

2023 LAKE WHITEFISH SPAWNING AND HABITAT INVESTIGATIONS IN THE VICINITY OF THE MATABITCHUAN GS, MATABITCHUAN RIVER



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1 Introduction

C. Portt and Associates was retained by Ontario Power Generation Inc. (OPG) to conduct a Lake Whitefish (*Coregonus clupeaformis*) spawning and spawning habitat assessment in 2022 and 2023 at the Matabitchuan Generating Station (GS) on the Matabitchuan River, approximately 37 km south of Halleybury, Ontario (Figure 1-1). This investigation is in support of the assessment of options for development opportunities at this site, which considers overhaul, refurbishment, and redevelopment. This document presents the results of the second Lake Whitefish spawning field investigations, undertaken in November 2023. The results of the 2022 field investigations were reported previously (C. Portt and Associates, 2023).



Figure 1-1. Location of the Matabitchuan Generating Station.

2 Background

The four unit generating station was constructed in 1910 with an installed capacity of 10,140 kilowatts, a hydraulic head of 95 m, and a maximum flow of 14 m³/s (OMNR and OPG, 2007; OPG 2020). It is located within the lower portion of the Matabitchuan River watershed, which flows into Lake Timiskaming. There are three water control dams upstream from the Matabitchuan GS. Net Creek Dam and North Milne Dam, owned by the Ontario Ministry of Natural Resources (OMNR), are located in the upper watershed. Rabbit Lake Dam, owned by OPG, is used to control flow from Rabbit Lake into the Matabitchuan River and Fourbass Lake (Figure 1-1; OMNR and OPG, 2007). The Matabitchuan GS is the only hydroelectric facility in the watershed.

Figure 2-1 identifies project infrastructure and illustrates the general waterbody and watercourse configuration in the vicinity of the GS. The Matabitchuan GS control dam (sluiceways) and intake structure are located on Fourbass Lake, approximately 800 m apart. The control dam and intake structure divert water to the powerhouse through penstocks, bypassing approximately 3 km of the Matabitchuan River that is now the spillway. Downstream from the GS the Matabitchuan River winds 3.6 km east to Lake Timiskaming (Figure 1-1; Figure 2-1). The low gradient of the river downstream of the GS means that the GS tailrace and the lower portion of the spill channel are readily accessible to Lake Whitefish from Lake Timiskaming.



Figure 2-1. Matabitchuan River in the vicinity of the Matabitchuan GS.

3 Field Investigations

3.1 Methods

To determine the proper timing and locations for Lake Whitefish spawning observations, knowledge of the environmental conditions required for Lake Whitefish spawning is necessary. These are:

- Lake Whitefish normally spawn when water temperatures drop below 7.8°C in the fall (Scott and Crossman, 1973; Holm *et al.* 2021), but peak at a lower temperature (Scott and Crossman, 1973). Becker (1983) states that shoal temperatures early in a spawning run were 6.1-4.4°C. At an Ontario location that is similar in latitude and physical character (Mattagami Lake Dam between Gogama and Timmins), C. Portt and Associates staff observed Lake Whitefish during their spawning run in the river when water temperatures were 4.7°C (2007) and 5.5°C (2009), but not at 2.0°C (2006) and 2.7°C (2008). At this location on the Matabitchuan River in 2022, C. Portt and Associates staff (G. Coker) observed Lake Whitefish during their spawning run when water temperatures were 6.7-7.6°C
- Lake Whitefish usually spawn over hard or stony bottom or sand (Scott and Crossman, 1973), but have also been known to spawn over mud, clay, and detritus (Stewart and Watkinson, 2004), and silty and weedy bottoms (Coad *et al.* 1995).
- Lake Whitefish usually spawn at water depths less than 8 m (Scott and Crossman, 1973; Holm *et al.* 2021).
- Lake Whitefish are usually restricted to the cool, well oxygenated regions of lakes and rivers (Coad *et al.* 1995; Nelson and Paetz, 1992; Smith, 1985). During their fall spawning period they move to the usually shallower spawning habitats of shoals and shorelines in lakes or shallow portions of rivers (Becker, 1983; McPhail and Lindsey, 1970).

