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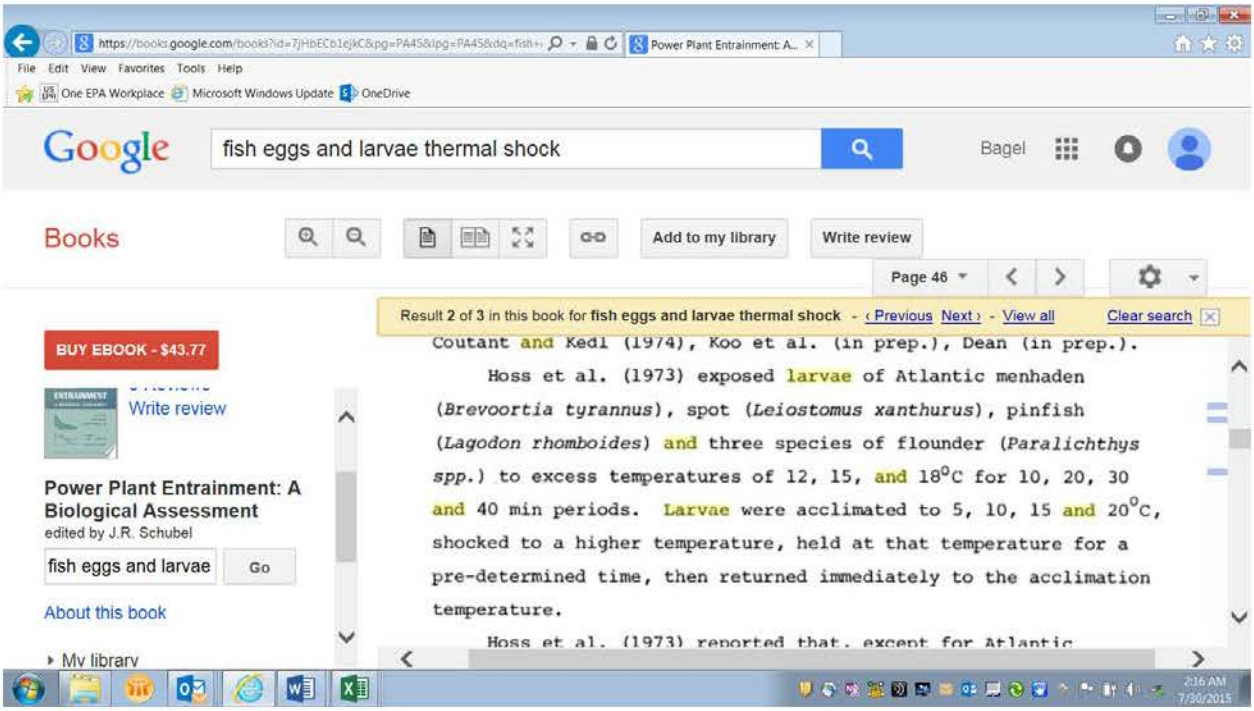

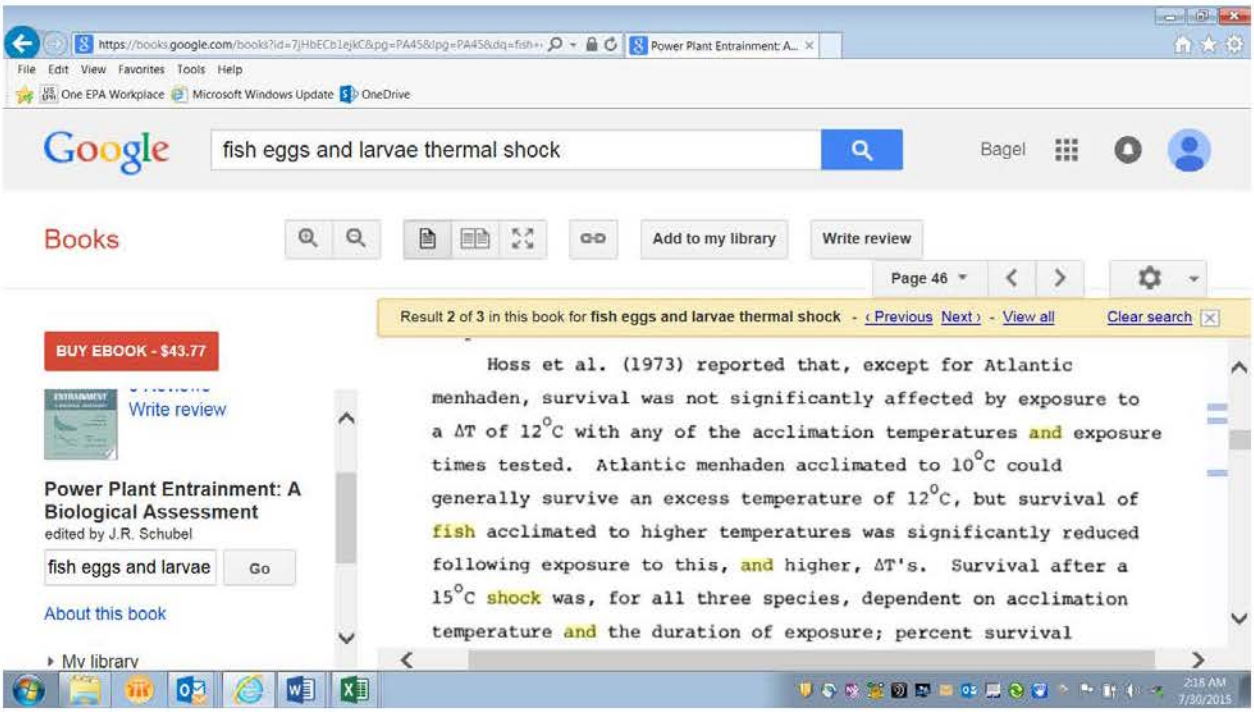

