THIS PROJECT IS FUNDED BY THE EU'S LIFE PROGRAMME

EVIDENCE FOR TRAFFICKING OF CRITICALLY ENDANGERED STURGEON IN THE LOWER DANUBE REGION

FINAL REPORT 2021

Authors:
Jutta Jahrl, Markus Boner,
Beate Striebel, Arne Ludwig

Acknowledgement:
Christophe Janz, Borislava Margaritova, Stoyan Mihov, Roselina Stoeva, Ekaterina Voynova, George Caracas, Cristina Munteanu, Vesna Maksimovic, Vukasin Djurkovic, Ivana Grubisic, Inna Hoch, Natalia Gozak (WWF);
Dietmar Lieckfeldt (IZW);
Sabine Hofem, Claudia Erven (Agroisolab)

The very helpful support provided by authorities in Bulgaria, Romania, Serbia and Ukraine is most gratefully acknowledged.

The following report was compiled by WWF in the course of the LIFE project "Sustainable Protection of Lower Danube Sturgeons by Preventing and Counteracting Poaching and Illegal Wildlife Trade". The project is coordinated by WWF Austria and implemented by WWF in Austria, Bulgaria, Romania, Serbia and Ukraine, together with the Danube Delta Biosphere Reserve Authority in Romania and the Leibniz Institute for Zoo and Wildlife Research (IZW) in Germany.

Publishing office
WWF Austria & WWF CEE

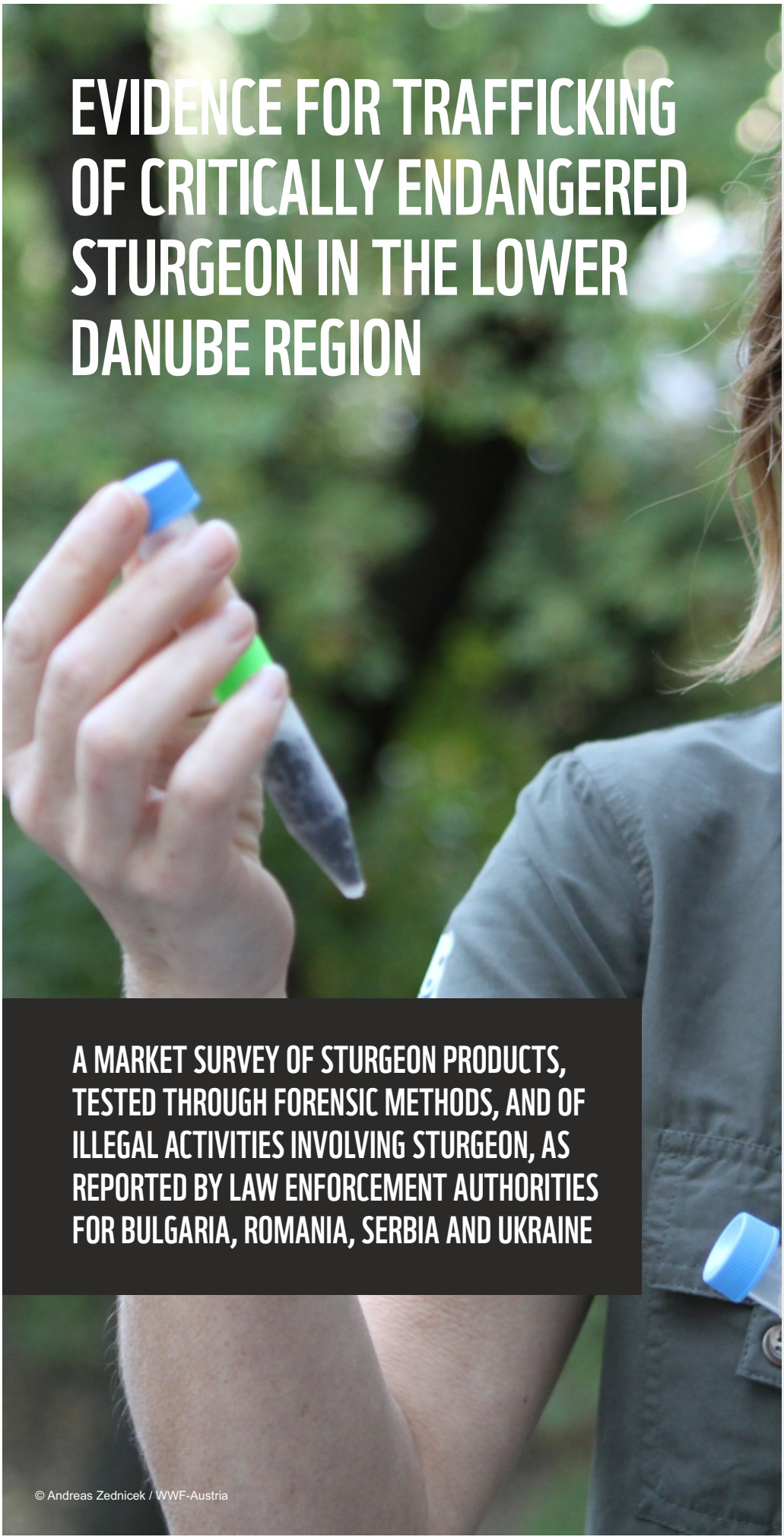
Design by Boyan Petkov

For contact details and further information,
please visit our international website at
www.danube-sturgeons.org

Cover photography: © George Caracas / WWF-Romania

WWF and project partners gratefully acknowledge funding support from the European Commission.
All content and opinions expressed in this publication are solely those of WWF and project partners.

EVIDENCE FOR TRAFFICKING OF CRITICALLY ENDANGERED STURGEON IN THE LOWER DANUBE REGION



A MARKET SURVEY OF STURGEON PRODUCTS, TESTED THROUGH FORENSIC METHODS, AND OF ILLEGAL ACTIVITIES INVOLVING STURGEON, AS REPORTED BY LAW ENFORCEMENT AUTHORITIES FOR BULGARIA, ROMANIA, SERBIA AND UKRAINE

© Andreas Zednicek / WWF-Austria

CONTENTS

EXECUTIVE SUMMARY

This report demonstrates the occurrence of sturgeon trafficking in the Lower Danube Region, specifically in Bulgaria, Romania, Serbia and Ukraine. It also provides first-time evidence of the scale of poaching and illegal trade, including in wild-caught sturgeons. Its findings were reached by combining official data on illegal fishing activities with the results of a large-scale market survey and wildlife forensic analysis. The report consists of a regional overview, which is followed by detailed sections for each of the four surveyed countries.

According to the United Nations Office on Drugs and Crime (UNODC), wildlife trafficking includes the illegal trade, smuggling, poaching, capture, or collection of endangered species of protected wildlife (including animals or plants that are subject to harvest quotas and regulated by permits), of derivatives, or products thereof.[1] In the case of sturgeons, illegal fishing and the illegal trade in their products — namely, meat and caviar — have been frequently cited as significant threats to sturgeon populations worldwide. While such illegality was much more widely reported in the past, zero catch and trade quotas have been established for wild populations, and there has also been a massive growth in trade of sturgeon products from aquaculture. These factors have all led to a perception in some quarters that the problem has been resolved. This perception is not universally shared; however substantiated data suggesting the contrary are rarely available.


© Evgeniy Polonskiy

[1] UNODC. Wildlife, Forestries and Fisheries Crime Module 3 Key Issues: Criminalization of Wildlife Trafficking. unodc.org

The current report, produced in the course of an EU-funded LIFE project (LIFE FOR DANUBE STURGEONS LIFE15/GIE/AT/001004), provides a unique compilation of evidence to underpin this statement, demonstrating its relevance for the last remaining viable sturgeon stocks in the European Union. **The report covers the entire trade chain. It combines:**

(1) official data from enforcement authorities on illegal fishing activities (this is the only publicly available compilation of such information for the region, which is collected by and usually only available to individual national agencies), and

(2) the results of a targeted market survey and the forensic analysis of collected samples, that demonstrate trade in illegal products.

The report is also unique in its regional dimension, as it covers the main four countries of the Lower Danube and North-Western Black Sea Region, which share the same migratory sturgeon populations.

During the study period, all fishing of and trade in all wild Danube sturgeon species was prohibited in Bulgaria, Romania and Ukraine. Serbia was the only Lower Danube country with legal fishing or trade of wild Danube sturgeon: only the catch of sterlet above 40 cm in total length was allowed until the end of 2018, after which this too became illegal. The trade in all sturgeons and their products from farmed or wild sources is further regulated through CITES [2] and — in the case of EU Member States — through EU Wildlife Trade Regulations,[3] which are supported by national legislation laying down criminal sanctions.

IN THE MARKET SURVEY, A TOTAL OF 145 SAMPLES WERE COLLECTED

at different locations and different types of retailers (shops and supermarkets, restaurants and bars, local markets, aquaculture facilities, intermediaries, fishermen, as well as online offers) in Bulgaria, Romania, Serbia and Ukraine. All samples were obtained between October 2016 and July 2020. The survey aimed to cover the whole range of available products — fresh and processed sturgeon meat as well as caviar. It also aimed to cover the market availability of these products throughout the year — including spawning periods, as well as festive seasons, when demand for sturgeon meat and caviar traditionally peaks.

All samples underwent DNA and isotope testing. Three lines of DNA evidence were combined to determine the species or hybrid of origin. This approach allows the highest available degree of certainty in the results at present. The three lines of DNA evidence were:

(1) mitochondrial DNA sequence polymorphism for species identification

(2) microsatellites for species detection and hybrid identification (ploidy)

(3) single nucleotide polymorphism genotyping for hybrid and species determination.

Stable isotope analysis was applied to deliver information on the production method (wild or farmed sourcing) of samples, using the proxy of the isotope composition of sturgeon feed, and in some cases, it also delivered information on the geographical origin.

According to the findings of the market survey and the forensic testing of collected samples, 30% of all samples were offered for sale illegally:

27 samples (19% of all samples) originated from wild-caught sturgeons

17 samples (12% of all samples) were caviar sold in violation of CITES Regulations (without mandatory CITES labels, with incorrect CITES codes or imported without CITES permits).

There is no reason to exclude the possibility that the volume of illegal trade could be considerably higher than documented by the cases in this survey.

In addition, in many instances, consumers were misled by the descriptions of the product, such as:

- "whitewashing" of products from wild sturgeons as captive bred
- "blackwashing" of farmed products as derived from wild-caught sturgeon
- artificial products sold as caviar
- meat from European catfish or Nile perch sold as sturgeon
- products from lower-priced sturgeon species being misrepresented as coming from higher-priced ones, such as beluga, and vice versa.

ADDITIONALLY, AT LEAST 214 OTHER CASES OF ILLEGALITY

(including the use of illegal fishing gear, as well as poaching and illegal trading) were compiled from

2 Convention on International Trade in Endangered Species of Wild Fauna and Flora (www.cites.org)

3 Council Regulation 338/97 of 9 December 1996 on the protection of species of wild fauna and flora by regulating trade therein; Commission Regulation 865/2006 of 4 May 2006 laying down detailed rules concerning the implementation of Council Regulation (EC) No 338/97 on the protection of species of wild fauna and flora by regulating trade therein.

the information provided by enforcement authorities in this study. This consists of cases from Romania (82), Bulgaria (82) and Ukraine (50), all of which took place between January 2016 and December 2020. The majority of cases were reported in 2018, 2019 and 2020. Sterlets were involved in the highest number of reported cases, followed by stellate sturgeon. The sturgeon species least frequently encountered were beluga and Russian sturgeon. The incidence of cases involving different species reflects the respective scarcity of these threatened species. It is worth noting that significant differences were observed in the completeness and type of information recorded by the different authorities, which limits conclusions and determination of trends in these illegal activities.

In Bulgaria alone, 594 pieces of illegal fishing hook lines (karmaci) were detected, adding to a combined length of more than 23.5 km.

OVERALL IT CAN BE CONCLUDED THAT TRAFFICKING IN STURGEON EXISTS IN ALL FOUR COUNTRIES,

and that illegal activity ranges from the use of illegal gear for targeting sturgeon to actual poaching, from consumer deception to violation of CITES labelling and import regulations, to the illegal trade in wild-caught sturgeon. The survival of highly threatened wild sturgeon species in this region will be dependent on continuous and increased efforts to reduce the threat of trafficking in wild sturgeon.

WITH THIS GOAL IN MIND, THE CURRENT REPORT AIMS TO:

- **shed light on the situation of sturgeon poaching and illegal trade**
- **inform responsible actors**
- **contribute to intelligence for future enforcement activities**
- **foster the exchange of relevant data among different authorities and between range countries**
- **encourage similar data collections or market surveys as follow-ups, as well as replication in other regions, using comparable methods.**

© WWF-Ukraine

© WWF-Ukraine


© Hannes Greber / WWF-Austria

1. INTRODUCTION

According to the IUCN (2010), sturgeons and paddlefishes (Acipenseridae) are the world's most endangered group of species.[4] Their eggs, which are sold as caviar, are among the most valuable wildlife products in international trade, and the consumption of sturgeon meat has a long-standing tradition in many regions.

This has led to heavy overexploitation and a dramatic decline of sturgeons worldwide, including in the Danube and Black Sea countries. The historical collapse of sturgeon fisheries in this region has been described in many papers, and has recently been highlighted in a document published by the Danube Sturgeon Task Force, 2020.[5] Of formerly six sturgeon species native to the Danube River, two — *Acipenser sturio* and *A. nudiventris* — are already considered extinct. Yet, the Black Sea and Danube River Basin are among the last regions with viable populations of sturgeon species globally. On the European continent, the Danube and the Rioni River in Georgia are the last rivers where sturgeon species are known to naturally reproduce. However, all remaining four species are listed as threatened by the IUCN, and three of them are critically endangered.

© WWF-Bulgaria

Effectively, sturgeon fishing and the resultant trade in wild-caught sturgeons is banned completely for all sturgeon species in the Lower Danube countries of Bulgaria, Moldova, Romania, Serbia and Ukraine. Furthermore, fishing of all sturgeon is prohibited permanently in all other Black Sea range states, specifically Georgia, Russia and Turkey. Except for Romania and Bulgaria, all these bans are permanently enacted in national law. Fishing bans in Romania and Bulgaria have so far had a limited lifespan. While Bulgaria has just renewed the 5-year period until the end of 2025, in Romania the public consultation for an unlimited fishing ban is ongoing at the time of writing this report.

In response to dramatic declines in many sturgeon populations globally, due - in large parts - to overharvesting, and with the aim of ensuring that the trade in sturgeon products is sustainable, all of the 27 species of Acipenseriformes have been listed in the Appendices of CITES since 1998.[6] With the exception of two species,[7] sturgeons are listed in Appendix II. International trade is regulated through a system of permits issued by national

4 IUCN. (18/03/2010) Sturgeon more critically endangered than any other group of species. iucn.org

5 Danube Sturgeon Task Force. DSTF Position on the Sturgeon fishing moratorium in the Danube River and the Black Sea - extended version. dstf.info

6 CITES. A Brief History of Sturgeons and CITES. cites.org

7 European sturgeon *(Acipenser sturio)* and Shortnose sturgeon *(Acipenser brevirostrum)* are listed in Appendix I, whereby all international commercial trade in wild-caught specimens is prohibited

CITES Management Authorities. Issuance of export permits requires a prior finding of legality of acquisition by a competent Management Authority, and advice from a competent Scientific Authority that the export will not be detrimental to the survival of the species. In addition, the EU regulations require prior issuance of import permits, under similar conditions. All species of sturgeon and paddlefish are covered by CITES, regardless of whether they are wild-caught or captive-bred. The inclusion of these sturgeon species in CITES also covers all parts of the fish and products derived thereof, including caviar, meat, fingerlings, fertilized eggs, cosmetics, etc.

IN 2000, A UNIVERSAL LABELLING SYSTEM FOR CAVIAR WAS INTRODUCED

to allow identification of the source. That system has been revised and updated on a number of occasions since then. CITES Resolution Conf. 12.7 (Rev.CoP17)[8] recommends that Parties implement the universal labelling system for all types of caviar — both products that are wild-sourced and those derived from aquaculture — for both international and — unusually in a CITES context — domestic trade. Labels must be non-reusable, i.e. they cannot be removed undamaged or be transferred to another container. It is stipulated that the label must seal the container, or if not, the packaging should permit other visual evidence of any opening. While the CITES labelling system recommends that the system be implemented for all domestic markets, according to CITES provisions they are mandatory only for international trade. However, in all EU Member States, the labels are required for the individual marking of any caviar container, both on international and domestic markets.[9]

CITES also stipulates that labels for caviar containers provide a minimum amount of information, in a defined code of letters and numbers. This information needs to include:

- the species or hybrid of origin
- the source code of the caviar ("W" for sturgeon harvested from the wild, "C" for captive-bred sturgeon etc.)
- the country of origin, etc.

For more details, also refer to the brochure 'STURGEONS AND CAVIAR - The basics of the legal caviar trade and caviar labelling'.[10]

Despite the legal protection of recent years, trafficking of sturgeon — which includes poaching and illegal trade — has been known to occur in all countries of the Danube region, and has also been reported by experts in many other sturgeon range countries globally (Cohen 1997, Zabyelina 2014, Van Uhm and Siegel 2016, Knight 2017, Harris and Shiraishi 2018). However, very few systematic market investigations have been published, and when they exist, it is rare for them to include DNA analysis of samples (Birstein et al. 1998, Doukakis et al. 2012, Fain et al. 2013, Ludwig et al. 2015, Pappalardo et al. 2019). This is a significant shortcoming, as DNA analysis can successfully determine the species origin of sturgeon products. In the case of meat, determining these attributes is rarely possible by visual inspection alone, and even more so with caviar. The current report is the only available research that also applies isotope analysis to assess whether samples derive from wild-caught or captive-bred sturgeons, making it a unique source of information.

Efforts of enforcement authorities to supervise markets, to regulate legal wildlife trade, and to prevent illegal trade are often insufficient. Reasons are manifold and often include low priority due to lack of awareness of the extent and impact of such illegalities and lack of capacities of staff and resources (i.e. laboratory technology for forensic methods), but corruption might also play a role. With regard to caviar, agency checks are usually limited to checking the presence and correct placing of labels and the completeness of the CITES codes. To actually verify whether the content of a caviar container matches the information on the label, forensic methods need to be applied. The same techniques are needed to verify the provenance of meat or whole fish offered for sale.

As generally observed in many fields of wildlife crime, data on these illegal activities is hard to find. The first initiative to shed light on the situation of the caviar trade in Bulgaria and Romania was published in 2013 (Jahrl 2013).

INSUFFICIENT CONTROL ACTIVITIES, LACK OF DATA AND LACK OF INDEPENDENT MARKET SURVEYS

have led to the prevailing opinion that this type of crime does not exist — and the scale of illegal activity tends to be underestimated. Another problem is that the provenance of sturgeons offered for sale in the Lower Danube and Black Sea region — whether as fresh or prepared meat, as a whole fish or in parts, or as caviar — is rarely declared in a way that can be verified. Namely, the information provided by sales persons or waiters regarding the sourcing from aquaculture or from the wild cannot always be expected to be reliable. Based on the aforementioned market survey in Romania and

8 CITES. Resolution Conf. 12.7 (Rev. CoP17) Conservation of and trade in sturgeons and paddlefish. cites.org

9 EUR-Lex. (27.02.2019) REGULATION (EC) No 865/2006 - CHAPTER XVI MARKING REQUIREMENTS. eur-lex, europa.eu

10 WWF. Caviar Labelling Brochure. danube-sturgeons.org

Bulgaria, on journalist investigations[11] and on recent seizures we can assume that some of these products are derived from poached wild Danube sturgeons, and that the trade and consumption of these products furthers drives illegal fishing.

Problems such as these and the lack of reliable data led to the decision to conduct market surveys in Bulgaria, Romania, Serbia and Ukraine. They included state-of-the-art forensic testing of samples, in order to better understand the dimensions of the trade in sturgeon products in the whole Lower Danube Basin. Furthermore, they were designed to provide national authorities with reliable and meaningful data that can be followed up with concrete investigations. Another aim was to provide information on research and laboratory methodology which can be applied in the control of the domestic sturgeon market. At the same time, existing data on seizures were collected from the responsible authorities, thus including all available information to build the clearest possible picture of the extent of trafficking. The publication at hand can thus be seen both as an update and an extension of the publication by WWF and TRAFFIC in 2013. It was produced over the course of the EU-funded LIFE project LIFE FOR DANUBE STURGEONS LIFE15/GIE/AT/001004 2016-2020, "Sustainable Protection of Lower Danube Sturgeons by Preventing and Counteracting Poaching and Illegal Wildlife Trade" (danube-sturgeons.org).

The study contributes to the implementation of various official international strategies:

(1) The results of this survey contribute to the **EU Action Plan against Wildlife Trafficking**,[12] in particular by addressing Objective 2.1 ("Ensure more even implementation of EU rules on the wildlife trade and develop a more strategic approach to checks and the enforcement of rules against wildlife trafficking at EU level"), specifically Action 10. (*"Improve rate of detection of illegal activities" with expected result "In addition to the checks at border-crossing points required under Regulation (EC) No 338/97, in-country compliance monitoring and enforcement ensured, in particular through regular checks on traders and holders such as pet shops, breeders and nurseries"). It may also contribute to Action 12. ("Define and assess priority risks regularly"*).

