*Environmental Biology of Fishes* **48**: 427–435, 1997.


# The threatened status of acipenseriform species: a summary

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Received 29.5.1996 Accepted 3.6.1996

*Key words:* IUCN, CITES, listing, overfishing, pollution, dam construction, sturgeons, paddlefishes

> … increased demand has recently driven the price of black market smoked sturgeon as high as $ 26 a kilogram. With poachers standing to gain roughly a third of this price [besides the much higher price of caviar], a large fish could be worth thousands of dollars.
>
> Gary Hamilton
> in *Canadian Geographic*, July/August 1996, p. 62

Papers in this volume describe many factors that expose acipenseriform fishes to particular risks of population decline and extinction. These range from such basic problems as how to define species boundaries and recognize different species of sturgeons, factors that necessarily impact all regulatory and law enforcement efforts. Other factors concern the extreme sensitivity of sturgeons to overfishing, their dependence on large, often polluted urban river systems for spawning, and migration routes blocked by hydroelectric dams. The value of the traditional reaction to such problems – stocking hatchery reared fish – is increasingly debated, particularly if the stocking occurs 'on top of' a remnant population of sturgeons. The prognosis for most species is extremely bleak, and has worsened during the few years that we have been recording information. Technical developments – such as the use of genetic markers to recognize different species of sturgeons (and their caviar) – may offer some new regulatory tools. Improved basic knowledge – especially behavioral and ecological data obtained by telemetry of wild fish – may help governments to protect sensitive and important sites, particularly spawning areas.

Stocking can be a mixed blessing, though it certainly helped historically to sustain some species, such as *Huso huso* in the Volga River and Caspian Sea. Reintroduction to portions of ranges from which a species has been extirpated may seem to be a laudable goal, although this has not yet been achieved for any acipenseriform species. As in cases of attempted restorations of salmoniform fishes, serious questions surround the choice of stocks that might be used for reintroduction. Given the short time during which we can hope to act to preserve the global biodiversity of sturgeons and paddlefishes, greater international awareness, better regulation and stricter enforcement of existing laws are essential. It seems especially important that all interested persons act to assemble the best possible data on the current status of their local species of sturgeons and paddlefishes.

