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Vertical and spatial distribution patterns of transparent exopolymer (TEP) in the East Sea during summer 2009

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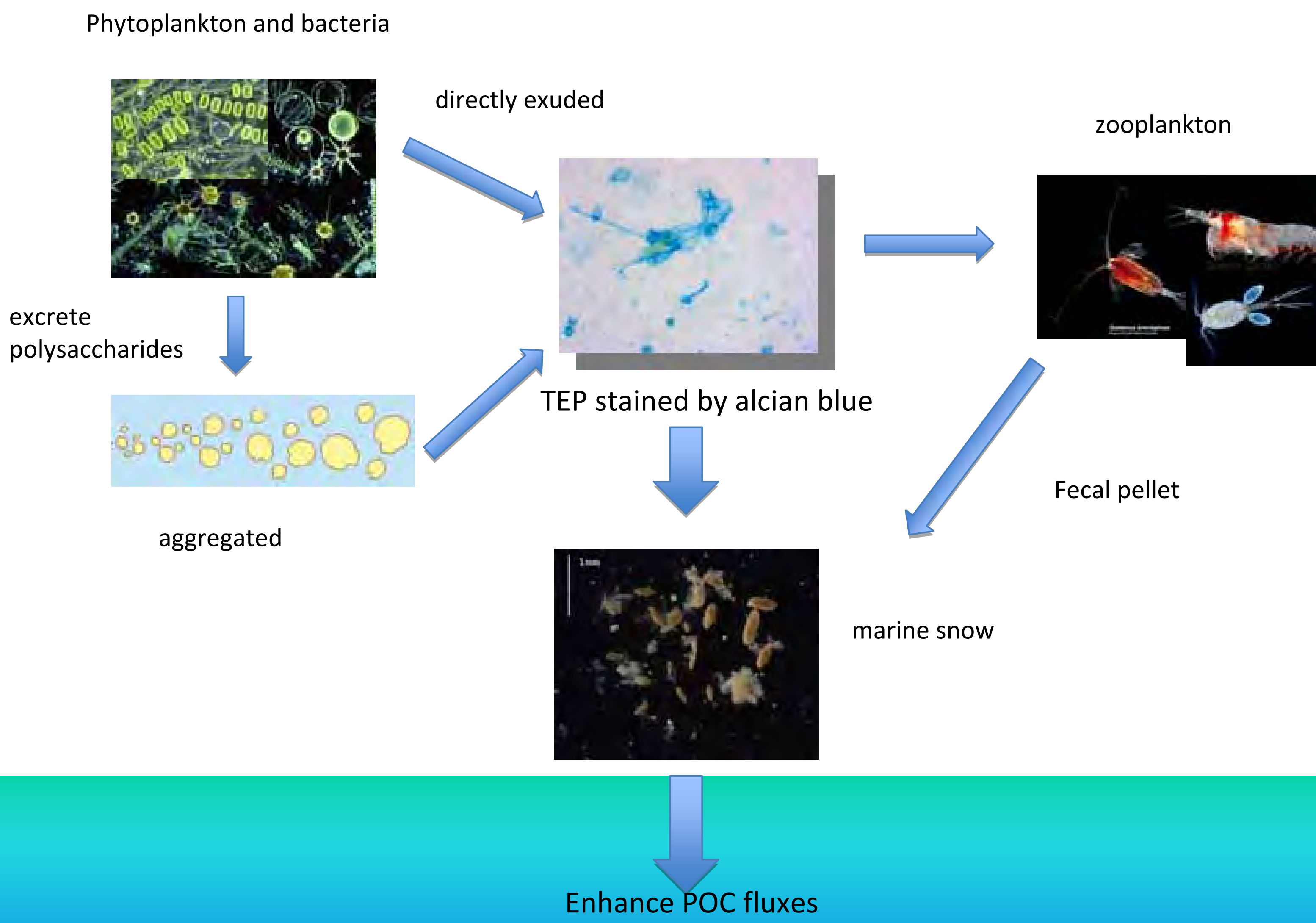
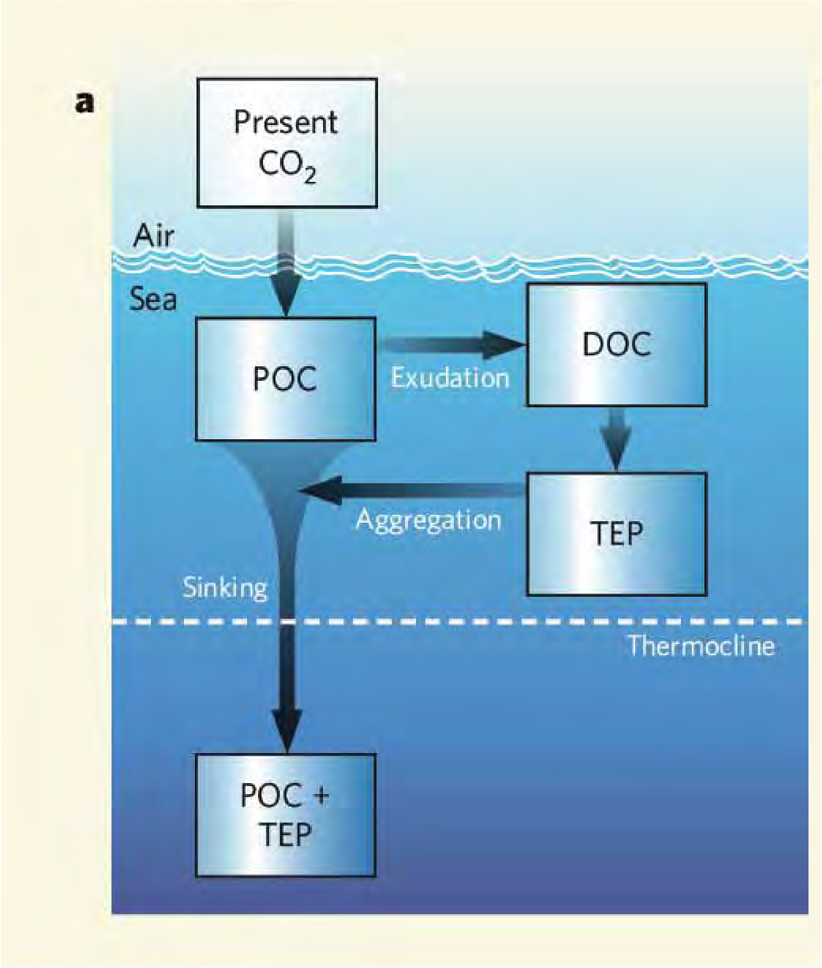
TEP (**T**ransparent **E**xopolymer **P**articles)



