

Annotations by Wallace (6-24-2013)
including new data overlay
with respect to pH figure on page 2 of
<http://www.pmel.noaa.gov/pubs/PDF/feel2899/feel2899.pdf>

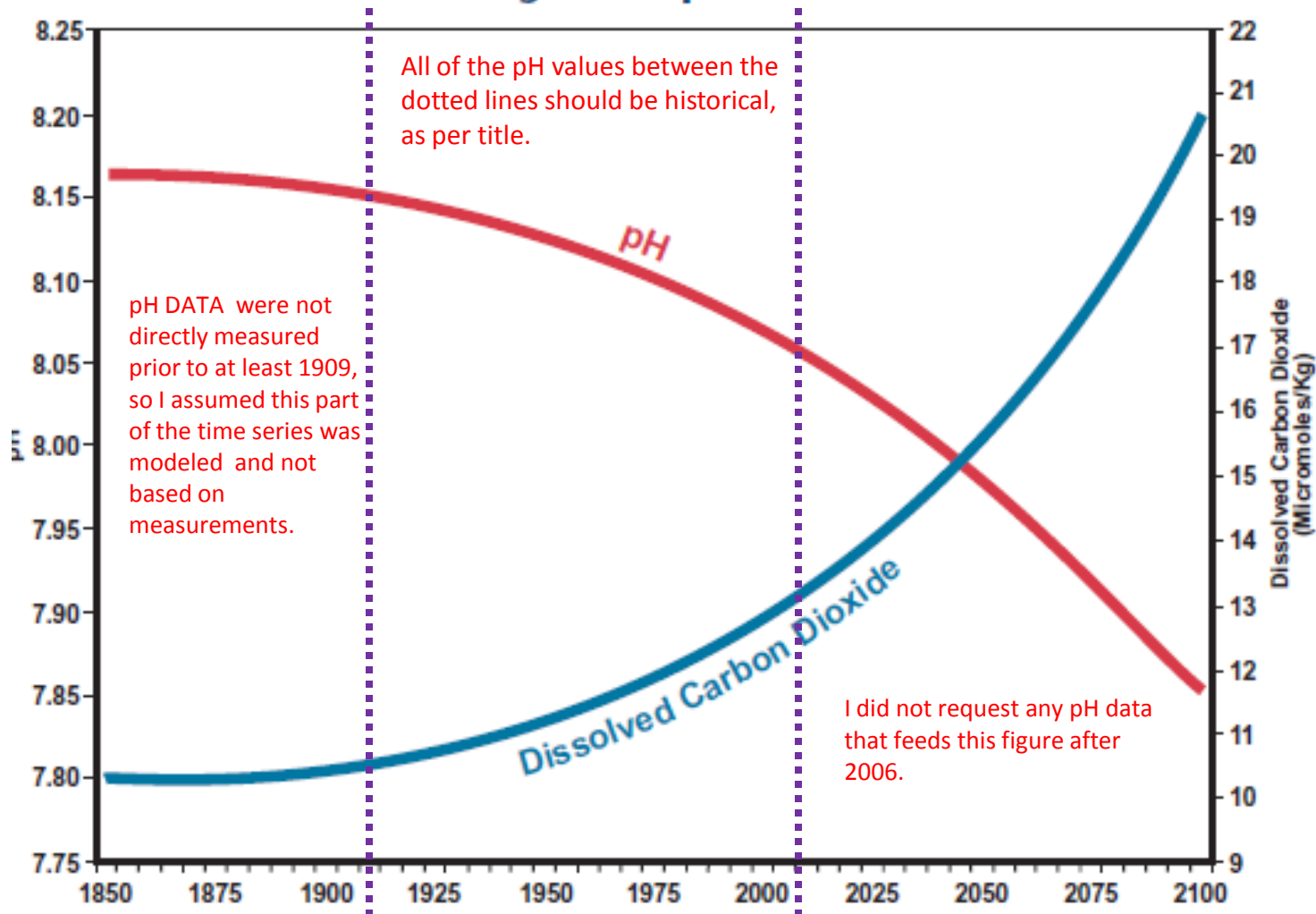
Any using this material should cite this by:

*Annotations and notes associated with
FOIA DOC-NOAA-2013-000884.*

*Wallace Personal communication with FEEL2899.pdf
authors Feely, Sabine, and others, email string over Spring
to Summer of 2013*

Wallace annotations of in red text and purple dotted lines.

