



DEAD OR ALIVE: TOWARDS A SUSTAINABLE WILDLIFE TRADE

One World One Health recommendations

3rd December, Brussels

International Bushmeat Trade

Overview and results of a two-year study on illegal meat import conducted at Brussels airport (2017-2018)



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Study aims

- Genetically identifying the species involved in this trafficking, determining their CITES status.
- Identifying invasive alien pathogens or species carried by or with illegally transported meat.
- Determining the nature, scale and driving forces of this trafficking.

- Collection of Samples from Brussels Airport
- Radiography
- Estimation of meat volumes
- Species Identification – Molecular tracing
- Challenges and limitations
- Questions and discussion

Collection of Samples from Brussels Airport

- **1) BACON** (for « Bagage Contrôles ») **actions**



- 2) CITES seizures

BELGIAN CUSTOMS AIRPORT NEWS



Cites 06/2018



Brussels airport



Bushmeat from Kinshasa.

05/09/2018

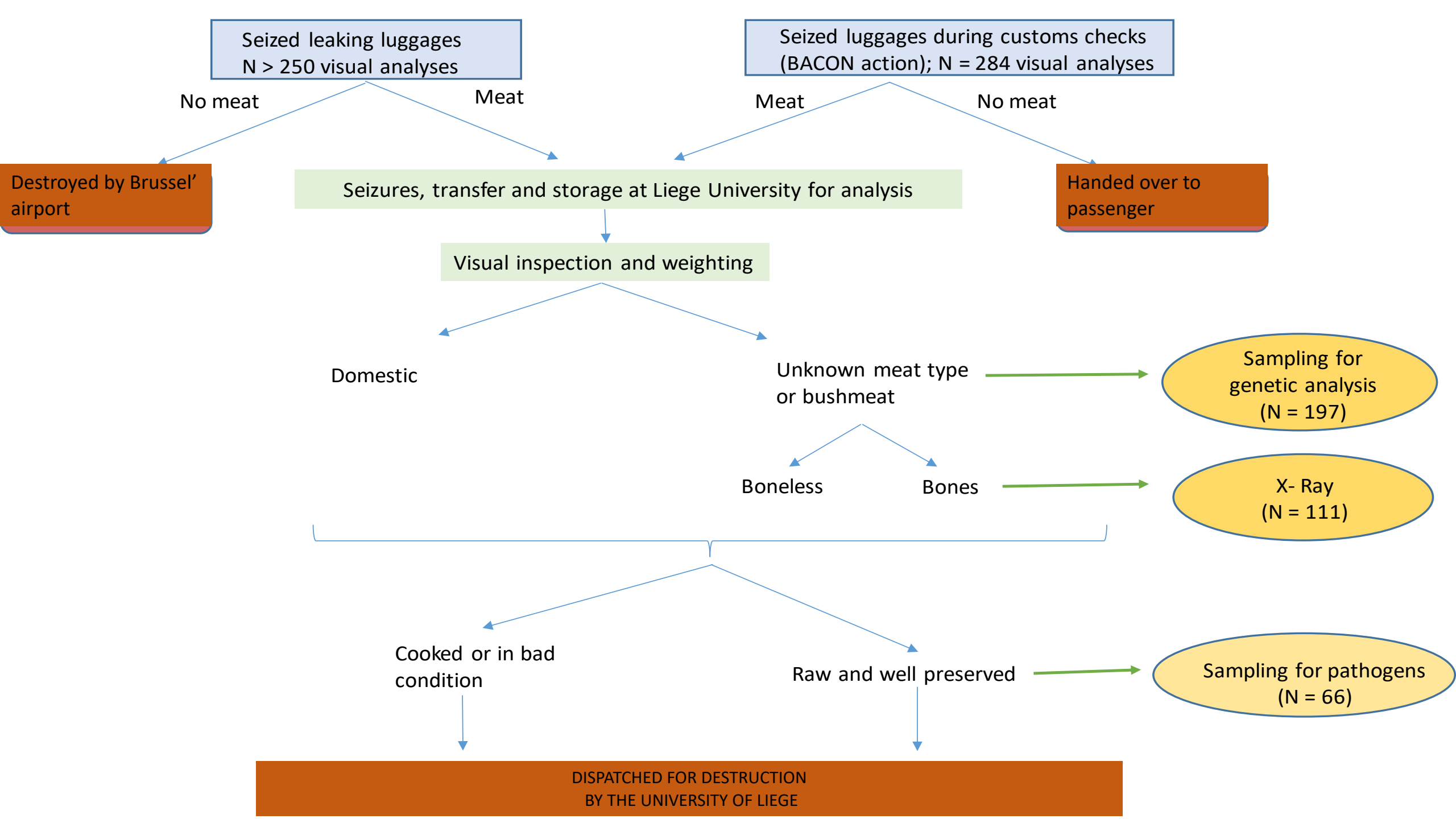
A coolbox filled with bushmeat was seized at the arrival of a Belgian citizen, who came from Kinshasa via Addis Ababa. The coolbox contained pieces of crocodile, turtles and other not identified bush meat. The meat, which was for own consumption, will be destroyed.