Most species and many populations of sturgeons

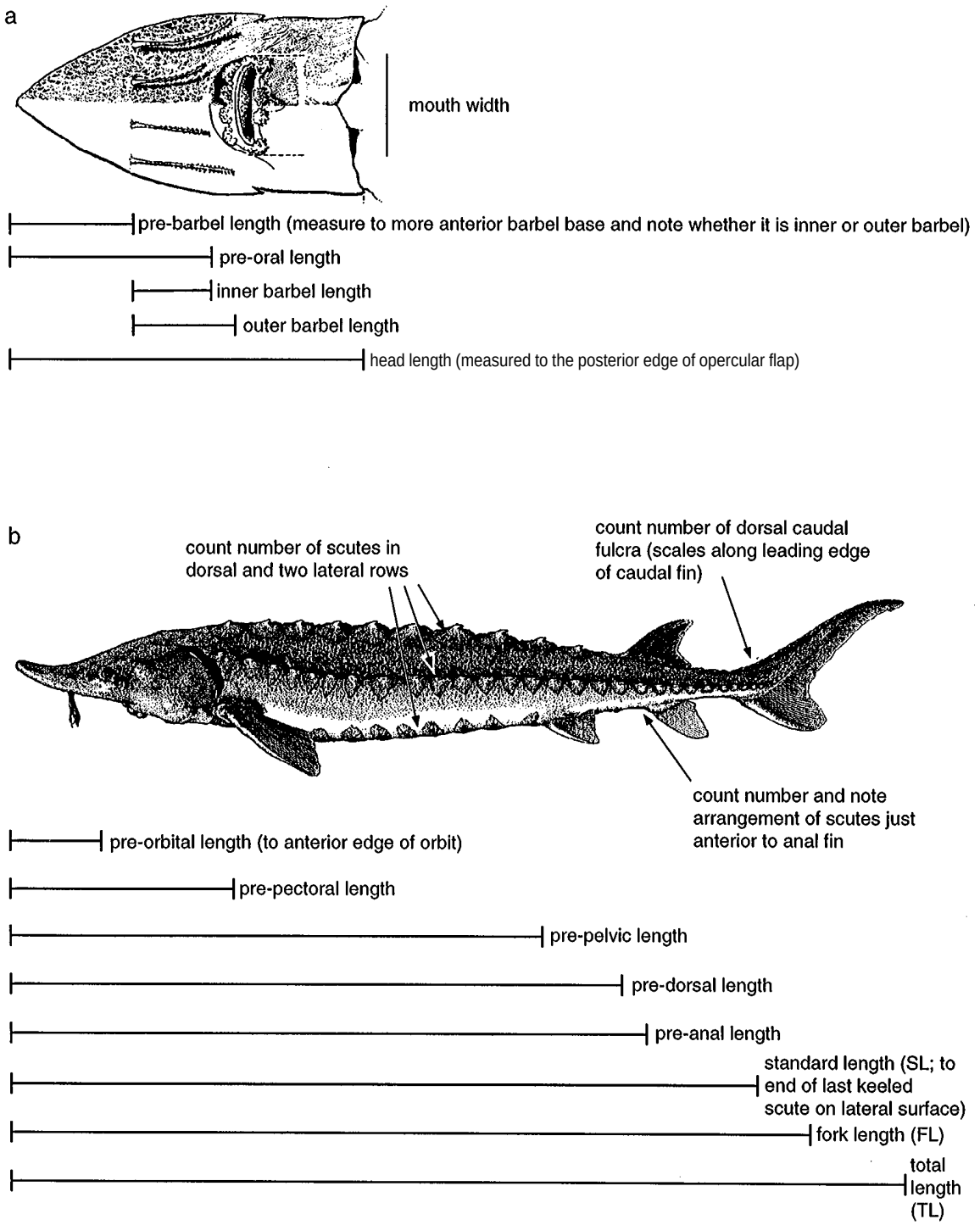


*Figure 1.* Standard measurements for sturgeons: a – Ventral view of mouth based on an illustration of *Scaphirhynchus platorynchus* modified from Bailey & Cross (1954). b – Lateral view of body based on an illustration of *Acipenser oxyrinchus* (518 mm TL) modified from Vladykov & Greeley (1963). A color photograph including a metric scale bar should be made showing the ventral view of the head (as in a) and lateral view of the body (as in b). All measurements should be recorded from each specimen, together with date and exact locality data, water conditions, observers name and institution, and fate of the specimen.

and paddlefishes, particularly anadromous forms, are in trouble (Birstein 1993, Bemis & Findeis 1994, Waldman 1995). Declines of sturgeon and paddlefish populations are described in many papers in this volume (e.g., Bacalbaşa-Dobrovici 1997, Graham 1997, Hensel & Holčík 1997, Khodoreskaya et al. 1997, Krykhtin & Svirskii 1997, Ruban 1997, Wei et al. 1997, Zholdasova 1997). Like other anadromous fishes, such as salmonids, sturgeons are extremely sensitive to overfishing (Boreman 1997, this volume). Overfishing, including unprecedented levels of poaching, is the main threat to sturgeon survival in Europe (especially in Russia), Siberia and China (Birstein 1993, 1996, Dumont 1995, Anonymous 1995a, De Meulenaer & Raymakers 1996, Ruban 1996). Poaching also plagues certain populations in the United States, such as Columbia River white sturgeon (Cohen 1997 this volume). Other factors, including pollution, at present play a less important role in the decline of populations (for instance, Khodorevskaya et al. 1997, Ruban 1997). Even species that are not fished for either caviar or meat, such as all three species of *Pseudoscaphirhynchus*, have declined, in this case primarily in response to the drying of the Aral Sea (Zholdasova 1997).