Two temperature loggers (Tidbit MX Temp 5000) were deployed by OPG personnel in the Matabitchuan River in the vicinity of the GS. One was deployed 52 m upstream of the Matabitchuan GS tailrace in the spill channel on October 11, 2023, and the other was deployed in the GS tailrace on October 12, 2023. The loggers recorded water temperature every hour. The logged temperature data were periodically offloaded by OPG staff and sent to C. Portt and Associates for evaluation. The frequency of downloads was increased as the water temperature approached Lake Whitefish spawning temperatures. The water temperature data and monitoring of local weather forecasts were used to determine the time of the field investigations.

Field investigations were conducted on November 7-8, 2023, by C. Portt and Associates staff (C. Portt, G. Coker), accompanied by OPG staff (Louis Belanger, Sean Goddard, Gillian MacLeod) two members of the Timiskaming First Nation (Mike Laderoute, Laurent Cardinal), and two members of the Temagami First Nation (Chris Ricker, Jacob Evans). The study area was examined during daylight on the first day to identify safety hazards, access routes, river conditions, barriers to upstream migration by Lake Whitefish and potential Lake Whitefish spawning habitat.

Substrate characteristics observed during this field investigation, and substrate mapping in the study area during 2020 field investigations by C. Portt and Associates, informed the locations examined for spawning

Lake Whitefish. A Garmin GPSmap 76CSx Global Positioning System (GPS) unit was used to determine the coordinates of key features and observations, including the locations of digital photographs of habitat. Additional water temperature readings were taken at various locations during the field investigation, using a hand-held electronic thermometer (Hanna Instruments, Checktemp pocket thermometer. Accuracy = 0.2°C).

On the nights of November 7 (18:30-19:45) and 8 (18:30-20:00), a powerful spotlight (1.5 million candlepower) was used from shore to search for Lake Whitefish, which are differentiated from other fishes by their size, body shape and fin placement, and colour. Several additional spotlights were utilized by other participants, increasing the likelihood that Whitefish would be observed if present. In addition to searching for fish in the water, observers looked for typical spawning behaviour, including jumping and otherwise breaking the water surface (Becker, 1983; Scott and Crossman, 1973), which was observed in 2022, to identify locations of spawning Lake Whitefish.

The locations searched for spawning Lake Whitefish are shown in Figure 3-1. The areas investigated on November 7 included the tailrace and approximately 70 m along the northwest bank of the spill channel upstream of the tailrace; upstream and downstream from the road bridge; approximately 600 m along the southeast and east side of the spill channel upstream of the bridge, to investigate how far upstream Whitefish could possibly go; and, approximately 170 m along the southeast side of the spill channel downstream of the road bridge, which includes approximately 120 m of the river downstream of the tailrace. On November 8, approximately 286 m downstream of the tailrace on the west side of the river was added to investigate potential spawning areas farther downstream in response to the higher flow velocities in 2023 at locations where spawning activity had been observed in 2022, and the approximately 600 m along the southeast and east side of the spill channel upstream of the bridge was reduced to about 178 m because it was thought that, based on high water velocities, Whitefish could not spawn farther upstream. Otherwise, the areas investigated were the same both nights.