FOD - Finance
Customs and Excise
GAD – team (Group anti drugs)
Building 706 – office: 7550
Bedrijvenzone
1830 Machelen



- Leaking Luggage

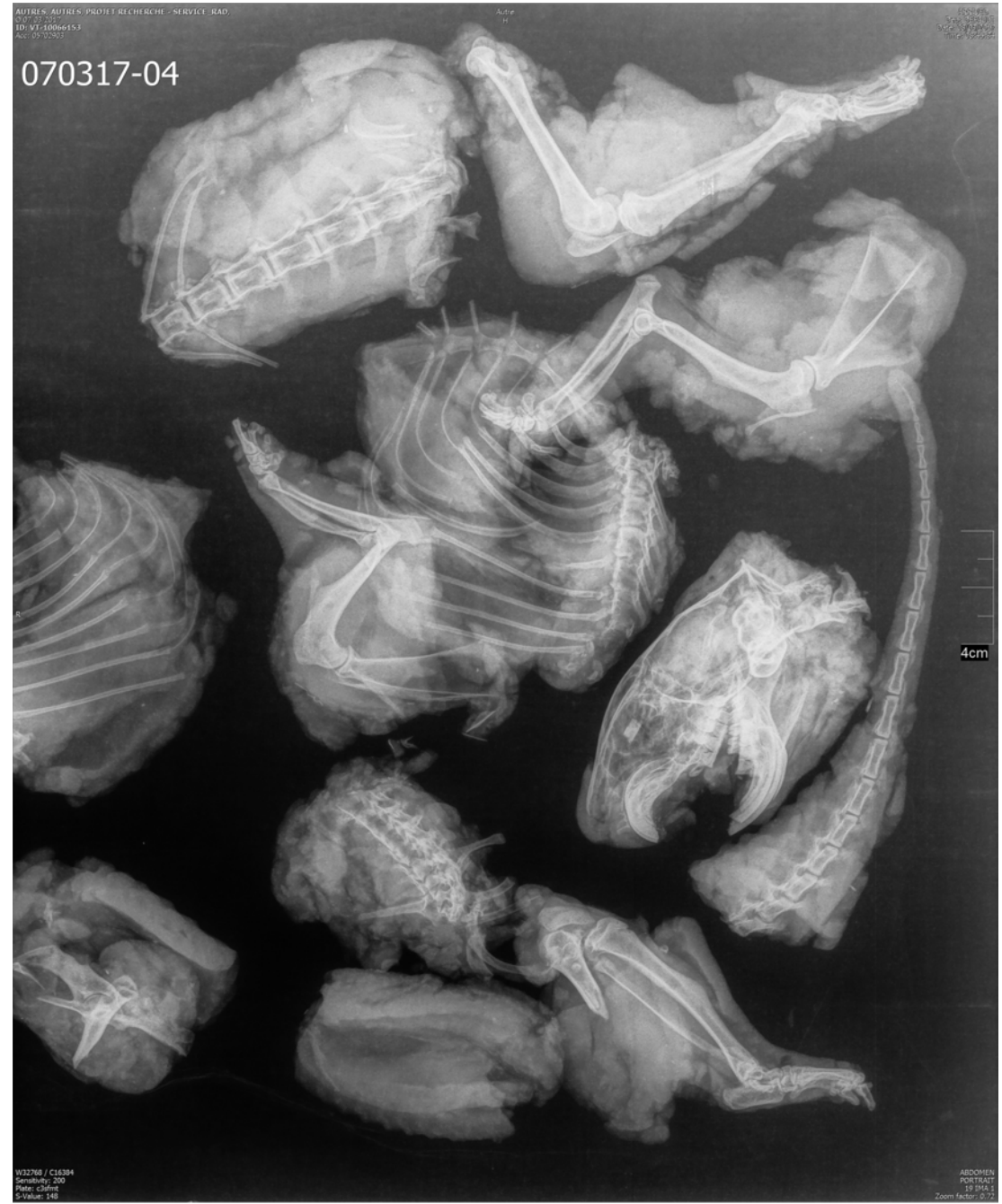