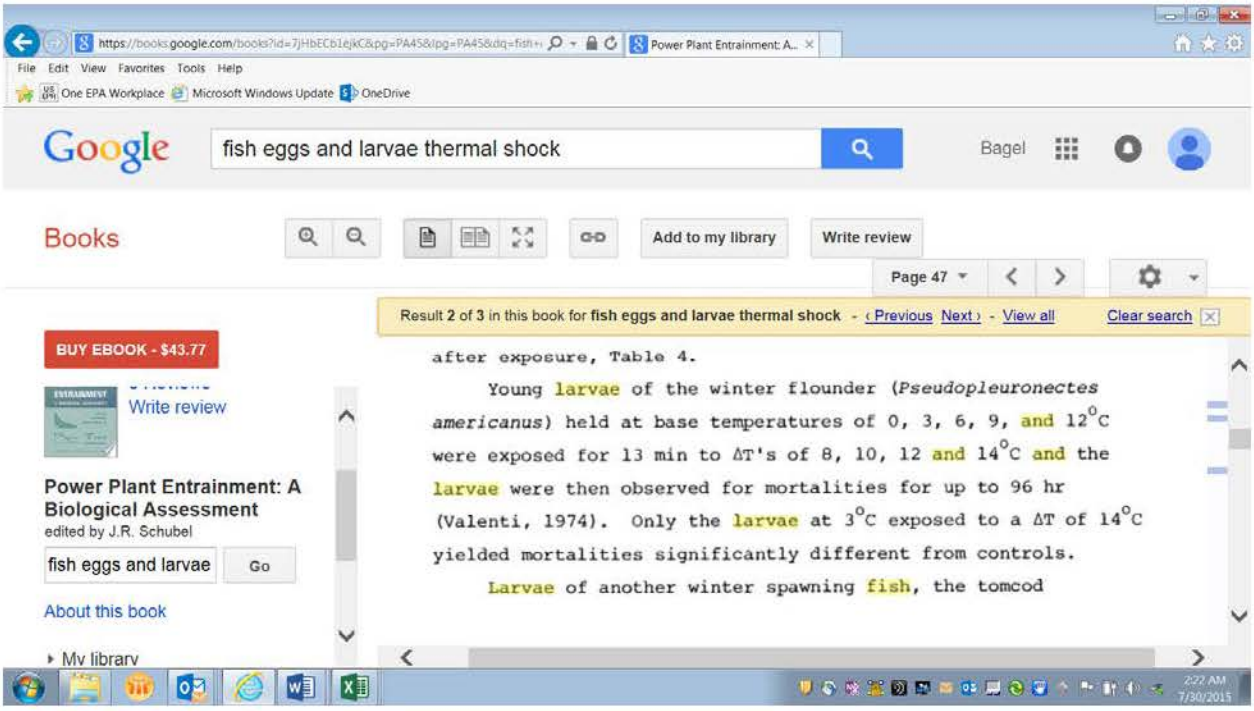
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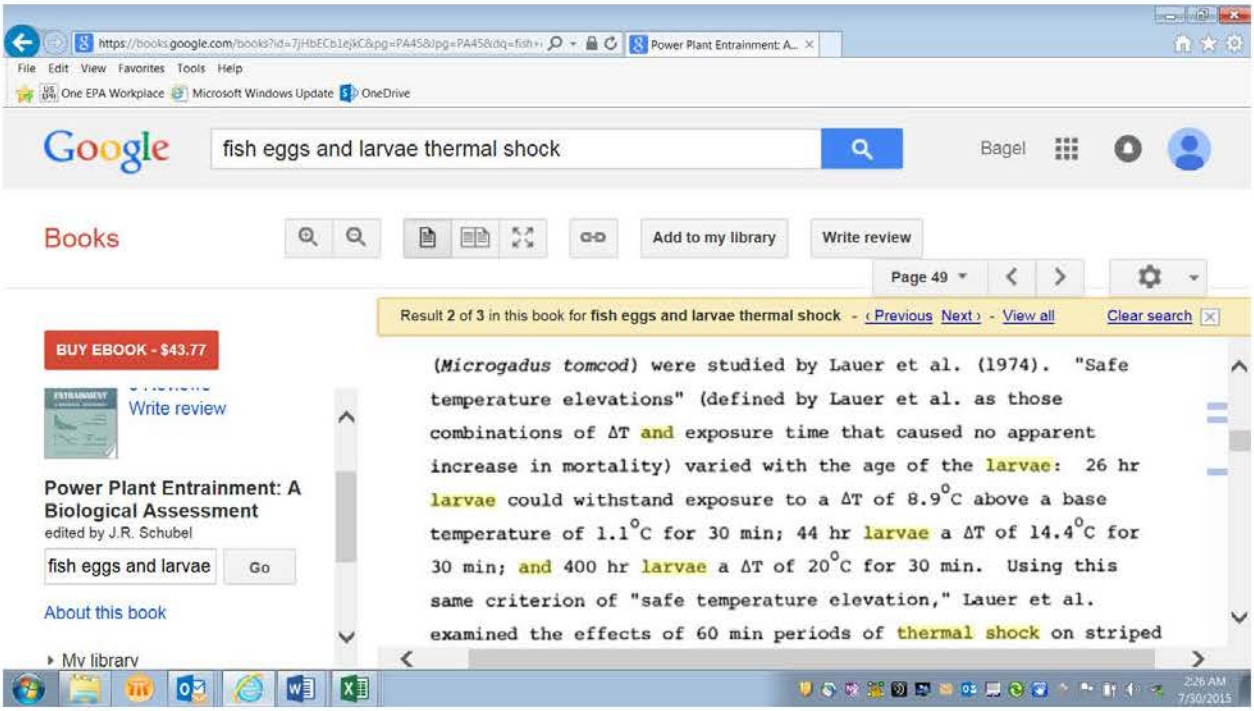
after exposure, Table 4.
