used or sharing of meat can happen. The type of the trap used depends on the animal targeted. The wheel trap is for example used for big animals especially the hippo and buffalos. Wire snares are used for warthogs, kobs, giant forest hogs and other small animals.

The crime script below details how bushmeat hunters in Rubirizi organize and execute a hunt using wheel traps and wire snares, and what happens when they are successful.

Bushmeat Hunting with wheel traps and wire snares in Rubirizi, QENP, Uganda					
Stage	**Steps and options**	**Spatial**	**Temporal**	**People**	**Interventions**
Preparation	● Recruit co-offenders: Hunting party formed from personal relationships. ●Obtain hunting equipment: wheel traps, wire snares, spears, pangas, arrows and others. ● Prepare other requirements for example car-tire sandals, tobacco (smoking & medicinal), snake poison herbs, matchsticks, razorblades, safety pins. ● Inform wives to prepare food (*entanda*) and hunting materials. ● Transport: Inform and pre-arrange with car/motorcycle owners to be on standby to transport bushmeat.	● Kasese ghost factories with abundant steel. ● Metal factories (Kicwamba). ● Hunting villages (Kicwamba, Rwandaro, Kafuro).	● 1 day to purchase. ● A few hours to mobilize.	● Lead hunter ● Assistant (trap owners) ● Co-hunters ● Wives of poachers	● Close monitoring of Kasese – major source of steel material for making wheel traps & wire snares. ● Monitor long distance trucks from Kampala that are mentioned as suppliers of other hunting material. ● Screen and regulate the sale of hunting materials and others used in making wire snares such as motorcycle acceleration cable. ● Enforce government programs to keep children in school and reduce possibility of new recruits into hunting. ● Empower women to discourage husbands from poaching, e.g. through more access to park benefits. ● Closer scrutiny of cars and motorcycles moving near park boundaries.
Pre-activity	● Inform possible buyers (close friends and relatives) that meat will soon arrive. ● Hide wheel traps, wire snares and other material in strategic places. ● Meet at agreed points prior to entry. ● Enter the park illegally under cover of night.	● Coffee /banana plantation, farms.	● Late evening hours. ● Early morning sunrise.	● Buyers (word of mouth) ● Lead hunter ● Co-hunters	● Conservation education to reduce possible accomplices. ● Encourage locals to report suspicious people/material. ● Improved relations with local communities to report any unusual absence of men from villages. ● Cameras installed near identified park entry points.
Activity	● Search swampy places, locate footmarks. ● Set wheel traps and wire snares or track/locate animal. ● Skin the animal to leave bones, put in sacks or on sticks (*omuaveto*).	● Swampy places or watering holes.	● Hippos eat at night. ● 1-3 days to hunt. ●30-60 minutes to skin an adult hippo.	● Hunters ● Skilled trapper in the group. ● Skilled skinners in the group.	● Monitor and place ranger posts in places found with old traps, more patrols following animal paths. ● Work closely with reformed poachers to understand changing methods of disguise and concealment. ● Training in crime scenes to trace hunters, effect arrest. ● Improve ranger response time.
Post-activity	● Exit the park. ● Transport meat to villages, hide/store. ● Take meat for household consumption. ● Sale meat individually via word of mouth, through relatives and close friends. ● Drink away proceeds. ● Possibly return and pick hippo teeth.	● Exit points (mentioned). ● Villages like Kicwamba, Magambo, Kafuro.	● Time depends on hunting methods and success, exit usually at night or before dawn to avoid detection.	● Driver/ car owner. ● Hunter and wife ● Lead hunter	● Demarcate park borders. Blurred boundaries are an asset for poachers to loiter and sneak into the park. ● Encourage park visitors and locals to report suspicious car and motorcycle movement near park boundaries. ● Re-introduce honorary guard program in villages identified as poaching hotspots. ● Alcohol addiction programs.

Discussion

There are potential prevention measures for QENP. First is addressing the issue of supply materials for wheel traps and wire snares that are used in bushmeat hunting. Steel wires are commonly used to make snares in Africa "as the material is inexpensive, durable and strong enough to capture large animals".[3] From interviews it is clear that wire snares are locally made from material originating from Kasese factories, motorcycle acceleration cables, vandalized electrical installations and in other cases supplied by long truck drivers from Kampala. One main intervention point here could be close monitoring of Kasese, a place seen as a ghost factory town and with a huge supply of metal and steel material that is used in making the wheel trap and other hunting materials. Close monitoring also applies to metal fabrication points in Rubirizi and neighboring towns where motorcycle acceleration cables are used in the making wire snares.

According to respondents, it is a common practice to take meat home for personal consumption and also sell it for income in the villages surrounding the park. Both hunters and women that provide supportive roles in hunting noted that drinking away proceeds was common after obtaining money. From their experiences, widows of poachers killed in the park described how their husbands would disappear from home and spend days in 'bars and with other women' after selling bushmeat and obtaining money. On the one hand, an intervention point here could be alcohol addiction programs. On the other, working with women as agents of change to discourage their husbands from poaching. In return, women can be allowed more access to park benefits as a motivation. Empowering women can also be linked to improving their ability to keep children in school thus reducing the possibility of new recruits into hunting.

Transportation of bushmeat from exit points to villages using cars and motorcycle taxis (bodabodas) is crucial in the bushmeat supply chain. As one hunter stated: 'You cannot consider yourself a successful hunter until the meat has been delivered to your wife and is in the saucepan'. Random and close monitoring of cars and motorcycles that move near boundaries of the protected area to increase the actual and perceived risk of detection. Hunters usually carry the meat from deep within the park to exit points where they are met by cars or motorcycles. Commonly cited exit points include around Kyansere, Kashaka, Kamiranjonjo, Omukihinja, Kasisa, Mugogo, and Mukorobozi. The meat is then sold/distributed to various places within the village such as Ndekye, Musumba, Mubanda, Butoha, Kyaluganda, Munyonyo, Ndangala, Rumuri, and Kalagala. Although emphasis on monitoring this kind of movement is an intervention that occurs probably after the animals have been killed, it can still disrupt an important stage of the bushmeat supply chain.

Further, the wildlife authority working with reformed poachers and those that they have hired should focus on understanding the methods of disguise and concealment used by poachers. The practice of hiring notorious poachers to help park officials is faced with one major setback of poor remuneration, which forces former poachers to quit the job and use their skills and knowledge elsewhere.

This crime script has looked at bushmeat hunting and specifically the most targeted wildlife species in the study (hippos, buffalos, warthogs, giant forest hog, Uganda Kob and bucks). Focus was placed on Rubirizi district and specifically the Banyaruguru ethnic group. The script has been able to map out bushmeat hunting and identify possible intervention points at different phases. One limitation relates to the sample or area of study (Rubirizi), considering that QENP is shared by other districts with different communities. Nevertheless, the crime scripting methodology allows to "identify the dynamic relationships between offenders/places/targets, pinch points and vulnerabilities in the process […]".[4]

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V

Three types of lion killing in Kruger and Limpopo National Parks

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Problem description

At least three distinct lion killing problems can be identified in Kruger (South Africa) and Limpopo (Mozambique) national parks.

1. Lion poaching in Kruger NP by Mozambican nationals crossing over the international border to South Africa, motivated by financial gain on the global market
2. Lions killed in human-wildlife conflicts with cattle owners in Limpopo NP-these killings may be incentivized by trade in body parts
3. Targeted poaching of lions in Limpopo NP for international and domestic markets

Here, the targeted poaching of lions is defined as a human caused mortality event where there was (1) no evidence of human-lion conflict i.e. incident far from livestock / village areas and, (2) there was evidence of deliberate attempts to kill lions, i.e. bait (meat) laid with poison and/or bait surrounded by snares and, (3) the body parts were removed. Using these criteria, poaching events that targeted lions and poaching events where lions were killed but were not the target species were distinguished.

This contribution uses crime scripting to unravel each problem and identify potential interventions. Given the diversity of context for these problems, the crime scripts include a brief overview of the drivers and facilitators of each one.

Information sources

The scripts were compiled using three distinct resources: participant observations and semi-structured interviews with rangers (N=16), lion mortality data, and lion trade information from Mozambique. All available data on lion mortalities across the study area between 2011 and 2018 were collated. Data was gathered as auxiliary data during camera-trapping surveys, spoor surveys, GPS collaring exercises and from field observations.[1–6] Data was also gathered from information reported to the author by National Parks and reserve management staff, and by anti-poaching patrol members. Mortality data collected included cause of death, such as natural, snared, trapped, poisoned, or shot and when possible the motive behind the killing, including in retaliation to livestock conflict, bushmeat poaching by-catch, or targeted poaching. Finally, information about the illegal wildlife trade of lions in Mozambique including specific lion body parts being traded and the possible destinations for these illegal body parts. These data were provided by the Mozambican Administrator of National Conservation Areas.

Problem 1: Transboundary targeted poaching of lions in Kruger NP by Mozambican nationals

Context

An increase in the targeted poaching of lions for body parts has occurred in Kruger NP since 2015.[5] This increase in lion poaching is likely the result of a new international demand for lion teeth and claws, combined with an established professional poaching culture and infrastructure built around rhino poaching, substantial Asian influence and trade in Mozambique, economic disparity between South Africans and neighboring Mozambicans, and contrasting lion densities between Kruger (South Africa) and Mozambique. Prior to 2015 lions were occasionally killed and body parts, primarily fat, skin, meat and clavicle, were sold for local traditional use.[5] The poachers involved in the more recent surge are mostly Mozambican nationals, entering illegally into Kruger NP from adjoining Limpopo NP in Mozambique. Poachers may be residents of Limpopo NP or of settlements in the buffer zone of

Limpopo NP. Most of Limpopo NP receives limited ranger patrols. The Kruger-Limpopo border is long and remote and largely un-patrolled, with some stretches commonly visited once a day or less. Most incidences have involved commercial professional poaching parties targeting elephants for ivory (and likely rhino) and then killing lions as a secondary activity, however in 2020 there have now been reports of poachers targeting lions only in a fashion similar to activities which have been occurring in Limpopo NP since 2014.

Commercial elephant, rhino and more recently lion poaching is a lucrative business in Mozambique and successful poachers are obviously financially more successful than most other members of their largely disenfranchised communities, as evidenced by their purchases of new 4x4 trucks, stereos, the opening of bars and importation of foreign alcohol.[6] Each of these three species are more common, by several orders of magnitude, in Kruger NP then in Limpopo NP, largely due to differences in effective wildlife protection over the years. Lions in Kruger NP are typically killed by eating poisoned meat cut from a poached elephant. The poachers will return a few days later to harvest body parts from any lions which died scavenging from the carcass. Limited information suggests that the lion body parts are being exported to Asian countries including Thailand.[5] Poaching has impacted rhino populations in Kruger[3] and may impact elephant populations however to date Kruger's lion population is relatively robust.[7] Targeted poaching of lions has caused the collapse of a smaller lion population in neighboring Limpopo NP.[5]

SCRIPT 1: **Transboundary targeted poaching of lions and elephants in Kruger NP by Mozambican nationals**					
Stage	**Steps and options**	**Spatial**	**Temporal**	**People**	**Interventions**
Preparation	● Prospective poachers receive word that money is to be made from lion and elephant/rhino poaching: this includes agents setting up poaching operations, Asian nationals recruiting poachers and poachers going in opportunistically. ● Mozambican national travels to Limpopo NP village from anywhere in Mozambique (often coastal towns). Residents live in the NP legally, but non-residents can enter easily over an unmanned road or by saying they are visiting relatives. ● Poacher pays for room and board in village houses. ● Poacher rents firearm, camo gear and poison from local poaching agent/middleman and joins poaching party. These contacts are easily established as poaching agents are readily identified in the towns. Experience handling firearms is common through war history of the country. ● Poaching agent buys aldicarb poison, possibly from South Africa where it is readily obtained and smuggled over the border. ● Poaching agent buys illegal rifles (several large caliber hunting rifles stolen from NP armoires over past years). ● Target location selection, using agent's experience and local guide once in the field. Foremost targets are elephants and rhinos, with lions targeted secondary using poisoned elephant meat after a kill. Locations will be inside Kruger NP, close to the Mozambican border.	● Poachers come from across Mozambique. ● Preparation steps within Limpopo NP villages.	● Constant	● Poaching party of around 3-5 men, including Limpopo NP residents and outsiders. The outsider will often carry the gun and thus take the biggest risk of being targeted by law enforcement. At least one local youth often working for the agent will join as a guide for tracking. Finally, a shooter with military experience is commonly present. ● Poaching agent. Known individuals who effectively run all poaching operations, and are very influential in the local towns – where poaching receives widespread local support. Poaching agents invest in legitimate businesses; construction, transport, bakery. ● Supporters including village house owners and poison sellers.	● Development of law-abiding culture- move away from bribe culture. ● Development of alternative legal and sustainable wildlife economies. ● Development of cultural appreciation for national wildlife and reserves. ● Infiltration and disruption of local poaching syndicates- connecting local agents to poaching events and smuggling of wildlife parts. ● Resettlement of villages from Limpopo NP . ● Removal of known poachers from NP. ● Control human movements in Limpopo NP. ● Control and restrict illegal firearms in Mozambique. ● Stronger border control including searching for smuggling of poisons ● Strengthen laws regarding the possession of poison (see Zimbabwe laws).

Stage	Steps and options	Spatial	Temporal	People	Interventions
Pre-activity	● Poaching agent arranges drop off and pick-up of poaching party, carrying insurance to pay bribes or fines in case of apprehension in Mozambique. ● Poaching party camps in bush in Mozambique near Kruger border, sheltered under a bush or tree and using minimal supplies. ● Poaching party crosses international border and enters Kruger NP illegally, carrying rifle, axe, poison, and one water bottle (easily avoiding detection).	● Pre-activity steps within Limpopo NP villages. ● Drop off and pick up points close to Kruger NP border. ● Poaching activity from Limpopo-Kruger border. ● Activity along eastern edge of Kruger, walking distance to Mozambique.	● Mostly at night ● Poaching trips can last 1 to 2 weeks.	● Poaching agent ● Poaching party	● Control human movements in Limpopo NP. ● Intensify patrols in Mozambique along border. ● Stop illegal entry into Kruger NP-coordinated efforts between Limpopo-Kruger NPs.
Activity	● Poaching party tracks elephants/rhinos. ● Shooter stalks and shoots medium sized elephant (ivory not too heavy to carry out). ● Poachers chop out ivory immediately with an axe and may cut off and keep tail. ● Poachers cut off chunks of elephant meat, lace them with poison and place them around to attract lions. ● Poachers may or may not cut branches and partially cover elephant carcass to reduce vultures or air patrols seeing carcass. ● Poachers may move back into Mozambique. ● Poachers hide ivory/rhino horn in bushes or trees and camp in separate locations from their poaching gears and gains, for a few days while waiting to see if there is a reaction from rangers (e.g. helicopters). ● Poachers return to carcass and butcher lions that ate poisoned meat, collecting teeth and claws and sometimes a piece of intestinal fat, sometimes also vulture heads.	● Kruger National Park ● Mozambique camp sites	● As little time as possible. ● Poaching takes place at night and early morning. ● In poaching trips of 1 to 2 weeks, 1 to 4 days are spent in Kruger where more risks are incurred by the poachers. ● Poaching peaks around Christmas time, due to reduced law enforcement presence; and during full moon due to improved visibility.	● Poaching party	● Locate poachers in Kruger quickly before they have a chance to find targets. ● Locate and destroy carcasses quickly before lions have eaten poison. ● Stakeout carcasses to apprehend poachers returning to poisoned meat. ● Locate poachers hidden or moving away from incident after poaching occurs .

Stage	Steps and options	Spatial	Temporal	People	Interventions
Post-activity	● Poachers return to Mozambique. ● Poachers walk back to village or are picked up by agent from the original drop off point. ● Poachers re-connect with agent to hand over items and receive payment. ● Ivory/rhino horn and lion teeth and claws are sold internationally, lion fat, elephant tail, vulture heads sold nationally or to South Africa. ● Ivory/rhino horn and lion teeth and claws bought by shipper who moves them through Maputo or other more remote airport or ports. ● Evidence suggests parts go to Vietnam. ● Elephant tail, lion fat, vulture heads sold to Sangomas or dealers in Maputo.	● Kruger Limpopo hosting village. ● Local black market. ● Maputo airport and port.	● Dependent on storage requirements	● Poaching party ● Poaching agent ● Buyers ● Forward sellers/traffickers	● Control human movements in Limpopo NP. ● Increased detection and control over animal parts moving through Mozambique airport and ports- sniffer dogs/rats, better control of secondary and remote/northern sea ports. ● Collaboration with Asian anti-trafficking agencies.

Problem 2: Illegal killing of lions in human-wildlife conflicts in Limpopo NP

Context

Limpopo NP has 18 villages within its borders, with total of 7000 people and 20 000 cattle. Cattle are kept as an investment and rarely eaten, they are free grazed during the day and some are corralled at night. A large percentage of cattle however are not corralled at night, including strays which are either left in the bush/field or are loose around the villages. Cattle are typically herded by young boys, who may not know how to count. There is research suggesting that herders who know how to count tend to leave less animals in the field. In the dry season, more cattle tend to be left in the bush because they may travel up to 10km from villages in search of grass. Additionally, cattle herds may meet and overlap with buffalo in areas with grass and water which are far from villages, especially when it is dry. Finally, cattle in Limpopo NP often range to within 2 km of the Kruger NP border.

There are no cattle in Kruger NP. Kruger has significantly higher lion densities than Limpopo NP creating a continual uni-directional flow of dispersing young lions from Kruger NP to Limpopo NP. Wild ungulate populations in Limpopo are severely depleted due to high levels of bushmeat poaching in the park. As a consequence, lions dispersing from Kruger NP into Limpopo NP may quickly encounter free-grazing cattle. Lions predate on cattle, as cattle are within the preferred weight range for lion prey. Young lions dispersing from Kruger, and without experience fearing humans are more prone to predating on cattle than lions with experience around villages.

Little is being done to mitigate lion-cattle conflict in Limpopo NP. There is a long-term plan to resettle the villages from Limpopo NP however this has been in operation since 2001 with limited progress to date. Re-settlement negotiations with the National Park/NGO have included purchasing cattle for the residents (thus increasing the number of cattle in the National Park) based on estimated historic losses to lions and spotted hyenas, as an attempt at compensation. However, there is no link between compensation and improved husbandry or tolerance. There are official land use zones, including no-grazing zones, within Limpopo NP however adherence to these is not enforced. The park and management NGO have a human wildlife conflict team program; however, their main operation procedure has been attempted lethal control (shooting) of problem lions after receiving complaints from residents. Over the past few years residents are however often not reporting conflict to the park/NGO but instead turning to professional poachers or traders who kill the lions and harvest body parts, primarily teeth and claws. These lions are killed by laying poison on cattle carcasses. Conflict killing of lions is responsible for 18% of lion mortalities in Limpopo NP.[5]

SCRIPT 2: **Illegal killing of lions in human-wildlife conflicts in Limpopo NP**					
Stage	Steps and options	Spatial	Temporal	People	Interventions
Preparation	● Professional elephant and rhino poachers approach cattle owners in their community to offer assistance in dealing with lions. May be the same people as involved in script 1. ● Poacher acquires poison, possibly TEMIC (aldicarb) or Chinese alternative from South Africa.	● Limpopo NP near village (<10km)	● Equal through year, likely killed at night.	● Poacher ● Cattle owner	● Resettlement of villages from Limpopo NP. ● Removal of known poachers from NP. ● Development of lion-conflict mitigation program (see below). ● Stronger border control including searching for smuggling of poisons. ● Strengthen laws regarding the possession of poison (see Zimbabwe).
Pre-activity	● Cattle owner finds carcass of cattle. ● Villagers and cattle owners contact poachers after cattle is killed by lion, actively avoiding park authorities and preventing their involvement. ● Cattle owner returns to poacher, and brings him to carcass location.	● Limpopo NP near village (<10km).	● Any time	● Poacher ● Cattle owner	● Resettlement of villages and cattle from Limpopo NP ● Removal of known poachers from NP. ● Implement lion-cattle conflict mitigation program while cattle are still in park, including improving daytime husbandry, older boys and men hired to herd, the use of communal herding, enforcing night time corralling of cattle, building lion proof corrals, and compensation only for individuals who exhibit proper husbandry. ● Stop new cattle being brought into park. ● Enforce of no-grazing zones (see Gonarezhou NP).
Activity	● Poacher poisons cattle carcass ● Poacher returns days later and harvests lion parts (teeth, claws and fat), similar to lions poached on elephant poaching operations in Kruger NP – indicating "professional" involvement ● Poacher dries lion fat for processing	● Limpopo NP near village (<10km)	● Around 3 days	● Poacher	● Control human movements in Limpopo NP. ● Locate and destroy carcasses quickly before lions have eaten poison. ● Ambush poachers returning to poisoned meat.
Post-activity	● Lion teeth and claws bought by shipper who smuggles them through Maputo airport or ports ● Some evidence that parts are going to Vietnam, either in personal baggage or cargo ● Tail and fat sold to local Sangomas or possibly to dealer or in market in Maputo	● Limpopo NP ● Local village ● Local black market ● Maputo airport or port	● Dependent on storage requirements	● Poacher ● Domestic buyers ● International buyers ● Trafficker	● Increased detection and control over animal parts moving through Mozambique airport and ports- sniffer dogs/rats, better control of secondary and remote/northern sea ports. ● Collaboration with Asian anti-trafficking agencies.

Problem 3: Targeted lion poaching in Limpopo NP for international and domestic trade

Context

Lions have been killed illegally in Limpopo NP for body parts and as retaliation of livestock depredation since at least 2011 and likely earlier.[5] Beginning in 2014 however there was a dramatic increase in the targeted poaching of lions (distinct from conflict killing) for body parts with this threat accounting for 61% of all lion mortalities and removing an estimated 17% of the park's lion population annually.[5] Largely due to this pressure the park's lion population declined by 66% (from 66 to 22 animals), the average pride size declined by 50% and the average number of females per pride declined by 89% between 2011-2017[4] with the resident population having effectively collapsed by 2019[6]. The use of poison was the most common means of killing lions and was recorded in 61% of mortalities with a noticeable increase in the use of poison to kill lions from 2013 onwards. Teeth and claws were the body parts harvested most often from illegally killed animals in the study area, with an increase from 2014 onwards. All targeted lion poaching events involved lions being killed with poisoned meat and or killed in baited snares or traps. Wild ungulates were used as bait in 63 % of targeted poaching incidents and the remains of poached elephants were used as bait in 37 % of incidents.[5]

Lions were killed by legal residents of Limpopo NP and possibly also other Mozambique Nationals. While it is illegal to kill wildlife in the park, wildlife protection and particularly lion protection efforts have been inadequate. There has been an increased militarization of counter-poaching efforts in a focal area of the park since 2017 with the involvement of a private security company, however these efforts came too late and covered too small of an area to benefit the greater lion population. Residents of Limpopo NP benefit economically from commercial poaching of rhino in Kruger NP and elephant and lion in Kruger and Limpopo NPs and several times revolted against authorities, closing roads, attacking rangers and tourists and hijacking National Park vehicles following the arrest or shooting of poachers. Panthera had a small dedicated lion protection unit between 2016-2018 however had to close the program due to increased security risks. The limited tourism in the park ceased eliminating any economic alternatives to poaching available to residents.