Radiography

- 79 x-rays

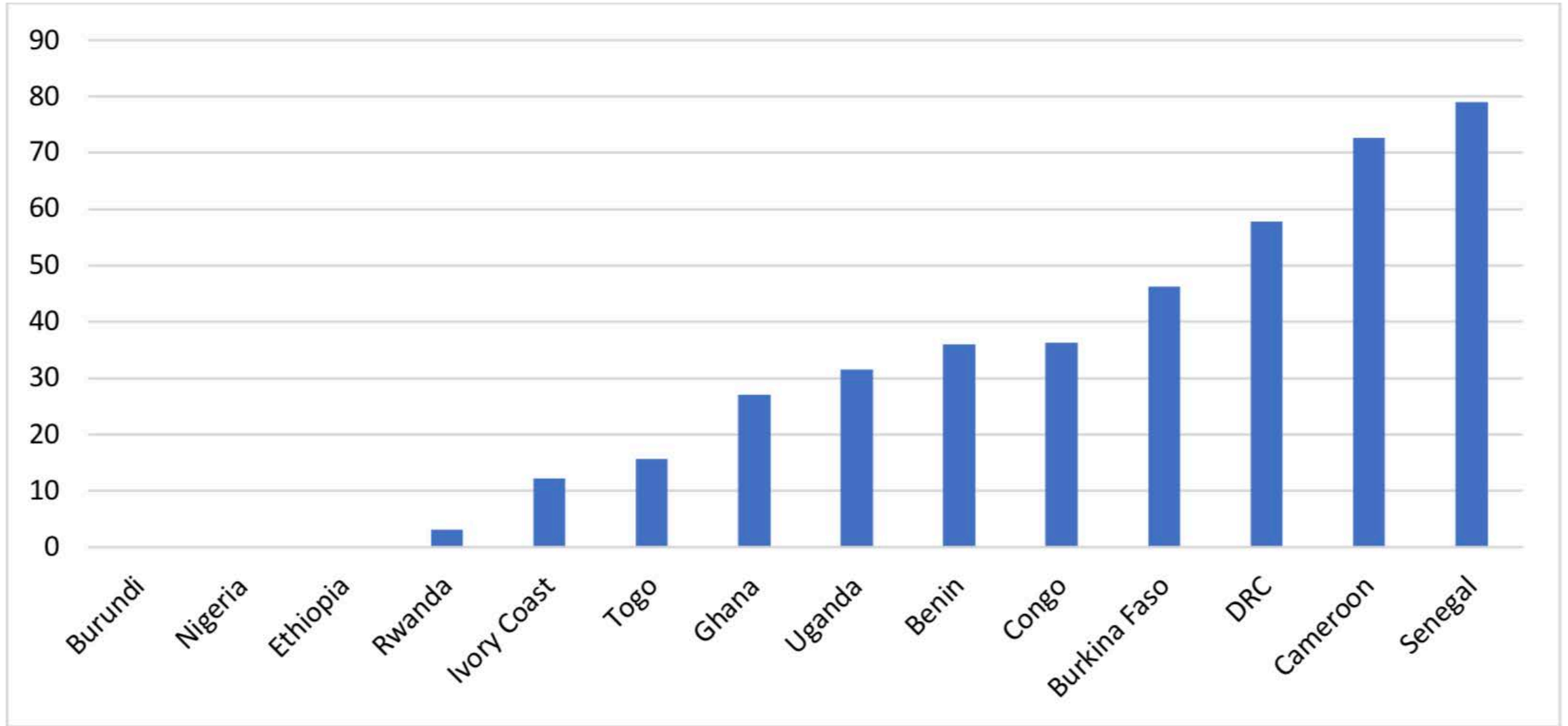
⇒ 55.7% of the animals radiographed were juveniles respectively

⇒ 17.7% of the samples x-rayed contained bullets.