In the longer term, it may also address Objective 2.2 (*"Increase capacity to combat wildlife trafficking of all parts of the enforcement chain and the judiciary"*), as well as Action 16. (*"Improve knowledge base on checks, investigations, prosecutions and judicial proceedings against wildlife trafficking"*, by supporting the streamlining of data collection methodology in the field of wildlife trafficking throughout the EU and awareness raised in relevant expert groups on crime statistics).

(2) The study clearly contributes to the **Pan-European Action Plan for Sturgeon**[13] adopted under the Bern Convention and endorsed for implementation under the EU BHDs. Objective 6 of the Action Plan states: "Eliminate illegal trade of all sturgeon products" and specifically Action 6.1.1. calls to *"Establish and make available forensic tools to differentiate species and origin of caviar and sturgeon products in processing and trade, by applying for the first time an isotope analysis to distinguish between sturgeon products from wild and captive sources."* Action 6.1.2. of the Pan European Action Plan states to *"routinely perform market and trade controls on domestic, intra-EU and international levels to assess level of illegal trade"*, of which the study at hand can be an example.

(3) Contributions are also in line with the **Vienna Declaration**,[14] a document resulting from the 8th International Symposium on Sturgeons, held 2017 in Vienna, with a participation of about 300 sturgeon experts from 32 countries. Recommendation 16 of the Declaration reads: *"Inspections in production and trade are to be carried out unannounced. They must use state-of-the-art techniques (e.g. DNA and isotope analysis) that are necessary to identify the species and origin and thereby guarantee effective monitoring of trade in caviar and other sturgeon commodities. This also needs to include caviar containers with CITES labels, as long as manipulations cannot be ruled out completely."*

"The need for random, unannounced controls was already outlined in a workshop on caviar trade in 2007 and was reiterated repeatedly in the Conference of Parties to CITES. The results of confiscations underscore the value of DNA testing in enforcement, when used in real time, since these measures can help detect the utilization of species other than labeled and can help to discourage illegal trade." (Vienna Declaration)

---

[11] e.g. Belgrade Insight (27.07-13.09.2018) Serbia's Appetite for Sterlet Drives Unique Sturgeon to the Brink. balkaninsight.com; Newsweek Romania, (14.10.2019) Caviar, crime and corruption on Romania's Danube River. Los Angeles Times, (22.08.2019) Craving for caviar is driving the Danube River's sturgeon to extinction. www.latimes.com; Balkan Insight, (20.05.2020) Decimated Danube: Sturgeon Revival Efforts Neglect Roots of Poaching. balkaninsight.com

[12] EUR-Lex. (26.02.2016) Communication from the Commission to the European Parliament, the Council, the European Economic and Social Committee of the Regions: EU Action Plan Against Wildlife Trafficking. eur-lex.europa.eu

[13] Council of Europe. (30.11.2018) Convention on the Conservation of European Wildlife and Natural Habitats. rm.coe.int

[14] WSCS. (12.04.2018) Vienna Declaration on Global Sturgeon Conservation. wscs.info

2. METHODOLOGIES

2.1. MARKET SURVEY SAMPLE COLLECTION

The methodology for carrying out this market survey was based on a previous survey on the sturgeon caviar trade in Bulgaria and Romania, and was fine-tuned in coordination with the multi-country project team. A common procedure was agreed on and put into writing for all surveyors. It included possible approaches and strategies as well as potential risks and how to mitigate them.

The survey started with and was accompanied by preparatory desk research. It included internet offers, ads in magazines, information from enforcement agencies (which was in some cases anecdotal), as well as media or other sources to identify supply and potential target locations for further investigations.

Sample collection focussed on areas along the Danube and the Black Sea, where sturgeons were traditionally fished, as well as on capitals and larger cities with financially strong consumers, since most trade in sturgeon is expected to happen there. Locations included selected shops (delicatessen stores, supermarket chains, fish and seafood shops, Russian delicatessens, etc.), restaurants or bars, local markets, intermediaries, aquaculture facilities and fishermen as well as online offers. These were contacted in order to locate sturgeon products offered for sale and to obtain samples.

The sample collection lasted from October 2016 to July 2020. The aim was to sufficiently cover the trade in all four countries, to cover a substantial time frame, and to include a broad variety of retailers and of suitable samples, with the goal of mapping the actual market situation. The main survey periods were the spring spawning season and the autumn spawning season times, when potential illegal catches of wild sturgeons are more likely to occur, as well as the period around St. Nicholas' Day, Christmas and New Year, when more sturgeon products are offered on the market, due to the increased demand around these traditional festive days.

Site visits were conducted covertly by surveyors. Each surveyor gave a convincing story, which would explain the interest in buying sturgeon or caviar, and which was adapted to the location and situation. Surveyors were nationals of the target country, had adequate background and experience and were briefed.

© George Caracas / WWF-Romania

While the range of available sturgeon products on domestic markets was reflected in the survey as far as possible, national circumstances were also considered (e.g. more caviar was expected to be found on the Ukrainian market, while sampling in Bulgaria or Serbia was more focussed on meat). The survey focussed exclusively on caviar and meat from sturgeon (Acipenser spp.), and surveyors were instructed to avoid buying other types of "caviar" or fish eggs, such as red salmon eggs, or forged sturgeon caviar (artificially made from protein).

Of each collected sample, at least 5-10 grams (a small spoonful, or 10-20 eggs of caviar) had to be put into at least two separate test tubes (to have a back-up for replication). Samples had to consist of pure meat or caviar and be handled rigorously to avoid contamination, mixing of samples with other organic matter (to avoid problems with isotope analysis; especially a challenge in restaurants), or mixing with other meat or caviar samples. Samples had to be kept in a freezer at -20°C, not in alcohol (which is detrimental for isotope analysis). Caviar tins or glasses could be kept unopened and cooled (they can last up to 2 years).

For shipping to research laboratories in Germany, samples had to be packed separately and sent in a cool box with thermal packs or dry ice, where possible. They were sent via courier service, or where this was not possible or feasible, via direct pick-up. For shipments from Serbia or Ukraine, as non-EU Member States, CITES export permits had to be requested from the respective CITES Management Authority as well as EU CITES import permits fom the German CITES Management Authority.

All samples[15] were analysed genetically[16] to identify the species or hybrid, and in their isotope composition,[17] to assess the source (aquaculture vs. wild) and geographical origin.

2.2. DNA ANALYSIS

It is well-known nowadays that nearly all sturgeon and paddlefish species comprise various degrees of intra- and interspecific genetic differentiation. These differences are used for species identification and hybrid detection. In this study, we used mitochondrial DNA sequence polymorphism as a starting point for species identification. Additional lines of evidence were collected by the use of microsatellites (e.g. for ploidy - hybrid and species identification) and Single Nucleotide Polymorphism (so called SNP) genotyping (e.g. for hybrid detection and for species identification in some cases). Combining these three lines of evidence, we can detect both species and hybrid status with a reliable degree of security.

The samples were stored in reaction tubes (frozen or in ethanol). DNA was extracted from ~25 mg of each sampleusing a Qiagen DNeasy Blood and Tissue Kit according to the manufacturer's instructions. The quality and quantity of the DNA was checked by gel electrophoresis and Nanodrop (Peqlab) measurement. Starting with PCR using universal primers CB1_L and CB2_H (Kocher et al. 1989), a fragment of approximately 300 bp of the mitochondrial

15 Except for 2 caviar samples from Serbia that could not be transferred to the research laboratories in Germany, as no CITES permits were granted (because these samples were illegally imported to Serbia)
16 By Leibniz Institute for Zoo and Wildlife Research (www.izw-berlin.de)
17 By Agroisolab GmbH (www.agroisolab.de)

cytochrome b gene was amplified. In addition, sturgeon specific primers were used for the amplification of mitochondrial sequences (cytochrome b and d-loop) as previously published (Ludwig and Kirschbaum 1998, Jenneckens et al. 2000, Ludwig et al. 2000, Birstein et al. 2005, Peng et al., 2007, Krieger et al. 2008). All PCR amplifications were conducted using a PEQSTAR 96 Universal Gradient Cycler (Peqlab) in 25 µl reaction volumes containing 2 µl genomic DNA solution, 0.5 U FastStart Taq DNA Polymerase (Roche), 1× reaction buffer with 2 mm MgCl2, 0.8 mm dNTP mixture, 1.6 mg ml−1 BSA and 0.4 µm of each primer. The thermocycling profile included an initial denaturing step at 95°C for 10 min, followed by 30–40 cycles of denaturing at 95°C for 30 seconds, annealing at 55–57°C for 30 seconds, extension at 72°C for 30 seconds, and a final extension at 72°C for 30 minutes. Depending on the quality of the DNA, sturgeon specific primers of the target gene were necessary to amplify shorter overlapping fragments (100–200 bp). All the fragments were sequenced using standard protocols for Sanger capillary sequencing (3130 × l Genetic Analyzer, ABI). The sequences were aligned using reference sequences archived in international databases (e.g., GenBank) and in our reference collection from previous studies. We conducted fragment length analysis for a set of sturgeon microsatellite loci as previously described for determination of ploidy (Jenneckens et al. 2001, Ludwig et al. 2001, Zane et al. 2002, Williot et al. 2005, Chassaing et al. 2011, Barmintseva and Mugue 2013, Havelka et al. 2014). One primer of each marker was fluorescently labelled, and automated fragment length analysis was performed with the machine mentioned above using the Rox500 length standard and GeneMapper v. 3.7 software (ABI). Additionally, a set of nuclear tests (SNP genotyping) was established in order to support species identification and hybrid detection. SNPs were analyzed as described previously (Boscari et al. 2014, 2017a, 2017b; Havelka et al. 2017, 2019).

For several reasons (uncertain phylogenetic relationship, artificial hybridization, and hybridization with escaped fish from aquaculture or release programmes), some species of sturgeons can not be distinguished by molecular methods:

- The very closely related species from the Russian sturgeon complex are difficult to identify. Russian sturgeon *Acipenser gueldenstaedtii* and Persian sturgeon *A. persicus* are not distinguishable by genetic markers; Siberian sturgeon *A. baerii* can be identified with 70-80% security only, whereas for Adriatic sturgeon *A. naccarii* reliable species-specific genetic markers exist.

- In particular, Russian sturgeon *(Acipenser gueldenstaedtii)* and Siberian sturgeon *(A. baerii)* share some mitochondrial and nuclear genotypes due to artificial and natural hybridizations of these two species in Russian aquaculture operations. Unfortunately, some backcrosses of these hybrids had been released in European waters and are commonly used in many sturgeon farms worldwide, including in the Danube region.

Summarising Q&As on DNA analysis are attached as **Annex 1**.

2.3. STABLE ISOTOPE ANALYSIS

The stable isotope method is the leading standard analytical tool to verify the authenticity of many materials (Primrose et al. 2010). This is also due to its universal application to a broad range of products (e.g. ivory - ivory database: http://ivoryid.org). The method was accepted in various court cases as an analytical proof (Camin 2017), including in caviar trade, where the method has provided evidence for illegal trading.[18]

The method relies on the principle that stable non-radioactive isotopes occur in nature in different relative proportions, because biological processes (such as the water cycle) influence their abundance variations. Stable isotope patterns deliver various information on the geographical origin (Camin et al. 2016) and the source i.e the production method or husbandry system (wild or farm) (Molkentin et al. 2015). However, the application of the stable isotope method always requires a representative database. It is therefore important not only that the reference samples are authentic, but also that a large number of references are available, especially for determining the geographical origin (Ziegler et al., 2016).

As most sturgeon species migrate from a marine environment to freshwater to spawn, the stable isotopes of oxygen and hydrogen can be applied for sturgeons and their products — meat and caviar — in order to verify the geographical origin (Figure 1).

The stable isotopes of the bio elements carbon, nitrogen and sulphur measured in animal tissue reflect the available feed and therefore indirectly the source of an animal or of its product (if it was wild-caught or captive-bred). This is due to the fact that all heterotrophic organisms need either plants (herbivores) or other animals (carnivores) as food sources. The isotope ratios in heterotrophic organisms are therefore ultimately determined by the food (DeNiro and Epstein 1976). However, a slight isotopic enrichment has to be taken into account. In general, it is assumed that the $\delta^{13}C$ isotope ratios, especially of proteins, are comparable to those of food or have only a low enrichment of approx. +0.5 ‰ (McCutchan 2003). A slight enrichment of 0 to +1 ‰ is assumed for $\delta^{34}S$ as well (Harrison et al. 2011). The $\delta^{15}N$ isotope ratio in the tissue of a heterotrophic organism always shows a higher enrichment of +2.0 to +3 ‰ compared to the food (McCutchan et al. 2003). That significant enrichment is mainly due to the isotope fractionation of the transaminase (Macko et al. 1987). That effect is repeated within the food chain, so that e.g. end members of the food chain can have

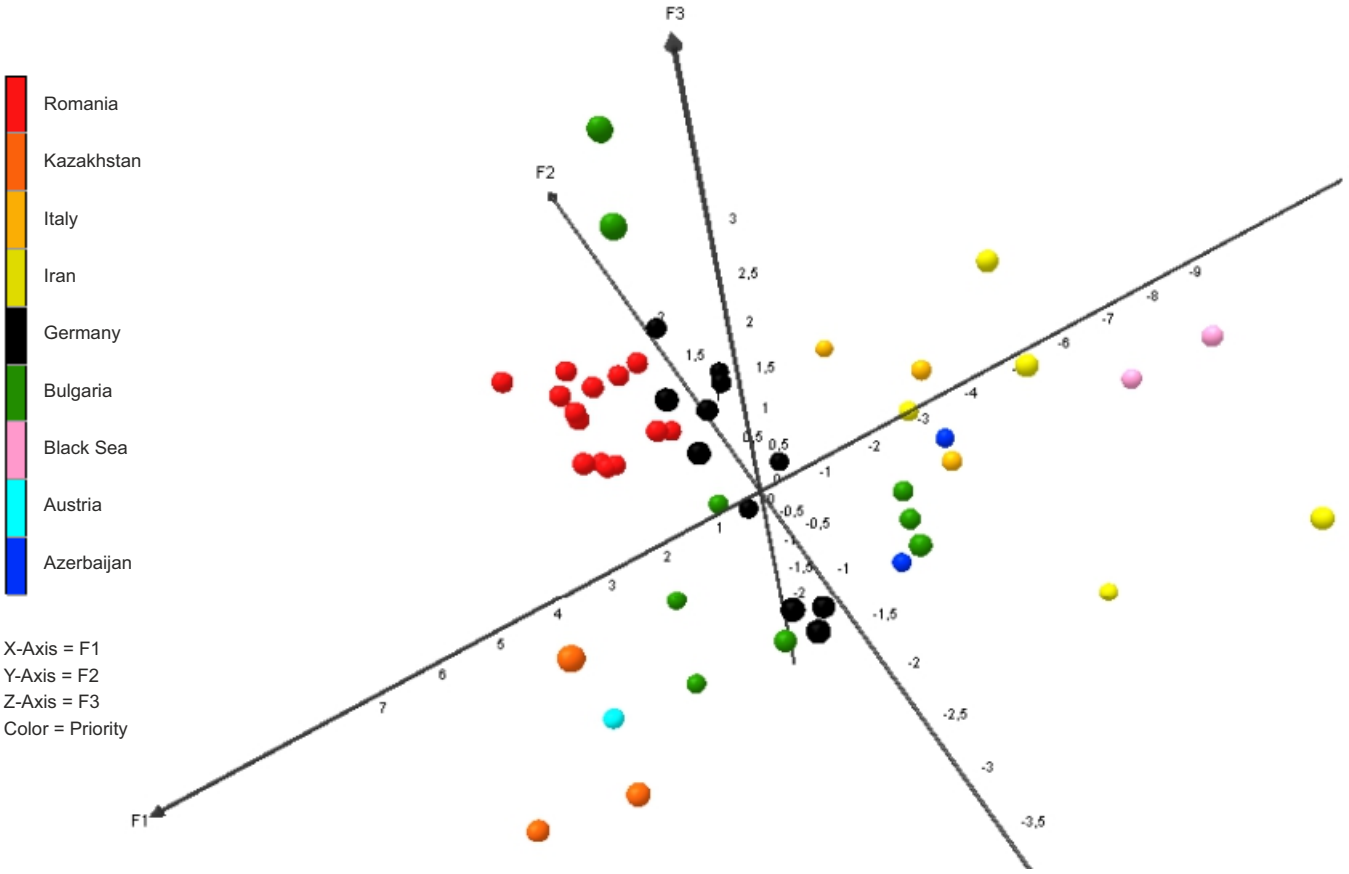


Figure 1: Discriminant analysis of sturgeon samples from different geographical origin using $\delta^{2}H$ and $\delta^{18}O$ of tissue water and $\delta^{2}H$ of raw protein; current project result (n=55)

[18] Oct. 2013: AKZ: 231 Ls 700 Ls 2870/11, Germany

$\delta^{15}N$ significant enrichment in the isotope ratios of up to 18 ‰ (Minagawa and Wada 1984). This causal dependence has long been used to track food chains. Therefore the $\delta^{13}C$ and $\delta^{15}N$ isotopes are old standards for uncovering the food chain and drawing conclusions about the food source (Wada et al. 1991).

This indirect source verification has been further validated for fish (Kim et al. 2015). Unfortunately, for sturgeon and their caviar the latest research (European sturgeon database) has shown that, considering the current state of knowledge, nitrogen and carbon isotope ratios deliver only a slight differentiation possibility with respect to the aquaculture system.

differentiation database based on a former customs research project was extended by 34 samples. Now, 81 references are currently available to distinguish between wild and captive.

The determination of geographical origin needs to find links between the environmental conditions and the caviar or sturgeon. This manifests itself in different food sources and different isotope signatures of the habitat - water. Ultimately, it requires that a sufficiently large number of reference samples are available to describe that causation. At present, the new data must be further verified in order to expand this differentiation of origin. This is still an ongoing process and should be expanded in a further project.

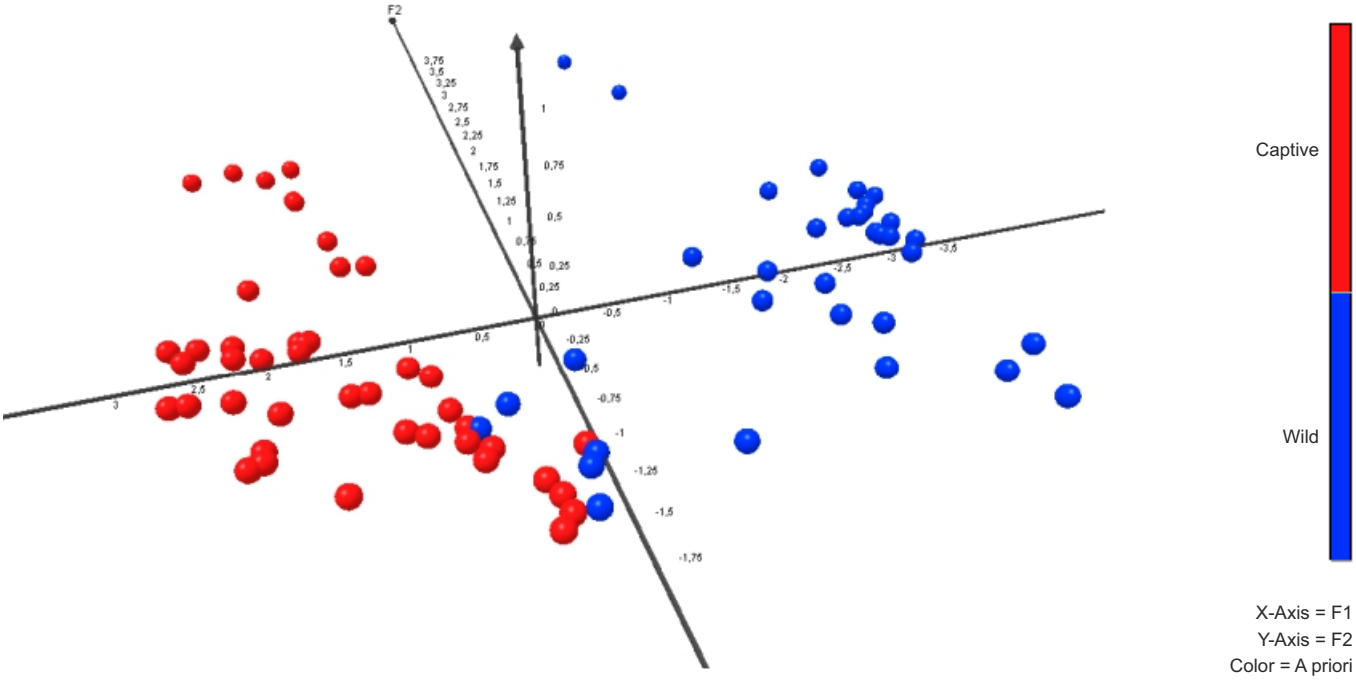


Figure 2: Discriminant analysis of caviar from wild / farmed sources using $\delta^{34}S$, $\delta^{15}N$ and $\delta^{13}C$ isotope ratio; current project result (n=81)

This might be linked with the complexity of sturgeon feed, as well as the varying feeding conditions. However, for caviar and sturgeon meat, the combination with sulphur isotopes is resulting in a high discrimination power for the source from wild or farmed and was therefore applied (Figure 2).