Persistent problems in identifying species of *Acipenser* outside of their supposedly native ranges cause us to make two practical suggestions. First, document by photography and measurement external features of live wild sturgeons. Intraspecific variation, particularly in wide ranging species such as *Acipenser ruthenus*, is extremely confusing and no single researcher is ever likely to have access to all river systems in which such species occur. Figure 1 proposes a series of measurements to be recorded, together with locality data including water flows, associated fauna, etc. These data will be most valuable when coupled with color photographs of the live specimen showing its natural coloration. Second, systematics cannot be stronger than the specimens and collections upon which it is based. Voucher specimens, especially large fish and ontogenetic series – even partial or salvaged specimens – with good locality data are needed for many species of acipenseriforms from many areas of the world, so we must take active roles in the growth and maintenance of sturgeon materials in permanent natural history collections. (As an aside, Grande & Bemis 1991, found it easier to find museum specimens of the Eocene Green River paddlefish, *Crossopholis* than the extant Chinese paddlefish, *Psephurus gladius*, which is quite the reverse of most paleoichthyological experience.)

For many years, stocking of artificially reared young has been used to maintain populations of acipenseriforms in the former Soviet Union (e.g., the three main commercial species of Caspian Sea sturgeons, *Huso huso, A. stellatus*, and *A. gueldenstaedtii*, Khodorevskaya et al. 1997) and in the United States (e.g., *Polyodon*, Graham 1997). The fragility of this approach is well-illustrated by events in Russia since the late 1980s, when stocking of Caspian Sea sturgeons began to decrease (Khodorevskaya et al. 1997). Not only do fewer hatcheries now operate on the Volga River, but also they are unable to catch enough brood stock, so that the beluga, *H. huso*, has become extremely threatened. Because of dam construction, beluga lost access to practically all of the spawning grounds in the Volga River. In 1995, the number of females caught in the Volga River delta was insufficient for artificial breeding. Therefore, in 1995 there was no natural or artificial reproduction of *H. huso* in the Volga River. The situation on the Danube River is similarly discouraging, for the two dams at the Iron Gates now prevent the historic migration of beluga between the Black Sea and the middle reaches of the Danube River. Artificial breeding of *H. huso* in the Danube River (in the Serbian part of the river) has also been unsuccessful, and there is no indication that the situation will improve in the near future. We must make the case throughout the world that even the very best stocking programs can only provide short-term solutions unless they are coupled to plans for protecting and increasing levels of natural reproduction.

Technology may aid in enforcing existing regulations and learning what to protect in nature, but our efforts as scientists must be focused not only on what we can learn about sturgeons and paddlefishes but also how to translate that knowledge into practical measures (Wirgin et al. 1997, this volume). For example, it is now possible to identify the caviar of certain species of sturgeons using species – specific

*Table 1.* Threatened status of acipenseriforms.

