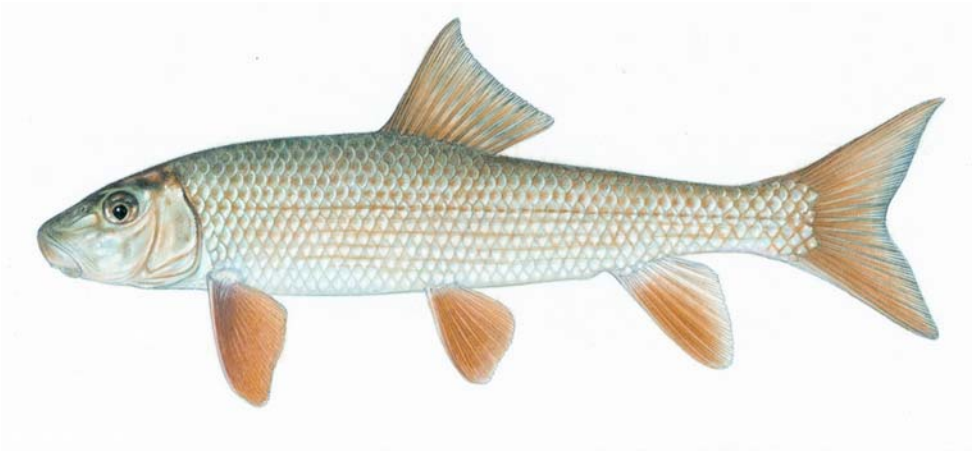
COSEWIC
Assessment and Update Status Report

on the

Black Redhorse
Moxostoma duquesnei

in Canada



THREATENED
2005

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 – May 2005

Common name
Black redhorse

Scientific name
Moxostoma duquesnei

Status
Threatened

Reason for designation
A freshwater fish with a very small, highly fragmented distribution and area of occupancy, as well as restricted spawning habitat preferences. Native populations are found in only 5 Ontario watersheds in areas heavily impacted by urbanization and agriculture. It is at risk of habitat loss and degradation as a result of increased siltation and turbidity. Dams may adversely affect flow regimes and have fragmented populations in the two major rivers where this species occurs.

Occurrence
Ontario

Status history
Designated Threatened in April 1988. Status re-examined and confirmed in May 2005. Last assessment based on an update status report.

COSEWIC
Executive Summary

Black Redhorse
Moxostoma duquesnei

Species Information

The black redhorse (*Moxostoma duquesnei*) is one of seven redhorse species in the genus *Moxostoma* of the sucker family Catostomidae found in Canada. It can be distinguished from the other redhorse species based on a combination of tail colour, lip morphology and lateral line scale count.

Distribution

The black redhorse has a wide, but disjunct, distribution in the Mississippi and Great Lakes drainages of eastern North America. In Canada, it is known from tributaries to lakes Erie, Huron, Ontario and St. Clair in southwestern Ontario.

Habitat

The black redhorse is limited to moderate to fast flowing areas in medium-sized, warmwater streams and rivers.

Biology

Maximum known age is 16 years and maximum known length and weight are 658 mm TL (total length) and 3200 g. Age at maturity ranges from 2 to 6 years. Sexual dimorphism is present. Black redhorse migrate to spawning habitat in spring. They are benthic feeders of crustaceans and insects.

Population Sizes and Trends

Despite extensive recent sampling, populations sizes and trends at all locations are unknown.

Limiting Factors and Threats

The black redhorse is less tolerant of slow currents, turbidity and siltation than other redhorse species found within its range. It has restrictive spawning habitat (water depth and substrate) preferences, and recruitment is vulnerable to changes in the flow

regime. It is likely impacted by changes in water quality and quantity related to agriculture, urbanization, dams and impoundments. Difficulty in identification and recreational by-catch together may also impact populations.

Special Significance of the Species

The black redhorse plays an important role as a nutrient cycler in aquatic ecosystems. It transfers energy from the benthic food web to the pelagic food web.

Existing Protection or Other Status Designations

The black redhorse and its habitat are protected by the federal Fisheries Act. In Canada, it is currently listed as Threatened by COSEWIC, Threatened by the Province of Ontario, and S2 by the Natural Heritage Information Centre. In the United States, subnational ranks are provided for 20 states.

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 agencies (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 members and the co-chairs of the species specialist and the Aboriginal Traditional Knowledge subcommittees. The Committee meets to consider status reports on candidate species.

DEFINITIONS (NOVEMBER 2004)

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 wildlife species for which there is inadequate information to make a direct, or indirect, assessment of its 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.

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Canada

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

Update
COSEWIC Status Report

on the

Black Redhorse
Moxostoma duquesnei

in Canada

2005

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SPECIES INFORMATION

Name and classification

Kingdom:	Animalia
Phylum:	Chordata
Class:	Actinopterygii
Order:	Cypriniformes
Family:	Catostomidae
Genus and species:	*Moxostoma duquesnei* (Lesueur 1817)
Common English name:	black redhorse (Nelson *et al.* 2004)
Common French name:	chevalier noir

Description

The black redhorse (*Moxostoma duquesnei*) is one of seven redhorse species in the genus *Moxostoma* of the sucker family Catostomidae found in Canada (Scott and Crossman 1998) (Figure 1). It is characterized by a laterally compressed, relatively shallow body (very low arch to back), long rounded snout (39.6-49.8% of head length), inferior mouth considerably overhung by snout, narrow upper lip, thick slightly concave lower lip with deep cleft and long plicae without transverse grooves, club-shaped pharyngeal teeth, circumpeduncle scale count of 12-13, and lateral line count of 44-47 (Holm and Boehm 1998; Scott and Crossman 1998).