Young larvae of the winter flounder (Pseudopleuronectes americanus) held at base temperatures of 0, 3, 6, 9, and 12°C were exposed for 13 min to ΔT's of 8, 10, 12 and 14°C and the larvae were then observed for mortalities for up to 96 hr (Valenti, 1974). Only the larvae at 3°C exposed to a ΔT of 14°C yielded mortalities significantly different from controls.
Larvae of another winter spawning fish, the tomcod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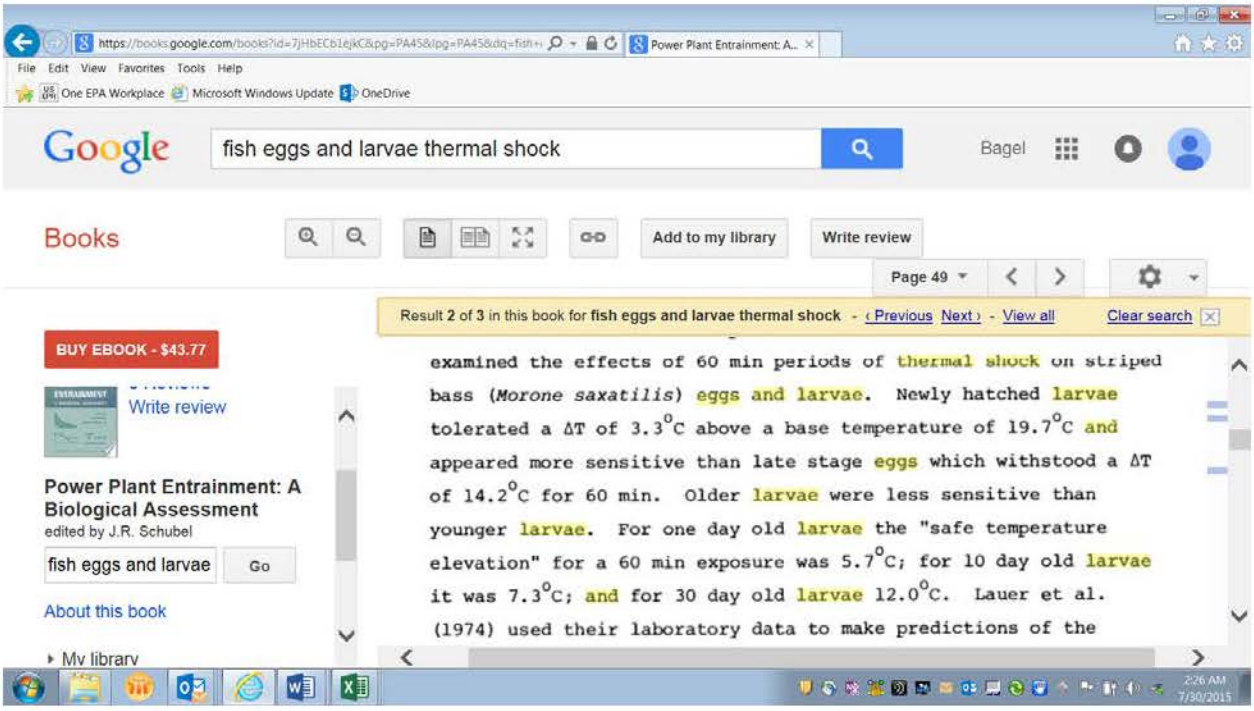
(Microgadus tomcod) were studied by Lauer et al. (1974). "Safe temperature elevations" (defined by Lauer et al. as those combinations of ΔT and exposure time that caused no apparent increase in mortality) varied with the age of the larvae: 26 hr larvae