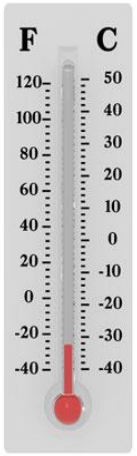
Development of Water Quality Criteria for Dissolved Oxygen and Temperature

Presentation for the
Water Resources Advisory Committee

July 13, 2011



Division of Water Quality Assessment and Standards

PA's Current Dissolved Oxygen Criteria

§ 93.7. Specific water quality criteria.

(a) Table 3 displays specific water quality criteria and associated critical uses. The criteria associated with the Statewide water uses listed in § 93.4, Table 2 apply to all surface waters, unless a specific exception is indicated in §§ 93.9a—93.9z. Other specific water quality criteria apply to surface waters as specified in §§ 93.9a—93.9z. All applicable criteria shall be applied in accordance with this chapter, Chapter 96 (relating to water quality standards implementation) and other applicable State and Federal laws and regulations.

TABLE 3

Parameter	*Symbol*	*Criteria*	*Critical Use**
Dissolved Oxygen		The following specific dissolved oxygen criteria recognize the natural process of stratification in lakes, ponds and impoundments. These criteria apply to flowing waters and to the epilimnion of a naturally stratified lake, pond or impoundment. The hypolimnion in a naturally stratified lake, pond or impoundment is protected by the narrative water quality criteria in § 93.6 (relating to general water quality criteria). For nonstratified lakes, ponds or impoundments, the dissolved oxygen criteria apply throughout the lake, pond or impoundment to protect the critical uses.	
	DO_1	For flowing waters, minimum daily average 6.0 mg/l; minimum 5.0 mg/l. For lakes, ponds and impoundments, minimum 5.0 mg/l.	CWF HQ-WWF HQ-TSF
	DO_2	Minimum daily average 5.0 mg/l; minimum 4.0 mg/l.	WWF
	DO_3	For the period February 15 to July 31 of any year, minimum daily average 6.0 mg/l; minimum 5.0 mg/l. For the remainder of the year, minimum daily average 5.0 mg/l; minimum 4.0 mg/l.	TSF
	DO_4	Minimum 7.0 mg/l.	HQ-CWF

Comparison of PA Dissolved Oxygen Criteria and EPA 1986 Dissolved Oxygen Criteria

	PA Current Dissolved Oxygen Criteria	EPA Levels of Risk - Dissolved Oxygen	
		Early Life stages	Other life stages
Warm Water Fish	Minimum daily average 5.0 mg/l; minimum 4.0 mg/l	No production impairment = 6.5 mg/l; Slight production impairment = 5.5 mg/l; Moderate production impairment = 5.0 mg/l	No production impairment = 6 mg/l; Slight production impairment = 5 mg/l; Moderate production impairment = 4 mg/l
Cold Water Fish	For flowing waters, minimum daily average 6.0 mg/l; minimum 5.0 mg/l. For lakes, ponds and impoundments, minimum 5.0 mg/l.	No production impairment = 11 mg/l*; Slight production impairment = 9 mg/l*; Moderate production impairment = 8 mg/l*	No production impairment = 8 mg/l; Slight production impairment = 6 mg/l; Moderate production impairment = 5 mg/l
High Quality - WWF/TSF (if SEJ)	Minimum daily average 6.0 mg/l; minimum 5.0 mg/l	No production impairment = 6.5 mg/l; Slight production impairment = 5.5 mg/l	No production impairment = 6 mg/l; Slight production impairment = 5 mg/l
High Quality - CWF (if SEJ)	Minimum 7.0 mg/l	No production impairment = 11 mg/l*; Slight production impairment = 9 mg/l*	No production impairment = 8 mg/l; Slight production impairment = 6 mg/l

* Concentrations shown are water column concentrations needed to achieve intergravel concentrations neccesary for the corresponding level of protection

Current Temperature Criteria in Chapter §93.7. Specific Water Quality Criteria, Table 3

Temperature	Maximum temperatures in the receiving water body resulting from heated waste sources regulated under Chapters 92, 96 and other sources where temperature limits are necessary to protect designated and existing uses. Additionally, these wastes may not result in a change by more than 2°F during a 1-hour period.	See the following table.