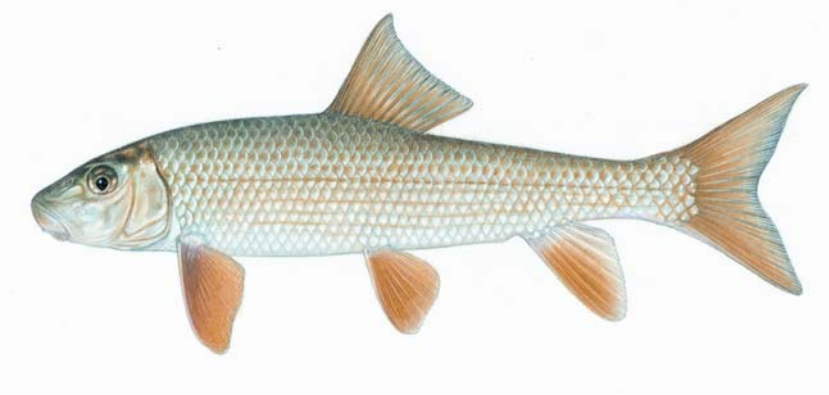

Figure 1. Black redhorse (*Moxostoma duquesnei*). Illustration by Joe Tomelleri. Used with permission of DFO.

The dorsal surface and upper sides are grey or olive-brown with a silver-blue overtone, the sides are lighter and usually silvery-blue, and the ventral surface is silver to milky white. The scales are dark edged, but not dark at the base, and all fins are slate grey (Scott and Crossman 1998).

During spawning season, males exhibit bold longitudinal stripes of black and colour ranging from orange to pink along their sides. Males have nuptial tubercles on their anal

and caudal fins (Jenkins and Burkhead 1993). Females show little, or no, spawning colour (Kwak and Skelly 1992).

The black redhorse differs from the other six Canadian redhorse species in the following ways. The black redhorse has a slate-grey tail, whereas a red tail is present in the river redhorse (*M. carinatum*), copper redhorse (*M. hubbsi*), shorthead redhorse (*M. macrolepidotum*) and greater redhorse (*M. valenciennesi*) (Holm and Boehm 1999). The black redhorse can be distinguished from the other two species of grey-tailed redhorses based on several characters (Holm and Boehm 1998). It can be distinguished from the silver redhorse (*M. anisurum*) by the presence of transverse grooves in the lips, slightly concave margin of the dorsal fin, lower pelvic fin ray count (9 vs. 10), and largely non-overlapping lateral line scale count (44-47 vs. 40-42). The black redhorse can be distinguished from the very similar golden redhorse (*M. erythrurum*) primarily by the largely non-overlapping lateral line scale count (44-47 vs. 40-42), lower pelvic fin ray count (9 vs. 10), and lack of nuptial tubercles on the head and scales of spawning males.

Designatable units

All Canadian populations are found within the Great Lakes-Western St. Lawrence ecozone of the freshwater ecozone classification adopted by COSEWIC. Population structure is unknown; however, an examination of the genetic structure of black redhorse in the Grand River is currently being conducted by S. Reid (Trent University).

DISTRIBUTION

Global range

The black redhorse has a wide, but disjunct, distribution in the Mississippi and Great Lakes drainages of eastern North America (Figure 2). It is found from Alabama and Mississippi in the south to Ontario and Michigan in the north, and from New York in the east to Oklahoma and Minnesota in the west. In the Mississippi drainage, the distribution east of the Mississippi River is continuous, but disjunct to the west (Lee *et al.* 1980, Page and Burr 1991). In the Great Lakes basin, disjunct populations are found in Ontario, Michigan and Wisconsin (Lee *et al.* 1980; Page and Burr 1991).

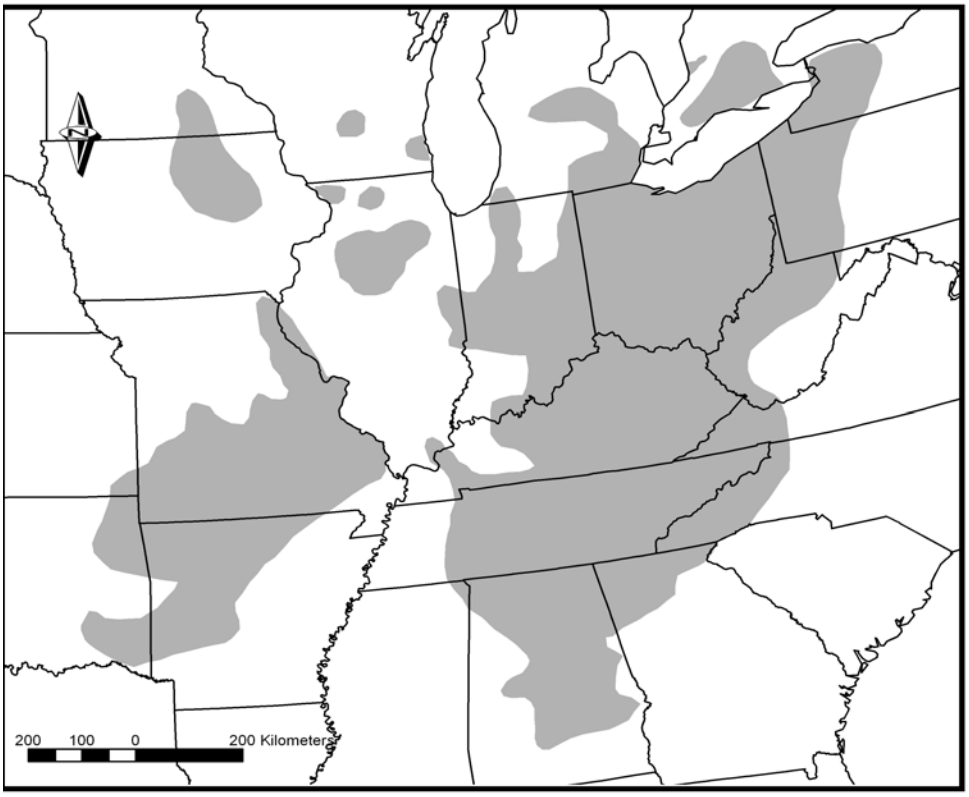

Figure 2. Global distribution of the black redhorse.