Historical & Projected pH & Dissolved CO₂



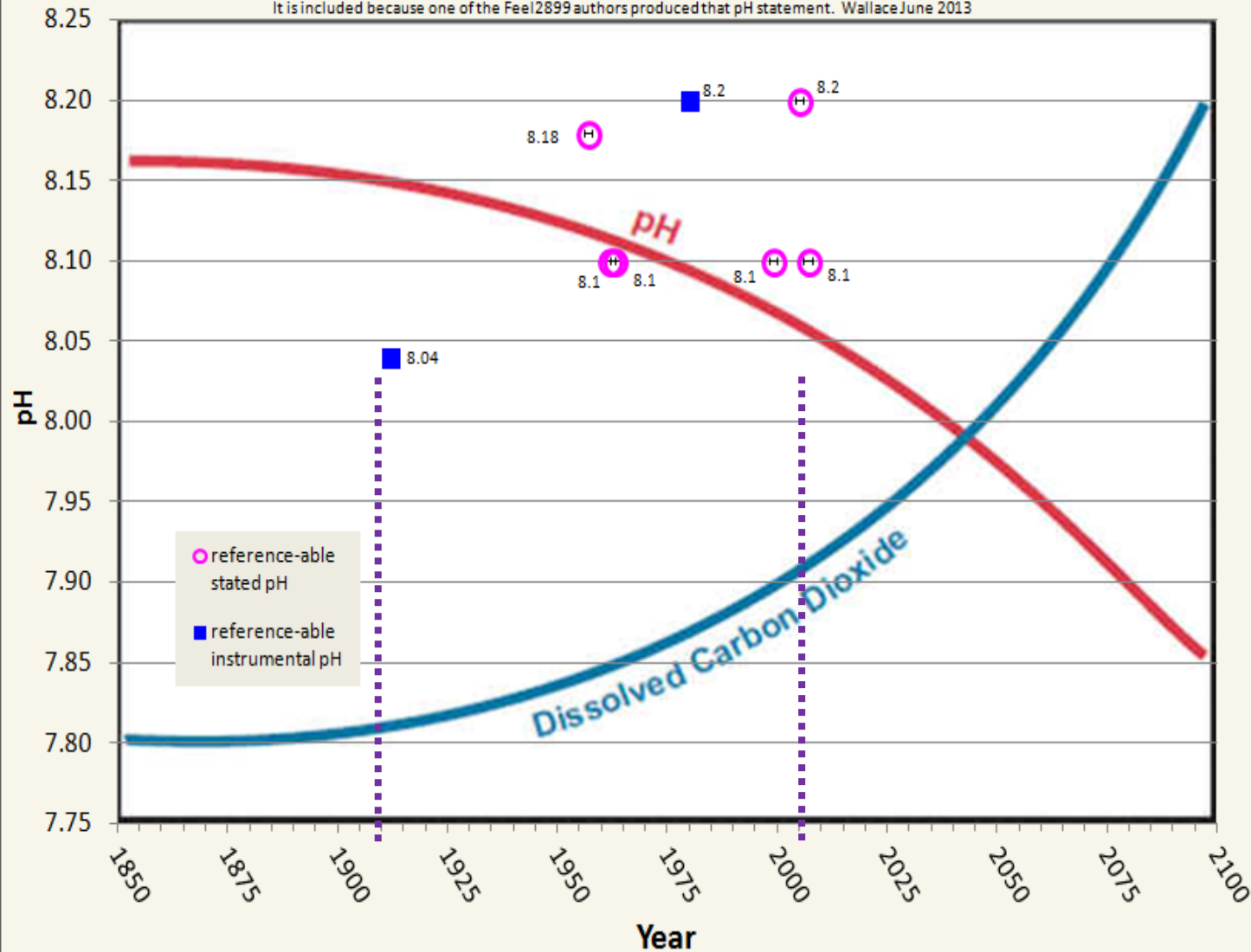
As the ocean concentration of carbon dioxide increases, so does acidity (causing pH to decline).

