Illegal Cheetah Trafficking Patterns

Gia Schutzer, Meng-Chiao (Joe) Wang, Danielle Yoseloff

W200 - Gunner Kleeman - Project 2 - December 2023

GitHub Repository

Context

Cheetahs have captured the interest of humans for thousands of years and in return, we have captured them. Wildlife protection efforts have shown a spotlight on the dangerously decreasing rates of cheetahs in the wild due to habitat loss and poaching. Cheetah pets are a popular symbol of wealth in many places, but this is causing unethical treatment of the animals and devastating effects for the species. Many laws around the world have been put in place to stop this practice, but obtaining reliable data on illegal animal trade is difficult due to the nature of the matter. Our work seeks to explore one of the few reliable and comprehensive datasets in this arena for two reasons. First, to spread awareness of the issue and second, to identify patterns that wildlife protection groups and law enforcement can use in their efforts to stop illegal cheetah trade.

Research Questions

What patterns exist in illegal cheetah trade and how can this information be used to prevent further cheetah loss?

- Demographics & Trade Incident Characteristics
    - What form of animals are traded the most – live animals, skins, or other parts?
    - How many animals are typically trafficked at once?
    - At what age are live animals most frequently traded?
- Geographic Characteristics
    - Where is the demand and supply of illegal trade most prevalent?
- Socioeconomic Factors
    - How do factors such as inequality and corruption relate to illegal trade activity?

Executive Summary

Increased tracking of key illegal cheetah transaction data can help prevent trade in the first place:

1. Age: tracking cheetah age at the time of illegal trade suggested that young cubs need focused protection from trade
2. Country: following origin and destination countries of trade informed that Africa and the Middle East are hot spots that need intervention
3. Corruption & Inequality: Corruption level of countries where illegal trade occurs suggests that more government regulations are needed, as well as monitoring areas with high inequality for potential animal trafficking

Our recommendation is to increase tracking of key trade data points to put a stop to illegal cheetah trade.

Source Data

Primary Dataset:

In this report we aim to understand the landscape of illegal cheetah trade across the years 2010-2019. In this report we will primarily explore *"The most extensive dataset relevant to seized and non-intercepted illegal trade in live cheetahs and cheetah parts for the decade 2010-2019, spanning over 300 sources and 56 countries in Africa, the Middle East, Asia, Europe, Oceania and North America. It includes 1,886 individual incidents involving at least 4,000 cheetahs or cheetah parts or products likely or confirmed to breach national laws or CITES regulations"*.

Tricorache, Patricia; Marker, Laurie; Yashphe, Shira (2021), "Global dataset for seized and non-intercepted illegal cheetah trade (Acinonyx jubatus) 2010-2019.", Mendeley Data, V2, doi: 10.17632/84k92j4n3y.2

Secondary Datasets:

Corruption Perception Index Data (2015)
"Corruption Perception Index 2015". Transparency International. Retrieved 1 December 2023.

Gini Coefficient Data (2015)
"Pre-Tax National Income | Total Population | Gini Coefficient | Adults | Equal Split | 2015". World Inequality Database. Retrieved 1 December 2023.

Other:

Cheetah Conservation Fund | https://cheetah.org/

Variables Used

- **Incident number:** Unique identifier of an illegal cheetah trade incident
- **Incident type:** Categorical variable defining whether incident was due to animal injury/mortality/welfare, possession or trade, or a seizure
- **Incident date**: Datetime variable with when the incident occurred
- **Country, region & country role:** Specific country / region of incident as well as whether the location was the origin, area of transit, or destination
- **# Cheetahs:** Numeric value with count of cheetahs involved in each incident
- **Units:** String that describes whether incident involved live cheetahs, cheetah skin, or other
- **Incident description:** Text data that contains partial data on cheetah age, etc.

- **Destination, origin, transit if known:** The name of the country that the cheetah trade came or transferred from, or destined to, if known. This is different from the country where the incident was identified.
- **CPI:** Numeric value with corruption index score by country
- **Gini:** Numeric value with Gini index score by country

Data Cleaning

1. Extracting Data From *incident_description*

We saw *incident_description* was a text entry field with inconsistent yet useful information. Some entries followed a consistent entry pattern for cheetah age and price. When we were not able to extract these values due to unstructured formatting or absence, we called those records unknown or nan.

