

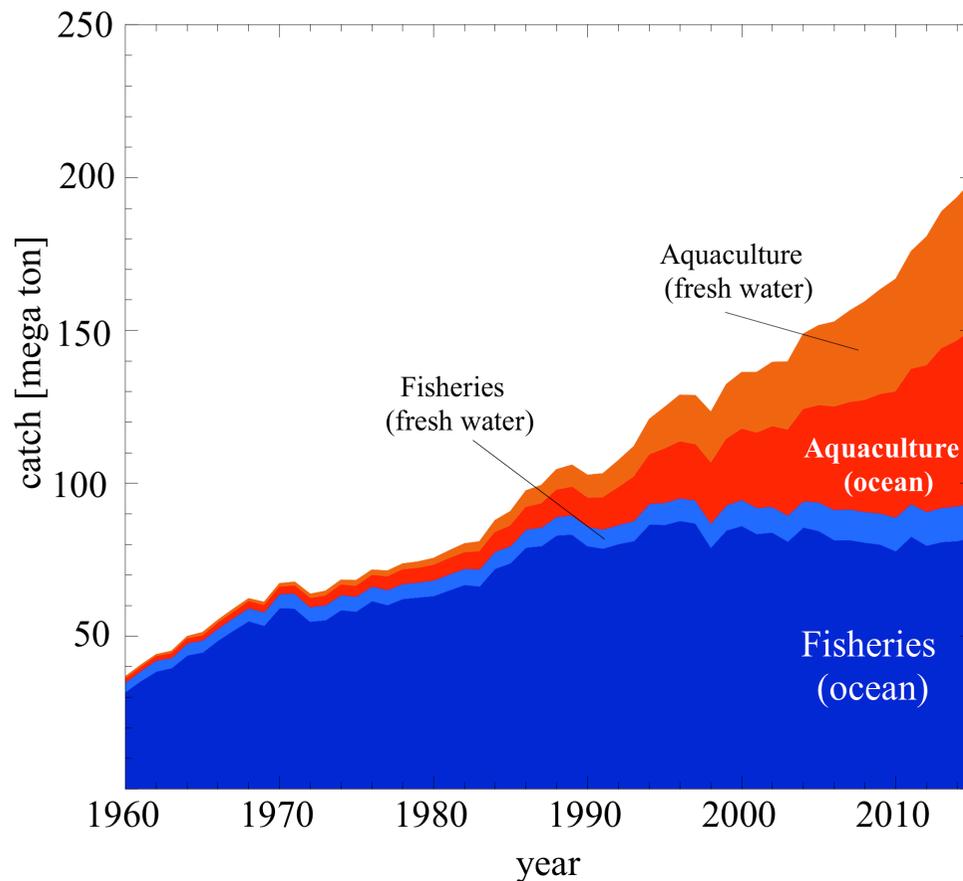
## Topics of this morning session

- looking over status of OA in each oceanic area (including coastal area)
- on-going activities on networking OA information  
#existing luck / gap?
- what is the required input from North Pacific / Japanese activities?

