

Report on activities of the SCOR/IAPWS/IAPSO Joint Committee on the Properties of Seawater (JCS)

Rich Pawlowicz

Chair, JCS

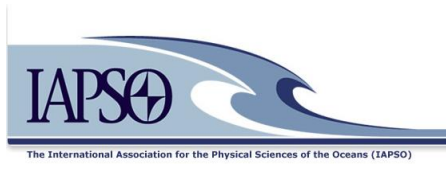
University of British Columbia

Vancouver, Canada

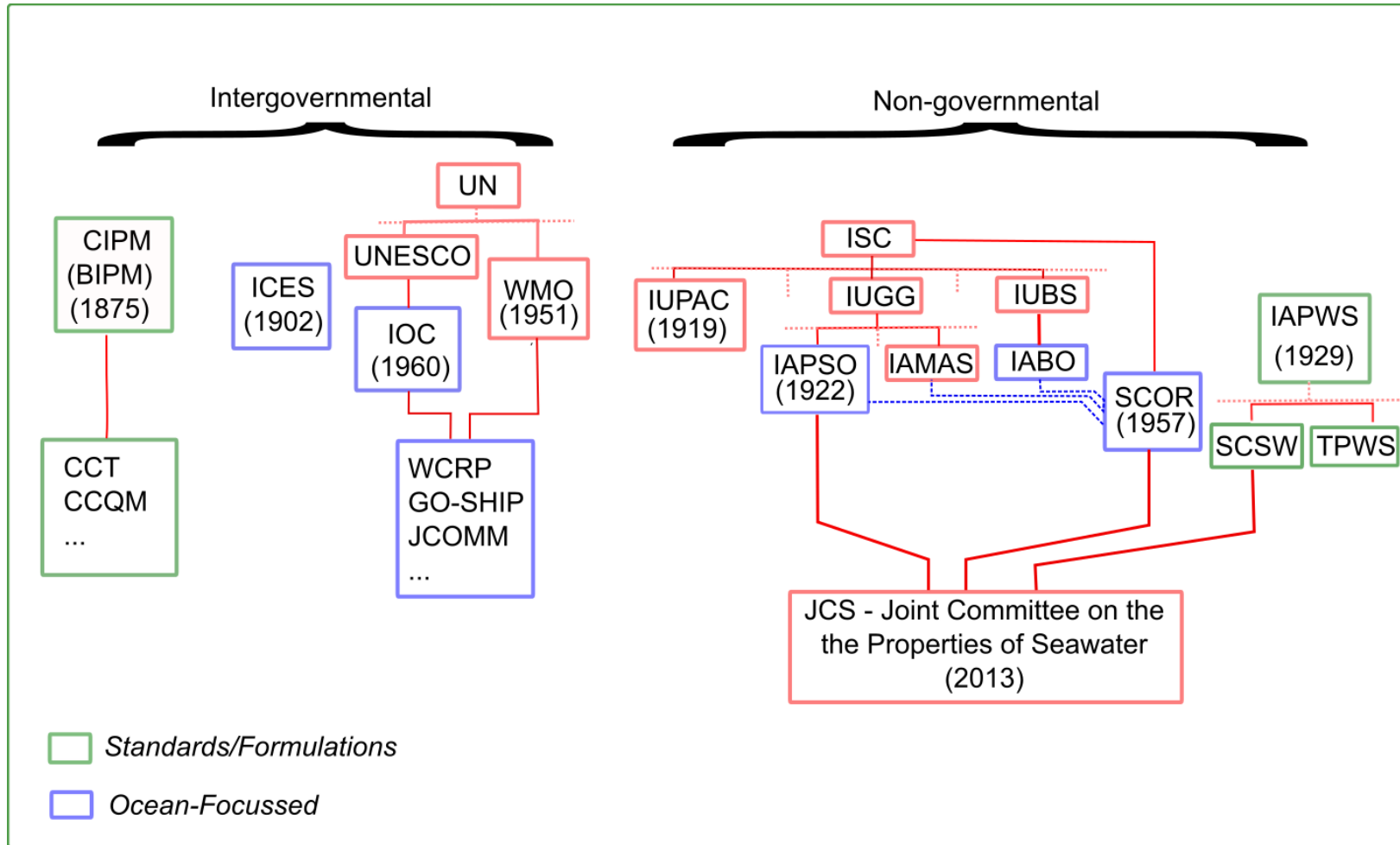


Purpose of JCS (2013, 2018 Terms of Reference)

