Aquatic Carbon Analysis

Oceans play a critical role in stabilizing our planet's climate. They act as a major carbon sink, absorbing nearly 25% of total anthropogenic CO_2 emissions that are released into the atmosphere each year.[1] This impacts many key factors associated with climate change—such as the global carbon budget, ocean acidification, and ecosystem productivity—which makes the study of our oceans essential.

Capturing this complexity requires more than a single measurement. To fully characterize the aquatic carbon cycle, accurate data from four key parameters is needed. Together, these provide a complete picture of the carbon cycle and its interactions with surrounding environments and organisms:

- Dissolved Inorganic Carbon (DIC)
- Partial Pressure of CO_2 (pCO_2)
- pH
- Total Alkalinity

Gruber, N. et al. (2023). "Trends and variability in the ocean carbon sink." Nat Rev Earth Environ 4, 119–134. https://doi.org/10.1038/s43017-022-00381-x

Dissolved Inorganic Carbon

Dissolved inorganic carbon (DIC) represents the concentration of CO_2 and other inorganic carbon species dissolved in water.

Measuring DIC is key to understanding the role of aquatic systems in the global carbon cycle, particularly in the context of ocean acidification and climate change. It provides insights into carbon sources and sinks and helps assess carbon fluxes, allowing you to better track the movement of carbon through aquatic environments.

LI-5300A DISSOLVED INORGANIC CARBON AND $\delta^{13}C$ DIC ANALYZERS

- Takes precise measurements across a wide range of DIC values
- Choice of CO_2 analyzers for both $\delta^{13}C$ and total DIC analysis
- Can extract 100% of CO_2 from water samples in as little as 4 minutes
- Suited for shipboard or laboratory measurements

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Partial Pressure of CO_2

Partial pressure of CO_2 (pCO_2) indicates the concentration of CO_2 gas in water and is critical for understanding carbon exchange between aquatic and atmospheric environments.

pCO_2 plays an important role in ocean acidification research. As atmospheric CO_2 levels rise, more CO_2 dissolves into water until equilibrium is reached—which lowers pH and oftentimes negatively impacts marine life. By monitoring pCO_2, these changes can be more accurately predicted and quantified.

LI-5400A pCO_2 SYSTEM

- Connect up to 5 calibration gas standards
- Take stable measurements in less than 4 minutes
- Compatible with freshwater and seawater environments
- Suited for shipboard/underway or laboratory measurements

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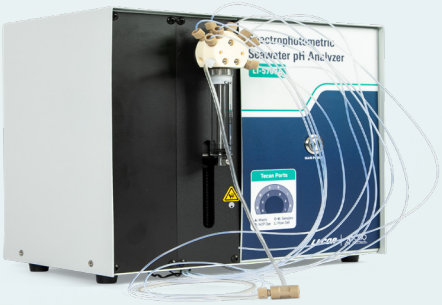
pH

pH represents the acidity (concentration of H^+) or alkalinity (concentration of OH^-) of water. Regulating pH is critical for maintaining optimal living conditions within organisms and across entire ecosystems.

Precise pH measurements give us insights into the dynamics and challenges of marine environments and ocean acidification. For instance, as oceans absorb atmospheric CO_2, their pH levels shift—which can ultimately threaten shellfish and coral reefs. Monitoring pH helps track these changes and assess the broader impacts on carbon cycles and marine life.

LI-5700A SPECTROPHOTOMETRIC SEAWATER pH ANALYZER



- Higher precision (0.001 pH) than most pH sensors
- Stable pH measurements for longitudinal studies
- Choice of dyes for both seawater and freshwater analysis
- Suited for shipboard or laboratory measurements

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Total Alkalinity

Total alkalinity measures water's capacity to absorb protons and neutralize acids without altering pH. This buffering capability is essential for maintaining stable conditions that support aquatic life.

Quantifying total alkalinity allows us to evaluate a body of water's ability to resist pH changes. This is particularly important as atmospheric CO_2 levels rise, and oceans continue absorbing excess carbon, creating pH environments that are no longer sustainable for shellfish or coral reefs. Total alkalinity measurements, therefore, are key to understanding and mitigating the effects of climate change on aquatic environments.

LI-5800A TOTAL ALKALINITY TITRATOR

- Measures alkalinity under Gran titration
- Ideal for both freshwater and seawater applications
- Takes high-precision (0.1%), automated measurements
- Suited for shipboard or laboratory measurements