| Species | English name | Distribution | Status (national listing or latest studies) | | IUCN listing | | CITES 1996 |
|---|---|---|---|---|---|---|---|
| | | | Status[1] | References | 1994 | 1996[2] | |
| **Family Acipenseridae** | | | | | | | |
| *Acipenser baerii* | Siberian sturgeon | Main Siberian rivers | | | | VU | |
| *A. baerii baerii* | Siberian sturgeon | Ob River basin | EN | Ruban 1996, 1997 | | EN | |
| *A. baerii stenorrhynchus* | Lena River sturgeon | Basins of the East Siberian rivers: Yenisey, Lena, Indigirka, Kolyma, and Anadyr | VU | Ruban 1997 | | VU | |
| *A. baerii baicalensis* | Baikal sturgeon | Lake Baikal (Siberia) | VU | RSFSR Red Data Book 1983, Pavlov et al. 1985, 1994 | | EN | |
| *A. brevirostrum*[3] | Shortnose sturgeon | Rivers, estuaries and ocean along east coast of North America from Indian River (Florida) to Saint John River (New Brunswick) | T (Canada & USA) | USFWS 1967, Williams et al. 1989, Manci 1993 | VU (Canada & USA) | VU | Appendix I |
| | | | V (Canada) | Campbell 1991 | | | |
| *A. dabryanus* | Yangtze or Dabry's sturgeon | Yangtze River system | EN (category I of state protection)[4] | Wei et al. 1997 | | CR | |
| *A. fulvescens* | lake sturgeon | Great Lakes and lakes of southern Canada | T (Canada & USA) | Williams et al. 1989, Manci 1993 | VU (Canada & USA) | VU | |
| *A. gueldenstaedtii* | Russian sturgeon | Black, Azov, Caspian seas and rivers entering into them | VU | Lelek 1987 | | EN | |
| | | Caspian Sea population | H | Khodorevskaya et al. 1997 | | EN | |
| | | Black Sea population | | | | EN | |
| | | Danube River population, Hungary | EN | Guti 1995 | | | |
| | | Danube River population, Romania | VU | Bănărescu 1995 | | | |
| | | Dnepr River population (Black Sea) | EN | Gringevsky 1994 | | | |
| | | Sea of Azov population | VU, H | Volovik et al. 1993 | | EN | |
| *A. medirostris* | Green sturgeon | Pacific coast of North America from Aleutian Islands and Gulf of Alaska to Ensenada, Mexico | V (Canada) | Campbell 1991 | | VU | |
| | | | T (USA) | Moyle et al. 1994 | | | |
| *A. mikadoi* | Sakhalin sturgeon | Pacific Ocean from Amur River to northern Japan, Korea, and Bering Sea, Tumnin (Datta) River | EN | USSR Red Data Book 1984, Pavlov et al. 1994 | | EN | |
| *A. naccarii* | Adriatic sturgeon | Adriatic Sea, Po and Adige Rivers | VU | Lelek 1987 | | VU | |
| *A. nudiventris* | Ship sturgeon | Aral, Caspian, Black seas and rivers entering into them | | | | EN | |
| | | Caspian Sea and rivers entering into it | EN | Pavlov et al. 1985, Lelek 1987 | | EN | |
| | | | H | Sokolov & Vasilev 1989 | | | |
| | | Black Sea and rivers entering into them (Russia, Ukraine) | EN | Pavlov et al. 1985, 1994 | | EN | |
| | | | H | Sokolov & Vasilev 1989 | | | |
| | | Danube River population | | | | CR | |
| | | Danube River population, Hungary | EN | Guti 1995 | | | |
| | | Danube River population, Romania | EX | Bănărescu 1995 | | | |
| | | Aral Sea (Central Asia) | EX | Zholdasova 1997 | | EX | |

*Table 1.* Continued.

