

Updated: 8 November 2019

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CEE 370 Environmental Engineering Principles

Lecture #26 Water Quality Management IV: Estuaries & Oceans

[Reading: Mihelcic & Zimmerman, Chapter 7](#)

[Reading: Davis & Cornwall, Chapt 5-5 to 5-6](#)

[Reading: Davis & Masten, Chapter 9-5 to 9-6](#)

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1

Combined sewer overflows

- CSOs
- Intended to protect wastewater systems from high flows
- A major source of contamination in many surface waters

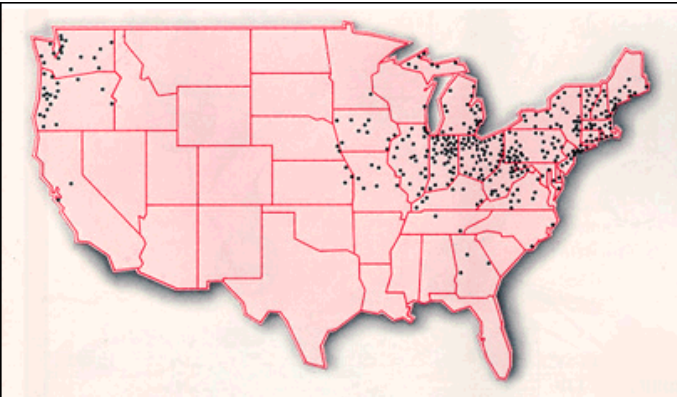
Figure 3-6. Regulation of storm-water overflow.

Pg 72, from Fair & Geyer, 1954

2

Combined Sewer Overflows

- Most CSOs are in the Northeast

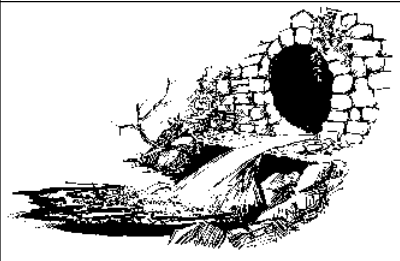


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Combined Sewer Overflows



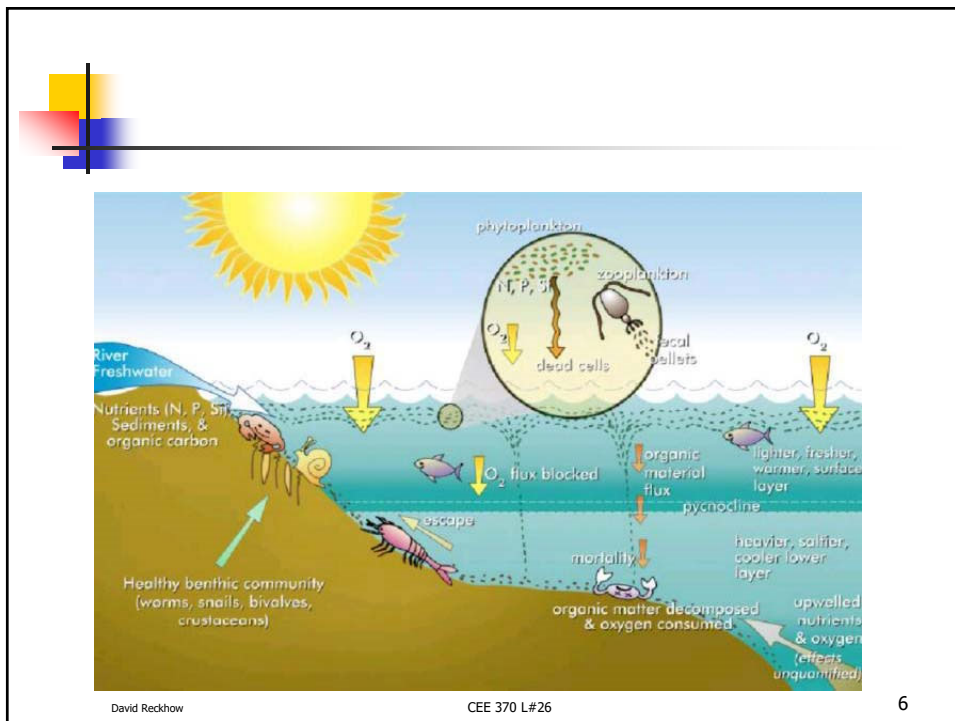
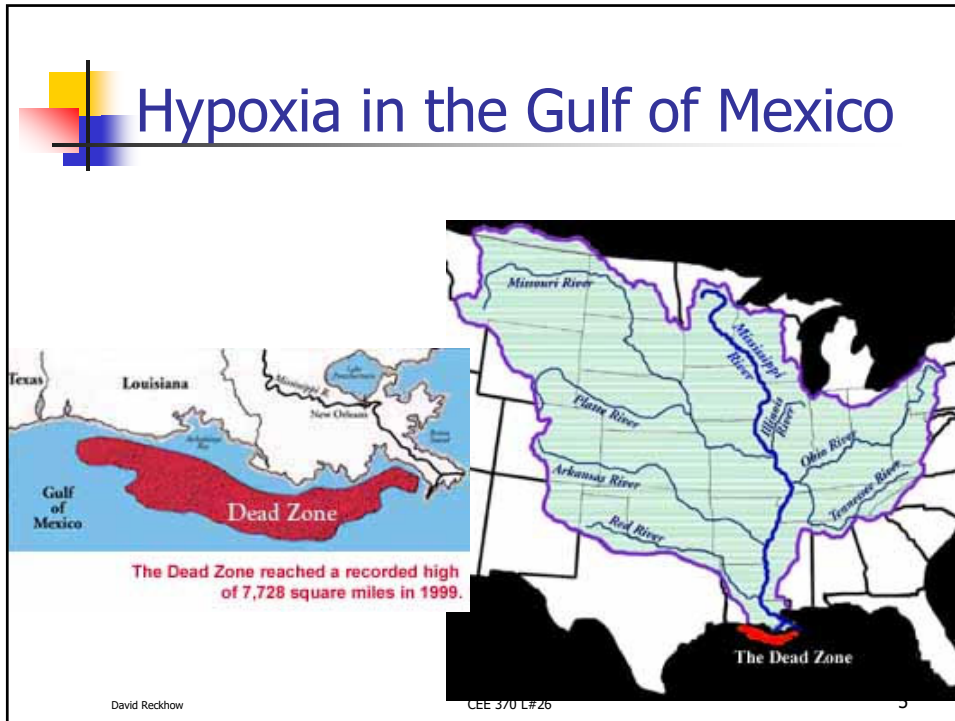
City	# outfalls
Boston	66
Cambridge	13
Chelsea	5
Fall River	19
Fitchburg	27
Gloucester	4
Haverhill	23
Lawrence	2
Lowell	15
Lynn	4
New Bedford	39
Somerville	12
Taunton	1
Worcester	1