However, the stable isotopic technology is only applicable if the feed in the wild is different to industrial feed. Therefore, it is important to keep in mind that the method cannot actually discriminate wild-caught from captive-bred sturgeon, but sturgeon fed with natural versus industrial feed. Also, the stable isotope analysis should always be linked with genetic analysis of species (otherwise e.g. a dish sold as sturgeon, with the fish identified as wild-caught, could actually be from a species that is not protected and was legally caught in the wild).

Compared to the determination of geographical origin, the verification of the husbandry system is still a simple application, because ultimately the different food is used as a means of discrimination. During the project, the first

SAMPLE PREPARATION

Aliquots of approximately 5g of all sturgeon samples, mainly caviar and meat, were freeze-dried with Isokryo (Agroisolab, Jülich, Germany) with an under pressure of 10mbar. The water vapour was frozen out with liquid nitrogen. The dried raw protein was extracted with dichloromethane in a soxhlet apparatus to separate nonpolar compounds as fat. After drying in a sand bath (60°C) the raw protein was homogenized with a ball mill.

ISOTOPIC RATIO MEASUREMENTS

The isotope ratio of $\delta^{18}O$ of the tissue water was determined by using an equilibration application with Multi-Flow in combination with IRMS (Isoprime, Cheadle, UK). Furthermore, the $\delta^{2}H$ ratio was measured by elemental analysis (EA 3000, Eurovector, Milano, Italy) with a chromium combustion tube, working temperature 1050°C.

The δ^2H ratio of the raw protein ratios were determined by high temperature pyrolysis at 1530°C in a Siliciumcarbid tube (patented Agroisolab) with coal filling in combination with IRMS (Isoprime, Cheadle, UK).

$\delta^{13}C$ and $\delta^{15}N$ were measured by elemental analysis (EA 3000, Eurovector, Milan, Italy) in combination with IRMS (NU Horizon, NU-Instruments – Wrexham, Wales). The combustion temperature was 1021°C for oxidation and 600°C for reduction. Reduction was carried out in the presence of copper. Combustion gases are separated by gas chromatographic column (3m).

$\delta^{34}S$ measurement was performed by elemental analysis (EA 3000, Eurovector, Milan, Italy) in combination with IRMS (Isoprime, Cheadle, UK). A one-tube combustion (oxidation and reduction in one tube, working temperature 1000°C) is used to solve issues caused by SO_3. Furthermore, combustion water is directly trapped with magnesium perchlorate.

The values of the isotopic ratios are expressed in delta-notation corresponding to international standards according to the following general formula:

$$\delta_{sample}\ (‰) = [(R_{sample} / R_{standard}) -1] * 1000$$

R_{sample} = isotopic ratio of the sample

$R_{standard}$ = isotope ratio of the respective international standard

Each sample was analysed at least twice and the values were averaged. Samples were normalised by using calibrated laboratory working standards. These are calibrated with international standards provided by the IAEA (International Atomic Energy Agency). Normally the calibrations of the laboratory working standards rely on more than two and up to four international standards, e.g. sulphur.

The quality of the measurement is routinely controlled in proficiency and international round-robin tests.

Summarising Q&As on stable isotope analysis are attached as **Annex 1**.

2.4. ANALYSIS OF AUTHORITY DATA ON STURGEON TRAFFICKING

As previously stated, the term "wildlife trafficking", according to the United Nations Office on Drugs and Crime (UNODC), involves the illegal trade, smuggling, poaching, capture, or collection of endangered species, of protected wildlife, derivatives, or products thereof. The data compiled in this survey encompasses different illegal acts and ranges from seized illegal fishing gear, to poached sturgeon, to caviar, meat products or whole specimens in the trade chain. The data presented were provided on request by competent authorities. This included different police branches, national or regional fishing authorities, CITES authorities (in the case of Serbia), judicial administration (in the case of Ukraine) and was compiled by WWF in a common database. A few cases derived from media reports and were included after double-checks ensured that they were not already covered by authority reports.

For this report, only incidents of sturgeon trafficking reported between 1.1.2016 and 31.12.2020 were considered. While older data are available for Romania and Bulgaria, this report only includes data from 2016 onwards, when a new order was issued in Romania and Bulgaria to prolong the national sturgeon fishing bans for a further five-year period until early 2021. For Ukraine it must be stated that such data, specifying information on sturgeon, was only available as of 2017.

The data in this report provides the only publicly available compilation of such information for the Lower Danube Region, which is in principle only collected by and available to individual national agencies.

Trends in seizure records derived from this data should not be viewed as a complete picture of illegal activities taking place in the countries covered, only as indicating patterns of these illegal activities. This is because the countries in question and their agencies differ in their enforcement efforts, and also in their reporting and recording of information. **The figures must be viewed as the minimum number of cases that occurred in the region over the assessed time period.** Due to their illegal nature, only cases detected by law enforcement authorities (or in a few cases reported by journalists) came to the authors' attention and the full extent of the situation remains unknown.

The types of data collected include:

- type of illegal fishing gear seized
- the species of sturgeon caught or traded
- the amount of goods discovered (mostly in kilogrammes of fish or number of individual specimens)
- the apprehending agency
- the location of the seizure and the date of apprehension of the poachers or detection of goods.

The level of detail in the reporting varies greatly between cases, and as mentioned above, it also differs between reporting agencies and between countries. This limits the comparability of data obtained, as well as any conclusions that can be reached from the amounts of sturgeon, caviar seized, or from other data.

Beluga poached in Ukraine 2016 found by a Vylkovo border police officer

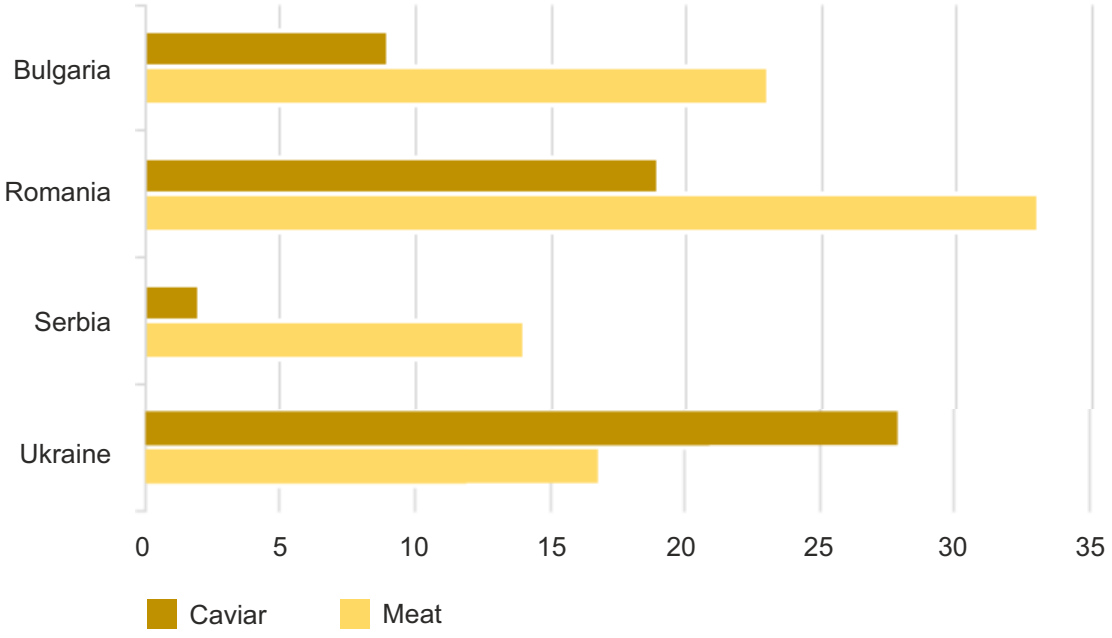
3. RESULTS AND CONCLUSIONS

3.1. MARKET SURVEY - REGIONAL COMPILATION

A total of 145 samples of sturgeon meat and caviar were collected in Bulgaria,[19] Romania, Serbia and Ukraine from shops or supermarkets, restaurants or bars, local markets, online offers, aquaculture facilities, intermediaries, fishermen and a private event. All samples were obtained between October 2016 and July 2020.

Detailed information on all samples are attached in **Annex 2**.

Collected samples	Total	Bulgaria	Romania	Serbia	Ukraine
Meat	**87 (60%)**	23 (72%)	33 (63%)	14 (88%)	17 (38%)
Caviar	**58 (40%)**	9 (28%)	19 (37%)	2 (12%)	28 (62%)
Total samples	**145**	**32**	**52**	**16**	**45**



[19] Three samples of Bulgarian caviar were bought in London, Brussels and Geneva, as Bulgarian caviar producers mainly sell their products abroad.

3.1.1. SAMPLES FROM WILD-CAUGHT STURGEONS

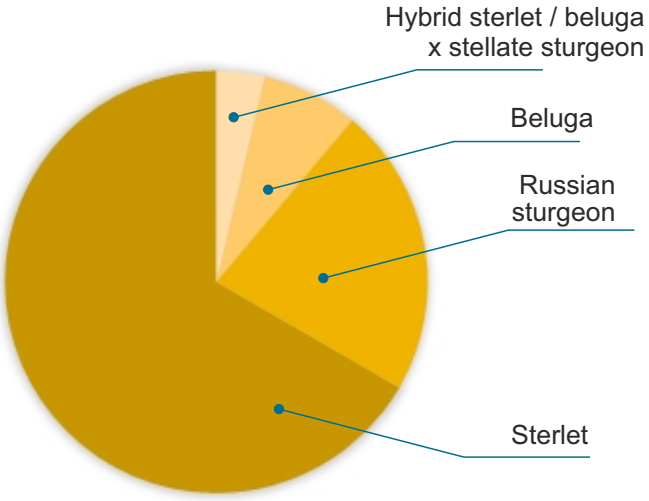
Of all samples, 38 were declared as wild, 72 were sold as farmed, and for the rest, this information was contradictory or not provided. The results of the isotope analysis proved - with confidence intervals of at least 95% - that **products of wild sturgeons were available in all four countries. 27 samples (19%) were found to originate from wild-caught sturgeons**.

For the 27 samples from wild sturgeons, different species were identified by DNA analysis. All species of sturgeon are subject to fishing and trade bans in all four countries, including sterlet in Serbia as of 1st January 2019; before this date, specimens above a total length of 40 cm could be legally fished (unless in closed season) and sold in Serbia, and only sterlets traded below this size were deemed as illegal cases.

According to the results, the following species were found to be targets of harvesting from the wild:

Sturgeon species	IUCN Red List status	Samples from wild caught specimens
Sterlet *(Acipenser ruthenus)*	Vulnerable	18
Russian sturgeon *(Acipenser gueldenstaedtii)*	Critically Endangered	6
Beluga *(Huso huso)*	Critically Endangered	2
Hybrid of sterlet or beluga with stellate sturgeon *(Acipenser stellatus)**	—	1

* natural hybridisation happens in wild sturgeons but is rare, though increasing with the decline of population



Wild-caught Sterlet sold in Romania © WWF-Romania

Of the 27 samples of wild-caught sturgeons, 25 were meat samples, whole or in parts (either fresh, salted or smoked fish, cooked, fried or in soup or other dishes), and only two samples were caviar.

Products from wild sturgeons were obtained from intermediaries (13 samples – 11 of which were sterlets bought in a single purchase from a vendor in Romania), at local markets (7 samples), in restaurants (6 samples) and ordered online (1 sample). Samples acquired in shops or from aquaculture facilities and even two cases of meat bought from fishermen were identified as being from farmed sturgeons (but not all were sold legally - see 3.1.2).

A further three samples were assessed by isotope analysis to be wild-caught. However, DNA analysis showed that two samples were not sturgeon but European catfish *(Silurus glanis)* and the other was American paddlefish *(Polyodon spathula),* a North American Acipenseriformes species popular in aquaculture. This species filter-feeds on natural plankton, which results in an isotope pattern that makes it appear to be wild-caught.

3.1.2. SAMPLES SOLD NOT IN COMPLIANCE WITH THE RELEVANT CITES RESOLUTION

A further seventeen samples of caviar (12% of all samples and 29% of all caviar samples) were found to be sold in violation of CITES and the EU Wildlife Trade Regulations and the national laws implementing these:

Caviar container not labelled correctly — label and CITES code affixed on the bottom of the jar, not providing visual evidence of any opening

- **2** caviar samples were illegally imported into the country (to Serbia from Germany without CITES permits)
- **4** caviar samples were sold without mandatory CITES labels in EU Member States[20] (2 in Romania, 2 in Bulgaria)
- **11** mislabelled caviar samples were sold in an EU Member State (Romania):
  - **7** of these were determined (with genetic analysis) to have a wrong species code
  - **3** were determined (with isotope analysis) to have a wrong code for the country of origin
  - **1** had a wrong code for species and country of origin.

It must also be mentioned that **on 10 of the caviar samples which were found to provide wrong information in their CITES codes, all labels failed to meet mandatory CITES requirements** (not sealing or providing visual evidence of opening). Notwithstanding, the labels must have been approved by the respective CITES Management Authority.

3.1.3. OTHER WRONGLY DECLARED PRODUCTS - CONSUMER DECEPTION

The findings listed above capture a variety of illegal activities in sturgeon trade which directly threaten wild sturgeons (3.1.1) or affect conservation efforts and trade regulation systems through CITES, at the EU and national level (3.1.2).

Additionally, in several cases the information provided by suppliers (sales persons, restaurant waiters, etc.) was found to be incorrect. Whether this was out of ignorance or on purpose remains unknown. The cases most relevant to this report were those products sold as farmed that were in fact determined to be from wild sturgeons — so called "white-washing" of illegal products (one of the samples covered in 3.1.1).

Conversely, 25 samples (17% of all samples) that were sold as wild were found through isotope analysis to have come from farmed sources ("black-washing"). This indicates that there is still an expected consumer demand for products from wild-caught sturgeon which suppliers are striving to satisfy (in some cases in high numbers, e.g. in Ukraine).

Misleading consumer	Bulgaria	Romania	Serbia	Ukraine
Samples sold as wild but actually farmed	5	–	3	17

[20] While CITES labelling of caviar on the domestic market is legally required in EU Member States, this is not implemented by most other CITES Parties. Caviar sold without label in e.g. Ukraine is not illegal.

Six samples were not even from sturgeon. Three were fake caviar: one sample bought in Ukraine and declared as Ukrainian sterlet caviar was an artificial product with DNA of a hybrid of *Acipenser schrenckii* and *Huso dauricus*, common in Chinese aquaculture; another sample from Ukraine was sold as beluga caviar from Russia but was an artificial product; one sample bought in Bulgaria was in fact labelled as caviar imitation from Ukraine and no DNA could be determined at all. Three samples in Romania, sold in sturgeon soup, were meat from European catfish *(Silurus glanis)* and from Nile perch *(Lates niloticus)*, respectively.

In 18 cases (in addition to 3 products from poached sturgeons that were also falsely sold as a different species, listed in 3.1.1., and 8 caviar samples with the wrong CITES species code, described in 3.1.2), a false sturgeon species or hybrid was declared for the meat or caviar offered for sale or consumption. In these cases, only DNA testing was able to reveal the false declaration.

Misleading consumer	Bulgaria	Romania	Serbia	Ukraine
Samples sold as wrong species	4	3	1	10

These instances represent a worrying trend of customer deception and lack of proper control in the field. The demand for sturgeon products— especially from the wild — remains and customers are given false products, which suggests an unrealistic abundance of these commodities.

3.1.4. CONCLUSIONS ON FINDINGS OF THE MARKET SURVEY

Products from wild-caught sturgeons were found in all four countries: Bulgaria, Romania, Serbia and Ukraine. This means that the illegal trade in sturgeons from the wild is still ongoing and a serious problem in the whole Lower Danube Region.

27 samples (19% of all samples) were determined to originate from wild-caught sturgeons. Since all sturgeon species in the surveyed region — including all sterlets in Serbia now, and those measuring below 40 cm before 2019 — have been under a fishing and trade ban, this means that **nearly a fifth of all collected samples were derived from poached sturgeons**.

A further **17 samples (12% of all samples) were caviar sold in violation of CITES obligations**. This means that **30% of all caviar samples did not meet CITES requirements and were therefore illegal**. All these samples were from farmed sturgeons. However, any such misdeclaration is a breach of the EU CITES Regulations, and any tolerance of such breaches ultimately undermines the stated aim of the Regulations to ensure that the international trade in specimens of wild animals and plants does not threaten their survival.

Taken together, this means that 30% of all samples (44 samples out of a total of 145 samples) were offered for sale illegally: 25 meat samples (29% of all meat samples) and 19 caviar samples (33% of all caviar samples).

If outcomes in the four countries are compared, findings of illegal products vary from 16 to 48% of collected samples. The alarmingly high figure of 48% is for Romania, where nearly half of all samples obtained were found to have been sold illegally. This is due to a single purchase of 11 sterlets, which were determined to be wild-caught, and to 10 samples purchased from one registered Romanian caviar processor and exporter, on all of which the CITES codes did not correspond with the ascertained species/hybrid or country of origin of the caviar.

As mentioned above, of the 145 collected samples, 60% were meat and 40% were caviar. However, it should be noted that **of all samples determined to originate from wild-caught sturgeon, 93% were meat (25 samples, in all four countries) and 7% were caviar (2 samples, in Ukraine). This points to particular poaching pressure on sturgeons for meat, at least on the domestic market**. This may well be because sturgeons with caviar are difficult to find in the wild, and are therefore caught very rarely. However, the possibility should also be considered that caviar from poached sturgeons is sold through other routes or smuggled abroad whereas meat is often sold on domestic markets.

	Total	Bulgaria	Romania	Serbia	Ukraine
Samples offered for sale illegally, in total - see 3.1.1 + 3.1.2 (in % of all samples of this country)	**43** (32 %)	**6** (19 %)	**25** (48 %)	**6** (38 %)	**7** (16 %)
Samples from wild-caught sturgeons - see 3.1.1 (in % of all samples - total/of this country)	**26** (20%)	**4** (13 %)	**12** (23 %)	**4** (25 %)	**7** (16 %)
Caviar sold in violation of CITES obligations- see 3.1.2	**17**	**2**	**13**	**2**	–
(in % of all samples - total/ of this country)	(13%)	(6 %)	(25 %)	(13 %)	–
(in % of all caviar samples - total/of this country)	(33%)	(22%+)	(68 %)	(100 %)	–

+ if only real sturgeon caviar collected in Bulgaria is considered, 40% of the 5 samples were offered illegally, i.e. without CITES labelling

In addition, several cases of consumer deception were found, which demonstrates that information given by sales persons on the provenance or species of origin is often not reliable.

Specifically, some products were offered as being from wild sturgeons — still a common sales technique to attract consumers — but were actually from captive-bred fish. Of more concern for sturgeon conservation is the meat declared as farmed, and which therefore appears to be legal, but in reality is derived from wild-caught sturgeon.

In other cases, products were wrongly declared. This includes specimens which were indeed sturgeon, but were declared as being from a higher-priced sturgeon species than was actually the case. In other cases, meat sold as sturgeon soup turned out to be from European catfish or Nile perch. Cases of misleading consumers were also described previously in other studies for sturgeon caviar e.g. in the USA (Doukakis et al. 2012) or UK (Johnson and Lyengar 2014), with purchasers tricked into paying higher prices.

Generally, it must be stated that consumer deception may be deemed as fraud in cases where it is done consciously and with the clear intention of personal gain. Overall, a high amount of samples that were tested proved to have been sold with false information. This demonstrates a prevailing bad governance in the trade, and that more stringent controls should be implemented.

CITES regulates trade in specimens of species listed in its Appendices. For species listed in Appendices I and II (thus applicable to all sturgeon species) Article I of the Convention defines the term "specimen" to include, in the case of an animal, any readily recognizable part or derivative thereof.

CITES Resolution 9.6 (Rev. CoP16) stipulates that the term "readily recognizable part or derivative", as used in the Convention, shall be interpreted to include any specimen which appears from an accompanying document, the packaging or a mark or label, or from any other circumstances, to be a part or derivative of an animal or plant of a species included in the Appendices, unless such part or derivative is specifically exempted from the provisions of the Convention. This interpretation is reflected in the definition of "specimen" in Council Regulation (EC) No. 338/97. Consequently, any product purporting to consist of or to include material from an animal listed in CITES Appendices I and II may be considered to be a specimen of a CITES species and trade must be regulated accordingly, up to and including the pursuit of criminal proceedings where the product is being sold in breach of EU Regulations. This remains the case even if the product does not, in reality, consist of or include such material. Offering meat of catfish or Nile perch for sale as that of sturgeon falls within the scope of this rule.

In a study on the global caviar market by TRAFFIC (Harris and Shiraishi 2018), submitted to the 30th meeting of the CITES Animals Committee (AC30 Inf. 33), several types of illegal trade of caviar and sturgeon products were identified, most of which were also found in the present survey in the Lower Danube Region:

Caviar and sturgeon meat taken from allegedly poached wild stocks are on sale at open air markets, "under the counter", or through individual contacts or online offers:

The current survey found that 25 samples of sturgeon meat and two samples of caviar, determined by forensic analysis as having been derived from wild-caught sturgeon, were on sale in Bulgaria, Romania, Serbia and

Ukraine, mainly at markets, in restaurants, through individual contacts or online offers.

Caviar labelling is not in compliance with the relevant CITES Resolution (e.g. labelling not containing all required information):

The current survey concurs with this finding. Caviar not labelled in compliance with the relevant CITES Resolution was found both in Bulgaria and Romania (EU Member States who are bound to implement CITES labelling requirements on their domestic markets, as well as in international trade). Caviar containers did not have CITES labels and codes at all, the label did not seal the container or provide visual evidence of any opening, and the CITES codes indicated the wrong species or hybrid or wrong country of origin.

