CONSIDERATION OF PROPOSALS FOR AMENDMENT OF APPENDICES I AND II

Other proposals

A. Proposal

Inclusion of the following species of Acipenseriformes in Appendix II of the Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES):

Acipenser baerii
Acipenser gueldenstaedtii
Acipenser nudiventris
Acipenser stellatus
Huso huso

in accordance with Article II 2.(a) / (b) and

Acipenser dabryanus
Acipenser fulvescens
Acipenser medirostris
Acipenser mikadoi
Acipenser naccarii
Acipenser persicus
Acipenser ruthenus
Acipenser schrenckii
Acipenser sinensis
Acipenser transmontanus
Huso dauricus
Pseudoscaphirhynchus fedtschenkoi
Pseudoscaphirhynchus hermanni
Pseudoscaphirhynchus kaufmanni
Scaphirhynchus albus
Scaphirhynchus platorynchus
Scaphirhynchus suttkusi
Psephurus gladius

in accordance with Article II 2.(b) for reasons of look-alike problems.

The species of Acipenseriformes already listed in CITES are:

Appendix I: *Acipenser brevirostrum*
Acipenser sturio
Appendix II: *Acipenser oxyrinchus* (subspecies: *A. o. oxyrinchus*, *A.o. desotoi*)
Polyodon spathula

B. Proponent

Federal Republic of Germany

C. Supporting Statement

Introduction

Sturgeons, belonging to the order Acipenseriformes, are one of the oldest types of living vertebrate on earth and are considered to be "living fossils" since fossil acipenseriforms are already known from the Jurassic (about 250 million years ago). Sturgeons inhabit rivers, seas and coastal marine waters, as well as some lakes, in the temperate zones of the entire Northern Hemisphere. The fish are either anadromous (which means that mature individuals migrate from the sea to the rivers for spawning, and that juveniles return to the sea), or spend their whole life in freshwater. Spawning always takes place in freshwater.

The current taxonomy of the order Acipenseriformes is debated, particularly as regards the number of species versus sub-species in the genus *Acipenser*, mainly owing to the ease with which species hybridise and moreover, produce fertile offspring. The taxonomy adopted in this proposal is according to the recent taxonomic review of the order by Birstein and Bemis (1997) who recognise 27 living species within the order, the family Acipenseridae consisting of 25 species (17 in the genus *Acipenser*, 2 in the genus *Huso*, 3 in the genus *Scaphirhynchus* and 3 in the genus *Pseudoscaphirhynchus*) and the family Polyodontidae (paddlefish) consisting of 2 species (1 in the genus *Polyodon* and 1 in the genus *Psephurus*).

The status of the populations of almost all sturgeon species currently gives reason for major concern. The Sturgeon Specialist Group of the IUCN Species Survival Commission undertook a full assessment of the conservation status of all sturgeon species. The results of this evaluation (included in the 1996 IUCN Red List of Threatened Animals) show, that at the global level, 23 of the 25 species of the family Acipenseridae and both species of the closely related family Polyodontidae are classified as threatened, 7 as Critical Endangered, 10 as Endangered and 10 as Vulnerable. The situation with the subspecies or subpopulations is more severe: of 22 individual subspecies or populations, 2 are Extinct, 2 are Critically Endangered, and 4 are Vulnerable; only one of these is not yet considered threatened. This evaluation thus indicates that the sturgeons and paddlefishes are as a group at serious risk of extinction in the near future. Indeed, it has been suggested by some experts that the sturgeons only chance for survival may be in captivity.

One major reason for the drastical decline of the sturgeon stocks within the last decade is overfishing, including unprecedented levels of poaching. Sturgeons are extremely vulnerable to overfishing because of their late maturity (between 6 and 25 years, depending on the species and sex) and because the individuals of several species are not spawning every year. Poaching drastically increased within the last years stimulated by the high demand and the high prices for sturgeon products, i.e. caviar, and represents one of the major threats to the survival of sturgeons.

The most valuable sturgeon product in trade on the international market is the highly priced caviar made of the oocytes (unfertilised eggs) of mature females. Mainly three sturgeon species (*Acipenser gueldenstaedtii*, *Acipenser stellatus* and *Huso huso*) are commercially exploited for their caviar, worldwide estimated as delicacy. However, according to experts and traders, the world caviar trade is undergoing a major crisis. While the sturgeon stocks are further depleted, the demand for caviar currently exceeds the actual supply by far. Thus, the general shortage of caviar of the three commercial sturgeon species already led to replacements by caviar from other sturgeon species (e.g. *Acipenser baerii*, *Acipenser nudiventris*, *Acipenser schrenckii*) which are in trade in mislabelled and falsely declared lots. The uncontrolled trade in caviar, including poaching and uncontrolled overfishing, will lead to a further reduction of the sturgeon stocks.

Only international efforts can slow the precipitous decline in sturgeon stocks worlwide. A strict regulation of the exploding trade in sturgeon products, i.e. caviar, is likely to benefit the sturgeon populations as well as the consumers of sturgeon products. Recognition of the crisis conditions that sturgeons are facing by their inclusion in CITES Appendix II is an imperative step.

The detailed supporting statement for each species of the order Acipenseriformes that should be included in CITES Appendix II is given on the following pages. Tables showing the catch and export and import statistics as well as other statistics referring to the trade in sturgeon products, i.e. caviar, are compiled in an appendix at the end of the document.

Acipenser baerii

1. Taxonomy

1.1	Class:	Actinopterygii
1.2	Order:	Acipenseriformes
1.3	Family:	Acipenseridae
1.4	Species: Subspecies:	*Acipenser baerii* Brandt, 1869 *Acipenser baerii baerii* Brandt, 1896 *Acipenser baerii stenorrhynchus* Nikol´skiî, 1896 *Acipenser baerii baicalensis* Nikol´skiî, 1896
1.5	Scientific synonyms:	*Acipenser sturio* (non Linnaeus) Pallas, [1814] *Acipenser stenorrhynchus* Nikol´skiî, 1896 *Acipenser stenorrhynchus* var. *baicalensis* Nikol´skiî, 1896 *Acipenser baeri*; Berg, 1911 *Acipenser baeri stenorrhynchus* Men´shikov, 1947 *Acipenser baeri stenorrhynchus* natio *baicalensis* Egorov, 1948 *Acipenser baeri* c*hatys* Dryagin, 1948
1.6	Common names:	English: Siberian sturgeon, Baikal sturgeon (*Acipenser baerii baicalensis*) French: Esturgeon sibérien Finnish: Siperiansampi German: Sibirischer Stör Polish: Jesiotr syberyjski Russian: Sibiriskiî osetr

2. Biological Parameters

2.1 Distribution

Country of origin: Russian Federation, ? China, ? Kazakhstan

Acipenser baerii inhabits almost all large Siberian rivers (Sokolov and Vasil´ev, 1989). Its range extends in the meridional direction from the Lena River basin and Ob Bay at 73-74´ n.l. to the basin of the Cherniyi Irtysh and Selenga Rivers at 48-49´ n.l., and in the longitudinal direction from the Ob River basin to the Kolmya River up to 97´ (Ruban, 1997). These fishes are most numerous in the middle and downstream sections of the rivers. They enter brackish water and travel into the bays of the Arctic Ocean (Sokolov and Vasil´ev, 1989).

Usually, three subspecies are recognized within *Acipenser baerii* (Ruban, 1997). The subspecies *Acipenser baerii baerii* is restricted to the Ob River and its main tributaries, including the Chernyi Irtysh River. The Ob River population of *Acipenser baerii baerii* is characterised by annual seasonal migrations to and from the Ob River and Ob Bay caused by the unique annual winter oxygen deficiency in the river water. The sturgeons leave most of the Ob River during winter and then stay in the Ob Bay, while in spring a migration upstream into the river occurs (Ruban, 1996).

The subspecies *Acipenser baerii stenorrhynchus* occurs in the basins of the East Siberian rivers Yenisei, Pyasina, Khatanga, Anabar, Yana, Olenek, Lena, Indigirka, Alazeya and Kolyma (Ruban and Akimova, 1991 and 1993; Ruban and Panaiotidi, 1994; Ruban, 1997).

Both subspecies, *Acipenser baerii baerii* and *Acipenser baerii stenorrhynchus*, are known to occur in two forms: one semi-migratory and the other more or less resident in one locality (Sokolov and Vasil´ev, 1989). The migratory form remains in estuaries or river deltas for feeding and swims a considerable distance upstream to spawn, whereas the resident form inhabit the middle and upper stretches of the rivers and does not undertake long-distance migrations. The resident form is considerably less numerous than the migrating one.

The third subspecies, *Acipenser baerii baicalensis* represents a unique freshwater, lacustrine-riverine form which occurs only in the Lake Baikal and migrates in the Selenga River for spawning. In the Lake Baikal, the population occurs mainly near the delta of the Selenga River and in the Barguzinskii and Chivyrkuuskii bays, while it is rarely encountered in the northern part of the lake at the issue of the Verkhnyaya Angara and Kichera Rivers (Ruban, 1997). From these main habitats within the lake *Acipenser baerii baicalensis* migrates along the coastal shallow-water zone into the large tributaries of Lake Baikal. In the Selenga River, it is known to migrate as far as 1,000 km upstream, entering the tributaries of the river including the Chikoi, Orhon, Tula and Delger-Muren Rivers.

There is little information about the distribution of *Acipenser baerii* in Kazakhstan and China. The Chinese Management Authority to CITES reports that distribution of the species ranges from the Ebihe River system to the Kaleimahe River system, and that within the territory of China *Acipenser baerii* occurs only in the Eerqisihe River system of Xinjiang (Qing Jianhua, pers. comm.).

Additionally, since the late 1950s, governmental programmes have been started to transfer juvenile Siberian sturgeons from various populations, but mainly from those in the Lena River and Lake Baikal, to different water bodies, including the Gulf of Finland and the Gulf of Riga in the Baltic Sea. They were introduced in lakes, such as Lake Ladoga, Pskov-Chud, Seliger and others in the Baltic watershed, in the Gor´kov and Volgograd impoundments along the Volga River and in man-made lakes downstream from Moscow (Berdichevskii et al., 1983 in Sokolov and Vasil´ev, 1989). Sokolov and Vail´ev (1989) state that stable, reproductive populations have developed in none of the European water bodies in the early 1980ies. However, the present range of these introduced populations is not clear.

2.2 Habitat availability

Many Siberian rivers have been dammed since the beginning 1950s which resulted in a loss of many habitats for the Siberian sturgeon. The migratory forms of *Acipenser baerii* have been especially affected because their long-distance migration to the spawning sites were prevented by the insurmountable barriers of the hydroelectric dams.

The migrating form of the Ob-Irtysh River population was cut off from approximately 40% of its spawning grounds through the construction of the Novosibirsk hydroelectric power station dam on the Ob River in 1957, as well as the Ust´-Kamenogorsk and the Shul´binsk hydroelectric power station dams built on the Irtysh River (Ruban, 1996).

The sturgeon population in the Yenisei River has been cut off from approximately 500-600 km of their habitat in the river by the construction of the Krasnoyarsk hydroelectric power station dam (Ruban, 1997). For these river systems the extent of habitat loss is documented, but many other Siberian rivers, for which no detailed data are available, have been dammed as well. The total extent of habitat loss for all subspecies of the Siberian sturgeon is not reported.

2.3 Population status

According to Ruban (1997) the contemporary status of the various populations and forms of *Acipenser baerii* can be assessed as Threatened or Endangered. The abundance of *Acipenser baerii baerii* in the Ob River basin as well as the abundance of the East-Siberian subspecies, *Acipenser baerii stenorrhynchus*, is very low and the Lake Baikal subspecies, *Acipenser baerii baicalensis* is extremely rare within its original range. However, there are no published data about an estimate of the total size of neither the entire population nor the subpopulations. The size of the population in captivity is not reported.

At locations where *Acipenser baerii* has been introduced, nothing is known about the population status (Sokolov and Vasil´ev, 1989).

The IUCN classified the status of *Acipenser baerii* as Vulnerable (IUCN, 1996). The status of the subspecies *Acipenser baerii baerii* in Siberia (Russia) and *Acipenser baerii baicalensis* in Siberia (Russia) is classified as Endangered, the subspecies *Acipenser baerii stenorrhynchus* in Siberia (Russia and Yakutia) is listed as Vulnerable.

2.4 Population trends

All populations of *Acipenser baerii* are believed to be in a depressed status and a gradual decline in the size and range of the different populations is recorded since the late 1930s (Ruban, 1997). This reduction might be reflected by the fishery statistics given for the formerly most abundant Ob River population which accounted for 80% of the total catch of Siberian sturgeon: in 1932-1938 the annual catch peaked in 1,401.1 metric tons, decreased gradually to 152.7 metric tons in 1979 and finally approximately 9.2 metric tons were legally caught in 1994 (Ruban, 1996).

The natural reproduction rate of all subspecies - which is already known to be very low - decreased drastically within the last years due to defects and degeneration of oocytes, a phenomenon evidently caused by the high water pollution of the Siberian Rivers (Akimova and Ruban, 1993 and 1995). In some populations the percentage of females of different age with degeneration of some oocytes during the period of cytoplasmic growth increased within four years from 77 to 100%. Apparently, almost in all populations the gametogenesis proceeds with significant anomalies. Taking into consideration a low reproduction potential of the Siberian sturgeon (Akimova and Ruban, 1993 and 1995; Ruban, 1997), even insignificant pathological changes in gameto- and gonadogenesis can result in a serious disturbance in natural reproduction of this species. For this reason, changes in the biology of reproduction in these fish could in long terms end up in a catastrophe for this species and cause further sharp decrease in abundance and range of this species in the near future (Ruban, 1997).

2.5 Geographic trends

A decrease in the range area of the two migrating subspecies of *Acipenser baerii* (*A. b. baerii* and *A. b. stenorrhynchus*has been recorded since the first hydroelectric dams where built on the Siberian rivers at the beginning 1950s (Ruban, 1997). These dams represent insurmountable barriers for the sturgeons and thus, many populations of *Acipenser baerii* (and mainly the migratory form) have been cut off their spawning grounds by dam constructions; for example, the Ob-Irtysh River population has been cut off from approximately 40% of its spawning grounds through the construction of the Novosibirsk hydroelectric power station dam on the Ob River in 1957, as well as the Ust´-Kamenogorsk and the Shul´binsk hydroelectric power station dams built on the Irtysh River in 1952 and in the following years (Ruban, 1996). In the Yenisei River, the species has been cut off from approximately 500-600 km of their habitat in the river by the construction of the Krasnoyarsk hydroelectric power station dam and in the Lena River, the range of the Siberian sturgeon was reduced by approximately 300 km of the upper reaches within the last 150 years (Ruban, 1997). Experts believe that a further decline in the range area of *Acipenser baerii* caused by further dam constructions and a high level of water pollution is probable (Ruban, 1997).

There is no information available about geographic trends for the populations of *Acipenser baerii* in Kazakhstan and China.

2.6 Role of the species in its ecosystem

Acipenser baerii reaches a maximum size of 2m in length (TL) and 200 to 210 kg in weight, but usually the fishes do not exceed 65 kg (Sokolov and Vasil´ev, 1989). The maximum age for the species is about 60 years. It feeds predominantly on benthic organisms, the most important of which are chironomid larvae. In the estuaries and deltas of Siberian rivers, the primary items in the diet include amphipods, isopods and polychaetes (Sokolov and Vasil´ev, 1989). Together with benthic organisms, large quantities of detritus and sediment are ingested constituting sometimes more than 90% of the stomach contents.

The possible consequences of depletion of the populations of *Acipenser baerii* for other species depending on or associated with it are not predictable.

2.7 Threats

According to Ruban (1997) all populations of *Acipenser baerii* are threatened by three main factors: the decrease in spawning grounds after the damming of the rivers (see 2.2 and 2.5), the overfishing and pollution.

Poaching increased considerably during the last years. Whereas in the past the legal annual catch of *Acipenser baerii* in all Siberian rivers amounted to 200 metric tons (Barannikova, 1995), in 1994 in the Ob River basin only, 250-300 metric tons of the Siberian sturgeon were illegally caught (Ruban, 1996). This increasing illegal catch of *Acipenser baerii* might be caused by the general shortage of caviar from the three commercial species (*Acipenser gueldenstaedtii*, *Acipenser stellatus* and *Huso huso*) on the world market. Caviar of *Acipenser baerii* has been found as a replacement for caviar falsely declared to be "beluga" (from *Huso huso*) in one of the New York City stores in 1995 (Desalle and Birstein, 1996).

The level of pollution in many Siberian rivers is enormous (Ruban, 1997). Industrial wastes are poured into the Ob River at its quarters on the Mongolian border originating from the mining and industrial regions of Khazakhstan and the Kuznetsk basin, as well as from such industrial centres as the cities of Chelyabinsk and Yekaterinburg (Peterson, 1993). The main producer of pollutants in West Siberia is the oil and gas industry in the region of Tyumen in the Ob River basin. The concentration of oil and petroleum products in the water of the Ob River amounted 0.54 mg/l in 1990 which exceeded the locally permissible levels by a factor of 10 (Green, 1993). East Siberian rivers, especially in Yakutia and the Kolyma River basin are mainly polluted by the local gold-mining industry. The pollution of Lake Baikal by direct dumping of wastes from industrial plants, including Russia's largest paper plant Baikal Pulp and Paper Combine built in 1966, was going on during the last thirty years on an enormous scale (Feshbach and Friendly, 1991; Peterson, 1993). Moreover, the water of many Siberian rivers, especially of the Ob and Yenisei basins, are contaminated with radioactive substances to a very high degree.

This increasing environmental contamination of practically all Siberian water bodies evidently affects all populations of the Siberian sturgeon. Long-term histological studies of the development and efficiency of the reproductive system in Siberian sturgeon populations from East Siberia (Akimova and Ruban, 1993 and 1995; Akimova et al., 1995) reveal that the gametogenesis in individuals from the Lena, Indigirka, Kolyma and Yenisei Rivers proceed with significant anomalies. While from 1964 to 1977 in the Lena River only single cases of degeneration of oocytes during the cytoplasmic growth have been recorded, the amount of females with such defects was already close to 59% of all examined specimens in 1986. The percentage of females with degenerated oocytes in the Indigirka River increased from 77% in 1984 to 100% in 1987. Additionally, further defects have been observed, such as the amitotic division of sex cells, the degeneration of oocytes and of the nuclear membranes in oocytes during vitellogenesis, defects in the oocyte membrane, degeneration of germ cells, extensive deformation of oocytes, the appearance of cavities with foreign body inclusions in the oocyte membrane and a mass resorption of mature eggs. Different populations of *Acipenser baerii* are in different stages of this pathological development of the reproductive system which is caused by environmental pollution. However, these changes in the biology of reproduction are believed to cause a further sharp decrease in the population size of the Siberian sturgeon whose reproduction potential is already considered as very low under normal circumstances (Ruban, 1997).

3. Utilization and Trade

3.1 National utilization

Acipenser baerii is one of the most valuable fishes in Siberia (Sokolov and Vasil´ev, 1989). Both meat and roe (processed as caviar) are used. The maximum catches of the Siberian sturgeon were recorded during the 1930s, when the annual harvest reached 1,280 to 1,770 metric tons (Votinov et al., 1975 in Sokolov and Vasil´ev, 1989). The main part of the catch, over 80%, always came from the Ob River system, followed by specimens caught in the Yenisei River system. In the other Siberian rivers the sturgeon catch was much smaller with no specialised sturgeon fishery established (Ruban, 1997). Historically, the Ob River population was the largest among all populations of the Siberian sturgeon (Ruban, 1996). In 1932-1938, the annual catch in the Ob

River system varied from 895.2 to 1,401.1 metric tons. Later the catch decreased gradually to 152.7 metric tons in 1979. According to Ruban (1996), the legal catch of Siberian sturgeon in the whole Ob River basin was 9.2 metric tons in 1994, while the illegal catch by poachers was about 250-300 metric tons.

Ruban (1996) reports that in the lower reaches of the Ob the sturgeon fishery uses drift nets with a length of 300 to 450 m during the migration of the fishes from the Ob Bay upstream into the river.

3.2 Legal international trade

No information available.

3.3 Illegal trade

Ruban (1996) indicates that the illegal catch of *Acipenser baerii baerii* by poachers in the entire Ob River basin was about 250-300 metric tons in 1994 (with data received from the Nizhneobrybvod, Lower Ob Fishery Office). Since market channels are not known, it is not clear whether the illegally captured fishes are utilised only for domestic consumption or if caviar is produced for export.

According to Desalle and Birstein (1996), caviar of *Acipenser baerii* was found as a replacement for beluga caviar (from the giant sturgeon *Huso huso*) in one of the New York City stores in 1995.

3.4 Actual or potential trade impacts

Trade might become a threat to the survival of the species because illegal fishery is increasing due to the high value of the fish and its caviar. According to Ruban (1997) overfishing was one of the main reasons for the decrease of the population size and is still a cause of major concern.

3.5 Captive breeding or artificial propagation for commercial purposes (outside country of origin)

Acipenser baerii is the most frequent sturgeon species that is cultivated in aquaculture. Siberian sturgeons from the Lena population, i.e. the subspecies *Acipenser baerii stenorrhynchus*, have been introduced in aquaculture in several European countries and are successfully propagated in France, Italy, Germany, Hungary, Netherlands, Denmark and Belgium (Sokolov and Vasil´ev, 1989, Williot et al., 1993). Williot et al. (1993) estimate the amount of the total annual production of the Siberian sturgeon in aquaculture to be approximately 20 metric tons in France, 10 metric tons in Italy, and 10 metric tons in Germany. There are no data available for the remaining European countries.

The Siberian sturgeon has also been introduced in aquaculture in China and Japan (Katsumi and Genjiroi, 1977; Anonymous, 1994). There are no data about the total production of *Acipenser baerii* within these countries.

4. Conservation and Management

4.1 Legal status

4.1.1 National

Only the subspecies of Lake Baikal, *Acipenser baerii baicalensis*, was listed in the Red Data Book of the Russian Federation in 1983 (Ruban, 1997). There is no further information about a conservation programme for the Endangered subspecies.

4.1.2 International

None.

4.2 Species management

4.2.1 Population monitoring

No information available.

4.2.2 Habitat conservation

No information available.

4.2.3 Management measures

Until now, the artificial propagation of the Siberian sturgeon has not played an important role in stock enhancement in Siberian natural waters. The Siberian sturgeon, in general the subspecies *Acipenser baerii stenorrhynchus* from the Lena River, is mainly cultivated for commercial purposes in warm water ponds in the European Part of the Russian Federation (Barannikova, 1995).

Birstein (1993b) indicates that Russian scientists hold few specimens of *Acipenser baerii baicalensis* at a hatchery near Moscow and are planning to work on artificial propagation of the subspecies within the framework of a recovery project.

No data about the production in aquaculture ponds or in hatcheries are available.

4.3 Control measures

4.3.1 International trade

None.

4.3.2 Domestic measures

No information available.

5. <u>Information on Similar Species</u>

6. <u>Other Comments</u>

All range states of the species has been contacted on 13 March 1996 and 21 May 1996. A copy of the first draft of the proposal ("working document") has been sent to all range states on 19 August 1996. The comments of the range states that have been received are attached in the appendix at the end of this document.

The "working document" has also been presented at the 13th meeting of the Animals Committee of CITES in Prague, Czech Republic, on 23-27 September 1996 for discussion.

Additionally, the Authorities of the Russian Federation have been contacted in a first meeting in Moscow on 25 to 26 June 1996 for bilateral consultations. A second meeting ("Multilateral Consultations on the Problems of Sturgeon Species within the Framework of CITES") which took place on 21-22 November 1996 in Moscow, has been organised in order to consult with the states of Azerbaijan, Kazakhstan, Turkmenistan and Ukraine (which are not members to CITES) as well as with China, Georgia, Iran, USA and the Russian Federation. The minutes of this meeting and the comments of the range states that have been received are attached in the appendix at the end of this document.

7. <u>Additional Remarks</u>

8. <u>References</u>

Akimova, N. V., A. I. Panaiotidi, and G. I. Ruban. 1995. Disturbances in the Development and Functioning of the Reproduction System of Sturgeons (Acipenseridae) of the Yenisey River. Journal of Ichthyology, 35 (6) :72-87.

Akimova, N.V. and G.I. Ruban. 1993. The condition of the Reproductive System of the Siberian Sturgeon, *Acipenser baeri*, as a Bioindicator. Journal of Ichthyology 33(4): 15-24.

Akimova, N.V. and G.I. Ruban.. 1995. Disturbances of Siberian Strugeon´s Generative System Resulted from Anthropogenic Influence. Proceedings of the Second International Symposium on Sturgeons, September 6-11, 1993. Moscow-Kostroma-Moscow (Russia). VNIRO Publication. Pp. 74-79.

Anonymous. 1994. Aquaculture Production: Overview of the World Production of Sturgeon from Aquaculture and Fishery. Aquaculture Europe 18 (4): 34.

Barannikova, I.A. 1995. Measures to Maintain Sturgeon Fisheries under Conditions of Ecosystem Changes. Proceedings of the Second International Symposium on Sturgeons, September 6-11, 1993. Moscow-Kostroma-Moscow (Russia). VNIRO Publication. Pp. 131-136.

Barannikova, I. A., I. A. Burtzev, A. D. Vlasenko, A. D. Gershanovich, E. V. Malarov, and M. S. Chebanov. 1995. Sturgeon fisheries in Russia. In: Proceedings of the Second International Symposium on Sturgeons, September 6-11, 1993. Moscow-Kostroma-Moscow (Russia). VNIRO Publication. Pp. 124-130.

Birstein, V.J. 1993a. Sturgeons and Paddlefishes: Threatened Fishes in Need of Conservation. Conservation Biology 7 (4):773-787.

Birstein, V.J. 1993b. Draft Application to CITES: Order Acipenseriformes. Unpublished.

DeSalle, R. and V. J. Birstein. 1996. PCR identification of black caviar. Nature, 381 :197-198.

Feshbach, M. and A. Friendly, Jr. 1991. Ecocide in the USSR. Health and Nature Under Siege. New York, Basic Books, 376 pp.

Green, E. 1993. Poisoned Legacy: Environmental Quality in the newly independant States. Environ. Sci. Technol. 27: 590-595.

IUCN (1996). 1996 IUCN Red List of Threatened Animals. IUCN, Gland, Switzerland.

Katsumi, S and N. Genjiroi. 1977. Rearing of Sturgeons in Japan. In: Proceedings of the 5th Japan-Soviet Joint Symposium on Aquaculture, Tokyo, Japan, September 1976. Pp. 379-393.

Peterson, D.J. 1993 Troubled Land. The Legacy of Soviet Environmental Destruction, Westview Press, Boulder. 276 pp.

Ruban, G.I. 1992. Plasticity in Natural and Experimental Populations of Siberian Sturgeon, *Acipenser baeri* Brandt. Acta Zoologica Fennica 1991: 43-46.

Ruban, G.I. 1996. The Siberian Sturgeon, *Acipenser baerii baerii,* Population Status in the Ob River. The Sturgeon Quarterly 4 (1/2): 8-9.

Ruban, G.I. 1997. Species Structure, Contemporary Distribution and Status of Siberian Sturgeon, *Acipenser baerii*. In: V. Birstein, J. R. Waldman, and W. E. Bemis (eds.). Sturgeon Biodiversity and Conservation. Kluwer Academic Publishers, Dordrecht. pp. 221-230.

Ruban, G.I. and N.V. Akimova. 1991. Notes on the Ecology of the Siberian Sturgeon, *Acipenser baeri*, in the Indirka River. Journal of Ichthyology 31 (8): 118-129.

Ruban, G.I. and N.V. Akimova. 1993. Ecological Characteristics of Siberian Sturgeon, *Acipenser baeri*, from the Kolyma River. Journal of Ichthyology 33 (5): 66-80.

Ruban, G.I. and A.I. Panaiotidi. 1994. A Comparative Morphological Analysis of the Siberian Sturgeon, *Acipenser baeri stenorrhynchus* and *A. baeri chatys* (Acipenseridae) of the Yenisey and Lena Rivers. Journal of Ichthyology 34 (8): 58-71.

Sokolov, L.I. and V.P. Vasile´v. 1989. *Acipenser baeri* Brandt, 1896. In: Holcík, J. (ed). The Freshwater Fishes of Europe. Vol. 1/II: General Introduction of Fishes. Acipenseriformes. Wiesbaden, AULA-Verlag. Pp. 263-284.

Williot, P., P. Bronzi and G. Arlati. A Very Brief Survey of Status and Prospects of Freshwater Sturgeon Farming in Europe (EEC). In: P. Kestemont and R. Billard (eds.). 1993. Workshop on Aquaculture of Freshwater Species (Except Salmonids). European Aquaculture Society, Special Publication No. 20, Ghent, Belgium.

Acipenser dabryanus

1. Taxonomy

   1.1 Class: Actinopterygii

   1.2 Order: Acipenseriformes

   1.3 Family: Acipenseridae

   1.4 Species: *Acipenser dabryanus* Duméril, 1868

   1.5 Scientific synonyms: None

   1.6 Common names: English: Yangtze (or Changjiang) sturgeon, River sturgeon, Dabry´s sturgeon

2. Biological Parameters

   2.1 Distribution

   Country of origin: China

   Acipenser dabryanus is endemic to the Yangtze River system (Nichols, 1943). The present distribution range of the species is mainly restricted to the upper main stream of the river upstream the Gezhouba Dam at Yichang, Hubei Province, but the fish also enter the major tributaries of this section including the rivers Ming, Tuo and Jialing (Zhuang et al., 1997). Occasionally, individuals are encountered in the lower and middle sections of the Yangtze River downstream the Gezhouba Dam and they are fairly rare in Dongting Lake (Hunan Province) and Poyang Lake (Jiangxi Province) (Zhuang et al., 1997).

   Dabry´s sturgeon is a potamic freshwater fish that inhabits the sandy shoals with silt ground and gentle water flow. When the water level rises in the mainstream in spring, the fish moves to the tributaries to feed. Young individuals often stay in sandy shallows and frequently occur in the stretches between Luzhou and Jiangjing, Sichuan Province, where the current velocity is not rapid (Zhuang et al., 1997).

   It is believed that the spawning grounds of *Acipenser dabryanus* are located in the upper mainstream where mature adults migrate in spring (Zhuang et al., 1997). However, there is a great lack of information about the species including the investigation of the spawning grounds. Young fish are reported to occur frequently in the reaches below Yibing City in Sichuan Province, whereas mature fish have not been found in that region. Hence, Zhuang et al. (1997) suggest that the spawning grounds may be located in the mainstream upstream the City of Yibing, and that young fish swim downstream immediately after hatching since they can be found in the reaches at Luxian, Hejiang and Jiangjing at approximately 100-200 km from the supposed spawning sites.

   2.2 Habitat availability

   Historically, under the natural, unaltered conditions that existed in the middle of the 20th century, *Acipenser dabryanus* was widely distributed in the upper and middle reaches of the Yangtze River and its tributaries (Nichols, 1943; Zhuang et al., 1997). In 1981, the Gezhouba Dam was built just at the point between the upper and middle Yangtze River at Yichang, Hubei Province. This dam represents an insurmountable barrier for the migration of many fishes including *Acipenser dabryanus* which is believed to migrate to its spawning grounds in the upper mainstream of the Yangtze River in springtime (Zhuang et al., 1997). Hence, the range area of Dabry´s sturgeon has been mainly restricted to the upper reaches of the Yangtze River just above Gezhouba Dam. Individuals are only occasionally encountered in the middle and lower sections of the river.

2.3 Population status

No estimates about the present size of the total stock are given. Zhuang et al. (1997) point out that the total population sharply declined within the last two decades and that nowadays only a few individuals can be found in the reaches above the Gezhouba Dam.

An analysis of the age composition of individuals caught in the upper reaches of the Yangtze River (Fu, 1988 and Zen et al., 1990 in Zhuang et al., 1997) showed that 92% of the specimens were below three years old and thus not mature yet. Males usually reach sexual maturity at an age of 4-6 years and females at an age of 6-8 years. Zhuang et al. (1997) suggest that in natural populations only 6.7% of individuals reached sexual maturity, 4.8% of males and 1.9% of females.

Acipenser dabryanus is listed as Critically Endangered by IUCN (1996).

2.4 Population trends

Zhuang et al. (1997) report that the population of *Acipenser dabryanus* is substantially declining since the middle of the 1970s. Experts believe that the present status of *Acipenser dabryanus* is Endangered or even Close to Extinction (Birstein, 1993 and 1993b) and that without taking any measures the population will further decline.

2.5 Geographic trends

With the building of Gezhouba Dam in 1981 just at a point between the upper and the middle reaches of the Yangtze River, the range area of *Acipenser dabryanus* has been mainly restricted to the upper reaches of the river where the spawning grounds are supposed to be located (Zhuang et al., 1997). Adult individuals living below the dam are prevented from upstream migrations to their original spawning sites by the massive hydroelectric construction. Adequate spawning grounds below the dam have not been found. Hence, the population living below the dam is disappearing.

A future hydroelectric project will possibly lead to a further restriction of the distribution range: the construction of the Three Gorges Dam at 47 km upstream of the Gezhouba Dam is supposed to be finished in 1997. It is expected that practically all habitats of *Acipenser dabryanus* will be inundated after the completion of this project (Zhuang et al., 1997).

2.6 Role of the species in its ecosystem

Despite its formerly great commercial importance *Acipenser dabryanus* has only been poorly investigated. Up to now, very limited information is available on the biology and life history of the species. Feeding habits of *Acipenser dabryanus* vary with age, season and habitat ((Zhuang et al., 1997). The food items are wide-ranging and although living animal prey is preferred, plant remains are frequently found in analyses of the stomach contents. Young fish initially feed almost exclusively on zooplankton and oligochaetes, older individuals eat oligochaetes, small fishes (e.g. gobies, etc.), aquatic insect larvae (chironomids, odonates) and aquatic plants.

The role of *Acipenser dabryanus* in its ecosystem is not clear. The possible consequences of a depletion of the populations of the species for other species depending on or associated with it are not predictable.

2.7 Threats

Since the middle of the 1970s the population of *Acipenser dabryanus* has been sharply declining mainly due to overexploitation. Mostly young specimens have been caught because adult individuals are very rare and do not like to concentrate and because fishermen used nets with small mesh size. The mean standard weight of individuals caught at Luzhou, Sichuan Province, is reported to have been lesser than 50 g which corresponds to an age younger than one year (Zhuang et al., 1997). In addition, the traditional fishing season coincided with the natural spawning season and thus even mature fish were taken.

Although the commercial fishery for *Acipenser dabryanus* has been completely banned since 1983, fishermen still catch Dabry´s sturgeon accidentally as a bycatch due to the small mesh size of the used nets. But even if the caught sturgeon usually are released to the river again, they are hurt in most cases and it is not clear if they will survive.

With the economic development and the increasing number of factories built along the Yangtze Valley, the water quality became worse within the last two decades. Pollution with untreated industrial waste water and pesticides and mineral fertilisers used in agriculture increased drastically. Those harmful substances not only endanger the fish directly but also have an influence on the reproduction of the food organisms. However, no data about the amount and the impact of toxins in the Yangtze River on the fauna are available.

Furthermore, the survival of *Acipenser dabryanus* is threatened by habitat alterations and destruction. The vegetation in the upper Yangtze Valley has been seriously destroyed and as a consequence, a vast amount of silt is washed into the river in raining season which effects the fishes and their food organisms (Zhuang et al., 1997). The construction of large hydroelectric dams across the river leads to a complete blocking of migration pathways. Individuals living below the Gezhouba Dam cannot reach their spawning grounds located in the upper section of the river above the dam and thus, are not able to reproduce. The population cut off its spawning grounds is on the verge of extinction. With the finishing of the Three Gorges Dam 47 km upstream the Gezhouba Dam in 1997, practically all habitats of *Acipenser dabryanus* will be inundated (Zhuang et al., 1997) and destroyed.

3. Utilization and Trade

3.1 National utilization

Acipenser dabryanus formerly represented an important commercial species in the upper Yangtze River in Sichuan Province. The landings of this species once reached 10% of the total harvest of Heijang Fishing Squad (Sichuan Province) in the 1960s (He, 1990 in Zhuang et al., 1997). In the 1970s, 5000 kg of *Acipenser dabryanus* could be caught by fisherman in a spring season (Zhuang et al., 1997). Since the end of the 1970s, the total landings sharply declined. In 1983, commercial fishery for *Acipenser dabryanus* was completely prohibited when the sturgeon was listed as an endangered species under the state's special protection in Category I (Zhuang et al., 1997).

3.2 Legal international trade

None.

3.3 Illegal trade

Not reported.

3.4 Actual or potential trade impacts

Not reported.

3.5 Captive breeding or artificial propagation for commercial purposes (outside country of origin)

Not reported.

4. Conservation and Management

4.1 Legal status

4.1.1 National

Acipenser dabryanus is protected by law as Endangered species with Category I status since 1983. This comprises a full protection of the species and a complete ban on fishery.

4.1.2 International

None.

4.2 Species management

4.2.1 Population monitoring

Information on a special monitoring programme for *Acipenser dabryanus* is not available.

4.2.2 Habitat conservation

Not reported.

4.2.3 Management measures

Chinese scientists are working on a project for artificial breeding and propagation of *Acipenser dabryanus* (Xie et al., 1992). Zhuang et al. (1997) report that artificial breeding had been successfully carried out in 1976 by Xie et al. and in 1986 by Tian et al. and they propose to establish several enhancement stations above and below the Gezhouba Dam.

4.3 Control measures

4.3.1 International trade

None.

4.3.2 Domestic measures

Not reported.

5. Information on Similar Species

Acipenser dabryanus is partly sympatric with the Chinese sturgeon, *Acipenser sinensis*. These two species are the only representatives of the family Acipenseridae found in the Yangtze River. While *Acipenser dabryanus* is a typical freshwater resident, *Acipenser sinensis* is an anadromous species which migrates long distances from the Sea to the spawning grounds in the Yangtze River. Both sturgeon species appear to be very similar in shape when they have the same length, whereas the maximum individual size of the Chinese sturgeon is much larger than that of *Acipenser dabryanus*. Both sturgeon species are listed as Endangered species in the Chinese Red Data Book and commercial fishery has been officially prohibited since 1983 (Zhuang et al., 1997).

6. Other Comments

The range state of the species has been contacted on 13 March 1996 and 21 May 1996. A copy of the first draft of the proposal ("working document") has been sent to the range state on 19 August 1996. The comments of the range state that have been received are attached in the appendix at the end of this document.

The "working document" has also been presented at the 13th meeting of the Animals Committee of CITES in Prague, Czech Republic, on 23-27 September 1996 for discussion.

Additionally, a meeting ("Multilateral Consultations on the Problems of Sturgeon Species within the Framework of CITES") which took place on 21-22 November 1996 in Moscow, has been organised in order to consult with the states of Azerbaijan, Kazakhstan, Turkmenistan and Ukraine (which are not members to CITES) as well as with China, Georgia, Iran, USA and the Russian Federation. The minutes of this meeting and the comments of the range states that have been received are attached in the appendix at the end of this document.

7. Additional Remarks

In addition to the consultations with the range states of the species, countries which range amongst the main caviar consumers, such as the states of the European Union, Switzerland and Japan, has been contacted on 13 March 1996 and 21 May 1996. The so obtained statistics and information are included in the text.

8. References

Birstein, V.J. 1993a. Sturgeons and Paddlefishes: Threatened Fishes in Need of Conservation. Conservation Biology 7 (4):773-787.

Birstein, V.J. 1993b. Draft Application to CITES: Order Acipenseriformes. Unpublished.

IUCN. 1996. IUCN Red List of Threatened Animals. IUCN, Gland, Switzerland.

Nichols, J.T. 1943. The Freshwater Fishes of China. Central Asiatic Expeditions: Natural History of Central Asia. Vol. IX. American Museum of Natural History, New York. Pp. 15-16.

Wei, Q., F. Ke, J. Zhang, P. Zhuang, J. Luo, R. Zhou and W. Yang. 1997. Biology, Fisheries and Conservation of Sturgeons and Paddlefish in China. In: Birstein, V., J.R. Waldman and W.E. Bemis (eds.). Sturgeon Biodiversity and Conservation. Kluwer Academic Publication, Dordrecht. Pp. 241-255.

Xie, D., Y. Tiang and D. Chen.1992. Study on Domestication of the Changjiang Sturgeon in Pond. Proceedings of the International Symposium on Sturgeons and Paddle4fishes. June 5-8, 1992. Chongqing, China. Pp. 6-7.

Zhuang, P., F. Ke, Q. Wei, X. He and Y. Cen. 1997. Biology and Life History of Dabry´s Sturgeon, *Acipenser dabryanus*, in the Yangtze River. In: Birstein, V., J.R. Waldman and W.E. Bemis (eds.). Sturgeon Biodiversity and Conservation. Kluwer Academic Publication, Dordrecht. Pp. 257-264.

Acipenser fulvescens

1. Taxonomy

1.1 Class: Actinopterygii

1.2 Order: Acipenseriformes

1.3 Family: Acipenseridae

1.4 Species: *Acipenser fulvescens* Rafinesque, 1817

1.5 Scientific synonyms:
Acipenser rubicundus Le Sueur, 1818
Acipenser maculosus Le Sueur, 1818
Acipenser heptipus Rafinesque, 1818
Dinectus truncatus Rafinesque, 1818
Sterletus serotimus Rafinesque, 1820
Sterletus ohiensis Rafinesque, 1820
Sterletus macrostomus Rafinesque, 1820
Acipenser legenarius Rafinesque, 1820
Acipenser muricatus Rafinesque, 1820
Acipenser rupertianus Richardson, 1836
Acipenser laevis Agassiz, 1850
Acipenser carbonarius Agassiz, 1850
Acipenser rhynchaeus Agassiz, 1850
Antaceus buffalo Duméril, 1870
Antaceus cincinnati Duméril, 1867
Acipenser liopeltis Guenther, 1870
Huso copei Duméril, 1870
Huso rauchii Duméril, 1870
Huso richardsonii Duméril, 1870
Huso anasimos Duméril, 1870
Huso paranasimos Duméril, 1870
Huso anthracinus Duméril, 1870
Huso lamarii Duméril, 1870
Huso atelaspis Duméril, 1870
Huso rafinesquii Duméril, 1870
Huso rosarium Duméril, 1870
Huso platyrhinus Duméril, 1870
Huso kirtlandi Duméril, 1870
Huso mertinianus Duméril, 1870
Huso honneymani Duméril, 1870

1.6 Common names:

English: Lake sturgeon, Freshwater sturgeon, Great Lakes sturgeon, Rock sturgeon, Stone sturgeon, Red sturgeon, Ruddy strugeon, Common sturgeon, Shell back sturgeon, Bony sturgeon, Smoothback
Finnish: Järvisampi
French: Esturgeon jaune, Camus (for adults), Escargot maillé or charbonnier (for juveniles)
Polish: Jesiotr jeziorny

2. Biological Parameters

2.1 Distribution

Countries of origin: Canada, U.S.A.

The lake sturgeon, *Acipenser fulvescens*, has one of the widest geographic ranges of North American freshwater fishes. Its range in North America includes three major watersheds: the Great

Lakes, the Hudson-James Bay and the Mississippi River (Lee et al., 1980; Houston, 1987; NPSSC, 1993). In the U.S.A., the range of the Lake sturgeon is mainly confined to the Great Lakes, but it also occurs in the Mississippi River drainage from the upper Mississippi River and its major tributaries to the southern border of Arkansas (NPSSC, 1993). The Canadian distribution of the Lake sturgeon includes rivers and lakes in the five provinces of Alberta, Saskatchewan, Manitoba, Ontario and Quebec. The species is found as far west as Edmonton on the North Saskatchewan River, as far east as St. Roch de Aulnaires on the St. Lawrence River, as far north as the Seal River (a tributary on the west coast of Hudson Bay) and as far south as Lake Erie (Houston, 1987; Ferguson and Duckworth, 1997).

Some populations in the different watersheds are isolated and fragmented due to dam constructions on the rivers (Thuemler, 1985 and 1997). Individuals from different populations of *Acipenser fulvescens* differ morphologically and genetically (Fortin et al., 1991; Guenette et al., 1992; Ferguson and Duckworth, 1997).

Lake sturgeon are usually confined to freshwater. However there are few records of individuals being taken in the brackish waters of the St. Lawrence River and Moose River near James Bay (Scott and Crossman, 1973). The usual habitat are the highly productive shoal areas of larger lakes and rivers (Houston, 1987).

2.2 Habitat availability

Due to the wide range of *Acipenser fulvescens*, encompassing many states and provinces, there is only sparse detailed and documented knowledge of the degradation and loss of habitats. Several rivers within the species range in both the U.S.A. and Canada have been blocked by dam constructions (Thuemler, 1985 and 1997; LaHaye et al., 1992). The construction of dams to power grist mills, saw mills, etc. may have had an early effect on the Lake sturgeon populations and is thought to be one of the major reasons for their decline in Lake Ontario (Houston, 1987). Hydroelectric dams built on most of the larger river streams in both Canada and U.S.A. not only restricted the movements of the species but also affected both periodic and seasonal water level fluctuations which resulted in a disruption and destruction of suitable spawning habitats (Houston, 1987; Ferguson and Duckworth, 1997).

2.3 Population status

Population estimates of *Acipenser fulvescens* are largely unavailable and different populations throughout the wide range are believed to be in different status (Houston, 1987). There is no estimate of the total size of the population and only few up-to-date estimates of some subpopulations in different watersheds.

Threader and Brousseau (1986) investigated Lake sturgeon in the lower Moose River system in the Hudson Bay lowland during 1980-1982 and estimated the size of the population to be about 7,088 fish with 95% confidence limits of 5,774 - 8,919. Population estimates were made on the basis of marked fish recaptured the following year and the adjusted Petersen estimator.

Kempinger (1996) gives an estimate for the Lake sturgeon population of the Lake Winnebago system, Wisconsin, which consisted of about 43,200 fish larger than 114 cm (TL) in 1990, the estimate based on a tagging study in Lake Winnebago.

Houston (1987), in his status survey of *Acipenser fulvescens* in Canada, indicates that the species is still common throughout most of its range but is rare in the Lakes Ontario and Winnipeg.

Ferguson and Duckworth (1997) recently gave a status survey for the Lake sturgeon in the Canadian provinces of Manitoba, Ontario and Quebec. In Manitoba the species is identified as a Vulnerable species under the Manitoba Endangered Species Act. The largest zone of extirpation and population reduction seems to have occurred in the Lake Winnipeg drainage area. The population status in major river systems ranges from remnant to good depending upon the section. In Ontario, robust and healthy populations are generally limited to more remote northern rivers and lakes. Populations have been reduced if not extirpated in the lower Laurentian Great Lakes of Lake Ontario and Lake Erie. Populations in the Ottawa River, Lake Nissiping, Abitibi River and Lake

Superior are believed to be severely depressed. Populations from the Lake of the Woods and possibly the north channel of Lake Huron and southern Lake Huron appear to be increasing from recent depressed levels. In Quebec, even though none of the Lake sturgeon populations are known to be extirpated, some have diminished and show sign of overexploitation.

The status of the populations of *Acipenser fulvescens* is classified as Vulnerable by IUCN (1996).

2.4 Population trends

All populations of *Acipenser fulvescens* have substantially declined throughout most of the species' range over the past 200 years (Houston, 1987; Kempinger, 1996; Ferguson and Duckworth, 1997) mainly due to overexploitation by man since the end of the 19th century. Houston (1987) states that although still common in most parts of its range in Canada, populations currently no-where enjoy the former abundances demonstrated prior to their becoming an important part of the commercial fisheries. Nowadays, the different populations are in a different status and there is no general trend indicated. Some populations (e.g. in the Lake of the Woods) are evidently increasing due to the closure of fisheries, while other populations are further declining, mainly in that regions which are still exploited such as the St. Lawrence, Ottawa, Hurricana and Guegan Rivers and the Baskatong Reservoir in Quebec (Ferguson and Duckworth, 1997).

For other states and provinces there are no trends indicated.

2.5 Geographic trends

No detailed information available.

2.6 Role of the species in its ecosystem

Acipenser fulvescens is non-anadromous sturgeon species, usually occurring in freshwater at shoal areas of larger lakes and rivers (Scott and Crossman, 1973). The fish reach on the average a total length of 0.9-1.9 m and a weight of approximately 160 kg, although there are few records of specimens exceeding 2.25 m in length (TL) and 100 kg in weight (Scott and Crossman, 1973).

Feeding habits differ according to food availability, the diet mainly consisting of benthic invertebrates, such as leeches, snails, small clams and insect larvae (Scott and Crossman, 1973). Small fish (sticklebacks or sculpins) have also been found in the stomach of some individuals and may also be an important dietary source in some areas (Houston, 1987). The Lake sturgeon, like other sturgeons, is a typical bottom dweller, adapted to feeding on the bottom, and is usually associated with other bottom feeders such as the White Sucker with which it competes at some stage of its life cycle. Several other fish species spawn in or near similar places as the Lake sturgeon. However, direct competition is avoided by differences in timing and location of the actual spawning and feeding of the various species (Scott and Crossman, 1973).

Predation of *Acipenser fulvescens* is limited because the scutes protect the young individuals and their relative large size the adults. Lampreys (*Petromyzon marinus* and *Ichthyomyzon unicuspis*) are known to attach themselves to Lake sturgeon and may seriously week them or at least kill them (Scott and Crossman, 1973).

Although the ecology of *Acipenser fulvescens* is relatively well known, the possible consequences of depletion of its population for those species depending on or associated with it are very complex and hardly predictable.

2.7 Threats

One of the main threats throughout the species range is probably the loss of suitable habitats due to dam construction on almost all larger river systems (Houston, 1987; Ferguson and Duckworth, 1997). Lake sturgeons depend on the riverine environment for reproduction and this makes them vulnerable to developments on rivers that alter the habitat. Hydroelectric generation facilities affect both periodic and seasonal water level fluctuations, causing a decreased production and loss of fish. The construction of dams also restrict movements of Lake sturgeon, preventing fish from reaching critical habitat such as suitable spawning sites and stranding fish between barriers. Such habitat alterations could impact on the genetic integrity of the species in these impounded systems (Ferguson et al., 1993). The fragmentation into isolated populations by insurmountable barriers may lead to a loss of genetic variability through evolutionary processes such as random genetic drift and inbreeding, as shown by Brown et al. (1992) for the White sturgeon, *Acipenser transmontanus*. Populations that have lowered genetic variability are less able to withstand future stresses (Ferguson and Duckworth, 1997). The protection of habitat is considered to be a key factor in the conservation and rehabilitation of the remaining Lake sturgeon stocks in many states and provinces.

The second major area of impact on Lake sturgeon populations is the pollution of almost all river systems within the species' range (Houston, 1987). Although not well investigated and documented, the environmental stress produced by aquatic contaminants resulting from point and non-point sources such as industries, municipalities, farmlands and other riparian owners had its affects and is still affecting the Lake sturgeon (Houston, 1987; Klempinger, 1996).

A third limiting factor for *Acipenser fulvescens* might still be the commercial fishery and overexploitation in some regions, the most important being located at the St. Lawrence River, Quebec, and still annually yielding 100 to 200 metric tons of Lake sturgeon (Fortin et al., 1992). Ferguson and Duckworth (1997) state that the St. Lawrence River population of *Acipenser fulvescens* shows signs of overexploitation from the intensive commercial fishing that has been occurring for several generations.

3. Utilization and Trade

3.1 National utilization

Since the existence of aboriginal culture in North America, *Acipenser fulvescens* have been a key food source, especially during spring ceremonial festivities at Lake sturgeon spawning sites (Ferguson and Duckworth, 1997). During the early 1800s Lake sturgeon was also sought after as a trade item since the isinglass (obtained from the inner lining of the air bladder) could be used as a clarifying agent in wine and beer making, the making of jellies etc. (Ferguson and Duckworth, 1997). Early settlers to North America did not value Lake sturgeon as food source, but this all changed about 1855 when a market for caviar developed at Sandusky, Ohio on Lake Erie. The sale of smoked flesh followed in 1860 (Ferguson and Duckworth, 1997). During the late 1800s Lake sturgeon became an important commercial fish in the upper Mississippi River and the entire Great Lakes region. Most of the fish were processed as smoked sturgeon, caviar, isinglass and fish oil (NPSSC, 1993). The bulk of this early fishery was in the Great Lakes and by 1885, the Lake Erie catch alone exceeded 2,300 metric tons (Houston, 1987). In Ontario, the value of the Lake sturgeon was not fully appreciated and most of the fish taken in Canadian waters were shipped to the U.S.A. With increasing market demands for sturgeon flesh and caviar, the fishery spread widely throughout the entire range of the Lake sturgeon. For example, the harvest from Lake Winnipeg, Manitoba, and its tributaries, the Red and Assiniboine Rivers, peaked at 445 metric tons in 1900. However, throughout the entire range of *Acipenser fulvescens* the fisheries had the same fate: after an initial high yield, the fisheries displayed a rapid and permanent decline in yield to very low levels (Houston, 1987). For example, Lake sturgeon catches in Lake Erie suffered an 80% decline in ten years (1885-1895) and the harvest from Lake Winnipeg and its tributaries crashed to 13 metric tons by 1910 when the fisheries were closed (Houston, 1987). After the fisheries in the larger lakes had declined the smaller northern inland waters became subject of commercial interest and by the late 1980s the combined northern inland harvest in Ontario was twice that of the Great Lakes (Duckworth et al., 1992 in Ferguson and Duckworth, 1997). In 1993, the total sturgeon landings in the provinces of Quebec and Ontario amounted to 250 metric tons and 19 metric tons respectively, while in 1994, 265 metric tons of sturgeons were landed in Quebec and 18 metric tons in Ontario (Laurette Gagnon, Statistics Unit, Department of Fisheries and Oceans, Ottawa, Ontario). These data do not distinguish between different sturgeon species and may also include *Acipenser oxyrinchus*.

At present the most important commercial fishery for *Acipenser fulvescens* in North America is located at the St. Lawrence River, Quebec, mainly on Lac St.Louis, Laprairie Basin and Lac St.

Pierre, and annually yields are currently between 100 and 200 metric tons corresponding to ca 15,000 - 30,000 fish (Fortin et al, 1993). The two main fishing gears within this river system are gill nets (the minimum mesh size allowed is 19 cm, stretched measure; the most widely used mesh sizes are 19 and 20.3 cm) and setlines (7/0 to 9/0 hook sizes).

In Lake Winnebago (Wisconsin and Michigan), spear fishers harvested an annual average of 14.98 metric tons of *Acipenser fulvescens* from 1974 to 1994, under a minimum size regulation of 114 cm (Kempinger, 1996).

In the Montreal-Trois-Rivières portion of the St. Lawrence River the commercial catch reached 216,7 metric tons between 1985 and 1989 (Lamoureux and Laforce, 1991).

From a review of the literature it remains unclear if the commercial harvest of *Acipenser fulvescens* only covers the domestic demands within the range states U.S.A. and Canada, or if parts and derivatives, e.g. caviar, are exported. There are no data about the caviar production in both countries available. Moreover, the landings of Lake sturgeon within the U.S.A., especially in the Mississippi River drainage, are insufficiently known.

3.2 Legal international trade

No information available.

3.3 Illegal trade

No information available.

3.4 Actual or potential trade impacts

No information available.

3.5 Captive breeding or artificial propagation for commercial purposes (outside countries of origin)

Not reported.

4. Conservation and Management

4.1 Legal status

4.1.1 National

Acipenser fulvescens is protected and managed in Canada under the Fisheries Act by the province in whose jurisdiction it occurs. Similar legislation exists in the U.S.A. to protect stocks in the eastern states (Houston, 1987). According to Williams et al. (1989) the species was listed as Threatened in the following states and provinces of the U.S.A. and Canada: Alabama, Arkansas, Georgia, Iowa, Illinois, Indiana, Kansas, Kentucky, Michigan, Minnesota, Missouri, Mississippi, Nebraska, New York, Ohio, Pennsylvania, Tennessee, Vermont Wisconsin, West Virginia; Alberta, Manitoba, New Brunswick, Newfoundland, Ontario, Quebec and Saskatchewan.

Acipenser fulvescens were protected in New York State by closure of the fisheries in 1976 (Carlson, 1995).

No further and up-to-date information available.

4.1.2 International

The species had been listed by CITES under Appendix II, but was delisted in 1983 as Canada and the U.S.A. both agreed that the species was not endangered (Houston, 1987).

4.2 Species management

4.2.1 Population monitoring

Tagging studies of *Acipenser fulvescens* are carried out in different states and provinces. No up-to-date information available.

4.2.2 Habitat conservation

Since the degradation and loss of suitable spawning grounds has been considered one of the main threats for *Acipenser fulvescens* (Houston, 1987) there have been several attempts of rip-rapping riverbanks, especially on the borders of Wisconsin's Lake Winnebago (NPSSC, 1993). The rip-rapped shore line greatly increased the area suitable for successful spawning. The spawning grounds in Des Prairies River were enlarged in 1985, during the reconstruction of the Des Prairies power plant spill way (LaHaye et al., 1992). The artificial spawning bed in the river showed a high proportion of stations with eggs present in 1990 and seemed to have been accepted by the Lake sturgeons.

The current implementation of the Canadian Federal Habitat is protecting valuable Lake sturgeon habitat (Ferguson and Duckworth, 1997). No further information available.

4.2.3 Management measures

In most regions of the U.S.A. and Canada commercial fishing has been completely banned or restricted (Birstein, 1993b).

The Fishery regulations of the Canadian provinces in Alberta, Saskatchewan, Manitoba, Ontario and Quebec (under the Federal Fisheries Act) control commercial and recreational fisheries for the Lake sturgeon through open and closed seasons, size limits, catch and possession limits and means of capture (e.g. net mesh sizes, etc.) (Houston, 1987). Regulations vary from province to province and year to year. No up to date information is available.

In the Menominee River, a boundary water between north-eastern Wisconsin and the upper peninsula of Michigan, a limited sport fishery is jointly managed by both states (Thuemler, 1997). This sport fishery is restricted to an opened season during two months in fall. Licensed anglers need a special permit to fish for *Acipenser fulvescens* in all Wisconsin waters. The minimum size limit is 127 cm (TL). The bag limit for every licensed angler is one fish per season. All legal fish taken in this sport fishery have to be registered and tagged at a Department of Natural Resources approved station.

Several state agencies are currently rearing and restocking lake sturgeon fingerlings in an attempt to recover once thriving populations (NPSSC, 1993). The Wisconsin Department of Natural Resources has been experimenting with artificial propagation of *Acipenser fulvescens* since 1979 at the Wild Rose State Fish Hatchery in Wisconsin (Ceskleba et al., 1985). Cooperative research into Lake sturgeon propagation has also been ongoing at the Center for Great Lakes Studies at the University of Wisconsin-Milwaukee. Ceskleba et al. (1985) give the following data of stocking efforts: in 1982 a total of 135,200 one day old embryos were stocked in the Red Cedar River and a total of 291 Lake sturgeons weighing 8.2 kg (250 yearlings from the Center for Great Lakes Studies and 41 juveniles or yearlings reared at Wild Rose State Hatchery) were stocked in the Menominee River; in 1983 a total of 82,000 eight day old embryos and 1,780 yearlings weighing 11 pounds were stocked in the St. Louis River, and 11,000 yearlings averaging 30 mm were stocked in the Menominee River. Further and up-to-date reports about the stock enhancement of the species, the size of the broodstock in captivity and the total production of fry and fingerlings are not available.

4.3 Control measures

4.3.1 International trade

None.

4.3.2 Domestic measures

In the Menominee River (States of Wisconsin and Michigan) the limited sport fishery for Lake sturgeon is closely monitored to guard against overexploitation (Thuemler, 1985 and 1997). All legal fish taken in the sport fishery have to be registered and tagged at a Department of Natural Resources approved station.

There is no further information about domestic measures in other states and provinces available.

5. Information on Similar Species

6. Other Comments

The range states of the species has been contacted on 13 March 1996 and 21 May 1996. A copy of the first draft of the proposal ("working document") has been sent to the range states on 19 August 1996. The comments of the range states that have been received are attached in the appendix at the end of this document.

The "working document" has also been presented at the 13th meeting of the Animals Committee of CITES in Prague, Czech Republic, on 23-27 September 1996 for discussion.

Additionally, a meeting ("Multilateral Consultations on the Problems of Sturgeon Species within the Framework of CITES") which took place on 21-22 November 1996 in Moscow, has been organised in order to consult with the states of Azerbaijan, Kazakhstan, Turkmenistan and Ukraine (which are not members to CITES) as well as with China, Georgia, Iran, USA and the Russian Federation. The minutes of this meeting and the comments of the range states that have been received are attached in the appendix at the end of this document.

7. Additional Remarks

8. References

Birstein, V.J. 1993. Sturgeons and Paddlefishes: Threatened Fishes in Need of Conservation. Conservation Biology 7 (4):773-787.

Birstein, V.J. 1993b. Draft Application to CITES: Order Acipenseriformes. Unpublished.

Brown, J.R., A.T. Beckenbach and M.J. Smith. 1992. Influence of Pleistocene Glaciations and Human Intervention upon Mitochondrial DNA diversity in White Sturgeon (*Acipenser transmontanus*) populations.

Campbell, R.R. 1991. Rare and Endangered Fishes and Marine Mammals of Canada: COSEWIC Fish and Marine Mammal Subcommittee Status Reports: VII. The Canadian Field Naturalist 105 (2): 151-156.

Carlson, D.M. 1995. Lake Sturgeon Waters and Fisheries in New York State. Journal of Great Lakes Research 21 (1): 35-41.

Ceskleba, D.G. S. AveLallement and T.F. Thuemler. 1985. Artificial Spawning and Rearing of Lake Sturgeon, *Acipenser fulvescens*, in Wild Rose State Fish Hatchery, Wisconsin, 1982-1983. Environmental Biology of Fishes 14 (1): 79-85.

Ferguson, M.M., L. Bernatchez, M. Gatt, B.R. Konkle, S. Lee, M.L. Malott and R.S. McKinley. 1993. Distribution of Mitochondrial DNA variation in Lake Sturgeon (*Acipenser fulvescens*) from the Moose River Basin, Ontario, Canada. Journal of Fish Biology 43 (Supp.A): 91-101.

Ferguson, M.M. and G.A. Duckworth. 1997. The Status and Distribution of lake sturgeon, *Acipenser fulvescens*, in the Canadian Provinces of Manitoba, Ontario and Quebec: a genetic perspective. In: Birstein, V., J.R. Waldman and W.E. Bemis (eds.). Sturgeon Biodiversity and Conservation. Kluwer Academic Publishers, Dordrecht. Pp. 299-309.

Fortin, R., J.-R Mongeau, G. Desjardins and P. Dumont. 1993. Movements and Biological Statistics of Lake Sturgeon (*Acipenser fulvescens*) populations from the St. Lawrence and Ottawa River System, Quebec. Canadian Journal of Zoology 71: 638-650.

Fortin, R., P. Dumont, J. R. Mongeau, M. Leveille, S. Guénette et G. Desjardins. 1991. Distinction des stocks d´Esturgeon jaune (*Acipenser fulvescens*) du Lac des Deux Montagnes et du couloir fluvial Saint-Laurent au moyen de l´étude des deplacements, de la croissance et de la mortalité. In: Williot, P. (ed.). Acipenser. CEMAGREF, Bordeaux. Pp. 295-314.

Fortin, R., S. Guénette et P. Dumont. 1992. Biologie, exploitation, modélisation et gestion des populations d´Esturgeon jaune (*Acipenser fulvescens*) dans 14 réseaux de lacs et de rivières du Québec. Québec, Ministere de la faune et Service de la faune aquatique, Montréal et Québec. 213 pp.

Guénette, S., E. Rassat and R. Fortin. 1992. Morphological Differentiation of Lake Sturgeon (*Acipenser fulvescens*) from the St. Lawrence and Lac des Deux Montagnes (Quebec, Canada). Canadian Journal of Fisheries and Aquatic Sciences, 49 :1959-1965.

Houston, J.J. 1987. Status of the Lake Sturgeon, *Acipenser fulvescens*, in Canada. Canadian Field-Naturalist 101(2): 171-185.

IUCN (1996). 1996 IUCN Red List of Threatened Animals. IUCN, Gland, Switzerland.

Kempinger, J.J. 1996. Habitat, Growth and Food of Young Lake Sturgeons in the Lake Winnebago System, Wisconsin. North American Journal of Fisheries Management 16: 102-114.

LaHaye, M., A. Branchaud, M. Gendron, R.Verdon and R. Fortin. 1992. Reproduction, Early Life History and Characteristics of the Spawning Grounds of the Lake Sturgeon (*Acipenser fulvescens*) in Des Prairies and L´Assomption Rivers, near Montréal, Quebec. Canadian Journal of Zoology 70: 1681-1689.

Lamoureux, P. et G. Laforce. 1991. Analyse des captures et caracteristiques biologiques de l´Esturgeon jaune (*Acipenser fulvescens*) dans le coloir fluvial du Saint-Laurent de 1985 a 1989. In: Williot, P. (ed.). Acipenser. CEMAGREF, Bordeaux. Pp. 315-326.

Lee, D. S., C. R. Gilbert, C. H. Hocutt, R. E. Jenkins, D. E. McAllister, and J. R. Stauffer, Jr. 1980. Atlas of North American Freshwater Fishes. North Carolina State Museum of Natural History., Raleigh. 867 pp.

National Paddlefish and Sturgeon Steering Committee (NPSSC). 1993. Framework For The Management and Conservation Of Paddlefish and Sturgeon Species In The United States. 41 pp.

Scott, W.B. and E.J. Crossman. 1973. Freshwater Fishes of Canada. Fisheries Research Board of Canada. Bulletin 184: 77-116.

Threader, R.W. and C.S. Brousseau. 1986. Biology and Management of the Lake Sturgeon in the Moose River, Ontario. North American Journal of Fisheries Management 6: 383-390.

Thuemler, T. F. 1997. Lake Sturgeon Management in the Menominee River, a Wisconsin-Michigan Boundary Water. In: V. Birstein, J. R. Waldman, and W. E. Bemis (eds.). Sturgeon Biodiversity and Conservation. Kluwer Academic Publishers, Dordrecht. pp. 311-317.

Thuemler, T.F. 1985. The Lake Sturgeon, *Acipenser fulvescens*, in the Menomee River, Wisconsin-Michigan. Environmental Biology of Fishes 14 (1): 73-78.