Less is known about the source of demand for the lion teeth and claws however in 2016 two shipments of lion teeth and claws with elephant ivory en route to Vietnam have been seized at the Maputo internationals airport by Mozambique officials.[5]

SCRIPT 3: Targeted lion poaching in Limpopo NP for international and domestic trade					
Stage	Steps and options	Spatial	Temporal	People	Interventions
Preparation	● Poachers buy poison, possibly aldicarbs from South Africa. ● Poachers make wire snares from abundant wire sources. ● Target selection, experienced in tracking lions or knowledge of lion areas.	● Limpopo NP ● Local villages and shops	● Constant	● Poachers, 2 to 3 people from local villages. ● Shop owners ● Firearm sellers	● Resettlement of villages in Limpopo NP. ● Removal of known poachers from NP. ● Stronger boarder control including searching for smuggling of poisons. ● Strengthen laws regarding the possession of poison (see Zimbabwe). ● Increase park patrols in areas used by lions.
Pre-activity	● Poachers commence multi-day poaching excursions into important wildlife areas – where Limpopo NP residents can legally forage for plants and fish. ● Poachers make a temporary camp nearby a water hole - often in a grove of trees overlooking waterhole. No tents but just a fire, sleeping spots and drying racks, carve wooden spoons.	● Limpopo NP, important wildlife areas.	● More prevalent during dry season, as people involved are working their crops in wet season.	● Poachers	● Control human movements in Limpopo NP. ● Removal of known poachers from NP. ● Focused patrols in areas used by lions.
Activity	● Poachers set snares for ungulates near water holes, along game trails or build brush fences with snares at holes. ● Poachers check snares every day or several days. ● Poachers butcher and remove snared ungulates, bring meat back to a camp and dry it. ● Poachers may leave many snares up after they collect enough meat. ● Poachers lay poison on some meat. ● Poachers set snares around some meat- may build a boma of branches around bait and place snares at entrance. ● Poachers check poison or snares every day or more. ● Poachers remove face, paws, teeth, intestinal fat, and possibly bones from lions and heads from vultures. ● Poachers may spend several days drying meat and lion parts for transport.	● Limpopo NP	● As little time as possible per activity. ● Poachers may spend a week or so, occasionally checking traps and after having returned to the village again. Rotting of the lion is not an issue to them.	● Poachers	● Control human movements in Limpopo NP. ● Removal of known poachers from NP. ● Increase park patrols in areas used by lions. ● Locate and destroy carcasses quickly before lions have eaten poison. ● Ambush poachers returning to poisoned meat.

Stage	Steps and options	Spatial	Temporal	People	Interventions
Post-activity	● Poachers walk back to village – along easiest and known routes- rivers and trails but usually avoiding main roads. ● Lion fat and vulture heads sold to local Sangoma's or dealers in Maputo. ● Lion parts bought by shipper who moves them through Maputo or other airport or port. ● Some evidence suggests that parts go to Vietnam.	● Limpopo NP ● Home village ● Local black market ● Maputo airport or port	● Dependent on storage requirements.	● Poacher ● Domestic buyers ● International buyers ● Trafficker	● Intercept poachers returning with lion parts. ● Control human movements in Limpopo NP. ● Removal of known poachers from NP. ● Conduct intel-led raids of markets for muti (traditional medicine). ● Increased detection and control over animal parts moving through Mozambique airport and ports- sniffer dogs/rats, better control of secondary and remote/northern sea ports. ● Collaboration with Asian anti-trafficking agencies.

Discussion

The targeted poaching of lions for body parts to supply foreign demand is a relatively new threat to lion conservation, however it is one which has the potential to cause dramatic declines of fragile sub-populations as evidenced by the collapse of the Limpopo NP sub-population.[4] The three distinct lion poaching crime scripts presented here all appear to have in common an apparent Asian demand for lion teeth and claws. This commonality in the demand leads to commonalities in poaching modus operandi including the widespread use of poisoned baits, cutting off of faces and paws and likely also in trade routes.

The scripts presented here are derived from the area where the targeted poaching of lions for these body parts was first described, however similar events have since been reported across lion range countries.[5] This threat may have first occurred in and around Limpopo NP due to unique local conditions including a stark disparity in economic opportunities between Mozambicans and South Africans, and between wildlife management and protection investment and capacity in wildlife including lion densities between the adjoining Limpopo NP, Mozambique and Kruger NP, South Africa. Perhaps most importantly this region has an established criminal syndicate which has been involved in rhino poaching, elephant poaching and vehicle smuggling[8] and could thus easily facilitate the emergence of a trade in lion body parts. In addition, the residents of Limpopo NP have been marginalized during a poor park development and resettlement process which has created resentment towards "government owned" wildlife.[8]

The recent collapse of the Limpopo NP lion sub-population shadows the collapse of the Limpopo NP rhino population and reduction in the park's elephant population, both due to high levels of poaching.[3] Lion poaching in adjoining Kruger NP then increased with a decrease in available lions in Limpopo NP.[4] The Kruger NP lion population is at or near ecological carrying capacity[7] and will therefore continue to provide immigration of dispersing lions into empty habitats in Limpopo NP, with Limpopo acting as sink habitat for Kruger lions. However, lions dispersing into Limpopo may also select for cattle and cattle areas, mistaking these as quality habitats and suitable prey, where they are then killed thus creating an ecological trap which has the potential to have greater population level impacts.

The interventions presented here are known to local law enforcement and park management authorities and are implemented to a lesser or greater degree. However, the fact that the Limpopo lion sub-population, like the Limpopo rhino and elephant populations, has collapsed is evidence that the interventions have been too little or too late. Many of the interventions implemented have largely focused on the activity stages of the crimes with the preparation stages perhaps given the least amount of focus. The challenges of intervening in the activity stages of these crimes are well known to local authorities; Limpopo NP is large (11 000 km^2), the park has a limited budget and capacity and economic opportunities in the country are sufficiently limited that there is a steady pool of prospective poachers. Bribery, corruption and intimidation are prevalent in the culture and poachers and poaching agents use this to control local police and park rangers. Large Asian infrastructure projects in and around the National Park may also provide the opportunities for poachers and poaching agents to make connections with traders and buyers.

In 2017 the NP implemented a militarization of counter poaching activities in a designated "Intensive Protection Zone" (IPZ) covering approximately 1/5 of the park. These efforts have been successful at deterring poaching activities from this area, as evidenced by the movements of GPS collared elephants which have begun to use the IPZ as refugia from poaching pressures in other parts of the park. The successes of interventions of poaching activities in the IPZ has however also led to the displacement of poaching pressures into other less heavily patrolled areas of the park, many of which were important lion habitats.

Thus, without drawing resources from interventions aimed at the activity stages in these crimes it is critical to deal with the ultimate problems which are relevant to the preparation and post-activity stages including; improving local socio-economics, improving governance, reducing corruption and strengthening wildlife crime related laws and judicial systems.

When designing interventions, it is important to go back to the primary reason for the counter poaching measures in order to evaluate their effectiveness. For instance, a counter-poaching initiative cannot be considered a success based on money spent, equipment purchased or even man power deployed but rather based on the target species or wildlife communities being effectively protected from harm. In the case of Limpopo NP, the counter poaching measures have therefore been ineffective at protecting lion populations.

Acknowledgements
I would like to thank all of the dedicated counter-poaching field rangers who risk their lives in the bush around the world every day so that future generations will still know wildlife.

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VI

Reactionary script after rhino poaching event

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Problem description

After a rhino poaching incident in an African game reserve, the crime scripting tool was used to reactively trace back the steps in the poaching process, and identify windows of opportunity based on patrol movements. A reactionary script like this, including the actions of multiple actors such as poachers and law enforcement, can help guide investigations – possibly even leading to prosecutions – and it can aid in the development of interventions and policies to prevent repeat victimization. In this case repeat victimization can be a repeat poaching event on the game reserve, using all or some of the same methods and opportunities.

The full decision-making processes of the poachers involved need to be considered to understand how the event unfolds. Crime scripts are useful to obtain a structured understanding of all stages within the crime commission process – where the actual killing of a rhino is only one stage in the script. Crime scripts explicitly articulate the decision-making process involved in a particular crime, specifying the actors, circumstances and components required during each stage, i.e. before, during, and after crime. Here, seven stages were identified: “preparation”, “illegal entry”, “searching”, “killing”, “returning”, “illegal exit”, “selling” (Figure 1). Figure 1 displays known and estimated information from the rhino poaching incident that is being scripted.

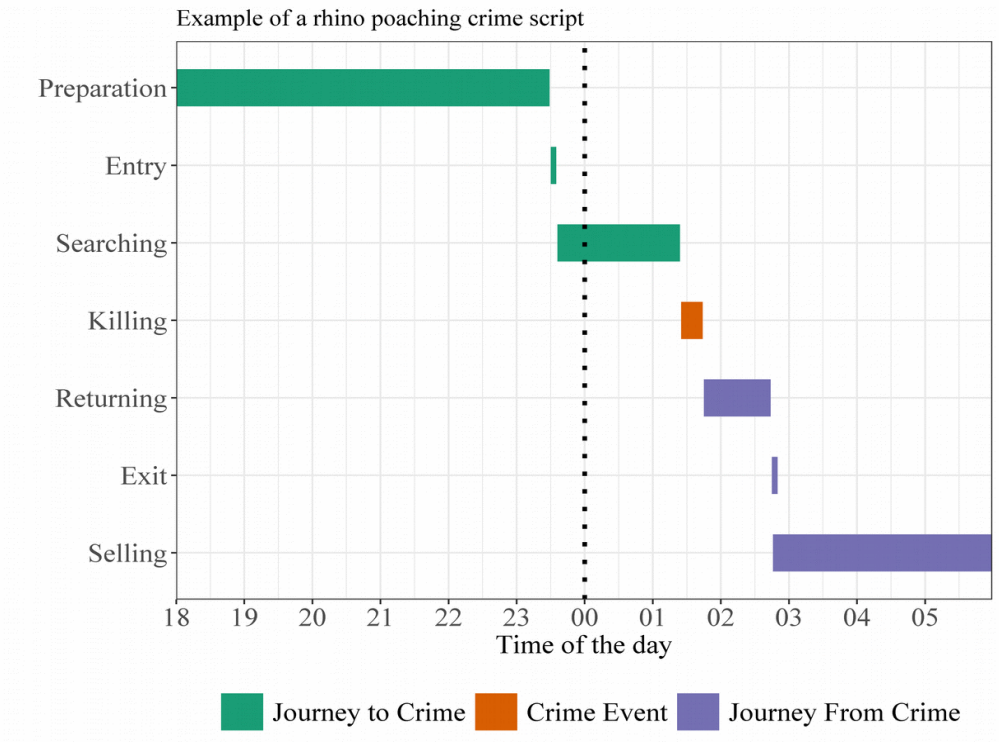

Figure 1. Overview of the seven different stages of a rhino poaching crime script. The example is based on known and estimated information from the poaching incident under investigation

Information sources

The reactionary scripting shown here is based on operational information from law enforcement teams in the game reserve, as well as spatial and temporal analyses thereof. For this example, the specific context was removed, presenting the thought process and application of reactionary scripting without sensitive information.

Crime process and script

Preparation

The process starts with a group of motivated poachers preparing to obtain a rhino horn. It is unknown how much time is typically spent on the preparation of a poaching event but presumably, several days, or even weeks will be necessary. Preparation at least includes obtaining a weapon to kill or immobilize the rhino and equipment to cut off its horn. Further actions likely also include collecting information on the patrol regime, offering bribes, obtaining food and water, and arranging a car and driver before poachers can head towards the border of the reserve to initiate the incursion.

Collecting information on the preparation stage is challenging because it includes information on legal activities, like purchasing or obtaining equipment. In addition, all these actions are done outside the borders of the reserve and cannot be detected by patrolling rangers. Still, it is possible to collect additional information. For example, in the current case under investigation, .458 and .404 projectiles were recovered from the poached rhino crime scene. In this region, these types of bullets are typically found in two industries: the big game hunting industry, and the lodge industry. The bullets are not commercially available unless a person has a license for a specific weapon. Therefore, poachers likely obtained the bullets by bribing someone who works at a local lodge or hunting company. Other types of evidence may include leftover food scraps, trash, cigarette and alcohol packets and tire tread marks. Such traces can help determine where poachers originated, their group size, and transportation methods.

As we will see later, the poachers entered the reserve from a small river / drainage line. This river runs near a local village Y. With plenty of roads around the area, poachers may have been dropped-off near the river, from where they continue on foot. They could have continued on foot, likely following the river towards the border of the reserve.

Illegal entry

The illegal entry into the reserve is the first offense in the rhino poaching crime script that rangers can detect and report. Poachers need to decide on where and when to cross the border before they can start hunting. The exact timing of the illegal entry in this case was unknown, as it will commonly be, but can be estimated from other sources of information through a scripting approach. Importantly, the entry location was identified.

On the day in question, a patrol team passed the entry location at 18:19 (red dotted line in figure 2). The earliest that the poachers could have entered the reserve was at 18:20. Here, we assume that patrol teams would have detected the illegal entry if poachers entered before 18:19. The gunshot was reported at 01:25, and the carcass was located 3.3 km away from the entry location. If we assume that poachers walked with an average speed of 3 km/h (Tobler's hiking function), it would take them approximately 66 minutes if they walked in a straight line from the entry location to the kill-site. Keeping this in mind, it is unlikely that poachers would have entered before 18:19, because that would mean they spent over 7 hours inside the reserve before the shots were fired (or reported). Furthermore, using the carcass location and time of gunshot, poachers likely did not enter later than 00:19. The maximum window of opportunity for entry was about 6 hours (light gray area in figure 2).

Refining Window of Opportunity for the Entry

Walking in a straight line from entry location to the kill site is an unlikely scenario. The entry and kill site are near a perennial river, so a more likely scenario is that the poachers followed the river until they reached a dam near the eventual kill-site. The distance along the river from entry to kill site is approximately 5.8 km, and would take them about 116 minutes, just under two hours. From this, it follows that poachers likely did not enter later than 23:29. In this scenario, the maximum window of

opportunity for entry was just over 5 hours (figure 2). Looking at the patrol data, another patrol team crossed the river at 23:13, but did not detect or report any poacher- related signs. Poachers might have entered after that team passed by, or it may have failed to detect the potential signs.

Another scenario would be that poachers have information about patrol regimes. To illustrate this scenario, we used patrol data from the months following the poaching incident and assumed that the observed patterns are similar to the patrol regime before the incident. The data show that 36% of all patrol visits to the entry site were between 18:00 and 21:00 (Figure 2). Patrol activity peaked at around 18:40. If poachers somehow know this pattern, it is likely that they would choose to enter after 21:00. The probability of encountering a patrol at the illegal entry site between 21:00 and midnight is 11%, compared to the 36% between 18:00 and 21:00.

Combining the two scenarios, poachers probably entered the reserve sometime between 21:00 and 23:30 (blue area in figure 2). Poachers may have followed the river after entering, but possibly also used patrol information to decide when to enter. Looking at the patrol data, the first patrol team ended their patrol at 23:03. Another patrol team crossed the river at around 23:13 and continued eastwards. A worrisome scenario would be that someone on the inside informed the poachers or signaled to them that it was safe to enter. In this scenario, the poachers likely entered sometime between 21:13 and 23:30 (red area in figure 2). Figure 2 shows the probability of a patrol being present at the entry location, over a 24-hour time period.

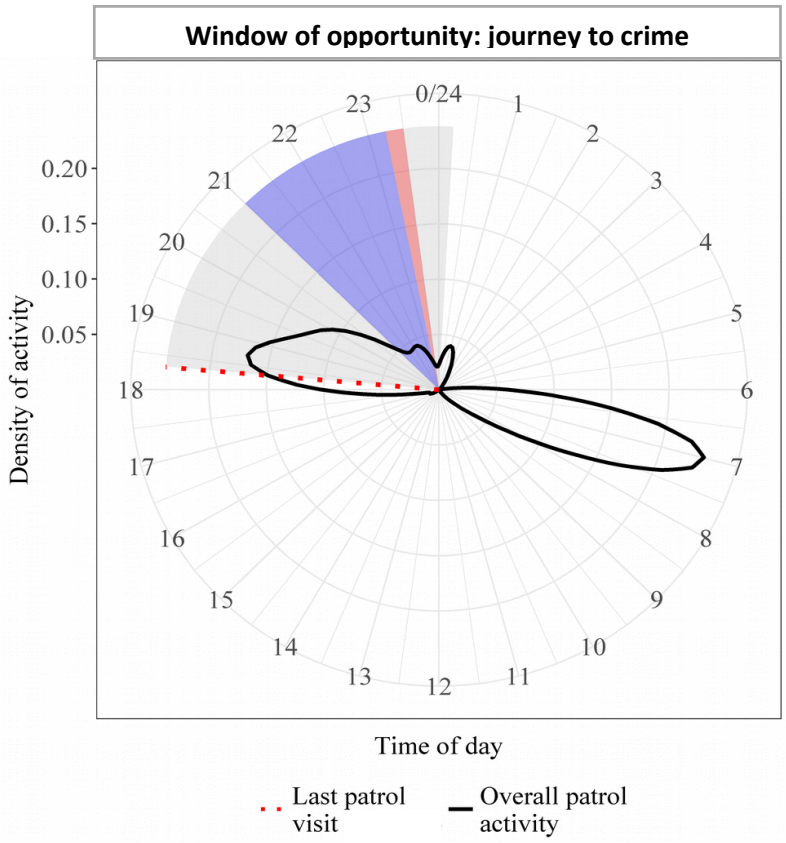

Figure 2. Patrol activity probability around the entry location (solid black line). The colored areas represent the windows of opportunity for entry. The red dotted line is the likely first possible entry time. The light gray area of 6 hours is the maximum window of opportunity to enter, the blue area of 2.5 hours is the window based on required walking time and general patrol avoidance, and the red area of 2 hours and 17 minutes (21:13-23:30) represents possible inside information to avoid a specific active patrol.

Searching

After the entry, poachers start searching for rhinos while avoiding detection. A possible poacher tactic could be to time their incursion with high rhino activity. This way poachers could optimize their chances of encountering a rhino or picking up fresh signs. The green line in Figure 3 represents the average activity pattern of rhinos based on analyses and publications on this subject. Rhinos seem to be most active in the early morning between 5 am and 10 am. The previously determined 'window of opportunity' estimations are also presented in the figure. Rhino activity was estimated to be quite low in the time range that poachers likely operated. From this, it seems that poachers did not time their incursion with activity peaks of rhinos.

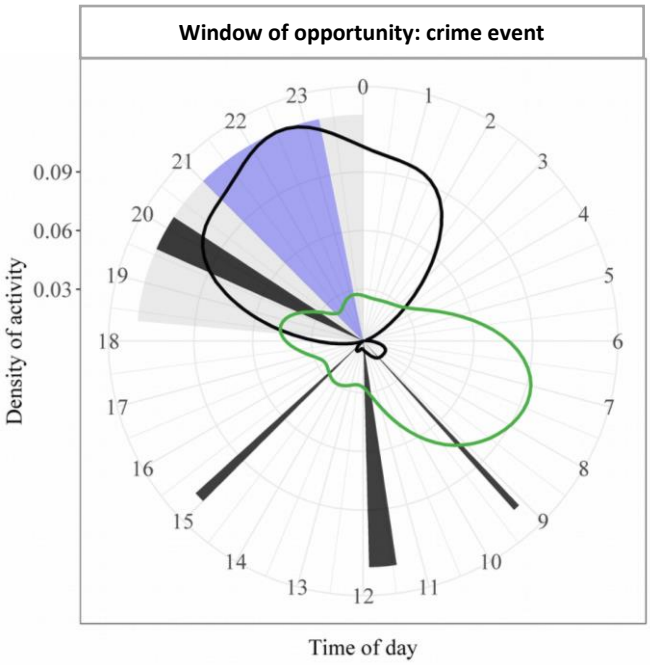

Figure 3. Activity probability estimation for patrols at dam (black line) and rhinos (green line). The black areas show when and for how long a patrol was present at the dam on the day before the incident that took place at night.

The black line in Figure 3 represents the likelihood of a patrol being present around the dam. For this estimation, we used patrol data from the months surrounding the poaching incident, excluding the data from the month in which it took place because it will likely bias the overall patrol activity estimation. In general, a patrol team is likely to be present between 7 pm and 2 am. Within the analyzed period, a patrol team visited the dam at least 66 out of 105 days, or 62% of the time. However, on the day/evening before the incident at night, no patrol team was present at the dam after 8 pm (black rectangles in Figure 3). Two sightings of rhinos were reported on the day before the poaching event, and patrol data show patrol presence to be focused at the areas where these sightings were recorded. This resulted in the entry site and dam being unprotected.

Killing

The three gunshots were reported by shareholders in the dam at 01:25. The shareholders live 600 — 650 m away from where the carcass was found. Around the time of gunshot, a patrol team was active near another water dam, approximately 2.1 km away from the carcass location, but did not report anything. Depending on whether the poachers were experienced hunters or not, horn removal can take somewhere between 5 to 30 minutes. This would mean that poachers left the crime scene between 01:30 and 01:55.

Returning to the border of the reserve

After cutting off the rhino's horn, poachers will need to make their way out of the reserve. This is perhaps the riskiest stage for the rhino poacher because they can get caught with the horn in their possession. A realistic assumption is that poachers will attempt to escape as soon as possible and do not try to hide inside the reserve. Therefore, we assume that the poachers' travelling speed is higher than when they were searching for rhinos. The nearest "exit" would be approximately 2.6 km away from the carcass location. Assuming a travelling speed of 5 km/h, poachers would have reached the point of exit between 02:00 and 02:30. In this scenario, however, the poachers probably would have ran into one of the patrol teams, which was driving in Northern direction along the boundary between 02:15 and 02:40. Another plausible scenario is that poachers used the same route as after they entered the reserve, by following the river again. The river likely provided some cover for the

poachers or perhaps an easier surface to walk or run on. Under this assumption, it took the poachers approximately 1 hour and 10 minutes to return to the reserve's border. Depending on how much time was spent on removing the rhino horn, poachers likely made their way towards the exit location somewhere between 01:30 and 03:05.

After the gunshot report, other patrol teams were informed about the incident. One of the patrol teams made their way back towards the incident location along the reserve's border. They crossed the river that the poachers likely used around 02:23. The team did not report any poacher signs at that moment and continued driving towards the gunshot location. Either the poachers had already passed that location, or they may have heard or seen the vehicle coming. In that scenario, they would likely hide until the patrol passed by.

Exit

The escape out of the reserve is often the last offense in the rhino poaching crime script that rangers can detect and report. Similar to the illegal entry, the timing of the exit is unknown but can also be estimated.

For this incident, the exit location was the same as the entry location. A possible reason why poachers acted in this way might be because someone was waiting for them to return, on the other side of the border. Figure 4 shows the probability of a patrol team being present near the entry-exit location (this is the same density line as in Figure 2). The earliest that the poachers could have exited was probably around 02:40. In this scenario poachers would have removed the horn very quickly and maintained a travel speed of approximately 5 km/h.

The entry-exit location was reported by patrol teams at 13:43, after the incident. The entry-exit location was not covered during a morning patrol. This means that technically the poachers had a maximum window of 13 hours to exit. However, the teams estimated the age of the sign to be around 6 to 12 hours old. According to their estimation, poachers left sometime between 01:43 and 07:43. The estimation of 01:43 would mean that poachers escaped within 20 minutes after the gunshot was reported at 01:25. Assuming that the shareholders reported the gunshots immediately, it is unlikely that poachers removed the horn and returned to the border within 20 minutes. The earliest that poachers likely could have reached the border would be around 02:40. Therefore, a more realistic estimation is that poachers escaped the reserve between 02:40 and 07:43 (blue area in figure 4). While not impossible, in most cases poachers do not hide inside the reserve after firing gunshots because there is a likelihood that they will be caught by patrolling rangers. Therefore, the most likely scenario here is that poachers moved towards the exit location, as soon as they obtained the rhino horn. This would suggest that they exited the reserve some time between 02:40 and 03:05, depending on how much time was spent on removing the horn (red area in Figure 4).

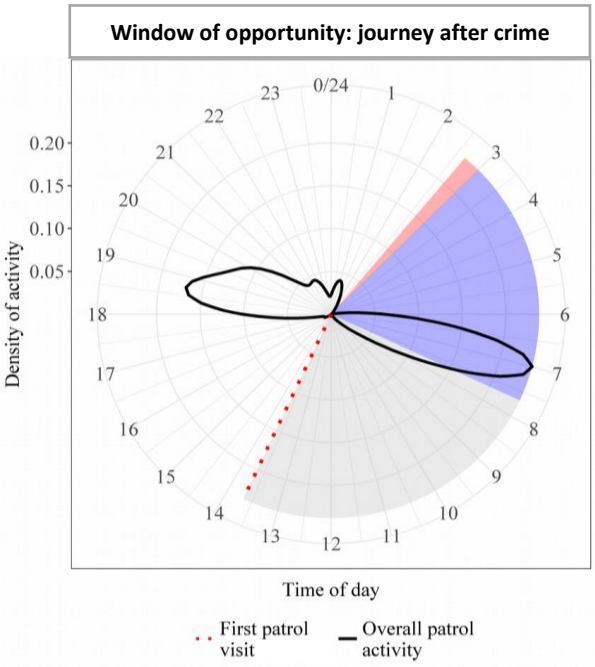

Figure 4. Patrol activity probability around the entry/exit location (solid black line). The area in gray, blue, and red represent different estimations of the poacher's window of opportunity to exit, with the red dotted line being the latest possible time.

