

# Diurnal and seasonal variation of pH in Oshoro Bay, Hokkaido, Japan



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## Background

Coastal marine organisms have already been experiencing low pH environment (< 7.9)

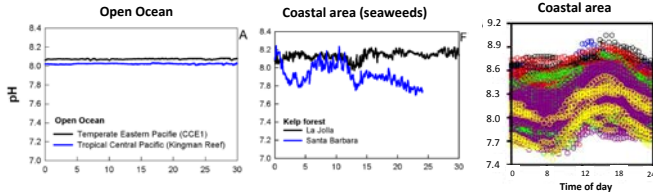


Fig. 1. Diurnal variation of pH in open and coastal ocean (Wootton et al., 2008; Hofmann et al., 2011)

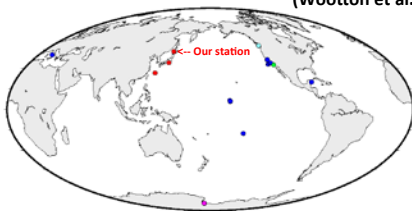


Fig. 2. Previous and on-going monitoring studies with pH sensor

Diurnal variation of pH in subarctic regions is not well known

## Seasonal variation (Jul. 2013 - Aug. 2015)

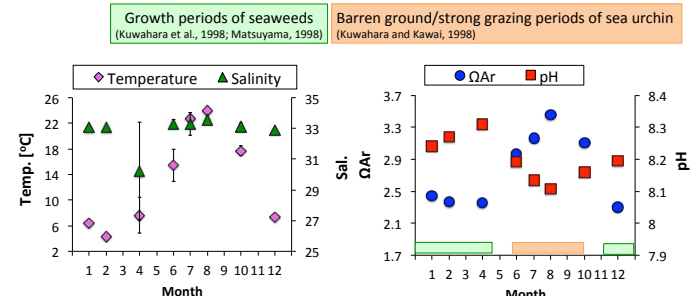


Fig. 4. Seasonal variation of pH,  $\Omega_{Ar}$ , temperature and salinity in the Oshoro Bay

- pH and aragonite saturation state had the opposite seasonal pattern
- Maximum pH value 8.35 was observed in April, and this period was consistent with growth periods of seaweeds in the bay (kuwahara et al., 1998).
- Minimum pH value in July may be due to relatively low seaweed abundance in the bay with strong grazing of sea urchins (Kuwahara and Kawai, 1998).

## Diurnal variation (30 Jul. - 5 Oct. 2014)

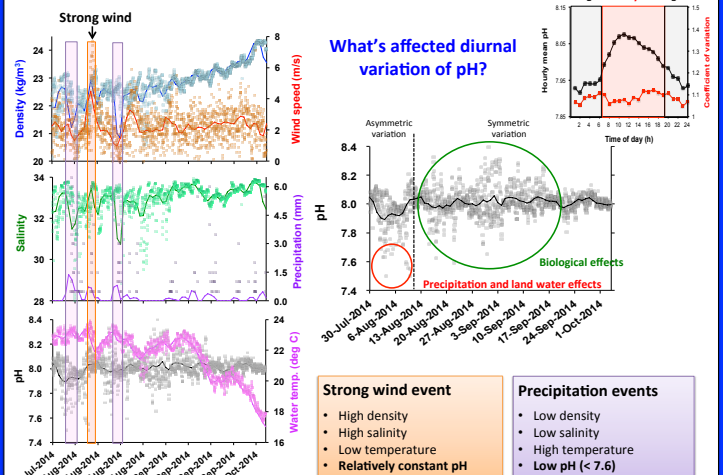


Fig. 5. Diurnal variation of density, wind speed, salinity, precipitation, pH and temperature

- No statistically significant relationships between the variation of pH (Hydrogen ion) and that of other variables (Temp., Sal., etc.)
- Increases in pH during the day and decreases during the night

## Objective

To understand current condition of ocean acidification based on diurnal and seasonal variation of pH in a subarctic region, the Oshoro Bay

## Materials and Methods

### 【Monitoring periods and measurements】

Seawater samples: July 2013 - August 2015

Sensors (pH, water temperature, salinity): 30 July - 5 October 2014

Measurements	Methods	Sampling time
pH	Sensor	Every hour
Temperature	@ 2 m depth	
Salinity		Every 2 months
Dissolved inorganic carbon (DIC)		
Total alkalinity (TA)	Water sample	
Macro nutrients		
pH & aragonite saturation state ( $\Omega_{Ar}$ )	CO2SYS (Pierrot et al., 2006)	

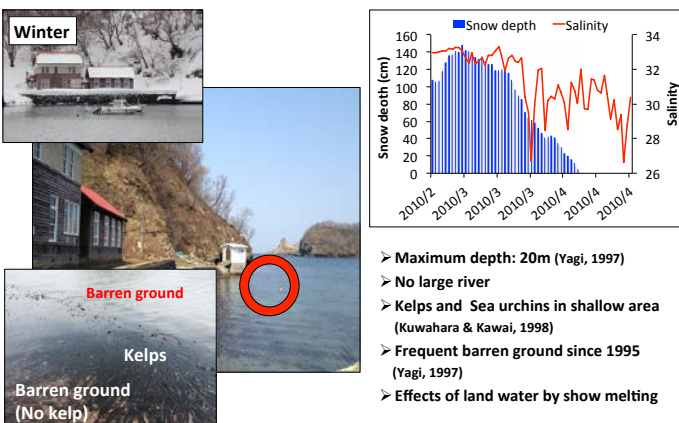


Fig. 3. Environmental characteristics of the Oshoro Bay

## Summary

Comparison of ranges between diurnal and seasonal variation of pH

	Mean	Min. pH value	Max. pH value	Maximum range
Diurnal	8.02	7.33	8.40	0.83
Seasonal	8.20	8.05	8.35	0.30
Difference	0.18	0.72	0.05	0.53

- ✦ Range of diurnal variation of pH was larger than that of seasonal variation in the Oshoro Bay
- ✦ Observed diurnal variation of pH may be driven by photosynthesis and/or respiration in resident organisms in the Oshoro Bay
- ✦ Coastal marine organisms in the bay were temporarily experienced low pH condition resulting from wide ranges of diurnal variation of pH