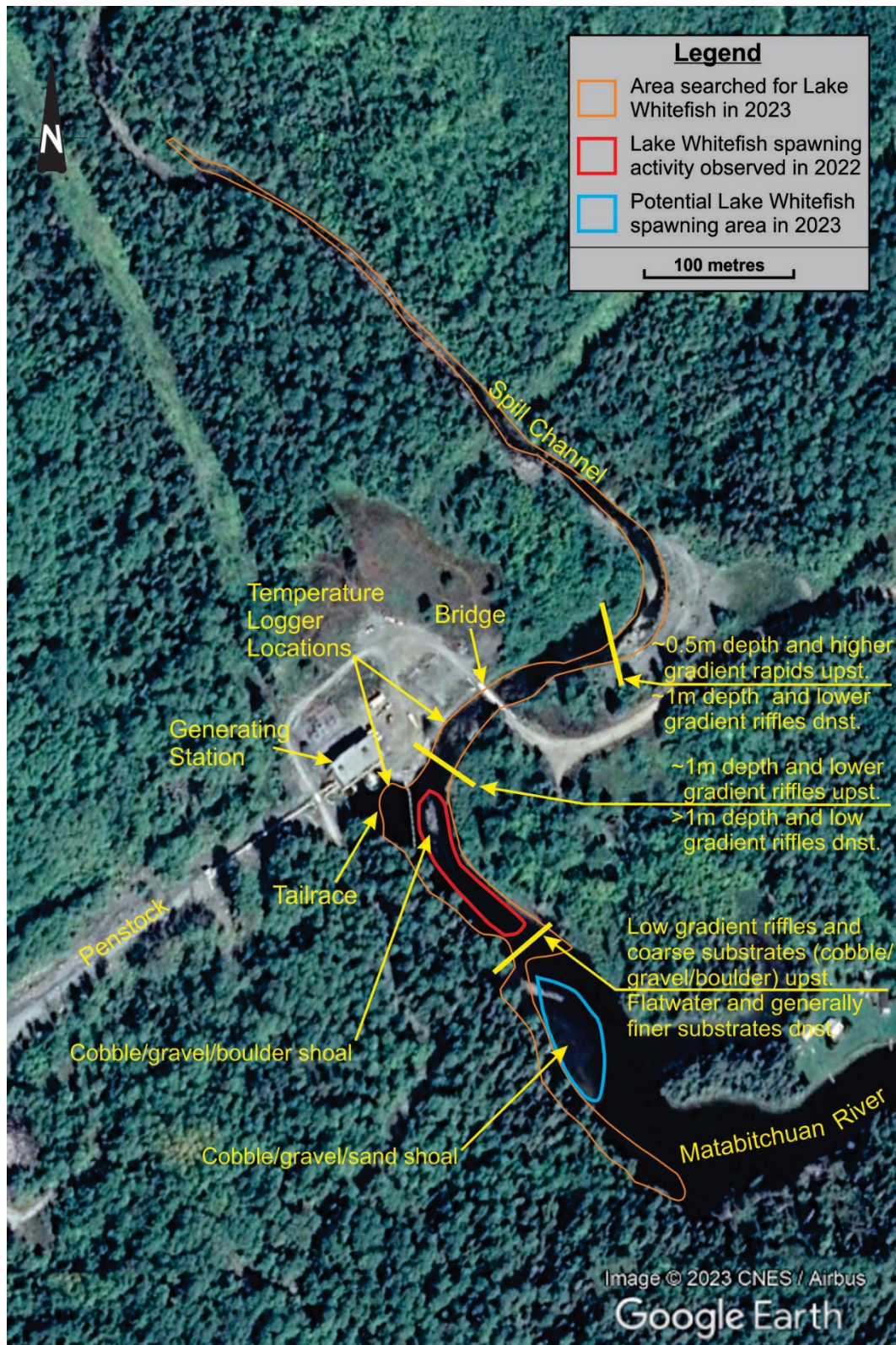


Figure 3-1. Area examined for Lake Whitefish on November 7 and 8, 2023, location of observed spawning activity in 2022, shoal considered to have high potential for spawning in 2023, locations of the temperature loggers, and general habitat characteristics.

3.2 Results and Discussion

3.2.1 Water temperature and flow

The water temperature decreased steadily in the first week of November 2023, falling below 7.8°C for the first time in the spillway on November 6, and in the GS tailrace on November 7 (Figure 3-2). The rate of water temperature decline was similar for the spillway and the tailrace, but diurnal temperature fluctuations were greater in the spillway, consistent with the water's exposure to ambient air temperature in the 3 km long spillway, compared to water that passed through the GS. On the days of the spawning investigations (November 7 and 8) the logged water temperature in the spillway averaged 7.3°C and fluctuated between 6.8 and 8.0°C, while the logged tailrace water temperature averaged 7.7°C and fluctuated between 7.4 and 8.1°C. Water temperatures taken with the hand-held thermometer at the time of the evening observations, within the spill channel and downstream of the tailrace where the tailrace and spill channel flows begin to mix, ranged between 7.2 and 7.3°C, which is within the preferred spawning range for Lake Whitefish.