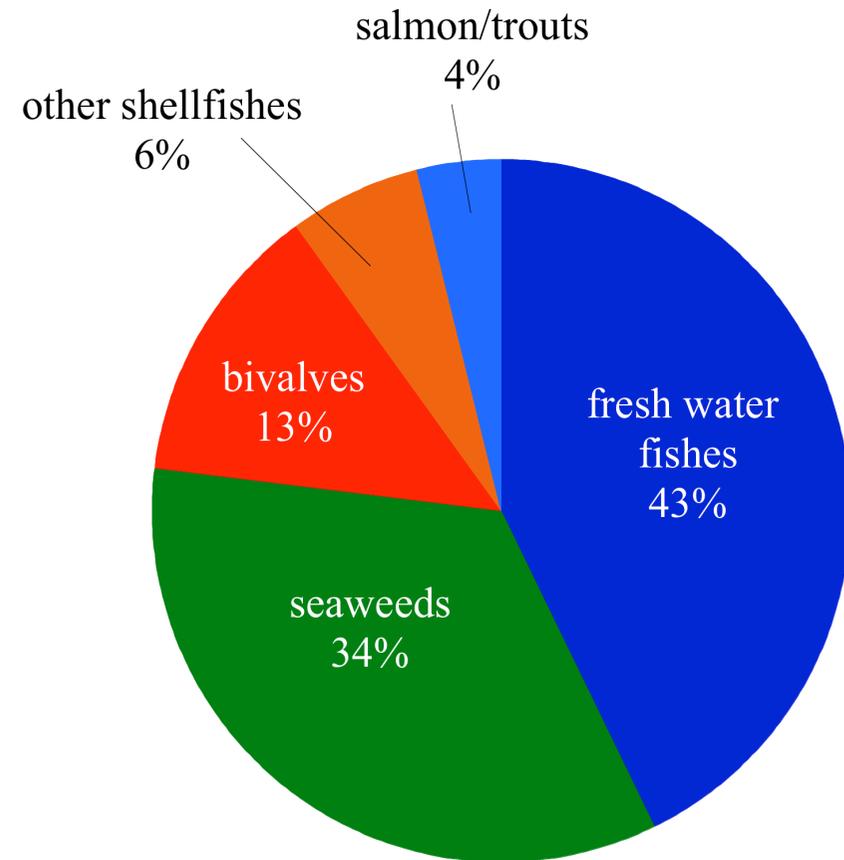
# How minutely do we need to monitor coastal pH variation?

- Needs for global network on coastal OA monitoring -

Statistics of world Fisheries  
(JFA 2016)



Percentage of catch  
in aquaculture industries (2016)

