

**COSEWIC**  
**Assessment and Update Status Report**

on the

**Paddlefish**  
*Polyodon spathula*

in Canada



**EXTIRPATED**  
**2008**

**COSEWIC**  
Committee on the Status  
of Endangered Wildlife  
in Canada



**COSEPAC**  
Comité sur la situation  
des espèces en péril  
au Canada

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## COSEWIC Assessment Summary

### Assessment Summary – April 2008

**Common name**

Paddlefish

**Scientific name**

*Polyodon spathula*

**Status**

Extirpated

**Reason for designation**

This fish, once found in the Great Lakes, was apparently never common in the Canadian portion of its range. It has not been observed in Canadian waters since 1917 despite extensive sampling and the fact that such a distinctive fish would have been easily recognizable

**Occurrence**

Ontario

**Status history**

Disappeared from Canada in approximately 1917. Designated Extirpated in April 1987. Status re-examined and confirmed in May 2000 and April 2008. Last assessment based on an update status report.



## COSEWIC Executive Summary

### **Paddlefish** *Polyodon spathula*

#### **Species information**

The paddlefish (*Polyodon spathula*) is an ancient species and, like its close relatives the sturgeons, it has been fished for its eggs, which are processed into caviar. It is a thick, robust fish with a long, spatula-like snout and a large, toothless mouth. The skin is smooth and scaleless.

#### **Distribution**

The present range of the Paddlefish is the Mississippi River system from Montana to Louisiana, and some smaller rivers draining into the Gulf of Mexico. In Canada, paddlefish were last reported about 90 years ago when they were occasionally encountered in lakes Huron, Superior, and Erie.

#### **Habitat**

There is little or no information on paddlefish habitat preferences in Canada. Paddlefish specimens collected from Canada at the turn of the 20<sup>th</sup> century were taken from inshore areas, or from moderately large tributary rivers of the Great Lakes.

#### **Biology**

There is no information on the general biology of the populations of paddlefish that inhabited the Great Lakes; the information available is from the populations of the Mississippi River system. Paddlefish can live for up to 50 years, or more, and reach lengths of up to 2 m, and weights in excess of 80 kg. Males reach sexual maturity at about 7-10 years of age, while females reach sexual maturity between the ages of 14 - 17. Females spawn every 2 to 7 years. Paddlefish migrate over long distances, preferring reservoirs or lakes during the winter and large rivers during the spawning season.

## **Population sizes and trends**

The paddlefish was known from Canada from specimens collected in Lake Huron, near Sarnia; in the Spanish River, tributary to Georgian Bay; and in Lake Helen on the Nipigon River. The species was also known from Lake Erie based on collections in the American waters of the lake. Since the turn of the 20<sup>th</sup> century, the peripheral range of the paddlefish began to shrink and the relict population of the Great Lakes has been lost. None have been collected in Canadian waters for over 90 years.

## **Limiting factors and threats**

There are five main limiting factors that affect paddlefish populations: the degradation or destruction of areas used for spawning; the construction of dams which block the movements of this species; a reduction of the amount of water in streams; industrial pollution; and, because this fish matures so slowly, over-harvesting, which can quickly deplete a population.

## **Special significance of the species**

In areas where paddlefish are extant this species is recognized as a sport and commercial species (primarily for caviar). Significant public and scientific interest has been generated in the species since it represents one of the most primitive groups of fishes in North America, and is of interest to the scientific community for genetic and evolutionary studies.

## **Existing protection or other status designations**

The paddlefish was assessed by COSEWIC in April 1987 as Extirpated, and this status was reconfirmed in May 2000. It is currently listed as an Extirpated species under Schedule 1 of the federal *Species at Risk Act* (SARA) [EC 2007]. Besides offering legal protection to the species and its habitat, the Act requires implementation of recovery initiatives.



## COSEWIC HISTORY

The Committee on the Status of Endangered Wildlife in Canada (COSEWIC) was created in 1977 as a result of a recommendation at the Federal-Provincial Wildlife Conference held in 1976. It arose from the need for a single, official, scientifically sound, national listing of wildlife species at risk. In 1978, COSEWIC designated its first species and produced its first list of Canadian species at risk. Species designated at meetings of the full committee are added to the list. On June 5, 2003, the *Species at Risk Act* (SARA) was proclaimed. SARA establishes COSEWIC as an advisory body ensuring that species will continue to be assessed under a rigorous and independent scientific process.