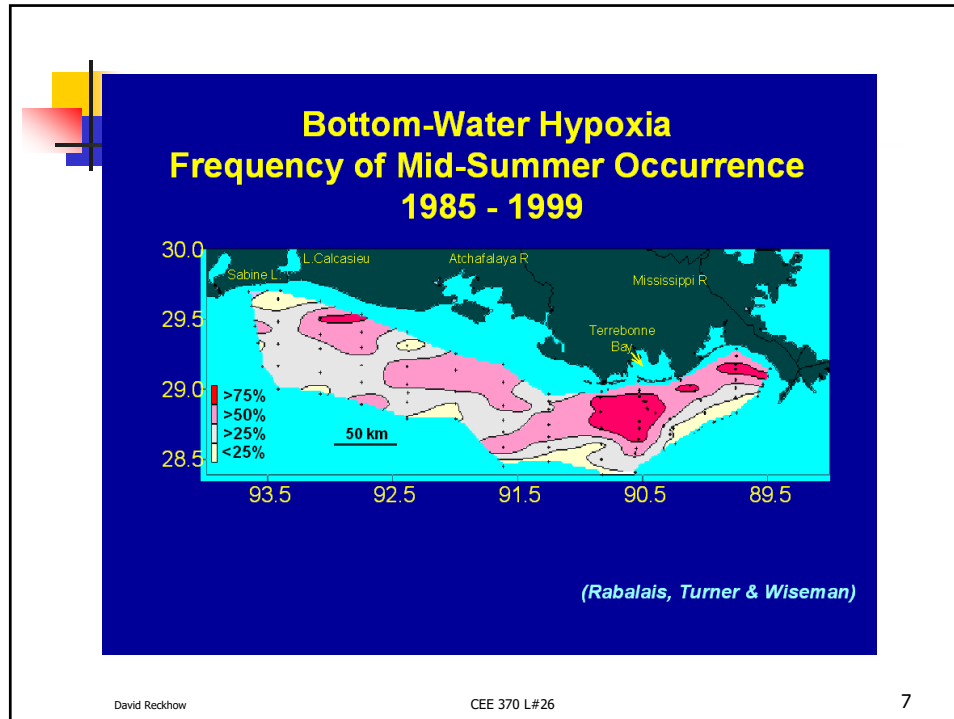
City	# outfalls
Agawam	12
Chicopee	40
Erving	1
Holyoke	15
Ludlow	5
Montague	3
Palmer	26
South Hadley	11
Springfield	25