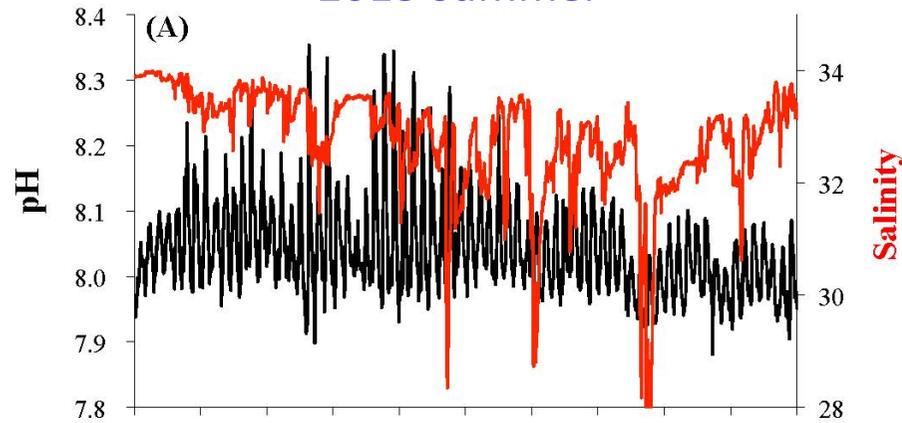


# High temporal pH variation in coastal area (Oshoro Bay)

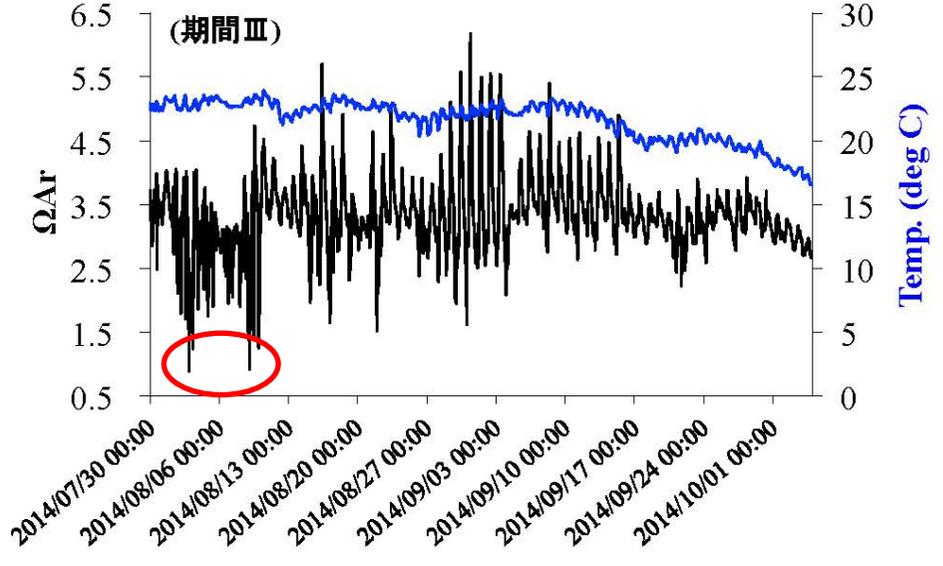
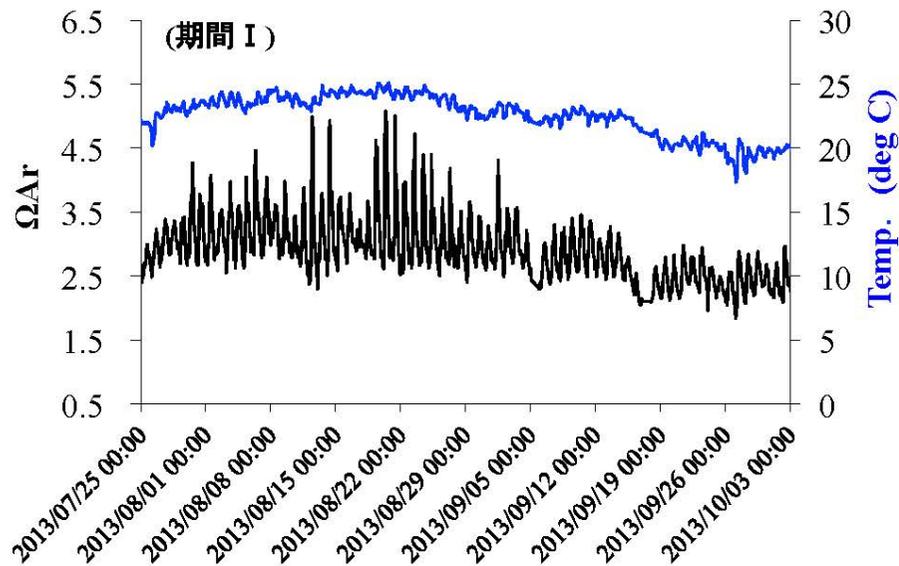
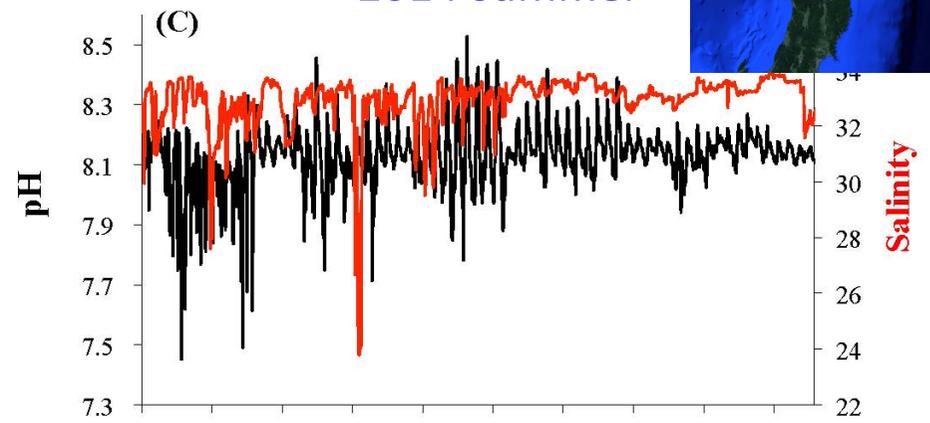
[Yamaka et al., PICES 2018 Annual Meeting]