could withstand exposure to a ΔT of 8.9°C above a base temperature of 1.1°C for 30 min; 44 hr larvae a ΔT of 14.4°C for 30 min; and 400 hr larvae a ΔT of 20°C for 30 min. Using this same criterion of "safe temperature elevation," Lauer et al. examined the effects of 60 min periods of thermal shock on striped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examined the effects of 60 min periods of thermal shock on striped bass (Morone saxatilis) eggs and larvae. Newly hatched larvae tolerated a ΔT of 3.3°C above a base temperature of 19.7°C and appeared more sensitive than late stage eggs which withstood a ΔT of 14.2°C for 60 min. Older larvae were less sensitive than younger larvae. For one day old larvae the "safe temperature elevation" for a 60 min exposure was 5.7°C; for 10 day old larvae it was 7.3°C; and for 30 day old larvae 12.0°C. Lauer et al. (1974) used their laboratory data to make predictions of the
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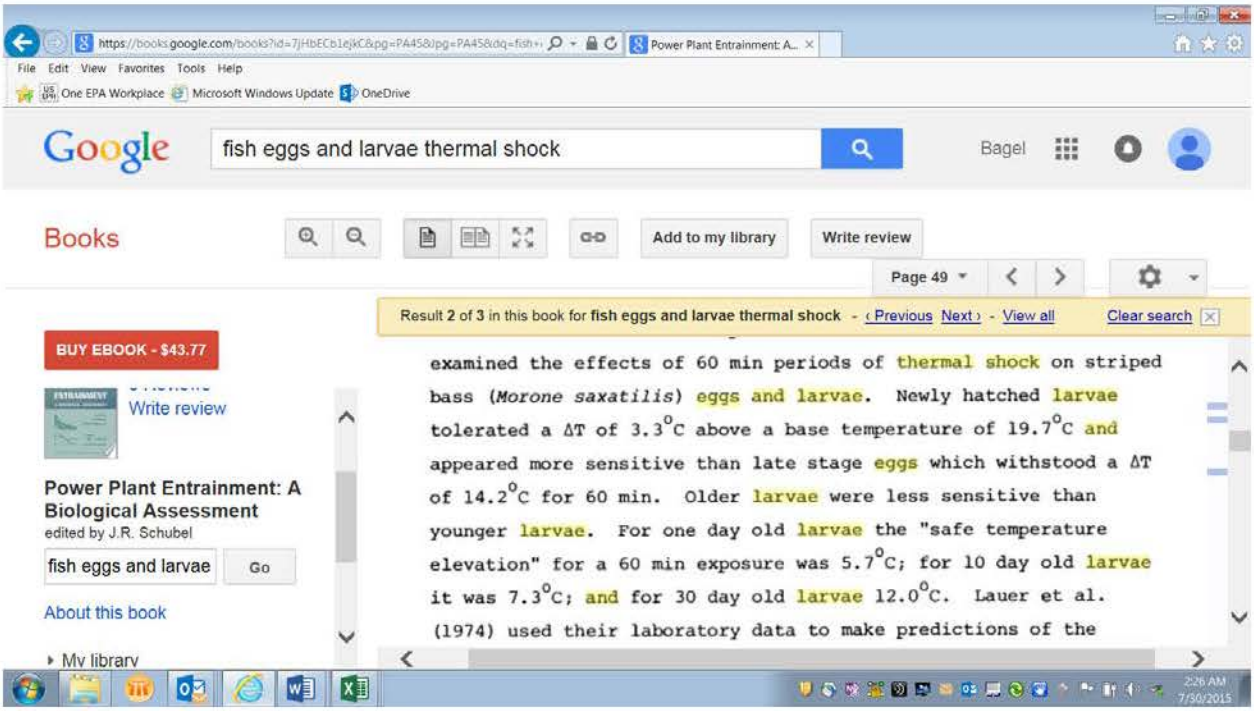
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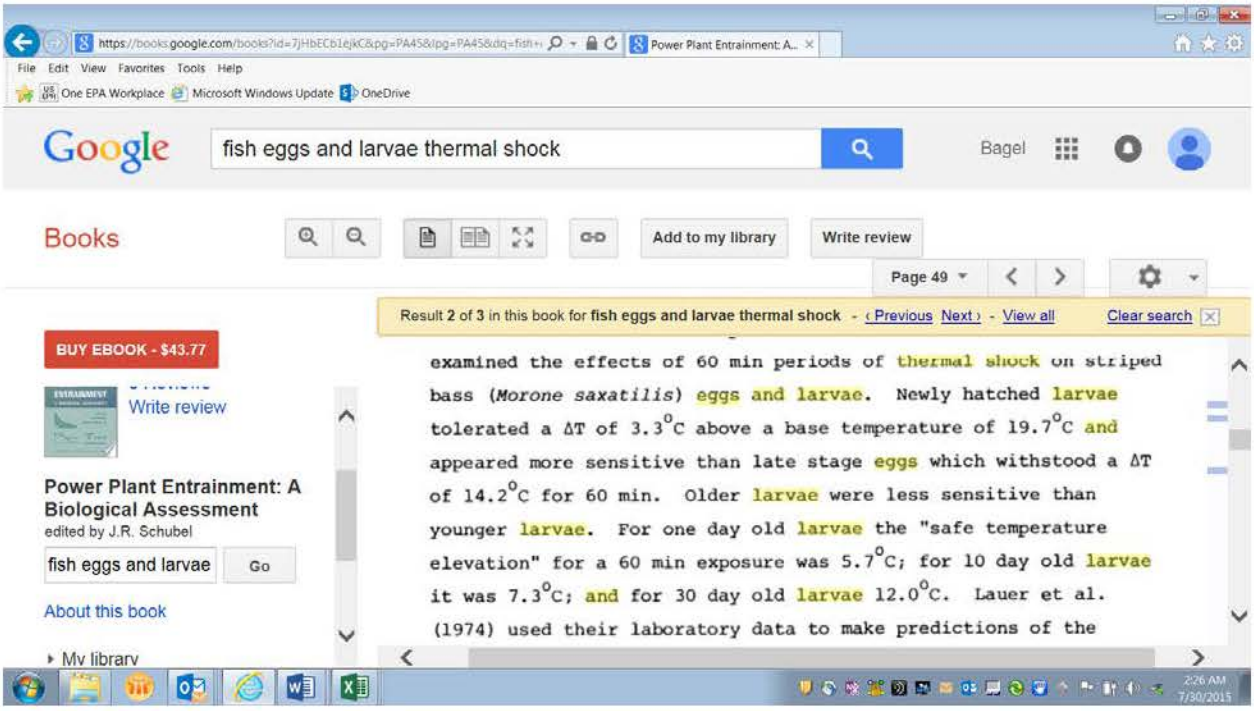
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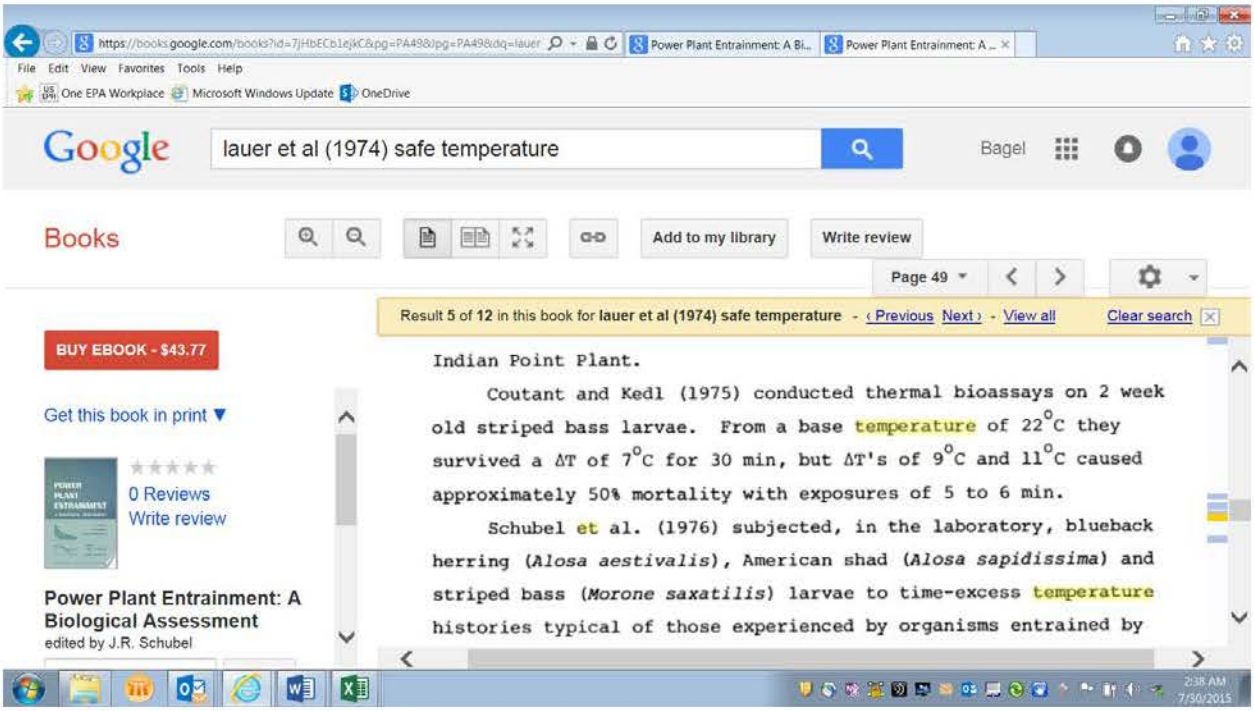
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Coutant and Kedl (1975) conducted thermal bioassays on 2 week old striped bass larvae. From a base temperature of 22°C they survived a ΔT of 7°C for 30 min, but ΔT's of 9°C and 11°C caused approximately 50% mortality with exposures of 5 to 6 min.
