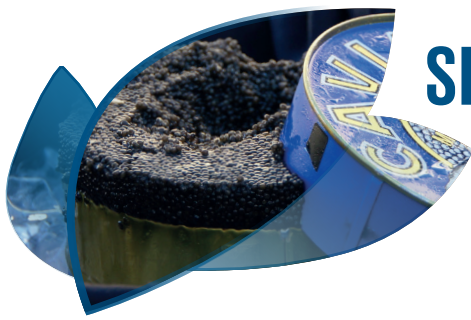


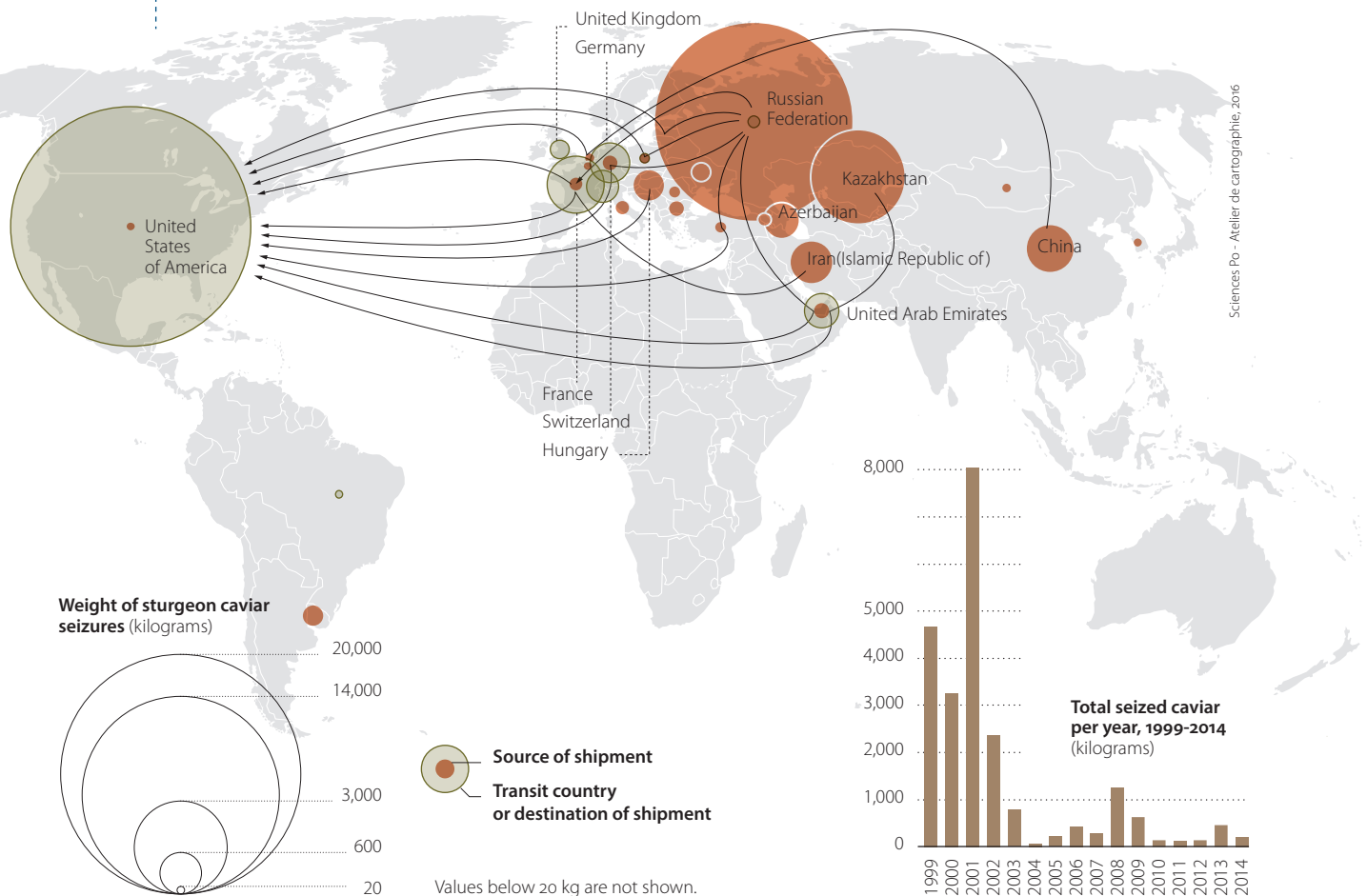


SEAFOOD

CASE STUDY: CAVIAR

THE SEAFOOD INDUSTRY

Map 1 Main flows of sturgeon caviar seizures (kg), 1999-2014



Source: World WISE

Note: The boundaries shown on this map do not imply official endorsement or acceptance by the United Nations. Dashed lines represent undetermined boundaries. The dotted line represents approximately the Line of Control in Jammu and Kashmir agreed upon by India and Pakistan. The final status of Jammu and Kashmir has not yet been agreed upon by the parties. A dispute exists between the Governments of Argentina and the United Kingdom of Great Britain and Northern Ireland concerning sovereignty over the Falkland Islands (Malvinas). The final boundary between the Republic of the Sudan and the Republic of South Sudan has not yet been determined.

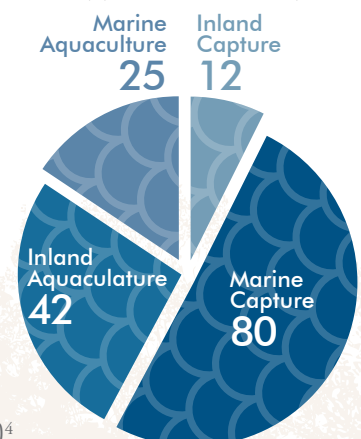
In common parlance, the word “wild-life” does not include fish, but this terrestrial bias has little rational basis. Marine species are born and live out their lives in an environment affected, but not controlled, by mankind. Their harvest makes use of a resource that is renewable, but only if not overexploited. And many marine species inhabit a global commons – the high seas – making their sustainable use an inherently international issue.

Aquaculture has grown rapidly, drawing heavily on wild fish for feed. As of 2012, however, most (57%) of the world’s fish supply came from

the wild (Fig. 1). This resource is of immense importance to humanity, as a source of both food and livelihoods. FAO estimates that 17% of the animal protein consumed by people globally comes from fish.¹ The global fishing industry generates more than 220 million jobs,² and direct employment in fishing has nearly doubled in recent years, from some 31 million fishermen in 1990 to 58 million in 2012.³