## COSEWIC MANDATE

The Committee on the Status of Endangered Wildlife in Canada (COSEWIC) assesses the national status of wild species, subspecies, varieties, or other designatable units that are considered to be at risk in Canada. Designations are made on native species for the following taxonomic groups: mammals, birds, reptiles, amphibians, fishes, arthropods, molluscs, vascular plants, mosses, and lichens.

## COSEWIC MEMBERSHIP

COSEWIC comprises members from each provincial and territorial government wildlife agency, four federal entities (Canadian Wildlife Service, Parks Canada Agency, Department of Fisheries and Oceans, and the Federal Biodiversity Information Partnership, chaired by the Canadian Museum of Nature), three non-government science members and the co-chairs of the species specialist subcommittees and the Aboriginal Traditional Knowledge subcommittee. The Committee meets to consider status reports on candidate species.

## DEFINITIONS (2008)

Wildlife Species	A species, subspecies, variety, or geographically or genetically distinct population of animal, plant or other organism, other than a bacterium or virus, that is wild by nature and is either native to Canada or has extended its range into Canada without human intervention and has been present in Canada for at least 50 years.
Extinct (X)	A wildlife species that no longer exists.
Extirpated (XT)	A wildlife species no longer existing in the wild in Canada, but occurring elsewhere.
Endangered (E)	A wildlife species facing imminent extirpation or extinction.
Threatened (T)	A wildlife species likely to become endangered if limiting factors are not reversed.
Special Concern (SC)*	A wildlife species that may become a threatened or an endangered species because of a combination of biological characteristics and identified threats.
Not at Risk (NAR)**	A wildlife species that has been evaluated and found to be not at risk of extinction given the current circumstances.
Data Deficient (DD)***	A category that applies when the available information is insufficient (a) to resolve a species' eligibility for assessment or (b) to permit an assessment of the species' risk of extinction.

\* Formerly described as "Vulnerable" from 1990 to 1999, or "Rare" prior to 1990.

\*\* Formerly described as "Not In Any Category", or "No Designation Required."

\*\*\* Formerly described as "Indeterminate" from 1994 to 1999 or "ISIBD" (insufficient scientific information on which to base a designation) prior to 1994. Definition of the (DD) category revised in 2006.



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The Canadian Wildlife Service, Environment Canada, provides full administrative and financial support to the COSEWIC Secretariat.

**Update  
COSEWIC Status Report**

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## SPECIES INFORMATION

### Name and classification

Kingdom	Animalia
Phylum	Chordata
Class	Actinopterygii
Order	Acipenseriformes
Family:	Polyodontidae
Species:	<i>Polyodon spathula</i> (Walbaum, 1792)
Common Name	
English:	paddlefish (Nelson <i>et al.</i> 2004)
French:	<i>spatulaire</i> (Coad 1995)
Other:	spoonbill, spoonie, spoonbill cat, duckbill cat

The order Acipenseriformes contains two extant families, and one fossil family of primitive fishes. The extinct family Chondrosteidae is known only from fossil evidence from the Lower Jurassic to the Lower Cretaceous periods (Scott and Crossman 1973). The sturgeon family (Acipenseridae) consists of 23 species in four genera of freshwater and anadromous fishes of the northern hemisphere (Scott and Crossman 1998). Five of the 16 species in the genus *Acipenser* (which dates back to the Upper Cretaceous Period) are known from Canadian waters: white sturgeon (*A. transmontanus*), Atlantic sturgeon (*A. oxyrinchus*), green sturgeon (*A. medirostris*), lake sturgeon (*A. fulvescens*), and shortnose sturgeon (*A. brevirostrum*). The paddlefish family (Polyodontidae) consists of two extant monotypic genera. The paddlefish, *Polyodon spathula* is native to North America, and the Chinese paddlefish, *Psephurus gladius*, to China (Dillard *et al.* 1986). Paddlefishes are one of the oldest known fishes, having first appeared some 300 to 400 million years ago. At least one fossil genus (*Crossophilis*) is known from the Eocene Green River Shale deposit of Wyoming.

