Acipenser stellatus Pallas, 1771

Stellate Sturgeon
Esturgeon étoilé
Esturión estrelado

Order: ACIPENSERIFORMES **Family: ACIPENSERIDAE**

SUMMARY

Stellate Sturgeon *Acipenser stellatus* has a wide distribution, occurring in the Caspian Sea, Black Sea and Sea of Azov and originally in many of the tributaries of these seas. However, the construction of dams on virtually all these rivers has significantly reduced the spawning area. The Ural River is one of the few major spawning rivers that has not been dammed. In addition to loss of habitat, the species has been subject to overfishing and egg-production has been disrupted due to environmental pollution. In the early 1990s, around 30% of the population in the Caspian Sea and almost all the stock in the Sea of Azov originated from re-stocking programmes. Re-stocking reportedly occurs in Azerbaijan, Iran, Kazakhstan, Romania and the Russian Federation, but monitoring of the sturgeon restocking is performed only in Iran. In addition, hatcheries have had difficulty in obtaining broodstock.

A. stellatus has always been rare in the Danube River, with only 7.8 tonnes (t) average annual catch in the middle Danube River between 1958 and 1981. However, recorded landings in Romania and Bulgaria increased from 6.2 t in 1997 to 14.5 t in 1999. In contrast, annual catches of the species have generally decreased in other range States, except in the Danube River Basin. In the northern Caspian Sea, reported catches dropped from 4,650 t in 1977 to approximately 4,600 t in 1990 and to an estimated 1,060 t for 1997 for the whole of the Caspian (according to data collected during this review). Range States decreased the catch quotas for *A. stellatus* by around one third for Azerbaijan, Kazakhstan and Ukraine in 2000. The size of the domestic market for sturgeon products in the Russian Federation are unknown. Iran estimated its domestic consumption to be 5% of the country's caviar production and 65% of the sturgeon meat production.

The major product from wild of *A. stellatus* recorded in international trade in 1998 was caviar, with caviar of this species being commercially known as Sevruga caviar. According to CITES data, caviar from *A. stellatus* represents the largest portion of caviar from all Acipenseriformes traded internationally. *A. stellatus* exports from range States in 1998 included a total of 103 t of caviar, mainly from Iran (46 t with an export quota of 50 t) and the Russian Federation (39 t with an export quota of 85 t, including quotas for Azerbaijan and Kazakhstan). For 1999, the Russian Federation set the caviar export quota at 42 t and exported 32.4 t. Assuming a standard rate of 6-7% in weight of caviar of the total catch (males and females), the total volume of caviar exported in 1998 represents a total catch of 1,471-1,717 t of *A. stellatus* caught by range States. Iran also exported 8,794 kg of meat of wild origin (including 4,000 kg declared as "bodies"). The total combined caviar export quotas for 2000 decreased from that of 1999 (from 111.8 t to 102.9 t), but increased significantly for meat (from 42 t to 334.5 t). A total of 25,700 live fish (of captive bred source - 25,000 from Poland imported into Germany) were exported in 1998. However, commercial aquaculture of this species appears to be in its infancy.

DISTRIBUTION AND POPULATION

The CITES database lists the current distribution of *Acipenser stellatus* as: Azerbaijan, Bulgaria, Czech Republic, Georgia, Greece (?), Hungary, Iran, Kazakhstan, Moldova, Romania, Russian Federation, Slovakia, Turkey, Turkmenistan, Ukraine, Yugoslavia (Anon., 2000a).

A. stellatus is classified as Endangered by IUCN (1996):
EN A2d Azerbaijan, Bulgaria, Georgia, Hungary, Iran, Kazakhstan, Moldova, Romania, Russian Federation, Turkmenistan, Ukraine, Yugoslavia
Caspian Sea Stock: VU A1acde + 2d Azerbaijan, Iran, Kazakhstan, Russian Federation, Turkmenistan
Sea of Azov Stock: EN A2d Russia [Mediterranean and Black Sea]
Black Sea Stock: EN A1acde + 2d Hungary, Romania, Ukraine, Yugoslavia [Mediterranean and Black Sea].

A. stellatus inhabits the Caspian, Azov and Black Seas although isolated catches have also been recorded in the Adriatic Sea (Birstein, 1993a; Shubina *et al.*, 1989). It is anadromous and enters the rivers that flow into these seas to spawn. The largest population is believed to occur in the Volga-Caspian region and produces 80% of the total sturgeon catch in this region (Anon., 1997). The species has always been considered rare in the middle Danube and after the construction of the Djerdap I and II hydropower stations, it is considered extirpated from both the upper and middle Danube (Hensel and Holcik, 1997). Although there are no recent population estimates available, Volovik *et al.* (1993) estimated the total *A. stellatus* biomass in the Sea of Azov during the mid-1980s to be 12,390 t. In 1990, 55,000 sturgeon were found dead on the shore of the Sea of Azov as a result of pollution and no population estimates have been made since. Due to reduced natural reproduction, about 60-98% of each generation in the Sea of Azov consisted of farm grown fish in the early 1990s (Volovik, *et al.*, 1993), while in the Caspian Sea around 30% originated from hatcheries. A decline in the commercial catch of this species reflects a decline in the population (Anon., 1997).

Azerbaijan: There is no recent information on the distribution in the Kura River, but Khodorevskaya *et al.* (1997) note that sturgeon no longer use the Kura and Terek rivers to spawn.

Bulgaria: As part of the Black Sea population, *A. stellatus* spawn in the Danube River. The breeding seasons are in spring, early-April (when the first catch of the year is recorded) and in autumn (end-September) (CITES Management Authority of Bulgaria, *in litt.* to TRAFFIC Europe, 15 September 2000). There has been a remarkable decline in *A. stellatus* catches in recent years (Karapetkova *et al.*, 1995), which now amount to only a few hundred kilogrammes per year (Pr N. Bacalbasa-Dobrovici, *in litt.* to IUCN/SSC Wildlife Trade Programme, September 2000).

Georgia: The south east coast of the Black Sea is an important feeding and wintering area for sturgeon (*A. stellatus*, *A. nudiventris*, *A. persicus colchicus, A. sturio* and *Huso huso*) that migrate upstream in a number of rivers for spawning. The main rivers used are the Supsa, Inguri, Chorokhi and particularly the Rioni (Zarkua and Tsuladze, 1999).

Greece: In the Aegean and Adriatic Seas, only a few isolated specimens have been recorded and it is doubtful if spawning still occurs in Greece (Lelek, 1987).

Hungary: Pinter (1991, cited in CITES Management Authority of Hungary, *in litt.* to TRAFFIC Europe, 13 September 2000) reported that last specimen was caught in 1965 (Mohács, Danube). Pr N. Bacalbasa-Dobrovici (*in litt.* to IUCN/SSC Wildlife Trade Programme, September 2000) considers the species as exceptionally rare whilst A. Rónyai (*in litt.* to IUCN/SSC Wildlife Trade Programme, September 2000) notes that *A. stellatus* is now considered extinct in Hungary.