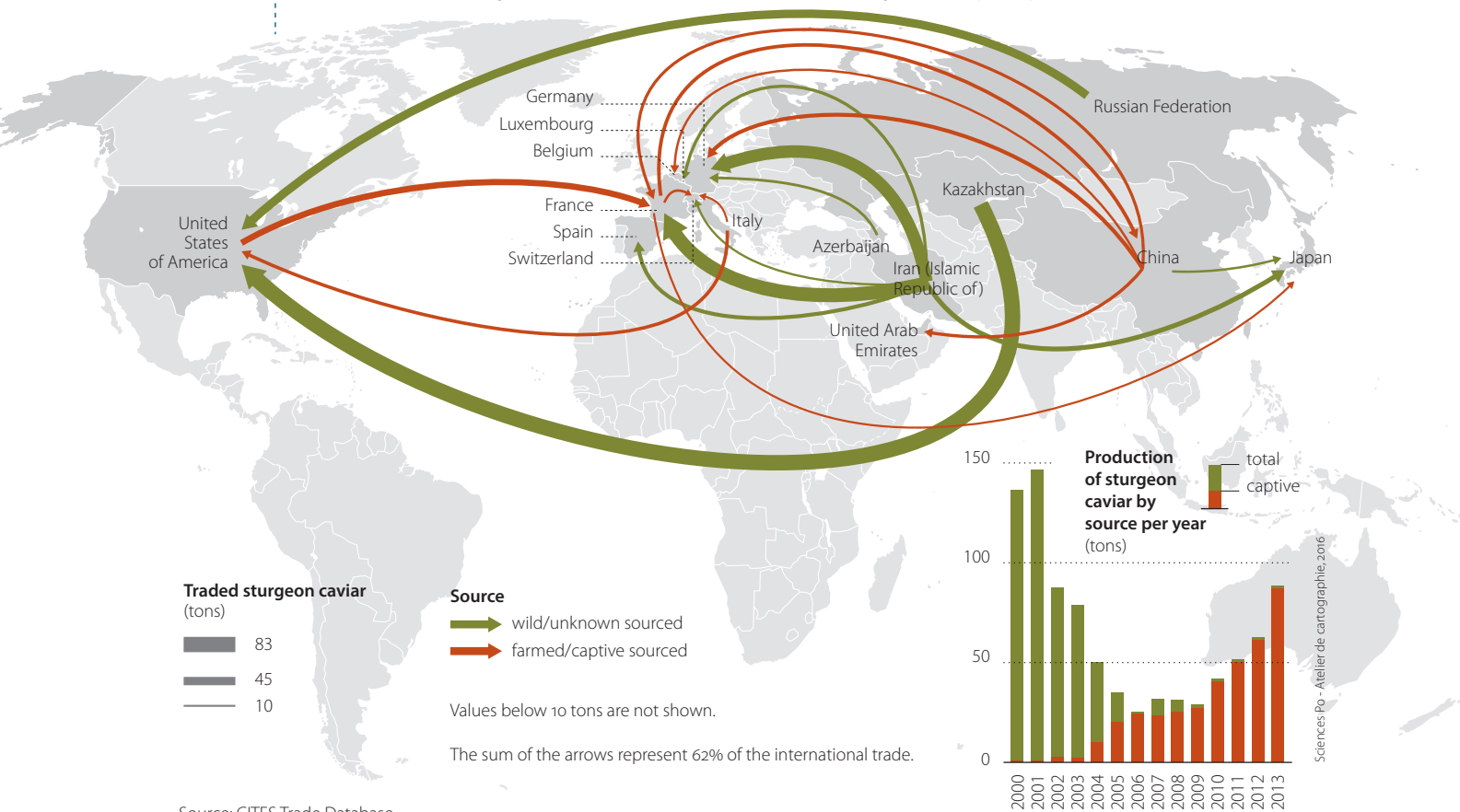
Fish are widely traded internationally, with most regions both importing and exporting large quantities of fish. For example, between 2008 and 2010,

Fig. 1 Global fish production by source (aquaculture, capture, inland, marine)(millions of tons), 2012



Source: FAO⁴

Map 2 Main flows of Sturgeon caviar trade based on CITES permits (tons), 2000-2013



Source: CITES Trade Database

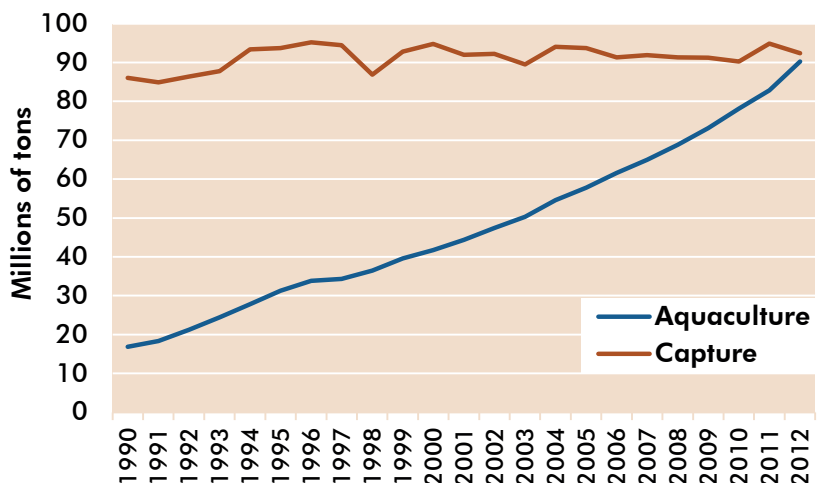
Note: The boundaries shown on this map do not imply official endorsement or acceptance by the United Nations. Dashed lines represent undetermined boundaries. The dotted line represents approximately the Line of Control in Jammu and Kashmir agreed upon by India and Pakistan. The final status of Jammu and Kashmir has not yet been agreed upon by the parties. A dispute exists between the Governments of Argentina and the United Kingdom of Great Britain and Northern Ireland concerning sovereignty over the Falkland Islands (Malvinas). The final boundary between the Republic of the Sudan and the Republic of South Sudan has not yet been determined.

Europe exported an average of US\$6 billion worth of fish per year to Asia, while Asia exported US\$8 billion worth of fish to Europe.⁵ The world's leading fishing firms are multinational conglomerates – often catching fish in one region, processing it in another, and selling it in a third – but small-scale fishing remains important in many parts of the world.

Both consumption and trade have grown rapidly. People eat twice as much fish per capita today as they did in the 1960s.⁶ In 2012, the world's supply of fish as food was over 19 kilograms per capita. In 1962, some 43 million tons of fish were consumed; by 2012, it was 158 million.⁷ In 1976, the world fish trade was worth US\$8 billion per annum. By 2012, it was worth \$129 billion.⁸

Developing countries are especially dependent on fish as a resource. In some, fish provide more than half

Fig. 2 Volume of fish production by aquaculture and capture fisheries (millions of tons), 1990-2012



Source: FAO FIGIS⁹

of all animal protein consumed.¹⁰ Exports of fish from developing countries grew from around US\$9 billion in 1989 to more than US\$35 billion in 2012, more than any other agricultural commodity.¹¹ Income

can also be gained by selling fishing rights to countries better placed to exploit this resource, and these revenues can provide a significant share of government funding. For example, both Mauritania and Guinea-Bissau

What does “fully exploited” mean?

It is often reported that a large share of fish stocks globally are “fully exploited or over-exploited”, but, in fact, only 29% of stocks were deemed overfished in 2011, less than in 2008.¹² “Fully exploited” actually means “optimally utilized”, and the goal is to bring 100% of the world’s fish stocks to this level of sustainable use. Under Article 62 of the Convention on the Law of the Sea, Member States are required to fully make use of their fish stocks, or provide others with the opportunity to do so.

*The coastal State shall determine its capacity to harvest the living resources of the exclusive economic zone. Where the coastal State does not have the capacity to harvest the entire allowable catch, it shall ... give other States access to the surplus of the allowable catch ...*¹³

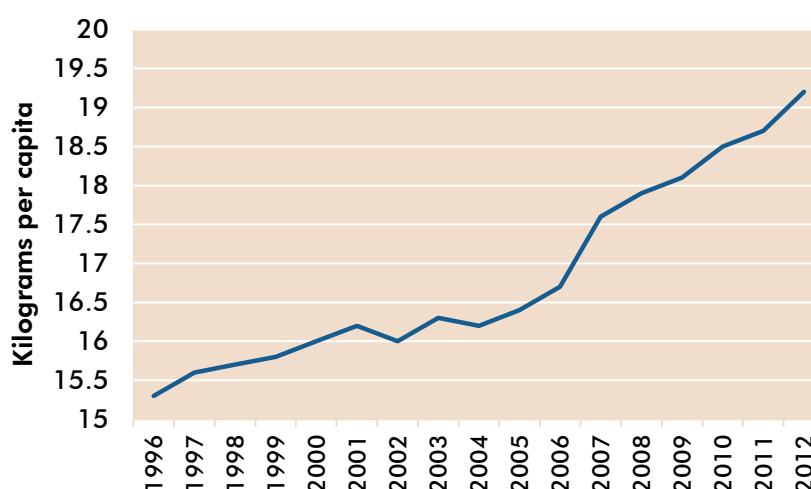
Illegal, unreported and unregulated fishing (IUU fishing) confounds this objective, because if regulated offtake achieves maximum sustainable yield, all unregulated taking will, by definition, lead to overexploitation. Overexploitation, often involving illegal fishing, has led to fisheries collapse on many occasions.¹⁴ Illegal offtake needs to be assessed when calculating how much fish can be harvested sustainably.

The technical challenge of establishing the allowable catch is another matter. Developing countries may lack the tools and resources to accurately make population assessments. While states that agreed to the 1982 Fish Stocks agreement are urged to be cautious,¹⁵ commercial pressures may override environmental concerns where clear data are lacking.

are reported to derive more than 40% of their national revenues from the sale of fishing rights to the EU.¹⁶

Given the volume and complexity of this trade, it is not surprising that

Fig. 3 Global per capita production of fish to be used as food (kg), 1996-2012



Source: FAO¹⁷

illegal fish are introduced into the supply chain. In a resolution adopted in November 2012, the UN General Assembly expressed its concern:

*... that some operators increasingly take advantage of the globalization of fishery markets to trade fishery products stemming from illegal, unreported and unregulated fishing and make economic profits from those operations, which constitutes an incentive for them to pursue their activities.*¹⁸

Understanding this terminology – “illegal, unreported and unregulated fishing”, often referred to as “IUU fishing” – is key to understanding fisheries crime. The term has no standard definition, but the most widely accepted one is very broad, encompassing all activities that fall outside the mechanisms established for international regulation of fishing.¹⁹ Criminal intent is not required.