Discharges through the tailrace, the spill channel, and total discharge during the field investigations are presented in Figure 3-3. Total discharge was relatively constant at approximately 22 m³/s prior to and during the 2023 field investigations and almost equally divided between flow through the GS and through the spillway.

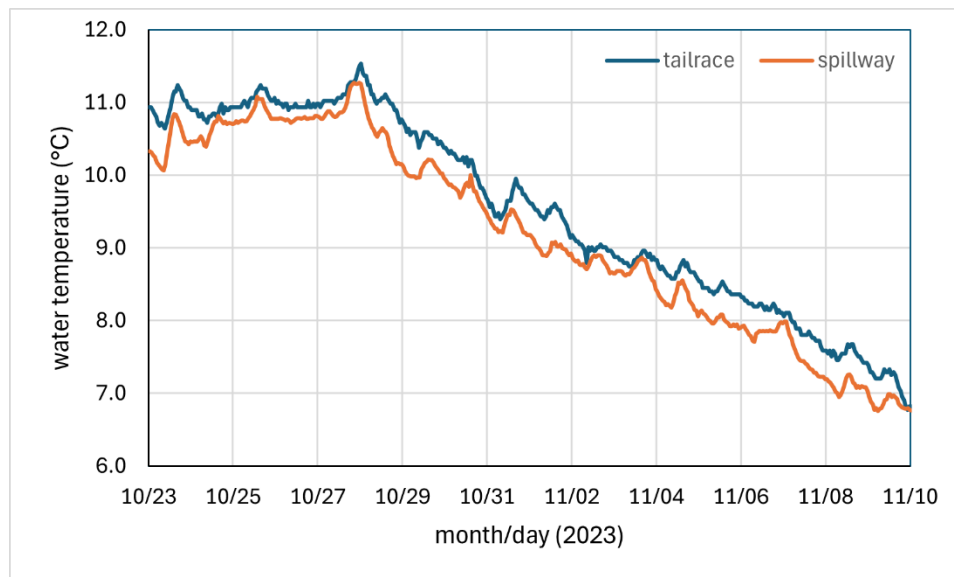


Figure 3-2. Water temperature in the Matabitchuan River, in the GS tailrace and at the bottom of the spillway, for the period October 23 – November 10, 2023.