Iran: *A. stellatus* previously entered the Sefidrud and the Gorgan rivers on the southern coast of the Caspian Sea to spawn (Shubina *et al.*, 1989). According to Dr. J. Holcik (*in litt.* to IUCN/SSC Wildlife Trade Programme, September 2000), the species does not occur in these rivers. However, according to Laluyee (1996) and Ramin (1998, both cited in Dr M. Pourkazemi, *in litt.* to IUCN/SSC Wildlife Trade Programme, September, 2000), maintain that *A. stellatus* enters the Sefidrud, Tajen and Gorganrud rivers in the southern shores of the Caspian Sea to spawn. *A. stellatus* migrates to the Sefidrud and other rivers during spring and autumn, the intensity of spawning being high particularly after heavy rainfall (Dr M. Pourkazemi, *in litt.* to IUCN/SSC Wildlife Trade Programme, September 2000).

Moldova: The Moldovan range on the Danube River is 811 m and sturgeon also occur in the Pruth River, a tributary of the Danube River (junction at km 137th) (Anon., 2000c). There are no recent records of the species occurring in the Dniester River. Pr. Bacalbasa-Dobrovici (*in litt.* to IUCN/SSC Wildlife Trade Programme, September 2000) reports that specimens have been caught in the Pruth, while Dr V. Lobcenco (*in litt.* to IUCN/SSC Wildlife Trade Programme, September 2000) notes that there have been no records of the species in recent years.

Romania: *A. stellatus* enters the Danube from the Black Sea to spawn downstream of Calarash. However, catches have dramatically declined after the damming of the lower Danube by the Djerdap I and Djerdap II hydropower stations (Bacalbasa-Dobrovici, 1997).

Russian Federation: The largest populations of *A. stellatus* occur in the Caspian Sea from where they ascend to the Volga, Ural and Terek-Kuma rivers to spawn. From the Sea of Azov the spawning population ascends to the lower sections of the Don and Kuban rivers (Shubina *et al.*, 1989). Volovik *et al.* (1993) estimated that *A. stellatus* accounts for 12,390 t (21%) of the total sturgeon biomass of the Sea of Azov.

Approximately 60% of the historic spawning sites remain intact in the northern Caspian Sea (Khodorevskaya *et al.*, 1997). Between 1985 and 1992, stocks declined sharply in the Volga and Ural rivers. In 1992, the Ural River population was only one third of the numbers observed in 1986, and Birstein (1993b) reports 90,000 spawning individuals in the Ural. The spawning population of the Volga River has been estimated by Levin (1997) to be approximately 116,000 mature individuals (a decline in recent years from 500,000 individuals). There are no population estimates available for the other rivers in which they spawn, but Vlasenko (1990) and Levin (1995) believe populations to be minimal. In the Sea of Azov, some natural spawning grounds are no longer accessible due to the construction of dams on the Don and Kuban rivers (Anon., 2000b).
Autonomous Republic of Dagestan: No information is available on the current status of populations in the Sulak and Samur rivers.

Serbia: The annual catch of 1.4-2.0 t dropped to 0.184 t in 1971 when Djerdap I Dam was built on the Danube (Hensel and Holcik, 1997).

Slovakia: The last specimen of *A. stellatus* was caught in 1926 (Holcik, 1995).

Turkey: *A. stellatus* has been observed here, possibly in the Kizil-Irmak and Yesil-Irmac rivers, but it is unclear whether they spawn. The Coruh River is a known spawning site and unidentified sturgeon species have been reported in small numbers in the Sakarya and Mert rivers. In the late 1980s, local fishermen estimated that only five to six gravid female sturgeon were caught from the Yesilirmak to supply a hatchery and up to 20 from the Kizilirmak (Edwards and Doroshov, 1989).

Ukraine: There is very little recent information on the distribution and status of *A. stellatus* in the Ukraine. According to Pavlov (1980), *A. stellatus* was formerly considered rare in the Dnieper River, where it was known mainly from the lower river. It also occurred in the Dniester and Bug rivers, but as a result of the construction of the Dubosar and Oleksandriv hydropower stations, its distribution was reduced and catches subsequently declined. The species occurs in the Don and Kuban rivers, where it has been a commercially important fish, however the catch declined significantly after the construction of the Cimlyansk hydropower station.

Former Yugoslavia: There are no records for the species in Croatian rivers (Taler, 1953). However, there was a significant drop in catch of all sturgeon species after 1970 and 1984, when the lower stretch of the Danube was respectively dammed by Djerdap I and II hydropower stations (Jankovic, 1993; 1996; Simonovic and Nikolic, 1996). Today, the species occurs in a 17.8 km stretch of the Danube River, from the Djerdap II dam to the border, close to the Timok River mouth (Pr N. Bacalbasa-Dobrovici, *in litt.* to IUCN/SSC Wildlife Trade Programme, September 2000).

HABITAT AND ECOLOGY

The species reaches a total length of 2.18 m, a maximum weight of 54 kg and maximum age of 35 years (Shubina *et al.*, 1989). The normal size ranges between 1.0-1.2 m and 6-8 kg. The age of *A. stellatus* spawners ranges between 6-28 years, on average 11-16 years. The average weight of females is 11-12 kg and 6-7 kg for males. Females constitute 40-48% of the spawning population (Levin, 1997).

Unlike other sturgeon species, *A. stellatus* is found in the middle and upper water layers. There are two forms, one of which spawns in winter and the other in spring. The spring form migration peaks in summer and ends in late autumn. The winter migrating form hibernates in rivers and reproduces the following year. The main feeding grounds of the Caspian are to the north, but a winter migration to the central and southern areas of the Caspian has been observed (Barannikova *et al.*, 1995).

Based on catches and caviar production in the late 1970s, the rate of caviar extracted per fish caught was estimated at 7 kg per 100 kg of the total catch (including males and females) for the three main commercial species of the northern Caspian Sea, *Huso huso*, *A. gueldenstaedtii* and *A. stellatus* (Doroshov and Binkowski, 1985, cited in Williot and Bourguignon, 1991).

Iran: Two forms of the species are found in the Caspian Sea: *A. stellatus* Pallas or north Caspian, and *A. stellatus cyrensis* Berg or south Caspian. The two forms can not be visually differentiated. The south Caspian form can be identified on the basis of later sexual maturity, slower growth and a lower fecundity (Bilialova *et al.*, 1989, cited in Dr M. Pourkazemi, *in litt.* to IUCN/SSC Wildlife Trade Programme, September 2000). Molecular studies on mitochondrial DNA and alloenzymes have reported high genetic diversity in *A. stellatus* in the southern Caspian Sea region (Pourkazemi, 1995). Sexual maturity of *A. s. cyrensis* is attained at an average age of 12 years for females (range of 6-18 years) and 9 years for males (range of 6-15 years) (Int. Sturgeon Res. Inst., 1998, cited in Dr M. Pourkazemi, *in litt.* to IUCN/SSC Wildlife Trade Programme, September 2000).