For IUU fishing to be regarded as a criminal offence, it needs to be defined as such in the relevant national legislation. CITES implementation laws, which sometimes have criminal provisions, apply to specimens introduced from the high seas, as well as those traded internationally. Although the number of marine species covered under CITES was expanded in 2013,²⁰ relatively few fish species are CITES listed. Most of the marine species listed by

CITES are not finned fish, and most of the fish species listed are not part of large-scale commercial fisheries.²¹ The listing of most sturgeon species is exceptional in this regard.

As a result, this report does not touch on what is likely the largest component of illegal fishing: the unauthorized taking of commercial seafood from national waters by international vessels. While some of these vessels target specific species, their catch is generally destined for general consumption. The case study that follows, in contrast, focuses on caviar, a luxury product that has increased in value as the wild population has collapsed.

Case Study: Caspian sturgeon caviar

Caviar is made from the unfertilized eggs of the *Acipenseridae* family (sturgeon and paddlefish), a group of scale-less fish that have been around since the early Jurassic. They are diadromous, like salmon, meaning they live most of their lives in salt water but are born in freshwater, and return there to reproduce. They are one of the largest fish appearing in fresh water, capable of growing to over one metric ton during their lifetimes, which can exceed a century. There are 28 sturgeon and paddlefish species in the world, the bulk of which are

Marine turtles

Marine turtles are highly migratory and are found all over the world.²² Some species can take up to 35 years to reach sexual maturity²³ and their survival rate to adulthood is quite low (about one egg out of 1,000).²⁴ One study of hawksbill turtles found that an adult female requires at least nine years of reproduction to replace itself.²⁵ These characteristics render them vulnerable to overexploitation.

All seven species are listed on CITES Appendix I, so commercial international trade of wild sourced marine turtles is not permitted. Domestic trade is permitted in some countries, however, particularly the harvesting and sale of eggs.

Prior to the international trade ban, Europe, Japan, and the United States were the primary markets for marine turtle products. Japan alone imported the equivalent of about 30,000 hawksbill turtles annually during the 1970s and 1980s.²⁶

While the eggs and meat are consumed as food, the illegal international trade primarily consists of ornamental objects, including whole stuffed turtles, whole polished shells, and products made from the shell.²⁷ Poaching appears to be most problematic in the “Coral Triangle”, particularly waters around Indonesia, Malaysia and the Philippines.²⁸ One hot spot for poaching appears to be the Derawan Archipelago of East Kalimantan, Indonesia. More recent seizures have

been made in the South China Sea and Sulu Sea.²⁹ Multiple seizures have involved Chinese and Vietnamese nationals.³⁰ WorldWise records the seizure of approximately 3,600 turtles and 31,500 eggs between 2005 and 2014, including domestic seizures.³¹

In addition to being slow to reproduce, marine turtles are not worth much on an individual basis. Eggs typically sell for around US\$1.50 apiece and the value of a whole turtle shell averages between US\$400 and US\$600.³² As a result, the prospects for commercial farming are not good and wild turtles are likely to be poached so long as a retail market for turtle products exists.

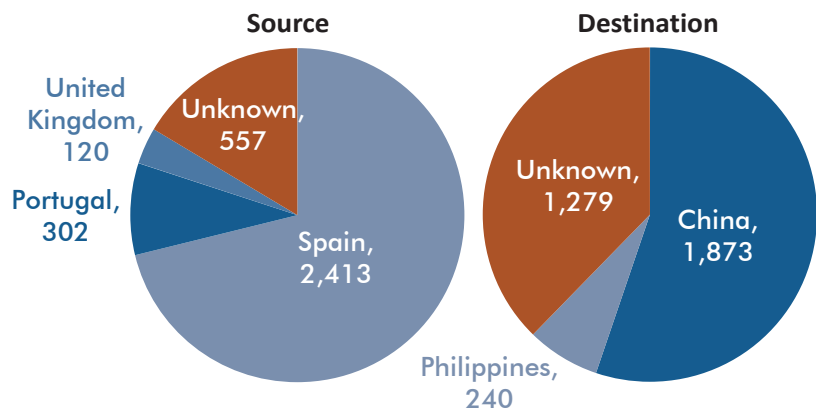


Glass eels

Eels are widely consumed as a food in Asia, particularly China and Japan. Breeding eels has proven problematic, so nearly all the global eel supply comes from wild sourcing. Most eels are captured during seasonal mass migrations as juveniles, before they acquire pigmentation. These “glass eels” are then grown to adult size at farms in Asia, particularly China.³³

Japanese eels³⁴ were traditionally consumed, but when populations began to dwindle, European eel³⁵ imports increased. Today, Japanese eel is considered endangered and European eel critically endangered, according to the IUCN. In 2009, the listing of the European eel on CITES Appendix II came into effect, and in December 2010, the EU imposed even stricter measures, banning exports from the Union.³⁶ As a result, demand for American eel³⁷ and Philippine mottled eel,³⁸ began to rise, and large illicit shipments of European eel began to be regularly detected. According to World WISE, at least 3.4 metric tons of glass eel were seized between 2011 and 2015, accounting for millions of individuals and worth as much as US\$7 million in destination markets.³⁹

Share of glass eel seizures by country identified as source and destination (kilograms), 2011-2015



Source: World WISE and other sources⁴⁰

Smuggling of glass eels from Europe involves direct movement from the main European Union source countries (France, Spain, and Portugal and the United Kingdom) to East Asia, primarily though air freight, often mislabeled as other fish products. The value of the glass eels — up to US\$2000 per kilogram in destination markets — is such that air couriership has been detected.⁴¹ Some detected shipments have transited Eastern European countries (including Albania, Bulgaria, Greece, Hungary, and the Former Yugoslav Republic of Macedonia), as well as Morocco and the Russian Federation.⁴²

The Spanish Civil Guard has carried out several operations against eel trafficking, revealing cooperation between Iberian and Eastern European smugglers, making use of fraudulent documentation.⁴³ In 2011, working with the Bulgarian authorities, 14 people were arrested and 1.5 metric tons of eels were seized.⁴⁴ In 2014, authorities arrested 13 people seizing hundreds of kilograms of glass eels.⁴⁵ In 2016, more than 600 kilograms of glass eels were seized at international airports on at least 12 different occasions. Of these, 340 kilograms were seized by Chinese authorities in Hong Kong, China,⁴⁶ and 250 kilograms were seized in Spain.⁴⁷

found in three broad areas,⁴⁸ all in the Northern Hemisphere:

- North America
- The Danube Basin
- The Caspian Sea and its tributaries

In the 19th Century, there was a period of time when most of the world's caviar came from the United States, but overexploitation led to the collapse of stocks.⁴⁹ There was a brief revival of this sturgeon and paddlefish harvesting in the 1980s, largely for the domestic market, as trade embargos cut off the traditional sources of supply.⁵⁰ The drastic decline of populations during this time led to strict controls, and although occasional poachers are detected, the United States is not an international source of wild caviar today.⁵¹

The Danube Basin is home to a number of sturgeon species prized for their caviar, including the famed beluga. Recent research has documented irregularities in the caviar markets of the region, although the extent of this activity is unclear.⁵² The research does not exist to give a good estimate of the number of sturgeon in the Danube Basin, but it is generally regarded as much smaller than that of the Caspian. Due to these small numbers, illegal exploitation may have a severe conservation impact,

but is unlikely to be a major source of criminal revenues.