- JCS is meant to act as:
 - an “international point of contact” for seawater-related questions
 - a permanent source of expertise on seawater issues for “parent” organizations
 - the maintainers of seawater-related software and standards for the scientific community (especially for **TEOS-10**, now also for MarChemSpec)
 - a conduit for cooperation with other scientific/technical organizations, e.g., BIPM, WMO, IUPAC
- JCS supports and promotes research activities related to the properties of seawater (field, lab, numerical)
- JCS may, from time to time, summarize knowledge and suggest gaps

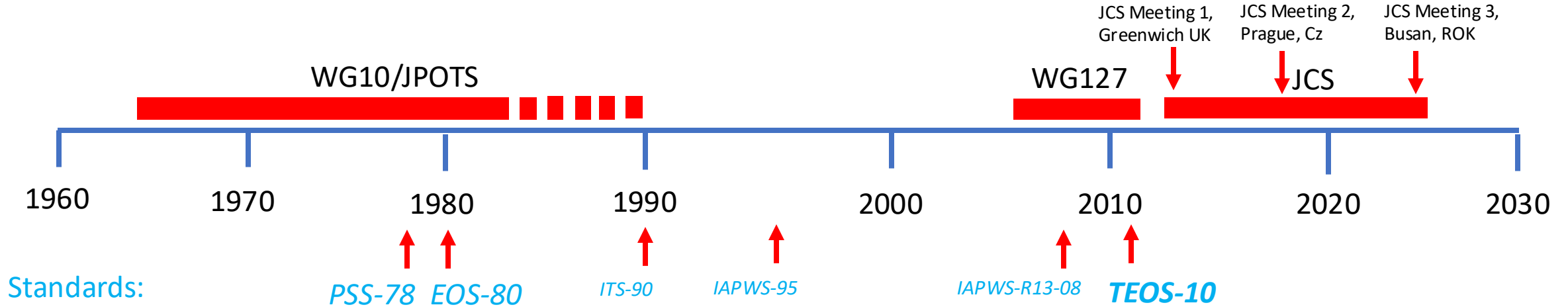


JCS and its parents (SCOR, IAPSO, IAPWS)





Timeline of “Seawater Properties”



• Membership:

- WG10/JPOTS (1964): (6 members, 1st meeting, ~20 participants) – joint with SCOR/ICES/IAPO/UNESCO
- WG10/JPOTS (1975): (12 members, 7th meeting, ~16 participants)
- WG127 – 11 full members – joint with SCOR/IAPSO/IAPWS. (IOC publishes TEOS-10)
- JCS (2013): 15 members (Workshop #1 at IAPWS-sponsored 16th ICPWS attendance ~30). Joint SCOR/IAPSO/IAPWS
- JCS (2018): 16 members (Workshop #2 at IAPWS-sponsored 17th ICPWS attendance ~20)
- JCS (2025): 22 members (Workshop #3 at IAPSO-sponsored BACO-25, attendance 5)
- JCS (future?):