Wild sourced caviar from sturgeon species can be deliberately mislabelled as aquaculture-derived species to allow laundering through the legal trade:

While this survey did not find cases of "white-washing" of caviar, one meat sample in Bulgaria was found sold as farmed, but in reality originated from wild-caught sturgeon. This provides evidence for laundering of products from poached sturgeons into the market.

Aquaculture-derived products are deliberately declared as wild-sourced or different species to sell at a higher price:

In this survey, 17% of all samples collected in the current survey were determined as farmed but sold as from wild-caught sturgeon. Clearly, this is used as a sales argument.

Falsified or forged CITES documents, or genuine CITES documents issued corruptly, are used to permit exports:

This type of illegal trade was not part of the current survey. However, the survey did find evidence of the illegal import of products without mandatory CITES permits, namely two caviar containers (50 g each) from Germany sold in Serbia without provision of CITES import documents by the Serbian CITES Management Authority.

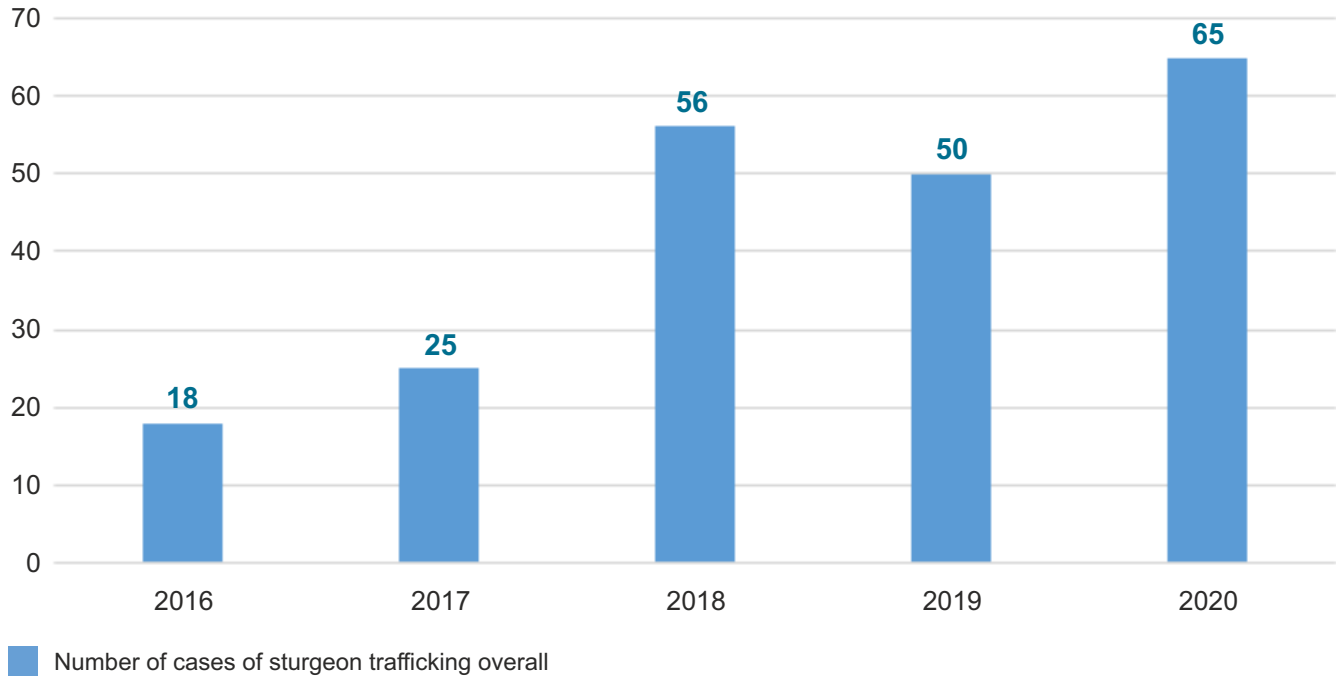
The results also demonstrate that a combination of genetic and isotope analysis is crucial in sturgeon market surveys — and this survey is the first of this kind.

The sulphur isotope composition allows discrimination between wild and farmed origin, while the genetic species determination is necessary to avoid misinterpretation. Two samples, sold as sturgeon, were assessed as wild-caught but were actually European catfish *(Silurus glanis)*; another sample determined as wild-caught was American paddlefish *(Polyodon spathula)*, a non-native Acipenseriformes species popular in aquaculture that feeds only on natural food, which results in an isotope pattern that appears as if it were wild caught. All three samples would have been wrongly evaluated as deriving from poached sturgeon based on isotope composition alone.

The detection of mislabelled caviar also requires both forensic methods: DNA analysis can check if the declared species is correct, while isotope analysis can verify the declared source as well as the region of origin.

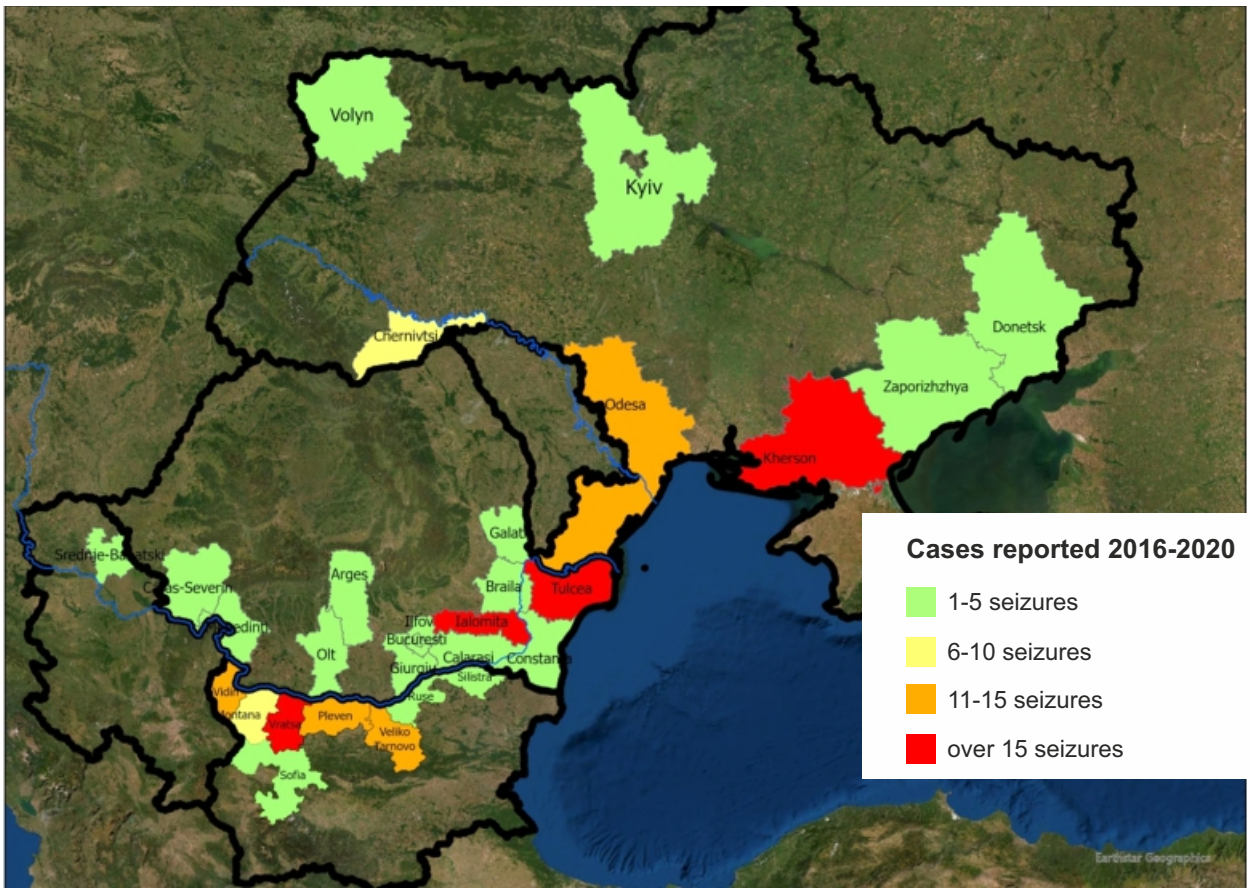
3.2. REGIONAL COMPILATION OF ILLEGAL INCIDENTS AND SEIZURES INVOLVING STURGEON

The regional analysis comprises three countries - Bulgaria, Romania and Ukraine. While requests for data were also filed with Serbian authorities, no comparable data could be obtained. Overall a minimum number of 214 cases of illegal activities targeting or involving sturgeon were compiled in this study: for Romania (82), Bulgaria (82) and Ukraine (50) for the period between 01.01.2016 and 31.12.2020. The first incident recorded in Ukraine dates back to 2017. This means that overall, few cases were reported in 2016 (18) and 2017 (25), as the majority of cases come from 2018 (56) and 2019 (50) and the highest amount was recorded in 2020 (65).



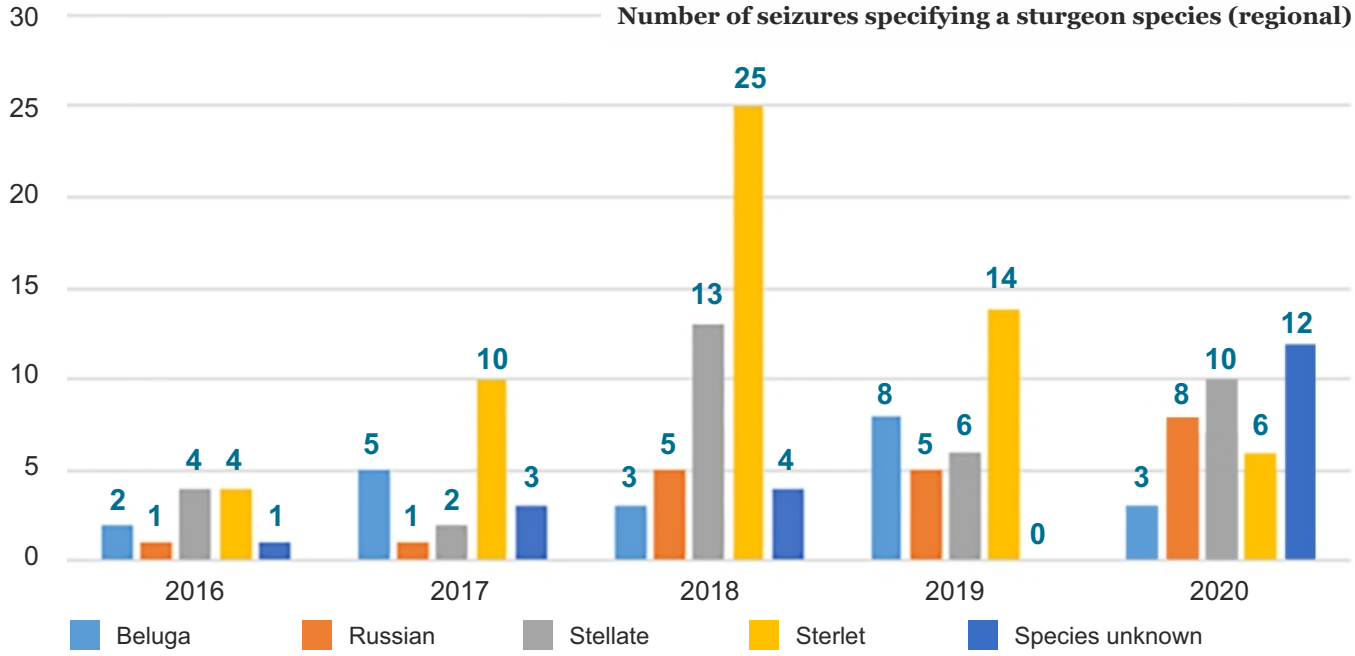
3.2.1. LOCALIZATION OF INCIDENTS

For most cases, but not all, a geographic location was provided. This was sometimes very specific, as in the case of Bulgarian data indicating the Danube riverine kilometre, where illegal gear was found. In other cases, no specific location was given, and such cases did not allow for a more detailed treatment. Nevertheless, with most incidents it was possible to attribute the oblast/province where the case occurred, and these are presented on the map below. Cases without any specified location are not represented on the map. The provinces with more than 15 incidents during the study period were Vratsa in Bulgaria, Ialomita and Tulcea in Romania, and Kherson in Ukraine.



3.2.2. STURGEON SPECIES REPORTED IN SEIZURES

All cases where authorities included information on the sturgeon species in the recorded data of a seizure are summarised in the graph below. Where several different species were found in the same incident, they are listed individually in the graph. Where one incident involved several specimens of one species, it was only recorded as one single case. According to the respective laws in Bulgaria, Romania and Ukraine, any accidentally caught sturgeon or sturgeon seized by authorities must be released immediately back into the same water basin in which they were caught, regardless of their state (dead or alive). Sterlets — the most abundant species, listed as Vulnerable in the IUCN Red List of Threatened Species™ — are involved in the highest number of cases (59), followed by the critically endangered stellate sturgeon (35) and beluga (21). Only 20 cases involved Russian sturgeons, which are critically endangered and extremely rare in the Danube, with very low natural reproduction still occurring.



3.2.3. CONCLUSIONS ON COLLECTED SEIZURE DATA

The number of 214 cases of illegal incidents registered during the study period and its occurrence in all three countries where data was obtainable (Romania (82), Bulgaria (82) and Ukraine (50) clearly point to the fact that poaching remains a threat to wild populations in this region.

The following illegal activities were documented:

- **use of illegal gear** for targeting sturgeon; in particular karmaci hook lines seem to be a huge problem in Bulgaria, where a total of 594 of these illegal sturgeon fishing lines were seized (see country chapter); the hook lines seized have a combined minimum length of 23,5 km
- **actual poaching** of sturgeons, which were seized in the boats or nets of fishermen
- **transportation of poached sturgeon** to another destination
- **selling of caviar or meat of poached sturgeon**.

Karmaci (or carmace) are fishing longlines with large and very sharp baitless hooks, usually 2-3 hooks per meter length. They were traditionally used to catch large sturgeon and are now prohibited fishing tools © WWF

A. stellatus in net with woman

The frequency with which a species is recorded in the seizures may also reflect its natural abundance in the wild. Sterlets were recorded most frequently, and Russian sturgeons were the least abundant. Risk areas can clearly be demonstrated (see map) in all countries.

Karmaci hook line

Prevailing gaps in data reporting and differences in type of data (alternatively represented in kilogrammes, specimens, jars) provided by the different enforcement entities were observed. As a result, conclusions regarding the total amount of kilogrammes or numbers of specimens are hard to discuss. From the incomplete data available **the minimum number of sturgeon specimens seized totals 602, including 3 from Bulgaria, 436 from Romania, 163 from Ukraine**. More details can be found in the chapters for each country.

No information was available on the control efforts of the enforcement agencies in the period covered. This makes it impossible to reach any conclusions as to whether the overall trend of illegal activities is increasing or decreasing. Generally, it would be expected that an increase in enforcement efforts would lead to an increase in reported cases at first; and that this would be followed, only after some time, by a subsequent decrease, provided that these efforts are sustained at a similar level, and that illegal activities are discouraged effectively. With the information available, one can only assume that numerous cases remain undetected and that the picture painted in this report is only the tip of the iceberg. It can be concluded that illegal fishing and trade of sturgeon remain ongoing threats in the region. It can also be noted that efforts of the enforcement agencies must be further increased in order to reduce the negative impact on the highly threatened populations.

It is strongly suggested that strategies for reporting of sturgeon trafficking be enhanced and harmonised between the different national entities, and also between the three countries. Doing so will facilitate regular and easier comparison of data, and allow for better evaluation of the impact of illegal activities on wild sturgeons.

3.3. BULGARIA

3.3.1. MARKET SURVEY RESULTS FOR BULGARIA

In Bulgaria, 32 samples were obtained in 72 visits: in restaurants (18 samples) and shops (10 samples), from aquaculture facilities (3 samples) and online purchases (1 sample). Of these, 23 samples were sturgeon meat and 9 were caviar. 6 caviar samples were collected in Bulgaria (one of which was sold as caviar imitation). 3 samples of Bulgarian caviar were bought in London, Brussels and Geneva, recognising the fact that Bulgarian caviar producers mainly sell their products abroad.

In total, 6 of the 32 samples (19% of all Bulgarian samples) were sold illegally.

SAMPLES FROM WILD-CAUGHT STURGEONS:

4 samples (13% of all Bulgarian samples) were identified as from wild-caught sturgeons:

Commodity	Species	Town	Type of retailer	Date of purchase
Meat	Russian sturgeon *(Acipenser gueldenstaedtii)*	Silistra	Restaurant°	25.05.2017
Meat	Sterlet *(Acipenser ruthenus)*	Kozloduj	Restaurant	11.11.2017
Meat	Sterlet *(Acipenser ruthenus)*	Silistra	Restaurant°	09.05.2018
Meat	Probably Russian sturgeon *(Acipenser gueldenstaedtii)*	Sofia	Shop	24.02.2020

° same restaurant

SAMPLES SOLD NOT IN COMPLIANCE WITH THE RELEVANT CITES RESOLUTION:

Of the five sturgeon caviar samples purchased in Bulgaria (one more was in fact artificial and not sturgeon caviar), **two caviar containers did not have the legally required CITES labels and codes and were therefore offered for sale illegally**. These represent 40% of the sturgeon caviar samples bought on the domestic market.

CONSUMER DECEPTION:

One meat sample was sold as from captive-bred sturgeon but was actually from a wild-caught specimen (the Russian sturgeon sold in Sofia). Seven meat samples were sold as originating from wild sturgeons but five of them were actually from captive-bred fish. Four meat samples were sold as a wrong sturgeon species (e.g. as beluga although they were in fact Russian sturgeon or sterlet).

© WWF-Bulgaria

Caviar sold without required CITES label and code

Detailed information on all samples are attached in **Annex 2**.

3.3.2. SEIZURE DATA COMPILATION FOR BULGARIA

The data used in this report on sturgeon trafficking in Bulgaria was obtained from the Bulgarian State Police, the Bulgarian Border Police, Bulgarian Customs, the Regional Inspectorate of Environment and Water, and the National Agency for Fisheries and Aquaculture of Bulgaria. All data were taken between 2016 to March and December 2020. The reported cases comprise a range of illegal activities, from the use of illegal gear to actual landing or transportation of poached fish with intent to trade.

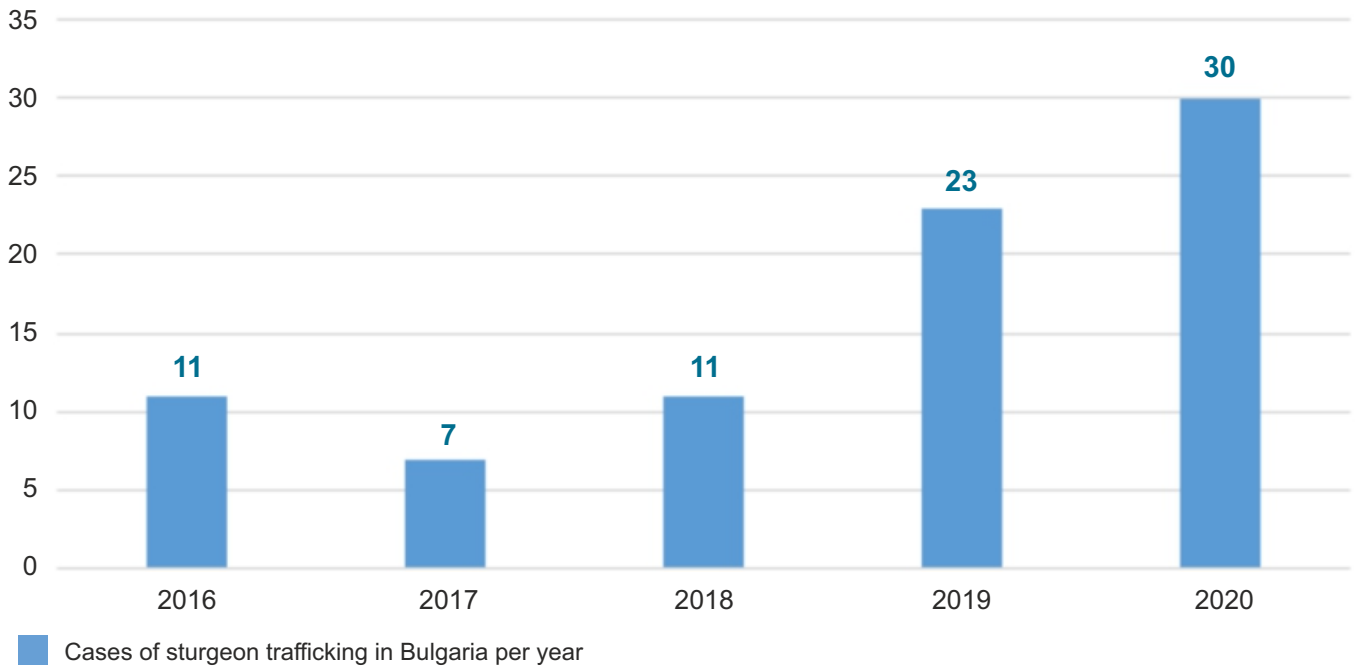
The data provided include:

- references to the type of illegal fishing gear seized
- species of sturgeon poached
- the amount of discovered goods (in kilogrammes of fish or number of individual specimens)
- the apprehending agency
- the location (specified as river kilometres)
- the date of apprehension of poachers or detection of goods
- information about the potential penalty, handling of the goods found and related court proceedings.