SYMBOL: CRITICAL USE: PERIOD	*$TEMP_1$ CWF*	*$TEMP_2$ WWF TEMPERATURE °F*	*$TEMP_3$ TSF*
January 1-31	38	40	40
February 1-29	38	40	40
March 1-31	42	46	46
April 1-15	48	52	52
April 16-30	52	58	58
May 1-15	54	64	64
May 16-31	58	72	68
June 1-15	60	80	70
June 16-30	64	84	72
July 1-31	66	87	74
August 1-15	66	87	80
August 16-30	66	87	87
September 1-15	64	84	84
September 16-30	60	78	78
October 1-15	54	72	72
October 16-31	50	66	66
November 1-15	46	58	58
November 16-30	42	50	50
December 1-31	40	42	42

Current Temperature Criteria in Chapter §93.7. Specific Water Quality Criteria, Table 3

Temperature

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April 16-30	52	58	58
May 1-15	54	64	64
May 16-31	58	72	68
June 1-15	60	80	70
June 16-30	64	84	72
July 1-31	66	87	74
August 1-15	66	87	80
August 16-30	66	87	87
September 1-15	64	84	84
September 16-30	60	78	78
October 1-15	54	72	72
October 16-31	50	66	66
November 1-15	46	58	58
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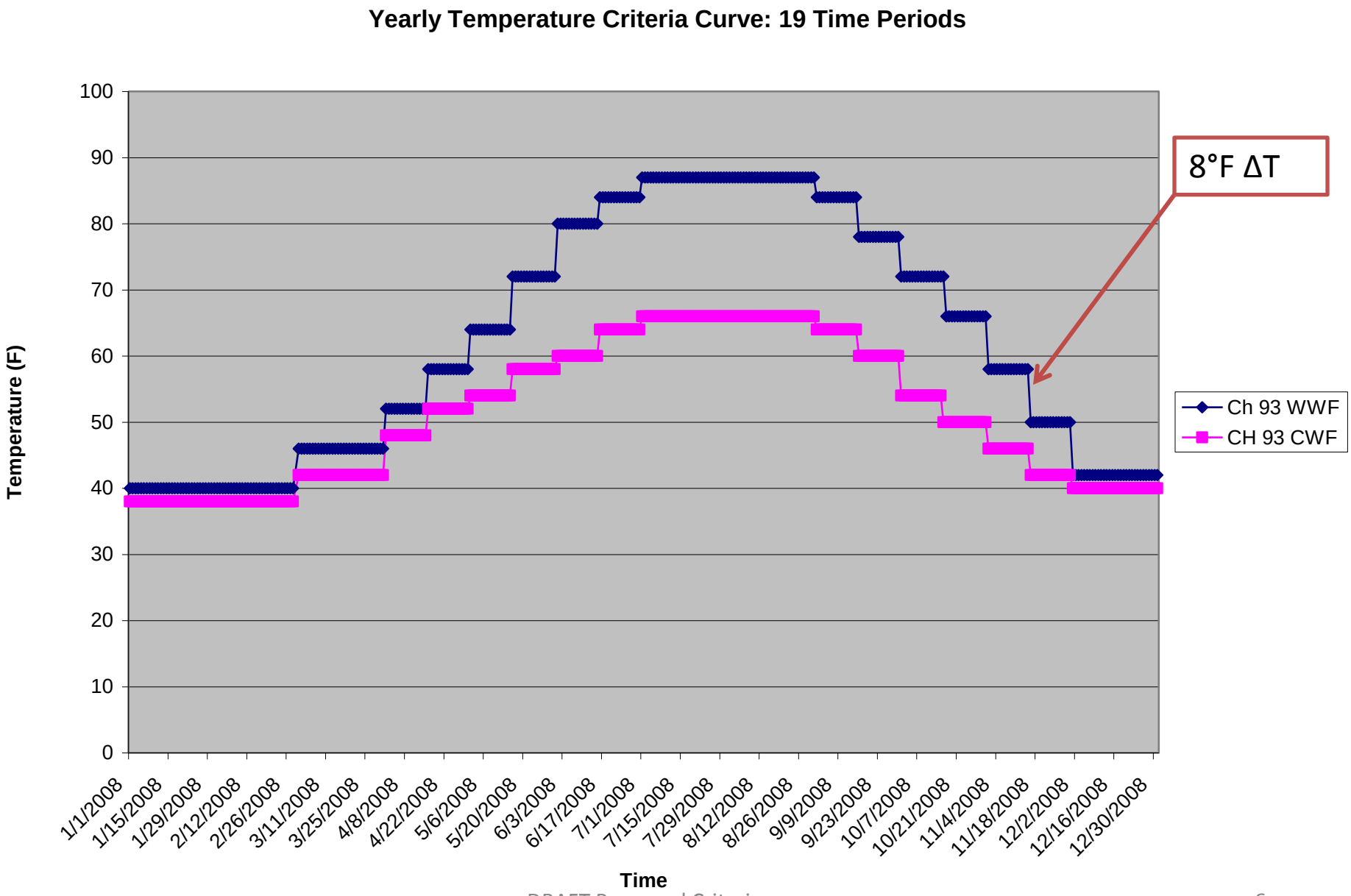
6 or 8 degree F change (ΔT) from one day to the next for WWF