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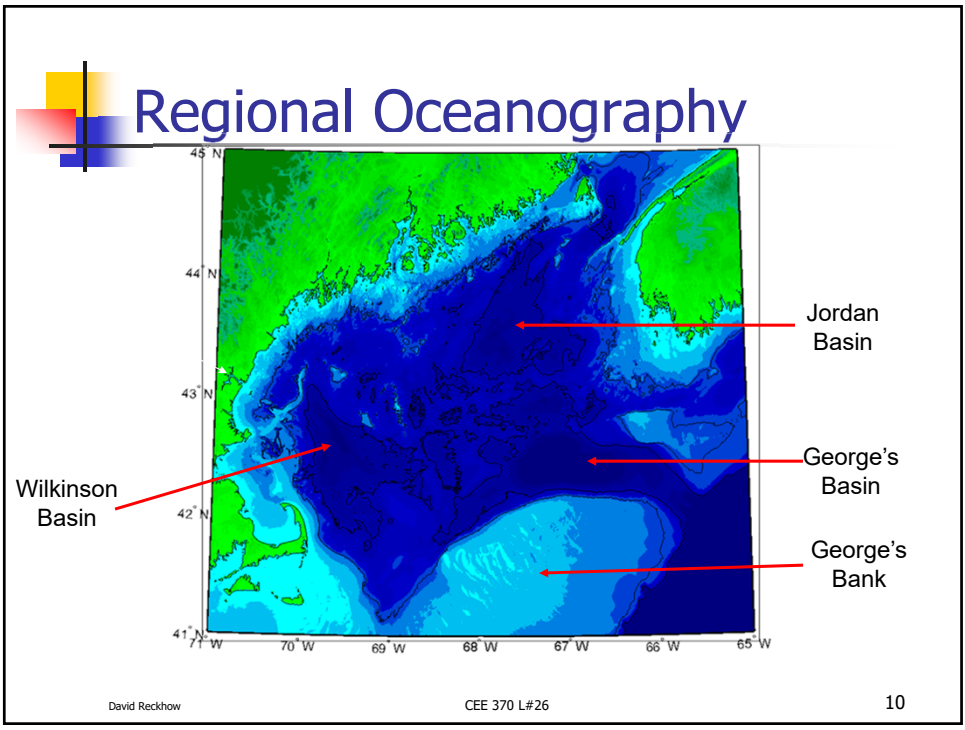


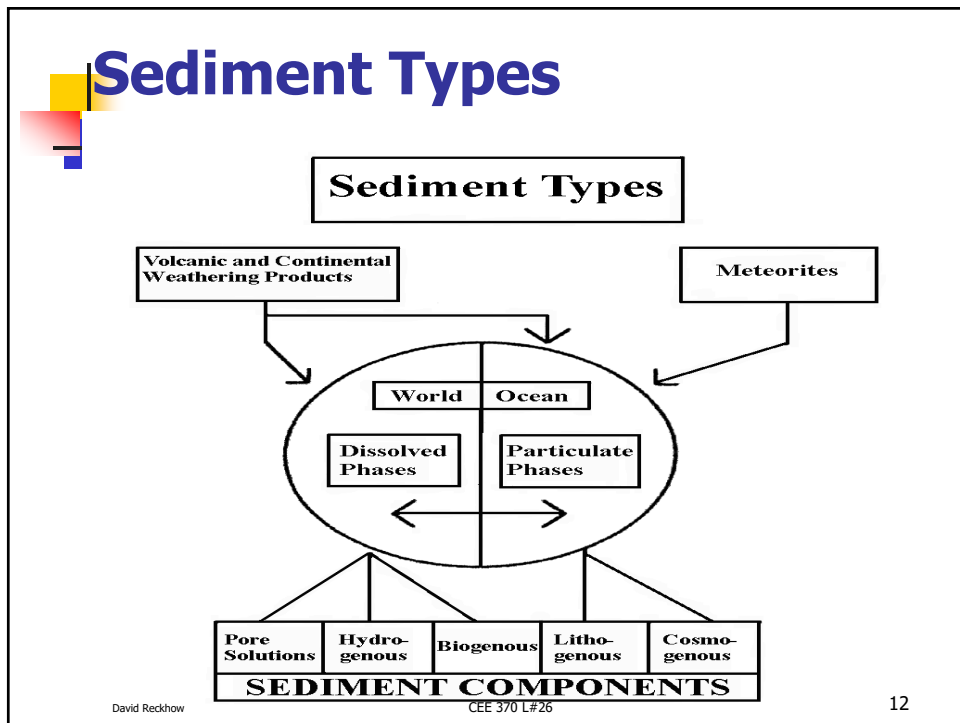
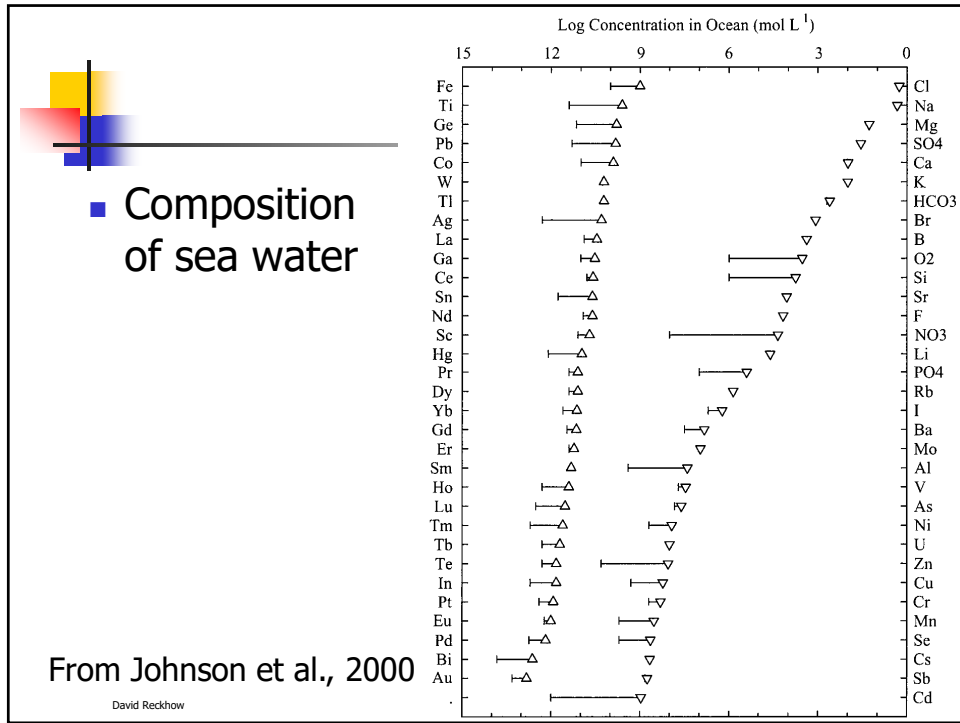
- ## 4 Disciplines
- Geological Oceanography
 - Structure of the sea floor
 - Chemical Oceanography
 - Chemical composition and properties of seawater
 - Physical Oceanography
 - Waves, tides, currents
 - Biological Oceanography
 - Oceanic life forms
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Physical Characteristics of the Oceans