Background image from pH figure on page 2 of <http://www.pmel.noaa.gov/pubs/PDF/feel2899/feel2899.pdf> Title of background figure : *Historical & Projected pH & Dissolved CO₂* Teal curve from reference background image is of a time series for dissolved CO₂. Although it is a key feature of the subject paper, it is not of interest in this contextual review of 20th Century Historic Ocean pH values. Accordingly, no further information is restored from that source to this graphic. The red curve is the subject of this time series data review.

Overlay of reference-able ocean pH values onto the historical portion of Feel2899.pdf curve

8 values shown represent references acquired by June of 2013. Latest value from after 2006.

It is included because one of the Feel2899 authors produced that pH statement. Wallace June 2013



The data items which have been added represent values recovered so far by Wallace through various searches on 20th century ocean pH data, esp. prior to 1988

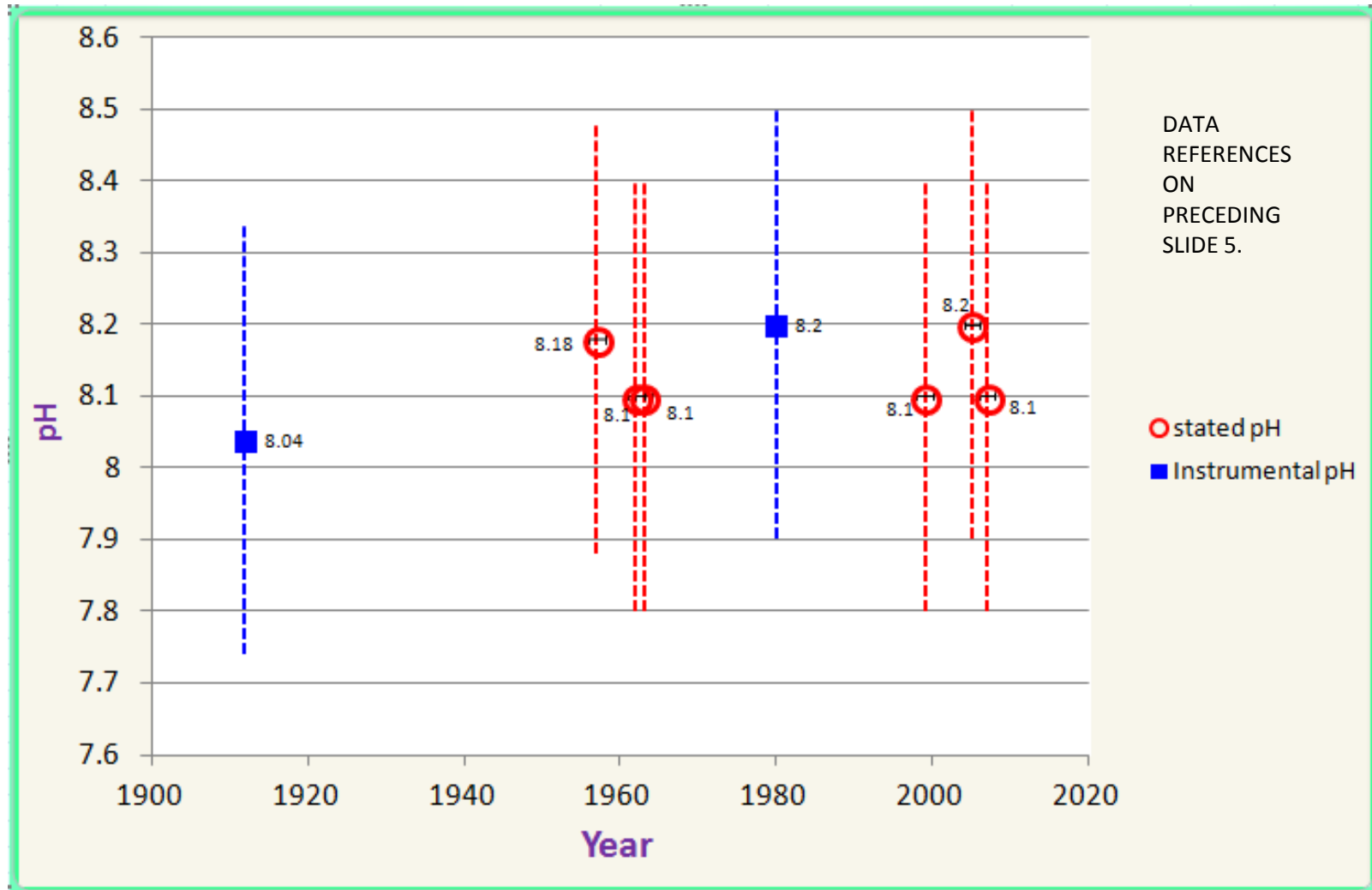
DATA REFERENCES ON FOLLOWING SLIDE 5.

