

WATER TEMPERATURES DECLINED WITHIN THE LES CHENEAUX ISLANDS
DURING A PERIOD OF UNPRECEDENTED RISE IN LAKE HURON WATER LEVEL

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ABSTRACT: The Les Cheneaux Watershed Council has monitored water quality variables within the Les Cheneaux Islands (LCI) since 2001, a project sponsored by the Les Cheneaux Islands Association. A period from 2013 through 2020 was different from previous years in that the Lake Huron rise (LHr) was substantial every year. Resulting LHr of 171 cm (67.4 in) occurred from a record low level in January 2013 to a record high level during the summer months of 2020. Water temperature profiles during the sampling season from May through Sep decreased 5°C (9.5°F) during the LHr. This study examines the relationship between L Huron level and LCI temperatures during those eight years. It is possible that the simple incursion of cooler LH water into the LCI channels could have contributed to lower seasonal temperatures. If that hypothesis is true, then such volumes of cooler, low-nutrient LH water could affect food webs within the islands which could have long lasting environmental effects on aquatic systems, especially the aquatic plant community. A follow-up examination of the phosphorus and plankton variation during the same period will follow this study.

RESULTS/DISCUSSION: Sites annually monitored from 2013 through 2020 are shown in Fig. 1 which identifies distinct zones within the LCI chain based upon nutrient availability, primarily phosphorus, to support the growth of rooted aquatic plants (macrophytes) and phytoplankton (free-living algae in the water column, or plankton). The Outer Island Zones (OIZ) typically have lower nutrition than the Inner Island Zone (IIZ). The OIZ share more exchange of water from LH and are deeper and colder. By comparison, the IIZ is characterized by shallower, warmer waters found more distant from open LH waters. The two OIZ are comprised of sites: 1,7,8,9 and the IIZ is comprised of sites: 4B, 4C and 5. Remaining sites are considered transition zones between the OIZ and IIZ. Mean temperatures for 12 sample sites monitored in 2020 are shown in Fig. 2. The peak temperature occurred in August, 2020, and temperatures varied from 9°C to 19.5°C, a range of 10.5°C.

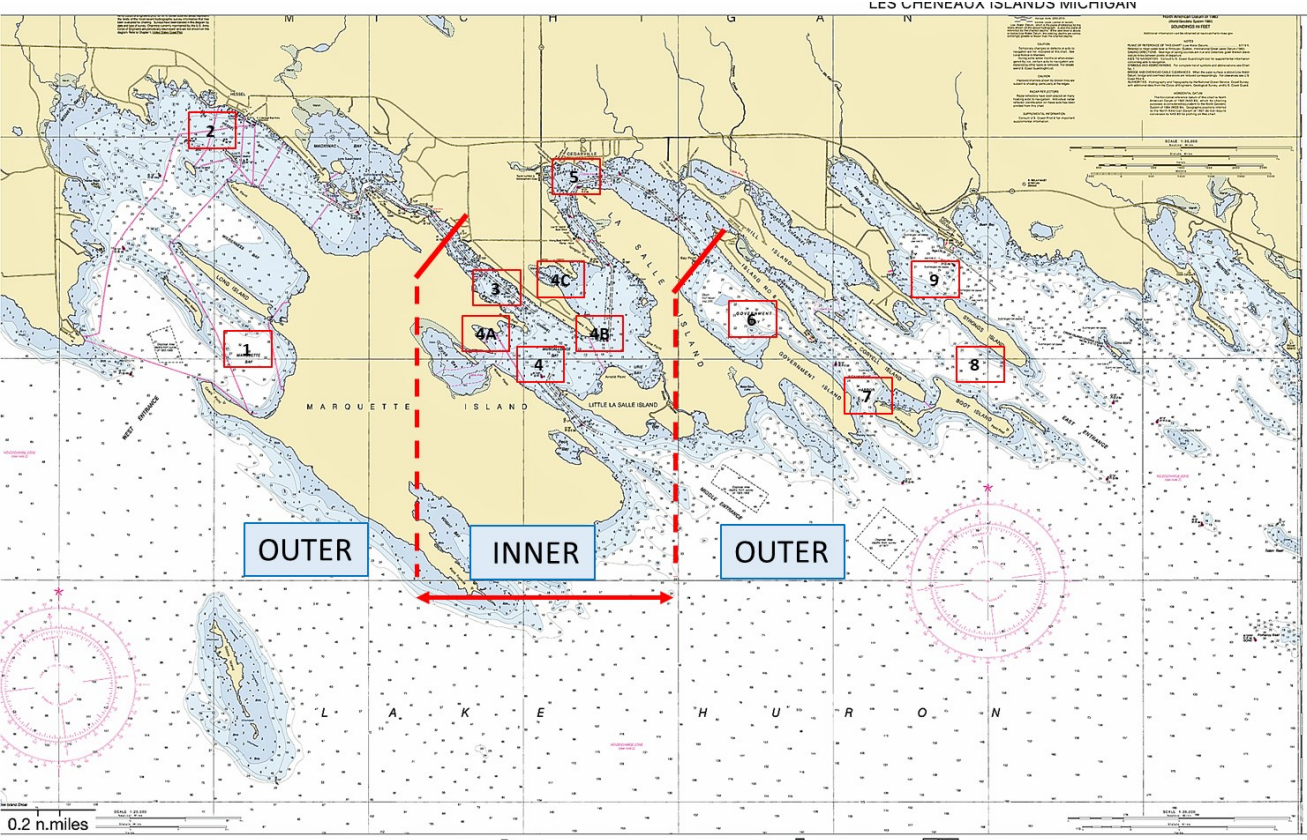
Delineation of the OIZ and IIZ is graphically shown for the year 2020 in Fig. 3. This figure illustrates the temperature difference between OIZ and IIZ, whereby sample sites in the OIZ are characterized by temperatures of at least one standard deviation unit lower than the mean temperature (sites: 1,7,8,9) and the IIZ temperatures (sites: 4B, 4C and 5) being at least one standard deviation unit higher than the mean temp. Mean temperatures for all sites ranged from 13°C to 16.5°C during the May-Sep 2020 sampling period.

