

Order: ACIPENSERIFORMES

Family: POLYODONTIDAE

SUMMARY

American Paddlefish *Polyodon spathula* is endemic to the continent and is the only paddlefish species present in the wild in North America. This species is widely distributed in the large river drainages of the eastern United States of America (USA). During the last century it has been extirpated from four states on the periphery of its range and even within states considered as strongholds for the species, portions of the historical range have diminished. The species reaches sexual maturity between 5-12 years of age and may live up to 40-50 years attaining a weight of up to 80 kg. Southern populations apparently grow more quickly than those in colder northern waters. Following a review of the status of the species in 1983, a number of significant changes in the management of the species were adopted, due to recognition of the threats posed by continued habitat degradation, pollution and the demand for paddlefish caviar.

Commercial catch of *P. spathula* is permitted in six states only: Arkansas, Illinois, Kentucky, Mississippi, Missouri and Tennessee. In the absence of past and present catch data from Mississippi, it is difficult to determine the trends in annual catches of *P. spathula*. A similar problem exists for Arkansas where reporting of paddlefish commercial catch is not compulsory. In 1992, the estimated commercial paddlefish fishery, excluding Mississippi, totalled approximately 242 t. The largest volumes were recorded in Arkansas (65%; 136,000-181,000 kg – 158,500 kg mean) and Tennessee (25%; 60,328 kg), with the remaining 10% shared by Illinois (21,145 kg), Kentucky (3,906 kg) and Missouri (2,188 kg).

The international trade in specimens of *P. spathula* since the species was listed in Appendix II in 1992 has consisted principally of captive-bred live fish and fertilised eggs. Exports from the USA increased during 1993 to 1997, with 9,644 to 265,300 live fish and 60,000-187,000 fertilised eggs respectively, and then decreased in 1998 to 70,000 live fish and 53,440 fertilised eggs. Results of artificial breeding for the release of *P. spathula* fry in the wild are available, but there seems to be no development of commercial farming for production of meat and caviar of *P. spathula* at present.

In 1992, the USA proposed the species for listing in CITES Appendix II in accordance with Article II, paragraph 2(a). Since Resolution Conf. 10.12 *Conservation of Sturgeon* entered into effect in 1998, recommending that range States “consider the feasibility of establishing annual export quotas for sturgeon specimens”, the USA did not establish export quotas for *P. spathula*.

DISTRIBUTION AND POPULATION

The CITES database lists the distribution of *Polyodon spathula* as: USA (Anon., 2000).

P. spathula is classified as Vulnerable by IUCN (1996):
VU C2b USA [Mississippi River].

P. spathula was previously abundant throughout the Mississippi River Basin and some adjacent estuaries of the Gulf of Mexico, and has been observed in the Great Lakes including Canadian waters. *P. spathula* is also found throughout the Missouri River basins and many of their tributaries (Graham, 1997). There has been no recent verification of the occurrence of *P. spathula* in Canada. The species is found in 22 states in the USA. However, whilst several paddlefish populations appear to be stable or increasing, the species is in decline in much of its current range due to continued habitat modification and degradation, increased water contamination and overfishing (Graham, 1997). Information presented in Graham (1997), was compiled in 1994.

In 1994, the population was reported to be stable in Arkansas, Indiana, Iowa, Kentucky, Louisiana, Minnesota, Mississippi, Missouri, Montana, Oklahoma, and South Dakota (Graham, 1997). Graham (1997) also reported that wild populations are considered to be increasing in Texas, West Virginia and Wisconsin,

whilst they have been declining in Illinois and North Dakota. The species has been extirpated from Maryland, New York, North Carolina and Pennsylvania (Gengerke, 1986, cited in Todd, 1998).

Alabama: *P. spathula* is the only species of Acipenseriformes confirmed to exist in this state (US Fish and Wildlife Service (USFWS), CITES Management Authority of USA, *in litt.* to TRAFFIC Europe, September 2000).

Kansas: *P. spathula* is present in the Arkansas, Kansas, Marais des Cygnes, Missouri, Neosho and Verdigris rivers. In all these rivers, restocking efforts have been undertaken and the population is considered to be stable and probably increasing (Graham, 1997).

Nebraska: The population is considered stable to declining (Graham, 1997) (see South Dakota, Missouri River common boundary: below Gavins Point Dam, near Yankton in South Dakota (USFWS, *in litt.* to TRAFFIC Europe, September 2000)).