Williams, J.E., J.E. Johnson, D.A. Hendrickson, S. Contreras-Balderas, J.D. Williams, M. Navarro-Mendoza, D.E. McAllister and J.E. Deacon. 1989. Fishes of North America. Endangered, Threatened or of Special Concern: 1989. Fisheries 14 (6): 2-19.

Acipenser gueldenstaedtii

1. Taxonomy

   1.1 Class: Actinopterygii

   1.2 Order: Acipenseriformes

   1.3 Family: Acipenseridae

   1.4 Species: *Acipenser gueldenstaedtii* Brandt, 1833

   1.5 Scientific synonyms:
   Acipenser sturio (non Linnaeus) Güldenstädt, 1772
   Acipenser pygmaeus Reisinger, 1830
   Acipenser aculeatus Fischer in Lovetsky, 1834
   Acipenser medius Fitzinger and Heckel, 1836
   Acipenser tuecka Fitzinger and Heckel, 1836
   Acipenser macropthalmus Fitzinger and Heckel, 1836
   Acipenser rostratus Fischer in Fitzinger and Heckel, 1836
   Acipenser schypa (non Gmelin) Fitzinger and Heckel, 1836
   Acipenser gueldenstaedti; Bonaparte, 1846
   Acipenser gueldenstaedti var. *scaber* Antipa, 1909
   Acipenser gueldenstaedti var. *golis* Antipa, 1909
   Acipenser gueldenstaedti var. *longirostris* Antipa, 1909
   Acipenser gueldenstaedti var. *acutirostris* Antipa, 1909
   Acipenser gueldenstaedti var. *tanaica* Marti, 1940
   Acipenser gueldenstaedti var. *colchica* Marti, 1940
   Acipenser gueldenstaedti colchicus; Berg, 1948
   Acipenser gueldenstaedti colchicus colchicus; Movchan, 1967
   Acipenser gueldenstaedti colchicus danubius Movchan, 1967

   1.6 Common names:
   Bulgarian: Ruska esetra
   English: Russian sturgeon, Ossetra
   Finnish: Venäjänsampi
   German: Waxdick
   Polish: Jesiotr kolchidzki, Jesiotr rosyjski
   Russian: Russkiî osetr
   Romanian: Nisetru
   Turkish: Karaca
   Name of caviar: osietra, asetra, oscietre, osetrovaya

2. Biological Parameters

   2.1 Distribution

   Countries of origin: Azerbaijan, Bulgaria, Georgia, Iran, Kazakhstan, Romania, Russian Federation, Turkey, Turkmenistan, Ukraine.

   Acipenser gueldenstaedtii inhabits the Caspian Sea, the Black Sea and the Sea of Azov (Vlasenko et al., 1989).

   The species is anadromous and enters the rivers that flow into these seas for spawning. In the Caspian Sea, the most important spawning river is the Volga but the species also migrates into the Ural River in Khazakhstan (Vlasenko et al., 1989). Only few spawners of *Acipenser gueldenstaedtii* are encountered in rivers along the southern and south-eastern coast of the Caspian Sea, such as the Samur, Kura, Lenkoranka and Astara (Vlasenko et al., 1989). According to Vlasenko et al. (1989) the taxonomic status of the sturgeon species in the Iranian Caspian region, where it is reported from the Sefid-Rud, Gorgan and Babol´ Rivers, requires precise investigations because mainly the Persian sturgeon, *Acipenser persicus*, occurs in this region and is not precisely distinguished from *Acipenser gueldenstaedtii*.

The anadromous migrations of the species in the Caspian and Black Sea basins are very similar. According to the time of the migration, there is a distinction between a spring race and a winter race (Vlasenko et al., 1989). The spring race begins the spawning run into the rivers in early spring, in the mid or late summer the run reaches a peak and finally ceases in late autumn. The so-called winter race generally does not spawn the same year they enter the river. These fish hibernate in the rivers and reproduce the following year. Several authors (summary in Vlasenko et al., 1989) also mention a non-anadromous and freshwater-resident form of *Acipenser gueldenstaedtii* which existed in the past. However, this form is believed to be Extinct (Birstein, 1993).

The juvenile sturgeons migrate downstream the rivers to feeding grounds in the sea. In the Caspian Sea, the main feeding grounds are located in the northern part.

Within the Caspian Sea there is a seasonal migration: in spring and summer most of the specimens are encountered in the northern part of the Sea on the main feeding grounds, while in autumn and winter a migration to the central and southern part of the sea has been observed (Barannikova et al., 1995).

2.2 Habitat availability

The construction of hydroelectric power stations as well as of water reservoirs in most of the rivers where the species spawned historically led to a sharp reduction of available spawning grounds. The winter race of *Acipenser gueldenstaedtii* was more affected by these dam constructions than the spring race, because it migrated to spawning grounds that were located far upstream, while the spring race generally ascended only 100 to 300 km upstream the mouth of the river.

In the Caspian Sea basin, the Russian sturgeon lost approximately 70% of all spawning grounds (Barannikova et al., 1995). In the main spawning river, the Volga, there remained only 430 ha of the total 3,600 ha after the damming of the river by the Volgograd Dam. The area of the natural spawning grounds in the Kura River has been reduced by dam constructions to about 160 ha, in the Terek River to 132 ha and in the Sulak River to 201.6 ha (Vlasenko, 1990). The only unregulated river flowing into the Northern Caspian Sea is the Ural which still provides an area of 1,400 ha for sturgeon spawning. The rivers that enter the Southern Caspian Sea along the Iranian coast (Sefid-Rud, etc.) are not dammed.

In the Black Sea and Sea of Azov, the situation is almost the same. Almost all rivers that enter these seas and are used by the anadromous sturgeons for spawning, have been blocked by dam constructions either of hydroelectric power stations or of irrigation systems. For example the regulation of the Kuban River flow resulted in the loss of approximately 140,000 ha of estuarine breeding grounds for all fluvial anadromous fish (Volovik et al., 1993). The construction of the Tsymlyansk reservoir on the Don River in 1952 resulted in an average loss of about 68,000 ha of spawning grounds for all fluvial anadromous fishes (Volovik et al., 1993). The Danube River has been blocked by the construction of the insurmountable dams Djerdap I and II ("Iron Gate") which prevented all anadromous fish species from an upstream migration to the spawning grounds located above the first dam (Bacalbasa-Dobrovici, 1997).

The reduction of available natural spawning grounds due to river flow regulations subsequently led to a reduction of the natural reproduction and the stock of the species is maintained to a high extent by artificial propagation. In 1993, about 80-95% of each generation of *Acipenser gueldenstaedtii* in the Sea of Azov consisted of artificially propagated fish (Volovik et al., 1993), while in the Caspian Sea about 30% originates from hatcheries (Barannikova, 1995).

2.3 Population status

There is no information about the total size of the population. The largest population of *Acipenser gueldenstaedtii* is believed to live in the Volga-Caspian region which produces up to 80 percent of the world sturgeon catch (Vlasenko, 1990; Khodorevskaya et al., 1997). Levin (1996) estimated that the spawning population that entered the Volga River in recent years constituted of about 120,000 to 150,000 mature individuals, ranging between 8 and 25 years old with fish older than 28 years being extremely rare. The method of census for this estimate is not provided. In the early 190s, the natural reproduction of *Acipenser gueldenstaedtii* within this region decreased to 830 metric tons because of the low number of sturgeons reaching the spawning grounds (Khodorevskaya et al., 1997). Vlasenko et al. (1989), Vlasenko (1990), Levin (1996) and Khodorevskaya et al. (1997) conclude that the size of the spawning populations of *Acipenser gueldenstaedtii* in the other rivers of the Caspian Sea basin became minimal.

In the Black Sea and Sea of Azov, the populations of *Acipenser gueldenstaedtii* are believed to be less abundant than in the Caspian Sea (Vlasenko et al., 1989). There are no recent estimates about the total size of the populations inhabiting these basins. Volovik et al. (1993) estimated that the total stock biomass of all sturgeons living in the Sea of Azov was about 59,000 metric tons in the mid 1980s, with *Acipenser gueldenstaedtii* accounting for 76% of the total sturgeon biomass (44.840 metric tons). However, in 1990, a mass death of sturgeon occurred in this watersheds and approximately 55,000 sturgeon individuals were found dead on the shore. Ever since, no estimation of the population size has been made.

IUCN (1996) classifies the status of the populations of *Acipenser gueldenstaedtii* in the Caspian Sea (Russia, Azerbaijan, Kazakhstan, Turkmenistan, Iran), in the Sea of Azov (Russia) and in the Black Sea (Ukraine, Romania, Hungary, Serbia) as Endangered.

2.4 Population trends

The decline of the official commercial catches of *Acipenser gueldenstaedtii* reflects a decline in the size of the population. In the Volga-Caspian region, where the species is most abundant, the legal catches declined from 13,400 metric tons in 1981 to 4,150 metric tons in 1992 (Levin, 1995). Levin (1996) estimated that the largest spawning population, the one which enters the Volga River for spawning, decreased in recent years from about 500,000-600,000 individuals to 120,000-150,000 individuals. The decrease in the Russian sturgeon catch was mainly caused by inadequate fishing regulations (Artyukhin, 1996). During the last decade, the sturgeons were caught during the summer, when individuals of the winter race, which comprised 85% of the whole population in the Volga-Caspian Sea basin, migrated into the river. Most of the migrants were harvested, and very few individuals could reach the spawning grounds. As a result, natural reproduction of *Acipenser gueldenstaedtii* decreased drastically, while the caviar market was overwhelmed by Russian sturgeon caviar of very poor quality.

The most alarming fact was the decrease of natural reproduction of the species which already began with the construction of the Volgograd Dam but still worsened within the last years due to the high pollution level in almost all spawning rivers. Although *Acipenser gueldenstaedtii* was subject to a large-scale ranching programme within the Russian Federation and probably also Iran, the stocks further declined. Barannikova (1995) estimates that about 36-40% of the sturgeon catch within the Russian part of the Caspian Sea originated from artificially propagated fish in 1993. In the Sea of Azov and Black Sea region, the situation is even worse: in 1993 more than 60% of Russian sturgeons within these basins came from hatchery-released juveniles (Barannikova et al., 1995).

Due to bad environmental conditions during the period from 1986 to 1993, the reproductive system of *Acipenser gueldenstaedtii* females showed an increasing degeneration and several anomalies in the gameto- and gonadogenesis occurred. Shagaeva et al. (1993) found that 100% of the eggs taken from *Acipenser gueldenstaedtii* females caught in the lower Volga River in 1990 showed anomalies and 100% of the larvae (both from hatcheries and natural environment) were not viable. In the Sea of Azov and Black Sea, a mass death of sturgeons was observed in 1990, which was undoubtedly caused by disastrous environmental conditions which may also have their effect on the remaining small population of *Acipenser gueldenstaedtii*. Considering these evident signs of a sharp decrease in natural reproduction, several experts fear a further reduction of the population of *Acipenser gueldenstaedtii* within its entire range. Levin (1995) states that artificial propagation techniques, although they contribute to a high amount to the maintaining of the stocks, cannot compensate for the damage caused to natural reproduction.

2.5 Geographic trends

A decrease in the range area of *Acipenser gueldenstaedtii* is due to the dam constructions on almost all rivers that the species formerly used to ascend for spawning.

In the Caspian Sea basin the species can currently ascend the Volga as far as the Volgograd reservoir, in the Kura it can migrate as far as the Vavarin Reservoir and in the Ural upstream to the city of Orenburg (Vlasenko et al., 1989). In the Terek, the fish can migrate upstream as far as the Kargalin Dam. In the Black and Azov Sea basins an upstream migration into the Danube, Don and Kuban Rivers is also prevented by various dam constructions.

2.6 Role of the species in its ecosystem

Acipenser gueldenstaedtii is mainly an anadromous species and only small freshwater resident populations has been reported in the past from few rivers. The fish reach 2.2-2.4 m in length (TL) and 65-115 kg in weight (Vlasenko et al., 1989). In the past, the Russian sturgeon reached an age of 48 years, but currently individuals do not exceed an age of 38 years because of overfishing (Vlasenko et al., 1989).

Acipenser gueldenstaedtii, like almost all other sturgeon species, is a bottom-dwelling feeder. Its diet depends upon the habitat, consisting mainly of molluscs (*Abra*, *Cardium*, *Corbulomya* spp.), polychaets (*Nereis* sp.), crustaceans (shrimps, crabs, etc.), chironomid larvae and small fishes such as gobiids and anchovies (Vlasenko et al, 1989).

On the pawning grounds, a considerable number of the Russian sturgeon eggs are consumed by sterlets (*Acipenser ruthenus*), gudgeon (*Gobio gobio*), bream (*Abramis brama*), white bream (*Abramis bjoerkna*) and Caspian roach (*Rutilus rutilus* m. *migratorius*). The larvae and juveniles moving downstream the rivers are preyed upon by shads (*Alosa* spp.), small belugas (*Huso huso*), *Pelecus cultratus*, several gobiids and especially by the wels, *Silurus glanis* (various authors compiled in Vlasenko et al. 1989).

The possible consequences of depletion of the population of *Acipenser gueldenstaedtii* for those species depending on or associated with it are very complex and hardly predictable.

2.7 Threats

The main threats to the species are the legal and illegal overfishing mainly during the spawning season, the loss of critical habitat such as spawning grounds due to dam constructions (as mentioned above: 2.2 and 2.5), and the high level of pollution in almost all rivers within its range.

The main threat to the survival of the Russian sturgeon (as well as that of *Acipenser stellatus* and *Huso huso*) is the legal and especially illegal overfishing stimulated by the high demand for black caviar on the international market (see 3.2 and 3.3). After the collapse of the USSR in 1991, besides Russia and Iran three new states (Azerbaijan, Kazakhstan and Turkmenistan) and two autonomous Russian Republics (Dagestan and Kalmykia) started the harvest of sturgeons (Ivanov et al., 1995a). Until the beginning of 1996, there has been no agreement between these countries bordering the Caspian Sea concerning a sustainable sturgeon fishery and adequate international fishing rules. Fishing in the open sea, which was completely prohibited by Soviet laws for a long period, was started mainly by Azerbaijan. As a consequence, mainly young and immature sturgeon were caught and the harvest in the open sea destroyed a major part of the future sturgeon stocks (Luk´yanenko et al., 1994). Additionally, inadequate fishing regulations, which allowed the catch during the summer season when the winter race (85% of the whole population of *Acipenser gueldenstaedtii* in the Volga-Caspian Sea basin) migrated into the river, drastically reduced the spawning population of this predominant race and hence of the major part of the population (Artyukhin, 1996). As a result, the natural reproduction of *Acipenser gueldenstaedtii* dropped drastically, while the caviar market was overwhelmed by a high amount of Russian sturgeon caviar of very poor quality made of the roe of immature females. The situation with the legal catch was so critical that the Russian experts discussed the need to completely prohibit the legal commercial catch of sturgeons in the Caspian Sea for one to two years (Ivanov et al., 1995a).

The decline of the populations of *Acipenser gueldenstaedtii* in the Caspian and Black Sea basins during the last years was mainly caused by the enormously high level of poaching (Artyukhin, 1996; Birstein, 1996; Zoltarev et al., 1996; Khodorevskaya et al., 1997). According to the opinion of experts, the size of the illegal catch is equal to or even higher than the legal catch. Poaching is common in almost all countries of the area: in Russia (with Dagestan and Kalmykia), Azerbaijan, Kazakhstan and even Iran. In the Volga River, during the last years practically all spawning fish have been caught by poachers before they could reach the spawning grounds below the Volgograd Dam (Artyukhin, 1996). The subsequent lack of mature fish even affected the work of the hatcheries near the Volgograd dam since it was not possible to catch enough mature Russian sturgeon for artificial breeding (Artyukhin, 1996). The high level of poaching hence affects not only the natural reproduction of the species but also the artificial propagation, and therefore represents the main threat to the survival of *Acipenser gueldenstaedtii*.

Illegal catch in the north-western part of the Black Sea (Ukrainian waters), especially trawling, caused a considerable decrease in the size of this population of *Acipenser gueldenstaedtii* in 1993-1994 as compared to 1991-1992 (Zolotarev et al., 1996). Poaching also affects the Danubian populations of the Russian sturgeon (Birstein, 1996b).

The construction of dams along most of the spawning rivers of *Acipenser gueldenstaedtii* dramatically reduced the natural spawning grounds of the species and consequently threatened the natural reproduction (see 2.2). Hydroelectric power station dams not only cut off sturgeons from their main spawning sites, but also change the flow of the rivers, and consequently the opportunity of spawners to use the spawning grounds that are still left intact. Alterations of the Volga River flow allow fewer Russian sturgeon to reach their spawning sites (Veshchev, 1995). The altered flow also affects the migration to the sea of juveniles either released from hatcheries or naturally hatched (Raspopov et al., 1995).

A further threat to the survival of *Acipenser gueldenstaedtii* is represented by the high level of pollution in the Caspian and Black Sea basins. During the period from the beginning 1970s until the collapse of the Soviet Union in 1991, the level of pollution increased dramatically in almost all rivers entering the Caspian Sea, the main sources being oil and other industrial sewage (Vlasenko, 1990; Dumont, 1995; Khodorevskaya et al., 1997). In the Volga River, for example, the concentrations of heavy metals, mercury, phenols, surface-active agents, pesticides and oil products by far exceeded the maximum permissible concentration within this period (Romanov and Altuf´yev,1993). Considerable concentrations of these pollutants were also found in the northern part of the Caspian Sea (Romanov and Altuf´yev, 1993). Several authors (Altuf´yev et al., 1992; Romanov and Altuf´yev, 1991 and 1993; Romanov and Sheveleva, 1993; Kuz´mina et al. 1993; Altuf´yev, 1994; Shagaeva et al., 1993; Shagaeva et al., 1995) have investigated the influence of the very high level of pollution in the Caspian Sea and studied the effect of the various toxins on sturgeons. The studies revealed that environmental pollution caused considerable changes in hormonal balance, in the blood system, and in protein and carbohydrate metabolism, marked disturbances in the genesis of organs (liver, gonads) and tissues (skeletal muscles, heart) and the appearance of neoplasm in liver, gonads and sex cells. General weakening of the fish as a result of toxins, disturbed metabolism and hormonal imbalance led to a number of disturbances in sturgeon gonadogenesis, e.g. the increase in number of hermaphroditic specimens, ovotestis and tumours, and to the appearance of new differentiation such as striated muscle tissue and fascicles of dense connective tissue formations which are normally absent in healthy fishes. A tendency was noted toward an increase in the number of aberrations, especially in the gameto- and gonadogenesis and in 1990, 100% of mature eggs taken from various sturgeon females showed various pathological anomalies suggesting the loss of viability. Moreover, in 1989 and 1990, a mass death of sturgeon larvae was observed caused by hatching aberrations and anomalous development such as defects in the fin fold and underdevelopment of the heart, both leading inevitably to death at early stages of development. In 1990, 100% of all investigated larvae (*Acipenser gueldenstaedtii*, *Acipenser stellatus*) showed such anomalous development which was caused by environmental toxins. The anomalies in larval structure took place both in nature and in the hatchery.

All these effects on sturgeons were clearly seen from 1986 until 1992 and were presumably caused by a release of toxic waste from one of the heavy industry plants located on the shores of the Volga River in the middle of the 1980s. Since the disintegration of the USSR in 1991, the production of the heavy industry drastically decreased which resulted in an improving water quality in the Volga-Caspian region. Thus, in the early 1990s, the number of sturgeons with a pronounced muscle dystrophy disease dropped significantly.

However, there is a threat of increasing pollution in the whole Caspian Sea in the near future. The fast raise of the sea water level - from 1993 to 1997 it increased in 2,15m (Radionov, 1994) - will result in covering "lakes" of deposited wasted oil and associated pollutants from industrial sewage along the shore. Such "lakes" are already located in all industrial parts of Azerbaijan along the coast (Dumont, 1995) and their number will increase with the raising sea level. Sturgeons are especially threatened by the pollution in this region, because the waters of Azerbaijan represent important feeding grounds for the fish during the winter. A further near future threat for the northern part of the Caspian Sea is the fast development of oil fields, especially the Tengiz oil field, in Kazakhstan (Sagers, 1994). Sturgeons will be especially affected by pollutants from this developing industry because their main spawning and feeding grounds are located in the region of the northern Caspian Sea. Moreover, the central part of the Caspian Sea is threatened by radioactive contamination from the Gur´evskaya nuclear reactor near Akatai, Kazakhstan (Dumont, 1995).

In the Black-Azov Sea basin the situation of pollution is almost the same (Volovik et al., 1993). The Danubian and Dniester sturgeon populations are mainly threatened by the pollution of the rivers and the sea, and by the eutrophication of coastal waters which results in the appearance of temporary hypoxic areas on the Black Sea shelf. Chronic toxicosis with poisonous substances led to a mass death of fishes and in summer 1990 about 55,000 sturgeon individuals were found dead on the shore (Volovik et al., 1993). Moreover, the introduction of the ctenophore *Mnemiopsis leydyi* into the Black Sea in the 1980s resulted in a destruction of the local pelagic food and thus affected the main feeding source of sturgeons (Dumont, 1995; Khodorevskaya et al., 1997).

3. Utilization and Trade

3.1 National utilization

Acipenser gueldenstaedtii is one of the three most important commercial sturgeon species in the world and its catch occupies the first place among all catches of acipenserids (Tab. 2, appendix).

However, its national utilization is not easy to describe since official fisheries statistics do not distinguish between sturgeon species. The three commercially most important species are *Acipenser gueldenstaedtii*, *Acipenser stellatus* and *Huso huso* and account for 90% of all sturgeon catches in the world.

The major fishing area for *Acipenser gueldenstaedtii*, as well as for the two other commercially important species, is the Caspian Sea where about 90% of the world sturgeon catches are landed (Tab. 1, appendix). Within the Russian part of the Caspian Sea region, the Volga-Caspian region is the most important and produced about 77% of the total Russian sturgeon catch in that region in 1994 (with the Astrakhan region producing 64.2%), while the Ural-Caspian region (Khazakhstan) produced 8.9% in 1994, the Kura region (Azerbaijan) produced 7.7% and the catch in Turkmenistan amounted to 6.4% of the total Russian sturgeon catch in the Caspian Sea (Tab. 4, appendix).

FAO fisheries statistics (Tab. 1, appendix) show a drastical decline of the total landings of Acipenseridae within the last years. Before the disintegration of the former USSR only two states, the USSR and Iran, were fishing for sturgeons in the Caspian Sea. There was a quota system between both states and a complete ban on the fishery in the open sea. In 1984, about 26,538 metric tons of sturgeons were landed world-wide, about 24,245 metric tons of which were caught in the USSR and 1,557 metric tons in Iran. In 1988, when the disintegration of the former USSR began, the world sturgeon catches had already declined to about 21,291 metric tons, with the Russian Federation accounting for 19,027 metric tons, Iran accounting for 1,851 metric tons. Since the collapse of the USSR in 1991, five states, i.e. the Russian Federation, Azerbaijan, Khazakhstan, Turkmenistan and Iran, and the two autonomous republics Dagestan and Kalmykia, are fishing for sturgeons in the Caspian Sea. Until the beginning of 1996, there were no fishing regulations, i.e. quota systems, between these states and republics and fishing in the open sea was no longer prohibited. Since 1988, the catches further declined to about 15,124 metric tons in 1991 (Russian Federation: 9,539 metric tons; Iran: 3,036 metric tons; Azerbaijan: 108 metric tons; Khazakhstan: 1,766 metric tons) and only 8141 metric tons in 1994 (Russian Federation: 4,460 metric tons; Iran: 1,700 metric tons; Azerbaijan: 95 metric tons; Khazakhstan: 635 metric tons). The above are the official figures. Unfortunately, the collapse of the USSR led to an expansion of illegal fishing which escapes any statistics. Furthermore, the FAO fisheries statistics do not distinguish between Russian inland waters, which means that the figures for the Russian Federation contain also a small amount of catches in the Siberian and Far Eastern water systems, estimated to be about 200 metric tons in 1993 (Barannikova et al., 1995) as well as an amount of catch in the Black Sea basin. Data for the state of Turkmenistan are not given by FAO and it remains unclear, if the catches in the republics of Dagestan and Kalmykia are included in the figures of the Russian Federation.

The catch statistics for *Acipenser gueldenstaedtii* in the northern part of the Caspian Sea basin show a steady decline from 7,800 metric tons in 1990 to 1,500 metric tons in 1994 (Tab. 2, appendix).

The second fishing area of *Acipenser gueldenstaedtii*, as well as of *Acipenser stellatus* and *Huso huso*, is the Black-Azov Sea region where the sturgeon fishery is concentrated mainly in the north-western part near the Danube Delta (Romania) and in the Sea of Azov. According to FAO statistics, the annual sturgeon catches within this region were about 1,527 metric tons in the 1970s, with the USSR accounting for 1,434 metric tons, Bulgaria accounting for 12 metric tons and Romania for 81 metric tons. For Turkey, no sizeable commercial catch of sturgeons has been officially recorded. The sturgeon catches in the Black and Azov Seas decreased to a minimum record of about 585 metric tons in 1988 (Russian Federation: 520 metric tons, Bulgaria: 1 metric ton; Romania: 35 metric tons; new independent state of Ukraine: 29 metric tons) but raised again to 1,257 metric tons in 1994 (Russian Federation: 1,012 metric tons; Bulgaria: 10 metric tons; Romania: 8 metric tons; Ukraine: 227 metric tons). According to Birstein (1996), the catches in Bulgaria and Romania further declined in 1995. Only 5.5 metric tons of sturgeons have been legally caught in Romania of which about 0.6 metric tons were *Acipenser gueldenstaedtii.* In Bulgarian waters, only 3 metric tons of sturgeons were legally caught in 1995.

Acipenser gueldenstaedtii is considered to be a valuable and delicious fish (Vlasenko et al., 1989). The edible part averages 64% of the total weight. Its dry-smoked flesh (balyk) is especially prized in the range states. A preserve made of the testes is used as medicine in the treatment of burns. The dried swim bladders (isinglass) are used to produce a strong glue for use in mechanical devices. The most highly priced product of this species is the caviar made from its eggs and called "osetrovaya"(in Russia), "asetra" (in Iran) or "osietra". According to Josupeit (1994) the yields in caviar average between 2 and 17% of the total sturgeon catch, and up to 6 kg of "osietra" caviar can be harvested from one mature female Russian sturgeon.

While the flesh of the Russian sturgeon is almost entirely produced for national trade, caviar is not only produced for domestic consumption but also for export. FAO statistics indicate that the global caviar production - like the world sturgeon catch - decreased drastically in the last decade, the statistics not distinguishing between caviar of the different sturgeon species. In the early 1980s, a total production of 2,500 metric tons of caviar has been officially recorded, and in 1992 about 1,500 metric tons have been legally produced world-wide (Josupeit, 1994). For 1996, experts estimate a total legal production of 122 metric tons of caviar world-wide, of which 190 metric tons originate from the Caspian Sea and 32 metric tons are coming from the Black-Azov Sea region, China, USA, Canada and Siberia (Tab. 7, appendix).

The three major sturgeon species of which caviar is produced are *Acipenser gueldenstaedtii*, *Acipenser stellatus* and *Huso huso*, and account for about 90% of the total caviar production. The major caviar producing countries are the Russian Federation and Iran. About 90% of the world production of caviar originates from the Caspian Sea. After the collapse of the USSR, the three independent states of Azerbaijan, Khazakhstan and Ukraine (probably also Turkmenistan) and the two autonomous republics of Dagestan and Kalmykia also started to produce caviar. According to FAO data (Josupeit, 1994) Iran experienced a steady increase of caviar production during the 1980s from about 200 to 300 metric tons, and almost all caviar produced in Iran (ca 95%) was exported. The main drop in the global production of caviar came from lower production in the Russian Federation. An important share of caviar used to stay in the former USSR, where about 85-90% of the production was consumed domestically and only 10% were exported (Josupeit, 1994; Taylor, 1996). The decline in disbursable income after the disintegration of the USSR led to a reduction of caviar consumption in all republics of the former USSR (Josupeit, 1994). As a consequence, almost all caviar produced in the CIS during the last years was exported. The dramatical decline in sturgeon resources within the last years (about 50%) will soon lead to a further decline in the quantity of caviar which can be offered on both the national and international market.

Acipenser gueldenstaedtii, like other sturgeons, is caught with drift and stake nets, long-lines and beach seines (Fischer et al., 1987). Poachers are mainly using bottom lines with hooks to catch sturgeons. Although it is possible to remove the eggs from live mature females by a surgical operation (a method designed by Russian scientists and especially carried out in hatcheries), the commercial harvest of caviar is still carried out by killing the animal, since the operation is too time consuming and survival rates of operated females are not reported. The declining catches of *Acipenser gueldenstaedtii* as well as of the other sturgeon species reflect a drastical reduction of the population. The natural reproduction of the species is believed to be very low at present and Barannikova (1995) estimated the natural reproduction rate in 1993 to amount only 20% . Since the disintegration of the former USSR in 1991 until the beginning of 1996, there were no fishing regulations between the range states in the Caspian Sea basin. Experts fear that the sturgeon stocks are overexploited and that the unregulated harvest is far from sustainable use. Especially the fishing in the open sea endangers the survival of the species, because a growing number of immature specimens is caught and hence the potential spawning stock is further reduced.

The two major sturgeon producing countries, e.g. the Russian Federation and Iran have ranching programmes for sturgeon species, including *Acipenser gueldenstaedtii*.

The Russian Federation already began the artificial breeding and raising of Russian sturgeon in the 1960s. Barannikova et al. (1995) report that in the early 1980s, 20 sturgeon hatcheries were operating in Russia, including 10 hatcheries in the Caspian Sea basin (of which 8 were located on the lower Volga) and 7 hatcheries in the Sea of Azov basin, while 3 hatcheries on Siberian rivers were producing *Acipenser baerii*. Levin (1995) states that the annual release of Russian sturgeon fry from hatcheries located in the lower Volga River was about 40-50 million juvenile individuals in 1993. Since 1994, only 2-4 of the former 8 hatcheries are still operating in the Volga River delta (V. Birstein, pers. comm.). According to Khodorevskaya et al. (1997) these hatcheries released about 37-40 million Russian sturgeon fingerlings in 1993, and in 1994 about 45-48 million juveniles had been produced (Tab. 20, appendix). The hatcheries located upriver near the Volgograd Dam could not catch enough breeders for artificial reproduction in the same years because of the overfishing by poachers on spawning sites.

In the former USSR, a large amount of the sturgeon fry produced in hatcheries was transported to the northern Caspian Sea by special hatch boats and then released to the feeding grounds which are located in this area (Levin, 1995). This procedure guaranteed a high survival rate for the juvenile sturgeons as compared to the release into the rivers where the young fish may be caught by predators and do not find suitable food organisms. However, Levin (1995) reports that the number of Russian sturgeon fry that was transported to and stocked into the Northern Caspian Sea was zero since 1993.

In the Sea of Azov region, about 30 million juveniles (mainly *Acipenser gueldenstaedtii* and *Acipenser stellatus*) were artificially propagated in hatcheries in 1993. Three hatcheries located on the Kuban River near the City of Krasnodar are still working efficiently. In 1993, they released 12.2 million Russian sturgeon juveniles and in 1994, 11 million juveniles were stocked into the Sea of Azov (Chebanov and Savelieva, 1995).

Iran is also artificially propagating sturgeons since 20 years when the first hatchery was built in Rasht. According to the Iranian SHILAT, currently 5 hatcheries are working for the restocking programme of sturgeon species. The annual fry release in Iranian waters was about 3.4 millions of sturgeon juveniles, the different species not further distinguished (Tab. 21, appendix).

The ranching of *Acipenser gueldenstaedtii* is contributing to a relative high degree to the size of the population and thus to the commercial fishery. In 1993, the estimated portion of *Acipenser gueldenstaedtii* originating from hatcheries in the lower Volga River was about 30% (Barannikova, 1995) while in the Sea of Azov, about 84-86% of the Russian sturgeon catch is from hatchery raised fish.

Beside ranching, in 1985 the USSR also started extensive fish farming of sturgeons, including *Acipenser gueldenstaedtii*, in warm effluent waters of thermal power stations. According to Barannikova et al. (1995) the total annual production of pond-reared sturgeon was about 200 metric tons within the area of the Russian Federation and about 200 metric tons in the Ukraine. These figures are given for all sturgeon species (4 different species and 6 different hybrids are grown). The so produced fish are contributing to the domestic demand for sturgeon meat. Caviar from sturgeon species grown in aquaculture is still not produced in economically significant quantities.

3.2 Legal international trade

The main and highly priced sturgeon product on the international market is caviar. However, official statistics do usually not distinguish between caviar of different sturgeon species. The three main commercial species are *Acipenser gueldenstaedtii*, *Acipenser stellatus* and *Huso huso* accounting for 90% of the world production of caviar. Caviar of *Acipenser gueldenstaedtii* is sold under the names , "osietra", "osetrovaya", "asetra" or "oscietre".

FAO statistics (Josupeit, 1994) indicate that the total world trade of caviar has declined, given the recent crisis of the Russian industry. In 1988, trade of caviar (excluding re-exports) was 370 metric tons, while in 1994 only 220 metric tons were officially recorded. However, these figures underestimate total trade as there is a substantial illegal trade and supply, especially after the collapse of the former USSR.

In 1992, FAO recorded the total exports of caviar with 366 metric tons, of which 169 metric tons were legally exported by Iran and only 55 metric tons by the Russian Federation, while Germany re-exported 48 metric tons (Josupeit, 1994; Tab. 9, appendix). The countries of origin of the remaining 94 metric tons of exported caviar were not further specified. The reported exportation of caviar declined since 1988, when 572 metric tons were officially recorded of which 225 metric tons came from Iran and 143 metric tons from the USSR (Tab. 9, appendix). Of the total Caspian caviar production, which in 1996 is estimated to total about 270 metric tons (Tab. 7, appendix), most will be traded on the international market, judging from previous years´ trade records (DeMeulenaer and Raymakers, 1996). The expected legal production of caviar in 1996 is 45 metric tons in Russia, 20 metric tons in Kazakhstan, about 5 metric tons in Azerbaijan and about 120 metric tons in Iran (Tab. 7, appendix). The illegal caviar production in the Caspian Sea basin in 1996 is estimated to be about 70-80 metric tons (Tab. 7, appendix).

FAO recorded the official imports of caviar being stable during the period from 1992 to 1994 and amounting to about 530 metric tons per year (Josupeit, 1994). The major import market for caviar from Iran (Tab. 11, appendix) and the former Soviet Union (Tab. 10, appendix) are the EU with an average importation of about 200 metric tons per year (Tab. 15, appendix), while Japan imported on the average 60 metric tons (Tab. 13, appendix), the U.S.A. about 52 metric tons (Tab. 14, appendix) and Switzerland an estimated 66 tons caviar per year (data provided by the ´Bundesamt für Verinärwesen´, Switzerland). However, some of the official import statistics (Japan and Switzerland) do not distinguish between roe from sturgeons and other fish species, a fact which causes a further problem to the estimation of the total volume of the caviar in trade.

Within the EU (Tab. 15, appendix), Germany is the main importer with an average of 81 metric tons per year, but a huge quantity is repackaged and re-exported into neighbouring countries. In 1994, the total import of caviar into Germany was 104.1 metric tons of which 27.3 metric tons were re-exported and 75.8 metric tons were consumed in the country (Tab. 17, appendix). France is the second major importer with an average of 53 metric tons per year and is the major consumer of caviar within the EU. In 1994, France imported 47 metric tons of caviar (Tab. 15, appendix). Belgium/Luxembourg and the UK import an average of 23 metric tons of caviar per year; in 1994, Belgium/Luxembourg imported 28 metric tons and the UK imported only 6 metric tons (Tab. 15, appendix). The main suppliers of caviar to the EU are the Russian Federation, Iran, Kazakhstan and China (Tab. 16, appendix).

Official Japanese import statistics (Tab 13, appendix) show a total annual import of caviar into Japan of 56 metric tons in 1994, the main suppliers being the Russian Federation (22 metric tons), Iran (25 metric tons) and China (7 metric tons). 2 metric tons of caviar are imported from other countries.

The US Marine Service statistics show a total import of 54.2 metric tons of caviar into the USA in 1994 (Tab. 14, appendix). The main suppliers of caviar to the USA are the Russian Federation, Canada, China, Kazakhstan, Sweden and Germany (Tab. 14).

Switzerland imported in 1994 about 62 metric tons of caviar, the main suppliers being Iran, France, Germany, Sweden, Canada, Russia and Japan. Switzerland re-exported in 1994 about 13.5 metric tons of caviar, mainly to Saudi Arabia, France, USA and Australia.

According to Taylor (1996), the total Western World demand for caviar from Iran and the Russian Federation was about 450 metric tons in 1995 (Tab. 6, appendix), of which 77 metric tons were Iranian "asetra" (from *Acipenser gueldenstaedtii* and probably *Acipenser persicus*) and 31 metric tons were Russian "osietra" (mainly from *Acipenser gueldenstaedtii*). However, Taylor estimates that the total production of caviar from Iran and the former USSR in 1995 was only 228 metric tons, including 50.5 metric tons of Iranian "asetra" and 80.5 metric tons of Russian "osietra". Hence, the Western World demand for caviar in general and for "osietra" in special exceeded the actual total production by more than 100%. While the actual production of Iranian osietra (or asetra) was much lower than the demand and thus failed to supply the demand, the amount of the Russian osietra production exceeded the actual demand. The latter fact demonstrates that the current production does not correspond to market requirements.

The world caviar market is currently undergoing a major crisis (Josupeit, 1994; TRAFFIC; 1995, Taylor, 1996; DeMeulenaer and Raymakers, 1996). Low quality caviar flooded the Western European markets in 1993 and 1994 (Taylor, 1996). This is mainly caused by over-exploitation, illegal production and smuggling of caviar, especially from the former Soviet Union. The sanitary conditions under which caviar is legally and illegally produced in this states are disastrous and as a result high amounts of processed caviar are only fit for disposal. Taylor (1995) estimated that for example in Azerbaidjan although the raw material was of high quality, almost 80% of the processed caviar was only fit for disposal due to disastrous conditions during production, packaging and dispatch. As a result prices collapsed also for the high quality caviar still arriving from the Republics of the former USSR and from Iran (Josupeit, 1994).

The average unit value of caviar exports shows an interesting development (Tab. 9, appendix). While the unit value of the Iranian caviar has steadily increased from US$ 109/kg before 1988 to US$ 249/kg in 1992, the value of the Russian caviar has gone down (Josupeit, 1994). The unit value of caviar exports from the former USSR peaked at US$ 279/kg in 1990. The recent changes in the former USSR and the decreasing quality of Russian caviar compelled Russians to sell at much lower prices, and the unit value fell to US$ 120/kg in 1992. However, German import data (Tab. 17, appendix) show prices for caviar from the CIS raising again after 1993.

According to Taylor (1996; Tab. 19a-b, appendix) the purchasing price for Russian "osietra" peaked in 1989 at about 700 US$ (468 DM) per kg net weight (duty unpaid) but fell down to about 555US$ (370 DM) per kg in 1995, while the purchasing price for Iranian "asetra" amounted to about 765 US$ (510 DM) per kg net weight in 1989, went down to 652 US$ (435 DM) per kg in 1993, but finally raised again to about 750 US$ (500 DM) per kg in 1994 and 1995. The retail prices for caviar in 1995 are shown in Table 18 (appendix).

The main importers expressed their concern about the present state of the resource and fear a drastic shortage of caviar within the near future (Josupeit, 1994; Taylor, 1996). It seems inevitable that trade in caviar, both legal and illegal is bound to shrink in the coming years and fail to supply demand (DeMeulenaer and Raymakers, 1996).

3.3 Illegal trade

According to several experts and TRAFFIC (1995) illegal catch of sturgeons (mainly the three commercially important species *Acipenser gueldenstaedtii*, *Acipenser stellatus*, *Huso huso*) is of major concern, accounting for perhaps more than 90% of all sturgeon caught in the Caspian Sea. In Russia, widespread illegal fishing for sturgeon is known to be practised, motivated by international demand for the highly priced caviar which cannot be met by the legal production. The illegally traded products are caviar and to a lesser degree the meat of the fish. Whereas the meat is probably for domestic consumption only, caviar is mainly smuggled outside the country and subject of an international illegal trade. This much is testified to by the 1452 sturgeon poachers detained and the more than 5 metric tons of illegally caviar and 113 metric tons of sturgeon confiscated in Russia in 1994 (according to the Ministry of Internal Affairs). In the Astrakhan region, the Russian centre of caviar trade, seven caviar canning plants operating illegally were closed down in the same year. Also in 1994, an additional 21 metric tons of sturgeon meat and 10.5 metric tons of caviar were confiscated as products of unauthorised fishing in other Russian regions (TRAFFIC, 1995). Reflecting the scale of illegal sturgeon fishing is the estimate that as much as 80% of the caviar trade is under unofficial control in parts of the CIS, and the illegal production of 1200 metric tons of caviar in Russia in 1990, and of 200 metric tons in 1992 was reported (Lindberg, 1994). The former quantity would equate to a sturgeon catch of about 16 000 metric tons, based on the calculation that approximately 7.5% of a given weight of sturgeon catch results in caviar. This amount is as high as the reported commercial sturgeon harvest at the time from the USSR (Tab. 1, appendix), representing a heavy toll on a declining stock.

Taylor (1995) estimates that the illegal trade of Russian caviar (mainly from the 3 commercially important species *Acipenser gueldenstaedtii*, *Acipenser stellatus*, *Huso huso*) which began on a large-scale since the disintegration of the former Soviet Union, peaked to about 100 metric tons in 1993. The trade channels are believed to pass from the Russian Federation mainly through the former Eastern block states, especially Poland, where poachers did not only smuggle caviar out of Russia, but also reprocessed and repackaged it and thus marketed it as "a new catch" (Taylor, 1996). Illegal caviar is sometimes repackaged in Eastern Europe and can retail at prices half or even less than normal, e.g. caviar of 700 US$ per kg is known to be sold for as low as 150 US$ per kg.

Taylor (1996) reports that in 1983, the illicit trade of Iranian caviar ("bazaar caviar", probably made of roe from *Acipenser gueldenstaedtii*, *Acipenser persicus*, *Acipenser stellatus* and *Huso huso*) reached its peak at 70 metric tons, which were transported to the West through adventurous channels. However, draconian measures by the Iranian state over ten years eventually brought the smuggling back down to pre-revolution levels of about 2-4 metric tons since 1993 (Taylor, 1996).

Large-scale smuggling and exporting of caviar has also developed in Azerbaijan and illegal trade channels led or still lead through Turkey (see Tab. 16, appendix) and Dubai, as well as Germany and U.S.A. (Taylor, 1996). The amount of caviar smuggled out of Azerbaijan was estimated to be more than 15 metric tons in 1993.

According to several importers in France, Germany and Belgium, the region of Astrakhan (Russia) and the State of Azerbaijan may be the two major suppliers of illegal Caspian caviar in trade, while Kazakhstan reputedly has a more controlled trading structure (DeMeulenaer and Raymakers, 1996).

Not only are sturgeon stocks, and thus the supply of caviar, under threat from unregulated fishing, but so are they also as a result of the illegal processing plants, which in turn circumvent appropriate control measures for caviar production. Caviar prepared in such unofficial processing plants does usually not meet the sanitary standards required by the importing countries and is considered to be of very low quality.

The proposed amendment is expected to stop the enormous illegal trade of caviar which leads to a complete overexploitation of the sturgeon stocks by means of a trade control given by the tools of CITES.

3.4 Actual or potential trade impacts

The caviar trade, especially the increasing illegal trade, threatens the survival of *Acipenser gueldenstaedtii* because the natural reproduction of the species within its entire range has decreased to a critical point within the last years and the production of caviar leads to a further reduction of mature females. The relative high prices for caviar seduces an increasing number of poachers to earn a high amount of money within a short time. Although the entire caviar supply by the main exporting countries such as Iran and the Russian Federation declined to an estimated amount of 228 metric tons in 1995 (Taylor, 1996), the Western World demand remained stable at about 450 metric tons in 1995, and thus exceeded the official supply by 100%.

3.5 Captive breeding or artificial propagation for commercial purposes (outside countries of origin)

According to Steffens (1994) and Anonymous (1994) *Acipenser gueldenstaedtii* has been introduced into aquaculture in Austria, Belgium, Germany, Hungary and Netherlands. There are no data available on the total production of each country and the size of the broodstock in captivity since the available statistics (Tab. 22, appendix) do not distinguish between sturgeon species.

4. Conservation and Management

4.1 Legal status

4.1.1 National

Acipenser gueldenstaedtii is not fully protected by law in any of the countries of origin.

In the Russian Federation, only the catch of the species is governmentally controlled which implements a special fishing license to be issued by the local department for Fishery Management. In Iran, private sturgeon fishery is prohibited and fishing regulations include a size limit of 1m minimum length.

The legal status of *Acipenser gueldenstaedtii* in the other countries of origin is not reported.

4.1.2 International

None.

4.2 Species management

4.2.1 Population monitoring

There is no information about a specific monitoring programme for *Acipenser gueldenstaedtii* neither in the Russian Federation nor Iran or any other range state.

In Romania, The Centre of Research for Fish Aquaculture, Fishing and Fishprocessing in Galati is monitoring the situation of sturgeon stocks upriver the Delta of the Danube (Birstein, 1996).

4.2.2 Habitat conservation

No information available.

4.2.3 Management measures

Early management measures in the Caspian Sea mainly conducted by the Russian Federation since the construction of the Volgograd Reservoir Dam in the 1960s included the construction of fish lifts, the construction of artificial spawning grounds below insurmountable dam constructions and the introduction of valuable food organisms (such as *Nereis diversicolor*) into certain regions of the Caspian Sea (Rochard et al., 1990).

Before the disintegration of the USSR, there was a strict management of the sturgeon fishery in the Caspian Sea, including a quota system, maximum and minimum size restrictions, closed seasons and a complete ban on the open sea fishery. Since the collapse of the USSR in 1991, five states (Russian Federation, Iran, Azerbaijan, Khazakhstan and Turkmenistan) and the two autonomous republics of Dagestan and Kalmykia are fishing for sturgeons in the Caspian Sea. Until the beginning of 1996, there was no regulation of the fishery between the bordering countries and the fishing in the open sea was no longer prohibited. Since 1992, there has been an effort to forge an international agreement governing Caspian sturgeon catch between Russia, Kazakhstan, Turkmenistan, Azerbaijan, and Iran. A Committee for the Conservation and Use of Biological Resources in the Caspian Sea has been founded. Until the beginning of 1996, however, delegations from the five Caspian countries involved have failed to agree on the size of their economic zones. In June 1996, the countries agreed on ban on fishing in the open sea. A quota system for the sturgeon catch has been set up between the former USSR countries: depending on the degree of contribution to the reproduction of sturgeon, each country obtains a quota in the Volga River (e.g. Russia 70%, Kazakhstan 18%, Azerbaijan 6% and Turkmenistan 6%).

The Russian Federation and Iran have ranching programmes for sturgeon species, including *Acipenser gueldenstaedtii*. In Russia, several State hatcheries are artificially breeding and raising sturgeons since the 1960s. According to Khodorevskaya et al. (1997) these hatcheries released about 37-40 million Russian sturgeon fingerlings in 1993, and in 1994 about 45-48 million juveniles of *Acipenser gueldenstaedtii* had been produced (Tab. 20, appendix).

Iran is also artificially propagating sturgeons since 20 years when the first hatchery was built in Rasht. According to the Iranian Fishery Organisation SHILAT, currently 5 hatcheries are working for the restocking programme of sturgeon species. The annual fry release in Iranian waters was about 3.4 millions of sturgeon juveniles, the different species not further distinguished (Tab. 21, appendix).

In the Sea of Azov region, about 30 million juveniles (mainly *Acipenser gueldenstaedtii* and *Acipenser stellatus*) were artificially propagated in hatcheries in 1993. Three hatcheries located on the Kuban River near the City of Krasnodar are still working efficiently. In 1993, they released 12.2 million Russian sturgeon juveniles and in 1994, 11 million juveniles of *Acipenser gueldenstaedtii* were stocked into the Sea of Azov (Chebanov and Savelieva, 1995).

4.3 Control measures

4.3.1 International trade

None.

4.3.2 Domestic measures

No information available.

5. Information on Similar Species

Acipenser gueldenstaedtii is sympatric with the stellate sturgeon, *Acipenser stellatus*, the beluga sturgeon, *Huso huso*, the Persian sturgeon, *Acipenser persicus,* and the ship sturgeon, *Acipenser nudiventris.*

The species is closely related to and shares many morphological characteristics with the Baltic sturgeon, *Acipenser sturio*, which is listed in Appendix I of CITES, as well as with the Persian sturgeon and the Adriatic sturgeon, *Acipenser naccarii*.

6. Other Comments

All range states of the species (except Azerbaijan, Georgia, Kazakhstan, Turkmenistan and Ukraine which have been contacted in a meeting, see below) has been contacted on 13 March 1996 and 21 May 1996. A copy of the first draft of the proposal ("working document") has been sent to all range states on 19 August 1996. The comments of the range states that have been received are attached in the appendix at the end of this document.

The "working document" has also been presented at the 13th meeting of the Animals Committee of CITES in Prague, Czech Republic, on 23-27 September 1996 for discussion.

Additionally, the Authorities of the Russian Federation have been contacted in a first meeting in Moscow on 25 to 26 June 1996 for bilateral consultations. A second meeting ("Multilateral Consultations on the Problems of Sturgeon Species within the Framework of CITES") which took place on 21-22 November 1996 in Moscow, has been organised in order to consult with the states of Azerbaijan, Kazakhstan, Turkmenistan and Ukraine (which are not members to CITES) as well as with China, Georgia, Iran, USA and the Russian Federation. The minutes of this meeting and the comments of the range states that have been received are attached in the appendix at the end of this document.

7. Additional Remarks

In addition to the consultations with the range states of the species, countries which range amongst the main caviar consumers, such as the states of the European Union, Switzerland and Japan, has been contacted on 13 March 1996 and 21 May 1996. The so obtained statistics and information are included in the text.

8. References

Altuf´yev, Yu.V. 1994. Morphofunctional Condition of Muscle Tissue and Liver of Juvenile Russian Sturgeon and Beluga with Chronic Intoxication. Journal of Ichthyology 34 (5): 134-138.

Altuf´yev, Yu.V., A.A. Romanov and N.N. Sheveleva. 1992. Histology of the Striated Muscle Tissue and Liver in the Caspian Sea Sturtgeons. Journal of Ichthyology 32: 100-115.

Anonymous. 1994. Aquaculture Production: Overview of the World Production of Sturgeon from Aquaculture and Fishery. Aquaculture Europe 18 (4): 34.

Artyukhin, E. N. 1995. The Current Status of Commercial Sturgeon Species in the Volga River-Caspian Sea Basin. In: Workshop “Sturgeon Stocks and Caviar Trade”, Bonn, October 9-10, 1995. In press.

Bacalbasa-Dobrovici, N. 1997. Endangered migratory sturgeons of the lower Danube River and its delta. In: V. Birstein, J. R. Waldman, and W. E. Bemis (eds.). Sturgeon Biodiversity and Conservation. Kluwer Academic Publication, Dordrecht. pp. 201-207.

Barannikova, I.A. 1995. Measures to Maintain Sturgeon Fisheries under Conditions of Ecosystem Changes. Proceedings of the Second International Symposium on Sturgeons, September 6-11, 1993. Moscow-Kostroma-Moscow (Russia). VNIRO Publication. Pp. 131-136.

Barannikova, I.A., I.A. Burtsev, A.D. Vlasenko, A.D. Gershanovich, E.V. Makarov and M.S. Chebanov. Sturgeon Fisheries in Russia. Proceedings of the Second International Symposium on Sturgeons, September 6-11, 1993. Moscow-Kostroma-Moscow (Russia). VNIRO Publication. Pp. 124-130.

Birstein, V. J. 1996a. Sturgeons May Soon Disappear from the Caspian Sea. Russian Conservation News, No. 7 :15-16.

Birstein, V. J. 1996b. Sturgeons in the Lower Danube: A Trip to Romania. The Sturgeon Quarterly, vol. 4 (½) :10-11.

Chebanov, M. S. and E. A. Savelieva. 1995. Sturgeon culturing on the Kuban River. Rybovodstvo I Rybolovstvo, No. 2 :10-13 (in Russian).

DeMeulenaer, T. and C. Raymakers. 1996. Sturgeons of the Caspian Sea and the international trade in caviar. TRAFFIC International.

Dumont, H. 1995. Ecocide in the Caspian Sea. Nature 377 :673-674.

Fischer, W., M. Schneider and M.-L. Bauchot. 1987. Fiches FAO d´Identification des Especes pour les Besoins de la Pêche. Mediterranee et Mer Noir, Zone de Pêche 37 (Révision 1), Vol. II: Vertèbres. FAO, Rome. Pp. 944-952.

Hensel, K., and J. Holcik. 1997. Past and current status of sturgeons in the upper and middle Danube. In: V. Birstein, J. R. Waldman, and W. E. Bemis (eds.). Sturgeon Biodiversity and Conservation. Kluwer Academic Publication, Dordrecht. pp. 185-200.

IUCN (1996). 1996 IUCN Red List of Threatened Animals. IUCN, Gland, Switzerland.

Ivanov, V. P., V. N. Belyaeva, and A. D. Vlasenko. 1995a. Regional distribution of commercial resources of the Caspian Sea. Rybnoe Khozyaistvo, No. 2 :18-21 (in Russian).

Ivanov, V. P., A. D. Vlasenko and R.P. Khodorevskaya. 1995b. How to preserve sturgeons. Rybnoe Khozyaistvo, No. 2 :24-26 (in Russian).

Jankovic, D. 1995. Populations of Acipenseridae prior to and after the Construction of the HEPS "Djerdap I and II". Proceedings of the Second International Symposium on Sturgeons, September 6-11, 1993. Moscow-Kostroma-Moscow (Russia). VNIRO Publication. Pp. 235-238.

Josupeit, H. World Trade of Caviar and Sturgeon. FAO, Rome. 100 pp.

Khodorevkaya, R.P., G.F. Dovgopol and O.L Zhuravleva. 1995. Formation of Commercial Sturgeon (Acipenseridae) Stocks. Proceedings of the Second International Symposium on Sturgeons, September 6-11, 1993. Moscow-Kostroma-Moscow (Russia). VNIRO Publication. Pp. 137-150.

Khodorevskaya, R. P., G. F. Dovgopol, O. L. Zhuravleva, and A. D. Vlasenko. 1997. Present status of commercial stocks of sturgeons in the Caspian Sea basin. In: V. Birstein, J. R. Waldman, and W. E. Bemis (eds.). Sturgeon Biodiversity and Conservation. Kluwer Academic Publication, Dordrecht. pp. 209-219.

Khodorevskaya, R.P., A.A. Polyaninova, P.P. Geraskin and A.A. Romanov. 1995. A Study on Physiological and Biochemical Status of Beluga Sturgeon, *Huso huso* (L.), and its Feeding Habits. Proceedings of the Second International Symposium on Sturgeons, September 6-11, 1993. Moscow-Kostroma-Moscow (Russia). VNIRO Publication. Pp. 164-177.

Kuz´mina, O. Yu., V.I. Luk´yanenko, Ye.I. Shakmalova, Ye.A. Lavova and Yu.V. Natochin. 1993. Specific Features of Water and Salt Homeostasis in Sturgeon during Muscle Degeneration. Journal of Ichthyology 33: 93-100.

Lelek, A. 1987. Threatened Fishes of Europe. The Freshwater Fishes of Europe. Vol. 9. The European Committee for the Conservation of Nature and Natural Resources - Council of Europe (ed.). Wiesbaden, AULA-Verlag. Pp. 42-57.

Levin, A.V. 1995. Russian Sturgeon, *Acipenser gueldenstaedti* Brandt, Stocking in the Volga-Caspian Basin. Proceedings of the Second International Symposium on Sturgeons, September 6-11, 1993. Moscow-Kostroma-Moscow (Russia). VNIRO Publication. Pp. 178-188.

Levin, A.V. 1996. The Distribution and Migration of Sturgeon in the Caspian Sea. In: Workshop "Sturgeon Stocks and Caviar Trade", Bonn, October 9-10, 1995. In press.

Lindberg, O. (1994). Black market turns importers to Iran for caviar. International Management, June 1994.

Lukyanenko, V. I., A. L. Polenov, and A. L. Yanshin. 1994. Is it possible to save Caspian sea sturgeons? Vestnik Rossiiskoi Akademii Nauk, 64 (7) :606-620 (in Russian).

Raspopov, V. M., P. V. Veshchev, A. S. Novikova, and A. E. Egorova. 1995. Causes of the critical situation with the natural reproduction of sturgeons in the Volga River. Rybnoe Khozyaistvo, No. 2 :21-23 (in Russian).

Rochard, E., G. Castelnaud and M. Lepage. Sturgeons (Pisces: Acipenseridae): Threats and Prospects. Journal of Fish Biology 37 (Suppl. A): 123-132.

Rodionov, S. N. 1994. Global and Regional Climate Interaction: The Caspian Sea Experience. Kluwer Academic Publishers, Dordrecht. 241 pp.

Romanov, A.A. and Yu.V. Altuf´yev. 1991. Tumors in the Sex Glands and Liver of the Caspian Sea Sturgeons. Journal of Ichthyology 30: 44-49.

Romanov, A.A. and Yu.V. Altuf´yev. 1993. Ectopic Histogenesis of Sexual Cells of Caspian Sea Sturgeon. Journal of Ichthyology 33 (2): 140-150.

Romanov, A.A. and N.N. Sheveleva. 1993. Disruption in the Gonadogenesis in Caspian Sturgeons (Acipenseridae). Journal of Ichthyology 33 (3): 127-133.

Sagers, M. J. 1994. The Oil Industry in the Southern-Tier Former Soviet Republics. Post-Soviet Geography, 35 (5) :267-298.

Shagaeva, V.G., M.P. Nikol´skaya, N.V. Akimova and K.P. Markov. 1995. Pathology of the Early Ontogenesis of the Volga River Basin Acipenseridae. Proceedings of the Second International Symposium on Sturgeons, September 6-11, 1993. Moscow-Kostroma-Moscow (Russia). VNIRO Publication. Pp. 62-73.

Shagaeva, V.G., M.P. Nikol´skaya, N.V. Akimova, K.P. Markov and N.G. Nikol´skaya. 1993. A Study of the Early Ontogeny of Volga Sturgeon (Acipenseridae) Subjected to Human Activity. Journal of Ichthyology 33 (6): 23-41.

Steffens, W. 1994. Internationales Symposium über Störe. Fischer & Teichwirt 4/1994: 129-131.

Taylor, S.1996. The Historical Development of the Caviar Trade and Industry. In: Workshop "Sturgeon Stocks and Caviar Trade", Bonn, October 9-10 1995. In press.

TRAFFIC Europe. 1995. A TRAFFIC network report to the CITES Animals Committee on the TRAFFIC Europe Study of the International Trade in Sturgeon and Sturgeon Products. Unpublished report. 3pp.

Veshchev, P. V. 1993. Effect of water level of the Volga River on reproduction of stellate sturgeon. Vodnye Resoursy, No. 2 :225-228 (in Russian).

Veshchev, P. V. 1995. Natural Reproduction of Volga River Stellate Sturgeon, *Acipenser stellatus*, under New Fishing Regulations. Journal of Ichthyology, 35 (9) :281-294.

Vlasenko, A. D. 1990. Sturgeon population size in the Caspian Sea. Rybnoe Khozyaistvo, No. 7: 53-56 (in Russian).

Vlasenko, A.D., A.V. Pavlov, L.I. Sokolov and V.P. Vasil´ev. 1989. *Acipenser gueldenstaedti* Brandt, 1833. In: Holcík, J. (ed). The Freshwater Fishes of Europe. Vol. 1/II: General Introduction of Fishes. Acipenseriformes. Wiesbaden, AULA-Verlag. Pp. 295-344.

Volovik, S.P., V.G. Dubinina and A.D. Semenov. 1993. Hydrobiology and Dynamics of Fisheries in the Azov Sea. Studies and Reviews. General Fisheries Council for the Mediterranean. No. 64. FAO, Rome. Pp. 1-58.

Zolotarev, P. N., V. A. Shlyakhov, and O. I. Akselev. 1996. Feeding grounds and feeding of the Russian sturgeon *Acipenser gueldenstaedti* and sevruga *Acipenser stellatus* in the north-western part of the Black Sea in contemporary ecological conditions. Voprosy Ikhtiologii, 36, No. 3 :357-362 (in Russian).

Acipenser medirostris

1. <u>Taxonomy</u>

    1.1 Class: Actinopterygii

    1.2 Order: Acipenseriformes

    1.3 Family: Acipenseridae

    1.4 Species: *Acipenser medirostris* Ayres, 1854

    1.5 Scientific synonyms: *Acipenser acutirostris* Ayres, 1854
    Acipenser agassizii Duméril, 1867
    Antaceus alexandri Duméril, 1867
    Antaceus oligopoltis Duméril, 1867

    1.6 Common names:
    English: Green sturgeon
    French: Esturgeon vert
    Finnish: Vihersampi

2. <u>Biological Parameters</u>

    2.1 Distribution

    Countries of origin: Canada, ? Mexico, U.S.A.

    Acipenser medirostris is distributed along the Pacific coast of North America from the Aleutian Islands and the Gulf of Alaska to Ensenada, Mexico (Moyle, 1976; Morrow, 1980; Houston, 1988) and is usually found near the mouths estuaries of larger rivers.

    Presumed spawning populations of *Acipenser medirostris* presently occur in the Fraser and Skeena Rivers in British Columbia (Canada), in the Rogue River (Oregon, U.S.A.), and in the Klamath, Sacramento and Trinity Rivers (California, U.S.A.) (Houston, 1988; NPSSC, 1993).

    The Green Sturgeon is an anadromous species which spends much of its life cycle at Sea, and enters the rivers along the Pacific coast for spawning. In Californian waters, Green sturgeon adult spawners migrate into freshwater in the spring and are broadcast spawners. Klamath River adult sturgeon, presumed to be migrating to and from the ocean, are found in the river during the spring, summer and early fall months (NPSSC, 1993). In the lower Fraser River adult Green sturgeon appear to migrate upstream in late summer and early fall, in advance of their spring spawning (Houston, 1988). The fish are usually found in the lower reaches of the rivers. The juveniles spend apparently less than two years in the rivers and estuaries before they emigrate to the ocean (Moyle et al., 1993).

    2.2 Habitat availability

    The nature, rate and extent of habitat loss or degradation are not documented. There are no reliable data about the loss of critical habitat such as spawning grounds, because *Acipenser medirostris* has not been studied very intensively.

    2.3 Population status

    Little is known of the status of the Green sturgeon populations and there are no estimates of the total size of the population. In Canadian waters the species is considered to be rare and the adult populations are estimated to be in the low thousands, the estimation based on catch statistics, average weights and comparison to the partly sympatric White sturgeon, *Acipenser transmontanus* (Houston, 1988). In the coastal waters and rivers of the U.S.A. the species seems to be more abundant as reflected by the estimated amount of about 6,000 to 10,000 adult individuals (> 1.3 m) that were annually caught in the 1980s (Moyle et al., 1993). However, there is no information about the total size of the population in American waters. In California, the status of the populations of *Acipenser medirostris* should be classified as Endangered (Moyle, 1995 a/b).

The species is listed as Vulnerable by IUCN (1996).

2.4 Population trends

In Canada, there are no indications of population trends for *Acipenser medirostris* because no reliable data exist on abundance or distribution. There seems to be no evidence for a general population decline (Houston, 1988). According to Houston (1988) some idea of numbers and trends may be gained from catch statistics: Green sturgeon made up 5 % of the total Columbia River sturgeon harvest in the period from 1941 to 1950, 21% in the period from 1951 to 1960 and 22% in the period from 1961 to 1971. Using average landing statistics and weights given by Parks (1978) this translates into roughly 200 to 500 fish per year for the period from 1941 to 1950 and 1,400 fish for the period from 1951 to 1971. However, increased catches of Green sturgeon over the period from 1940 to 1970, may reflect the imposition of maximum and minimum size restrictions which might mean the inclusion of more of the smaller individuals in catch statistics. Green sturgeon are mainly an incidental species in the salmon gill net fishery and increased catch of this species in salt or brackish waters over the period indicated could also reflect increased effort in the salmon fishery (Houston, 1988).

As for the U.S.A., there is little quantitative information about the population trends either. However, *Acipenser medirostris* is commercially harvested within its range in American waters with an estimated amount of 6,000 to 10,000 adults (> 1.3 m) that are caught every year.

Moyle et al. (1993) indicate that the fisheries data are meager but suggest a current overexploitation of a population of large, old fish. The authors further predict that *Acipenser medirostris* will rapidly approach threatened species status in the U.S.A..

2.5 Geographic trends

Since the Green sturgeon is one of the least studied sturgeons, there is no reliable information on its historical range. There are no reports about geographic trends but it is believed, that the species was formerly present in some other rivers (besides the presently five known rivers where the fish are spawning) along the Pacific coast (Moyle et al., 1993). The extent of decrease in range area cannot be estimated, since no reliable data exist.

2.6 Role of the species in its ecosystem

Acipenser medirostris is an anadromous sturgeon species which can reach 2.3 m in length (TL) and 158 kg in weight, with an estimated age of 60 years (Houston, 1988; Moyle et al., 1993). However, the fish seldom exceeds 1.3 m and 45 kg and most of those caught weighed between 20 to 40 kg (Moyle, 1976). The Green sturgeon is a typical bottom feeder, the food consisting predominantly of chironomids, mysids, *Daphnia*, *Chaoborus* larvae, molluscs, copepods and other invertebrates (Houston, 1988). Large individuals may also take fish and crayfish which have been sucked off the bottom or taken alive (Scott and Crossman, 1973). There may be some competition for food and suitable habitat with the partly sympatric White sturgeon, *Acipenser transmontanus*. However, Green sturgeon are seldom far from saltwater while White sturgeon are often found far inland (Houston, 1988).

The possible consequences of a depletion of the population of *Acipenser medirostris* on species depending on or associated with it are not predictable.