Canadian range

In Canada, the black redhorse is limited to southwestern Ontario (Figure 3). In the Lake Erie drainage, it is known from the Catfish Creek (now believed extirpated) and Grand River watersheds. It is present in the Thames River watershed in the Lake St. Clair drainage. Populations in the Grand and Thames rivers are fragmented by dams (5 in the Grand and 3 in the Thames) resulting in occurrence in 7 and 5 locations respectively. It is known from the Bayfield River, Maitland River and, only recently (since 2002), the Ausable River watersheds in the Lake Huron drainage. It is also known from a single location in the Spencer Creek watershed draining into western Lake Ontario. Two specimens were reportedly collected in the Sauble River of the Lake Huron drainage by the Ontario Department of Planning and Development in 1958, and deposited in the Royal Ontario Museum (ROM) (ROM Accession No. RMA0446). The specimens were identified in 1969 by Dr. W. Beamish, University of Guelph, and subsequently discarded by the Royal Ontario Museum (E. Holm, ROM, pers. comm.). More recent sampling on the Sauble River has failed to capture any additional specimens (E. Holm, ROM, pers. comm.). In the absence of voucher specimens, this record is deemed questionable and excluded from Figure 3.

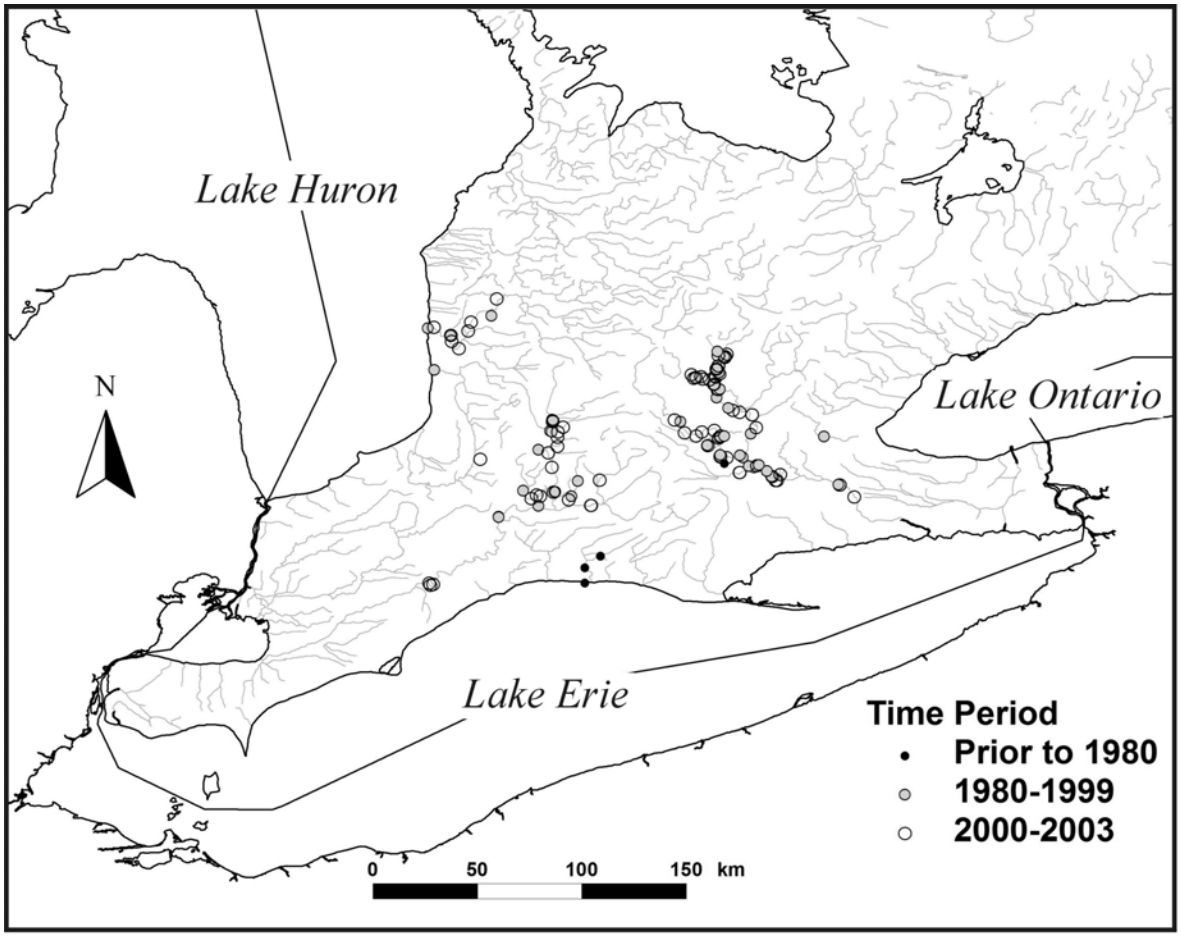

Figure 3. Canadian distribution of the black redhorse.

HABITAT

Habitat requirements

Black redhorse generally inhabit moderately sized, cool, clear streams (Bowman 1970). In summer, they generally prefer pools and overwinter in deeper pools (Bowman 1970). Although few studies have quantified specific habitat variables associated with the presence of black redhorse, it has been reported in streams with gradients ranging from 1.2-1.5 m/km (Parker and Kott 1980) and average annual discharge ranging from 14 to 20 m^3/s (Bowman 1970; Parker and Kott 1980) in well oxygenated and relatively fertile water with July water temperature averaging approximately 20ºC (Parker 1989). In a study of the occurrence of redhorse species in a survey of 77 sites in Indiana, redhorses were found at sites characterized by greater depth (mean = 0.61 m vs. 0.31 m) and slower current (mean = 0.06 m/s vs. 0.49 m/s) than sites without redhorses (Brown 1984). There were no significant differences in pH, dissolved oxygen and temperature.

Based on collections made in 1997, Holm and Boehm (1998) described the habitat in Canada as rivers 25-130 m wide, 0.1-1.8 m in depth with usually moderate to fast, but occasionally slow, current, and substrates of rubble, gravel, sand, boulders and silt. It was rarely associated with submerged aquatic vegetation. The habitat of sites sampled throughout its range in southwestern Ontario in 2002 and 2003 was similar to that described by Holm and Boehm (1998) (N.E. Mandrak, S. Reid, unpubl. data).