Ohio: According to Graham (1997), the status of the *P. spathula* population is unknown (Graham, 1997). However, state authorities consider the species to be limited in distribution and relatively rare (USFWS, *in litt.* to TRAFFIC Europe, September 2000).

South Dakota: Graham (1997) considers the population to be stable. Currently, the paddlefish population below Gavins Point Dam contains too few mature individuals to be attractive to the caviar trade and the remaining paddlefish populations (in the Missouri River above Gavins Point Dam) are not abundant enough to attract interest (USFWS, *in litt.* to TRAFFIC Europe, September 2000).

Virginia: The status of the population is unknown (Graham, 1997).

HABITAT AND ECOLOGY

This species prefers large rivers and lakes. Paddlefish normally inhabit deep water, but during the summer can be found near the surface and at variable depths. *P. spathula* grows to 0.4-0.7 kg in the first year and the largest specimens caught measured 2.3 m and weighed 80 kg. Sexual maturity occurs at 5-9 years for males and 8-12 years for females with 1-1.2 m total body length (Hochleithner and Gessner, 1999). Southern stocks generally grow more quickly than their northern counterparts and rarely exceed 15 years of age, however, northern stocks have been recorded as old as 40-50 years (Scarnecchia and Graham, 1999). Spawning occurs in early spring but adults are unlikely to spawn every year (Hochleithner and Gessner, 1999). Eggs hatch in 12-14 days.

The paddlefish's large mouth strains small crustaceans, algae, ephemeropterid larvae and mayflies. They are also occasional bottom feeders. During their first year, they are generally particle feeders, after which they begin to filter-feed. It has been suggested that their paddle-like bill senses plankton concentration levels (Hochleithner and Gessner, 1999).

THREATS TO SURVIVAL AND DOMESTIC USE

A major threat to paddlefish is the damming of large rivers. This has eliminated much of their spawning habitat by controlling spring flooding and keeping water within riverbanks. Intentional and unintentional snagging by anglers also results in mortality. Whilst the paddlefish is heavily parasitized by lampreys *Ichthyomyzon* spp., the impact of this is unknown.

An assessment of the impact of fisheries on wild populations of *P. spathula* has not been possible due to the lack of data. Many states, particularly Arkansas and Mississippi, do not require commercial fishermen to report their catches. According to surveys and voluntary reporting, in 1992, 65% of the catch recorded in five of the six states that still allow commercial fishing of *P. spathula* came from Arkansas (Graham, 1997). In Mississippi, no surveys were conducted and no catches were voluntarily reported.

Unless otherwise stated, information hereunder has been provided by USFWS (CITES Management Authority of USA, *in litt.* to TRAFFIC Europe, September 2000).

Of all states in the USA where *P. spathula* occurs (Graham, 1997),

- some allow commercial fishery: Arkansas, Illinois, Kentucky, Mississippi, Missouri and Tennessee;
- some prohibit the commercial fishery, but allow sport fishing: Indiana, Iowa, Kansas, Montana, Nebraska, North Dakota, Oklahoma and South Dakota; and
- others do not have large enough populations for a viable commercial fishery and therefore prohibit both commercial and sport fishing: Alabama, Louisiana, Maryland, Minnesota, New York, North Carolina, Ohio, Pennsylvania, Texas, Virginia, West Virginia and Wisconsin.

Reported catch of *P. spathula* in commercial fishing states (kilogrammes)

	1989	1990	1992	1996	1997
Arkansas	?	?	158,500	?	?
Illinois	73,473	?	21,150	?	22,289
Kentucky	?	?	3,910	?	?
Missouri	25,850	?	2,500	4,411	?
Tennessee	?	220,610	60,330	29,411	?
Total	?	?	242,000	?	?

Source: Graham, 1997

The 1992 official reported catches suggest that the largest volumes were caught in Arkansas (65%) and Tennessee (25%) (Graham, 1997).

The average combined annual catch of *P. spathula* for the late-1990s in Illinois, Kentucky, Missouri and Tennessee was estimated at 111.8 t. Compared to data collected by Graham (1997), a sharp drop was recorded in Tennessee (24.9 t in 1999) while other states reported increased catches, such as 62.1 t in Kentucky in 1999 and 2.5 t in Missouri in 1998.