### Morphological description

Paddlefish are primitive Chondrostean (fishes having a persistent notochord and largely cartilaginous skeleton), ray-finned fishes distinguished by their large mouth and elongated, flattened, paddle-shaped snout or rostrum (hence the common name), which may comprise up to half the length of the body. They have skeletons composed mainly of cartilage, skins with a few reduced rhomboid scales on the up-turned (heterocercal) tail fin, with the upper lobe larger than the lower (Figure 1). There is also a long, pointed opercular flap that reaches nearly to the pelvic fin. Males can be distinguished from females by the raised urogenital papilla (Trautman 1981; Becker 1983; Scarnecchia and Schmitz 2003).



Figure 1. Paddlefish, *Polyodon spathula*. Adapted from EC (2007).

The paddlefish is a uniform dark blue-grey to black on the back and side, with a lighter underside. The average size range is 0.5 to 1.2 m in length and the average weight ranges from 0.9 to 9 kg. Larger fish may measure up to 2 m in total length and weigh more than 80 kg (Becker 1983, Trautman 1981; Dillard *et al.* 1986; Parker 1988).

### **Genetic description**

The genetic population structure of the paddlefish in Canada is unknown. Three genetic strains are currently recognized in the United States (U.S.): the upper Missouri river basin in Montana and North Dakota, the Missouri and Mississippi River basins in the south central and central U.S., and the Alabama River system (NatureServe 2007). However, there is a low level of genetic variability among populations, and the potential for polytypy is probably low as populations in the different river systems have only been relatively recently isolated (Carlson *et al.* 1982; Starnes 1995).

### **Designatable units**

All Canadian specimens occurred within the Great Lakes-Upper St. Lawrence Biogeographic Zone of the Freshwater Biogeographic Zone classification adopted by COSEWIC. There is no evidence to support the identification of designatable units below the species level.

### **Eligibility**

The paddlefish is recognized as a species native to North America (Nelson *et al.* 2004) and Canada. It appears that they were once more widely distributed (Hubbs and Lager 1958; Eddy and Underhill 1974; Burr 1980; Trautman 1981; Cooper 1983; Hubbs

*et al.* 2004), but never common in the Great Lakes. Canada was never a significant part of the distribution, and the species has disappeared from the Great lakes Basin, as well as other highly peripheral areas such as Maryland, Michigan, New York, North Carolina and Pennsylvania (Graham 1997), which probably never represented a significant part of the range (Cooper 1983).

Very few specimens were ever collected in Canada, and the last was in 1917. Therefore it is difficult to determine if these were part of a once larger population (Reid *et al.* 2007). Aboriginal Traditional Knowledge might prove useful in answering the question, since this unique fish would not have gone unnoticed. However, at the time of writing such information had not been made available.

The onus is not to prove that it was native to Canadian waters, but that it was not. At this point in time, since there is no firm evidence to the contrary, one cannot, without negating the precautionary principle, definitively state that it was not native to Canadian waters.

The issue was best summarized by Becker (1983) who considered the species to be native to the fauna of the Great lakes, but encountered on their way to natural extirpation.

## **DISTRIBUTION**

### **Global range**

The paddlefish lives in the slow-flowing waters of the Mississippi Valley and adjacent Gulf of Mexico drainages, as well as the Missouri, and Ohio River systems (Figure 2) [Burr 1980; Parker 1987, 1988], and was historically found in the Great Lakes (Halkett 1913; Trautman 1957). Paddlefish was never common in the Great Lakes; it was known with certainty only from Lake Erie, where there were at least two well-authenticated records, both before 1910 (Van Meter and Trautman 1970).

### **Canadian range**

The occurrence of this species in Canadian waters (Figure 2) is based on reports of specimens collected in Lake Huron, near Sarnia (2 specimens), in the Spanish River, a tributary of Georgian Bay (1 specimen), and in Lake Helen on the Nipigon River (Halkett 1913). There is also mention of records from the Lake Superior drainage basin (1 specimen) from the late 1800s and early 1900s (Halkett 1913). The last Canadian record is from 1917 (Parker 1988; Reid *et al.* 2007). Records from Lake Erie (Trautman 1957) are derived from the waters of the American side of the lake. Authentication of these records is problematic and some have questioned their validity (Parker 1988).



Figure 2. Global distribution of the paddlefish. Modified from Parker (1988).. • former Canadian distribution  
— current U.S. distribution

There have been no records of the species in Canadian waters over the past 90 years and it is presumed extirpated from Canada. At this time, it is impossible to know the true extent of its occurrence in Canada, but it would have undoubtedly been greater than 100,000 km<sup>2</sup> [estimated from a polygon of best fit (see COSEWIC 2007) applied to the known former range], which represents approximately 3% of the global range. Given the lack of information on its actual distribution and habitat preferences in Canada, it is impossible to determine the area of occupancy, but it would probably have been less than 100,000 km<sup>2</sup>.