Age means the cheetah age(s) when the incident occured. Price refers to the amount paid for the illegal cheetah trade and currency is the currency of the price for the trade. From this field we created usable columns for *cheetah_age_in_months*, *life_stage*, *price*, and *currency*.

	incident_description
2	cheetah, lions, tiger, Iberian wolf, European Lynx, 3 pumas, eagle and falcons seized. Animals ...
3	Transported on land as luggage, confiscated by KWS
4	Cheetahs from XX confiscated by Ministry of Environment and Water
5	18-mo cheetah of unknown origin transferred to zoo
6	approx. 3 months old) confiscated from private individual by the Khorixas Ministry of Environmen...
...	...
1881	cubs offered for sale by different dealers (WhatsApp group)
1882	(Code 017-032): Age: 4M; Sex: 1U; Price: UNK
1883	(Code 455-002): Age: 10M; Sex: 1M; Price: 22000 SAR
1884	(Code 677-001): Age: 2Y3M; Sex: 1M; Price: 32000 SAR
1885	(Code 457-002): Age: 3M; Sex: 1M,1F; Price: 26000 SAR

a. Cheetah_age_in_months, life_stage

For observations following the consistent age format we used regular expressions to extract the age entry. When a range of ages were entered we choose to use the first one. When life stages were entered rather than ages we mapped those values to the average months for cubs, youth, and adults as defined by the Cheetah Conservation Fund. We then calculated the months when ages were provided with a years component. We were able to derive clean age information for 61% of incidents.

By making these substitutions and not extracting age values with less structured formatting, we expect some bias to exist in the values. While we will still use this data as valid we recognise conclusions around cheetah age will be more true to the source if age categories are used. This is why we also created a categorical column for *life_stage* based on our calculated age column.

b. price, currency

For observations with consistent price format the price entry and price currency were extracted into their own columns using regular expression capture groups.

	incident_description	cheetah_age_in_months	price	currency
1881	cubs offered for sale by different dealers (WhatsApp group)	NaN	NaN	NaN
1882	(Code 017-032): Age: 4M; Sex: 1U; Price: UNK	4.0	NaN	NaN
1883	(Code 455-002): Age: 10M; Sex: 1M; Price: 22000 SAR	1.0	22000.0	SAR
1884	(Code 677-001): Age: 2Y3M; Sex: 1M; Price: 32000 SAR	27.0	32000.0	SAR
1885	(Code 457-002): Age: 3M; Sex: 1M,1F; Price: 26000 SAR	3.0	26000.0	SAR

2. Calculating number of incidents by origin, transit, and destination countries

Each unique incident (as defined by the incident_no column) in this dataset has (1) a country column indicating where the incident was reported, (2) a country_role column that indicates the role of the country at the time the incident occurred (origin, transit, or destination country), and (3) origin_if_known, transit_if_known, and destination_if_known countries that indicate the origin/transit/destination country of the incident, if known.

From these six columns (incident_no, country, country_role, transit_if_known, destination_if_known, origin_if_known), we created a reference data frame called `geo_final.` This data frame calculates the total number of incidents by country (rows) and country type (columns - origin, transit, destination).

First, we had to pivot the data to get the total number of incidents by country (rows) and country_role (columns).

country_role	D	O	O/D	O/T	T	T/D
country						
Afghanistan	1.0	NaN	NaN	NaN	NaN	NaN
Angola	NaN	NaN	NaN	4.0	NaN	NaN
Armenia	NaN	NaN	NaN	NaN	1.0	NaN
Australia	1.0	NaN	NaN	NaN	NaN	NaN
Bahrain	7.0	NaN	NaN	NaN	1.0	NaN