Young-of-the-year (YOY) black redhorse were found in shallow pools and slackened current in the Thames and Nith rivers in Ontario (Parker 1989). In the Grand River, YOY are most commonly observed among beds of swamp loosestrife (*Decodon verticullatus*) in relatively quiet waters. During the summer, large juveniles (approx. 150 mm) have been observed to feed alone along the bottom of sandy pools (Bowman 1970), and immature black redhorse have been captured in shallow pools below riffles (Parker and Kott 1980). In the Grand River, approximately 35% of black redhorse collection sites contained both juveniles and adults (S. Reid, unpubl. data); juveniles are typically captured in pools and run habitats downstream of riffles during the summer (S. Reid, unpubl. data).

Trends

As the result of lack of historical habitat data, nothing is known about trends in habitat within the Canadian range of the black redhorse. In general, portions of the Thames and Grand River watersheds have become more urbanized, non-urban areas are under heavy agriculture production, and populations have been fragmented by dams.

Protection/ownership

All of the black redhorse sites fall on public waterways, and their habitat is afforded protection by the federal Fisheries Act. In addition, several sites are within conservation areas operated by conservation authorities. Most of the adjacent shoreline habitat is privately owned, and much of it is in agricultural production.

BIOLOGY

General

The published maximum known age is 11 years and maximum known length and weight are 658 mm TL (total length) and 3200 g (Coker *et al.* 2001, Howlett 1999). Based on 267 black redhorse sampled in the Grand River (Ontario), maximum age was 16 years based on fin ray sections, maximum total length was 511 mm, and maximum weight was 1558 g (S. Reid. unpubl. data).

Reproduction

Age at maturity was found to range from 2 to 5 years in southwest Missouri (Howlett 1999), and listed as 2 to 6 years by Jenkins and Burkhead (1993). In the Grand River (Ontario), the youngest mature individuals were 3 (female) and 4 (male) years old (S. Reid, unpubl. data). Black redhorse fecundity in the Grand River (Ontario) was 4,126-11,551 eggs per female, and the egg diameter ranged from 2.6 to 2.9 mm at spawning (Kott and Rathman 1985). Based on these data, the relationship between egg number and female length is estimated as: egg number = $(2.46*10^{-6})L(mm)^{3.713}$ (Mandrak and Casselman 2004).

Eggs are nonadhesive (Bowman 1970). Egg hatching success has not been investigated in black redhorse; however, in laboratory conditions robust redhorse (*Moxostoma robustum*) survival to hatch has been determined to be approximately 66% under ideal conditions (Dilts 1995). The size of fry at emergence ranges between 8.2 and 9.1 mm (Kay *et al*. 1994).

Kwak and Skelly (1992) observed spring spawning in Illinois at water temperatures ranging from 15-21ºC. Black redhorse spawned in riffle habitats, avoiding the swiftest areas, over substrates ranging in size from fine gravel to large cobble. However, small cobble was used most frequently. Spawning-ready male and female black redhorse were collected from the Grand River on May 28 and 29, 2002 when water temperature was 15^{o}C, May 23, 2003 (water temperature 13^{o}C), and May 20, 2004 (water temperature 17.4^{o}C) (S. Reid, unpubl. data).

Sexual dimorphism is found in spawning individuals of black redhorse. Males exhibit nuptial body coloration and have tubercles on their anal and caudal fins. Females show little, or no, spawning colour (Kwak and Skelly 1992). Kwak and Skelly (1992) reported that females have no nuptial tubercles, whereas Scott and Crossman (1998) indicated that females might have minute tubercles. The sex ratio has been examined in only a few populations and none differed significantly from 1:1 (Meyer 1962; Bowman 1970; Parker and Kott 1980). However, males generally outnumber females on the spawning grounds, but this likely indicates that males stay on the spawning grounds longer than females (Meyer 1962; Bowman 1970).

Kwak and Skelly (1992) observed black redhorse spawning in an Illinois river. Large numbers (7-80 fish) of both sexes gathered at the edges of riffles, and divided into smaller groups as they moved into the riffles. Both sexes took up positions, often behind large rocks, with no apparent territoriality. Groups of up to six fish with individuals positioned within a few centimetres of each other were common. Both sexes shifted positions frequently, including rolling over the backs of other members of the spawning group—but always maintained a position facing upstream. Females were flanked by up to four males. The mating event took place with a quiver of the caudal regions by all fish involved, lasting about two seconds. Mating usually ended when one or more of the group members moved rapidly to new positions, but sometimes the group just gradually reduced their vibrating and maintained positions.

Survival

Black redhorse longevity increases with increasing latitude. In Tennessee, Schumate (1988) reported black redhorse maximum age to be 8 years (Schumate 1988). In Missouri, maximum black redhorse age has been interpreted to be 10 or 11 years (Bowman 1970; Howlett 1999). Black redhorse collected from the Grand River, Ontario included individuals as old as 16 years (Reid and Mandrak 2002). In Ohio, Smith (1977) reports that the annual survival rate for black redhorse is 0.64; however, this survival rate is not broken down by age class. Bowman examined the survival rate of black redhorse 5 years of age and older from two rivers in Missouri (Tables 1 and 2, Bowman 1959) and found it to be similar to that in Ohio. Survival rates are not available for younger black redhorse.

Table 1. Global, National, and Subnational (State and Provincial) ranks and status for black redhorse (*Moxostoma duquesnei*) (NatureServe 2004).

Global	US National	Canadian National	Subnational	
			US States	Ontario
G5	Not found in TESS (USFWS database of Threatened and Endangered Species)	Threatened; N2	S1 – KS, MS, WI S2 – IA, NY S2S3 - IL S3 – MI, VA S4 - AR, GA, IN, MN, NC, OK, PA, WV S5=AL, TN S? – MO, OH	S1

Table 2. Survival rates of black redhorse populations from Niangua and Big Piney rivers, Missouri (Bowman 1959).

Age Class	Niangua River	Big Piney River
5	0.49	0.68
6	0.48	0.49
7	0.33	0.03
8	0.03	0.02
9	0.02	0.01
10	0.01	-

Physiology

Length-weight equations have been developed by a number of studies and are reported in Table 3. Additionally, von Bertalanffy growth equations have been determined for several populations (Table 4).