Selling

After escaping the reserve, the poachers will have to return home or to a hiding place. It is unknown how much time there is between escaping the reserve and selling the horn to a middleman. As long as the poacher has the horn in his possession, he runs the risk of receiving higher charges if he gets arrested. Therefore, a poacher probably aims to sell the horn as soon as possible. Similar as to the preparation stage, it is difficult to obtain information on where, when, and how this happens and a lot is unknown at this stage. The best way to collect such information would be through poacher arrests. Arrested poachers may provide us with more information about how he was planning to go about selling the horn, or how he operated in the past.

Crime script summary

Poachers prepared for the hunt by collection at least two hunting rifles. In addition, they may have bribed rangers to obtain information on patrol regimes but no solid evidence exists to prove this. In the evening preceding poaching event, poachers most likely left from the nearby village Y or were dropped off near the river. Poachers then followed the river bed up North towards the border fence, arriving at approximately 23.00. They may have seen a patrol vehicle passing by around 23:13. After crossing underneath the fence line, they followed the river bed into the reserve. Poachers searched for approximately 1.5 hours, and covered around 5.8 km before arriving at the dam. They found rhinos at that location and fired three gunshots at 01:25. The poachers cut off the horns of the rhinos and made their way back to the border. They probably used a similar route as when they entered the reserve. The poachers returned to the border between approximately 02:40 and 03:05 at the same location as their entry. It is possible that a vehicle outside the reserve was waiting for them to provide cover and to hide the horn. The poachers likely spent less than 4 hours inside the reserve.

Discussion

The reactionary scripting of law enforcement actions, allows us to estimate windows of opportunity and likely decision-making processes of poachers. As such, using this approach a plausible *modus operandi* can be determined for a specific poaching event. Windows of opportunity, as well as their reliance on patrol coverage, can be identified, so changes can be made to reduce such opportunity. This may lead to preventing repeat victimization of the reserve. Additionally, the information above can guide investigations into the perpetrators, because it provides clues that can be followed up to arrive at suspects and possible charges.

Because the script deals with a specific case, it is unclear how it can be applied to other, similar crime events. Only with additional information from other events or from poacher arrests can one determine how common specific steps are. Additional information can also help determine how many resources should be diverted to preventing these specific opportunities, without displacing the crime to a different location, a different time, a different method or a different crime type all together.

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VII

Identifying gaps in knowledge with crime scripting: an example for bushmeat poaching

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The other contributions to this volume of *The Poaching Diaries* have described the value of crime scripting for unpacking and addressing wildlife crime problems. This contribution explains how scripting can be used to identify gaps in knowledge about wildlife crime activities and inspire measures to collect missing information. Unlike the other scripts, it is not specific to a location, but rather a generic script constructed from the academic literature on bushmeat poaching. Given this lack of specificity, it does not use scripting to develop a roadmap for interventions because prevention strategies should be developed using detailed, context specific information. Instead it shows how scripting can be used to design data collection strategies. In doing so it demonstrates the use of scripting to understand a general crime type and provides a strong foundation for developing future scripts of specific bushmeat poaching problems. It begins with a brief overview of bushmeat poaching followed by a description of the methods used to construct the script. Knowledge gaps identified by the scripting process and suggestions on how data could be collected to fill them are discussed, as are directions for future research.

Introduction

Bushmeat poaching, or the illegal hunting of wild meat, is a problem in many developing countries with biodiverse ecosystems.[1] Over six million tons of bushmeat are harvested in the Congo and Amazon Basins combined annually,[2] from reptiles, birds, amphibians and mammals such as antelopes, bushpigs, hippopotami, primates and buffaloes.[3] In fact, in Sub-Saharan Africa, over 500 different species of bushmeat are consumed, over 400 terrestrial animal species are hunted in South and South-Eastern Asia, while in South America this number equates to almost 200 species.[4] However, this over-harvesting is threatening species with extinction,[5] disrupting ecosystem function[6] and spreading zoonotic diseases.[7]

Compared to trophy poaching (e.g. for ivory or rhino horn), bushmeat poaching is often (but not always) associated with rural poverty.[8,9] Bushmeat provides a source of meat, income and medicine to many families who lack other livelihood opportunities.[10] Conflict with wild animals is also a growing problem for communities living around protected areas who may poach animals to protect their crops and obtain meat.[11] To address the problem, enforcement-based approaches can be combined with alternative livelihood projects (e.g. goat rearing, bee keeping) and measures to reduce human-wildlife conflict.[10] However, several challenges are threatening to undermine these efforts, including rapid population growth, inadequate law enforcement, corruption, poverty and a lack of cooperation between different agencies.[3,12–14]

Previous contributions have demonstrated how crime science and scripting approaches can generate useful insights and context-specific solutions for different types of poaching.[15] This contribution builds upon these ideas by demonstrating how a generic bushmeat poaching script might be constructed. Ideally, empirical data are used to construct a script to a specific context (e.g. jaguar poaching in Suriname[16]). However, constructing a script using the literature is also a worthwhile exercise. This can help to systematically organize available information, identify gaps in knowledge and inspire creative methods to collect missing information.

Building a generic bushmeat poaching script

People use a wide range of methods to poach animals (e.g. blow pipes, bows and arrows, guns, nets, snares, spears) in different habitats, from tropical forests to open savannahs (see Dobson et al.,

2019[17] for a review). However, a ubiquitous bushmeat hunting[a] method, particularly in Africa, is wire snaring.[3] Wires are easily obtainable (e.g. made from tires and motorcycle brake cables) and catch a variety of different animals.[18] Snaring is particularly problematic because snares are hard to detect, they are highly wasteful, cause significant injuries to caught animals[19] and kill non-target characteristic species, such as elephants.[20] To that end, this script focuses upon the snare poaching of duikers (small to medium sized antelopes) within a protected area (Figure 1).

To build the script, key words were typed into Google Scholar to find publications on poaching ("snare hunting" "snare poaching" "wire hunting" "wire poaching" until 2019). This generated 447 papers, 16 of which were used to construct the script as they contained specific and detailed information about hunting activities. The most detailed studies were doctoral dissertations, with the research predominantly undertaken in African countries.[21–25] Dissertations are ideal sources of information as they are often open source and do not have strict word count restrictions compared to peer-review papers.

Following similar methods employed by qualitative researchers,[26] text related to hunting activities was copied and pasted into Microsoft Word under headings that best summarized a particular script stage. For example, "an animal caught in a trap is killed by a few blows to the head"[27] and "spears are necessary with snare hunting, as men use them to kill animals in the snare"[28] were coded under the heading "dispatch animal". The Nvivo Qualitative software package can also be used for this purpose and has additional organizational and notation functionalities.[29] Guided by the literature, the headings were then re-organized sequentially to reflect the step-by-step process of snare poaching duikers. The script can be found in Figure 1.

In this example, a small group leaves the village in the morning or late afternoon[34] and they enter the protected area by breaking its fence.[33] Day-poaching trips are common,[24] but in this example, the group spends a day walking to a camp.[35] Camp activities include cooking food, sleeping and processing caught animals.[21] To reduce the chance of arrest, a person might refrain from walking directly on trails (to hide footprints),[37] or spy on ranger patrols[22] or try to bribe rangers if caught.[36] It is assumed that a person will prioritise avoiding detection while poaching, thus 'avoiding rangers' is placed near the top of the script.

The next day, individuals leave the camp to check their own traplines.[23] A number of activities are conducted concurrently, including searching for places to lay new snares, checking active snares (and removing/replacing old snares) and searching for trapped animals. Trap success is related to spatial placement (e.g. near water points, animal trails, trees, burrows), the properties of the snare (thickness, height off the ground, loop diameter, type of trap, such as neck or leg snare), laying pattern ('trap lines' vs. 'scattergun') and the particular skill of the hunter (e.g. regularly moving and checking snares, also to avoid animals becoming spoiled).[19,32,40] This allows some degree of prey selection, since snares are made according to the kind of footprints observed on the trail.[24] Snares will also be moved if animals are no longer using a trail, as a result of breakage from escaped/trapped animals and to locate more productive areas.[25]

After finding a trapped animal, it will be dispatched (if alive), removed from the snare and carried to a camp, where it can be butchered into smaller pieces and smoked to preserve the meat and remove any rotten flesh.[21] Larger animals will be butchered at the trap site.[25] Animals which have decomposed beyond three days after death are discarded.[24] Porters can be called to carry the meat back to the village while the group continues poaching.[24,31] After all snares have been checked, the

[a] Note that 'hunting' (legal) and 'poaching' (illegal) are used interchangeably in this contribution.

group returns home, where the meat is consumed within the family and/or sold to neighbours[28] and local markets.[32]

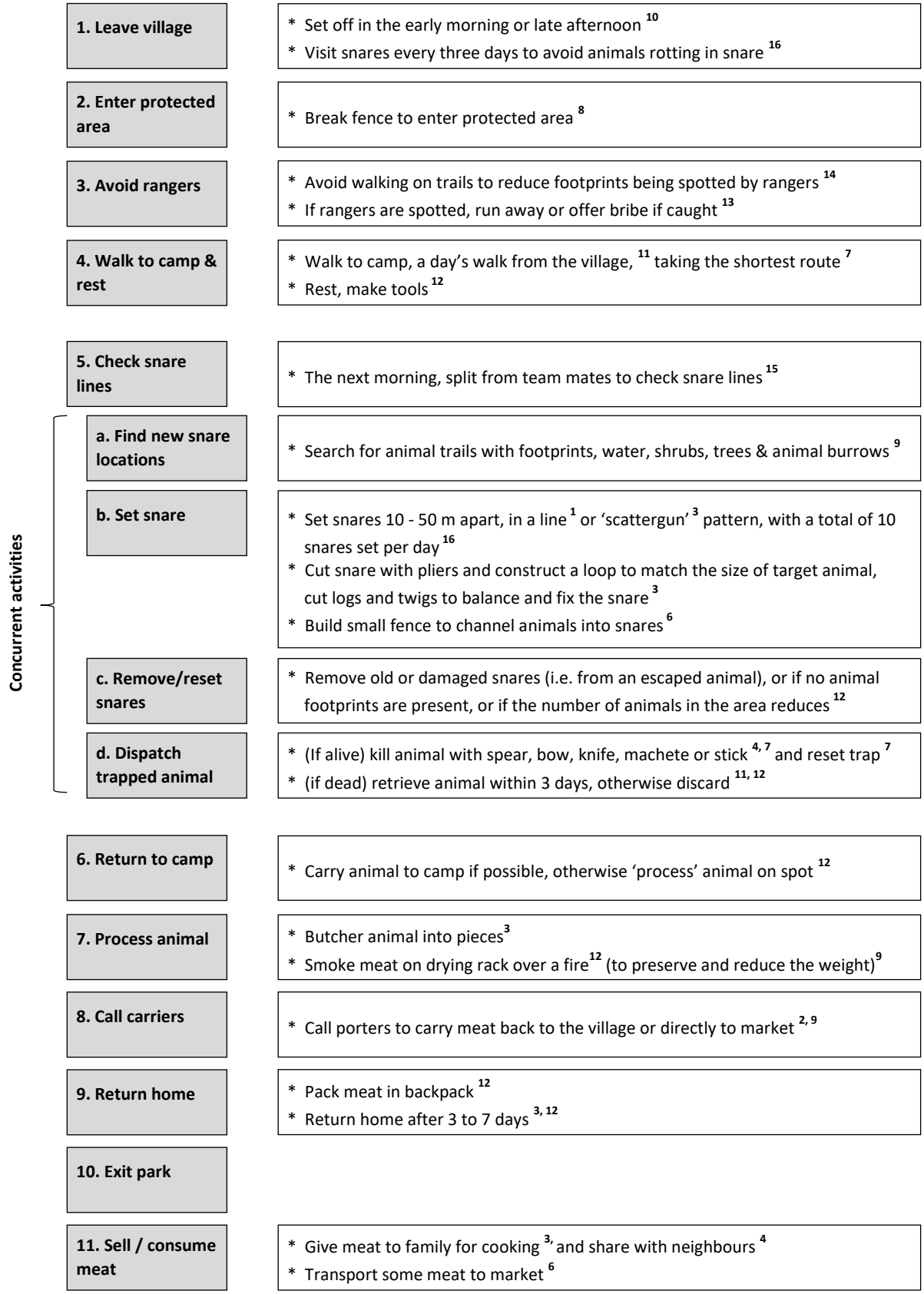

Figure 1. Generic script for snare poacher inside a protected area. References: 1 = [30]; 2 = [31]; 3= [21]; 4 = [28]; 5 = [17]; 6 = [32]; 7 = [27]; 8 = [33]; 9 = [24]; 10 = [34]; 11 = [35]; 12 = [19,25]; 13 = [36]; 14 = [37]; 15 = [38]; 16 = [39].

Missing information and planning research projects

Of course, these poaching activities may not occur in every setting. For example, hunting trips can last between three days[32] to a week.[40] Some people trap all year,[25] while others trap more during the wet season when animals reproduce and because their footprints can be easily seen.[35,41] In other cases, trapping decreases when people become too busy with farming.[35] Nevertheless, constructing a generic script can highlight the factors that influence different behaviors and identify avenues for further investigation. Table 1 summarizes each stage of the script from Figure 1 with a list of follow up questions and some proposed methods to collect the missing information.

Table 1: Missing information generated from the generic script and methods to collect the data.

Stage	Follow-up questions	Methods to collect data
1. Leave village	• Do people always hunt in the morning/afternoon and what influences that decision? • What factors might lead someone to abandon hunting?	• Place camera traps on hunting paths • Interview study
2. Enter protected area	• Do people enter the PA at the same points?	• GPS map all trails entering a protected area • Place camera traps on paths to observe active trails • Count footprints on each trail
3. Avoid rangers	• What is the probability of a ranger detecting a snare/poacher? • What other strategies do people use to avoid rangers and other risks, and what are the scripts to avoid those risks?	• Mock ranger patrols with fake snares and hunters • Interview study (e.g. Knapp, 2012)[45]
4. Walk to camp and rest	• What factors influence where a camp is placed? • What factors other than animal abundance influences the distances that people walk to poach?	• GPS map camps with rangers and conduct statistical analyses on environmental correlates of camp locations
5. Check snare lines	• How does the structure of the trail network influence snare locations? • What strategies do people use to find their snares (e.g. snare-to-snare, zig,zag movements) • What factors influence whether an animal is caught in a snare? • Do people leave spare snares in the protected area or do they bring them home?	• GPS mapping of animal trails • Provide GPS devices to hunters to record trails • Mock trap study with fake snares and animals • Interview study
6. Return to camp	• How many snare lines per camp? Does this depend upon the number of people in the group?	• Interview study • Hunter diaries and follows
7. Process animal	• How long does it take to butcher and smoke animals (e.g. size dependent)?	• Participant observational study, hunter diaries
8. Call carriers	• Do people always use carriers for meat and if not, why? • Do carriers use different paths to reach the camps? Do they poach? • What new technologies might facilitate poaching? (e.g. smart phones)	• Interview study
9. Return home	• What activities do people do before returning home? Do they hide snares, clear up, hide the camps?	• Interview study
10. Exit protected area	• Do people use the same paths walking back home or not?	• See 'enter protected area' • Interview study
11. Sell / consume meat	• How long does bushmeat last a family? • Can people tell the difference between bushmeat and domestic meat?	• Household surveys • Blind testing studies (e.g. Koster, 2010)

There was a large gap in the literature regarding detailed descriptions of how people avoid detection when poaching. This might be due to the sensitivity and difficulty of acquiring this information. However, criminologists have discussed the importance of understanding how offenders and crime preventers adapt and co-evolve to one another's activities.[43,44] This information would be useful for designing adaptive counter-strategies to wildlife offenders. Similarly, it would be useful to know more about the factors that disrupt poaching activities and building scripts for those. For example, people can get lost, be arrested by rangers, become injured (by wildlife, colleagues and the environment) and fall sick.[22,45] An interview study might be appropriate to address these knowledge gaps as people can be asked directly about their behaviors. This does raise ethical concerns about how to gain consent from hunters, especially if the information will be used for enforcement purposes.[22] One solution might be to collaborate with experienced anthropologists who can build rapport and trust with local communities.

Another worthwhile exercise would be to investigate the factors that affect the probability of rangers detecting snares and trespassers in protected areas, as this will ultimately affect the number of animals poached. Therefore, one might design some kind of experimental study to lay 'fake' snares in different conditions, and then ask real rangers to try and detect them as they patrol (for example, as done in Cambodia[46, 47]). The experiment could be repeated using different kinds of equipment (e.g. binoculars, metal detectors, sniffer dogs) to assess how detection could improve.

As a final example, many studies described the importance of animal trails for snare placement.[19,21, 22,24,25] Not unrelatedly, criminologists have emphasized the importance of analyzing the spatial structure of street networks (the substrate along which urban offenders "forage") to predict hotspots of urban crime.[48,49] Therefore, one might collaborate with biologists or geographers to map animal trails using GPS devices, satellite data or camera traps. These tools could also be used to mark entrance points into protected areas and record which trails are active for hunters and animals.

Future directions

A more advanced approach to crime scripting is computer simulation modelling.[22,50] The process of constructing simulations is very similar to crime scripting, albeit more detailed. First, a literature review is conducted to better understand the problem of interest. The level of complexity and what to include (or not) in the simulation is determined based on this review. Much like a crime script, all of the simulation's components are described and visually depicted in flow diagrams, decision-trees and tables. These conceptual models are implemented as computer algorithms inside a simulation software package (i.e. such as NetLogo[51]), where the model is tested an evaluated. For example, a poaching model might include virtual animals, poachers and rangers moving inside a virtual protected area (see Hill et al., 2014[52]). The simulation can then be used as a decision-making tool to suggest courses of action, to make improvements to a system and simulate how policies might affect different stakeholders. This is desirable when real-world experiments might not be possible for financial, practical or ethical reasons. For example, one might test how different ranger patrol strategies affect the number of snares detected or animals lost from poaching.

Even without the use of a simulation model, the conceptual design process alone is nonetheless a worthwhile exercise. Crime scripting tends to focus on one type of agent (normally the offender). On the other hand, a simulation approach involves mapping out the step-by-step actions of multiple agents involved with a problem[44,53] and can incorporate alternative scripts for each condition. For example, separate scripts would be required for a poacher who 1) searches for good places to lay snares, 2) searches for trapped animals and 3) evades rangers and so on. This offers a more realistic view of the decision-making process involved.[53] Similar to crime scripts, ideas for prevention can be generated at each step.

One thing to bear in mind is that crime scripts and simulation models reflect a person's *understanding* of a problem, which may or may not be reflective of reality (indeed, if the model was perfect, then it would no longer be a model!). Ideally, all scripts should be scrutinized by domain experts to increase their credibility.[54] Combined, these techniques can assist practitioners to better understand and reduce different kinds of wildlife crime and conservation problems.

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VIII

Redwood Burl Poaching in the Redwood State & National Parks, California, USA

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Problem description

The coastal redwoods, or *Sequoia sempervirens*, are the tallest trees and among the oldest living organisms on earth. They are also an endangered species according to the IUCN. Once prominent throughout the Pacific Northwest region of the U.S., only 5 percent of old-growth coast redwoods remain due to commercial logging since the 1850s. What is left of the remaining population is largely concentrated in three California state parks, including the most visited one, Redwood National and State Parks (RNSP) that is co-managed with the National Park System. The RSNP, created in 1968 and co-managed since 1994, is roughly 455 km^2 in size.[1]

Poaching of redwood burls within the RNSP were largely rare occurrences typically amounting to less than one incident a year. However, between 2012 and 2014, there was a drastic increase in incidents culminating into a crisis. During this period, roughly 90 burls were removed from 24 trees while one tree was deliberately cut down for burls that were high on the trunk. Redwood burls are gnarly growths—similar to a tumor—that grow on some coastal redwood trunks. Burls contain the DNA of the parent tree so that if the tree were to perish, the burl provides a mechanism to generate a clone of the parent tree and re-populate. Without the burl, redwoods are more susceptible to disease and can ultimately perish without the ability to reproduce itself.[2]

Offenders specifically target redwood burls because of their unique grain pattern that is coveted by consumers in domestic and international markets. Typically, redwood burl is processed into tables, bowls, trinkets, as well as dashboard trims for luxury vehicles. Redwood burls can be legally cut and processed as long as they were sourced from private property. However, once removed from the tree, there is no way to determine whether the burl was harvested from private property or protected areas. Therein lies the opportunity to poach and fence burl as legally sourced wood.[2]

Information sources

Data were collected over a 5-day period in August 2016 in an effort to better understand the nature of burl poaching and how it might be prevented. Crime scripts were developed based upon informal interviews with RNSP rangers (n=3); official investigation reports of all incidents occurring between 2013-2016, which included interviews with two offenders, potential witnesses, and burl shop owners; media reports of burl poaching incidents since 2013; and field observations. During field observations, we visited two burl shops and seven sites containing all 24 targeted trees. At these sites, we recorded GPS coordinates, elevation, and measurements of burls cuts (height, width) and their approximate height from the ground. Additionally, we measured non-victimized burls at these same sites as controls to understand why some redwoods were targeted while others were ignored.

Crime process and script

A crime script table (Table 1) was created to understand the four main stages of offending from *preparation* to *post-activity*. At the initial stage, *preparation*, an offender, or co-offenders, obtain tools to cut the burl, such as a chainsaw, and headlamps to be able to work at night. In addition, offenders secure a vehicle that can transport potentially large and heavy burls, and determine potential buyers, such as a burl shop. Tools necessary for burl cutting and dragging it to vehicles are all legally purchased and have common uses outside of this crime.

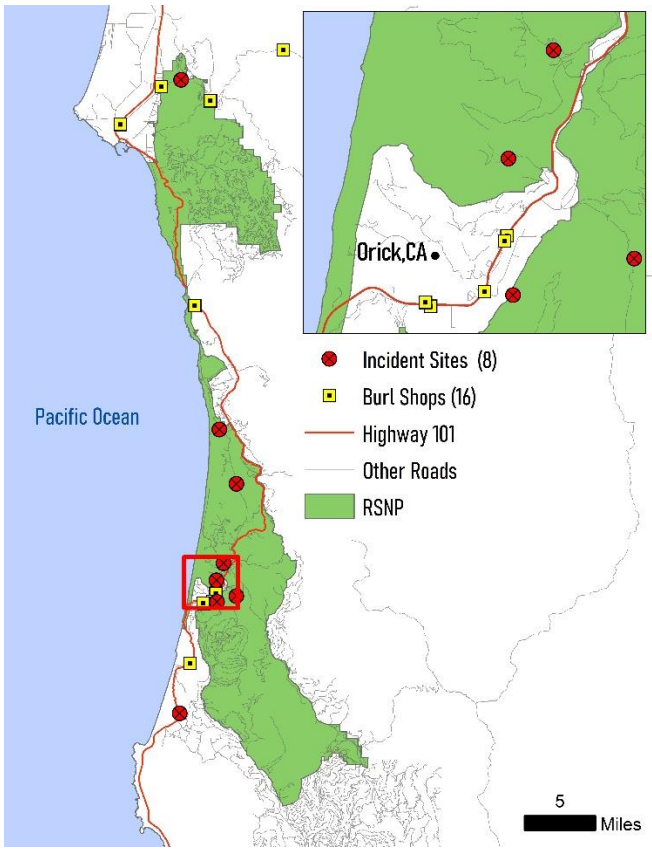

Figure 1. Map of RNSP.

At the next stage, *pre-activity*, entering and exiting the RNSP is made easy for both visitors and offenders as there are numerous entrances throughout the park (~20) that are not gated with the exception of the two main entrances. The road network is one of the best predictors of poaching incidents. Over 50 percent of targeted trees were less than 100 feet from a road and over 90 percent were within less than 400 feet. Some offenders also use old logging roads (i.e. closed roads) to access harder to reach areas of the RNSP.[2] Rangers suspect that much of burl poaching occurs during the wintertime when there are fewer park visitors, but more importantly, it is easier to forage through the forest using unofficial paths, otherwise known as social paths, when vegetation is dormant. Temporal concentrations may exist, but they are difficult to ascertain given that poaching incidents are discovered days, weeks, or even months after the fact. The only temporal information we know of is based on interviews with two offenders that were arrested in 2014 where they admitted to operating in the middle of the night when the park is closed and fewer witnesses could potentially hear chainsaws cutting burls.