Then, we had to consolidate the country_role by attributing those with two roles combined into two separate roles. For example, incident XYZ that has country_role “O/D” will be counted as one incident under both the origin and destination country role columns.

```
geo_pivot.reset_index(inplace = True)
geo_pivot.fillna(0, inplace=True)
geo_pivot['O'] = geo_pivot['O/D'] + geo_pivot['O'] + geo_pivot['O/T']
geo_pivot['D'] = geo_pivot['O/D'] + geo_pivot['D'] + geo_pivot['T/D']
geo_pivot['T'] = geo_pivot['T'] + geo_pivot['T/D'] + geo_pivot['O/T']
geo_pivot = geo_pivot[['country', 'O', 'D', 'T']]
geo_pivot.columns = ['country','origin', 'destination', 'transit']
geo_pivot
```

	country	origin	destination	transit
0	Afghanistan	0.0	1.0	0.0
1	Angola	4.0	0.0	4.0
2	Armenia	0.0	0.0	1.0
3	Australia	0.0	1.0	0.0
4	Bahrain	0.0	7.0	1.0

Finally, Xxx_if_known columns had to be transformed into separate series containing the number of incidents per xxx_if_known country. Then, joined to the main country column using the shortest full spelling of the country name as the join key/common denominator. It is important to note here that most incidents do not have a value for xxx_if_known columns.

	country	origin	transit	destination
32	Somaliland	136.0	127.0	11.0
12	Ethiopia	44.0	0.0	0.0
20	Kenya	41.0	0.0	0.0
33	South Africa	28.0	20.0	9.0
31	Somalia	22.0	25.0	0.0

Analysis

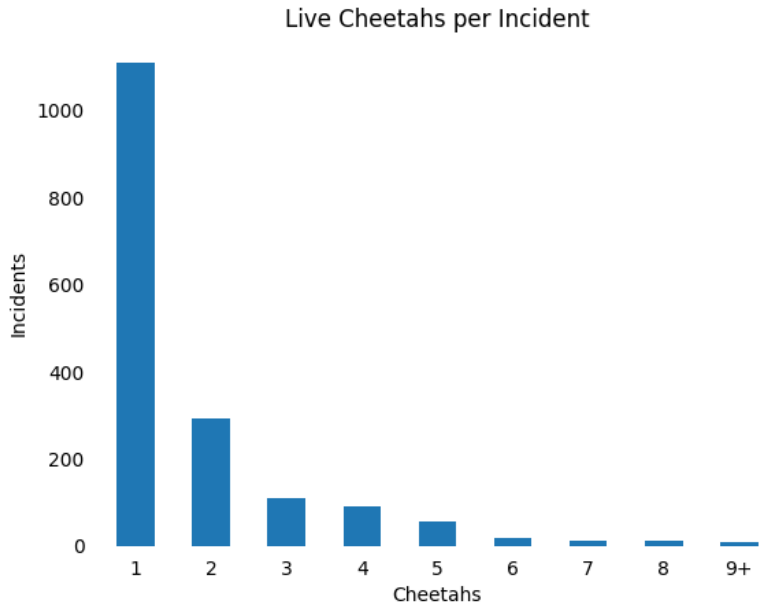
Demographics & Trade Incident Characteristics

First we would like to understand what kind of incidents are being intercepted.