Table 3. Summary of length-weight equations developed for black redhorse populations. Form of length-weight equation: log(weight g) = b + mlog(length mm)

B	m	Comments	Source
-4.58	2.94	Niangua River	Bowman 1970
-4.59	2.95	Big Piney River	Bowman 1970
-5.7475	3.363	immature fish	Smith 1977
-4.748	2.9554	mature male	Smith 1977
-4.6607	2.9227	mature female	Smith 1977
-5.39	3.158	Grand River	S. Reid (unpubl. data)

Table 4. Summary of von Bertalanffy growth equations developed for black redhorse. Form of von Bertalanffy equation: $L_t = L_\infty[1-e^{-k(t-t0)}]$

L_∞	k	t_0	Comment	Source
385.4	0.39	-0.48	James River	Howlett 1999
369.3	0.39	0.30	Bull Creek	Howlett 1999
378.3	0.34	-0.29	Swan Creek	Howlett 1999
426.4	0.45	-0.34	Elk River	Howlett 1999
490.9	0.26	-0.75	Grand River	S. Reid (unpubl. data)

Movements/dispersal

Access to critical spawning habitat is essential for the continued existence of the black redhorse. During the spring, redhorse species migrate to spawning habitats (Jenkins 1970). Hackney *et al.* (1968) documented tagged river redhorse to travel more than 15 km upstream to spawn. Post-spawn migrations up to 15 km by the greater redhorse were observed in the Grand River (Cooke and Bunt 1999). Two black redhorse were radio-tracked in the Grand River from June to October 2003. These fishes moved a total of 475 m and 2,000 m upstream from the original capture location (Clark 2004).

Nutrition and interspecific interactions

The black redhorse is a bottom feeder using the grazing and picking method with a high preference for crustaceans and insects (Coker *et al*. 2001). Young black redhorse, less than 65 mm in length, are thought to be primarily planktivorous, while larger fish are thought to be primarily benthivorous (Bowman 1970). In Canada, black redhorse are syntopic with up to five other redhorse species. Given their similar morphology, habitat and prey preferences (Coker *et al.* 2001, Clark 2004), competition likely occurs between redhorse species. However, subtle differences in these preferences and morphology may minimize such interactions (Clark 2004).

Behaviour/adaptability

The black redhorse is believed to be intolerant of siltation (Scott and Crossman 1998). Redhorse species have the potential to re-establish populations in waters where

they have been extirpated if other populations exist nearby (Jenkins and Burkhead 1993). However, the presence of barriers to migration (i.e. dams) along many of the rivers likely reduces their ability to recover from disturbances.

POPULATION SIZES AND TRENDS

Virtually nothing is known about the sizes of black redhorse populations in Ontario. Therefore, identifying trends in population sizes is not possible. However, some inferences about population trends can be made by examining historical and current occurrence data.

In the Lake Erie drainage, the black redhorse has been widely collected in the Grand River and its tributaries. It has been recently collected at almost all known historic sites, as well as several new sites. In 2002 and 2003, over 400 black redhorse were captured at 24 sites throughout the Grand River basin. The distribution of black redhorse populations is generally concentrated in the less fragmented and the middle portions of the watershed. New site localities were identified along the Grand River between Waterloo and Paris, below the weir at Caledonia, and at York. These new records are likely the result of the use of better-targeted methods (backpack and boat electrofishing). During late May, spawning-ready black redhorse were collected in riffles downstream of the weir at Caledonia and at the Brant Conservation Area between Paris and Brantford. At 35% of black redhorse sites, both juveniles and adults were found. Although not previously collected in these drainages, black redhorse were not collected in recent sampling of the Speed River drainage, along the Conestogo River upstream of Wallenstein, upstream of Inverhaugh along the Grand River or along the Nith River upstream of New Hamburg.

Black redhorse have not been collected in Catfish Creek since 1938. Resampling of all historic sites on Catfish Creek on at least 12 occasions between 1941 and 2002 (E. Holm, ROM, unpubl. data; N.E. Mandrak, unpubl. data) using suitable methods (backpack electrofishing, seining) failed to yield any additional specimens. Currently, Catfish Creek is a highly turbid, slow-moving stream in a predominately agricultural watershed (N.E. Mandrak, pers. obs.); therefore, it appears that suitable habitat no longer exists in Catfish Creek and that black redhorse is no longer present in Catfish Creek.

In the Lake St. Clair drainage, the black redhorse has been collected in the upper Thames River and its tributaries (Figure 3). The Thames River has not been recently sampled as well as the Grand River; however, there are recent records (since 2002) of black redhorse for the mainstem and most tributaries where it was collected historically (N.E. Mandrak, unpubl. data; J. Schwindt, unpubl. data).

In the Lake Huron drainage, the black redhorse has been found in the Bayfield and Maitland rivers (Figure 3). During recent sampling (2002; N.E. Mandrak, unpubl. data), it was found at all historic sites in these rivers.

In 2002, the black redhorse was found, for the first time, in the Ausable River (N.E. Mandrak, unpubl. data). It was found at one of 25 sites sampled throughout the watershed. Although it is likely native in the Ausable River, but previously undetected, additional sampling of suitable habitat using targeted methods (backpack electrofishing, seining) needs to be undertaken to determine the extent of its occurrence in this watershed.

In 1998, several specimens of black redhorse were collected in a reservoir on Spencer Creek, a tributary to western Lake Ontario. The disjunct nature of this record, and the apparently unsuitable habitat of the reservoir, suggest that these specimens may have been introduced. However, headwater stream capture between Spencer Creek and the Grand River cannot be ruled out.

The disjunct nature of black redhorse populations in the American portion of lakes Erie, St. Clair and Huron (Trautman 1981, Bailey *et al.* 2004), and the large expanses of unsuitable habitat between American and Canadian populations, make a rescue effect highly unlikely.

LIMITING FACTORS AND THREATS

The distribution of black redhorse is likely limited by the availability of preferred habitat within its Canadian range (Parker 1989). It is an inhabitant of moderate-high gradient habitat in medium-sized warmwater streams and rivers (Bowman 1970). Black redhorse are less tolerant of low gradients, turbidity and siltation than other redhorse species found within its range (Trautman 1981). However, it is often more abundant in cool, swift, rocky streams than the golden redhorse (Jenkins and Burkhead 1993). Due to restrictive spawning habitat (water depth and substrate) preferences, black redhorse recruitment is vulnerable to changes in the flow regime. High flow levels were observed by Bowman (1970) to result in the abandonment of a historically utilized spawning shoal. In the Grand River, large increases in discharge during the spawning period prevented the spawning of ripe individuals of another redhorse species, the greater redhorse (Cooke and Bunt 1999).

