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PREDICTING WHEN LAKE ONTARIO'S THERMAL BAR DISAPPEARS??

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THE THERMAL BAR

Since the early 1980's, Great Lakes anglers have recognized the importance of a lake temperature zone formed in the spring, known as a thermal bar, as an attractant to trout and salmon - especially steelhead. The thermal bar is literally a vertical wall of dense, sinking water (at a temperature of 39°F) that forms near shore and gradually moves offshore as the lake absorbs heat from the sun. The downwelling effect in the bar and upwelling currents on the shoreward side of the bar form an area within which the lake actually "turns over" from top to bottom. Eventually the bar vanishes in the late spring-early summer as the lake begins to "stratify" or form layers of cooler water near the bottom, under layers of warmer waters at the surface.

By utilizing information on the lake's thermal warming, anglers have significantly increased their spring catches by trolling in and around this thermal feature. A recent study may provide the means of predicting when the thermal bar disappears each year in Lake Ontario. In effect, this could enable anglers to optimize their use of the seasonal thermal events in the lake by knowing when to apply inshore vs. offshore fishing tactics.

WHAT FACTORS INFLUENCE THE DISAPPEARANCE OF THE THERMAL BAR?

G. Keith Rodgers, a scientist with the Canada Centre for Inland Waters (CCIW), developed a technique that can forecast the approximate date of disappearance of Lake Ontario's thermal bar, based on past trends (1965-85) in air and deep-water lake temperatures. Rodgers discovered that warmer winter conditions typically lead to a more rapid thermal bar formation and disappearance because of the higher heat content in the deeper areas of the lake which facilitates lake warming. This can be seen in Rodgers' plot (**Fig. 1**) of deep-lake temperatures (Tw) with the date of disappearance of the thermal bar (Da). (This date is expressed as numbers of days past April 1). The average date of stratification in Lake Ontario, which is preceded by the disappearance of the thermal bar, is June 15 (or 75 days past April 1). The earliest date of lake stratification in Lake Ontario, observed during this study, was in mid-May of 1983 (The winter of 1982-83 was unusually warm - the 10th warmest in over 200 yrs!) and the latest being the first week of July 1982 (the winter of 1981-82 being a severe one). Because of the close relationship between winter severity and deep-lake temperatures, winter air temperatures would affect the rate of spring warming and eventual disappearance of the thermal bar. Rodgers' data supports this notion, as seen in **Fig. 2**. The cold, severe winters of 1970, 1977, 1978 and 1982 resulted in cool deep-lake temperatures and delayed stratification into late June - early July (Fig.1).

Rodgers also suggested that winds, storms, ice conditions could also influence the onset of thermal stratification. More research is needed to address how these factors affect the progression of the thermal bar.

HOW CAN THE DISAPPEARANCE OF THE THERMAL BAR BE PREDICTED?

Fig. 1 describes the relationship between deep-lake water temperatures (Tw) on April 1 and the date of thermal bar disappearance (Da) in Lake Ontario based on this 20 year study, and can ultimately be used to predict future values of Da, once the deep-lake water temperatures are known. Obviously for the typical Lake Ontario angler, obtaining deep-lake temperatures, needed to predict when the thermal bar disappears, is not an easy proposition! **Fig. 2** describes the relationship between winter air temperatures and deep-lake water temperatures in Lake Ontario. This graph can, in effect, be used to estimate the spring deep-lake temperatures from winter air temperatures without actually taking water temperatures. All that is needed for an angler to plan for and take optimal advantage of thermal bar fishing is to obtain the average winter air temperatures.

Here are some easy steps for predicting when the thermal bar disappears:

1) Obtain average monthly air temperatures from December to March and from this information, calculate the average winter air temperature (Ta). Monthly air temperatures are available from National Weather Service, local airports, college meterorology/earth science departments and are also compiled by NY Sea Grant Extension Office at SUNY Brockport. To take you through these steps, let's estimate the predicted date of disappearance of the thermal bar in spring 1989. From National Weather Service, average monthly air temperatures during winter 1988-89 were Dec., 30.0°F; Jan., 31.3°F; Feb., 22.7°F; and March, 33.0°F. The average winter air temp. can be easily calculated by adding these monthly temps and dividing the sum by 4. From this, the mean or average 1989 winter air temp was found to be 29.25°F. This number is the Ta value used in the next step.