2.7 Threats

In Canadian waters, the main threat to *Acipenser medirostris* is considered to be the decreasing availability of large rivers with suitable estuaries which provide the species with adequate spawning and feeding habitats (Houston, 1988). Dam constructions on major rivers and other human activities such as mining which alter the aquatic environment could be detrimental to this species. Environmental pollution, especially of the river estuaries, is considered to be a further limiting factor for the populations of the Green sturgeon (Houston, 1987). The incidental catches of *Acipenser medirostris* by the salmon fishery and the very limited sport fishery are considered to be insignificant.

While in Canada, no commercial fishery for the species exists, the U.S.A. yearly records an estimated catch of 6,000 to 10,000 of adult Green sturgeon (>1.3 m). Moyle (1993) states that the fisheries data suggest that fisheries may be mining a population of large, old fish. The author further predicts that *Acipenser medirostris* is rapidly approaching threatened species status in the U.S.A. because of this overexploitation.

In all three Californian rivers that the sturgeon enters for spawning, there are concerns that the Green sturgeon stocks are being over-harvested (NPSSC, 1993). The possibility that Green sturgeon stocks migrate and mix with other fish populations even increases these concerns because the sturgeons might be caught as a bycatch.

3. Utilization and Trade

3.1 National utilization

In the U.S.A., fishing data for *Acipenser medirostris* are meager, but it is estimated that probably 6,000 to 10,000 adult Green sturgeon (>1.3 m) are harvested every year (Moyle et al., 1993). Presently, Green sturgeon are harvested in the Sacramento River system (San Francisco and San Pablo bays), in the Klamath River system, the mouth of the Columbia River and Willapa Bay and Grays Harbor, Washington (NPSSC, 1993). According to Moyle (1993), the few data suggest that fisheries may be "mining" a population of large, old fish. There is no information on the parts and derivatives that are used of this fish.

In Canada, the Green sturgeon is not utilized commercially, as the flesh and roe has a disagreeable taste and odour (Houston, 1987 and 1988). However, individuals are incidentally taken as by-catch of the Salmon gill net fishery and the sturgeon sports fishery in the Fraser River may account for small numbers of fish each year which are apparently not significant (Houston, 1987).

3.2 Legal international trade

Not reported.

3.3 Illegal trade

Not reported.

3.4 Actual or potential trade impacts

No information available.

3.5 Captive breeding or artificial propagation for commercial purposes (outside countries of origin)

Not reported.

4. Conservation and Management

4.1 Legal status

4.1.1 National

In the U.S.A., *Acipenser medirostris* is not protected by law. In Canada, the species has been listed as Vulnerable by the federal Committee on the Status of Endangered Wildlife in Canada (COSEWIC) (Houston, 1987; Campbell, 1991).

Currently, all commercial and recreational fisheries in Fraser River (upstream of river mouth) must release all caught sturgeon in accordance with the 1994 retention ban; while aboriginal fisheries in the Fraser River have agreed to a voluntary release of incidentally caught sturgeon (Echols et al., 1995).

4.1.2 International

None.

4.2 Species management

4.2.1 Population monitoring

In the U.S.A., according to NPSSC (1993), the California Department of Fish and Game, Bay Delta Project conducts on-going biological surveys on the Green sturgeon. No information about a special monitoring programme for *Acipenser medirostris* in Canadian waters is available.

4.2.2 Habitat conservation

Not reported.

4.2.3 Management measures

Neither in the U.S.A. nor in Canada special management measures for *Acipenser medirostris* exist (Houston, 1988).

Season closures for other species and size restrictions are the only regulations that provide protection for the populations of the Green sturgeon: in Canada any fish over 100 cm may be caught and in the U.S.A. in the Columbia River, a minimum size limit of 1.22 m protects younger fish, while a maximum size limit of 1.83 m (= 6 ft.) protects the female broodstock (Houston, 1988). In British Columbia, Canada, a retention ban has been imposed in 1994: all commercial and recreational fisheries in Fraser River (upstream of the river mouth) must release all caught sturgeon. Aboriginal fisheries in the Fraser River have agreed to a voluntary release of incidentally caught sturgeon (Echols et al., 1995). However, catches of sturgeon in any British Columbia marine waters fishery (outside the Fraser mouth) may be retained.

4.3 Control measures

4.3.1 International trade

None.

4.3.2 Domestic measures

In the U.S.A., a number of Federal, State and Tribal management entities monitor West Coast sturgeon fisheries.

The U.S. Fish and Wildlife Service monitors the capture of sturgeon in Native American spring and fall salmon (chinook) gill net fisheries; the Fisheries Department of Hoopa Valley Business council monitors the sturgeon catch in the Trinity River within the Hoopa Valley Indian Reservation; the Oregon Department of Fish and Wildlife conducts beach seining on the Rogue River in Oregon; the Washington Department of Fisheries and the Oregon Department of Fish and Wildlife monitor the commercial and recreational catches of Green sturgeon in the Columbia River; the Washington Department of Fisheries monitors the harvest in Willapa Bay and Grays Harbour, Washington (NPSSC, 1993).

For Canadian waters, there is no specified information available.

5. Information on Similar Species

The American Green sturgeon, *Acipenser medirostris*, was considered for a long time to be the same species as the Asian Sakhalin sturgeon, *Acipenser mikadoi* (Scott and Crossman, 1973; Houston 1988). Some authors regarded the Asiatic form as a distinct subspecies, *Acipenser medirostris mikadoi* (Lindberg and Legeza, 1965). Recent investigation of the DNA content of both forms show that the genome size of the American and Asian form differ considerably (Birstein et al, 1993; Blacklidge and Bidwell, 1993; Birstein et al.,1997). Birstein (1993a and 1993c) concluded that these two forms should be regarded as different species.

Acipenser medirostris is partly sympatric with the White sturgeon, *Acipenser transmontanus*, which is more abundant than the Green sturgeon (Houston, 1987). Both sturgeon species look very similar and apparently some intergrades do occur in the Columbia River (Lane, 1989). Since it is difficult to distinguish the two species readily, provincial and federal fishing regulations and catch records do not differentiate between Green and White sturgeon. The most reliable method of separation to-date appears to be the position of the anus with respect to the insertion of the pelvic fins. In Green sturgeon the anus is in line with or anterior to the pelvic fin insertion, while in White sturgeon the anus is posterior to the pelvic insertion. The lateral scute count tends to be higher in White sturgeon (38-48) compared with Green sturgeon (23-30) (Scott and Crossman, 1973).

6. Other Comments

The range states of the species has been contacted on 13 March 1996 and 21 May 1996. A copy of the first draft of the proposal ("working document") has been sent to all range states on 19 August 1996. The comments of the range states that have been received are attached in the appendix at the end of this document.

The "working document" has also been presented at the 13th meeting of the Animals Committee of CITES in Prague, Czech Republic, on 23-27 September 1996 for discussion.

Additionally, a meeting ("Multilateral Consultations on the Problems of Sturgeon Species within the Framework of CITES") which took place on 21-22 November 1996 in Moscow, has been organised in order to consult with the states of Azerbaijan, Kazakhstan, Turkmenistan and Ukraine (which are not members to CITES) as well as with China, Georgia, Iran, USA and the Russian Federation. The minutes of this meeting and the comments of the range states that have been received are attached in the appendix at the end of this document.

7. Additional Remarks

8. References

Birstein, V.J. 1993a. Sturgeons and Paddlefishes: Threatened Fishes in Need of Conservation. Conservation Biology 7 (4):773-787.

Birstein, V.J. 1993b. Draft Application to CITES: Order Acipenseriformes. Unpublished.

Birstein, V.J. 1993c. Is *Acipenser medirostris* one or two species? The Sturgeon Quarterly, Vol. 1, No. 2: 8.

Birstein, V. J., R. Hanner, and R. DeSalle. 1997. Phylogeny of the Acipenseriformes: cytogenetic and molecular approaches. In: V. Birstein, J. R. Waldman, and W. E. Bemis (eds.). Sturgeon Biodiversity and Conservation. Kluwer Academic Publication, Dordrecht. pp. 127-155.

Campbell, R.R. 1991. Rare and Endangered Fishes and Marine Mammals of Canada: COSEWIC Fish and Marine Mammal Subcommittee Status Reports: VII. The Canadian Field Naturalist 105 (2): 151-156.

Echols, J.E. and Fraser River Action Plan Fishery Management Group. 1995. Review of Fraser River White Sturgeon (*Acipenser transmontanus*). Department of Fisheries and Oceans, Vancover, B.C. 33 pp.

Houston, J.J.P. 1987. Status Report on the Green Sturgeon, *Acipenser medirostris* in Canada. Report to the Committee on The Status of Endangered Wildlife in Canada (COSEWIC). 15 pp.

Houston, J.J.P. 1988. Status of the Green Sturgeon, *Acipenser medirostris*, in Canada. Canadian Field Naturalist 102 (2): 286-290.

IUCN (1996). 1996 IUCN Red List of Threatened Animals. IUCN, Gland, Switzerland.

Lane, D.E. 1989. Status of the White Sturgeon, *Acipenser transmontanus*, in Canada. Report to the Committee on The Status of Endangered Wildlife in Canada (COSEWIC). CWS, Ottawa. 20 pp., 4 figs.

Morrow, J.E. 1980. The Freshwater Fishes of Alaska. Alaska Northwest Publishing, Anchorage, Alaska.

Moyle, P.B. 1976. Inland Fishes of California. University of California Press, Los Angeles, California.

Moyle, P.B. 1995a. The decline of anadromous fishes in California. Conservation Biology, 8(3) :869-870.

Moyle, P.B. 1995b. Conservation of native freshwater fishes in the Mediterranean-type climate of California, USA: A review. Biol. Cons. 72(2) :271-279.

Moyle, P.B., P.J. Foley and R.M. Yoshiyama. 1993. Status and Biology of the Green Sturgeon, *Acipenser medirostris*. In: 123rd Annual Meeting of the American Fisheries Society, Portland, Oregon, August/September 1993. Session 1.3. Symposium: Biology and Management of North American Sturgeons. Pp. 14-15.

National Paddlefish and Sturgeon Steering Committee (NPSSC). 1993. Framework For The Management and Conservation Of Paddlefish and Sturgeon Species In The United States. 41 pp.

Parks, N.B. 1978. The Pacific Northwest Commercial Fishery for Sturgeon. Marine Fisheries Review 40: 17-20.

Scott, W.B. and E.J. Crossman. 1973. Freshwater Fishes of Canada. Fisheries Research Board of Canada. Bulletin 184: 77-116.

Acipenser mikadoi

1. Taxonomy

1.1	Class:	Actinopterygii	
1.2	Order:	Acipenseriformes	
1.3	Family:	Acipenseridae	
1.4	Species:	*Acipenser mikadoi* Hilgendorf, 1892	
1.5	Scientific synonyms:	*Acipenser medirostris* Ayres, 1854 *Acipenser medirostris mikadoi* Schmidt,1950	
1.6	Common names:	English: Japanese: Polish:	Sakhalin sturgeon Chôzame Jesiotr sachalinski

2. Biological Parameters

2.1 Distribution

Countries of origin: ? China, ? Japan, Russian Federation.

Acipenser mikadoi occurs in the Sea of Japan, from Korea to Northern Japan, in the Tatar Strait, in the Sakhalin Island waters, in the Amur River, in the Sea of Okhotsk, in the sea areas of the Primorsky Region and in the Bering Sea (Masuda et al., 1984; Honma, 1988; Artyukhin and Andronov, 1990; Birstein, 1993; Shilin, 1995).

The Sakhalin sturgeon is an anadromous species which historically spawned in a few short rivers flowing down from the Sikhote-Alin mountains in the Tatar Strait (Russian Far East) and in two rivers of Hokkaido Island (Japan)(Berg, 1948). The only current spawning site of the species is the Tumnin (or Datta) River in the Khaborovsk region in the Russian Far East (Artyukhin and Andronov, 1990; Shilin, 1995). Spawning occurs in June on pebbles in the lower reaches of the Tumnin River, adults not being found above 100 km from the estuary. It is supposed that young individuals spend 3-5 years in the Tumnin river near the estuary and then begin to migrate to the Tatar Strait and moving off the estuary to 150-200 km south- and northwards.

2.2 Habitat availability

During the last decades, the species lost almost all of its spawning sites in the small rivers that enter the Sea in the Khabarovsk and Primorsky Region and in the Sakhalin Island as well as on Hokkaido Island (Artyukhin and Andronov, 1990; Shilin, 1995). Today only one river is known where the Sakhalin sturgeon is spawning: the Tumnin River in the Khabarovsk Region in Russia.

2.3 Population status

Artyukhin and Andronov (1990) and Shilin (1995) indicate that the abundance of *Acipenser mikadoi* is low. There is no estimate of the total size of the population. Artyukhin and Andronov (1990) report that approximately 100 individuals of *Acipenser mikadoi* annually enter the Tumnin River for spawning, which is the only recently known spawning site for the species. Recent studies of Artyukhin and Romanov (1994) indicate that only a few dozen mature adults enter the Tumnin river for spawning annually. The data the authors obtained were from their own experimental catching efforts and from authenticated anonymous records of local fishermen.

The stock in captivity - according to Artyukhin and Romanov (1994) - consists of a total of ten specimens (hatched in 1987) at the hatchery "Osetr" in Konakovo near Moscow and of a total of about eighty juvenile individuals (from developed eggs from Tumnin River delivered in 1991) at the Okhotsk hatchery in Sakhalin Island.

Acipenser mikadoi is listed as Endangered by IUCN (1996).

2.4 Population trends

Berg (1948) already reported that the species has always been rare within its distribution range but according to Shilin (1995) the population size decreased during the last thirty years, and today only one spawning population is known from the Tumnin River. The abundance of *Acipenser mikadoi* is constantly decreasing and because of the low reproduction rate, the population cannot rapidly be restored. The only known spawning population is in a precarious situation and is most likely to disappear in 10-15 years without special protective measures. According to Shilin (1995) there is no evidence for an effective natural reproduction since the author failed to catch sturgeon larvae and yearlings during his investigations in 1990 and 1992. On the contrary, Artyukhin and Romanov (1994) report that they have been successful to catch large juveniles in the estuary of the Tumnin River which may testify the fact that reproduction of the Sakhalin sturgeon still occurs up to date.

2.5 Geographic trends

The historically known spawning sites of the species were restricted to a few small rivers in Hokkaido Island and to several quite short rivers flowing down from the mountain range of Sikhote-Alin into the Tatar Strait in Russia, including the Tumnin and the Koppi River (Khabarovsk Region), the Viakhtu and the Tym River (Sakhalin Island) and possibly the Partisanskaya (or Suchan) River (Primorsky Region)(Artyukhin and Romanov, 1994). Currently, *Acipenser mikadoi* is only spawning in the Tumnin river, and for the formerly inhabited rivers no records of *Acipenser mikadoi* spawning populations exist.

2.6 Role of the species in its ecosystem

The biology and ecology of *Acipenser mikadoi* have not been studied and the role of the species in its ecosystem is not clear.

2.7 Threats

Artyukhin and Andronov (1990) suggest the main cause for the low abundance and decrease of the Sakhalin sturgeon populations being the lack of food in estuaries where young fish usually feed, while poaching is regarded as a cause of great concern. Shilin (1995) however, considers poaching to be the main threat to the survival of the species. The author indicates that poachers caught nearly all mature adults that ascended the Tumnin River for spawning in one season, i.e. up to 100 specimens.

Besides poaching, the Sakhalin sturgeon is threatened by the salmon fishery. Individuals of various ages are known to be the bycatch in gill nets used for salmon fishing at the Tumnin River (Shilin, 1995).

Furthermore, the spawning population of the Sakhalin sturgeon is threatened by the pollution of the water through oil products in the lower reaches of the Tumnin River and waste products of gold-mining in the upper reaches of the Tumnin River (Shilin, 1995).

Two parasites, *Polypodium* sp. and *Amphilina* sp., have been found in females of *Acipenser mikadoi* by Artyukhin and Romanov (1994) infecting either the eggs (*Polypodium*) or the entire animal. However, the degree of infection of the population in the wild with both parasites has not been studied.

3. <u>Utilization and Trade</u>

3.1 National utilization

Acipenser mikadoi has been caught in the rivers where it ascended to spawn, mainly in Russia, but since 1983 it is listed in the Red Data Book of the Russian Federation, which comprises a complete ban on fishery. In the past, 0.6-0.7 metric tons of Sakhalin sturgeon were caught annually (Berg et al., 1949). Besides this record from the early 1940s, there is no detailed information neither on the harvest and the used parts of the fish nor on the catch statistics. Moreover, no data on the Open Sea fishery and on the fishery in Japan and adjacent waters, are available. Krykhtin and Svirskii (1996) report that more than 50 specimens of the Sakhalin sturgeon are captured annually near the river mouth or in the lower flow of the rivers flowing in the Sea of Okhotsk and Sea of Japan, including 5 to 10 individuals caught in the estuary of the Amur River.

The fish is caught mainly for its meat. There is virtually no information on the production and quality of caviar produced from the roe of *Acipenser mikadoi*.

Shilin (1995) indicates that poaching of *Acipenser mikadoi* increased drastically at the Tumnin River in the beginning 1990s and that almost all mature fish (up to 100 specimens) that ascended the river for spawning has been caught by illegal fishermen.

3.2 Legal international trade

No information available.

3.3 Illegal trade

As indicated by Artyukhin and Andronov (1990), Pavlov et al. (1994) and Shilin (1995) the illegal fishery increased during the last years due to a very rapid rise of domestic prices, the lack of this product in internal trade and cut down in financial and material support of fishing inspectors. Bearing in mind that only an estimated few dozen to one hundred specimens of *Acipenser mikadoi* ascend the Tumnin River (Artyukhin and Romanov, 1994), it seems likely that the fish and its parts and derivatives is mainly domestically utilised. There are no reports about illegal international trade.

3.4 Actual or potential trade impacts

No information available.

3.5 Captive breeding or artificial propagation for commercial purposes (outside countries of origin)

Not reported.

4. Conservation and Management

4.1 Legal status

4.1.1 National

Listed as Endangered species in the Red Data Book of the Russian Federation (1983). This implements a total protection of the species and a complete ban on fishery.

Shilin (1995) points out that formally, the control of poachers is carried out continuously at the Tumnin River (Khabarovsk Region, Russia) and is conducted by fish inspectors aiming at protection of the entire fish fauna. Shilin (1995) states that the efficiency of this control is not sufficient, because according to the authors investigations poaching is still the main factor for a decrease of the populations of *Acipenser mikadoi*.

4.1.2 International

None.

4.2 Species management

4.2.1 Population monitoring

The programme for conservation of *Acipenser mikadoi* in the Russian Far East (Shilin, 1995) elaborated by the Department of Protection and Rational Use of Animals (Russian Federal Research Institute of Nature Conservation and Reserves) includes a long-term monitoring programme in order to determine the population dynamics, the spawning grounds and the natural reproduction.

4.2.2 Habitat conservation

Not reported.

4.2.3 Management measures

One of the main management measures of the programme for conservation of *Acipenser mikadoi* in the Russian Far East (Shilin, 1995) is the artificial propagation and reintroduction of the species. Concerning the broodstock in captivity Artyukhin and Romanov (1996) report that a total of ten specimens (hatched in 1987) exists at the hatchery "Osetr" in Konakovo near Moscow and a total of about eighty juvenile individuals (from developed eggs from Tumnin River delivered in 1991) is held at the Okhotsk hatchery in Sakhalin Island.

Shilin (1995) suggests that the artificial propagation can annually support the replenishment of the Sakhalin sturgeon population in the Tumnin River by some tens of thousands of fry which will prevent the extinction of this population, and will make it possible to initiate the restoration of the species in some other rivers where it occured in the past. So far, no data about the annual production of Sakhalin sturgeon fry in the above mentioned hatcheries is available.

Dr. Evgenii Artyukhin (Central Laboritory of Fish Reproduction, St. Petersburg, Russia) continues his programme on artificial breeding of *Acipenser mikadoi*.

4.3 Control measures

4.3.1 International trade

Not reported.

4.3.2 Domestic measures

Shilin (1995) reports that a formal control of illegal fishery conducted by fish inspectors is carried on continuously on the Tumnin River in the Khabarosk Region in Russia but the authors doubts is effectiveness.

The programme for conservation of *Acipenser mikadoi* in the Russian Far East (Shilin, 1995) elaborated by the Department of Protection and Rational Use of Animals (Russian Federal Research Institute of Nature Conservation and Reserves) includes educational measures to inform people of the real threats of the Sakhalin sturgeon. Educational activity is proposed to be carried out by mass media, as well as through issuing posters and leaflets.

5. Information on Similar Species

The Sakhalin sturgeon, *Acipenser mikadoi*, was considered for a long time to be the same species as the American Green sturgeon, *Acipenser medirostris* (Scott and Crossman, 1973; Houston 1988). Other authors regarded the Asiatic form as a distinct subspecies, *Acipenser medirostris mikadoi* (Lindberg and Legeza, 1965; Shilin, 1995). Recent investigation of the DNA content of both forms show that the genome size of the Asian and American form differ considerably (Birstein et al, 1993; Blacklidge and Bidwell, 1993). Birstein (1993a and 1993c) concluded that these two forms should be regarded as different species (see discussion in Birstein and Bemis, 1997).

6. Other Comments

All range states of the species has been contacted on 13 March 1996 and 21 May 1996. A copy of the first draft of the proposal ("working document") has been sent to all range states on 19 August 1996.

The comments of the range states that have been received are attached in the appendix at the end of this document.

The "working document" has also been presented at the 13th meeting of the Animals Committee of CITES in Prague, Czech Republic, on 23-27 September 1996 for discussion.

Additionally, the Authorities of the Russian Federation have been contacted in a first meeting in Moscow on 25 to 26 June 1996 for bilateral consultations. A second meeting ("Multilateral Consultations on the Problems of Sturgeon Species within the Framework of CITES") which took place on 21-22 November 1996 in Moscow, has been organised in order to consult with the states of Azerbaijan, Kazakhstan, Turkmenistan and Ukraine (which are not members to CITES) as well as with China, Georgia, Iran, USA and the Russian Federation. The minutes of this meeting and the comments of the range states that have been received are attached in the appendix at the end of this document.

7. Additional Remarks

8. References

Artyukhin, E.N. and A.E. Andronov. 1990. A Morphological Study of the Green Sturgeon *Acipenser medirostris* (Chondostei, Acipenseridae) from the Tumnin (Datta) River and Some Aspects of the Ecology and Zoogeography of Acipenseridae. Journal of Ichthyology 30 (7): 11-21.

Artyukhin, E.N. and A.G. Romanov. 1994. Artificial Breeding of the Endangered Species *Acipenser medirostris mikadoi* in the Field. Proceedings of the International Conference on Sturgeon Biodiversity and Conservation, New York 1994.

Berg, L.S. 1948. [The Freshwater Fishes of the USSR and Adjacent Countries.]. Moscow and Leningrad, Nauka Publication, Vol. I, pp. 57-109. (Engl. translation published by National Science Foundation, Washington D.C., 1962).

Berg, L. S., A. S. Bogdanov, N. I. Kozhin, and T. S. Rass. (eds.) 1949. Fishes Harvested in the USSR. Pishchepromizdat, Moscow. 787 pp. (in Russian).

Birstein, V.J. 1993a. Sturgeons and Paddlefishes: Threatened Fishes in Need of Conservation. Conservation Biology 7 (4):773-787.

Birstein, V.J. 1993b. Draft Application to CITES: Order Acipenseriformes. Unpublished.

Birstein, V.J. 1993c. Is *Acipenser medirostris* one or two species? The Sturgeon Quarterly, Vol. 1, No. 2: 8.

Birstein, V. J., and W. E. Bemis. 1997. How many species are there within the genus *Acipenser*? In: V. Birstein, J. R. Waldman, and W. E. Bemis (eds.). Sturgeon Biodiversity and Conservation. Kluwer Academic Publication, Dordrecht. pp. 157-163.

Birstein, V.J., A.I. Poletaev and B.F. Goncharov. 1993. The DNA Content in Eurasian Sturgeon Species determined by Flow Cytometry. Cytometry 14: 377-383.

Blacklidge, K.H. and C.A. Bidwell. 1993 Three Ploidy Levels indicated by Genome Quantification in Acipenseriformes of North America. Journal of Heredity 84(6): 427-430.

Honma, Y. 1988. Records and Distributional Notes on the Sturgeons along the Coast of Japanese Archipelago. Bulletin of the Biogeographic Society of Japan 43 (10): 51-55.

Houston, J.J. 1988. Status of the Green Sturgeon, *Acipenser medirostris*, in Canada. Canadian Field Naturalist 102: 286-290.

IUCN. 1996. IUCN Red List of Threatened Animals. IUCN, Gland, Switzerland.

Krykhtin, M.L. and V.G. Svirskii. 1997. Endemic Sturgeons of the Amur River: Kaluga, *Huso dauricus*, and Amur Sturgeon, *Acipenser schrenckii*. In: Birstein, V., J.R. Waldman and W.E. Bemis (eds.). Sturgeon Biodiversity and Conservation. Kluwer Academic Publication, Dordrecht. Pp. 231-239.

Lindberg, G.U. and M.I. Legeza. Fishes of the Sea of Japan and Adjacent Areas of the Okhotsk and Yellow Seas. Part 2. Nauka Publishers, Moscow and Leningrad, Russia.

Masuda, H., K. Amaoka, C. Araga, T. Uyeno and T. Yoshino. 1984. The Fishes of the Japanese Archipelago. Tokay University Press. P. 18.

Pavlov, D. S., K. A. Savvaitova, L. I. Sokolov, and S. S. Alekseev. 1994. Rare and endangered animals. Fishes. Vysshaya Shkola, Moscow. 334 pp. (in Russian).

Scott, W.B. and E.J. Crossman, 1973. Freshwater Fishes of Canada. Journal of the Fisheries Research Board of Canada. Ottowa, Canada. Pp. 77-116.

Shilin, N.I. 1995. Programme for Conservation of *Acipenser medirostris mikadoi* in the Russian Far East. Proceedings of the Second International Symposium on Sturgeons, September 6-11, 1993. Moscow-Kostroma-Moscow (Russia). VNIRO Publication. Pp. 262-267.

Acipenser naccarii

1. Taxonomy

   1.1 Class: Actinopterygii

   1.2 Order: Acipenseriformes

   1.3 Family: Acipenseridae

   1.4 Species: *Acipenser naccarii* Bonaparte, 1836

   1.5 Scientific synonyms: *Acipenser huso* (non Linnaeus) Naccari, 1822
   Acipenser sturionellus Nardo, 1827
   Acipenser heckelii Fitzinger in Brandt and Ratzeberg, 1833
   Acipenser platycephalus Heckel in Fitzinger and Heckel, 1836
   Acipenser nasus Heckel, 1847
   Acipenser ladanus Chiereghini in Nardo, 1847
   Acipenser nardoi Heckel, 1851

   1.6 Common names:

English:	Adriatic sturgeon, Italian sturgeon
French:	Esturgeon de l´Adriatique
Italian:	Storione cobice; Cobice
Portuguese:	Esturgiao
Serbo-Croat:	Jadranska jesetra
Spanish:	Esturión del Adriático

2. Biological Parameters

   2.1 Distribution

Countries of origin: Albania, ? Former Yugoslavia, ? Greece, Italy

Acipenser naccarii inhabits the coastal waters of the Adriatic Sea from Venice and Triest to Greece and Corfu and enters the river Po and some of its northern tributaries in Italy for spawning (Lelek, 1987; Tortonese, 1989; Rossi et al., 1991; Bianco, 1995; Cataldi et al., 1995). Tortonese (1989) reports that the Adriatic sturgeon is still present on both sides of the Po dam near Caorso, between Cremona and Piazenca. In 1995, a so far unknown population of *Acipenser naccarii* has been found in Albania (Birstein et al., 1997).

During its stay in the Sea, *Acipenser naccarii* does not enter pelagic waters but remains near the shore, at the mouths of the rivers. It prefers depths of 10 to 40 m over sandy or muddy bottoms (Paccagnella, 1948 in Tortonese, 1989).

The upstream migration into Italian rivers occurs during the first months of the year. The reproductive period of the Adriatic sturgeon starts in May and lasts till the end of June (Tortonese, 1989). The juveniles remain in freshwater for at least one year, but it is believed that for many specimens the whole life cycle occurs in freshwater. It is not clear if there are two different forms: an anadromous and a permanently freshwater form.

   2.2 Habitat availability

Acipenser naccarii was once present in all the rivers of the Venetian basin including the rivers Adige, Brenta, Bacchiglione, Livenza, Piave and Tagliamento (Tortonese, 1989). At present, it inhabits mainly the Po River and some of its northern tributaries in the Lombardy Region (Rossi et al., 1991; Cataldi et al., 1995). The habitat degradation during the last decades is mainly due to continual environmental pollution and construction of artificial dams and weirs along the rivers (Cataldi et al., 1995).

2.3 Population status

There are no estimates of the total size of the population in the wild. Tortonese (1989) indicates that this species is believed to be rare everywhere in Italy, even in areas where it had been abundant in the past. According to Bronzi et al. (1994) in 1993 only 19 specimens have been caught.

The broodstock of the Adriatic sturgeon in captivity in Italy constitutes of about 50 individuals caught as juveniles aged 1-2 years in the wild in 1977, and is now composed of animals aged between 10 and 20 years with a weight between 10 and 60 kg.

The status of the populations of *Acipenser naccarii* has been classified as Vulnerable by IUCN (1996).

2.4 Population trends

During the last decades, the abundance of *Acipenser naccarii* has dramatically decreased as reflected by the annual catches of 2-3 metric tons per year in the beginning 1970s and 200 kg per year in 1990-1992. In 1993, only 19 specimens have been caught (Bronzi et al., 1994).

2.5 Geographic trends

Not reported

2.6 Role of the species in its ecosystem

Acipenser naccarii is a rather poorly studied species and its ecology is not known in detail (Lelek, 1987). The possible consequences of a depletion of the populations of the species for other species depending on or associated with it are not predictable.

2.7 Threats

The abundance of the population of *Acipenser naccarii* was heavily reduced by fishery: more than 80% of the specimens sold at the fish market during 1981-1988 had a weight of less than 3.5 kg and thus, were fished before the reproductive phase (Bronzi et al., 1994).

Besides the overexploitation, the reduction is also a consequence of continual pollution of the rivers (Bronzi et al., 1994) and the current pollution of the Po River threatens the existence of the species. An additional factor are the dams and weirs that are built along the rivers and represent insurmountable barriers for the migration of the species.

Dezfuli et al. (1990) and Bronzi et al. (1994) indicate that during their studies most of the examined Adriatic sturgeon were parasitized by *Leptorhynchoides plagicephalus* (Acanthocephala) which has a negative effect on the growth rate of the sturgeon.

3. Utilization and Trade

3.1 National utilization

According to Tortonese (1989) *Acipenser naccarii* has little commercial value. Only the flesh is used, the eggs are not consumed as caviar. In North Italy, particular nets for the capture of sturgeons were formerly used along the rivers when the fish were more abundant. Now the capture of the species has become only occasional in most places (Tortonese, 1989). The catches decreased drastically from approximately 2-3 metric tons per year at the beginning of the 1970s (Arlati and Rossi, 1995) to about 200 kg per year in the period from 1990 to 1992 and in 1993, only 19 specimens have been caught (Bronzi et al., 1996).

Since 1988, *Acipenser naccarii* is artificially propagated in Italy. The broodstock constitutes of about fifty individuals caught as juveniles at the age of 1-2 years in the wild in 1977, and kept in captivity in freshwater, and is now composed of animals aged between 10 and 20 years with a weight between 10 and 60 kg (Bronzi et al., 1996). The annual production is about 300,000 larvae and is utilized both for restocking and fattening purposes (Bronzi et al., 1996). Arlati and Bronzi (1995) report that the total annual production of sturgeon farming in Italy was about 380 metric tons in 1993, the Adriatic sturgeon accounting for approximately 9%. The production is obtained from a total of 15 farms including 3 hatcheries and 4 experimental plants.

The market is covered by 98% of fresh fish with a preference of large size from 6 to 14 kg of which about 17% are marketed live for release into private lakes for sport fishing, mainly in Northern and Central Italy (Arlati and Bronzi, 1995). The farm gate price of whole fresh fish is about 11-12 $ per kg for small size and about 13 $ per kg for medium to large size. The remaining 2% are sold as smoked fillets at 50 $ per kg, or pre-cooked slices at about 33 $ per kg (Arlati and Bronzi, 1995). All these market data are given for 1993 and the entire aquaculture production of sturgeons in Italy including several sturgeon species. The production of sturgeon is mainly for the domestic market.

3.2 Legal international trade

No data available.

3.3 Illegal trade

Not reported.

3.4 Actual or potential trade impacts

Not reported.

3.5 Captive breeding or artificial propagation for commercial purposes (outside countries of origin)

According to Rosenthal and Geßner (1992) and Williot et al. (1993), *Acipenser naccarii* has been introduced in aquaculture in Hungary and Spain. A current joint venture of Italian, Danish and Hungarian companies is reproducing various sturgeon species in Hungarian aquaculture. The total annual production of sturgeon farming in Hungary was 50 metric tons produced in 6 sturgeon farms (Anonymous, 1994). So far, no separate data for the production of *Acipenser naccarii* are available.

4. Conservation and Management

4.1 Legal status

4.1.1 National

Acipenser naccarii is not protected by law in Italy. The Venetian Region introduced a minimum legal size of more than 1 m (TL) in 1987 and the Lombardy Region permits the catch of specimens longer than 0.6 m (TL) (Bronzi et al., 1994).

4.1.2 International

Acipenser naccarii is listed in Appendix II of the Bern Convention ("Freshwater Fish of Annexes II and IV of the EC Habitats Directive (92/43/EEC)").

4.2 Species management

4.2.1 Population monitoring

According to Bronzi (1996) a programme for the restoration of the Italian sturgeon, *Acipenser naccarii*, has been planned by the organisations of Regione Lombardia, ENEL S.p.A., University of Ferrara and CNR in the northern regions of Italy. This programme includes the monitoring of the population by tagging methodologies and radio tracking.

4.2.2 Habitat conservation

Not reported.

4.2.3 Management measures

A programme for the restoration of the endangered Adriatic sturgeon *Acipenser naccarii* has been planned by the organisations of Regione Lombardia, ENEL S.p.A., University of Ferrara and CNR. The programme has various objectives, the first aim being the establishment of a bank of broodstock for restocking purposes (Bronzi et al., 1994).

Within this framework, the Regione Lombardia has since 1988 annually restocked several rivers of its territory with a total of 22,500 fingerlings and 7,500 juveniles (>1 year) produced by artificial propagation in fish farms from a broodstock of about 50 individuals caught in the wild.

4.3 Control measures

4.3.1 International trade

Not reported.

4.3.2 Domestic measures

Not reported.

5. Information on Similar Species

Acipenser naccarii has been sympatric with *Huso huso* and *A. sturio* (Appendix I of CITES) in the past, but both species have not been recorded in the range area since 1975 (Rossi et al., 1991; Bronzi et al., 1994). According to Tortonese (1989) the Adriatic sturgeon has often been confused with *Acipenser sturio* by fisherman.

Several authors (summarised in Tortonese, 1989) believe that *Acipenser naccarii* is closely related to the Russian sturgeon, *Acipenser gueldenstaedti* which shares many morphological and genetic characters.

6. Other Comments

The range states of the species has been contacted on 13 March 1996 and 21 May 1996. A copy of the first draft of the proposal ("working document") has been sent to the range states on 19 August 1996. The comments of the range states that have been received are attached in the appendix at the end of this document.

The "working document" has also been presented at the 13th meeting of the Animals Committee of CITES in Prague, Czech Republic, on 23-27 September 1996 for discussion.

7. Additional Remarks

8. References

Anonymous. 1994. Aquaculture Production: Overview of the World Production of Sturgeon from Aquaculture and Fishery. Aquaculture Europe 18 (4): 34.

Arlati, G. and P. Bronzi. 1995. Sturgeon Farming in Italy. Proceedings of the Second International Symposium on Sturgeons, September 6-11, 1993. Moscow-Kostroma-Moscow (Russia). VNIRO Publication. Pp. 321-332.

Bianco, P. G. 1995. Mediterranean endemic freshwater fishes of Italy. Biological Conservation, vol. 72:159-169.

Birstein, V. J., J. Betts and R. DeSalle. 1997. Molecular identification of *Acipenser sturio* specimens: A note on recovery plans. Biological Conservation (in press)

Bronzi, P., G. Arlati, S. Cataudella, R. Rossi. 1994. Sturgeon Distribution in Italy. Proceedings of the International Conference on Sturgeon Biodiversity and Conservation, New York 1994.

Cataldi, E., P. Bronzi, E. Ciccotti, P. Di Marco, O. Di Santo, G. Monaco and S. Ctaudella. Morphology of Gills, Digestive Tract and Kidney of Italian Sturgeon, *Acipenser naccarii*, in Fresh and Saline Water: Preliminary Results. Proceedings of the Second International Symposium on Sturgeons, September 6-11, 1993. Moscow-Kostroma-Moscow (Russia). VNIRO Publication. Pp. 52-61.

Dezfuli, B.S., G. Grandi, P. Franzoi, and R. Rossi. 1990. Osservazioni istologiche sul tratto digerente di *Acipenser naccarii* (Bonaparte) del fiume Po infestato da *Leptorhynchoides plagicephalus* (Acanthocephala). Riv. Idrobiol., 29(1) :177-183.

IUCN. 1996. IUCN Red List of Threatened Animals. IUCN, Gland, Switzerland.

Lelek, A. 1987. Threatened Fishes of Europe. The Freshwater Fishes of Europe. Vol. 9. The European Committee for the Conservation of Nature and Natural Resources - Council of Europe (ed.). Wiesbaden, AULA-Verlag. Pp. 42-57.

Rosenthal, H. and J. Geßner. 1992. Status and Prospects of Sturgeon Farming in Europe. In: Rosenthal, H. and E. Grimaldi (eds). Efficiency in Aquaculture Production: Production Trends, Markets, New Products and Regulations. Pp. 143-188.

Rossi, R., G. Grandi, R. Trisolini, P. Franzoi, A. Carrieri, B.S. Dezfuli and E. Vecchietti. 1991. Osservazioni sulla biologia e la pesca dello storione cobice *Acipenser naccarii* Bonaparte nella parte terminale del fiume Po. Atti Soc. Ital. Sci. Nat. Museo Civ. Storia Nat. Milano 132 (10): 121-142.

Tortonese, E. 1989. *Acipenser naccarii* Bonaparte 1836. In: Holcík, J. (ed). The Freshwater Fishes of Europe. Vol. 1/II: General Introduction of Fishes. Acipenseriformes. Wiesbaden, AULA-Verlag. Pp. 285-293.

Williot, P., P. Bronzi and G. Arlati. 1993. A very brief survey of status and prospects of freshwater farming in Europe (EEC). In: Kestemont, P. and R. Billard (eds.). Workshop on Aquaculture of Freshwater Species (Except Salmonids). European Aquaculture Society Special Publication No. 20. Ghent, Belgium. Pp. 32-36.

Acipenser nudiventris

1. Taxonomy

   1.1 Class: Actinopterygii

   1.2 Order: Acipenseriformes

   1.3 Family: Acipenseridae

   1.4 Species: *Acipenser nudiventris* Lovetzky, 1828

   1.5 Scientific synonyms:
   Acipenser shyp Forster, 1767
   Acipenser schypa Güldenstädt, 1772
   Acipenser sturio non Linnaeus, Pallas [1814]
   Acipenser shypa Eichwald, 1831
   Acipenser shipa Lovetzky, 1834
   Acipenser glaber Fitzinger und Heckel, 1836
   Acipenser turritus Fitzinger and Heckel, 1836
   Acipenser shypa Kessler, 1856
   Acipenser nudiventris nudiventris Lovetzky, 1828
   Acipenser nudiventris derjavini Borzenko, 1950

   1.6 Common names:
   Bulgarian: Ship
   Czech: Jeseter hladky
   English: Ship sturgeon, Spiny sturgeon, Fringebarbel sturgeon, Thorn sturgeon, Bastard sturgeon
   French: Esturgeon à barbillons frangés
   German: Glattdick
   Hungarian: Szintok
   Polish: Szypr
   Russian: Ship
   Romanian: Viza
   Serbo-Croat: Sim
   Spanish: Esturión barba de flecos

2. Biological Parameters

   2.1 Distribution

Countries of origin: Azerbaijan, Bulgaria, ? Georgia, ? Iran, Kazakhstan, ? Moldova, ? Romania, Russian Federation, ? Turkmenistan, ? Ukraine, ? Uzbekistan.

Acipenser nudiventris inhabits the Caspian Sea, the Black and Azov Seas (Sokolov and Vasil´ev, 1989). The species is anadromous and mature adults ascend the rivers entering these seas for spawning.

In the Caspian Sea basin, there were two reproductively isolated groups of *Acipenser nudiventris*, one in the northern Caspian Sea which ascended the Ural River (Kazakhstan) and probably the Volga for spawning, and one in the southern Caspian Sea which migrated into the Kura River (Azerbaidjan), the Sefidrud River (Iran) and probably in smaller numbers the Lenkoranka and Astara Rivers (Caucasian shore) (Sokolov and Vasil´ev, 1989, Makarova et al., 1991). Currently, only the Ural River population (which represents the spring race of the species) occurs in the Caspian Sea basin (Avetisov, 1992).

In the Black Sea and the Sea of Azov, the ship sturgeon was only rarely found (Sokolov and Vasil´ev, 1989). The main spawning sites were located in the Rioni River and very rarely individuals entered the Don and Kuban Rivers. In the Danube, where a resident population of *Acipenser nudiventris* was reported to spawn in the past, there is no current report of any individual and the population in this river is believed to be critically endangered or extinct (Pinter, 1991;

Banarescu, 1994; Bacalbasa-Dobrovici, 1997; Hensel and Holcik, 1997). On the southern coast of the Black Sea in Turkey, there were only few records of some individuals and it is presumed that *Acipenser nudiventris* does not spawn in rivers along the Black Sea coast of Turkey (FAO, 1989).

In the Aral Sea, *Acipenser nudiventris* formerly ascended the Amu Darya River and the Syr Darya River. Only the winter race of the species was present in this basin. Currently, this population which was morphological distinct from the others, is believed to be Extinct (Zholdasova, 1997).

In 1933 and 1934 specimens of the Aral Sea population of *Acipenser nudiventris* have been introduced into the Ili River, which flows into the Lake Balkash in Kazakhstan. The fishes acclimatized there and formed a new population (Sokolov and Vasil´ev, 1989).

The preferred habitat are relatively shallow waters with muddy ground. For this reason, the ship sturgeon is most abundant in the vicinity of river mouths (Berg, 1948).

2.2 Habitat availability

Since the beginning of the 1950s almost all rivers in which *Acipenser nudiventris* used to spawn, e.g. the Danube, the Don, the Kuban and the Kura, with exception of the Ural River, have been dammed by hydroelectric power facilities. This resulted in a loss of almost all spawning grounds in the Caspian and Black-Azov Seas. Nowadays, the species is believed to be Extinct in the Danube River (Pinter, 1991; Birstein, 1996) in which it was formerly most abundant within the Black Sea area and ascended as far as the city of Bratislava at a distance of 1,869 km from the mouth (Sokolov and Vasil´ev, 1989). In the Caspian Sea basin, specimens of *Acipenser nudiventris* used to ascend the main spawning river, the Kura, up to a distance of 650 km from the mouth and farther, but the Mingechaur Dam constructed in 1954 blocked the way to the spawning grounds. In the early 1990s, only an estimated number of 1-4 individuals reached the spawning grounds below the dam and the natural reproduction rate is believed to be less than 10% (Makarova et al., 1991). In the Aral Sea basin, the waters of both tributaries, the Amu Darya and Syr Darya, have been used for an enormous irrigation system for the cotton industries and since the beginning 1950s the water regimes of both rivers have been completely destroyed. As a consequence, the Aral Sea which depends on these two tributaries is drying and lost up to 60-70% of its former volume (Ellis, 1990).

The Aral Sea population of *Acipenser nudiventris* is believed to be Extinct because there is no practically no record of the species since the end of the 1970s (Zholdasova, 1997).

2.3 Population status

Published data that give information on the total size of the population are largely unavailable.

In the Caspian Sea, where historically the most numerous population of *Acipenser nudiventris* occured, the main abundance of the species is south of the mouth of the Kura River (Azerbaijan) (Makarova et al., 1991). The largest spawning population ascended the Kura River whereas the spawning populations ascending the Sefidrud River (Iran) in the southern Caspian Sea and the Ural River (Kazakhstan) in the northern Caspian Sea are believed to be smaller (Makarova et al., 1991). During their investigations on the Kura River in the period from 1983-1987, Makarova et al. (1991) found that only a small number of ship sturgeon adults ascended the Kura River for spawning and they estimated the migrating spawning stock to consist of 66 to 112 individuals. Since then no popualtion estimates have been made but Avetisov (1992) indicates that currently stocks of *Acipenser nudiventris* in all rivers entering the Caspian Sea with the exception of the Ural River are on the verge of extinction. In the Ural River, an estimated 1,500 to 18,600 individuals of the ship sturgeon annually spawned during the period from 1978-1990 (Avetisov, 1992).

There are no size estimates for the Black and Azov Seas population of *Acipenser nudiventris* either. The populations in both seas are believed to be on the verge of extinction (Avetisov, 1992). In the Danube River system *Acipenser nudiventris* is considered to be Extinct (Pinter, 1991; Banarescu, 1994; Birstein, 1996).

The Aral Sea population of *Acipenser nudiventris* is believed to be Extinct (Birstein, 1993; Zholdasova, 1996). Findings of the species in the Aral Sea and the Amu Darya River are not reported since 1989 except the oral communication of one specimen (4 kg) found in 1990 in the region of Il´dzhik and one specimen (2 kg) found in 1991 35 km upstream from Chardzhou (Zholdasova, 1997).

The population in the Lake Balkash basin, where the species has been introduced, seems to be extinct because of the drying out of this lake (Bond et al., 1992).

IUCN (1996) classifies the status of the different populations of *Acipenser nudiventris* as follows:

– the Aral Sea population in Uzbekistan and Kazakhstan is Extinct,
– the Black Sea population in Russia and Ukraine is listed as Endangered,
– the Danube River population in Romania and Hungary is listed as Critically Endangered and
– the Caspian Sea population in Kazakhstan, Azerbaijan and Iran is listed as Endangered.

2.4 Population trends

The stocks of *Acipenser nudiventris*, in comparison with other sturgeons have always been less abundant and the species only contributed to about 1% of the total sturgeon catches in the entire Caspian Sea (Sokolov and Vasil´ev, 1989). Because of that lower commercial importance due to its scarcety, there is only little quantitative information about population trends.

In general, all populations are believed to be Endangered or even on the verge of Extinction (Birstein, 1993; Avetisov, 1992 in Birstein, 1993b).

In the Caspian Sea basin, Makarova et al. (1991) indicate that the abundance of *Acipenser nudiventris* within its main spawning river, the Kura, decreased drastically since 1954, when the Mingechaur Dam was built. This is reflected by the decreasing annual catch which amounted to 15-20% of the overall catches of sturgeons before the dam construction and decreased gradually to less than 2% at the end of the 1980s. The same authors report that the parental stock ascending the Kura has been almost entirely eliminated and that only one to four individuals passed through to the spawning sites at the end of the 1980s. Within that period, they estimated the rate of natural reproduction to be less than 10%, as concluded from the very low abundance of young ship sturgeons that migrate downstream the Kura. The entire still existing stock of *Acipenser nudiventris* is mainly maintained by artificial propagation which according to Makarova et al. (1991) failed to restore the former abundance of the species. There are no trends indicated for the remaining spawning rivers that enter the Caspian Sea, but it is believed that the size of the populations is decreasing in the entire Caspian Sea. Ship sturgeon stocks spawning in all rivers except the Ural River, which is the only river that is not dammed, are on the verge of extinction (Avetisov, 1992).

In the Black and Azov Seas *Acipenser nudiventris* has always been rare (Sokolov and Vasil´ev, 1989). The reduction of the populations within this region is not well documented by numbers. In the Danube River, the populations of *Acipenser nudiventris* in the upper and middle reaches are critically endangered, while the population in the lower reaches is extinct (Pinter, 1991; Jancovic, 1995; Guti, 1995; Birstein 1996; Hensel and Holcik, 1997). In the Azov Sea, in recent years summer asphyxiation led to a mass death of fish and in 1990 about 55,000 dead sturgeon specimens were found on the shore (Volovik et al., 1993). In both the Black Sea and the Sea of Azov the populations of *Acipenser nudiventris* are believed to further decline and to be on the verge of extinction (Avetisov, 1992 in Birstein, 1993b).

At the beginning 1930s, the Aral ship sturgeon population was relatively abundant and supported as an important commercial species a fishery of about 3,000 to 4,000 tons per year (Zholdasova, 1997). In 1936-1937 a mass death of ship sturgeon occured which was caused by a mass infection with a specific marine parasite of sturgeons, *Nitzschia sturionis* (Monogenoidea). The parasite was brought in with the introduction of the Caspian stellate sturgeon, *Acipenser stellatus*, into the Aral Sea in 1933 and 1934. During 1936 and 1937 there were considerable losses among the Aral ship sturgeons, which had not developed immunity against the new parasite (Sokolov and Vasil´ev, 1989). The small remaining population was further destroyed by illegal fishery during spawning and by the effects of the Aral Sea ecological catastrophe, i.e. the drying of the Aral Sea (Birstein, 1993a; Zholdasova, 1997). Since the end of the 1970s no findings of *Acipenser nudiventris* in the lower flow of the main spawning river Amu Darya were reported and the population is believed to be extinct (Zholdasova, 1997).

2.5 Geographic trends

Due to dam constructions of hydroelectric power facilities across all main spawning rivers since the beginning 1950s, the range area of *Acipenser nudiventris* decreased drastically. The species almost completely disappeared from the Danube River in which it was formerly reported as far as the city of Bratislava, 1,869 km from the mouth (Pinter, 1991; Birstein, 1996). In the Kura River, the spawning population of *Acipenser nudiventris* ascended as far as 650 km upstream but the way to the spawning grounds was blocked by the Mingechaur Dam, built in 1954 (Sokolov and Vasil´ev, 1989).

Acipenser nudiventris practically disappeared from the Aral Sea basin, because the waters of the two tributaries, the Syr Darya and the Amu Darya, are drawn off for a vast irrigation system for the cotton industry since the beginning 1950s and the Aral Sea is drying (Ellis, 1990; Smith, 1994; Zholdasova, 1997).

2.6 Role of the species in its ecosystem

Acipenser nudiventris is an anadromous sturgeon species which may reach a total length of about 1.70 to 2.03 m, the maximum known age being 36 years (Sokolov and Vasil´ev, 1989). Although anadromous, the species shows a general predilection for freshwater and is believed to stay longer in the rivers than other species of the family (Makarova et al., 1991). Some small populations are even known to be resident in the rivers (Sokolov and Vasil´ev, 1989).

Acipenser nudiventris, like other sturgeons is a typical benthos feeder, its diet mainly consisting of molluscs, insect larvae and crustaceans. Derzhavin (1949, in Sokolov and Vasil´ev, 1989) indicates that ship sturgeons in the Caspian and Black-Azov Seas also feed on the eggs of other sympatric sturgeons such as *Acipenser gueldenstaedtii*, *Acipenser stellatus* and *Huso huso*, and may destroy masses of eggs. Fully-grown ship sturgeons in the Caspian Sea feed primarily on fishes, especially gobiids, and on a considerably smaller amount on molluscs (*Cardium* sp. and *Monodacna* sp.). In the mid 1980s, an important element in the diet of species in the southern Caspian Sea became the crab *Rhitropanopeus harrissi* (up to 70%) which has been accidentally introduced in the Caspian Sea at the end of the 1950s and has adapted well to the habitat (Filippov, 1972 in Sokolov and Vasil´ev, 1989).

Competition in food with the other sturgeon species inhabiting the Caspian and Black-Azov Seas is not reported. Makarova et al. (1991) mention numerous predators in the rivers that catch ship sturgeon, but the species are not given.

The possible consequences of depletion of the population of *Acipenser nudiventris* for those depending on or associated with it are complex and not predictable.

2.7 Threats

The main threats to the species are the loss of critical habitat such as spawning grounds due to dam constructions (as mentioned above:2.2 and 2.5), the high level of pollution in almost all rivers within its range, and the legal and illegal fishing during the spawning season.

During the last 15-18 years, the level of pollution increased drastically in almost all rivers entering the Caspian Sea basin and the Black and Azov Sea basin, the main sources being oil and other industrial sewage as well as chemicals used in agriculture such as mineral fertilisers and pesticides (Vlasenko, 1990; Volovik, 1993). Oil pollution will in the near future undoubtedly be the main threat to the whole area of the Northern Caspian Sea basin, including the Ural River in Kazakhstan where the ship sturgeon is still spawning. The oil production in the area of Emba field and especially the development of Tengiz field (both fields are located in Kazakhstan) will cause an enormous pollution (Sagers, 1994) which will threaten the survival of all sturgeons in that region. Additionally to the oil production, the shipping of oil will inevitably result in water pollution of the Northern Caspian Sea area. In 1996, for example,. 20,000 metric tons of oil have been shipped from Tengiz to Baku (Azerbaijan) by Chevron Overseas Petroleum Corporation (Williams, 1996).

Besides the impact of water pollution, the exploitation by the fishery gives still reason for concern. Makarova et al. (1991) report that fishing is only allowed in the rivers and mainly mature individuals at a pre-spawning state were caught. The same authors indicate that illegal catching of *Acipenser nudiventris* in the Kura River occurred during the spawning migration and further reduces the size of the already reduced spawning stock.

The fact that the ship sturgeon is still commercially caught was proved by DeSalle and Birstein (1996) and Birstein (1997). These authors examined commercially available lots of caviar purchased in reputable New York gourmet shops and found several mislabellings. In two cases, caviar which was declared as Russian sturgeon (*Acipenser gueldenstaedtii*) and stellate sturgeon (*Acipenser stellatus*) caviar was in fact replaced by caviar of *Acipenser nudiventris*.

Despite the critical situation of the species which currently only spawns in the Ural River, the Kazakh authorities planned for 1996 a production of 2 metric tons of ship sturgeon caviar processed from the roe of female *Acipenser nudiventris* caught in the Ural River (according to data provided by S. Taylor, Dieckmann & Hansen GmbH, Hansen). In case this plan will be fulfilled, a considerable part of the ship sturgeon spawning population will be destroyed.

3. Utilization and Trade

3.1 National utilization

Acipenser nudiventris is a commercial valuable fish: the refrigerated or frozen flesh was used to prepare dried or smoked fish products, such as ´balyk´, and the value of its caviar is intermediate between that from the Russian sturgeon, *Acipenser gueldenstaedtii*, and stellate sturgeon, *Acipenser stellatus* (Sokolov and Vasil´ev, 1989). However, because of its relative scarcety, the ship sturgeon ranked lowest of all the migratory commercial sturgeon species accounting for not more than 1% of the sturgeon catch in the Caspian Sea in the past (Berdichevskii and Petrenko, 1979 in Sokolov and Vasil´ev, 1989).

In the Caspian Sea, the annual catch during the 1950s to 1960s was about 7,700 individuals. One of the main catching area was the lower Kura River where the annual catch amounted to about 2,500 to 3,000 ship sturgeon in the period from 1922 to 1927 and reached 5,000 to 6,000 specimens in the 1930s (Berg, 1948). Before the regulation of the Kura River in 1954, the catches of *Acipenser nudiventris* composed 15-20% of the overall catches of sturgeon. After the regulation of the river, the catches began gradually to decrease and amounted to about 6% during the period from 1972-1975, 4% during the period from 1976-1979, 3% during the period from 1980-1983 and at the end of the 1980s the annual catch of the species did not reach 2% of the overall total sturgeon catch (Makarova et al., 1991). No further up-to-date information about the annual catch of the species and caviar production in the Kura River region is available.

DeSalle and Birstein (1996) and Birstein (1997) proved the fact that *Acipenser nudiventris* is still commercially caught, most probably in the Ural River in Kazakhstan where the species still spawns. The authors, examining commercially available caviar lots purchased in New York gourmet shops, found two cases of a replacement of declared Russian sturgeon (*Acipenser gueldenstaedtii*) and stellate sturgeon (*Acipenser stellatus*) caviar by ship sturgeon caviar. Additionally and despite the critical situation of the species, the Kazakh authorities planned for 1996 a total production of 2 metric tons of ship sturgeon caviar from females caught in the Ural River (according to data provided by S. Taylor, Dieckmann & Hansen GmbH, Hansen).

As *Acipenser nudiventris* was probably always rare in the Black and Azov Seas, the commercial catch of this species within the region was always small (Birstein, 1993b) and is not well documented. Birstein (1993b) indicates that nowadays the legal commercial fishery of the ship sturgeon has completely collapsed in this region.

The ship sturgeon also had an important commercial value in the Aral Sea. The total annual catch averaged 3,000 to 4,000 metric tons in the period from 1928-1935 (Zholdasova, 1997). After the mass death of the species in 1936-1937 caused by an introduced ectoparasite, the abundance of the ship sturgeon was markedly reduced. In 1940, the fishery for *Acipenser nudiventris* was completely closed within the Aral Sea basin with the exception of allowed bonus catch (Tleuov and Sagitov, 1973). The Aral Sea has lost its commercial fishery importance and the entire marine fishery was stopped in 1984.

Acipenser nudiventris has been artificially propagated in some hatcheries in the period from 1965 to 1971 (Sokolov and Vasil´ev, 1989). However, these attempts have obviously been given up since the 1980s and there is no further information about a current propagation programme for the species.

3.2 Legal international trade

No information available.

3.3 Illegal trade

Not reported.

3.4 Actual or potential trade impacts

DeSalle and Birstein (1996) and Birstein (1997) proved by PCR (Polymerase Chain Reaction) identification of caviar samples purchased in New York stores that caviar of *Acipenser nudiventris* is still commercially sold as a replacement of caviar from Russian sturgeon (*Acipenser gueldenstaedtii*) and stellate sturgeon (*Acipenser stellatus*). According to data provided by S. Taylor (Dieckmann & Hansen GmbH, Hamburg) the Kazakh authorities planned a total production of 2 metric tons of ship sturgeon caviar from females caught in the Ural River. The trade of caviar from *Acipenser nudiventris* threatens the survival of the species since a considerable part of the spawning population in the Ural River - the only spawning population of the species that is currently existing - will be destroyed.

3.5 Captive breeding or artificial propagation for commercial purposes (outside countries of origin)

Not reported.

4. Conservation and Management

4.1 Legal status

4.1.1 National

According to the Convention of Fishery in the Black Sea (Bulgaria, Romania, Russian Federation) the catch of *Acipenser nudiventris* within that region is absolutely prohibited (Fischer et al., 1987). In Turkey, the fishery for sturgeons has been prohibited since 1979 (FAO, 1989). In the Caspian Sea region, the species is not protected by law. The Aral Sea population is listed in the Uzbek SSR Red Data Book (1983) The Azov-Black Sea and Aral populations are recommended for inclusion in the Red Data Book of the Russian Federation (Pavlov et al, 1994).

4.1.2 International

None.

4.2 Species management

4.2.1 Population monitoring

No information available.

4.2.2 Habitat conservation

No information available.

4.2.3 Management measures

Acipenser nudiventris has been artificially propagated in the Black-Azov Seas and in the Caspian Sea during the 1960s and 1970s in order to maintain the declining stocks for commercial harvest. Makarova et al. (1991) report that at the end of the 1980s an annual average of 0.8 million young ship sturgeon has been released into the southern Caspian Sea. At present, there is no artificial propagation of *Acipenser nudiventris* because mature breeders to create a broodstock are not available.

4.3 Control measures

4.3.1 International trade

None.

4.3.2 Domestic measures

Not reported.

5. Information on Similar Species

Acipenser nudiventris is sympatric with Acipenser gueldenstaedtii, Acipenser stellatus and Huso huso in the Caspian Sea and the Black-Azov Seas.

6. Other Comments

All range states of the species (except Azerbaijan, Georgia, Kazakhstan, Turkmenistan and Ukraine which has been contacted in a meeting, see below) has been contacted on 13 March 1996 and 21 May 1996. A copy of the first draft of the proposal ("working document") has been sent to all range states on 19 August 1996. The comments of the range states that have been received are attached in the appendix at the end of this document.

The "working document" has also been presented at the 13th meeting of the Animals Committee of CITES in Prague, Czech Republic, on 23-27 September 1996 for discussion.

Additionally, the Authorities of the Russian Federation have been contacted in a first meeting in Moscow on 25 to 26 June 1996 for bilateral consultations. A second meeting ("Multilateral Consultations on the Problems of Sturgeon Species within the Framework of CITES") which took place on 21-22 November 1996 in Moscow, has been organised in order to consult with the states of Azerbaijan, Kazakhstan, Turkmenistan and Ukraine (which are not members to CITES) as well as with China, Georgia, Iran, USA and the Russian Federation. The minutes of this meeting and the comments of the range states that have been received are attached in the appendix at the end of this document.

7. Additional Remarks

8. References

Avetisov, K. B. 1992. The present status of the ship sturgeon, *Acipenser nudiventris*, within its distribution area. In: Ivanov, A. P. (ed.) Reproduction of Acipenserids, Salmonids, and Some Less Valuable Fish. VNIRO, Moscow. Pp. 3-15 (in Russian).

Bacalbasa-Dobrovici, N. 1997. Endangered migratory sturgeons of the lower Danube River and its delta. In: V. Birstein, J. R. Waldman, and W. E. Bemis (eds.). Sturgeon Biodiversity and Conservation. Kluwer Academic Publication, Dordrecht. pp. 201-207.

Banarescu, P. M. 1994. The present-day conservation status of the fresh water fish fauna of Romania. Ocrot. nat. med. inconj., 38 :5-20.

Berg, L.S. 1948. [The Freshwater Fishes of the USSR and Adjacent Countries.]. Moscow and Leningrad, Nauka Publication, Vol. I, pp. 57-109. (Engl. translation published by National Science Foundation, Washington D.C., 1962).

Birstein, V.J. 1993a. Sturgeons and Paddlefishes: Threatened Fishes in Need of Conservation. Conservation Biology 7 (4):773-787.

Birstein, V.J. 1993b. Draft Application to CITES: Order Acipenseriformes. Unpublished.

Birstein, V.J. 1996. Sturgeons in the Lower Danube. The Sturgeon Quarterly, vol. 4, no. 1/2: 10-11.

Birstein, V. J., B. Sorkin, and R. DeSalle. 1997. Species identification of black caviar: a PCR based tool for sturgeon species conservation. Molecular Ecology (in press).

Bond, A. R., P. P. Micklin, and M. J. Sager. 1992. Lake Balkhash Dwindling, Becoming Increasingly Saline. Post-Soviet Geography, 33 (2) :131-134.

DeSalle, R., and V. J. Birstein. 1996. PCR identification of black caviar. Nature 381 :197-198.

Ellis, W.S. 1990. The Aral: A Soviet Sea Lies Dying. National Geographic 177 (2): 71-92.

FAO, 1989. Technical Cooperation Programme, Turkey. Appraisal of the Sturgeon and Seatrout Fisheries and Proposals for a Rehabilitation Programme. FI: TCP/TUR/8853. Report prepared by D. Edwards and S. Doroshov for the project "Sturgeon and Seatrout Fisheries Development".

Fischer, W., M. Schneider and M.-L. Bauchot. 1987. Fiches FAO d´Identification des Especes pour les Besoins de la Pêche. Mediterranee et Mer Noir, Zone de Pêche 37 (Révision 1), Vol. II: Vertèbres. FAO, Rome. Pp. 944-952.

Guti, G. 1995. Conservation status of fishes in Hungary. Opuscula Zoologica Budapest, 27/28 :153-158.

Hensel, K., and J. Holcik. 1997. Past and current status of sturgeons in the upper and middle Danube. In: V. Birstein, J. R. Waldman, and W. E. Bemis (eds.). Sturgeon Biodiversity and Conservation. Kluwer Academic Publication, Dordrecht. pp. 185-200.

IUCN. 1996. IUCN Red List of Threatened Animals. IUCN, Gland, Switzerland.

Jankovic, D. 1995. Populations of Acipenseridae prior to and after the Construction of the HEPS "Djerdap I and II". Proceedings of the Second International Symposium on Sturgeons, September 6-11, 1993. Moscow-Kostroma-Moscow (Russia). VNIRO Publication. Pp. 235-238.

Lelek, A. 1987. Threatened Fishes of Europe. The Freshwater Fishes of Europe. Vol. 9. The European Committee for the Conservation of Nature and Natural Resources - Council of Europe (ed.). Wiesbaden, AULA-Verlag. Pp. 42-57.

Markarova, I.A., A.P. Alekperov and T.S. Zarbalina. 1991. Present Status of the Spawning Run of Sheap Sturgeon, *Acipenser nudiventris*, in the Kura River. Journal of Ichthyology 31 (5): 17-22.

Pavlov, D. S., K. A. Savvaitova, L. I. Sokolov, and S. S. Alekseev. 1994. Rare and endangered animals. Fishes. Vysshaya Shkola, Moscow. 334 pp. (in Russian).

Pinter, K. 1991. Sturgeons in Hungary, Past and Present Situation. In: Williot, P. (ed.). 1991. Acipenser. Bordeaux, CEMAGREF Publication. Pp. 173-178.

Sagers, M. J. 1994. The Oil Industry in the Southern-Tier Former Soviet Republics. Post-Soviet Geography, 35 (5) :267-298.

Smith, D. R. 1994. Change and Variability in Climate and Ecosystem Decline in Aral Sea Basin Deltas. Post-Soviet Geography, 35 (3) :142-165.

Sokolov, L.I. and V.P. Vasil´ev. 1989. *Acipenser nudiventris* Lovetsky, 1828. Holcík, J. (ed). The Freshwater Fishes of Europe. Vol. 1/II: General Introduction of Fishes. Acipenseriformes. Wiesbaden, AULA-Verlag. Pp. 206-225.

Tleuov, R. T. and N. I. Sagitov. 1973. Acipenserid fishes of the Aral Sea. FAN Press, Tashkent. 155 pp. (in Russian).

Volovik, S.P., V.G. Dubinina and AQ.D. Semenov. 1993. Hydrobiology and Dynamics of Fisheries in the Azov Sea. Studies and Reviews. General Fisheries Council for the Mediterranean. No. 64. FAO, Rome. Pp. 1-58.

Williams, S. 1996. U.S.-Led Consortium Moves to Improve Flow of Landlocked Caspian Oil to West. The Wall Street Journal, Friday, October 11 :A8.