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| *A. oxyrinchus* | Atlantic sturgeon | Atlantic Ocean (Canada and USA, east coast) | | | | Lr (nt) | |
| *A. oxyrinchus desotoi*[5] | Gulf sturgeon | Gulf of Mexico and northern coast of South America | T | Williams et al. 1989, USFWS 1990b, Manci 1993 | | VU | |
| *A. o. oxyrinchus* | Atlantic sturgeon | Rivers, estuaries and ocean along east coast of North America from the St. Johns River (Florida) to Hamilton Inlet (Labrador) | SC (USA) | Williams et al. 1989 | VU (Canada & USA) | LR (nt) | Appendix II |
| *A. persicus* | Persian sturgeon | Caspian and Black seas and rivers entering into them | EN | Lelek 1987 | | EN | |
| | | Caspian Sea population | | | | VU | |
| | | Black Sea population | R | Pavlov et al. 1994 | | EN | |
| *A. ruthenus* | Sterlet | Drainages of main rivers entering the Caspian and Black seas (Volga, Danube) | EN | Lelek 1987 | | VU | |
| | | Volga River population | | | | LR (lc) | |
| | | Danube River population | | | | VU | |
| | | Danube River population, Hungary | VU | Guti 1995 | | | |
| | | Danube River population, Romania | VU | Bănărescu 1995 | | | |
| | | Dnepr River population | EN | Gringevsky 1994 | | | |
| | | Ob, Irtysh, Yenisey rivers (Siberia) | | | | VU | |
| *A. schrenckii* | Amur River sturgeon | Amur River system (Siberia) | T | Manci 1993 | VU (China & Russia) | EN | |
| | | | EN | Krykhtin & Svirskii 1997 | | | |
| *A. sinensis* | Chinese sturgeon | Yangtze River system (China) | EN, H (category I of state protection)[4] | Wei et al. 1997 | | EN | |
| *A. stellatus* | Stellate sturgeon or sevruga | Caspian, Azov, Black and Aegean seas and rivers entering into them | | | | EN | |
| | | Caspian Sea population | | | | VU | |
| | | | H | Khodorevskaya et al. 1997 | | | |
| | | Black Sea population | | | | EN | |
| | | Dnepr River population (Black Sea) | EN | Gringevsky 1994 | | | |
| | | Danube River population, Hungary | EN | Guti 1995 | | | |
| | | Danube River population, Romania | EN | Bănărescu 1995 | | | |
| | | Sea of Azov | VU, H | Volovik et al. 1993 | | EN | |
| *A. sturio* | Atlantic (Baltic) sturgeon | Baltic, Eastern North Atlantic, Mediterranean, and Black Sea | EN[6] | USSR Red Data Book 1984, Lelek 1987, Holcik et al. 1989 | EN | CR | Appendix I |
| *A. transmontanus* | White sturgeon | Rivers and Pacific coast of North America from the Gulf of Alaska to Baja California | V (Canada) | Campbell 1991 | | LR (nt) | |
| | | | V (California, USA) | Moyle 1994 | | | |
| | | Kootenai River and Kootenai Lake in Idaho, Montana, and British Columbia downstream of Libby Dam in Montana | EN | USFWS 1994[7] | | EN | |

*Table 1.* Continued.

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| *Huso dauricus* | Kaluga sturgeon | Amur River system | EN | Krykhtin & Svirskii 1997, Wei et al. 1997 | EN | EN | |
| *H. huso* | Giant sturgeon or beluga | Caspian, Black, and Adriatic seas and rivers entering into them | VU | Lelek 1987 | | EN | |
| | | Caspian Sea population | | | | EN | |
| | | | H | Khodorevskaya et al. 1997 | | | |
| | | Black Sea population | | | | EN | |
| | | Dnepr River population (Black Sea) | EN | Gringevsky 1994 | | | |
| | | Danube River population, Hungary | EN | Guti 1995 | | | |
| | | Danube River population, Romania | VU | Bănărescu 1995 | | | |
| | | Azov Sea population | EN | Pavlov et al. 1994 | | CR | |
| | | Adriatic Sea population | | | | EX | |
| *Pseudoscaphirhynchus fedtschenkoi* | Syr-Dar shovelnose sturgeon | Syr-Darya River (Kazakhstan, Central Asian) | EN | USSR Red Data Book 1984 | | CR | |
| | | | EX | Pavlov et al. 1985, 1994 | | | |
| *P. hermanni* | Small Amu-Dar shovelnose sturgeon | Amu-Darya River (Uzbekistan, Central Asia) | EN | USSR Red Data Book 1984 | | CR | |
| | | | EX | Pavlov et al. 1985 | | | |
| *P. kaufmanni* | Large Amu-Dar shovelnose sturgeon | Amu-Darya River (Turkmenistan, Uzbekistan & Tadjikistan, Central Asia) | EN | USSR Red Data Book 1984 | | EN | |
| | | | CR | Zholdasova 1997 | | | |
| *Scaphirhynchus albus* | Pallid sturgeon | Missouri and Mississippi River basins | EN[8] | Williams et al. 1989, USFWS 1990b, Manci 1993 | EN | EN | |
| *S. platorynchus* | Shovelnose sturgeon | Missouri and Mississippi River basins | E | Williams et al. 1989 | | VU | |
| *S. suttkusi* | Alabama sturgeon | Mobil basin in Alabama and Mississippi | EN[9] | Williams et al. 1989, Williams & Clemmer 1991, Manci 1993, 1994 | EN | CR | |
| **Family Polyodontidae** | | | | | | | |
| *Polyodon spathula* | North American paddlefish | Mississippi River system, particularly Missouri and its tributaries | SC (USA & Canada) | Williams et al. 1989 | VU (USA) | VU | Appendix II |
| *Psephurus gladius* | Chinese paddlefish | Yangtze River system | EN (category I of state protection)[4] | Wei et al. 1997 | VU | CR | |