At the *activity* stage, from a micro-level perspective, offenders like to target burls that are less than 10 feet off the ground, large in circumference, and located on trees situated at a higher—or the same—elevation relative to the road. Because burls can often weigh hundreds of kilos, offenders often use gravity to push or drag them downhill once cut. From a macro-level perspective, hot spot patterns emerged within the southern, and partly in the northern end, of the RNSP. These concentrations are contingent on proximity to roads, proximity to a greater number of burl shops in the vicinity, and abundance of redwood trees.[3]

In the final stage, *post-activity*, offenders will generally drag, roll, or carry their burls intact onto their truck bed, and bring it home for temporary storage. Likely, they will want to dispose of the product as quickly as possible to avoid being arrested and also to receive quick cash for their work. If they are not selling via online marketplaces, burls will typically be offloaded at burl shops. Burl shops are common in the area around the park (16 burl shops as of 2012). Such shops enable the problem because they are they not required to ask for the identification of burl sellers. Some shop owners are complicit in the trade as they are aware they are purchasing illicit burl from suspicious individuals. Once fenced at these outlets, burls are usually processed quickly (i.e. cut into large slabs) so that law enforcement cannot match the removed burl to a specific victimized tree in the RNSP.
Only three individuals have been arrested for burl poaching in the RNSP since 2012 where park rangers were able to match the cut burls with victimized trees. All three offenders were from Orick,

CA, a small town embedded within the southern half of the RNSP (see Figure 1) where the greatest number of burl shops exist. Notably, two co-offenders were arrested in 2014 after a law enforcement stakeout of an area, but the most recent arrest was of a sole individual. Little is known whether co-offenders are more common than single offenders.

Redwood Burl Poaching					
Stage	**Steps**	**Spatial**	**Temporal**	**People**	**Interventions**
Preparation	● Obtaining tools (bolt cutters, chainsaws, headlamps, chains to drag burl) that can be legally purchased or stolen. ● Identify facility/home to store the burl until processed and/or sold. ●Recruiting co-offenders, if necessary, by identifying available networks, consider familiarity with PA. ● Site/target selection: *scouting ahead; available tools/skills; available routes for a vehicle; ease of transportation to vehicle (i.e. close to road, site uphill from road); available social paths, far from busy areas (trails, parking lots, camping sites); select burls within reach (<10ft) and on back of trees where cuts are not easily visible.* ● Learn law enforcement practices/schedules. ● Secure access to a suitable vehicle (i.e. pick-up truck, ATV). ● Determine potential buyers (i.e. burl shops, wood turners).	●PA (possibly legal entry posing as a visitor).		● Poacher ● Seller	● Formally warn potential burl outlets of purchasing illicit burl. ● Identify online marketplaces where burls have been sold and collaborate with them to set up a burl certification program for online sales.
Pre-activity	● Using owned/rented/stolen vehicle to enter PA via multiple entrances, using closed roads when needed (i.e. logging roads). ● Entering PA can be done legally during park open hours, or illegally at night by getting around any physical barriers (i.e. cutting chains barring entrance to the park), if any. ● Listen to rangers' radio communications to determine where they are.	●PA (possibly legal entry posing as a visitor). ●Road network.	●Mostly at night. ●Preferably during the Winter.	●Poacher.	●Allocate patrolling resources according to poaching risk within the park (see Kurland[3]). ●Automatic gates with vandal-proof license plate readers and motion sensor lights at high-risk access points. ●Vandal-proof CCTV cameras at PA's high-risk entrance/exit points. ● Alert locals and tourists with flyers/signage of suspicious behavior and provide anonymous tip line.
Activity	● Cut burls ● Process on-site if needed by cutting into smaller pieces—although not always desirable or common. ● If dealing with a very large burl and unable to drag/carry/roll it all in one trip, return to the site (sometimes on multiple occasions) to continue removing its pieces.	●PA ●Elevated terrain relative to the road. ●In close proximity to the road. ●Away from official trails, parking lots and camping sites.	●As little time as possible. ●Mostly at night. ●Preferably in the Winter.	●Poacher	●Magnetic sensors hidden in the ground or hidden cameras can be used in victimized sites when there are still burls or burl pieces pending removal. ●Investigate parked cars next to PA at night for suspected poachers.

Stage	Steps	Spatial	Temporal	People	Interventions
Post-activity	● Carry, drag, or roll down burl from site to vehicle. ● Escape, possibly breach fence again. ● Transport burl to a storage facility or buyer, *or* store at home. ● Process into slabs quickly once at burl outlet (poacher or buyer) to make it difficult for law enforcement to identify the burl and match it to the tree. ● Contact buyers—known buyer or advertise. ● Sell to known buyer, burl shop or via internet. ● Share gains.	●PA ●Local burl shops ●Local area where 16 burls shops exist, many concentrated in Orick, CA along US 1.	●Most likely will dispose of the product at a burl shop during working hours while shops are open.	● Poacher ● Seller	●Automatic gates with vandal-proof license plate readers and motion sensor lights at high-risk access points. ●Vandal-proof CCTV cameras at PA's high-risk entrance/exit points. ●Anonymous tip line. ●Require that burl shops make a copy of all burl sellers' photo IDs. ●Implement a verification system that requires burl shops to record the GPS location/address of a cut burl, a photo of the redwood tree, and the measurements of the burl.

Discussion

It is recommended spatially explicit interventions be introduced in high-risk areas identified in previous research.[3] More specifically, patrolling resources, automatic gates with vandal-proof license plate readers and motion sensor lighting, vandal-proof CCTV cameras, and magnetic sensors (to detect chainsaws) should be implemented in those areas that are at the highest risk of victimization. Apart from these strategies, promoting anonymous tip lines, alerting locals and tourists of suspicious behavior via signage or flyers, and requiring more verifiable proof from burl sellers that redwood burls have been legally cut from private property can potentially deter would-be offenders. To date, only magnetic sensors have been implemented in high risk areas. The aforementioned strategies could potentially be implemented within the RSNP if funding was increased. Notably, such strategies may be applicable to other parks with similar problems, such as theft of downed redwood in other state parks in California, which have proved to be more common over time.

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IX
Cactus Poaching in Saguaro National Park

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Problem description

Spanning just over 90,000 acres of arid desert land, Saguaro National Park (SNP) is home to one of the most iconic symbols of the American West, the saguaro (sa-WAH-ro) cactus. Located in two sections both east and west of Tuscon, Arizona, SNP is situated in the Sonoran Desert, which is the most botanically diverse desert in the world.[1] These plants are protected under numerous laws to prevent their unregulated removal and trade, including federal laws protecting U.S. National Parks, the Arizona Native Plant Protection Act, the Lacey Act, and CITES for international trade. Despite these legal protections, theft is an increasingly serious threat, if not the biggest threat, to the sustainability of many succulent species; cacti are among the world's top five most threatened taxonomic groups, with a third of the species at risk of extinction.[2]

Fortunately for SNP, there have been no definitive cases of saguaro "cactus rustling" within the park in a number of years, and there is just one major case in which an offender was caught stealing multiple cacti in 2007.[3] However, local law enforcement indicate that it is difficult to differentiate between a hole left by a stolen saguaro and one left by an animal or a rock being moved. Officials believe that cactus theft may still be occurring without being able to officially confirm it.
Based on the known cases, there is generally one main type of offender engaged in saguaro cactus poaching – the opportunist driven by the market for ornamental cacti. Opportunists seek financial gain by targeting showy, larger, and locally available cacti, which includes saguaros that are mainly used for exhibitionist purposes; these specimens can be easily fenced via nurseries, landscape companies, or the online marketplace. Currently, saguaro sells for about $100 per foot.[4] As xeriscaping grows in popularity in rapidly expanding cities in the Southwest, succulents are increasingly in demand and, therefore, more valuable.

Within SNP, there are 25 different species of cacti, and several species are especially at risk for poaching, but none are officially endangered.[1] Most notably, the saguaro cactus (*Carnegia gigantea*), with its tall stature and branching arms that signify desert culture, is highly prized and has been poached from the park for decades.

Information sources

In an effort to better understand the nature of saguaro poaching, crime scripts were developed based upon an informal interview with a Saguaro National Park ranger (n=1), media reports of saguaro poaching incidents, a TRAFFIC report on cacti trade, and peer-reviewed journal articles.

Crime process and script

There are several factors contributing to the increased potential for cacti theft from Saguaro National Park. First, the vastness of the park means that direct surveillance of all areas is impossible; there are too few rangers and other wildlife protection resources to monitor all visitors for illegal activities. Currently, eight permanent law enforcement officers work in the park. This freedom allows not only visitors to enjoy the seclusion of the park, but also potential poachers can take advantage of the lack of guardianship to simply drive into the park, quickly identify and dig up a targeted cactus, and drive out of the park without fear of being seen.

Second, thieves can identify, dig up, and transport saguaro cacti with relative ease and swiftness. Despite the substantial weight of cacti and the seemingly deterrent spines, anyone familiar with the tools used to transport large cacti can do so without the use of large equipment. In the case that a

large cactus would be targeted, more people may need to be involved to hold the plant and to cut the thick tap root, while a vehicle could be used to pull the cactus out of the ground. The spines can be covered with a thick blanket or tarp, which can also be used to carry the cactus to the truck bed or trailer. Knowledgeable offenders would be sure to mark which side of the cactus faced the sun before excavating to ensure it is replanted properly later, while uninformed offenders might not. Doing so prevents sunburn that can happen with improperly replanted cacti.

Third, offloading stolen plants is simple for poachers who may choose to fence to complacent nurseries nearby, arrange with a private buyer to adorn a front yard, or sell on the online marketplace to meet the high demand from international markets.[4,5] In addition, detection of illicit plants at borders is difficult.

Saguaro Cacti poaching in Saguaro National Park					
Stage	**Steps and options**	**Spatial**	**Temporal**	**People**	**Interventions**
Preparation	● Obtaining equipment: shovel(s), carrying sling or tarp/blankets/canvas/carpet, truck, gloves/"cactus mitts", rope, tubing, tool to cut tap root. ● Prepare storage requirements: storage before delivery to buyer; identify location to drop plants temporarily until return to pick up again. ● Recruiting co-offenders: identify available networks. ● Lining up buyers: landscape companies, online marketplace, individual buyers, nurseries. ● Target selection: scout cacti in feasible locations beforehand.	● Garden /landscape supply stores in area. ● Entering SNP legally or illegally.		● Ringleader ● Assistants to dig and carry. ● Buyer ● Seller (if different from poacher).	● Microchip at-risk saguaro cacti within SNP, close to roads and between at-risk heights. ● Encourage consumers to seek out cacti grown legally and sustainably. ● Use geolocations to map suspected poaching activity to establish current and future potential hotspots to focus patrol resources on riskiest areas. ● Determine the months with highest rates of reported suspected poaching (i.e. tourist high season vs. low season) to strategically increase patrols. ● Post signage alerting locals and visitors that removing cacti from within SNP is illegal and can result in fines. ● Inform nurseries of potential red flags of illicit saguaro sales (e.g. bare roots exposed, no permit, suspicious address of origin).
Pre-activity	● Transport: personal vehicle large enough to transport heavy/large cactus (flatbed trailer), rent a truck, steal vehicle. ● Enter Park: legally drive in during normal park hours, illegally enter after hours. ● Park as close as possible to target cactus: remain on roadway, pullout off of roadway, go off-road.	● Few roads go into/throughout SNP: rough trails not suitable for long flatbed trailers.	● After-work hours: using company vehicle or equipment.	● Poacher ● Assistants ● Driver (may have a CDL if large commercial truck is used). ● Other park visitors.	● Screen entries/exits: *License Plate Reader Cameras, Identify risky vehicles. CCTV at park entrances/exits to monitor for large loads that may indicate serious cactus theft.* ● Law enforcement officer traffic stops and enforcement. ● When a specific threat is identified drone surveillance can be used to identify a cactus poacher.

Stage	Steps	Spatial	Temporal	People	Interventions
Activity	● Walk to location of cactus: pre-scouted, identify new targets in field. ● Dig out roots and cut root tap of cactus. ● Carry to truck bed. ● Secure for transport: conceal, make to look legitimate.	● SNP. ● Within carrying distance to where vehicle is parked *(dependent on size of cactus and n of people carrying).*	● 30-60 minutes required per plant (at minimum) to several hours if done with care. ● Cooler weather (winter) more desirable than heat of summer.	● Poacher. ● Assistants to dig up, carry, and secure cactus. ● Driver ● Other park visitors in vicinity.	● Encourage park visitors and local residents to report suspicious activity to police directly or through anonymous tip lines (i.e. National Park Service Investigative Service Tip line).
Post-activity	● Drive out of park. ● Transport: *to storage, direct to buyer* ● Contact buyer: *known buyer, post online, communicate with seller network (i.e. landscape service/nursery).* ● Sell. ● Share gains.	● SNP ● Local landscape co./nursery/ independent buyer. ● Out-of-town landscape co/nursery/ independent buyer. ● Online marketplace.	● Stolen saguaros are unlikely to stay out of the ground for long; more likely to be immediately transferred to customer or temporarily placed in the soil to keep it healthy.	● Buyer ● Seller ● Driver ● Assistants: *move cactus, wrap/secure for extended transport.*	● Arizona law requires official permits for legally-obtained cacti for sale to nurseries or the public and official address. ● Promote legal sale at wholesale prices of cacti that were transferred from development/construction sites near park. Allow regulated removal of mature saguaros from such sites. ● Shut down or fine nurseries and landscapers who buy and sell illicit cacti. ● Monitor and alert authorities to illegal online marketplaces/ websites. ● Enforce fines and jail time for offenders: *increase penalties and risk of successful prosecution.*

Discussion

There are several situational considerations unique to SNP that should factor in to any proposed interventions or prevention activities. First, scenic drives through the park are only permitted from 7am to sunset. Some roads do crosscut the park and serve as thoroughfares for regular traffic, though some involve rough terrain not suitable for cars or large trailers. Second, roads reach only a relatively small segment of either portion of the park, limiting the spatial options for poaching of large cacti. Third, visitation to the park varies greatly between the seasons, with peak season between January and April, while the hot summer weather during low season reduces visitation by more than half peak season rates. Finally, when the visitor centers are closed, such as on major holidays, the roads and trails within the park remain open.

Apart from situational considerations, some saguaros are at higher risk of poaching due to their features. Saguaros are extremely slow-growing and can take 50 to 70 years to grow arms.[1] Demand is high for older cacti when their iconic arms have sprouted. However, poachers will be less likely to target such mature saguaros because they become too large and unwieldy to handle and transport due to their massive weight and longer arms, and their root systems are far too substantial to cut through quickly with basic tools and skills. Instead, poachers target those that are about 5-7 feet tall, or about 40 years old,[3] which are more removable.

Considering these facilitating factors, and situational and target characteristics, a variety of possible interventions may offer solutions that can reduce the ease, motivation, and rewards of cactus crime. Specifically, the Situational Crime Prevention (SCP) framework helps to identify opportunity-based interventions for saguaro poaching that affect opportunities of potential poachers at all three stages of their offending – before, during, and after – by touching on the categories of SCP techniques laid out by Cornish and Clarke[6] and Freilich and Newman[7]. Table 1 describes a variety of possible approaches in relation to their applicability to different steps and stages of the crime script and the spatial, temporal, and human factors involved in each step.

One example of an intervention that has coincided with the absence of known saguaro poaching is the microchipping of the most vulnerable saguaros. Park officials identified cacti along roads that were deemed to be the most likely to be poached and inserted microchips into their flesh. Since the microchip identification project began in 2015, nearly 1,000 saguaros have been microchipped out of the park's 1.9 million or so specimens, and no definitive poaching has occurred of chipped saguaros in more than six years. Based on the crime script, microchipping is an intervention that focuses on the 'preparation' stage of saguaro poaching, with effects that can also influence the outcomes of the 'post-activity' phase.

Another avenue for intervention could be to identify signs of possible illegal activity that can help guide investigations into potential cactus theft. For example, an improperly replanted cactus in someone's yard that suffers from sunburn could be a sign that a nonprofessional, possibly illegal transplant has taken place due to the lack of basic knowledge of cactus care and sensitivity to the orientation of the sun relative to the plant. Another example would be a Saguaro that has signs of trauma, such as missing limbs or major bruising, which could indicate a poorly executed transplant.

Alongside the many threats facing saguaro cacti in America's southwest, including climate change, land development, non-native invasive species, and wildfires, poaching poses a uniquely opportunity-based, human-driven problem that can be tackled with smart, problem-specific interventions. When considering the wider applications of the current crime script, other crime problems related to wildlife and natural resources can benefit from the analysis conducted on Saguaro poaching. It may be the case that many wildlife crimes involve similar activities, actors, and tools, and therefore can be approached in similar ways. Cactus theft is common among many species, as are thefts of other varieties of flora; building the knowledge base of these types of crimes can ultimately help to identify

effective, realistic interventions that authorities can consider for the specific geographical, environmental, and jurisdictional characteristics of the wildlife crime problems they face.

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X

Trade and trafficking in small-clawed otters for the exotic pet market in Indonesia, Japan and Thailand

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Problem description

Japan, Indonesia and Thailand are all experiencing an 'otter craze', where demand for otters as an exotic pet is becoming increasingly common. This trend is putting the very future of some otter species at risk.

In Japan, 'Instagram-famous' pet otters, and otter cafes are driving the acceptability of and demand for otters as pets for individual buyers, fueling the craze. There is even a Japanese term, "usolar" meaning "otter fanatic". Whilst there are some breeders in Japan, these are small scale opportunists such as local pet shop breeders, and only a very small number of cubs actually appear to be born in these places.[1] As such, the Japanese online pet trade resultant from the craze, is most likely supplied through illegal trafficking of animals through South East Asia.[1] Importantly, there is a large gap between actual numbers of Asian small-clawed otters in Japan and numbers that have been officially imported.[2] There is an ambiguity and, in some cases, reluctance to disclose the source of otters found in Japanese otter cafes. Again, while numerous breeding locations exist in Japan, it is widely recognized by breeders and dealers that it is extremely difficult to successfully breed otters in captivity.[3,4] It is therefore evident that market demand is met through a supply of trafficked otters from South East Asia (Thailand, Indonesia and Malaysia).

In Indonesia, otters are also popular as pets, particularly in urban settings. Online pet stores and Facebook buy/sell groups exist in abundance, and otters sold are either wild-caught or bred by local amateur breeders. The Indonesian trade in otters is both domestic and international, with Japan being one of the key import markets. In Thailand, the trade in otters caters mainly to domestic consumers and is predominantly conducted on Facebook with most buyers and sellers based in Bangkok and otters sourced in-country. There is however an unknown degree of international export occurring, evident through the 2017 seizure of 32 otters en-route from Thailand to Japan.[5]

In 2016, Traffic (the wildlife trade monitoring network) produced a study of the illegal otter trade based on seizures in selected Asian countries between 1980 and 2015.[6] An 'emerging trend' of live otters being hunted and sold for pets was identified, in countries like Indonesia, Thailand and Malaysia. In 2018, a further Traffic study of the online trade of pet otters uncovered 50 separate advertisements with an average of 960 otters for sale at any given time. Indonesia was home to 449 of these advertisements, accounting for 711 otters for sale.[2,5]

Seizures of live otters (in international trade) were virtually unknown before 2002, however, they have steadily increased. Between 2015 and 2017, 59 live otters were confiscated (Indonesia, Thailand and Vietnam).[4] In Japan, the increase in seizures went from 2 otters in 2007 to 32 in 2017.[7] The proliferation of social media and other online marketplaces, together with an increased demand for interactive experiences and 'ownership' of the species has dramatically contributed to the expansion of trade in these animals.

Four otter species are native to Thailand and Indonesia, while Japan's populations are reported extinct. These are the Eurasian otter (*Lutra lutra*), hairy-nosed otter (*Lutra sumatrana*), small-clawed otter (*Aonyx cinereus*) and smooth-coated otter (*Lutrogale perspicallata*). Out of these, the species most traded is the small-clawed otter,[1] considered to be a suitable pet because of its small size (and small nails). It is considered to be a 'cute' and charismatic animal with wide public appeal boosted by the internet.[8,9] Whilst all four otter species are protected in Thailand, in Indonesia the Asian small-

clawed otter is not protected by law and is vulnerable to poaching. The lack of legislative clarity and explicit protection for all otter species in Indonesia has created a "grey area" which traders and breeders can exploit. In Japan there is no relevant legislation regarding the keeping, breeding or trading of otters once they are in-country, whether imported, bred domestically, or of uncertain status.

The small-clawed otter faces a high risk of extinction. Hunting for international trade as well as habitat loss and degradation are responsible for the decline in the species across much of Asia.[4] Consequently, the small-clawed otter was up-listed from Appendix II to Appendix I during the 18th meeting of the Conference of Parties (CoP18) of the Convention on International Trade in Endangered Species of wild fauna and flora (CITES) in 2019. Hunting for trade and the rise in commercial exploitation of the species in violation of national laws and CITES regulations were recognised as major concerns. While the up-listing bans all international commercial trade of the species, the emerging illegal trade in otters as pets is a continuing threat to the species and a major cause for concern, as protection loopholes are exploited.

Information sources

Here, two crimes scripts are generated, based on investigative reporting of World Animal Protection and research by Traffic. During these projects various methods of poaching, trafficking, laundering and "consumption" of the otters were identified in the field, allowing for a crime scripting presentation that identifies various possible intervention points in this diffuse and complex process.

The original World Animal Protection reports are based on unstructured and semi-structured field interviews and observations conducted in Japan, Indonesia and Thailand between October and November 2018; March 2019 and August 2019.[10] To understand the trade flow from capture to export, enquiries worked 'backwards' focusing on wildlife dealers and employees of otter cafes (including the owner of one chain of cafes) to uncover the supply chain journey. Overall interviews in Japan were conducted at otter cafes (n=10); pet shops (n=3) and with an individual breeder (n=1). In Indonesia interviews were conducted with sellers at a pet market (n=5); otter community groups (n=3); pet shops, individual sellers, traders and breeders (n=10); government officials (n=3) and a cargo handler (n=1). Information was also gathered from online otter breeders (n=11) and from workers at a captive breeding operation (n=2). In Thailand, interviews were conducted with traders (n=5); Farmers (n=5) and collectors (n=2). Traffic reporting is based on analyses of seizure data and online advertisements in trading countries.

Here, an actor-based crime script will present the steps taken in the process of otter poaching, and a product-based crime script will follow the otter along the wildlife crime continuum through the trafficking steps. In each of these, intervention points will be discussed that may break up this long and wide-reaching chain of events.

Crime processes and scripts

Poaching: Indonesia

Technically, the hunting of any species from the wild in Indonesia (e.g. for pets or to provide breeding stock) requires a license (with a given quota issued). However, no harvest quotas have been granted for the small-clawed otter in Indonesia, and therefore any hunting/trade is de facto illegal.[2] In Indonesia, distinct roles are adopted by a variety of players in the poaching of otters. Otters are poached opportunistically, purposefully, or to order, with cubs and juveniles being the main target. Collectors known as Pangapu act as middlemen between hunter and dealer who do not meet each other directly. The middleman acts as the indirect point of contact for both. Final buyers, such as pet owners, cafes, private breeders, etc., will purchase the cubs from the dealer.

The focus of their poaching activities are rural areas in proximity to fish farms where otters are prevalent, attracted by the readily available supply of fish. Fish farmers can directly, or indirectly be involved with the poaching process. Otters are considered a pest in rural areas because of their predation of fish in farms and farmers often kill otters for this reason. Interviews indicated farmers also opportunistically hunt to capture cubs to sell into the pet trade, aware of the profit that can be made from their sale. Fish farmers will contact collectors when they are in possession of an animal for sale, or speculatively when they are looking to fulfil an order a collector has. Collectors and hunters operate across Indonesia, particularly in rural areas. Collectors are not local to the areas where otters are hunted and may travel across vast distances (2-3 hour journeys) to collect animals from poachers.

Poachers are able to collect as many as 40 cubs (or in some cases as many as requested by the collector/Pangapu) suggesting a well-orchestrated hunt. If a large number of 'stock' is required, a financial bonus can incentivize the hunters to go and catch more. Experienced hunters or farmers are preferred because of the aggressive and protective nature of adult otters who can make it difficult to hunt the young. Collectors prefer larger cubs, considered easier to care for as they can go up to thirty-six hours without water, compared to smaller cubs who need more regular care and feeding.

