SEA-BIRD SCIENTIFIC

Technical Note

Shallow vs. Deep SeapHOx V2

Major Differences and Determining Appropriate Use Cases

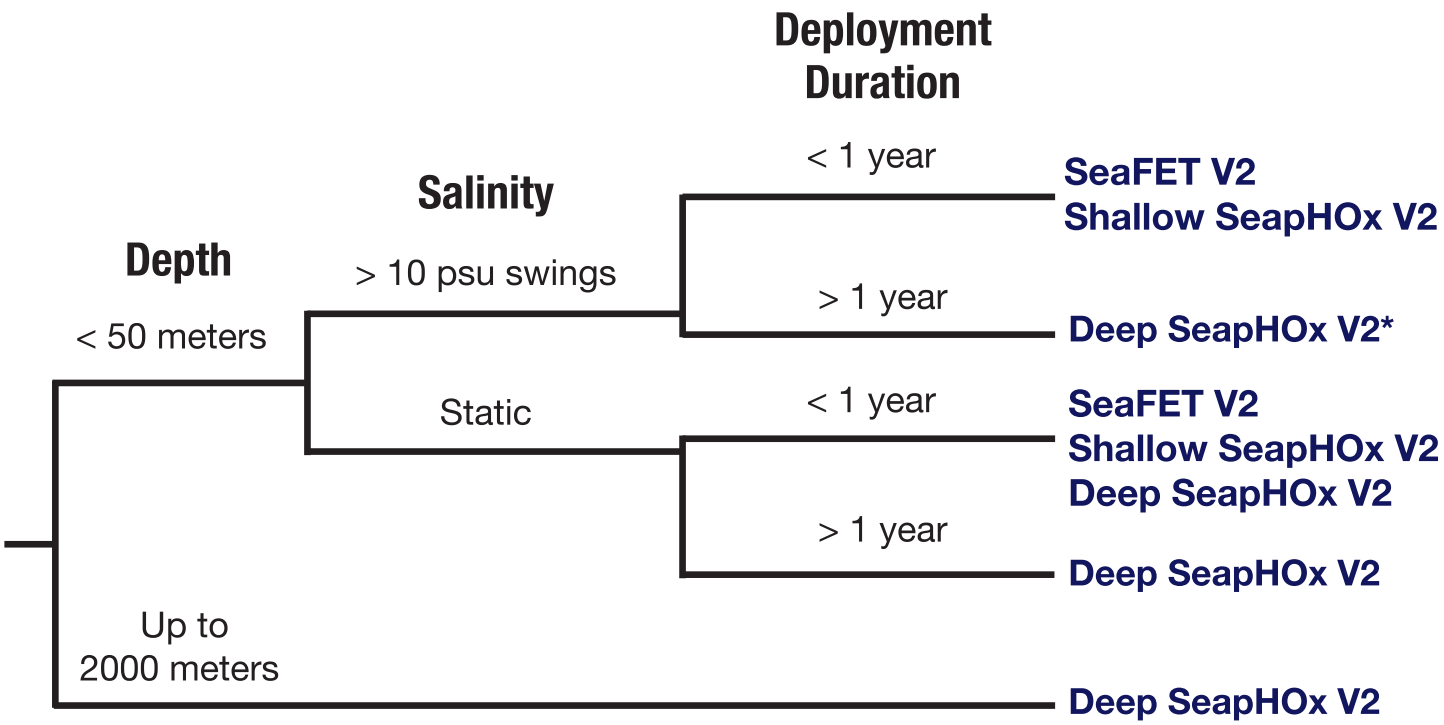
Introduction

The **Shallow SeapHOx V2** and **Deep SeapHOx V2** are two pH sensors that use an Ion Selective Field Effect Transistor (ISFET) to measure pH in seawater. While both harness the same underlying technology, the shallow and deep versions have a different ISFET and reference electrode construction. Aside from the depth rating, logistical and environmental circumstances determine which pH sensor is best for a given deployment.

Main considerations stem from differences in the electrode construction between the Shallow and Deep versions. The Shallow SeaFET V2 and Shallow SeapHOx V2 come equipped with an internal reference electrode bathed in KCl gel, which maintains better accuracy during large swings in salinity than the Deep SeapHOx V2's external reference electrode. However, the electrode on the Shallow versions has a limited 1-year lifespan, ultimately limiting the sensor's total deployment length and requiring annual service.