As a result, this chapter focuses on what historically has been regarded as the source of the world's greatest caviars: the Caspian. Essentially a salt water lake, cut off from the oceans long ago, the Caspian provided a refuge in which the massive sturgeon could proliferate to great numbers. The countries bordering the Caspian Sea have long pursued the sturgeon for its roe, and, for most of this time, the resource seemed inexhaustible. At the turn of the 20th Century, close to 30,000 tons of sturgeon were harvested annually, and older accounts suggest even greater volumes. In the following decades, harvests have fluctuated, peaking again at close to 30,000 tons in the late 1970s and early 1980s, when over 90% of global landings were made in the Caspian.⁵³ The Caspian is home to the three most famed varieties of caviar:

- beluga (from *Huso huso*)
- osetra (from *Acipenser gueldenstaedtii* and *Acipenser persicus*) and,
- sevruga (from *Acipenser stellatus*)

Of these, the beluga sturgeon is largest, rarest, and most prized. Top grade beluga sturgeon caviar can retail for upwards of US\$10,000 per kilogram,⁵⁴ and about 10% of the weight of a mature female sturgeon can be

roe.⁵⁵ On a per animal basis, sturgeon is worth more than any terrestrial animal besides perhaps rhino. It is not surprising, then, that poaching has long been a feature of the global caviar market.

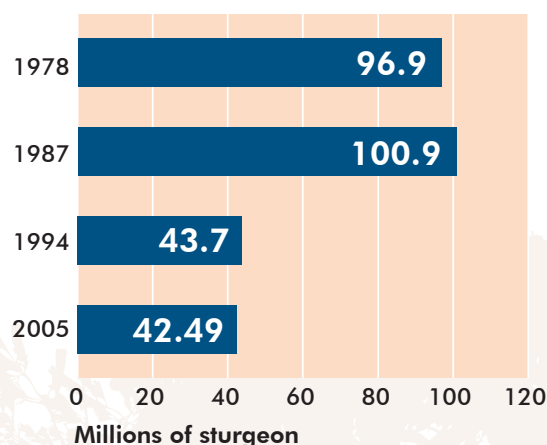
Supply

The current status of the Caspian sturgeon is uncertain. There have been no recent international population surveys. According to official estimates, the Caspian saw its population halved in the late 1980s and early 1990s.⁵⁶ Since that time, population declines have been reflected in decreasing catch volumes. In 1980, some 30,000 tons of Caspian sturgeon were landed, but reported catches have plummeted since that time.

In 1998, all species of sturgeon not previously listed were included in CITES Appendix II, and in 2000, export quotas were implemented.⁵⁷ This protection covers both sturgeon meat and caviar, which comprise distinct markets. The quota for exports of wild caught sturgeon declined until it became zero in 2011. During most of these years, exporters were not even able to meet their quotas, reflecting the scarcity of the species.

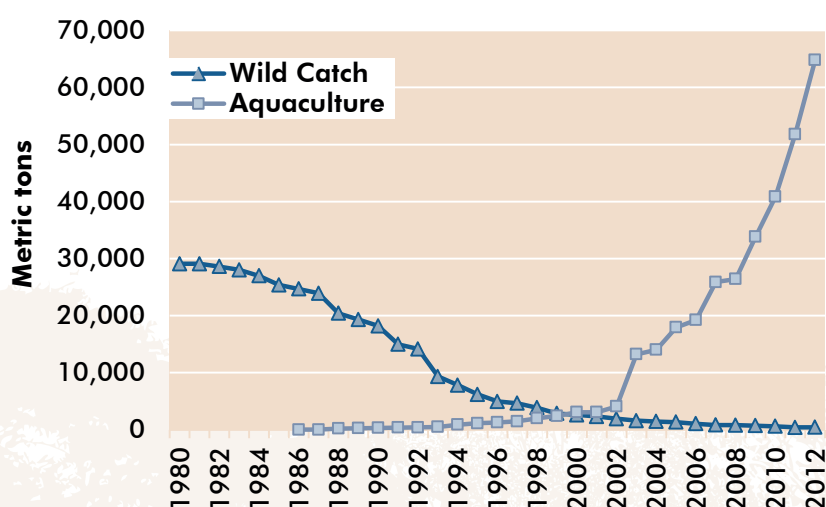
Poaching is just one of many reasons the stocks are declining, but it may be a pivotal one. The progressive

Fig. 4 Estimated Caspian Sea sturgeon population (millions), selected years



Source: Khodorevskaya, Ruban and Pavlov, 2009⁵⁸

Fig. 5 Global sturgeon meat production by source (wild catch and aquaculture) (metric tons), 1980-2012



Source: FAO

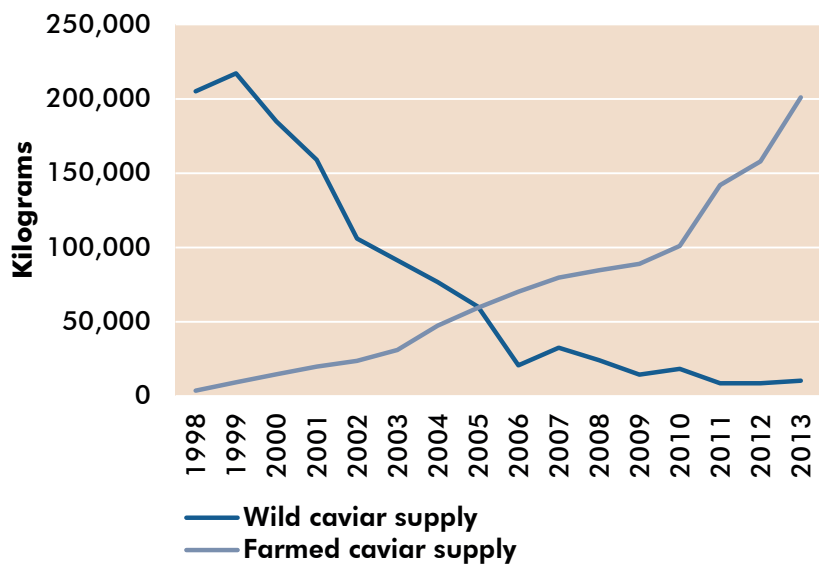
obstruction of the fresh waterways feeding the Caspian has deprived the sturgeon of their spawning areas, and so the population today is dependent on restocking. Restocking efforts continue, but since they are often financed from revenues generated by the catch, they appear to be spiralling downward. The reduction in the share of breeding females in the population has led experts to proffer a pessimistic prognosis for Caspian sturgeon populations.⁵⁹ In 2010, the IUCN declared sturgeon to be more critically endangered than any other group of species.⁶⁰

This progressive decline in the wild sturgeon catch prompted widespread aquaculture projects, aimed at producing both sturgeon meat and caviar, which became productive in the early 2000s. By 2012, aquaculture production was more than 60,000 tons of sturgeon meat, double what the catch had been in 1980. But while almost all the wild catch in the 1980s came from the Caspian Sea, exported by the former Soviet Union and the Islamic Republic of Iran, China produces most of the world's sturgeon today.

Caviar production is different from sturgeon production. Most sturgeon harvested for their meat are taken when they weigh about one kilogram, long before they are capable of producing roe. The premium varieties of caviar come from fish such as the beluga, which can take well over a decade to reach sexual maturity, so while farmed sturgeon production quickly surpassed the wild catch, it has taken more time for farmed caviar to fill the market gap. Exports of wild caught caviar declined from over 500 tons in the early 1980s to virtually nothing as CITES controls were implemented. This decline in availability caused a sharp rise in prices in the early 2000s, and a corresponding rise in trafficking.