To poach the cubs, hunters use a variety of methods, with dogs often used to sniff out dens. Adult otters are known to be fiercely protective of their young, so to extract the cubs parents either have to be scared away or killed. Hunters may set fire to the area surrounding the nest, using smoke and flames to drive the adults away and enabling access to the cubs. Alternatively, small pellet guns are used to shoot and kill the parents so the cubs can be extracted from the nest.

There appears to be little awareness of, or regard for, this licensing legislation (which anyway provides only indirect protection), and there is little, if any, stigma around hunting the species. Of concern, was the identification of a person in position of authority within government agency facilitating the sourcing of wild otters. With the potential for corruption in the process, and ultimately a lack of enforcement – the poaching process may be readily facilitated. Anecdotal evidence from wildlife traders revealed that appropriate permits can be acquired from established contacts, with payments at various levels to smooth the way. The issuing of permits may be seen as an opportunity to make money, expediting paperwork for those who pay and delaying or withholding permits for those who do not.

There is a profitable market to be made, particularly at the end of the supply chain. Dealers in Indonesia value cubs depending on size, with larger cubs being more profitable. Profits are split between the collector and dealer, with funds also being spent on transportation. The traders who purchase the cubs direct from the dealer can sell on for a small profit margin. In Japan however, we see a much larger value being given to otters, which sell for up to 300 times higher – making the trade in otters in Japan a highly lucrative business, particularly with the cheap costs involved in sourcing them in countries like Indonesia.

Poaching: Thailand

In Thailand, unlike Indonesia, the small-clawed otter is protected, and it is therefore prohibited to keep, hunt or trade them under all circumstances. Because of this, the poaching, selling and trafficking of otters is much more underground and secretive. However, it is clear a network of operations exists in the sourcing of otters. Wildlife dealers and pet shop owners have a network of suppliers and collectors who source otters for them, also primarily from fish farms with farmers usually making contact to sell otter cubs if they have them. The dealer finds a farmer in a village who acts as 'supplier'. This person calls when they have otter cubs to sell. The dealer keeps the operation as a small closed group, only contacting a few farmers. Because of the illegalities around the trade,

there is a level of anonymity and those involved in the trade are very cautious regarding potential sales. If the sale is not confirmed by the transfer of money, communications will end.

The ‘collectors’ are mainly from Bangkok and turn up to collect cubs from various farmers. This allows dealers to be able to procure 40 cubs at a time, as stock is gathered (up to ten at a time) from various suppliers across their known networks. Farmers may provide otters opportunistically and for profit, calling dealers to sell otter cubs if they have them. Cubs are collected during two breeding seasons that occur between November-January and usually at the start of the rainy season May-July. Methods observed in Indonesia, such as using fire and smoke, are also implemented in Thailand. Collectors here have also developed a particular tool for the purpose of catching otters in fish farm ponds. Similarly, bribes are said to play an important role in the process, with dealers agreeing there is awareness of what happens, and bribes are indeed accepted.

Importantly, there was the belief expressed by one trader that their actions are helping preserve populations as the farmers who provide the otters regard them as pests and kill them, they are inadvertently rescuing them by selling to people who will look after them.

Poaching of small-clawed otters in Indonesia and Thailand					
Stage	**Steps and options**	**Spatial**	**Temporal**	**People**	**Interventions**
Preparation	● Wildlife dealer receives order from customer. ● Wildlife dealer contacts collector/middlemen to place order for otter cubs. ● Collectors contact network of hunters and fish farmers. ● Middlemen and poachers prepare facilities for keeping otters until they are weaned, with food and water supplies. ● Hunters identify suitable location for hunting cubs. ● Collect materials for poaching: tools to make fire, firearm.	● Indonesia: middlemen operate networks across vast areas. ● Thailand: middlemen take orders to sell to the domestic market. which appears to be principally dealers who are buying in order to sell abroad. ● Poaching sites are rural areas, often in vicinity of fish farms.	● Poached to order or opportunistically depending on demand and availability. ● Targeting otter cubs, in breeding seasons Nov-Jan & May-July (Thailand specific).	● Wildlife trader/ pet shop owner/market trader. ● Hunter (locals and fish farmers). ● Middleman ● Dealer ● Customer	● Identify fish farms where otter predation is an issue in order to implement Human wildlife conflict resolution to ensure farmers aren't tempted to sell pest otters. ● Implement mitigation program to protect fishponds from otters (boundaries, fences, etc.). ● Target known hunting sites. ● Prosecute offenders. ● Monitor social media channels where otters are for sale and take action to reduce demand. ● Survey fish farmers about attitudes towards otters to identify target locations where hunters may operate. ● Otter population census to determine where hunters might operate and implement patrols in the area to discourage hunting.
Pre-activity	● Collector travels to poaching site (in the case of Thailand, coming from Bangkok). ● Prepare firearm. ● Prepare tools to make fire. ● Take position and allow dog to sniff out area. ● Set fire to land and watch area carefully as smoke builds from fires set. ● Bribe officials to allow hunt/avoid arrest (Thailand).	● Poaching site likely to be (near) fish farm. ● Proximity of otter nests.	● Hunts launched during breeding seasons Nov-Jan & May-July (Thailand).	● Poacher ● Fish Farmer ● Middleman ● Government officials	● Target fish farmers supplying cubs into the trade and utilize them to identify visiting collectors as they are often involved in the collection of other wildlife. ● Educate farmers and poachers on role of otters in the ecosystem and raise awareness of their fate in cafes as pets in unsuitable environments, to encourage them to change tactics. In response to the belief that they are protecting the animals.
Activity	● When dog finds nest shoot and kill adult otters. ● Extract cubs from nest after adults have been smoked out or killed.	● Poaching site		● Poacher	● Use local communities to report poaching events. Report where they see fires which may suggest active hunts and encourage them to look out for outsiders, particularly men with dogs / visitors to fish farms. ● Respond to signs of smoke /fleeing of adult otters. ● Identify and target fish farmers that are keeping otters in cages for sale.
Post-activity	● Exit poaching site with otters. ● Contact middleman. ● Provide cubs to middleman.			● Poacher ● Collector	● Monitor fish farms

Trafficking: Indonesia, Thailand and Japan
In Indonesia, otter trade supplies both domestic and international demand, being an important source country for Japanese import specifically. Transporting otters to domestic buyers is the task of the collector and details remain vague. Domestic Indonesian trade is believed to be conducted via mail order online (Facebook), after which otters are shipped by post, transported in a postal train via special delivery service. Routes no longer than 12 hours are recommended to avoid mortality.

The methods by which otter cubs are exported out of Indonesia are also unclear. Field visits and access to the inside of a breeding farm during World Animal Protection investigations, allowing conversation with workers, as well as other research, confirms the existence of an active captive breeding farm in Indonesia, that is said to be laundering wild-caught otters for export out of the country to Japan. While not fully understood, this is a potentially important route by which otters may be trafficked internationally in contravention of CITES regulations, and illustrative of the complex legal situation. Through this facility, otters can be 'greenwashed' for trade to Japan to supply pet cafes or to be sold into the pet industry. Investigations revealed the farm trades otters primarily for export, with an individual interviewed revealing that wild-caught or locally bred otters are acquired by the farm, and 12-15 otters are exported per month.

The 'legal operation' is said to be used to conduct illicit trade by acquiring authoritative paperwork and permits for 'legal trade', enabling export of otters sourced from the wild when labelled as captive bred. It is understood that otters have been exported to Japan as 'non-commercial souvenirs'. Under a Minister for Forestry decree it is permitted to transport two living animals from Indonesia as a souvenir for non-commercial purpose, when some specific conditions are met. The souvenir loophole, which would also be present in CITES regulations, may be a mechanism by which usual procedures for exporting Appendix II species (which the small-clawed otter was listed as at the time of investigation) were circumvented, given that both the commercial nature of the cafes and sale of imported otters into the pet industry would normally not allow for this. Moreover, given the commercial nature of the farm in question, they would be excluded from acquiring permits with non-commercial purposes – further indicating laundering under false pretenses.

In Thailand, trade mainly supplies domestic demand, facilitated primarily through Facebook, with some evidence of international export. Here, middlemen keep the cubs and hand feed them until they are weaned and are considered strong enough to travel. Cubs under three months are not suited for transit as they are too vulnerable and may not survive the trip which would mean a financial loss to all involved at this stage. It is an expensive business to collect cubs and look after them until they are ready to be transported because they are noisy and difficult to keep undercover without drawing unwanted attention and complaints from neighbors.

Domestic and international trafficking of otters					
Stage	**Steps and options**	**Spatial**	**Temporal**	**People**	**Interventions**
Procure	● Establish trading contacts (see previous script). ● Find and collect otters (see previous script).	● Across Indonesia and operating from Bangkok, Thailand.		● Customer ● Wildlife dealer ● Middleman ● Hunter, collector, fish farmer.	● Demand reduction campaigns, employing information on ecological and animal welfare consequences to the otter populations and individuals. Target poachers, fish farmers, (prospective) pet owners, prominent social media personalities, otter café owners and visitors.
Broker	● Middleman is contacted by collector or farmer when otters are poached (on order or ad hoc). ● Middleman receives or collects otter from collector (Thailand). ● Middleman feeds otter cubs until weaned (Thailand), or otters are greenwashed through breeding facility (Indonesia).	● Fish farms ● Middlemen based in Bangkok. ● Breeding farm in Indonesia.		● Middleman ● Poacher, fish farmer ● Captive breeder	● Enforce captive breeding and trade restrictions, close regulatory and CITES loopholes. ● Triangulate wild population, captive breeding stock, export and import figures to determine scale of greenwashing.
Transport	● In Thailand buyer pays for motorbike courier or bus driver to transport (and feed) otter en route to Bangkok. Separate motorbike courier delivers otter to final buyer. ● In Indonesia domestic trade otters are shipped by post on postal trains via special delivery (on routes of less than 12 hours). ● In Indonesia, international trafficking otters are potentially shipped through ports via Singapore, carried on-flight or labelled as captive bred and exported as souvenirs to Japan.			● Buyer ● Middleman ● Motorbike couriers ● Bus driver ● Port and airline officials ● Postal service ● Captive breeder	● Identify bus routes and services used for transport and conduct (random) checks of packages. ● Screen packages for otters on postal trains. ● Inform (air)port officials on what to look for, and screen packages and luggage. ● Understand and close legal loopholes that facilitate trafficking as souvenirs, enforce regulations, implement anti-corruption measures such as rotating permitting staff.
Consume	● Pet owners in Thailand, Indonesia or Japan buy otters. ● Otter cafes attract customers, offering otter experience. ● Pet owners show otters on social media.				● Outreach to social media websites to ban advertisements that facilitate illegal trade, and videos of pet otters.

Discussion

Due to the growing popularity and demand for otters as pets, and the increase in players wanting to get involved in this lucrative industry, it is of upmost importance that we better understand the crime process so that relevant and appropriate enforcement measures can be identified and implemented by the relevant authorities to protect small-clawed otters.

Captive breeding operations and corruption are facilitating laundering and trafficking. We have identified at least one operation (and another under development) using these methods, and the precautionary principle suggests enforcement should be looking for other as of yet unknown operations. The exact methods and loopholes used to facilitate this process need to be better understood and monitored, as weak regulations, weak law enforcement and corruption at various levels have made it possible for a Japanese national to become a successful wildlife dealer and trafficker in Indonesia.

Further evidence would be helpful regarding the specific roles and involvement of the various actors involved, including the key players, such as wildlife traders, collectors and hunters, but also the associates that are responsible for moving the animals between locations and who play a role in facilitating the illicit movement of animals at key locations (i.e. personnel within cargo ports and airports). It is of upmost importance that action is taken targeting the various players involved, whilst strengthening law enforcement efforts to protect wildlife from trade.

Given that there are no harvest quotas for wild otters in Indonesia, at least in the very first instance it should be made clear and transparent how parent stock in the captive breeding operation have been obtained. Second to that, operations need to be closely monitored, particularly in light of the uplisting which came into effect in November 2019. The uplisting of small clawed otters to Appendix I prevents international trade in the species for commercial purposes (excluding exceptional circumstances). It is important to assess how the uplisting might affect and potentially impact/change the current hunting and trading methods, and particularly the continued use of corrupt actors to facilitate international exports from Indonesia, and imports into the key market of Japan.

It is vital that if any otters are exported as captive bred, documentation and accompanying paperwork are legitimate and do not contravene the CITES convention. It is suspected, based on observations in Thailand where the species is protected, that the trade in Indonesia may become highly secretive and sales might shift online through social media channels where a layer of anonymity to the players involved can be added.

It is imperative that custom agents and relevant authorities in source and demand countries collaborate to monitor and intercept animals being smuggled internationally. With animals being exported out of Indonesia with apparent ease, importing countries such as Japan need to make a concerted effort to monitor and assess wildlife being imported into Japan, and assess their legitimacy by thoroughly examining documents for import and questioning source and purpose.

We can hypothesize about the potential routes and methods for trafficking otters, based on information gathered from wildlife dealers about the trafficking of other species they are involved with. However, in order to implement enforcement action to better protect the species from both domestic and international trade it will be important to gather more specifics relevant to the small-clawed otter. We know from numerous testimonials that corruption, bribery and involvement of law enforcement and government agencies is common, however understanding how such relationships are formed, developed and sustained will be key to addressing them.

Finally, the Japanese part in the supply chain can be better understood as dealers and traders facilitating the connection between source and destination may also utilize the souvenir loophole to launder and traffic up to two otters from Indonesia to Japan. This loophole is likely also applicable to Appendix I species, and thus captive facilities such as the identified farm and individual operators can keep using this – even if part of their operations are illegal or non-compliant; the loophole remains. Transport as a souvenir may be legal, but it is facilitating illegal trafficking when it is exploited for commercial purposes. The failure to identify destinations, as direct or indirectly being otter cafes, pet shops or pet owners allows for this exploitation. An important intervention would thus be to address legal loopholes and ambiguity. As well as addressing the demand in countries like Japan, by engaging with social media platforms and popular users thereof. This may start even with addressing the belief of hunters that they are saving the individual otters.

Questions remain about the trafficking of otter cubs in Thailand and Indonesia. The background, motivations and potential other hunting or poaching activity of the collectors can be better understood, as well as when they prefer to hunt on daily, weekly and seasonal cycles. Further, the number of people and exact roles in the poaching process are not entirely clear, given testimony of as many as 40 cubs per hunt. The hunters may be active outside fish farms as well, so hunting locations and reliance on fish farms can be more closely understood. Specifically, given the specialized nature, the hunting dogs may offer important intervention points as these may be expensive and require extensive training. Additionally, it is imperative to understand how bribes are used to facilitate their journey through the supply chain. Little is known about how otter cubs are stored and transported from poaching site to transit locations, particularly the duration that hunters and collectors keep the cubs for – given that at least in Thailand this will have to be done secretly.

As we see a rise in the popularity of wildlife dealers using online platforms to sell species of the exotic, Indonesia will need to address the lack of law pertaining to online trafficking. Similarly, steps are needed to address protecting the species within Indonesia. In Thailand, it is evident that listing the species as protected is not enough. Trade needs to be monitored and regulated and enforcement action taken against anyone found in breach of the law. Without effective enforcement and regulation, the trade in this species will continue to flourish.

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XI

Large carnivore poaching using steel wire snares by Vietnamese poaching groups in tropical forests of Peninsular Malaysia

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Problem Description

Although deforestation and forest degradation have long been considered the most significant threats to tropical biodiversity in Southeast Asia, hunting is by far the greatest immediate threat to the survival of most of the region's endangered vertebrates.[1] Finding and killing wildlife (especially elusive big cats) in the dense tropical rainforest requires specialized skills and trapping techniques which typically involve setting (intricate) wire or cable snares along animal trails.[2] Because snares are low-cost and indiscriminate by nature, they can lay waste to large numbers of wildlife (targeted and non-targeted) with relatively low investment, making it the predominant method of killing wildlife in the Southeast Asian tropics.[1–4]

In the forests of Malaysia, snaring for wildlife takes on multiple forms that vary by the material used, target species, and poacher nationality. For example, this type of hunting is a long-standing tradition of local and indigenous communities that use nylon or rattan snares to target wild pig (*Sus scrofa*), muntjac (*Muntiacus muntjac*), other small mammals, and terrestrial birds. This script, however, focuses on the activities of specialized Vietnamese poachers because they have been observed to conduct massive snaring incursions in Malaysian forests, specifically targeting large carnivores like tigers (*Panthera tigris jacksoni*), leopards (*Panthera pardus*) and sun bears (*Helarctos malayanus*) in recent years. Vietnamese hunters have been perfecting this fieldcraft for generations and trapping is deeply embedded in their culture and economy.[5] Whereas these groups used to hunt wildlife as a secondary activity during the collection of agarwood, they have evolved to a near exclusive focus on harvesting high-value wildlife. This shift was likely driven by the growing importance of Vietnam as a transit and destination country for illegal wildlife products, and by links between poachers and organized criminal syndicates in Vietnam, who would organize the logistics for poachers to travel to source countries for their hunting trips.[6,7]

Information sources

This crime script was developed using information from several years of patrol data, unstructured interviews with patrollers from civilian anti-poaching teams operating in different landscapes across the Malaysian peninsula as well as wildlife rangers from the Department of Wildlife and National Parks Malaysia (DWNP), and post-arrest interviews with Vietnamese poachers. Information from the Reference Guide to Traps in Peninsular Malaysia[8] and Guide to Deep Forest Counter-Poaching Operations (*in prep*) were also used to formulate the crime script.

Crime process and script

Preparation

While there are a number of Vietnamese communities that reside and work in sawmills and factories in Peninsular Malaysia, their involvement in poaching incursions tends to be in non-specialist roles. These individuals are usually recruited as cooks, porters, or a camp manager. It is observed that the snare specialists travel directly from Vietnam specifically for the poaching incursions. Their travel arrangements are managed by the poaching agents who reside in Malaysia. These Vietnamese passport holders can enter Malaysia visa-free for 30 days, and once they are in-country they will stay in transit houses, usually owned by agents, while other logistics are organized.

Poaching with wire snares requires careful targeting of good locations, crafting and setting of the trap, and time waiting for a catch. As such, these snaring gangs need to prepare for difficult trekking and surviving in the deep forest for extended periods of time, staying between 2-5 months at a time.

This extensive and intensive operation requires logistics preparation to supply the poaching group for months in the forest. Vietnamese poaching gangs often rely on agents to procure the tools, food supplies, and weapons, as well as arrange for transportation to and from the forest edges.

Pre-activity
After tools and food supplies are packed into their large gunny sacks, the poaching gang is transported, typically by 4WD vehicles driven by their agents, to the edge of the forest. The drop-off locations that are usually selected are plantation or logging roads, tucked away from public view. From there, they would begin trekking in, moving from camp to camp until they find a location that is nestled (and hidden) between prominent ridge lines that would provide optimal snaring locations and will set a semi-permanent basecamp there. These basecamps are usually well hidden off a steep slope next to a small stream, because a water source is needed for the cooking of bone glue/cake. Understanding the specific requirements for these basecamps helps to narrow the search conducted by patrol teams when looking for the poachers' camps.

Activity
In the dense tropical jungles with undulating terrain, poachers will select narrow ridgelines where clear animal trails are present to set their snares. Narrow trails allow better funneling for target animals to walk right into the snares. Based on the gauge of the steel wires and the tension of multiple spring poles used, Vietnamese snares are set exclusively to target large mammals. Based on the remains of wildlife observed to have been left by these poachers, by-catch include wild pig, serow (*Capricornis sumatraensis*), tapir (*Tapirus indicus*) and muntjac. Canines, claws and gall bladders of sunbears, leopards, and clouded leopards (*Neofelis nebulosa*) have been observed to be harvested by the poachers. These observations indicate further exclusivity to large carnivores that are deemed valuable and targeted by Vietnamese poachers for commercial sale.

For these extended periods of time that poachers operate in the forest, they carry in rice and instant noodles for rations, which will be supplemented with wild meat (usually wild pig and muntjac), caught as by-catch from the snares they would deploy. Poachers stay several weeks in one basecamp, servicing multiple snare lines, and up to 2-3 months total before going out for a resupply run. These resupply runs would typically be organized by the same agents and enable poachers to handover wildlife products for 'safekeeping' or sale. Subsequently, poachers can carry on their poaching operation for another 2-3 months.
Initial processing of snared animals occurs at the snare site. Desired parts are taken by the poachers and remains of the carcass are left at the snare location as bait while the snares are reset for other carnivores. Further processing is done at camp, where claws and canines are cleaned, meat for consumption is cooked, gall bladders are dried, and bones are boiled into bone glue for five days.

Post-Activity (aftermath)
As most of the processing of the wildlife parts occurs in the forest at base camp, poachers would decide to exit the forest and end their operations when they have acquired enough products but also when they run out of rice and other rations. They would typically trek back to the same area where they entered the forest, using their tree markings to navigate. Once they are within GSM phone signal range, they would contact their agent to arrange for pick-up. This is why it is important that access points are identified and monitored, especially where there is phone signal, so that poaching gangs may be intercepted.
Poachers would sell their products back to the agents, who would then arrange for their travel out of Malaysia and organize for the products to be smuggled separately. Unfortunately, not much is known about how they exit from the country undetected despite overstaying the 30-day visitor pass, or how the agents arrange the smuggling of the products and onward sale. Bone glue has been observed to be smuggled on flight as cake (food item) in hand-carry. Knowing what form wildlife products are smuggled in would help airport and border security to identify and intercept the smuggling.

Mammal poaching with snares by Vietnamese poachers in Malaysia					
Stage	**Steps and options**	**Spatial**	**Temporal**	**People**	**Interventions**
Preparation	● Recruitment of co-offenders: -- poachers may be recruited by agents in VN or MY -- poachers may recruit one another and contact agents to arrange for logistics	● Snare expert poachers are recruited in Vietnam. ● Support roles (cook/porter) can be recruited from Vietnamese community residing in Malaysia.	● Year round. Recruitment happens before poachers travel to Malaysia.	● Poacher(s) ● Agent(s) ● Poaching party	● Work with VN community in MY to identify recruitment areas and methods. ● Work with Vietnam-based NGOs to investigate and interview members from the communities where poachers are from to identify recruitment methods and devise interventions.
	● Travel from Vietnam to Malaysia, either by land or sea.	● By land: poachers could travel legally through Thailand into Malaysia. ● By sea: Vietnamese illegal fishing boats are known to enter Malaysian waters along the east coast.	● Year round	● Poacher(s) ● Agent/ Transporter ● Illegal fishing boat crew	● Build collaboration with immigration to create profile of poachers that can be used for extra screening or preparing alerts. ● Build collaboration with Navy/fisheries to look for illegal immigration via fishing boats.
	● Waiting in transit house (usually owned by agent) while supplies are procured and/or other poachers arrive.	● Transit houses are usually wherever the agents are based. This may not necessarily be in the same state as the target site.	● Poachers would stay in this transit house for a few days before getting transported by the agent to the forest edge.	● Poacher(s) ● Agent(s)	● Work with VN community in MY to raise awareness on the Malaysian law against wildlife crime and the severity of consequences to discourage facilitation.
	● Obtain tools and equipment for snaring: -- 8-9mm steel cable for snare -- machetes -- mattocks -- spearheads	● Malaysian hardware stores in transit town where poachers stop before entering the forest. ● Vietnamese machetes and spearheads are most likely procured from Vietnam before entering Malaysia.	● Year round	● Agent(s)	● Solicit hardware store owners to send alerts to authorities when they observe customers purchasing reels and reels of steel wire of that gauge, especially when they notice foreign buyers. ● Inform border patrol of what to look for regarding these specialist tools.