Canada never was a significant part of the distribution, but in the U.S. the species has also been extirpated in Maryland, Michigan, New York, North Carolina and Pennsylvania (Graham 1997), as well as from the Great Lakes basin, all highly peripheral areas, which probably never represented a significant part of the range (Cooper 1983). It is also considered to be imperiled, or critically imperiled in other peripheral areas such as Montana, Minnesota, and Ohio (NatureServe 2007).

## HABITAT

### Habitat requirements

There is little or no information on paddlefish habitat preferences in Canada. Paddlefish specimens collected from Canada at the turn of the 20<sup>th</sup> century were taken from inshore areas of the Great Lakes or from moderately large tributary rivers of the Great Lakes (Halkett 1913; Parker 1988).

In the U.S., paddlefish are reported from large slow-moving waters of the Mississippi, Missouri and Ohio River system (Pflieger 1975; Becker 1983; Rosen *et al.* 1982; Parker 1988; Etnier and Starnes 1993; NatureServe 2007). There, the habitats preferred by paddlefish are seasonally variable, and directly linked to food supply (they are invertebrate filter feeders), and flow rates (Southall and Hubert 1984). During the spring spawning period, paddlefish were found to congregate below dams and in tailwater areas. Spawning in the Missouri river occurs in fast, shallow water over gravel bars (Stancil *et al.* 2002). At other times of the year they utilized main channel borders, backwater areas and areas with reduced current at water depths in excess of 1.5 m (Rosen *et al.* 1982; Burkhead and Jenkins 1991). These reduced current velocities ranged from 0 to 30 cm/sec (Southall and Hubert 1984; Moen *et al.* 1992; Jennings and Zigler 2000). In late fall, they may move to deeper areas (>3 m) to overwinter (Rosen *et al.* 1982; Crance 1987). They are known to congregate in small areas below structures such as sandbars, protected bays, bridge supports and eddies in the tailwaters below dams. When such structures are unavailable to provide refuge from high current velocities, they may select nearshore habitat with low current velocities (Southall and Hubert 1984; Moen *et al.* 1992; Jennings and Zigler 2000).

It is possible to rear paddlefish in large impoundments, but paddlefish must have access to large, free-flowing rivers for successful spawning (Russell *et al.* 1980; Russell 1983). Spawning needs include water temperatures of 16° C, clean gravel substrate for egg attachment, and increased water flow to trigger spawning (Russell 1983).

## **Trends**

Trends in paddlefish habitat quality in the Great Lakes are similar to those affecting lake sturgeon (see Dick *et al.* 2006). Many of the structures that may have blocked upstream migration around the turn of the 20<sup>th</sup> century are still present or have been replaced by other structures that also block migration. The rate of habitat change is unknown. Site-specific modification to migratory routes may benefit U.S. populations, but would not impact the status of this species in Canada. In the U.S., barriers to migration and loss of suitable spawning habitat have been identified as causes of range fragmentation.

The importance of habitat loss to paddlefish populations is not well documented; the loss of habitat was considered far less important than overfishing in their decline (Parker 1988; NatureServe 2007). In fact, many of the populations were reduced to remnant status prior to major environmental perturbations affecting paddlefish habitat.

Habitat destruction and river modification are the most obvious changes affecting paddlefish distribution and abundance. Construction and operation of dams on mainstem streams have had severe impacts. Dams eliminated traditional spawning sites (paddlefish can live in reservoirs but need streams for spawning), interrupted natural spawning migrations, altered water flow regimes, dewatered streams, and eliminated backwater areas that were important as nursery and feeding areas (see Graham 1997; Pflieger 1997). Dams have curtailed the long-range movements that may be required to maintain populations (Dillard *et al.* 1986). It is likely that structural changes in big river systems have adversely affected most of the species's original habitat (Sparrowe 1986).

## **Protection/ownership**

Paddlefish habitat may be protected by the *Canadian Environmental Assessment Act*, *Canadian Environmental Protection Act*, *Federal Fisheries Act*, *Canada Water Act*, *Ontario Environmental Protection Act*, *Ontario Environmental Assessment Act*, *Ontario Planning Act*, *Ontario Lakes and Rivers Improvement Act*, and *Ontario Water Resources Act*. Although specific, direct protection is not offered through such legislation, protection is afforded through protection of wetlands and habitats. Most of the lands adjacent to the known occurrences were privately owned.