Zholdasova, I. 1997. Sturgeons and the Aral Sea ecological catastrophe. In: V. Birstein, J. R. Waldman, and W. E. Bemis (eds.). Sturgeon Biodiversity and Conservation. Kluwer Academic Publishers, Dordrecht. pp. 373-380.

Acipenser persicus

1. Taxonomy

   1.1 Class: Actinopterygii

   1.2 Order: Acipenseriformes

   1.3 Family: Acipenseridae

   1.4 Species: *Acipenser persicus* Borodin, 1897

   1.5 Scientific synonyms: *Acipenser güldenstädti* Brandt (in Brandt and Ratzeburg), 1833
   Acipenser güldenstädti persicus Berg, 1933
   Acipenser güldenstädti var. *colchica* Marti, 1940 (in part)
   Acipenser persicus colchicus Artyukhin and Zarkua, 1986

   1.6 Common names: English: Persian sturgeon
   Russian: Persidskiî osetr

2. Biological Parameters

   2.1 Distribution

   Countries of origin: Azerbaijan, Georgia, Iran, Kazakhstan, Russian Federation.

   Acipenser persicus inhabits the Caspian Sea and the Eastern part of the Black Sea (Vlasenko et al., 1989).

   The species is anadromous and undertakes long migrations into rivers for spawning. In the northern part of the Caspian Sea small spawning populations migrated into Volga and Terek rivers (Russian Federation). The main spawning populations of the Persian sturgeon concentrate in the Southern Caspian Sea and ascends the rivers on the Iranian coast (Sefid-Rud, Gorgan-Chaii) as well as the Sulak and Samur Rivers (Dagestan) and the Kura River (Azerbaijan) (Vlasenko et al., 1989). *Acipenser persicus* is widely distributed in all parts of the sea, but it feeds and spends the winter mainly in the southern and central Caspian Sea (Vlasenko et al., 1989). Most of its population remain near the south and south-eastern coasts (Kazancheev, 1981).

   In 1986, investigations by Artyukhin and Zarkua (1986) revealed the presence of *Acipenser persicus* in the Black Sea where specimens were obtained from the Rioni River in the Caucasus. The authors suppose that *Acipenser persicus* may also be present in the Inguri River as well as in other Caucasian mountain rivers and possibly in rivers along the Anatolian coast. The Rioni River population is represented by the spring race.

   2.2 Habitat availability

   The construction of hydroelectric power stations as well as of water reservoirs in almost all rivers where the species spawns led to a sharp reduction of available spawning grounds. In the Caspian Sea basin, the all sturgeon species lost approximately 80% of their spawning grounds (Barannikova et al., 1995). In the main spawning river, the Volga, there remained only 430 ha of the total 3,600 ha after the damming of the river by the Volgograd Dam. The area of the natural spawning grounds in the Kura River has been reduced by dam constructions to about 160 ha, in the Terek River to 132 ha and in the Sulak River to 201.6 ha (Vlasenko, 1994).

   The reduction of available natural spawning grounds due to river flow regulations subsequently led to a reduction of the natural reproduction of several sturgeon species (Barannikova et al., 1995; Khodorevskaya et al., 1997). Although not reported for *Acipenser persicus*, it can be concluded that the species is also affected.

2.3 Population status

Information about the total size of the population of *Acipenser persicus* has not been published. The only information available is about the size of the Rioni River population (Georgia) that, in the early 1980s, was estimated to consist of about 17,000 specimens (Pavlov et al., 1994).

Lelek (1987) classified the status of *Acipenser persicus* in the Caspian Sea as Endangered. The IUCN (1996) classifies the status of the Black Sea population in Russia, Georgia and Turkey as Endangered and the status of the Caspian Sea population in Russia, Azerbaijan and Iran as Vulnerable.

2.4 Population trends

In the recent literature, there are no trends indicated for the population of *Acipenser persicus*.

2.5 Geographic trends

There are no geographic trends indicated for *Acipenser persicus*.

2.6 Role of the species in its ecosystem

Little information is published about the ecology of this anadromous species. Vlasenko et al. (1989) state that the fish may reach a total length (TL) of 2.28 m and a weight of 70 kg, but specimens in the Volga river do not exceed the length of 1.70 m (TL) and 30 kg in weight. According to Lelek (1987) the feeding habits are similar to those of *Huso huso*.

The diet of young individuals consists mainly of benthic invertebrates such as molluscs, insect larvae and crustaceans, while adult fish are mainly fish-consuming. Predation of *Acipenser persicus* is not reported.

The possible consequences of a depletion of the species´ population for other species depending on or associated with it are not predictable.

2.7 Threats

The main threats to the species are the loss of critical habitat such as spawning grounds due to dam constructions (as mentioned above: 2.2 and 2.5), the high level of pollution in almost all rivers within its range, and the legal and illegal fishing during the spawning season.

During the last 15-18 years, the level of pollution increased drastically in almost all rivers entering the Caspian Sea, the main sources being oil and other industrial sewage (Vlasenko, 1994). In the southern part of the Caspian Sea, pollution may soon affect the main population of the species. The Kura River is one of the major sources of pollution: due to draining mining and industrial sewage from the upper part of the river (Georgia and Armenia) the river water carries high concentrations of heavy metals such as copper and molybdenum (Dumont, 1995). Additionally, the intensifying oil pollution in the southern part of the sea along the coast of Azerbaijan threatens the environment. In this region "lakes" of spilled oil and toxic waste have formed which are gradually engulfed by the raising sea water and will be transported to the open sea and along the southern coast. The Caspian Sea water level rapidly raised during the last 15 years and increased in about 2 m within this period (Rodionov, 1994; Dumont, 1995).

There is no information about the total amount of legal and illegal catch of the species since it is usually not distinguished from its close relative *Acipenser gueldenstaedtii*. However, it can be concluded that *Acipenser persicus* is also subject to poaching and that the spawning population is threatened by the illegal catch.

3. Utilization and Trade

3.1 National utilization

Acipenser persicus is a highly appreciated fish. The products, caviar and flesh, have a great nutritional value (Vlasenko et al., 1989). However, *Acipenser persicus* escapes any official catch statistic since it had not been distinguished from the commercially important *Acipenser gueldenstaedtii*. Kazancheev (1981) reports that from 1974 to 1978, the catch in the Kura River fluctuated between 90 and 220 metric tons. No further catch statistics for the species, neither from the Russian Federation nor from Iran are available. It can be supposed that the reported catch of *Acipenser gueldenstaedtii* possibly includes a part of *Acipenser persicus*. The species was estimated by Kazanskii (1979, in Vlasenko et al., 1989) to account for 10-15% of all of the sturgeons in the Volga, while Artyukhin (1979, in Vlasenko et al., 1989) did not think that more than 6-7% of sturgeons in the Volga belonged to this species. It may be concluded that according to its main distribution along the southern and south-eastern coast, the species is also included in the catches of *Acipenser gueldenstaedtii* in Iran. Subsequently, it seems probable that eggs of *Acipenser persicus* processed as caviar are sold under the name of "osietra", "asetra" or "osietre" which are usually used for caviar made from the roe of *Acipenser gueldenstaedtii*. Josupeit (1994), in her book about the world trade of caviar does not even mention the species. From official statistics it remains unclear, to what degree *Acipenser persicus* is nationally utilized and the relationship between national and international trade is not reported.

3.2 Legal international trade

Since *Acipenser persicus* is usually not distinguished from the commercially important *Acipenser gueldenstaedtii*, there are no data about the legal international trade available.

3.3 Illegal trade

An illegal trade of products of *Acipenser persicus* is not reported, since the species is usually not distinguished from *Acipenser gueldenstaedtii*. Illegal trade of products of *Acipenser gueldenstaedtii*, i.e. caviar, increased since the collapse of the former USSR and it might be supposed that there is also an in illegal trade of caviar from *Acipenser persicus*. However, the level of the illegal trade of *Acipenser persicus* products is unknown.

3.4 Actual or potential trade impacts

The actual or potential trade impacts of the proposed amendment on *Acipenser persicus* are not easy to evaluate, since the degree of national utlization and the relationship between national and international trade are unknown.

3.5 Captive breeding or artificial propagation for commercial purposes (outside countries of origin)

Not reported.

4. Conservation and Management

4.1 Legal status

4.1.1 National

According to the available information *Acipenser persicus* is not protected by law in any of the countries of origin.

4.1.2 International

Acipenser persicus is currently not subject to international species-protection agreements.

4.2 Species management

4.2.1 Population monitoring

No information available.

4.2.2 Habitat conservation

A special habitat conservation programme for the habitat of the species is not reported. Pavlov et al. (1994) pointed to the need in creating a protected marine zone in the area of the Rioni River delta.

4.2.3 Management measures

Specific management measures for *Acipenser persicus* are not reported. It might be guessed that the species benefited from the management measures that were implemented in the former USSR. Early management measures in the Caspian Sea mainly conducted by the Russian Federation included introduction of valuable food organisms (such as *Nereis diversicolor*) into certain regions of the Caspian Sea (Rochard et al., 1990).

Before the desintegration of the USSR, there was a strict management of the sturgeon fishery in the Caspian Sea, including a quota system, maximum and minimum size restrictions, closed seasons and a complete ban on the sea fishery. Since the collapse of the USSR, five states (Russian Federation, Iran, Azerbaijan, Khazakhstan and Turkmenistan) and the two autonomous republics of Dagestan and Kalmykia are fishing for sturgeons in the Caspian Sea. At present, there is no regulation of the fishery and the fishing in the sea is not controlled.

Iran has intensive ranching programmes for sturgeon species, which may include *Acipenser persicus*. The total number of produced fry is not given in the literature. Barannikova (1995) reports that biotechnology of the Persian sturgeon artificial propagation at hatcheries in the Volga River has been suggested, but the species rearing was not common in 1993. Pavlov et al. (1994) proposed a ranching programme for the Rioni River population of *Acipenser persicus*, but there is no further information on thios programme available.

4.3 Control measures

4.3.1 International trade

None.

4.3.2 Domestic measures

No information available.

5. Information on Similar Species

Acipenser persicus is sympatric with *Acipenser gueldenstaedtii, Acipenser stellatus, Acipenser nudiventris* and *Huso huso.*

The taxonomic status of *Acipenser persicus* is not clear (discussion in Birstein and Bemis, 1997). The population of *Acipenser persicus* in the Kura and Sefid-Rud Rivers was believed to be a subspecies of *Acipenser gueldenstaedtii* and was named *Acipenser gueldenstaedti persicus* by Berg (1933 in Vlasenko et al., 1989). The population of *Acipenser persicus* in the Volga and Ural Rivers was thought to be an intraspecific group of *Acipenser gueldenstaedtii*. In 1973 and 1974 several scientists (summary in Vlasenko et al., 1989) investigated the antigenic components in the blood serum proteins of specimens from the Kura and Volga and found that they were identical but different from those of *Acipenser gueldenstaedtii*. Subsequent analyses of morphometric and meristic characters of both species revealed that they are different.

These investigations induced Vlasenko et al. (1989) to regard *Acipenser persicus* as a valid species. However, this taxonomic evaluation is often ignored until today and *Acipenser persicus* is very often not mentioned as a separate species in the recent literature.

6. Other Comments

The range states of the species (except Azerbaijan, Georgia, and Kazakhstan which have been contacted in a meeting, see below) has been contacted on 13 March 1996 and 21 May 1996. A copy of the first draft of the proposal ("working document") has been sent to the range states on 19 August 1996. The comments of the range states that have been received are attached in the appendix at the end of this document.

The "working document" has also been presented at the 13th meeting of the Animals Committee of CITES in Prague, Czech Republic, on 23-27 September 1996 for discussion.

Additionally, the Authorities of the Russian Federation have been contacted in a first meeting in Moscow on 25 to 26 June 1996 for bilateral consultations. A second meeting ("Multilateral Consultations on the Problems of Sturgeon Species within the Framework of CITES") which took place on 21-22 November 1996 in Moscow, has been organised in order to consult with the states of Azerbaijan, Kazakhstan, Turkmenistan and Ukraine (which are not members to CITES) as well as with China, Georgia, Iran, USA and the Russian Federation. The minutes of this meeting and the comments of the range states that have been received are attached in the appendix at the end of this document.

7. Additional Remarks

8. References

Artyukhin, E. N., and Z. G. Zarkua. 1986. On the question of taxonomic status of the sturgeon in the Rioni River (the Black Sea basin). Voprosy Ikhtiologii, 26 :61-67 (in Russian).

Barannikova, I.A. 1995. Measures to Maintain Sturgeon Fisheries under Conditions of Ecosystem Changes. Proceedings of the Second International Symposium on Sturgeons, September 6-11, 1993. Moscow-Kostroma-Moscow (Russia). VNIRO Publication. Pp. 131-136.

Barannikova, I.A., I.A. Burtsev, A.D. Vlasenko, A.D. Gershanovich, E.V. Makarov and M.S. Chebanov. 1995. Sturgeon Fisheries in Russia. Proceedings of the Second International Symposium on Sturgeons, September 6-11, 1993. Moscow-Kostroma-Moscow (Russia). VNIRO Publication. Pp. 124-130.

Birstein, V. J., and W. E. Bemis. 1997. How many species are there within the genus *Acipenser*? In: V. Birstein, J. R. Waldman, and W. E. Bemis (eds.). Sturgeon Biodiversity and Conservation. Kluwer Academic Publishers, Dordrecht. pp. 157-163.

Borodin, N. A. 1897. A report about a summer 1895 zoological expedition on board of the cruiser "Uralets" in the northern part of the Caspian Sea. Vestnik Rybopromyshlennosti, 1 :1-31 (in Russian).

Dumont, H. 1995. Ecocide in the Caspian Sea. Nature, 377 :673-674.

IUCN. 1996. IUCN Red List of Threatened Animals. IUCN, Gland, Switzerland.

Kazancheev, E.N. 1981. Ryby Kaspiiskogo morya. Izd. Lëgkaya i pishchevaya promyshlennost´, Moskva. (In Russian).

Marti, V. Yu. 1940. Systematics and biology of the Russian sturgeon from the Caucasian shore of the Black Sea. Zoologicheskii Zhurnal, 19 :865-872 (in Russian).

Pavlov, D. S., K. A. Savvaitova, L. I. Sokolov and S. S. Alekseev. 1994. Rare and endangered animals. Fishes. Vysshaya Shkola, Moscow. 334 pp. (in Russian).

Rodionov, S. N. 1994. Global and Regional Climate Interaction: The Caspian Sea Experience. Kluwer Academic Publishers, Dordrecht. 241 pp.

Vlasenko, A.D. 1994. The Present Status and Conservation of Sturgeons (Acipenseridae) in the Caspian Basin. Proceedings of the International Conference on Sturgeon Biodiversity and Conservation, New York 1994.

Vlasenko, A.D., A.V. Pavlov and V.P. Vasil´ev. 1989. *Acipenser persicus* Borodin, 1897. In: Holcík, J. (ed). The Freshwater Fishes of Europe. Vol. 1/II: General Introduction of Fishes. Acipenseriformes. Wiesbaden, AULA-Verlag.Pp. 345-366.

Volovik, S.P., V.G. Dubinina and AQ.D. Semenov. 1993. Hydrobiology and Dynamics of Fisheries in the Azov Sea. Studies and Reviews. General Fisheries Council for the Mediterranean. No. 64. FAO, Rome. Pp. 1-58.

Acipenser ruthenus

1. Taxonomy

   1.1 Class: Actinopterygii

   1.2 Order: Acipenseriformes

   1.3 Family: Acipenseridae

   1.4 Species: *Acipenser ruthenus* Linnaeus, 1758

   1.5 Scientific synonyms:
   Acipenser sterlet D´Aubenton, 1758
   Acipenser pygmaeus Pallas, 1814
   Acipenser marsiglii Brandt in Brandt and Ratzeberg, 1833
   Acipenser kamensis Lovetzky, 1834
   Acipenser obtusirostris Lovetzky, 1834
   Acipenser gmelini Fitzinger and Heckel, 1836
   Acipenser dubius Fitzinger and Heckel, 1836
   Acipenser leucotica Brandt, 1853
   Acipenser griscescens Brandt, 1853
   Sterletus kankreni Duméril, 1870
   Sterletus helenae Duméril, 1870
   Sterletus ruthenus sibericus Dybowski, 1874
   Acipenser jeniscensis Herzenstein, 1895
   Acipenser ruthenus var. *albinea* Brusina, 1902
   Acipenser ruthenus var. *birostrata* Brusina, 1902
   Acipenser ruthenus var. *obiturostris* Brusina, 1902
   Acipenser ruthenus var. *septemcarinata* Brusina, 1912
   Acipenser ruthenus var. *alba* Antipa; 1909
   Acipenser ruthenus var. *erytraea* Antipa; 1909
   Acipenser ruthenus var. *brevirostris* Antipa; 1909
   Acipenser primigenius Chalikov, 1944
   Acipenser ruzskyi loganzen, 1946
   Acipenser ruthenus kamensis; Berg, 1948
   Acipenser ruthenus ruthenus n. *marsiglii* Berg, 1948

   1.6 Common names:

Czech:	Jeseter maly
English:	Sterlet
Finnish:	Sterletti
German:	Sterlet
Polish:	Sterlet a. czeczuga
Russian:	Sterlyad´

2. Biological Parameters

   2.1 Distribution

Countries of origin: Austria, Bulgaria, Czech Republic, Former Yugoslavia, ? Germany, ? Hungary, Moldova, Romania, Russian Federation, Turkey, Switzerland, Ukraine.

The sterlet is a Eurasian species inhabiting rivers flowing into the Caspian, Black Azov, Baltic, White, Barents and Kara Seas (Sokolov and Vasil´ev, 1989).

The following description of the present range area of *Acipenser ruthenus* is taken from Sokolov and Vasil´ev (1989). There is no more recently published review on the current range of the species.

In the Caspian Sea basin, the main river where the species occurs is the Volga, in which *Acipenser ruthenus* is encountered throughout nearly the entire course, including the reservoirs. The species is also found in the major tributaries of the Volga River, such as the Kama, Vyatka, Oka, Vetluga, Sura and Chusovaya. *Acipenser ruthenus* is only rarely encountered in the Ural River.

In the Sea of Azov basin, *Acipenser ruthenus* inhabited the middle and lower sections of the Don. In the Kuban River, *Acipenser ruthenus* has always been rare. However, there is no current record of the species in these rivers.

In the Black Sea basin, the species inhabits mainly the rivers Dnieper and Danube, and it rarely occurs in the Dniester, southern Bug, and the Gulf of Dnieper-Bug. In the Danube River system, the sterlet is still known from some tributaries, e.g. the Tisza, Sava, Drava and Raba. In 1980, the range of the sterlet in the Danube expanded due to improved water quality and the species reappeared in the tributaries Morava and Váh.

In the White and Barents Sea basin, the sterlet inhabited the Northern Dvina River system. There is no actual information about the present status and distribution of *Acipenser ruthenus* within this river system.

Acipenser ruthenus inhabits also the Siberian river systems of the Ob, Irtysh and Yenisei which enter the Laptev and Kara Seas.Some authors name the Siberian form *Acipenser ruthenus* natio *marsiglii* Brandt, 1833 (Berg,1948)

Acipenser ruthenus has also been subject to several attempts of introductions into new habitats. Sokolov and Vasil´ev (1989) report that sterlets from the Northern Dvina have been successfully transferred into the Pechora and Western Dvina (Daugava) where they adapted to the new habitat and formed new populations.

The sterlet is a freshwater species which usually does not undertake long-distance migrations. Sometimes, specimens enter the brackish water region in the northern Caspian Sea. The preferred habitat are deep depressions in the riverbed with a current and stony, gravely or sandy bottoms.

2.2 Habitat availability

The damming of almost all rivers throughout the species range which started in the 1930s led to a sharp decline in critical habitat such as spawning grounds. The spawning success of this freshwater resident sturgeon species depends directly on the water level which is drastically influenced by the operation of the hydroelectric power systems. Especially in the spring season, when spawning occurs, the water level of many of the rivers was artificially lowered by such operations and led to a mass death of sterlet eggs and fingerlings along the river bank (Jankovic, 1995). Changes in the water regimes, especially a decline in the flow velocity, also led to a degeneration of the reproductive system (Lukin et al., 1981).

2.3 Population status

The status of the various populations of *Acipenser ruthenus* is insufficiently known and there is no information about the total size of the population.

The only recently published information on the populations in the Volga River basin concentrated on the Vyatka River population of *Acipenser ruthenus* (Kuznetsov et al., 1995) which was in a rather good shape at the beginning of the 1990s.

In the Danube River, the populations are currently restricted to the middle and upper reaches. The species is extirpated from the German section of the Danube River, endangered in the Austrian section, it greatly diminished in the Slovakian river section and has practically disappeared from the lower Danube (Jancovic, 1995; Birstein, 1996; Bacalbasa-Dobrovici, 1997; Hensel and Holcik,1997).

Birstein (1993) indicates that the populations in the Northern Dvina basin in northern Russia entirely disappeared and that there has been no record of the sterlets in the Siberian rivers Ob, Irtysh and Yenisei for many years.

The IUCN (1996) classifies the status of the different populations as follows:

The status of the populations in the rivers entering the Caspian and Black Seas is Vulnerable (in Russia it is at Lower Risk, in Ukraine it is Critically Endangered while in Romania, Hungary and Serbia it is Vulnerable).

The status of the populations in the Siberian rivers systems (Ob, Irtysh and Yenisei) is classified as Vulnerable.

2.4 Population trends

Several authors (Sokolov and Vasil´ev, 1989; Birstein, 1993; Jankovic, 1995) indicate a sharp decline of the size of almost all populations of *Acipenser ruthenus*. According to Birstein (1993), the Northern Dvina population seems to have entirely disappeared and there is no recent record of the sterlet in the Siberian rivers Ob, Irtysh and Yenisei. The Danubian population declined drastically since the construction of the Iron Gate II Dam in 1984 and currently *Acipenser ruthenus* has practically disappeared in the lower Danube (Jancovic, 1995; Birstein, 1996; Bacalbasa-Dobrovici, 1997; Hensel and Holcik,1997). Lukin et al. (1981) found that the biology of the sterlet population in the Volga River changed as a consequence of dams built in the 1930s through the 1950s and that several specimens do not mature.

2.5 Geographic trends

The range area of *Acipenser ruthenus* declined since the 1930s through 1950s, when dams were built on almost all rivers were the species was common. However, there is no detailed information about the decrease in range area neither in the rivers of the Black-Azov Sea and Caspian Sea basins nor in the Siberian river systems.

2.6 Role of the species in its ecosystem

The sterlet is a relative small freshwater sturgeon species, usually reaching a total length of 1.0 m and a weight of about 6-6.5 kg. The fish is a typical benthic feeder and its diet consists mainly of insect larvae (Chironomidae, Trichoptera, Ephemeroptera, Simuliidae, etc.), small molluscs (*Sphaerium*, *Pisidium*, *Viviparus*, etc.), Oligochaetea, Polychaeta, Hirudinea and other invertebrates. During the spawning period of other fishes, the sterlet feed readily on the eggs, including eggs of other acipenserids like *Acipenser gueldenstaedtii*, *Acipenser stellatus* and *Huso huso*. The primary food competitors of the sterlet are the ruffe (*Gymnocephalus cernus*) the bream (*Abramis brama*) and the white bream (*Abramis bjoerkna*) (Aristovskaya, 1954 in Sokolov and Vasil´ev, 1989). Predators of the species are not reported.

The possible consequences of depletion of the population of *Acipenser ruthenus* for those species depending on or associated with it are very complex and hardly predictable.

2.7 Threats

Acipenser ruthenus is threatened by a loss of suitable habitat due to dam constructions on almost all rivers throughout its range. The subsequent lowering of the river water level mainly during the spring season and the changes of the hydrological regime led to a decline of suitable spawning grounds as well as to the death of eggs and fingerlings along the river banks (Jankovic, 1995). The ongoing construction activities of the Gabcikovo hydropower station further threaten the survival of the sterlet in the uppermost part of the middle Danube and the lower Morava (Hensel and Holcik, 1997).

In the Siberian rivers as well as in the Volga River system, the pollution increased drastically within the last years (Peterson, 1993; Romanov and Altuf´ev, 1993) and threatend the survival of *Acipenser ruthenus*. The consequences of the high degree of various toxic chemicals (Oil products, phenols, PCBs, mercury, etc.) in the river waters have not been specifically investigated for *Acipenser ruthenus* but it may be concluded that the species is also affected. Akimova and Ruban (1993) and Akimova et al. (1995) have studied the impact on the partly sympatric species *Acipenser baerii* in Siberian waters and several authors (Altuf´yev et al., 1992; Romanov and

Altuf´yev, 1991 and 1993; Romanov and Sheveleva, 1993; Kuz´mina et al. 1993; Altuf´yev, 1994; Shagaeva et al., 1993; Shagaeva et al., 1995) studied the effect of high pollution in the Volga on the anadromous species *Acipenser gueldenstaedtii*, *Acipenser stellatus* and *Huso huso*. The results of all studies showed that all investigated sturgeon species had degenerations in the reproductive system and anomalies in the gameto- and gonadogenesis. Degeneration of the muscle tissues and several organs (liver) have also been revealed. It can be presumed that *Acipenser ruthenus* may also be affected and probably shows similar phenomena of degeneration. Lukin et al. (1981) found that specimens of *Acipenser ruthenus* in the Volga River system grow unusually fast in large water reservoirs but do not mature. According to Birstein (1993), the Northern Dvina population of *Acipenser ruthenus* seems to have entirely disappeared from the rivers because of uncontrolled logging and pollution.

The inappropriate fishing method of bottom trawling which is used in some rivers for the harvest of *Acipenser ruthenus* and other ground living fish further destroys the habitat of the species and threatens its survival.

3. Utilization and Trade

3.1 National utilization

The sterlet was of small commercial interest as compared to other sturgeon species. According to Sokolov and Vasil´ev (1989) the size of the catch was considerable in the past and the largest number of *Acipenser ruthenus* was caught in the Volga River system. Formerly, in catches landed along the shores of this river system 50% of the fishes were sterlets. From 1935 to 1939, the world-wide sterlet catch amounted to 750-800 metric tons, of which about 700 metric tons were caught in the USSR. Nowadays, the fishery for the sterlet is banned in most of the water bodies in the former USSR, and only a limited number of males is caught to produce a commercially important hybrid with females of *Huso huso* (Sokolov and Vasil´ev, 1989).

Most of the sterlets captured recently come from the Danube River system. From 1958 through 1981, the sterlet catch in these waters ranged from 117 metric tons in 1963 to 36 metric tons in 1979 and averaged 63.5 metric tons annually. The catch was greatest in the former Yogoslavia and averages 57.5% of the total catch, the catch in Bulgaria accounted for 21.8%, while Romania accounted for 10.5%, Hungary for 3.5% and the Czech Republic for 0,5%. Actual data on the catch of *Acipenser ruthenus* are largely unavailable. Official FAO statistics, that do not distinguish between sturgeon species, reveal that the total catch of sturgeons in 1994 was 10 metric tons in Bulgaria and 8 metric tons in Romania, the other countries bordering the Danube are not recorded. Jankovic (1995) reports that the sterlet catch in the former Yugoslavian part of the Danube averaged 4.7 metric tons within the period from 1984-1989. Birstein (1996) and Bacalbasa-Dobrovici (1997) indicate that *Acipenser ruthenus* has practically diappeared from the lower Danube and that there is currently no commercial catch of the species in this river section.

Acipenser ruthenus is caught in numerous different ways: in various kind of nets, fish traps, willow baskets (called "vandams") and with barbed lances and bottom trawls (Sokolov and Vasil´ev).

Sterlets are usually marketed alive, and rarely refrigerated, frozen or smoked (Sokolov and Vasil´ev, 1989). According to Josupeit (1994) the fish does not constitute a substantial source of caviar. It is not clear whether the fish is only subject to a national market or if a part of the products (possibly frozen or smoked flesh) is exported.

Acipenser ruthenus is also reared in aquaculture in the Russian Federation, the Ukraine, Hungary and Germany (Anonymous, 1994). Williot et al. (1993) estimated that the total production of sterlet in Germany was about 5 metric tons in 1993 and that the installed capacity of production is 10 metric tons. For the remaining states there are no data available.

3.2 Legal international trade

There is no detailed information available on a legal international trade in the species. A potential trade may include live specimens for aquaculture.

3.3 Illegal trade

No information available.

3.4 Actual or potential trade impacts

No information available.

3.5 Captive breeding or artificial propagation for commercial purposes (outside countries of origin)

According to Anonymous (1994), the sterlet has been introduced in aquaculture in Belgium and Italy. Welcomme (1988) also reports of an introduction of *Acipenser ruthenus* into aquaculture in France. The size of the broodstock in captivity and the annual production is not given in the literature.

A hybrid between *Huso huso* and *Acipenser rutenus* called "bester" which is fast growing and produces fertile descendants is also subject to aquaculture in European countries. The total size of the production of "bester" is not given in the available statistics.

4. Conservation and Management

4.1 Legal status

4.1.1 National

Acipenser ruthenus is listed in the Ukrainian Red Data Book (Gringevsky, 1995). The conservation status of *Acipenser ruthenus* in Slovakia is Endangered but in the proposal of a new law for protected species of Slovakia, *Acipenser ruthenus* is not included (J. Cibula, Slovak Agency of the Environment, Bratislava). In the Russian Federation, the legal status of *Acipenser ruthenus* is that of a partially protected species with a ban on catching.

There is no information available about the legal status of *Acipenser ruthenus* in the other range states.

4.1.2 International

Acipenser ruthenus is listed in Appendix III of the Bern Convention (protected fauna).

4.2 Species management

4.2.1 Population monitoring

There is no information about specific monitoring programmes for the species in most of the range states.

In Romania, The Centre of Research for Fish Aquaculture, Fishing and Fishprocessing in Galati is monitoring the situation of sturgeon stocks upriver the Delta of the Danube (Birstein, 1996).

4.2.2 Habitat conservation

Not reported.

4.2.3 Management measures

The management measures for *Acipenser ruthenus* within its range states is insufficiently known. Sokolov and Vasil´ev (1989) state that in 1989 the fishery for sterlet was banned in most of the water bodies of the Russian Federation. However, there is no further and up-to-date information available.

In the Slovakian part of the Danube the fishery is allowed but there is a closed season from March 16 to June 15 (J. Cibula, Slovak Agency of the Environment, Bratislava).

Acipenser ruthenus is artificially propagated in warm water ponds in the Russian Federation, Ukraine, Hungary and Germany. Evidently, this culturing of the species is mainly conducted for the production of meat for domestic markets.

4.3 Control measures

4.3.1 International trade

None.

4.3.2 Domestic measures

No information available.

5. Information on Similar Species

6. Other Comments

All range states of the species (except Ukraine which has been contacted in a meeting, see below) has been contacted on 13 March 1996 and 21 May 1996. A copy of the first draft of the proposal ("working document") has been sent to all range states on 19 August 1996. The comments of the range states that have been received are attached in the appendix at the end of this document.

The "working document" has also been presented at the 13th meeting of the Animals Committee of CITES in Prague, Czech Republic, on 23-27 September 1996 for discussion.

Additionally, the Authorities of the Russian Federation have been contacted in a first meeting in Moscow on 25 to 26 June 1996 for bilateral consultations. A second meeting ("Multilateral Consultations on the Problems of Sturgeon Species within the Framework of CITES") which took place on 21-22 November 1996 in Moscow, has been organised in order to consult with the states of Azerbaijan, Kazakhstan, Turkmenistan and Ukraine (which are not members to CITES) as well as with China, Georgia, Iran, USA and the Russian Federation. The minutes of this meeting and the comments of the range states that have been received are attached in the appendix at the end of this document.

7. Additional Remarks

8. References

Akimova, N. V., A. I. Panaiotidi, and G. I. Ruban. 1995. Disturbances in the Development and Functioning of the Reproduction System of Sturgeons (Acipenseridae) of the Yenisey River. Journal of Ichthyology, 35 (6) :72-87.

Altuf´yev, Yu.V. 1994. Morphofunctional Condition of Muscle Tissue and Liver of Juvenile Russian Sturgeon and Beluga with Chronic Intoxication. Journal of Ichthyology 34 (5): 134-138.

Altuf´yev, Yu.V., A.A. Romanov and N.N. Sheveleva. 1992. Histology of the Striated Muscle Tissue and Liver in the Caspian Sea Sturtgeons. Journal of Ichthyology 32: 100-115.

Anonymous. 1994. Aquaculture Production: Overview of the World Production of Sturgeon from Aquaculture and Fishery. Aquaculture Europe 18 (4): 34.

Bacalbasa-Dobrovici, N. 1997. Endangered migratory sturgeons of the lower Danube River and its delta. In: V. Birstein, J. R. Waldman, and W. E. Bemis (eds.). Sturgeon Biodiversity and Conservation. Kluwer Academic Publishers, Dordrecht. pp. 201-207.

Birstein, V.J. 1996. Sturgeons in the Lower Danube. The Sturgeon Quarterly, vol. 4, no. 1/2: 10-11.

Gringevsky, M.V. 1995. Evaluation of the Contemporary Status of Sturgeons in the Dnieper River Basin. The Sturgeon Quarterly 3 (1): 9.

Hensel, K., and J. Holcik. 1997. Past and current status of sturgeons in the upper and middle Danube. In: V. Birstein, J. R. Waldman, and W. E. Bemis (eds.). Sturgeon Biodiversity and Conservation. Kluwer Academic Publishers, Dordrecht. pp. 185-200.

IUCN. 1996. IUCN Red List of Threatened Animals. IUCN, Gland, Switzerland.

Jankovic, D. 1995. Populations of Acipenseridae Prior to and after the Construction of the HEPS "Djerdap I and II". Proceedings of the Second International Symposium on Sturgeons, September 6-11, 1993. Moscow-Kostroma-Moscow (Russia). VNIRO Publication. Pp. 235-238.

Kuz´mina, O. Yu., V.I. Luk´yanenko, Ye.I. Shakmalova, Ye.A. Lavova and Yu.V. Natochin. 1993. Specific Features of Water and Salt Homeostasis in Sturgeon during Muscle Degeneration. Journal of Ichthyology 33: 93-100.

Kuznetsov, V. A., M. L. Grekov, and E. B. Kas yanenko. 1995. Some Ecological and Morphological Characteristics of the Sterlet, *Acipenser ruthenus*, from the Middle Vyatka River. Journal of Ichthyology, 35 (9) :8-19.

Lelek, A. 1987. Threatened Fishes of Europe. The Freshwater Fishes of Europe. Vol. 9. The European Committee for the Conservation of Nature and Natural Resources - Council of Europe (ed.). Wiesbaden, AULA-Verlag. Pp. 42-57.

Lukin, A. V., V. A. Kuznetsov, N. Kh. Khalitov, N. N. Danilov, K. P. Tikhonov, and R. R. Melent' va. 1981. Sterlet from the Kuibyshev Reservoir and Its Ways of Adaptation to the New Environment. Izdatelstvo Kazanskogo Universiteta, Kazan. (in Russian).

Romanov, A.A. and N.N. Sheveleva. 1993. Disruption in the Gonadogenesis in Caspian Sturgeons (Acipenseridae). Journal of Ichthyology 33 (3): 127-133.

Romanov, A.A. and Yu.V. Altuf´yev. 1991. Tumors in the Sex Glands and Liver of the Caspian Sea Sturgeons. Journal of Ichthyology 30: 44-49.

Romanov, A.A. and Yu.V. Altuf´yev. 1993. Ectopic Histogenesis of Sexual Cells of Caspian Sea Sturgeon. Journal of Ichthyology 33 (2): 140-150.

Shagaeva, V.G., M.P. Nikol´skay, N.V. Akimova and K.P. Markov. 1995. Pathology of the Early Ontogenesis of the Volga River Basin Acipenseridae. Proceedings of the Second International Symposium on Sturgeons, September 6-11, 1993. Moscow-Kostroma-Moscow (Russia). VNIRO Publication. Pp. 62-73.

Shagaeva, V.G., M.P. Nikol´skaya, N.V. Akimova, K.P. Markov and N.G. Nikol´skaya. 1993. A Study of the Early Ontogeny of Volga Sturgeon (Acipenseridae) Subjected to Human Activity. Journal of Ichthyology 33 (6): 23-41.

Sokolov, L.I. and V.P. Vasil´ev. 1989. *Acipenser ruthenus* Linnaeus, 1758. In: Holcík, J. (ed). The Freshwater Fishes of Europe. Vol. 1/II: General Introduction of Fishes. Acipenseriformes. Wiesbaden, AULA-Verlag. Pp. 227-262.

Welcomme, R. L. 1988. International Introductions of Inland Aquatic Species. FAO Fisheries Technical Paper No. 294. 318 pp.

Williot, P., P. Bronzi and G. Arlati. A Very Brief Survey of Status and Prospects of Freshwater Sturgeon Farming in Europe (EEC). In: P. Kestemont and R. Billard (eds.). 1993. Workshop on Aquaculture of Freshwater Species (Except Salmonids). European Aquaculture Society, Special Publication No. 20, Ghent, Belgium.

Acipenser schrenckii

1. Taxonomy

   1.1 Class: Actinopterygii

   1.2 Order: Acipenseriformes

   1.3 Family: Acipenseridae

   1.4 Species: *Acipenser schrenckii* Brandt, 1869

   1.5 Scientific synonyms: *Acipenser multiscutatus* Tanaka, 1908

   1.6 Common names:

English:	Amur sturgeon
Japanese:	Amûru-chôzame
Polish:	Jesiotr amurski
Russian:	Amurskiî osetr

2. Biological Parameters

   2.1 Distribution

Countries of origin: China, ? Japan, Russian Federation.

Acipenser schrenckii is endemic to the Amur River system where it occurs from the delta to the upper reaches including the large tributaries Argun and Shilka (Berg, 1948; Nikol´skii,1956).

The Amur River is formed by a confluence of the Argun and Shilka rivers and flows into the Amur delta in the Tatar Strait. The Amur delta is an estuary 48 km long and 16 km wide. Taking the longest of its branches, the River Shilka, as its source, the Amur is 4,092 km long and its basin has a total size of 1,856,000 km^2. The river valley is like a channel and when describing the river flow it is usual to divide it into three sections: an upper section up to the town of Blagoveshchensk (upper Amur, 883 km long), a middle section up to the mouth of the Ussuri River (middle Amur, 975 km long) and a lower section from the Ussuri confluence to the delta (lower Amur, 966 km long).

In the Amur River basin, *Acipenser schrenckii* is represented by two ecological forms which - according to their colour - are called grey sturgeon and brown sturgeon (Krykhtin and Svirskii, 1997). The brown sturgeon is less abundant than the grey form, its proportion in catches being 4 to 8 times less. It seems there are only a few low-abundant local groups of the brown sturgeon in the Amur. Brown adult and young individuals occur in the middle and lower parts of the Amur and their movements do not exceed 100 km either upstream or downstream.

The distribution range of the predominating grey form of *Acipenser schrenckii* within the Amur is fragmented: one population lives in the estuary, but does not move to the Sea; one population is concentrated in the middle Amur, one in the upper Amur and one in the Zeya-Bureya lowlands (Krykhtin and Svirskii, 1996).

   2.2 Habitat availability

In contrast to the most large rivers, the Amur is not dammed by hydroelectric dams yet. Information on habitat loss or degradation is not available.

   2.3 Population status

Krykhtin and Svirskii (1996) give an estimate of the size of the different populations using data of mass marking carried out at the end of the 1980s and calculated data (area method) based on irregular catches in the lower and middle Amur:

At present, the size of the estuary population is relatively small with about 3,000 fish older than two years living in the estuary and brackish waters.

The lower Amur population currently comprises about 95,000 individuals older than two years whereas the middle Amur population is estimated to have about 190,000 individuals aged over two years.

The Zeya-Bureya population of *Acipenser schrenckii* is very small and is believed to be on the verge of extinction (Krykhtin and Svirskii, 1996).

Acipenser schrenckii is listed as Endangered by IUCN (1996).

2.4 Population trends

The size of all Amur sturgeon populations in the Amur basin considerably decreased since the turn of the century (Krykhtin and Svirskii, 1996). At the end of the 19th century, when the highest catches were recorded (607 metric tons per annum), the largest population was that of the middle Amur which constituted 89% of the total annual catch on the Russian side in the stretch between the village of Ekaterino-Nikol´skaya to the village of Tambovskaya. Only 3% of the whole annual catch were from the lower reaches and estuary and the remaining 8% were caught in the upper reaches upstream the village of Ekaterino-Nikol´skaya. These differences in yield in the different sections of the Amur reflect the differences in the abundance of the Amur sturgeon populations. The catch by fisherman was ten times less in the lower Amur and estuary than in the middle Amur lowland.

Even if the fishing force has not been reduced, the catch of *Acipenser schrenckii* decreased by a factor of 5 in 1909 and by a factor of about 145 in 1948 (total catch: 4.2 metric tons of Amur sturgeon) as compared with the catch at the turn of the century (Krykhtin and Svirskii, 1996). As a result of increasing fishery concentrating mainly in the middle Amur on both the Russian and Chinese side the stocks of *Acipenser schrenckii* further declined since the 1960s, the middle Amur population being the most effected (Wei et al., 1996; Krykhtin and Svirskii, 1996).

In 1958, Russia introduced a strict limit on catches to reduce the overfishing of mature fish which is effective until now.

However, the tendency towards decrease of all populations of *Acipenser schrenckii* revealed already at the end of the 1960s is at present retained and a further reduction of the population size should be expected, especially in the middle Amur (Krykhtin and Svirskii, 1996). The extremely small Zeya-Bureya population is believed to be on the verge of disappearance (Krykhtin and Svirskii, 1996).

2.5 Geographic trends

No data on a decrease in the range area of *Acipenser schrenckii* are available.

2.6 Role of the species in its ecosystem

Acipenser schrenckii is a freshwater fish reaching a total length of 3 m and a weight exceeding 190 kg at an age of 60 years and older. These data are given for the grey form of the Amur sturgeon whereas the brown form has a slower growing rate and is usually smaller at the same age. *Acipenser schrenckii* feeds on benthos and freshwater molluscs and larvae of the Arctic lamprey are usually present in its stomach while cannibalism is rarely occurring (Svirskii, 1971 in Krykhtin and Svirskii, 1996).

The possible consequences of a depletion of the population of *Acipenser schrenckii* for other species depending on or associated with it are not investigated and hardly predictable.

2.7 Threats

Overexploitation is the main reason of the observed and expected reduction of the populations of *Acipenser schrenckii* (Krykhtin and Svirskii, 1996 and 1997). The legal and illegal fishery in the Amur on both the Russian and Chinese side have sharply increased within the last years due to the permission of free trade and the high prices for caviar. In the lower reaches of the river, in the Russian part, illegal fishery is carried out by organised groups who catch the sturgeon mainly during the spawning migration and on the spawning grounds in a pre-spawning state (Krykhtin and Svirskii, 1996). Hence, the amount of potentially sexually mature fish is declining drastically which means an enormous impact on the size of the total population of these fish with very low reproduction rate.

Within the last years the water pollution of the Amur with heavy metals, oil products, phenol, mineral fertilisers and other pollutants from gold-mining operations as well as from agriculture increases gradually on both the Russian and Chinese banks of the river, usually downstream the towns (Matthiesen, 1993; Krykhtin and Svirskii, 1996). However, a direct impact of this contamination on the ichthyofauna and especially on the health of the kaluga populations has not been studied.

Additionally, the revival of the Khinganski Dam project, a large hydroelectric dam, planned by the Chinese authorities threatens to wipe out all spawning sites of the Amur sturgeon (Birstein, 1993b).

3. Utilization and Trade

3.1 National utilization

Acipenser schrenckii is a commercial species and is caught on both the Chinese and Russian side. The meat is consumed domestically and caviar is processed of the roe. In the 1950s, the sturgeons were caught by pull nets and row hooks which afterwards were replaced by three-layer gill nets (Wei et al., 1997).

At the end of the 19th century, the highest catches of *Acipenser schrenckii* peaked in more than 607 metric tons per annum on the Russian side, especially caught in the middle Amur. Since the beginning 20th century the catches of the Amur sturgeon decreased gradually, only 4.2 metric tons being officially recorded in 1948 (Krykhtin and Svirskii, 1996 and 1997). Further reduction of the sturgeon stocks led to an annual closure of the fishery introduced by the USSR in 1958 and effective until now. The catching of *Acipenser schrenckii* is only allowed from June 15 till July 15 within the quota of 60 metric tons, the fish being 50-100 kg in weight and 185-220 in length (Birstein, 1993b). Despite this harvest regulations, intensive fishery in the lower Amur section started in 1991, and, in general, catches recently increased everywhere (Krykhtin and Svirskii, 1996). The official Russian records indicate 64.4 metric tons in 1991, 62.6 metric tons in 1992 and 47.8 metric tons in 1993 for both *Acipenser schrenckii* and *Huso dauricus*. However, experts report that within the last years illegal fishery drastically increased with the permission of free trade and estimate that at least 200 metric tons of kaluga and Amur sturgeon have been caught annually from 1991 till 1993. No data about the amount of caviar produced on the Russian side of the Amur are available. It is not clear whether the Russian caviar is only domestically consumed or exported.

On the Chinese side, the catches of the Amur sturgeon have been low before the 1970s due to the rare occurrence of the fish (Wei et al., 1997). The catch statistics of China give no separate data for the Amur sturgeon and the sympatric *Huso dauricus*. From 1952 to 1956 the annual yield of both sturgeon species from the entire middle Amur on the Chinese banks ranged between 70 to 80 metric tons, in 1981 a total of 141 metric tons has been caught and in 1987 a yield of 200 metric tons has been reached (Wei et al., 1997). Russian experts even indicate a total annual yield of 410 metric tons in 1989 (kaluga and Amur sturgeon) and 170 metric tons in 1993 of illegal fishery on the Chinese banks.

China started the export of osietra and kaluga caviar (the former produced of the roe of *Acipenser schrenckii*) both often sold under the name of "Amur sturgeon caviar" in the 1970s with an amount of 3 metric tons (Wei et al., 1997). Since 1990, an annual amount of 12-15 metric tons of

Kaluga/osietra caviar are exported, the main importers being Japan (ca 50%) and USA (ca 50 %) (Taylor, 1996).

In 1995, DeSalle and Birstein (1996) found that caviar of *Acipenser schrenckii* was sold under the false declared name of "Eastern beluga" in New York City stores.

3.2 Legal international trade

China is exporting an annual amount of about 12-15 metric tons of caviar of *Acipenser schrenckii* (osietra or Amur River sturgeon caviar) and of *Huso dauricus* (kaluga), the statistics not distinguishing between the caviar of these two species. About half of the Chinese production goes to Japan, the other 50% to the USA. The export price for Chinese caviar was about $ 195.00 per kg net weight CIF at the receiving end in 1995 (Taylor, 1996).

3.3 Illegal trade

Illegal fishery is indicated by both Chinese and Russian experts who estimate the illegal catches at about 410 metric tons of *Acipenser schrenckii* and *Huso dauricus* in 1989 and 170 metric tons in 1993. However, no reliable data about the real amount of illegal fishery for both sturgeon species are available. Illegal market channels are insufficiently known.

3.4 Actual or potential trade impacts

According to Russian and Chinese experts (Krykhtin and Svirskii, 1996 and 1997; Wei et al., 1997) the illegal fishery for the Amur sturgeon, which increased since the permission of free trade and because of the very high prices for caviar, is the main threat for the survival of the species. Mainly spawners at a pre-spawning state are illegally caught and hence the breeding stock is drastically reduced which means an enormous impact on the size of the total population of these fish with very low reproduction rate.

3.5 Captive breeding or artificial propagation for commercial purposes (outside countries of origin)

Not reported.

4. Conservation and Management

4.1 Legal status

4.1.1 National

Acipenser schrenckii is not totally protected by law neither on the Russian nor on the Chinese side, but there are some rules to regulate and control the harvest.

The Chinese Heilongjiang Government issued specific regulations of protection and management for sturgeons in 1950 and renewed them in 1982. The current regulations include gear restrictions, minimum harvest size, i.e. total length (TL) of 100 cm for *Acipenser schrenckii*, a closed area at Luobei, seasonal closed areas and a closed period for fishery as well as appropriate punishment measures (Wei et al., 1996). Chinese scientists (Wei et al., 1996) put forward that these regulations were not fully implemented due to the insufficient strength of fisheries management departments.

The USSR introduced an annual close of the Amur sturgeon fishery in 1958 which is formally effective until now (Krykhtin and Svirskii, 1996 and 1997). However, it is allowed to catch *Acipenser schrenckii* 50-100 kg in weight and 185-220 cm in length from June 15 till July 15 within the quota of 60 metric tons (according to Point 22.3 of "The Fishing Rules in Far Eastern Water Bodies of the USSR", 1981 cited in Birstein, 1993b). However, these regulations do not seem to be very effective, because legal and illegal fishery for sturgeons increased within the last years.

Artificial propagation of *Acipenser schrenckii* is only reported from the Chinese side within the period from 1988 till 1991: a propagation station for the Amur sturgeon was set up at Qingdeli in 1988 and stocked a total of about 900,000 of fry (0.2 - 0.4 g) and of 168,000 of fingerlings (1.0 - 1.5 g or 20 - 30 g) into the Amur during that period (Chen et al., 1993; Chen and Zhou, 1993; Wei et al., 1997). Wei et al. (1997) indicate that it is difficult to perform the regular work in the propagation station since no specific funds are available.

No data about artificial propagation of *Acipenser schrenckii* on the Russian side are available. However, Krykhtin and Svirskii (1996 and 1997) report about sturgeon hatcheries being constructed at the Russian banks of the Amur. Artificial propagation of *Acipenser schrenckii* is conducted by Dr. Svirskii as part of his scientific programme and he succeeded to create a broodstock in captivity (Svirskii et al., 1993).

For instance, there is no agreement between Russia and China concerning regulations of sturgeon fishery in the frontier waters.

4.1.2 International

None.

4.2 Species management

4.2.1 Population monitoring

Not reported.

4.2.2 Habitat conservation

Not reported.

4.2.3 Management measures

Both range states, Russia and China, launched fishing regulations in order to control the harvest of *Acipenser schrenckii*. Russia set up an annual close of sturgeon fishery in 1958, but it is allowed to catch *Acipenser schrenckii* 50-100 kg in weight and 185-220 cm in length from June 15 till July 15 within the quota of 60 metric tons (according to Point 22.3 of "The Fishing Rules in Far Eastern Water Bodies of the USSR", 1981 cited in Birstein, 1993b).

China issued specific regulations including a minimum harvest size for the Amur sturgeon of a total length of 100 cm (Wei et al., 1997).

There is no agreement between the two states concerning the controlled harvest of *Acipenser schrenckii*.

4.3 Control measures

4.3.1 International trade

None.

4.3.2 Domestic measures

Not reported.

5. Information on Similar Species

Acipenser schrenckii is sympatric with the kaluga, *Huso dauricus* and spawning of both species takes place on the same spawning grounds. During spawning a small number of hybrids may come into life

(2-5% of all larvae) which are predominantly males (up to 79%) and can reach a total length (TL) of 1.9 m and 70 kg in weight.

6. Other Comments

All range states of the species has been contacted on 13 March 1996 and 21 May 1996. A copy of the first draft of the proposal ("working document") has been sent to all range states on 19 August 1996. The comments of the range states that have been received are attached in the appendix at the end of this document.

The "working document" has also been presented at the 13th meeting of the Animals Committee of CITES in Prague, Czech Republic, on 23-27 September 1996 for discussion.

Additionally, the Authorities of the Russian Federation have been contacted in a first meeting in Moscow on 25 to 26 June 1996 for bilateral consultations. A second meeting ("Multilateral Consultations on the Problems of Sturgeon Species within the Framework of CITES") which took place on 21-22 November 1996 in Moscow, has been organised in order to consult with the states of Azerbaijan, Kazakhstan, Turkmenistan and Ukraine (which are not members to CITES) as well as with China, Georgia, Iran, USA and the Russian Federation. The minutes of this meeting and the comments of the range states that have been received are attached in the appendix at the end of this document.

7. Additional Remarks

8. References

Berg, L.S. 1948. [The Freshwater Fishes of the USSR and Adjacent Countries.]. Moscow and Leningrad, Nauka Publication, Vol. I, pp. 57-109. (Engl. translation published by National Science Foundation, Washington D.C., 1962).

Birstein, V.J. 1993a. Sturgeons and Paddlefishes: Threatened Fishes in Need of Conservation. Conservation Biology 7 (4):773-787.

Birstein, V.J. 1993b. Draft Application to CITES: Order Acipenseriformes. Unpublished.

Chen S., P. Xu, X. Zhou, M. Zhao, D. Sun, H. Liu, and W. Xu. 1993. Experimental feeding of the Amur sturgeon, *Acipenser schrencki* Brandt, on artificial food. In: International Symposium on Sturgeons, September 6-11, 1993. Abstract Bulletin. VNIRO, Moscow, pp. 86-87.

Chen, S., X. Zhou. 1993. Artificial breeding techniques for the Amur sturgeon (*Acipenser schrencki* Brandt). In: International Symposium on Sturgeons, September 6-11, 1993. Abstract Bulletin. VNIRO, Moscow, pp. 68-69.

Chereshnev, I.A. 1992: Rare, Endemic and Endangered Freshwater Fishes of Northeast Asia. Journal of Ichthyology 32 (8): 110-124.

DeSalle, R., and V.J. Birstein. 1996. PCR identification of black caviar. Nature, 381 :197-198.

IUCN. 1996. IUCN Red List of Threatened Animals. IUCN, Gland, Switzerland.

Krykhtin, M. L., and V. G. Svirskii. 1996. The catch of sturgeons and the status of sturgeon stocks in the Amur River. In: Workshop “Sturgeon Stocks and Caviar Trade”, Bonn, October 9-10, 1995. In press.

Krykhtin, M.L. and V.G. Svirskii. 1997. Endemic Sturgeons of the Amur River: Kaluga, *Huso dauricus*, and Amur Sturgeon, *Acipenser schrencki*. In: Birstein, V., J.R. Waldman and W.E. Bemis (eds.). Sturgeon Biodiversity and Conservation. Kluwer Academic Publishers, Dordrecht. Pp. 231-239.

Masuda, H., K. Amaoka, C. Araga, T. Uyeno and T. Yoshino. 1984. The Fishes of the Japanese Archipelago. Tokay University Press. P. 18.

Matthiesen, P. 1993. The last Cranes of Siberia. The New Yorker, May 3, 1993: 76-86.

Nikol´skii, G. V. 1956. Fishes of the Amur River Basin. Mosow and Leningrad, Izdatelstvo Akad. Nauk USSR, pp. 26-49.

Svirskii, G. V. 1971. The Amur River sturgeon and kaluga. Uchenye Zapiski Dalnevostochnogo Gosudarstvennogo Universiteta, 15 :19-33 (in Russian).

Svirskii, V. G., V. A. Nazarov, and E. I. Rachek. 1993. The Amur River sturgeons and prospects for their culture in the Far East of Russia. In: International Symposium on Sturgeons, September 6-11, 1993. VNIRO, Moscow, p. 67.

Taylor, S.1996. The Historical Development of the Caviar Trade and Industry. In: Workshop "Sturgeon Stocks and Caviar Trade", Bonn, October 9-10 1995. In press.

Wei, Q., F. Ke, J. Zhang, P. Zhuang, J. Luo, R. Zhou and W. Yang. 1997. Biology, Fisheries and Conservation of Sturgeons and Paddlefish in China. In: Birstein, V., J.R. Waldman and W.E. Bemis (eds.). Sturgeon Biodiversity and Conservation. Kluwer Academic Publishers, Dordrecht. Pp. 241-255.

Acipenser sinensis

1. Taxonomy

1.1	Class:	Actinopterygii	
1.2	Order:	Acipenseriformes	
1.3	Family:	Acipenseridae	
1.4	Species:	*Acipenser sinensis* Gray, 1834	
1.5	Scientific synonyms:	*Acipenser sinensis* Gray, 1935 *Acipenser kikuchii* Jordan and Snyder, 1901	
1.6	Common names:	English: Finnish: Japanese:	Chinese sturgeon Kiinansampi Kara-chôzame

2. Biological Parameters

2.1 Distribution

Countries of origin: China, ? Japan.

Acipenser sinensis inhabits the China Sea and the Sea of Japan and enters the main stream of the Yangtze River and the Pearl River (in south-east China) (Kimura, 1934; Nichols, 1943; Ting, 1949; Masuda et al., 1984; Wei et al., 1997).

The Chinese sturgeon is a typical anadromous fish. The migration pattern is only given for the population entering the Yangtze, whereas little information about the Pearl River population is available. Adults with gonads approaching maturity arrive at the mouth of the Yangtze in June or July and continuously ascent along the main stream of the river. They occur in the Yangtze at a distance of 1,000 - 1,850 km from the mouth in September / October and spend the winter here. Spawning takes place in October / November of the subsequent year (Wei et al., 1997).

Juveniles with a total length (TL) of 7 - 38 cm considered to be one winter old occur at the Yangtze Estuary from mid April to early October. Juveniles with a few kilograms in weight can be found in the coast areas near the mouth and individuals with 25-225 kg in weight were registered in the East China Sea and Yellow Sea (Wei et al, 1997).

2.2 Habitat availability

The anadromous migration of *Acipenser sinensis* was blocked by the Gezhouba Dam, a large hydroelectric dam which was built in 1981 at Yichang, Hubei Province between the upper and middle reaches of the Yangtze River. This dam represents an insurmountable barrier for many migratory fishes including *Acipenser sinensis*. Before the dam construction, the mature adults migrated to a section of the upper reaches of the Yangtze River above Huling City to the lower reaches of the Jingsha River below Xingshi Town for spawning, up to a distance of approximately 2,500 to 3,300 km from the mouth. Since the damming of the river, the anadromous distance has been shortened by 1,450 km to 1,850 km (Wei et al., 1997).

In the near future, the habitat will be further destroyed by the construction of the Three Georges Dam which will be completed in 1997.

2.3 Population status

An estimate of the total size of the population of *Acipenser sinensis* is not given. According to several Chinese scientists (summary in Wei et al., 1997), two subpopulations of the Chinese sturgeon exist: one entering the Yangtze River and one entering the Pearl River in Southeast China.

Both subpopulations differ in morphology, spawning season and migration pattern and it is not clear if they should be classified as two separate species.

An estimate of the total number of individuals is only given for the migratory population in the Yangtze River: Wei et al. (1997) investigated this stock during 1983 and 1984 by tagging 57 adults and recapturing them in the same or in the following year. Their studies led to the conclusion that about one thousand adult specimens ascended the Yangtze in 1983 and 1984. Ever since, no population estimate has been made but experts indicate that the abundance of *Acipenser sinensis* in Yangtze River is very low and that the Pearl River population can hardly be found nowadays (Wei et al., 1997).

Acipenser sinensis is listed as Endangered by IUCN (1996).

2.4 Population trends

There is no quantitative and referenced information whether the population of *Acipenser sinensis* is increasing, stable or declining. Experts believe the Chinese sturgeon in Yangtze River to be Endangered (Yang, 1992; Birstein, 1993a and 1993b) and that without taking further measures, i.e. the establishment of protected areas, the survival of the species is questionable (Wei et al., 1997). Liu (1995) states that an estimated 90% of the eggs on the spawning site near the Gezhouba Dam are eaten by *Coreius heterodon* and that, as result, the sturgeon population is further declining.

2.5 Geographic trends

The range area of the Yangtze population of *Acipenser sinensis* has been restricted to the lower reaches of the river since the Gezhouba Dam, built in 1982, blocked the migration to the traditional spawning grounds in the upper reaches of the river. The fish were cut off from at least sixteen known spawning sites located in the section from the upper Yangtze above Huling City to the lower Jingsha River below Jingshi Town (Wei et al., 1997).

Data on the Pearl River population are not available.

2.6 Role of the species in its ecosystem

Despite its formerly great commercial value, ecological studies about *Acipenser sinensis* have hardly been made and the role of the species in its ecosystem is not clear. The possible consequences of a depletion of the populations of the species for other species depending on or associated with it are not predictable.

2.7 Threats

Besides the overfishing during the spawning period, the main threat for the Yangtze population of *Acipenser sinensis* was the building of the insurmountable Gezhouba Dam in 1981 which cut off the fish from its traditional spawning grounds in the upper river. Since then only one major spawning site has been found below the dam (Wei et al., 1997).

Moreover, the construction of a new hydroelectric dam across the Yangtze River, the Three Gorges project, which is expected to be finalised in 1997, will have a vast impact on the survival of the Chinese sturgeon: it is planned to collect 1.3 million metric tons of gravel and rocks from the reach below Gezhouba dam as material for the new dam. This measure will directly damage the last known spawning grounds of *Acipenser sinensis* (Wei et al., 1997).

The Pearl River population is faced with similar threats: the construction of a hydroelectric power station, Changzhou Dam, across the Pearl River will block the pathway to the spawning grounds (Chu et al., 1994 in Wei et al., 1997).

With the economic development and the increasing number of factories built along the Yangtze Valley, the water quality became worse within the last two decades. Pollution with untreated industrial waste water and pesticides and mineral fertilisers used in agriculture increased drastically. Those harmful substances not only endanger the fish directly but also have an influence on the reproduction of the food organisms (Zhuang et al., 1997). However, no data about the amount and the impact of toxins on the fauna neither in the Yangtze River nor in the Pearl River are available. Wei et al. (1997) investigated the gonads of *Acipenser sinensis* in the Yangtze River and found that in a part of fishes these organs are developing abnormally since 1982. Mainly the ovaries are effected and in regression or degeneration through partial or full fat consumption. The eggs are described to have an unusual appearance in shape and colour and the egg diameter is smaller than usual. These phenomena have been observed in other sturgeon species (Kozlovsky 1968, Romanov and Altuf´ev, 1990) and are obviously due to chemical pollution.

Furthermore, the survival of *Acipenser sinensis* is threatened by habitat alterations and destruction. The vegetation in the upper Yangtze Valley has been seriously destroyed and as a consequence, a vast amount of silt is washed into the river in raining season which effects the fishes and their food organisms (Zhuang et al., 1997).

The juveniles of *Acipenser sinensis* that feed in the Yangtze River estuary before migrating into the East China Sea are threatened by the fishery for eels and anchovies in that region (Liu, 1995). Thousands of nets are set in the river and across channels as well as on tidal flats. About 6,000 juvenile Chinese sturgeon have been annually caught and killed in the estuary with about 75% taken by nets.

3. Utilization and Trade

3.1 National utilization

Before 1981, the commercial fishery for *Acipenser sinensis* was mainly restricted to the middle and upper reaches of the Yangtze. Fishing was unlimited, but seasonal, mostly in fall. Gears included gill nets (upper reach) and row hooks (middle reach). Exact data of catches in the entire river have not been available until 1972. In the period of 1972 to 1980, the annual mean catch of the migratory population of *Acipenser sinensis* was 77,550 kg which corresponds to 517 individuals (150 kg / indiv.) for the entire river (Wei et al., 1997). In 1981 and 1982, after the damming of the river, almost all individuals occurring below the dam were caught and as a consequence the catch reached the peak record of 1,163 specimens (including 161 from the reaches above the dam). Since 1983, the commercial fishery for *Acipenser sinensis* has been completely banned. Fishing is only allowed for scientific or propagation purposes and annually about 100 specimens are caught (Wei et al., 1997).

In 1983, artificial spawning of *Acipenser sinensis* was successfully carried out by the Yangtze River Fisheries Institute for the first time. A propagation station was set up at Yichang concerned with artificial propagation of the species and scientific research. An annually caught stock of approximately 100 adult individuals are studied and used for propagation purposes since 1983. An annual mean of 250,000 fry and some fingerlings were stocked into the river. From 1983 to 1993, a total of 2.8 million of fry and 16,851 of fingerlings with a size ranging from 2 to 10 g have been released into the river (Wei et al., 1997). These artificial propagation operations are part of the conservation programme for the Chinese sturgeon.

3.2 Legal international trade

None.

3.3 Illegal trade

Not reported.

3.4 Actual or potential trade impacts

No information available.

3.5 Captive breeding or artificial propagation for commercial purposes (outside countries of origin)

Not reported.

4. Conservation and Management

4.1 Legal status

4.1.1 National

In 1983, the commercial fishery for *Acipenser sinensis* has been banned. In 1988, the Chinese sturgeon was listed as Protected Animal in class I by Chinese law (Wei et al., 1997). The full protection of the species includes several protective measures like the setting up of protection stations along the river and a propagation station at Yichang (Wei et al., 1997).

4.1.2 International

None.

4.2 Species management

4.2.1 Population monitoring

Details about a specific monitoring programme for the species are not available.

4.2.2 Habitat conservation

According to Wei et al. (1997) and Liu (1995) six protection stations for *Acipenser sinensis* have been set up along the river since 1983. Detailed information about a habitat protection for the Chinese sturgeon are not given.

4.2.3 Management measures

As part of the conservation programme for *Acipenser sinensis* commercial fishery has been completely banned since 1983 and a harvest from the wild of about 100 individuals annually is only designated for scientific and propagation purposes (Wei et al., 1997).

Artificial propagation of *Acipenser sinensis* is carried out by a special propagation station at Yichang where annually a total of 250,000 of fry and some fingerlings are released into the river (Wei et al., 1997).

In 1988, the Chinese Sturgeon Temporary Farming and Protection Station was founded in Zhongming County with the responsibility for saving the young sturgeon caught in fishnets, especially in the Yangtze River estuary (Liu, 1995). The young sturgeon are placed in well oxygenated water and then moved into ponds or tanks for temporary holding until they are rehabilitated. In the period from 1988 to 1993, 1,093 juveniles have been saved and released. Moreover, a closed fishing season in the estuary from June 22 to August 22 has been established to further protect young sturgeons (Liu, 1995).

4.3 Control measures

4.3.1 International trade

None.

4.3.2 Domestic measures

Not reported

5. Information on Similar Species

Acipenser sinensis is partly sympatric with the Yangtze sturgeon, *Acipenser dabryanus*. These two species are the only representatives of the family Acipenseridae found in the Yangtze River.While *Acipenser sinensis* is an anadromous species which migrates long distances from the Sea to the spawning grounds in the Yangtze River, *Acipenser dabryanus* is a typical freshwater resident. Both sturgeon species appear to be very similar in shape when they have the same length, whereas the maximum individual size of the Chinese sturgeon is much larger than that of *Acipenser dabryanus*. Both sturgeon species are listed as Endangered species and commercial fishery has been completely prohibited since 1983.