2) Estimate the winter deep-lake temperature (Tw) from the average winter air temperature (Ta, from step 1) by using the graph in **Fig. 2**. From the average winter air temperature calculated in step 1, locate this temperature's position on the bottom scale and follow it straight up until it intersects the data line on the graph. Mark this point, and draw a straight horizontal line to the scale on the left, marked Tw. The point where it intersects the scale is the estimated deep-lake water temperature. For spring 1989, this point should be on 37.3°F.

3) Now that you have the estimated deep-lake temp. you can now estimate the predicted date of the thermal bar's disappearance (Da) using the graph in **Fig. 1.** Locate the deep-lake water temp. on the scale on the left hand side of the graph and draw a straight horizontal line to the right until it intersects the data line. Again, mark this point and draw a straight line down until it meets the bottom scale of the graph. This point is the predicted date of disappearance of Lake Ontario's thermal bar (Da), expressed in numbers of days past April 1. For spring 1989, this should be around 48 days after April 1.

4) To convert that awkward number, Da from step 3, to an actual date, the table below will help. Locate the predicted number of days past April 1 under the column Da, (for 1989, it should be 48 days after April 1 or May 19).

Da	Date
5	April 6
10	April 11
15	April 16
20	April 21
25	April 26
30	May 1
35	May 6
40	May 11
45	May 16
50	May 21
55	May 26
60	May 31
65	June 5
70	June 10
75	June 15
80	June 20
85	June 25
90	June 30
95	July 5
100	July 10

* For more detailed information on the thermal bar that can help you apply this predictive technique, the following readings are recommended. **Copies of these references and this publication are available from:**

New York Sea Grant Extension 405 Administration Building, SUNY College @ Brockport, Brockport, New York 14420
(716) 395-2638

Thermal fronts: magnets for salmon and trout, by Michael Voiland. Great Lakes Fisherman April 1986: pp. 50-52.

Finding salmon and trout in Lake Ontario, by James Haynes Water Spectrum. Spring 1983: pp. 30-37.

Movements of Pacific salmon in Lake Ontario in spring and summer: evidence for wide dispersal, by James Haynes and C.J. Keleher. Journal of Freshwater Ecology. Vol 3, pp. 289-297. 1986.

Movements of rainbow steelhead trout in Lake Ontario and a hypothesis for the influence of spring thermal structure, by James Haynes. Journal of Great Lakes Research, Vol 12: pp. 304-313. 1986

Temperature guide for salmon and trout by Tom Huggler. Great Lakes Fisherman. October 1984: pp. 20-21

Time of onset of full thermal stratification in Lake Ontario in relation to lake temperatures in winter, by G. Keith Rodgers. Canadian Journal of Fisheries and Aquatic Sciences, Vol 44: pp. 2225-2229. 1987.

Figure 1. **The relationship between deep-lake water temperatures and the date of disappearance of the thermal bar in Lake Ontario. (from Rodgers 1987)**