[1] Categories are given in the new IUCN system (IUCN Red List Categories 1994): EX = extinct; CR = critically endangered; EN = endangered; VU = vulnerable; LR = low risk; LR(nt) = near threatened; LC(lc) = least concern; or in the U.S. Office of Endangered Species system: E = endangered; T = threatened; SC = special concern. H (Hatcheries) designates species whose natural reproduction is limited; such species are artificially bred and juveniles obtained are released into their natural habitat.

[2] Proposals of the Sturgeon Specialist Group, IUCN

[3] All populations of *A. brevirostrum* along the east coast of the USA and Canada are listed as endangered by the USFWS, Title 50, parts 17.11, 17.12 (USFWS, 1967; DOI, 1973).

[4] A list of wild animals by the states special protection in category I and II. 14 pp. (in Chinese).

[5] Populations of *A. oxyrinchus desotoi* are listed as endangered in AL, FL, GA, LA, and MS by the USFWS, Title 50, parts 17.11, 17.12; federally threatened status from September 30, 1990 (USFWS 1990b).

[6] According to the IUCN Red List (1994), the status of *A. sturio* is different in different countries: Albania (EN), Algeria (EN), Belgium (EX?), Finland (EX?), France (EN), Germany (EX?), Greece (EN), Iceland (EX?), Ireland (EX?), Italy (EN), Morocco (E), Netherlands (EX?), Norway (EX?), Poland (EX?), Portugal (EN), Romania (EN), Russia (EN), Spain (EX?), Switzerland (?), Turkey (EN), Ukraine (EN), United Kingdom (EN), Yugoslavia (EX?). The status of *A. sturio* for Spain and Netherlands should be considered as E since in 1992 sturgeons were caught in both countries (Volz & DeGroot 1992, Elvira & Almodovar 1993). In 1995, a few live *A. sturio* were caught in Albania (Tamas Gulyas personal communication).

[7] Kootenai River population of *A. transmontanus* is listed as federally endangered from 6 September, 1994 (USFWS 1994).

[8] Populations of *S. albus* are listed as endangered in AR, IA, IL, KS, KY, LA, MO, MS, MT, ND, NE, SD and TN by the USFWS, Title 50, parts 17.11, 17.12; federally endangered status from September 6, 1990 (USFWS 1990a).

[9] Proposed listing of *S. suttkusi* as endangered has been withdrawn (Federal Register 59, No. 240: 64794–6409 (1994)). For the present, USFWS has placed this species in Category 2 (those species for which insufficient information is available to determine whether to proceed with a proposed rule to list or to consider the species extinct). At its meeting in Edmonton (Canada), 15–19 June 1995, the American Society of Ichthyologists and Herpetologists urged USFWS to list *S. suttkusi* as an endangered species (Anonymous 1995b, Mayden & Kuhajda 1996).