### 2013 summer



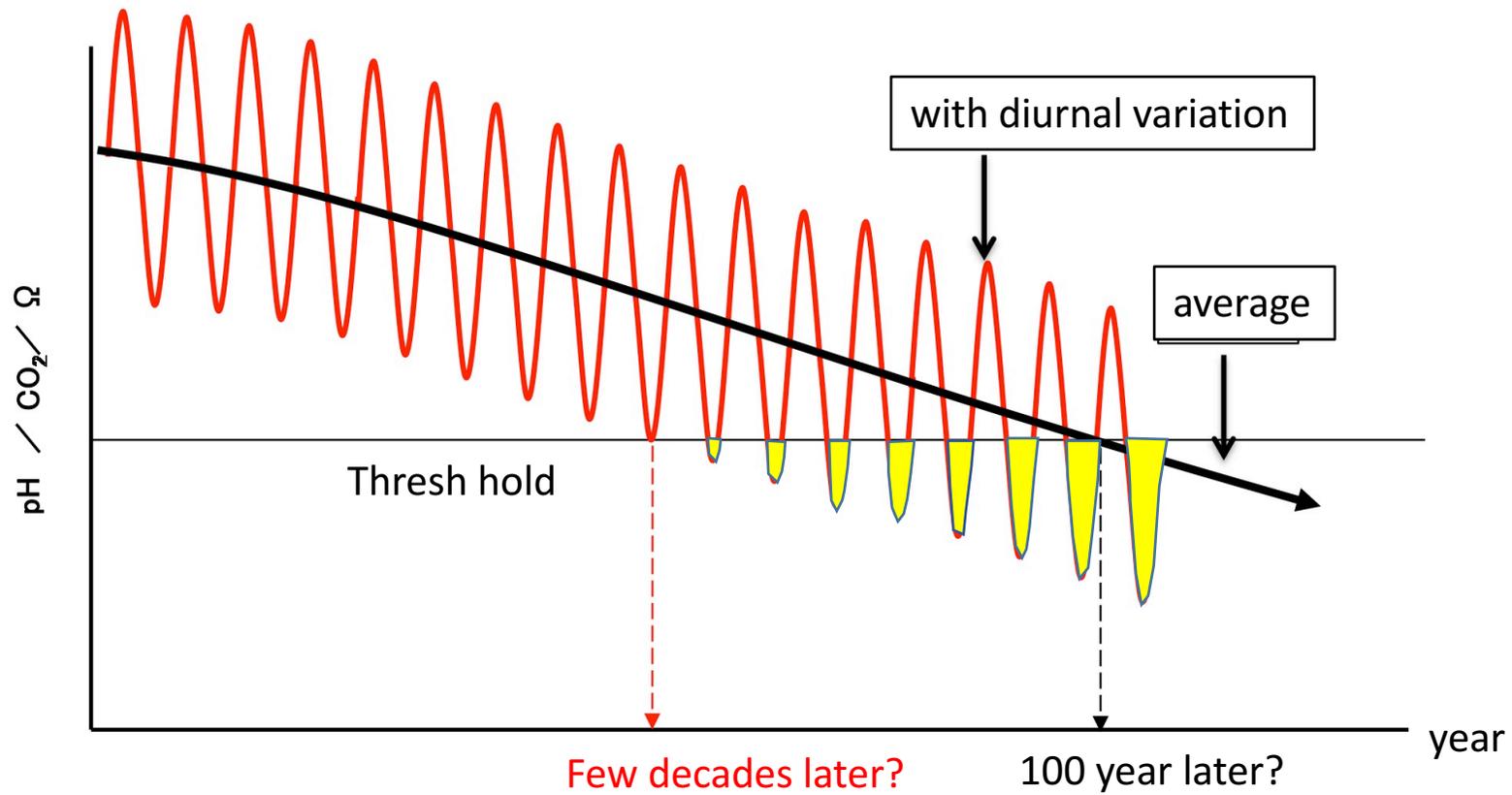
### 2014 summer



pH amplitude:  
avg.  $0.18 \pm 0.08$   
max 0.44  
min 0.08

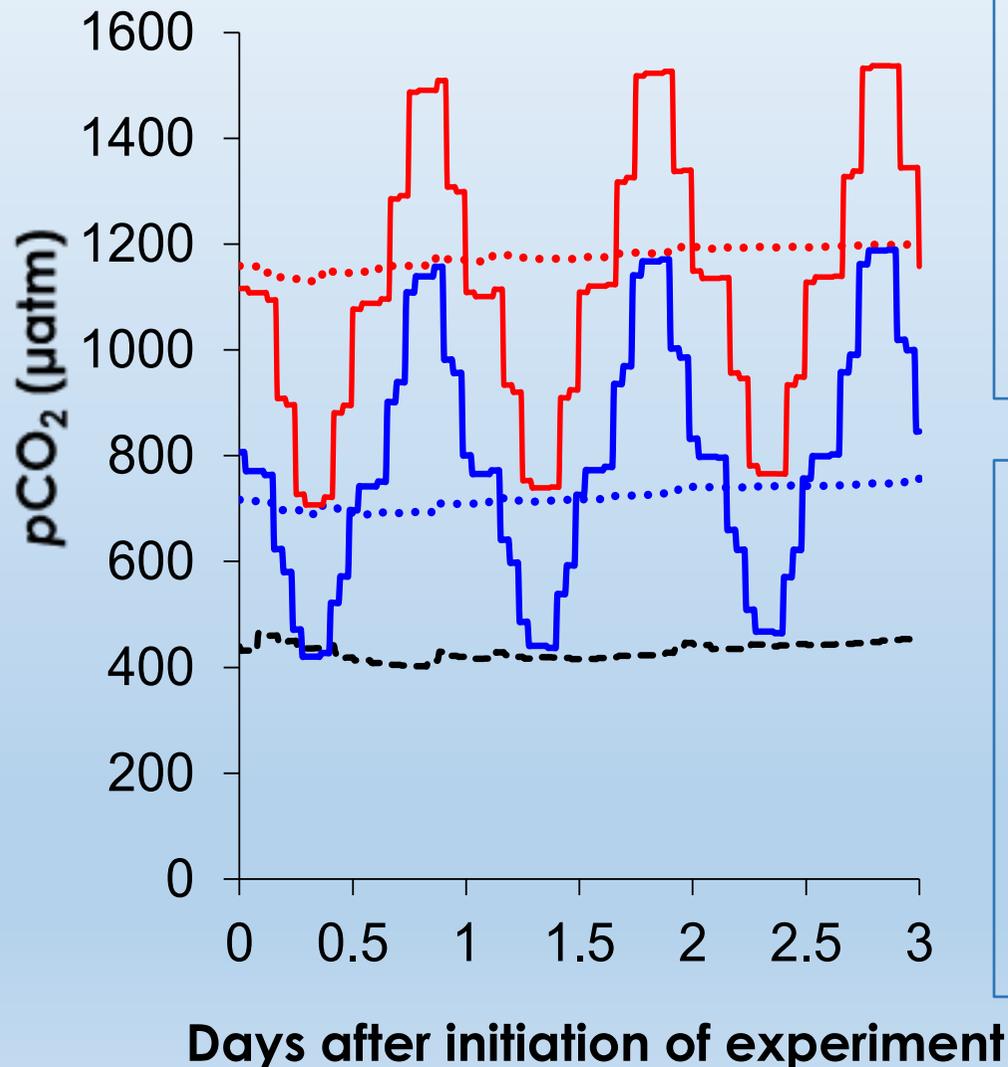
pH amplitude:  
avg.  $0.28 \pm 0.19$   
max 0.83  
min 0.05

High diurnal/seasonal variation of pH in coastal area:  
What does biota respond to? Average or Minimum?