Sea	Area (10 ⁶ km ²)	Volume (10 ⁶ km ³)	Depth (m)	
			ave	max
Pacific	181	714	3,940	11,022
Atlantic	107	351	3,293	9,219
Indian	74	285	3,870	7,400
Total	362	1350	3,729	11,022

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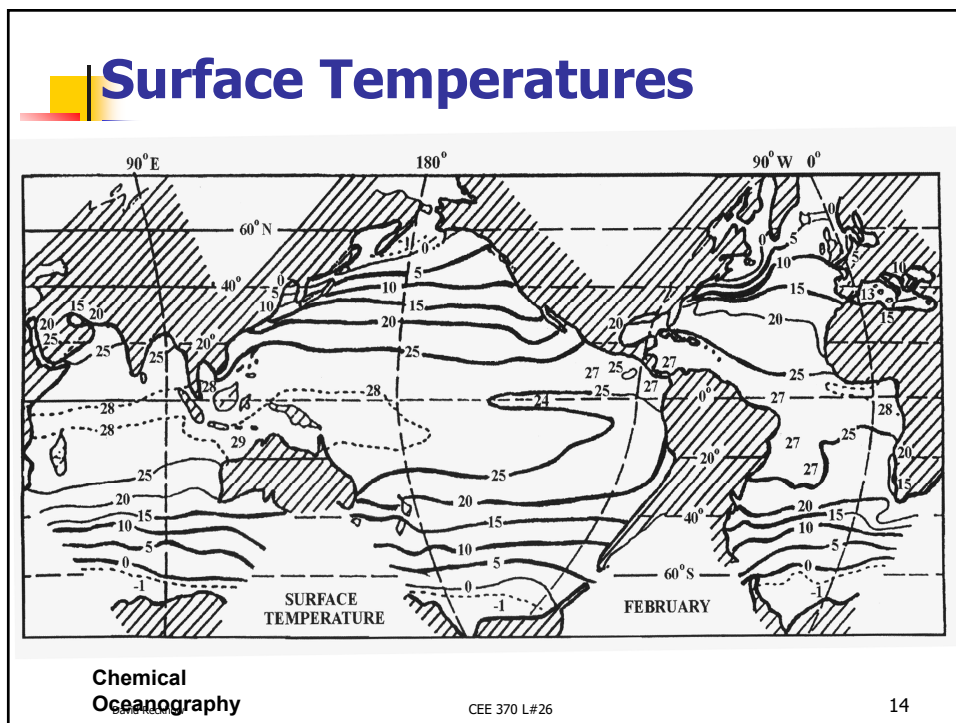