Stage	Steps and options	Spatial	Temporal	People	Interventions
Preparation (cont)	● Organize rations; usually rice, instant noodles, instant coffee, cigarettes, talc, batteries, joss sticks, etc.	● Sundry stores or markets in transit town in Malaysia.	● Rations are usually procured just a few days before the poachers enter the forest for their poaching activities.	● Agent(s)	● Solicit storeowners to inform authorities when orders for these 'forest rations' are made. Some of these Vietnamese or Thai products could be imported and sold in specialty stores, which can be located.
	● Select site: -- experienced poacher knowledge -- agent/transporter knowledge -- local communities consulted for information of wildlife observed	● Forest area visited by experienced poacher on a previous trip. ● Forest area known by transporter to be prolific.	● It is uncertain whether this gets decided before the poachers leave Vietnam or when they have arrived at the transit houses in Malaysia.	● Experienced Poacher(s) ● Transporter(s) ● Agent ● Local community	● Identify areas/locations with repeated victimization and record locations of signature tree markings associated with snaring incursions to increase frequency of patrols along these trails. ● Engage with local communities residing by forest edge that could be brought on-side to alert authorities when approached by foreign poachers for information on wildlife.
Pre-activity	● Transport to forest edge: -- 4WD owned by agent -- van owned by agent -- taxi	● Transport from transit house to selected access points along forest edge. ● These access points tend to be in oil palm plantation or logging concessions. ● Forests with highways bisecting them also allow easy access to poachers and they can deploy using taxis. ● These access points are almost always secluded areas.	● Night deployments are preferred to avoid being noticed.	● Poacher(s) ● Transporter(s)	● Build spatial profiles of access points: Given the selectivity of these access points, they can be identified based on some criteria: secluded, access leads to logging trail or ridge line trail, phone signal. When identified, these access points can be monitored using cameras or gatekeepers. Drop-off points have been observed to be reused multiple times, even for resupplies.

Stage	Steps and options	Spatial	Temporal	People	Interventions
Pre-activity (cont)	● Entering the forest -- logging trails -- ridge line animal trails	● Poachers trek along known trails, logging trails, and ridge lines to get to a location they deem suitable to be their basecamp.	● Treks from their drop-off points to reach their basecamp could take several days, particularly with heavy loads at the start of their incursion.	● Poacher(s)	● Poachers who are revisiting a site they have operated in before would have left behind tree marking signs to follow back. These tree markings act as their navigation in and out of the forest and can be studied and exploited by enforcement teams.
	● Selecting location for operational basecamp	● Within 500m from nearest snare on ridge line. ● Close proximity to a small stream as water source is needed for cooking bone cake. ● On slope and hidden away from main trails.	● Up to 1-2 months at a basecamp	● Poacher(s)	● Target search at areas that fit the physical criteria described.
	● Prepare snares at camp: -- cut up steel cable from reel into 3m lengths -- carve trigger pins -- tie pins to wire -- add whipping to prevent ends of wire from fraying -- prepare treadle boards	● At basecamp	● Uncertain how long this would typically take. More information could be obtained from post-arrest interviews	● Snare expert poacher(s)	
Activity	● Set steel wire leg snares	● Narrow and prominent ridge lines	● Uncertain how long each snare would take to set up. Estimated 30-60 mins though this should be confirmed with interviews with poachers. ● Snare lines are checked every few days. ● Snares are usually left on trails even after poachers have left the forest.	● At least 2-3 poachers to set one large cable snare up.	Potential snare locations can be identified, and patrols can target these prominent ridge lines.

Stage	Steps and options	Spatial	Temporal	People	Interventions
	● Processing catch at basecamp -- drying meat / gall bladders -- cleaning canines and claws -- boiling up bone glue	● Initial processing of carcass at snare site (taking only parts of value). ● Further processing of parts at basecamp .	● Boiling of bone glue could take up to 5 days of continuous simmering.	● Poacher(s)	● The bone glue processing anchors poaching teams to water source locations, which provides patrol teams to target searches for active poaching camp.
Post-activity	● Exit from forest	● Usually retracing steps back to point of entry, following tree markings made along the way. ● Search for GSM signal to make call to agent for pick-up.	● 3-5 months when supplies run out ● 1-2 days wait at exit point for pick-up to arrive	● Poacher(s)	● Access points can be monitored with cameras to send alerts when poaching teams return for pick-up
	● Transport	Exit point back to transit house	● 1-day travel to transit house	● Poacher(s) ● Agent(s)	
	● Sell products	● Sell in Malaysia back to agent in exchange for arranging transport back to Vietnam ● Sell other products to known buyers in Vietnam		● Poacher(s) ● Agent(s) in MY ● Agent(s) in VN	● Work with airport and border security to raise awareness on the forms in which wildlife parts are likely to be smuggled into destinations such as Vietnam or China. This could include samples of x-ray images from known cases to help them identify them at screening. ● Train and use detection dogs at airports and borders to identify bone glue in addition to other smuggled wildlife products.

Discussion

The crime scripting process for this poaching activity has helped to identify the specificity of the mode of operation that Vietnamese large carnivore poachers adhere to, driven by the environmental conditions. Being able to use multiple sources of information to triangulate data from interviews, patrol observations, open source research, etc. has painted a clearer picture of this crime type, which allows for more targeted interventions. The factors that help predict and restrict their area of snare operations help guide forest patrols to target efforts along prominent ridgelines and improve site protection strategies. The probability of finding active poaching incursions in large dense forested landscapes with small patrol force has always been very low. Being able to predict where poachers are more likely to set snares and likely to camp has given forest patrol teams targeted search tactics to interdict the incursions. These tactics can also be employed and tested in similar tropical landscapes where snaring for large carnivores is prevalent.

It is recognized that there are still some information gaps to fill, particularly in the recruitment and organization of the poaching operation before the poaching team deploys in the forest, as well as the onward sale of the wildlife products. More information in these steps could perhaps allow for interventions that involve engaging the Vietnamese communities to affect behavioral change for prevention measures. Further understanding of the facilitating agents/transporters could also weaken the links in these operations.

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XII
Amber Mining in Northwest Ukraine

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Problem description

The demand for amber, the fossilized resin of ancient trees, for use in jewelry, décor, and alternative medicine in Asia has resulted in an amber rush in Ukraine. Reminiscent of the Wild West during the Gold Rush in America, "sun stone" mining in Ukraine is a dangerous, unruly endeavor. It emerged from the instability that resulted from the fall of the Soviet Union when the state-run enterprises were essentially closed, and opportunistic individuals entered the market. The amber business exploded in popularity in the early 2010s when amber's value and demand hit impressive highs, which encouraged the impoverished locals to cash in on the local business. However, decades of unregulated mining have devastated expanses of territory in northwest Ukraine and led to a tense stalemate between illegal miners, law enforcement, and the Ukrainian government.

Due to a Ukrainian law that prohibits the extraction of amber by individuals and limits commercial mining only to companies that obtain a permit, the majority of the amber mining that occurs in Ukraine is illegal; it is nearly impossible to obtain a permit to mine legally. The law also prohibits the sale, transport, or purchase of amber without a permit. Even those few legitimate corporations that have had permits in the past have faced challenges to successfully renew them due to the vast amounts of paperwork and bureaucracy that is involved. Because of these regulatory issues and the pervasive corruption that exploits them, the amber market is controlled by heavily armed and violent gangs facilitated by complacent or corrupt officials, with law enforcement either unable or unwilling to intervene in a meaningful, effective way.

Shortly after the Ukrainian Euromaidan revolution ended in 2014, miners began demanding the legal right to capitalize on territory they perceived as theirs to exploit while simultaneously pushing back against the protection offered by corrupt officials that had thus far facilitated their activities. During this time of major sociopolitical transition in the country, coupled with the onset of the ongoing conflict with Russia in the same year, there was an injection of weapons and small arms, including military-grade firearms and explosive devices, into the civilian market. Success in the illicit amber market has relied heavily on easy access to these weapons to provide security and deter government interference. With this ease of access to weapons by civilians and former military members with training in how to use them, weapons are one of the most important tools required to carry out amber mining successfully. Armed standoffs frequently occurred between groups of miners and law enforcement at the height of intensive amber mining, and scouts still post along roadways to warn mining groups of potential visitors. Police officers in the region remain wary of retaliation by miners, including attacks on their homes, for interfering in their work. Under this blanket of security and deterrence, miners can work unimpeded.

The emergence and expansion of illegal amber mining has had far-reaching effects throughout Ukraine. Among the most apparent are devastating environmental damage, obstruction of the rule of law, and perpetuating corrupt systems. In heavily mined areas, a symptom of the forced flooding of the topsoil coupled with deforestation is a higher tendency for unnatural flooding and a depletion of the soil nutrients. Filipovich and Shevchuk[1] described the environmental damage caused by mining as catastrophic. Some of the less visible, yet equally concerning consequences include economic losses through black market finances and stymied long-term social and economic development. As local human capital is expended on illicit enterprises such as amber mining, the government and the local communities receive no official revenues. In a country that is undergoing governmental decentralization, this lack of local legitimate investment can lead to declines in local public services

that depend on these funds like infrastructure maintenance and development, community organizations, and social services.
During the amber rush between 2014 to 2017, it is estimated that 50,000 Ukrainians were involved in the illicit amber market. At its peak, one kilogram of amber was worth up to $3,000,[2] which is close to the average annual salary in rural Ukraine. Ordinary people from the region joined the existing illicit groups in mining due to the prospect of a large payout from netting even a small volume of amber. The lack of viable income-generating jobs in the region, combined with an influx of trained fighters returning home from the ATO (Anti-Terrorist Operation zone) in the conflict against Russia, created an environment amenable to illicit income-generation. The issue also took on a political spirit when miner groups refused to pay off corrupt authorities and began demanding that legal pathways for individual mining be written into law.

Indicators today signal that illegal amber extraction is on the decline in Ukraine. The global amber market is experiencing a "deep economic crisis," according to a prominent global amber association, Le'amber Consortium.[3] Since 2017, the global demand for amber has declined, leading to a dramatic devaluation that is discouraging people from engaging in its extraction.[4] While there are several factors driving this decline, one may be that Russian and Ukrainian legitimate enterprises and black markets have been overproducing in recent years, so there is an overabundance of amber available at lower prices.

Despite the high profile of this illicit market and significant news reporting in recent years, little research exists from a criminological context. As the Ukrainian government continues to work to pass legislation that will provide mechanisms for the legalization of certain forms of amber extraction, the years-long standoff between locals in the region and the government continues. The most common method of amber mining described in the next section is unlikely to ever be legalized, due to its environmental impact and riskiness, meaning it will always be considered illegal. This contribution seeks to explore and describe the process of illegal amber mining in Ukraine using a crime scripting approach.

Information sources
This script was compiled using an exploratory qualitative research design. A literature review was completed of relevant existing scholarly and "grey" literature about amber mining in Ukraine that was available online. Such literature includes articles in peer-reviewed journals, news reports, official reporting from Ukrainian police and security services, and special investigative reports available online in English, Ukrainian, or Russian. One (1) interview was held with a Ukrainian law enforcement official who worked in one of the regions popular for mining, and was believed to have in-depth knowledge about amber mining. One (1) informal conversation was held with a former resident of Rivne, a region that is heavily mined for amber.
While there may be a lack of academic research and official government reporting on amber mining, there is a considerable amount of information that can be collected from various online sources. From these resources, it was possible to construct a detailed crime script for amber mining. Table 1 displays information on the different stages and steps involved in the process.

Crime process and script – Amber Extraction in Northwest Ukraine
Amber mining in Ukraine is a messy, dangerous job that can take several different forms, yet has been accessible to common villagers and experienced laborers alike. Mining can be a solitary activity but having at least three members in a group makes it a more efficient endeavor. There do not appear to be any seasonal limitations to amber extraction, as there are techniques to penetrate frozen ground in the winter. Motivated offenders work night and day, using lamps or spotlights to work in the dark. To begin extraction at the lowest level of actors – those who are physically carrying out the roughest work in remote wooded areas – target selection involves determining where amber might be located in the ground. Land coverage of mining hot spots includes nearly 14,000 sq. km. of

territory in Ukraine,[5] mostly within the three northwest regions of Rivne, Volyn, and Zhytomyr. Rudimentary methods for geolocating amber may include three approaches. First, mining sites are based on established territories already known to contain amber. Secondly, geological maps of expert assessments of the earth below the topsoil can be used to identify potential new amber hot spots where test holes are dug to survey the land. Finally, a more advanced method of land surveying involves the use of expensive expert ground survey equipment that can determine the makeup of the ground below, much like an x-ray of the ground.
Once a site is found to contain amber stores, miners need a large amount of equipment. At the basic level, what Shevchuk (2018)[5] refers to as "artisanal mining," shovels, fine nets, a homemade hydraulic pump, and hoses to transport large volumes of water from a nearby water source are needed. Hydraulic pumps are commonly made from old car engines. A person or group can dig a hole several (5 – 8) meters deep, pump it full of water, and mix the sandy soil to allow the amber to float above it and fetch the stones out with a net. This dangerous form of extraction also requires the use of waterproof boots and other industrial-grade outerwear, as the offender must work in the sandy, swampy ground that has the potential to be a deadly trap that does claim the occasional victim.[6] Solo miners can also use pits previously excavated by other groups to try and fish out smaller amounts of amber that may have been left behind, with a net.

At a more sophisticated and organized level, which is more common in recent years, large enterprises will bring in industrial-grade equipment, including backhoes, high-powered hydraulic pumps, fire hoses, and large trucks to do their work. It may have been the case previously that amber extraction could only occur close to a reliable water source due to the large amounts of water that is needed for the process. However, well-funded operations can build networks of water hoses or pipes to transport water farther away from the source, thereby expanding the area of potential mining. At one time, there may be dozens of people working in different pits in the same area, each requiring hoses, nets, shovels, and massive amounts of water supplied using pumps. Throughout the process of site identification and preparation, trees and shrubbery may need to be removed from the dense pine and birch forests where amber is typically found. Clearing the area requires the use of chainsaws or larger tree-removal machinery, in addition to vehicles to remove and transport the felled trees. Illegal logging is a persistent problem in Ukraine, even in protected areas like national parks, and any tree cutting associated with amber mining would likely be considered a violation of the law.

Once the amber is collected, it can take several routes out of the woods and on to its next destination. Based on official government reporting, many people smuggle large amounts of amber across Ukraine's borders. Smugglers have been apprehended with amounts as small as several kilograms to as much as a ton of raw, unprocessed amber in their vehicles as they have attempted to cross into the European Union.[a] Poland to the northwest has been identified as the main destination,[b] though several confiscations along the borders of Ukraine's southwest Transcarpathian region indicate alternate routes are also used.[c] Customs and border security officials have been implicated in aiding amber smuggling across the border, and false custom declarations may be used.[d] Other reporting indicates that the amber can be transported to processing facilities within Ukraine where workers, including people illegally residing in the country, clean and cut the stones to make jewelry and other products intended for the international market.[e] A portion of finished amber is also sold in Ukraine. After being smuggled into the EU – to Poland in particular – it is often processed and streamed into the legitimate market, where it goes on to buyers in Asia and the Middle East.

[a] https://www.npu.gov.ua/news/zlochini-proti-dovkillya/na-rivnenshhini-policzejski-viyavili-majzhe-20-kilogramiv-burshtinu-pid-chas-obshukiv-u-dvox-avto/
[b] https://datajournalism.agency/8/
[c] https://ssu.gov.ua/en/news/1/category/1/view/5503#.YCvUA0UL.dpbs
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Amber mining in Ukraine					
Stage	**Steps and options**	**Spatial**	**Temporal**	**People**	**Interventions***
Preparation	● Target selection: source known amber areas, use geological maps and dig test holes, acquire and use ground survey sensing equipment. ● Coordinate mining efforts and plan operations: set times, locations, access routes, plan sourcing of required equipment and vehicles. ● Recruiting co-offenders: identify available networks. ● Lining up buyers: Chinese/Middle East wholesalers based in Kyiv. ● Obtaining equipment: shovel, hydraulic pump, piping and pipe infrastructure, rubber tube, pressure hose (industrial grade), waterproof boots, waterproof wading pants, fine fishing net, backhoe, cell phones, vehicles, transport trucks. ● Obtain weapons: shotgun, military-grade, RPG, (substep: military weapons training), grenade, machete. ● Prepare storage requirements: storage before delivery to buyer, before transporting across Polish border. ● Manage local authorities: bribe, pay "protection racket". ● Build water transport infrastructure for pumping.	● Hardware stores in region stock items in abundance. ● Target locations are rural areas, close enough to main water source; distance variable based on hose/pipe infrastructure. ● Local communities' private residences for equipment thefts.	● Not seasonal – all year ● Day and night	● Local villagers ● Ringleader/gang leader(s) ● Former active military combatants ● Buyer	● Public information campaigns that highlight the long-term impacts of mining. ● Increasing focus on supply-related crimes (i.e. burglary, theft, auto theft, etc.). ● Pass legislation for legal extraction with sustainable yield and methods. ● Map (potential) mining sites and access routes, to increase enforcement. ● Buy back campaigns for guns.
Pre-activity	● Transport: personal vehicle, moped, motorcycle, pickup truck. ● Enter Digging Area: legally drive into woods, park along nearest roadway. ● Park as close as possible to digging area: remain on roadway, go off-road. ● Security: set up armed observation posts around digging area and access routes.	● Rural wooded area. ● Long distance from nearest Police station.	● Not seasonal – all year ● Day and night	● Spotter/lookout ● Driver ● Local villagers	● Strongly enforce traffic rules. ● Boost stolen and wanted vehicle identification, tracking, and location.

Stage	Steps and options	Spatial	Temporal	People	Interventions*
Activity	● Walk to location of digging: pre-scouted, identify new targets in field. ● Connect to water source. ● Dig holes: locate amber pit or move to new location if empty. ● Use hydraulic pump to flood ground. ● Extract amber: using net, large sieve. ● Secure for transport: conceal, store in duffle bags, dry goods sacks (i.e. fuel pellets), or plastic bags in vehicle.	● Rural wooded area ● Long distance from nearest Police station	● Not seasonal – all year ● Day and night	● Spotter/lookout ● Pump operators ● Security	● Increase law enforcement presence through aerial or ground patrolling.
Post-activity	● Drive out of area. ● Transport: to storage, direct to buyer, across international border; to processing center within Ukraine. ● Use false customs declarations at border crossing. ● Contact buyer: known buyer, post online, communicate with seller network. ● Store/stockpile raw amber ● Sell ● Share gains	● Transporting to processing center within Ukraine; across international border.	● Not seasonal – all year ● Day and night	● Border Agent ● Seller ● Buyer: international company, Ukrainian company	● Interdicting traffickers attempting to cross border or en route to border. ● Strongly enforce traffic rules, using minor infractions to stop and search vehicles that may be involved in transporting amber. ● Identify processing centers within Ukraine, and collaborate with Poland to secure border and processing facilities.

Discussion and Conclusion

Despite the danger and risk involved in amber extraction, the informal market provides income for a significant portion of the population in northwestern Ukraine. Ukraine is only one of many sources for amber globally, and illicit markets also exist in other regions. Russia has a robust state-run enterprise, but illegal mining is common. Latin America is a popular market for scientists and collectors looking for fossilized animals or insects encapsulated in amber, and for jewelry-makers seeking the rare blue amber found in the Dominican Republic. However, the pit flooding method used in Ukraine is not common. This may be due in part to the relatively shallow depth that amber lies in Ukraine. Typically, it is found just several meters down, compared to pits in the Dominican Republic that are more than forty meters deep. In Russia, much of the unregulated amber extraction takes place underwater by scuba divers in the Baltic Sea. Based on comparisons to amber extraction in other locales, the ease of access and ability to use rudimentary yet destructive methods increase the opportunities in Ukraine.

Government efforts to pass legislation to both increase official penalties for the act and create legitimate pathways for individuals to mine legally remain stalled. Therefore, it may prove more effective, at least in the short-term, to explore novel approaches to prevention. For example, using remote sensing based on satellite imagery to map existing mining hot spots and track offender activity as new pits are opened may offer law enforcement a safe yet reliable method to plan interventions.[5,7] Another route for intervention may be found in the new community police officers being deployed across the country that will be filling the void in effective, trustworthy law enforcement to rural areas; they may be better-positioned to record reported thefts and other criminal activities that miners perpetrate against members of the surrounding communities, which can be used by crime analysts to track offenders' activities. This includes the precursor activity of illegal logging, which has been identified as a serious offense by the Head of the National Police of Ukraine. Finally, traffic stops by police, the national guard, and other security services along common routes for trafficking have led to seizures of raw amber. Legislative changes that will give police more power for search and seizure are needed, in addition to equipping officers with specialized tools such as night vision and contraband detection K-9s, to optimize the effect of this intervention.

The Ukrainian police forces were reorganized in 2015 and continue to undergo reforms that involve efforts to root out corruption and modernize the law enforcement response to crime and security issues. However, the continuation of illegal amber mining exposes the weakness of the current mechanisms for police to intervene. Ultimately, until the Ukrainian government can pass laws that will tip the scales in favor of law enforcement and the legal system, the informal amber market in Ukraine will be driven by international demand and pricing at a global scale.

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XIII

Illegal fishing in the Great Barrier Reef Marine Park, Australia

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Problem description

The Great Barrier Reef Marine Park (GBRMP) is a large Marine Protected Area (MPA) covering approximately 344,400km^2 and stretching some 2,300 km along the coast of Queensland in Australia. The GBRMP falls within the Great Barrier Reef World Heritage Area, recognized as having outstanding universal value, with a – '*natural significance which is so exceptional as to transcend national boundaries and to be of common importance for present and future generations of all humanity'.* [1] The economic, social and iconic value of the Great Barrier Reef (GBR) was recently calculated at AUD$56 billion, and annually the GBR generates an estimated AUD$6.4 billion from activities including tourism, commercial fishing and recreational use, supporting 39,000 direct jobs.[2]

The Great Barrier Reef Region's natural beauty and natural phenomena endure, but they are showing signs of deterioration in several areas.[3] These include the impacts of climate change, poor water quality, coastal development, and some fishing practices. Illegal fishing (poaching) is a common occurrence in the GBRMP and adds additional anthropogenic pressures to an already deteriorating system.[3,4] The most common type of poaching observed is illegal recreational fishing from no-take Marine National Parks (MNPs).[4] Responsibility for compliance management in the GBRMP lies with the Australian Government and is undertaken by the Great Barrier Reef Marine Park Authority (GBRMPA) in partnership with the Queensland government through the joint Field Management Program (FMP). This case study explores the application of Crime Script Analysis (CSA) and Situational Crime Prevention (SCP) techniques for managing the recreational poaching problem in the southern GBRMP.

Recreational fishing is a popular pastime for many residents in the state of Queensland. In 2004, the GBRMP underwent a significant re-zoning process increasing the area of no-take MNPs from 3% to 33% of the total marine protected area. While the area allocated as no-take increased, these new zones remain open to non-extractive activities such as general recreational and tourism uses. Many of these new MNPs exist in places that observe high rates of this legitimate activity, such as the location used in this case study. In addition, recreational fishers are not prevented from accessing no-take MNPs with their fishing equipment as long as it remains stowed and secure. This represents a complicating feature for compliance management in the GBRMP with Marine Park Rangers having to catch offenders in the act of fishing to prove illegal activity. Given the limits of enforcement resources and the ability of potential offenders to enter no-take MNPs, promoting voluntary compliance becomes a necessary objective for compliance management in the GBRMP. To achieve such an objective the poaching problem needs to be understood beyond the illegal act itself, and include knowledge of the recreational fishing process. Unpacking the activity in this way and applying appropriate SCP techniques to the results offers significantly increased options for managing complex compliance problems such as poaching.

Information sources

The Field Management Compliance Unit (FMCU) reports around 500 offences each year for illegal recreational fishing in no-take MNPs. Most of these reports originate from detections made by rangers in the field undertaking vessel patrols and aerial surveillance. Each incident report contains information such as the vessel registration, date and time of the offence, GPS coordinates and details of individual offenders including date of birth and residential address.

Crime process and script

While individuals poach for many reasons (recreational, commercial, traditional, subsistence), central to the act is the physical requirement for would-be offenders to come into contact with vulnerable targets in the absence of capable guardians. Consistent with the theories of environmental criminology, recent criminological research examining recreational poaching in the GBRMP has identified the convergence of these elements as a fundamental driver of non-compliance.[5–7] These studies characterize the opportunity structure for poaching in no-take MNPs as: a) proximity to access points (land and sea journey), b) attractiveness of MNPs to recreational activity (i.e. good coral cover, depth, slope, islands and infrastructure), and, c) the availability of leisure time to go fishing (weekends and suitable weather conditions). Guardianship is also central to poaching opportunity. Given the size of the GBRMP, understanding where and when poaching occurs provides critical information for managers to ensure that the limited compliance resources relative to the size of the protected area are allocated to the right places at the right times.