DNA primers (DeSalle & Birstein 1996). This may help law enforcement agencies to detect violations of CITES and other regulations, and coupled to the development of this technology must be increased willingness to speak publicly on matters concerning enforcement of environmental laws. As another example of technology and efforts to conserve sturgeons, radio telemetric studies revealed the spawning sites of shortnose sturgeon in the Connecticut River (e.g., Buckley & Kynard 1985). One of these sites lies just below Holyoke Dam, Holyoke, Massachusetts, where the river passes through a highly disturbed urban environment. Knowledge of the existence of this spawning site enables public utilities and state highway officials to limit their further impact on this portion of the river, particularly during the spring spawning season. In the future, it may become necessary to seek specific regulations protecting individual spawning sites from dredging or other destructive impacts.

The highly threatened status of all extant acipenseriform species is summarized in Table 1, which updates information given by Birstein (1993). Data for the main basins inhabited by sturgeons are given separately. For the Danube River, evaluations are shown for both the middle (Slovak-Hungarian) and lower (Romanian) reaches. Restocking efforts are also mentioned in Table 1. The international evaluation of status is given for 1994 (IUCN Red List) and 1996. Data for 1996 were collected by the Sturgeon Specialist Group created within the Species Survival Commission of IUCN in 1994 (Birstein 1995). The last column of Table 1 shows the present listings of species of sturgeons on the Appendices I or II of CITES (Convention on International Trade in Endangered Species of Wild Fauna and Flora).

It is evident from Table 1 that all European and Asian sturgeon species are in trouble. For various reasons, however, only the European Atlantic sturgeon, *A. sturio*, attracts serious international attention to its conservation (Elvira & Gessner 1996, Williot et al. 1997, this volume). Meanwhile, the situation for many other species worsens. The construction of Three Gorges Dam on the Yangtze River continues. When it is completed, the spawning grounds of all three endemic Chinese species, of which two (*Acipenser dabryanus* and *Psephurus gladius*) are already critically endangered, will be destroyed. Plans to develop oil fields in the northern part of the Caspian Sea in Kazakhstan and Turkmenistan (Sager 1994, Dumont 1995) threaten the future of all sturgeons in the Caspian Sea. But even without these fundamental environmental changes it is evident that we may soon lose at least some of the Eurasian sturgeon species. 'Like the Californian condor, the sturgeons only chance of survival may be in captivity' (Dumont 1995).

The status of the American species of Acipenseriformes is comparatively much better than that of the Eurasian species (Table 1). Considering the many ongoing recovery programs for almost all American species (partly described in this volume by Bain 1997, Beamesderfer & Farr 1997, Graham 1997, Kynard 1997, Smith & Clugston 1997), the future of American species seems to be much better than that of the Eurasian ones, especially those with many extirpated populations. But as suggested above, we must be careful not to become so reliant on artificial stocking of certain species that we neglect to develop ways to encourage – or at least to permit – natural spawning to play as large a role as possible in maintaining populations.

Clearly, Table 1 presents an initial step of the evaluation of the status of acipenseriforms; a complete picture of the status of the group revealed river by river in each basin will take much effort and time. But it seems that this effort is necessary if we are to understand what is really left of the former range of the extant acipenseriform species. Time is short, and we will be grateful for any forthcoming improvements to our data base.

## Acknowledgements

We thank the many readers and contributors to *The Sturgeon Quarterly*, which since its inception in 1993 has helped to keep all of us aware of the global circumstances of sturgeons and paddlefishes.