Kazakhstan: Until 1993, the mouth of the Ural River was dredged annually to allow vessels to travel upstream to Atyrau (former Gur'yev) harbour. Since 1993, this annual management of the river channel has not been carried out and is an obstacle to migration (Anon., 2000c).

THREATS TO SURVIVAL AND DOMESTIC USE

Hydroelectric power stations and water reservoirs constructed on the vast majority of rivers have reduced spawning ground availability by approximately 40% in the Caspian basin (Barannikova *et al.*, 1995). In addition, pollution has far exceeded maximum permissible concentrations in the Volga River and the northern Caspian Sea (Romanov and Altuf'yev, 1993). However, since 1991 the intensity of industrial development decreased, leading to an improvement in water-quality. The rise of the sea level of the Caspian now threatens to engulf lakes of pollutants along the shore line.

Overexploitation has posed an increasing threat over the years. In the mid 1990s, open sea fishing in the Caspian and reputedly high levels of illegal catch served to reduce the number of mature sturgeons to such a level that the Volgograd hatcheries in the Russian Federation were unable to collect mature fish to stock the hatcheries.

In the former Soviet Union and Iran, strict legislation regarding sturgeon fisheries had been in effect for decades until the emergence of three new independent States in the Caspian Sea Basin in 1992 (Azerbaijan, Kazakhstan and Turkmenistan) (De Meulenaer and Raymakers, 1996). Current information suggests that amendments of previous regulations and/or adoption of new legislation are now in effect in most new range States in the Caspian Sea as well as in Black Sea (including the Danube River) and Sea of Azov basins. In the latter, Bulgaria, Romania and Ukraine are the most important sturgeon fishing nations. However, enforcement measures appear to be lacking and numerous experts as well as government officials have reported an increasing pressure of illegal fishing practices and criminal activities surrounding the caviar trade in most of the range (Anon., 2000b; Dobbs, 1992; Doward, 2000; Evtouchenko, 1997; King, 1998; Ward, 2000a; 2000b)

The total commercial sturgeon catch in the Caspian Sea Basin peaked at 27,300 t in 1977. *A. stellatus* represented 17% (4,650 t) of this total (Levin, 1997). The catch of *A. stellatus* in the northern Caspian Sea decreased from approximately 4,600 t in 1990 to 1,600 t in 1994 (Khodorevskaya *et al*., 1997). The Russian Caspian Sea catch of *A. stellatus* was 1,060 t in 1997 (Anon., 2000b). The species was always considered rare in the Danube River, with only an average annual catch of 7.8 t in the middle Danube River between 1958 and 1981 (Hensel and Holcik, 1997). However, landings recorded from the lower Danube River in Romania and Bulgaria increased from 6.2 t in 1997 to 14.5 t in 1999.

Azerbaijan: The range of the species in the Kura River, including spawning grounds, has been reduced to about 160 ha due to the construction of the Vavarin reservoir and dam. Waters of this region represent important winter feeding grounds, however, lakes of deposited oil and pollutants lie on the shore lines of the Caspian and as the sea level rises these 'lakes' will be engulfed (Dumont, 1995).

Along the northern and southern coast of Azerbaijan, within the 200-nautical mile Exclusive Economic Zone, sturgeon species are caught as by-catch in stationary nets and *kilka* (Clupeidae) fishing devices. Young and adult migrating fish are caught by coastal fisheries when the water temperatures change. Young fish make up to 17.7% of the by-catch.

Species composition of recorded sturgeon landings

	A. persicus* & *A. gueldenstaedtii	***A. stellatus***	***H. huso***	***A. nudiventris***
Catch	63.47%	30.77%		5.76%
By-catch	78.50%	16.80%	3.70%	1%

Source: CITES Management Authority of Azerbaijan, *in litt.* to TRAFFIC Europe, 18 September 2000

Annual recorded landings (catch and by-catch) of *A. stellatus* (tonnes)

	1990	**1991**	**1992**	**1993**	**1994**	**1995**	**1996**	**1997**	**1998**	**1999**	**2000**
A. stellatus	20.00	27.00	25.00	92.00	67.60	31.80	44.80	27.10	20.70	33.50	20.76
Total	*74.00*	*88.20*	*111.00*	*240.10*	*201.20*	*162.50*	*120.30*	*128.60*	*82.40*	*108.90*	*63.22*

Source: CITES Management Authority of Azerbaijan, *in litt.* to TRAFFIC Europe, 18 September 2000

Bulgaria: Wild sturgeon populations have been threatened by a decrease in the number of spawning grounds on the Danube River as a result of human development, particularly hydroelectric facilities. The long-lasting unregulated fisheries have disrupted the age composition of the populations through the selective catch of sexually mature fish, and to by-catch of young sturgeon as they migrate to the sea. Water pollution has also influenced the metabolism of sturgeon (CITES Management Authority of Bulgaria, *in litt.* to TRAFFIC Europe, 15 September 2000). The species is affected by overfishing and pollution (Pr N. Bacalbasa-Dobrovici, *in litt.* to IUCN/SSC Wildlife Trade Programme, September 2000).

Annual catch of *A. stellatus* (tonnes)

	1995	**1996**	**1997**	**1998**	**1999**
A. stellatus	0.1	0.5	1.4	3.7	6.0
Total sturgeon catch	*14.7*	*32.5*	*49.8*	*55.9*	*50.5*
n° of licenses issued	0	0	122	155	169

Source: CITES Management Authority of Bulgaria, *in litt.* to TRAFFIC Europe, 15 September 2000

Domestic consumption of caviar in Bulgaria is limited to 7-10% of the total caviar production of Bulgaria. The entire production of sturgeon meat is consumed within Bulgaria.

Georgia: During the fishing seasons, particularly coastal anchovy fisheries, numerous sturgeon juveniles are caught as by-catch. The estimated catch of all species of sturgeon declined from 77,000 individuals in 1977, to 57,000 in 1980 and 27,000 in 1986. During the 1990s, illegal fishing in Georgia expanded rapidly due to poor control (Zarkua and Tsuladze, 1999).

Iran: For the past five years, the Iranian domestic market for caviar and sturgeon meat has been estimated at 5% and 65% of the country's total production respectively.

Annual catch of *A. stellatus* (tonnes)

	1990	**1991**	**1992**	**1993**	**1994**	**1995**	**1996**	**1997**	**1998**	**1999**	**2000 ***
A. stellatus	1,114.0	1,019.5	917.9	679.1	672.5	562.2	507.1	360.1	346.3	288.1	-
Total	*2,296.3*	*2,315.1*	*2,058.0*	*1,462.1*	*1,380.9*	*1,216.3*	*1,310.0*	*1,043.5*	*1,127.9*	*923.3*	*182.4*

* Catch in spring 2000 only.

