Status of the Central Stoneroller, *Campostoma anomalum*, in Canada*

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Aside from two records in the upper Niagara drainage, the Central Stoneroller (*Campostoma anomalum*) is restricted to a small area in the Thames River drainage upstream of London. This range is within a rectangle 25 by 45 km. The Thames River drainage population is isolated from the rather widespread populations in the United States. There are no population estimates for Canadian occurences. Available evidence suggests that the small Canadian populations are expanding in range. It is unknown whether this is a long-term trend, whether the expansion is cyclic, or the result of one or two years' reproductive success. This species is one of the few periphyton feeders in Canadian waters. It is the sole representative of the genus in Canada and it has several adaptations to herbivory:cartilaginous lips, ventral mouth, and an elongate intestine wound spirally about the gas bladder. While the Canadian populations are in no known immediate danger, their status, given their very small range and sensitivity to aquatic pollution, should be carefully monitored. Studies are needed to determine their populations levels, and nursery and overwintering requirements. Dam construction in the Thames River should take into account the presence of this species which does not thrive in impoundments. The taxonomy of the Canadian population requires study to determine which subspecies inhabits our waters.

Le roule-caillou (*Campostoma anomalum*) dont on a signalé à deux reprises la présence dans le bassin du cours supérieur de la rivière Niagara, est confiné à une petite partie du réseau hydrographique de la rivière Thames, en amont de London. Son aire de répartition s'étend en deçà d'un rectangle de 25 km sur 45 km. La population de réseau hydrographique de la Thames est isolée des populations des États-Unis, dont l'aire de répartition est passablement étendue. Il n'y a pas d'estimations de populations pour la population canadienne: les données disponibles portent à croire que son aire est en train de s'étendre. On ignore si les données portent à croire que son aire est en train de s'étendre. On ignore si cette tendance se maintiendra à long terme, si elle s'inscrit dans un cycle particulier ou si elle est due à une ou deux bonnes années de reproduction. Il s'agit d'une des rares espèces des eaux canadiennes à se nourrir de périphyton. Le roule-caillou est le seul représentant de son genre au Canada. Il présente plusieurs caractéristiques des herbivores: lèvres cartilagineuses, bouche infèrieure, intestin allongé et enroulé autour de la vessie natatoire. Bien que les populations canadiennes ne semblent pas en danger pour l'instant, on devrait les surveiller étroitement vu leur répartition restreinte et leur sensibilité à la pollution aquatique. Il faudrait entreprendre des études pour déterminer les niveaux des populations, ainsi que leurs besoins pour ce qui est des aires de croissance et d'hivernage. Avant d'entreprendre la construction d'un barrage sur la rivière Thames, on devrait tenir compte de la présence de cette espèce, qui ne se développe pas bien dans les bassins de retenue. La classification de la population canadienne requiert la réalisation d'études qui permettront de déterminer quelle sous-espèce habite nos cours d'eau.

Key Words: Central Stoneroller, *Campostoma anomalum*, cyprinids, rare species, minnows, Ontario.

The Central Stoneroller, *Campostoma anomalum*, is a light brown coloured member of the minnow family. The fish (Figure 1) is characterized by horny sheaths on the upper and lower jaws and an intestine coiled about the gas bladder. The species is one of the larger minnows, maximum length up to 28.7 cm (Lennon and Parker 1960), and a maximum age of six years. The species resembles the River Chub, *Nocomis micropogon*, and smaller White Suckers, *Catostomus commersonii*. *Campostoma anomalum* is the only Canadian representative of the genus and it was unknown in Canada prior to 1972 (Gruchy et al. 1973). It is one of the few fishes which feed on periphyton.

Distribution

The Central Stoneroller occurs in streams throughout much of the eastern and central United States (*see* Burr 1980). In the west, scattered populations occur in the Dakotas, including sections of the Red River watershed in the Hudson Bay basin. Scattered populations also occur in the Mississippi River basin in Wyoming, Colorado, and New Mexico. In the south the stoneroller is found in the Rio Grande drainage in New Mexico, Texas, and Mexico, and in the headwaters of many rivers along the Gulf slope from Texas to Georgia. The eastern limit of the range of the stoneroller extends to the Atlantic drainage along the eastern limit of the Appalachian highlands

*Rare status approved and assigned by COSEWIC April 1985.