Ocean pH time series, Wallace estimate

based on the independent and sometimes indirect sources located as of June 2013

	id	site info and/or reference	year	pH	comments	values in addition
instrumental	1	from the 20 m depth entry of the Oceanographic Observations During the cruise of the "Veslemoy" to spitsbergen in 1912 http://www.nodc.noaa.gov/archive/arc0022/0054149/1.1/data/0-data/AARI1.0054149/	1912	8.04	from the 20 m depth entry of the Oceanographic Observations During the cruise of the "Veslemoy" to spitsbergen in 1912 other values over depth __>	8.08 8.04 7.92 7.95 7.93 7.984
		http://nwis.waterdata.usgs.gov/nwis/qwdata/?site_no=461337124042705&agency_cd=USGS&param_group=PHY&format=rdb	1980	8.2	Clatsop County, Oregon coast Latitude 46°13'37", Longitude 124°04'27"	
stated in a reference	2	Roger Revelle and Hans Suess, 1957 "Carbon Dioxide Exchange Between Atmosphere and Ocean and the Question of an Increase of Atmospheric CO2 during the Past Decades" Tellus IX (1957), 1	1957	8.18	an estimation based on global ocean volume and chemistry	
	3	R.M. Garrels and M.E. Thompson, 1962, "A chemical model for sea water at 25deg C and one atmosphere total pressure" American Journal of Science, Vol. 260, p. 57-66	1962	8.1	an estimation based on ocean chemistry	
	4	Goldberg, 1963, I. Chemistry 1. The Oceans as a Chemical System. In The Sea, Volume 2: The Composition of Sea-Water Comparative and Descriptive.. John Wiley and Sons, Inc.	1963	8.1	citing Sillen (1961)	7.9 8.3
	6	Kleypas, Joan A., R. W. Buddemeier, D. Archer, JP Gattuso, C. Langdon, and BN Opdyke, 1999, "Geochemical Consequences of Increased Atmonspheric Carbon Dioxide on coral Reefs", Science 2 april 1999, vol. 284 no 5411 pp. 118-120	1999	8.1	a claim which is simply stated.	8 8.2
	7	The Royal Society, June 2005, "Ocean acidification due to increasing atmospheric carbon dioxide". Policy document 12/05. ISBN 0 85403 617 2	2005	8.2	a claim which is simply stated.	
	8	Table 2 of Chapter 6.1 (of 6. Salinity and the composition of sea water. 6.1 The major ion composition of sea water)) of •Dickson A. G., Sabine C. L. & Christian J. R., 2007. Guide to best practices for ocean CO2 measurements. PICES Special Publication 3:1-191.	2007	8.1	a claim which is simply stated.	

Preliminary HISTORIC OCEAN PH DATA FROM LITERATURE SOURCES



If the range of uncertainty were +/- 0.3 pH units (as suggested by one reference), then the error bars would show as the dotted lines. The trend of historic ocean pH is flat, if not slightly weighted towards alkalinization.

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Spring to Summer of 2013