States allowing commercial fishing

Arkansas: Commercial harvest of *P. spathula* in 1992 was estimated at 136-181 t (Graham, 1997). From 1990 to 1999, the Arkansas Game and Fish Commission collected USD150,000-300,000 annually in revenues for the sale of commercial and paddlefish sport fishing licenses, permits and tags. There is no compulsory reporting system for reporting commercial catch data to the authorities in Arkansas. Based on voluntary reporting of commercial fisheries, 69 kg of paddlefish roe (caviar) were harvested in 1998 (total catch of paddlefish estimated at 410 kg), while 230 kg average annual harvest of caviar (worth USD16,256) was reported for 1987 and 1988.

Illinois: The reported commercial catch of *P. spathula* was 73,473 kg in 1989 and 22,289 kg in 1997 (with 33 kg of roe –caviar) (Todd, 1998).

Kentucky: *P. spathula* are caught for commercial purposes in Kentucky.

Catch statistics for *P. spathula* (kilogrammes)

	1999 Jan.-June 2000	
Meat	59,766	84,254
Caviar	2,375	5,645
Total	62,141	89,899

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

Mississippi: No catch data were reported. Historically, Mississippi has not collected data on *P. spathula* catch. There is no compulsory reporting system to collect either commercial or sport fishing data. No scientific publication has reported past or present paddlefish catches in this State, but Graham (1997) notes that high commercial harvest may have occurred in the mid-1980s. Law enforcement intelligence suggests that *P. spathula* are being illegally caught by commercial fishermen for their roe (caviar). Poaching is an ongoing problem, consisting not of isolated infrequent occurrences, but rather being

organised and secretive operations (D. Ruche, Mississippi Department of Wildlife, Fisheries and Parks, *in litt.* to the USFWS, 16 August 2000).

Missouri: The 1989 estimated catch of *P. spathula* was 25,850 kg.

Annual catch of *P. spathula* in the Mississippi River (section in the State of Missouri) (kilogrammes)

1992	1993	1994	1995	1996	1997	1998
2,344	3,758	2,033	2,911	4,411	1,054	2,504

Source: Todd, 1998

Tennessee: Commercial harvest of *P. spathula* is allowed. The sport fishery harvest is not significant in volume. In 1975, the commercial paddlefish catch reached 197,768 kg.

Commercial catch of *P. spathula* (kilogrammes)

	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999
Catch	220,651	47,627	60,444	53,885	59,218	57,100	29,417	40,503	24,234	24,899
Roe (caviar)			84.8	724.4	565.6	683.1	63.5	283.9	855.5	1,404.3

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

Paddlefish roe is an important source of income for commercial fishermen. The flesh (meat) is of less importance and is sold both within and outside Tennessee. Poaching has been reported to the authorities, but the state authorities claimed that it is difficult to evaluate during the fishing seasons because enforcement officers are too busy administering the permits and tags.

States allowing sport fishing only

Indiana: The state's estimated annual harvest was 10,000 kg for 1996 (Hesse and Carreiro, 1997, cited in Todd, 1998).

Iowa: Only sport harvest (snagging) of paddlefish and sturgeon is allowed. Two fish are permitted daily, with a possession limit of four. Sport fishing (snagging) has been prohibited in the Big Sioux and Missouri rivers since 1993. Data on sport fishing were not provided by the state authorities. Some illegal harvest of paddlefish is suspected by the authorities, but has not been confirmed.

Kansas: *P. spathula* sport snagging fisheries are limited to specific locations. They are significant local events attracting anglers from other neighbouring towns that contribute to the economy of relatively small Kansas towns. There are no official reports of poaching, but it is suspected that illegal activities occur.

Number of *P. spathula* harvested by anglers at sport fishery locations (number of fish caught)

	1992	1993	1994	1995	1996	1997	1998	1999	2000
Marais des Cygnes	4	87	19	12	11	75	58	457	5
Neosho River	71	541	325	769	479	394	800	2,010	98
Total	75	628	344	781	490	469	858	2,467	103

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

Montana: In the late 1980s-early 1990s, an estimated 1,360-4,536 kg of *P. spathula* roe has been collected each spring during the sport snagging (Graham, 1997). From 1990 to 1994, a total of 2,270 kg of *P. spathula* roe was collected annually from a total of 7,000 fish caught at the Intake Diversion Dam east of Glendive (Wilkinson, 1997). Several fishing grounds are on the Montana-North Dakota border. The annual average number of *P. spathula* harvested in Montana from 1995 to 1999 was 1,207 (ranging from 717 in 1998 to 1,706 in 1999). With an average body weight of 19 kg (Scarnecchia *et al.*, 1996), the annual catch would represent 23 t.