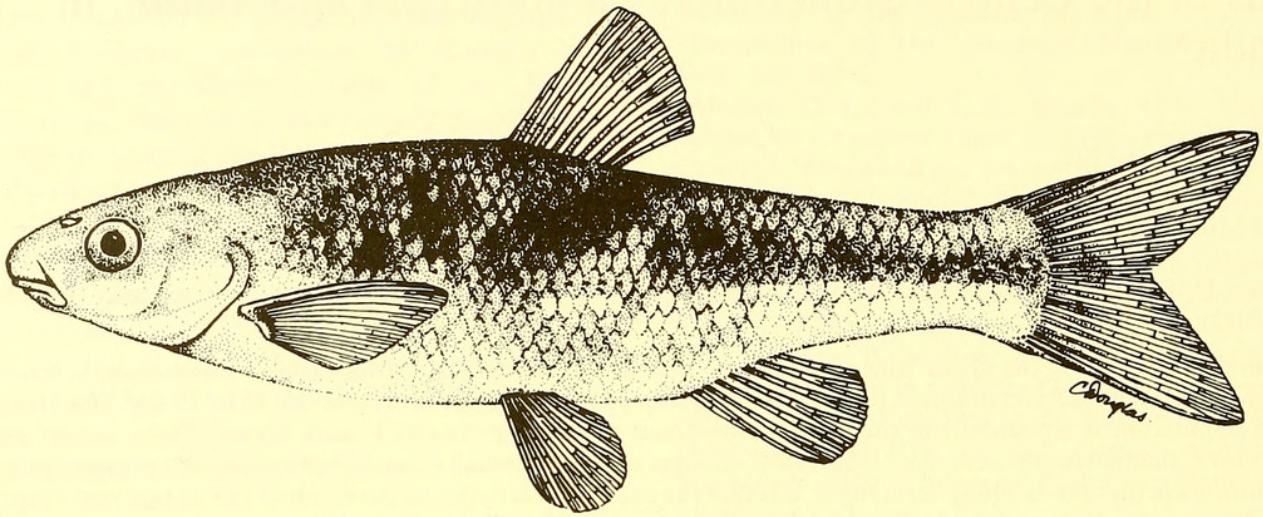

FIGURE 1. Central Stoneroller, *Campostoma anomalum* (drawing by C. H. Douglas, National Museum of Natural Sciences).

from Georgia to New York. In the northern part of its range, this species occurs in a few tributaries of Lake Ontario in New York and Ontario, in the Lake Erie and Mississippi River drainages of Ohio, in the Lake St. Clair drainage of Ontario, and in the Mississippi River basin of Wisconsin and Minnesota.

In Ontario, the stoneroller is found primarily in the Thames River watershed. A small number of specimens have also been reported from the Niagara River (Figure 2). In the Thames River watershed the stoneroller occurs in the North Thames River from Mitchell, Middlesex County (43°27′30″N, 81°12′20″W), to London, Middlesex County (42°58′45″N, 81°58′45″W), and in the Thames River from Dorchester, Middlesex County (42°59′13″N, 81°03′58″W), to London. Collections have also been made from Whirl Creek, Fish Creek, Nineteen Creek, Otter Creek, Gregory Creek, Wye Creek, Stoney Creek, Medway Creek, and the Avon River which flow into the North Thames River, and from Pottersburg Creek and Waubuno Creek, which flow into the Thames River. Stonerollers have also been collected in Ontario from the Niagara River at the mouth of Frenchman's Creek near Fort Erie, Welland County (42°56′42″N, 78°55′30″W), and from the Niagara River at Fort Erie (42°56′22″N, 78°55′05″W).

The stoneroller's Ontario range in the Thames River watershed fits within a rectangle 25 by 45 km and is located over 125 km from American populations in Michigan. Ontario specimens from the Niagara River are closer to American populations in New York than to the Thames River populations, which are over 160 km away. Thus the Thames River populations are disjunct from both Niagara and American St. Clair basin populations.

Protection

The Ontario populations are under no special legal or other form of protection except for the general protection of habitat sections of the Fisheries Act.

Population Size and Trend

The population size of stonerollers in Ontario has not been estimated. However, the range of the stoneroller population in the North Thames River appears to have expanded considerably over the past seven years. The 1972 survey of Gruchy et al. (1973) covered many of the areas where this species is now abundant, yet specimens were captured by Gruchy only in Fish Creek and its tributary, Nineteen Creek (Gruchy, personal communication). In surveys carried out by the Ontario Ministry of Natural Resources up to 1975, stonerollers were captured over a wider area but no specimens were taken north of St. Marys in the North Thames River. The apparent distribution of this species in 1979 in the North Thames River, as documented in this study, was considerably more extensive than indicated by earlier Ontario Ministry of Natural Resources surveys, suggesting continued expansion of this population.