## BIOLOGY

### General

Nothing is known of the biology of paddlefish in Canada and all available information comes from populations in the United States.

### Reproduction

Little is known about the life history of this fish, but spawning is reported to occur during April and May when water temperatures range from 10 to 17°C (Purkett 1961; Wallus 1986; Lein and DeVries 1998). Mature fish move upstream to the vicinity of spawning areas where they congregate in deeper areas of the river (Purkett 1961; Pasch *et al.* 1980). Movement onto the spawning areas is initiated by increases in water velocity, with optimal velocities being 60 to 140 cm/sec (Crance 1987). The act of spawning is apparently triggered by increased water flow (Purkett 1961; Pasch *et al.* 1980; Jennings and Zigler 2000).

Paddlefish spawn over gravel bars, rock or rip/rap at water depths of 2 – 12 m (optimal depths 3 – 6 m), in areas with enough current to keep the eggs aerated and silt free (Pasch *et al.* 1980; Wallus 1986; Crance 1987). The eggs are adhesive and stick to substrate (Purkett 1961), hatching in 7 to 9 days. Females weighing 9 to 36 kg may release 70 – 300,000 eggs (Dillard *et al.* 1986), although larger females may be capable of producing over 500,000 eggs.

### Growth

Larvae (newly hatched young) look very different from adults and swim actively from top to bottom in the water column, apparently to take advantage of currents to carry them from high velocity spawning areas to nursery habitats. Current velocities of 30 – 122 cm/s are thought to be required to achieve this transport (Wallus 1986). Currents in nursery areas are much lower, permitting the young fish to feed without expending large amounts of energy (Crance 1987). Growth rates between populations are variable (Bonislavsky 1977; Pasch *et al.* 1980; Combs 1982), but growth is rapid, and at one month the young begin to resemble adults, and by 18 months individuals may attain average weights of 2 – 3 kg. Under ideal conditions, juveniles may add up to 4.5 kg per year to their body weight (Dillard *et al.* 1986). Lentic (reservoir) populations had faster growth at age 0 than lotic populations, but growth rates were similar for ages 2 - 10, suggesting that initial growth differences produced the divergence between lentic and lotic populations. Maximum age was not different between lentic and lotic populations.

Mean total lengths of adults from various populations in the midwestern states range from 70 to 150 cm (Carlander 1969). Males apparently grow more slowly than females, and are usually one-half to two-thirds the weight of females (Dillard *et al.* 1986). Sexual maturity is estimated to be at 7 – 10 years for males and possibly 14 - 17

for females (Parker 1988; Scarnecchia and Schmitz 2003; NatureServe 2007). In Missouri, maturity is attained at lengths of about 140 cm (TL) for females, and 127 cm (TL) for males (Carlson and Bonislowsky 1981). Males apparently spawn every year, but females may require 2 to 7 years to develop mature ova before spawning again (Parker 1988; Jennings and Zigler 2000).

## **Survival**

There is little, or no, information on rates of natural mortality but the species is highly susceptible to exploitation as are most Acipenseriformes. Piscivorous species, such as walleye (*Sander vitreus*), and sauger (*Sander canadensis*), may be significant predators on young paddlefish (Mero *et al.* 1994). Average life expectancy is thought to be about 15 years (Burkhead and Jenkins 1991), but some individuals may live up to 50 years or longer (Scarnecchia and Schmitz 2003). Most large fish (18 - 40 kg) caught in the mid-west are females ranging in age from 15 to 50 years (average about 26 years). Most of the smaller fish (4.5 - 18 kg) are males ranging from 9 to 50 years of age and averaging about 16 years (Scarnecchia and Schmitz 2003).

## **Diet**

All life stages of paddlefish are primarily invertivores, feeding mainly on zooplankton, small invertebrates and insect larvae, using their long gill rakers to filter food from the water (Dillard *et al.* 1986). Small fishes may also be eaten (Jennings and Zigler 2000), as well as algae and aquatic plants (Becker 1983).