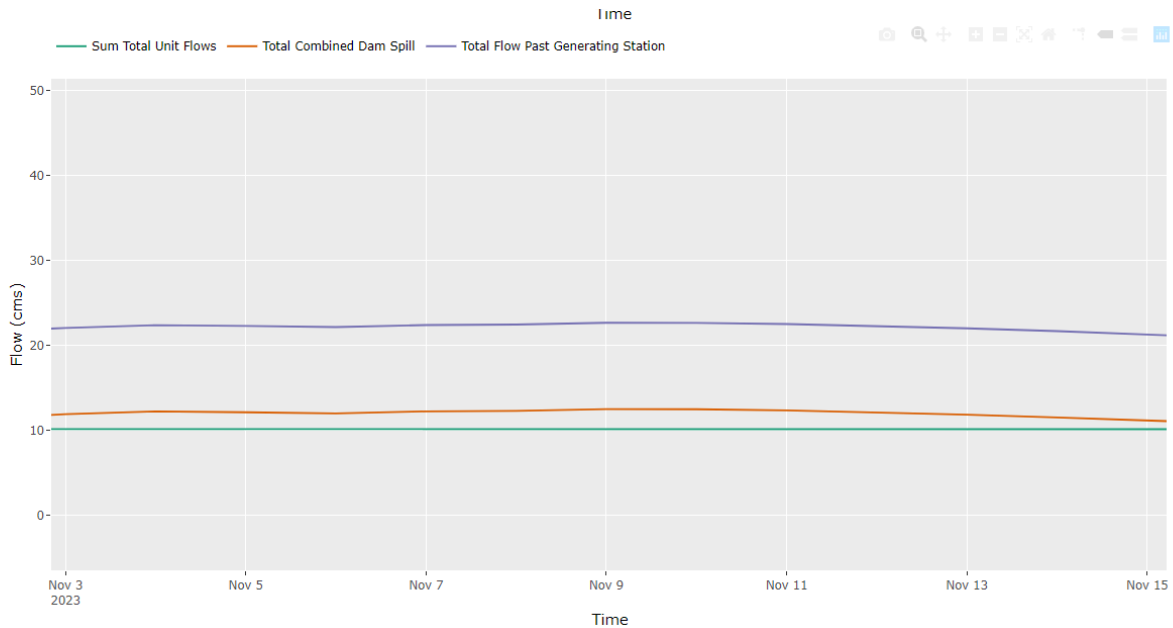


Figure 3-3. Discharge in m^3/s (cms) through the GS and tailrace (Sum Total Unit Flow), through the spillway (Total Combined Dam Spill), and the total river discharge (Total Flow Past the Generating Station) for the period November 3-15, 2023. Graph provided by OPG.

3.2.2 Spawning Observations

Lake Whitefish Spawning activity was not seen during either evening of observations in 2023. No Lake Whitefish were observed on November 7, 2023. On November 8, 2023, a Lake Whitefish was observed swimming just below the water's surface, approximately 195 m downstream of the tailrace. In the same area, the smell of fish spawning, which was present during Lake Whitefish spawning in 2022, was identified briefly by G. Coker and several of the other attending personnel, and the sound of splashing was also detected briefly. A swimming beaver was also observed in this area, which might have been the source of the splashing that was heard. The observed Lake Whitefish and the smell of fish spawn adjacent to a shoal that appeared to be potential spawning habitat under the river discharge conditions in 2023 (Figure 3-1) suggests that spawning was occurring there. Unfortunately, the potential spawning shoal is too far from the river edge to be directly observed from shore. A second fish the size of a mature Lake Whitefish was observed on the evening of November 8, approximately 60 m downstream of the tailrace, but it was not definitively identified.

The area in which the spawning activity was observed in 2022 and the area where spawning activity is thought to have been occurring in 2023 (Figure 3-1) have the basic attributes of typical Lake Whitefish riverine spawning habitat, with sufficient depth for the rising of paired fish while emitting eggs and sperm, some gentle but complex currents and eddies, and coarse substrates. Flow through the GS was the same in 2022 and 2023 ($10.3 \text{ m}^3/\text{s}$). Flow through the spillway ranged from <1 to 3.4 in 2022 and was approximately $12 \text{ m}^3/\text{s}$ in 2023. Consequently, in 2023 water velocities were higher (Figure 3-4) and may have been too high for Lake Whitefish to spawn in the location where spawning was observed in 2022.

Downstream from the shoals described above the substrate is finer and the current velocities are lower and thought to be unsuitable for Lake Whitefish spawning. Upstream, the spillway is shallow (Figure 3-5) and soon becomes fast and turbulent (Figure 3-6). Based upon the examination of upstream spillway habitat characteristics conducted by C. Portt and Associates in 2020, there are no locations farther

upstream that would provide suitable spawning habitat for Lake Whitefish, and there are several bedrock waterfalls that prevent fish from moving upstream to the Fourbass Lake control dam.



Figure 3-4. View downstream from the road bridge showing the difference in spill channel flow and velocity between 2022 (upper photo) when the spill channel discharge was $3.4 \text{ m}^3/\text{s}$, and 2023 (lower photo) when spill channel discharge was $12.1 \text{ m}^3/\text{s}$.



Figure 3-5. View upstream from the road bridge, showing the lower gradient portion of the spillway. November 8, 2023. The substrate is visible, illustrating the shallow nature of this area.