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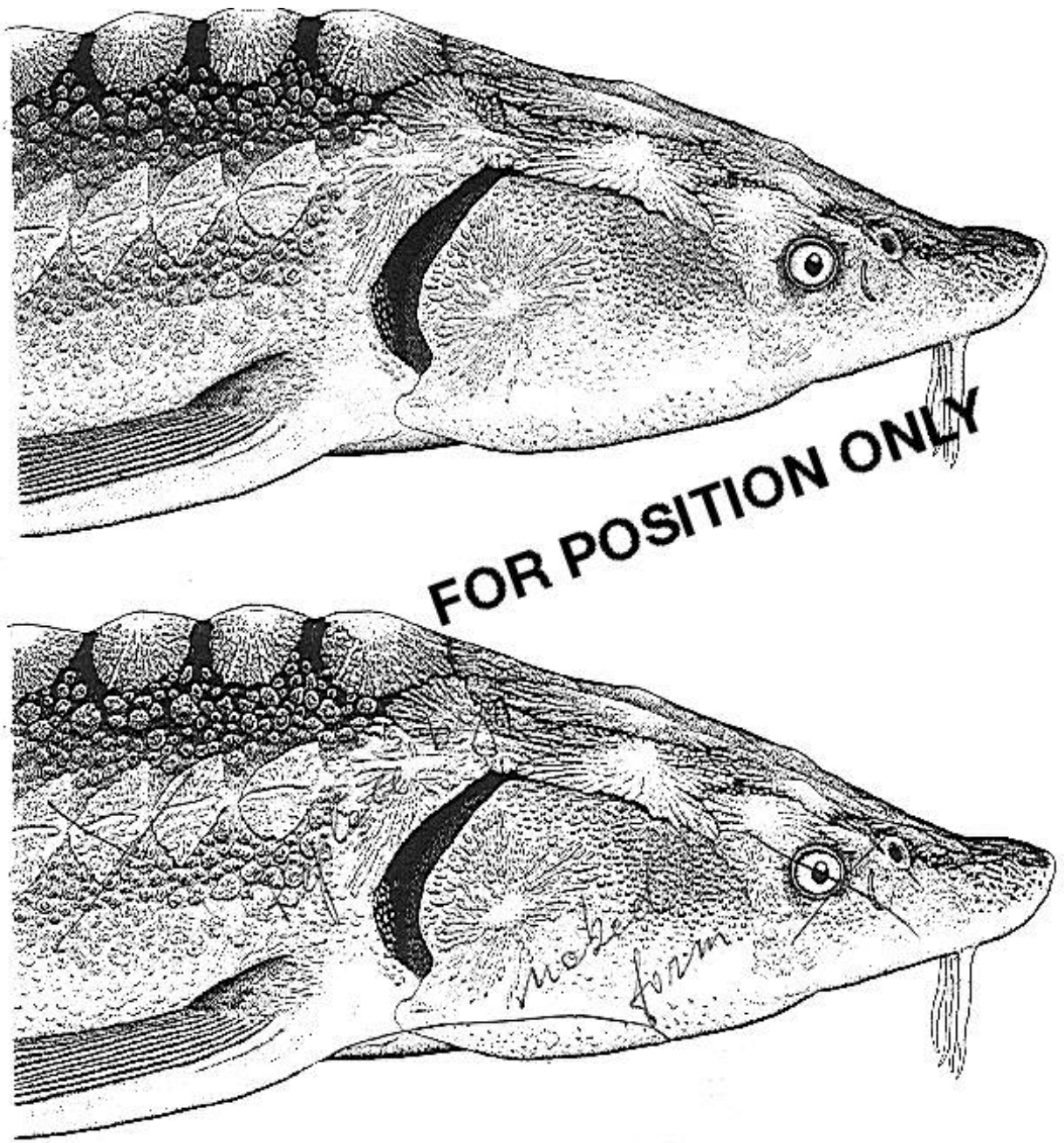


Portraits of juvenile *Acipenser gueldenstaedtii* from the Black Sea stock, 71 cm TL armored form above a 77 cm rare naked form; the same individuals as on the frontispiece photographs. Originals by Paul Vecsei, 1996.