This case study examines illegal recreational fishing in the no-take MNP at Lady Musgrave Island (LMI) (MNP-23-1168) in the southern GBRMP (Figure 1). This zone observes high-levels of recreational activity and subsequently high-levels of recreational poaching. The LMI MNP contains a number of large coral reefs, small islands with sheltered anchorages and access to the LMI lagoon and camping facilities on LMI itself.

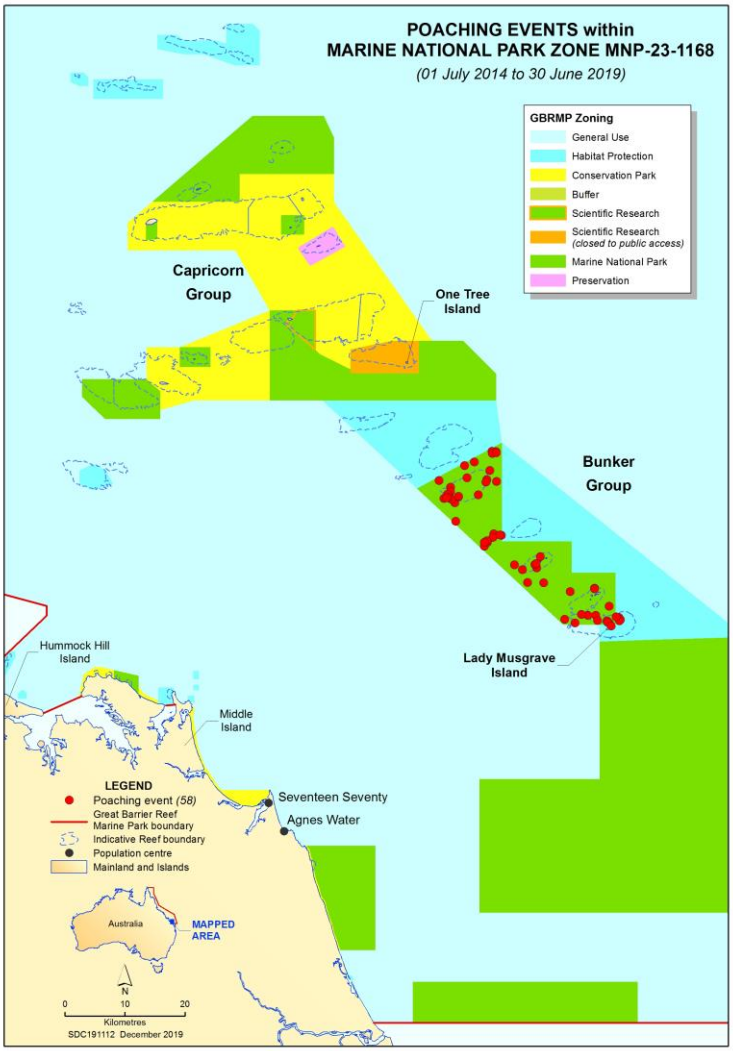


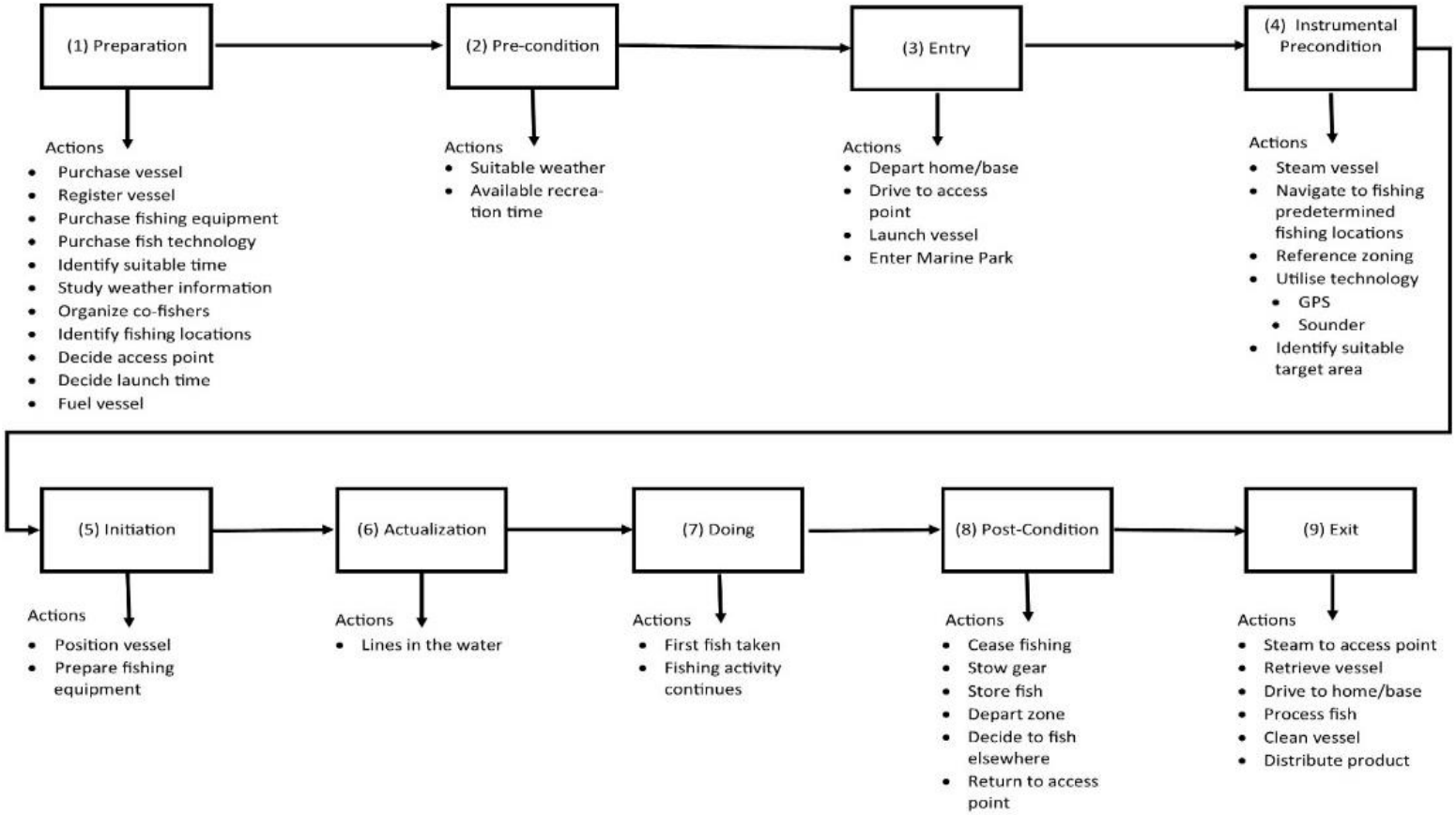
Figure 2. Illegal recreational fishing (poaching) events in MNP-23-1168, 2014-2019.

GBRMPA compliance incident data shows that the majority of offenders caught poaching in the LMI MNP are from South East Queensland, travelling a median distance of 400km to the nearest access point at the Town of 1770.[6] Poaching in the LMI MNP is clustered in locations that are most suitable to fishing, along reef edges and locations with sloping sea floor. The highest concentration of poaching occurs near LMI itself, the main attractive feature of this no-take zone. Finally, the GRBMPA incident data indicates the presence of both seasonal and daily temporal patterns of poaching activity. Poaching in this MNP is commonly observed between March and September, with the highest risk months being May, June and July. Likewise, poaching is most likely to occur on either a Saturday or Sunday, with the risk of observed non-compliance decreasing significantly during the week.[6] These seasonal patterns relate to the prevailing weather conditions throughout the year. Analysis by GBRMPA also shows that most incidents occur in less than 10 knots of wind, further defining the opportunity drivers for poaching in this no-take MNP.

This summary of poaching in the LMI MNP provides a clear example of journey to crime and the spatial, temporal and environmental conditions that influence the choices made by would-be offenders fishing in this region of the GBRMP. These influencing variables reflect the opportunity structure for illegal recreational fishing in this MNP. Being crime specific is critical to the conceptualization and implementation of crime prevention strategies and identifying the structure of crime commission is important for unpacking the situational factors that influence offender decision-making.[8] Through the application of CSA, the crime commission is broken down into stages (before, during and after), providing a greater scope for better-informed management responses, specifically using a SCP framework.

Figure 2 below represents a CSA for the scenario of recreational poaching in the LMI MNP outlined above. Applying the original nine-stage methodology put forward by Cornish (1994)[8], and in keeping with being crime specific, the diagram unpacks the staged event sequences for, a) illegal, unreported and unregulated (IUU) fishing (*protoscript*), b) poaching from no-take MNPs in the GBRMP (*script*) and finally, c) poaching in the LMI MNP (*track*). The crime script reveals the actions required to be undertaken by would-be offenders for each stage of the crime commission, with stages 1-5 representing the *before*, stages 6 and 7 the *during*, and stages 8 and 9 the *after*. Offenders are required to fulfill each stage of the crime sequence to successfully complete their objectives.

Figure 2. A crime script for illegal recreational fishing in the LMI MNP, adapted from[8,9].



Given that most offenders in the LMI MNP live some 400km from the Town of 1770 boat ramp, a high level of preparation is required. The most significant of these relates to accessibility and the precondition of suitable weather windows for safe boating. In addition, these suitable weather conditions will generally be further limited by the leisure time available to would-be offenders, typically weekends and public and school holiday periods. GBRMPA managers use these patterns to flag short-term increases in spatio-temporal risk, increasing compliance effort including education, engagement and enforcement strategies to match potential spikes in recreational activity.

Table 1 represents a crime script matrix for poaching in the LMI MNP. The event stages taken from the CSA in Figure 1 have been reduced to four sections; stage 1 *Preparation*, stages 2-5 *Pre-activity*, stages 6-7 *Activity*, and stages 8-9 *Post-activity*. The matrix includes the identification of 'controllers' to categorize the actors involved in the process or those who could get involved to address the problem. The interventions section in the script draws from SCP techniques to map the spatial and temporal elements for each section, with the people involved and possible intervention strategies. For example, the *pre-activity* stages are characterized by the land and sea travel patterns of would-be offenders, along with the seasonal and day-of-week temporal risks for fishing in this region.

Crime script analysis matrix for poaching in MNP-23-1168					
Stage	**Steps and options**	**Spatial**	**Temporal**	**People**	**Possible interventions**
Preparation (1)	● Purchase vessel ● Register vessel ● Purchase fishing equipment ● Purchase fish technology ● Identify suitable time ● Study weather information ● Organize fishing friends ● Line up buyers (if supplying black market) ● Identify fishing locations ● Decide access point ● Decide launch time	● Boat dealers in SEQ ● Fishing supply stores		***Offenders*** ● Poachers ***Handlers*** ● Family ● Friends ● Co-workers ● Fisher friends ● Fishing publications ● Fishing media personalities ● Boat dealerships ● Boat engine manufactures ● Boating/fishing technology providers ● Weather services (websites/apps) ● Fishing equipment suppliers ● Peak industry bodies ***Guardians*** *NA* ***Managers*** ● GBRMPA/FMP	***Increase the effort*** **5. Control tools/weapons** Support navigation technology companies to include GBRMPA Zoning Plan layers on all devices sold in Qld. ***Reduce provocations*** **16. Reduce Frustration and Stress** Continue to develop and implement a comprehensive education/engagement program to ensure that Marine Park users understand the GBRMP Zoning Plan and benefits of NTZs. **19. Neutralize peer pressure** Partner with industry and communities to champion the value of conservation initiatives and reduce peer pressure. ***Remove excuses*** **23. Alert conscience** Advertise/Inform on weather/fishing conditions websites/apps Engage with fishing media personalities to relay GBRMPA message (TV/Newspaper) – have others promote the GBRMPA message.
Pre-activity (2,3,4,5)	● Await suitable weather ● Available recreation time ● Depart home/base ● Check-in to accommodation ● Drive to access point ● Launch vessel ● Enter Marine Park ● Steam vessel	● Drive north along HWY1 – Access point at 1770 via Round Hill road. ● Access GBRMP at 1770 boat ramp	● Seasonal – July to September ● Condition < 15kts – but <10kts best ● Weekends ● Long weekends	***Offenders*** ● Poachers ***Handlers*** ● Family ● Friends ● Co-workers ● Fisher friends ● Boating/fishing technology providers	***Increase the effort*** **1. Target harden** Increase compliance patrol (vessel/aerial) effort and FMP presence at high-risk reef locations, during high-risk periods. **8. Reduce anonymity *and*** **10. Strengthen formal surveillance** Compliance officers record vehicle/vessel registrations encountered during patrols.

Stage	Steps and options	Spatial	Temporal	People	Possible interventions
Pre-activity (2,3,4,5) (cont)	● Navigate to fishing predetermined fishing locations ● Reference zoning ● Utilize technology (GPS, Sounder) ● Identify suitable target area ● Enter no-take zone (legal) ● Position vessel ● Prepare fishing equipment	● Direct steam (60km) to Lady Musgrave Island ● Steam to suitable reef area for fishing	● School holidays	● Weather services (websites/apps) ***Guardians*** (***informal***) ● Recreational fishers ● Island campers ● Camp supervisor ● Tourism staff ● Researchers ● Tourism operators ● Commercial fishing operators (***formal***) ● Government agencies ***Managers*** ● GBRMPA/FMP ● Accommodation providers (1770) ● Tourism operators ● Peak body groups	**9. Use place managers** Encourage tourism operators to report suspicious activity. ***Reduce provocations*** **16. Reduce Frustration and Stress** Reduce frustration by applying a consistent approach to compliance management and controlling poaching in high use areas. **17. Avoid Disputes** Partner with GPS technology companies to improve GBRMPA zoning layers on devices including warning alerts upon entering no-take MNPs. **20. Discourage Imitation** Respond quickly to reports of poaching, advertise patrol presence in hotspot locations. ***Remove excuses*** **22. Post instructions** Post instructions at boat ramps and along access roads to alert recreational fishers about the rules and location of MNPs, their restricted use and the consequences of poaching. **23. Alert conscience** Use displays along access roads, Marine Park Ranger presence/ engagement at the 1770 boat, and zoning alerts on marine navigation aids to alert recreational fishers about the restricted use and the consequences of poaching in MNPs. **24. Assist compliance** Ensure the adequate availability of GBRMPA Zoning Maps. **25. Control Drugs and Alcohol** Conduct multi-agency cross-decking patrol strategies including QLD Police random drug and alcohol testing.

Stage	Steps and options	Spatial	Temporal	People	Possible interventions
Activity (6,7)	● Lines in the water (illegal) ● First fish taken ● Fishing activity continues	● Access no-take zone ● Locate fishing mark – spatial attractors	● Day for targeting Coral Trout – shorter time due to increased risk of detection ● Night for targeting 'red' fish	***Offenders*** ● Poachers ***Handlers*** ● Vessel crew ***Guardians*** (***informal***) ● Recreational fishers ● Tourism staff ● Researchers ● Commercial fishing operators (***formal***) ● GBRMPA/FMP ● Other government agencies	***Increase the effort*** **1. Target harden** Increase compliance patrol effort and FMP presence at high-risk reef locations, during high-risk periods. ***Increase the risks*** **6. Extend guardianship** Encourage/enable other MPA users (tourism/recreational/research) to report illegal or suspicious activity. **7. Assist natural surveillance** Enhance public reporting tools such as poaching hotlines or smart phone apps. **10. Strengthen formal surveillance.** Continue innovation strategies aimed at enhancing the effectiveness of compliance resources, for example supporting evidence-based adaptive management programs.
Post-activity	● Cease fishing ● Stow gear ● Store fish ● Depart zone ● Decide to fish elsewhere ● Return to access point ● Steam to access point ● Retrieve vessel ● Drive to home/base ● Process fish ● Clean vessel ● Distribute/sell product (black market)	● Fishing marks ● Safe anchorages ● 1770 boat ramp ● Drive south to home base – Round Hill Rd and HWY1. ● Meet buyer to offload product (black market)	● Night return to boat ramp to avoid compliance checks	***Offenders*** ● Poachers ***Handlers*** ● Family ● Co-workers ● Fisher friends ***Guardians*** NA ***Managers*** ● GBRMPA ● FMP ● Other government agencies ● Accommodation managers Island managers	***Increase the effort*** **3. Screen exits** Support Qld Boating and Fishery (QBFP) officers to conduct targeted bag limit/species compliance checks at boat ramp and roadside inspections along exit routes. **8. Reduce Anonymity** Publicize successfully compliance actions and prosecutions for poaching offences. ***Reduce the rewards*** **14. Disrupt markets** Continue to engage with QBFP to limit black market activity through the promotion of complaint seafood supply chains. **15. Deny benefits** Maximize Commonwealth and State legislation to impose fines, prosecute offenders. ***Remove excuses*** **21. Set rules** Implement a comprehensive education program to ensure that Marine Park users understand the GBRMP Zoning Plan and benefits of MPAs.

Discussion

This case study provides an example of how the theories of environmental criminology and crime analysis techniques can be used to develop wide ranging compliance management strategies that go beyond traditional detect and deter approaches. Central to managing compliance problems in this way is the use of data analysis to underpin the process of CSA and the formulation of SPC techniques. In this example, we used empirical findings to identify the opportunity structure for poaching in this specific no-take MNP. For example, using historic incidents data we were able to identify the primary offender group and how they travel to access this particular area of the GBRMP. The incident data also demonstrated that poaching tends to be concentrated in a small number of suitable fishing locations mostly on weekends and in good weather. From this analysis we derived the crime script for recreational poaching in this particular no-take MNP, and in turn identified possible SCP strategies for various stages of the process.

Such an approach removes the focus of crime away from the poaching event, allowing managers to consider who the offenders are, how they access the GBRMP, where they go to fish and when they go fish. CSA provides a mechanism to step through each of these considerations and breakdown the crime process into stages - before, during and after.

Understanding this process allows GBRMPA managers to design comprehensive micro-targeted education, engagement and enforcement strategies. For example, prior to high-risk periods, GBRMPA utilize large signs on the only road into the Town of 1770 to alert the conscience of recreational fishers travelling the 400kms from southern Queensland (figure 3). GBRMPA also undertake targeted boat ramp engagement events to ensure that recreational fishers are informed about the rules associated with activity in no-take MNPs. Finally, GBRMPA apply a risk-based and intelligence-led approach to patrol effort planning aimed at ensuring the effective allocation of compliance resources to the right places at the right times.

Figure 3. A compliance information sign at a point along the only access road into the Town of 1770.

To date, the effectiveness of such approaches in reducing poaching in the GBRMP and protected areas more broadly remain unclear. While recreational poaching in the GBRMP is reasonably well understood, the fact that most incidents are detected during planned vessel and aerial patrols exposes an inherent bias in the data and analysis. The potential knowledge gap that this represents in the GBRMP reflects the problem of the *dark figure* for poaching in protected areas more broadly. Measuring patrol effort against the known opportunity structure at a local level can be helpful in limiting the gap between known and unknown levels of poaching. Developing an understanding of the relationship between patrol effort and incident detections can also provide an important benchmark for measuring the influence/effectiveness of non-traditional prevention strategies, such as those identified through the CSA/SCP process undertaken in this case study. Ultimately, positive conservation outcomes in PAs rely heavily on achieving sustainable levels of voluntary compliance. By deconstructing the poaching process from beginning to end and identifying prevention strategies at key pinch points, CSA offer managers with a useful methodology for achieving such an objective.

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Appendix
A Brief Introduction to Crime Scripting

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**Note: This appendix is an updated version of instructional material sent to contributors to The Poaching Diaries: Crime Scripting for Wilderness Problems. It was used to facilitate the intake process and development of the crime scripts presented in this volume.*

The goal of this document is to introduce the method of crime scripting to readers like yourself that are interested in wildlife protection. The objective is to provide you with a basic foundation for developing your own crime script for a problem that needs attention. Crime scripting can help you unpack problems and brainstorm about ways to deal with them more holistically.

1 – Introduction

As argued by Derek Cornish, effective and efficient interventions to prevent crime rely on an in-depth knowledge of the offender's modus operandi (MO): the legal and illegal actions taken to commit a crime.[1] A criminal act, such as poaching an animal, is just one of many events in the process of committing a crime. Thinking about prevention, interventions can be used to target these other steps as well. For example, you can target offenders while they prepare for the crime, commit the crime, or during the aftermath of their crime.

Prevention measures can be taken at any stage by raising barriers that deter or demotivate potential offenders. Key is that these barriers individually or collectively disrupt the criminal process by reducing criminal opportunities or motivations. By analyzing your local problem in detail, it is possible to create specific interventions, rather than broad, one-size fits all interventions that often prove ineffective at the micro-level. Crime scripting is a useful process for Problem-Oriented Policing initiatives, that are highly context specific and often employ Situational Crime Prevention techniques.[2]

Crime scripting is a useful way to identify stages in the process of the crime you are dealing with.[1] Crime scripts represent the full sequence of actions taken by an offender prior to, during and following the commission of a specific crime (in a specific setting), and as such give a step-by-step account of the event.[3,4] By including spatial and temporal information about each action, as well as details on the individuals or roles involved, you build an overview that lays bare the interdependencies in the process. This can be used to develop durable interventions and identify information gaps.

1.1. Writing crime scripts

Crime scripts are developed and analyzed for specific crime problems. First, development identifies the relevant stages of the criminal process, as well as the actions taken to complete them. For example, in the *preparation* stage, an action may be *acquiring equipment and materials*. Note that not all actions in the process are necessarily illegal. You can for example legally obtain and possess materials later used for snaring, such as power cables. Still, an understanding of the materials used in snaring and the ways to get them can highlight intervention points that prevent the crime from taking place later on. Think for example of working with the owner of a scrapyard to improve security and prevent individuals from stealing old power cables.

Actions in a crime process that repeatedly lead to success for offenders can become part of a hot modus operandi or 'hot MO'. In other words, a common method for committing the crime. Identifying what enables or facilitates these methods in your local setting allows you to target these hot MO's more specifically. The second part of crime scripting is the analysis of the script to identify

intervention points and knowledge gaps. Building on that, you can even consider how offenders might adapt and how crime might be displaced to other times, locations or targets. Some further considerations are important here:

- Complex crimes and environments will generate highly variable behavior patterns from the start. Therefore, many different MO's may exist, even if one of them is most common. An intervention targeting a hot MO may not remove all opportunity to commit a crime.[1,5]
- Criminal opportunity and criminal events are dynamic. Offenders are focused on achieving their goal, but they are flexible in the ways to get there. No matter how hot a MO is, it may be easily replaced by other methods.
- Not all steps in the process of a crime depend on other steps of that process in the same way. This means that an intervention on one step may not disrupt the whole process as much as an intervention on another step.

In short, adaptation to interventions may lead to what is known as displacement. This can be in choice of location, time to offend, targets chosen, types of offenders (not everybody is equally deterred by the same interventions), methods used, crime type, etc. Crime scripts can help you think ahead when developing interventions: what opportunity remains, what alternative MO's may become hot either because it was second best or because it is a way around your new barriers?

1.2 Crime Script types

Cornish[1] identified four levels of specificity for scripting exercises; metascript, protoscript, script, and track. Table 1 provides examples taken from both Cornish's original work and Borrion's work on quality assurance in scripting.[6] Added to these is are analogous wildlife crime examples. These levels allow you to categorize scripts that may be related (e.g. various types of robbery), and show the level of detail captured when describing very context and problem specific crimes at the track level.

Table 1. Levels of specificity in crime scripting, as described by Cornish[1]

Crime script levels					
Examples	**Theft[6]**	**Sexual offending[6]**	**Poaching[7]**	**Poaching[7]**	**Poaching[7]**
Metascript	Theft	Sexual offending	Poaching	Poaching	Poaching
Protoscript	Robbery	Sexual offending against children	Hunting terrestrial animals	Live capture of animals	Gathering terrestrial plants
Script	Robbery from a person	Sexual offending against male children	Wire snaring for bushmeat	Trapping birds for pet trade	Collection of cacti for trade
Track	Subway mugging	Sexual abuse against male children in a specific institution	Wire snaring of small ungulates in a specific reserve	Using glue traps to collect parrots	Digging out high value cacti species

Scripts can further be classified as pro-active, reactive and hypothetical[4]; see Table 2. In turn, each of these can be *actor-based* – following the actions of an offender in the process of a crime, or *product-based* – highlighting the actors and locations involved with the product along the crime continuum from poaching through trafficking to sale.[8,a,b] When using the tool for operational guidance, there is flexibility in how information is structured, and these classifications should not be seen as a limiting factor.