6. Other Comments

The range states of the species has been contacted on 13 March 1996 and 21 May 1996. A copy of the first draft of the proposal ("working document") has been sent to all range states on 19 August 1996. The comments of the range states that have been received are attached in the appendix at the end of this document.

The "working document" has also been presented at the 13th meeting of the Animals Committee of CITES in Prague, Czech Republic, on 23-27 September 1996 for discussion.

Additionally, a meeting ("Multilateral Consultations on the Problems of Sturgeon Species within the Framework of CITES") which took place on 21-22 November 1996 in Moscow, has been organised in order to consult with the states of Azerbaijan, Kazakhstan, Turkmenistan and Ukraine (which are not members to CITES) as well as with China, Georgia, Iran, USA and the Russian Federation. The minutes of this meeting and the comments of the range states that have been received are attached in the appendix at the end of this document.

7. Additional Remarks

8. References

Birstein, V.J. 1993a. Sturgeons and Paddlefishes: Threatened Fishes in Need of Conservation. Conservation Biology 7 (4):773-787.

Birstein, V.J. 1993b. Draft Application to CITES: Order Acipenseriformes. Unpublished.

Fabricant, F. 1991. As Annual Price War Begins, Caviar Business is in Turmoil. The New York Times, December 4, C 3.

IUCN. 1996. IUCN Red List of Threatened Animals. IUCN, Gland, Switzerland.

Kozlovsky, A.D. 1968. Resorption of Sexual Products in Fishes as a Stimulus to Biological Modification. Problems in Ichthyology 8: 803-807.

Liu, Q. 1995. Conservation and Propagation of the Chinese Sturgeon in the Yangtze River. Proceedings of the Second International Symposium on Sturgeons, September 6-11, 1993. Moscow-Kostroma-Moscow (Russia). VNIRO Publication, Moscow. Pp. 259-261

Masuda, H., K. Amaoka, C. Araga, T. Uyeno and T. Yoshino. 1984. The Fishes of the Japanese Archipelago. Tokay University Press. P. 18.

Nichols, J.T. 1943. The Freshwater Fishes of China. Central Asiatic Expeditions: Natural History of Central Asia. Vol. IX. American Museum of Natural History, New York. Pp. 15-16.

Romanov, A.A. and Yu.V. Altuf´ev. 1990. Tumors in the Sex Glands and Liver of Sturgeons (Acipenseridae) of the Caspian Sea. Journal of Ichthyology 30: 44-49.

Ting, H. 1949. Notes on a sturgeon from the Min River, China. Copeia 1949: 65-68.

Wei, Q., F. Ke, J. Zhang, P. Zhuang, J. Luo, R. Zhou and W. Yang. 1997. Biology, Fisheries and Conservation of Sturgeons and Paddlefish in China. In: Birstein, V., J.R. Waldman and W.E. Bemis (eds.). Sturgeon Biodiversity and Conservation. Kluwer Academic Publishers, Dordrecht. Pp. 241-255.

Zhuang, P., F. Ke, Q. Wei, X. He and Y. Cen. 1997. Biology and Life History of Dabry´s Sturgeon, *Acipenser dabryanus*. In: Birstein, V., J.R. Waldman and W.E. Bemis (eds.). Sturgeon Biodiversity and Conservation. Kluwer Academic Publishers, Dordrecht. Pp. 257-264.

Acipenser stellatus

1. Taxonomy

1.1 Class:	Actinopterygii
1.2 Order:	Acipenseriformes
1.3 Family:	Acipenseridae
1.4 Species:	*Acipenser stellatus* Pallas, 1771
1.5 Scientific synonyms:	*Acipenser seuruga* Güldenstädt, 1772 *Acipenser helops* Pallas, 1814 *Acipenser ratzeburgii* Brandt in Brandt and Ratzeburg, 1833 *Acipenser stellatus donensis* Lovetsky, 1834 *Helops stellatus*; Bonaparte, 1846 *Acipenser stellatus danubialis* Brusina, 1902 *Acipenser stellatus illyricus* Brusina, 1902 *Acipenser stellatus stellatus cyrensis* Berg, 1932 *Gladostomus stellatus* Holly, 1936
1.6 Common names:	Bulgarian: Pastruga Czech: Jeseter hvezdnaty English: Stellate sturgeon, Sevruga, Star sturgeon, Starry sturgeon French: Esturgeon étoilé Finnish: Tähtisampi German: Sternhausen Hungarian: Söregtok Italian: Storione stellato Polish: Siewruga Russian: Sevryuga Romanian: Pastruga Serbo-Croat: Pastruga Slovene: Jeseter hviezdnaty Spanish: Esturión estrellado Portuguese: Esturjâo estrelado Swedish: Stjärnstör sevruga Turkish: Mersin, Mersin baligi Name of caviar: sevruga

2. Biological Parameters

2.1 Distribution

Countries of origin: Azerbaijan, Bulgaria, Czech Republic, Former Yugoslavia, Georgia, Hungary, Iran, ? Italy, Kazakhstan, Moldova, Romania, Russian Federation, Slovakia, Turkey, Turkmenistan, Ukraine.

Acipenser stellatus inhabits the Caspian Sea, the Sea of Azov, the Black Sea (Shubina et al., 1989; Birstein, 1993).

The species is anadromous and enters the rivers that flow into these seas for spawning. The largest populations of *Acipenser stellatus* are concentrated in the Caspian Sea where they ascend the Volga, Ural, Terek-Kuma Rivers (Russian Federation). There is no recent information about the distribution of the species in the Kura (Azerbaijan), Sulak and Samur (Dagestan) rivers, where the species occured in the past. Stellate sturgeon probalbly also enter the Sefid-Rud River and the Gorgan River along the southern coast of the Caspian Sea (Iran) (Shubina et al., 1989).

From the Sea of Azov, the spawning population of *Acipenser stellatus* ascends lower sections of the Don and Kuban rivers (Shubina et al., 1989).

From the Black Sea, the spawning stellate sturgeon still migrate into the Danube River. There is no recent record of the species in the Dniester, Dnieper and Bug. Some individuals have also been found along the southern Turkish coast of the Black Sea and probably in the Kizil-Irmak and Yesil-Irmac rivers, but it is not clear whether the species enters these rivers for spawning (FAO, 1989).

In the Aegean and Adriatic Sea, only few isolated specimens have been recorded in the past and it is doubtful if a spawning population of *Acipenser stellatus* still exists in this sea basin (Lelek, 1987).

The anadromous migrations of the species are very similar in all inhabited basins. According to the time of the migration, there is a distinction between a spring race and a winter race (Shubina et al., 1989). The spring race usually begins the spawning run into the rivers in early spring, in the mid or late summer the run reaches a peak and finally ceases in late autumn. The so-called winter race generally does not spawn the same year they enter the river. These fish hibernate in the rivers and reproduce the following year.

The juvenile sturgeons migrate downstream the rivers to feeding grounds in the sea. In the Caspian Sea the main feeding grounds are located in the northern part.

Within the Caspian Sea there is a seasonal migration: in spring and summer most of the specimens are encountered in the northern part of the Sea on the main feeding grounds, while in autumn and winter a migration to the central and southern part of the sea has been observed (Barannikova et al., 1995).

The stellate sturgeon is a typical benthic inhabitant of coastal waters in seas and the lowland sections of rivers (Shubina et al, 1989). Unlike other sturgeon species, *Acipenser stellatus*, is not only found on the bottom of such water systems but also intensively utilises the middle and upper water layers.

2.2 Habitat availability

The construction of hydroelectric power stations as well as of water reservoirs in almost all rivers where the species spawns led to a sharp reduction of available spawning grounds. In the Caspian Sea basin, the stellate sturgeon lost approximately 40% of all spawning grounds (Barannikova et al., 1995). In the main spawning river, the Volga, there remained only 430 ha of the total 3,600 ha after the damming of the river by the Volgograd Dam. The area of the natural spawning grounds in the Kura River has been reduced by dam constructions to about 160 ha, in the Terek River to 132 ha and in the Sulak River to 201.6 ha (Vlasenko, 1996). The only unregulated river flowing into the Caspian Sea is the Ural which still provides an area of 1,400 ha for sturgeon spawning.

In the Black Sea and Sea of Azov, the situation is almost the same. Almost all rivers that enter these seas and are used by the anadromous sturgeons for spawning, have been blocked by dam constructions either of hydroelectric power stations or of irrigation systems. For example the regulation of the Kuban River flow resulted in the loss of approximately 140,000 ha of estuarine breeding grounds for all fluvial anadromous fish (Volovik et al., 1993). The construction of the Tsymlyansk reservoir on the Don River in 1952 resulted in an average loss of about 68,000 ha of spawning grounds for all fluvial anadromous fishes (Volovik et al., 1993). The Danube River has been blocked by the construction of the insurmountable dams Djerdap I and II ("Iron Gate") which prevented all anadromous fish species from an upstream migration to the spawning grounds located above the first dam (Bacabalsa-Dobrivici, 1997).

The reduction of available natural spawning grounds due to river flow regulations subsequently led to a reduction of the natural reproduction and the stock of the species is maintained to a high extant by artificial propagation. In 1993, about 60-98% of each generation of *Acipenser stellatus* in the Sea of Azov consisted of farm-grown fish (Volovik et al., 1993), while in the Caspian Sea about 30% originates from hatcheries (Barannikova, 1995).

2.3 Population status

There is no information about the total size of the population. The largest population of *Acipenser stellatus* is believed to live in the Volga-Caspian region which produces about 80 percent of the total sturgeon catches (Vlasenko, 1996; Khodorevskaya, 1997)). Levin (1996) estimated that the spawning population that entered the Volga River in recent years constituted of about 116,000 mature individuals, with an average age of 10-14 years. The method of census for this estimate is not provided. Birstein (1993b) reports that in 1988 about 90,000 individuals have been recorded on the spawning grounds of the Ural River. There are virtually no estimates of spawning populations in the other rivers that enter the Caspian Sea, but several authors (Vlasenko, 1996; Levin, 1996) believe them to be minimal.

There are also no recent estimates about the total size of the populations inhabiting the Black and Azov Seas watersheds. Volovik et al. (1993) estimated that the total stock biomass of all sturgeons living in the Sea of Azov was about 59,000 metric tons in the mid 1980s, with *Acipenser stellatus* accounting for 21% of the total sturgeon biomass (12,390 metric tons). However, in 1990, a mass death of sturgeon occurred in this watersheds and approximately 55,000 sturgeon individuals were found dead on the shore. Ever since, no estimation of the population size has been made.

The IUCN (1996) classifies the status of the populations of *Acipenser stellatus* as follows: the status of the Caspian Sea population (Russia, Azerbaijan, Kazakhstan, Turkmenistan, Iran) is Vulnerable, while the status of the populations in the Sea of Azov (Russia) and in the Black Sea (Ukraine, Romania, Hungary, Serbia) is Endangered.

2.4 Population trends

The decline of the commercial catches of *Acipenser stellatus* reflect a decline in the size of the population. In the Volga-Caspian region, where the species is most abundant, the catches declined from 13,350 metric tons in 1977 to 5,600 metric tons in 1989 (Vlasenko, 1990 in Birstein, 1993b). Levin (1996) estimated that the largest spawning population, the one which enters the Volga River for spawning, decreased in recent years from about 500,000 individuals to 116,000 individuals. The most alarming fact was the decrease of natural reproduction of the species which already began with the construction of the Volgograd Dam but still worsened within the last years due to the high pollution level in almost all spawning rivers. Although *Acipenser stellatus* is subject to a large-scale ranching programme within the Russian Federation and probably also Iran, the stocks further declined. Barannikova (1995) estimates that about 30 % of the stellate sturgeon catch within the Russian part of the Caspian Sea originated from farm-grown fish in 1993. In the Sea of Azov and Black Sea region, the situation is even worse: in 1993 more than 80% of stellate sturgeons within these watersheds came from hatchery-released juveniles (Barannikova et al., 1995).

Due to bad environmental conditions, the reproductive system of *Acipenser stellatus* females showed an increasing degeneration and several anomalous developments in the gameto- and gonadogenesis occurred. Shagaeva et al. (1993) found that 100% of the eggs taken from *Acipenser stellatus* females caught in the lower Volga River in 1989 showed anomalies and 100% of the larvae (both from hatcheries and natural environment) were not viable. In the Sea of Azov and Black Sea, a mass death of sturgeons was observed in 1990, which was undoubtedly caused by disastrous environmental conditions. They may also have their effect on the remaining small population of *Acipenser stellatus*. Considering these evident signs of a sharp decrease in natural reproduction, several experts fear a further reduction of the population of *Acipenser stellatus* within its entire range. Levin (1995) states that artificial propagation techniques, although they contribute to a high amount to the maintaining of the stocks, cannot compensate for the damage caused to natural reproduction.

2.5 Geographic trends

A decrease in the range area of *Acipenser stellatus* is due to the dam constructions on almost all rivers that the species formerly used to ascend for spawning.

In the Caspian Sea basin the species can currently ascend the Volga as far as the Volgograd Dam, in the Kura it can migrate as far as the Vavarin Reservoir and in the Ural upstream to the city of Orenburg (Vlasenko et al., 1989). In the Terek, the fish can migrate upstream as far as the Kargalin Dam. In the Black and Azov Sea basins an upstream migration into the Danube, Don and Kuban Rivers is also prevented by various dam constructions. Damming caused the extirpation of the stellate sturgeon populations in the middle and upper part of the Danube River (Hensel and Holcik, 1997).

2.6 Role of the species in its ecosystem

Acipenser stellatus is an anadromous sturgeon species which may reach a total length of 2.18 (TL) and a maximum weight of 54 kg (Shubina et al, 1989). However, the fish usually range between 1.0 to 1.2 m and 6 to 8 kg. The maximum age that was recorded of a stellate sturgeon was 35 years (Shubina et al., 1989). *Acipenser stellatus* feeds on various benthic organisms depending on the habitat where it occurs. The main diet consists of molluscs, polychaets, oligochaets, insect larvae and small fish (mainly gobiids).

Predation pressure on the stellate sturgeon occurs only during its early development stages. The eggs are reportedly eaten by cyprinids (*Abramis bjoerkna*, *Pelecus cultratus*), gobiids (*Gobio* spp.) and by *Acipenser ruthenus* (Shubina et al., 1989). Larvae and young-of-the-year stellate sturgeon are preyed upon by *Silurus glanis*, *Stizostedion volgense* and various gobiids.

The possible consequences of depletion of the population of *Acipenser stellatus* for those species depending on or associated with it are very complex and hardly predictable.

2.7 Threats

The main threats to the species are the legal and illegal overfishing mainly during the spawning season, the loss of critical habitat such as spawning grounds due to dam constructions (as mentioned above: 2.2 and 2.5), and the high level of pollution in almost all rivers within its range.

The main threat to the survival of the stellate sturgeon (as well as that of *Acipenser gueldenstaedtii* and *Huso huso*) is the legal and especially illegal overfishing stimulated by the high demand for black caviar on the international market (see 3.2 and 3.3). After the collapse of the USSR in 1991, besides Russia and Iran three new states (Azerbaijan, Kazakhstan and Turkmenistan) and two autonomous Russian Republics (Dagestan and Kalmykia) started the harvest of sturgeons (Ivanov et al., 1995a). Until the beginning of 1996, there has been no agreement between these countries bordering the Caspian Sea concerning a sustainable sturgeon fishery and adequate international fishing rules. Fishing in the open sea, which was completely prohibited by Soviet laws for a long period, was started mainly by Azerbaijan. As a consequence, mainly young and immature sturgeon were caught and the harvest in the open sea destroyed a major part of the future sturgeon stocks (Luk´yanenko et al., 1994). As a result, the natural reproduction of *Acipenser stellatus* dropped drastically, while the caviar market was overwhelmed by a high amount of stellate sturgeon caviar of very poor quality made of the roe of immature females. The situation with the legal catch was so critical that the Russian experts discussed the need to completely prohibit the legal commercial catch of sturgeons in the Caspian Sea for one to two years (Ivanov et al., 1995a).

The decline of the populations of *Acipenser stellatus* in the Caspian and Black Sea basins during the last years was mainly caused by the enormously high level of poaching (Artyukhin, 1996; Birstein, 1996; Zoltarev et al., 1996; Khodorevskaya et al., 1997). According to the opinion of experts, the size of the illegal catch is equal to or even higher than the legal catch. Poaching is common in almost all countries of the area: in Russia (with Dagestan and Kalmykia), Azerbaijan, Kazakhstan and even Iran. In the Volga River, during the last years practically all spawning fish have been caught by poachers before they could reach the spawning grounds below the Volgograd Dam (Artyukhin, 1996). The subsequent lack of mature fish even affected the work of the hatcheries near the Volgograd dam since it was not possible to catch enough mature stellate sturgeon for artificial breeding (Artyukhin, 1996). The high level of poaching hence affects not only the natural reproduction of the species but also the artificial propagation, and therefore represents the main threat to the survival of *Acipenser stellatus*.

Illegal catch in the north-western part of the Black Sea (Ukrainian waters), especially trawling, caused a considerable decrease in the size of this population of *Acipenser stellatus* in 1993-1994 as compared to 1991-1992 (Zolotarev et al., 1996). Poaching also affects the Danubian populations of the stellate sturgeon (Birstein, 1996b).

The construction of dams along most of the spawning rivers of *Acipenser stellatus* dramatically reduced the natural spawning grounds of the species and consequently threatened the natural reproduction (see 2.2). However, this does not seem to be a limiting factor for the population of *Acipenser stellatus* in the Volga River. Estimates show that the spawning grounds in the Volga River below the Volgograd Dam can accomodate 280,000 stellate sturgeon spawners (Veshchev, 1993). But during the last thirty years, their number was considerably below this value (Veshchev, 1995). Hydroelectric power station dams not only cut off sturgeons from their main spawning sites, but also change the flow of the rivers, and consequently the opportunity of spawners to use the spawning grounds that are still left intact. Alterations of the Volga River flow allow fewer stellate sturgeon to reach their spawning sites (Veshchev, 1995). The altered flow also affects the migration to the sea of juveniles either released from hatcheries or naturally hatched (Raspopov et al., 1995).

A further threat to the survival of *Acipenser stellatus* is represented by the high level of pollution in the Caspian and Black Sea basins. During the period from the beginning 1970s until the collapse of the Soviet Union in 1991, the level of pollution increased dramatically in almost all rivers entering the Caspian Sea, the main sources being oil and other industrial sewage (Vlasenko, 1990; Dumont, 1995; Khodorevskaya et al., 1997). In the Volga River, for example, the concentrations of heavy metals, mercury, phenols, surface-active agents, pesticides and oil products by far exceeded the maximum permissible concentration within this period (Romanov and Altuf´yev,1993). Considerable concentrations of these pollutants were also found in the northern part of the Caspian Sea (Romanov and Altuf´yev, 1993). Several authors (Altuf´yev et al., 1992; Romanov and Altuf´yev, 1991 and 1993; Romanov and Sheveleva, 1993; Kuz´mina et al. 1993; Altuf´yev, 1994; Shagaeva et al., 1993; Shagaeva et al., 1995) have investigated the influence of the very high level of pollution in the Caspian Sea and studied the effect of the various toxins on sturgeons. The studies revealed that environmental pollution caused considerable changes in hormonal balance, in the blood system, and in protein and carbohydrate metabolism, marked disturbances in the genesis of organs (liver, gonads) and tissues (skeletal muscles, heart) and the appearance of neoplasm in liver, gonads and sex cells. General weakening of the fish as a result of toxins, disturbed metabolism and hormonal imbalance led to a number of disturbances in sturgeon gonadogenesis, e.g. the increase in number of hermaphroditic specimens, ovotestis and tumours, and to the appearance of new differentiation such as striated muscle tissue and fascicles of dense connective tissue formations which are normally absent in healthy fishes. A tendency was noted toward an increase in the number of aberrations, especially in the gameto- and gonadogenesis and in 1990, 100% of mature eggs taken from various sturgeon females showed various pathological anomalies suggesting the loss of viability. Moreover, in 1989 and 1990, a mass death of sturgeon larvae was observed caused by hatching aberrations and anomalous development such as defects in the fin fold and underdevelopment of the heart, both leading inevitably to death at early stages of development. In 1990, 100% of all investigated larvae (*Acipenser gueldenstaedtii*, *Acipenser stellatus*) showed such anomalous development which was caused by environmental toxins. The anomalies in larval structure took place both in nature and in the hatchery.

All these effects on sturgeons were clearly seen from 1986 until 1992 and were presumably caused by a release of toxic waste from one of the heavy industry plants located on the shores of the Volga River in the middle of the 1980s. Since the disintegration of the USSR in 1991, the production of the heavy industry drastically decreased which resulted in an improving water quality in the Volga-Caspian region. Thus, in the early 1990s, the number of sturgeons with a pronounced muscle dystrophy disease dropped significantly.

However, there is a threat of increasing pollution in the whole Caspian Sea in the near future. The fast raise of the sea water level - from 1993 to 1997 it increased in 2,15m (Radionov, 1994) - will result in covering "lakes" of deposited wasted oil and associated pollutants from industrial sewage along the shore. Such "lakes" are already located in all industrial parts of Azerbaijan along the coast (Dumont, 1995) and their number will increase with the raising sea level. Sturgeons are especially threatened by the pollution in this region, because the waters of Azerbaijan represent important feeding grounds for the fish during the winter. A further near future threat for the northern part of the Caspian Sea is the fast development of oil fields, especially the Tengiz oil field, in Kazakhstan (Sagers, 1994). Sturgeons will be especially affected by pollutants from this developing industry because their main spawning and feeding grounds are located in the region of the northern Caspian Sea. Moreover, the central part of the Caspian Sea is threatened by radioactive contamination from the Gur´evskaya nuclear reactor near Akatai, Kazakhstan (Dumont, 1995).

In the Black-Azov Sea basin the situation of pollution is almost the same (Volovik et al., 1993). The Danubian and Dniester sturgeon populations are mainly threatened by the pollution of the rivers and the sea, and by the eutrophication of coastal waters which results in the appearance of temporary hypoxic areas on the Black Sea shelf. Chronic toxicosis with poisonous substances led to a mass death of fishes and in summer 1990 about 55,000 sturgeon individuals were found dead on the shore (Volovik et al., 1993).

Moreover, the introduction of the ctenophore *Mnemiopsis leydyi* into the Black Sea in the 1980s resulted in a destruction of the local pelagic food and thus affected the main feeding source of sturgeons (Dumont, 1995; Khodorevskaya et al., 1997).

3. Utilization and Trade

3.1 National utilization

Acipenser stellatus is one of the three most important commercial species in the world and its catch occupies the second place among all catches of acipenserids (Tab. 2, appendix).

However, its national utilization is not easy to describe since official fisheries statistics do not distinguish between sturgeon species. The three commercially most important species are *Acipenser stellatus, Acipenser gueldenstaedtii*, and *Huso huso* and account for 90% of all sturgeon catches in the world.

The major fishing area for *Acipenser stellatus*, as well as for the two other commercially important species, is the Caspian Sea where about 90% of the world sturgeon catches are landed. Within the Russian part of the Caspian Sea region, the Volga-Caspian region is the most important producing about 80% of the total catch.

According to Khodorevskaya et al. (1997) *Acipenser stellatus* accounts for 30-35% of all sturgeon catches in the Volga-Caspian region.

FAO fisheries statistics (Tab. 1, appendix) show a drastical decline of the total landings of Acipenseridae within the last years. Before the disintegration of the former USSR only two states, the USSR and Iran, were fishing for sturgeons in the Caspian Sea. There was a quota system between both states and a complete ban on the fishery in the open sea. In 1984, about 26,538 metric tons of sturgeons were landed world-wide, about 24,245 metric tons of which were caught in the USSR and 1,557 metric tons in Iran. In 1988, when the disintegration of the former USSR began, the world sturgeon catches had already declined to about 21,291 metric tons, with the Russian Federation accounting for 19,027 metric tons, Iran accounting for 1,851 metric tons. Since the collapse of the USSR in 1991, five states, i.e. the Russian Federation, Azerbaijan, Khazakhstan, Turkmenistan and Iran, and the two autonomous republics Dagestan and Kalmykia, are fishing for sturgeons in the Caspian Sea. Until the beginning of 1996, there were no fishing regulations, i.e. quota systems, between these states and republics and fishing in the open sea was no longer prohibited. Since 1988, the catches further declined to about 15,124 metric tons in 1991 (Russian Federation: 9,539 metric tons; Iran: 3,036 metric tons; Azerbaijan: 108 metric tons; Khazakhstan: 1,766 metric tons) and only 8141 metric tons in 1994 (Russian Federation: 4,460 metric tons; Iran: 1,700 metric tons; Azerbaijan: 95 metric tons; Khazakhstan: 635 metric tons). The above are the official figures. Unfortunately, the collapse of the USSR led to an expansion of illegal fishing which escapes any statistics. Furthermore, the FAO fisheries statistics do not distinguish between Russian inland waters, which means that the figures for the Russian Federation contain also a small amount of catches in the Siberian and Far Eastern water systems, estimated to be about 200 metric tons in 1993 (Barannikova et al., 1995) as well as an amount of catch in the Black Sea basin. Data for the state of Turkmenistan are not given by FAO and it remains unclear, if the catches in the republics of Dagestan and Kalmykia are included in the figures of the Russian Federation.

The catch statistics for *Acipenser stellatus* in the northern part of the Caspian Sea basin show a steady decline from 5,700 metric tons in 1990 to 1,500 metric tons in 1994 (Tab. 2, appendix).

The second fishing area of *Acipenser stellatus*, as well as of *Acipenser stellatus* and *Huso huso*, is the Black-Azov Sea region where the sturgeon fishery is concentrated mainly in the north-western part near the Danube Delta (Romania) and in the Sea of Azov. According to FAO statistics, the annual sturgeon catches within this region were about 1,527 metric tons in the 1970s, with the USSR accounting for 1,434 metric tons, Bulgaria accounting for 12 metric tons and Romania for 81 metric tons. For Turkey, no sizeable commercial catch of sturgeons has been officially recorded. The sturgeon catches in the Black and Azov Seas decreased to a minimum record of about 585 metric tons in 1988 (Russian Federation: 520 metric tons, Bulgaria: 1 metric ton; Romania: 35 metric tons; new independent state of Ukraine: 29 metric tons) but raised again to 1,257 metric tons in 1994 (Russian Federation: 1,012 metric tons; Bulgaria: 10 metric tons; Romania: 8 metric tons; Ukraine: 227 metric tons). According to Birstein (1996), the catches in Bulgaria and Romania further declined in 1995. Only 5.5 metric tons of sturgeons have been legally caught in Romania of which about 3.9 metric tons were *Acipenser stellatus.* In Bulgarian waters, only 3 metric tons of sturgeon species were legally caught in 1995.

Acipenser stellatus is considered to be a valuable and delicious fish (Shubina et al., 1989). The edible part averages 63% of the total weight. The most highly priced product of this species is the caviar made from its eggs and called "sevruga". According to Josupeit (1994) the yields in caviar average between 2 and 17% of the total sturgeon catch, and up to 2 kg of "sevruga" caviar can be harvested from one mature female stellate sturgeon.

While the flesh of the stellate sturgeon is almost entirely produced for national trade, caviar is not only produced for domestic consumption but also for export. FAO statistics indicate that the global caviar production - like the world sturgeon catch - decreased drastically in the last decade, the statistics not distinguishing between caviar of the different sturgeon species. In the early 1980s, a total production of 2,500 metric tons of caviar has been officially recorded, and in 1992 about 1,500 metric tons have been legally produced world-wide (Josupeit, 1994). For 1996, experts estimate a total legal production of 122 metric tons of caviar world-wide, of which 190 metric tons originate from the Caspian Sea and 32 metric tons are coming from the Black-Azov Sea region, China, USA, Canada and Siberia (Tab.7, appendix).

The three major sturgeon species of which caviar is produced are *Acipenser gueldenstaedtii*, *Acipenser stellatus* and *Huso huso*, and account for 90% of the total caviar production. The major caviar producing countries are the Russian Federation and Iran and 90% of the world production of caviar originates from the Caspian Sea. After the collapse of the USSR, the three independent states of Azerbaijan, Khazakhstan and probably also Turkmenistan, and the two autonomous republics of Dagestan and Kalmykia also started to produce caviar. In the Black and Azov Sea region, the newly independant state of Ukraine also produced caviar.

According to FAO data (Josupeit, 1994) Iran experienced a steady increase of caviar production during the 1980s from about 200 to 300 metric tons, and almost all caviar produced in Iran (ca 95%) was exported (Josupeit, 1994). The main drop in the global production of caviar came from lower production in the Russian Federation. An important share of caviar used to stay in the former USSR, where about 85-90% of the production was consumed domestically and only 10% were exported (Josupeit, 1994; Taylor, 1996). The decline in disbursable income after the desintegration of the USSR led to a reduction of caviar consumption in all republics of the former USSR (Josupeit, 1994). As a consequence, almost all caviar produced in the CIS during the last years was exported. The dramatical decline in sturgeon resources within the last years (about 50%) will soon lead to a decline in the quantity of caviar which can be offered on both the national and international market.

Acipenser stellatus, like other sturgeons, is mainly caught with drift and stake nets and beach seines (Fischer et al., 1987). Poachers are mainly using bottom lines with hooks to catch sturgeons. Although it is possible to remove the eggs from live mature females by a surgical operation (a method designed by Russian scientists and especially carried out in hatcheries), the commercial harvest of caviar is still carried out by killing the animal, since the operation is too time consuming and survival rates of operated females are not reported. The declining catches of *Acipenser stellatus* as well as of the other sturgeon species reflect a drastical reduction of the population. The natural reproduction of the species is believed to be very low at present and Barannikova (1995) estimated the natural reproduction rate in 1993 to amount only 20% . Since the disintegration of the former USSR in 1991 until the beginning of 1996, there were no fishing regulations between the range states in the Caspian Sea basin. Experts fear that the sturgeon stocks are overexploited and that the present unregulated harvest is far from sustainable use. Especially the fishing in the open sea endangers the survival of the species, because a growing number of immature specimens is caught and hence the potential spawning stock is further reduced.

The two major sturgeon producing countries, e.g. the Russian Federation and Iran have ranching programmes for sturgeon species, including *Acipenser stellatus*.

The Russian Federation already began the artificial breeding and raising of sturgeons in the 1960s. Barannikova et al. (1995) report that in the early 1980s, 20 sturgeon hatcheries were operating in Russia, including 10 hatcheries in the Caspian Sea basin (of which 8 were located on the lower Volga) and 7 hatcheries in the Sea of Azov basin, while 3 hatcheries on Siberian rivers were producing *Acipenser baerii*.

Since 1994, only 2-4 of the former 8 hatcheries are still operating in the Volga River delta (V. Birstein, pers. comm.). According to Khodorevskaya et al. (1997) these hatcheries released about 10-11 million stellate sturgeon juveniles in 1993, and in 1994 only 4-7 million juveniles of *Acipenser stellatus* had been produced (Tab. 20, appendix). The hatcheries located upriver near the Volgograd Dam could not catch enough breeders for artificial reproduction in the same years because of the overfishing by poachers on spawning sites.

In the former USSR, a large amount of the sturgeon fry produced by this artificial propagation was transported to the northern Caspian Sea by special hatch boats and then released to the feeding grounds which are located in this area (Levin, 1995). This procedure guaranteed a high survival rate for the juvenile sturgeons as compared to the release into the rivers where the young fish may be caught by predators and do not find suitable food organisms. However, Levin (1995) reports that the number of sturgeon fry that was transported to and stocked into the Northern Caspian Sea was zero since 1993.

In the Sea of Azov region, about 30 million juveniles (mainly *Acipenser gueldenstaedtii* and *Acipenser stellatus*) were artificially propagated in hatcheries in 1993. Three hatcheries located on the Kuban River near the City of Krasnodar are still working efficiently. In 1993, they released 12.5 million stellate sturgeon juveniles and in 1994, 13.5 million juveniles were stocked into ther Sea of Azov (Chebanov and Savelieva, 1995).

Iran is also artificially propagating sturgeons since 20 years when the first hatchery was built in Rasht. According to the Iranian SHILAT, currently 5 hatcheries are working for the restocking programme of sturgeon species. The annual fry release in Iranian waters was about 3.4 millions of sturgeon juveniles, the different species not further distinguished (Tab. 21, appendix).

The ranching of *Acipenser stellatus* is contributing to a relative high degree to the size of the population and thus to the commercial fishery. In 1993, the estimated portion of *Acipenser stellatus* originating from hatcheries in the lower Volga River was about 30% (Barannikova, 1995) while in the Sea of Azov, about 80% of the stellate sturgeon catch is from hatchery raised fish.

Beside ranching, in 1985 the USSR also started extensive fish farming of sturgeons, including *Acipenser stellatus*, in warm effluent waters of thermal power stations. According to Barannikova et al. (1995) the total annual production of pond-reared sturgeon was about 200 metric tons within the area of the Russian Federation and about 200 metric tons in the Ukraine. These figures are given for all sturgeon species (4 different species and 6 different hybrids are grown). The so produced fish are contributing to the domestic demand for sturgeon meat. Caviar from sturgeon species grown in aquaculture is still not produced in economically significant quantities.

3.2 Legal international trade

The main and highly priced sturgeon product on the international market is caviar. However, official statistics do usually not distinguish between caviar of different sturgeon species. The three main commercial species are *Acipenser stellatus, Acipenser gueldenstaedtii* and *Huso huso* accounting for 90% of the world production of caviar. Caviar of *Acipenser stellatus* is sold under the name "sevruga".

FAO statistics (Josupeit, 1994) indicate that the total world trade of caviar has declined, given the recent crisis of the Russian industry. In 1988, trade of caviar (excluding re-exports) was 370 metric tons, while in 1994 only 220 metric tons were officially recorded. However, these figures underestimate total trade as there is a substantial illegal trade and supply, especially after the collapse of the former USSR.

In 1992, FAO recorded the total exports of caviar with 366 metric tons, of which 169 metric tons were legally exported by Iran and only 55 metric tons by the Russian Federation, while Germany re-exported 48 metric tons (Josupeit, 1994; Tab. 9, appendix). The countries of origin of the remaining 94 metric tons of exported caviar were not further specified. The reported exportation of caviar declined since 1988, when 572 metric tons were officially recorded of which 255 metric tons came from Iran and 143 metric tons from the USSR (Tab. 9, appendix). Of the total Caspian caviar production, which in 1996 is estimated to total about 270 metric tons (Tab. 7, appendix), most will be traded on the international market, judging from previous years´ trade records (DeMeulenaer and Raymakers, 1996). The expected legal production of caviar in 1996 is 45 metric tons in Russia, 20 metric tons in Kazakhstan, about 5 metric tons in Azerbaijan and about 120 metric tons in Iran (Tab. 7, appendix). The illegal caviar production in the Caspian Sea basin is estimated to be about 70-80 metric tons in 1996.

FAO recorded the official imports of caviar being stable during the period from 1992 to 1994 and amounting to about 530 metric tons per year (Josupeit, 1994). The major import market for caviar from Iran (Tab. 11, appendix) and the former Soviet Union (Tab. 10, appendix) are the EU with an average importation of about 200 metric tons per year (Tab. 15, appendix), while Japan imported on the average 60 metric tons (Tab. 13, appendix), the U.S.A. about 52 metric tons (Tab. 14, appendix) and Switzerland an estimated 66 tons caviar per year (data provided by the ´Bundesamt für Verinärwesen´, Switzerland). However, some of the official import statistics (Japan and Switzerland) do not distinguish between roe from sturgeons and other fish species, a fact which causes a further problem to the estimation of the total volume of the caviar in trade.

Within the EU (Tab. 15, appendix), Germany is the main importer with an average of 81 metric tons per year, but a huge quantity is repackaged and re-exported into neighbouring countries. In 1994, the total import of caviar into Germany was 104.1 metric tons of which 27.3 metric tons were re-exported and 75.8 metric tons were consumed in the country (Tab. 17, appendix). France is the second major importer with an average of 53 metric tons per year and is the major consumer of caviar within the EU. In 1994, France imported 47 metric tons of caviar (Tab. 15, appendix). Belgium/Luxembourg and the UK import an average of 23 metric tons of caviar per year; in 1994, Belgium/Luxembourg imported 28 metric tons and the UK imported only 6 metric tons (Tab. 15, appendix). The main suppliers of caviar to the EU are the Russian Federation, Iran, Kazakhstan and China (Tab. 16, appendix).

Official Japanese import statistics (Tab 13, appendix) show a total annual import of caviar into Japan of 56 metric tons in 1994, the main suppliers being the Russian Federation (22 metric tons), Iran (25 metric tons) and China (7 metric tons). 2 metric tons of caviar are imported from other countries.

The US Marine Service statistics show a total import of 54.2 metric tons of caviar into the USA in 1994 (Tab. 14, appendix). The main suppliers of caviar to the USA are the Russian Federation, Canada, China, Kazakhstan, Sweden and Germany (Tab. 14).

Switzerland imported in 1994 about 62 metric tons of caviar, the main suppliers being Iran, France, Germany, Sweden, Canada, Russia and Japan. Switzerland re-exported in 1994 about 13.5 metric tons of caviar, mainly to Saudi Arabia, France, USA and Australia.

According to Taylor (1996), the total Western World demand for caviar from Iran and the Russian Federation was about 450 metric tons in 1995 (Tab. 6, appendix), of which 200 metric tons were Iranian "sevruga" and 140 metric tons were Russian "sevruga". However, Taylor estimates that the total production of caviar from Iran and the former USSR in 1995 was only 228 metric tons, including 55 metric tons of Iranian "sevruga" and 30 metric tons of Russian "sevruga". Hence, the Western World demand for caviar in general and "sevruga" in special exceeded the actual total production by more than 100%.

The world caviar market is currently undergoing a major crisis (Josupeit, 1994; TRAFFIC, 1995, Taylor, 1996; DeMeulenaer and Raymakers, 1997). Low quality caviar flooded the Western European markets in 1993 and 1994 (Taylor, 1996). This is mainly caused by over-exploitation, illegal production and smuggling of caviar, especially from the former Soviet Union. The sanitary conditions under which caviar is legally and illegally produced in this states are disastrous and as a result high amounts of processed caviar are only fit for disposal. Taylor (1995) estimated that for example in Azerbaidjan although the raw material was of high quality, almost 80% of the processed caviar was only fit for disposal due to disastrous conditions during production, packaging and dispatch. As a result prices collapsed also for the high quality caviar still arriving from the Republics of the former USSR and from Iran (Josupeit, 1994).

The average unit value of caviar exports shows an interesting development Tab. 9, appendix). While the unit value of the Iranian caviar has steadily increased from US$ 109/kg before 1988 to US$ 249/kg in 1992, the value of the Russian caviar has gone down (Josupeit, 1994). Unit value of caviar exports from the former USSR peaked at US$ 279/kg in 1990. The recent changes in the former USSR and the decreasing quality of Russian caviar compelled Russians to sell at much lower prices, and the unit value fell to US$ 120/kg. However, German import data (Tab. 17, appendix) show prices for caviar from the CIS raising again after 1993.

According to Taylor (1996; Tab. 19a-b, appendix) the purchasing price for Russian "sevruga" peaked in 1989 at about 500 US$ (332 DM) per kg net weight (duty unpaid) but fell down to about 435 US$ (290 DM) per kg in 1995, while the purchasing price for Iranian "sevruga" amounted to about 517 US$ (345 DM) per kg net weight in 1989, went down to 450 US$ (304 DM) per kg in 1990, but finally raised again to 570 US$ (380 DM) per kg in 1995. The retail prices for caviar in 1995 are shown in Table 18 (appendix).

The main importers expressed their concern about the present state of the resource and fear a drastic shortage of caviar within the near future (Josupeit, 1994; Taylor, 1996). It seems inevitable that trade in caviar, both legal and illegal, is bound to shrink in the coming years and will fail to supply demand (DeMeulenaer and Raymakers, 1996).

3.3 Illegal trade

According to several experts and TRAFFIC (1995) illegal catch of sturgeons (mainly the three commercially important species *Acipenser gueldenstaedtii*, *Acipenser stellatus*, *Huso huso*) is of major concern, accounting for perhaps more than 90% of all sturgeon caught in the Caspian Sea.

In Russia, widespread illegal fishing for sturgeon is known to be practised, motivated by international demand for the highly priced caviar which cannot be met by the legal production. The illegally traded products are caviar and to a lesser degree the meat. Whereas the meat is probably for domestic consumption only, caviar is mainly smuggled outside the country and subject of an international illegal trade. This much is testified to by the 1452 sturgeon poachers detained and the more than 5 metric tons of illegally caviar and 113 metric tons of sturgeon confiscated in Russia in 1994 (according to the Ministry of Internal Affairs). In the Astrakhan region, the Russian centre of caviar trade, seven caviar canning plants operating illegally were closed down in the same year. Also in 1994, an additional 21 metric tons of sturgeon meat and 10.5 metric tons of caviar were confiscated as products of unauthorised fishing in other Russian regions (TRAFFIC, 1995). Reflecting the scale of illegal sturgeon fishing is the estimate that as much as 80% of the caviar trade is under unofficial control in parts of the CIS, and the illegal production of 1200 metric tons of caviar in Russia in 1990, and of 200 metric tons in 1992 was reported (Lindberg, 1994). The former quantity would equate to a sturgeon catch of about 16 000 metric tons, based on the calculation that approximately 7.5% of a given weight of sturgeon catch results in caviar. This amount is as high as the reported commercial sturgeon harvest at the time from the USSR (Tab. 1, appendix), representing a heavy toll on a declining stock.

Taylor (1995) estimates that the illegal trade of Russian caviar (mainly from the 3 commercially important species *Acipenser gueldenstaedtii*, *Acipenser stellatus*, *Huso huso*) which began on a large-scale since the disintegration of the former Soviet Union, peaked to about 100 metric tons in 1993. The trade channels are believed to pass from the Russian Federation mainly through the former Eastern block states, especially Poland, where poachers did not only smuggle caviar out of Russia, but also reprocessed and repackaged it and thus marketed it as "a new catch" (Taylor, 1996). Illegal caviar is sometimes repackaged in Eastern Europe and can retail at prices half or even less than normal, e.g. caviar of 700 US$ per kg is known to be sold for as low as 150 US$ per kg.

Taylor (1996) reports that in 1983, the illicit trade of Iranian caviar ("bazaar caviar", probably made of roe from *Acipenser gueldenstaedtii*, *Acipenser persicus*, *Acipenser stellatus* and *Huso huso*) reached its peak at 70 metric tons, which were transported to the West through adventurous channels. However, draconian measures by the Iranian state over ten years eventually brought the smuggling back down to pre-revolution levels of about 2-4 metric tons since 1993 (Taylor, 1996).

Large-scale smuggling and exporting of caviar has also developed in Azerbaijan and illegal trade channels led or still lead through Turkey (see Tab. 16, appendix) and Dubai, as well as Germany and U.S.A. (Taylor, 1996). The amount of caviar smuggled out of Azerbaijan was estimated to be more than 15 metric tons in 1993.

According to several importers in France, Germany and Belgium, the region of Astrakhan (Russia) and the State of Azerbaijan may be the two major suppliers of illegal Caspian caviar in trade, while Kazakhstan reputedly has a more controlled trading structure (DeMeulenaer and Raymakers, 1996).

Not only are sturgeon stocks, and thus the supply of caviar, under threat from unregulated fishing, but so are they also as a result of the illegal processing plants, which in turn circumvent appropriate control measures for caviar production. Caviar prepared in such unofficial processing plants does usually not meet the sanitary standards required by the importing countries and is considered to be of very low quality.

The proposed amendment is expected to stop the enormous illegal trade of caviar which leads to a complete overexploitation of the sturgeon stocks by means of a trade control given by the tools of CITES.

3.4 Actual or potential trade impacts

The caviar trade, especially the increasing illegal trade, threatens the survival of *Acipenser stellatus* because the natural reproduction of the species within its entire range has decreased to a critical point within the last years and the production of caviar leads to a further reduction of mature females. The relative high prices for caviar seduces an increasing number of poachers to earn a high amount of money within a short time. Although the entire caviar supply by the main exporting countries such as Iran and the Russian Federation declined to an estimated amount of 228 metric tons in 1995 (Taylor, 1996), the Western World demand remained stable at about 450 metric tons in 1995, and thus exceeded the supply by 100%.

3.5 Captive breeding or artificial propagation for commercial purposes (outside countries of origin)

According to Anonymous (1994) *Acipenser stellatus* has been introduced into aquaculture in Belgium and France. The size of the broodstock and the total production is not given in the available statistics.

4. Conservation and Management

4.1 Legal status

4.1.1 National

Acipenser stellatus is not fully protected by law in any of the range states.

In the Russian Federation and Iran, private sturgeon fishery is prohibited and a special fishing licence is necessary to catch sturgeon.

The legal status of *Acipenser stellatus* in the other range states is not reported.

4.1.2 International

Acipenser stellatus is listed in Appendix III of the Bern convention (protected fauna).

4.2 Species management

4.2.1 Population monitoring

There is no information about a specific monitoring programme for *Acipenser stellatus* in the Russian Federation, Iran, as well as in the other range states.

In Romania, The Centre of Research for Fish Aquaculture, Fishing and Fishprocessing in Galati is monitoring the situation of sturgeon stocks upriver the Delta of the Danube (Birstein, 1996).

4.2.2 Habitat conservation

No information available.

4.2.3 Management measures

Early management measures in the Caspian Sea mainly conducted by the Russian Federation since the construction of the Volgograd Reservoir Dam in the 1960s included the construction of fish lifts, the construction of artificial spawning grounds below insurmountable dam constructions and the introduction of valuable food organisms (such as *Nereis diversicolor*) into certain regions of the Caspian Sea (Rochard et al., 1990).

Before the disintegration of the USSR, there was a strict management of the sturgeon fishery in the Caspian Sea, including a quota system, maximum and minimum size restrictions, closed seasons and a complete ban on the open sea fishery. Since the collapse of the USSR in 1991, five states (Russian Federation, Iran, Azerbaijan, Khazakhstan and Turkmenistan) and the two autonomous republics of Dagestan and Kalmykia are fishing for sturgeons in the Caspian Sea. Until the beginning of 1996, there was no regulation of the fishery between the bordering countries and the fishing in the open sea was no longer prohibited. Since 1992, there has been an effort to forge an international agreement governing Caspian sturgeon catch between Russia, Kazakhstan, Turkmenistan, Azerbaijan, and Iran. A Committee for the Conservation and Use of Biological Resources in the Caspian Sea has been founded. Until the beginning of 1996, however, delegations from the five Caspian countries involved have failed to agree on the size of their economic zones. In June 1996, the countries agreed on ban on fishing in the open sea. A quota system for the sturgeon catch has been set up between the former USSR countries: depending on the degree of contribution to the reproduction of sturgeon, each country obtains a quota in the Volga River (e.g. Russia 70%, Kazakhstan 18%, Azerbaijan 6% and Turkmenistan 6%).

The Russian Federation and Iran have ranching programmes for sturgeon species, including *Acipenser stellatus*. In Russia, several State hatcheries are artificially breeding and raising sturgeons since the 1960s. According to Khodorevskaya et al. (1997) these hatcheries released about 10-11 million stellate sturgeon fingerlings in 1993, and in 1994 about 4-7 million juveniles of *Acipenser stellatus* had been produced (Tab. 20, appendix).

Iran is also artificially propagating sturgeons since 20 years when the first hatchery was built in Rasht. According to the Iranian Fishery Organisation SHILAT, currently 5 hatcheries are working for the restocking programme of sturgeon species. The annual fry release in Iranian waters was about 3.4 millions of sturgeon juveniles, the different species not further distinguished (Tab. 21, appendix).

In the Sea of Azov region, about 30 million juveniles (mainly *Acipenser gueldenstaedtii* and *Acipenser stellatus*) were artificially propagated in hatcheries in 1993. Three hatcheries located on the Kuban River near the City of Krasnodar are still working efficiently. In 1993, they released 12.5 million stellate sturgeon juveniles and in 1994, 13.5 million juveniles of *Acipenser stellatus* were stocked into the Sea of Azov (Chebanov and Savelieva, 1995).

In Romania, *Acipenser stellatus* is artificially propagated by the Center of Research for Fish Aquaculture, Fishing and Fishprocessing in Galati (Birstein, 1996). The limiting factor of the breeding programme in 1995 was the small number of stellate breeders caught in the river. There is no information about the size of the broodstock in captivity and the amount of production of young sturgeons within this country.

4.3 Control measures

4.3.1 International trade

None.

4.3.2 Domestic measures

Not reported.

5. Information on Similar Species

Acipenser stellatus is sympatric with *Acipenser gueldenstaedtii*, *Acipenser persicus*, *Acipenser nudiventris* and *Huso huso*.

6. Other Comments

All range states of the species (except Azerbaijan, Georgia, Kazakhstan, Turkmenistan and Ukraine which have been contacted in a meeting, see below) has been contacted on 13 March 1996 and 21 May 1996. A copy of the first draft of the proposal ("working document") has been sent to the range states on 19 August 1996. The comments of the range states that have been received are attached in the appendix at the end of this document.

The "working document" has also been presented at the 13th meeting of the Animals Committee of CITES in Prague, Czech Republic, on 23-27 September 1996 for discussion.

Additionally, the Authorities of the Russian Federation have been contacted in a first meeting in Moscow on 25 to 26 June 1996 for bilateral consultations. A second meeting ("Multilateral Consultations on the Problems of Sturgeon Species within the Framework of CITES") which took place on 21-22 November 1996 in Moscow, has been organised in order to consult with the states of Azerbaijan, Kazakhstan, Turkmenistan and Ukraine (which are not members to CITES) as well as with China, Georgia, Iran, USA and the Russian Federation. The minutes of this meeting and the comments of the range states that have been received are attached in the appendix at the end of this document.

7. Additional Remarks

In addition to the consultations with the range states of the species, countries which range amongst the main caviar consumers, such as the states of the European Union, Switzerland and Japan, has been contacted on 13 March 1996 and 21 May 1996. The so obtained statistics and information are included in the text.

8. References

Altuf´yev, Yu.V. 1994. Morphofunctional Condition of Muscle Tissue and Liver of Juvenile Russian Sturgeon and Beluga with Chronic Intoxication. Journal of Ichthyology 34 (5): 134-138.

Altuf´yev, Yu.V., A.A. Romanov and N.N. Sheveleva. 1992. Histology of the Striated Muscle Tissue and Liver in the Caspian Sea Sturtgeons. Journal of Ichthyology 32: 100-115.

Anonymous. 1994. Aquaculture Production: Overview of the World Production of Sturgeon from Aquaculture and Fishery. Aquaculture Europe 18 (4): 34.

Bacalbasa-Dobrovici, N. 1997. Endangered migratory sturgeons of the lower Danube River and its delta. In: V. Birstein, J. R. Waldman, and W. E. Bemis (eds.). Sturgeon Biodiversity and Conservation. Kluwer Academic Publishers, Dordrecht. pp. 201-207.

Barannikova, I.A. 1995. Measures to Maintain Sturgeon Fisheries under Conditions of Ecosystem Changes. Proceedings of the Second International Symposium on Sturgeons, September 6-11, 1993. Moscow-Kostroma-Moscow (Russia). VNIRO Publication. Pp. 131-136.

Barannikova, I.A., I.A. Burtsev, A.D. Vlasenko, A.D. Gershanovich, E.V. Makarov and M.S. Chebanov. Sturgeon Fisheries in Russia. Proceedings of the Second International Symposium on Sturgeons, September 6-11, 1993. Moscow-Kostroma-Moscow (Russia). VNIRO Publication. Pp. 124-130.

Birstein, V.J. 1993a. Sturgeons and Paddlefishes: Threatened Fishes in Need of Conservation. Conservation Biology 7 (4):773-787.

Birstein, V.J. 1993b. Draft Application to CITES: Order Acipenseriformes. Unpublished.

Birstein, V.J. 1996a. Sturgeons May Soon Disappear from the Caspian Sea. Russian Conservation News, No. 7 :15-16.

Birstein, V.J. 1996b. Sturgeons in the Lower Danube: A Trip to Romania. The Sturgeon Quarterly, Vol. 4 (½) :10-11.

Chebanov, M. S., and E. A. Savelieva. 1995. Sturgeon culturing on the Kuban River. Rybovodstvo I Rybolovstvo, No. 2 :10-13 (in Russian).

DeMeulenaer, T. and C. Raymakers. 1996. Sturgeons of the Caspian Sea and the international trade in caviar. TRAFFIC International.

Dumont, H. 1995. Ecocide in the Caspian Sea. Nature 377 :673-674.

FAO, 1989. Technical Cooperation Programme, Turkey. Appraisal of the Sturgeon and Seatrout Fisheries and Proposals for a Rehabilitation Programme. FI: TCP/TUR/8853. Report prepared by D. Edwards and S. Doroshov for the project "Sturgeon and Seatrout Fisheries Development".

Fischer, W., M. Schneider and M.-L. Bauchot. 1987. Fiches FAO d´Identification des Especes pour les Besoins de la Pêche. Mediterranee et Mer Noir, Zone de Pêche 37 (Révision 1), Vol. II: Vertèbres. FAO, Rome. Pp. 944-952.

Hensel, K., and J. Holcik. 1997. Past and current status of sturgeons in the upper and middle Danube. In: V. Birstein, J. R. Waldman, and W. E. Bemis (eds.). Sturgeon Biodiversity and Conservation. Kluwer Academic Publishers, Dordrecht. pp. 185-200.

IUCN (1996). 1996 IUCN Red List of Threatened Animals. IUCN, Gland, Switzerland.

Ivanov, V. P., A. D. Vlasenko, and R.P. Khodorevskaya. 1995b. How to preserve sturgeons. Rybnoe Khozyaistvo, No. 2 :24-26 (in Russian).

Ivanov, V. P., V. N. Belyaeva, and A. D. Vlasenko. 1995a. Regional distribution of commercial resources of the Caspian Sea. Rybnoe Khozyaistvo, No. 2 :18-21 (in Russian).

Jankovic, D. 1995. Populations of Acipenseridae Prior to and after the Construction of the HEPS "Djerdap I and II". Proceedings of the Second International Symposium on Sturgeons, September 6-11, 1993. Moscow-Kostroma-Moscow (Russia). VNIRO Publication. Pp. 235-238.

Josupeit, H. World Trade of Caviar and Sturgeon. FAO, Rome. 100 pp.

Khodorevkaya, R.P., G.F. Dovgopol and O.L Zhuravleva. 1995. Formation of Commercial Sturgeon (Acipenseridae) Stocks. Proceedings of the Second International Symposium on Sturgeons, September 6-11, 1993. Moscow-Kostroma-Moscow (Russia). VNIRO Publication. Pp. 137-150.

Khodorevskaya, R. P., G. F. Dovgopol, O. L. Zhuravleva, and A. D. Vlasenko. 1997. Present status of commercial stocks of sturgeons in the Caspian Sea basin. In: V. Birstein, J. R. Waldman, and W. E. Bemis (eds.). Sturgeon Biodiversity and Conservation. Kluwer Academic Publishers, Dordrecht. pp. 209-219.

Khodorevskaya, R.P., A.A. Polyaninova, P.P. Geraskin and A.A. Romanov. 1995. A Study on Physiological and Biochemical Status of Beluga Sturgeon, *Huso huso* (L.), and its Feeding Habits. Proceedings of the Second International Symposium on Sturgeons, September 6-11, 1993. Moscow-Kostroma-Moscow (Russia). VNIRO Publication. Pp. 164-177.

Kuz´mina, O. Yu., V.I. Luk´yanenko, Ye.I. Shakmalova, Ye.A. Lavova and Yu.V. Natochin. 1993. Specific Features of Water and Salt Homeostasis in Sturgeon during Muscle Degeneration. Journal of Ichthyology 33: 93-100.

Lelek, A. 1987. Threatened Fishes of Europe. The Freshwater Fishes of Europe. Vol. 9. The European Committee for the Conservation of Nature and Natural Resources - Council of Europe (ed.). Wiesbaden, AULA-Verlag. Pp. 42-57.

Levin, A.V. 1995. Russian Sturgeon, *Acipenser gueldenstaedti* Brandt, Stocking in the Volga-Caspian Basin. Proceedings of the Second International Symposium on Sturgeons, September 6-11, 1993. Moscow-Kostroma-Moscow (Russia). VNIRO Publication. Pp. 178-188.

Levin, A.V. 1996. The Distribution and Migration of Sturgeon in the Caspian Sea. In: Workshop "Sturgeon Stocks and Caviar Trade", Bonn, October 9-10 1995. In press.

Lindberg, O. (1994). Black market turns importers to Iran for caviar. International Management, June 1994.

Lukyanenko, V. I., A. L. Polenov, and A. L. Yanshin. 1994. Is it possible to save Caspian sea sturgeons? Vestnik Rossiiskoi Akademii Nauk, 64 (7) :606-620 (in Russian).

Raspopov, V. M., P. V. Veshchev, A. S. Novikova, and A. E. Egorova. 1995. Causes of te critical situation with the natural reproduction of sturgeons in the Volga River. Rybnoe Khozyaistvo, No. 2 :21-23 (in Russian).

Rochard, E., G. Castelnaud and M. Lepage. Sturgeons (Pisces: Acipenseridae): Threats and Prospects. Journal of Fish Biology 37 (Suppl. A): 123-132.

Rodionov, S. N. 1994. Global and Regional Climate Interaction: The Caspian Sea Experience. Kluwer Academic Publishers, Dordrecht. 241 pp.

Romanov, A.A. and N.N. Sheveleva. 1993. Disruption in the Gonadogenesis in Caspian Sturgeons (Acipenseridae). Journal of Ichthyology 33 (3): 127-133.

Romanov, A.A. and Yu.V. Altuf´yev. 1991. Tumors in the Sex Glands and Liver of the Caspian Sea Sturgeons. Journal of Ichthyology 30: 44-49.

Romanov, A.A. and Yu.V. Altuf´yev. 1993. Ectopic Histogenesis of Sexual Cells of Caspian Sea Sturgeon. Journal of Ichthyology 33 (2): 140-150.

Sagers, M. J. 1994. The Oil Industry in the Southern-Tier Former Soviet Republics. Post-Soviet Geography, 35 (5) :267-298.

Shagaeva, V.G., M.P. Nikol´skaya, N.V. Akimova and K.P. Markov. 1995. Pathology of the Early Ontogenesis of the Volga River Basin Acipenseridae. Proceedings of the Second International Symposium on Sturgeons, September 6-11, 1993. Moscow-Kostroma-Moscow (Russia). VNIRO Publication. Pp. 62-73.

Shagaeva, V.G., M.P. Nikol´skaya, N.V. Akimova, K.P. Markov and N.G. Nikol´skaya. 1993. A Study of the Early Ontogeny of Volga Sturgeon (Acipenseridae) Subjected to Human Activity. Journal of Ichthyology 33 (6): 23-41.

Shubina, T.N., A.A. Popova and V.V. Vasil´ev. 1989. *Acipenser stellatus* Pallas, 1771. In: Holcík, J. (ed). The Freshwater Fishes of Europe. Vol. 1/II: General Introduction of Fishes. Acipenseriformes. Wiesbaden, AULA-Verlag. Pp. 395-443.

Taylor, S.1996. The Historical Development of the Caviar Trade and Industry. In: Workshop "Sturgeon Stocks and Caviar Trade", Bonn, October 9-10 1995. In press.

TRAFFIC Europe. 1995. A TRAFFIC network report to the CITES Animals Committee on the TRAFFIC Europe Study of the International Trade in Sturgeon and Sturgeon Products. Unpublished report. 3pp.

Veshchev, P. V. 1993. Effect of water level of the Volga River on reproduction of stellate sturgeon. Vodnye Resoursy, No. 2 :225-228 (in Russian).

Veshchev, P. V. 1995. Natural Reproduction of Volga River Stellate Sturgeon, *Acipenser stellatus*, under New Fishing Regulations. Journal of Ichthyology, 35 (9) :281-294.

Vlasenko, A. D. 1990. Sturgeon population size in the Caspian Sea. Rybnoe Khozyaistvo, No. 7 :53-56 (in Russian).

Vlasenko, A.D. 1994. The Present Status and Conservation of Sturgeons (Acipenseridae) in the Caspian Basin. Proceedings of the International Conference on Sturgeon Biodiversity and Conservation, New York 1994.

Volovik, S.P., V.G. Dubinina and AQ.D. Semenov. 1993. Hydrobiology and Dynamics of Fisheries in the Azov Sea. Studies and Reviews. General Fisheries Council for the Mediterranean. No. 64. FAO, Rome. Pp. 1-58.

Zolotarev, P. N., V. A. Shlyakhov, and O. I. Akselev. 1996. Feeding grounds and feeding of the Russian sturgeon *Acipenser gueldenstaedti* and sevruga *Acipenser stellatus* in the north-western part of the Black Sea in contemporary ecological conditions. Voprosy Ikhtiologii, 36, No. 3 :357-362 (in Russian).

Acipenser transmontanus

1. Taxonomy

   1.1 Class: Actinopterygii

   1.2 Order: Acipenseriformes

   1.3 Family: Acipenseridae

   1.4 Species: *Acipenser transmontanus* Richardson, 1836

   1.5 Scientific synonyms: *Acipenser aleutensis* Fitzinger and Heckel, 1836
   Acipenser brachyrhynchus Ayres, 1854
   Antaceus caryi Duméril, 1867
   Antaceus ayresii Duméril, 1867
   Antaceus putnami Duméril, 1867

   1.6 Common names:

Dutch:	Pacific steur
English:	White sturgeon, Pacific sturgeon, Oregon sturgeon, Columbia sturgeon, Sacramento sturgeon
Finnish:	Valkosampi, Valkosilmäkuha
French:	Esturgeon blanc
Polish:	Jesiotr amerykanski

2. Biological Parameters

   2.1 Distribution

Countries of origin: Canada, U.S.A.

Acipenser transmontanus is restricted to the Pacific shores of North America from the Aleutian Islands of Alaska to Monterey, California (Scott and Crossman, 1973; Lane, 1991). Sizeable populations of this species are apparently limited to three river systems, the Fraser River and its tributaries in British Columbia, Canada; the Columbia River system (lower Columbia River and its tributaries in the States of Washington, Oregon, Montana and Idaho, U.S.A.; upper Columbia River in British Columbia, Canada) and the Sacramento-San Joaquin Rivers in California, U.S.A. (Scott and Crossman, 1973; Lane, 1991; NPSSC, 1993; Echols et al., 1995).

A genetically distinct population of *Acipenser transmontanus* that has been isolated from other populations in the Columbia River basin for approximately 10,000 years is found in the Kootenai River and Lake (in Idaho, Montana and British Columbia) (Apperson, 1993; Birstein and Bemis, 1995).

Acipenser transmontanus seems not necessarily be an anadromous species, since some populations in the Columbia River got landlocked where dams have been constructed (Lane, 1991; McCabe et al., 1993). However, there are only few records of the species encountered on Sea and most of the specimens are found in the river systems even if the rivers are not impounded (Scott and Crossman, 1973). The migration pattern of the White sturgeon is not fully understood up to date.

   2.2 Habitat availability

On the Columbia River, hydropower dams, the first constructed in the 1930s, have inundated sections of the once free flowing river (Rieman and Beamesderfer, 1990). A white sturgeon population that once moved freely within the river system and between the river and the ocean is now restricted to a single free-flowing segment with assess to the ocean and several smaller segments (reservoirs) blocked by dams. White sturgeon do move between the reservoirs, but the extent of movements relative to historic patterns is unknown and is thought to be very limited. Habitat throughout the Columbia River has been altered by flow regulation, channel modification, diking and dredging. The lowering of spring and summer discharges from hydropower system operation reduces the availability of spawning grounds and the population living in impounded waters seems to be less reproductive than the population living in the unimpounded river segment (Beamesderfer, 1993; Parsley and Beckman, 1994).

On the Kootenai River, the Libby Dam was built in 1972. The operation of the dam since its construction has kept the river discharges artificially low throughout the spawning season in spring (Apperson, 1993; Birstein and Bemis, 1995). This led to a reduced availability of adequate spawning grounds and, as a consequence, there has been virtually no recruitment of juveniles into the population since the mid-1970s.

For both other river systems of the species' range, the Fraser River and Sacramento-San Joaquin River basins, the loss or degradation of habitat are not documented.

2.3 Population status

There is no estimate of the total size of the population and investigations on the abundance mainly concentrate on the three river systems in which *Acipenser transmontanus* occurs. The largest population is believed to live in the Columbia River basin (Lane, 1991) and the unimpounded river section downstream from the Bonneville Dam (the lowermost dam) to the ocean supports the most productive population of White sturgeon within its total range (De Vore, 1993; DeVore et al., 1995). This might be reflected by the average yield, which during the past ten years has been approximately 350 metric tons annually; in 1987, a record 72,00 White sturgeon were harvested from the lower Columbia River.

In British Columbia, the largest known population of *Acipenser transmontanus* is found in the Fraser River system (Echols et al., 1995). However, there are no estimates of the total size of the population in Canadian waters.

By 1990, the size of the Kootenai River White sturgeon population has been estimated to consist of 880 individuals with approximately 80% of the specimens being more than 20 years old (Apperson, 1993). This estimate is based on setlines and angling samples during 1989 through 1992 and on tag returns.

In the Sacramento- San Joaquin Estuary, the population of *Acipenser transmontanus* has been estimated by 1990 to consist of about 27,000 individuals with a total length (TL) of 102 cm and more. These data are gained by a tagging programme of the California Department of Fish and Game (Kohlhorst, 1995).

Acipenser transmontanus is listed to be at Lower Risk by IUCN (1996). The status of the Kootenai River subpopulation (USA) is classified as Endangered by IUCN (1996).

Both the U.S.A. and Canada have introduced *Acipenser transmontanus* in aquaculture. However, there are no data about the size of the population in captivity.

2.4 Population trends

All populations of *Acipenser transmontanus* drastically declined since the turn of the century when the stocks were overexploited in all known river systems that are inhabited by the species (Scott and Crossman, 1973; Rieman and Beamesderfer, 1990; Echols, 1995; Kohlhorst, 1995).

For the abundance of *Acipenser transmontanus* in Canadian waters, i.e. the Fraser River system, and for population trends within the last decades, no reliable data exist. Lane (1991) states that the extant populations in Canada may presently appear to be in a healthy state.