## **Dispersal/migrations**

Paddlefish move from overwintering areas in deeper waters of large rivers or reservoirs to spawning areas in the spring (see Habitat). Paddlefish appear to be very highly mobile especially during the spring migration (see Parker 1988), sometimes moving over long distances. For example, tagged fish in Missouri moved over 1900 km down the Missouri River into the Mississippi (Unkenholz 1983), although spawning runs of 80 to 270 km are more common (NatureServe 2007). In Missouri, the maximum activity range over the course of a year was 92 km (Moen *et al.* 1992).

## **Interspecific interactions**

The young and smaller fish may be the prey of piscivorous fishes, but predation on larger fish has not been reported (Mero *et al.* 1994).

## **Behaviour/adaptability**

Successful migration to spawning areas and initiation of spawning is dependent on barrier-free migration routes, specific water temperatures and flow rates. Thus, populations may be negatively impacted by any anthropogenic change to their habitat. However, paddlefish do display some degree of adaptation. They have been known to



move through reservoir floodgates and spillways into areas below spillways (Pitman and Parks 1994), and may pass open dam gates (Southall and Hubert 1984). They may also actively select artificial features such as rock piles, revetments, locks, and tailwaters of dams, etc., as holding areas (Parker 1988). Paddlefish may be successfully cultured and hatchery stocks now support several paddlefish populations in the United States (Parker 1988; NatureServe 2007).

Improvements to water quality in non-wadeable Ohio rivers have also been associated with greater abundance and distribution of paddlefish (Yoder *et al.* 2005).

## POPULATION SIZES AND TRENDS

In Canada, the paddlefish was designated as Extirpated by COSEWIC in 1987, and re-confirmed in 2000, as no specimens have been seen since 1917. Although there have been no targeted surveys, there have been numerous Great Lakes sampling events as part of routine inventories by the Ontario Ministry of Natural Resources and the monitoring of commercial fish harvests. A fish with such unique characteristics could hardly fail to be noted in routine inventories, or if taken by an angler.

Very few specimens were ever collected in Canada, therefore it is difficult to determine if these were part of a once larger population, or if they were stray fish that had made their way into the Great Lakes (Reid *et al.* 2007). However, several authors (Hubbs and Lager 1958; Eddy and Underhill 1974; Burr 1980; Trautman 1981; Cooper 1983; Hubbs *et al.* 2004) have suggested that they were once part of the fauna of the Great Lakes basin, although they were known with certainty only from Lake Erie (Trautman 1981). Others (Greene 1935: *cited in* Becker 1983; Cavender 1987; Hubbs *et al.* 2004) have argued that their presence in (at least the lower) Great Lakes was as a result of migration through canals built in the late 1800s to join Lake Erie and the Ohio River, and the Mississippi River to Lake Michigan. Trautman (1957) favoured a pre-Columbian invasion, with a small, relict population in Lake Erie, since the presence of the species there seemed to pre-date canal building, but Cavender (1987) indicated that the lack of paddlefish fossils in northern Ohio was suggestive of its being rare in Lake Erie, or introduced after European colonization.

The species remains widespread (though less so than historically) in the Mississippi and Gulf Slope drainages of the U.S. (Figure 2), but since the early 1900s has disappeared from all peripheral areas, including Ontario, Michigan, Pennsylvania, New York, Maryland, and North Carolina (NatureServe 2007). More recently, paddlefish have been shown to be in decline in much of the range, and populations have disappeared from other peripheral areas in Texas, Louisiana, Tennessee, Wisconsin, Virginia and West Virginia (NatureServe 2007). Of the 22 states with extant populations, it is presently ranked as secure only in Kentucky and South Dakota (NatureServe 2007).

Paddlefish have been shown to have aquaculture potential (Perschbacher no date), and many states have implemented stocking programs to supplement existing stocks or undertake recovery programs (Pflieger 1997; NatureServe 2007).

## **LIMITING FACTORS AND THREATS**

It is not known what led to the demise of the paddlefish in Canada, or the Great Lakes. Trautman (1981) suggested that its extirpation from Lake Erie could have been the result of blocking of upstream spawning migrations by dams on tributaries and/or destruction of the spawning habitat.

In the U.S., habitat degradation and destruction have been the most obvious changes that could have affected paddlefish distribution and abundance (Dillard *et al.* 1986). The water use practices and the construction and operation of dams and impoundments have eliminated traditional spawning areas (paddlefish can live in reservoirs, but need streams to spawn in), interrupted migrations, altered flow regimes, dewatered streams, and eliminated backwater nursery and feeding areas (Graham 1997; Pflieger 1997). Sparrowe (1986) suggested that structural changes to, and on, big river systems have adversely affected most of the original habitat.

