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Best Practices for autonomous measurement of seawater pH with the Honeywell Durafet pH sensor

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INTRODUCTION

Coastal ecosystems are vulnerable to ecological and biogeochemical perturbations from ocean acidification (OA) (Doney et al. 2009, Howarth et al. 2011). However, determining the effects of OA on nearshore ecosystems, including coastal and estuarine waters, is difficult due to the interplay of numerous factors including freshwater inputs, tidal forcing, water stratification, nutrient over-enrichment, algal blooms, and hypoxia (Fabry et al. 2008, Borges and Gypens 2010). Understanding the impacts of OA in the coastal environment requires coordination of monitoring efforts to ensure that intercomparable data on OA and its effects on nearshore ecosystems are collected. The California Current Acidification Network (C-CAN) was initiated, in part, to address these issues. C-CAN has developed a vision that lowers barriers to making seawater CO2 measurements of sufficient quality to understand ecosystem effects of changing ocean chemistry1. One of C-CAN's core monitoring principles is that seawater OA measurements should facilitate determination of aragonite saturation state (Ω) and a complete description of the carbonate system (McLaughlin et al. 2014). This requires direct measurement of at least two carbonate system parameters, of which seawater pH is considered a master variable for understanding the impacts of OA on coastal ecosystems.

Ion Sensitive Field Effect Transistor (ISFET) pH sensors have been found to be stable and accurate for monitoring fine-scale changes in pH in open ocean environments (Le Bris and Birot 1997, Martz et al. 2010) and are becoming widely-accepted for open ocean and nearshore monitoring of high frequency variability in pH (Hofmann et al. 2011, Kroeker et al. 2011, Yu et al. 2011). However, to date there have been no broadly agreed upon best practices for deployment of such sensors. C-CAN's efforts to develop a coordinated monitoring program documenting changing ocean chemistry have led to a growing number of non-specialist users who are adopting ISFET sensors for continuous, autonomous measurement of pH in a variety of settings, exposing a need for coordinated best practices for deployment of ISFET sensors and data quality assurance and quality control. Clearly defined best practices for deployment of ISFET sensors is critical for assessing data quality and intercomparability across users, which is crucial to interpreting data from a network of sites.

The purpose of this document is to provide broadly applicable recommended protocols for autonomous pH sensors incorporating the Honeywell Durafet (based on the published work of Bresnahan et al., 2014). The Honeywell Durafet pH sensor is a commercially available and widely used sensor, which has been deployed in a variety of configurations by different users. The recommendations in this document evolved from sensor deployments carried out in various locations since 2009.

Recommendations are summarized below and a brief discussion of each point is provided on the following pages. Recognizing that not all recommendations can be practically met, the primary recommendation for all sensor users is embodied in the final protocol regarding error reporting.

Full text: 861_CCAN_Durafet_Best_Practices_Manual.pdf