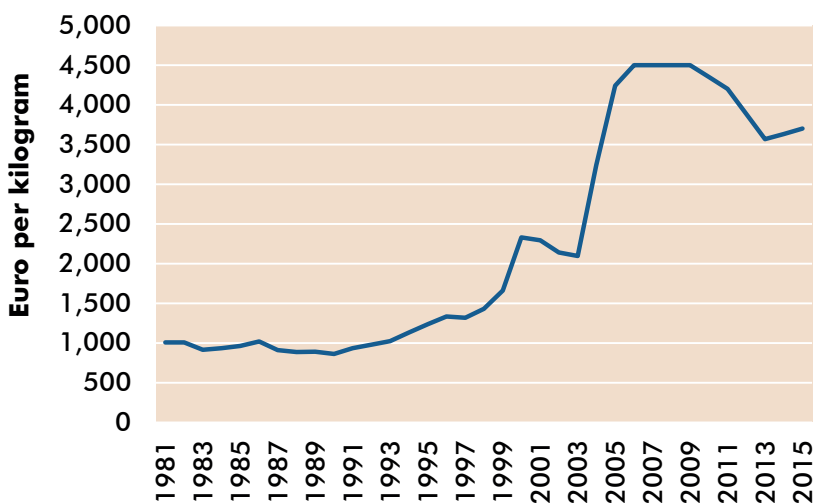
Most farmed caviar production today comes from the Siberian Sturgeon (*Acipenser baerii*), which can mature in three to four years under the optimal conditions found in a sturgeon

Fig. 6 Exports of wild-sourced caviar and aquaculture caviar production (kilograms), 1998-2013



Source: CITES Trade database, UNODC Research⁶¹

Fig. 7 Average retail price of osetra caviar in selected countries (euro/kg, current price), 1981-2015



Source: Petrossian, A. 2006, and Jones, A. 2015⁶²

farm, with each fish reaching about eight kilograms and producing just under a kilogram of caviar apiece. The most commonly farmed sturgeon producing a premium caviar is Russian Sturgeon (*Acipenser gueldenstaedtii*), sourced of the famed osetra. Aquaculture production of all species combined reached 240 tons in 2014, which, if it were all exported, would restore the global caviar supply to levels last experienced in the late 1990s.⁶³ It appears that the price of caviar is already responding to this growing availability, and seizures of

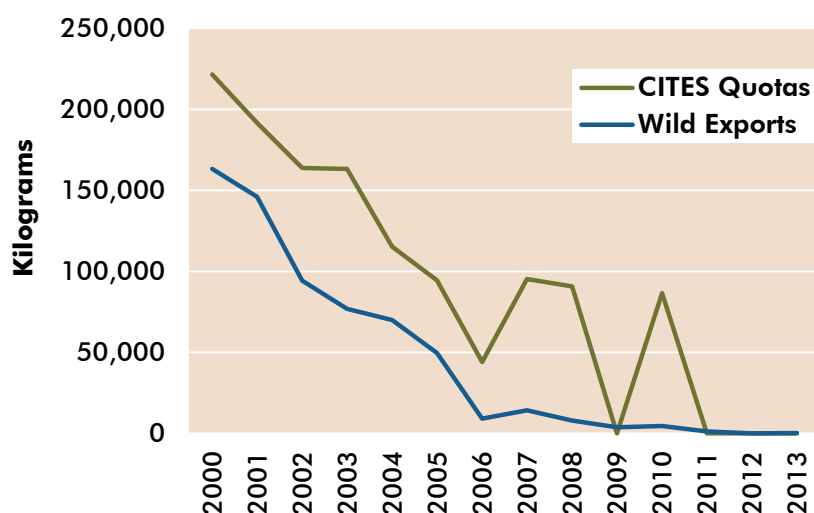
contraband have also declined precipitously.

Although current estimates of the global sturgeon population are not available, it is likely the wild biomass today is considerably less than that of the farmed population, estimated to be on the order of 300,000 tons.⁶⁴ Thus, there are likely more sturgeon in captivity than in the wild today.

Legal trade

As noted above, the legal international trade in caviar has been transformed in the last two decades, from one

Fig. 8 CITES Caspian caviar export quotas and CITES-listed exports of wild caviar (kilograms), 2000-2013



Source: CITES Trade Database

that was almost entirely sourced from the Caspian Sea catch to one that is almost entirely supplied by aquaculture. This transition led to a period when the legal caviar supply was much less than demand, presenting an opportunity for organized crime. In addition, four of the five Caspian Sea states were parts of the Soviet Union, where caviar had been a state monopoly. Organized crime developed in the interval between the collapse of the old regime in the late 1980s and the development of new regulatory systems to replace it.⁶⁵

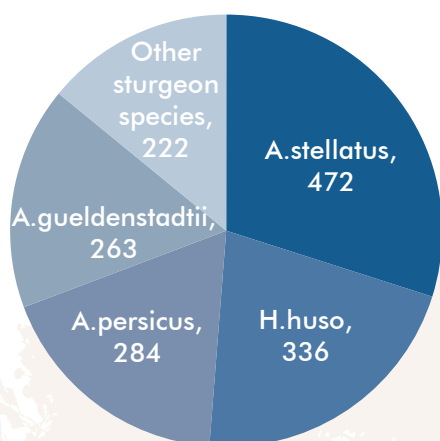
These dynamics are reflected in the price statistics. Despite the decline in the official production of wild-sourced caviar from over 600 tons in the mid-1980s to about 200 tons in 2000, the price of osetra remained fairly stable. This is precisely the time when the black market for caviar was at its height. The sharp spike in prices between 2002 and 2006 suggests a supply squeeze during this period, and the persistence of these high prices likely reflects continued scarcity relative to the 1980s. Prices began to fall as farmed production came on

line in the mid-2000s, but are likely to remain higher than they were in the days when catches were plentiful.

From 1998 to 2013, CITES export permits show that the leading wild caviar exporting nations were the Islamic Republic of Iran, the Russian Federation, and Kazakhstan, all Caspian states, followed by the United States. Based on the trade statistics presented to CITES between 1998 and 2013, 80% of the wild sourced caviar exported during that period came from the three best known Caspian grades: beluga (from *Huso huso*) osetra (from *Acipenser gueldenstaedtii* and *Acipenser persicus*) and sevruga (from *Acipenser stellatus*).

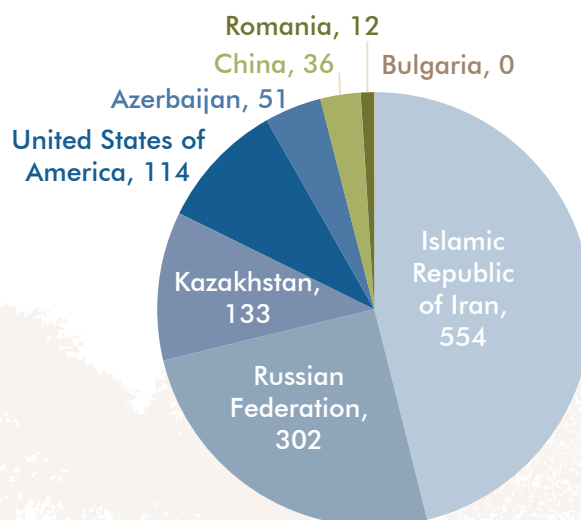
The CITES permits issued between 1998 and 2013 show the leading importers of wild sourced caviar to be the European Union, the United States, and Switzerland. Within the EU, France and Germany are the largest importers. Besides their role as consumers, France, Germany, and Switzerland are also important 'transit' points for caviar, re-exporting over half of the caviar they import. Some source countries, such as the US and the Russian Federation, consume a good share of the caviar they produce.⁶⁶

Fig. 9 Share of CITES-listed legal wild sourced imports of caviar by species (metric tons), aggregated 1998-2013



Source: CITES Trade Database

Fig. 10 Share of CITES-listed legal wild sourced imports of caviar by source country (metric tons), aggregated 1998-2013



Source: CITES Trade Database

Illegal trade

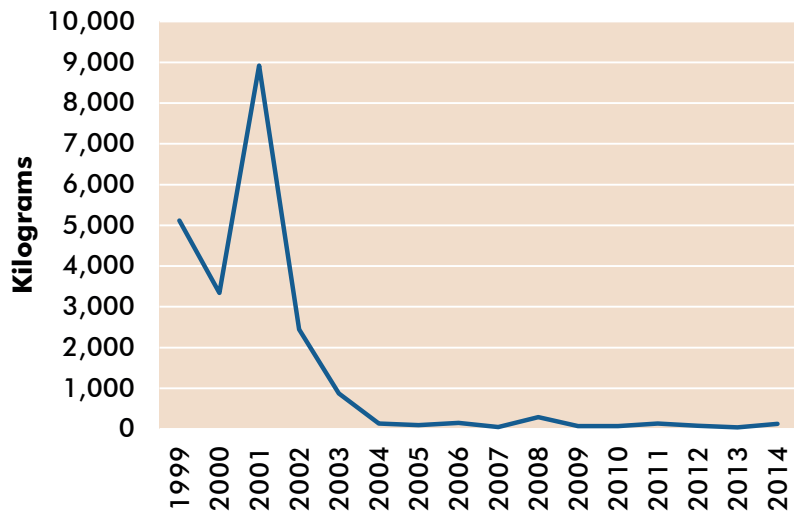
Perhaps not surprisingly, what is known about the illicit market in caviar closely parallels the licit market. As a delicate fresh food product, there does not appear to be a big international underground market for caviar today. Those willing to spend hundreds of dollars on a few ounces of roe want the prestige and quality guarantee associated with a brand name and a trusted retail outlet.