Although this range expansion is encouraging, too much confidence should not be placed in maintenance or continued expansion of these populations. The cause of the expansion is as yet unknown. It is possible that expansion is due to temporary amelioration of habitat due to an upswing in, for example, climatic conditions. Further observations in the summer of 1982 by Thomas A. Edge suggested that the species was maintaining itself.

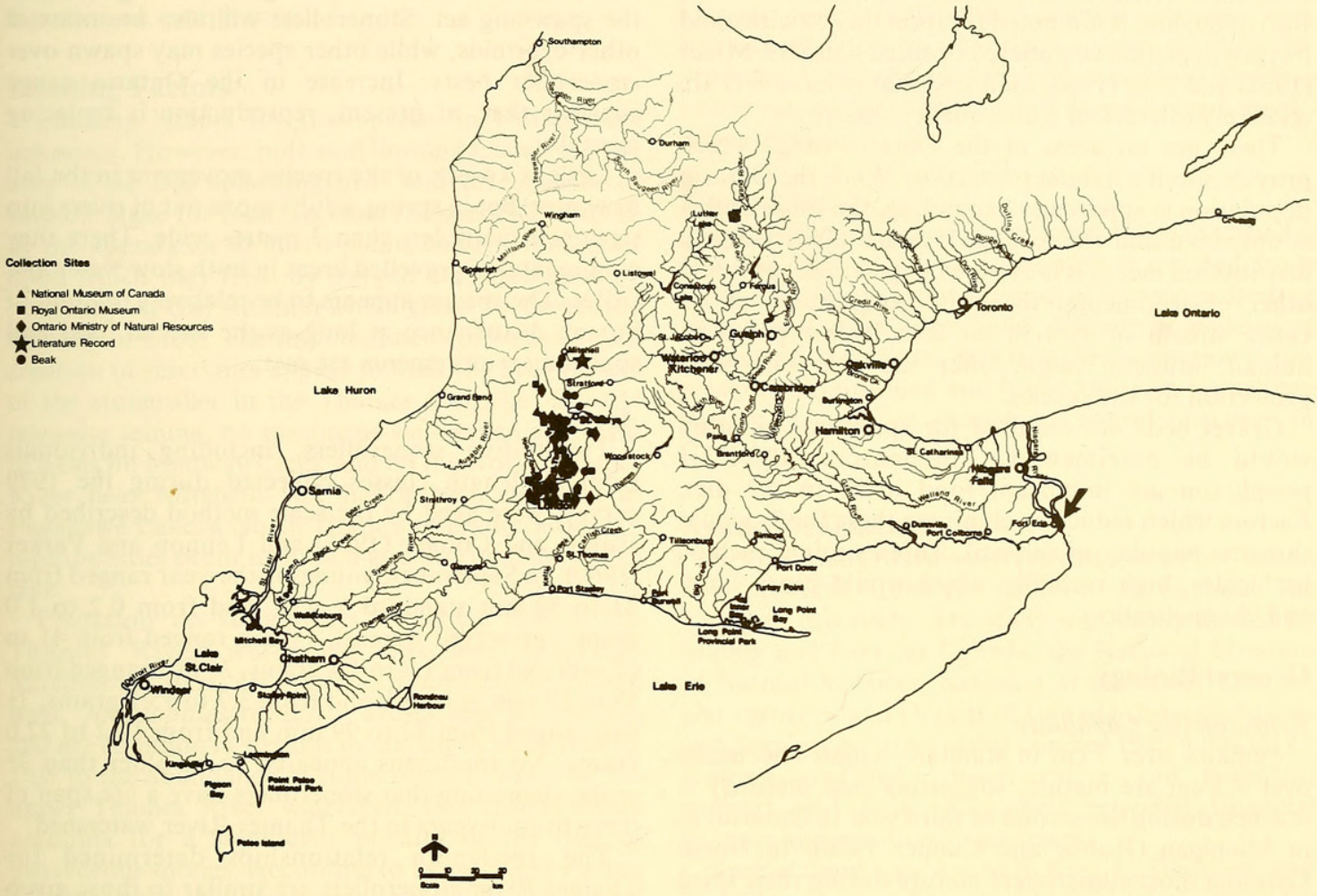

FIGURE 2. Collection records of the Central Stoneroller in Ontario (adapted from Parker and McKee 1980).