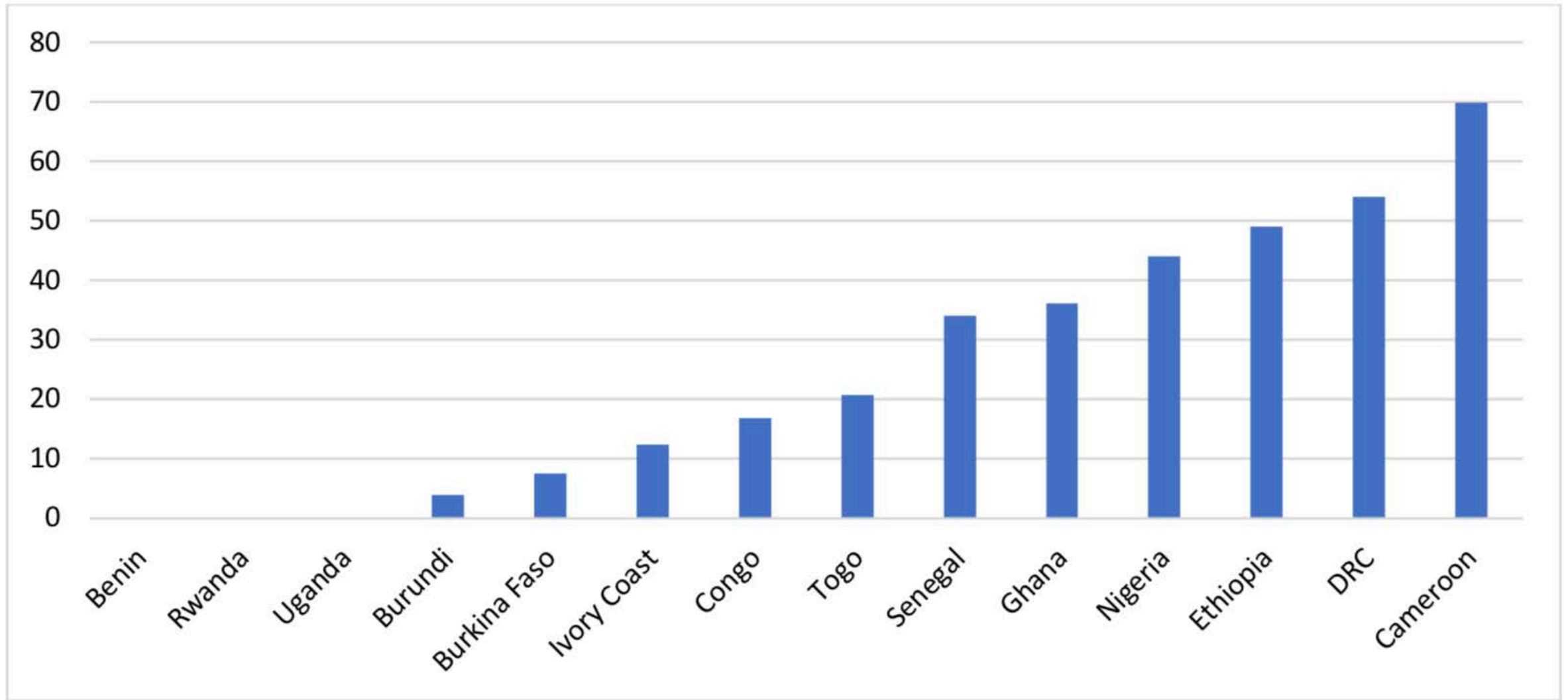
- Most of the pangolins (3 out of 4) and rodents (28 out of 37) were juveniles while all primates were adults.

Estimation of meat volumes

- Results from BACON and CITES actions during period of 1/1/2017 to 7/10/2018
 - ⇒ Total of 794 kg of meat from 284 seizures from all countries were seized.
 - ⇒ 166 (647 kg) of these seizures came from Africa.
 - ⇒ average weight of bushmeat and livestock meat seized per flight route were recorded to estimate the total rates of bushmeat import.

