



**SEAL**  
Analytical



# High Precision Nutrient Analysis in Seawater

*The high precision, robust design and low detection limit of SEAL analyzers make them the first choice for seawater analysis. Leading seawater laboratory and research institutes world-wide use AutoAnalyzer, QuAAtro and TrAAcs.*



## NOTABLE SEAWATER USERS

- ▶ Woods Hole Oceanographic Institution – Woods Hole, Massachusetts
- ▶ French Research Institute for Exploitation of the Sea (IFREMER) – France
- ▶ Scripps Institution of Oceanography – San Diego, California
- ▶ National Institute for Oceanographic Research (NIOZ) – Netherlands
- ▶ Atlantic Oceanographic and Meteorological Laboratory (AOML/NOAA) – Miami, FL
- ▶ Japan Agency for Marine-Earth Science and Technology (JAMSTEC) – Japan
- ▶ University of Hawaii – Department of Oceanography – Honolulu, Hawaii
- ▶ Bermuda Institute of Ocean Sciences (BIOS) – Bermuda
- ▶ Alaska Department Fisheries and Game – Juneau, Alaska
- ▶ The Commonwealth Scientific and Industrial Research Organisation (CSIRO) – Australia
- ▶ Plymouth Marine Laboratory – Plymouth, UK
- ▶ The Australian Institute of Marine Science (AIMS) – Australia

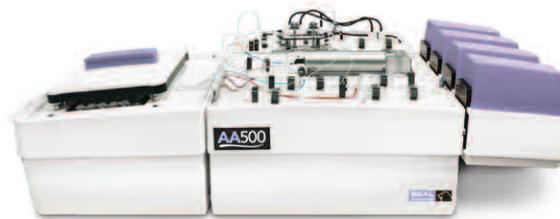
Parameter	Notes	Detection Limit	Refractive Index	Multi-Test Available	Multi-Range Available
Ammonia	Fluorometric; Low Detection Limit, Unaffected by Salinity	2 nMol	Zero	N	N
Ammonia	Colorimetric; Grasshof, Inframer and NIOZ low-phenol methods available	5 nMol	Varying Depending on salinity	Y	Y
Nitrate/TON	Cd Coil or Column available	2 nMol	Not Detectable	Y	Y
Nitrite	NEDD	1 - 2 nMol	Not Detectable	Y	Y
Phosphate	Grasshof and low-Sb methods available	2 - 3 nMol	0.01 nM	Y	Y
Silicate	Molybdate	40 nMol	Not Detectable	Y	Y

Other methods including Total Nitrogen and Phosphorous with inline digestion are also available.



**QuAAtro39**

## ON LAND AND AT SEA

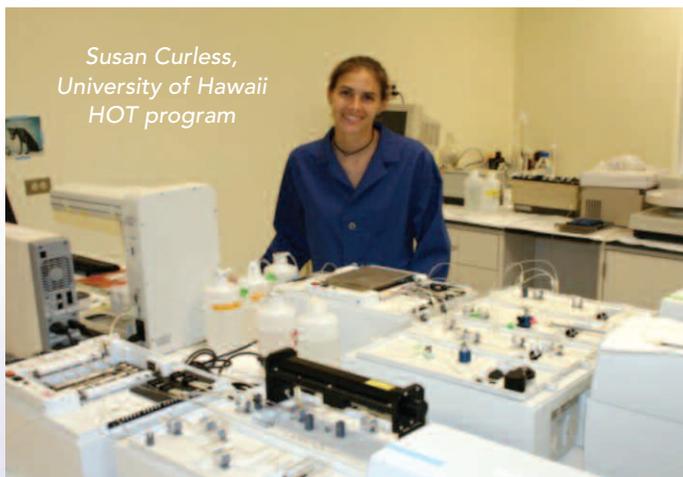


**AA500**



**AQ400**

SEAL analyzers are designed to stand up to tough conditions on board an ocean-going research vessel and are in routine shipboard use from the Arctic Ocean to the Weddel Sea. The latest instruments use LED light sources which are unaffected by vibration and are extremely stable. A special bench fixing kit is available for the QuAAtro to quickly and securely mount it in a floating laboratory. SEAL analyzer are also designed with walk-away automation in mind. Long runs and many tests can be done without operator intervention. SEAL systems can automate the calibration standards, resample over range samples, and run multiple tests at the same time.