In the Columbia River, the largest population of *Acipenser transmontanus* is found (De Vore, 1993). The status and dynamics of each functionally isolated population in the impounded river channel is unique and the productivity is less in the reservoirs than in the unimpounded area between the estuary and the lowermost dam (Bonneville Dam) (Beamesderfer, 1993; Beamesderfer et al., 1995). The populations in the reservoirs are believed to decrease, since natural reproduction is reduced due to a low water level artificially produced by a low discharge of hydropower system operation and a resulting reduction of adequate spawning grounds. There are no trends indicated for the most abundant and highly reproductive population living in the lower stretches of the Columbia River from the mouth to the lowermost Bonneville Dam. However, some authors (Rieman and Beamesderfer, 1990; DeVore, 1993) indicate that this stock is overexploited with an exploration rate being twice of that what the population could sustain.

The Kootenai River population of *Acipenser transmontanus* has drastically declined with the building of the Libby Dam (Montana) in 1972 which resulted in a loss of adequate spawning grounds. While Andrusak (1980, in Lane 1991) estimated the population size in the Kootenai River and Lake to approximately 3,000 to 5,000 fish (estimate based on tag returns), population estimates from 1982 and 1990 show a decline in the number of fish present from 1,194 to 880, a decline caused by an absence of recruitment of juveniles to the population since the mid 1970s (Apperson, 1993; Birstein and Bemis, 1995).

Tagging studies in the Sacramento-San Joaquin estuary in California indicate that the abundance of legal-sized (with a total length of 102 cm and more) white sturgeon has varied from approximately 11,000 to 128,000 individuals during the last 35 years (Kohlhorst, 1995). Results of a tagging studies in 1990 and 1991 show a substantial decline in White sturgeon abundance in the estuary from a high of 128,000 in 1984 to only 27,000 in 1990 (numbers include only individuals with a total length of 102 cm and more), which corresponds to an increased sport fishery since 1984 (Kohlhorst, 1995).

2.5 Geographic trends

No information available.

2.6 Role of the species in its ecosystem

Acipenser transmontanus is the largest North American sturgeon and probably the largest fish found in the freshwater of Canada (Scott and Crossman, 1973). The reported (but unsubstantiated) record of one White sturgeon was approximately 6 m in length and 630 kg in weight and the estimated age of the species may exceed 100 years (Lane, 1991). In incidental catches, however, the total length of the specimens mainly varies between 0.18 to 2.26 m, with larger fish being extremely rare (Scott and Crossman, 1973).

The White sturgeon is mainly a bottom feeder. The food of smaller sturgeons consists predominantly of chironomids and to smaller amounts of mysids, daphnids, *Chaoborus* larvae, molluscs, immature mayfly, caddisfly, stonefly and copepods (Scott and Crossman, 1973). For larger individuals (> 50 cm), fish (lampreys, sculpins, threespine stickleback etc.),crayfish (*Pacifastacus* spp., etc.) and chironomids become the principal food items.

There are no published accounts of predators of either young or adult White sturgeon other than the report of attacks by the Pacific lamprey, *Entosphenus tridentatus* (Scott and Crossman, 1973). White sturgeon probably compete for food in fresh waters with the Green sturgeon, *Acipenser medirostris*, as well as with other bottom-feeding fish (Scott and Crossman, 1973).

Even if the ecology of *Acipenser transmontanus* is rather well known, the consequences of a depletion of the population for those species depending or associated with it is not predictable.

2.7 Threats

The main threat to the species is considered to be the loss of habitat and adequate spawning grounds due to dam construction on the inhabited river systems. Hydropower system operations on the Columbia River led to a low water level through low discharges, mainly in spring and summer, which reduced the availability of spawning habitat for white sturgeon and resulted in a lower productivity of some populations (Parsley and Beckman, 1994). Also the dams have greatly altered natural current velocities that may be critical to sturgeon spawning success. Brown et al. (1992) conducted a mitochondrial DNA (mtDNA) analysis of the Fraser River and Columbia River stocks. Their main conclusion was that the effect of damming the Columbia River resulted in limiting the mtDNA diversity in the Columbia White sturgeon population, compared to the Fraser River stock.

The construction of Libby Dam on the Kootenai River also led to a decline of the population caused by a drastical reduction of natural reproduction due to the lack of suitable spawning sites (Apperson, 1993).

Although the extant population in the unimpounded Fraser River appears to be in a healthy state, the species is considered to be Vulnerable, because *Acipenser transmontanus* is restricted to a relatively small range in Canada and is therefore at risk of environmental changes that could occur in a small area having a large effect on the Canadian population (Lane, 1991). Lane (1989) states that both river systems in British Columbia, the Fraser River and the upper Columbia River are subject to hydroelectric developments and other activities associated with urbanisation and agriculture practices which could render the existing habitat unsuitable for reproduction.

Overexploitation evidently threatens the most productive population in the lower Columbia River and to a lower degree the population in the Sacramento-San Joaquin Estuary (Rieman and Beamesderfer, 1990; DeVore, 1993; Kohlhorst, 1995). In the lower Columbia River it is estimated that the exploitation rate is about twice what the population could sustain (DeVore, 1993). Several authors (Lane, 1991; Echols et al., 1995) state that with increasing and strengthened fishing regulations, the illegal catches probably raised and poaching is considered a serious problem. However, there are no estimates of its extent available.

The effects of pollution as a potential threat to the species have not been studied.

3. Utilization and Trade

3.1 National utilization

Acipenser transmontanus is an important commercial and sports fish. The flesh of this sturgeon is highly acceptable as food and the eggs are readily prepared and marketed as caviar.

On the Columbia River, a commercial fishery for *Acipenser transmontanus* started in the 1880s. The fishery expanded to a peak yield of nearly 2,500 metric tons (ca 80,000 fish) in 1892 and then declined to less than 45.4 metric tons by 1899 (Rieman and Beamesderfer, 1990). Yield from the fishery fluctuated between 45.4 metric tons and 227 metric tons from 1899 to the late 1960s. In 1987 the total yield of sport, commercial fishery was about 800 metric tons. In 1991, the estimated recreational and commercial harvests in the lower Columbia River were 22,700 and 3,800 fish respectively (McCabe et al., 1993).

On the Sacramento and San Joaquin Rivers in California, the commercial fisheries for the White sturgeon greatly reduced the populations in the estuary and rivers in the late 1800s. As a result of the overexploitation, all sturgeon fishing was prohibited in the Sacramento-San Joaquin estuary in 1917. The fishery was reopened in 1954 to sport angling only. The exploitation rate in 1990/91 was approximately 3.3% (ca 890 fish per year) (Kohlhorst, 1995).

In Canada, the bulk of the White sturgeon harvest came historically from the Fraser River, where the sturgeon was taken in nets set for salmon (Scott and Crossman, 1973). Fraser River White sturgeon became commercially important during the late 1800s and early 1900s. Harvest increased after 1880 by an average of 27 metric tons per year, and peaked at 517 metric tons in 1897 (Echols et al., 1995). During this period of intensive harvesting, sturgeon were caught primarily for their roe (caviar) and swim bladder linings (isinglass). Catches fell drastically in the early 1900s and by 1905 the annual sturgeon harvest averaged only 20 metric tons. Since 1913, commercial catches have been below 50 metric tons, while the annual commercial harvest in Fraser River rarely exceeded 15 metric tons since 1917 (Lane, 1991; Echols et al, 1995). The catch statistics of British Columbia do not distinguish between White and Green sturgeon. The mentioned data do not contain the sport and aboriginal fishery, which accounted for an estimated 18 metric tons and 11 metric tons respectively in 1983 (Lane, 1991). In 1994, British Columbia imposed a retention ban on any sturgeon fishery in the Fraser River, and all caught sturgeons must be released.

As for the parts and derivatives of *Acipenser transmontanus* that are utilised, the flesh of the sturgeon meets only with the demands for domestic markets. However, it is not clear whether the caviar made of roe from *Acipenser transmontanus* is also only domestically consumed or if it is exported.

The White sturgeon is subject to aquaculture in both the U.S.A and Canada and small amounts of caviar are produced from the so cultivated fish. There is no information about the total production of fish and caviar in aquaculture.

3.2 Legal international trade

No information available.

3.3 Illegal trade

Several authors (Lane, 1991; Echols et al., 1995) indicate poaching of the White sturgeon and report of a certain "black market" for its flesh and caviar, but neither the total level of illegal catches nor their relevance for national and international trade is known.

One famous case of poaching of White sturgeon has been revealed in a court trial in 1994: Mr. Arnold Hansen, a head of the Hansen Caviar Company, New Jersey (U.S.A.) hired two poachers who illegaly produced more than 1,352 kg of White sturgeon caviar in the Washington and Oregon states (Cohen, 1997). Mr. Hansen retailed this caviar and sold it to airplane companies as the most highly priced caviar of beluga. Experts estimated that for the production of this amount of caviar approximately 2,000 male and female White sturgeon (ripe and unripe) were killed in a five year period. Mr. Hansen was found guilty and was sentenced to eighteen months in federal prison, penalty, and three years probation.

During their investigation of caviar samples bought in New York City stores in spring 1995, Birstein et al. (1997) found a case of replacement of Russian Sturgeon (*Acipenser gueldenstaedtii*) caviar by caviar of White sturgeon.

3.4 Actual or potential trade impacts

No information available.

3.5 Captive breeding or artificial propagation for commercial purposes (outside countries of origin)

Acipenser transmontanus has been introduced in aquaculture in Italy, Hungary, Denmark and Germany (Rosenthal and Geßner, 1992; Logan et al., 1995). While in the other European countries the aquaculture of the species is believed to be pure experimental, Italy is annually producing 300 metric tons of White sturgeon (Williot et al., 1993). There are no data about the size of the broodstock in each of the countries.

4. Conservation and Management

4.1 Legal status

4.1.1 National

Since 1917, the commercial fishing for sturgeon is prohibited in California (Kohlhorst, 1995).

In the early 1980s, the State of Montana has listed *Acipenser transmontanus* as a species of special concern (NPSSC, 1993).

In 1990, *Acipenser transmontanus* has been declared Vulnerable by the federal Committee on the Status of Endangered Wildlife in Canada (COSEWIC) (Campbell, 1991). Recently, the British Columbia provincial classification of the Fraser River White sturgeon was changed from blue to red (2 to 3 on scale of 3) to indicate an Endangered status (Echols et al., 1995). Currently, all commercial and recreational fisheries in Fraser River (upstream of river mouth) must release all caught sturgeon in accordance with the 1994 retention ban; while aboriginal fisheries in the Fraser River have agreed to a voluntary release of incidentally caught sturgeon (Echols et al., 1995).

In 1994, the Kootenai River population (Kootenai River and Kootenai Lake in Idaho, Montana and British Columbia) of *Acipenser transmontanus* was listed as an Endangered species under the authority of the Endangered Species Act of 1973 (Federal Register 59, No. 171:45989-46002) (Birstein and Bemis, 1995), the category Endangered affording maximum protection.

4.1.2 International

None.

4.2 Species management

4.2.1 Population monitoring

There is no detailed information about a special monitoring programme for *Acipenser transmontanus*.

4.2.2 Habitat conservation

No information available.

4.2.3 Management measures

In British Columbia, a retention ban has been imposed in 1994: all commercial and recreational fisheries in Fraser River (upstream of the river mouth) must release all caught sturgeon. Aboriginal fisheries in the Fraser River have agreed to a voluntary release of incidentally caught sturgeon (Echols et al., 1995). However, catches of sturgeon in any British Columbia marine waters fishery (outside the Fraser mouth) may be retained. In other Canadian rivers, where only minor populations of *Acipenser transmontanus* are found, there are fishing regulations including the minimum size limit of 100 cm TL, and in the Lower Mainland and Omineca-Peace Regions there is a maximum size limit of 200 cm TL (Lane, 1991). In the Thompson-Nicola, Caribou, Skeena and Omineca-Peace regions only one sturgeon per fisherman per year is allowable (Lane, 1991).

The Californian Department of Fish and Game uses a mathematical model as a management tool to evaluate sport angling regulations for *Acipenser transmontanus* in the Sacramento-San Joaquin Estuary (Kohlhorst, 1995). The current fishing regulations for sport fishery include a year-round season and a one fish per day creel limit with a minimum size limit of 117 cm TL and a maximum size limit of 183 cm TL.

Sports fishing for *Acipenser transmontanus* in the Idaho portion of the Snake River was restricted to catch and release fishing in 1970 (Cochnauer and Lukens, 1993). The state of Idaho has terminated commercial harvest of this species (NPSSC, 1993).

The States of Oregon and Washington adopted a maximum size restriction of 102 cm Tl for the sport fishery and 122 cm TL for the commercial fishery, while the maximum size restriction is 183 cm TL for both commercial and sport fishery (Rieman and Beamesderfer, 1990). The Oregon Department of Fish and Wildlife uses a computer simulation programme to examine potential yields and sustainable exploitation rates for the White sturgeon in the lower Columbia River (Rieman and Beamesderfer, 1990). Stock enhancement has been reported for the Columbia River (Rieman and Beamesderfer, 1990), but so far no detailed information about the total annual production is available.

4.3 Control measures

4.3.1 International trade

No information available.

4.3.2 Domestic measures

In Canada as well as in the U.S.A., the fishery of *Acipenser transmontanus* is monitored and controlled by Fishery Officers and Guardians of federal and provincial agencies (Echols et al., 1995; Kohlhorst, 1995). Further detailed information about domestic measures is not available.

5. Information on Similar Species

Acipenser transmontanus is partly sympatric with the Green sturgeon, *Acipenser medirostris*, which is less abundant (Scott and Crossman, 1973; Houston, 1987). Both sturgeon species look very similar and apparently some intergrades do occur in the Columbia River (Lane, 1989). Since it is difficult to distinguish the two species readily, provincial and federal fishing regulations and catch records do not differentiate between Green and White sturgeon.

The most reliable method of separation to-date appears to be the position of the anus with respect to the insertion of the pelvic fins. In Green sturgeon the anus is in line with or anterior to the pelvic fin insertion, while in White sturgeon the anus is posterior to the pelvic insertion. The lateral scute count tends to be higher in White sturgeon (38-48) compared with Green sturgeon (23-30) (Scott and Crossman, 1973).

6. Other Comments

The range states of the species has been contacted on 13 March 1996 and 21 May 1996. A copy of the first draft of the proposal ("working document") has been sent to the range states on 19 August 1996. The comments of the range states that have been received are attached in the appendix at the end of this document.

The "working document" has also been presented at the 13th meeting of the Animals Committee of CITES in Prague, Czech Republic, on 23-27 September 1996 for discussion.

Additionally, a meeting ("Multilateral Consultations on the Problems of Sturgeon Species within the Framework of CITES") which took place on 21-22 November 1996 in Moscow, has been organised in order to consult with the states of Azerbaijan, Kazakhstan, Turkmenistan and Ukraine (which are not members to CITES) as well as with China, Georgia, Iran, USA and the Russian Federation. The minutes of this meeting and the comments of the range states that have been received are attached in the appendix at the end of this document.

7. Additional Remarks

8. References

Anders, P. 1993. Recovery Plan for White Sturgeon in the Kootenai River, Idaho. In: 123rd Annual Meeting of the American Fisheries Society, Portland, Oregon, August/September 1993. Session 1.3. Symposium: Biology and Management of North American Sturgeons. P. 22.

Apperson, K.A. 1993. White Strugeon on the Kootenai River: Tracking the Decline (And Recovery?). In: 123rd Annual Meeting of the American Fisheries Society, Portland, Oregon, August/September 1993. Session 1.3. Symposium: Biology and Management of North American Sturgeons. P. 15.

Beamesderfer, R. 1993. Potential Production of Impounded and Unimpounded White Sturgeon Populations in the Lower Columbia River. In: 123rd Annual Meeting of the American Fisheries Society, Portland, Oregon, August/September 1993. Session 1.3. Symposium: Biology and Management of North American Sturgeons. P.18.

Beamesderfer, R. C. P., T. A. Rien, and A. A. Nigro. 1995. Differences in the Dynamics and Potential Production of Impounded and Unimpounded White Sturgeon Populations in the Lower Columbia River. Transactions of the American Fisheries Society 124 :857-872.

Birstein, V.J. 1993. Sturgeons and Paddlefishes: Threatened Fishes in Need of Conservation. Conservation Biology 7 (4):773-787.

Birstein, V.J. and W. Bemis (eds.). 1995. Endangered Status. The Sturgeon Quarterly vol. 3, no.1: 12.

Birstein, V.J., B. Sorkin, and R. DeSalle. 1997. Species identification of black caviar: a PCR tool for sturgeon species conservation. Molecular Ecology (in press).

Brown, J.R., A.T. Beckenbach and M.J. Smith. 1992. Influence of Pleistocene Glaciations and Human Intervention upon Mitochondrial DNA diversity in White Sturgeon (*Acipenser transmontanus*) populations.

Campbell, R.R. 1991. Rare and Endangered Fishes and Marine Mammals of Canada: COSEWIC Fish and Marine Mammal Subcommittee Status Reports: VII. The Canadian Field Naturalist 105 (2): 151-156.

Cochnauer, T. and J.R. Lukens. 1993. Response of White Sturgeon, *Acipenser transmontanus*, Populations in the Middle Snake River, Idaho to Catch and Release. In: 123rd Annual Meeting of the American Fisheries Society, Portland, Oregon, August/September 1993. Session 1.3. Symposium: Biology and Management of North American Sturgeons. P. 19.

Cohen, A. 1997. Sturgeon poaching and black market caviar. In: Birstein, V., J. R. Waldman, and W. E. Bemis (eds.). Sturgeon Biodiversity and Conservation. Kluwer Academic Publishers, Dordrecht. Pp. 419-422.

De Vore, J. 1993. Lower Colubia White Sturgeon: A Case of Research and Management Synergism. In: 123rd Annual Meeting of the American Fisheries Society, Portland, Oregon, August/September 1993. Session 1.3. Symposium: Biology and Management of North American Sturgeons. P. 20.

De Vore, J. D., B. W. James, C. A Tracy, and D. A. Hale. 1995. Dynamics and Potential Production of White Sturgeon in the Unimpounded Lower Columbia River. Transactions of the American Fisheries Society 124 :845-856.

Echols, J.E. and Fraser River Action Plan Fishery Management Group. 1995. Review of Fraser River White Sturgeon (*Acipenser transmontanus*). Department of Fisheries and Oceans, Vancover, B.C. 33 pp.

Houston, J.J.P. 1988. Status of the Green Sturgeon, *Acipenser medirostris*, in Canada. Canadian Field Naturalist 102 (2): 286-290.

IUCN. 1996. IUCN Red List of Threatened Animals. IUCN, Gland, Switzerland.

Kohlhorst, D.W. 1995. Use of a Mathematical Model as a Management Tool to Evaluate Sport Angling Regulations for White Sturgeon, *Acipenser transmontanus*, in the Sacramento-San Joaquin Estuary, California. Proceedings of the Second International Symposium on Sturgeons, September 6-11, 1993. Moscow-Kostroma-Moscow (Russia). VNIRO Publication. Pp. 239-249.

Lane, D.E. 1989. Status of the White Sturgeon, *Acipenser transmontanus*, in Canada. Report to the Committee on The Status of Endangered Wildlife in Canada (COSEWIC). CWS, Ottawa. 20 pp., 4 figs.

Lane, D.E. 1991. Status of the White Sturgeon, *Acipenser transmontanus*, in Canada. Canadian Field-Naturalist 105 (2): 161-168.

Logan, S. H., W. E. Johnston, and S. I. Doroshov. 1995. Economics of joint production of sturgeon (*Acipenser transmontanus* Richardson) and roe for caviar. Aquaculture, 130 :299-316.

McCabe, G.T.Jr., R.L. Emmett and S.A. Hinton. 1993. Feeding Ecology of Juvenile White Sturgeon (*Acipenser transmontanus*) in the Lower Columbia River, Northwest Science 67 (3): 170-180.

National Paddlefish and Sturgeon Steering Committee (NPSSC). 1993. Framework For The Management and Conservation Of Paddlefish and Sturgeon Species In The United States. 41 pp.

North, J.A., R.C. Beamesderfer and T.A. Rien. 1993. Distribution and Movements of White Sturgeon in Three Lower Columbia River Reservoirs. Northwest Science 67 (2): 105-110.

Parsley, M.J. and L. G. Beckman. 1994. White Sturgeon Spawning and rearing Habitat in the Lower Columbia River. North American Journal of Fisheries Management 14: 812-827.

Rieman, B.E. and R.C. Beamesderfer. 1990. White Sturgeon in the Lower Columbia River: Is the Stock Overexploited? North American Journal of Fisheries Management 10: 388-396.

Rosenthal, H. and J. Geßner. 1992. Status and Prospects of Sturgeon Farming in Europe. In: Rosenthal, H. and E. Grimaldi (eds). Efficiency in Aquaculture Production: Production Trends, Markets, New Products and Regulations. Pp. 143-188.

Scott, W.B. and E.J. Crossman. 1973. Freshwater Fishes of Canada. Fisheries Research Board of Canada. Bulletin 184: 77-116.

Williot, P., P. Bronzi and G. Arlati. A Very Brief Survey of Status and Prospects of Freshwater Sturgeon Farming in Europe (EEC). In: P. Kestemont and R. Billard (eds.). 1993. Workshop on Aquaculture of Freshwater Species (Except Salmonids). European Aquaculture Society, Special Publication No. 20, Ghent, Belgium.

Huso dauricus

1. Taxonomy

1.1 Class:	Actinopterygii
1.2 Order:	Acipenseriformes
1.3 Family:	Acipenseridae
1.4 Species:	*Huso dauricus* (Georgi, 1775)
1.5 Scientific synonyms:	*Acipenser dauricus* Georgi, 1775 *Acipenser orientalis* Pallas, 1814 *Huso orientalis* Pallas, 1814 *Huso kaluschka* Steller in Pallas, 1814 *Acipenser mantschuricus* Basilewsky, 1855
1.6 Common names:	English: Kaluga sturgeon, Kaluga Finnish: Amurinkitasampi Japanese: dauria-chôzame Russian: Kalugae Name of caviar: Kaluga, Keluga, Amur sturgeon caviar

2. Biological Parameters

2.1 Distribution

Countries of origin: China, Russian Federation.

Huso dauricus is endemic to the Amur River system where it occurs from the delta to the upper reaches including the large tributaries and lakes (Berg, 1948; Nikol´skii,1956). Young individuals are reported to enter during the summer months the Sea of Okhotsk and the Sea of Japan reaching the north-eastern part of the Sakhalin Island, the northern part of the Tatar Strait, the coastal waters of Hokkaido Island and of Honshu Island off Niigata (Kostarev and Tyurnin, 1970; Gritsenko and Kostyunin, 1979; Amaoka and Nakaya, 1975; Honma and Itano, 1994).

The Amur River is formed by a confluence of the Argun and Shilka rivers and flows into the Amur delta in the Tatar Strait. The Amur delta is an estuary 48 km long and 16 km wide. Taking the longest of its branches, the River Shilka, as its source, the Amur is 4,092 km long and its basin has a total size of 1,856,000 km^2. The river valley is like a channel and when describing the river flow it is usual to divide it into three sections: an upper section up to the town of Blagoveshchensk (upper Amur, 883 km long), a middle section up to the mouth of the Ussuri River (middle Amur, 975 km long) and a lower section from the Ussuri confluence to the delta (lower Amur, 966 km long).

The distribution range of the kaluga in the Amur is fragmented: a population living in the estuary and coastal zones can be distinguished from local populations in the lower Amur, middle Amur and Zeya-Bureya river system (Svirskii, 1971; Krykhtin and Svirskii, 1996).

(1) The estuary population is represented by a predominating (75-80%) freshwater and a saltwater form. While the freshwater form feeds in the freshwater zone of the estuary only, the saltwater form winters in the freshwater zone and migrates to the brackish water of the delta and further to the northern part of the Tatar Strait and south-western part of the Sakhalin Gulf for feeding in the second half of June to the beginning of July. In autumn, when the salinity in the estuary increases, it moves back to the freshwater zone.

The major part of the estuary population migrates to the spawning grounds at 50-150 km upstream from Nikolajevsk-on-Amur and only a small part migrates to sites located less than 500 km upstream from the mouth of the river. Some individuals even migrate up to the city of Khaborovsk at the middle Amur for spawning.

The major spawning migration from the estuary to the Amur river starts in autumn and beginning of winter (winter seasonal form). The spawners winter in the river and spawning takes place during the next year. A small amount of spawners (about 5%) migrate in the Amur in spring and spawn soon after having reached the spawning sites (spring seasonal form).

(2) The lower Amur population feeds mainly in the region of the lower section of the Amur from the Ussuri confluence to the delta. Mature individuals migrate to the same spawning grounds and spawn at the same time as individuals of the estuary population.

(3) The middle Amur population inhabits an area approximately 900 km distant from the mouth of the river including the upper part of the lower Amur and the lower part of the middle Amur. Distinct spawning migration of this population takes place in May to the first half of June. The major spawning grounds are located in the lower region of the middle Amur, predominantly in the frontier waters of the river. Some minor spawning grounds can be found in the rivers Sungari and Ussuri.

(4) The Zeya-Bureya population is now represented by single specimens in the upper region of the middle Amur, in the upper Amur and in the lower regions of the rivers Zeya, Shilka and Argun. They migrate to spawning grounds located in the upper Amur and in a region extending about 250 km downstream the city of Blagoveshchensk in the second half of May to June.

2.2 Habitat availability

In contrast to the most large rivers, the Amur is not dammed by hydroelectric dams yet. Information on habitat loss or degradation is not available.

2.3 Population status

Krykhtin and Svirskii (1996) give an estimate of the size of the different populations using data of mass marking carried out at the end of the 1980s and calculated data (area method) based on irregular catches in the lower and middle Amur:

(1) The estuary population is relatively most abundant and contained almost 70,000 individuals older than one year at the end of the 1980s, of which approximately 5,000 (14%) with a weight exceeding 100 kg were potentially sexually mature. In 1993, a decrease of 30-35% of the potentially sexually mature fish has been recorded due to illegal catches in the lower Amur region.

According to calculated data, the individual kaluga populations in the Amur proper are smaller and consist predominantly of young fish, with mature fish accounting only for 2-3%:

(2) the lower Amur population is estimated to consist of approximately 40,000 individuals older than two years;

(3) the middle Amur population is believed to have approximately 30,000 specimens aged two years and older;

(4) the abundance of the Zeya-Bureya population is very low, judging by the very low catches in the boundaries of the Amur district accounting for only 0.09-1.03 metric tons.

The status of the populations of *Huso dauricus* is classified as Endangered by IUCN (1996).

2.4 Population trends

The size of all kaluga populations in the Amur basin considerably decreased since the turn of the century (Krykhtin and Svirskii, 1996). At the end of the 19th century, when the highest catches were recorded (more than 595 metric tons per annum), the largest population was that of the middle Amur which constituted 87% of the total annual kaluga catch on the Russian side, while the estuary and lower Amur populations accounted for no more than 2% and the Zeya-Bureya population around 11%.

Even if the fishing force has not been reduced, the catch of kaluga decreased by a factor of 3.5 in 1909 and by a factor of about 10 in 1948 (total catch: 61 metric tons of kaluga) as compared with the catch at the turn of the century (Krykhtin and Svirskii, 1997). As a result of increasing fishery concentrating mainly in the middle Amur on both the Russian and Chinese side the kaluga stocks further declined since the 1960s, the middle Amur population being the most effected (Wei et al., 1996; Krykhtin and Svirskii, 1996 and 1997).

In 1976, Russia introduced a strict limit on catches to reduce the overfishing of mature fish which resulted in an 35% increase of the total size of the estuary population with the amount of larger and thus mature fish (> 100 kg in weight) increasing by a factor of 2.5, as compared with the level of the early 1970s (Krykhtin and Svirskii, 1996). It was hoped that the estuary population would gradually increase if the stocks were carefully controlled and exploited. In 1993, however, illegal fishery in the lower Amur during the spawning migration led to a 30-35% reduction of the potentially sexually mature individuals of the estuary population.

Currently, in the Amur proper, the kaluga populations consist predominantly of young fish with mature individuals accounting only for 2-3% (Krykhtin and Svirskii, 1996). Because of its very slow rate of natural reproduction due to late maturity (on an average at an age of 14-23 years) and slow breeding rhythm, the tendency towards decrease of the kaluga population revealed already at the end of the 1960s is at present retained and a further reduction of the population size should be expected, especially in the middle Amur (Krykhtin and Svirskii, 1996). The extremely small Zeya-Bureya population is believed to be on the verge of disappearance (Krykhtin and Svirskii, 1996).

2.5 Geographic trends

No data on a decrease in the range area of *Huso dauricus* are available.

2.6 Role of the species in its ecosystem

Huso dauricus is one of the largest freshwater fishes reaching a total length that can exceed 5.6 m and a weight greater than 1 ton with an age of 80 years and older.

Until the age of one year kaluga consume mostly invertebrates but can also swallow larvae of pelagophilic fishes (f.e. larval gudgeons and fry of the catfish). At the age of three to four years it starts feeding on adult fishes (f.e. gudgeons, lamprey, ide, chum salmon, pink salmon, wild carp etc.) (Berg, 1948). The species consumed depend on the habitat or site of catching. In the estuaries and coastal sea regions kaluga catch of saffron cod and sea bass. During winter and the spawning migration, the fish do not feed. Incidents of cannibalism are rather frequent (Krykhtin and Svirskii, 1996).

The possible consequences of a depletion of the population of *Huso dauricus* for other species depending on or associated with it are not investigated and hardly predictable.

2.7 Threats

Overexploitation is the main reason of the observed and expected reduction of the kaluga populations (Krykhtin and Svirskii, 1996). The legal and illegal fishery in the Amur on both the Russian and Chinese side have sharply increased within the last years due to the permission of free trade and the high prices for caviar. Illegal fishery is carried out by organised groups who catch the kaluga mainly during the spawning migration and on the spawning grounds in a pre-spawning state

(Krykhtin and Svirskii, 1996 and 1997). Hence, the amount of potentially sexually mature fish is declining drastically which means an enormous impact on the size of the total population of these fish with very low reproduction rate.

Within the last years the water pollution of the Amur with heavy metals, oil products, phenol, mineral fertilisers and other pollutants from gold-mining operations as well as from agriculture increases gradually on both the Russian and Chinese banks of the river, usually downstream the towns (Matthiesen, 1993; Krykhtin and Svirskii, 1996). However, a direct impact of this contamination on the ichthyofauna and especially on the health of the kaluga populations has not been studied.

Investigations of the ovaries of some females (Svirskii, 1984) revealed a parasite, *Polypodium hydroforme*, which is effecting the fecundity and leading to a mean decrease of 19%.

Additionally, the revival of the Khinganski Dam project, a large hydroelectric dam, planned by the Chinese authorities threatens to wipe out all spawning sites of the kaluga (Birstein, 1993b).

3. Utilization and Trade

3.1 National utilization

Huso dauricus is a commercial species and is caught on both the Chinese and Russian side. The meat is consumed domestically and caviar mainly named "kaluga" like the fish itself is processed of the roe. In the 1950s, the sturgeons were caught by pull nets and row hooks which afterwards were replaced by three-layer gill nets (Wei et al., 1996).

At the end of the 19th century, the highest catches of *Huso dauricus* peaked in more than 595 metric tons per annum on the Russian side, especially caught in the middle Amur. Since the beginning 20th century the catches of kaluga decreased gradually, 61 metric tons being officially recorded in 1948 (Krykhtin and Svirskii, 1996). Further reduction of the sturgeon stocks led to an annual closure of the kaluga fishery introduced by the USSR in 1958 and effective until now. The catching of kaluga is only allowed from June 15 till July 15 within the quota of 60 metric tons, the fish being 50-100 kg in weight and 185-220 in length (Birstein, 1993b). Despite this harvest regulations, intensive fishery of kaluga in the lower Amur section started in 1991, and, in general, catches recently increased everywhere (Krykhtin and Svirskii, 1996 and 1997). The official Russian records indicate 64.4 metric tons in 1991, 62.6 metric tons in 1992 and 47.8 metric tons in 1993 for both *Huso dauricus* and *Acipenser schrenckii*. However, experts report that within the last years illegal fishery drastically increased with the permission of free trade and estimate that at least 200 metric tons of kaluga and Amur sturgeon have been caught annually from 1991 till 1993. No data about the amount of kaluga caviar produced on the Russian side of the Amur are available. It is not clear whether the Russian kaluga caviar is only domestically consumed or exported.

On the Chinese side, the catches of kaluga have been low before the 1970s due to the rare occurrence of the fish (Wei et al., 1996). The catch statistics of China give no separate data for *Huso dauricus* and the sympatric Amur sturgeon, *Acipenser schrenckii*. From 1952 to 1956 the annual yield of both sturgeon species from the entire middle Amur on the Chinese banks ranged between 70 to 80 metric tons, in 1981 a total of 141 metric tons has been caught and in 1987 a yield of 200 metric tons has been reached (Wei et al., 1996). Russian experts even indicate a total annual yield of 410 metric tons in 1989 (kaluga and Amur sturgeon) and 170 metric tons in 1993 of illegal fishery on the Chinese banks.

China started the export of kaluga and osietra caviar (the latter produced of the roe of *Acipenser schrenckii*) both often sold under the name of "Amur sturgeon caviar" in the 1970s with an amount of 3 metric tons (Wei et al., 1996). Since 1990, an annual amount of 12-15 metric tons of Kaluga/Amur sturgeon caviar are exported, the main importers being Japan (ca 50%) and USA (ca 50 %) (Taylor, 1996).

3.2 Legal international trade

China is exporting an annual amount of about 12-15 metric tons of caviar of *Huso dauricus* (kaluga) and of *Acipenser schrenckii* (osietra), the statistics not distinguishing between the caviar of these two species. About half of the Chinese production goes to Japan, the other 50% to the USA. The export price for Chinese caviar was about $ 195.00 per kg net weight CIF at the receiving end in 1995 (Taylor, 1996).

3.3 Illegal trade

Illegal fishery is indicated by both Chinese and Russian experts who estimate the illegal catches at about 410 metric tons of kaluga and *Acipenser schrenckii* in 1989 and 170 metric tons in 1993. However, no reliable data about the real amount of illegal fishery for *Huso dauricus* are available. Illegal market channels are insufficiently known.

3.4 Actual or potential trade impacts

According to Russian and Chinese experts (Krykhtin and Svirskii, 1996 and 1997; Wei et al., 1996) the illegal fishery for kaluga, which increased since the permission of free trade and because of the very high prices for caviar, is the main threat for the survival of the species. Mainly spawners at a pre-spawning state are illegally caught and hence the breeding stock is drastically reduced which means an enormous impact on the size of the total population of these fish with very low reproduction rate.

3.5 Captive breeding or artificial propagation for commercial purposes (outside countries of origin)

Not reported.

4. <u>Conservation and Management</u>

4.1 Legal status

4.1.1 National

Huso dauricus is not totally protected by law neither on the Russian nor on the Chinese side, but there are some rules to regulate and control the harvest.

The Chinese Heilongjiang Government issued specific regulations of protection and management for sturgeons in 1950 and renewed them in 1982. The current regulations include gear restrictions, minimum harvest size, i.e. total length (TL) of 200 cm for kaluga, a closed area at Luobei, seasonal closed areas and a closed period for fishery as well as appropriate punishment measures (Wei et al., 1996). Chinese scientists (Wei et al., 1996) put forward that these regulations were not fully implemented due to the insufficient strength of fisheries management departments.

The USSR introduced an annual close of the kaluga fishery in 1958 which is effective until now (Krykhtin and Svirskii, 1996). However, it is allowed to catch *Huso dauricus* 50-100 kg in weight and 185-220 cm in length from June 15 till July 15 within the quota of 60 metric tons (according to

Point 22.3 of "The Fishing Rules in Far Eastern Water Bodies of the USSR", 1981 cited in Birstein, 1993b). It is not clear, whether these regulations are effective, but it seems unlikely because legal and illegal fishery for kaluga increased within the last years.

So far, artificial propagation of *Huso dauricus* is not reported but both Russia and China have constructed and are still constructing sturgeon hatcheries on the Amur (Krykhtin and Svirskii, 1996; Wei et al., 1996).

There is no agreement between Russia and China concerning regulations of sturgeon fishery in the frontier waters.

4.1.2 International

None.

4.2 Species management

4.2.1 Population monitoring

Not reported.

4.2.2 Habitat conservation

Not reported.

4.2.3 Management measures

Both range states, Russia and China, launched fishing regulations in order to control the harvest of *Huso dauricus*. Russia set up an annual close of kaluga fishery in 1958, but it is allowed to catch *Huso dauricus* 50-100 kg in weight and 185-220 cm in length from June 15 till July 15 within the quota of 60 metric tons (according to Point 22.3 of "The Fishing Rules in Far Eastern Water Bodies of the USSR", 1981 cited in Birstein, 1993b).

China issued specific regulations including a minimum harvest size for kaluga of a total length of 200 cm (Wei et al., 1996).

There is no agreement between the two states concerning the controlled harvest of *Huso dauricus*.

4.3 Control measures

4.3.1 International trade

None.

4.3.2 Domestic measures

Not reported.

5. Information on Similar Species

Huso dauricus is sympatric with the Amur sturgeon, *Acipenser schrenckii* and spawning of both species takes place on the same spawning grounds.

The only closely related species belonging to the same genus is the beluga, *Huso huso*, which is also highly commercially exploited because of its famous caviar.

The beluga inhabits the Caspian Sea, the Black Sea and the Sea of Azov. The present status of the populations of *Huso huso* is considered to be Endangered, local populations in the Dnieper (Black Sea) and Sea of Azov are believed to be Close to Extinction. The caviar of both species of the genus *Huso* is almost of the same quality and can hardly be distinguished.

6. Other Comments

The range states of the species has been contacted on 13 March 1996 and 21 May 1996. A copy of the first draft of the proposal ("working document") has been sent to the range states on 19 August 1996. The comments of the range states that have been received are attached in the appendix at the end of this document.

The "working document" has also been presented at the 13th meeting of the Animals Committee of CITES in Prague, Czech Republic, on 23-27 September 1996 for discussion.

Additionally, the Authorities of the Russian Federation have been contacted in a first meeting in Moscow on 25 to 26 June 1996 for bilateral consultations. A second meeting ("Multilateral Consultations on the Problems of Sturgeon Species within the Framework of CITES") which took place on 21-22 November 1996 in Moscow, has been organised in order to consult with the states of Azerbaijan, Kazakhstan, Turkmenistan and Ukraine (which are not members to CITES) as well as with China, Georgia, Iran, USA and the Russian Federation. The minutes of this meeting and the comments of the range states that have been received are attached in the appendix at the end of this document.

7. Additional Remarks

8. References

Amaoka, K. and K. Nakaya. 1975. First Record of Kaluga Sturgeon, *Huso dauricus*, from Japan. Japanese Journal of Ichthyology 22 (3): 164-166.

Berg, L.S. 1948. [The Freshwater Fishes of the USSR and Adjacent Countries.]. Moscow and Leningrad, Nauka Publication, Vol. I, pp. 57-109. (Engl. translation published by National Science Foundation, Washington D.C., 1962).

Birstein, V.J. 1993a. Sturgeons and Paddlefishes: Threatened Fishes in Need of Conservation. Conservation Biology 7 (4):773-787.

Birstein, V.J. 1993b. Draft Application to CITES: Order Acipenseriformes. Unpublished.

Chereshnev, I.A. 1992: Rare, Endemic and Endangered Freshwater Fishes of Northeast Asia. Journal of Ichthyology 32 (8): 110-124.

Gritsenko, O.F. and G.M. Kostyunin. 1979. The Amur Whitefish, *Coregonus ussuriensis* Berg, and the Kaluga, *Huso dauricus* (Georgi) in the Sakhalin Waters. Problems in Ichthyology 19 (6): 1125-1128.

Honma, Y. and H. Itano. 1994. A Record of Great Siberian Sturgeon, *Huso dauricus*, off Niigata, Sea of Japan (Osteichthyes: Acipenseridae). Japanese Journal of Ichthyology 41 (3): 317-321.

IUCN. 1996. IUCN Red List of Threatened Animals. IUCN, Gland, Switzerland.

Kostarev, V.L. and Tyurnin, B.V. 1970. Kaluga in Waters of the North-West Okhotsk Sea. Proceedings of the Pacific Research Institute of Fisheries and Oceanography 74: 346-347.

Krykhtin, M. L., and V. G. Svirskii. 1996. The catch of sturgeons and the status of sturgeon stocks in the Amur River. In: Workshop “Sturgeon Stocks and Caviar Trade”, Bonn, October 9-10, 1995. In press.

Krykhtin, M.L. and V.G. Svirskii. 1997. Endemic Sturgeons of the Amur River: Kaluga, *Huso dauricus*, and Amur Sturgeon, *Acipenser schrencki*. In: Birstein, V., J.R. Waldman and W.E. Bemis (eds.). Sturgeon Biodiversity and Conservation. Kluwer Academic Publishers, Dordrecht. Pp. 231-239.

Masuda, H., K. Amaoka, C. Araga, T. Uyeno and T. Yoshino. 1984. The Fishes of the Japanese Archipelago. Tokay University Press. P. 18.

Matthiesen, P. 1993. The last Cranes of Siberia. The New Yorker, May 3, 1993: 76-86.

Nikol´skii, G. V. 1956. Fishes of the Amur River Basin. Mosow and Leningrad, Izdatelstvo Akad. Nauk USSR, pp. 26-49.

Svirskii, G. V. 1971. The Amur River sturgeon and kaluga. Uchenye Zapiski Dalnevostochnogo Gosudarstvennogo Universiteta, 15 :19-33 (in Russian).

Svirskii, V. G. 1984. *Polypodium hydroforme* (Coelenterata) in the Amur River acipenserids. Parasitologiya, 18 :362-366 (in Russian).

Svirskii, V. G., V. A. Nazarov, and E. I. Rachek. 1993. The Amur River sturgeons and prospects for their culture in the Far East of Russia. In: International Symposium on Sturgeons, September 6-11, 1993. Abstract Bulletin. VNIRO, Moscow, p. 67.

Taylor, S.1996. The Historical Development of the Caviar Trade and Industry. In: Workshop "Sturgeon Stocks and Caviar Trade", Bonn, October 9-10 1995. In press.

Wei, Q., F. Ke, J. Zhang, P. Zhuang, J. Luo, R. Zhou and W. Yang. 1997. Biology, Fisheries and Conservation of Sturgeons and Paddlefish in China. In: Birstein, V., J.R. Waldman and W.E. Bemis (eds.). Sturgeon Biodiversity and Conservation. Kluwer Academic Publishers, Dordrecht. Pp. 241-255.

Huso huso

1. Taxonomy

   1.1 Class: Actinopterygii

   1.2 Order: Acipenseriformes

   1.3 Family: Acipenseridae

   1.4 Species: *Huso huso* Linnaeus, 1758

   1.5 Scientific synonyms:
   Acipenser huso Linnaeus, 1758
   Acipenser albula Forster, 1767
   Acipenser husoniformis Lovetzky, 1834
   Huso ichthyocolla Bonaparte, 1846
   Acipenser vallisnerii Molin, 1851
   Acipenser brandtii Günther, 1870
   Huso huso maeoticus Sal´nikov and Malyatskii, 1934
   Huso huso ponticus Sal´nikov and Malyatskii, 1934
   Huso huso ponticus occidentalis Sal´nikov and Malyatskii, 1934
   Huso huso ponticus orientalis Sal´nikov and Malyatskii, 1934
   Huso huso caspicus Babushkin, 1942
   Huso huso caspicus curensis Babushkin, 1942

   1.6 Common names:
   Bulgarian: Moruna
   Czech: Vyza, Vyza velka
   English: Giant sturgeon, Great sturgeon, Beluga, European sturgeon
   French: Beluga
   Finnish: Kitasampi
   German: Hausen
   Greek: Akipíssios, Mocuna
   Hungarian: Viza
   Icelandic: Mjaldur
   Italian: Storione ladano, Storione attilo
   Polish: Bieluga z. wyz
   Portuguese: Esturjâo do Cáspio
   Russian: Beluga
   Romanian: Morun
   Serbo-Croat: Moruna
   Spanish: Beluga
   Turkish: Mersin morinasi, Mersinmorinasi (baligi)
   Name of caviar: beluga

2. Biological Parameters

   2.1 Distribution

Countries of origin: Azerbaijan, ? Czech Republic, ? Former Yugoslavia, ? Georgia, Iran, ? Italy, Kazakhstan, ? Moldova, Romania, Russian Federation, Slovenia, Turkey, Turkmenistan, Ukraine.

Huso huso inhabits the Caspian Sea, the Black Sea and the Sea of Azov (Pirogovskii et al., 1989; Birstein 1993). It also occured in the Adratic Sea in the past, but is believed to be exstinct in this basin.

The species is anadromous and ascends the rivers that enter these seas for spawning. In the Caspian Sea, the main spawning river is the Volga, but the species is also encountered in the Ural River (Kazakhstan) and probably in the Kura River (Azerbaijan). It is also reported from the Sefid-Rud and Gorgan Rivers on the southern coast of the Caspian Sea (Iran) (Pirogovskii et al., 1989).

A few individuals of *Huso huso* enter the rivers along the Black Sea coast bordering the Caucasus, including the Rioni River (Elanidze, 1983 in Pirogovskii et al., 1989). The only current record of a spawning population of the species in the Black Sea basin is in the Danube River.

In the Sea of Azov, there is no recent record of the species.

In the Adriatic Sea, historically only solitary individuals have been reported from the northern part of Venice and the lower sections of the Po River (Fischer et al., 1987; Pirogovskii et al., 1989). Since 1972, there were no reports of *Huso huso* in the Po River basin (Rossi et al., 1991).

The anadromous migrations of the species are very similar in all inhabited water systems. According to the time of the migration, there is a distinction between a spring race and a winter race (Berg, 1948). The spring race usually begins the spawning run into the rivers in early spring, in the mid or late summer the run reaches a peak and finally ceases in late autumn. The so-called winter race generally does not spawn the same year they enter the river. These fish hibernate in the rivers and reproduce the following year.

The juvenile sturgeons migrate downstream the rivers to feeding grounds in the sea. In the Caspian Sea the main feeding grounds are located in the northern part.

Within the Caspian Sea there is a seasonal migration: in spring and summer most of the specimens are encountered in the northern part of the Sea on the main feeding grounds, while in autumn and winter a migration to the central and southern part of the sea has been observed (Barannikova et al., 1995).

2.2 Habitat availability

The construction of hydroelectric power stations as well as of water reservoirs in almost all rivers where the species spawns led to a sharp reduction of available spawning grounds. In the Caspian Sea basin, the beluga sturgeon lost approximately 90% of all spawning grounds (Barannikova et al., 1995; Khodorevskaya and Novikova, 1995; Khodorevskaya et al., 1997). In the main spawning river, the Volga, there remained only 430 ha of the total 3,600 ha after the damming of the river by the Volgograd Dam. The area of the natural spawning grounds in the Kura River has been reduced by dam constructions to about 160 ha, in the Terek River to 132 ha and in the Sulak River to 201.6 ha (Vlasenko, 1990), and thus lost their value as natural spawning sites for beluga sturgeon (Khodorevskaya and Novikova, 1995). The only unregulated river flowing into the Caspian Sea is the Ural which still provides an area of 1,400 ha for sturgeon spawning.

In the Black Sea and Sea of Azov, the situation is almost the same. Almost all rivers that enter these seas and are used by the anadromous sturgeons for spawning, have been blocked by dam constructions either of hydroelectric power stations or of irrigation systems. For example the regulation of the Kuban River flow resulted in the loss of approximately 140,000 ha of estuarine breeding grounds for all fluvial anadromous fish (Volovik et al., 1993). The construction of the Tsymlyansk reservoir on the Don River in 1952 resulted in an average loss of about 68,000 ha of spawning grounds for all fluvial anadromous fishes (Volovik et al., 1993). The Danube River has been blocked by the construction of the insurmountable dams Djerdap I and II ("Iron Gate") which prevented all anadromous fish species from an upstream migration to the spawning grounds located above the first dam (Jankovic, 1995; Bacabalsa-Dobrivici, 1997).

The reduction of available natural spawning grounds due to river flow regulations subsequently led to a reduction of the natural reproduction and the stock of the species is maintained to a high extant by artificial propagation. In 1993, about 100% of each generation of *Huso huso* in the Sea of Azov consisted of farm-grown fish (Volovik et al., 1993), while in the Caspian Sea about 91% originates from hatcheries (Barannikova, 1995).

2.3 Population status

There is no information about the total size of the population. The largest population of *Huso huso* is believed to live in the Volga-Caspian region which produces about 80 percent of the total sturgeon catches (Vlasenko, 1990). Levin (1996) estimated that the spawning population that entered the Volga River in recent years constituted of about 8,000-9,000 mature individuals, with females accounting only for 20-24%. The method of census for this estimate is not provided. There are virtually no estimates of spawning populations in the other rivers that enter the Caspian Sea, but all experts (Vlasenko, 1990; Khodorevskaya and Novikova, 1995; Levin, 1996) believe them to be minimal.

There are no recent estimates about the total size of the populations inhabiting the Black and Azov Seas basins. Volovik et al. (1993) estimated that the total stock biomass of all sturgeons living in the Sea of Azov was about 59,000 metric tons in the mid 1980s, with *Huso huso* accounting for 3% of the total sturgeon biomass (1,770 metric tons). However, in 1990, a mass death of sturgeon occurred in this watersheds and approximately 55,000 sturgeon individuals were found dead on the shore. Ever since, no estimation of the population size has been made.

In the Danube River, the beluga is now extirpated in the upper part of the river and critically endangered in the middle part because of damming (Hensel and Holcik, 1997). Only few small individuals were reported in 1995 in the lower part of the river (Birstein, 1996b).

The IUCN (1996) classifies the status of the different populations of *Huso huso* as follows:

- the population in the Sea of Azov is Critically Endangered,
- the Black Sea population (Russia, Ukraine, Romania, Hungary and Serbia) is Endangered,
- the Caspian Sea population (Russia, Azerbaijan, Kazakhstan, Turkmenistan and Iran) is Endangered, and the Adriatic Sea population (Italy) is Extinct.

2.4 Population trends

The decline of the commercial catches of *Huso huso* reflect a decline in the size of the population. In Volga-Caspian region, where the species is most abundant, the catches declined from an average of 2,650 metric tons in the 1970s to 460 metric tons in the 1993 (Raspopov, 1993). Moreover, the data show that the fishery is presently wiping out the maturating fish (Raspopov 1990 and 1993). The most alarming fact was the decrease of natural reproduction of the species which already began with the construction of the Volgograd Dam but still worsened within the last years due to the high pollution level in almost all spawning rivers. Although *Huso huso* was subject to a large-scale ranching programme within the Russian Federation and probably also Iran, the stocks further declined. Barannikova (1995) estimates that about 91% of the beluga sturgeon catch within the Russian part of the Caspian Sea originated from farm-grown fish in 1993. In the Sea of Azov and Black Sea region, the situation is even worse: in 1993, 100% of beluga sturgeons within these watersheds came from hatchery-released juveniles (Barannikova et al., 1995) and the stocks are exclusively maintained by artificial propagation.

At present, the spawning population of the beluga sturgeon in the Volga River consists mainly of fish that hatched after the beginning of the river flow regulation (Khodorevskaya et al., 1997). The sex ratio and age structure of this population has changed drastically. The growth of the fish appears to be retarded because the size of the beluga spawners has decreased, e.g from 1971 to 1973 the average weight of spawners was 110 kg, while from 1989 to 1992 it was only 63 kg (Khodorevskaya et al, 1995a). The number of females entering the Volga Riva decreased from 50% in 1980 to 17.6% in 1990.

Due to bad environmental conditions, the reproductive system of sturgeon females showed an increasing degeneration and several anormalities in the gameto- and gonadogenesis occurred. Shagaeva et al. (1993) found that 100% of the eggs taken from *Acipenser stellatus* females caught in the lower Volga River in 1989 showed anomalies and 100% of the larvae (both from hatcheries and natural environment) were not viable. The same can be concluded for *Huso huso*. In the Sea of Azov and Black Sea, a mass death of sturgeons was observed in 1990, which was undoubtedly caused by disastrous environmental conditions. They may also have their effect on the remaining small population of *Huso huso*. Considering these evident signs of a sharp decrease in natural reproduction, several experts fear a further reduction of the population of *Huso huso* within its entire range. Levin (1995) states that artificial propagation techniques, although they contribute to a high amount to the maintaining of the stocks, cannot compensate for the damage caused to natural reproduction.

2.5 Geographic trends

A decrease in the range area of *Huso huso* is due to the dam constructions on almost all rivers that the species formerly used to ascend for spawning.

In the Caspian Sea basin the species can currently ascend the Volga as far as the Volgograd reservoir, in the Kura it can migrate as far as the Vavarin Reservoir and in the Ural upstream to the city of Orenburg (Pirogovskii et al., 1989). In the Black and Azov Sea basins an upstream migration into the Danube, Don and Kuban Rivers is also prevented by various dam constructions.

2.6 Role of the species in its ecosystem

Huso huso is the largest sturgeon species and may reach total length of 6.0 m (TL) and a weight exceeding 1,000 kg (Berg, 1948). However such specimens are nowadays rarely encountered. Currently, the mean length of immature females and males is about 2.25 and 2.15 m, respectively, while the length of mature individuals is about 2.20 to 2.60 m (Khodorevskaya et al., 1995a). The maximum age that was recorded for the species is 118 years (Babushkin, 1964 in Pirogovskii et al., 1989) but it is believed that individuals may exceed this age.

Huso huso is a piscivorous fish that starts preying on other fish and vertebrates at a very early life stage. Pirogovskii et al. (1989) give a list of more than 30 fish species that were found in the stomach of full-grown *Huso huso*.

The beluga is only predated at very early life stages. Considerable quantities of the eggs and larvae fall prey to *Acipenser ruthenus* and other fishes such as *Leuciscus idus*, *Stizostedion volgense*, *Stizostedion lucioperca*, *Silurus glanis* (Ginzburg, 1972 in Pirogovskii et al, 1989).

The possible consequences of depletion of the population of *Huso huso* for those species depending on or associated with it are very complex and hardly predictable.

2.7 Threats

The main threats to the species are the legal and illegal overfishing mainly during the spawning season, the loss of critical habitat such as spawning grounds due to dam constructions (as mentioned above: 2.2 and 2.5), and the high level of pollution in almost all rivers within its range.

The main threat to the survival of the beluga sturgeon (as well as that of *Acipenser stellatus* and *Acipenser gueldenstaedtii*) is the legal and especially illegal overfishing stimulated by the high demand for black caviar on the international market (see 3.2 and 3.3). Beluga sturgeons are especially threatened by overfishing because the beluga caviar is a very highly priced product (see tab. 18 and 19, appendix).

After the collapse of the USSR in 1991, besides Russia and Iran three new states (Azerbaijan, Kazakhstan and Turkmenistan) and two autonomous Russian Republics (Dagestan and Kalmykia) started the harvest of sturgeons (Ivanov et al., 1995a). Until the beginning of 1996, there has been no agreement between these countries bordering the Caspian Sea concerning a sustainable sturgeon fishery and adequate international fishing rules. Fishing in the open sea, which was completely prohibited by Soviet laws for a long period, was started mainly by Azerbaijan.

As a consequence, mainly young and immature sturgeon were caught and the harvest in the open sea destroyed a major part of the future sturgeon stocks (Luk´yanenko et al., 1994). The situation with the legal catch was so critical that the Russian experts discussed the need to completely prohibit the legal commercial catch of sturgeons in the Caspian Sea for one to two years (Ivanov et al., 1995a).

The decline of the populations of *Huso huso* in the Caspian and Black Sea basins during the last years was mainly caused by the enormously high level of poaching (Artyukhin, 1996; Birstein, 1996; Zoltarev et al., 1996; Khodorevskaya et al., 1997). According to the opinion of experts, the size of the illegal catch is equal to or even higher than the legal catch. Poaching is common in almost all countries of the area: in Russia (with Dagestan and Kalmykia), Azerbaijan, Kazakhstan and even Iran. In the Volga River, during the last years practically all spawning fish have been caught by poachers before they could reach the spawning grounds below the Volgograd Dam (Artyukhin, 1996). The subsequent lack of mature fish even affected the work of the hatcheries during the last years since it was not possible to catch enough mature beluga sturgeon for artificial breeding (Artyukhin, 1996). The high level of poaching hence affects not only the natural reproduction of the species but also the artificial propagation, and therefore represents one of the main threats to the survival of *Huso huso*.

The construction of dams along most of the spawning rivers of *Huso huso* dramatically reduced the natural spawning grounds of the species and consequently threatened the natural reproduction (see 2.2). Hydroelectric power station dams not only cut off sturgeons from their main spawning sites, but also change the flow of the rivers, and consequently the opportunity of spawners to use the spawning grounds that are still left intact. Alterations of the Volga River flow allow fewer beluga sturgeon to reach their spawning sites (Veshchev, 1995). The altered flow also affects the migration to the sea of juveniles either released from hatcheries or naturally hatched (Raspopov et al., 1995).

A further threat to the survival of *Huso huso* is represented by the high level of pollution in the Caspian and Black Sea basins. During the period from the beginning 1970s until the collapse of the Soviet Union in 1991, the level of pollution increased dramatically in almost all rivers entering the Caspian Sea, the main sources being oil and other industrial sewage (Vlasenko, 1990; Dumont, 1995; Khodorevskaya et al., 1997). In the Volga River, for example, the concentrations of heavy metals, mercury, phenols, surface-active agents, pesticides and oil products by far exceeded the maximum permissible concentration within this period (Romanov and Altuf´yev, 1993). Considerable concentrations of these pollutants were also found in the northern part of the Caspian Sea (Romanov and Altuf´yev, 1993). Several authors (Altuf´yev et al., 1992; Romanov and Altuf´yev, 1991 and 1993; Romanov and Sheveleva, 1993; Kuz´mina et al. 1993; Altuf´yev, 1994; Shagaeva et al., 1993; Shagaeva et al., 1995) have investigated the influence of the very high level of pollution in the Caspian Sea and studied the effect of the various toxins on sturgeons. The studies revealed that environmental pollution caused considerable changes in hormonal balance, in the blood system, and in protein and carbohydrate metabolism, marked disturbances in the genesis of organs (liver, gonads) and tissues (skeletal muscles, heart) and the appearance of neoplasm in liver, gonads and sex cells. General weakening of the fish as a result of toxins, disturbed metabolism and hormonal imbalance led to a number of disturbances in sturgeon gonadogenesis, e.g. the increase in number of hermaphroditic specimens, ovotestis and tumours, and to the appearance of new differentiation such as striated muscle tissue and fascicles of dense connective tissue formations which are normally absent in healthy fishes. A tendency was noted toward an increase in the number of aberrations, especially in the gameto- and gonadogenesis and in 1990, 100% of mature eggs taken from various sturgeon females showed various pathological anomalies suggesting the loss of viability. Moreover, in 1989 and 1990, a mass death of sturgeon larvae was observed caused by hatching aberrations and anomalous development such as defects in the fin fold and underdevelopment of the heart, both leading inevitably to death at early stages of development. In 1990, 100% of all investigated larvae (data for *Acipenser gueldenstaedtii* and *Acipenser stellatus*, but the same effects may be concluded for *Huso huso*) showed such anomalous development which was caused by environmental toxins. The anomalies in larval structure took place both in nature and in the hatchery.

All these effects on sturgeons were clearly seen from 1986 until 1992 and were presumably caused by a release of toxic waste from one of the heavy industry plants located on the shores of the Volga River in the middle of the 1980s. Since the disintegration of the USSR in 1991, the production of the heavy industry drastically decreased which resulted in an improving water quality in the Volga-Caspian region. Thus, in the early 1990s, the number of sturgeons with a pronounced muscle dystrophy disease dropped significantly.

However, there is a threat of increasing pollution in the whole Caspian Sea in the near future. The fast raise of the sea water level - from 1993 to 1997 it increased in 2,15m (Radionov, 1994) - will result in covering "lakes" of deposited wasted oil and associated pollutants from industrial sewage along the shore. Such "lakes" are already located in all industrial parts of Azerbaijan along the coast (Dumont, 1995) and their number will increase with the raising sea level. Sturgeons are especially threatened by the pollution in this region, because the waters of Azerbaijan represent important feeding grounds for the fish during the winter. A further near future threat for the northern part of the Caspian Sea is the fast development of oil fields, especially the Tengiz oil field, in Kazakhstan (Sagers, 1994). Sturgeons will be especially affected by pollutants from this developing industry because their main spawning and feeding grounds are located in the region of the northern Caspian Sea. Moreover, the central part of the Caspian Sea is threatened by radioactive contamination from the Gur´evskaya nuclear reactor near Akatai, Kazakhstan (Dumont, 1995).

In the Black-Azov Sea basin the situation of pollution is almost the same (Volovik et al., 1993). The Danubian and Dniester sturgeon populations are mainly threatened by the pollution of the rivers and the sea, and by the eutrophication of coastal waters which results in the appearance of temporary hypoxic areas on the Black Sea shelf. Chronic toxicosis with poisonous substances led to a mass death of fishes and in summer 1990 about 55,000 sturgeon individuals were found dead on the shore (Volovik et al., 1993). Moreover, the introduction of the ctenophore *Mnemiopsis leydyi* into the Black Sea in the 1980s resulted in a destruction of the local pelagic food and thus affected the main feeding source of sturgeons (Dumont, 1995; Khodorevskaya et al., 1997).

3. Utilization and Trade

3.1 National utilization

Huso huso is one of the three most important commercial species in the world and its catch occupies the third place among all catches of acipenserids (Tab. 2, appendix).

However, its national utilization is not easy to describe since official fisheries statistics do not distinguish between sturgeon species. The three commercially most important species are *Acipenser gueldenstaedtii*, *Acipenser stellatus* and *Huso huso* and account for 90% of all sturgeon catches in the world.

The major fishing area for *Huso huso*, as well as for the two other commercially important species, is the Caspian Sea where about 90% of the world sturgeon catches are landed. Within the Russian part of the Caspian Sea region, the Volga-Caspian region is the most important producing about 80.% of the total catch.

According to Khodorevskaya et al. (1995) *Huso huso* accounts for 5-7% of all sturgeon catches in the Volga-Caspian region.

FAO fisheries statistics (Tab. 1, appendix) show a drastical decline of the total landings of Acipenseridae within the last years. Before the disintegration of the former USSR only two states, the USSR and Iran, were fishing for sturgeons in the Caspian Sea. There was a quota system between both states and a complete ban on the fishery in open the sea.

In 1984, about 26,538 metric tons of sturgeons were landed world-wide, about 24,245 metric tons of which were caught in the USSR and 1,557 metric tons in Iran. In 1988, when the disintegration of the former USSR began, the world sturgeon catches had already declined to about 21,291 metric tons, with the Russian Federation accounting for 19,027 metric tons, Iran accounting for 1,851 metric tons. Since the collapse of the USSR in 1991, five states, i.e. the Russian Federation, Azerbaijan, Khazakhstan, Turkmenistan and Iran, and the two autonomous republics Dagestan and Kalmykia, are fishing for sturgeons in the Caspian Sea. Until the beginning of 1996, there were no fishing regulations, i.e. quota systems, between these states and republics and fishing in the open sea was no longer prohibited. Since 1988, the catches further declined to about 15,124 metric tons in 1991 (Russian Federation: 9,539 metric tons; Iran: 3,036 metric tons; Azerbaijan: 108 metric tons; Khazakhstan: 1,766 metric tons) and only 8141 metric tons in 1994 (Russian Federation: 4,460 metric tons; Iran: 1,700 metric tons; Azerbaijan: 95 metric tons; Khazakhstan: 635 metric tons). The above are the official figures. Unfortunately, the collapse of the USSR led to an expansion of illegal fishing which escapes any statistics. Furthermore, the FAO fisheries statistics do not distinguish between Russian inland waters, which means that the figures for the Russian Federation contain also a small amount of catches in the Siberian and Far Eastern water systems, estimated to be about 200 metric tons in 1993 (Barannikova et al., 1995) as well as an amount of catch in the Black Sea basin. Data for the state of Turkmenistan are not given by

FAO and it remains unclear, if the catches in the republics of Dagestan and Kalmykia are included in the figures of the Russian Federation.

The catch statistics for *Huso huso* in the northern part of the Caspian Sea basin show a steady decline from 900 metric tons in 1991 to 153 metric tons in 1994 (Tab. 2, appendix).

The second fishing area of *Huso huso*, as well as of *Acipenser stellatus* and *Acipenser gueldenstaedtii*, is the Black-Azov Sea region where the sturgeon fishery is concentrated mainly in the north-western part near the Danube Delta (Romania) and in the Sea of Azov. According to FAO statistics, the annual sturgeon catches within this region were about 1,527 metric tons in the 1970s, with the USSR accounting for 1,434 metric tons, Bulgaria accounting for 12 metric tons and Romania for 81 metric tons. For Turkey, no sizeable commercial catch of sturgeons has been officially recorded. The sturgeon catches in the Black and Azov Seas decreased to a minimum record of about 585 metric tons in 1988 (Russian Federation: 520 metric tons, Bulgaria: 1 metric ton; Romania: 35 metric tons; new independent state of Ukraine: 29 metric tons) but raised again to 1,257 metric tons in 1994 (Russian Federation: 1,012 metric tons; Bulgaria: 10 metric tons; Romania: 8 metric tons; Ukraine: 227 metric tons). According to Birstein (1996), the catches in Bulgaria and Romania further declined in 1995. Only 5.5 metric tons of sturgeons have been legally caught in Romania of which about 1 metric ton was *Huso huso.* In Bulgarian waters, only 3 metric tons of sturgeons were legally caught in 1995.

Huso huso is considered to be a valuable and delicious fish (Pirogovskii et al., 1989). The edible part averages 63% of the total weight of the fish. Its flesh is distinguished by a very high nutritional value. The dried swim bladders (isinglass) are used to produce a strong glue for use in mechanical devices. The most highly priced product of this species is the caviar made from its eggs and called "beluga". According to Josupeit (1994) the yields in caviar average between 2 and 17% of the total sturgeon catch, and up to 18 kg of "beluga" caviar can be harvested from one mature female giant sturgeon.

