Application Note:
Defensible Data with Less Time and Effort

Background:
Louisiana's commercial shrimp fishery is of significant value to the state as a whole and to the communities along its gulf coast. In 2011 the value of this catch was on the order of $130 million. To properly manage the opening and closing of the state's bi-annual commercial shrimp season the state has relied on two environmental markers to estimate the health of the shrimp population, and thereby the duration of the spring and fall open seasons.

The first is an estimation of shrimp size based on in-situ recorded seawater salinity and temperature data in natural shrimp habitats along the Louisiana coast. The second is a frequent field-catch by biologists to measure shrimp maturity. Understandably, the field catch activity can be costly and time consuming especially to track the health of hundreds of estuary habitats, some in very remote locations.

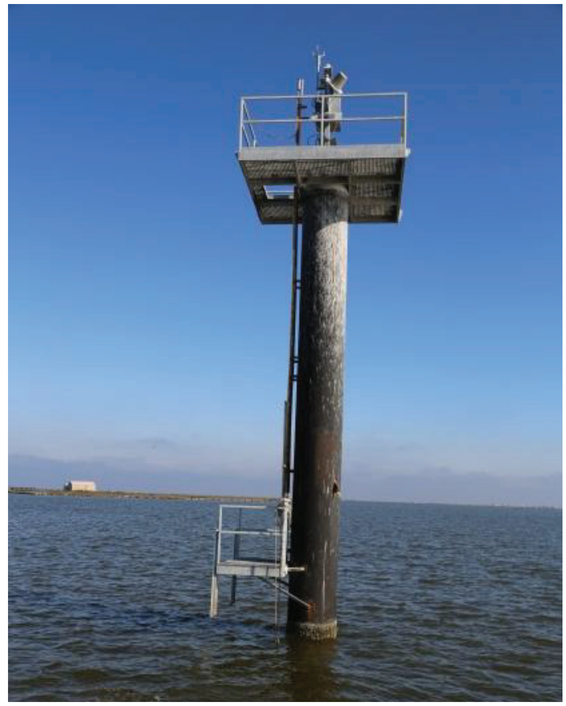

Figure 1a: Sea-Bird HydroCAT deployment location at Caillou Lake, near Houma, LA

Project Initiation:
To attempt to reduce the reliance on costly field-catch activities researchers are exploring use of higher quality, long duration deployment, in-situ instrument packages, especially for the most remote of habitat locations. To this end a group of federal Hydrologic Scientists and Field Technicians in Louisiana set out to evaluate the performance of the latest water quality instruments in a coastal environment. These hydrologists selected an existing measurement site for the evaluation, located in Caillou Lake, near Houma, Louisiana. This site was selected as it is centered near a number of critical shrimp habitats and historically has exhibited very high fouling in summer months.

Figure 1b: Sea-Bird HydroCAT deployment location at Caillou Lake, near Houma, LA

The project began in May 2012 with deployment of three water quality instruments, including the Sea-Bird Scientific HydroCAT. The project's main goal was to determine the duration that a given instrument could be relied upon to provide high quality and stable salinity and temperature data for use in shrimp sizing estimation calculations. The instruments were moored next to an existing observation pier using a winch as shown in Figure 1, above.

After deployment the hydrologists then visited the deployment site every 30 or so days. During each visit these experts downloaded data from each of the three instruments and took water quality readings using a clean instrument.

Initial Results:

The hydrologists first returned to the deployment site in mid-July. Data from all three deployed comparison instruments was collected, as was a dataset from a clean, freshly-calibrated reference profiling instrument. Each instrument was also photographed to record its condition upon removal from the lake. None of the deployed instruments were cleaned in any way. Upon inspection the HydroCAT showed significant biological growth (barnacles, etc..) on its exterior, with two notable exceptions. As shown in the Figure 2, below, the intake and exhaust ports for the internal measurement flowpath were not obscured by biofouling growth. These ports were kept clear through the regular use of the onboard integrated pump and micro-volume anti-foulant devices.