Source: CITES Management Authority of Iran, *in litt*. to TRAFFIC Europe, 24 September 2000

Production of sturgeon meat and caviar in Iran in 1992 and 1999 (tonnes)

	1992				**1999**			
	Meat	**% ***	**Caviar**	**% ***	**Meat**	**% ***	**Caviar**	**% ***
A. stellatus	**695.4**	***43.9***	**153.4**	***56.6***	**218.3**	***30.6***	**36.5**	***37.5***

Total	**1,604.2**	**262.3**	**730.2**	**99.3**

* Percentages relate to the share of *A. stellatus* products in the total Iranian sturgeon fisheries.
Source: Dr M. Pourkazemi, *in litt.* to IUCN/SSC Wildlife Trade Programme, September 2000

The above tables indicate that the total tonnage of meat and caviar of *A. stellatus* produced in Iran comprised 92% and 88% of the country's annual catch in weight in 1992 and 1999, respectively.

Kazakhstan: The Ural River provides 1,400 ha of spawning ground and is the only river with unregulated flow into the Caspian. Oil fields are developing rapidly in the northern Caspian, especially the Tengiz oil field (Sagers, 1994); pollution from this industry affects spawning and feeding grounds. Radioactive contamination from a nuclear reactor also poses a threat (Dumont, 1995).

Annual catch of *A. stellatus* in the 1990s (tonnes)

	1990	**1991**	**1992**	**1993**	**1994**	**1995**	**1996**	**1997**	**1998**	**1999**	**2000 ***
A. stellatus	1,498.0	1,313.0	1,002.0	547.0	274.0	197.9	175.1	227.6	235.0	140.0	117.4
Total	*1,963.0*	*1,767.0*	*1,437.3*	*1,109.0*	*556.0*	*573.0*	*367.8*	*389.5*	*490.0*	*279.0*	*230.5*

* Spring catch.
Source: CITES Management Authority of Kazakhstan, *in litt.* to TRAFFIC Europe, 21 September 2000

Moldova: Catch of *A. stellatus* has been prohibited since the species was listed in the Red Data Book in 1995 (Anon., 2000c).

Romania: Pollution emitted between 1970 and 1989 has been the greatest threat to this species. The loss of spawning habitat due to dam construction has posed an important threat, but to a lesser extent than pollution. Overfishing and poaching have increased in recent years (Pr N. Bacalbasa-Dobrovici, *in litt.* to IUCN/SSC Wildlife Trade Programme, September 2000).

Annual catch of *A. stellatus* for 1991 to 1999 (kilogrammes)

1991	**1992**	**1993**	**1994**	**1995**	**1996**	**1997**	**1998**	**1999**
2,184	2,910	2,405	2,852	6,506	4,941	4,788	4,003	8,556

Source: Dr N. Patriche, *in litt.* to IUCN/SSC Wildlife Trade Programme, 5 September 2000
Note: These data include catches in the Danube River and Delta as well as in the Black Sea.

From 1991 to 1999, approximately 32% of the total Romanian sturgeon catch in the Danube River comprised *A. stellatus*. Romanian scientific surveys have concluded that the population of *A. stellatus* is quite well represented in the Danube River (Dr N. Patriche, *in litt.* to IUCN/SSC Wildlife Trade Programme, 5 September 2000).

Russian Federation: Construction of the Volgograd dam led to a 82% decrease in the range and spawning grounds formerly available in the Volga River. The remaining area can accommodate 280,000 spawning sturgeon, but during the last 30 years their numbers have been estimated to be considerably less than this (Veschecv, 1993; 1995). Dam construction has also restricted the range in the Terek and Sulak rivers, with the spawning ground having been reduced to 132 ha and 202 ha respectively (Vlasenko, 1990). In the Black Sea and Sea of Azov region, the Kuban River flow has been regulated resulting in the loss of 140,000 ha of spawning grounds. The Tsymlyansk reservoir, on the Don River in 1952, removed approximately 68,000 ha of spawning ground (Volovik *et al.*, 1993).

The Volga River hatcheries started to release juveniles in 1957. From the release of half a million juveniles in 1959, numbers increased to around 16 million in 1970. In the late 1980's, approximately 30% of *A. stellatus* caught in the Volga River were from hatcheries. The numbers released did not seem to affect the numbers of wild spawners later entering the rivers (Khodorevskaya *et al.*, 1997).

Shagaeva *et al.* (1993) found that 100% of the eggs taken from *A. stellatus* in the lower Volga (both of wild and captive bred (hatchery) sources) in 1989 had anomalous larvae because of poor environmental conditions. It is thought that these eggs may not have been viable. However, water quality has started to improve in the Volga–Caspian region since the decline of heavy industrial activities in the former USSR.

From 1992 to 1997, approximately 40% of the Russian sturgeon catches in the Caspian Sea were composed of *A. stellatus* (Anon., 2000b)

Catch of *A. stellatus* in the Caspian Sea (tonnes)

	1992	1993	1994	1995	1996	1997
Catch	3,610	1,349	1,467	968	675	449

Source: Caspian Fisheries Research Institute (KaspNIRKh), cited in Anon., 2000b

The level of domestic consumption of sturgeon products in the Russian Federation is unknown, but is said to be the main outlet of illegal sturgeon fisheries (Mr Roman V. Ivakhnenko, State Fisheries Committee, pers. comm. to TRAFFIC Europe-Russia, September 2000). Based on the number of sets of illegal fishing equipment recorded by enforcement agencies of the Caspian Sea and the Sea of Azov, the illegal sturgeon catch was evaluated at six to ten times the legal catch (Anon., 2000b). In 1997, the estimated volume of the Moscow sturgeon meat market was three times the annual catch quotas for sturgeon species (Anon., 1998).

Turkey: Spawning grounds have been reduced. From 1969 to 1979, the Turkish annual sturgeon landings ranged from 310 t to 10 t, with an annual average of 112 t (Edwards and Doroshov, 1989). In 1989 in Samsun, a Turkish landing site on the Black Sea, one caviar processor claimed that his production had decreased from 8 t per year of caviar between the 1940s and the 1970s, to 200 kg per year at the end of the 1980s. In 1989, sturgeon were caught as by-catch by trawlers that operated legally along the Turkish coast at a distance greater than three nautical miles, but also illegally within the three nautical mile limit. This represented the main fishing pressure on sturgeon species. In April 1989, *A. stellatus*, *A. gueldenstaedtii*, *A. sturio* and *H. huso* were observed in Samsun (Edwards and Doroshov, 1989). The investigators were told that *A. nudiventris* was also landed in Samsun.

Ukraine: Pollution and, to a lesser extent, loss of spawning grounds, have affected this species. Overfishing has been a problem in recent years.

Former Yugoslavia: Most of the Danube River spawning grounds are no longer accessible due to the construction of the Djerdap dams.