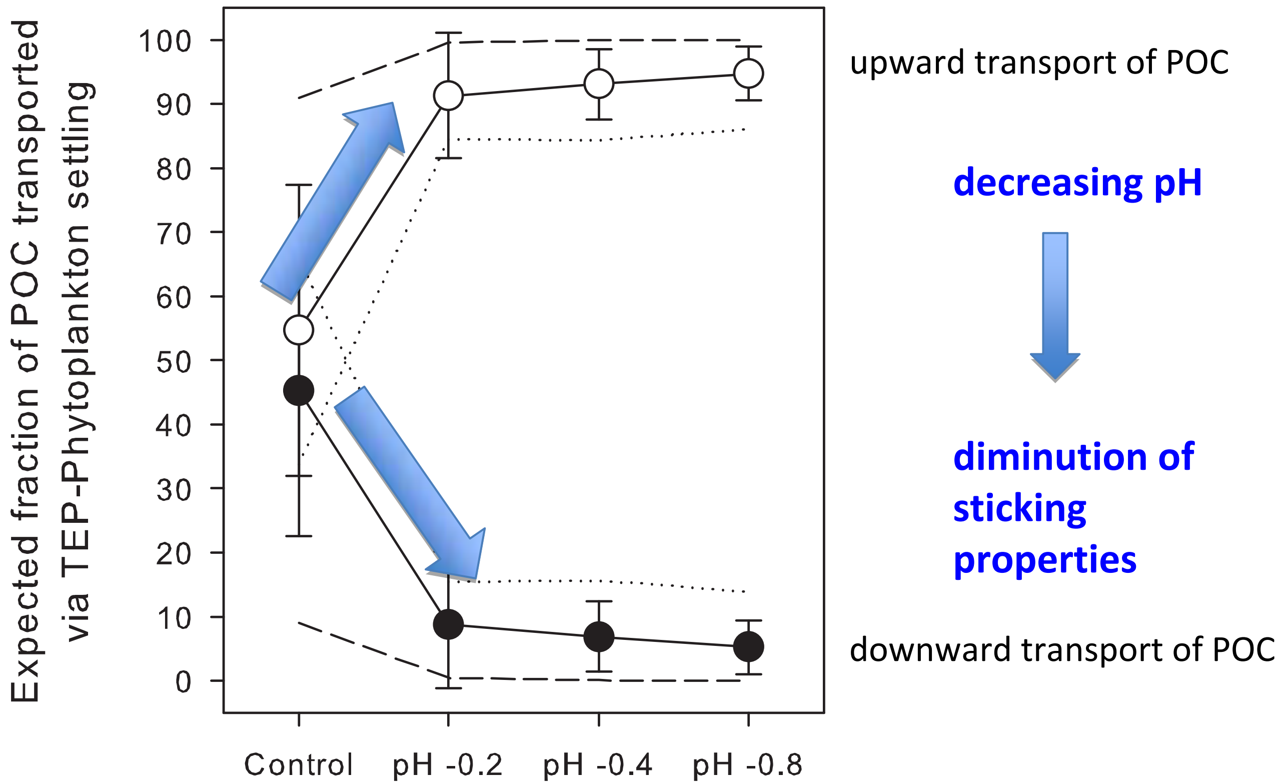
Enhanced TEP production in High CO_2 ocean