Schubel et al. (1976) subjected, in the laboratory, blueback herring (Alosa aestivalis), American shad (Alosa sapidissima) and striped bass (Morone saxatilis) larvae to time-excess temperature histories typical of those experienced by organisms entrained by

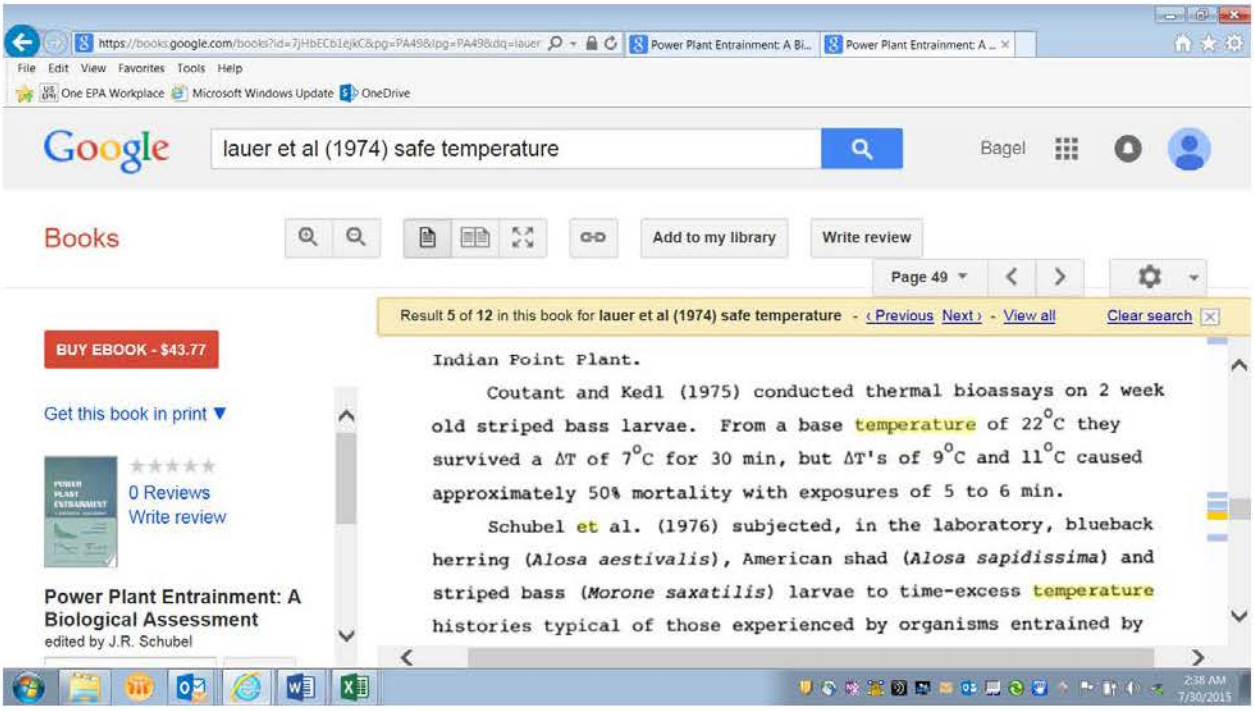
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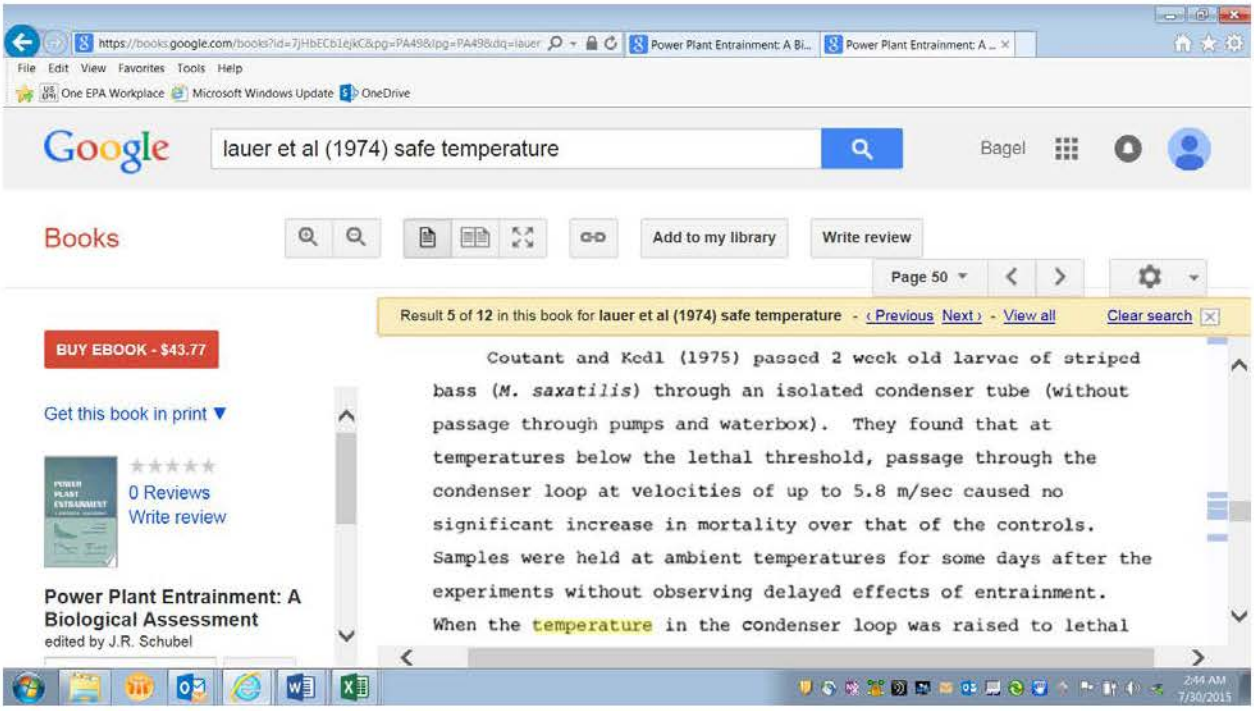
Table 6-1. Summary statistics for the three month temperature data set for Stations 1 through 10. Station 2 has no mid-depth temperature sensor, so no data is presented for that station location. The raw temperature data was recorded every five minutes at all stations and The raw temperature data was recorded every five minutes at all stations at all depths (PSNH; August 15 - November 14, 2011).