While the flesh of the giant sturgeon is almost entirely produced for national trade, caviar is not only produced for domestic consumption but also for export. FAO statistics indicate that the global caviar production - like the world sturgeon catch - decreased drastically in the last decade, the statistics not distinguishing between caviar of the different sturgeon species. In the early 1980s, a total production of 2,500 metric tons of caviar has been officially recorded, and in 1992 about 1,500 metric tons have been legally produced world-wide (Josupeit, 1994). For 1996, experts estimate a total legal production of 122 metric tons of caviar world-wide, of which 190 metric tons originate from the Caspian Sea and 32 metric tons are coming from the Black-Azov Sea region, China, USA, Canada and Siberia (Tab.7, appendix).

The three major sturgeon species of which caviar is produced are *Acipenser gueldenstaedtii*, *Acipenser stellatus* and *Huso huso*, and account for 90% of the total caviar production. The major caviar producing countries are the Russian Federation and Iran and 90% of the world production of caviar originates from the Caspian Sea. After the collapse of the USSR, the three independent states of Azerbaijan, Khazakhstan and probably also Turkmenistan, and the two autonomous republics of Dagestan and Kalmykia also started to produce caviar. In the Black and Azov Sea region, the newly independant state of Ukraine also produced caviar. According to FAO data (Josupeit, 1994) Iran experienced a steady increase of caviar production during the 1980s from about 200 to 300 metric tons, and almost all caviar produced in Iran (ca 95%) was exported (Josupeit, 1994). The main drop in the global production of caviar came from lower production in the Russian Federation.

An important share of caviar used to stay in the former USSR, where about 85-90% of the production was consumed domestically and only 10% were exported (Josupeit, 1994; Taylor, 1996). The decline in disbursable income after the desintegration of the USSR led to a reduction of caviar consumption in all republics of the former USSR (Josupeit, 1994). As a consequence, almost all caviar produced in the CIS during the last years was exported. The dramatical decline in sturgeon resources within the last years (about 50%) will soon lead to a decline in the quantity of caviar which can be offered on both the national and international market.

Huso huso, like other sturgeons, is mainly fished with long-lines and beach seines (Fischer et al., 1987). Poachers are mainly using bottom lines with hooks to catch sturgeons. Although it is possible to remove the eggs from live mature females by a surgical operation (a method designed by Russian scientists and especially carried out in hatcheries), the commercial harvest of caviar is still carried out by killing the animal, since the operation is too time consuming and survival rates of operated females are not reported. The declining catches of *Huso huso* as well as of the other sturgeon species reflect a drastical reduction of the population. The natural reproduction of the species is believed to be very low at present (Barannikova, 1995) and it is feared that virtually no natural reproduction of *Huso huso* occurs today. Since the disintegration of the former USSR in 1991 until the beginning of 1996, there were no fishing regulations between the range states in the Caspian Sea basin. Experts fear that the sturgeon stocks are overexploited and that the present unregulated harvest is far from sustainable use. Especially the fishing in the open sea endangers the survival of the species, because a growing number of immature specimens is caught and hence the potential spawning stock is further reduced.

The two major sturgeon producing countries, e.g. the Russian Federation and Iran have ranching programmes for sturgeon species, including *Huso huso*.

The Russian Federation already began the artificial breeding and raising of sturgeons in the 1960s. Barannikova et al. (1995) report that in the early 1980s, 20 sturgeon hatcheries were operating in Russia, including 10 hatcheries in the Caspian Sea basin (of which 8 were located on the lower Volga) and 7 hatcheries in the Sea of Azov basin, while 3 hatcheries on Siberian rivers were producing *Acipenser baerii*.

Since 1994, only 2-4 of the former 8 hatcheries are still operating in the Volga River delta (V. Birstein, pers. comm.). According to Khodorevskaya et al. (1997) these hatcheries released about 10 million beluga sturgeon juveniles, and in 1994 about 12 million juveniles of *Huso huso* had been produced (Tab. 20, appendix). However, in 1995, only 80 beluga females were caught in the northern part of the Caspian Sea of which only 35 were used for artificial breeding (Birstein, 1996a). This number of females is not sufficient for the efficient raising of juveniles and the artificial reproduction of the species is threatened.

In the former USSR, a large amount of the sturgeon fry produced by this artificial propagation was transported to the northern Caspian Sea by special hatch boats and then released to the feeding grounds which are located in this area (Levin, 1995). This procedure guaranteed a high survival rate for the juvenile sturgeons as compared to the release into the rivers where the young fish may be caught by predators and do not find suitable food organisms. However, Levin (1995) reports that the number of sturgeon fry that was transported to and stocked into the Northern Caspian Sea was zero since 1993.

In the Sea of Azov basin, hatcheries located on the Don River stopped the artificial reproduction and release of beluga sturgeon juveniles in 1992, but a hatchery located on the Kuban River is still working effficiently and successfully raised and released 116.000 beluga juveniles in 1994 (Chebanov and Savelieva, 1995).

Iran is also artificially propagating sturgeons since 20 years when the first hatchery was built in Rasht. According to the Iranian SHILAT, currently 5 hatcheries are working for the restocking programme of sturgeon species. The annual fry release in Iranian waters was about 3.4 millions of sturgeon juveniles, the different species not further distinguished (Tab. 21, appendix).

The ranching of *Huso huso* is contributing to a relative high degree to the size of the population and thus to the commercial fishery. In 1993, the estimated portion of *Huso huso* originating from hatcheries in the lower Volga River was about 91% (Barannikova, 1995) while in the Sea of Azov, about 100% of the Russian sturgeon catch is from hatchery-grown fish and the population is only supported by artificial breeding.

Beside ranching, in 1985 the USSR also started extensive fish farming of sturgeons, presumably also including *Huso huso*, in warm effluent waters of thermal power stations. According to Barannikova et al. (1995) the total annual production of pond-reared sturgeon was about 200 metric tons within the area of the Russian Federation and about 200 metric tons in the Ukraine.

These figures are given for all sturgeon species (4 different species and 6 different hybrids are grown). The so produced fish are contributing to the domestic demand for sturgeon meat. Caviar from sturgeon species grown in aquaculture is still of inferior quality and not produced in significant quantities.

3.2 Legal international trade

The main and highly priced sturgeon product on the international market is caviar. However, official statistics do usually not distinguish between caviar of different sturgeon species. The three main commercial species are *Acipenser gueldenstaedtii*, *Acipenser stellatus* and *Huso huso* accounting for 90% of the world production of caviar. Caviar of *Huso huso* is sold under the name "beluga" and is considered to have the best quality. Because of its high price as compared to the caviar of other species, "beluga" is only traded in small quantities.

FAO statistics (Josupeit, 1994) indicate that the total world trade of caviar has declined, given the recent crisis of the Russian industry. In 1988, trade of caviar (excluding re-exports) was 370 metric tons, while in 1994 only 220 metric tons were officially recorded. However, these figures underestimate total trade as there is a substantial illegal trade and supply, especially after the collapse of the former USSR.

In 1992, FAO recorded the total exports of caviar with 366 metric tons, of which 169 metric tons were legally exported by Iran and only 55 metric tons by the Russian Federation, while Germany re-exported 48 metric tons (Josupeit, 1994; Tab. 9, appendix). The countries of origin of the remaining 94 metric tons of exported caviar were not further specified. The reported exportation of caviar declined since 1988, when 572 metric tons were officially recorded of which 255 metric tons came from Iran and 143 metric tons from the USSR (Tab. 9, appendix). Of the total Caspian caviar production, which in 1996 is estimated to total about 270 metric tons (Tab. 7, appendix), most will be traded on the international market, judging from previous years´ trade records (DeMeulenaer and Raymakers, 1996). The expected legal production of caviar in 1996 is 45 metric tons in Russia, 20 metric tons in Kazakhstan, about 5 metric tons in Azerbaijan and about 120 metric tons in Iran (Tab. 7, appendix). The illegal caviar production in the Caspian Sea basin is estimated to be about 70-80 metric tons in 1996.

FAO recorded the official imports of caviar being stable during the period from 1992 to 1994 and amounting to about 530 metric tons per year (Josupeit, 1994). The major import market for caviar from Iran (Tab. 11, appendix) and the former Soviet Union (Tab. 10, appendix) are the EU with an average importation of about 200 metric tons per year (Tab. 15, appendix), while Japan imported on the average 60 metric tons (Tab. 13, appendix), the U.S.A. about 52 metric tons (Tab. 14, appendix) and Switzerland an estimated 66 tons caviar per year (data provided by the ´Bundesamt für Verinärwesen´, Switzerland). However, some of the official import statistics (Japan and Switzerland) do not distinguish between roe from sturgeons and other fish species, a fact which causes a further problem to the estimation of the total volume of the caviar in trade.

Within the EU (Tab. 15, appendix), Germany is the main importer with an average of 81 metric tons per year, but a huge quantity is repackaged and re-exported into neighbouring countries. In 1994, the total import of caviar into Germany was 104.1 metric tons of which 27.3 metric tons were re-exported and 75.8 metric tons were consumed in the country (Tab. 17, appendix). France is the second major importer with an average of 53 metric tons per year and is the major consumer of caviar within the EU. In 1994, France imported 47 metric tons of caviar (Tab. 15, appendix). Belgium/Luxembourg and the UK import an average of 23 metric tons of caviar per year; in 1994, Belgium/Luxembourg imported 28 metric tons and the UK imported only 6 metric tons (Tab. 15, appendix). The main suppliers of caviar to the EU are the Russian Federation, Iran, Kazakhstan and China (Tab. 16, appendix).

Official Japanese import statistics (Tab 13, appendix) show a total annual import of caviar into Japan of 56 metric tons in 1994, the main suppliers being the Russian Federation (22 metric tons), Iran (25 metric tons) and China (7 metric tons). 2 metric tons of caviar are imported from other countries.

The US Marine Service statistics show a total import of 54.2 metric tons of caviar into the USA in 1994 (Tab. 14, appendix). The main suppliers of caviar to the USA are the Russian Federation, Canada, China, Kazakhstan, Sweden and Germany (Tab. 14).

Switzerland imported in 1994 about 62 metric tons of caviar, the main suppliers being Iran, France, Germany, Sweden, Canada, Russia and Japan. Switzerland re-exported in 1994 about 13.5 metric tons of caviar, mainly to Saudi Arabia, France, USA and Australia.

According to Taylor (1996), the total Western World demand for caviar from Iran and the Russian Federation was about 450 metric tons in 1995 (Tab. 6, appendix), of which 3.5 metric tons were Iranian "beluga" and 0.2 metric tons were Russian "beluga". However, Taylor estimates that the total production of caviar from Iran and the former USSR in 1995 was only 228 metric tons, including 2 metric tons of Iranian "beluga" and 2 metric tons of Russian "sevruga". Hence, the Western World demand for caviar in general exceeded the actual total production by more than 100%. A general lack of beluga caviar on the international market has already caused replacements by other sturgeon caviar mislabelled as beluga (DeSalle and Birstein, 1996).

The world caviar market is currently undergoing a major crisis (Josupeit, 1994; TRAFFIC, 1995, Taylor, 1996; DeMeulenaer and Raymakers, 1997). Low quality caviar flooded the Western European markets in 1993 and 1994 (Taylor, 1996). This is mainly caused by over-exploitation, illegal production and smuggling of caviar, especially from the former Soviet Union. The sanitary conditions under which caviar is legally and illegally produced in this states are disastrous and as a result high amounts of processed caviar are only fit for disposal. Taylor (1995) estimated that for example in Azerbaidjan although the raw material was of high quality, almost 80% of the processed caviar was only fit for disposal due to disastrous conditions during production, packaging and dispatch. As a result prices collapsed also for the high quality caviar still arriving from the Republics of the former USSR and from Iran (Josupeit, 1994).

The average unit value of caviar exports shows an interesting development. While the unit value of the Iranian caviar has steadily increased from US$ 109/kg before 1988 to US$ 249/kg in 1992, the value of the Russian caviar has gone down (Josupeit, 1994; Tab. 9, appendix). The unit value of caviar exports from the former USSR peaked at US$ 279/kg in 1990. The recent changes in the former USSR and the decreasing quality of Russian caviar compelled Russians to sell at much lower prices, and the unit value fell to US$ 120/kg. However, German import data (Tab. 17, appendix) show prices for caviar from the CIS raising again after 1993.

According to Taylor (1996; Tab. 19a-b) the purchasing price for Russian "beluga" peaked in 1989 at about 2,091 US$ (1,394 DM) per kg net weight (duty unpaid) but fell down to 990 US$ (660 DM) per kg in 1995, while the purchasing price for Iranian "beluga" amounted to about 3,900 US$ (2,600 DM) per kg net weight in 1989, went down to 2,400 US$ (1,600 DM) per kg in 1991, and was finally only 1,425 US$ (950 DM) per kg in 1994 and 1995. Table 18 (appendix) shows retail prices for caviar in 1995.

Taylor (1996) states that the selling price for "beluga" has been to high for years, and thus the demand in the Western World sharply declined with the result that it is only bought in the tiniest quantities.

The main importers expressed their concern about the present state of the resource and fear a drastic shortage of caviar within the near future (Josupeit, 1994; Taylor, 1996). It seems inevitable that trade in caviar, both legal and illegal, is bound to shrink in the coming years and will fail to supply demand (DeMeulenaer and Raymakers, 1996).

3.3 Illegal trade

According to several experts and TRAFFIC (1995) illegal catch of sturgeons (mainly the three commercially important species *Acipenser gueldenstaedtii*, *Acipenser stellatus*, *Huso huso*) is of major concern, accounting for perhaps more than 90% of all sturgeon caught in the Caspian Sea.

In Russia, widespread illegal fishing for sturgeon is known to be practised, motivated by international demand for the highly priced caviar which cannot be met by the legal production. The illegally traded products are caviar and to a lesser degree the meat. Whereas the meat is probably for domestic consumption only, caviar is mainly smuggled outside the country and subject of an international illegal trade. This much is testified to by the 1452 sturgeon poachers detained and the more than 5 metric tons of illegally caviar and 113 metric tons of sturgeon confiscated in Russia in 1994 (according to the Ministry of Internal Affairs). In the Astrakhan region, the Russian centre of caviar trade, seven caviar canning plants operating illegally were closed down in the same year. Also in 1994, an additional 21 metric tons of sturgeon meat and 10.5 metric tons of caviar were confiscated as products of unauthorised fishing in other Russian regions (TRAFFIC, 1995). Reflecting the scale of illegal sturgeon fishing is the estimate that as much as 80% of the caviar trade is under unofficial control in parts of the CIS, and the illegal production of 1200 metric tons of caviar in Russia in 1990, and of 200 metric tons in 1992 was reported (Lindberg, 1994). The former quantity would equate to a sturgeon catch of about 16 000 metric tons, based on the calculation that approximately 7.5% of a given weight of sturgeon catch results in caviar. This amount is as high as the reported commercial sturgeon harvest at the time from the USSR (Tab. 1, appendix), representing a heavy toll on a declining stock.

Taylor (1995) estimates that the illegal trade of Russian caviar (mainly from the 3 commercially important species *Acipenser gueldenstaedtii*, *Acipenser stellatus*, *Huso huso*) which began on a large-scale since the disintegration of the former Soviet Union, peaked to about 100 metric tons in 1993. The trade channels are believed to pass from the Russian Federation mainly through the former Eastern block states, especially Poland, where poachers did not only smuggle caviar out of Russia, but also reprocessed and repackaged it and thus marketed it as "a new catch" (Taylor, 1996). Illegal caviar is sometimes repackaged in Eastern Europe and can retail at prices half or even less than normal, e.g. caviar of 700 US$ per kg is known to be sold for as low as 150 US$ per kg.

Taylor (1996) reports that in 1983, the illicit trade of Iranian caviar ("bazaar caviar", probably made of roe from *Acipenser gueldenstaedtii*, *Acipenser persicus*, *Acipenser stellatus* and *Huso huso*) reached its peak at 70 metric tons, which were transported to the West through adventurous channels. However, draconian measures by the Iranian state over ten years eventually brought the smuggling back down to pre-revolution levels of about 2-4 metric tons since 1993 (Taylor, 1996).

Large-scale smuggling and exporting of caviar has also developed in Azerbaijan and illegal trade channels led or still lead through Turkey (see Tab. 16, appendix) and Dubai, as well as Germany and U.S.A. (Taylor, 1996). The amount of caviar smuggled out of Azerbaijan was estimated to be more than 15 metric tons in 1993.

According to several importers in France, Germany and Belgium, the region of Astrakhan (Russia) and the State of Azerbaijan may be the two major suppliers of illegal Caspian caviar in trade, while Kazakhstan reputedly has a more controlled trading structure (DeMeulenaer and Raymakers, 1996).

Not only are sturgeon stocks, and thus the supply of caviar, under threat from unregulated fishing, but so are they also as a result of the illegal processing plants, which in turn circumvent appropriate control measures for caviar production. Caviar prepared in such unofficial processing plants does usually not meet the sanitary standards required by the importing countries and is considered to be of very low quality.

The proposed amendment is expected to stop the enormous illegal trade of caviar which leads to a complete overexploitation of the sturgeon stocks by means of a trade control given by the tools of CITES.

3.4 Actual or potential trade impacts

The caviar trade, especially the increasing illegal trade, threatens the survival of *Huso huso* because the natural reproduction of the species within its entire range has decreased to a critical point within the last years and the production of caviar leads to a further reduction of mature females. The relative high prices for caviar seduces an increasing number of poachers to earn a high amount of money within a short time. Although the entire caviar supply by the main exporting countries such as Iran and the Russian Federation declined to an estimated amount of 228 metric tons in

1995 (Taylor, 1996), the Western World demand remained stable at about 450 metric tons in 1995, and thus exceeded the official supply by 100%.

3.5 Captive breeding or artificial propagation for commercial purposes (outside countries of origin)

The captive breeding of *Huso huso* outside the countries of origin is not reported in any of the available aquaculture statistics. However, a hybrid between *Huso huso* and *Acipenser ruthenus* called "bester" which is fast growing and produces fertile descendants is subjet to aquaculture in European countries. The total size of the production of "bester" is not given in the available statistics.

4. Conservation and Management

4.1 Legal status

4.1.1 National

The national legal status of *Huso huso* within its range states is insufficiently known.

The Sea of Azov population of *Huso huso* has been recommended for listing in the Red Data Book of the Russian Federation (Pavlov et al., 1994).

4.1.2 International

Huso huso is listed in Appendix III of the Bern Convention (protected fauna).

4.2 Species management

4.2.1 Population monitoring

The specific monitoring programmes for *Huso huso* within its range states are insufficiently known.

In Romania, The Centre of Research for Fish Aquaculture, Fishing and Fishprocessing in Galati is monitoring the situation of sturgeon stocks upriver the Delta of the Danube (Birstein, 1996).

4.2.2 Habitat conservation

Not reported.

4.2.3 Management measures

Early management measures in the Caspian Sea mainly conducted by the Russian Federation since the construction of the Volgograd Reservoir dam included the construction of fish lifts, the construction of artificial spawning grounds below insurmountable dam constructions and the introduction of valuable food organisms (such as *Nereis diversicolor*) into certain regions of the Caspian Sea (Rochard et al., 1990).

Before the disintegration of the USSR, there was a strict management of the sturgeon fishery in the Caspian Sea, including a quota system, maximum and minimum size restrictions, closed seasons and a complete ban on the sea fishery. Since the collapse of the USSR in 1991, five states (Russian Federation, Iran, Azerbaijan, Khazakhstan and Turkmenistan) and the two autonomous republics of Dagestan and Kalmykia are fishing for sturgeons in the Caspian Sea. Until the beginning of 1996, there was no regulation of the fishery between the bordering countries and the fishing in the open sea was no longer prohibited. Since 1992, there has been an effort to forge an international agreement governing Caspian sturgeon catch between Russia, Kazakhstan, Turkmenistan, Azerbaijan, and Iran. A Committee for the Conservation and Use of Biological Resources in the Caspian Sea has been founded. Until the beginning of 1996, however, delegations from the five

Caspian countries involved have failed to agree on the size of their economic zones. In June 1996, the countries agreed on ban on fishing in the open sea. A quota system for the sturgeon catch has been set up between the former USSR countries: depending on the degree of contribution to the reproduction of sturgeon, each country obtains a quota in the Volga River (e.g. Russia 70%, Kazakhstan 18%, Azerbaijan 6% and Turkmenistan 6%).

The Russian Federation and Iran have ranching programmes for sturgeon species, including *Huso huso*. In Russia, several State hatcheries are artificially breeding and raising sturgeons since the 1960s. According to Khodorevskaya et al. (1997) these hatcheries released about 10 million beluga sturgeon fingerlings in 1993, and in 1994 about 12 million juveniles of *Acipenser stellatus* had been produced (Tab. 20, appendix). However, in 1995, the number of mature beluga females in the northern Caspian Sea was very low and not sufficient for the efficient artificial raising of juveniles (Birstein, 1996a).

Iran is also artificially propagating sturgeons since 20 years when the first hatchery was built in Rasht. According to the Iranian Fishery Organisation SHILAT, currently 5 hatcheries are working for the restocking programme of sturgeon species. The annual fry release in Iranian waters was about 3.4 millions of sturgeon juveniles, the different species not further distinguished (Tab. 21, appendix).

In the Sea of Azov basin, hatchery located on the Kuban River is still working efficiently, and successfully raised and released 116,000 beluga juveniles in 1994 (Chebanov and Savelieva, 1995).

4.3 Control measures

4.3.1 International trade

Not reported.

4.3.2 Domestic measures

Not reported.

5. Information on Similar Species

Huso huso is sympatric with *Acipenser gueldenstaedtii*, *Acipenser persicus*, *Acipenser stellatus* and *Acipenser nudiventris*.

The species is closely related to the Kaluga, *Huso dauricus*, which is an endemic of the Amur River system. The two species are the only members of the genus *Huso.*

6. Other Comments

All range states of the species (except Azerbaijan, Georgia, Kazakhstan, Turkmenistan and Ukraine which have been contacted in a meeting, see below) has been contacted on 13 March 1996 and 21 May 1996. A copy of the first draft of the proposal ("working document") has been sent to the range states on 19 August 1996. The comments of the range states that have been received are attached in the appendix at the end of this document.

The "working document" has also been presented at the 13th meeting of the Animals Committee of CITES in Prague, Czech Republic, on 23-27 September 1996 for discussion.

Additionally, the Authorities of the Russian Federation have been contacted in a first meeting in Moscow on 25 to 26 June 1996 for bilateral consultations. A second meeting ("Multilateral Consultations on the Problems of Sturgeon Species within the Framework of CITES") which took place on 21-22 November 1996 in Moscow, has been organised in order to consult with the states of Azerbaijan, Kazakhstan, Turkmenistan and Ukraine (which are not members to CITES) as well as with China, Georgia, Iran, USA and the Russian Federation. The minutes of this meeting and the comments of the range states that have been received are attached in the appendix at the end of this document.

7. Additional Remarks

In addition to the consultations with the range states of the species, countries which range amongst the main caviar consumers, such as the states of the European Union, Switzerland and Japan, has been contacted on 13 March 1996 and 21 May 1996. The so obtained statistics and information are included in the text.

8. References

Altuf´yev, Yu.V. 1994. Morphofunctional Condition of Muscle Tissue and Liver of Juvenile Russian Sturgeon and Beluga with Chronic Intoxication. Journal of Ichthyology 34 (5): 134-138.

Altuf´yev, Yu.V., A.A. Romanov and N.N. Sheveleva. 1992. Histology of the Striated Muscle Tissue and Liver in the Caspian Sea Sturtgeons. Journal of Ichthyology 32: 100-115.

Bacalbasa-Dobrovici, N. 1997. Endangered migratory sturgeons of the lower Danube River and its delta. In: V. Birstein, J. R. Waldman, and W. E. Bemis (eds.). Sturgeon Biodiversity and Conservation. Kluwer Academic Publishers, Dordrecht. pp. 201-207.

Barannikova, I.A. 1995. Measures to Maintain Sturgeon Fisheries under Conditions of Ecosystem Changes. Proceedings of the Second International Symposium on Sturgeons, September 6-11, 1993. Moscow-Kostroma-Moscow (Russia). VNIRO Publication. Pp. 131-136.

Barannikova, I.A., I.A. Burtsev, A.D. Vlasenko, A.D. Gershanovich, E.V. Makarov and M.S. Chebanov. Sturgeon Fisheries in Russia. Proceedings of the Second International Symposium on Sturgeons, September 6-11, 1993. Moscow-Kostroma-Moscow (Russia). VNIRO Publication. Pp. 124-130.

Berg, L.S. 1948. [The Freshwater Fishes of the USSR and Adjacent Countries.]. Moscow and Leningrad, Nauka Publication, Vol. I, pp. 57-109. (Engl. translation published by National Science Foundation, Washington D.C., 1962).

Birstein, V.J. 1993a. Sturgeons and Paddlefishes: Threatened Fishes in Need of Conservation. Conservation Biology 7 (4):773-787.

Birstein, V.J. 1993b. Draft Application to CITES: Order Acipenseriformes. Unpublished.

Birstein, V.J. 1996a. Sturgeons May Soon Disappear from the Caspian Sea. Russian Conservation News, No. 7 :15-16.

Birstein, V.J. 1996b. Sturgeons in the Lower Danube. The Sturgeon Quarterly, vol. 4, no. 1/2: 10-11.

Birstein, V. J., B. Sorkin, and R. DeSalle. 1997. Species identification of black caviar: a PCR based tool for sturgeon species conservation. Molecular Ecology (in press).

DeSalle, R., and V. J. Birstein. 1996. PCR identification of black caviar. Nature, 381 :197-198.

DeMeulenaer, T. and C. Raymakers. 1996. Sturgeons of the Caspian Sea and the international trade in caviar. TRAFFIC International.

Dumont, H. 1995. Ecocide in the Caspian Sea. Nature 377 :673-674.

Fischer, W., M. Schneider and M.-L. Bauchot. 1987. Fiches FAO d´Identification des Especes pour les Besoins de la Pêche. Mediterranee et Mer Noir, Zone de Pêche 37 (Révision 1), Vol. II: Vertèbres. FAO, Rome. Pp. 944-952.

Hensel, K., and J. Holcik. 1997. Past and current status of sturgeons in the upper and middle Danube. In: V. Birstein, J. R. Waldman, and W. E. Bemis (eds.). Sturgeon Biodiversity and Conservation. Kluwer Academic Publishers, Dordrecht. pp. 185-200.

IUCN (1996). 1996 IUCN Red List of Threatened Animals. IUCN, Gland, Switzerland.

Ivanov, V. P., A. D. Vlasenko, and R.P. Khodorevskaya. 1995b. How to preserve sturgeons. Rybnoe Khozyaistvo, No. 2 :24-26 (in Russian).

Ivanov, V. P., V. N. Belyaeva, and A. D. Vlasenko. 1995a. Regional distribution of commercial resources of the Caspian Sea. Rybnoe Khozyaistvo, No. 2 :18-21 (in Russian).

Jankovic, D. 1995. Populations of Acipenseridae Prior to and after the Construction of the HEPS "Djerdap I and II". Proceedings of the Second International Symposium on Sturgeons, September 6-11, 1993. Moscow-Kostroma-Moscow (Russia). VNIRO Publication. Pp. 235-238.

Josupeit, H. World Trade of Caviar and Sturgeon. FAO, Rome. 100 pp.

Khodorevkaya, R.P., G.F. Dovgopol and O.L Zhuravleva. 1995. Formation of Commercial Sturgeon (Acipenseridae) Stocks. Proceedings of the Second International Symposium on Sturgeons, September 6-11, 1993. Moscow-Kostroma-Moscow (Russia). VNIRO Publication. Pp. 137-150.

Khodorevskaya, R. P., G. F. Dovgopol, O. L. Zhuravleva, and A. D. Vlasenko. 1997. Present status of commercial stocks of sturgeons in the Caspian Sea basin. In: V. Birstein, J. R. Waldman, and W. E. Bemis (eds.). Sturgeon Biodiversity and Conservation. Kluwer Academic Publishers, Dordrecht. pp. 209-219.

Khodorevskaya, R. P., and A. S. Novikova. 1995. Status of Beluga Sturgeon, Huso huso, in the Caspian Sea. Journal of Ichthyology, 35(9) :59-68.

Khodorevskaya, R.P., A.A. Polyaninova, P.P. Geraskin and A.A. Romanov. 1995. A Study on Physiological and Biochemical Status of Beluga Sturgeon, *Huso huso* (L.), and its Feeding Habits. Proceedings of the Second International Symposium on Sturgeons, September 6-11, 1993. Moscow-Kostroma-Moscow (Russia). VNIRO Publication. Pp. 164-177.

Kuz´mina, O. Yu., V.I. Luk´yanenko, Ye.I. Shakmalova, Ye.A. Lavova and Yu.V. Natochin. 1993. Specific Features of Water and Salt Homeostasis in Sturgeon during Muscle Degeneration. Journal of Ichthyology 33: 93-100.

Lelek, A. 1987. Threatened Fishes of Europe. The Freshwater Fishes of Europe. Vol. 9. The European Committee for the Conservation of Nature and Natural Resources - Council of Europe (ed.). Wiesbaden, AULA-Verlag. Pp. 42-57.

Levin, A.V. 1995. Russian Sturgeon, *Acipenser gueldenstaedti* Brandt, Stocking in the Volga-Caspian Basin. Proceedings of the Second International Symposium on Sturgeons, September 6-11, 1993. Moscow-Kostroma-Moscow (Russia). VNIRO Publication. Pp. 178-188.

Levin, A.V. 1996. The Distribution and Migration of Sturgeon in the Caspian Sea. In: Workshop "Sturgeon Stocks and Caviar Trade", Bonn, October 9-10 1995. In press.

Lindberg, O. (1994). Black market turns importers to Iran for caviar. International Management, June 1994.

Lukyanenko, V. I., A. L. Polenov, and A. L. Yanshin. 1994. Is it possible to save Caspian sea sturgeons? Vestnik Rossiiskoi Akademii Nauk, 64 (7) :606-620 (in Russian).

Pavlov, D. S., K. A. Savvaitova, L. I. Sokolov, and S. S. Alekseev. 1994. Rare and endangered animals. Fishes. Vysshaya Shkola, Moscow. 334 pp. (in Russian).

Pirogovskii, M.I., L.I. Sokolov and V.P. Vasil´ev. 1989. *Huso huso* (Linnaeus, 1758). In: Holcík, J. (ed). The Freshwater Fishes of Europe. Vol. 1/II: General Introduction of Fishes. Acipenseriformes. Wiesbaden, AULA-Verlag. Pp. 156-200.

Raspopov, V.M. 1990. Fecundity of the Winter and Spring Races of the Volga-Caspian Beluga, *Huso huso*. Journal of Ichthyology 30 (4): 152-159.

Raspopov, V.M. 1993. Age Structure and Population Dynamics of the Beluga, *Huso huso*, Migrating into the Volga. Journal of Ichthyology 33 (3): 105-112.

Rochard, E., G. Castelnaud and M. Lepage. Sturgeons (Pisces: Acipenseridae): Threats and Prospects. Journal of Fish Biology 37 (Suppl. A): 123-132.

Rodionov, S. N. 1994. Global and Regional Climate Interaction: The Caspian Sea Experience. Kluwer Academic Publishers, Dordrecht. 241 pp.

Romanov, A.A. and N.N. Sheveleva. 1993. Disruption in the Gonadogenesis in Caspian Sturgeons (Acipenseridae). Journal of Ichthyology 33 (3): 127-133.

Romanov, A.A. and Yu.V. Altuf´yev. 1991. Tumors in the Sex Glands and Liver of the Caspian Sea Sturgeons. Journal of Ichthyology 30: 44-49.

Romanov, A.A. and Yu.V. Altuf´yev. 1993. Ectopic Histogenesis of Sexual Cells of Caspian Sea Sturgeon. Journal of Ichthyology 33 (2): 140-150.

Rossi, R., G. Grandi, R. Trisolini, P. Franzoi, A. Carrieri, B. S. Dezfuli, and E. Vecchietti. 1991. Osservazioni sulla biologia e la pesca dello storione cobice (*Acipenser naccarii*, Bonaparte) nelle parte terminale del fiume Po. Atti Soc. Ital. Sci. Natur. Mus. Civ. Stor. Natu. Milano, 132 :121-142.

Sagers, M. J. 1994. The Oil Industry in the Southern-Tier Former Soviet Republics. Post-Soviet Geography, 35 (5) :267-298.

Savelieva, E. A., and M. S. Chebanov. 1995. For the first time in the Kuban River region, Sea of Azov beluga are restocked. Rybovodstvo I Rybolovstvo, No. 2 :18 (in Russian).

Shagaeva, V.G., M.P. Nikol´skaya, N.V. Akimova, K.P. Markov and N.G. Nikol´skaya. 1993. A Study of the Early Ontogeny of Volga Sturgeon (Acipenseridae) Subjected to Human Activity. Journal of Ichthyology 33 (6): 23-41.

Shagaeva, V.G., M.P. Nikol´skaya, N.V. Akimova and K.P. Markov. 1995. Pathology of the Early Ontogenesis of the Volga River Basin Acipenseridae. Proceedings of the Second International Symposium on Sturgeons, September 6-11, 1993. Moscow-Kostroma-Moscow (Russia). VNIRO Publication. Pp. 62-73.

Taylor, S.1996. The Historical Development of the Caviar Trade and Industry. In: Workshop "Sturgeon Stocks and Caviar Trade", Bonn, October 9-10 1995. In press.

TRAFFIC Europe. 1995. A TRAFFIC network report to the CITES Animals Committee on the TRAFFIC Europe Study of the International Trade in Sturgeon and Sturgeon Products. Unpublished report. 3pp.

Vlasenko, A. D. 1990. Sturgeon population size in the Caspian Sea. Rybnoe Khozyaistvo, No. 7 :53-56 (in Russian).

Vlasenko, A.D. 1996. The Present Status and Conservation of Sturgeons (Acipenseridae) in the Caspian Basin. Proceedings of the International Conference on Sturgeon Biodiversity and Conservation, New York 1994. In press.

Volovik, S.P., V.G. Dubinina and AQ.D. Semenov. 1993. Hydrobiology and Dynamics of Fisheries in the Azov Sea. Studies and Reviews. General Fisheries Council for the Mediterranean. No. 64. FAO, Rome. Pp. 1-58.

Pseudoscaphirhynchus fedtschenkoi

1. Taxonomy

1.1	Class:	Actinopterygii
1.2	Order:	Acipenseriformes
1.3	Family:	Acipenseridae
1.4	Species:	*Pseudoscaphirhynchus fedtschenkoi* (Kessler, 1872)
1.5	Scientific synonyms:	*Scaphirhynchus fedtschenkoi* Kessler, 1872 *Pseudoscaphirhynchus fedtschenkoi brevirostris* Berg, 1905 *Pseudoscaphirhynchus fedtschenkoi intermedia* Berg, 1905 *Pseudoscaphirhynchus fedtschenkoi longirostris* Berg, 1905
1.6	Common names:	English: Syr-Dar shovelnose Russian: Syrdar´inskii lopatonos

2. Biological Parameters

2.1 Distribution

Countries of origin: Kazakhstan, Tadjikistan, Uzbekistan.

The species is endemic to the Syr Darya River where it inhabits the middle reaches of the river from the Fergana Valley to the lower reaches (Nikol´skii, 1938; Berg, 1948; Reshetnikov and Shakirova, 1993). The Syr Darya is characterised as a turbid river with a mean annual sediment out wash from the Naryn and Kara Darya drainages (which meet to form the Syr Darya) of 357 t/km^2 (Salikhov and Kamilov, 1995).

P. fedtschenkoi is not migratory but spends its whole life in freshwater. Adults are reported to spawn near Chinaz on rocky sediments in the second half of April (Berg, 1948).

2.2 Habitat availability

Being one of the two rivers feeding the Aral Sea, the Syr Darya is the longest river in Central Asia with a total catch area of around 462.000 km^2. The Syr Darya and its tributaries flow through the economically most important regions of the Central Asian Republics of Tadjikistan, Uzbekistan and Khazakhstan and are the main sources of their water supply (Salikhov and Kamilov, 1995).

Their waters had been used for centuries for irrigation, particularly in the Fergana Valley and Tashkent Oasis; however, irrigation systems were local and their impact on the composition of the ichthyofauna was slight (Shul´ts, 1956).

From 1950 on, large-scale hydroconstruction has been started using the waters for an irrigation system for the newly settled cotton industry. In the following years, by increasing agricultural production (90% of all cotton grown in Russia is produced in this region) through expansion of irrigation, the Syr Darya, perhaps more than any other river, was subjected to massive hydroconstruction. 22 reservoirs with a total area of 1854 km^2 were constructed in its basin and as a result the Syr Darya and all of its tributaries were regulated (Salikhov and Kamilov, 1995). At present time, a branched irrigation network exists virtually throughout the entire middle course of the Syr Darya. Water depletion increased annually and reached 50 km^2/a in the 1980s (Salikhov and Kamilov, 1995).The whole water regime has been destroyed and due to the formation of channel reservoirs, the flow velocity changed. Thus, life conditions for endemics of the turbid waters of Central Asia, like the Syr Darya shovelnose as well as the main aboriginal core of the ichthyofauna of the middle and piedmont sections of the Syr Darya basin, became unfavourable.

As a consequence of the large-scale hydroconstruction on both river systems of the Syr Darya and Amu Darya, the Aral Sea is drying and since 1960 lost up to 70% of its volume (Feschbach and Friendly, 1991; Peterson, 1992; Smith, 1994).

2.3 Population status

P. fedtschenkoi has always been reported to be rare within its distribution range (Nikol´skii, 1938). Like other members of the ichthyofauna of the Syr Darya, it has been studied rather extensively. Nikol´skii (1938) and Berg (1948) describe the species as polymorphic and distinguish three forms: "the type form" with a long snout and without cercus, "morpha brevirostris" with short snout and long cercus and "morpha intermedia" with moderately elongate snout and a cercus. After Berg (1948) all these forms were not infrequently found in the same catch.

At present, the population of *P. fedtschenkoi* is practically extinct (Birstein, 1993 and 1997). For the last 25 years there have been no reports of the species being caught (Mitrofanov et al., 1986; Salikhov and Kamilov, 1995).

Pseudoscaphirhynchus fedtschenkoi is listed as Extinct by Pavlov et al. (1994) and as Critically Endangered by IUCN (1996).

2.4 Population trends

The population of *Pseudoscaphirhynchus fedtschenkoi* is practically extinct (Birstein, 1993) because of the complete destruction of its habitat.

2.5 Geographic trends

The water regime of the Syr Darya has been completely destroyed because of the construction of an enormously large irrigation system for cotton growing. New habitats in form of drainage lakes, like the Arnasayskaya lake system and Lake Sarykamysh (Fergana Valley), appeared and offered new life conditions for typical lake forms (Salikhov and Kamilov, 1995). However, the original habitat is lost for the main aboriginal core of the ichthyofauna adapted to turbid waters.

2.6 Role of the species in its ecosystem

Pseudoscaphirhynchus fedtschenkoi has been rather extensively studied and its role in the ecosystem is not clear. Nikol´skii (1938) mentions the Syr Darya shovelnose to feed on benthic invertebrates.

2.7 Threats

The Syr Darya shovelnose is threatened by a complete loss of its natural habitat, i.e. the complete regulation of the river flow of the Syr Darya because of the construction of a large irrigation system for cotton industry. In addition, runoff waters are carrying large amounts of salts as well as mineral fertilisers and toxic chemicals used for cotton growing which, undoubtedly, affect the ichthyofauna in many aspects (growth rate, fecundity, survival, etc.) (Salikhov and Kamilov, 1995). However, this effect has not been studied for the basin of the Syr Darya and its inhabitants including *P. fedtschenkoi* but has only been demonstrated for other fish species in the Lake Sarykamysh of the Amu Darya basin (Sal´nikov and Reshetnikov, 1991).

As a consequence of the large irrigation system all main river basins of the Aral Sea - the Amu Darya, Zeravshan, Kashka Darya and Syr Darya - have been connected which has resulted in mixing of faunas and dispersal of some species (Salikhov and Kamilov, 1995).

In the 1930s the introduction of non-native fish species into the river systems of the Aral Sea basin was started in order to increase the diversity of commercial fishes. This also involved the middle course of the Syr Darya and the wide dispersal of a number of newly introduced species has affected the local ichthyofauna. Some Far Eastern invaders crowded out native species from their typical niches (Salikhov and Kamilov, 1995). A specific effect on *P. fedtschenkoi* has not been studied but may be probable.

3. Utilization and Trade

3.1 National utilization

Pseudoscaphirhynchus fedtschenkoi has no commercial value and is not caught (Birstein, 1993).

3.2 Legal international trade

Not reported.

3.3 Illegal trade

None

3.4 Actual or potential trade impacts

None

3.5 Captive breeding or artificial propagation for commercial purposes (outside countries of origin)

None

4. Conservation and Management

4.1 Legal status

4.1.1 National

Pseudoscaphirhynchus fedtschenkoi is listed as Endangered in the USSR Red Data Book (1984), in the Kazakh SSR Red Data Book (1978) and the Uzbek SSR Red Data Book.

4.1.2 International

None.

4.2 Species management

4.2.1 Population monitoring

None

4.2.2 Habitat conservation

None

4.2.3 Management measures

Not reported.

4.3 Control measures

4.3.1 International trade

None

4.3.2 Domestic measures

None

5. Information on Similar Species

The Aral population of the ship sturgeon, *Acipenser nudiventris*, is another victim of the Aral Sea disaster (i.e. drying of the Aral Sea as a result of using the waters of Syr Darya and Amu Darya for irrigation for the cotton industry). *A. nudiventris* is a migratory species and its members of the Aral population were reported to spawn together with *P. fedtschenkoi* in the Syr-Darya near Chinaz (Berg, 1948). At present, the Aral population of *A. nudiventris* is considered to be Extinct (Zholdasova, 1997).

Two other species of the same genus *Pseudoscaphirhynchus, P. hermanni* and *P. kaufmanni* (status after IUCN (1996): Critically Endangered) inhabit the second big river of the Aral Sea basin, the Amu Darya.

A closely related genus, *Scaphirhynchus* Heckel, has three species in the Mississippi and Missouri, U.S.A., which are listed as Critically Endangered (*Scaphirhynchus suttkusi*), Endangered (*Scaphirhynchus albus*) and Vulnerable (*Scaphirhynchus platorynchus*).

6. Other Comments

The range states of the species (except Kazakhstan which has been contacted in a meeting, see below) has been contacted on 13 March 1996 and 21 May 1996. The comments of the range states that have been received are attached in the appendix at the end of this document.

The "working document" has also been presented at the 13th meeting of the Animals Committee of CITES in Prague, Czech Republic, on 23-27 September 1996 for discussion.

Additionally, a meeting ("Multilateral Consultations on the Problems of Sturgeon Species within the Framework of CITES") which took place on 21-22 November 1996 in Moscow, has been organised in order to consult with the states of Azerbaijan, Kazakhstan, Turkmenistan and Ukraine (which are not members to CITES) as well as with China, Georgia, Iran, USA and the Russian Federation. The minutes of this meeting and the comments of the range states that have been received are attached in the appendix at the end of this document.

7. Additional Remarks

8. References

Berg, L.S. 1948. [The Freshwater Fishes of the USSR and Adjacent Countries.]. Moscow and Leningrad, Nauka Publication, Vol. I, pp. 57-109. (Engl. translation published by National Science Foundation, Washington D.C., 1962).

Birstein, V.J. 1993. Sturgeons and Paddlefishes: Threatened Fishes in Need of Conservation. Conservation Biology 7 (4):773-787.

Birstein, V.J. 1997. Threatened fishes of the world: *Pseudoscaphirhynchus* spp. (Acipensridae). In: V. Birstein, J. R. Waldman, and W. E. Bemis (eds.). Sturgeon Biodiversity and Conservation. Kluwer Academic Publishers, Dordrecht. pp. 381-383.

Dukravets, G.M. and V.P. Mitrofanov. 1982. Rare and endangered fish species of the Kazakhstan fauna. In: Animal world of Kazhachstan and Problems of Its Preservation. Alma-Ata, Nauka Publication, pp. 68-70.

Feshbach, M. and A. Friendly, Jr. 1991. Ecocide in the USSR. Health and Nature Under Siege. New York, Basic Books, 376 pp.

IUCN. 1996. IUCN Red List of Threatened Animals. IUCN, Gland, Switzerland.

Mitrofanov, V. P., G. M. Dukravets, H. E. Peresidi, and A. N. Poltorykhina. 1986. Fishes of Kazakhstan. Vol. 1. GYLYM Press, Alma-Ata. 271 pp. (in Russian).

Nikol´skii, G. V. 1938. Fishes of Tadzhikistan. Mosow and Leningrad, Izdatelstvo Akad. Nauk USSR, pp. 55-74.

Pavlov, D. S., K. A. Savvaitova, L. I. Sokolov, and S. S. Alekseev. 1994. Rare and endangered animals. Fishes. Vysshaya Shkola, Moscow. 334 pp. (in Russian).

Pavlovskaya, L.P. and I.M. Zholdasova. 1991.Antropogenic Changes in the Fish Fauna of the Amu Darya River (based on data from sampling drift of eggs and larvae). Journal of Ichthyology 31 (8): 106-117.

Peterson, D.J. 1993. Troubled Lands. The Legacy of Soviet Environmental Destruction. Boulder e.a., Westview Press. 276pp.

Reshetnikov, Yu.S. and F.M. Shakirova.1993. A Zoogegraphical Analysis if the Ichthyofauna of Central Asia Including a List of Freshwater Fishes. Journal of Ichthyology 33 (4): 99-111.

Sal´nikov, V.B. and Yu.S. Reshetnikov. 1991. Formation of Fish Populations in Artificial Waters in Turkmenistan. Journal of Ichthyology 31 (8). 82-95.

Salikhov, T.V. and B.G. Kamilov.1995. Ichthyofauna of the Mid-Syr Darya Basin. Journal of Ichthyology 35 (6): 61-71.

Shul´ts, V.L. 1956. Rivers of Central Asia. Leningrad, Gidrometeoizdat.

Smith, D. R. 1994. Change and Variability in Climate and Ecosystem Decline in Aral Sea Basin Deltas. Post-Soviet Geography, 35 (3) :142-165.

Zholdasova, I. 1997. Sturgeons and the Aral Sea ecological catastrophe. In: V. Birstein, J. R. Waldman, and W. E. Bemis (eds.). Sturgeon Biodiversity and Conservation. Kluwer Academic Publishers, Dordrecht. pp. 373-380.

Pseudoscaphirhynchus hermanni

1. Taxonomy

   1.1 Class: Actinopterygii

   1.2 Order: Acipenseriformes

   1.3 Family: Acipenseridae

   1.4 Species: *Pseudoscaphirhynchus hermanni* (Kessler, 1877)

   1.5 Scientific synonyms: *Scaphirhynchus hermanni* Kessler, 1877
   Pseudoscaphirhynchus rossikowi Nikolski, 1900

   1.6 Common names: English: Small Amu-Dar shovelnose
   Russian: Malyi amudar´inskii lopatonos

2. Biological Parameters

   2.1 Distribution

   Countries of origin: Turkmenistan, Uzbekistan.

   Pseudoscaphirhynchus hermanni is endemic to the Amu Darya River where it occurs in the middle course of the river from Termez to the mouths (Berg, 1948; Reshetnikov and Shakirova, 1993).

   Like the other species of the genus, *P. hermanni* is not migratory and spends its whole life cycle in freshwater. Shovelnoses, including *P. hermanni*, occur only in turbid waters. Their known habitats are represented by shallow water rivers with sandy or stony-pebble ground (Nikol´skii, 1938).

   2.2 Habitat availability

   The Amu Darya is one of the two rivers that feed the Aral Sea and represents with a total extension of 1,257 km the largest and full-water river of Central Asia. The entire flow is formed in the mountain regions of Pamir and Hindu Kush and has no tributaries for the space of the last 1,257 km to the Aral Sea (Salikhov and Kamilov, 1995).

   Like the waters of the Syr Darya, those of the Amu Darya had been used for centuries for irrigation. However, irrigation systems were local and their impact on the composition of the ichthyofauna was slight (Salikhov and Kamilov, 1995).

   In the 1950s, large-scale hydroconstruction was started using the waters for a vast irrigation and drainage network for cotton industry (Ellis, 1990; Feshbach and Friendly, 1993; Smith, 1994). During the last 15-20 years, great changes have occurred in the Amu Darya ecosystem under the influence of regulated flow and flow depletion: the river is regulated by two dams (Takhiatash and Tuya-muyun) and in its basin 17 reservoirs with a total area of 1,463 km^2 were constructed (Pavlovskaya and Zholdasova, 1991). Hydrological conditions changed drastically because of increased water diversion through numerous irrigation canals, the largest being the Karakum Canal which originates in the upper plains section of the Amu Darya and leads the waters to the fields of southern Turkmenistan. The total length of the presently functioning channel of the canal is 1,100 km and another 272 km are still under construction.

   Fluctuations in the volume of the Amu Darya flow have always occurred and before the complete regulation of the river were mostly due to variations of the glacier-snow supply. A spring-summer peak and a dry-season fall were quite distinct (Zholdasova, 1997). From the middle of the 1970s until the end of the 1980s the annual flow decreased drastically because of the massive hydroconstruction. Direct connections of the river with the Aral Sea were interrupted in the middle of the 1970s, when the volume of the river water flow to the Takhiatash hydrocomplex was decreased to such an extent that it was fully withdrawn for irrigation and no downstream flow took place. In 1982 the Amu Darya flow did not reach the Aral Sea at all. The river bed in the region of the Takhiatash hydrocomplex downstream from the dam dried and became drainless. Many side channels of the river dried, natural floods ceased and the appearance of the delta markedly changed (Zholdasova, 1997).

The complete regulation of the flow of the Amu Darya led to total destruction of the original water regime and, consequently, to the loss of the typical habitat for *P. hermanni*.

2.3 Population status

Nikol´skii (1938) and Berg (1948) already mention *P. hermanni* as rare within its distribution range. Ever since, no population estimates have been made and the species has not been further investigated because of its low abundance and commercial value. There was no finding of *P. hermanni* reported after 1982 and it was believed that this species has disappeared. However, in April 1996, three specimens of *P. hermanni* have been caught in the Amu Darya, the first record of the species since the last fifteen years (Salnikov, 1996).

IUCN (1996) classified the status of the population of *P. herrmanni* as Critically Endangered.

2.4 Population trends

Since findings of *P. hermanni* were not reported after 1982 the population was believed to be Extinct (Pavlov et al., 1994). The recent finding of three specimens (Salnikov, 1996) however, indicate that some individuals of *P. hermanni* are still present in the Amu Darya.

2.5 Geographic trends

Since in 1960 the massive hydroconstruction on the Amu Darya started the range area of *P. hermanni* decreased drastically because of the complete regulation of the river flow and a resulting low water level (Zholdasova, 1997). However, there is no information available about the direct impact on the populations of *P. hermanni* because the species was not monitored.

The entire Aral Sea ecosystem and that of the Amu Darya and Syr Darya, which discharge into it, are under extreme stress because of the massive anthropogenic impact on the water regimes, and in the foreseeable future no change in the situation for the better appears likely (Smith, 1994; Zholdasova, 1997).

2.6 Role of the species in its ecosystem

Like the other representatives of the genus *Pseudoscaphirhynchus*, *P. hermanni* has been rather extensively studied. There is little information about the biology of the species (Tleuov and Sagitov, 1973) and its role in the ecosystem is not clear. The possible consequences of a depletion of the populations of the species for other species depending on or associated with it are not predictable.

2.7 Threats

The main threat for the survival of *P. hermanni* is the destruction of its typical habitat in the middle and upper course of the Amu Darya through using the waters of the river for an enormous irrigation system for the cotton industry. Distinct water deficiency was especially produced in the lower river flow and let not only to its drying but also to salination because the natural sediments in this region are saline. Initially, the mean many-year total content of ions in the Amu Darya water was 540 mg/l (Rogov, 1957 in Zholdasova, 1997). Now the mean annual water mineralization in the middle river flow varied during the last decade within 600 to 1,500 mg/l (Zholdasova, 1997). Naturally, the lower river flows are regions where the increased mineralization is most pronounced: in Nukus (215 km from the mouth) the mean annual mineralization was 1,525.5 mg/l in 1989 and 946.8 in 1990 (Yearbook of Surface Waters Quality, 1991 in Zholdasova, 1997)

Accompanying the large-scale cotton growing, a chemization of the agriculture begun in the 1960s which involved wide application of mineral fertilisers and pesticides contaminating the environment. Additionally, a contamination of the surface waters (rivers and lakes) due to the disposal of drainage waste from the zone of irrigated land cultivation took place. The volume of this disposal sharply increased by the end of the 1980s with a total volume of 32 km^3/year in Central Asia out of which 21.1 km^3 were deposited in the Amu Darya basin (Zholdasova, 1997).

Increased mineralization, contamination of the waters with mineral fertilizers and pesticides and a general pollution with oil products, heavy metals and organic substances, completely changed the hydrochemical regime of the Amu Darya basin (Zholdasova, 1997) and affected the local ichthyofauna in many aspects of their biology (growth rate, fecundity, survival, etc.). However, the particular impact on the populations of *P. hermanni* has not been investigated.

3. Utilization and Trade

3.1 National utilization

Because of its low abundance *Pseudoscaphirhynchus hermanni* was not caught and had no commercial value (Nikol´skii, 1938; Berg, 1948).

3.2 Legal international trade

None

3.3 Illegal trade

None

3.4 Actual or potential trade impacts

None

3.5 Captive breeding or artificial propagation for commercial purposes (outside countries of origin)

None

4. Conservation and Management

4.1 Legal status

4.1.1 National

P. hermanni is listed as Endangered in the USSR Red Data Book (1984), in the Uzbek SSR Red Data Book (1993) and in the Turkmen SSR Red Data Book (1984).

4.1.2 International

None

4.2 Species management

4.2.1 Population monitoring

None

4.2.2 Habitat conservation

None

4.2.3 Management measures

None

4.3 Control measures

4.3.1 International trade

None

4.3.2 Domestic measures

None

5. Information on Similar Species

P. hermanni is sympatric with the large Amu-Dar shovelnose *P kaufmanni* and closely related with the third representative of the genus, *P. fedtschenkoi* which lives in the Syr Darya and is also believed to be Extinct (Pavlov et al., 1994). All three species are victims of the Aral Sea ecological catastrophe.

6. Other Comments

The range states of the species has been contacted in a meeting ("Multilateral Consultations on the Problems of Sturgeon Species within the Framework of CITES") which took place on 21-22 November 1996 in Moscow. The minutes of this meeting and the comments of the range states that have been received are attached in the appendix at the end of this document.

7. Additional Remarks

8. References

Berg, L.S. 1948. [The Freshwater Fishes of the USSR and Adjacent Countries.]. Moscow and Leningrad, Nauka Publication, Vol. I, pp. 57-109. (Engl. translation published by National Science Foundation, Washington D.C., 1962).

Birstein, V.J. 1993. Sturgeons and Paddlefishes: Threatened Fishes in Need of Conservation. Conservation Biology 7 (4):773-787.

Birstein, V.J. 1997. Threatened fishes of the world: *Pseudoscaphirhynchus* spp. (Acipensridae). In: V. Birstein, J. R. Waldman, and W. E. Bemis (eds.). Sturgeon Biodiversity and Conservation. Kluwer Academic Publishers, Dordrecht. pp. 381-383.

Ellis, W.S. 1990. The Aral: A Soviet Sea Lies Dying. National Geographic 177 (2): 71-92.

Feshbach, M. and A. Friendly, Jr. 1991. Ecocide in the USSR. Health and Nature Under Siege. New York, Basic Books, 376 pp.

IUCN. 1996. IUCN Red List of Threatened Animals. IUCN, Gland, Switzerland.

Nikol´skii, G. V. 1938. Fishes of Tadzhikistan. Mosow and Leningrad, Izdatelstvo Akad. Nauk USSR, pp. 55-74.

Pavlov, D. S., K. A. Savvaitova, L. I. Sokolov, and S. S. Alekseev. 1994. Rare and endangered animals. Fishes. Vysshaya Shkola, Moscow. 334 pp. (in Russian).

Pavlovskaya, L.P. and I.M. Zholdasova. 1991.Antropogenic Changes in the Fish Fauna of the Amu Darya River (based on data from sampling drift of eggs and larvae). Journal of Ichthyology 31 (8): 106-117.

Reshetnikov, Yu.S. and F.M. Shakirova.1993. A Zoogegraphical Analysis if the Ichthyofauna of Central Asia Including a List of Freshwater Fishes. Journal of Ichthyology 33 (4): 99-111.

Sal´nikov, V.B. and Yu.S. Reshetnikov. 1991. Formation of Fish Populations in Artificial Waters in Turkmenistan. Journal of Ichthyology 31 (8). 82-95.

Salikhov, T.V. and B.G. Kamilov.1995. Ichthyofauna of the Mid-Syr Darya Basin. Journal of Ichthyology 35 (6): 61-71.

Salnikov, V. B., V. J. Birstein, and R. L. Mayden. 1996. The contemporary status of the two Am Darya River shovelnose sturgeons, *Pseudoscaphirhynchus kaufmanni* and *P. hermanni.* Sturgeon Quarterly, 4 (3) :8-10.

Smith, D. R. 1994. Change and Variability in Climate and ecosystem Decline in Aral Sea Basin Deltas. Post-Soviet Geography, 35 (3) :142-165.

Tleuov, R. T., and N. I Sagitov. 1973. Acipenserid Fishes of the Aral Sea. FAN Press, Tashkent. 155 pp. (in Russian).

Zholdasova, I. 1997. Sturgeons and the Aral Sea ecological catastrophe. In: V. Birstein, J. R. Waldman, and W. E. Bemis (eds.). Sturgeon Biodiversity and Conservation. Kluwer Academic Publishers, Dordrecht. pp. 373-380.

Pseudoscaphirhynchus kaufmanni

1. Taxonomy

   1.1 Class: Actinopterygii

   1.2 Order: Acipenseriformes

   1.3 Family: Acipenseridae

   1.4 Species: *Pseudoscaphirhynchus kaufmanni* (Bogdanov, 1874)

   1.5 Scientific synonyms: *Scaphirhynchus kaufmanni* Bogdanov, 1874

   1.6 Common names:
   English: Large Amu-Dar shovelnose, False shovelnose sturgeon, Shovelfish
   Polish: Wielki lopatonos
   Russian: Amudar´inskii lopatonos

2. Biological Parameters

   2.1 Distribution

Countries of origin: Tadjikistan, Turkmenistan, Uzbekistan.

Pseudoscaphirhynchus kaufmanni is endemic to the Amu Darya (Turkmenistan and Uzbekistan, Central Asia), and occurs from the Pyandzh (near Faizabad-kala) to the mouth (Nikol´skii, 1938; Berg, 1948; Reshetnikov and Shakirova, 1993; Birstein, 1997).

In former times, the major part of the population of *P. kaufmanni* was constantly located in the foothill and valley zones of the river. It was largely concentrated at Kerki-Chardzhou-Il´dzhik in the upper and middle valley flow but its abundance in the lower river flow was significant, too (Zholdasova, 1997). Specimens of *P. kaufmanni* were sometimes encountered in the brackish water of Taldyk bay in the Delta of the Amu Darya (Berg, 1948).

Now, the species is preserved only in the middle Amu Darya flow. Studies carried out in 1989 and 1990 (Zholdasova, 1997) and in 1996 (Salnikov, 1996) showed a concentration of *P. kaufmanni* in its traditional habitats in the middle flow in a region from Kerki to Chardzhou.

Like its relatives of the same genus, *P. kaufmanni* is a non-migratory freshwater fish which occurs exclusively in the flow-type of turbid waters with a high sediment out wash. It never occurs in the lakes of the Amu Darya basin and Nikol´skii (1938) believed that in the stagnant water it rapidly died. Thus the typical habitat is represented by turbid shallow-water rivers with sandy or stony-pebbled ground (Nikol´skii, 1938).

   2.2 Habitat availability

The Amu Darya is one of the two rivers that feed the Aral Sea and represents with a total extension of 1,257 km the largest and full-water river of Central Asia. The entire flow is formed in the mountain regions of Pamir and Hindu Kush and has no tributaries for the space of the last 1,257 km to the Aral Sea (Salikhov and Kamilov, 1995).

Like the waters of the Syr Darya, those of the Amu Darya had been used for centuries for irrigation. However, irrigation systems were local and their impact on the composition of the ichthyofauna was slight (Salikhov and Kamilov, 1995).

In the 1950s, large-scale hydroconstruction was started using the waters for a vast irrigation and drainage network for cotton industry (Ellis, 1990; Feshbach and Friendly, 1993; Smith, 1994). During the last 15-20 years, great changes have occurred in the Amu Darya ecosystem under the influence of regulated flow and flow depletion: the river is regulated by two dams (Takhiatash and

Tuya-muyun) and in its basin 17 reservoirs with a total area of 1,463 km^2 were constructed (Pavlovskaya and Zholdasova, 1991). Hydrological conditions changed drastically because of increased water diversion through numerous irrigation canals, the largest being the Karakum Canal which originates in the upper plains section of the Amu Darya and leads the waters to the fields of southern Turkmenistan. The total length of the presently functioning channel of the canal is 1,100 km and another 272 km are still under construction (Sal´nikov, 1995).

Fluctuations in the volume of the Amu Darya flow have always occurred and before the complete regulation of the river were mostly due to variations of the glacier-snow supply. A spring-summer peak and a dry-season fall were quite distinct (Zholdasova, 1997). However, from the middle of the 1970s until the end of the 1980s the total annual flow decreased drastically because of the massive hydroconstruction. Direct connections of the river with the Aral Sea were interrupted in the middle of the 1970s, when the volume of the river water flow to the Takhiatash hydrocomplex was decreased to such an extent that it was fully withdrawn for irrigation and no downstream flow took place. In 1982 the Amu Darya flow did not reach the Aral Sea at all. The river bed in the region of the Takhiatash hydrocomplex downstream from the dam dried and became drainless. Many side channels of the river dried, natural floods ceased and the appearance of the delta markedly changed (Zholdasova, 1997).

Thus, Zholdasova (1997) suggests that in the low-water period from the middle of the 1970s until the end of the 1980s the fall of the current rate, the clearing of the water and the decrease in the area of river beds prevented a migration of *P. kaufmanni* from the middle course of the Amu Darya to the upper course where it has not been recorded since 1989.

2.3 Population status

At the end of the 1960s, *P. kaufmanni* young-of-the-year made up 26% of all young fishes descending the Amu Darya, while at the end of the 1970s and during the 1980s, Pavlovskaya and Zholdasova (1991) found no young-of-the-year at all. During their investigations (Pavlovskaya and Zholdasova, 1991) in 1989, only a single late prolarva was caught in the region of Denau.

Zholdasova (1997) describes the present abundance and population density of *P. kaufmanni* as low in the plain regions of the upper and middle flow but gives no estimate of the total number of individuals. However, it is pointed out that *P. kaufmanni* still reproduces under modern river conditions even if the rate of population replenishment is very low.

According to Zholdasova (1997), the modern age series of the still existing population of *P. kaufmanni* is shortened by eight groups as compared with the age series in the 1960s when the age of the fish population varied from one to fourteen years with a predominance of a three to six-year old group. The present collections are represented mostly by young fish, one to six years old, with a predominance of three-year (36.8%) and four-year old (41.6%) individuals.

Distinct subpopulations of *P. kaufmanni* are not described. However, the species was represented by two forms: the "normal" with an average length of adults of about 0.4 m and weight about 0.8 kg and the "dwarf" with an average length of adults of about 0.3 m and 0.4 kg in weight (Tleuov and Sagitov, 1973).

P. kaufmanni is listed as Critically Endangered by IUCN (1996).

2.4 Population trends

According to Zholdasova (1997), the resting small population of *Pseudoscaphirhynchus kaufmanni* is still reproducing under modern river conditions. However, the species is considered to be Critically Endangered (Pavlovskaya and Zholdasova, 1991; Birstein, 1997) due to multifactoral environmental threats.

2.5 Geographic trends

Since in 1960 the massive hydroconstruction on the Amu Darya started the range area of *P. kaufmanni* decreased drastically because of the complete regulation of the river flow and a resulting low water level (Zholdasova, 1997). Mainly the upper course of the river was affected by this massive human impact and thus, the distribution area of *P. kaufmanni* was restricted to a small territory between Kerki and Chardzhou in the middle Amu Darya course. However, there is little information available about the direct impact on the populations of *P. kaufmanni* because the species was not monitored during the 1970s and 1980s.

The entire Aral Sea ecosystem and that of the Amu Darya and Syr Darya, which discharge into it, are under extreme stress because of the massive anthropogenic impact on the water regimes, and in the foreseeable future no change in the situation for the better appears likely. On the contrary, the irrigation network in the Aral Sea basin is still expanding. In Turkmenistan, the south-west branch of the largest irrigation canal, the Karakum Canal, will be completed in the near future and will then establish a direct connection between the Amu Darya River and the Caspian Sea.

2.6 Role of the species in its ecosystem

Like the other representatives of the genus *Pseudoscaphirhynchus*, *P. kaufmanni* has been rather extensively studied Tleuov and Sagitov, 1973; Salnikov et al., 1996). There is little information about the biology of the species and its role in the ecosystem is not clear. The possible consequences of a depletion of the populations of the species for other species depending on or associated with it are not predictable.

2.7 Threats

The threats for the survival of *P. kaufmanni* are multifactoral, the main being the destruction of its typical habitat in the Amu Darya through using the waters of the river for an enormous irrigation system for the cotton industry. This includes the complete regulation of the flow and a subsequent decrease of the water level. Distinct water deficiency was especially produced in the lower river flow and let not only to its drying but also to salination because the natural sediments in this region are saline. Initially, the mean many-year total content of ions in the Amu Darya water was 540 mg/l (Rogov, 1957 in Zholdasova, 1997). Now the mean annual water mineralization in the middle river flow varied during the last decade within 600 to 1,500 mg/l (Zholdasova, 1997). Naturally, the lower river flows are regions where the increased mineralization is most pronounced: in Nukus (215 km from the mouth) the mean annual mineralization was 1,525.5 mg/l in 1989 and 946.8 in 1990 (Yearbook of Surface Waters Quality, 1991 in Zholdasova, 1997). However, in contrast to the small Amu-Dar shovelnose *P. kaufmanni* which also occurred in former times in the brackish water in the Delta of the Amu Darya, is supposed to be salt-tolerant to a certain degree. Zholdasova (1997) suggests that this salt-tolerance enhanced the survival of the species even under the present high mineralization level.