Arrigo (2007)

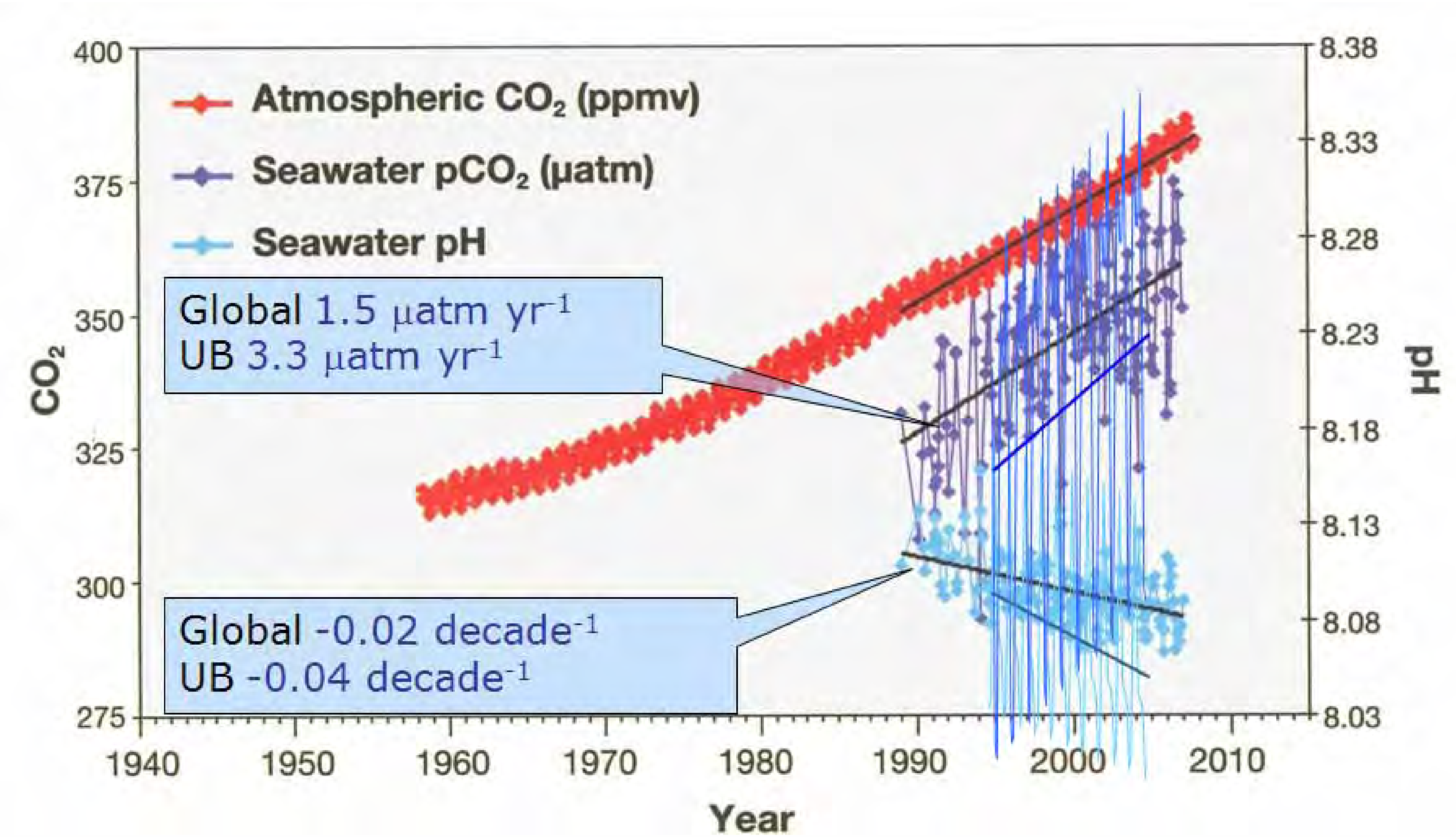
TEP in the acidic ocean

decreasing the TEP driven aggregation and sedimentation