The Missouri, Mississippi and Ohio rivers are the heartland of the American agriculture industry. Along these rivers and their tributaries agricultural development has resulted in habitat degradation through soil erosion, and fertilizer and pesticide runoff. Industrial pollution and problems with municipal wastes are also a major concern along the Ohio River and tributaries of the Mississippi (Sparrowe 1986; NatureServe 2007).

Paddlefish mature slowly and are easily caught, and like sturgeon, they are susceptible to over-harvest (Mettee *et al.* 1996). Poaching is a major concern, as the females are sought for their roe, which can be made into caviar and egg prices can be as high as \$154 a kg (NatureServe 2007). In 1997, biologists estimated that nearly 1000 females had been illegally harvested in Kentucky alone (Rasmussen and Graham 1998). All captured fish are killed, and since the sexes are not easy to differentiate, four to five males are taken for every female with eggs – translating into 5000-6000 fish sacrificed for caviar.

The genetic integrity of the species is also threatened by release of inbred hatchery stock, and introductions from other parts of the range (NatureServe 2007).

## **SPECIAL SIGNIFICANCE OF THE SPECIES**

The Ontario populations were the only representation of the genus in Canada. Paddlefish are not only of interest as “living fossils”, but are also valued as food fish. Paddlefish, like sturgeon, are valued for their roe, which can be made into caviar, and for their boneless, firm white meat. They are also prized as a sports fish in many parts of their range.

## **EXISTING PROTECTION OR OTHER STATUS DESIGNATIONS**

The current global, national (United States and Canada), subnational (state) and provincial ranks for paddlefish are presented in the Technical Summary. The species is listed by IUCN as Vulnerable and is protected (including parts and derivatives) in international trade through an Appendix II listing by CITES.

The paddlefish was last re-examined and designated as Extirpated by COSEWIC in May 2000. In Ontario, the provincial status is Extirpated (OMNR 2007), while the provincial S Rank from NatureServe is SX (Extirpated) [NatureServe 2007]. The general status ranking for the paddlefish is 1 - (Extirpated) for Canada and Ontario (CESCC 2006).

The paddlefish is listed as an Extirpated species under the federal *Species at Risk Act* (SARA) [EC 2007]. Besides offering legal protection to the species, the Act requires the development of a Recovery strategy. The Proposed Recovery Strategy (Reid *et al.* 2007) determined that recovery of this species in Canada is not technically or biologically feasible at this time.

## TECHNICAL SUMMARY

### ***Polyodon spathula***

Paddlefish

Spatulaire

Range of occurrence in Canada: Ontario

#### **Extent and Area information**

<ul style="list-style-type: none"> <li>extent of occurrence (EO)(km<sup>2</sup>) (Historic - Polygon Method) - Current</li> </ul>	<p>&gt;100,000 km<sup>2</sup></p> <p>0</p>
<ul style="list-style-type: none"> <li>specify trend (decline, stable, increasing, unknown)</li> </ul>	Unknown
<ul style="list-style-type: none"> <li>are there extreme fluctuations in EO (&gt; 1 order of magnitude)?</li> </ul>	Unknown
<ul style="list-style-type: none"> <li>area of occupancy (AO) (km<sup>2</sup>) - Historic - Current</li> </ul>	<p>&lt; 100,000 km<sup>2</sup></p> <p>0</p>
<ul style="list-style-type: none"> <li>specify trend (decline, stable, increasing, unknown)</li> </ul>	Not Applicable
<ul style="list-style-type: none"> <li>are there extreme fluctuations in AO (&gt; 1 order magnitude)?</li> </ul>	Unknown
<ul style="list-style-type: none"> <li>number of extant locations</li> </ul>	0
<ul style="list-style-type: none"> <li>specify trend in # locations (decline, stable, increasing, unknown)</li> </ul>	Not Applicable
<ul style="list-style-type: none"> <li>are there extreme fluctuations in # locations (&gt;1 order of magnitude)?</li> </ul>	Unknown
<ul style="list-style-type: none"> <li>habitat trend: specify declining, stable, increasing or unknown trend in area, extent or quality of habitat</li> </ul>	Decline