Descriptive Oceanography

- **Distribution of t , S and density**
- **Currents in the World Oceans**
- **Water Masses in the Oceans**
- **Use of Chemical Tracers**
 ^{14}C , Tritium, ^3He , CFC
- **Age of Water Masses**
- **The Ocean Conveyor Belt**

Chemical
Oceanography

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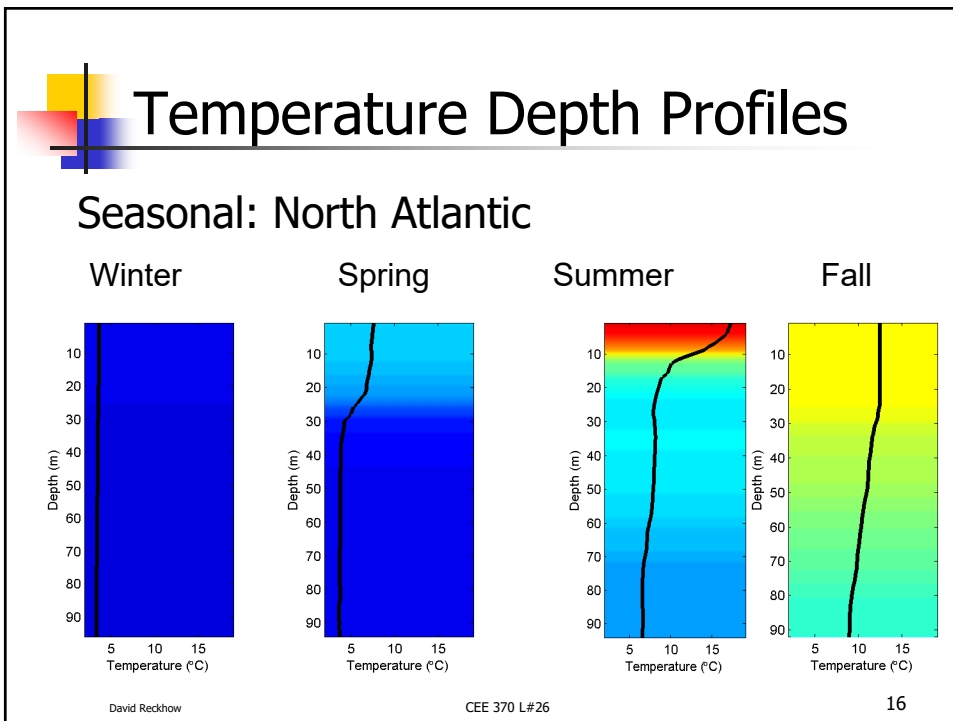