	Count	Percent
LIVE	1755	93.0%
SKIN	106	6.0%
OTHER	23	1.0%

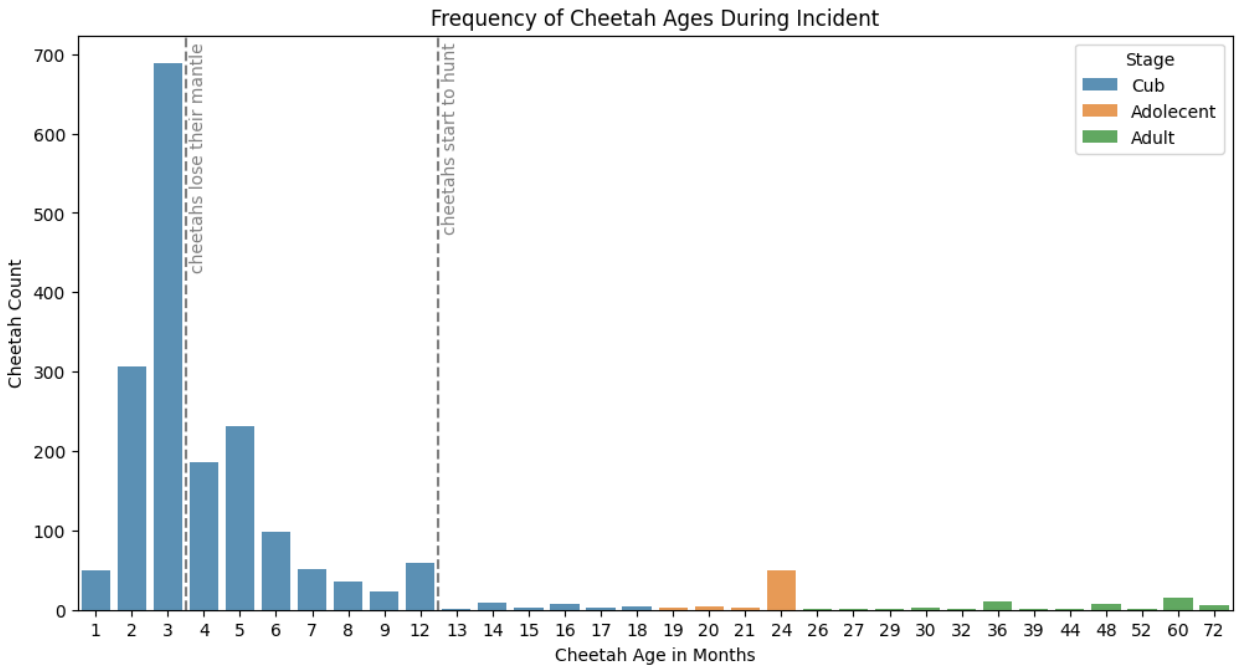
We see most of these incidents involve live cheetahs. While this data indicates live cheetahs trade is more common than cheetah skins; it may be more likely that cheetah skin illegal trade is not intercepted as frequently due to more difficulties identifying or due to organizational intervention strategy.

This leads us to explore the logistics of live cheetah trade. Next, we looked at how many cheetahs were involved per live incident. As expected we see that by far the majority of incidents involve single cheetahs. This is likely because it is easier to conceal the transportation of one cheetah than multiple. Perhaps this also indicates cheetahs are illegally traded on a per demand basis.



To further understand the logistics of illegal trade we ask: How old are the live cheetahs being traded? It is important to note here that some values in our age column were derived from average life stages so values were substituted at 9 months, 21 months, and 24 months. We added a life stage factor to make this more apparent however we see minimal effect from those substitutions.

We see that most illegally traded cheetahs are cubs, particularly under 3 months. At 3 months cheetah cubs lose their mantle, the fluffy coat of fur that the babies are born with. We also see that few cheetahs are traded after 12 months. While cheetahs are considered cubs until 18 months, they begin to hunt at 12 months. These markers could be a confirmation that the intention for these trades is to have cheetahs as cute pets.



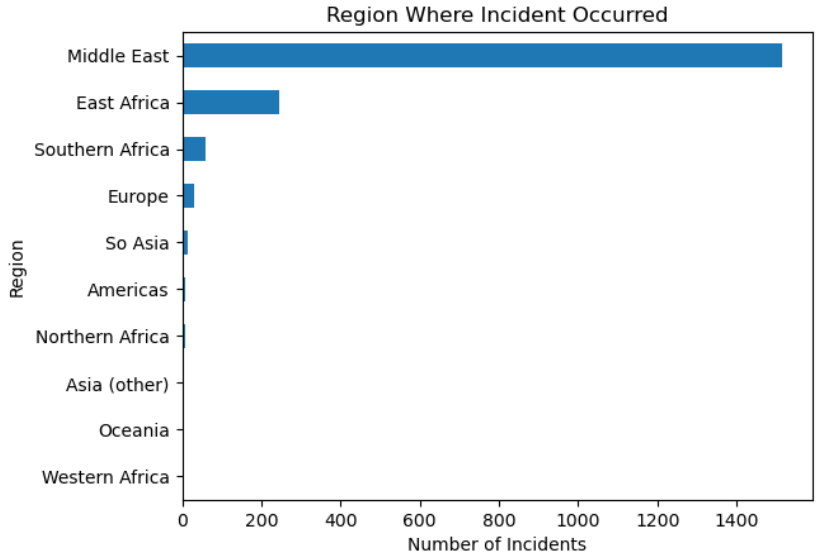
We now have a clearer picture of how illegal trade happens. Cheetahs are illegally traded individually when they are very young. While some illegal trade occurs with cheetah skin there is either more activity in live trade or live trade is intercepted more effectively.