Water Temperature at Data Logger Stations 1 - 10
PSNH Schiller Station Thermal Study August 15 - November 14, 2011

Sensor Depth		Station Number									
		1	2	3	4	5	6	7	8	9	10
Surface	Average Temp (Deg C)	14.3	14.8	15.0	14.8	14.3	14.4	15.4	14.7	14.7	14.4
	Average Temp (Deg F)	57.8	58.6	58.9	58.6	57.7	58.0	59.7	58.5	58.5	57.9
	Max Temp (Deg C)	22.2	24.5	24.9	24.1	23.3	23.3	26.0	25.8	25.9	24.6
	Max Temp (Deg F)	72.0	76.0	76.9	75.3	73.9	73.9	78.8	78.5	78.6	76.2
	Standard Deviation (Deg C)	3.6	3.7	3.8	3.7	3.6	3.5	3.7	3.5	3.4	3.5
	Standard Deviation (Deg F)	6.4	6.6	6.9	6.6	6.4	6.3	6.7	6.3	6.2	6.2
Mid	Average Temp (Deg C)	14.3	NA	14.6	14.5	14.1	14.2	14.4	14.3	14.5	14.2
	Average Temp (Deg F)	57.8	NA	58.2	58.1	57.4	57.6	58.0	57.7	58.1	57.6
	Max Temp (Deg C)	22.2	NA	23.6	22.9	22.4	22.8	22.7	22.5	22.3	22.1
	Max Temp (Deg F)	72.0	NA	74.4	73.2	72.4	73.1	72.9	72.6	72.2	71.9
	Standard Deviation (Deg C)	3.6	NA	3.6	3.5	3.6	3.4	3.4	3.4	3.3	3.4
	Standard Deviation (Deg F)	6.4	NA	6.5	6.4	6.4	6.2	6.1	6.1	6.0	6.2
Deep	Average Temp (Deg C)	14.3	14.6	14.6	14.4	14.2	14.2	14.2	14.2	14.5	14.2
	Average Temp (Deg F)	57.8	58.3	58.2	58.0	57.5	57.5	57.6	57.6	58.1	57.6
	Max Temp (Deg C)	22.2	23.5	23.0	22.6	22.4	22.5	22.2	22.1	22.2	22.1
	Max Temp (Deg F)	72.0	74.3	73.4	72.7	72.4	72.6	72.0	71.9	72.0	71.7
	Standard Deviation (Deg C)	3.6	3.6	3.6	3.5	3.6	3.4	3.4	3.4	3.3	3.4
	Standard Deviation (Deg F)	6.4	6.4	6.4	6.3	6.4	6.1	6.1	6.1	6.0	6.1

Change in Water Temperature from Ambient Water Temperature (Station 1)										
PSNH Schiller Station Thermal Study Sept 15- Nov 14 2011										
Sensor		Station ID								
Depth		**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**
Surface	**Average Change (Deg C)**	0.48	0.63	0.45	0.06	0.57	1.13	0.18	0.18	0.05
	Max Change (Deg C)	3.81	5.71	4.83	2.87	6.58	5.27	5.43	4.52	3.17
	Standard Deviation (Deg C)	0.73	0.94	0.61	0.35	1.45	0.97	0.66	0.55	0.34
Mid	**Average Change (Deg C)**	NA	0.28	0.18	-0.07	0.39	0.12	0.00	-0.03	-0.09
	Max Change (Deg C)	NA	5.81	2.91	2.10	6.58	3.83	3.33	1.58	1.29
	Standard Deviation (Deg C)	NA	0.56	0.33	0.25	1.43	0.43	0.30	0.27	0.27
Deep	**Average Change (Deg C)**	0.28	0.27	0.13	-0.04	0.33	-0.08	-0.08	-0.03	-0.09