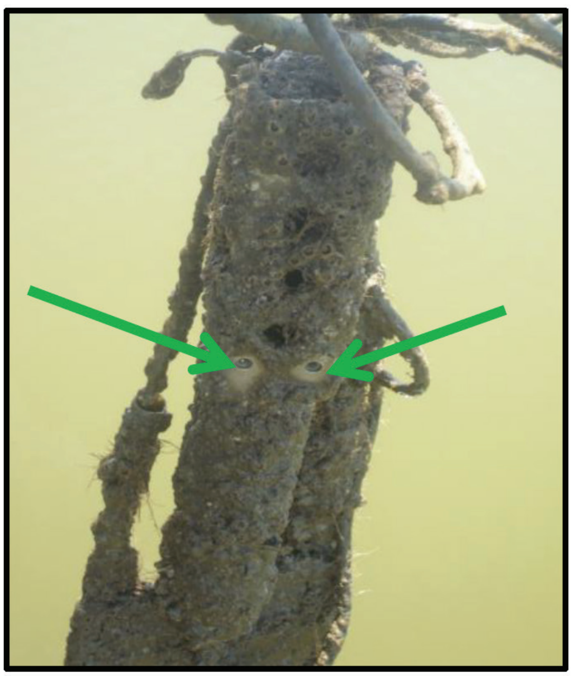

Figure 2: HydroCAT exterior after first visit recovery showing clear intake and exhaust ports.

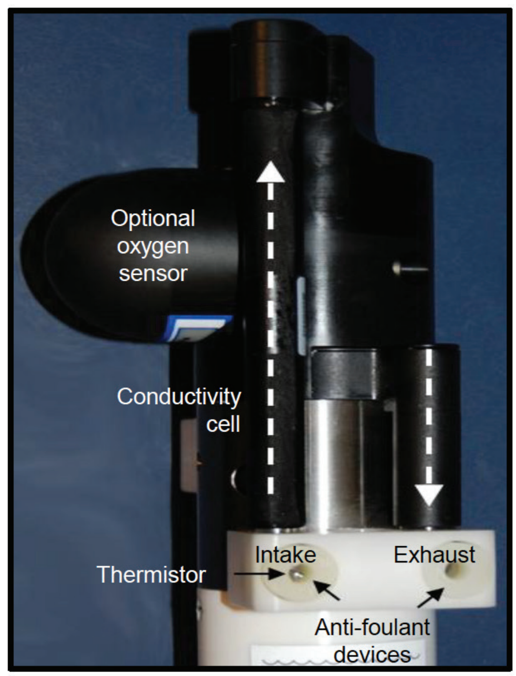

Figure 3: Internal flow path on the HydroCAT.

After the first visit the experts assembled Table 1, below, comparing the results for each instrument. Note that the elapsed time since the initial deployment in May of 2012 was 55 days.

Table 1:
First visit instrument specific conductivity variance from clean instrument (55 days elapsed).

	Sea-Bird HydroCAT	Instrument #2	Instrument #3
Measured variance in specific conductivity from clean instrument	-0.19%	-15.71%	-77.95%

After almost two months of deployment the HydroCAT was still well within the U.S. Geological Survey's variance specification of ±3% for specific conductivity, in spite of heavy fouling.

Follow Up Results:

The hydrologists again returned to the Caillou Lake site in the middle of August. They completed the same tasks while on site as before and produced the set of results shown below in Table 2. Note that the elapsed time since the initial deployment was 84 days.

Table 2:
Second visit instrument specific conductivity variance from clean instrument (84 days elapsed).

	Sea-Bird HydroCAT	Instrument #2	Instrument #3
Measured variance in specific conductivity from clean instrument	-0.78%	-39.78%	-67.78%

After an additional month of deployment (for a total of nearly three) the HydroCAT demonstrated the ability to maintain competent, stable specific conductivity measurements, well within the federal agency's specification of ±3%.

Results Discussion

Figure 4, on page four, shows the cumulative results for the two visits to the Caillou Lake site during the summer high-fouling season. Instruments #2 and #3 drifted from -15% and -77% respectively in specific conductivity compared to the clean instrument after nearly 60 days of deployment while the HydroCAT drifted less than -0.2%. After nearly 90 days instrument #2 had drifted an additional -25% and instrument #3 had recovered slightly to -67%.