It would be interesting to understand how the price and age of cheetahs interact, however we could only compare prices of the same currency. When we look at our extracted data fields the largest sample of prices come from Saudi Arabian currency with only a few hundred records. As seen above, our dataset contains 1755 live cheetah incidents across 10 years. Due to currency fluctuation over a decade and the low observation rate from our largest populated currency we do not believe this data is substantial enough to draw conclusions about illegal trade as a whole.

	currency
NaN	1261
SAR	426
KWD	102
AED	64
QAR	24
RUR	2
EGP	2
USD	2
AER	1

Geographic Characteristics

From our initial analysis, we found that most incidents were reported in the Middle East, followed by Africa.



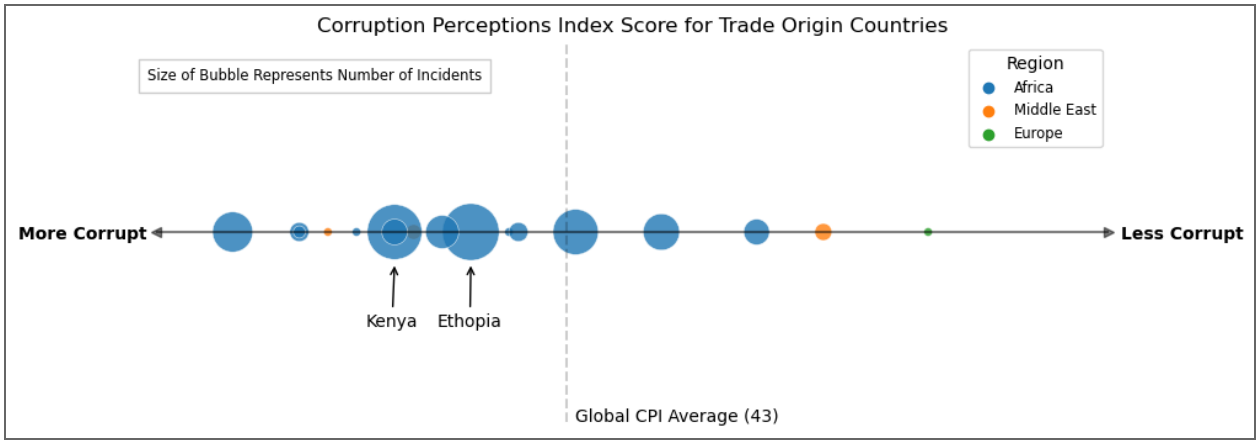
Through a deeper look, we found that most cheetah trade originated in countries throughout East and Southern Africa (Somaliland, Ethiopia, Kenya) and were transferred through and destined for the Middle East, specifically Saudi Arabia, Kuwait, and UAE. This data also suggests that most incidents were reported at the destination, versus the origin or transit locations (assuming no missing data).

Though there are destination countries outside of the Middle East, the number of incidents reported were minimal (~1 incident per country). This may reflect (1) less cheetahs being exported outside of the MENA region, likely because of prolonged distance, (2) less cheetah trade incidents detected in those destination countries, or (3) missing data.