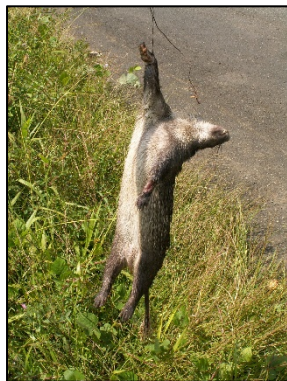


Estimated weight (in kg) of livestock meat imported every week through Zaventem Airport from West, Central and East African countries.

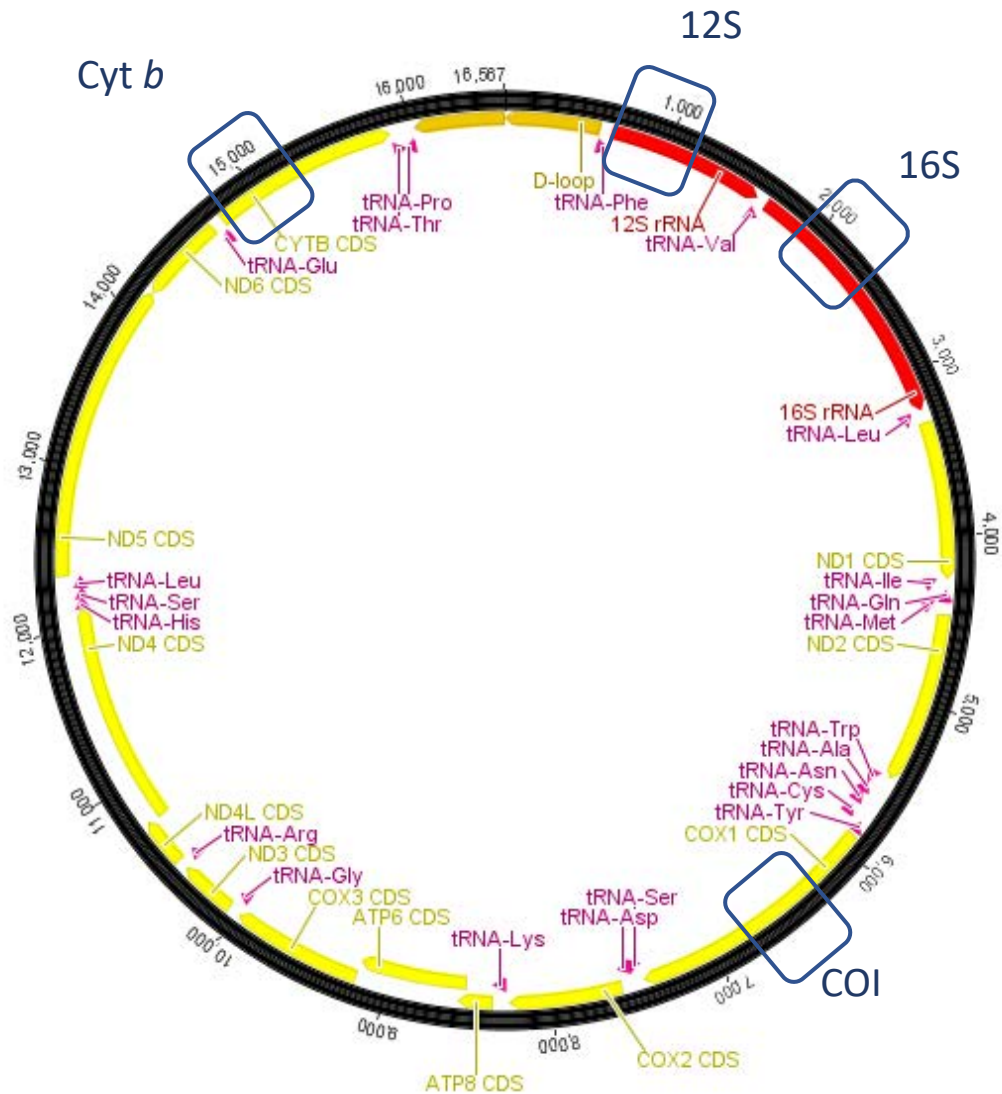


Estimated weight (in kg) of bushmeat imported every week through Zaventem Airport from West, Central and East African countries.