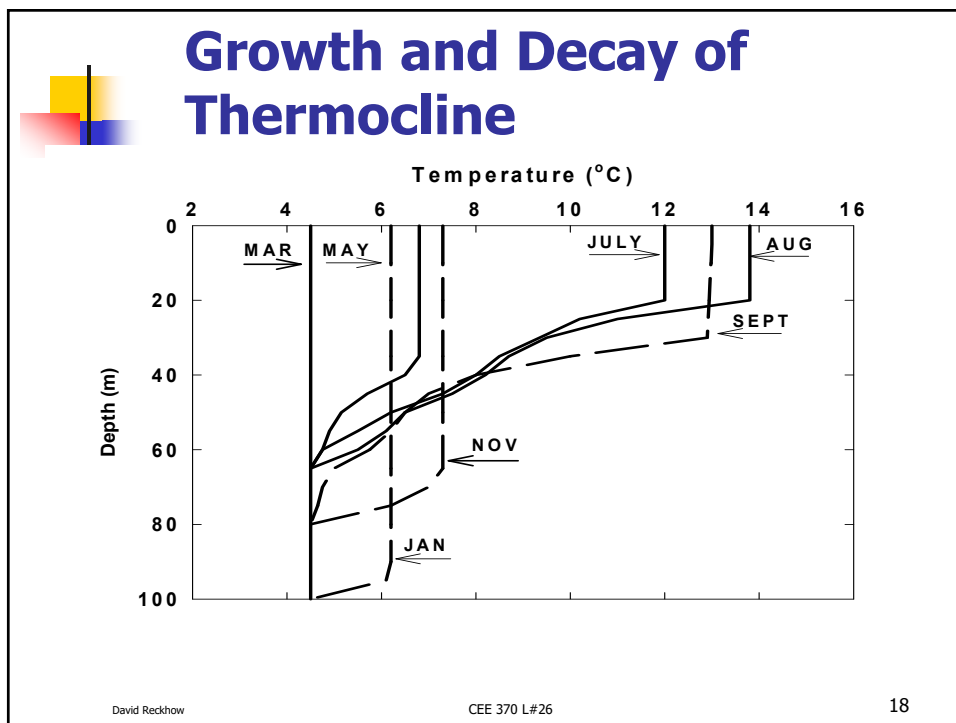
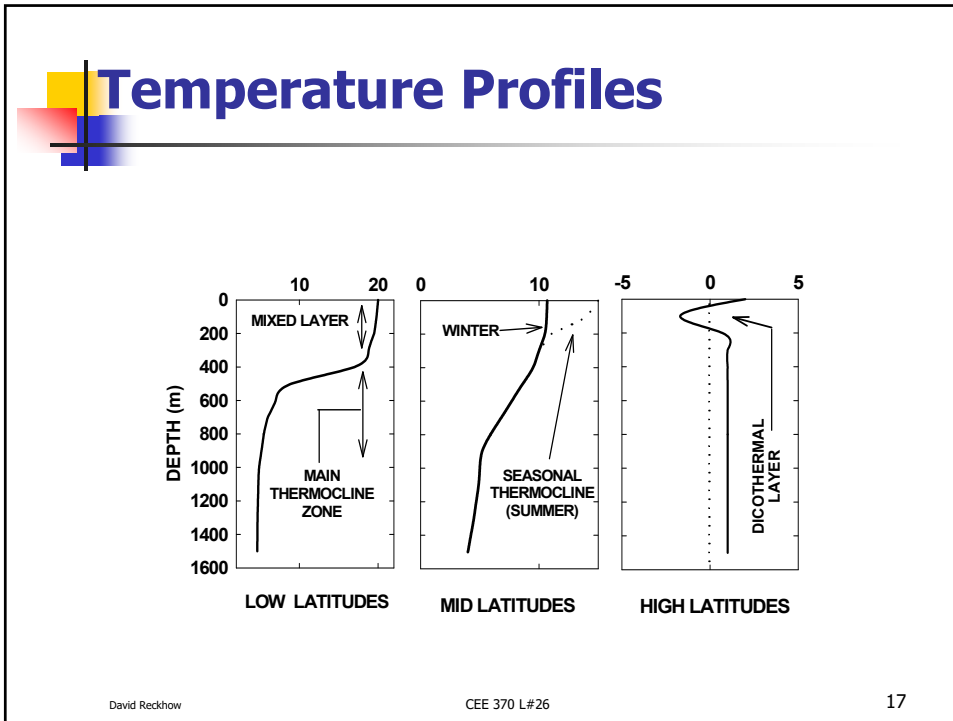
Temperature Distribution

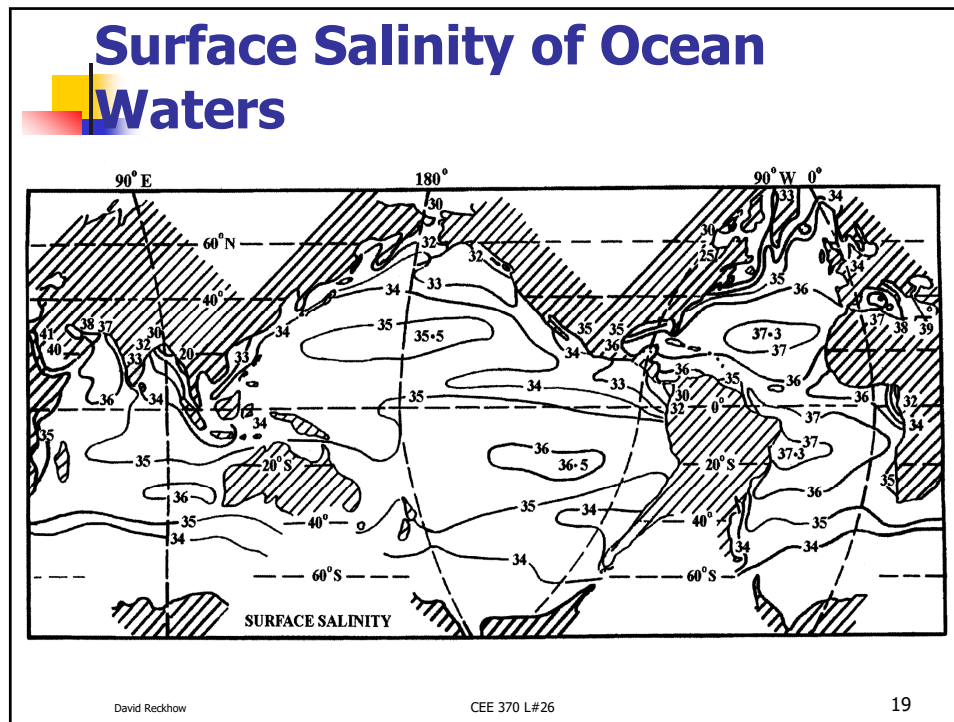
Solar Radiation
Waters are colder in Polar regions
Waters are warmer in Equatorial Regions