Accompanying the large-scale cotton growing, a chemization of the agriculture begun in the 1960s which involved wide application of mineral fertilisers and pesticides contaminating the environment. Additionally, a contamination of the surface waters (rivers and lakes) due to the disposal of drainage waste from the zone of irrigated land cultivation took place. The volume of this disposal sharply increased by the end of the 1980s with a total volume of 32 km^3/year in Central Asia out of which 21.1 km^3 were deposited in the Amu Darya basin (Zholdasova, 1997).

Increased mineralization, contamination of the waters with mineral fertilisers and pesticides and a general pollution with oil products, heavy metals and organic substances, completely changed the hydrochemical regime of the Amu Darya basin (Zholdasova, 1997) and affected the local ichthyofauna in many aspects of their biology (growth rate, fecundity, survival, etc.). However, the particular impact on the populations of *P. hermanni* has not been investigated.

An additional potential threat to the species and its ecosystem may be the finishing of the Karakum Canal and thus the direct connection between the Amu Darya River and the Caspian Sea. Sal´nikov (1995) makes a prediction about the impact on the ichthyofauna resulting from this direct connection but considers the migration of fishes from the Caspian Sea through the Karakum Canal to the Amu Darya as unlikely.

3. Utilization and Trade

3.1 National utilization

The native Moslem population of Central Asia did not use these fishes for food and did not catch them. A commercial fishing began only after the appearance of the Russian population in this region at the end of the 19th century and continued until the 1930s (Birstein, 1993).

Now, *P. kaufmanni* is considered to have no commercial value and due to its small size and rare occurrence within the large range area it is not caught (Zholdasova, 1997).

3.2 Legal international trade

None

3.3 Illegal trade

Birstein (1993b) indicates an illegal trade of life specimens at the aquarium market.

3.4 Actual or potential trade impacts

Not reported.

3.5 Captive breeding or artificial propagation for commercial purposes (outside countries of origin)

Not reported.

4. Conservation and Management

4.1 Legal status

4.1.1 National

Pseudoscaphirhynchus kaufmanni is listed as Endangered in the Red Books of the Uzbek SSR (1983), Turkmen USSR (1985) and USSR (1984) with category I status.

4.1.2 International

None.

4.2 Species management

4.2.1 Population monitoring

The Sturgeon Specialist Group of the IUCN/SSC included in their Action Plan (1994) a status survey of *Pseudoscaphirhynchus kaufmanni* in Turkmenistan and Uzbekistan, being undertaken by its group members. Results have not been published yet.

4.2.2 Habitat conservation

None

4.2.3 Management measures

The Sturgeon Specialist Group of the IUCN/SSC included in their Action Plan (1994) an international breeding programme for *Pseudoscaphirhynchus kaufmanni* being undertaken by its group members. Results have not been published yet.

The few attempts to raise *P. kaufmanni* in captivity were not successful (Goncharov et al., 1991).

4.3 Control measures

4.3.1 International trade

None

4.3.2 Domestic measures

None

5. Information on Similar Species

P. kaufmanni is sympatric with the small Amu-Dar shovelnose whose population is on the verge of disappearance. It is also closely related to the third representative of the genus *Pseudoscaphirhynchus, P. fedtschenkoi* which lived in the Syr Darya and is believed to be Extinct. All three species are victims of the Aral Sea ecological catastrophe.

6. Other Comments

The range states of the species has been contacted in a meeting ("Multilateral Consultations on the Problems of Sturgeon Species within the Framework of CITES") which took place on 21-22 November 1996 in Moscow. The minutes of this meeting and the comments of the range states that have been received are attached in the appendix at the end of this document.

7. Additional Remarks

8. References

Berg, L.S. 1948. [The Freshwater Fishes of the USSR and Adjacent Countries.]. Moscow and Leningrad, Nauka Publication, Vol. I, pp. 57-109. (Engl. translation published by National Science Foundation, Washington D.C., 1962).

Birstein, V.J. 1993a. Sturgeons and Paddlefishes: Threatened Fishes in Need of Conservation. Conservation Biology 7 (4):773-787.

Birstein, V.J. 1993b. Draft Application to CITES: Order Acipenseriformes. Unpublished.

Birstein, V.J. 1997. Threatened fishes of the world: *Pseudoscaphirhynchus* spp. (Acipensridae). In: V. Birstein, J. R. Waldman, and W. E. Bemis (eds.). Sturgeon Biodiversity and Conservation. Kluwer Academic Publishers, Dordrecht. pp. 381-383.

Ellis, W.S. 1990. The Aral: A Soviet Sea Lies Dying. National Geographic 177 (2): 71-92.

Feshbach, M. and A. Friendly, Jr. 1991. Ecocide in the USSR. Health and Nature Under Siege. New York, Basic Books, 376 pp.

Goncharov, B. F., O. I. Shubravy, and V. K. Uteshev. 1991. Reproduction and Early Development of *Pseudoscaphirhynchus kaufmanni* Bogdanov under Artificial Environmental Conditions. The Soviet Journal of Developmental Biology, 22 (5) :296-301.

IUCN. 1996. IUCN Red List of Threatened Animals. IUCN, Gland, Switzerland.

Nikol´skii, G. V. 1938. Fishes of Tadzhikistan. Mosow and Leningrad, Izdatelstvo Akad. Nauk USSR, pp. 55-74.

Pavlov, D. S., K. A. Savvaitova, L. I. Sokolov, and S. S. Alekseev. 1994. Rare and endangered animals. Fishes. Vysshaya Shkola, Moscow. 334 pp. (in Russian).

Pavlovskaya, L.P. and I.M. Zholdasova. 1991.Antropogenic Changes in the Fish Fauna of the Amu Darya River (based on data from sampling drift of eggs and larvae). Journal of Ichthyology 31 (8): 106-117.

Reshetnikov, Yu.S. and F.M. Shakirova.1993. A Zoogegraphical Analysis if the Ichthyofauna of Central Asia Including a List of Freshwater Fishes. Journal of Ichthyology 33 (4): 99-111.

Sal´nikov, V.B. 1995 Possible Changes in the Composition of the Ichthyofauna after Completion of the Karakum Canal in Turkmenistan. Journal of Ichthyology 35 (7): 108-121.

Sal´nikov, V.B. and Yu.S. Reshetnikov. 1991. Formation of Fish Populations in Artificial Waters in Turkmenistan. Journal of Ichthyology 31 (8). 82-95.

Salikhov, T.V. and B.G. Kamilov.1995. Ichthyofauna of the Mid-Syr Darya Basin. Journal of Ichthyology 35 (6): 61-71.

Salnikov, V. B., V. J. Birstein, and R. L. Mayden. 1996. The contemporary status of the two Am Darya River shovelnose sturgeons, *Pseudoscaphirhynchus kaufmanni* and *P. hermanni.* Sturgeon Quarterly, 4 (3) :8-10.

Smith, D. R. 1994. Change and Variability in Climate and ecosystem Decline in Aral Sea Basin Deltas. Post-Soviet Geography, 35 (3) :142-165.

Tleuov, R. T., and N. I Sagitov. 1973. Acipenserid Fishes of the Aral Sea. FAN Press, Tashkent. 155 pp. (in Russian).

Zholdasova, I. 1997. Sturgeons and the Aral Sea ecological catastrophe. In: V. Birstein, J. R. Waldman, and W. E. Bemis (eds.). Sturgeon Biodiversity and Conservation. Kluwer Academic Publishers, Dordrecht. pp. 373-380.

Scaphirhynchus albus

1. Taxonomy

   1.1 Class: Actinopterygii

   1.2 Order: Acipenseriformes

   1.3 Family: Acipenseridae

   1.4 Species: *Scaphirhynchus albus* (Forbes and Richardson, 1905)

   1.5 Scientific synonyms: *Parascaphirhynchus albus* Forbes and Richardson, 1905

   1.6 Common names: English: Pallid sturgeon, White Sturgeon, White shovelnose, White hackleback

2. Biological Parameters

   2.1 Distribution

Country of origin: U.S.A.

Scaphirhynchus albus is endemic to the Missouri and Mississippi River basins. Its distribution range encompasses the Missouri River from the mouth of the Marias River in Montana to its confluence with the Mississippi River at St. Louis, and in the Mississippi River from St. Louis to the Gulf of Mexico (Bailey and Cross, 1954). The pallid sturgeon is also found in the lower 200 miles of Yellowstone River in Montana and the lower 20 miles of other large tributaries and distributaries to the Missouri and Mississippi Rivers including the Platte, Niobrara, Kansas, Ohio, Arkansas, Red, Yazoo and Atchafalaya Rivers (U.S. Fish and Wildlife Service, 1993; Duffy et al.,1996).

The preferred habitat of *Scaphirhynchus albus* is apparently the main channel of large turbid rivers such as the Missouri and Mississippi (Kallemeyn, 1983). Pallid sturgeon evolved to live on the bottom of large rivers which were free flowing throughout the flood plain, had a diversity of depths, velocities and channel morphology, and were unobstructed by main stem dams (Forbes and Richardson, 1905; Kallemeyn, 1983; U.S. Fish and Wildlife Service, 1993; Duffy et al., 1996).

   2.2 Habitat availability

Projects by the U.S. Army Corps of Engineers designed to deepen and stabilise the lower Missouri River have reduced the water surface area by 50% and largely eliminated the numerous islands and side channels that were formerly present (Funk and Robinson, 1974). Six large mainstream reservoirs constructed on the upper river have modified the natural seasonal flood patterns and resulted in measurable reductions in turbidity all the way to the river mouth. Similar changes are evident in the Mississippi River downstream from the mouth of the Missouri (Carlson et al., 1985).

Today approximately 51% of the pallid sturgeons´ big-river habitat on the Missouri and Mississippi Rivers is channelized and 28% is now in reservoirs. The remaining 21% is affected by reservoir dam discharges (Dryer and Latka, 1994). The free flowing reaches are greatly altered in temperature, turbidity and hydrography. The circumstantial evidence of decreases in abundance of *Scaphirhynchus albus* has come primarily from areas that have undergone significant habitat modification (Kallemeyn, 1983). Either the riverine habitat has been eliminated completely by the constructions of dams or it has undergone significant changes due to channel modification projects. Habitat loss has been identified to be the main threat for the survival of the species (U.S. Fish and Wildlife Service, 1993; Dryer and Latka, 1994).

   2.3 Population status

At present, between 6,000 and 21,000 individuals of *Scaphirhynchus albus* exist throughout the entire range of the species (Keenlyne, 1995; Duffy et al., 1996). Tag and recapture data from the

Missouri River allowed to estimate that 50 to 100 specimens remain in the river section above the Fort Peck Dam (Montana) and 200 to 300 specimens are resident in the river section between the Fort Peck Dam and the Garrison Dam (North Dakota). Moreover, it is estimated that probably a number of 25 to 50 individuals of pallid sturgeon live in the Oahe Reservoir as well as in the river section between the Gavins Point Dam and the Fort Randall Dam in South Dakota. In the river section between the Oahe Dam and the Big Bend Dam an estimated number of 50 to 100 specimens exists.

In the channelized lower Missouri and Mississippi rivers, between 3,175 and 15,850 pallid sturgeon individuals are resident, while in the Atchafalya River an estimated number of 2,750 to 4,100 specimens exists (Duffy et al., 1996).

The IUCN (1996) classifies the status of the pallid sturgeon populations as Endangered.

2.4 Population trends

The meagre population data that exist on *Scaphirhynchus albus* show a sharp decline in numbers of observations over the past 30 years (Dryer and Latka, 1994). In the 1960s, there were 500 observations reported, or on the average 50 observations per year. By the 1980s, only 56 observations were reported, or on the average about 6 per year. Ageing, remnant populations of a few individuals apparently now exist in a handful of areas throughout the entire range of the species.

On account of the increased effort to locate pallid sturgeons for scientific research and management purposes, the number of observations raised since 1990, when the species was listed, to about 50 observations per year. In general, the status of *Scaphirhynchus albus* is considered to be Endangered (Williams t al., 1989, U.S. Fish and Wildlife Service, 1993). It is believed that natural reproduction decreased drastically due to the lack of adequate spawning sites and that the population in the wild is too low to recover without an augmentation programme (Dryer and Latka, 1994).

There is no evidence of natural reproduction of the upper Missouri populations of *Scaphirhynchus albus* (Keenlyne, 1995), but some natural reproduction may occur in the Atchafalya River population (Keenlyne, 1995; Duffy et al., 1996).

2.5 Geographic trends

Not reported.

2.6 Role of the species in its ecosystem

The pallid sturgeon is one of the largest fish species found in the Missouri and Mississippi Rivers, reaching a total length of 1.7 m and a weight of 39 kg (Gilbraith et al., 1988 in Dryer and Latka, 1994). Fish and aquatic insects have been the principle items found in the few pallid sturgeon stomachs that have been examined (Kallemeyn, 1983). Due to its rare occurrence *Scaphirhynchus albus* is one of the lesser known North American freshwater fishes and little information has been collected on the species (Kallemeyn, 1983; Duffy et al., 1996). The role of the species in its ecosystem is not clear. The possible consequences of a depletion of the populations of the pallid sturgeon for other species depending on or associated with it are not predictable.

2.7 Threats

Habitat destruction or modification has been identified by the Endangered Species Committee of the American Fisheries Society as the principal threat to the pallid sturgeon (Deacon et al., 1979). Pallid sturgeon populations may have been affected early on from commercial fishing but in recent years have declined to critically low levels on account of one primary reason: habitat loss (Dryer and Latka, 1994).

Based on recent preliminary information, pollution is a likely threat to the species over much of its range (Dryer and Latka, 1994). It is suspected that chemical contamination can adversely affect developing eggs, development of embryos or survival of fry and thereby reduce reproductive success. Ruelle and Henry (1994) investigated the concentrations of contaminants in the sympatric species *Scaphirhynchus platorynchus* and found that whole-body fish and eggs accumulate elevated concentrations of contaminants. The mean selenium concentration in eggs of females from Montana is so high (10.62 mkg/g) that it can cause reproductive failure in eggs. The concentration of organochlorines in the tissue of *Scaphirhynchus platorynchus* is also so high (up to 199 mkg/g) that the State of Missouri has issued a human health consumption advisory for Missouri and Mississippi River sturgeon egg and flesh (Birstein 1993b).

Carlson et al. (1985) discovered hybridisation of the pallid sturgeon with the sympatric shovelnose sturgeon, *Scaphirhynchus platorynchus*, and interpreted this as a recent phenomenon resulting from environmental changes caused by human-induced reductions in habitat diversity and measurable changes in environmental variables such as turbidity, flow regimes and substrate types. Bailey and Cross (1954) did not report hybrids in the 1950s. All of the hybrids studied by Carlson et al. (1985) were females, but in 1991-1992 also male hybrids were reported (Keenlyne et al., 1994). The studied hybrids were as prevalent in the examined samples as *Scaphirhynchus albus*, suggesting that hybridisation between the species of *Scaphirhynchus* may occur frequently. This hybridisation could present a threat to the survival of *Scaphirhynchus albus*, through genetic swamping if the hybrids are fertile, and through competition for a limited habitat.

A further threat to the species is that it can at times be difficultly distinguished from the sympatric *Scaphirhynchus platorynchus* which can still be commercially harvested in 5 of 13 states where pallid sturgeon occur.

3. Utilization and Trade

3.1 National utilization

Historically, pallid sturgeon, shovelnose sturgeon (*Scaphirhynchus platorynchus*) and lake sturgeon (*Acipenser fulvescens*) were commercially harvested in all states on the Missouri and Mississippi Rivers (Helms, 1974). The larger pallid and lake sturgeon were sought for their eggs which were sold as caviar, whereas shovelnose sturgeon were historically destroyed as a bycatch. Commercial harvest of all sturgeon has declined substantially since record keeping began in the late 19th century. Pallid sturgeon are usually not distinguished from shovelnose sturgeon in commercial catch records. Hence, no data about the catch and caviar production of *Scaphirhynchus albus* are available. In 1979, the Endangered Species Committee of the American Fisheries Society has classified *Scaphirhynchus albus* as threatened throughout its range and in most states where the species has been formally classified, fishing regulations required the release of any pallid sturgeon. In 1990, *Scaphirhynchus albus* was added to the list of Threatened and Endangered Wildlife and Plants comprising a complete ban on fishery.

According to Kallemeyn (1983) most pallid sturgeon are taken incidentally by anglers and commercial fisherman while they are fishing for other species, f.e. the closely related *Scaphirhynchus platorynchus*.

3.2 Legal international trade

None.

3.3 Illegal trade

Not reported.

3.4 Actual or potential trade impacts

None.

3.5 Captive breeding or artificial propagation for commercial purposes (outside country of origin)

Not reported.

4. <u>Conservation and Management</u>

4.1 Legal status

4.1.1 National

Scaphirhynchus albus was added to the list of Threatened and Endangered Wildlife and Plants on September 6, 1990. The species is totally protected and catching is prohibited. The purposes of the Endangered Species Act are to provide a means whereby the ecosystem upon which Endangered and Threatened species depend may be conserved, and to provide a programme for the conservation of such species. At the end of 1993, a Pallid Sturgeon Recovery Plan has been designed by a selected Pallid Sturgeon Recovery Team (U.S. Fish and Wildlife Service, 1993).

4.1.2 International

None.

4.2 Species management

4.2.1 Population monitoring

Since the species was listed in 1990, a Pallid Sturgeon Recovery Team made up of fishery biologists from the state game and fish agencies across the species' range, two representatives of the U.S. Fish and Wildlife Service, one representative from Academia and one representative from the U.S. Army Corps of Engineers has been selected (Dryer and Latka, 1994). A Pallid Sturgeon Recovery Plan has been worked out in 1993. This plan includes the monitoring of the species conducted by researchers with the Fish and Wildlife Service Cooperative Research Unit at Montana State University and the Montana Department of Fish, Wildlife and Parks. The jointly conducted studies use telemetry and sonics to determine movements and habitat selection of adult *Scaphirhynchus albus* in Montana, hoping to locate a spawning site which has been unsuccessful until 1994 (Dryer and Latka, 1994).

4.2.2 Habitat conservation

The first work area of the Pallid Sturgeon Recovery Plan is to protect the pallid sturgeon populations and their habitat. According to Dryer and Latka (1994) activities are underway to consult with federal agencies to minimise the impact of their actions. U.S. Fish and Wildlife Service offices are consulting with the U.S Army Corps of Engineers on permitted actions such as dredging for navigation, sand and gravel mining, placement of intakes and water diversions for irrigation and operations of main stem Missouri River dams.

4.2.3 Management measures

The Pallid Sturgeon Recovery Plan comprises the short-term recovery objective to prevent extinction of the populations presently occurring in the wild by 1998 and the long-term objective to achieve naturally-reproducing, self-sustaining populations within designated Missouri and Mississippi reaches by the year 2040 (Dryer and Latka, 1994). The management measures include the protection of the species and its habitat, a monitoring programme to determine the spawning sites, public information and a culture and hatchery programme. A pallid sturgeon artificial propagation programme should be developed and activities are underway to develop guidance documents for supplementing wild populations through stocking, broodstock collections, feeding trials and facility modifications. Dryer and Latka (1994) report that Blind Pony State Hatchery in Missouri is holding five adult pallid sturgeon and Gavins Point NFH in South Dakota is holding fourteen individuals. These fish have adapted to captivity and will serve as future broodstock.

4.3 Control measures

4.3.1 International trade

None.

4.3.2 Domestic measures

The Pallid Sturgeon Recovery Plan includes the objective to inform the public of the species' status and needs for protection and recovery. For these reason, the Pallid Sturgeon Recovery Team is periodically mailing out a Pallid Sturgeon Recovery Update. They also regularly feature the pallid sturgeon or the big-river ecosystem as a theme at sport show and State fair booths (Dryer and Latka, 1994).

5. Information on Similar Species

The pallid sturgeon, *Scaphirhynchus albus*, is sympatric with the shovelnose sturgeon, *Scaphirhynchus platorynchus*, throughout the Missouri and Atchafalaya rivers and the lower Mississippi River downstream of its confluence with the Missouri (Dryer and Latka, 1994). Although *Scaphirhynchus albus* can reach a higher total length (up to 1.7 m) than the smaller *Scaphirhynchus platorynchus* which rarely exceeds 0.8 m, both species cannot easily be distinguished and especially sport anglers fishing for *Scaphirhynchus platorynchus* cannot identify the species (Kallemeyn, 1983). Whereas fishing for *Scaphirhynchus albus* is completely prohibited, sport fishing and a small amount of commercial fishing for *Scaphirhynchus platorynchus* is still allowed in some of the range states.

Besides, Carlson et al. (1985) and Keenlyne et al. (1994) found evidence of interbreeding between the pallid and shovelnose sturgeon and Phelps and Allendorf (1983) proved that there is a close genetic similarity between both species. They are electrophoretically indistinguishable at 37 loci, share the same allele at 34 monomorphic loci and have similar allelic frequencies at three polymorphic loci.

In 1991, another species belonging to the genus *Scaphirhynchus*, *Scaphirhynchus suttkusi*, has been found in the Mobile basin of the Alabama and Mississippi (Williams and Clemmer, 1991). It is not clear whether this lately discovered species has been mixed up with its two sympatric relatives in earlier times.

Another sympatric species belonging to the second family of the order Acipenseriformes, the Polyodontidae, is the American paddlefish, *Polyodon spathula*, which has been exploited for its caviar and is now listed in Appendix II of CITES.

6. Other Comments

The range state of the species has been contacted on 13 March 1996 and 21 May 1996. A copy of the first draft of the proposal ("working document") has been sent to the range state on 19 August 1996. The comments of the range state that have been received are attached in the appendix at the end of this document.

The "working document" has also been presented at the 13th meeting of the Animals Committee of CITES in Prague, Czech Republic, on 23-27 September 1996 for discussion.

Additionally, a meeting ("Multilateral Consultations on the Problems of Sturgeon Species within the Framework of CITES") which took place on 21-22 November 1996 in Moscow, has been organised in order to consult with the states of Azerbaijan, Kazakhstan, Turkmenistan and Ukraine (which are not members to CITES) as well as with China, Georgia, Iran, USA and the Russian Federation. The minutes of this meeting and the comments of the range states that have been received are attached in the appendix at the end of this document.

7. Additional Remarks

8. References

Bailey, R.M. and F.B. Cross.1954. River Sturgeons of the Genus *Scaphirhynchus*: Characters, Distribution and Synonymy. Papers of the Michigan Academy of Sciences, Arts and Letters 39: 169-208.

Birstein, V.J. 1993a. Sturgeons and Paddlefishes: Threatened Fishes in Need of Conservation. Conservation Biology 7 (4):773-787.

Birstein, V.J. 1993b. Draft Application to CITES: Order Acipenseriformes. Unpublished.

Carlson, D.M., W.L. Pflieger, L. Trial and P.S. Haverland. 1985. Distribution, Biology and Hybridization of *Scaphirhynchus albus* and *Scaphirhynchus platorynchus* in the Missouri and Mississippi Rivers. Environmental Biology of Fishes vol.14, no.1: 51-59.

Dryer, M. and D. Latka. 1994. Population Status of the Pallid Sturgeon (*Scaphirhynchus albus*). Proceedings of the International Conference on Sturgeon Biodiversity and Conservation, New York 1994.

Duffy, W. G., C. R. Berry, and K. D. Keenlyne. 1996. The Pallid Sturgeon. Biology and Annotated Bibliography Through 1994. South Dakota Cooperative Fish and Wildlife Research Unit Technical Bulletin 5 :1-32.

Forbes, S.A. and R.E. Richardson. 1905. On a new shovelnose sturgeon from the Mississippi. Bull. Illinois St. Lab. Nat. History 7: 37-44.

Funk, J.L. and J.W. Robinson. 1974. Changes in the Channel of the Lower Missouri River and Effects on Fish and Wildlife. Mo. Dep. Conserv. Aquatic Series II, 52 pp.

Helms, D. 1974. Shovelnose sturgeon, *Scaphirhynchus platorynchus*, in the navigational impoundments of the upper Mississippi River. Technical Series. Iowa State Conservation Commission 74-3, 68 pp.

IUCN. 1996. IUCN Red List of Threatened Animals. IUCN, Gland, Switzerland.

Kallemeyn, L. 1983. Status of the Pallid Sturgeon *Scaphirhynchus albus*. Fisheries 8 (1): 3-9.

Keenlyne, K. D. 1995. Recent North American studies on pallid sturgeon, *Scaphirhynchus albus* (Forbes and Richardson). In: Proceedings of the Second International Symposium on Sturgeons, September 6-11, 1993. Moscow-Kostroma-Moscow (Russia). VNIRO Publication, Moscow. Pp. 225-234.

Keenlyne, K. D., L. K. Graham and B. C. Reed. 1994. Hybridization between the pallid and shovelnose sturgeons. Proceedings of the South Dakota Academy of Sciences, 73 :59-66.

Keenlyne, K.D., E.M. Grossman and L.G. Jenkins. 1992. Fecundity of the Pallid Sturgeon. Transactions of the American Fisheries Society 121: 139-140.

Keenlyne, K.D. and L.G. Jenkins. 1993. Age at Sexual Maturity of the Pallid Sturgeon. Transactions of the American Fisheries Society 122: 393-396.

Phelps, S.R. and F. Alllendorf. 1983. Genetic Identitiy of Pallid and Shovelnose Sturgeon (*Scaphirhynchus albus* and *Scaphirhynchus platorynchus*). Copeia 1983 (3): 696-700.

Ruelle, R. and C. Henry. 1994. Life History Observations and Contaminants Evaluation of Shovelnose Sturgeon. U.S. Fish and Wildlife Service, Pierre, South Dakota.

U.S. Fish and Wildlife Service. 1993. Pallid Sturgeon Recovery Plan. U.S. Fish and Wildlife Service, Bismarck, North Dakota, 55 pp.

Williams, J.E. and G.H. Clemmer. 1991. *Scaphirhynchus suttkusi*, a new sturgeon (Pisces: Acipenseridae) from the Mobile Basin of Alabama and Mississippi. Bulletin of the Alabama Museum of Natural History 10: 17-31.

Williams, J.E., J.E. Johnson, D.A. Hendrickson, S. Contreras-Balderas, J.D. Williams, M. Navarro-Mendoza, D.E. McAllister and J.E. Deacon. 1989. Fishes of North America. Endangered, Threatened or of Special Concern: 1989. Fisheries 14 (6): 2-19.

Scaphirhynchus platorynchus

1. Taxonomy

   1.1 Class: Actinopterygii

   1.2 Order: Acipenseriformes

   1.3 Family: Acipenseridae

   1.4 Species: *Scaphirhynchus platorynchus* (Rafinesque, 1820)

   1.5 Scientific synonyms: *Accipenser platorhynchus* Rafinesque, 1820
   Acipenser cataphractus Gray, 1834
   Scaphirhynchus rafinesquei Heckel, 1836
   Scaphirhynchus mexicanus Giltay, 1928

   1.6 Common names:
   English: Shovelnose sturgeon, Sand sturgeon, Hackleback, Switchtail
   Finnish: Lapiosampi
   Polish: Lopatonos amerykanski

2. Biological Parameters

   2.1 Distribution

   Country of origin: U.S.A.

   Scaphirhynchus platorynchus is endemic to the Missouri and Mississippi River basins (Bailey and Cross, 1954.) It occurs widely in the Mississippi River and its major tributaries (Carlson et al., 1985).

   The shovelnose sturgeon is a freshwater species and is usually found in pools behind sandbars in unchannelized rivers (Schmulbach et al., 1975; Durkee et al., 1979), along the main channel border, below dams or in association with wing dams in navigational rivers (Carlson et al., 1985) and in the riverine habitat upstream of reservoirs in impounded rivers (Curtis, 1990 in Keenlyne, 1997). Primarily a bottom dweller, they are usually associated with a sandy substrate, often near rock or gravel where a current exists (Carlson et al., 1985).

   2.2 Habitat availability

   Projects by the U.S. Army Corps of Engineers designed to deepen and stabilise the lower Missouri River have reduced the water surface area by 50% and largely eliminated the numerous islands and side channels that were formerly present (Funk and Robinson, 1974). Six large mainstream reservoirs constructed on the upper river have modified the natural seasonal flood patterns and resulted in measurable reductions in turbidity all the way to the river mouth. Similar changes are evident in the Mississippi River downstream from the mouth of the Missouri (Carlson et al., 1985).

   Today approximately 51% of the big-river habitat on the Missouri and Mississippi Rivers is channelized and 28% is now in reservoirs. The remaining 21% is affected by reservoir dam discharges (Dryer and Latka, 1994). The free flowing reaches are greatly altered in temperature, turbidity and hydrography. Either the riverine habitat has been eliminated completely by the constructions of dams or it has undergone significant changes due to channel modification projects.

   2.3 Population status

   Scaphirhynchus platorynchus is still one of the most abundant sturgeons in North America (Keenlyne, 1997). Its abundance seems to be related to the size of the rivers in which they live and to the human impact on these rivers. There is no estimate of the size of the total population.

Keenlyne (1997) noted that no status review has been compiled for this species during the last ten years and tried to obtain status information with a questionnaire sent to all 24 states within the range area of the species. The results are as follows (Keenlyne, 1997):

Scaphirhynchus platorynchus is considered to be extirpated in 5 of the range states (Alabama, New Mexico, Pennsylvania, Tennessee and West Virginia) and considered to be rare, endangered or of special concern in 9 of the range states (Louisiana, Minnesota, Mississippi, North Dakota, Ohio, Oklahoma, South Dakota, Texas and Wyoming). While Indiana has not sufficient information on the present status of the shovelnose sturgeon, the remaining 9 range states (Arkansas, Illinois, Iowa, Kansas, Kentucky, Missouri, Montana, Nebraska and Wisconsin) indicate that the species is still so abundant that it is subject to commercial and sport fishery.

IUCN (1996) classified the status of the populations of *Scaphirhynchus platorynchus* as Vulnerable.

2.4 Population trends

Shovelnose sturgeon were once so common that they were considered a nuisance to commercial fishermen and were destroyed when caught. (Coker, 1930). Barnickol and Starrett (1951) indicated that the decline of the species in the Mississippi River also coincided with the development of the river as a navigational channel. Shovelnose sturgeon abundance has been estimated for rivers of several sizes with a variety of habitats and varying degrees of modification. Schmulbach (1974 in Keenlyne 1997)) estimated 2,500 fish per km for the unchannelized Missouri River, Helms (1974 in Keenlyne 1997) estimated 1,030 fish per km for the navigation altered Mississippi River, Christenson (1975 in Keenlyne, 1997) estimated 100 fish per km for the small Red Cedar River in Wisconsin and Elser et al. (1977) estimated 403 to 537 fish per km for the Tongue River in Montana.

At present, *Scaphirhynchus platorynchus* is still one of the most abundant sturgeons in North America, even if population numbers have been reduced throughout most of its range, a trend already noted by Bailey and Cross (1954). But although not so abundant as it once was, the shovelnose sturgeon is still one of the few sturgeons that can be harvested commercially in the U.S.A. (Helms, 1974; Carlson et al., 1985). Keenlyne (1997) tried to gather information about the population trends of *Scaphirhynchus platorynchus* by sending a questionnaire to each of the 24 range states. The results are as follows (Keenlyne, 1997): the populations of *Scaphirhynchus platorynchus* are considered to be extirpated in 5 of the range states (Alabama, New Mexico, Pennsylvania, Tennessee and West Virginia), 12 states (Alabama, Arkansas, Kansas, Missouri, Nebraska, North Dakota, Ohio, Oklahoma, Texas, west Virginia, Wisconsin and Wyoming) indicated that shovelnose populations have declined in the last fifty years and 6 states (Iowa, Minnesota, Montana, Nebraska, North Dakota and Wyoming) report that since 1990 the populations of *Scaphirhynchus platorynchus* are considered to be stable while for the remaining range states insufficient information about the population trend is available.

2.5 Geographic trends

No detailed information about rate and extent of decrease in range area are available. Keenlyne (1997) notes that *Scaphirhynchus platorynchus* is nowadays considered to be extirpated in 5 of its range states (Alabama, New Mexico, Pennsylvania, Tennessee and West Virginia).

2.6 Role of the species in its ecosystem

Scaphirhynchus platorynchus is one of the smaller North American sturgeons, seldom weighing more than 2 kg over most of its range except in the upper Missouri River, where individuals over 7 kg have been found (Keenlyne, 1997). The maximum body size rarely exceeds 0.8 m in length. The shovelnose sturgeon is an opportunistic feeder which preys on aquatic invertebrates, primarily immature insects (Carlson et al., 1985). The role of the species in its ecosystem has not been studied.

2.7 Threats

The range and many populations of *Scaphirhynchus platorynchus* have been reduced as a result of human impact, either through overharvest early in the century or through modification of its river habitats by dams and river training structures (Keenlyne, 1997).

In the questionnaire developed by Keenlyne (1997), 19 states responded that habitat alteration is a concern in regard to the welfare of the shovelnose sturgeon, 6 range states mentioned that pollution is still a concern, one mentioned overharvest, one mentioned hybridisation with the sympatric pallid sturgeon, *Scaphirhynchus albus,* and 3 states expressed no issues of concern.

Flow alteration and habitat fragmentation, as a result of damming of many of the rivers within the range of the species, is a continuing problem to the long-term health of the shovelnose sturgeon, especially as damming and fragmentation may be affecting reproduction and growth rate (Keenlyne, 1997). The altered stream flows affect the ability of *Scaphirhynchus platorynchus* to find food as well as the abundance and welfare of organisms the fish feed on (Keenlyne, 1997). In areas of poor food supply the growth rate of the species is less and Zweiacker (1967 in Keenlyne, 1997) found that Missouri shovelnose sturgeon nearly ceased growing and reproducing after the Missouri dams were constructed. In addition, several authors have identified reproduction problems with the species, e.g massive follicular atresia and high levels of hermaphroditism from 2.1 to 3 % (June, 1977; Carlson et al., 1985).

Pollution is a likely threat to the species over much of its range (Dryer and Latka, 1994). It is suspected that chemical contamination can adversely affect developing eggs, development of embryos or survival of fry and thereby reduce reproductive success. Ruelle and Henry (1994) investigated the concentrations of contaminants in *Scaphirhynchus platorynchus* and found that whole-body fish and eggs accumulate elevated concentrations of contaminants. The mean selenium concentration in eggs of females from Montana is so high (10.62 mkg/g) that it can cause reproductive failure in eggs. The concentration of organochlorines in the tissue of *Scaphirhynchus platorynchus* is also so high (up to 199 mkg/g) that the State of Missouri has issued a human health consumption advisory for Missouri and Mississippi River sturgeon egg and flesh (Birstein 1993b).

Carlson et al. (1985) discovered hybridisation of the shovelnose sturgeon with the sympatric pallid sturgeon, *Scaphirhynchus albus*, and interpreted this as a recent phenomenon resulting from environmental changes caused by human-induced reductions in habitat diversity and measurable changes in environmental variables such as turbidity, flow regimes and substrate types. Bailey and Cross (1954) did not report hybrids in the 1950s. All of the hybrids studied by Carlson et al. (1985) were females, possibly indicating an unbalanced sex ratio, as has been reported in some other fish hybrids. The studied hybrids were as prevalent in the examined samples as *Scaphirhynchus albus*, suggesting that hybridisation between the species of *Scaphirhynchus* may occur frequently. This hybridisation is considered to be a threat to the survival of the very rare pallid sturgeon but may also affect the populations of *Scaphirhynchus platorynchus* to a certain degree.

The commercial harvest of *Scaphirhynchus platorynchus* is still allowed in 7 of its range states, while sport fishery still exists in 12 of the range states. Although the fishery decreased within the last fifty years, the commercial harvest and sport angling affects the populations of *Scaphirhynchus platorynchus.*

Becker (1983) lists the shovelnose sturgeon as host for glochidia of the commercially valuable yellow sand shell (*Lampsilis teres*), the pimple-back (*Quadrula pustulosa*) and the hickory-nut mussel (*Obovaria olivaria*); for the parasitic larval form of the latter *Scaphirhynchus platorynchus* is the only known host.

3. <u>Utilization and Trade</u>

3.1 National utilization

Historically, shovelnose sturgeon (*Scaphirhynchus platorynchus*), pallid sturgeon, *Scaphirhynchus albus*, and lake sturgeon (*Acipenser fulvescens*) were commercially harvested in all states on the Missouri and Mississippi Rivers (Helms, 1974). The larger pallid and lake sturgeon were sought for their eggs which were sold as caviar, whereas shovelnose sturgeon were historically destroyed as a bycatch. Commercial fishing of *Scaphirhynchus platorynchus* became intensive at the beginning of this century and reached 300 metric tons per year (Carlander, 1954). However, the harvest of all sturgeon has declined substantially since record keeping began in the late 19th century (Keenlyne, 1997). At present, *Scaphirhynchus platorynchus* is the only sturgeon species in the Mississippi and Missouri River basin that is subject to commercial fishery and sport angling (Keenlyne, 1997). A commercial fishery for the shovelnose sturgeon still exists in 7 of the range states (Arkansas, Illinois, Indiana, Iowa, Kentucky, Missouri and Wisconsin) while sport angling is allowed in 12 states (Arkansas, Illinois, Indiana, Iowa, Kansas, Kentucky, Minnesota, Missouri, Montana, Nebraska, Wisconsin, Wyoming).

About 25 metric tons of shovelnose sturgeon are commercially harvested annually of which about 60% of the total harvest originates from the Mississippi River above St. Louis, Missouri (Keenlyne, 1997). Keenlyne (1997) evaluated the results of his questionnaire sent to the range states. The so obtained data on commercial harvest, products and prices by state in 1992 are compiled in Table 5 (Appendix).

The meat and roe of *Scaphirhynchus platorynchus* are produced only for domestic consumption. Most of the commercial harvest is taken with trammel nets, some fishermen also use traps. Spring traps are often "baited" with mature females, which tend to draw more sturgeons.

According to Keenlyne (1997) sport angling of shovelnose sturgeon is generally considered low. Few fisherman fish specifically for *Scaphirhynchus platorynchus*, and much of the catch is incidental to fishing for other species. Few data exist on sport fishing exploitation rates on shovelnose sturgeon. Christenson reported about a 2% annual exploitation rate and Elser (1977) about a 1% rate.

3.2 Legal international trade

Not reported.

3.3 Illegal trade

Not reported.

3.4 Actual or potential trade impacts

Not reported.

3.5 Captive breeding or artificial propagation for commercial purposes (outside country of origin)

Not reported.

4. Conservation and Management

4.1 Legal status

4.1.1 National

No information available.

4.1.2 International

None.

4.2 Species management

4.2.1 Population monitoring

Not reported.

4.2.2 Habitat conservation

Not reported.

4.2.3 Management measures

Not reported.

4.3 Control measures

4.3.1 International trade

None.

4.3.2 Domestic measures

Not reported.

5. Information on Similar Species

The shovelnose sturgeon, *Scaphirhynchus platorynchus*, is sympatric with the pallid sturgeon, *Scaphirhynchus albus*, throughout the Missouri and Atchafalaya rivers and the lower Mississippi River downstream of its confluence with the Missouri (Dryer and Latka, 1994; Duffy et al., 1996). Although *Scaphirhynchus albus* can reach a higher total length (up to 1.7 m) than the smaller *Scaphirhynchus platorynchus* which rarely exceeds 0.8 m, both species cannot easily be distinguished and especially sport anglers fishing for *Scaphirhynchus platorynchus* often cannot identify the species (Kallemeyn, 1983). Whereas fishing for *Scaphirhynchus albus* is completely prohibited, sport fishing and a small amount of commercial fishing for *Scaphirhynchus platorynchus* is still allowed in some of the range states.

Besides, Carlson et al. (1985) and Keenlyne et al. (1994) found evidence of interbreeding between the pallid and shovelnose sturgeon and Phelps and Allendorf (1983) proved that there is a close genetic similarity between both species. They are electrophoretically indistinguishable at 37 loci, share the same allele at 34 monomorphic loci and have similar allelic frequencies at three polymorphic loci.

In 1991, another species belonging to the genus *Scaphirhynchus*, *Scaphirhynchus suttkusi*, has been found in the Mobile basin of the Alabama and Mississippi (Williams and Clemmer, 1991). It is not clear whether this lately discovered species has been mixed up with its two sympatric relatives in earlier times.

Another sympatric species belonging to the second family of the order Acipenseriformes, the Polyodontidae, is the American paddlefish, *Polyodon spathula*, which has been exploited for its caviar and is now listed in Appendix II of CITES.

6. Other Comments

The range state of the species has been contacted on 13 March 1996 and 21 May 1996. A copy of the first draft of the proposal ("working document") has been sent to the range state on 19 August 1996. The comments of the range state that have been received are attached in the appendix at the end of this document.

The "working document" has also been presented at the 13th meeting of the Animals Committee of CITES in Prague, Czech Republic, on 23-27 September 1996 for discussion.

Additionally, a meeting ("Multilateral Consultations on the Problems of Sturgeon Species within the Framework of CITES") which took place on 21-22 November 1996 in Moscow, has been organised in order to consult with the states of Azerbaijan, Kazakhstan, Turkmenistan and Ukraine (which are not members to CITES) as well as with China, Georgia, Iran, USA and the Russian Federation. The minutes of this meeting and the comments of the range states that have been received are attached in the appendix at the end of this document.

7. Additional Remarks

8. References

Bailey, R.M. and F.B. Cross.1954. River Sturgeons of the Genus *Scaphirhynchus*: Characters, Distribution and Synonymy. Papers of the Michigan Academy of Sciences, Arts and Letters 39: 169-208.

Barnickol, P.G. and W. Starrett. 1951. Commercial and Sport Fishes of the Mississippi River between Caruthersville, Missouri and Dubuque, Iowa. Bulletin of the Illinois Natural History Surv. 25: 267-350.

Becker, G.C. 1983. Fishes of Wisconsin. University of Wisconsin Press, Madison. 1052pp.

Birstein, V.J. 1993a. Sturgeons and Paddlefishes: Threatened Fishes in Need of Conservation. Conservation Biology 7 (4):773-787.

Birstein, V.J. 1993b. Draft Application to CITES: Order Acipenseriformes. Unpublished.

Carlander, H.B. 1954. A History of Fish and Fishing in the Upper Mississippi River. Special Publication. Upper Mississippi River Conservation Committee.

Carlson, D.M., W.L. Pflieger, L. Trial and P.S. Haverland. 1985. Distribution, Biology and Hybridization of *Scaphirhynchus albus* and *Scaphirhynchus platorynchus* in the Missouri and Mississippi Rivers. Environmental Biology of Fishes vol.14, no.1: 51-59.

Coker, R.E. 1930. Studies of Common Fishes of the Mississippi River at Keokuk. U.S. Bur. Fishery Bulletin 45: 145-225.

Dryer, M. and D. Latka. 1994. Population Status of the Pallid Sturgeon (*Scaphirhynchus albus*). Proceedings of the International Conference on Sturgeon Biodiversity and Conservation, New York 1994.

Duffy, W. G., C. R. Berry, and K. D. Keenlyne. 1996. The Pallid Sturgeon. Biology and Annotated Bibliography Through 1994. South Dakota Cooperative Fish and Wildlife Research Unit Technical Bulletin 5 :1-32.

Durkee, P., B. Paulson and R. Bellig. 1979. Shovelnose Sturgeon (*Scaphirhynchus platorynchus*) in the Minnesota River. Minnesota Academy of Sciences 45: 18-20.

Elser, A.A., R.C. McFarland and D. Schwehr. 1977. The Effect of Altered Streamflow on Fish of the Yellowstone and Tongue Rivers, Montana. Montana Department of Fish and Game. Technical Report 8: 1-180.

Funk, J.L. and J.W. Robinson. 1974. Changes in the Channel of the Lower Missouri River and Effects on Fish and Wildlife. Mo. Dep. Conserv. Aquatic Series II, 52 pp.

Helms, D. 1974. Shovelnose sturgeon, *Scaphirhynchus platorynchus*, in the navigational impoundments of the upper Mississippi River. Technical Series. Iowa State Conservation Commission 74-3, 68 pp.

IUCN. 1996. IUCN Red List of Threatened Animals. IUCN, Gland, Switzerland.

June, F.C. 1977. Reproductive Patterns in Seventeen Species of Warmwater Fishes in a Missouri River Reservoir. Environmental Biology of Fishes 2: 285-296.

Kallemeyn, L. 1983. Status of the Pallid Sturgeon *Scaphirhynchus albus*. Fisheries 8 (1): 3-9.

Keenlyne, K. D. 1997. Life history and status of the shovelnose sturgeon, *Scaphirhynchus platorynchus*. In: V. Birstein, J. R. Waldman, and W. E. Bemis (eds.). Sturgeon Biodiversity and Conservation. Kluwer Academic Publishers, Dordrecht. Pp. 291-298.

Keenlyne, K. D., L. K. Graham, and B. C. Reed. 1994. Hybridization between the pallid and shovelnose sturgeons. Proc. S.D. Acad. Sci., 73 :59-66.

Phelps, S.R. and F. Allendorf. 1983. Genetic Identitiy of Pallid and Shovelnose Sturgeon (*Scaphirhynchus albus* and *Scaphirhynchus platorynchus*). Copeia 1983 (3): 696-700.

Ruelle, R. and C. Henry. 1994. Life History Observations and Contaminants Evaluation of Shovelnose Sturgeon. U.S. Fish and Wildlife Service, Pierre, South Dakota.

Schmulbach, J.C., G.Gould and C.L. Goren. 1975. Relative Abundance and Distribution of Fishes in the Missouri River , Gavins Point Dam to Rulo, Nebraska. South Dakotza Academy of Sciences 54: 194-222.

Williams, J.E. and G.H. Clemmer. 1991. *Scaphirhynchus suttkusi*, a new sturgeon (Pisces: Acipenseridae) from the Mobile Basin of Alabama and Mississippi. Bulletin of the Alabama Museum of Natural History 10: 17-31.

Scaphirhynchus suttkusi

1. Taxonomy

   1.1 Class: Actinopterygii

   1.2 Order: Acipenseriformes

   1.3 Family: Acipenseridae

   1.4 Species: *Scaphirhynchus suttkusi* Williams and Clemmer, 1991

   1.5 Scientific synonyms: None

   1.6 Common names: English: Alabama sturgeon

2. Biological Parameters

   2.1 Distribution

   Country of origin: U.S.A.

   The Alabama sturgeon, *Scaphirhynchus suttkusi*, is endemic to the Mobile Basin of Alabama and Mississippi (Williams and Clemmer, 1991; Majden and Kuhadja, 1996).

   2.2 Habitat availability

   The habitat of the Alabama sturgeon has been widely destroyed within the Mobile Basin (Manci, 1993; Majden and Kuhadja, 1996). For many decades, the U.S. Army Corps of Engineers - in an effort to minimise flooding and its effects - has modified vast stretches of stream beds through channelization, removal of vegetation and other destructive techniques. The stream channels were deepened and narrowed to the point where significantly less suitable stream bed was available for feeding and reproduction. Dams built to control flooding destroyed many miles of stream and dramatically altered the downstream water chemistry and flow pattern.

   2.3 Population status

   There are no estimates about the total size of the population. The IUCN (1996) classifies the status of the populations of *Scaphirhynchus suttkusi* as Critically Endangered.

   2.4 Population trends

   There is no information about population trends of *Scaphirhynchus suttkusi*. The only recently recognised species is believed to be Critically Endangered (Williams and Clemmer, 1991; IUCN, 1996). Manci (1993) states that dams prevent upstream migrations and, as a result, spawning success is drastically reduced. Rapid or even moderate rates of recovery will be impossible for this species. Even if habitats can be restored, the low reproductive rate of the Alabama sturgeon precludes a swift return to its former numbers.

   2.5 Geographic trends

   No information available.

   2.6 Role of the species in its ecosystem

   Scaphirhynchus suttkusi has only been discribed in 1991 (Williams and Clemmer, 1991) and its biology has been poorly studied. Mayden and Kuhajda (1996) mention that the Alabama sturgeon feeds on insects and other aquatic invertebrates. The role of the species in its ecosystem is not clear. The possible consequences of a depletion of the populations of the Alabama sturgeon for other species depending on or associated with it are not predictable.

2.7 Threats

Manci (1993) puts forward that the principal threat to *Scaphirhynchus suttkusi* is the destruction of its habitat within the Mobile bBsin. Besides the destruction of favourable life conditions such as turbidity through the dam constructions along the rivers, spawning migrations upstream the rivers are prevented and, as a result, spawning success is drastically reduced.

3. Utilization and Trade

3.1 National utilization

According to Manci (1993), *Scaphirhynchus suttkusi* had been caught by fishers using poultry parts, fish and other commercially prepared baits. Besides, there is no information on the utilization of the only lately discribed species.

3.2 Legal international trade

None.

3.3 Illegal trade

No information available.

3.4 Actual or potential trade impacts

Not reported.

3.5 Captive breeding or artificial propagation for commercial purposes (outside country of origin)

Not reported.

4. Conservation and Management

4.1 Legal status

4.1.1 National

The U.S. Fish and Wildlife Service (USFWS) proposed to list the Alabama sturgeon, *Scaphirhynchus suttkusi*, as an Endangered species with critical habitat under the authority of the Endangered Species Act on 15 June 1993 (U.S Federal Register, 1993). On 21 June 1994 the USFWS postponed the listing decision for six months (U.S. Federal Register, 1994a) to provide additional time to assess the conservation status of the species through sampling. From July to December, no specimens were captured. Consequently, the listing proposal was withdrawn on 15 December 1994 (U.S. Federal Register, 1994b). After that, two new specimens were captured in the Alabama River system, on 18 April and 19 May 1995. Mayden and Kuhajda (1996, p. 269) note: "An effective recovery plan for *Scaphirhynchus suttkusi* must minimally include efforts to increase appropriate spawning habitats, increase access across dams to upstream and downstream river stretches, establish minimum flow regimes, and decrease silt loads within the river".

4.1.2 International

None.

4.2 Species management

4.2.1 Population monitoring

No information available.

4.2.2 Habitat conservation

No information available.

4.2.3 Management measures

No information available.

4.3 Control measures

4.3.1 International trade

None.

4.3.2 Domestic measures

No information available.

5. Information on Similar Species

Scaphirhynchus suttkusi is closely related to the two other species belonging to the same genus *Scaphirhynchus*, the pallid sturgeon, *Scaphirhynchus albus*, and the shovelnose sturgeon, *Scaphirhynchus platorynchus*. According to Mayden and Kuhajda (1996) *Scaphirhynchus suttkusi* has not received universal recognition as being distinct from *Scaphirhynchus platorynchus*. Their re-evaluation of meristic and mensural data from the original description and analysis of additional data, including data from a recently captured Alabama Sturgeon, indicate that these two species are distinct. However, *Scaphirhynchus suttkusi* is often not yet recognised as a valid species.

Another sympatric species belonging to the second family of the order Acipenseriformes, the Polyodontidae, is the American paddlefish, *Polyodon spathula*, which has been exploited for its caviar and is now listed in Appendix II of CITES.

6. Other Comments

The range state of the species has been contacted on 13 March 1996 and 21 May 1996. A copy of the first draft of the proposal ("working document") has been sent to the range state on 19 August 1996. The comments of the range state that have been received are attached in the appendix at the end of this document.

The "working document" has also been presented at the 13th meeting of the Animals Committee of CITES in Prague, Czech Republic, on 23-27 September 1996 for discussion.

Additionally, a meeting ("Multilateral Consultations on the Problems of Sturgeon Species within the Framework of CITES") which took place on 21-22 November 1996 in Moscow, has been organised in order to consult with the states of Azerbaijan, Kazakhstan, Turkmenistan and Ukraine (which are not members to CITES) as well as with China, Georgia, Iran, USA and the Russian Federation. The minutes of this meeting and the comments of the range states that have been received are attached in the appendix at the end of this document.

7. Additional Remarks

8. References

IUCN. 1996. IUCN Red List of Threatened Animals. IUCN, Gland, Switzerland.

Lee, D. S., C. R. Gilbert, C. H. Hocutt, R. E. Jenkins, D. E. McAllister, and J. R. Stauffer, Jr. (eds.). 1980. Atlas of North American Freshwater Fishes. North Carolina State Museum of Natural History, Raleigh.

Manci, W.E. 1993. Sturgeons. In: Marshall Cavendish Corporation. 1993. Endangered Wildlife of the World. Vol 9: 1160-1168.

Mayden, R. L., and B. R. Kuhajda. 1996. Systematics, Taxonomy, and Conservation Status of the Endangered Alabama Sturgeon, *Scaphirhynchus suttkusi* Williams and Clemmer (Actinopterygii, Acipenseridae). Copeia, 1996 (2) :241-275.

U.S. Federal Register. 1993. Proposed endangered status and designation of critical habitat for the Alabama sturgeon; proposed rule. Vol. 58, No. 113 (15 June 1993) :33148-33153.

U.S. Federal Register. 1994a. Extension of the final decision to list the Mobile River system population of the Alabama sturgeon as an endangered species with critical habitat. Vol. 59, No. 118 (21 June 1994). :31970-31974.

U.S. Federal Register. 1994b. Withdraw of proposed rule for endangered status and critical habitat for the Alabama sturgeon; proposed rule. Vol. 59, No. 240 (15 December 1994) :64784-64809.

Williams, J.E. and G.H. Clemmer. 1991. *Scaphirhynchus suttkusi*, a new sturgeon (Pisces: Acipenseridae) from the Mobile Basin of Alabama and Mississippi. Bulletin of the Alabama Museum of Natural History 10: 17-31.

Psephurus gladius

1. Taxonomy

   1.1 Class: Actinopterygii

   1.2 Order: Acipenseriformes

   1.3 Family: Polyodontidae

   1.4 Species: *Psephurus gladius* (Martens, 1862)

   1.5 Scientific synonyms: *Polyodon gladius* Martens, 1862
   Polyodon angustifolium Kaup, 1862

   1.6 Common names:
   Chinese: Yin yui, Wei, Chin yui
   English: Chinese paddlefish, Chinese swordfish, White sturgeon
   Finnish: Miekkasampi
   Polish: Wioslonos chinski

2. Biological Parameters

   2.1 Distribution

Country of origin: China.

Psephurus gladius is endemic to the Yangtze River (Chang Jiang) and its attached tributaries, including the rivers of Tuojiang, Mingijang, Jialimjiang, Qiuantangjiang and Yongjiang, and lakes (Dongting, Poayang) (Liu and Zeng, 1988; Liu et al., 1995). In the past, the species was commonly found in the trunk of the Yangtze River and only sometimes in the tributaries (Wei et al, 1997).

Psephurus gladius is supposed to be anadromous (Anonymous, 1988 in Wei et al., 1997) because mature adults are reported to migrate to sea and are historically documented in the East China Sea, The Yellow Sea and The Yellow River (Liu and Zeng, 1988). In addition, individuals are sometimes accidentally brought in by high spring tides, so that they are rarely discovered in the lower reaches of the Qiantang and Yangjiang rivers of Zhejiang Province (Liu and Zeng, 1988). The pattern of migration is not completely investigated yet.

In the Yangtze River proper, yearlings and adults of *Psephurus gladius* have been widely distributed in the upper, middle and lower reaches but the developing zygotes and fry are restricted to an area in the upper reaches of the river upstream of Luzhou (Liu and Zeng, 1988). However, the specific locations of spawning grounds are unclear yet. It is considered that they are scattered and limited to the upper reaches of the Yangtze in Chongqing section (Wei et al., 1997).

   2.2 Habitat availability

In 1981, the Gezhouba Dam was built just at the point between the upper and middle Yangtze River at Yichang, Hubei Province. This dam represents an insurmountable barrier for many migratory fishes and *Psephurus gladius* is one of the most affected (Liu et al., 1995) because its spawning grounds are located in the upper reaches of the river. The population has been divided in one below and one above the dam. Whereas the population above the dam in the upper portions of the Yangtze is still able to reproduce due to the availability of adequate spawning grounds and unchanged environmental conditions, the population in the middle and lower reaches below the dam is faced with environmental changes and a complete loss of breeding sites because of the massive hydroconstruction (Liu et al., 1995). Wei et al. (1997) suggest that adequate spawning grounds have disappeared in the middle and lower reaches of the Yangtze River since 1986 because from that time no juvenile has been found in the section below Gezhouba Dam downstream to the mouth of the river.

2.3 Population status

The entire population of *Psephurus gladius* is decreasing, mainly since 1976 due to overfishing and pollution (Liu, 1995). In a study conducted along the mainstream of the Yangtze River in Sichuan Province from 1974 to 1975, Liu and Zeng (1988) were able to capture only ten individuals of an age greater than one year. The authors state that during 1976 to 1986 the population decreased immensely due to heavy fishing and that since 1987 individuals with a body weight greater than 100 kg are seldom encountered (individuals may reach a body weight of approximately 300 kg and reach sexual maturity with a body weight of approximately 25 kg). Liu et al. (1995) report that they have failed to collect large living specimens over two years old since 1989.

In general, the population of *Psephurus gladius* is believed to be in a depressed status (Liu et al., 1995). American scientists who visited China in the beginning 1990s never saw a live individual of *Psephurus gladius* and were only told that singular specimens have been captured recently (Georgi, 1994; Mims, 1994 and 1995). Yuan et al. (1992) report that the fish is very rare now and that it is even difficult to catch a living specimen. Wei et al. (1997) state that after 1988 only three to ten adults were annually found in the section below Gezhouba Dam. However, no estimation of the total number of the still existing individuals is given.

The IUCN (1996) classifies the status of the populations of *Psephurus gladius* as Critically Endangered.

2.4 Population trends

The building of the Gezhouba Dam in 1981 just at a point between the upper and middle Yangtze River led to a division of the population in two subpopulations. The population in the upper reaches of the Yangtze is supposed to survive because the spawning grounds are located in this section and the environmental conditions have not changed after the dam construction (Liu et al., 1995). On the opposite, the population living below the dam in the middle and lower reaches of the river is deprived of adequate spawning grounds and faced with environmental changes due to the dam construction. During their investigations from 1989 to 1991, Liu et al. (1995) were able to collect young fishes aged from one to three years in the upper reaches, whereas no juvenile has been found in the section below the dam since 1986. Hence, it is believed that the population living above the dam is still reproducing while within the population downstream the dam no natural reproduction is taking place anymore. The age structure of a collection of 17 specimens incidentally caught below Gezhouba Dam from 1981 to 1986, ranged from 8 to 12 years and included only a single female aged 10 years (Wei et al., 1997). After 1988, only three to ten adults were annually found in the section below the dam (Wei et al., 1997).

2.5 Geographic trends

As described above (2.4) the building of the Gezhouba Dam led to a division of the population in two. It is presumed that only the population above the dam is able to survive whereas the population below the dam is expected to disappear sooner or later (Liu et al., 1995). Thus, in the future the distribution of *Psephurus gladius* will be restricted only to the upper Yangtze River, where the species still finds adequate living and spawning conditions. A migration of mature adults to Sea is not possible anymore due to the insurmountable hydroelectric barrier but the role of this migration is not clear yet.

A future hydroelectric project will possibly lead to a further restriction of the distribution range: for 1997, the building of the Three Gorges Dam at 47 km upstream of the Gezhouba Dam is planned.

2.6 Role of the species in its ecosystem

The biology of *Psephurus gladius* has been poorly investigated although the fish had a high commercial value. It is a predaceous fish feeding primarily on small to medium sized fishes (like *Gobius*, *Coreius* and *Coilia*) but also taking crabs and shrimps (Liu and Zeng, 1988). Reaching a standard length up to 7 m (SL), *Psephurus gladius* is the largest freshwater fish in China (Nichols, 1943).

2.7 Threats

The sharp reduction of the population size of *Psephurus gladius* is mainly due to overfishing and overexploitation in the 1960s and 1970s until the complete ban on fishery in 1983 (Liu and Zeng, 1988). But even though the commercial fishery for *Psephurus gladius* was prohibited, there still might be some illegal catching and caviar production (Birstein, 1993b) which may further threaten the survival of the still-existing few individuals.

One of the major threats for the Chinese paddllefish is the loss of adequate spawning grounds as a result of building insurmountable hydroelectric dams like the Gezhouba Dam which completely cut off the population living in the middle and lower reaches of the Yangtze River from their spawning sites located in the upper reaches of the river. A future hydroelectric project, the Three Gorges Dam, is planned to be built in the upper reaches in 1997. This project will lead to a further reduction of available spawning grounds and thus endangers the survival of *Psephurus gladius* (Wei et al., 1997).

Moreover, Liu et al. (1992) and Wei et al. (1997) indicate that there is a high level of water pollution in the Yangtze River which represents an additional threat to the species' survival. However, no data about the specific effect of toxins and pollutants on *Psephurus gladius* are available.

3. Utilization and Trade

3.1 National utilization

Psephurus gladius represents one of the most valuable fishes in China and is famous and highly sought for its delicious caviar. But despite this great commercial importance, the catch of *Psephurus gladius* was relatively low: prior to 1976 the total annual catch for the entire Yangtze River was estimated to be only 25,000 kg, less than 1% of the total annual Yangtze River fishery for all species (Liu and Zeng, 1988). Since 1976, the catches of *Psephurus gladius* have decreased for several reasons, the most important factors being overfishing, pollution, loss of migratory routes and adequate spawning grounds.

In 1983, *Psephurus gladius* was protected by law as Endangered species and in 1989, it was placed in category I status and fishery was completely prohibited (Liu, 1995).

3.2 Legal international trade

Not reported

3.3 Illegal trade

Not reported

3.4 Actual or potential trade impacts

Not reported

3.5 Captive breeding or artificial propagation for commercial purposes (outside country of origin)

Not reported

4. Conservation and Management

4.1 Legal status

4.1.1 National

Psephurus gladius is protected by law as Endangered species since 1983 and placed in category I with the highest degree of protection since 1989 (Liu, 1995). This includes a complete ban on fishery. Protected stations for *Psephurus gladius* were set up along the river flow in the provinces of Hubei and Sichuan (Wei et al., 1997).

4.1.2 International

None.

4.2 Species management

4.2.1 Population monitoring

Details about a specific monitoring programme for *Psephurus gladius* are not published. However, Wei et al. (1997) indicate, that since 1980 (i.e. the building of Gezhouba Dam) considerable investigations about the Yangtze ichthyofauna were made, becoming a basis for fisheries management and conservation.

4.2.2 Habitat conservation

Since 1989, protected stations (habitats) were set up along the Yangtze River in the provinces of Hubei and Sichuan. Further information on specific habitat conservation is not available.

4.2.3 Management measures

Since Chinese scientists believe that artificial propagation might be the most effective way to maintain the population of *Psephurus gladius*, several attempts of captive breeding has been undertaken but failed until 1994 (Wei et al., 1997). The causes for the failure included the difficulties of catching an adequate broodstock due to the low abundance of *Psephurus gladius*, and of the simultaneous availability of ripe male and female individuals.

Recently, joint efforts between China and the USA to conserve and restore *Psephurus gladius* by artificial propagation have been initiated (Mims, 1995).

4.3 Control measures

4.3.1 International trade

None.

4.3.2 Domestic measures

Not reported.

5. Information on Similar Species

Psephurus gladius is sympatric with the Yangtze sturgeon, *Acipenser dabryanus*, and the Chinese sturgeon, *Acipenser sinensis*. The location of the spawning grounds of *Psephurus gladius* and *Acipenser sinensis* are supposed to be the same (Liu et al., 1995) whereas their spawning seasons are different (March to April for *Psephurus gladius* and September to October for *Acipenser sinensis*).

The only closely related species belonging to the same family, Polyodontidae, is the American paddlefish, *Polyodon spathula*, which lives in North America, mainly in the Mississippi River basin. *Polyodon spathula* is listed in Appendix II of CITES.

6. Other Comments

The range state of the species has been contacted on 13 March 1996 and 21 May 1996. A copy of the first draft of the proposal ("working document") has been sent to the range state on 19 August 1996. The comments of the range state that have been received are attached in the appendix at the end of this document.

The "working document" has also been presented at the 13th meeting of the Animals Committee of CITES in Prague, Czech Republic, on 23-27 September 1996 for discussion.

Additionally, a meeting ("Multilateral Consultations on the Problems of Sturgeon Species within the Framework of CITES") which took place on 21-22 November 1996 in Moscow, has been organised in order to consult with the states of Azerbaijan, Kazakhstan, Turkmenistan and Ukraine (which are not members to CITES) as well as with China, Georgia, Iran, USA and the Russian Federation. The minutes of this meeting and the comments of the range states that have been received are attached in the appendix at the end of this document.

7. Additional Remarks

8. References

Birstein, V.J. 1993a. Sturgeons and Paddlefishes: Threatened Fishes in Need of Conservation. Conservation Biology 7 (4):773-787.

Birstein, V.J. 1993b. Draft Application to CITES: Order Acipenseriformes. Unpublished.

Georgi, T. 1994. The sensory pores of *Psephurus gladius*. The Sturgeon Quarterly, 2 (2) :6-7.

IUCN. 1996. IUCN Red List of Threatened Animals. IUCN, Gland, Switzerland.

Liu, C. and Y. Chenhan. 1988. Notes on the Chinese Paddlefish, *Psephurus gladius* (Martens). Copeia 1988 (2): 482-484.

Liu, Ch., T.A. Georgi, X. Diao and J. Liu. 1995. Biology of the Chinese Paddlefish, *Psephurus gladius* (Martens). Proceedings of the International Symposium on Sturgeons, September 6-11, 1993. Moscow-Kostroma-Moscow, VNIRO. Pp. 13-21.

Mims, S.D. 1994. Chinese paddlefish research: A model for U.S.-China Aquatic conservation. Diversity, 10 (4) :23-25.

Mims, S.D. 1995. Will the Chinese Paddlefish Survive? U.S. and Chinese Conservation Efforts.Sturgeon Quarterly 3 (2): 12.

Mims, S.D., T.A. Georgi and C. Liu.1993. The Chinese Paddlefish, *Psephurus gladius*: Biology, Life History and Potential for Cultivation. World Aquaculture 24 (1): 46-48.

Nichols, J.T. 1943. The Freshwater Fishes of China. Central Asiatic Expeditions: Natural History of Central Asia. Vol. IX. American Museum of Natural History, New York. Pp. 15-16.

Wei, Q., F. Ke, J. Zhang, P. Zhuang, J. Luo, R. Zhuo and W. Yang. 1997. Biology, Fisheries, and Conservation of sturgeons and paddlefish in China. In: V. Birstein, J. R. Waldman, and W. E. Bemis (eds.). Sturgeon Biodiversity and Conservation. Kluwer Academic Publishers, Dordrecht. pp. 241-255.