The level of detail in the reporting varies greatly between cases, with a few incidents covering all of the above points of inquiry.

NUMBER OF TRAFFICKING CASES BY YEAR:

In Bulgaria, a total of 61 cases of illegal activity linked to the poaching and trade of protected sturgeon species were reported by enforcement authorities between 14.01.2016 and 19.03.2020. In the vast majority of cases, the reports were of discoveries of banned fishing gear; only in 3 cases was illegally caught fish reported. The data shows that most seizures of illegal fishing gear occurred during the spring, in the months between February and April, coinciding with the spring migration. The second peak is during the autumn migration, mainly in the months October and November.



NUMBER OF CASES PER SPECIES AND KILOGRAM:

Only three cases involving a sturgeon specimen were recorded between 2016 and 2020 in Bulgaria. All other cases pertained only to fishing gear seized, with no fish being seized. The first was a beluga sturgeon caught on 19.02.2019 in the village of Aidemir, Silistra. The two-metre long specimen, weighing 165 kg, was still alive, and was tagged and released back into the wild. The second case took place on 11.02.2020 near the town of Svishtov and involved a Russian sturgeon weighing 6.5 kilograms. The most recent incident involved a large beluga sturgeon weighing 100 kilograms, which was discovered near the town of Kozlodui on 19.03.2020. As the specimen was still alive, it was released back into the wild.

FISHING GEAR SEIZED:

Between 2016 and 2020, 594 pieces of karmaci fishing lines[21] were discovered by law enforcement authorities in Bulgaria:

Table 1:
Number of Karmaci fishing lines found in Bulgaria (2016-2020)

2016	2017	2018	2019	2020
50 karmaci	26 karmaci	86 karmaci	172 karmaci	260 karmaci

The karmaci lines found by enforcement authorities within this five-year period in Bulgaria alone have a combined length of 23,450 metres. An additional 13 cases involving 119 karmaci lines were reported without any indication of the lines' lengths.

This high number of karmaci hook lines found is remarkable and can not be observed in other countries. Connected with the low numbers of illegally caught sturgeons detected and reported by law enforcement authorities, this situation merits a deeper investigation.

3.4. ROMANIA

3.4.1. MARKET SURVEY RESULTS FOR ROMANIA

In Romania, 52 samples were obtained in 81 visits: in shops (16 samples), in restaurants or bars (11 samples), from one intermediary (11 samples), in online purchases (6 samples), at aquaculture facilities (3 samples) and markets (2 samples), from fishermen (2 samples) and at a private event (1 sample). Of these, 33 samples were meat and 19 were caviar.

Of the 52 samples bought in Romania, 25 (48%) were sold illegally.

SAMPLES FROM WILD-CAUGHT STURGEONS:

12 meat samples (23% of all samples) were identified as from wild-caught specimens:

Commodity	Species	Town	Type of retailer	Date of purchase
Meat	Sterlet *(Acipenser ruthenus)* - 11 pieces	Giurgeni	Intermediary	23.05.2018
Meat	Beluga *(Huso huso)*	Bucharest	Restaurant	23.05.2018

SAMPLES SOLD NOT IN COMPLIANCE WITH THE RELEVANT CITES RESOLUTION:

13 of the 19 caviar samples collected in Romania (25% of all samples and 68% of all caviar samples bought in Romania) were identified as illegally sold:

- 2 caviar containers from a Romanian company — not registered as processor, repackager or exporter according to CITES — were not labelled at all.
- 11 caviar containers had labels and CITES codes but the codes were found to be incorrect and the caviar samples therefore mislabelled:
  - in 7 of these cases, the standard species code did not correspond with the species or hybrid determined by DNA analysis

[21] Karmaci are fishing longlines with large and very sharp baitless hooks, usually 2-3 hooks per meter length. They were traditionally used to catch large sturgeon and are now prohibited fishing tools.

Unlabelled caviar sold in Romania

– in 3 cases, the code for the country of origin did not correspond with the geographic origin assessed by isotope composition ratio
– in 1 case, both the standard species code and the code for the country of origin did not correspond.

In addition, on 10 of these samples from one CITES-registered Romanian caviar processor and exporter,[22] the labels were not affixed in adherence to CITES recommendations (they did not seal the container or permit other visual evidence of any opening).

CONSUMER DECEPTION:

Three meat samples were sold as a wrong sturgeon species (e.g. as beluga although it was Russian sturgeon, and also vice versa). Three meat samples in "sturgeon soup" were actually European catfish and Nile perch, respectively.

Meat sample determined as from wild-caught Beluga

Detailed information on all samples are attached in **Annex 2**.

3.4.2. SEIZURE DATA COMPILATION FOR ROMANIA

The Romanian data on sturgeon trafficking stem from reporting by the Romanian State and Provincial Police (including the Danube Delta Police Department), the Romanian Border Police, the National Environmental Guard, the Romanian National Agency for Fisheries and Aquaculture, as well as external sources such as Romanian news outlets, WWF Romania, and Radio Delta.

The data include references to:

- the type of illegal fishing gear seized
- the species of sturgeon poached
- the amount of discovered goods (in kilogrammes of fish/caviar or number of individual specimens)
- the apprehending agency
- the location and date of apprehension of poachers or detection of goods.
- some information is available about the potential penalty, the handling of the goods found and related court proceedings.

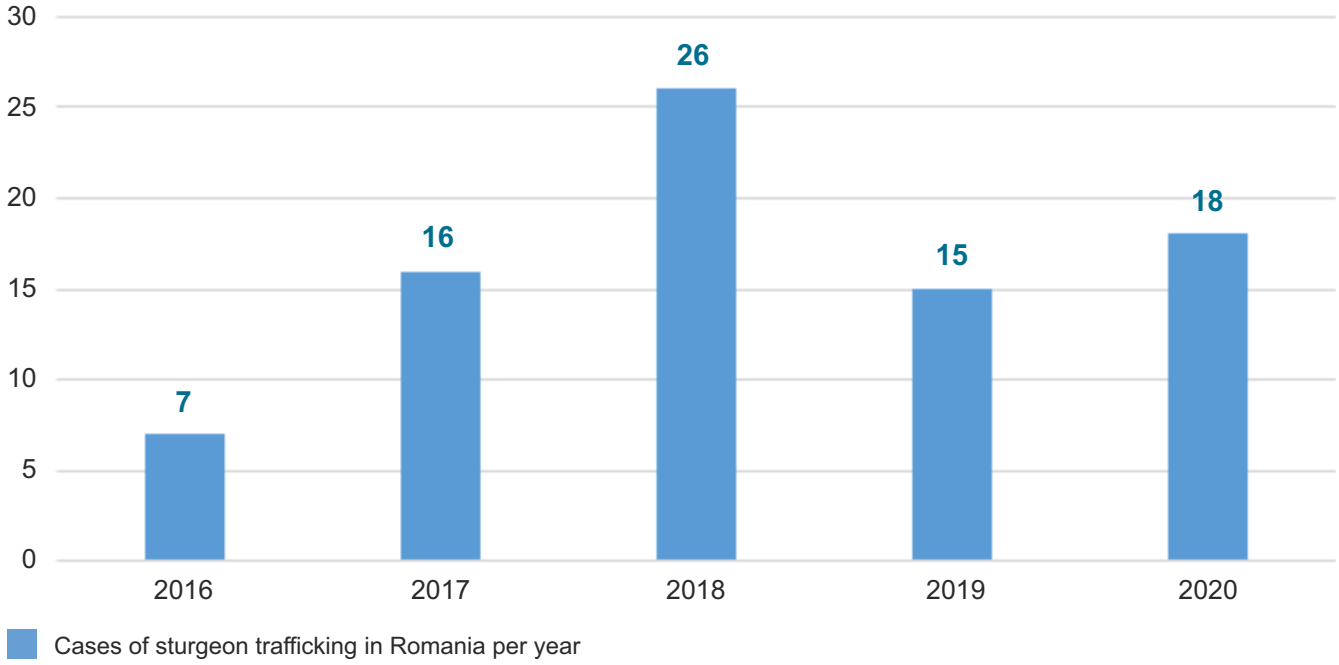
The completeness of the data varies greatly from case to case.

NUMBER OF TRAFFICKING CASES BY YEAR:

Overall, 82 cases of sturgeon trafficking (trade, poaching and use of prohibited fishing equipment) were reported in Romania for the period April 2016 to December 2020. An additional series of cases relate to sturgeons, which allegedly took place between 05. and 09.06.2017, were omitted from this analysis, as the veracity of accounts could not be confirmed with Romanian authorities.

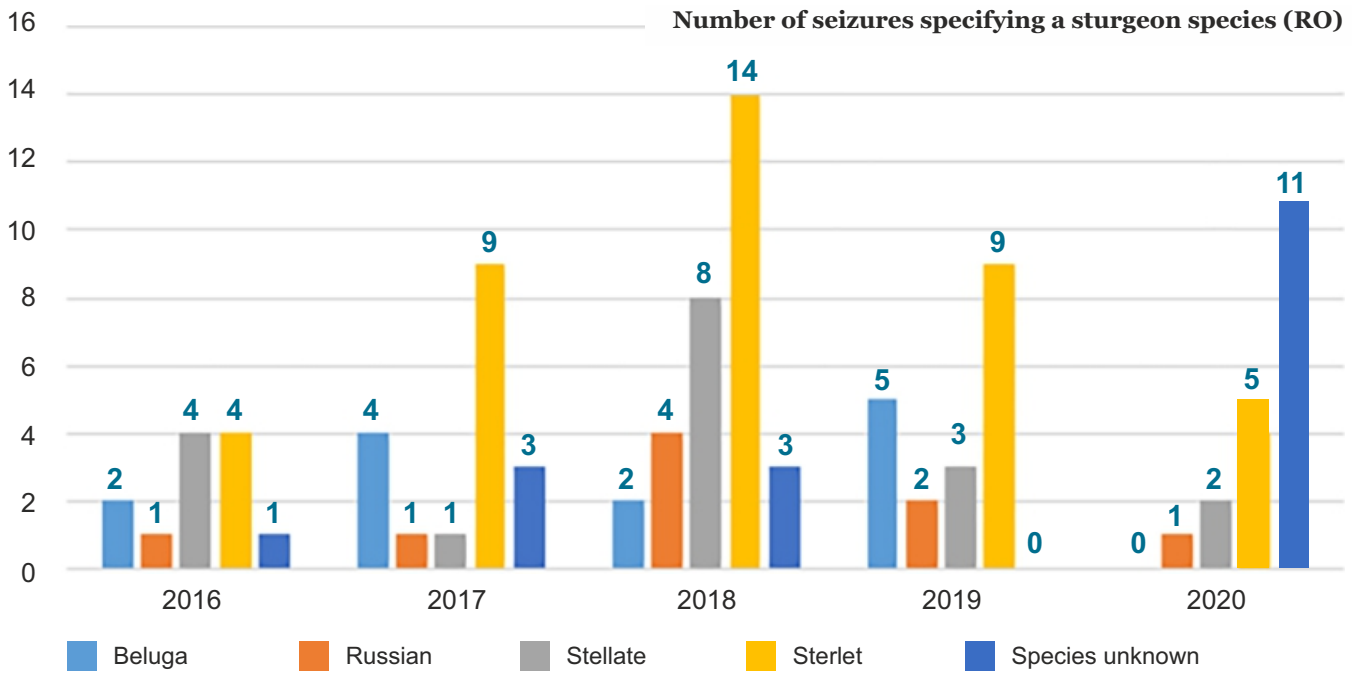
Meat sample sold as beluga but was actually from Russian sturgeon

22 CITES. Register of Caviar Exporters. cites.org



NUMBER OF CASES PER SPECIES:

The graph below lists the number of cases by type of sturgeon detected by enforcement authorities between 2016 and 2020 in Romania. If several different species were found in the course of the same operation, they are listed individually in the graph. Yet, if one case involved several specimens of the same species, it is only listed once. Throughout the entire time period, 13 cases involved beluga sturgeons, 9 involved Russian sturgeons, 18 involved stellate sturgeons and in 41 cases, sterlets were discovered. In further 18 cases, no data regarding the type of species was provided.



FISHING GEAR SEIZED:

Of the 82 cases of sturgeon trafficking recorded in Romania between 2016 and 2020, only 13 contain indications regarding the fishing gear that was used by poachers. These include 1 gillnet, 1 karmak,[23] 2 monofilament nets and 9 fishing nets (specific type undefined). These data indicate that not only karmaci, but also other fishing techniques pose a threat to sturgeon.

KILOGRAMS OF STURGEON MEAT AND CAVIAR ON RECORD:

Reporting on sturgeon trafficking in Romania sometimes includes data on the number of fish detected by the enforcement unit, sometimes the weight of the meat discovered, and in some cases both or neither. The table below gives an overview of the amount of fish and caviar (in kilogrammes) found in Romania between 2016 and 2020. **In total, at least 3427.6 kg of sturgeon meat and at least 25.8 kg of caviar were discovered by law enforcement authorities in this time frame.**

Kilograms of trafficked sturgeon meat/caviar in Romania (2016-2020)

	2016	2017	2018	2019	2020
Sturgeon	419.1 kg	1292.4 kg	573.35 kg	715.2 kg	427.5 kg
Caviar	–	2.8 kg	0.4 kg	–	22.6 kg

Additionally, four jars of caviar were seized on 02.10.2018, but were reported without any weight of the content, and had to be omitted from the calculations.

A snapshot of a caviar seizure in Romania from August 2020:

Tulcea policemen from the Delta caught six people in Argeș County while offering and purchasing illegal caviar. 22.6 kilograms of black caviar transported in 40 glass containers were seized. It is estimated that the products have a market value of approximately 50,000 Euros.

Source: infotulcea.ro

https://danube-sturgeons.org/coup-of-the-delta-police-caviar-of-50000-euros-confiscated/

NUMBER OF SPECIMENS SEIZED:

In Romania, during the period 2016-2020 analysed in this report, law enforcement authorities detected at least 436 specimens of sturgeon that were illegally fished in the Danube or its tributaries. The following table breaks this number down by year. Only cases in which authorities reported the specific number of fish involved were used to create the table.

Number of sturgeon specimens seized in Romania (2016-2020)

2016	2017	2018	2019	2020
5	94	190	40	107

[23] Karmaci are fishing longlines with large and very sharp baitless hooks, usually 2-3 hooks per meter length. They were traditionally used to catch large sturgeon and are now prohibited fishing tools.

3.5. SERBIA


© WWF Adria - Serbia

3.5.1. MARKET SURVEY RESULTS FOR SERBIA

In Serbia, 16 samples were obtained in 31 visits: from aquaculture facilities (7 samples), restaurants and markets (3 samples each), online purchases (2 samples) and from an intermediary (1 sample). Of these, 14 samples were meat and 2 were caviar.

A total of 38% of samples obtained in Serbia (6 out of 16) were sold illegally.

SAMPLES FROM WILD-CAUGHT STURGEONS:

Of the 16 samples, 4 meat samples (25% of all samples) were identified as from wild-caught sturgeons:

Commodity	Species	Town	Type of retailer	Date of purchase
Meat	Sterlet *(Acipenser ruthenus)** - 3 pieces	Belgrade	Market	23.05.2018
Meat	Sterlet *(Acipenser ruthenus)**	Belgrade	Restaurant	29.07.2018

* until 01.01.2019, sterlet could still be caught and sold in Serbia, but only if it measured above a total length of 40cm. These sterlets were clearly below the allowed size.


© WWF Adria - Serbia

Wild-caught sterlets sold below the then still allowed catch size of 40 cm

Impressions of the market survey in Serbia from May 2018:

As part of the undercover market survey, sterlets were bought on Zemun fish market in Belgrade. All specimens were clearly below the – at that time still allowed – catch size of 40 cm. Isotope analysis revealed that they were wild-caught, proving the illegal trade in poached sterlets on Zemun market.

As of January 1st 2019, sterlets are strictly protected, and any fishing and trade of wild sterlets – and all other sturgeons – is prohibited in Serbia.

https://www.youtube.com/watch?v=DjR1l6Dby18&ab_channel=WWFSrbija

SAMPLES SOLD NOT IN COMPLIANCE WITH THE RELEVANT CITES RESOLUTION:

Caviar was extremely scarce on the domestic market, and only two samples could be found via an online platform. One was sold as beluga caviar, the other as caviar from Russian sturgeon, each jar contained 50 g. Both were from a German producer and had correct CITES labels and codes. However, they were **illegally imported to Serbia, as no CITES import permits were issued** by the CITES Management Authority of the Republic of Serbia.

Smuggled caviar

© WWF Adria - Serbia

CONSUMER DECEPTION:

Seven meat samples (44% of all collected samples) were declared as originating from wild sturgeons. Three of these were in fact from captive-bred fish, and one was also declared as a wrong sturgeon species (as beluga although it was not beluga).

Detailed information on all samples are attached in **Annex 2**.

3.5.2. SEIZURE DATA COMPILATION FOR SERBIA

The Republic of Serbia adjoins a short stretch of the Lower Danube, and thus shares responsibility for the migratory sturgeon populations of the Lower Danube Region. However, despite requests for data filed with the CITES Management Authority, the border patrol and the Environmental Inspection and Fishery Authority, unfortunately no comparable data could be obtained. The only available reports from the CITES Management Authority for the period between 2015 and 2017 did not include any records of sturgeon seizure of Danube origin. Regarding data on illegal fishing, it appears that no regular reports are compiled, and where reports exist, sturgeon species are not specified. It should be noted that the Ministry of Environmental Protection of the Republic of Serbia adopted the permanent fishing ban on sterlet only recently. As it entered into force from 1st January 2019, monitoring of the enforcement of this ban will be needed in the future. All other migratory sturgeon species were already protected before this time.

3.6. UKRAINE

3.6.1. MARKET SURVEY RESULTS FOR UKRAINE

In Ukraine, 45 samples were obtained in 90 visits: in restaurants (13 samples), at markets (12 samples) and in shops (10 samples), from online purchases (6 samples) and intermediaries (4 samples). Of these, 28 samples were caviar and 17 were meat.

SAMPLES FROM WILD-CAUGHT STURGEONS:

Of the 45 samples, 5 meat and 2 caviar samples (16% of all samples) were identified as from wild-caught sturgeons:

Commodity	Species	Town	Type of retailer	Date of purchase
Meat	Hybrid of sterlet *(Acipenser ruthenus)* or beluga *(Huso huso)* with stellate sturgeon *(Acipenser stellatus)**	Vylkove	Intermediary	13.12.2017
Meat	Russian sturgeon *(Acipenser gueldenstaedtii)*	Odessa	Market	14.12.2017
Meat	Russian sturgeon *(Acipenser gueldenstaedtii)*	Odessa	Market	14.12.2017
Meat	Russian sturgeon *(Acipenser gueldenstaedtii)*	Kherson	Market	15.12.2017
Caviar	Russian sturgeon *(Acipenser gueldenstaedtii)*	Kiev	Intermediary	22.12.2017
Meat	Beluga *(Huso huso)*	Kiev	Market	07.02.2018
Caviar	Mix of sterlet (*Acipenser ruthenus*) with Siberian sturgeon (*A. baerii*)	-	Online shop	01.05.2020

* natural hybridisation happens in wild sturgeons but is rare, though increasing with the decline of populations

Products from wild-caught sturgeons sold in Ukraine © WWF-Ukraine

© WWF-Ukraine

SAMPLES SOLD NOT IN COMPLIANCE WITH THE RELEVANT CITES RESOLUTION:

In Ukraine, of 28 caviar samples, only 10 had a CITES label and CITES code. This is not required by Ukrainian law on the domestic market, in contradiction of international CITES recommendations, but mandatory in international trade.

CONSUMER DECEPTION:

24 samples (53% of all collected samples) were sold as originating from wild sturgeons - a very high amount that can be an indicator for the demand for sturgeon from the wild - but 17 of these were actually from captive-bred specimens. Ten meat samples were sold as a wrong sturgeon species (e.g. one was sold as Russian sturgeon or beluga although it was a hybrid of *Acipenser schrenckii* and *Huso dauricus*; or in other cases, even as Russian sturgeon although it was in fact the more expensive beluga). One sample declared as Ukrainian sterlet caviar was an artificial product with DNA of a hybrid of *Acipenser schrenckii* and *Huso dauricus*, another caviar sample was artificially produced and without sturgeon DNA.

© WWF-Ukraine

Caviar with correct CITES labels and codes sold in Ukraine

Detailed information on all samples are attached in **Annex 2**.

Wild-caught sturgeon sold in Ukraine

3.6.2. SEIZURE DATA COMPILATION FOR UKRAINE

For Ukraine, data is available for the period 2017-2020 and was obtained from the Kherson, Chernivtsi, Odessa, Azov Sea and Black Sea Fishing Patrols, Ukrainian customs officials, the Ukrainian State Border Guard Service, Ukrainian State Police, the State Fisheries Agency of Ukraine, the State Environmental Inspection, and the State Judicial Administration of Ukraine. Few cases have also been added from Ukrainian news outlets, if not already covered by authority data.