INTERNATIONAL TRADE

The listing of *A. stellatus* in CITES Appendix II entered into effect on 1 April 1998. Complete data for this species were therefore limited to nine months of trade (April-December 1998). Gross exports of trade in specimens of *A. stellatus* in 1998 are given in the Appendix.

CITES Annual Reports for 1998 suggest that caviar of *A. stellatus*, commercially known as "Sevruga", represented the largest portion of all sturgeon caviar traded internationally. Range States exported a total of 103,085 kg in 1998; Iran (45,955 kg), the Russian Federation (38,981 kg), Kazakhstan (17,467 kg), Azerbaijan (422 kg) and Romania (260 kg).

Other specimens reported in international trade in 1998 were meat (8,794 kg exported by Iran and imported by France and Italy), live fish (25,000 individuals exported by Poland and imported into Germany (CITES Management Authority of Poland, *in litt.* to TRAFFIC Europe, 31 August 2000)), and eight skins (probably destined to be processed into leather, exported by Iran to Switzerland and subsequently re-exported to Italy). The live juveniles exported by Poland in 1998 were of captive bred source (see "Captive Breeding").

In addition to caviar, a further 51,500 specimens (fertilised eggs or caviar ; see *Note* at the end of this section) were traded internationally. Of these, 26,500 were declared to be from a wild source and originated from Hong Kong (non-range State), and 20,400 were declared of pre-Convention stock imported from the Russian Federation into Greece and subsequently re-exported to the USA.

Exports of *A. stellatus* from Russia in 1999

	Quantity (kg)	Description	Importer	No of permits
A. stellatus	2.50	Live eggs	GR DE	2 Export
	32,418.72	Caviar	US, CY, DK, DE, GB, FR, CH, NL, BE, JP	52 Export + 10 Re-export
	5,740.00	Meat	US	2 Export

Source: CITES Management Authority of the Russian Federation, *in litt*. to TRAFFIC Europe, 18 September 2000

Export quotas established by range States (kilograms)

	1998		1999			2000	
	Caviar	Meat	Caviar	Meat		Caviar	Meat
Azerbaijan			3,800	38,000		2,450	24,500
Iran	50,000		40,000			35,000	
Kazakhstan			24,000			22,000	199,000
Romania			2,000	4,000		2,100	23,000
Russian Fed.	85,000		42,000		**Caspian**	30,350	72,000
					Azov	11,000	16,000
Total	***135,000***		***111,800***	***42,000***		***102,900***	***334,500***

Source: CITES Notification No.s 1998/35-36-61, 1999/21-47-53-68 and 2000/053-056

Illegal trade: In 1998, a total of 541kg *A. stellatus* caviar shipments of unknown origin was confiscated by US Customs upon import. This comprised 410 kg re-exported by Turkey and 114 kg re-exported by the United Arab Emirates. Discrepancies between trade statistics of countries importing and exporting caviar can indicate illegal activities. Such discrepancies were found in 1995 and 1996 for instance for Turkey (customs declared caviar exports 21 t and 80 t respectively) and European Union Member States (6 t and 20 t respectively) (Raymakers, 1999). Additionally, Turkish 1996 caviar exports totalled 121 t (Raymakers, 1999), while the country's sturgeon fisheries has been limited to only few incidental catches since the late 1980s (Edwards and Doroshov, 1989).

Poaching and smuggling are closely related and have been intensively reported in the media of both range States and importing countries (Evtouchenko, 1997; McDonald, 2000; Snyder, 2000). Much of the illegally caught sturgeon is destined to the domestic market, particularly meat (Anon., 1998).

Note: The use of the term "eggs" and the unit "kg" or "g" to describe shipments of both caviar and fertilised eggs complicates the analysis of trade data. Similar difficulties arise from the unit used for export quotas of fertilised eggs, which is kilograms ("kg") instead of "number of specimens". Kilograms do not directly correspond to the number of specimens, and hence does not allow for the effective evaluation of quotas.

CONSERVATION MEASURES

A. stellatus is not fully protected in any range State other than Moldova. However, a license is required for fishing in most of the countries and private sturgeon fisheries are prohibited in Iran.

Regarding juvenile restocking efforts, despite the large-scale aquaculture programmes of the Russian Federation since the 1960s (20 hatcheries were fully operational in the 1980s) and Iran (hatcheries have been operational for 20 years), stocks have continued to decline (Dr M. Pourkazemi, *in litt*. to IUCN/SSC Wildlife Trade Programme, September 2000).

Azerbaijan: The Intergovernmental Commission for Caspian Biological Resources, composed of representatives of all range States, has set annual catch quotas.

Annual catch quotas allocated to Azerbaijan (tonnes)

	1990	**1991**	**1992**	**1993**	**1994**	**1995**	**1996**	**1997**	**1998**	**1999**	**2000**
A. stellatus	120	163	163								42.7
Total	*200*	*308*	*510*	*480*	*360*	*182*	*160.5*	*160.5*	*160.5*	*108.67*	*108.35*

Source: CITES Management Authority of Azerbaijan, *in litt.* to TRAFFIC Europe, 18 September 2000

Three hatcheries were built in the lower Kura River by the authorities of the former Soviet Union in the 1960s. A World Bank feasibility study reported that the total capacity of the hatcheries was originally 12 million, but that this capacity had dropped significantly over the years (T. Turner, World Bank consultant, *in litt*. to TRAFFIC Europe, 6 October 2000). World Bank funds have been allocated for the construction of a new sturgeon hatchery and farm that will have the capacity of 15 million fry per year; this should be operational in the next few years. Concerns have been raised about the availability of adult sturgeon to constitute the broodstock of the farm.

Estimated number of sturgeon fry released in the Kura River (million fingerlings)

	1990	**1991**	**1992**	**1993**	**1994**	**1995**	**1996**	**1997**	**1998**	**1999**	**2000**
A. stellatus	3.747	2.870	0.400	0.608	0.392	0.302	1.040	2.100	1.320	8.822	6.869
Total	*17.523*	*9.082*	*2.980*	*1.838*	*1.142*	*1.242*	*4.070*	*6.065*	*6.220*	*20.290*	*16.965*

Source: CITES Management Authority of Azerbaijan, *in litt.* to TRAFFIC Europe, 18 September 2000

The State institution responsible for sturgeon fishery and processing matters is "State Concern Azerbalyg". Commercial sturgeon fisheries are prohibited in the open sea. No fishing license was required until 2000. The only fishing gear permitted for sturgeon catch in the Kura River is "sweep nets" of 35-55 mm mesh size. The minimum size limit set for *A. stellatus* is 90 cm in the Kura River, and 110 cm in coastal waters (Anon., 2000c).

Bulgaria: Measures at the national level as described hereunder are needed, but they must be linked to co-ordinated actions of all countries in the Black Sea region. In Bulgaria, sturgeon fisheries are prohibited for 30 days, from 20 April to 20 May each year, at the peak of the breeding season. The authorities may approve a 15-day extension of the closed season pending the natural conditions of the year. Explosives, poison, bottom trawling and dragging, as well as stunning substances and devices are prohibited fishing methods. The minimum size limit for *A. stellatus* is 75 cm in the Danube River and 100 cm along the Black Sea coast.