After a few notable prosecutions of major importers,⁶⁷ it appears few major labels are packaging or retailing illegally sourced caviar. CITES packaging standards have also proven effective, and have made an important contribution to improving the traceability of caviar in trade and facilitating enforcement of CITES provisions.⁶⁸ Forensic testing of caviar samples in the US show a decline in mislabeled caviar from 19% in 1995-1996 (before the CITES listing) to 10% in 2006-2008 (after international controls were in place). In the latter period, all of the fraudulent caviar was found on-line – none of the samples from retail outlets were mislabeled.⁶⁹ This level of compliance compares very favorably to forensic studies of other seafood products.⁷⁰

Tracking this trend in the seizure data requires a broad time frame, stretching back to the late 1990s. Fortunately, World WISE incorporates data from the United States, which at the time was the leading legal market for caviar exports, extending back this far. In 2001, nearly nine metric tons of caviar were seized in the United States, including 16 seizures of over 100 kilograms. In 2013, less than 40 kg was seized, with the largest seizure being 16 kg. In addition, while large volumes of face cream allegedly containing caviar extract and lacking CITES permits have been seized, there have been very few notable seizures of caviar made in Europe in recent years.

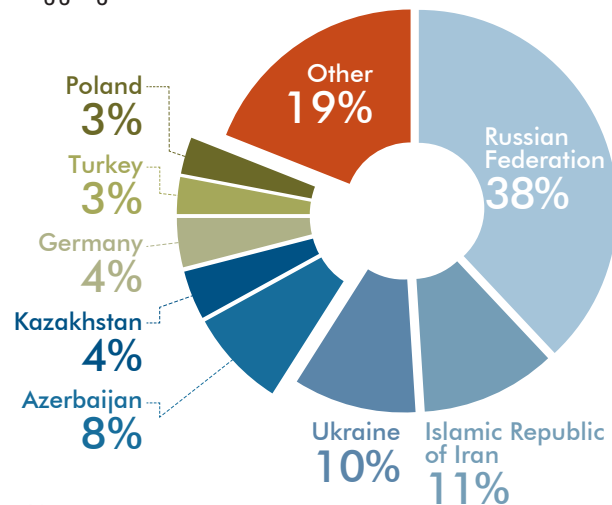
According to World WISE, the Caspian states, particularly the Russian

Fig. 11 Seizures of caviar in the United States (kilograms), 1999-2014



Source: US Fish and Wildlife, LEMIS data

Fig. 12 Share of caviar seizures by country identified as source, aggregated 1999-2014



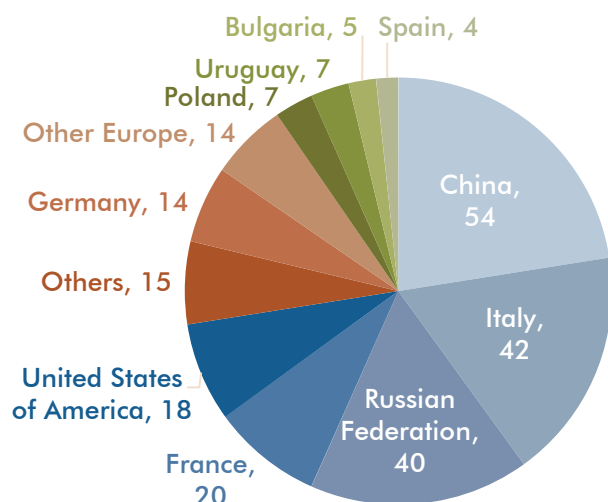
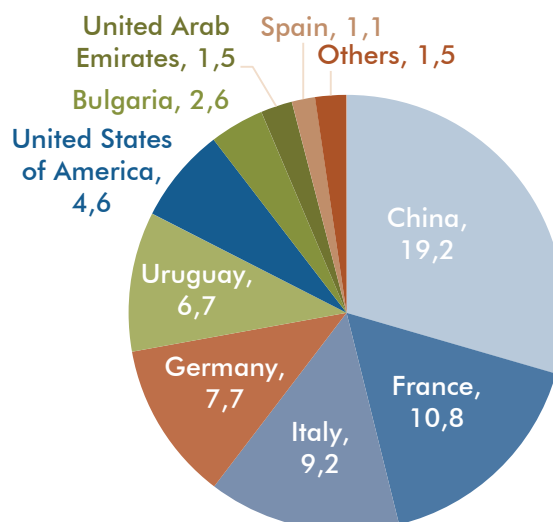
Source: World WISE

Federation, were the origin of most of the caviar seized during this broad time period, although some seizures indicated a Ukrainian origin. The provenance, or immediate source of the shipment, was also most frequently the Caspian source countries, but Ukraine, Germany, Turkey, and Poland were often within the trafficking routes. While there have been a few large seizures of caviar sent through the post, most recent seizures involved small quantities of commercially packaged caviar taken at airports.

It is possible, of course, that international caviar traffickers have

responded to interdiction with increasingly sophisticated smuggling techniques, and that these methods have been successful in evading controls to the present day, though no evidence for this has been found. Another possible explanation is:

- wild-sourced Caspian sturgeon became so scarce that even criminals had a hard time getting hold of it;
- what they were able to find was distributed locally; and,
- the international illicit market was subsequently displaced by the growth of farmed sturgeon.

Fig. 13 Global farmed caviar production by country (metric tons), 2014Source: Survey of caviar producers⁷¹**Fig. 14** Share of CITES-listed legal farmed caviar exports by country of export (metric tons), 2012

Source: CITES Trade Database

It also remains possible that wild-sourced caviar is being passed off as a farmed product. This “laundering” would be best detected by looking for anomalies in the legal trade, such as exports of large quantities of farmed caviar from countries without the capacity to produce this volume.

Based on a survey of registered producers,⁷² some 240 metric tons of farmed caviar was produced in 2014, up from just over 200 metric tons the year before. China leads the world in farmed caviar production, with 54 metric tons of sales in 2014, followed by Italy and the Russian Federation. After accounting for domestic consumption, it might be expected that these three countries would lead the world in farmed caviar exports.

Recorded exports of farmed caviar account for about half estimated production in 2012 (65 out of 158 tons that year). All countries reporting large exports of farmed caviar have documented caviar farming capacity, although some clearly re-export caviar farmed in other countries. The Russian Federation and the Islamic Republic of Iran, formerly the two largest exporters of caviar, are not on the list of key exporters.

Analysis

The caviar story illustrates the way that the growth of farming can reduce demand for illegally sourced wildlife in international markets. International trafficking of caviar has clearly decreased since the late 1990s, as evinced in dramatically reduced seizures. Tighter trade controls and the availability of an affordable and comparable farmed product appear to have been effective in this respect. On the other hand, reduced trafficking can also be attributed to dwindling stocks, which is tragic on several levels. Aside from the loss in the wild of a species that has thrived from pre-history, a distinctive wild-sourced product with an illustrious history – Caspian caviar – has all but disappeared from international markets. Countries that previously benefitted from billions in exports have lost this resource, as well as the livelihoods associated with it.

Media reports continue to highlight sturgeon poaching around the Caspian and paddlefish poaching in the United States, but in recent years, very little caviar has been seized while being trafficked across international borders. If there is poaching, the caviar appears to be destined for the

domestic markets of the range countries. As discussed above, research has also indicated irregularities in the Danube Basin, which could be feeding markets within the European Union.⁷³ An additional concern is the potential for farming operations to launder wild-caught sturgeon, used either as breeding stock or directly as a source of roe.

What size is the illicit market today? In 1987, when caviar was a Soviet monopoly, the estimated sturgeon population in the Caspian was around 100 million, and the reported catch was just under 20,000 tons of sturgeon. This suggests a catch rate of one ton of fish for every 5000 sturgeon in the Sea. In 1994, after the dissolution of the Soviet Union but before the CITES listing of the main caviar species, the population was estimated at about 44 million and the catch was about 5000 tons, suggesting a catch rate of one ton for every 8800 sturgeon. As the population declined, it was clearly getting harder to find the remaining fish. In 2005, after the imposition of international controls, the official estimated population remained close to 44 million, but the harvest had dropped to only 770 tons, or one ton per every 57,000 sturgeon. The caviar export

quota for 2005 was not met: some 98 metric tons were permitted, but only 54 were exported.⁷⁴

For 2015, there is a zero export quota for caviar from wild-caught Caspian sturgeon, so the international market is entirely illicit.⁷⁵ A current population estimate is not available, but all indications are that the past decade has not been good for the Caspian sturgeon.