Habitat

Suitable habitat is widespread in the central United States, but judging by the restricted distribution in Canada and in Michigan, the species is at the northern limit of its range and some factors, perhaps temperature, are limiting its occurrence in Ontario. Judging merely by its distribution in Ontario, suitable habitat is localized. Trends in quality and quantity of critical habitat are unknown, although the stoneroller's recent expansion suggests that suitable habitat may be increasing. This may be due to temporary factors such as a warming trend in the climatic cycle, or possibly to man-made influences such as increased periphyton. On the other hand, the spread might have resulted simply from two or three years' successful spawnings.

In the Thames drainage, *C. anomalum* occurs in both pools and riffles of small to medium-sized streams. Stream widths at capture sites ranged from 2 to 35 m. In riffles, stonerollers were often captured in clumps of *Potamogeton pectinatus* where water velocities were reduced. Large stonerollers (5 cm standard length) were usually found in relatively deep riffles (to 0.5 m) and pools (to 1.5 m), while smaller fish were more common in shallower pools and riffles. Lennon and Parker (1960) also noted that this species normally occurs in creeks and small rivers.

Over the range of *C. anomalum* in the Thames drainage, stream gradients average 1.0 to 3.7 m/km. Downstream from London where the stoneroller is absent, gradients drop abruptly to an average of 0.5 m/km. Elsewhere this species is abundant in streams having relatively high gradients but is generally absent from low-gradient streams (Lennon and Parker 1960).

Campostoma anomalum is apparently tolerant of some variation in water quality. In mid-September this species was found at temperatures of 17.5–25°C and oxygen levels of 3–17 mg/L. During late spring, temperatures of 14–25°C and dissolved oxygen concentrations of 10–16 mg/L were observed. Diurnal fluctuations of 3–25 mg/L oxygen were common during low flow in the North Thames (Wong and Clark 1976). Turbidity levels also fluctuate considerably in this system, largely owing to intensive agriculture and erosion. While the stoneroller prefers

clear water (Hubbs and Lagler 1947; Trautman 1957; Burr 1980) and is not noted for its ability to withstand oxygen depletion or polluted or silted habitats, Miller (1964) and Burr (1980) indicated that stonerollers are relatively tolerant of water quality variations.

There are no areas of the Ontario range which provide specific habitat protection. While the Ontario population is apparently expanding, the cause of this is unknown and the localized nature of its Ontario distribution means it is exposed to pesticide spills and other environmental disasters. Acquisition of an entire stream or two in an area little-exposed to human influence might offer the best long-term protection for the species.

Gravel beds are required for spawning; siltation would be detrimental. Filamentous algae or periphyton are important food items in the diet. Factors which reduce or eliminate these foods would threaten population survival. Threats might include herbicides, high turbidity which would block light, and channelization.

General Biology

Reproductive Capability

Females over 7 cm in standard length and males over 7.5 cm are mature, suggesting that maturity is reached during the second or third year in Ontario, as in Michigan (Hubbs and Cooper 1936). In North Carolina most stonerollers mature during their third or fourth year and females usually mature before males (Lennon and Parker 1960).

Males and females in spawning condition were captured in small tributaries of the North Thames River in mid-May at water temperatures of 14 to 16°C. Specimens were all spawned out in creeks where the water temperature averaged 21°C in late May. Miller (1964) and Smith (1935) reported a wider temperature range for spawning stonerollers in the United States: Miller stated that spawning begins in mid-April and continues until early June over a temperature range of 14 to 24°C in New York, and Smith suggested an even wider spawning temperature range of 12 to 27°C for Illinois populations.

Few specimens were captured in the main stream of the North Thames River during the spring survey. Schools of spawning stonerollers were captured in riffles and eddies of small tributary creeks (usually less than 3 m in width) with clean gravel bottoms. The water velocity in these creeks ranged from 0.30 to 0.45 metres/second. Dissolved oxygen levels averaged 10 to 16 mg/L.

The spawning process has been described in detail by Langlois (1937) and Miller (1962, 1964). Males build nests of gravel in both slow water and riffle areas. Males are territorial and guard the nests. Eggs are covered with sand and fine gravel during and after the spawning act. Stonerollers will also use nests of other cyprinids, while other species may spawn over stoneroller nests. Increase in the Ontario range suggests that, at present, reproduction is replacing mortality.

Little is known of the species movement in the fall or winter, but in spring, adults move out of rivers into streams usually less than 3 metres wide. There they congregate on gravelled areas in both slow water and riffles. The species appears to be relatively tolerant of human disturbance as long as the special food and spawning requirements are met.