Most field biologists have a limited ability to correctly identify black redhorse, especially juveniles (Parker 1989). Black redhorse and golden redhorse are often found together (i.e. syntopic) where their ranges are sympatric, and are among the most difficult species of redhorse to distinguish from each other (Jenkins and Burkhead 1993). Past biological studies (e.g. creel censuses, fish community inventories) in Ontario often failed to report the presence of redhorses to species due to problems with species identification and lumping of fish into the category of suckers or coarse fish (Cooke and Bunt 1999). Identification problems limit our ability to assess trends and to identify and protect new sites.

The two largest populations of black redhorse in Canada are found along the Grand and Thames rivers. Urban growth, the impoundment of riverine habitats and

agricultural activities threaten remaining populations. Population growth in the Grand River basin has been projected to be 30% over the next 20 years (www.grandriver.ca). Major urban centres in the central part of the watershed coincide with known locations of the black redhorse populations. Impairment of habitat and water quality may result from land use changes, water utilization and sewage disposal (Portt *et al*. 2003). Habitat quality in the upper Thames River watershed is also adversely affected by urban and rural land uses. Much of the forest cover in the watershed has been cleared. Water quality is negatively affected by spills, drainage practices, run-off and bank alteration.

Dams and impoundments have been identified as potential limiting factors for black redhorse populations (Portt *et al*. 2003). Over 50 dams are present throughout the Grand River watershed and black redhorse populations are generally concentrated in the less fragmented mid-watershed region (Armstrong-Philips 1983). Seventy-eight dams are found throughout the upper Thames River watershed (www.thamesriver.org). Any further dam construction would adversely affect black redhorse populations by altering upstream and downstream habitat conditions; restricting the movements of individual fish; and limiting gene flow between populations. In the United States, impoundments have been shown to have a strong negative impact on black redhorse abundance (Travnichek and Maceina 1994, Quinn and Kwak 2003). Fishways constructed at the Mannheim Weir (Grand River) permit upstream spawning migrations of golden redhorse, greater redhorse, white sucker (*Catostomus commerconi*), and northern hog sucker (*Hypentelium nigricans*), thereby mitigating some of the adverse effects of dams on catostomids (Bunt *et al*. 2001). However, fishway monitoring data from the Mannheim and Dunnville weirs on the Grand River indicate differential use by *Moxostoma* species. Despite their presence and relative abundance upstream and downstream of the Mannheim weir, no black redhorse were collected during 3 years of monitoring at the Mannheim weir (Bunt *et al*. 2001).

The Grand River supports a popular recreational fishery and associated pressures are expected to increase with urban growth. Black redhorse populations may be directly affected by angling harvest and indirectly by the creation of new sportfishing opportunities (i.e. brown trout and walleye stocking) (Portt *et al*. 2003, OMNR and GRCA 1998). Incidental captures of black redhorse by anglers and bow hunters targeting carp have been reported in the Grand River (Portt *et al*. 2003). The Grand River Management Plan (OMNR and GRCA 1998) identified the potential, but unknown, risk of introductions of "top predators" such as walleye and northern pike or alternatively potential competitors (e.g. brown trout) on resident fish species. The vulnerability of soft-bodied fish species such as suckers to piscivorous fish is well known. The importance of benthic invertebrates in the diet of black redhorse and their use of pool habitats suggest the potential for competition between stream-dwelling salmonids and black redhorse; however, no case studies evaluating this have been reported (Jenkins 1970, Jenkins and Burkhead 1993). Barriers to hybridization among *Moxostoma* species include aggressive behaviour and differences in spawning time, temperature and habitat (Curry and Spacie 1984, Kwak and Skelly 1992).

SPECIAL SIGNIFICANCE OF THE SPECIES

Like all sucker species, the black redhorse plays an important, yet underrated, role as a nutrient cycler in aquatic ecosystems. It transfers energy (i.e. nutrients) from the benthic food web (where it feeds) to the pelagic food (web where it is preyed upon).

Historically this species was recognized by Aboriginal peoples of the area and was fished for food during spring spawning runs. Sometime during the past it was noted that populations had declined and been replaced by white sucker (H. Lickers, Mohawk Council of Akwesasne, Department of the Environment, Cornwall, ON; personal communication 2005).

EXISTING PROTECTION OR OTHER STATUS DESIGNATIONS

The black redhorse and its habitat are protected by the federal Fisheries Act. In Canada, it is currently designated as Threatened by COSEWIC, Threatened by the Province of Ontario, and S2 by the Natural Heritage Information Centre. In the United States, it has been assigned a conservation status by 20 states.

TECHNICAL SUMMARY

Moxostoma duquesnei
Black redhorse chevalier noir
Limited to southwestern Ontario.

Extent and Area information	
• *extent of occurrence (EO)(km²) Calculated from Figure 3*	20,000
• *specify trend (decline, stable, increasing, unknown)*	Slight increase
• *are there extreme fluctuations in EO (> 1 order of magnitude)?*	No
• *area of occupancy (AO) (km²).* For rivers with multiple sites, calculated as length of river between uppermost and lowermost sites multiplied by average width. Not determined for species from waterbodies with single site. The population in Catfish Creek has probably been extirpated; the Spencer creek population may have been introduced.	Ausable River – single site Bayfield River – single site Spencer Creek – single site Grand River 175km x 0.05km=8.75 Maitland River 40km x 0.05km = 2.00 Thames River 150km x 0.05km=7.50 Catfish Creek 16km x 0.025km=0.4 Total=18.65
• *specify trend (decline, stable, increasing, unknown)*	Stable
• *are there extreme fluctuations in AO (> 1 order magnitude)?*	No
• *number of extant locations (Catfish Creek population extirpated)* Grand River - 7, Thames - 5, Ausable - 1, Bayfield - 1, Maitland - 1, Spencer – 1 (probably introduced; not included)	15
• *specify trend in # locations*	I new site (Ausable River), I extirpated site (Catfish Creek, and one introduced site (Spencer Creek)
• *are there extreme fluctuations in # locations (>1 order of magnitude)?*	No
• *habitat trend*	Unknown
Population information	
• *generation time (average age of parents in the population*	~5 years
• *number of mature individuals (capable of reproduction) in the Canadian population*	Unknown
• *total population trend: I extirpation – now stable?*	Unknown, appears stable
• *if decline, % decline over the last/next 10 years or 3 generations, whichever is greater*	
• *are there extreme fluctuations in number of mature individuals (>1 order of magnitude)?*	No