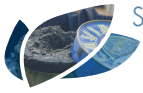
Without seizure or population data, poaching estimates are highly speculative. Comparing reported Caspian catches and caviar exports from 1998 to 2004, it appears between about 5% and 7% of the catch weight was exported as caviar, with an average of 5.6%. If this ratio held true today, and the catch declined as indicated above, then perhaps 20 tons of illegal caviar would have been taken in 2015. While this is not an insignificant amount of caviar, lack of international seizures suggest it is likely destined for domestic markets. Even if the actual catch was ten times this amount, the economic value of this criminal market would be relatively small compared to other illicit markets, although the ecological impact would not be.

Of course, it is possible that unknown changes in the illicit market have transpired, making it impossible to extrapolate trends from the old data. The catch rate could have been radically improved by technical innovations, and the broadening of the EU's borders in recent years may have provided novel, and yet undetected, methods for introducing illegal catch. Recent research on the Danube has indicated a large share of detected adult sturgeon are male, suggesting poaching during the upstream migration.⁷⁶ From a conservation perspective, every individual taken today poses a higher threat to the species than in the past, and so while the criminal markets are not large, anti-poaching efforts have taken on more importance than ever before.

Endnotes

- 1 "The state of the world fisheries and aquaculture", (Rome, FAO, 2014), p. 4.
- 2 FAO Statistical Yearbook 2013.
- 3 FAO, 2014, op cit.
- 4 FAO, "The state of the world fisheries and aquaculture," (Rome, FAO, 2012).
- 5 FAO, 2012, op cit.
- 6 According to FAO's 2014 State of the World's Fisheries, "World per capita apparent fish consumption increased from an average of 9.9 kg in the 1960s to 19.2 kg in 2012 (preliminary estimate)."
- 7 FAO, 2012, op cit.
- 8 FAO, 2014, op cit.
- 9 FAO fishery statistics, accessed at: <http://www.fao.org/fishery/statistics/global-aquaculture-production/query/en>; <http://www.fao.org/fishery/statistics/global-capture-production/query/en>
- 10 FAO Statistical Yearbook 2013.
- 11 FAO, 2014, op cit.
- 12 FAO, 2014, op cit, p. 7.
- 13 The United Nations Convention on the Law of the Sea: http://www.un.org/depts/los/convention_agreements/texts/unclos/unclos_e.pdf, p. 46.
- 14 One of the best documented cases is the collapse of the Grand Banks cod fishery in the Northwest Atlantic. In a fishery that had consistently produced between 100,000 and 300,000 tons annually since the mid-nineteenth century, catches declined to almost nothing after massive overfishing in the 1960s and 1970s.
- 15 The United Nations Agreement for the Implementation of the Provisions of the United Nations Convention on the Law of the Sea of 10 December 1982 relating to the Conservation and Management of Straddling Fish Stocks and Highly Migratory Fish Stocks: http://www.un.org/depts/los/convention_agreements/texts/fish_stocks_agreement/CONF164_37.htm
- 16 Swedish Society for Nature Conservation, "To draw the line: EU fisheries agreements in West Africa", (Stockholm, 2009).
- 17 FAO, "The state of the world fisheries and aquaculture", 2002, 2008, and 2014 editions.
- 18 United Nations General Assembly, "Sustainable fisheries, including through the 1995 Agreement for the Implementation of the Provisions of the United Nations Convention on the Law of the Sea of 10 December 1982 relating to the Conservation and Management of Straddling Fish Stocks and Highly Migratory Fish Stocks, and related instruments" 21 November 2012 (A/67/L.22)
- 19 According to the International Plan of Action to Prevent, Deter and Eliminate Illegal, Unreported and Unregulated Fishing, illegal fishing refers to fishing activities:
 - (1) conducted by national or foreign vessels in waters under the jurisdiction of a State, without the permission of that State, or in contravention of its laws and regulations;
 - (2) conducted by vessels flying the flag of States that are parties to a relevant regional fisheries management organization but operate in contravention of the conservation and management measures adopted by that organization and by which the States are bound, or relevant provisions of the applicable international law; or
 - (3) in violation of national laws or international obligations, including those undertaken by cooperating States to a relevant regional fisheries management organization.
 Unreported fishing refers to fishing activities:
 - (1) which have not been reported, or have been misreported, to the relevant national authority, in contravention of national laws and regulations; or
 - (2) undertaken in the area of competence of a relevant regional fisheries management organization which have not been reported or have been misreported, in contravention of the reporting procedures of that organization.
 Unregulated fishing refers to fishing activities:
 - (1) in the area of application of a relevant regional fisheries management organization that are conducted by vessels without nationality, or by those flying the flag of a State not party to that organization, or by a fishing entity, in a manner that is not consistent with or contravenes the conservation and management measures of that organization; or
 - (2) in areas or for fish stocks in relation to which there are no applicable conservation or management measures and where such fishing activities are conducted in a manner inconsistent with State responsibilities for the conservation of living marine resources under international law. <ftp://ftp.fao.org/docrep/fao/005/y3536e/y3536e00.pdf>
- 20 The number of marine species covered by CITES was expanded by five species of sharks and all manta ray at the 16th Conference of the Parties in 2013, but the entry into force of these listings was delayed by 18 months to allow time for Parties to resolve related technical and administrative issues
- 21 Marine turtles and a number of marine mammal species have been listed, including some whales, some dolphins, some porpoises, some fur seals, and dugongs. In addition, some species of shark, ray, shellfish, and coral are included in the Appendices. Some oddities, such as seahorses, totoaba, and coelacanths are internationally protected as well. Attempts to list commercial fish species, such as bluefin tuna, have not been successful.
- 22 The most numerous of the species are thought to be the Olive Ridley, estimated at more than 1 million animals. This species is unique compared to other marine turtles in the fact their reproduction differs from other marine turtles where thousands to hundreds of thousands of female olive ridley turtles come ashore to lay their eggs at the same time, an event known as an arribada. The hawksbill turtle on the other hand is roughly estimated to be 22,000 to 29,000 nesting females. NOAA. (2014). Olive ridley sea turtle (*Lepidochelys olivacea*), 5-year review: Summary and evaluation. National Marine Fisheries Service office of protected resources Silver Spring, Maryland and U.S. fish and wildlife service southeast region, Jacksonville ecological services field office, 87 pp. Valverde, R.A., Orrego, C.M., Tordoir, M.T., Gomez, F.M., Solis, D.S., Hernandez, R.A.,