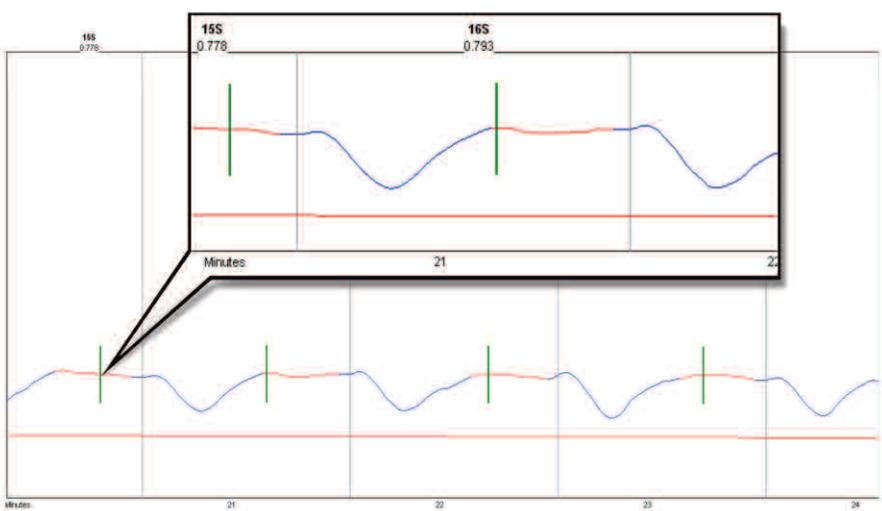


Susan Curless,  
University of Hawaii  
HOT program



Kilo Moana  
Research Vessel,  
University of Hawaii

## Low Level Replicates in Seawater Study



### DATA AND STATISTICS

0.787	0.965	0.869
0.836	0.924	0.783
0.857	0.881	0.760
0.835	0.905	0.833
0.947	0.886	0.802

Average: 0.858  
 Standard Deviation: 0.061  
 MDL: 0.159 (0.005 µmol)

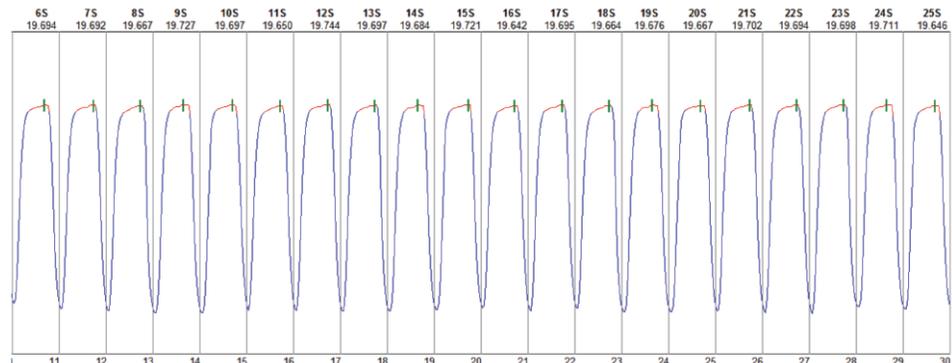
Replicates at 1 ppb  
 PO<sub>4</sub> 90 samples/hr

## Mid Level Reproducibility Seawater Study

### DATA AND STATISTICS

Average: 19.69 µmol  
 Standard Deviation: 0.027 µmol

NO<sub>3</sub> + NO<sub>2</sub> (NO<sub>x</sub>)  
 at 60 samples/hr



## Automated TN and TP by Online UV Digestion

Featured on both MT-17 and MT-23 Manifolds, the UV Digestion Coil allows for online Total Nitrogen and Total Phosphorus analysis through a UV-Persulfate Digestion. Each sample and standard is pulled into a 50-turn quartz coil that has a UV-C Lamp running the entire length through the center.