• *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)?*	Yes
• *list each population and the number of mature individuals in each* Although the species is found only in 6 extant steams, there are multiple locations in the Thames and Grand Rivers due to the presence of dams. The population in Catfish Creek has probably been extirpated; the Spencer Creek population may have been introduced.	Ausable River Bayfield River Grand River (likely multiple populations) Maitland River Spencer Creek Thames River (likely multiple populations) Catfish Creek Number of mature individuals unknown for all
• *specify trend in number of populations*	Unknown
• *are there extreme fluctuations in number of populations (>1 order of magnitude)?*	Unknown
Threats	
- urbanization, agriculture, dams, habitat degradation, recreation by-catch, difficult to identify	
Rescue Effect (immigration from an outside source)	Low
• *does species exist elsewhere (in Canada or outside)?*	Yes
• *status of the outside population(s)?*	S2 - NY; S3 - MI; S? - OH
• *is immigration known or possible?*	Yes
• *would immigrants be adapted to survive here?*	Yes
• *is there sufficient habitat for immigrants here?*	Yes
Quantitative Analysis	Data Not Available

Existing Status

Nature Conservancy Ranks (Naturserve 2004)
Global – G5
National
US – N5
Canada – N2
Regional
US – AL – S5, AR – S4, GA – S4, IL – S2S3, IN – S4, IA – S2, KS – S1, KY – S4S5, LA – S5, MI – S3, MN – S4, MS – S1, MO – SNR, NY – S2, NC – S4, OH – SNR, OK – S4, PA – S4,TN – S5, TX – S3, VA – S3,WV – S4, WI – S1
Canada – ON – S2

Wild Species 2000 Canadian Endangered Species Council 2001)
Canada – 1
Ontario – 1

COSEWIC
Threatened – (May 2005)

Status and Reasons for Designation

Status: Threatened	**Alpha-numeric code**: D2
Reasons for Designation: A freshwater fish with a very small, highly fragmented distribution and area of occupancy, as well as restricted spawning habitat preferences. Native populations are found in only 5 Ontario watersheds in areas heavily impacted by urbanization and agriculture. It is at risk of habitat loss and degradation as a result of increased siltation and turbidity. Dams may adversely affect flow regimes and have fragmented populations in the two major rivers where this species occurs.	
Applicability of Criteria **Criterion A** (Declining Total Population): Not Applicable – population and trend data not available. EO and AO have increased because of the discovery of a population in the Ausable R; however the Spencer Creek population was likely introduced. **Criterion B** (Small Distribution, and Decline or Fluctuation): Not Applicable – The species does have a very restricted distribution with a small AO (< 18.7 km^2). Although the species occurs at 15 locations it is native to only five rivers in southern Ontario. The two rivers with the most abundant populations are impacted by urban development that will affect the preferred habitat of this species. However, the 15 locations are fragmented to the extent that there are 30 or so populations, therefore exceeding the minimum threshold (10). **Criterion C** (Small Total Population Size and Decline): Not Applicable – population and trend data not available. **Criterion D** (Very Small Population or Restricted Distribution): Meets criterion for T D2, area of occupancy less than 20 km^2, populations are scattered and fragmented (no rescue effect) and exposed to several factors which promote habitat loss and degradation.	
Criterion E (Quantitative Analysis): Data not available.	

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H. Lickers. 2005. Mohawk Council of Akwesasne, Department of the Environment, Cornwall, Ontario.
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LITERATURE CITED

Armstrong-Philips Ltd. 1983. A study of fish passage in the Grand River basin. A report prepared for the Ministry of Energy in cooperation with the Ontario Ministry of Natural Resources and Grand River Conservation Authority.

Bailey, R.M., W.C. Latta, and G.R. Smith. 2004. An atlas of Michigan fishes with keys and illustrations for their identification. University of Michigan Museum of Zoology Miscellaneous Publications No. 192. 215 pp.

Bowman, M.L. 1959. The life history of the black redhorse, *Moxostoma duquesnei* (Le Sueuer), in Missouri. Ph.D. Thesis, University of Missouri. 144 p.

Bowman, M.L. 1970. Life history of the Black Redhorse, *Moxostoma duquesnei* (Le Sueur), in Missouri. Transactions of the American Fisheries Society 98:546-559.

Brown, B.A. 1984. Comparative life histories of some species of redhorse, subgenus *Moxostoma*, genus *Moxostoma*. Master's Thesis. Indiana State University, Terre Haute, Indiana. 74 p.

Bunt, C.M., B.T. van Poorten, and L. Wong. 2001. Denil fishway utilization patterns and passage of several warmwater species relative to seasonal, thermal and hydraulic dynamics. Ecology of Freshwater Fish 10:212-219.

Canadian Endangered Species Council. 2001. The general status of species in Canada. Ottawa: Minister of Public Works and Government Services.

Clark, J.W. 2004. Redhorse suckers (*Moxostoma*) in the Grand River, Ontario; how do six ecologically similar species coexist? M.Sc. Thesis. Department of Zoology, University of Guelph, Guelph, ON. 79 p.

Coker, G.A., C.B. Portt, and C.K. Minns. 2001. Morphological and ecological characteristics of Canadian freshwater fishes. Canadian Manuscript Report of Fisheries and Aquatic Science. 2554:iv+86p.

Cooke, S.J. and C.M. Bunt. 1999. Spawning and reproductive biology of the Greater Redhorse, *Moxostoma valenciennesi*, in the Grand River, Ontario. Canadian Field-Naturalist 113:497-502.

COSEWIC. 2004. Canadian species at risk, November 2004. Committee on the Status of Endangered Wildlife in Canada (COSEWIC), CWS, Ottawa. 58 pp.