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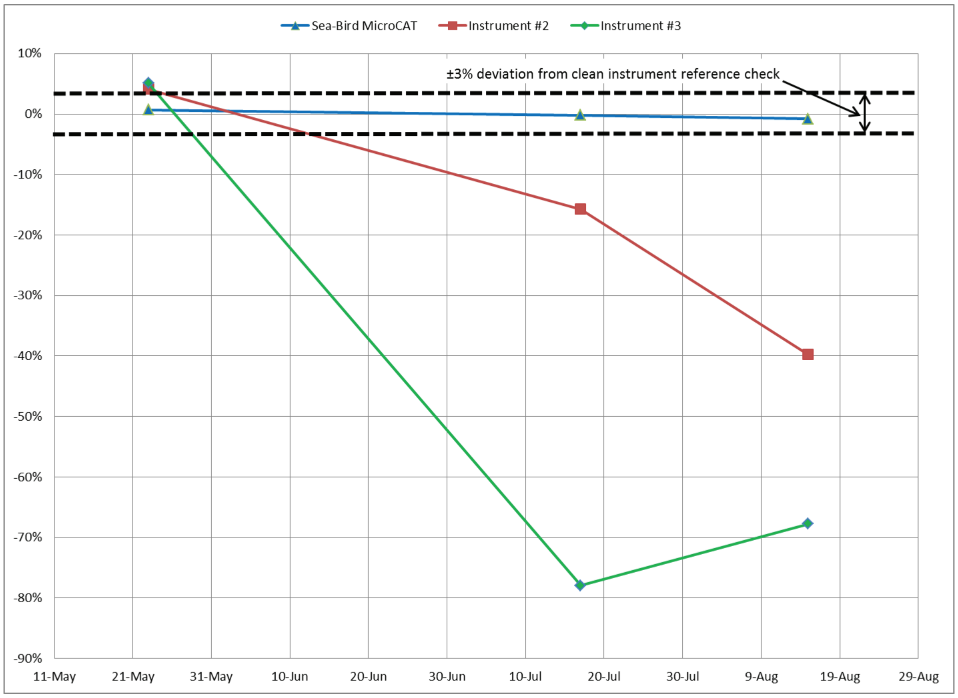

Figure 4: Deviation from clean instrument specific conductivity measurements for three in-situ water quality instruments deployed at Caillou Lake measurement site, summer 2012.

The HydroCAT was still less than -1% off compared to the clean instrument during this visit. After being returned to Sea-Bird the HydroCAT was recalibrated and the drift rate was determined to be 0.1%, well within the 3% drift specification of the USGS. This graphic and the post deployment calibration data demonstrates the ability of the HydroCAT to maintain competent data throughout a nearly 90 day operational cycle.

Conclusion:

Over the course of the deployment three major benefits were realized. T he h igher accuracy and extended deployment capabilities enabled the hydrologists greater flexibility in c onducting their field work. If conditions were unsafe or unscheduled delays prevented them from getting on site the instrument would continue to log accurate and reliable data until the next time someone could get on site. Second, the additional accuracy and deployment durability meant that the raw data required no post processing. This represents a significant time saving back at the lab for the individuals involved in collecting, processing, and approving the data for publication. When data requires post processing the hydrologist must apply correction curves and his corrections must then be vetted and approved. Once this has been done the data quality is then rated in accordance with USGS standards. Considerable time may then have been put into collecting, correcting and publishing data with a fair or poor quality rating. Finally, and most importantly, because the data requires little to no post processing the it is more defensible. Because the raw data meets the QA/QC requirements of the USGS without post processing it automatically receives an excellent data quality rating. Raw data with an excellent quality rating is less open to interpretation or questioning by the public or private sector.

Ultimately this demonstration proved that the HydroCAT can be used in a continuous monitoring program to provide accurate, defensible data that can be published more efficiently even given the variable conditions of environmental monitoring.

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