Upwelling
Waters are colder off the Western Coasts of continents

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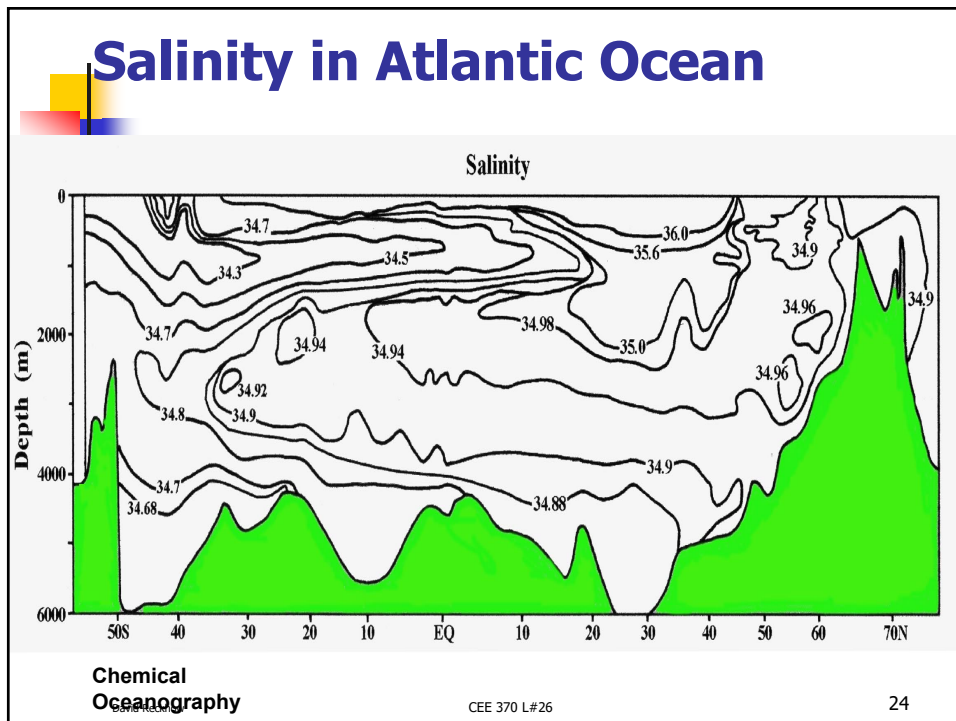
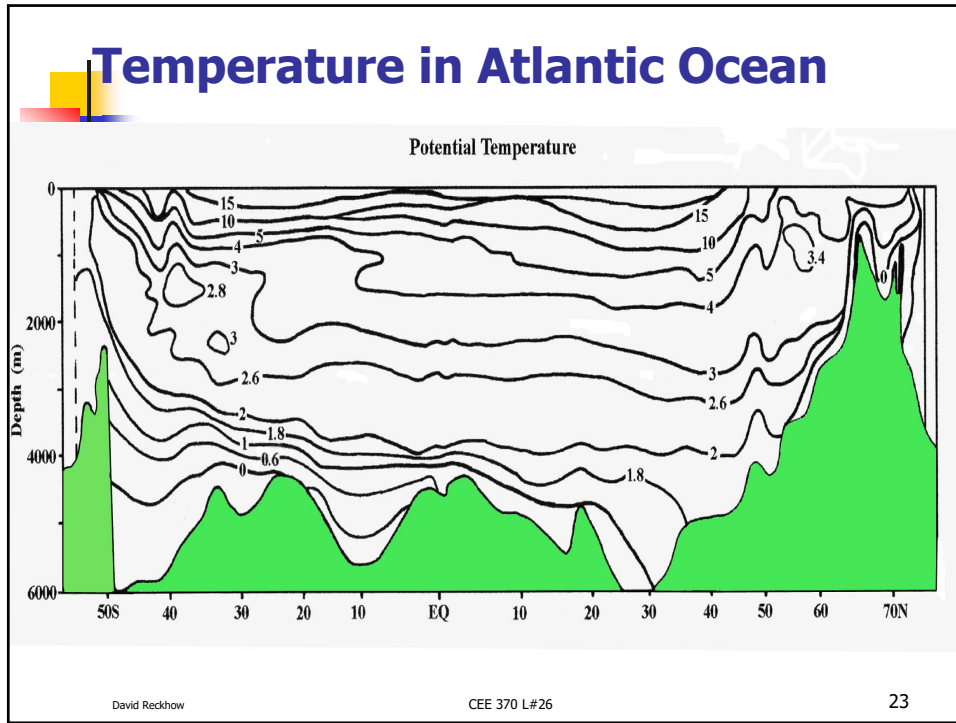