Nebraska: There is no commercial fishery of *P. spathula*. Sport fisheries of the species are regulated. Annual catch quotas of 275 fish for bow and arrow and 1,400 fish for snag fishing are allocated. Quotas are enforced by distributing no more than two tags per fisher. Poaching occurs on the Missouri River. Investigations following on from a 'sting operation' are on-going.

(see South Dakota for combined harvest estimates for *P. spathula* snagging fishery only).

North Dakota: During 1993 and 1994, 2,268 kg and 1,726 kg of *P. spathula* roe were respectively collected (Graham, 1997). The annual average number of *P. spathula* harvested in North Dakota from 1995 to 1999 was 1,356 (ranging from 800 in 1997 to 1,970 in 1998). With an average body weight of 19 kg (Scarnecchia *et al.*, 1996), the annual catch would represent 25.8 t. The average annual volume of caviar produced from 1993-2000 by a company collecting the sport fishery catch was 2,705 kg/year, ranging from 4,127 kg in 1998 to 1,537 kg in 1997.

Oklahoma: No catch data were reported by the state authorities.

South Dakota: Only harvest of *P. spathula* by sport anglers during a limited season and on a limited ground (common boundary with Nebraska) is allowed.

Number of *P. spathula* caught by sport fishers along the common South Dakota and Nebraska boundary during the snagging season (number of fish)

	1992	1993	1994	1995*	1996*	1997	1998	1999
No of fish	1,000	1,529	1,568	2,200	1,828	948	1,125	1,334

* quota exceeded due to delay in closing the season caused by the administrative procedure required.

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

The harvest was managed with an annual 1,600 fish quota system from 1992-1996, and by a tag/permit system from 1997-1999. There are no data for 2000 because the snagging season starts on 1 October. An estimated additional 100-150 paddlefish are harvested annually during the July archery season.

States prohibiting commercial and sport fisheries

Alabama: The species is protected by law but no poaching activity is known or suspected.

Louisiana: There has been no legal commercial harvest of *P. spathula* in Louisiana since 1986. There have been complaints to the state authorities about illegal catch and possession. Recently, a request for a permit to transport and export 5,000 lbs (2,268 kg) of paddlefish roe per month was submitted to the state authorities.

Ohio: No catch data were reported by the state authorities. No poaching has been recorded by the authorities.

Texas: No information provided.

Virginia: Only historic anecdotal reports of fishing.

West Virginia: No information provided.

Wisconsin: *P. spathula* harvest has been prohibited since 1992. No poaching has been recorded, except for a recent case of more than 60 paddlefish incidentally caught in a large seine net and intentionally killed by the commercial fisher.

Introduced populations:

China: Significant imports (see "International Trade" and "Captive Breeding") of live *P. spathula* were introduced in captive breeding facilities in China. There is no documentation on the potential damage of the introduction of exotic Acipenseriformes on local species. If specimens of *P. spathula* escape in to the Yangtze River, this may threaten the Chinese paddlefish *Psephurus gladius*, which is on the brink of extinction. Experts have agreed that the potential threats that must be taken into consideration are: the introduction of new pathological germs in wild populations, food competition in case of acclimatisation of

the exotic specimens and hybridisation with the local species (Cemagref, *in litt.*, press release, 26 January 2000).

INTERNATIONAL TRADE

P. spathula is one of four Acipenseriformes species listed in the CITES Appendices before 1997. The listing was proposed by the USA at the 8th meeting of the Conference of the Parties in 1992.

Gross exports and comparative tabulation of trade in *P. spathula* from 1992 to 1998 are given in the Appendix. Annual Reports from 1992 to 1998 suggest that most specimens of *P. spathula* traded internationally are fertilised eggs and live fish. Trade volumes increased progressively from 1993 (30,000 fertilised eggs and 9,644 live fish) to 1997 (187,000 and 238,700 respectively), before decreasing in 1998 to 70,000 fertilised eggs (as confirmed by China, the only importer in 1998 (CITES Management Authority of China, *in litt.* to TRAFFIC Europe, 28 August 2000)) and 23,440 live fish. China is the main destination for both fertilised eggs (54%, 60,600 eggs/year in average from 1994-1998) and live specimens (31%, 42,000 fingerlings/year in average from 1994-1997). Other major importers (in decreasing order of importance) are: Romania, Hungary, France, Germany, Taiwan (Province of China) and Japan. These specimens are supplying the demand of captive breeding facilities, in Moldova for instance (see "Captive Breeding").

A market for meat seems to exist since small volumes of meat were exported from the USA to Canada in 1995 and 1996 (46 kg and 381 kg respectively).