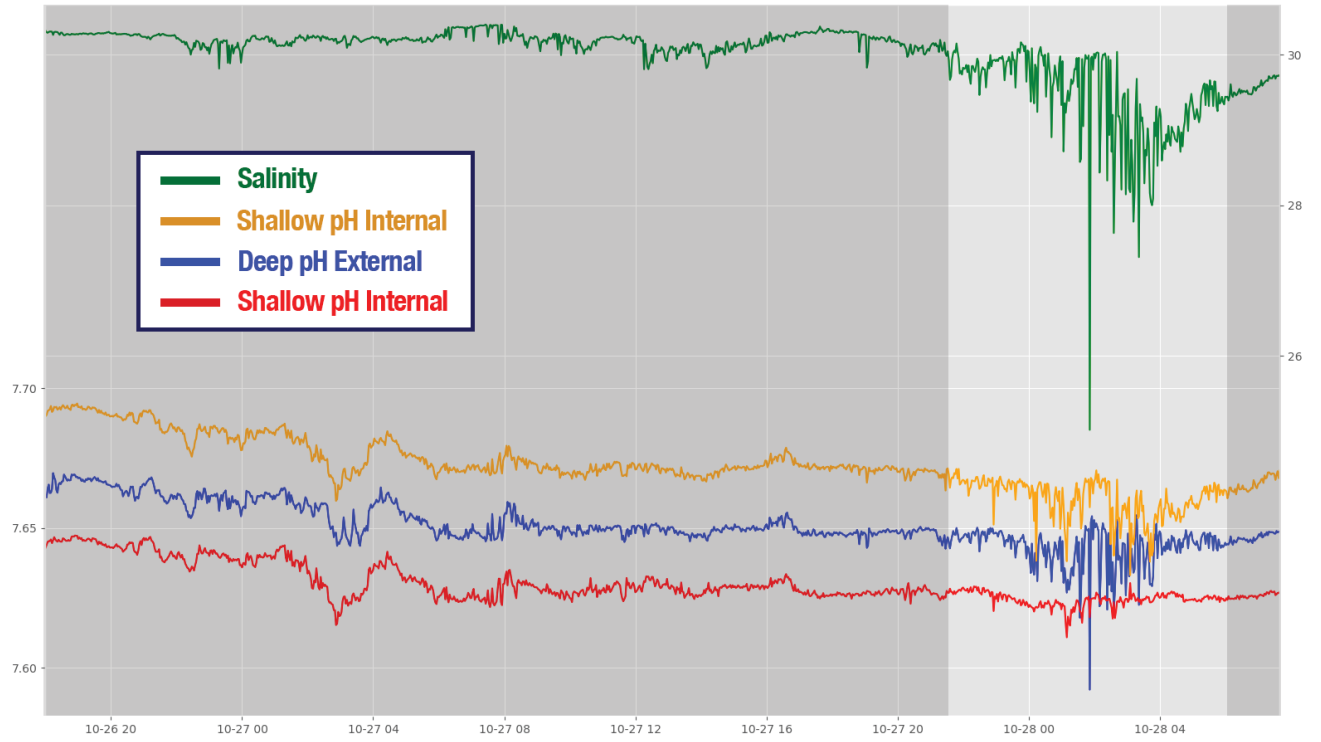
The External Reference on the Deep SeapHOx V2 has a slower response time to rapid changes in salinity. For some environments, this may result in a small amount of error in pH accuracy during periods of rapidly changing salinity. However, the solid-state electrode construction is such that the Deep SeapHOx V2 can provide quality data for over a year.

The chart below demonstrates a recommended decision tree when considering which instrument to use for any given deployment:



Field Data Examples

The figure below originates from a Shallow SeapHOx V2 and a Deep SeapHOx V2 deployed alongside one another in an estuarine environment. During parts of the year, high rainfall can result in large salinity swings of up to 10 psu:



The highlighted section shows a 4-hour period of high rainfall, where salinity varied significantly. **The resulting pH data during this period from the Deep SeapHOx V2 (blue) and pH External from the Shallow SeapHOx V2 (orange) shows significantly more noise than the pH Internal values from the Shallow SeapHOx V2 (red).** Other deployments have shown that pH External can have a slower response to changing pH after large salinity swings. **The magnitude of error is typically within 0.05 pH**.

Alternatively, the figure on the right demonstrates the expected lifespan of the internal reference on the Shallow SeapHOx V2. In this deployment, the internal reference was over 1-year old. By the end of this deployment it had depleted the electrolyte, leading to drastic swings in pH and eventual failure. Meanwhile, the Deep SeapHOx V2 was able to provide quality data that agreed with validation samples for well beyond 1 year.