Socioeconomic Characteristics

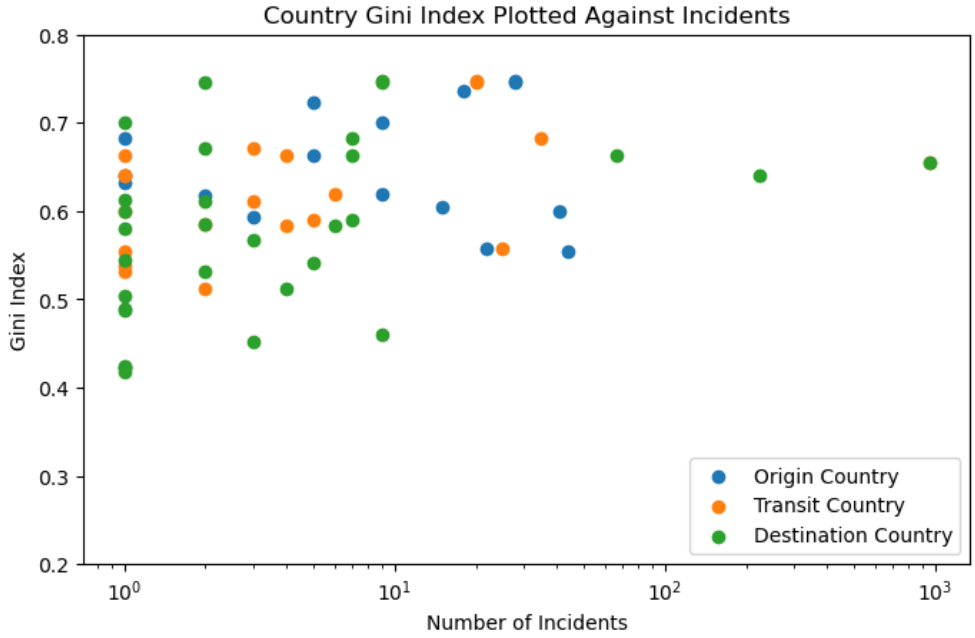
We used two key indicators to understand how to best characterize the markets where cheetah trade is common. The first measure, the Corruption Perceptions Index (CPI) ranks countries and territories across the world by their perceived levels of public sector corruption. Countries are rated from a scale of 0 to 100, the former representing extreme corruption and the latter representing the opposite. The second measure, the Gini index, quantifies income or wealth inequality on a scale from 0 to 1. Higher values represent more inequality, while lower values indicate more equality.

The figure below represents how countries that had at least 1 incident of illegal cheetah trade fall on the spectrum of corruption. Here, we also focused specifically on the countries where the trafficking originated. Note that certain countries that are not internationally recognized (specifically Somaliland) do not have CPI data available and therefore are not represented below.



The chart indicates that in most countries where more trade originated, corruption levels are below average. We see specifically that Kenya and Ethiopia, two countries with some of the highest recorded incidents, fall to the lower end of the scale. This could suggest that these animals are being captured and trade is being initiated in areas where poachers/traders don't face legal consequences or are able to bribe government officials.

Next, we examined data around inequality to understand how that might manifest in countries where illegal cheetah trade is common. The plot below shows a country's Gini index the number of incidents that occurred in that market.



We don't see specific patterns emerge as it relates to the differences in origin vs. transit. vs. destination countries, but all trend towards the higher end of the Gini index scale, indicating greater inequality. Origin and transit countries in particular are all rated 0.5 or higher, whereas destination countries are a bit more variable. Countries with more incidents additionally tend to

have higher indices. These findings are similar to those outlined above regarding corruption – countries that have less favorable socioeconomic conditions tend to experience more illegal cheetah trafficking.

Conclusion & Implications

Our data points to several key findings regarding illegal cheetah trade. First, we see that poachers are most likely to trade live cheetahs that are still cubs, and typically only transport one animal at a time. These incidents are most likely to occur in the Middle East and East Africa regions, originating more frequently in Somaliland, Ethiopia, and Kenya and the destination most commonly being Saudi Arabia. When we look at the socioeconomic data in these markets, we see that the countries where trafficking originates in areas that tend to be more corrupt, and countries where these incidents occur also tend to have greater income inequality.

These findings can act as insights for those aiming to stop the practice of illegal animal trafficking. Utilizing this data, wildlife conservationists and government officials should increase protection for cheetah cubs, focusing their efforts in primarily East African countries. Second, authorities in Saudi Arabia, Kuwait, and the UAE should ensure that they increase efforts to monitor illegal animal trade and be vigilant for animal smuggling. Lastly, it's important to be aware of the socioeconomic factors that may put certain markets at risk.