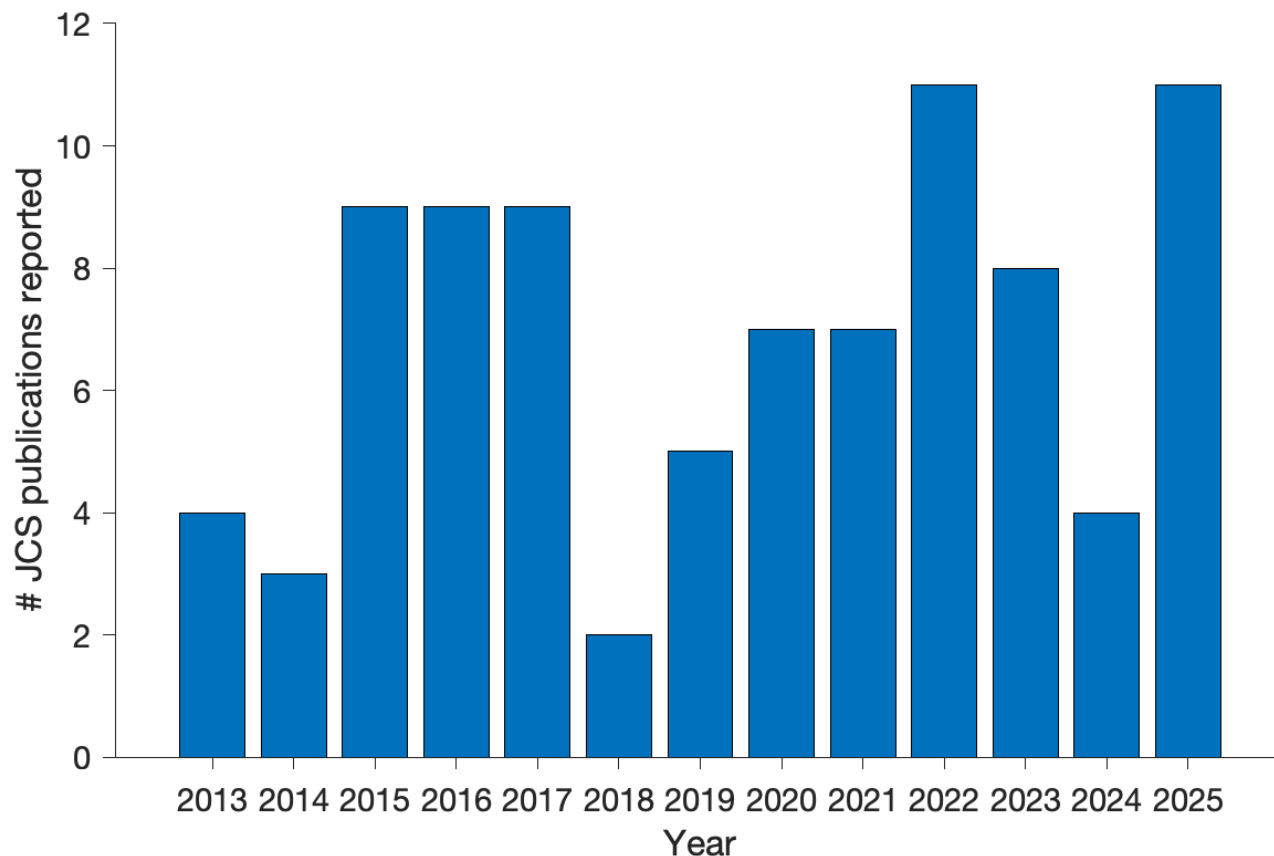


JCS Papers published

(extracted from previous annual reports)

• Important publications in 2025:

- 1) H. Uchida, M. Oe, and M. Wakita, **History of Batch-to-Batch Comparative Studies of International Association for the Physical Sciences of the Oceans Standard Seawater**, 2025, pg. 139-162, in *Chemical Reference Materials for Oceanography: History, Production, and Certification*. Eds: M. Aoyama, C. Cheong, and A. Murata, Springer Nature, Singapore.
- 2) H. Uchida, M. Wakita, A. Makabe, A. Murata, A. Petrovic, **Changes in the Composition of International Association for the Physical Sciences of the Ocean Standard Seawater**, 2025, pg 163-189, in *Chemical Reference Materials for Oceanography: History, Production, and Certification*. Eds: M. Aoyama, C. Cheong, and A. Murata, Springer Nature,
- 3) G. Capitaine, R. Schäfer, F. Bastkowski, D. Stoica, O. Pellegrino, R. Quendera, E. P. Achterberg, T. Wagener, S. L. Clegg, S. Seitz, P. Fisticaro, **pH_T measurements of TRIS buffer solutions in an artificial seawater matrix in the salinity range 5–40 and temperature range 5–40 °C. Part 1: measurements and data fitting**, *Marine Chemistry*, 273, 104551 <https://doi.org/10.1016/j.marchem.2025.104551>



↑
 Taskgroups:
Salinity/Density,
pH,
RH

↑
 Added:
Chemical
Speciation

TEOS-10 related activities: Web site

www.teos-10.org

- **Software:**
 - GSW (8 languages), SIA (2 languages)
- **Educational resources:**
 - Slides
 - TEOS-10 Primer
 - Full course on thermodynamics
 - 2 lecture overview of seawater thermodynamics
- JCS news (annual reports)
- JCS membership
- List of Publications (relevant to definition of TEOS-10)

- Web site contents remain stable (IAPSO funding), but as it is unmaintained future not clear. No statistics could be generated this year



TEOS-10
Thermodynamic Equation Of Seawater - 2010

MENU

- Home
- Publications
- Software
- Educational resources
- JCS news
- About JCS
- About WG127
- Contact us

HOME

This site is the official source of information about the Thermodynamic Equation Of Seawater - 2010 (TEOS-10), and the way in which it should be used.

TEOS-10 is based on a Gibbs function formulation from which all thermodynamic properties of seawater (density, enthalpy, entropy sound speed, etc.) can be derived in a thermodynamically consistent manner. TEOS-10 was adopted by the Intergovernmental Oceanographic Commission at its 25th Assembly in June 2009 to replace EOS-80 as the official description of seawater and ice properties in marine science.