Only one export quota was established since 1998. It was set by the Russian Federation at 5 kg of fertilised eggs for 2000. Three live specimens (possibly adults) were imported into the Russian Federation from the USA in 1998.

CONSERVATION MEASURES

Both commercial and sport fishing are prohibited in Alabama, Louisiana, Maryland, Minnesota, New York, North Carolina, Ohio, Pennsylvania, Texas, Virginia, West Virginia and Wisconsin (Graham, 1997). Unless otherwise stated, information for this section was provided by the USFWS (CITES Management Authority of USA, *in litt.* to TRAFFIC Europe, September 2000).

States allowing commercial fishing

Arkansas: For commercial fisheries, seasonal restrictions apply in some areas. A 76 cm eye-to-fork-of-tail minimum length limit from fall until spring is set as additional protection for females (Graham, 1997). For sport fishing, a daily catch limit of two paddlefish is set.

Illinois: No information provided.

Kentucky: The catch is regulated under the commercial fishing and snagging legislation which controls the type of gear, the fishing requirements (e.g. number and size of fish) and the waters open to fishing.

Mississippi: Sport and commercial fisheries are permitted. However, during the period 1 November to 30 April, it is illegal to fish for, take or possess paddlefish or its parts, including roe (caviar). A list of areas closed to the use of commercial fishing gear exists.

Missouri: *P. spathula* is classified as game, so sport and commercial fisheries are permitted.

Tennessee: Strict regulations exist for both commercial and sport harvest of *P. spathula*. Only one area permits sport fishing, with a limit of one fish per day. Paddlefish and its parts caught by sport fishing methods may not be sold.

States allowing sport fishing only

Indiana: Sport fishery is limited to hook-and-line (Graham, 1997).

Iowa: The commercial fishery was closed in 1986 (Graham, 1997). There is no size limit for sport fisheries. Together with neighbouring states, Iowa closed *P. spathula* sport fisheries on the Missouri and Big Sioux rivers in 1992.

Kansas: State regulation for sport fishing of *P. spathula* is strict. It includes, for instance, reporting of the catch at a check station where a numbered tag is attached to each fish caught. Restocking efforts have been undertaken in all rivers. The fry are reared in a state-run hatchery, using seedlings (eggs or fry) from Missouri or Oklahoma. The policy is to restock the reservoirs of rivers with fish that were obtained from the nearest existing stock. All stock must be tagged with coded wire tags.

Number of P. spathula released through restocking by the Kansas Department of Wildlife and Parks in Kansas and Oklahoma (number of fry)

	1992	1993	1994	1995	1996	1997	1998	1999	2000
Number of fry	22,267	11,685	16,918	6,196	0	0	0	0	7,100

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

Montana: Sport fishing only is allowed. The main fishing area is common to Montana and North Dakota. Regulations of both states are therefore linked. A tag limitation programme has been installed and the catch is allowed only from 1 May to 15 June in a limited area of the Missouri River. The average number of tags distributed from 1995 to 1999 is 6,467/year.

Nebraska: The state shares its *P. spathula* fishery with South Dakota along the Missouri River common boundary. Quotas of 275 and 1,400 fish (individuals) have been adopted for bow and arrow and snag fishing respectively. As in South Dakota, a slot length limit of 88-114 cm and fishing seasons were established for the two types of sport fisheries (see South Dakota).

North Dakota: Only sport fishing is permitted. The main fishing area is common to Montana and North Dakota. Regulations of both states are therefore linked. A tag limitation programme has been installed and catch is allowed only from 1 May to 15 June in a limited area of the Missouri River. The average number of tags distributed from 1992 to 2000 is 5,703/year. A research programme on *P. spathula* began in 1990. This includes research on reproduction, age structure and catch rates by the use of 10,000 micro-tags. Eight years of data suggest that the catch rate is closely correlated to the population constraints. The caviar of fish caught by sport fishermen is collected by an organisation, North Star Caviar, Joint Venture, and sold on the local and international market. The provisions of the sale of paddlefish products in North Dakota have been defined through a memorandum of understanding. This was signed in June 2000, between North Star Caviar, Joint Venture and the North Dakota Game and Fish Department. The benefit of the trade in caviar must be invested in "resource-related" projects.

Oklahoma: The sport fishery of *P. spathula* is strictly regulated, including fishing seasons, daily catch limits, restricted fishing gears and the obligation to tag every fish caught. Some *P. spathula* are being released in Oklahoma rivers by the state of Kansas (see above). The Oklahoma restocking programme is monitored.