Curry, K.D. and A. Spacie. 1984. Differential use of stream habitat by spawning catostomids. American Midland Naturalist 111(2):267-279.

Dilts, E.W. 1995. Effects of fine sediment and gravel quality on survival to emergence of larval robust redhorse *Moxostoma robustum*. Master's Thesis. University of Georgia, Athens, Georgia. 61 p.

Hackney, P.A., W.M. Tatum and S.L. Spencer. 1968. Life History Study of the River Redhorse, *Moxostoma carinatum* (Cope), in the Cahaba River, Alabama, with notes on the management of the species as a sports fish. Proceedings of the 21st Annual Conference of the Southeast Association of the Game Fisheries Commission. pp. 324-332.

Holm, E. and D. Boehm. 1999. Characteristics of adult *Moxostoma* in Ontario. Unpublished report. Royal Ontario Museum, Toronto, Ontario.

Holm, E. and D. Boehm. 1998. Sampling for fishes at risk in southwestern Ontario. Unpublished report prepared by the Centre for Biodiversity and Conservation Biology, Royal Ontario Museum, for the Ontario Ministry of Natural Resources, Southcentral Region and Aylmer District. Revised 2001.

Howlett, D.T. 1999. Age, growth and population structure of Black Redhorse (*Moxostoma duquesnei*) and golden redhorse (*Moxostoma erythrurum*) in southwest Missouri. M.Sc. Thesis, Southwest Missouri State University. 58 p.

Jenkins, R.E. 1970. Systematic studies of catostomid fish tribe Moxostomidae. Ph.D. Dissertation. Cornell University, Ithaca, New York. 799 p.

Jenkins, R.E., and N.M. Burkhead. 1993. Freshwater fishes of Virginia. American Fisheries Society, Bethesda, Maryland, 1079 p.

Kwak, T.J. and T.M. Skelly. 1992. Spawning habitat, behaviour, and morphology as isolating mechanisms of the golden redhorse, *Moxostoma erythrurum*, and the Black Redhorse, *M. duquesnei*, two syntopic fishes. Environmental Biology of Fishes 34:127-137.

Kay, L.K., R. Wallus, and B.L. Yeager. 1994. Reproductive biology and early life history of fishes in the Ohio river drainage. Tennessee Valley Authority, Chattanooga, Tennessee.

Kott, E., and N. Rathmann. 1985. Distribution and fecundity of the black redhorse sucker (*Moxostoma duquesnei*) in the Upper Grand River basin. Wilfrid Laurier University, Waterloo, Ontario. Research Paper No. 8575. 17 p.

Lee, D.S., C.R. Gilbert, C.H. Hocutt, R.E. Jenkins, D.E. McAllister, and J.R. Stauffer Jr. Editors. 1980. Atlas of North American Freshwater Fishes. North Carolina Biological Survey Publication Number 1980-12.

Mandrak, N.E. and S. Casselman. 2004. Black redhorse (*Moxostoma duquesnei*) critical habitat case study. Canadian Science Advisory Secretariat Research Document. In prep.

Meyer, W.H. 1962. Life history of three species of redhorse (*Moxostoma*) in the Des Moines River, Iowa. Transactions of the American Fisheries Society 91:412-419.

NatureServe. 2004. NatureServe Explorer: An online encyclopedia of life. Version 4.0. NatureServe, Arlington, Virginia. Website: http://www.natureserve.org/explorer. [accessed: September 26, 2004].

Nelson, J.S., E.J. Crossman, H. Espinosa-Perez, L.T. Findley, C.R. Gilbert, R.N. Lea and J.D. Williams. 2004. A list of scientific and common names of fishes from the United States and Canada. Sixth Edition. American Fisheries Society Special Publication 29.

Ontario Ministry of Natural Resources and Grand River Conservation Authority. 1998. Grand River Fisheries Management Plan. 105 p.

Page, L.M., and B.M. Burr. 1991. A field guide to freshwater fishes, North America; North of Mexico. Houghton Mifflin Company. Boston, Massachusetts. 432 pp. + xii.

Parker, B.J. 1989. Status of the black redhorse, *Moxostoma duquesnei*, in Canada. Canadian Field-Naturalist 103:175-179.

Parker, B. and E. Kott. 1980. The black redhorse. Pp. 188-206 in: Rare, threatened, and endangered fish species of Southern Ontario. Beak Inc., Mississauga, Ontario; Supply and Services; Fisheries and Oceans; and National Museum of Natural Sciences.

Portt, C., G. Coker and K. Barret. 2003. Recovery strategy for fish species at risk in the Grand River, Ontario. Draft Recovery Strategy submitted to RENEW Secretariat.

Quinn, J.W., and T.J. Kwak. 2003. Fish assemblage changes in an Ozark River after impoundment: A long-term perspective. Transactions of the American Fisheries Society 132:110-119.

Reid, S. and N.E. Mandrak. 2002. Evaluation of the status of Grand River black redhorse (*Moxostoma duquesnei*) populations and potential limiting factors. Final Report to the Interdepartmental Recovery Fund.

Shumate, R.L. 1988. Age and growth characteristics of *Moxosotoma duquesnei* and *Moxostoma erythrurum* in the Roaring River upstream and downstream of a fish barrier. Master's Thesis. Tennessee Technological University, Cookeville, Tennessee.

Scott, W.B., and E.J. Crossman. 1998. Freshwater fishes of Canada. Fisheries Research Board of Canada Bulletin 184. 966 pp + xvii. Reprinted by Galt House Publications, Burlington, ON.

Smith, C.A. 1977. The biology of three species of *Moxostoma* (Pisces-Catastomidae) in Clear Creek, Hocking, and Fairfield counties Ohio, with an emphasis on the golden redhorse, *M. erythrurum* (Rafinesque). Doctoral dissertation, Ohio State University, Columbus, Ohio. 158 p.

Trautman, M.B. 1981. The fishes of Ohio with illustrated keys. Revised Edition. The Ohio State University Press, Columbus, OH.

Travnichek, V.H., and M.J., Maceina. 1994. Comparison of flow regulation effects on fish assemblages in shallow and deep water habitats in the Tallapoosa River, Alabama. Journal of Freshwater Ecology 9:207-216.

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COLLECTIONS EXAMINED

None.