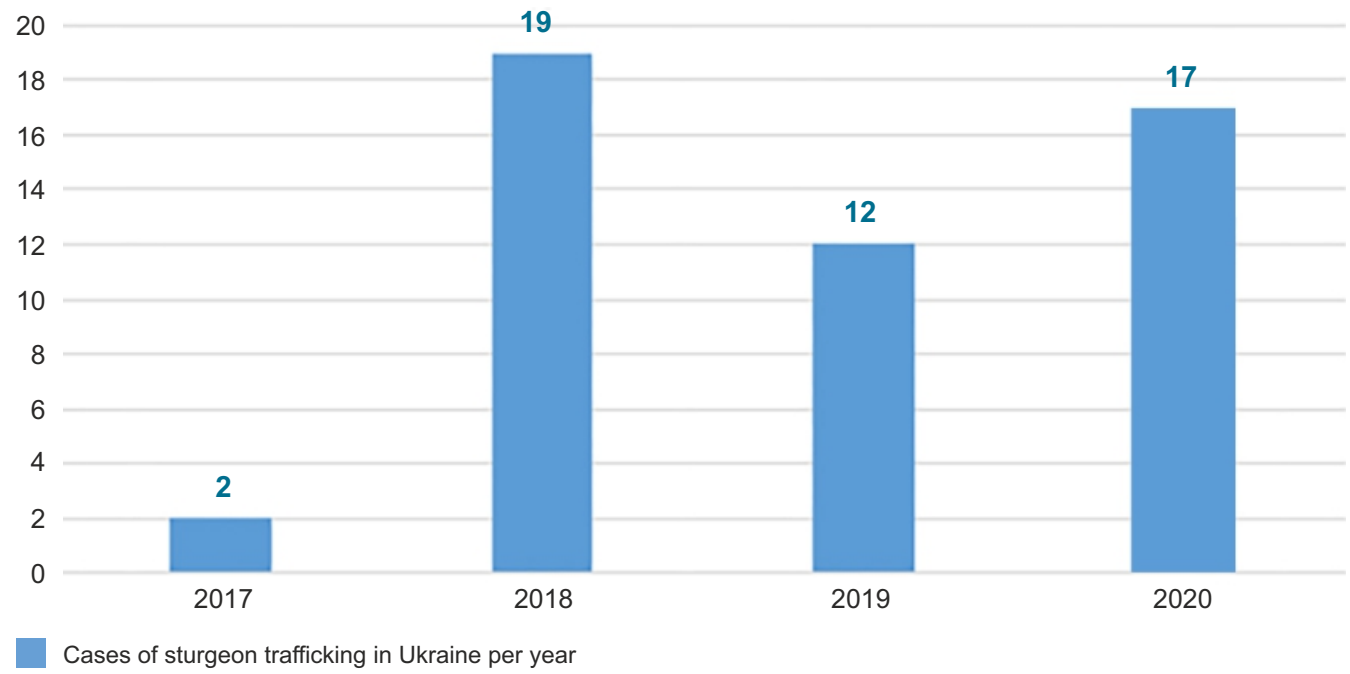
The reporting includes information about:

- the date and location of the cases
- indications of the amount of fish involved (in kilogrammes or in number of individual fish)
- the fishing gear used
- the name of the apprehending agency
- what happened to the discovered good
- details about court cases and penalties.

However, many cases are filed without complete information for all these categories. Before 2017, law enforcement institutions in Ukraine did not collect information about sturgeon trafficking separately. Only in 2017 was a new chapter added to official reports of the State Fishing Authority containing information on sturgeon trafficking. For the common compilation period 2016-2020, the first case of sturgeon trafficking in Ukraine was thus recorded on 11.08.2017. The most recent case was reported on 27.12.2020.

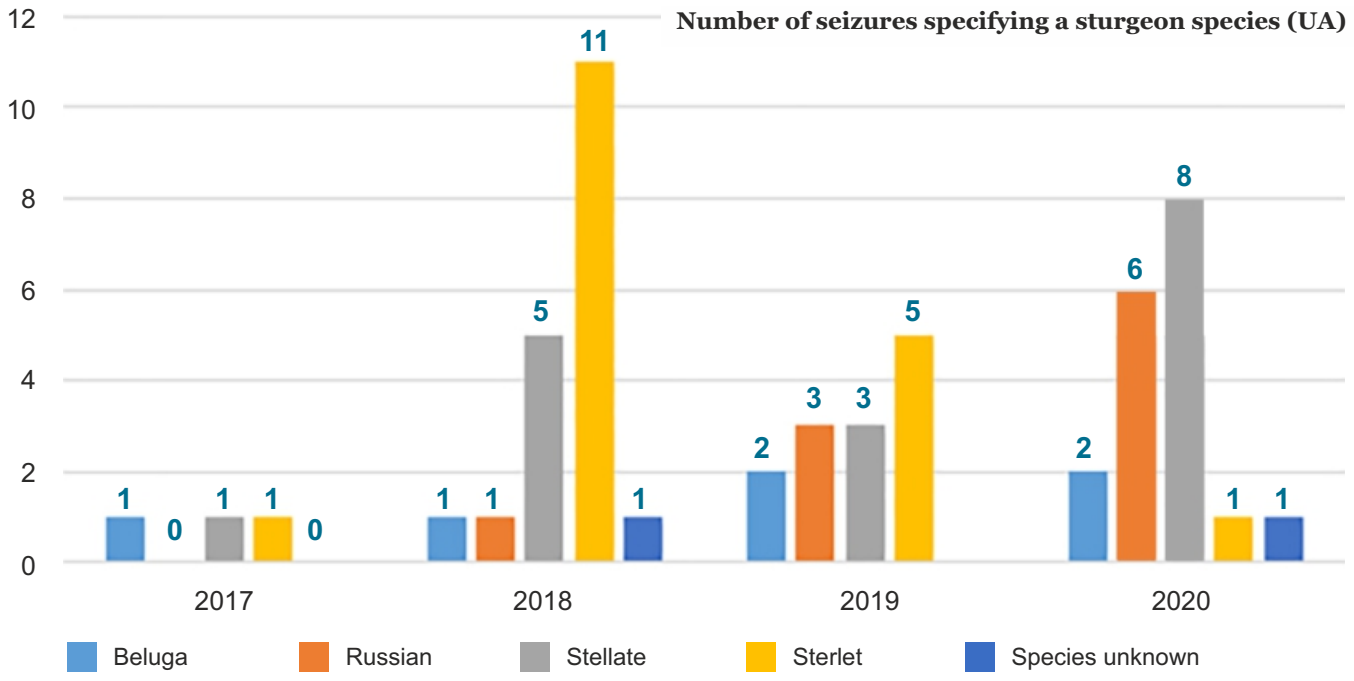
NUMBER OF TRAFFICKING CASES BY YEAR:

All recorded cases in the graph below include a discovery of sturgeon or caviar by the authorities. In some of them, fishing gear was also noted. **In total, 50 cases of sturgeon trafficking were reported during the period covered.**



NUMBER OF CASES PER SPECIES:

In the period covered, 6 of the reported sturgeon trafficking cases involved beluga sturgeons, 10 involved Russian sturgeons, 17 involved stellate sturgeons, and 18 cases involved sterlets. In two cases, the type of sturgeons found is unknown. Cases involving caviar have not been included in the graph below. If two or more species of sturgeon were discovered in the course of the same operation, they are counted as individual cases in the graph. Yet, if one case involved several specimens of the same species, it is only listed once.



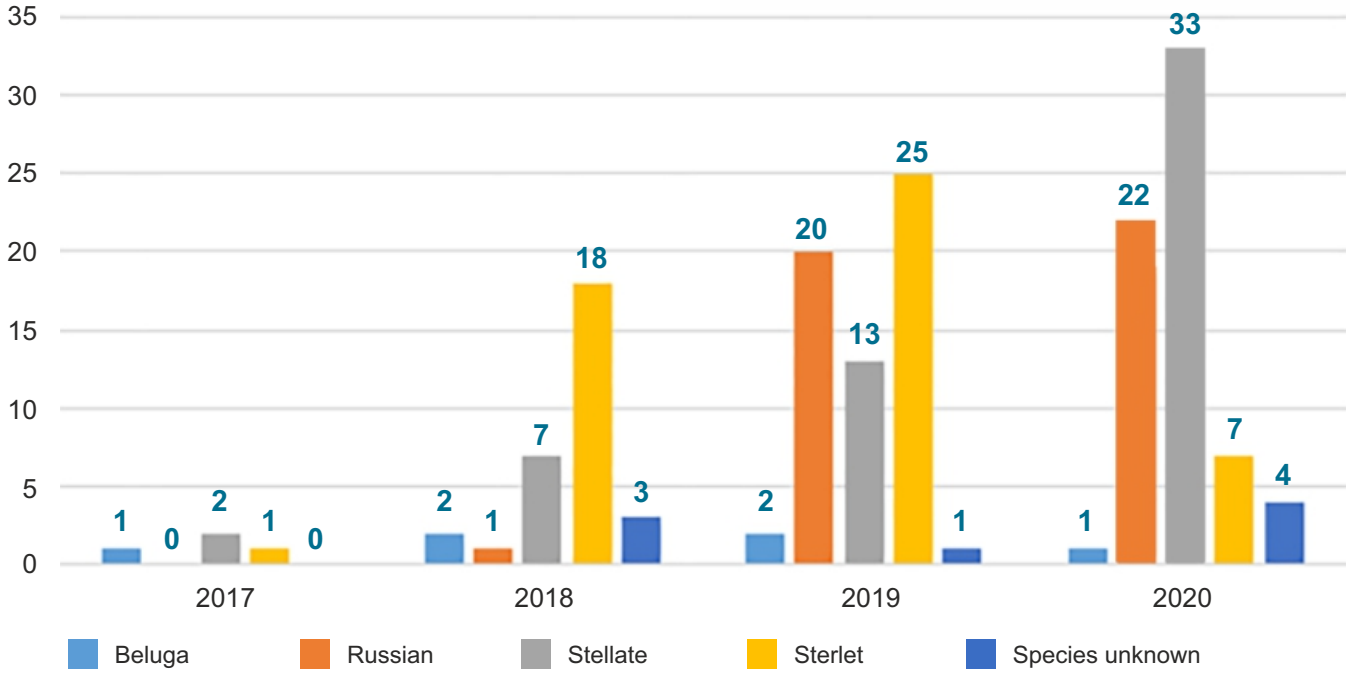
FISHING GEAR SEIZED:

Of the four countries analysed in this report, Ukraine features the most specific reporting. This allows for the data to be broken down not only by the number of fish found per year — 163 for the entire period — but also by individual species. Only cases in which the number of fish was explicitly reported were used in the compilation of the data of the graph.

FISHING GEAR USED IN THE TRAFFICKING CASES:

In Ukraine, 31 of the 50 reported cases include data on the fishing gear used. In one case, scaffolding nets were used, in another floating nets, and in a third, authorities found a beam trawl. Gill nets were used in 5 different cases, while authorities reported nets (specific type undefined) in a further 23 cases.

Number of seized sturgeon in Ukraine by species



KILOGRAMS OF STURGEON MEAT AND CAVIAR ON RECORD:

The table below gives an overview of the amount of sturgeon and caviar (in kilograms) seized in Ukraine between 2017 and 2020. In 26 out of the 50 reported cases, enforcement authorities indicated the weight of the seized fish. On two occasions in March 2020, Ukrainian customs officials seized caviar that was being smuggled across the border with Poland. A further case from 20.10.2019 involved 40 glass jars and 40 packages of caviar seized by customs at Boryspil Airport. Because their weight was not reported, this case was not included in the table below. In two other cases (28.11.2017 and 12.08.2018) law enforcement authorities seized 1.5 kg and 6 kg of dried fish. As dried fish meat weighs significantly less than fresh fish, these two cases have also been left out in the table.

Kilograms of sturgeon meat/caviar seized in Ukraine (2017-2020)

	2017	2018	2019	2020
Sturgeon	3.25 kg	26.6 kg	32.5 kg	225.4 kg
Caviar	–	–	–	31.75 kg

4. RECOMMENDATIONS

The results of the market survey clearly show that wild sturgeons are illegally caught and brought onto the market in all four countries of the Lower Danube Region. The data from the reporting authorities add to this picture by providing evidence that illegal fishing occurs throughout the region. This data, collected on a regional basis, is unique in the methods applied (by analysis of samples with genetic and isotope tests) and in combining different data sources (undercover sample collection on domestic markets and official data from national law enforcement authorities).

The fact that it is a region-wide survey is also of crucial importance, as the countries of the Lower Danube and North-Western Black Sea share the same sturgeon populations. Poaching incidents in one country threaten the survival of the entire population. Equally, enforcement efforts in one country support the protection of the whole shared populations, thus also benefiting other range countries.

With the worryingly low numbers of sturgeon populations in the wild, this prevailing direct threat through illegal fishing and trade limits the chances of recovery for stocks and fuels the decline of populations, some of which are on the brink of extinction, as demonstrated by the recent extinction of ship sturgeon *(Acipenser nudiventris)* in this region. The existing legal protection through fishing bans and trade regulations must become a priority of law enforcement actions, and must be enforced with continuous efforts. Together with the environmental impact, other forms of crimes can be involved and should be investigated, such as loss of taxation revenue, consumer deception or fraud, health and veterinary issues, corruption and the potential involvement of organized crime.

LAW ENFORCEMENT

The following recommendations are listed based on the findings of this report:

ENHANCED CONTROLS OF THE DOMESTIC TRADE

Controls have to cover the whole trade chain and include all types of retailers (including shops and markets, restaurants, online trade, sturgeon producers and intermediaries). In the current survey, sturgeon products were found which were being offered for sale illegally in all of the above-mentioned retailer categories.

Inspections have to be carried out in cases of reasonable suspicion, but also randomly and unannounced on a regular basis, and should include forensic analysis of samples (see below).

CONTROL OF CITES CAVIAR LABELLING REQUIREMENTS

Various contraventions of CITES caviar labelling requirements were documented in the survey:

- caviar without mandatory CITES labels
- labels not affixed according to CITES recommendations
- incorrect CITES codes.

Enforcement agencies in EU Member States need to make sure that any caviar container on the domestic market is labelled correctly, regardless of whether the caviar was produced or processed in their territory or if it was imported.

INTER-AGENCY COOPERATION AND COORDINATION

A number of different law enforcement agencies are responsible for the control of different parts of the trade chain (fishing, aquaculture producers, the processing industry, shops, markets, restaurants, online trade, international trade). This makes close cooperation essential. National authorities in the region have started to establish formal or informal groups and are encouraged to increase and expand these networks to include all potentially responsible agencies (e.g. sanitary inspection and food safety agencies that control restaurants). Regular meetings and real time communication will assist in developing common approaches. This includes prioritizing and focusing enforcement effort on areas of key concern, and planning and carrying out joint and coordinated controls where those are most needed. Furthermore, agencies can support each other in completing competencies and sharing know-how, capacity or equipment.

INCREASED BORDER CONTROLS

Relevant national enforcement authorities should ensure that CITES provisions of sturgeon products leaving or entering their country are observed: specifically, that information regarding the species, source (e.g. wild, captive-bred), geographical origin etc. of the product match those provided on the CITES documents and on the caviar label/packaging; and that forensic techniques (see below) are used to minimise the risk of fraud and illegal trade.

CROSS-BORDER COOPERATION AND COORDINATION BETWEEN AUTHORITIES AT EU AND INTERNATIONAL LEVEL

The particular situation of Lower Danube states sharing the same sturgeon populations highlights the importance of cross-border cooperation among responsible authorities. This includes regular coordination meetings, exchange of data as well as joint field operations and targeted cross-border enforcement actions. This has already started in the region and should be continued and intensified.

Enforcement agencies should share information about caviar and sturgeon seizures and other findings with EU and international bodies (EU Enforcement Group, World Customs Organisation, Interpol and EnviCrimeNet,[24] CITES Secretariat, national authorities in involved countries of origin, transit or destination). They should also use appropriate information exchange tools such as EU-TWIX.[25] This is of particular importance within the EU as one common market, where products — including illegal ones — can be transferred freely.

[24] www.envicrimenet.eu
[25] www.eu-twix.org

SUFFICIENT RESOURCES AND CAPACITY BUILDING FOR LAW ENFORCEMENT AGENCIES

Effective law enforcement requires sufficient resources for all relevant agencies. Adequate manpower, equipment, operational costs, etc. must be provided.

In addition, all responsible agencies need capable and well-trained staff with good knowledge of the complex legal situation, practical experience in the field, and up-to-date information and intelligence. Training and regular refresher courses should be made available to law enforcement officials. WWF can assist with materials in several languages which can be found at: www.danube-sturgeons.org/material.

STATE-OF-THE-ART FORENSIC ANALYSIS

There is a need for consistent controls of sturgeons and their products, which should - in cases of substantiated suspicion - use genetic and isotope analysis, in order to help detect illegal harvesting and trade, and to guarantee effective monitoring of the sturgeon market chain. These must include sturgeon products that are declared to derive from aquaculture, and caviar containers with CITES labels, as the reliability and integrity of these labels and their CITES codes have been found to be flawed.

Since DNA analysis can often not differentiate wild from farmed products, this method must be combined with other techniques such as isotope analysis. Doing so will verify the species as well as the source and geographical origin.

The availability of national institutions for carrying out the required methods should be investigated. If no national institution can carry out the tests, the possibility of expanding their profile for these should be explored. An alternative option would be to have samples analysed in other countries with relevant expertise and resources.

COORDINATED/STRUCTURED COLLECTION OF INTELLIGENCE

It is strongly suggested that the authorities continue the reporting on illegal activities and seizures including sturgeon. The data structure should be harmonised and shared actively between national agencies.

Data should be recorded as completely as possible. In addition, information on control efforts must be monitored to enable an examination of trends, as well as an evaluation of the impact of control efforts.

A regular exchange between the Lower Danube countries is encouraged and should serve as a basis for intelligence-led investigations.

JURISDICTION

Not only do the illegal fishing and trade of sturgeon pose serious threats to the few remaining wild sturgeon populations, they also impair the costly conservation efforts undertaken by individual states, the EU and conservation organisations. They may also involve contraband, organized crime and lost tax revenues for the countries concerned, as well as health and veterinary issues. Wildlife crime acts targeting sturgeons need to be taken seriously; grave cases must be brought to trial and dealt with appropriately; and substantial penalties need to be in place to discourage offenders.

POLICY - CITES MANAGEMENT AUTHORITIES AND CITES PARTIES

CITES Management Authorities in parties who are not yet implementing the CITES caviar labelling provisions for domestic trade (such as Ukraine or Serbia, as well as China, Russia and the USA inter alia) should fully revise relevant national legislation to implement CITES Resolution Conf. 12.7 (Rev.CoP17). Particular attention needs to be paid to the universal caviar labelling system for the domestic trade, in order to enable distinction of legal from illegal products and the effective regulation of trade in sturgeon.

CITES Management Authorities should strictly require appropriate quality and design of the CITES caviar labels of national companies producing or repackaging caviar. They must also ensure that the labels are affixed in a way that provides visual evidence of any opening, that they are non-reusable, and that the CITES code is readable and easy to locate.

OTHER MARKET ACTORS

Other actors engaged in the trade in sturgeon, such as aquaculture operators, retailers of all types, and even consumers should be regularly informed, and their awareness of the issue and of their obligations should be raised.

GENERAL RECOMMENDATION FOR REPLICATION

Finally, it is strongly recommended that this kind of survey be repeated in the Lower Danube region every 3-5 years. Doing so will help evaluate whether or not the situation changes, and if the measures taken have had a positive effect.

At the same time, a replication of the study design in other key sturgeon markets is essential. Such a replication should definitely include Range States such as Azerbaijan, Kazakhstan, the Russian Federation, Georgia, China and the United States of America, as well as key consumption and production countries in Europe.

MATERIAL PRODUCED BY THE PROJECT LIFE FOR DANUBE STURGEONS TO ASSIST LAW ENFORCEMENT:

Identification of sturgeon species

- brochure: English
- video Identification of Wild Danube Sturgeon Species: English
- video Identification of Exotic and Hybrid Sturgeon Species: English

CITES caviar labelling

- brochure: English
- video: English

EU-TWIX - Trade in Wildlife Information eXchange

- brochure: English original kindly provided by EU TWIX

How to handle and release sturgeon safely

- brochure: English

Fighting wildlife crime: Danube Sturgeons – European and International Legal Framework for Sturgeons Protection

- brochure: English

All material can be found under **www.danube-sturgeons.org/material**

REFERENCES

Barmintseva A.E., Mugue N.S. (2013): The use of microsatellite loci for identification of sturgeon species (*Acipenseridae*) and hybrid forms. Genetika 49, 1093-105.

Birstein V.J., Doukakis P., Sorkin B., DeSalle R. (1998): Population Aggregation Analysis of Three Caviar-Producing Species of Sturgeons and Implications for the Species Identification of Black Caviar. Conservation Biology Volume 12, No. 4, 766-775.

Birstein, V. J., Ruban, G., Ludwig, A., Doukakis, P., DeSalle, R., 2005: The enigmatic Caspian Sea Russian sturgeon: how many cryptic forms does it contain? Syst. Biodiv. 3, 203– 218.

Boscari, E., Barmintseva A. E., Pujolar J.M., Doukakis P., Mugue N., Congiu L. (2014): Species and hybrid identification of sturgeon caviar: a new molecular approach to detect illegal trade. Molecular Ecology Resources. 14, 489-98.