Number of P. spathula fry released through the Oklahoma restocking programme (number of fry)

Reservoir	1992	1993	1994	1995	1996	1997	1998	1999	2000
Kaw	18,890	25,185	16,750	2,013	?	?	?	?	?
Oologah	?	?	?	5,974	112	10,719	2,037	8,837	3,450
Texhoma	?	?	?	?	?	?	?	5,757	20,846
Total	18,890	25,185	16,750	7,987	112	10,719	2,037	14,594	24,296

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

South Dakota: *P. spathula* catch is managed jointly with Nebraska, due to the common boundary on the Missouri River. The fishing seasons are limited to 16 days in the middle of July for archery fishermen, and to 30 days in October for the snagging fishery. A catch quota also applies to the latter. From 1992 to 1996, the catch quota was reached in six days or less. As of 1997, the management of the paddlefish snagging fishery was switched to a tag/permit system and a total of 2,250 tag/permits were issued annually from 1997 to 1999 by South Dakota and Nebraska. Several other restrictions have been adopted for the snag fishery. *P. spathula* measuring 35-45 inches (88-114 cm) must be released, and snagging is allowed only from 7:00 to 19:00 daily. Archery anglers can fish from sunrise to sunset. Graham (1997) noted that all anglers are prohibited from selling or trading any paddlefish or sturgeon flesh (meat) and/or body parts. Since 1990, the state has been restocking juveniles.

States prohibiting commercial and sport fisheries

Alabama: *P. spathula* is protected by State Regulation 220-2-94: "It is illegal to take or attempt to take paddlefish from all public waters of Alabama by any method or to process paddlefish or any part of a paddlefish. Any paddlefish accidentally captured shall be immediately returned to the waters from where it came. This regulation does not apply to commercially packaged paddlefish products imported from out-of-state, or to paddlefish cultured at hatchery operations or grow out ponds permitted through the Commissioner, Department of Conservation and Natural Resources".

Louisiana: *P. spathula* has been protected since 1986. No sport or commercial fisheries are allowed. It is illegal to possess paddlefish, sturgeon and their body parts, including roe (caviar). Violations carry a maximum fine of USD2,500/fish. There is a management plan for each species of paddlefish and sturgeon occurring in the state, including population monitoring, habitat restoration and stock enhancement. Captive breeding and restocking efforts of *P. spathula* have been carried out in Louisiana for 10 years.

Minnesota: *P. spathula* fishing has been closed statewide, but there is no regulation, nor restocking programme.

New York: Since the population is too low to be of interest either to commercial or sport fisheries, *P. spathula* has no official status or special protection. Fingerling restocking was initiated in 1998, and if there is significant survival of these, prohibition of harvest will be adopted by the fall of 2002.

Ohio: *P. spathula* was listed as an Ohio Endangered Species from 1974 until 1987 when it was re-listed as Threatened. However, this does not afford any legal or regulatory status. Ohio does not have a commercial or sport catch/quota for the species. *P. spathula* cannot, however be taken within 1,000 feet downstream of four large dams in the state. Ohio is currently participating in research and outreach programs for *P. spathula*.

Pennsylvania: Commercial and sport fisheries are prohibited. The state is engaged in a long-term restoration effort for paddlefish in the major rivers of western Pennsylvania. Individuals released through the programme should have reached sexual maturity.

Texas: The state is actively restocking and there are indications that the populations is increasing (Graham, 1997).

Virginia: Classified as Threatened (Graham, 1997).

West Virginia: The state began stocking juveniles in the Ohio and Kanawha rivers in 1992 (Graham, 1997).

Wisconsin: *P. spathula* has been assigned the status of Threatened in 1989; possession is illegal.

CAPTIVE BREEDING

An aggressive restocking programme for *P. spathula* has been undertaken in many states in the USA (Graham, 1997). The success of experimental releases of *P. spathula* has been investigated (Beamesderfer and Farr, 1997).

According to FAO Fishstat, the world annual production of farmed sturgeon and paddlefish (mostly for the meat market) has increased rapidly, from 160 t in 1987 to 2,576 t in 1998. Species specific data are not available in the FAO database, but according to available information, there seems to be no current significant production of caviar and/or meat of *P. spathula* in commercial farms (USFWS, CITES Management Authority of USA, *in litt.* to TRAFFIC Europe, September 2000).