Species Identification – Molecular tracing



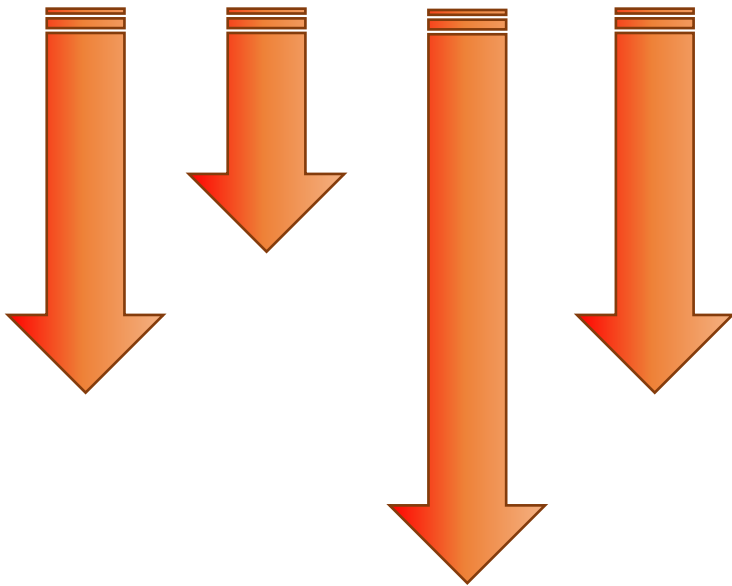
DNABUSHMEAT → A 'universal' DNA-typing approach for the identification of African bushmeat



- Four universal pairs of primers
- PCR amplification across 10 mammalian Orders

Decision pipeline for the taxonomic assignment of nucleotide sequences

Four-gene strategy



Taxonomic coverage in Genbank

Taxon?

sequence

Similarity- and tree-based methods

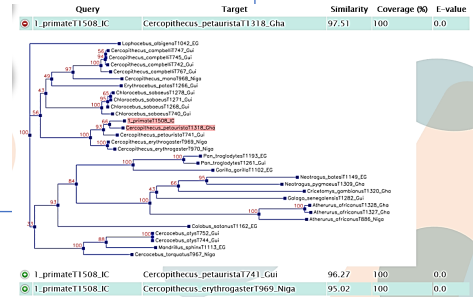
Expert validation of sequence identity

BLASTn – GENBANK
DNABushmeat

Taxonomic coverage and accuracy

Consensus on taxonomic assignment

sequence ID

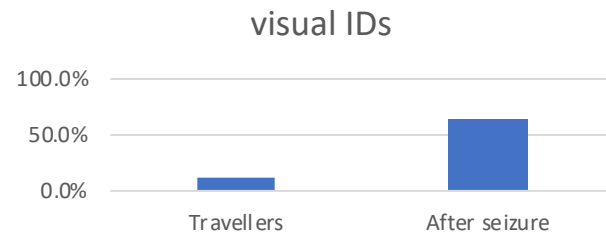


In total: 197 samples (21 Feb 2017 – 7 Oct 2018)

- 84 passengers
- 105 leaking luggage
- 8 unknown source

Visual IDs:

- 81 livestock
- 75 wild game
- 41 unknown

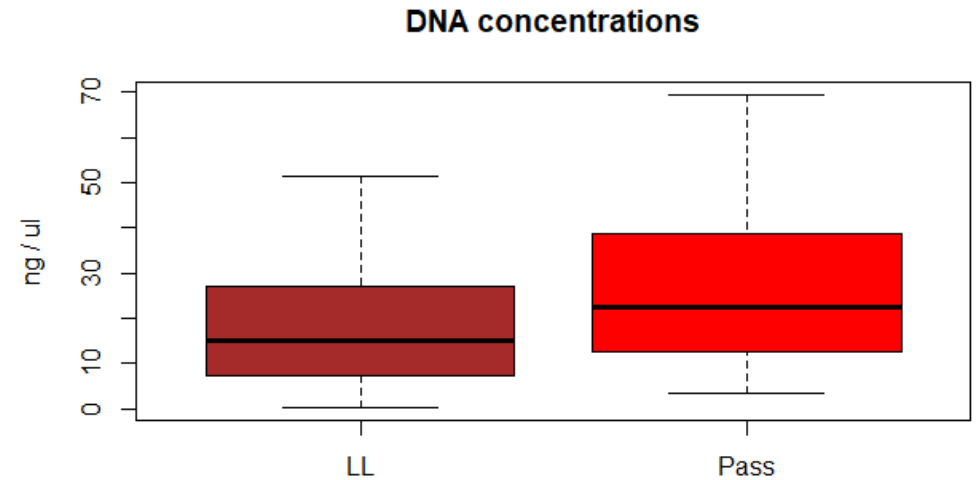


Origin:

- 76 unknown
- Cameroon, DR Congo, Togo, Ivory Coast, Ethiopia, Ghana, Senegal, Uganda

Samples from passengers yielded significantly higher DNA concentrations than leaking luggage

(Wilcoxon-Mann-Whitney test; Z-Score = -2.74147; p -value = 0.00614)



Gene	Cyt <i>b</i>	COI	12S	16S	Visual
No data	17	22	20	16	68 (30)
Wrong ID	7	16	5	3	28

→ 145 samples (i.e. 93 % of the samples) were identified, of which 139 were species-level

Issues:

- 2 duikers *Cephalophus nigrifrons* / *C. rufilatus*
- 2 antelopes *Tragelaphus eurycerus* / *T. spekii*
- 1 monkey *Chlorocebus cynosuroides* / *C. aethiops*
- 1 tuna *Katsuwonus* / *Thunnus* spp.

Spectrum of meat categories estimated from visual identification (left) and DNA-typing (right).

U = Unknown attribution

→ 6 % of livestock were genetically identified as wild game

→ 15 % of wild game were genetically traced to livestock

When considering specific visual IDs, the level of wrong identification reached 30,5 %

“Antelope” → Red river hog

“Beef” → Domestic goat

“Chicken” → Domestic rabbit

“Chicken” → Greater cane rat

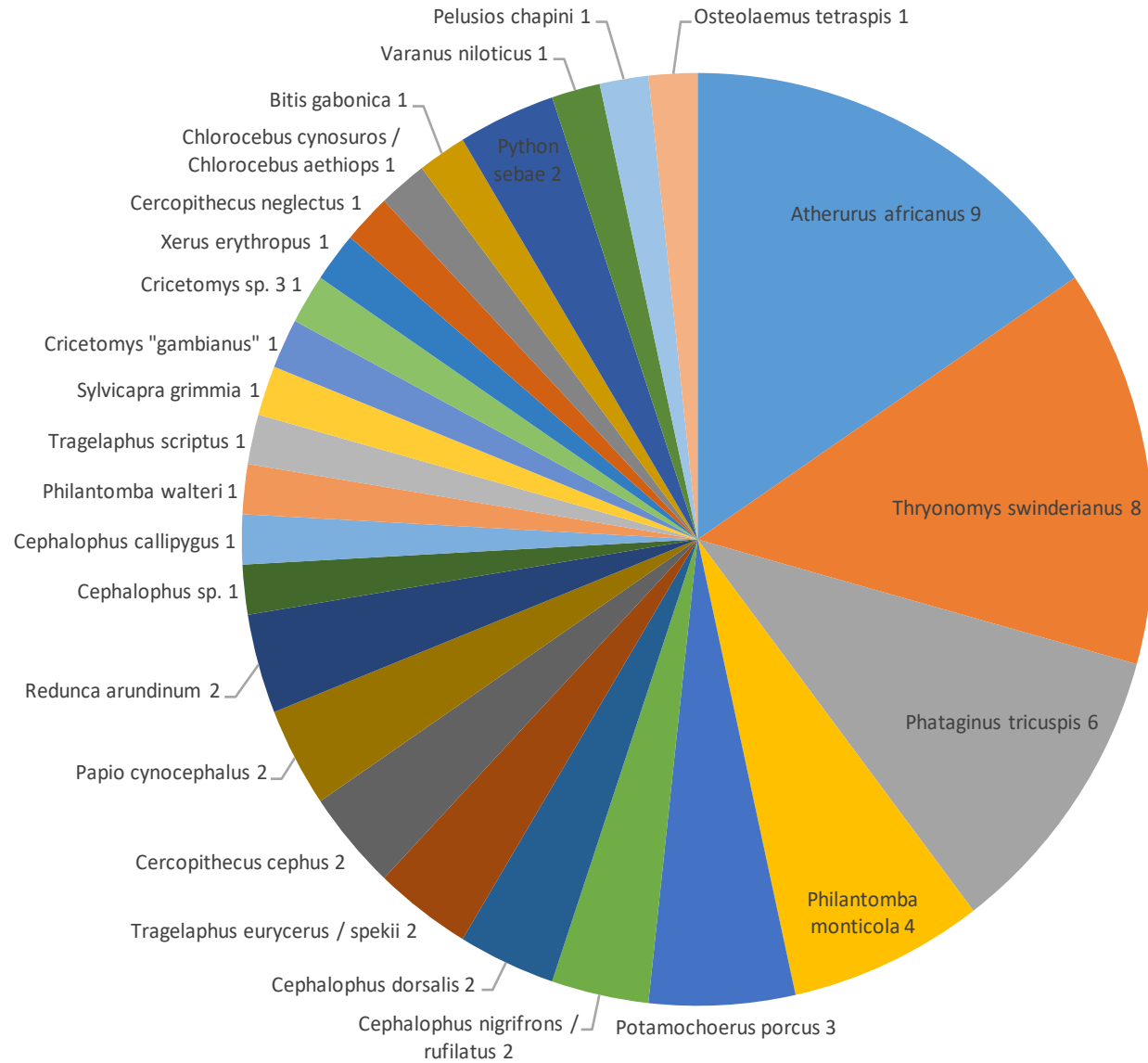
“Rat” → Walter’s duiker

...

Spectrum of the meat diversity seized at the Brussels' airport:

- 1) Artiodactyla are the dominant taxon (116 samples), followed by Rodentia (20)
- 2) 6 other Orders are minimally represented: Pholidota (6), Primates (6), Lagomorpha (1), Squamata (4), Testudines (1), Crocodylia (1), Perciformes (1)
- 3) Livestock represent the majority of samples
- 4) Within Livestock, the domestic cattle is dominant, followed by the domestic goat (ca. 20%) and the domestic pig