Boscari E., Barmintseva A.E., Zhang S., Yue H., Li C., Shedko S.V., Lieckfeldt D., Ludwig A., Wei Q.W., Mugue N.S., Congiu L. (2017a): Genetic identification of the caviar-producing Amur and Kaluga sturgeons revealed a high level of concealed hybridization. Food Control 82, 243-250.

Boscari, E., Vitulo N., Ludwig A., Caruso C., Mugue N.S., Suciu R., Onara D.F., Papetti C., Marino I.A.M., Zane L., Congiu L. (2017b): Fast genetic identification of the Beluga sturgeon and its sought-after caviar to stem illegal trade. Food Control. 75, 145-152.

Camin F. (2017): Stable isotopes techniques for verifying the declared geographical origin of food in legal cases. Trends in Food Sci. & Technol. 61, 176-187.

Camin F., Bontempo L., Perini M., Piasentier E. (2016): Stable Isotope ratio analysis for assessing the authenticity of food of animal origin. Comprehensive reviews in food science and food safety. 15, 868-876.

Chassaing O., Hanni C., Berrebi P. (2011): Distinguishing species of European sturgeons Acipenser spp. using microsatellite allele sequences. Journal of Fish Biology 78, 208–226.

Cohen A. (1997): Sturgeon poaching and black market caviar: a case study. Environmental Biology of Fishes 48, 423–426.

DeNiro M.J., Epstein S. (1976): You are what you eat (plus a few per mil): the carbon isotope cycle in food chains. Geological Society of America, Abstracts, Progress 8, 834–835.

Fain S. R., Straughan D. J., Hamlin B. C., Hoesch R. M., LeMay J. P. (2013): Forensic genetic identification of sturgeon caviars traveling in world trade. Conserv Genet (2013) 14, 855–874. DOI 10.1007/s10592-013-0481-z

Doukakis P., Pikitch E.K., Rothschild A., DeSalle R., Amato G., Kolokotronis S.-O. (2012): Testing the Effectiveness of an International Conservation Agreement - Marketplace Forensics and CITES Caviar Trade Regulation. PLoS ONE Volume 7, issue 7, 1-9

Harris L., Shiraishi H. (2018): Understanding the global caviar market. Results of a rapid assessment of trade in sturgeon caviar. TRAFFIC and WWF joint report.

Harrison S.M., Schmidt O., Moloney A.P., Kelly S.D., Rossmann A., Schellenberg A., Camin F., Perini M., Hoogewerff J., Monahan F.J. (2011): Tissue turnover in ovine muscles and lipids as recorded by multiple (H, C, O, S) stable isotope ratios. Food Chem. 124(1), 291-297.

Havelka M., Hulák M., Ráb P., Rábová M., Lieckfeldt D., Ludwig A., Rodina M., Gela D., Psenicka M., Bytyutskyy D., Flajshans M. (2014): Fertility of a spontaneous hexaploid male Siberian sturgeon, *Acipenser baerii*. BMC Genet. 15, 5.

Havelka M., Boscari E., Sergeev A., Mugue N., Congiu L., Arai K. (2019): A new marker, isolated by ddRAD sequencing, detects Siberian and Russian sturgeon in hybrids. Animal Genetics 50, 115-116.

Havelka M., Fujimoto T., Hagihara S., Adachi S., Arai K. (2017): Nuclear DNA markers for identification of Beluga and Sterlet sturgeons and their interspecific Bester hybrid Scientific reports 7, 1694.

Jahrl J. (2013): Illegal caviar trade in Bulgaria and Romania - Results of a market survey on trade in caviar from sturgeons (Acipenseridae). WWF Austria & TRAFFIC, Vienna, Austria.

Jenneckens I., Meyer J. N., Debus L., Pitra C., Ludwig A. (2000): Evidence of mitochondrial DNA clones of Siberian sturgeon, *Acipenser baerii*, within Russian sturgeon, *Acipenser gueldenstaedtii*, caught in the River Volga. Ecol. Lett. 3, 503–508.

Jenneckens I., Meyer J. N., Hörstgen‐Schark G., May B., Debus L., Ludwig A. (2001): A fixed allele at microsatellite locus LS‐39 exhibiting species‐specificity for the black caviar producer *Acipenser stellatus*. J. Appl. Ichthyol. 17, 39– 42.

Johnson T. A., Iyengar A. (2014): Phylogenetic Evidence for a Case of Misleading Rather than Mislabeling in Caviar in the United Kingdom. J Forensic Sci, 2014. doi: 10.1111/1556-4029.12583

Kim H., Kumar K.S., Shin K.-H. (2015): Applicability of stable C and N isotope analysis in inferring the geographical origin and authentication of commercial fish (Mackerel), Yellow Croaker and Pollock). Food Chemistry, 172, 523-527.

Knight J. (2017): Operation Roadhouse: How inter-agency collaboration stopped illegal Paddlefish depredation. The National Agency of Conservation Law Enforcement Chiefs (NACLEC).

Kocher T. D., Thomas W. K., Meyer A., Edwards S. V., Pääbo S., Villablanca F. X., Wilson A. C. (1989): Dynamics of mitochondrial DNA evolution in animals: amplification and sequencing with conserved primers. Proc. Nat. Acad. Sci. USA 86, 6196–6200.

Krieger J., Hett A. K., Fuerst, P. A., Artykhin E., Ludwig A. (2008): The molecular phylogeny of the order Acipenseriformes revisited. J. Appl. Ichthyol. 24(S1), 36–45.

Ludwig A., Kirschbaum F. (1998): Comparison of mitochondrial DNA sequences between the European and the Adriatic sturgeon. J. Fish Biol. 52, 1289–1291.

Ludwig A., May B., Debus L., Jenneckens I. (2000): Heteroplasmy in the mtDNA control region of sturgeon (*Acipenser*, *Huso* and *Scaphirhynchus*). Genetics 156, 1933–1947.

Ludwig A., Belfiore N. M., Pitra C., Svirsky V., Jenneckens I. (2001): Genome duplication events and functional reduction of ploidy levels in sturgeon (*Acipenser*, *Huso* and *Scaphirhynchus*). Genetics 158, 1203–1215.

Ludwig A., Lieckfeldt D., Jahrl J. (2015): Mislabeled and counterfeit sturgeon caviar from Bulgaria and Romania. Journal of Applied Ichthyology 31(4), 587-591.

Macko S.A., Fogel M.L., Hare P.E., Hoering T.C. (1987): Isotopic fractionation of nitrogen and carbon in the synthesis of amino acids by microorganism. Chemical Geology. 65, 79-92.

McCutchan J.H., Lewis W.M., Kendall C., McGrath C.C. (2003): Variation in trophic shift for stable isotope ratios of carbon, nitrogen, and sulfur. Oikos, 102, 378-390.

Minagawa M., Wada E. (1984): Stepwise enrichment of 15N along food chains: Further evidence and the relation between 15N and animal age. Geochim. Cosmochim Acta. 48, 1135-1140.

Molkentin J., Lehmann I., Ostermeyer U., Rebhein H. (2015) Authenticating the production origin of salominds by chemical and isotope analyses. Food Control 53, 55-66.

Pappalardo A.P., Petraccioli A., Capriglione T., Ferrito V. (2019): From Fish Eggs to Fish Name: Caviar Species Discrimination by COIBar-RFLP, an Efficient Molecular Approach to Detect Fraud in the Caviar Trade. Molecules 24(13): 2468.

Peng Z., Ludwig A., Wang D., Diogo R., Wei Q., He S. (2007): Age and biogeography of major clades in sturgeons and paddlefishes (Pisces: Acipenseriformes). Mol. Phylogent. Evol. 42, 854–862.

Primrose S, Woolfe M., Rollinson S. (2010): Food forensics: methods for determining the authenticity of foodstuffs. Trends in Food Science and Technology, 21, 582.590.

Van Uhm D. and Siegel D. (2016): The illegal trade in black caviar. Trends in Organized Crime 19, 67-87.

Wada E., Mizutani H., Minagawa M. (1991): The Use of Stable Isotopes for Food Web Analysis. Crit. Reviews Food Science and Nutrition. 30, 361-371.

Williot P., Brun R., Rouault T., Pelard M., Mercier D., Ludwig A. (2005): Artificial spawning in cultured sterlet sturgeon, *Acipenser ruthenus L.*, with special emphasis on hermaphrodites. Aquaculture 246, 263– 273.

Zabyelina Y.G. (2014): The “fishy” business: a qualitative analysis of the illicit market in black caviar. Trends in Organized Crime 17(3):181-198.

Zane L., Patarnello T., Ludwig A., Fontana F., Congiu L. (2002): Isolation and characterization of microsatellites in the Adriatic sturgeon (*Acipenser naccarii*). Mol. Ecol. Notes 2, 586– 588.

Ziegler S., Merker S., Streit B., Boner M., Jacob D. E. (2016): Towards understanding isotope variability in elephant ivory to establish isotopic and source-area determination. Biological conservation. 197, 154-163.

ANNEX 1. QUESTIONS AND ANSWERS

FORENSIC METHODS FOR STURGEON PRODUCTS IN TRADE

Arne Ludwig (Leibniz Institute for Zoo and Wildlife Research - IZW),
Markus Boner (Agrosiolab)

How can sturgeon species/hybrids be determined?
GENETIC ANALYSIS

GENERAL PRINCIPLE

- mtDNA: DNA found in mitochondria of cells; maternal inheritance - > only maternal species can be determined, no hybrids
- nDNA: DNA found in cell nucleus; maternal and paternal inheritance -> hybrids and parentage can be determined

GENETIC METHODS FOR SPECIES IDENTIFICATION

- DNA sequencing for detecting maternal species/lineages and multi-locus fingerprinting for hybrid identification
- Microsatellites (short repeats of nuclear DNA)
- SNP genotyping (species-specific mutations)

SAMPLES FOR DNA ANALYSIS - WHAT TISSUE/PROCESSED MATERIAL CAN BE USED, HOW DO SAMPLES NEED TO BE TAKEN, STORED, SHIPPED ETC.?

- Any type of fresh tissue (e.g. fin clips, eggs, muscle or blood) is suitable for DNA analyses
- A small spoonful of material (5-10 gram) is sufficient
- Samples can be stored in pure ethanol (min. 70%) or frozen (-20°C); caviar samples can be kept in the original tin unopened and cooled
- Ethanol samples should be stored cool (fridge – around 4°C) and dark.
- Shipping should be done by parcel /courier services
- CITES export and import permissions are necessary for samples from outside the EU. Please contact us in front so that we can apply for import permits.

LIMITATIONS OF DNA ANALYSIS

- Identification of closely related species (e.g. Russian sturgeon *Acipenser gueldenstaedtii* vs Persian sturgeon *Acipenser persicus*) or species impacted by hybridization (e.g. *Acipenser gueldenstaedtii* vs Siberian sturgeon *Acipenser baerii*)
- Identifying different populations (e.g. beluga from Danube vs Caspian Sea)
- Identification captive bred vs wild (unless species is not found in the wild)

WHICH FACTORS CAN INFLUENCE THE VALIDITY?

- All sturgeon species (but not *Acipenser persicus*) and their hybrids can be identified by genetic methods but problems exist for hybrid x hybrid crosses
- Results of genetic analyses are evaluated and used by court – to be valid evidence, samples must be handled rigorously (no contamination, no mixing of samples, proper labelling and documentation, etc.)
- Results can be influenced by poor sampling (esp. using the same tools for different samples so that samples are mixed; inaccurate marking and documentation of samples) or insufficient storing conditions of samples (resulting in degraded DNA that cannot be analysed)

How can the source (wild vs captive bred) and the geographical origin of sturgeon meat/caviar be determined?

STABLE ISOTOPE ANALYSIS (SIRA)

GENERAL PRINCIPLE

It is well known that the elements occur in various forms, which differ only in the numbers of neutrons called isotopes. Most of them are radioactive but some heavy isotopes are stable as well. The building blocks of life – hydrogen, oxygen, carbon, nitrogen and sulphur – exist in various heavy forms, which are notified as stable isotopes. The ratio of these isotopes to one another differs from material to material and from region to region. Therefore, the stable isotope method is a universal, non-radioactive analytical tool to test the authenticity e.g. the origin, food webs (including feeding conditions) and adulteration. In detail, there is a well-known pattern of $^{2}H/^{1}H$ and $^{18}O/^{16}O$ in the meteoric water as well as in the ground water, and every material including plants and animals gets a significant fingerprint in the tissue water depending on the local tap water. The pattern of $^{2}H/^{1}H$ and $^{18}O/^{16}O$ in the meteoric water depends mainly on the temperature, the landscape altitude and the distance from the sea (continental effect). Adding the remaining stable isotopes of the elements of life (C, N, S) further information is available. Soils show different isotope ratios of $^{15}N/^{14}N$ and $^{34}S/^{32}S$ depending firstly on the natural geological composition and secondly on the cultivation. For example, the isotopic composition of fertilizers varies from their type (organic nitrogen or synthetically produced from air nitrogen, sulphur of volcanic or biological origin). Finally, the $^{13}C/^{12}C$ isotope ratio of plants depends on the type of metabolism and of local climatic conditions. In result, plants such as maize (C^4-plants) show different $^{13}C/^{12}C$ ratios to wheat (C^3-plants).

Plants implement these isotope signatures in their organic tissue; afterwards those signatures will be transferred to animals via the food web. Furthermore, the trophic level is reflected in the enrichment of $^{15}N/^{14}N$ as well.

WHICH ISOTOPE RATIOS ARE USED FOR SOURCE IDENTIFICATION?

- Carbon ($^{13}C/^{12}C$)
- Sulphur ($^{34}S/^{32}S$)
- Nitrogen ($^{15}N/^{14}N$)

WHICH ISOTOPE RATIOS ARE USED FOR IDENTIFICATION OF GEOGRAPHICAL ORIGIN?

Priority information

- Hydrogen ($^{2}H/^{1}H$)
- Oxygen ($^{18}O/^{16}O$)

Secondary information

- Carbon ($^{13}C/^{12}C$)
- Nitrogen ($^{15}N/^{14}N$)
- Sulphur ($^{34}S/^{32}S$)
- [Strontium ($^{87}Sr/^{86}Sr$)]

INFRASTRUCTURE, EQUIPMENT ETC. NEEDED FOR ISOTOPE ANALYSIS

Elemental analyser [EA, e.g. EuroVector] in combination with CF-IRMS (Continuous Flow – Isotopic Ratio Mass Spectrometer).

$^{18}O/^{16}O$: CO_2 Equilibration (e.g. Multiflow, Elementar) in combination with CF-IRMS.

SAMPLES FOR ISOTOPE ANALYSIS - WHAT TISSUE/ PROCESSED MATERIAL CAN BE USED, HOW DO SAMPLES NEED TO BE TAKEN, STORED, SHIPPED ETC.?

Normally it is preferable to analyse the stable isotopic ratio of the caviar directly. This is recommended to avoid any turnover effect in the tissues, which may cause differences in the stable isotopic signature in the tissues. Nevertheless, the $^{34}S/^{32}S$ isotopes should show a robust signature in the proteins.

LIMITATIONS OF ISOTOPE ANALYSIS

Stable isotope methods deliver information of the feeding or environmental living conditions. These causations could be used to draw conclusions from the stable isotopic results.

Normally the origin check is one of the biggest challenges as for any given country or region there will be a defined

distribution of signatures for the isotopes analysed. That distribution can be improved/refined by further reference data, but once settled as being a data set that is representative of the country it should be kept in mind that there will be other locations on earth with the same signature set. It is possible to show, perhaps with very high probability that a test sample is or is not similar to reference data representative of the declared origin. This exclusion principle can be strong enough to call into question the validity of the origin claim.

HOW RELIABLE ARE THE RESULTS?

The stable isotopic method is accepted in court cases [1] and recommended in various international guidelines for tracking the origin, e.g. UNODC guidelines ivory, EU guidelines timber tracking.

[1] Camin F. Boner M. et al. (2017) Stable isotope techniques for verifying the declared geographical origin for food in legal cases. Trends in Food Science & Technology. 64, 176-187.

WHICH FACTORS CAN INFLUENCE THE VALIDITY?

Processing effects such as added water or cooking could have a significant effect on the tissue of caviar or meat. Still yet, there are verification studies missing to confirm or to reject these effects. Normally Agroisolab provides special containers / packages for sampling. Normally 20 g caviar or 50 g meat is sufficient for the preparation. Fresh or frozen sample is free of choice. Nevertheless, samples should arrive in the laboratory in unrotten conditions and in sealed containers.

ANNEX 2. MARKET SURVEY DATA

SPECIES

HUS – Beluga *(Huso huso)*
RUT – Sterlet *(Acipenser ruthenus)*
GUE – Russian sturgeon *(Acipenser gueldenstaedtii)*
STE – Stellate sturgeon *(Acipenser stellatus)*
BAE – Siberian sturgeon *(Acipenser baerii)*
SCH – Amur sturgeon (*Acipenser schrenckii)*
DAU – Kaluga *(Huso dauricus)*
NAC – Adriatic sturgeon *(Acipenser naccarii)*
SPA – American paddlefish *(Polyodon spathula)*
XXX x XXX – hybrid of 2 species

SAMPLES

Caviar

Meat

CONFORMITY WITH DECLARED INFORMATION

With high confidence conform

Likely conform

Questionable

Likely not conform

With high confidence not conform

LEGALITY

With high confidence legal

Likely legal

Questionable

Likely misleading consumer

Misleading consumer

Likely illegal

With high confidence illegal

BULGARIA

						SOURCE W: wild-caught, C: captive-bred		COUNTRY OF ORIGIN (caviar - according to CITES code)		SPECIES OR HYBRID		CONCLUSION REGARDING LEGALITY
Sample code	**Type of sample**	**Date of acquisition**	**Location of acquisition**		**Caviar correctly labelled?**	***Declared source***	***Conformity***	***Declared origin***	***Conformity***	***Declared species***	***Conformity***	
BG_1_1	Meat	19/5/2017	Sofia	Shop	N/A	C	C 86%	-	-	Information not provided	HUS	
BG_4_1	Meat	25/5/2017	Silistra	Restaurant	N/A	Information not provided	W 95%	-	-	HUS	GUE	**Poached**
BG-8-18	Meat	6/11/2017	Sofia	Restaurant	N/A	C	C >94%	-	-	Information not provided	RUT or HUS x STE	
BG-7-18	Meat	8/11/2017	Burgas	Restaurant	N/A	W (from the Black Sea)	C 87%	-	-	Information not provided	GUE	
BG-9-18	Meat	11/11/2017	Silistra	Restaurant	N/A	Information not provided	C 95%	-	-	STE	GUE	
BG-15-18	Meat	11/11/2017	Kozloduj	Restaurant	N/A	W (from the Danube)	W >99%	-	-	RUT	RUT	**Poached**
BG-5-18	Meat	14/11/2017	Silistra	Restaurant	N/A	W (Danube fish)	C 86%	-	-	STE	RUT or HUS x STE	
BG-4-18	Meat	25/11/2017	Malko Tarnovo	Restaurant	N/A	C	C >95%	-	-	BAE or GUE	RUT or HUS x STE	
BG_L	Caviar	17/12/2017	London	Shop	Yes	C	C 98%	Bulgaria		HUS	HUS	
BG-12-18	Caviar	9/4/2018	Sofia	Shop	N/A	C	C	-	-	Information not provided	No result	**Artifical product sold as caviar imitation**
BG-6-18	Meat	9/5/2018	Kozloduj	Restaurant	N/A	W (from the Danube)	W >99%	-	-	RUT	RUT	**Poached**
BG-10-18	Meat	10/5/2018	Varna	Restaurant	N/A	W (caught in Black Sea)	C 86%	-	-	Information not provided	NAC x GUE	
BG-11-18	Meat	10/5/2018	Ruse	Shop	N/A	W	C 87%	-	-	Information not provided	GUE	