Export quotas are set on the basis of catch data, trends and the biological characteristics of the species. A system was established for the distribution of export quotas among export companies that are obliged to restock the Danube River with sturgeon fry before they are authorised to export sturgeon specimens, but until now, no fry of *A. stellatus* have been released. Due to budgetary constraints, Bulgaria has not monitored the wild sturgeon population in recent years, nor the success of its restocking programme (e.g. through tagging of released fingerlings). However, plans have been prepared for these activities (CITES Management Authority of Bulgaria, *in litt.* to TRAFFIC Europe, 15 September 2000). A special prohibition was adopted on the use of "unbaited hooks" for sturgeon catch (Anon., 2000c).

Georgia: Until the early 1990s, artificial breeding of sturgeon was carried out in the Varistkhi Sturgeon Plant built in 1983 on the Rioni River with mixed results (Zarkua and Tsuladze, 1999).

Hungary: The species has been protected since 1989 (Pintér 1991). According to Decree No. 1/1982 (III.15.) on the *Protected and Strictly Protected Species of Flora and Fauna, Value of their Specimens,*

Determination of the Range of Protected and Strictly Protected Caves and Exemptions from Restrictions and Prohibitions Set for Certain Protected Animal Species, prior authorisation from the National Park Directorate is required for the capture, killing, possession, captive breeding, introduction of specimens from exotic population, artificial exchange of genetic matter between populations, exchange and sale or purchase of *A. stellatus* (CITES Management Authority of Hungary, *in litt*. to TRAFFIC Europe, 13 September 2000).

Iran: At all sturgeon catch stations, biometric measurements are carried out for each species. The age, length, sex and weight of fish landed are recorded. The population structure is estimated on the basis of age groups. As a result of these studies carried out for the past 10 years, the number of catch stations were decreased by 50%, changes were adopted on sturgeon catch methods, and lower export quotas were set for the past five years. Export quotas are established on the basis of results of research programmes and the annual monitoring of stocks. These activities include the following parameters and activities: Maximum Sustainable Yield and total catch, rehabilitation of stocks, management and sustainable exploitation through restriction of illegal catch and overfishing. Monitoring fishing efforts and regulating the time of catch are also carried out on the basis of research results (CITES Management Authority of Iran, *in litt*. to TRAFFIC Europe, 24 September 2000).

Annual release of *A. stellatus* fry (million fish)

	1990	**1991**	**1992**	**1993**	**1994**	**1995**	**1996**	**1997**	**1998**	**1999**
A. stellatus	0.36	0.47	0.07	0.30	0.46	0.27	0.22	0.29	0.18	0.13
Total	*4.56*	*6.60*	*3.45*	*4.17*	*5.91*	*9.13*	*12.35*	*21.63*	*24.56*	*19.10*

Source: CITES Management Authority of Iran, *in litt*. to TRAFFIC Europe, 24 September 2000

A labelling system is in place, where each tin of caviar holds a sign or mark that indicates at least the date and place of catch, the name of the catch station, name of processor and the species.

Additional conservation measures have been undertaken for all sturgeon in the southern shores of the Caspian Sea. The fishing permits of more than 6,000 fishermen engaged in fishing using gill nets have been bought, and employment for these fishermen has been created in other fishery operations regarding catch of kilka and beach seine catch. Coastal patrols have also been strengthened (Dr M. Pourkazemi, *in litt.* to IUCN/SSC Wildlife Trade Programme, September 2000).

Kazakhstan: Commercial sturgeon catch is only allowed in the tributaries of the Caspian Sea, but scientific catch is permitted in the open sea with an annual quota of 20 t. Sturgeon fisheries are regulated by law. There are two fishing seasons, one during spring spawning and the other during the time of winter migration. The exact dates of the fishing seasons vary with the climate and are therefore set annually by authorised scientific organisations. As in most former Soviet Republics, "sweep nets" (bottom nets that are hauled several times a day) with a minimum mesh size and which are marked with the name and address of the owner, are the only legal fishing gear for sturgeon. Each fisherman can only set one net at the time. A fishing license is also required. Sturgeon fishing grounds (called "tonia") are limited: there are 12 on the Ural River and 8 on the Kigach River. The minimum catch size limit for *A. stellatus* is 110 cm. The ratio of males and females caught is not regulated. The purchase price at the landing site is based on a fixed legal rate of caviar weight extracted per female; *A. stellatus* is set at 15.4% of the total body weight (Anon., 2000c). Annual commercial catch quotas are allocated to Kazakhstan by the Intergovernmental Commission for Caspian Biological Resources.

Annual commercial catch quotas allocated to Kazakhstan (tonnes)

	1996	**1997**	**1998**	**1999**	**2000**
A. stellatus			305	215	215.5
Total	***375***	***480***	***460***	***405***	***371***

Source: CITES Management Authority of Kazakhstan, *in litt.* to TRAFFIC Europe, 21 September 2000

Two hatcheries, the Uralo-Atyrau and the Atyurau, have been operational since 1998.

Annual release of *A. stellatus* fry (number of fingerlings)

	1998	1999	2000
A. stellatus	1,058,993	2,581,005	3,771,060
Total	*1,706,193*	*5,318,471*	*5,507,160*

Source: CITES Management Authority of Kazakhstan, *in litt.* to TRAFFIC Europe, 21 September 2000

Moldova: Fishery of *A. stellatus* is prohibited in Moldova since the species was included in the National Red Data Book (Anon., 2000c) and is protected by law (Anon., 1999). No monitoring of the population of *A. stellatus* has been undertaken recently (Dr V. Lobcenco, *in litt*, to IUCN/SSC Wildlife Trade Programme Trade Programme, September 2000).

Romania: Bacalbasa-Dobrovici (*in litt*, to IUCN/SSC Wildlife Trade Programme Trade Programme, September 2000) believes that the fishing pressure should be reduced in the lower Danube. He reports that that the existing legislation pertaining to the region is neither adequate nor enforced, particularly in Romania. A fishing license is required in Romania to capture this species (Dr N. Patriche, *in litt.* to IUCN/SSC Wildlife Trade Programme Trade Programme, 5 September 2000). There is a research programme for artificial spawning and culture of *A. stellatus*, and a restocking programme started in 1993. The total number of juveniles restocked in the Danube River is 44,850 fingerlings (Dr N. Patriche, *in litt.* to IUCN/SSC Wildlife Trade Programme Trade Programme, 5 September 2000).