Table 2. Three main crime script types

Crime script types	
Reactive	The development and analysis of a script in the direct aftermath of a criminal event that actually took place. In such circumstances, in addition to aiming to apprehend an offender one should aim to understand his MO, so as to put measures in place to prevent its success in the future and thereby **prevent** repeat victimization (a well-established theme in criminology). In these scripts you can describe in detail the situation as it played out during each stage. This allows for detailed inclusion of the law enforcement perspective and identification of where opportunities for offending existed. For example, after a poaching incident you can write out the story of which patrol units were where at what time, what they saw and heard, and how they reacted to this (i.e. "gunshots heard to the east at 8PM", patrol team A followed up). With this you can determine likely courses of action taken by the offenders, based on windows of opportunity.
Proactive	Proactive scripting involves taking in information from other sources, such as protected areas that just had an incident, the press describing rises in crime, court proceedings detailing MO's, academic literature, etc. You can learn about crime and MO's and see how they map onto your own situation. This to help you answer if sufficient barriers are in place to prevent the same thing happening at your site. Here you aim to **avoid being the next victim** of a known MO.
Hypothetical	Hypothetical scripting is to place yourself in the mind of the offender and understand all steps you would have to take, and barriers to overcome if you were to share the offender's goal. What would one need to do and what could one do to successfully commit a specific crime in your area of jurisdiction? The hypothetical script that results from this exercise can offer up the various actions available to a would-be offender, and challenge you to see how easy or difficult it may be to for instance poach big game in your PA. Where can required materials be sourced from, how can offenders learn about targets, how and where can offenders enter the PA, etc. To construct a hypothetical script, this information can be collected from many sources such as those listed in section 1.4. of this document.

[a] Even more classifications and finer detail can be used when standardizing scripting methods, including instrumental, situational or personal[6]; single perspective or interpersonal; and potential, planned or performed.[6] For more information on these, refer to the further reading section at the end of this document.
[b] Borrion also presents methods for quality assurance, allowing for evaluation of your scripting approach in a standardized way[6]; as well as a review of scripting in general and standardization more specifically.[10]

1.3. Stages and actions

Additionally, Cornish[1] described the general components of a script, universal to all crimes. These are preparation, entry, pre-condition, instrumental pre-condition, instrumental initiation, instrumental actualization, doing, post-condition and exit, detailed in Table 3. Alternatively, a more condensed model proposed by Tompson & Chainey and adopted in this volume, captures the same in only preparation, pre-activity, activity and post-activity.[6,9] The script consists of these stages and actions within those stages.

Table 3. Components of a universal script

Nr.	Stage	Actions
1	**Preparations**	All actions made in preparation for the crime are described in this stage. Generally these will take place outside of the crime setting, and may not be illegal in nature. This may take place over a long period of time, well in advance of the criminal event. Think for instance of acquiring material, scouting for and selecting suitable hunting grounds, forming a party with co-offenders, lining up buyers of illicitly gained wildlife products, and establishing a criminal network.
2	**Pre-conditions**	These are the actions taken to establish or await conditions under which the crime can be committed. Again these may not be illegal actions, and can include travel to site and loitering to wait for targets to appear.
3	**Entry**	Entry to the scene. Entry to a location may be legal or illegal (i.e. one can legally enter a tourist lodge to then steal cameras, or one may illegally break a fence to enter a protected area with the aim of collecting firewood). Further, entry may take place before the stage of pre-conditions, especially when entry itself is legal.
4	**Instrumental pre-conditions**	Proximate actions directly taken to commit the crime. This includes for example tracking animals and selecting a target.
5	**Instrumental initiation**	The main offense commences, and the offender for example closes in on the target.
6	**Instrumental actualization**	The crime is committed. Here for example aim is taken and shots are fired.
7	**Doing**	The action taken to fulfil the goal of the offender. Obviously the poaching event has already taken place as soon as the animal is killed upon shots being fired. However, being goal-oriented the offender wants e.g. the rhino horn. “Doing” thus involves cutting off the horn for example.
8	**Post-condition**	All actions involved with the aftermath of the offense, like escaping the scene but also transporting, processing and storing goods like for example a tiger skin and every action associated with that (i.e. applying chemicals).
9	**Exit**	Exit from the scene may take place before some of the actions taken in the post-condition stage. For example some processing may take place on-site and some may take place off-site. Importantly, a post-condition of selling the items to buyers logically will take place after the exit.

Taken from Tompson & Chainey,[9] and Haelterman,[4] for clearer operational use and flexibility in the order of events, these stages are condensed into

- **Preparation** (*1*)
- **Pre-activity** (*2*, *3*, *4*, *5*)
- **Activity** (*6*, *7*)
- **Post-activity** (*8*, *9*)

The four stages are used in this volume, as they can include the same level of detail as the original nine, while providing more flexibility (e.g. including exit, processing and sale in the post-activity stage). In here, it is important to make sure all logically required actions are included in the correct order. This, because fine detail allows for better intervention design, and chronological order allows you to think about small and large scale dependencies. Product-based scripts contain different stages, dependent on the specific product and process (see also script 2 on leopards and script 10 on otters, in this volume).[8]

1.4. Potential data sources

To develop a crime script – a full understanding of specific MO's in specific settings – you can draw from various sources of information.

Primary sources are the observations and accounts of the actors involved in the process. You and your colleagues may be some of those actors yourself. Through interviews you can gather information on for example

- How the crime scene was assessed and chosen
- How the target/victim was selected
- The tools/equipment/finances needed and the source thereof
- The skills required
- The effort needed
- Perceived criminal opportunity
- Perceived barriers

People you can interview for this information may be

- Active offenders
- Prisoners
- Historic offenders
- Law enforcement personnel
- Researchers
- Game wardens
- Tourist guides
- Market salespeople
- Local community members

Secondary sources to get this information from include

- Police reports
- Court records
- Internal crime analyses
- Law enforcement data
- Camera trap imagery
- Biological monitoring data
- Academic literature
- Grey literature

Here lot of information comes from people in the process: the offenders, community members, Protected Area staff and law enforcement. You can however include further useful information by understanding the targets. Since these are animals and plants, they will be silent, but by using biological monitoring data, and by becoming acutely aware of potential target species' ecology, i.e. migration patterns, life cycles, breeding patterns and general distribution, you can incorporate the "role" played by these targets by determining where windows of opportunity for crime exist.

2 - Script template

How you present your crime script will likely depend on your content and audience. There is a lot of flexibility here and either a text-based, tabular, flowchart or other style may present your information best. Your presentation can show interdependencies in the process, and as such it may help you pinpoint good places for interventions, as shown by Brayley, Cockbain and Laycock in a flowchart.[2] In this volume we will present crime scripts in a table organized by the 4 stages (preparation, pre-activity, activity, post-activity) in the rows. The components that make up these stages are described in the columns (stage, steps and options, spatial, temporal, people, interventions and knowledge gaps). This template is shown in Table 5.

The example in our template shows a hypothetical actor-based script of steps required in the process of hunting and killing an animal. As someone familiar with your specific problems, you will be able to get into much more detail in your crime script, and describe the track level. Even more relevant detail and interdependencies can be shown, by adding further columns to the standard scripting models (see Table 4). Going beyond a traditional table with stages, actions and interventions has the potential to benefit your operations.

In addition, the script may be visualized in a timeline, as shown in Figure 1. By taking relevant times and durations, the temporal aspects can be summarized in a separate overview as shown in Figure 2. This highlights how long stages can take, especially relative to other events in the crime process, as well as how they link together sequentially. Moving beyond the preparation phase it will be possible to add a timeline to indicate *when* actions are most likely to be taken. This is especially relevant to a reactive script where times may be known or can be estimated based on law enforcement's spatial and temporal presence to determine windows of opportunity. In a hypothetical script you may still be able to add certain times if you know a target species is only "available" at given moments.

Table 4. Additional information to capture in crime scripts

Additional information to capture on actions in a crime script	
Spatial characteristics	Where do or can actions take place? E.g. list all known markets where blacksmiths work, capable of manufacturing certain types of traps. This is relevant information for interventions, insofar that if certain actions are bound to certain locations they may be effective intervention targets.
Temporal characteristics	Detailing when actions are likely to take place (e.g. poachers may be most likely to enter the PA at 8PM) as well as the duration of each action will help you identify suitable intervention stages.
People involved	Many of the crimes you are dealing with are committed by a group of people or a network. You may add further columns to your script to identify who is carrying out the action described, again realizing that not all of these are criminal actions but they do not need to be to be an effective intervention point.
Alternative MO's	What are displacement candidates in time, space, crime, offender, target, methods, MO's? Are these addressed by the intervention or do they need additional attention. This can be part of a discussion section.

Table 5. Script template filled in with hypothetical information about a poaching event.

Made-up hypothetical protoscript for active poaching						
Stage	**Steps and *options***	**Spatial**	**Temporal**	**People**	**Interventions**	**Knowledge gaps**
Preparation	● Obtaining a weapon: *homemade, legal purchase, illegal purchase, steal* ● Prepare processing and storage requirements: *obtain equipment, facilities and materials needed* ●Recruiting co-offenders: *Identify available networks, considering required expertise for target species and PA* ● Lining up buyers ● Site/target selection: *scouting ahead, based on market demand; available tools/skills; animal ecology and perceived barriers*	●Known arms sellers located in A, B, C ●Chemicals only available on market D ●PA (possibly legal entry posing as tourist)	●Daily markets	● Poacher ● Seller ● Ringleader	After analysis	After analysis
Pre-activity	● Transport: *Land, air, water*; using owned/rented/stolen vehicle (→ subscript *car theft*) ● Entering PA: *breach the fence, transnational border crossing* ● Tracking target animal: *maneuver through the PA as determined by natural and law enforcement barriers and target animal ecology*	●PA can only be entered from the south, due to heavy rain making north inaccessible	●Season dependent	●Poacher	After analysis	After analysis
Activity	● Approach animal, take aim, shoot ● Process on site: dehorn, declaw, skin	●PA	●As little time as possible	●Poacher	After analysis	After analysis
Post-activity	● Escape, possibly breach fence again ● Transport ● Process for store/transport/sale: clean, apply chemicals, package ● Store ● Contact buyers, *known buyer or advertise* ● Sell, *known buyer or open market* ● Share gains	●PA ●Home village ●Local black market A	●Dependent on storage requirements	● Poacher ● Seller ● Ringleader	After analysis	After analysis

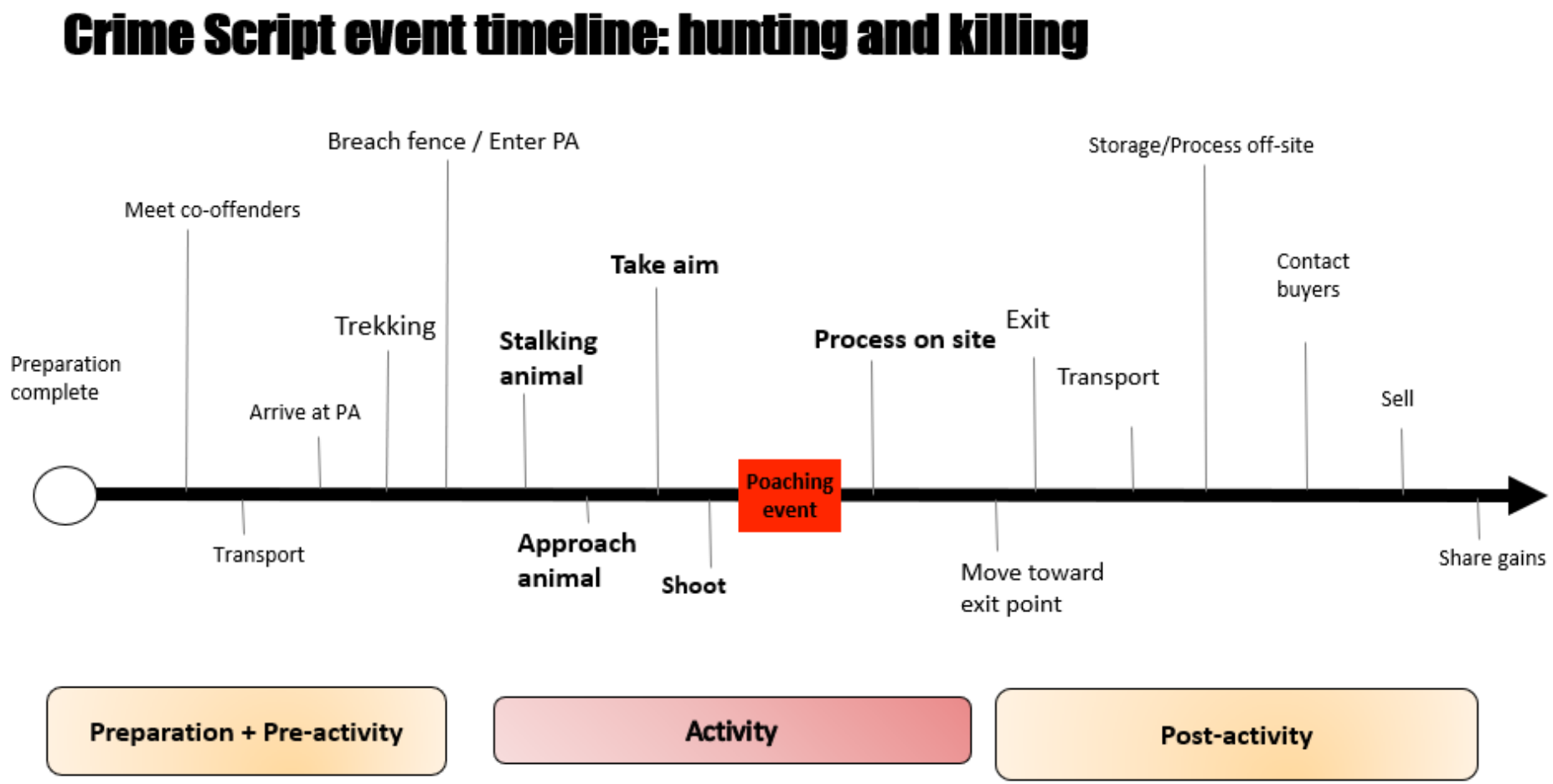

Figure 3. Crime script even timeline (adapted from Wai Yee Lam, personal communication).

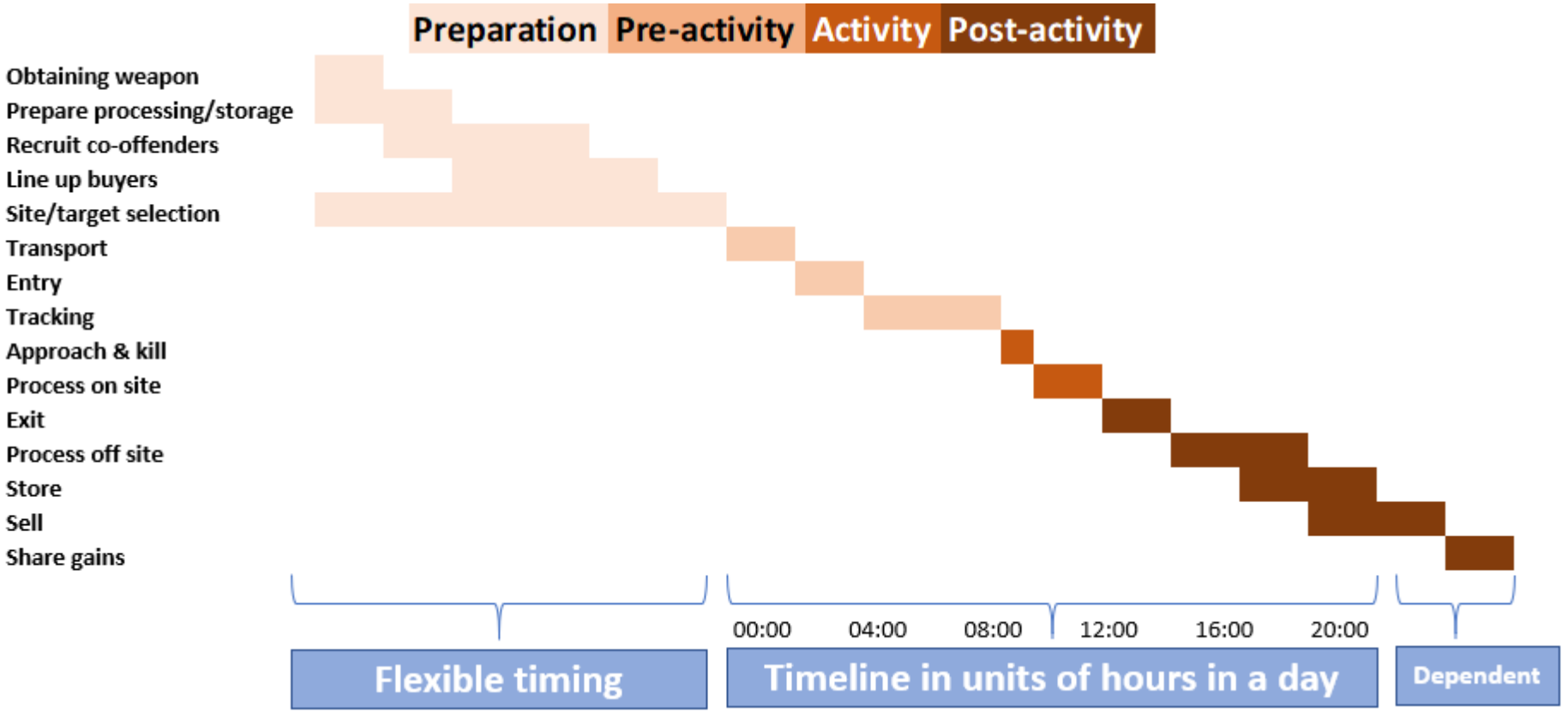

Figure 4. Overview of temporal elements of a script (adapted from Nick van Doormaal, personal communication).

3 – Analysis and Interventions

Analysis of the crime script aims to pinpoint where and how in the process intervention measures can be put in place. The script should be used to make you think about what is needed to make each action possible, to learn what can be done to create barriers. General questions may include

- What markets are available to source required equipment from?
- When are these markets available?
- Can controls be put in place in the market? (market managers, registrations, CCTV, etc.)
- What social or criminal networks can be accessed to recruit co-offenders, where and how are they likely to meet?
- What transport is required for the PA and the target animals as well as where is this transport likely to be available?
- What barriers might offenders perceive and when are these in place (e.g. if animals migrate by season)?
- What vulnerable areas are there to enter the PA and what makes them vulnerable?
- What chemicals are needed to store skins and where are these available?
- What weaponry is needed for potential target species in my PA and where is this available?
- Where are potential target species located at what times?

Interventions may seek to disrupt these opportunities, by for example restricting availability of chemicals, recruiting market salespeople to cooperate with you to do so, increasing patrol presence at specific locations and times, etc. The 25 techniques for Situational Crime Prevention shown in the introduction to this volume, and reprinted here in Table 6, provide an example of interventions to inspire your thinking. If interventions are implemented it is important to carefully monitor their effects, given that adaptation and displacement is likely. It is important to think about how you will evaluate success before implementation. You may find that additional interventions are needed, while you can also show that the original intervention is effective. This ensures that you do not misguidedly replace effective barriers and re-open opportunity structures.

4 - Crime script checklist for contributors

- ❑ Identify problem
- ❑ Select crime script type: Reactive, proactive, hypothetical
- ❑ Short problem description, introducing the script to describe context, background, scripting choices, data sources and collection methods and the intervention options identified
- ❑ Select data/information sources
- ❑ Collect data/information
- ❑ Fill in stages with an exhaustive list of required and optional actions to complete the stage, and additional information for each of those actions
- ❑ Analyze and brainstorm to identify intervention methods
- ❑ Consult peers / send in for feedback (at any point)
- ❑ Discussion section dealing with limitations, knowledge gaps, interventions and ways to evaluate them

Table 6. The 25 techniques of situational crime prevention with examples for urban (●) and wilderness (★) problems

Increase effort	Increase risk	Reduce rewards	Reduce provocations	Remove excuses
Target harden ● Bullet-proof glass between taxi drivers and passengers ★ Reinforced store room for seized wildlife products and weapons/traps	*Extend guardianship* ● Leave light on at home when away ★ Use technology to monitor location of vulnerable animals	*Conceal targets* ● Pull jewellery from display cases and put in safe at night ★ Buffer zone around core areas	*Reduce frustrations/stress* ● Regular updates for passengers on delayed public transport ★ Community involvement in protected area management	*Set rules* ● Clear limits for liquids in carry-on baggage ★ Collaborative agreements for wildlife harvesting and use
Control access to facilities ● Visitor registration at office buildings ★ Vehicle tracking of contractors working within the reserve	*Assist natural surveillance* ● Encourage and support whistleblowers ★ Hotline for visitors to report suspicious activity	*Remove targets* ● Cashless payments ★ Destroy ivory stockpile	*Avoid disputes* ● Staggered closing time for bars ★ Rapid response teams for wildlife damage	*Post instructions* ● 'No smoking' signs ★ Signs with clear harvest regulations near offtake zones
Screen exits ● Ticket checks to exit public transport ★ Vehicle checks when exiting protected area	*Reduce anonymity* ● Driver name, photo, and permit number posted in taxi ★ Public hearings and media coverage of major arrests	*Identify property* ● 'DNA' spray on property ★ RHODIS DNA database for rhinos	*Reduce temptation/arousal* ● Zero-tolerance of racist chants at football matches ★ Support services for victims of wildlife attacks	*Alert conscience* ● Navigation device with speeding notification ★ 'No Trespassing' signs along reserve boundary
Deflect offenders ● Metal detectors at entrance of large shopping areas ★ Dog detection units at major transportation hubs	*Use place managers* ● Pressure building owners to fix broken fences, locks, and lights ★ Work with restaurant owners to discourage the sale of bushmeat	*Disrupt markets* ● Closure of dark web marketplaces ★ Demand reduction campaigns for wildlife products	*Neutralize peer pressure* ● Media campaigns such as 'Stop bullying now!' ★ Wildlife clubs for children and adults	*Assist compliance* ● Free plastic bags for liquids in carry-on luggage ★ Immediate compensation programs for wildlife damage
Control tools/weapons ● Limit access to medicines used to make methamphetamine ★ Limit public sale of pesticides commonly used to poison animals	*Strengthen formal surveillance* ● Traffic cameras ★ New outposts in areas with low patrol effort	*Deny benefits* ● Dye packages in bags with stolen money ★ Asset forfeiture of items purchased with wildlife crime profits	*Discourage imitation* ● Ban videos of dangerous 'challenges' on YouTube ★ Ban videos of exotic animals kept as pets or as tourist attractions on YouTube	*Control drugs/alcohol* ● Train bartenders to avoid overserving ★ Zero-tolerance policy for drinking on duty

*Notes: Copied from Table 2, Introduction, *The Poaching Diaries: Crime Scripting for Wilderness Problems*. For more information about Situational Crime Prevention, see recommended readings at the Center for Problem-Oriented Policing.

Further reading

The readings below in particular provide further background on the crime scripting method, its use and the variety of options, applications and styles available to its users.

- *The Procedural Analysis of Offending and its Relevance for Situational Prevention (1994), by Derek Cornish.*[1] (Full text)
  - This is the original work of Derek Cornish, adapting scripting to crime, and showing its utility in developing prevention measures.

- *The Value of Crime Scripting: Deconstructing Internal Child Sex Trafficking (2011), by Helen Brayley, Eleanor Cockbain and Gloria Laycock.*[2] (Full text)
  - The authors discuss the value of crime scritping for developing Situational Crime Prevention meausres, and link scripting to Problem-Oriented Policing.

- *Quality assurance in crime scripting (2013), by Hervé Borrion*.[6] (Full text)
  - In this work Borrion suggests ways to standardize and evaluate crime scripting to maintain quality and utility for prevention measures based on actions in a criminal process.

- *Crime Script Analysis – Preventing Crimes against Business (2016), by Harald Haelterman.*[4] (Full text)
  - In this book, Haelterman presents a wide overview of the crime scripting method for the purpose of situational crime prevention. It deals with historical origins, types, development and application.

- *Crime scripting: a systematic review (2019), by Hashem Dehghanniri and Hervé Borrion.*[10] (Full text)
  - Dehghanniri and Borrion review the use of crime scripting in (academic) literature to date, with particular focus on their utility and the usefulness of standardization; following Borrion's 2013 work.

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