- Gomez, G.B., Brenes, L.S., Baltodano, J.P., Fonseca, L.G., and Spotila, J.R. (2012). Olive Ridley Mass Nesting Ecology and Egg Harvest at Ostional Beach, Costa Rica. *Chelonian Conservation and Biology*. 11 (1). NOAA (2013). Hawksbill sea turtle (*Eretmochelys imbricata*), 5-year review: Summary and evaluation. National Marine Fisheries Service office of protected resources Silver Spring, Maryland and U.S. fish and wildlife service southeast region, Jacksonville Ecological Service office, 89 pp.
- 23 Age to sexual maturity varies depending on species. Kemp's ridley (smallest of the hard shelled marine turtles) range from 7-12 years; while loggerheads and greens can be as high as 30-35 years. For leatherbacks (not hard shelled) the largest of the marine turtles, sexual maturity can be reached between 13-14 years of age. N. Frazer, "Survival from egg to adulthood in a declining population of loggerhead turtles, *Caretta caretta*", *Herpetologica*, vol. 42, No. 1 (1986), pp. 47-55.
- 24 Ibid.
- 25 James Richardson, Rebecca Bell and Thelma H. Richardson, "Population Ecology and Demographic Implications Drawn From an 11-Year Study of Nesting Hawksbill Turtles, *Eretmochelys imbricata*, at Jumby Bay, Long Island, Antigua, West Indies", *Chelonian Conservation and Biology*, vol. 3, No 2 (1999), pp. 244-250.
- 26 The *Bekko* trade was the largest and most prestigious market, sourced primarily from hawksbill turtles due the thickness and the beautifully coloured patterns on the scutes. The grade (quality and price) of *Bekko* ornaments depend on its colour and markings. One hawksbill turtle is estimated to produce about 780g of *Bekko*. P. van Dijk and C. Shepherd, "Shelled out? A Snapshot of *Bekko* Trade in Selected Locations in South-east Asia", (Southeast Asia, TRAF-FIC, 2004).
- 27 A. Bräutigam and K. Eckert, "Turning the Tide: Exploitation, Trade and Management of Marine Turtles in the Lesser Antilles, Central America, Colombia and Venezuela", (Cambridge, TRAFFIC International, 2006).
- 28 The Indian Ocean - South-East Asian (IOSEA) Marine Turtle Memorandum of Understanding Illegal take and trade of marine turtles in the IOSEA Region. Seventh Meeting of the Signatory States. Bonn, Germany 8-11 September 2011. MT-IO-SEA/SS.7/Doc.10.1. T. Lam and others, "Market Forces: An Examination of Marine Turtle Trade in China and Japan", (Hong Kong, China, TRAFFIC East Asia, 2011).
- 29 Ibid.
- 30 Ibid.
- 31 A total of 249 seizures accounted for 31,516 eggs and a total of 515 seizures accounting for 3,611 turtles (52% Hawksbill and 15% Green turtles).
- 32 Items crafted from shell can sell for considerably more. See Lam, et al. 2011. op cit., 2011
- 33 H. Shiraishi and V. Crook, "Eel market dynamics: an analysis of *Anguilla* production, trade and consumption in East Asia", (Tokyo, TRAFFIC, 2015)
- 34 *Anguilla japonica*
- 35 *Anguilla anguilla*
- 36 Council Regulation (EC) No 338/97
- 37 *Anguilla rostrata*
- 38 *Anguilla luzonensis*
- 39 At a market price of about US\$2000 per kilogram. See online methodological annex for details.
- 40 Customs press release for Spain, Hong Kong, CITE Biennial reports, European Commission. SWD(2016)38 doc, and Spanish CITES Authority.
- 41 European Commission. SWD(2016)38 - Analysis and Evidence in support of the EU Action Plan against Wildlife Trafficking accompanying the document: EU Action Plan against Wildlife Trafficking
- 42 European Commission. SWD(2016)38 - Analysis and Evidence in support of the EU Action Plan against Wildlife Trafficking accompanying the document: EU Action Plan against Wildlife Trafficking
- 43 Press releases of Government of Spain: www.guardiacivil.es/es/prensa/noticias/4047.html and www.guardiacivil.es/es/prensa/noticias/4975.html
- 44 Press releases of: www.guardiacivil.es/es/prensa/noticias/4047.html and www.guardiacivil.es/es/prensa/noticias/4975.html
- 45 Press releases of: www.guardiacivil.es/es/prensa/noticias/4047.html and www.guardiacivil.es/es/prensa/noticias/4975.html
- 46 See Hong Kong Customs and Excise Department Press releases for 2016: http://www.customs.gov.hk/en/publication_press/press/index_id_1504.html; and http://www.customs.gov.hk/en/publication_press/press/index_id_1534.html; and http://www.customs.gov.hk/en/publication_press/press/index_id_1546.html; and http://www.customs.gov.hk/en/publication_press/press/index_id_1556.html; and <http://www.info.gov.hk/gia/general/201603/08/P201603080247.htm>.
- 47 Data obtained from Spanish CITES Authorities.
- 48 The Amur River could perhaps be included, although historically caviar harvesting for the international market has been less prevalent from this source.
- 49 For a history of the caviar trade, see Richard Adams Carey, *The Philosopher Fish*. Cambridge: Perseus Books, 2005.
- 50 Ibid.
- 51 Based on World WISE and CITES Trade Database analysis.
- 52 A. Ludwig, D. Lieckfeldt, and J. Jahl, "Mislabelled and counterfeit sturgeon caviar from Bulgaria and Romania." *Journal of Applied Ichthyology*. Vol 31, No 4, 587-591, 2015.
- 53 Based on FAO Yearbook statistics and G. Ruban and R Khodorevskaya, "Caspian Sea sturgeon fishery: a historic overview," *Journal of Applied Ichthyology*, vol. 27 (2011), pp.199-208.
- 54 See, for example, the prices of the Petrossian caviar retailer: <http://www.petrossian.com/caviar-1-petrossian-special-reserve-caviar-509.html>
- 55 Based on interviews conducted for this study with sturgeon farmers, a mature sturgeon can produce 15 to 20% of its weight in caviar, and mature belugas can weigh many hundreds of kilograms. See online methodological annex for details.
- 56 R. Khodorevskaya, G. Ruban and D. Pavlov, *Behaviour, Migrations, Distribution and Stocks of Sturgeons in the Volga-Caspian Basin*, (Neu Wulmstorf, World Sturgeon Conservation Society Special Publication, No. 3, 2009).
- 57 Two species had been controlled earlier. *A. sturio* was first listed in Appendix II and transferred to Appendix I in 1975. *A. brevirostrum* was listed in Appendix I in 1975. Harvest quotas were also attempted, but with limited success.
- 58 R. P. Khodorevskaya, et al 2009, op cit.
- 59 Ruban and Khordorevskaya, 2011 op cit.
- 60 See IUCN "Sturgeon more critically endangered than any other group of species", 18 March 2010: <http://www.iucn.org/?4928/Sturgeon-more-critically-endangered-than-any-other-group-of-species>
- 61 Exports represent those of Russia and Iran. See Tom De Meulenaer and Caroline Raymakers, *Sturgeons of the Caspian Sea and the international trade in caviar*, (Cambridge, Traffic International, 1996).
- 62 Armand Petrossian, "The Traders Perspective". *Proceedings of the International Sturgeon Enforcement Workshop to Combat Illegal Trade in Caviar*. Prepared by TRAF-FIC Europe for the European Commission, 2006, Brussels, Belgium. More recent prices from Alan Jones, see online methodological annex for details.
- 63 Research conducted for UNODC. See online methodological annex for details.
- 64 See online methodological annex for details.
- 65 Louise Shelley, "Post-Soviet organized crime: Problem and response", *European Journal on Criminal Policy and Research*, vol. 3, No. 4 (1995), pp. 7-25.
- 66 During the days when wild exports were permitted, the US was the leading destination of Caspian caviar. The Russian Federation, as the original source of the world's finest caviars, has always had a large market for the product. Although one of the largest producers of farmed caviar, producing 40 tons in 2014, it reported no exports. Similarly, the US produced 18 tons in 2014, but only exported around six metric tons.
- 67 United States Department of Justice, *Caviar Convictions* (since 1/1/2000), Accessed on 9 May 2016 at: https://www.justice.gov/sites/default/files/enrd/legacy/2013/08/30/CaviarConvictionsSince2001_new.pdf
- 68 Victoria Mundy and Glenn Sant, "Traceability systems in the CITES context: A review of experiences, best practices and lessons learned for the traceability of commodities of CITES-listed shark species (2015) <https://cites.org/sites/default/files/eng/prog/shark/docs/Bodyofnfl2.pdf>
- 69 P. Doukakis and others, "Testing the Effectiveness of an International Conservation Agreement: Marketplace Forensics and CITES Caviar Trade Regulation", *PLoS ONE* 7(7): e40907. doi:10.1371/journal.pone.0040907.
- 70 See, for example, the tests conducted by Oceana: http://oceana.org/sites/default/files/National_Seafood_Fraud_Testing_Results_FINAL.pdf



- 71 Field research. See online methodological annex for details. For a slightly different assessment, see P. Bronzi and H. Rosenthal, "Present and future sturgeon and caviar production and marketing: A global market overview", *Journal of Applied Ichthyology*, vol. 30, No.6 (2014), pp 1536-1546.
- 72 See online methodological annex for details.
- 73 A. Ludwig, D. Lieckfeldt and J. Jahrl, "Mislabelled and counterfeit sturgeon caviar from Bulgaria and Romania", *Journal of Applied Ichthyology*, vol. 31, No. 4 (2015), pp. 587-591.
- 74 See CITES Secretariat, *Export quotas for specimens of Acipenseriformes species included in Appendix II for 2005* and exports from the CITES Trade Database.
- 75 The sturgeon quotas are published on the CITES web site: <https://cites.org/sites/default/files/common/quotas/2015/SturgeonQuotas2015.pdf>
- 76 See the annexes to the activity reports from the Galati Lower Danube River Administration: <http://www.afdj.ro/en/content/romomed>