The type of sturgeon fishing gear is strictly regulated by Romanian law. The fishing season is set every year by Ministerial Order. A fishing license is required to catch sturgeon in Romanian waters. The minimum size limit for *A. stellatus* is 100 cm. The catch quota for *A. stellatus* for 1998 and 1999 was set at 20 t per year. Catch quotas are calculated by independent scientific institutes, such as the Danube Delta Institute in Tulcea and the Centre for Conservation, Fish Farming, Fishing and Fish Processing in Galati (Anon., 2000c).

Release of sturgeon juveniles in the Danube River (number of fingerlings)

	1993	1994	1995	1996	1997	1998	1999
A. stellatus	1,000	4,000		10,000	11,600	10,000	6,750

Source: Centre for Conservation, Fish Farming, Fishing and Fish Processing, Galati, December 2000, cited in Anon., 2000c

Russian Federation: For Caspian Sea populations, the former Soviet Republics set annual catch quotas in agreement with Iran. Sturgeon catch quotas have been established by the Intergovernmental Commission for Caspian Biological Resources since the early 1990s. The annual share of sturgeon catches of each former USSR Caspian range State as adopted by the Commission since 1993 are as follows: the Russian Federation 70%, Kazakhstan 17.6%, Azerbaijan 6.1%, and Turkmenistan 6.3%. There are two fishing seasons in the Caspian Sea waters: from ice melting to June 5 and from 1 September until the time of ice formation. A license is required to catch sturgeon in all Russian waters. The minimum size limit for *A. stellatus* caught in Russian Caspian waters is 110 cm along the coast and 90 cm in the northern Caspian Sea (Anon., 2000c). Russian catch quotas are currently declared by the Federal Government following the recommendations given by the State Fisheries Committee in consensus with an independent council of experts (Anon., 2000b).

Release of *A. stellatus* in the Volga River and the Sea of Azov by Russian hatcheries (number of fingerlings)

	1979-1980	1981-1985	1986-1990	1991-1995	1996-1998
Volga River	16,400,000	19,400,000	16,200,000	10,100,000	15,500,000
Sea of Azov	18,950,000	19,120,000	73,800,000	13,040,000	14,293,103

Source: Azov and Caspian Fisheries Research Institute (Az- and KaspNIRKh), cited in Anon., 2000b

From 1979 to 1998, approximately 24.6% and 50.4% of all fry released by Russian hatcheries in the Volga River and the Sea of Azov respectively comprised *A. stellatus* (Anon., 2000b).

Export quotas established by the CITES Management Authority of the Russian Federation consist of 90% of the caviar production, which in turn varies according to the catch quotas set for each species of sturgeon

(Mr Roman V. Ivakhnenko, State Fisheries Committee, pers. comm. to TRAFFIC Europe-Russia, September 2000). The annual catch quotas or Total Allowable Catches (TAC) allocated by the State Fisheries Committee, is based on the recommendations of scientific agencies such as the Russian Federal Research Institute of Fisheries and Oceanography (VNIRO) and the Pacific Research Institute of Fisheries and Oceanography (TINRO). The TAC includes the commercial catch, the scientific catch, and the catch of mature males and females destined to form hatchery broodstock.

Recent data on the monitoring of catch per species, including the size composition and sex ratio of fish caught are not available. The volume of domestic consumption of sturgeon products in the Russian Federation, mostly meat and caviar, is unknown (Mr Roman V. Ivakhnenko, State Fisheries Committee, pers. comm. to TRAFFIC Europe-Russia, September 2000).

Turkey: In 1979, with the exception of *H. huso* of more than 140 cm long, the fishery for sturgeon was prohibited in Turkish waters (Edwards and Doroshov, 1989). Circular 34/1, effective from 2000-2002, prohibits the collection of Acipenseriformes (CITES Management Authority of Turkey, *in litt*. to TRAFFIC Europe, 20 September 2000).

Turkmenistan: In coastal commercial waters, sturgeon fishery is allowed for scientific research only, with an annual catch limit of 20 t. The Turkmenistan State Committee of Fisheries issues an annual license for sturgeon commercial catches to the State enterprise, Balkanbalyk. No other company, Turkmen or otherwise has the right to engage in commercial sturgeon fisheries in Turkmen inland waters. An annual catch quota for the species is set by the Intergovernmental Commission for Caspian Biological Resources. There is no sex ratio set for sturgeon landings (Anon., 2000c).

Ukraine: Sturgeon fishing in the Danube River is permitted throughout the year, except from 16 March to 15 April. The by-catch of sturgeon is regulated. For example, for sprat trawling, a tolerance of two sturgeon specimens of trade length (see below) may be caught per tonne of sprat. The mesh size of nets used to catch sturgeon should be a minimum of 120 mm and a maximum of 150mm. Only fishermen who have been allocated an annual sturgeon quota by the State Committee for Fishery are allowed to catch sturgeon. The minimum size limits for *A. stellatus* are 100 cm for fish caught in the Black Sea and the Danube River, and 80 cm for those caught in the Sea of Azov (Anon., 2000c).

Annual catch quotas for *A. stellatus* for 1997 to 1999 (tonnes)

		1996	**1997**	**1998**	**1999**
Total		*505*	*424*	*210*	*225*
A. stellatus	Sea of Azov and adjacent waters		125	45	30
	Black Sea and Danube River			10	3

Source: State Committee for Fishery of Ukraine, cited in Anon., 2000c

There is currently no sturgeon fry restocking programme in Ukraine.

Yugoslavia: The closed fishing season set in the Danube River for *H. huso*, *A. gueldenstaedtii* and *A. stellatus*, is from 15 May to 15 June. Certain types of fishing gear are prohibited to catch sturgeon and an agreement was signed between Romania and Yugoslavia on the prohibition of gear that cause high mortality of untargeted fish. Any fishing activity, including all commercial and sport fisheries, requires a license in Yugoslav waters. Licenses are issued on a per district basis and the sturgeon fishing grounds are limited to 17.8 km downstream of the Djerdap II dam and the mouth of the Timok River. The minimum size limit for *A. stellatus* was set at 75 cm, but catches of the species have been prohibited from 1996 to 2000. A restocking programme is being carried out by the Centre for Fish Reproduction of the "Djerdap Fishing Company" in Malla Vrbica village (Anon., 2000c).

CAPTIVE BREEDING

The reduction in area of natural spawning grounds due to river flow regulation has caused population declines. Fish reared in hatcheries have therefore been introduced to maintain the stock. Approximately 30% of the Caspian stock originates from hatcheries (Barannikova, 1995). In 1993, 60-98% of each

generation of *A. stellatus* in the Sea of Azov was derived from aquaculture (Volovik *et al.*, 1993). *A. stellatus* has also been introduced into aquaculture in Belgium and France (Welcomme, 1988).

Overfishing has prevented hatcheries from catching enough mature fish to maintain the necessary broodstock (Artyukhin, 1997). Levin (1995) stated that although aquaculture contributes considerably to the maintenance of the stocks, it cannot compensate for the damage caused to natural reproduction.