A significant change compared with past practice is that TEOS-10 uses Absolute Salinity S_A (mass fraction of salt in seawater) as opposed to Practical Salinity S_p (which is essentially a measure of the conductivity of seawater) to describe the salt content of seawater. Ocean salinities now have units of g/kg.

Absolute Salinity (g/kg) is an SI unit of concentration. The thermodynamic properties of seawater, such as density and enthalpy, are now correctly expressed as functions of Absolute Salinity rather than being functions of the conductivity of seawater. Spatial variations of the composition of seawater mean that Absolute Salinity is not simply proportional to Practical Salinity; TEOS-10 contains procedures to correct for these effects.

The document What every oceanographer needs to know about TEOS-10 (the "TEOS-Primer" for short) is a concise summary of the salient theoretical concepts which underpin TEOS-10, while Getting started with the GSW Oceanographic Toolbox of TEOS-10 guides the user through the steps required to process and publish physical oceanographic data using TEOS-10. A detailed explanation of the TEOS-10 thermodynamic description of seawater can be found in the TEOS-10 Manual which has been published by IOC, SCOR and IAPSO. Note that a pdf version of TEOS-10 Lecture Slides is located on the publications page.

Importantly, while Absolute Salinity (g/kg) is the salinity variable that is needed in order to calculate density and other seawater properties, the salinity which should be archived in national data bases continues to be the measured salinity variable, Practical Salinity (PSS-78). To avoid confusion while the use of Practical Salinity in scientific publications is phased out, published values of salinity should be specifically identified as being either Practical Salinity with the symbol S_p or Absolute Salinity with the symbol S_A .

Links at left provide more detailed information about publications describing the new approach, and computer codes that implement it.

TEOS-10 PRIMER

Click to open the TEOS-10 Primer (pdf)

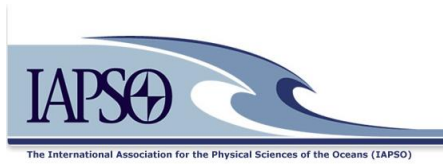
TEOS-10 LECTURE SLIDES

Click to open the TEOS-10 teaching aid slides(powerpoint)

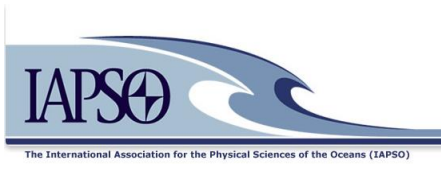
DISCLAIMER

Designed by Paul Barker & Anooosh Sarraf



Proposal going forward

- Problem: research is vigorous, continuing, and needed, but shared goals less clear. Time for a JCS leadership change, but no candidates identified for leading a larger committee. Thus we propose:
- The Committee will consist of a SMALL number of experts who will be appointed as special advisors, one of which can be the chair for reporting purposes, and the past chair.
 - (proposed 3 special advisors on: salinity/density, metrology, thermodynamics - a return to a TEOS-10 focus)
- Terms of reference for the committee will also be re-examined on 5 year terms, but are proposed to be:
 1. To provide advice to parent organizations on operational and research issues related to TEOS-10
 2. To be a contact for TEOS-10 standards and documentation and GSW Software, and on any related web sites, and make recommendations about website structure necessary upgrades (on an irregular basis)
 3. To maintain a list of priority research tasks related to seawater properties.
 4. To maintain an email list for “TEOS-10 interested parties”.



JCS Structure (2025)

- **Executive**
 - Chair: R. Pawlowicz, Vice Chairs: S. Seitz (**vacant**)
- **Taskgroups:**
 - **Salinity/Density**
 - Chair: (Pawlowicz), (Seitz), H. Uchida, R. Woosley, Y. Kayukawa
 - **pH**
 - Chair: A. Dickson, M.F. Camoes, S. Clegg, F. Bastkowski
 - **Moist Air**
 - Chair: O. Hellmuth, J. Lovell-Smith, R. Feistel, S. Bell
 - **Chemical Speciation**
 - Chair: D. Turner, (S. Clegg), P. Croot, C. Foti. M. Gledhill, M. Hain, P. Lodeiro, L. Haffert
- **Expert Subgroups**
 - **Thermodynamics** (Feistel)
 - **Numerical modelling and applications** T. McDougall
 - **Software** (**vacant**)
 - **Industry** C. Bachler/Anton Paar, R. Williams/OSIL