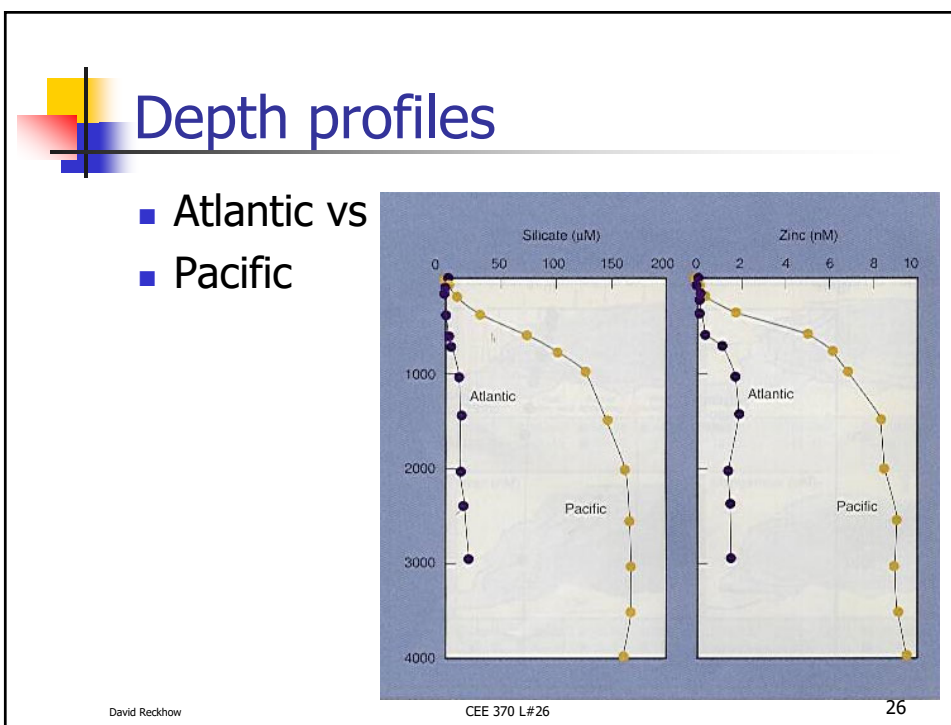
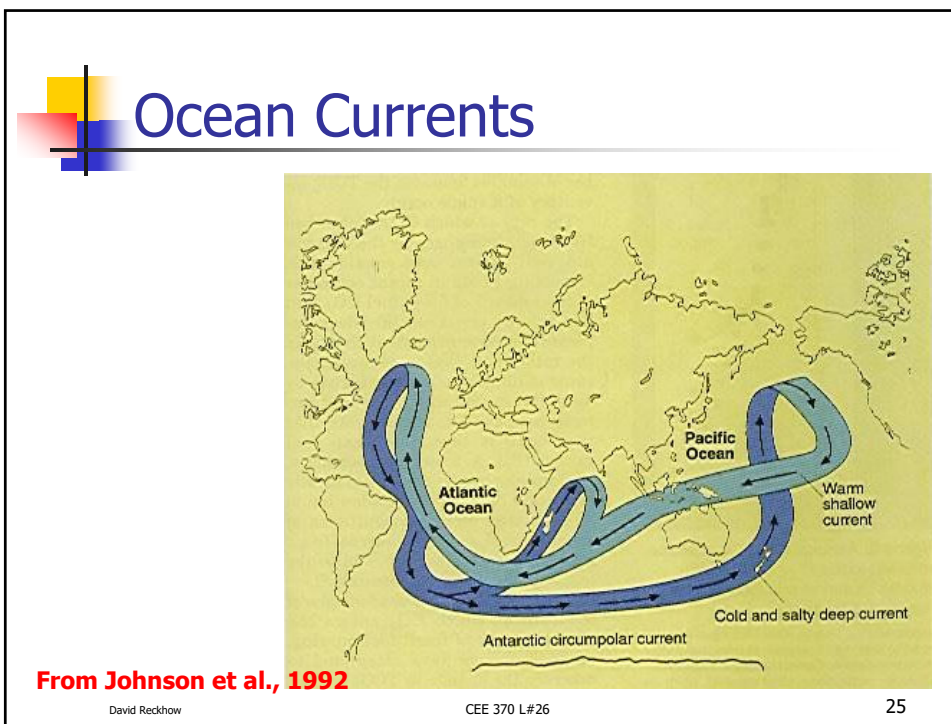



Salinity Distribution

- **Precipitation and Melting of Ice**
 1. Salinity is lower in Polar Regions
 2. Salinity is lower in Equatorial Regions
 3. Salinity is lower in Estuarine Regions
- **Evaporation and Freezing**
 1. Salinity is higher in mid-Latitudes
 2. Salinity is higher in Med. and Red Seas
 3. Salinity is higher in the Atlantic than the Pacific

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- To next lecture

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