Azerbaijan: Three hatcheries were built in the 1960s and have contributed to the former Soviet Union sturgeon restocking programme ever since. Their combined annual productive capacity was 12 million fry, but this has dropped significantly due to rising levels of the Caspian Sea, and the lack of funds allocated to hatchery maintenance (T. Turner, World Bank consultant, *in litt*. to TRAFFIC Europe, 6 October 2000).

Georgia: Until the early 1990s, artificial breeding of sturgeon species was carried out at the Varistkhi Sturgeon Plant. Built in 1983 and located on the Rioni River, the results obtained were not always 'satisfactory' (Zarkua and Tsuladze, 1999).

Hungary: There are no captive breeding facilities for *A. stellatus* (CITES Management Authority of Hungary, *in litt.* to TRAFFIC Europe, 13 September 2000).

Iran: Captive breeding activities have been carried out for *A. stellatus* in the southern shores of the Caspian Sea. The breeding, rearing and release of more than 10 million fingerlings into the sea has been undertaken in recent years. The artificial rearing and production of broodstock consisting of 2,000 breeders in earthen ponds has also been undertaken and *A. stellatus* has also been introduced into permanent inland water bodies (Dr M. Pourkazemi, *in litt.* to IUCN/SSC Wildlife Trade Programme, September 2000).

Kazakhstan: Two hatcheries exist in Kazakhstan, Uralo-Atyrau and Atyurau, which have been operational since 1998 (CITES Management Authority of Kazakhstan, *in litt*. to TRAFFIC Europe, September 2000).

Poland: The presence of fish farms and hatcheries of sturgeon in Poland was confirmed by the CITES Management Authority of Poland (*in litt.* to TRAFFIC Europe, 31 August 2000). The following sturgeon species are bred in captivity: *A. baerii*, *A. gueldenstaedtii*, *A. ruthenus*, *A. stellatus*, *H. huso*, *Polyodon spathula* and hybrids of some of these species. In most cases, hybrids are F1 generation live specimens (fertilised eggs) imported in to Poland from range States, particularly the Russian Federation. Some farms keep F2 generation specimens, which are bred in Poland and used as broodstock, partly for the production of juveniles for both the domestic and international market.

Romania: An aquaculture programme exists and has been releasing 10,000 fish of 1-3 g per year (Bacalbasa-Dobrovici, *in litt.* to IUCN/SSC Wildlife Trade Programme, September 2000). The programme is thought to be efficient, but quantitative data are lacking (Suciu *et al*., 1998). Approximately 30,000 juveniles are retained each year for aquaculture and research purposes (Dr N. Patriche, *in litt.* to IUCN/SSC Wildlife Trade Programme Trade Programme, 5 September 2000). In Romania, hatcheries and captive breeding of *A. stellatus* in earth ponds, with the aim of developing commercial farms, are still at an experimental stage (Dr N. Patriche, pers. comm. to TRAFFIC Europe, September 1999).

According to FAO Fishstat, the world annual production of farmed sturgeon and paddlefish (mostly for the meat market) has increased rapidly, from 160 t in 1987 to 2,576 t in 1998. Species specific data are not available in the FAO database, but according to aquaculture companies, there is currently no significant production of meat of *A. stellatus* in commercial farms.

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Gross exports* and export quotas for *Acipenser stellatus* 1998

TAXON	TERM	UNIT	Exporter	1998	Export quotas 1998
Acipenser stellatus	**bodies #1**	**Kg**	**IR**	**4,000**	
Acipenser stellatus	Eggs		AE	237	
Acipenser stellatus	Eggs		AU	4	
Acipenser stellatus	Eggs		CH	12	
Acipenser stellatus	Eggs		DE	26,538	
Acipenser stellatus	Eggs		DK	128	
Acipenser stellatus	eggs #2		GR	20,400	
Acipenser stellatus	Eggs		NL	713	
Acipenser stellatus	Eggs		SG	1	
Acipenser stellatus	Eggs		US	297	
Acipenser stellatus	Eggs	Kg	AE	12,168	
Acipenser stellatus	Eggs	Kg	AU	214	
Acipenser stellatus	Eggs	Kg	AZ	422	
Acipenser stellatus	Eggs	Kg	BE	221	
Acipenser stellatus	Eggs	Kg	CA	21	
Acipenser stellatus	Eggs	Kg	CH	19,059	
Acipenser stellatus	Eggs	Kg	DE	15,638	
Acipenser stellatus	Eggs	Kg	DK	4,694	
Acipenser stellatus	eggs	Kg	FI	50	
Acipenser stellatus	eggs	Kg	FR	1,398	
Acipenser stellatus	eggs	Kg	GB	1,015	
Acipenser stellatus	eggs	Kg	GR	68	
Acipenser stellatus	eggs	Kg	HK	41	
Acipenser stellatus	eggs	Kg	IR	45,955	50,000
Acipenser stellatus	eggs	Kg	KZ	17,467	
Acipenser stellatus	eggs	Kg	NL	6	
Acipenser	eggs	Kg	PE	17	

stellatus					
Acipenser stellatus	eggs	Kg	PL	4,820	
Acipenser stellatus	eggs	Kg	RO	260	
Acipenser stellatus	eggs	Kg	RU	38,981	85,000 (incl. quotas for AZ and KZ)
Acipenser stellatus	eggs	Kg	SA	79	
Acipenser stellatus	eggs	Kg	SG	121	
Acipenser stellatus	eggs	Kg	TR	10,994	
Acipenser stellatus	eggs	Kg	US	9,656	
Acipenser stellatus	live		AE	706	
Acipenser stellatus	live		PL	25,000	
Acipenser stellatus	meat	Kg	DE	50	
Acipenser stellatus	meat	Kg	IR	4,735	
Acipenser stellatus	meat	Kg	US	9	
Acipenser stellatus	skins		CH	8	
Acipenser stellatus	skins		IR	8	

* **Definition:** "Gross exports are the sum of all reported exports and re-exports in a particular commodity or species in a particular year or series of years;... Gross trade is thus a simple measure of the total number of items recorded in international trade. However, gross trade may be an overestimate of the total number of actual specimens in trade as re-exports are not deducted from the total." (Anon., 1996). This is particularly applicable to caviar of which shipments are often exported, re-packaged and re-exported. For instance, in the mid-1990s, Germany re-exported as much as 45% of its annual caviar imports (De Meulenaer and Raymakers, 1996).

#1 The term "bodies" should be interpreted as "meat" (Dr P. Bronzi, *in litt*. to IUCN/SSC Wildlife Trade Programme, 8 September 2000).

#2 The import of 20,400 eggs into Greece (re-exported to the US) without a specified unit, almost certainly refers to "fertilised eggs" and not to caviar. The term "eggs" being used for both caviar and fertilised eggs and the absence of a unit (e.g. specimens, grammes, etc.) renders data analyses problematic. For example, in this case, if the quantity is interpreted in kilogrammes (20,400 kg) it would lead to an overestimate of 20.4 t of caviar in trade.