China: In 1988, the Fishery Institute of Xiantao City in central China's Hubei Province started to introduce a small quantity of fertilised eggs of *P. spathula* from the USA to conduct experimental grow-out in ponds. The institute did not succeed with hatching and rearing until 1991. Since 1991, China imported an annual average of 100,000 fertilised eggs from the USA. However, no individual has been raised to adult age until now (Dr Meng Xianlin, CITES Management Authority of China, *in litt.* to TRAFFIC Europe, 28 August 2000).

Moldova: *P. spathula* was introduced in the country to study multi-species captive breeding, with Stellate Sturgeon *Acipenser stellatus* in grow-out ponds (A. Vedrashco, pers. comm. to TRAFFIC Europe, 14 March 2000).

USA: Restocking programmes have started in Louisiana, Kansas, New York, Oklahoma, Pennsylvania, South Dakota, Texas and West Virginia. There are no records of commercial captive breeding or aquaculture activities within Arizona, Delaware, Florida, Louisiana, Minnesota, New York, Ohio, Oklahoma, South Dakota, Tennessee, Utah, Wisconsin and Wyoming. Farms and hatcheries have been developed under state or commercial initiatives to produce fingerlings for restocking (Missouri), conduct short term grow-out for research (Wisconsin), refine captive propagation techniques (Georgia) and develop intensive grow-out culture (Texas) (Andreasen, 1999).

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Gross exports* of *Polyodon spathula* 1992-1998

TAXON	TERM	UN	Exp	199	1993	1994	1995	1996	1997	1998
		IT		2						
<i>Polyodon spathula</i>	bodies		US	0	0	0	0	0	3,500	0
<i>Polyodon spathula</i>	eggs		US	0	60,000	150,305	88,000	160,000	187,000	180,000
<i>Polyodon spathula</i>	eggs	kg	US	0	0	0	0	0	0	7
<i>Polyodon spathula</i>	live		GB	0	0	90	600	500	400	0
<i>Polyodon spathula</i>	live		HU	0	0	0	31,300	1,000	3,000	0
<i>Polyodon spathula</i>	live		US	30	9,644	212,240	57,104	90,004	265,300	53,440
<i>Polyodon spathula</i>	meat	kg	US	0	0	0	46	381	0	0
<i>Polyodon spathula</i>	specimens		US	0	0	0	0	0	0	9

* **Definition:** "Gross exports are the sum of all reported exports and re-exports in a particular commodity or species in a particular year or series of years;... Gross trade is thus a simple measure of the total number of items recorded in international trade. However, gross trade may be an overestimate of the total number of actual specimens in trade as re-exports are not deducted from the total." (Anon., 1996).

This is particularly applicable to caviar of which shipments are often exported, re-packaged and re-exported. For instance, in the mid-1990s, Germany re-exported as much as 45% of its annual caviar imports (De Meulenaer and Raymakers, 1996).

Comparative Tabulation of trade in *Polyodon spathula* 1992-1998

Year	Imp	Exp	Origin	Imports reported				Exports reported					
				Quantity	Unit	Term	P	S	Quantity	Unit	Term	P	S
Eggs													
1993	DE	US		60,000	eggs	S	C	30,000	Eggs	T	C		
1994	AT	US		10,000	eggs	T	C						
1994	CN	US						63,000	Eggs	T	C		
1994	FR	US						2,000	Eggs	T	C		
1994	GB	US		305	live	T	W	305	Eggs	T	C	"live": fertilised	
1994	HU	US						15,000	Eggs	T	C	eggs? or	
				Total	10,305			80,305				roe in kg or gr?	
				1994:									
1995	CN	US						40,000	Eggs	T	U		
1995	CN	US						10,000	Eggs	T	C		
1995	FR	US		10,000	eggs	T	W	10,000	Eggs	T	C		
1995	HU	US						25,000	Eggs	T	C		
				Total	10,000			85,000					
				1995:									
1996	CZ	US		20,000	eggs	T	F	20,000	Eggs	T	W		
1996	HU	US						100,000	Eggs	T	W		
1996	IL	US						20,000	Eggs	T	W		
				Total	20,000			140,000					
				1996:									
1997	CN	US						120,000	Eggs	T	O		
1997	GR	US						10,000	Eggs	T			
1997	HU	US						7,000	Eggs	T			
1997	IL	US						50,000	Eggs	T			

			Total				187,00		
			1997:				0		
1998	CN	US					150,00	Eggs	T
							0		
1998	CN	US	70,000	eggs	B	C	30,000	Eggs	T
			Total				180,00		
			1998:				0		
1998	CZ	US	RU	3 kg	eggs	T	F		
1998	SG	US		4 kg	eggs	T	W		
			Total				7 kg		
			1998:						