Similar to traditional hot plate or autoclave digestion, samples undergoing Total Nitrogen analysis have inorganic and organic nitrogen compounds oxidized to Nitrate. A cadmium column is then used to reduce the Nitrate to Nitrite, which then reacts with a Sulfanilamide/NEDD reagent. When operating in the lowest range, users can achieve a Detection Limit of 0.7 µg/L

For Total Phosphorus, organically bound phosphorus is released during the UV digestion. Additionally, polyphosphates are converted to ortho-phosphate by acid hydrolysis at 90°C. The resulting digest then reacts with molybdate and ascorbic acid. With the MT-17 offering ranges up to 45 mg/L and the MT-23 giving a Detection Limit of 1 µg/L for its lowest range, the AA3 offers a solution for many labs through the use of this online UV Digestion Coil.



Please contact us at  
[sales@seal-us.com](mailto:sales@seal-us.com)  
 for more information!



# Detection and Flowcell Options

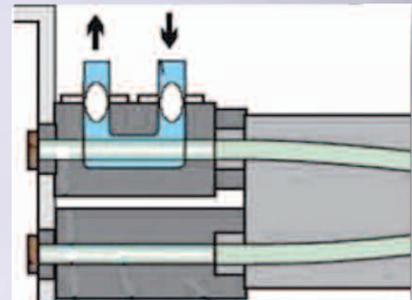


## LWCC (Liquid Waveguide Capillary Cell)

LWCC is a capillary flowcell used for ultra-sensitive absorbance measurements. It is a flowcell with a long optical path length (500 - 5000 mm) that allows sample measurements at ultra low concentrations. When using a 1000mm LWCC, a 1 mAU signal is enhanced 100 fold to 100 mAU compared with a 10 mm flowcell. Less signal amplification is required and noise is greatly reduced. Studies for Nitrite over a calibration range of 0 – 10 ppb show a detection limit of 0.0013 ppb as N (0.0009 µM).

## Low Volume Flowcell

The QuAAtro and AA500 digital detection systems have such low noise and high sensitivity, a 10mm path length flowcell is used for most routine seawater applications. This maximizes light transmission and minimizes the refractive index blank (RIB). 30mm and 50mm flowcells are also available. Bubble-through-the-flowcell maintains separation between sample and wash and prevents disturbances at the start and finish of sample peaks whose salinity varies from the wash. The sapphire flowcells designed for seawater analysis, have planar sides and together with the narrow angle light from the LED further reduces the salt matrix effects on the optical signal from RIB and Schlieren effects.

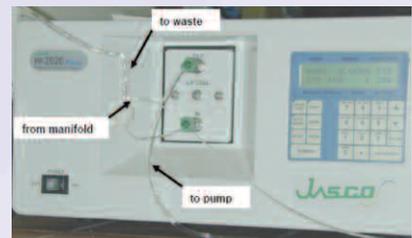


## LED Light Source Detector

Developed for trace-level on-board seawater analysis with a very stable, long life, completely immune to vibration. Available for all nutrient parameters. It has been used successfully in Research vessels in Force 10 gale winds. SEAL LED photometers are used in AA500 and QuAAtro Analyzers in many ship board laboratories around the world.

## Fluorometer

Optical disturbances from salt matrix effect colorimetric ammonia analysis in seawater. An alternative method for analyzing ammonia is by fluorometry. The sample is reacted with o-phthalaldehyde (OPA) at 75 deg C in the presence of borate buffer and sodium sulfite. The fluorometer is used with the AA500 or QuAAtro and the results are not affected at all by Refractive index issues. Detection limits are similar or lower than standard phenate chemistry.



[www.seal-analytical.com](http://www.seal-analytical.com)

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