Age

Twenty-five stonerollers, including individuals from all length classes collected during the 1979 survey, were aged by the scale method described by Hubbs and Cooper (1936) and Lennon and Parker (1960). In September, young-of-the-year ranged from 23 to 39 mm standard length, and from 0.2 to 1.0 grams (preserved weight), 1+ fish ranged from 41 to 62 mm and from 1.3 to 4.4 grams, 2+ fish ranged from 55 to 87 mm in length and from 3.7 to 15.1 grams, 3+ fish ranged from 82 to 99 mm and from 15.2 to 22.0 grams. No specimens appeared to be older than 3+ years, suggesting that stonerollers have a life span of three to four years in the Thames River watershed.

The age-length relationships determined for Thames River stonerollers are similar to those given by Lewis and Elder (1953) and Gunning and Lewis (1956) for Illinois populations, and by Carlander (1969) for Ohio populations. In the northern United States this species has a maximum age of about 3+ years and maximum total lengths are reported to be 143 mm in Illinois, 152 mm in Michigan, and 178 mm in Ohio (Gunning and Lewis 1956; Hubbs and Cooper 1936; Trautman 1957, respectively). Lennon and Parker (1960) found a maximum age of six years and a maximum length of 287 mm for stonerollers in North Carolina.

Food

Lennon and Parker (1960) reported that stonerollers feed mostly on periphyton in North Carolina. Carlander (1969) reported that this species feeds primarily on algae but also consumes some chironomid larvae. Trautman (1957) reported that stonerollers consume "micro-plants and small animals". This species was observed scouring the bottom over the spawning areas of Rosyface Shiners, *Notropis rubellus*, (Pfeiffer 1955) and Black Redhorse, *Moxostoma duquesnei*, (Bowman 1959), but egg predation was not verified in either case.

The subterminal mouth, cartilaginous lips, elongate intestine and black peritoneum are all probably

morphological adaptations that aid in feeding on, and digestion of, periphyton.

Limiting Factors

Limiting factors for this species in Ontario are unknown. However, potential limiting factors are the area of silt-free spawning beds and the amount of suitable algae for food. In Ohio the species is limited by the abundance of micro-plants and small animals upon which they feed, by oxygen depletion, and by pollutants or clay siltation which greatly decrease the amount of food. The impoundment of streams and creation of reservoirs appear to limit the distribution of the stoneroller in the Thames drainage. Despite intensive seining, no specimens were taken upstream of dams on Medway Creek and on the North Thames River near Mitchell. Nor has it been reported in Fanshawe Lake, a North Thames reservoir, although high densities occur upstream and downstream of the lake.

Predation on stonerollers by other fish in the Thames River watershed was not observed. Smallmouth Bass, *Micropterus dolomieui*, and Rock Bass, *Ambloplites rupestris*, are largely piscivorous and are common in streams inhabited by stonerollers. Due to the abundance of stonerollers in much of the upper Thames River watershed, this species likely accounts for a significant portion of the diet of piscivorous species. According to Lennon and Parker (1960), centrarchids appear to control the number of stonerollers by predation. There is no evidence, however, to suggest that predation is a limiting factor at present in Ontario.

Most stonerollers collected in Ontario harboured the "black-spot" trematode, *Uvulifer*, and infestations were heavy in some specimens. Berra and Au (1978) found that black-spot infestations are often heavier in this species than in other cyprinids. Hoffman (1967) provided a check list of stoneroller parasites.

Special Significance of the Species

Lennon and Parker (1960) summarized the importance of stonerollers to man. This species is locally favoured both as food fish and as a bait fish in the United States. Fishermen use bits of worms on small hooks to catch these fish when the latter congregate over spawning beds. This species is reputed to be one of the best bait minnows for bass, pickerel, and catfish. It can be raised in bait production ponds and makes an interesting aquarium fish. Stonerollers have been known to limit the production of Rainbow Trout, *Salvelinus gairdneri*, by destroying trout redds during spawning.

This species is the only representative of its genus in Canada and has a number of unique morphological characters such as a gut spirally wound around its gas bladder and cartilaginous sheaths on the lips. Ecologically it is an important species because few other Canadian species feed on filamentous algae or on the micro-plants and animals found in sand, muck, or periphyton.

Evaluation

Since this species has a very small range in Canada, and the Thames River population is isolated from other populations, and because of its unique feeding niche, the Central Stoneroller deserves some level of protection in Canada. Whereas the population is not presently diminishing and is not under an immediate threat, the species should be considered rare in Canada.

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The information in this report is based on a study by Bradley J. Parker and Paul M. McKee (1980) published in part by McKee and Parker (1982), plus some data collected by Thomas A. Edge in the summer of 1982.

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