Comparative Tabulation of trade in *Polyodon spathula* 1992-1998 (continued)

Year	Imp	Exp	Origin	Imports reported				P	S	Exports reported				P	S
				Quantity	Unit	Term				Quantity	Unit	Term			
Live															
1992	JP	US								30		Live	T	C	
1993	DE	US								1,500		Live		C	
1993	HK	US								644		Live	T	C	
1993	JP	US								3,000		Live	T	C	
1993	TW	US								4,500		Live	T	C	
Total 1993:												9,644			
1994	JP	GB	US	90	live	T	C			90		Live	T	C	
1994	CN	US								20,000		Live	T	C	
1994	DE	US		60,000	eggs	T	C			60,000		Live		C	"eggs" or "live"? i.e. fertilised eggs?
1994	FR	US		80,000	live		C			20,000		Live	T	C	
1994	HU	US								40,000		Live	T	C	
1994	IT	US		5	live	S	C			5,000		Live		U	
1994	JP	US		1,060	live	T	C			3,060		Live	T	C	
1994	TW	US								3,875		Live	T	C	
Total 1994:				141,155								152,025			
1995	JP	GB	US	600	live	T	C			600		Live	T	C	
1995	AT	HU								800		Live		C	
1995	BE	HU	US							2,000		Live		C	
1995	DE	HU								5,000		Live	T	C	
1995	FR	HU	US							1,500		Live		C	
1995	GB	HU	US	1,000	live	T	C			1,000		Live		C	
1995	GR	HU	US							21,000		Live		C	
1995	DE	US		25,000	live	T	C								
1995	DE	US		2,500	live	T				2,500		Live	T	U	
1995	FR	US								10,000		Live	T	C	
1995	GB	US		600	live	T	C			600		Live	T	C	
1995	GB	US		4	live	B	C			4		Live		W	
1995	JP	US		3,000	eggs	T	F			4,000		Live	T	C	"eggs" or "live"? i.e. fertilised eggs?
1995	MX	US								5,000		Live	T	U	
1995	RO	US								10,000		Live	T	U	
Total 1995:				32,704								64,004			
1996	JP	GB	US							500		Live	T	C	
1996	AT	HU	US							600		Live		F	
1996	BE	HU	US							400		Live		F	
1996	CN	US								35,000		Live	T	C	
1996	DE	US		20,000	eggs	T	C			20,000		Live	T	C	"eggs" or "live"? i.e. fertilised eggs?
1996	DE	US		4	live	Z	C			4		Live		W	
1996	FR	US		10,000	live		W			960		Live	T	C	
1996	GB	US		1,500	live	T	C			1,000		Live	T	W	
1996	JP	US		2,000	live	T	F			1,500		Live	T	C	
1996	JP	US								1,500		Live	T	W	
1996	RO	US								10,000		Live	T	C	
1996	TW	US								8,500		Live	T	C	
1996	TW	US								1,000		Live		C	
1996	TW	US								1,000		Live	T	W	
Total 1996:				33,504								81,964			

Comparative Tabulation of trade in *Polyodon spathula* 1992-1998 (continued)

Year	Imp	Exp	Origin	Imports reported				P	S	Exports reported			
				Quantity	Unit	Term				Quantity	Unit	Term	P
Live (continued)													
1997	MY	GB	US							400	Live	T	C
1997	PL	HU	US							3,000	Live	T	F
1997	AT	US		15,000	live		T	F					
1997	CN	US								113,000	Live	T	C
										0			
1997	FR	US		30,000	live			F		15,000	Live	T	C
1997	GB	US		400	live		T	C		400	Live	T	O
1997	JP	US		3,500	bodies		T	F		3,500	Live	T	O
1997	RO	US								100,000	Live	T	C
										0			
1997	TW	US								2,400	Live	T	C
1997	TW	US								1,000	Live	T	O
			Total	48,900						238,700			
			1997:							0			
1998	FR	US		45,000	live		T	F		15,000	Live	T	W
1998	JP	US								2,100	Live	T	O
1998	JP	US								340	Live	T	C
1998	RO	US								6,000	Live	T	W
			Total	45,000						23,440			
			1998:										
Specimens													
1998	DE	US			6 specimens		S	O		6	Specimens		O
1998	RU	US								3	Specimens		O
Meat													
1995	CA	US								46 kg	Meat	T	W
1996	CA	US								381 kg	Meat	T	W