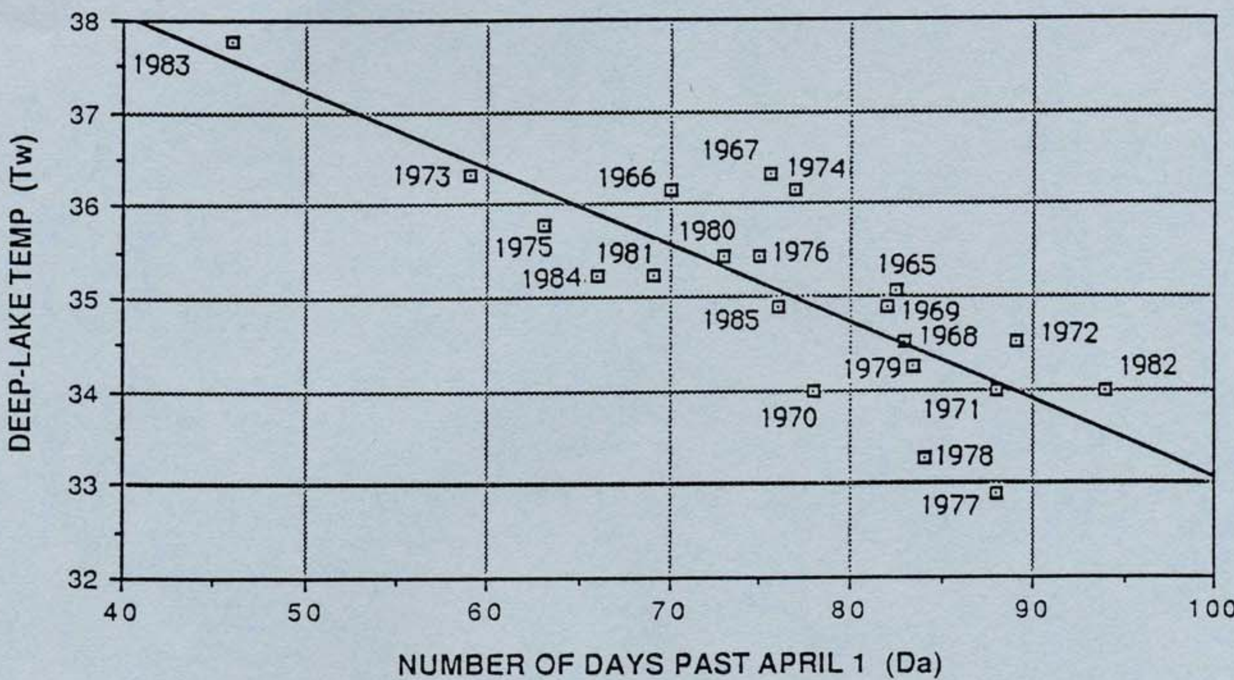
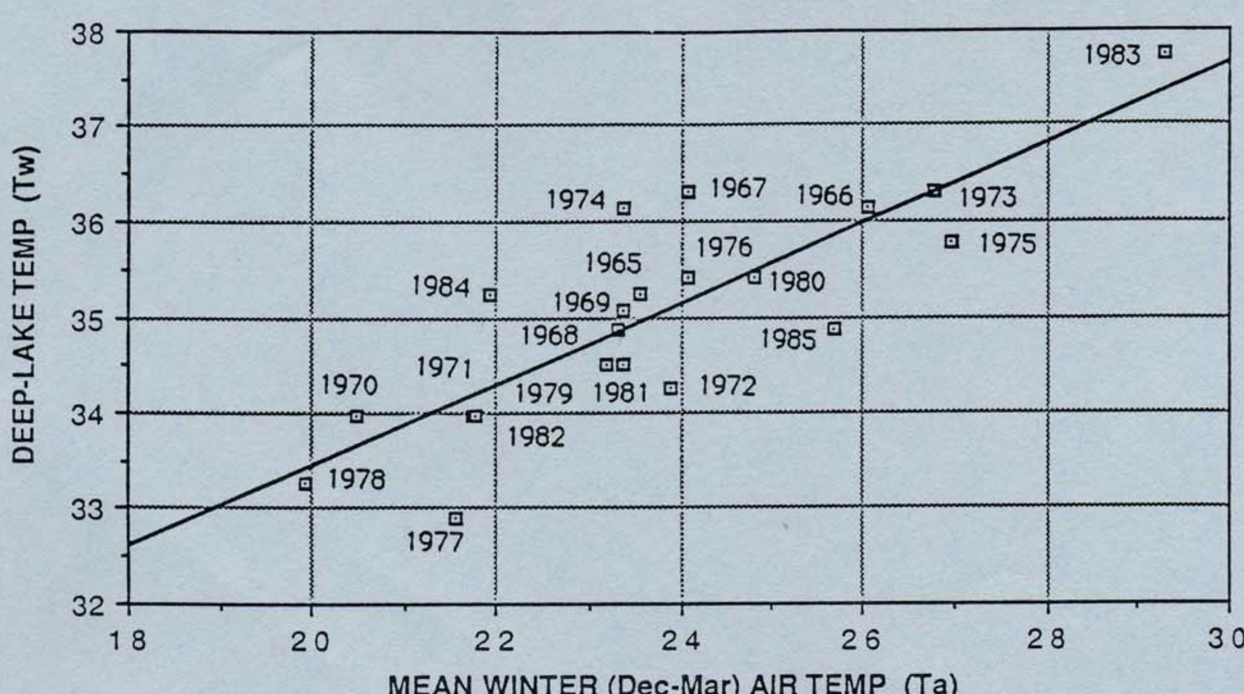


Figure 2. **The relationship between winter air temperatures and deep-lake water temperatures in Lake Ontario. All temperatures are in degrees Farenheit (F). (from Rodgers 1987.)**



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