- 5) Artiodactyla was most prominent among wild game samples (ca. 45%), followed by Rodentia (ca. 27.5%)
- 6) Among wild game samples 5 species represented half of the seizures: the African brush-tailed porcupine (9), the greater cane rat (8), the African common pangolin (6), the blue duiker (4), and the red river hog (3)

Spectrum of the meat diversity seized at the Brussels' airport:



- Take home message:

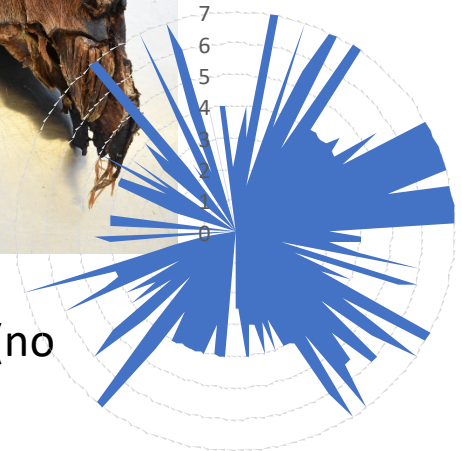
I- The Method

1) DNA-typing was critical in determining the taxonomic identity of the meat seized at Brussels' airport:
93 % of the meat was identified

2) The method was extended to a large spectrum of meat processing (**rotten meat, cooked meat, smoked meat**) and of non-mammalian groups (**Aves, Squamates, Crocodylia, Testudines**)



3) Degraded DNA (risk of cross-contaminations) + difficult visual IDs + low traceability of the flights (no geographic origin) = **challenges to the resolution of DNA-typing**



- Take home message:

II- The meat

1) Livestock

→ the prevalence of domestic cattle found in the samples raises the question of what is driving this demand

2) Wild game

→ Has this demand been translocated to Brussels?

3) CITES

→ if $> 1/3$ of the wild game species transiting into European airports are CITES-listed:
law enforcement?

Challenges and limitations

- Controls did not cover all potential introduction pathways
- No randomization of targeted flights
- Luggage in transit was not controlled (except LL)
- Lack of data related to numerous seizures
- Cross-country movements of the meat before the flight was generally unavailable

Questions and discussion