#### **Population information**

<ul style="list-style-type: none"> <li>generation time (average age of parents in the population) (indicate years, months, days, etc.)</li> </ul>	16 for males 26 for females
<ul style="list-style-type: none"> <li>number of mature individuals (capable of reproduction) in the Canadian population (or, specify a range of plausible values)</li> </ul>	0
<ul style="list-style-type: none"> <li>total population trend: specify declining, stable, increasing or unknown trend in number of mature individuals</li> </ul>	Not Applicable
<ul style="list-style-type: none"> <li>if decline, % decline over the last/next 10 years or 3 generations, whichever is greater (or specify if for shorter time period)</li> </ul>	
<ul style="list-style-type: none"> <li>are there extreme fluctuations in number of mature individuals (&gt; 1 order of magnitude)?</li> </ul>	No
<ul style="list-style-type: none"> <li>is the total population severely fragmented (most individuals found within small and relatively isolated (geographically or otherwise) populations between which there is little exchange, i.e., ≤ 1 successful migrant / year)?</li> </ul>	Yes
<ul style="list-style-type: none"> <li>list each population and the number of mature individuals in each</li> </ul>	0
<ul style="list-style-type: none"> <li>specify trend in number of populations (decline, stable, increasing, unknown)</li> </ul>	Not Applicable
<ul style="list-style-type: none"> <li>are there extreme fluctuations in number of populations (&gt;1 order of magnitude)?</li> </ul>	No

#### **Threats (actual or imminent threats to populations or habitats)**

1. dams blocking access to spawning habitats, habitat degradation and overharvesting
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<b>Rescue Effect (immigration from an outside source)</b>	Unlikely
• <i>does species exist elsewhere (in Canada or outside)?</i>	Yes - US
• <i>status of the outside population(s)?</i>	No longer found in the Great lakes basin, Extirpated from neighbouring states MI, PA, and NY, in decline in MN, IL, OH, and WI
• <i>is immigration known or possible?</i>	Unlikely
• <i>would immigrants be adapted to survive here?</i>	Unknown
• <i>is there sufficient habitat for immigrants here?</i>	Unknown

### Quantitative Analysis

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### Existing Status

<p><b>Nature Conservancy Ranks</b> (NatureServe 2007)</p> <p><b>Global</b> – G4</p> <p><b>National</b></p> <p>US – N4</p> <p>Canada NX</p> <p><b>Regional</b></p> <p>US – AL (S3), AR (S2?), IL (S2S3), IN (S3), IO (S3), KS (S3), KY (S4), LA (S3), MI (SX), MN (S2), MO (S3), MS (S3), MT (S1S2), NE (S2), NY (SX), NC (SH), ND (SNR), OH (S2), OK (S1S2), PA (SX), SD (S4), TN (S3), TX (S3), VA (S1), WV (S1), WI (S2)</p> <p>Canada – ON – SX</p> <p><b>Wild Species 2005</b> (Canadian Endangered Species Council 2006)</p> <p>Canada – 1</p> <p>Ontario – 1</p> <p><b>Ontario</b></p> <p>Extirpated (OMNR 2007)</p> <p><b>IUCN</b> – VU (NatureServe 2007)</p> <p><b>CITES</b> – Appendix II (NatureServe 2007).</p> <p><b>AFS</b> – SC (NatureServe 2007).</p> <p><b>COSEWIC</b></p> <p>Extirpated 1987, 2000, 2008</p>
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### Status and Reasons for Designation

<b>Status:</b> Extirpated	<b>Alpha-numeric code:</b> Not Applicable
<p><b>Reasons for Designation:</b></p> <p>This fish, once found in the Great Lakes, was apparently never common in the Canadian portion of its range. It has not been observed in Canadian waters since 1917 despite extensive sampling and the fact that such a distinctive fish would have been easily recognizable.</p>	

**Applicability of Criteria**

<b>Criterion A</b> (Declining Total Population): Not Applicable – no individuals seen since 1917.
<b>Criterion B</b> (Small Distribution, and Decline or Fluctuation): Not applicable – no individuals seen since 1917.
<b>Criterion C</b> (Small Total Population Size and Decline): Not applicable – no individuals seen since 1917.
<b>Criterion D</b> (Very Small Population or Restricted Distribution): Not Applicable – no individuals seen since 1917.
<b>Criterion E</b> (Quantitative Analysis): Not Applicable – no data.

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Nick Mandrak and Al Dextrase provided background information on recent collection efforts and editorial support.

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### **COLLECTIONS EXAMINED**

None.