

Salinity and Salinity Measurement in Marine Aquaria

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In the marine aquarium, salinity is a measure of the dissolved sodium chloride and other major ions in salt water. Salinity measurement is complex, and varies by temperature¹, as well as by the ionic makeup of major ions (chloride, sulfate, sodium, and magnesium) in the water² (see tables 1 and 2 below). Salinity is one of the most important parameters to measure in salt water aquaria. There are a variety of different ways for the marine aquarist to measure salinity, including swing-arm hydrometers, floating hydrometers, refractometers, and conductivity probes. Units of measurement usually vary by the instrument. Natural seawater typically ranges from 34-37 ppt, with 35 ppt considered an average reading for reef environments³. Seawater with a salinity of 35 ppt corresponds to a specific gravity of 1.0264, or a conductivity of 53 mS/cm at 77 degrees. Ron Shimek, PhD, Randy Holmes-Farely, PhD, and Eric Borneman, PhD all recommend a target of 35 ppt for reef aquaria.

Key points for salinity in marine aquaria are; 1) decide on a **target** salinity, and 2) strive for **stability** (e.g., fresh water toptoff, auto-toptoff of small amounts over time, stability in major ions (water changes, dosing of calcium, magnesium, and alkalinity)).

Temperature (°F)	Temperature (°C)	Specific Gravity
74	23.5	1.0270
75	24.0	1.0268
76	24.5	1.0266
77	25.0	1.0264
78	25.5	1.0262
79	26.0	1.0260
80	26.5	1.0258
81	27.0	1.0256
82	27.5	1.0254

Table 1: Specific gravity by temperature with a salinity of 35 ppt.⁴

Magnesium (ppm)	Salinity (ppt)	Refractive Index	Predicted Salinity (ppt)	Relative Error in Salinity (%)
800	35	1.33925	34.2	2.20%
900	35	1.33928	34.3	2.00%
1000	35	1.33931	34.5	1.40%
1100	35	1.33934	34.7	0.90%
1200	35	1.33938	34.9	0.30%
1280	35	1.33940	35.0	0.00%
1300	35	1.33941	35.1	0.30%
1400	35	1.33944	35.2	0.60%
1500	35	1.33947	35.4	1.10%

Natural Seawater

Table 2: The error in salinity measurement via refractive index when magnesium is present at unusually high or low concentrations.

¹ Shimek, R, "What are Natural Reef Salinities and Temperatures...Really...and Does It Matter?" <http://web.archive.org/web/20030218193420/www.animalnetwork.com/fish2/aqfm/1997/nov/features/1/default.asp>
² Holmes-Farley, R, "Refractometers and Salinity Measurement" <http://reefkeeping.com/issues/2006-12/rhf/index.php>
³ Borneman, EH, "Aquarium Corals: Selection, Husbandry, and Natural History" T.F.H. Publications, 2004
⁴ Holmes-Farley, R, "Temperature Corrections for Hydrometers" <http://www.reefkeeping.com/issues/2004-07/rhf/index.php>