BULGARIA

Sample code	Type of sample	Date of acquisition	Location of acquisition		Caviar correctly labelled?	SOURCE (W: wild-caught, C: captive-bred)		COUNTRY OF ORIGIN (caviar - according to CITES code)		SPECIES OR HYBRID		CONCLUSION REGARDING LEGALITY
						Declared source	*Conformity*	*Declared origin*	*Conformity*	*Declared species*	*Conformity*	
BG_G	Caviar	23/5/2018	Brussels	Shop	Yes	C	C 86%	Bulgaria		HUS	HUS	
BG-16-18	Meat	3/7/2018	Malko Tarnovo	Restaurant	N/A	C	C >95%	-	-	BAE or GUE	GUE or NAC	
BG_G	Caviar	18/7/2018	Geneva	Shop	Yes	C	C 89%	Bulgaria		GUE	GUE	
BG-13-18	Meat	25/7/2018	Ryahovo	Restaurant	N/A	W	C 95%	-	-	Information not provided	GUE	
BG-17-18	Meat	5/8/2018	Vidin	Restaurant	N/A	C	C >97%	-	-	HUS	HUS	
BG-14-18	Meat	7/9/2018	Uzana	Restaurant	N/A	C	C 78%	-	-	GUE	GUE	
BG_20_20	Caviar	11/2019		Aquaculture facility	N/A	C	C 83%	N/A	-	Information not provided	STE or xSTE	
BG_21_20	Meat	12/2019		Aquaculture facility	N/A	C	C 96%	-	-	Information not provided	STE or xSTE	
BG_22_20	Caviar	12/2019		Aquaculture facility	N/A	C	C >98%	N/A	-	Information not provided	GUE or BAExGUE	
BG_52_1	Meat	15/2/2020	Sofia	Restaurant	N/A	C	C 96%	-	-	Information not provided	BAE or GUE or hybrid	
BG_56_1	Meat	16/2/2020	Sofia	Restaurant	N/A	Information not provided	C 82%	-	-	GUE??	BAE or GUE or hybrid	
BG_59_1	Meat	21/2/2020	Sofia	Restaurant	N/A	C	C >98%	-	-	RUT	RUT	
BG_59_2	Meat	21/2/2020	Sofia	Restaurant	N/A	C	C 74%	-	-	GUE?	BAE or GUEx other species	**Captive-bred?**
BG_60_1	Meat	24/2/2020	Sofia	Shop	N/A	C	W 99%	-	-	GUE?	GUE or BAE or hybrid	**Poached**
BG_60_2	Meat	24/2/2020	Sofia	Shop	N/A	C	C 87%	-	-	HUS	RUT	
BG_61_1	Meat	29/2/2020	Sofia	Restaurant	N/A	Information not provided	C 83%	-	-	Information not provided	GUE or BAE or hybrid	
BG_63_1	Caviar	1/4/2020	Sofia	Online order	No (label without CITES code not sealing the container)	Information not provided	C >98%	No CITES code	-	GUE	BAE or GUEx other species	**Unlabelled caviar**
BG_65_1	Caviar	30/7/2020	Sofia	Shop	Yes	C	C >98%	China	No clear result	SCHxDAU	DAU or SCHxDAU	
BG_65_2	Caviar	30/7/2020	Sofia	Shop	No (label without CITES code not sealing the container)	Information not provided	C 83%	No CITES code	-	GUE	BAE or GUEx other species	**Unlabelled caviar**

SERBIA

Sample code	Type of sample	Date of acquisition	Location of acquisition		Caviar correctly labelled?	SOURCE (W: wild-caught, C: captive-bred)		COUNTRY OF ORIGIN (caviar - according to CITES code)		SPECIES OR HYBRID		CONCLUSION REGARDING LEGALITY
						Declared source	*Conformity*	*Declared origin*	*Conformity*	*Declared species*	*Conformity*	
RS 01 _1	Meat	23/11/2017	Vršac	Aquaculture facility	N/A	C	C 99%	-	-	GUE	GUE	
RS 01 _2	Meat	23/11/2017	Vršac	Aquaculture facility	N/A	C	C 99%	-	-	GUE	GUE	
RS 01 _3	Meat	23/11/2017	Vršac	Aquaculture facility	N/A	C	C 99%	-	-	GUE	GUE	
RS 12_1	Caviar	14/2/2018	Belgrade	Online order	Yes	C	Not tested	CN	Not tested	GUE	Not tested	Illegally imported
RS 16_1	Meat	20/4/2018	Radujevac		N/A	W	C >99%	-	-	HUS	Not HUS	
RS 20_1	Meat	23/5/2018	Belgrade		N/A	W	W >99%	-	-	RUT	RUT	Poached
RS 20_2	Meat	23/5/2018	Belgrade	Fish market	N/A	W	W >99%	-	-	RUT	RUT	Poached
RS 20_3	Meat	23/5/2018	Belgrade	Fish market	N/A	W	W >99%	-	-	RUT	RUT	Poached
RS 12_2	Caviar	10/7/2018	Belgrade	Online order	Yes	C	Not tested	CN	Not tested	HUS	Not tested	Illegally imported
RS 21_1	Meat	29/7/2018	Belgrade	Restaurant	N/A	W	W >99%	-	-	RUT	RUT	Poached
RS 24_1	Meat	14/9/2018	Belgrade	Restaurant	N/A	W	C >98%	-	-	RUT	RUT	
RS 01 _4	Meat	3/12/2018	Vršac	Aquaculture facility	N/A	C	C >99%	-	-	RUT	RUT	
RS 01 _5	Meat	3/12/2018	Vršac	Aquaculture facility	N/A	C	C >99%	-	-	RUT	RUT	
RS 24_2	Meat	24/12/2018	Belgrade	Restaurant	N/A	W	C >98%	-	-	RUT	RUT	
RS 28_1	Meat	21/1/2019	Novi Sad	Aquaculture facility	N/A	C	C 98%	-	-	RUT	RUT	
RS 28_2	Meat	21/1/2019	Novi Sad	Aquaculture facility	N/A	C	C 95%	-	-	RUT	RUT	

ROMANIA

Sample code	Type of sample	Date of acquisition	Location of acquisition		Caviar correctly labelled?	SOURCE (W: wild-caught, C: captive-bred)		COUNTRY OF ORIGIN (caviar - according to CITES code)		SPECIES OR HYBRID		CONCLUSION REGARDING LEGALITY
						Declared source	*Conformity*	*Declared origin*	*Conformity*	*Declared species*	*Conformity*	
RO 1_1	Caviar	28/10/2016	Bucharest	Shop	No (label not sealing container)	C	C 99%	Romania		RUTxHUS	HUS	**Mislabelled caviar**
RO_2_1	Meat	21/3/2017	Tulcea	Market	N/A	Information not provided	C 90%	-	-	GUE	GUE	
RO_3_1	Caviar	15/6/2017	Bucharest	Shop	Yes	C	C 99%	Germany		SCHxDAU	SCH x DAU	**Mislabelled caviar**
RO_4_1	Caviar	18/8/2017	Bucharest	Shop	No (label not sealing container)	C	C 99%	Romania		RUTxHUS	NAC	**Mislabelled caviar**
RO_4_2	Caviar	18/8/2017	Bucharest	Shop	No (label not sealing container)	C	C 99%	Romania		RUTxHUS	? x NAC	**Mislabelled caviar**
RO_4_3	Caviar	18/8/2017	Bucharest	Shop	No (label not sealing container)	C	C 99%	Romania		RUTxHUS	? x NAC	**Mislabelled caviar**
RO_5_1	Caviar	18/12/2017	Bucharest	Shop	Yes	C	Results inconclusive	Germany	Results in-conclusive	BAE	Results inconclusive	**Results inconclusive**
RO_4_4	Meat	07/1/2018	Bucharest	Shop	N/A	C	C 56%	-	-	HUS	GUE	
RO_8_1	Caviar	19/3/2018		Online Order	Yes	C	C 96%	China		SCHxDAU	SCH x DAU	
RO_12_1	Caviar	19/3/2018		Online Order	Yes	C	C 99 %	Romania		HUSxRUT	No clear exclusion	
RO_12_2	Caviar	19/3/2018		Online Order	Yes	C	C 99 %	Romania		GUE	GUE	
RO_12_3	Caviar	19/3/2018		Online Order	Yes	C	C 97%	Romania		STE	STE	
RO_6_6	Meat	21/3/2018	Bucharest	Market	N/A	Information not provided	C 66%	-	-	HUS	HUS	**Captive-bred?**
RO_9_1	Caviar	22/3/2018	Borcea, Calarasi	Aquaculture Facility	No (CITES label/code missing)	Information not provided	C 93%	No CITES code	Not from Europe	STE	STE	**Unlabelled caviar**
RO_11_1	Caviar	24/3/2018	Bucuresti	Shop	Yes	C	C 97 %	China		SCHxDAU	SCH x DAU	
RO_18_1	Meat	25/3/2018	Tulcea	Restaurant	N/A	Information not provided	C 95%	-	-	GUE	HUS	
RO_23_1	Meat	26/3/2018	Bucharest	Restaurant	N/A	Information not provided	C 82%	-	-	Information not provided	No result	
RO_7_2	Caviar	12/5/2018	Floresti, Cluj	Shop	No (label not sealing container)	C	C 98 %	Romania		GUE	BAE or GUE	**Mislabelled caviar**
RO_7_3	Caviar	12/5/2018	Floresti, Cluj	Shop	No (label not sealing container)	C	C 98 %	Romania		GUE	BAE or GUE	**Mislabelled caviar**
RO_7_4	Caviar	12/5/2018	Floresti, Cluj	Shop	No (label not sealing container)	C	C 91%	Romania		GUE	HUS x RUT	**Mislabelled caviar**
RO_4_5	Meat	18/5/2018	Bucharest	Shop	N/A	C	C 91%	-	-	GUE	GUE	
RO_20_3_1	Meat	23/5/2018	Giurgeni	Intermediary	N/A	Information not provided	W >99,9%	-	-	RUT	RUT	**Poached**
RO_20_3_2	Meat	23/5/2018	Giurgeni	Intermediary	N/A	Information not provided	W >99,9%	-	-	RUT	RUT	**Poached**

ROMANIA

Sample code	Type of sample	Date of acquisition	Location of acquisition		Caviar correctly labelled?	SOURCE (W: wild-caught, C: captive-bred)		COUNTRY OF ORIGIN (caviar - according to CITES code)		SPECIES OR HYBRID		CONCLUSION REGARDING LEGALITY
						Declared source	*Conformity*	*Declared origin*	*Conformity*	*Declared species*	*Conformity*	
RO_20_3_3	Meat	23/5/2018	Giurgeni	Intermediary	N/A	Information not provided	W >99,9%	-	-	RUT	RUT	Poached
RO_20_3_4	Meat	23/5/2018	Giurgeni	Intermediary	N/A	Information not provided	W >99,9%	-	-	RUT	RUT	Poached
RO_20_3_5	Meat	23/5/2018	Giurgeni	Intermediary	N/A	Information not provided	W >99,9%	-	-	RUT	RUT	Poached
RO_20_3_6	Meat	23/5/2018	Giurgeni	Intermediary	N/A	Information not provided	W >99,9%	-	-	RUT	RUT	Poached
RO_20_3_7	Meat	23/5/2018	Giurgeni	Intermediary	N/A	Information not provided	W >99,9%	-	-	RUT	RUT	Poached
RO_20_3_8	Meat	23/5/2018	Giurgeni	Intermediary	N/A	Information not provided	W >99,9%	-	-	RUT	RUT	Poached
RO_20_3_9	Meat	23/5/2018	Giurgeni	Intermediary	N/A	Information not provided	W >99,9%	-	-	RUT	RUT	Poached
RO_20_3_10	Meat	23/5/2018	Giurgeni	Intermediary	N/A	Information not provided	W >99,9%	-	-	RUT	RUT	Poached
RO_20_3_11	Meat	23/5/2018	Giurgeni	Intermediary	N/A	Information not provided	W >99,9%	-	-	RUT	RUT	Poached
RO_22_1	Meat	23/5/2018	Bucharest	Restaurant	N/A	Information not provided	W >99,9%	-	-	Information not provided	HUS	Poached
RO_26_1	Meat	7/6/2018	Agigea, Constanta	Restaurant	N/A	Information not provided	C 76%	-	-	Information not provided	GUE	
RO_27_1	Meat	7/6/2018	Navodari, Constanta	Restaurant	N/A	Information not provided	C >98%	-	-	Information not provided	GUE	
RO_32_1	Meat	9/6/2018	Jurilovca, Tulcea	Bar	N/A	Information not provided	C 87%	-	-	Information not provided	BAE or GUE	
RO_32_1	Meat	9/6/2018	Jurilovca, Tulcea	Bar	N/A	Information not provided	W >99%	-	-	RUT	European catfish	
RO_7_6	Caviar	14/6/2018	Bucuresti	Shop	No (label not sealing container)	C	C 99%	Finland		BAE	GUE or NAC	Mislabelled caviar
RO_7_7	Caviar	15/6/2018	Bucuresti	Shop	No (label not sealing container)	C	C 94%	Bulgaria		GUE	NAC or BAE or GUE x RUT	Mislabelled caviar
RO_35_1	Meat	21/6/2018	Galati	Shop	N/A	C	C >99%	-	-	HUS	BAE or GUE	
RO_37_1	Meat	5/7/2018	Sulina	Restaurant	N/A	Information not provided	C 99%	-	-	Information not provided	GUE	
RO_38_1	Meat	5/7/2018	Sulina	Fisherman	N/A	Information not provided	C >99%	-	-	Information not provided	BAE or GUE	
RO_38_2	Meat	12/7/2018	Sulina	Fisherman	N/A	Information not provided	C 96%	-	-	GUE	GUE	
RO_39_1	Meat	4/10/2018	Jurilovca, Tulcea	Restaurant	N/A	Information not provided	C 97%	-	-	Information not provided	Nile perch	
RO_40_1	Meat	7/3/2019	Bucharest	Restaurant	N/A	Information not provided	C >98%	-	-	Information not provided	BAE or GUE	
RO_3_2	Meat	3/4/2019	Bucharest	Shop	N/A	C	C 78%	-	-	BAE	BAE or GUE or hybrid	

ROMANIA

Sample code	Type of sample	Date of acquisition	Location of acquisition		Caviar correctly labelled?	SOURCE (W: wild-caught, C: captive-bred)		COUNTRY OF ORIGIN (caviar - according to CITES code)		SPECIES OR HYBRID		CONCLUSION REGARDING LEGALITY
						Declared source	*Conformity*	*Declared origin*	*Conformity*	*Declared species*	*Conformity*	
RO_26_2	Meat	20/4/2019	Agigea, Constanta County	Restaurant	N/A	C	C 79%	-	-	GUE	GUE or BAE x GUE	
RO_42_1	Meat	22/5/2019	Tulcea	Private host	N/A	C	W 99%	-	-	Information not provided	European catfish	
RO_44_1	Meat	24/5/2019		Online order	N/A	Information not provided	C >98%	-	-	Information not provided	GUE x other species	
RO_12_4	Meat	6/6/2019	Horia, Tulcea	Aquaculture facility	N/A	C	C 99%	-	-	STE	STE	
RO_43_1	Caviar	18/12/2019		Online order	No (label not sealing container)	C	C 93%	Romania	No clear results	GUE	BAE or GUE x RUT	**Mislabelled caviar**
RO_9_2	Caviar	2/6/2020	Borcea, Calarais	Aquaculture facility	No (CITES label/code missing)	Information not provided	C 96%	No CITES code	No clear results	STE	STE	**Unlabelled caviar**

UKRAINE

Sample code	Type of sample	Date of acquisition	Location of acquisition		Caviar correctly labelled? *	SOURCE (W: wild-caught, C: captive-bred)		COUNTRY OF ORIGIN (caviar - according to CITES code)		SPECIES OR HYBRID		CONCLUSION REGARDING LEGALITY
						Declared source	*Conformity*	*Declared origin*	*Conformity*	*Declared species*	*Conformity*	
UA_1_1	Caviar	8/12/2016	Kiev	Intermediary	No CITES label	W	C >99%	-	-	GUE (orally)	GUE	
UA_3_1	Caviar	9/10/2017	Odessa	Restaurant	Yes	C	C 97%	Ukraine		BAE acc code, GUE acc label	BAE or GUE	
UA_5_1	Meat	13/12/2017	Vylkove	Intermediary	N/A	W	W >99%	-	-	RUT	RUT or HUS x STE	Poached
UA_8_1	Caviar	14/12/2017	Odessa	Market	No CITES label	W	C 86%	-	-	HUS	No result	
UA_8_2	Meat	14/12/2017	Odessa	Market	N/A	W	W >99%	-	-	GUE	GUE	Poached
UA_8_3	Meat	14/12/2017	Odessa	Market	N/A	W	W >99%	-	-	GUE	GUE	Poached
UA_9_1	Caviar	14/12/2017	Odessa	Shop	No CITES label	W	C >99%	-	-	HUS (orally)	HUS	
UA_10_1	Meat	14/12/2017	Odessa	Shop	N/A	Information not provided	C >98%	-	-	GUE	GUE	
UA_12_1	Caviar	14/12/2017	Odessa	Restaurant	Yes	C	C 95%	Ukraine		RUT	RUT	
UA_12_2	Meat	14/12/2017	Odessa	Restaurant	N/A	W	C >94%	-	-	HUS	HUS	
UA_13_1	Meat	15/12/2017	Kherson	Market	N/A	W	W >99%	-	-	GUE	GUE	Poached
UA_16_1	Caviar	15/12/2017	Kherson	Shop	No CITES label	W	C 98%	-	-	GUE	GUE	
UA_19_1	Caviar	21/12/2017	Lviv	Market	No CITES label	C	C 96%	-	-	GUE (orally)	BAE or GUE	
UA_19_2	Meat	21/12/2017	Lviv	Market	N/A	C	C 97%	-	-	GUE	BAE or GUE	
UA_21_1	Caviar	21/12/2017	Lviv	Shop	No CITES label	C	C >99%	-	-	GUE	BAE or GUE	
UA_22_1	Caviar	21/12/2017	Lviv	Shop	Yes	C	W 64%	Germany	No clear result	BAExNAC	NAC or xNAC	
UA_29_1	Caviar	22/12/2017	Kiev	Intermediary	No label at all	C	W >99%	-	-	Paddlefish (acc. seller)	SPA	Non-native sturgeon species feeding on natural food only - has "wild" isotope ratio when farmed
UA_29_2	Caviar	22/12/2017	Kiev	Intermediary	No CITES label	W	W >99%	-	-	GUE (orally)	BAE or GUE	Poached
UA_31_1	Caviar	11/1/2018	Kiev	Restaurant	Yes	C	C 94%	Ukraine	No clear result	RUT acc code, Osetr acc label	RUT	
UA_32_1	Caviar	15/1/2018	Kiev	Restaurant	Yes	C	C 97%	Germany	No clear result	BAE	BAE or GUE	
UA_34_1	Caviar	2/6/2018	Kiev	Restaurant	Yes	C	C 98%	Ukraine	No clear result	RUT	RUT	
UA_34_2	Meat	2/6/2018	Kiev	Restaurant	N/A	W	C 98%	-	-	GUE	BAE or GUE	

UKRAINE

Sample code	Type of sample	Date of acquisition	Location of acquisition		Caviar correctly labelled?	SOURCE (W: wild-caught, C: captive-bred)		COUNTRY OF ORIGIN (caviar - according to CITES code)		SPECIES OR HYBRID		CONCLUSION REGARDING LEGALITY
						Declared source	*Conformity*	*Declared origin*	*Conformity*	*Declared species*	*Conformity*	
UA_36_1	Caviar	2/7/2018	Kiev	Market	No label at all	W	C 87%	-	-	STE (orally)	RUT	
UA_40_1	Meat	2/7/2018	Kiev	Market	N/A	W	W >99%	-	-	HUS	HUS	Poached
UA_42_1	Caviar	10/2/2018	Kiev	Shop	Yes	C	C 98%	Ukraine		RUT	RUT	
UA_46_1	Caviar	10/2/2018	Dnipro	Shop	No CITES label	C	C >93%	-	-	RUT	Fake, with SCHxDAU DNA	
UA_48_1	Caviar	17/5/2018	Dnipro	Shop	No CITES label	W	C >99%	-	-	GUE	SCHxDAU	
UA_49_1	Meat	17/5/2018	Dnipro	Shop	N/A	W	C >99%	-	-	GUE	HUS	
UA_53_1	Caviar	17/5/2018		Online	No CITES label	W	C >90%	-	-	HUS	SCHxDAU	
UA_57_1	Caviar	20/5/2018	Kharkiv	Market	No CITES label	W	C >99%	-	-	GUE	SCHxDAU	
UA_57_2	Meat	20/5/2018	Kharkiv	Market	N/A	W	C >99%	-	-	GUE	GUE	
UA_59_1	Caviar	20/5/2018	Kharkiv	Shop	Yes	C	C 99%	Ukraine		RUT	RUT	
UA_60_1	Meat	20/5/2018	Kharkiv	Restaurant	N/A	C	C 90%	-	-	RUT	BAE or GUE	
UA_82_1	Meat	23/2/2020	Kyiv	Restaurant	N/A	W	C 98%	-	-	HUS	BAE or GUE	
UA_84_1	Caviar	26/2/2020	Kyiv	Restaurant	Yes	C	C 82%	Ukraine	-	RUT	RUT	
UA_85_1	Meat	6/3/2020	Kyiv	Restaurant	N/A	C	C 82%	-	-	GUE	BAE or GUE	
UA_85_2	Caviar	6/3/2020	Kyiv	Restaurant	Yes	C	C 97%	Ukraine	-	HUSxRUT	HUSxRUT	
UA_86_1	Meat	13/3/2020	Kyiv	Market	N/A	W	C >98%	-	-	GUE	GUE	
UA_86_2	Caviar	13/3/2020	Kyiv	Market	No CITES label	W	C >98%	-	-	GUE	HUS	
UA_87_1	Caviar	17/4/2020	-	Online	No CITES label	W	C >98%	-	-	GUE	SCHxDAU	
UA_87_2	Caviar	17/4/2020	-	Online	No CITES label	W	C >98%	-	-	HUS	DAU	
UA_88_1	Caviar	1/5/2020	-	Online	No CITES label	W	W 76%	-	-	HUS	RUT and BAE mixed	Likely poached
UA_89_1	Meat	22/6/2020	-	Online	N/A	C	C >98%	-	-	GUE	GUE	
UA_89_2	Caviar	22/6/2020	-	Online	No CITES label	C	C >98%	-	-	HUS	No result	Artificial product sold as caviar
UA_90_1	Meat	7/7/2020	Vylkove	Restaurant	N/A	C	C >98%	-	-	GUE	GUE	

* CITES caviar labelling on the domestic market not legally required in Ukraine

© Andrey Nekrasov

Working to sustain the natural world for the benefit of people and wildlife.

together possible™ panda.org

For contact details and further information, please visit our international website at **www.panda.org**