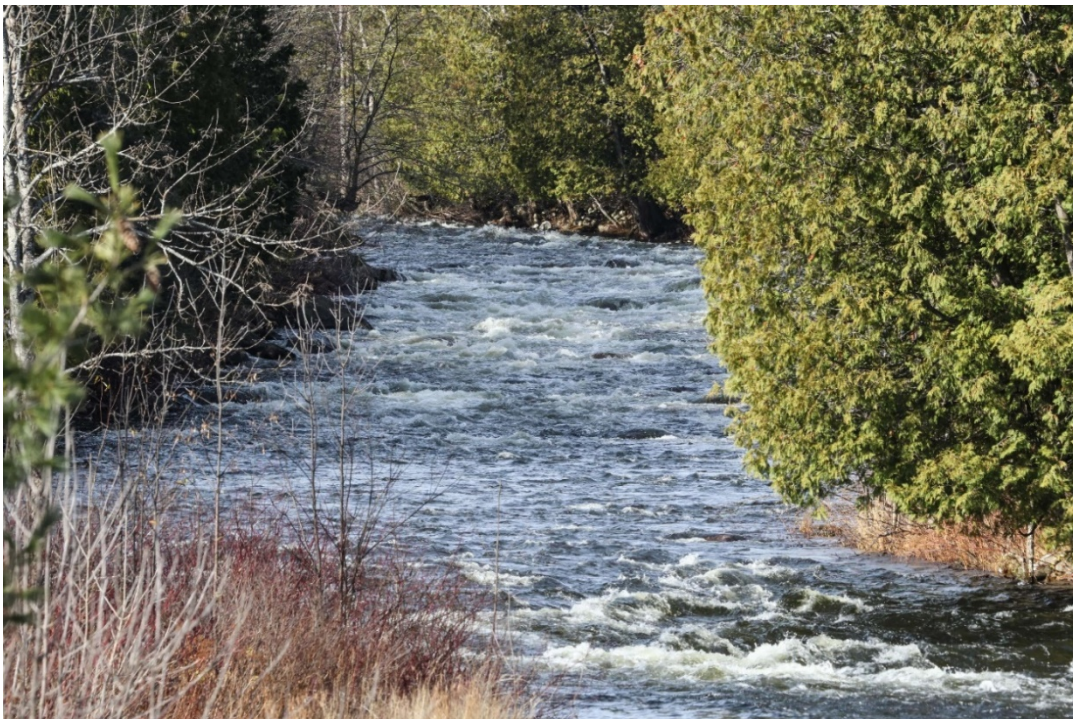


Figure 3-6. View of the spillway, looking upstream approximately 200 m upstream of the road bridge. November 8, 2023.

4 Conclusions

Lake Whitefish spawn in the Matabitchuan River immediately downstream of the Matabitchuan GS tailrace. Lake Whitefish were observed displaying spawning behaviour on three consecutive nights in 2022 but no spawning behaviour was observed in 2023. On the second evening of observations in 2023, an adult Whitefish was observed at the water's surface and the odour of fish spawn was detected adjacent to a potential spawning shoal located about 138 m downstream from the spawning location observed in 2022, though the potential spawning shoal could not be seen due to its distance from shore. Higher river discharge in 2023 resulted in higher flow velocities at the 2022 spawning location, which may have affected its suitability for spawning. The downstream potential spawning shoal is located in a wider and generally deeper section of river (Figure 3-1) and therefore it will always have slower flow velocities than the upstream location where spawning activity was observed in 2022.

Similar to the 2022 findings, habitat conditions within the spill channel in 2023 appear to be unsuitable for Lake Whitefish spawning. The spill channel, especially upstream of the road bridge, is too shallow, fast, and turbulent for Lake Whitefish spawning.

In conclusion, Lake Whitefish from Lake Timiskaming utilize the Matabitchuan River for spawning at suitable locations downstream of the Matabitchuan River GS tailrace. The precise locations used may depend upon the river discharge at the time of spawning.

5 References

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