Staircase Effect: steep steps in spring and fall

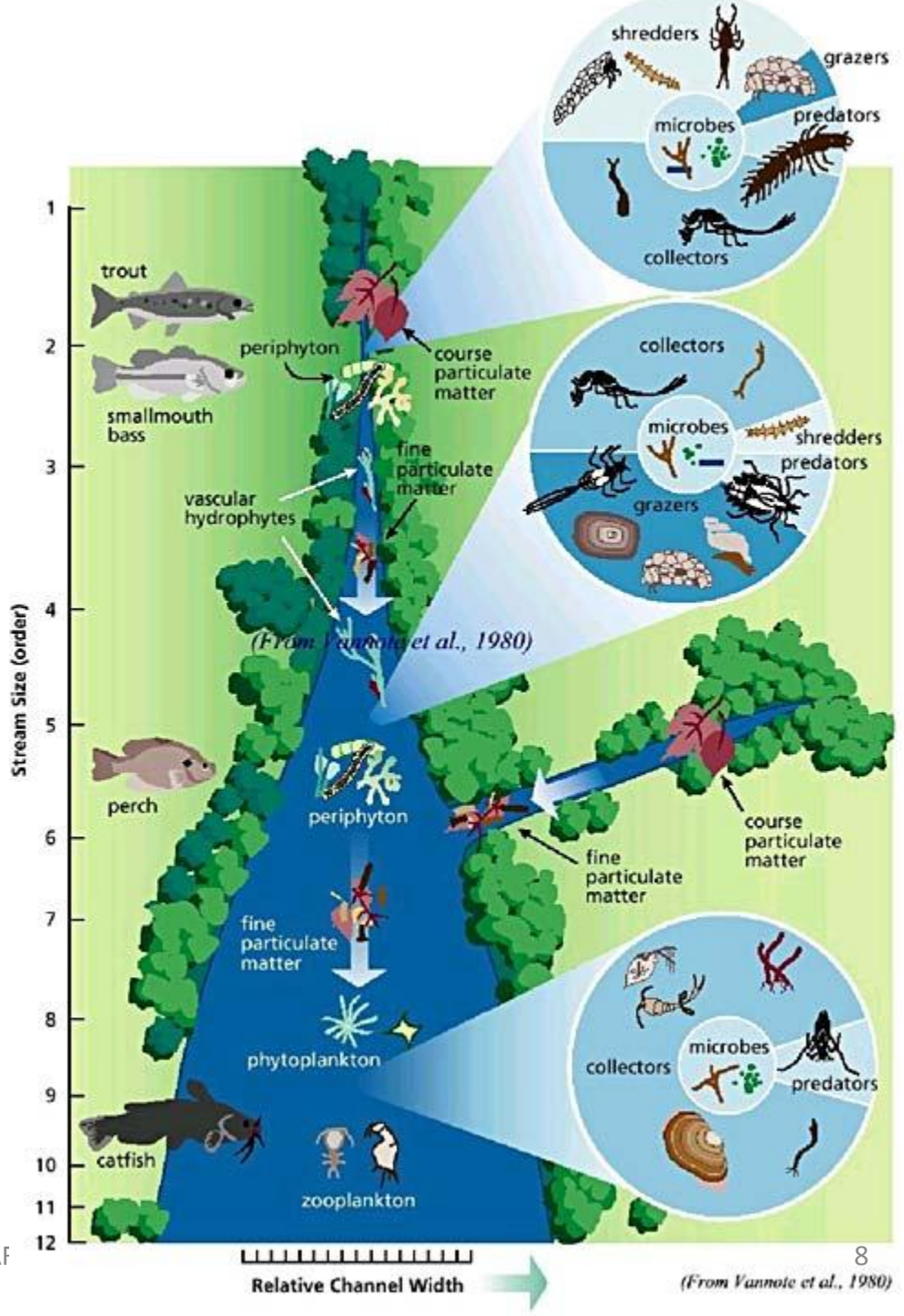


Temperature studies show that fish critical thermal thresholds are highly dependent on **acclimation temperature**.

River Continuum Concept:

The predictable pattern of change as water flows downstream:

- Physical parameters such as flow, velocity, depth, width of the stream or river
- Chemical parameter such as temperature and dissolved oxygen
- Biological communities such as assemblages of fish and macroinvertebrates



What about 2°F change in temperature regulation?

Criteria

Maximum temperatures in the receiving water body resulting from heated waste sources regulated under Chapters 92, 96 and other sources where temperature limits are necessary to protect designated and existing uses. Additionally, these wastes may not result in a change by more than 2°F during a 1-hour period.

Under Development

Effects of Elevated and Fluctuating Temperature Regimes on Macroinvertebrate and Fish in Pennsylvania's Warm Water Streams and Rivers

STROUD WATER RESEARCH CENTER