*modified from Yamamoto-Kawai et al.*

# Effects of diurnally-variable pCO<sub>2</sub> on ezo-abalone larvae by culture experiment [Onitsuka et al., 2018]



## Constant treatments

Targeted pCO<sub>2</sub>

400 µatm, 800 µatm, 1200 µatm

Results of monitoring

(Dotted lines)

430 ± 15, 732 ± 19, 1175 ± 20 µatm

## Diel cycle treatments

Targeted pCO<sub>2</sub>

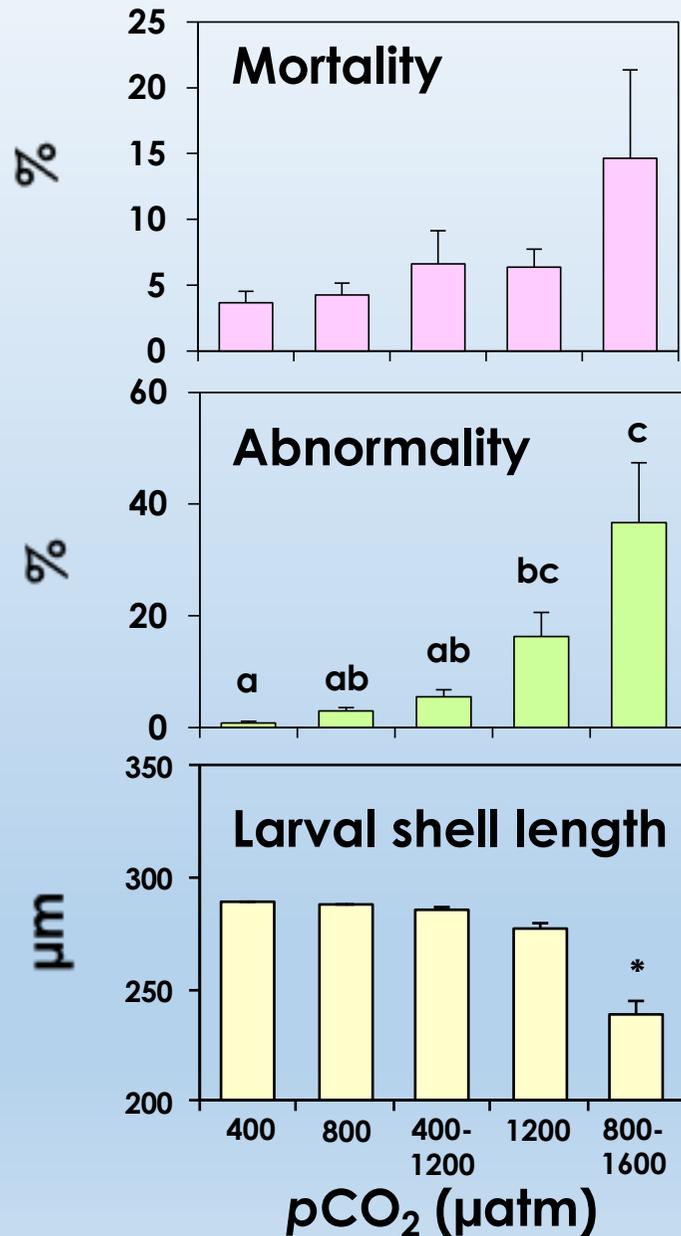
400-1200 µatm, 800-1600 µatm

Results of monitoring

(Solid lines)

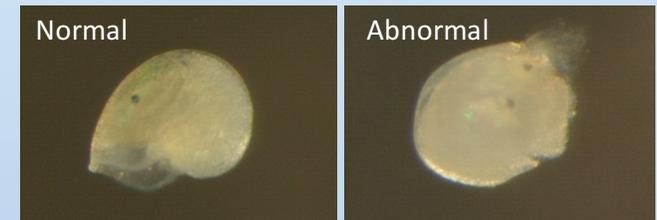
420-1189 µatm, 739-1537 µatm

# Results : Effects on larval fitness



There were no significant differences in mortality rate among all the pCO<sub>2</sub> treatments.