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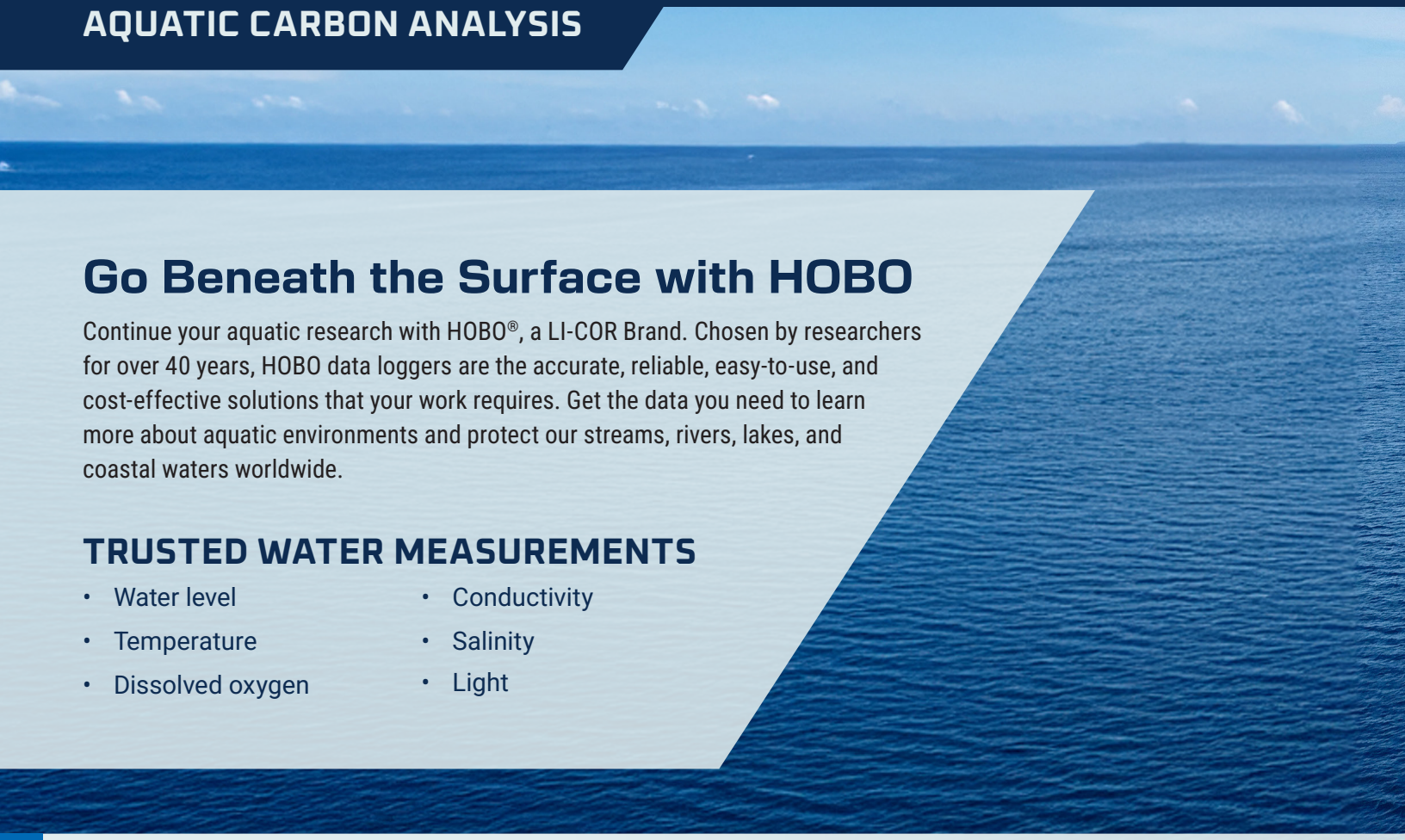

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TRUSTED WATER MEASUREMENTS

- Water level
- Temperature
- Dissolved oxygen
- Conductivity
- Salinity
- Light

Key Specifications

DISSOLVED INORGANIC CARBON

LI-5300A DISSOLVED INORGANIC CARBON ANALYZER

Gas analyzer: LI-7815; included; externally mounted
Precision (1σ): ± 0.1% at DIC level ~ 2000 µmol/L
Measurement time: ~ 8 minutes per measurement
Sample volume: 0.5 to 4 mL per measurement

LI-5350A DISSOLVED INORGANIC CARBON ANALYZER

Gas analyzer: LI-850; included; internally mounted
Precision (1σ): 0.15% at 2000 µmol/L
Measurement time: ~ 4 minutes per measurement
Sample volume: 0.2 to 1.5 mL per measurement

LI-5370A ISOTOPIC DISSOLVED INORGANIC CARBON ANALYZER

Gas analyzer: LI-7825; included; externally mounted
Precision (1σ): 0.1% at 2000 µmol/L
Precision $\delta^{13}C$ (1σ): 0.04 per mil at DIC level ~ 2000 µmol/L
Measurement time: ~ 8 minutes per measurement
Sample volume: 0.5 to 4 mL per measurement

LI-5405A pCO_2 SYSTEM

Reference gases: Three to five standard gases; should cover the sample concentration range
Precision: Better than 1 ppm
Complimentary Measurement: Chlorophyll fluorescence, dissolved oxygen, salinity, GPS

LI-5700A SPECTROPHOTOMETRIC SEAWATER pH ANALYZER

Precision: Better than 0.001 pH units
Automation: Unattended analysis of up to 9 samples
Sample volume: 40 mL
pH indicator: m-cresol purple
Spectrophotometer: Agilent Cary 60
Spectrophotometric flow cell: 10 cm optical path length with thermostated water jacket

LI-5800A TOTAL ALKALINITY TITRATOR

Precision: ± 0.1% for an alkalinity of ~ 2300 µmol/L
Typical sample volume: 20-25 mL per repeat
Time per sample: 7-10 minutes per repeat

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