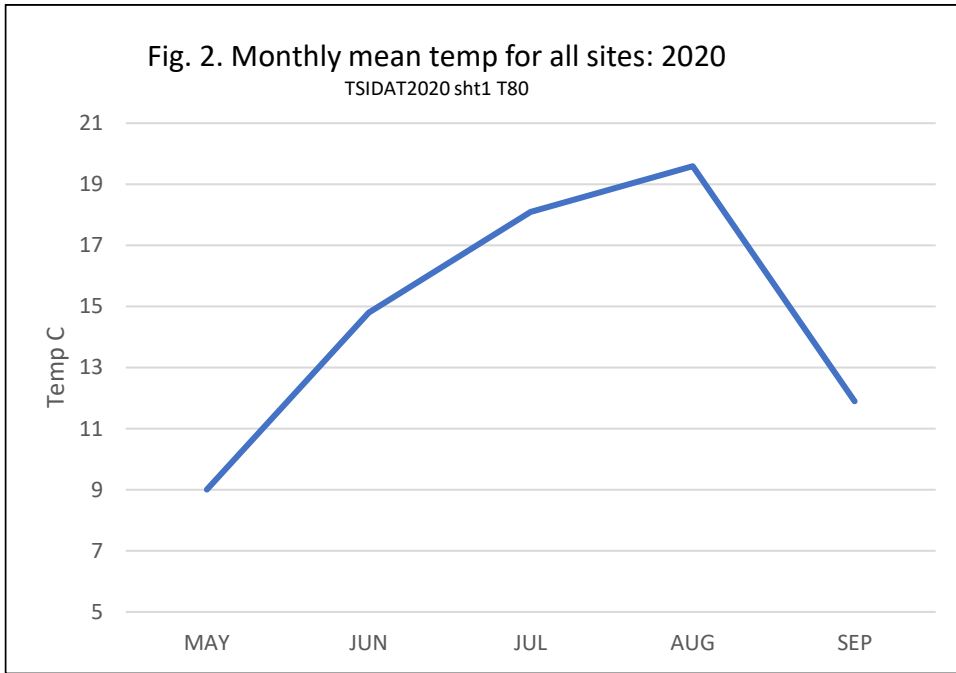
Figures 4A and 4B indicate that the temperature curves for the OIZ and IIZ are remarkably similar for the eight-year period of continuous LHr. The relative trendline slopes and annual rise or decline in temp tracked closely within and between sites in the OIZ and IIZ groups. Mean trendline slopes as well as annual shifts of OIZ and IIZ curves can be considered almost identical given the correlation coefficient (r) of 0.91 (Fig. 5). Similarity in temperature shifts is unexpected in that one would expect shifts in the IIZ to occur quicker and more radically than in the OIZ because the shallow IIZ water should warm and cool more quickly than the deeper OIZ sites. Trendlines for all curves are downward, reflecting progressive, annual cooling of Les Cheneaux waters during the study period from 2013 through 2020. It could be argued that OIZ site temperatures would shift more slowly than IIZ sites because those OIZ sites deeper are also influenced by the open LH temperatures. If that were true, then there would be a temperature response lag for the IIZ sites due to the OIZ cooling or warming. However, this was not the case.

SUMMARY: Water temperatures within the Les Cheneaux Islands (LCI) trended downward in a linear fashion 5°C (9.5°F) during an eight-year period while the L Huron level increased 171 cm (67.4 in) (Fig. 6). The relation of these curves supports the hypothesis that inflowing, cooler waters from L Huron during the 8-yr period of unprecedented lake rise played a major role in the decline of LCI water temperatures during the same period. Factors of annual sunshine, precipitation and air temperature are not included in this report. Long-term effects of lower water temperature and potential nutrient dilutions on rooted plants and plankton communities within the island waters are unknown at this time.

Fig. 1. Nutrient and productivity zones of the Les Cheneaux Islands. An Inner Island Zone (IIZ: higher nutrient and higher plant/animal productivity) is shown between the vertical/angled red lines and an Outer Island Zones (OIZ: lower nutrients and less productive) is shown East and West of the Inner Island Zone.

Boxed numbers signify sample sites.





Note: Alpha-numeric suffix at the end of figure title indicates database source of graphed values.