Abnormality rate was significantly higher in the 1200 μatm, and **more in 800-1600 μatm**



Shell length in the **800-1600 μatm** was significantly shorter but **not in the 1200 μatm**.

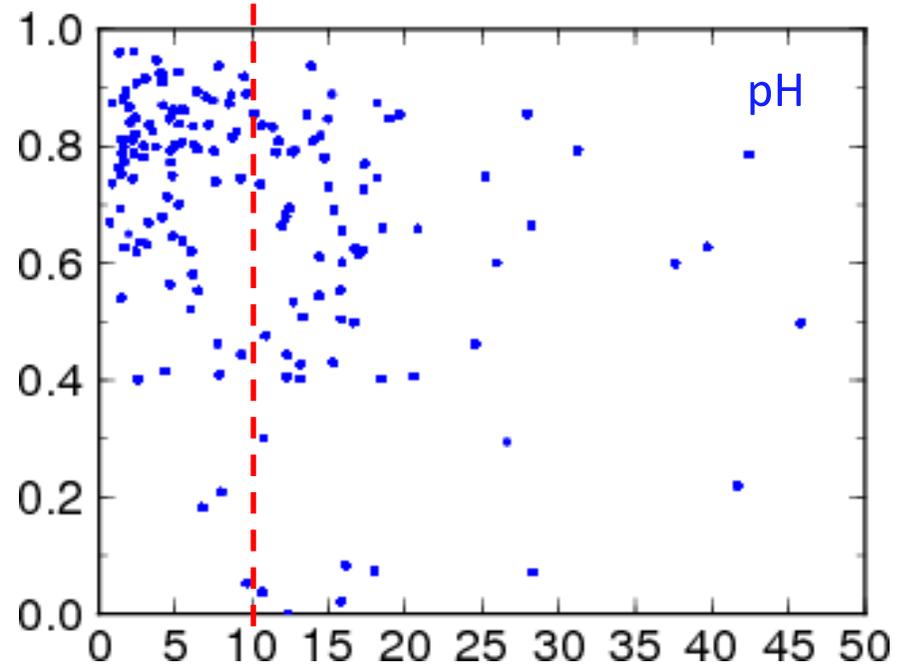
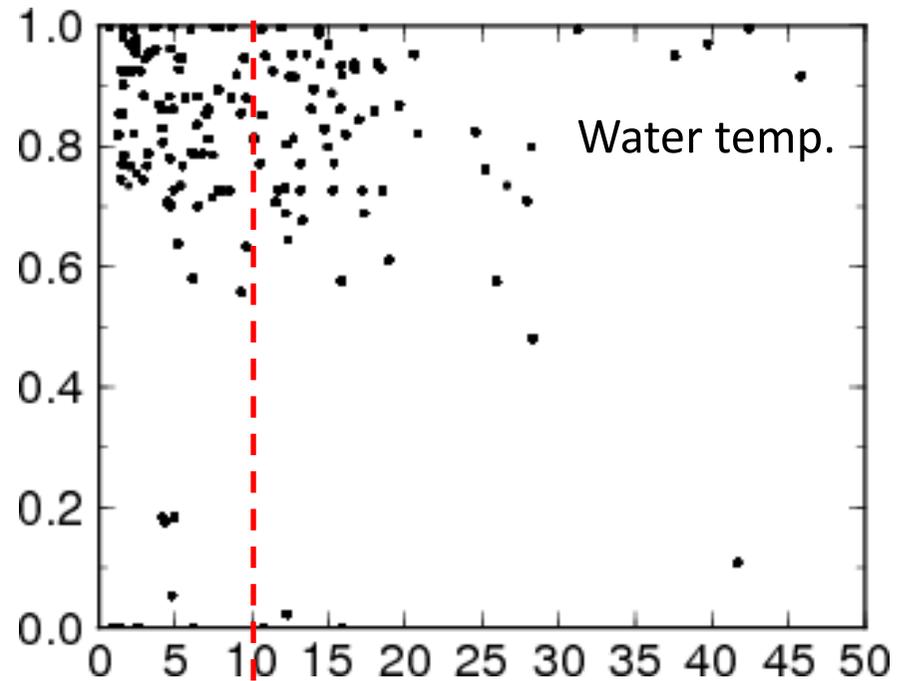
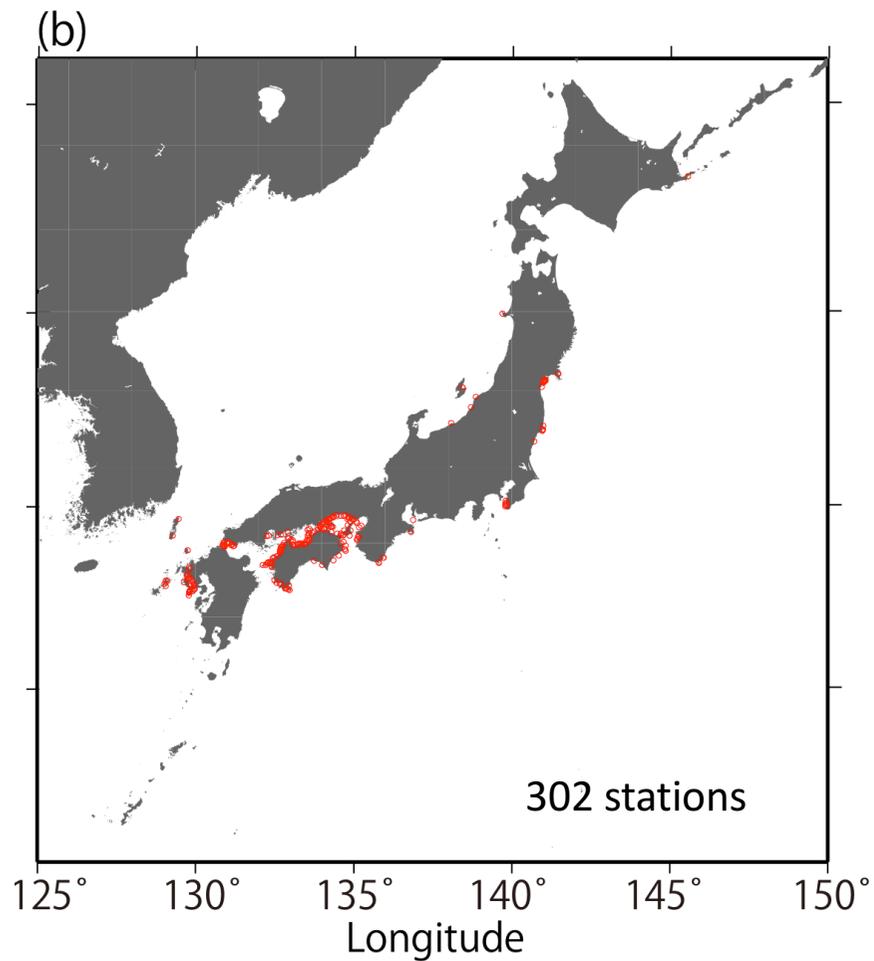


# High spatial variation of pH and pCO<sub>2</sub> in coastal area (Arasaki station, FRA)

(pH)



Cross-correlation of pH variation  
Among Japan-MOE coastal  
pH monitoring stations  
*[Ishizu et al., submit to JO]*



# Requested Specification of coastal pH monitoring

- time resolution: enough resolution to determine diurnal / day - to - day variation
- spatial resolution: less than 10km (in the case of Japanese coast)

\*this level of high- res *in situ* monitoring is almost impossible to manage worldwide.

\*how we overcome this needs/seeds gap?

- coastal ocean model?
- other kind of pH monitoring system including citizens activities?

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