	Max Change (Deg C)	3.24	4.47	2.04	2.00	6.48	3.24	2.09	1.81	1.05
	Standard Deviation (Deg C)	0.54	0.45	0.26	0.20	1.40	0.32	0.23	0.21	0.22
	Notes									
		All Data provided by PSNH								
		Station 2 has no mid depth temperature sensor								
		Data collected in 5 minute intervals								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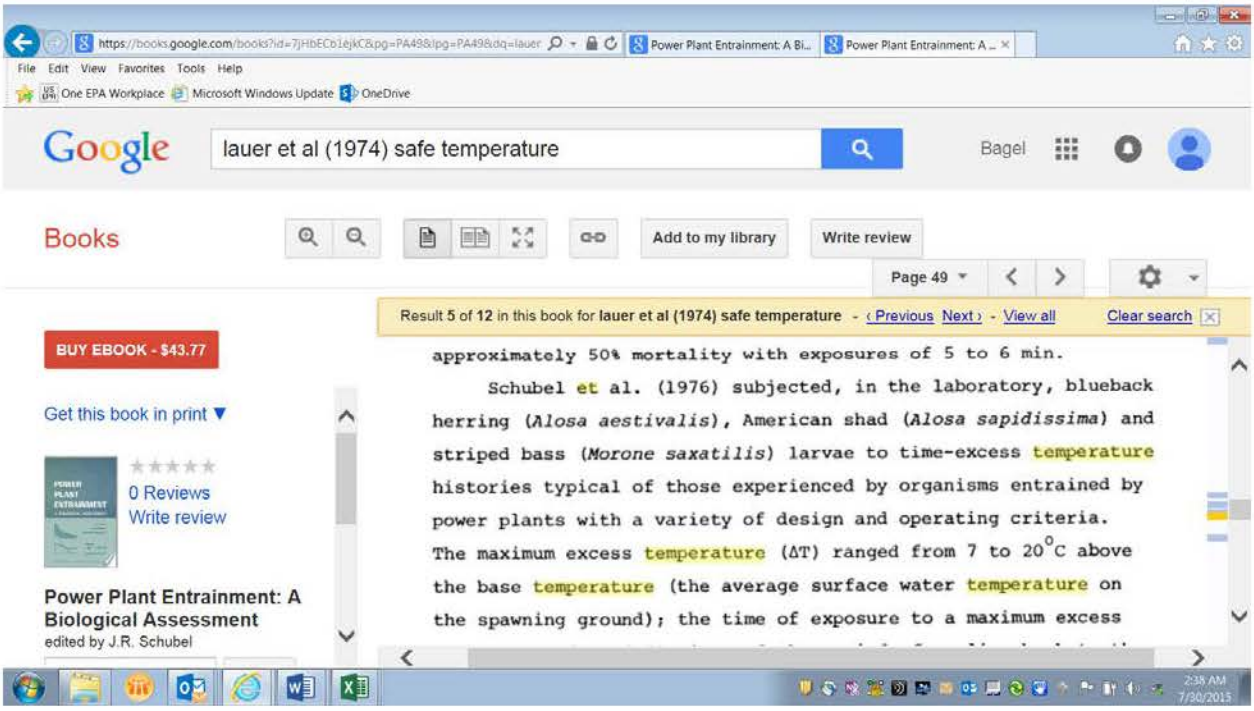
Coutant and Kedl (1975) passed 2 week old larvae of striped bass (M. saxatilis) through an isolated condenser tube (without passage through pumps and waterbox). They found that at temperatures below the lethal threshold, passage through the condenser loop at velocities of up to 5.8 m/sec caused no significant increase in mortality over that of the controls. Samples were held at ambient temperatures for some days after the experiments without observing delayed effects of entrainment. When the temperature in the condenser loop was raised to lethal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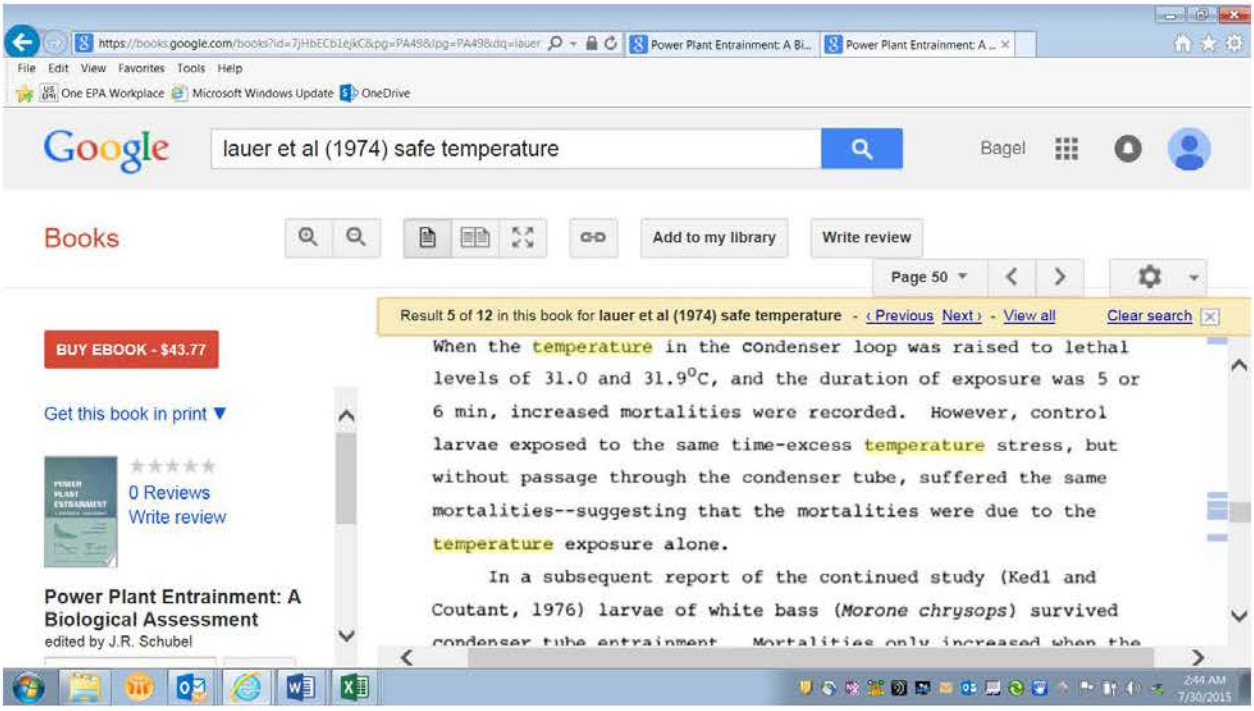
approximately 50% mortality with exposures of 5 to 6 min.
Schubel et al. (1976) subjected, in the laboratory, blueback herring (Alosa aestivalis), American shad (Alosa sapidissima) and striped bass (Morone saxatilis) larvae to time-excess temperature histories typical of those experienced by organisms entrained by power plants with a variety of design and operating criteria. The maximum excess temperature (ΔT) ranged from 7 to 20°C above the base temperature (the average surface water temperature on the spawning ground); the time of exposure to a maximum excess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When the temperature in the condenser loop was raised to lethal levels of 31.0 and 31.9°C, and the duration of exposure was 5 or 6 min, increased mortalities were recorded. However, control larvae exposed to the same time-excess temperature stress, but without passage through the condenser tube, suffered the same mortalities--suggesting that the mortalities were due to the temperature exposure alone.
In a subsequent report of the continued study (Kedl and Coutant, 1976) larvae of white bass (Morone chrysops) survived
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