Mari (2008)

Fast acidification in the East Sea



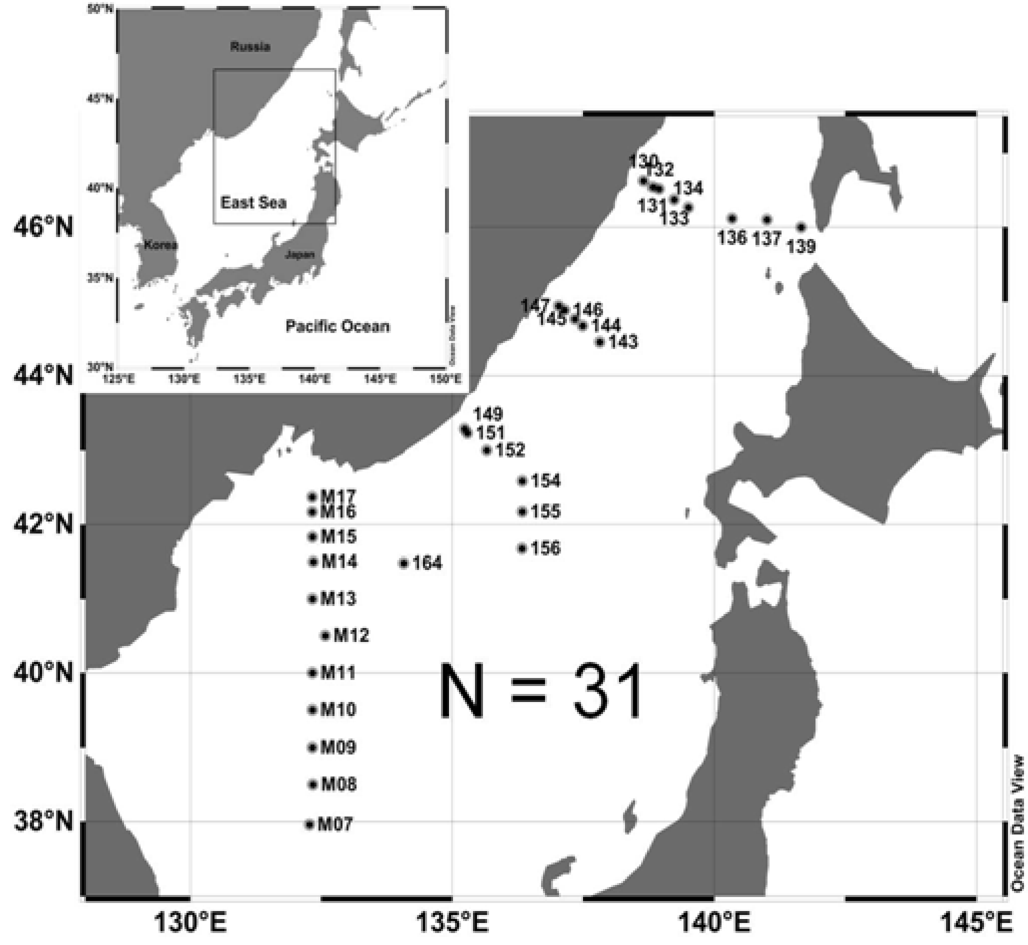
Kim et al. (in prep)

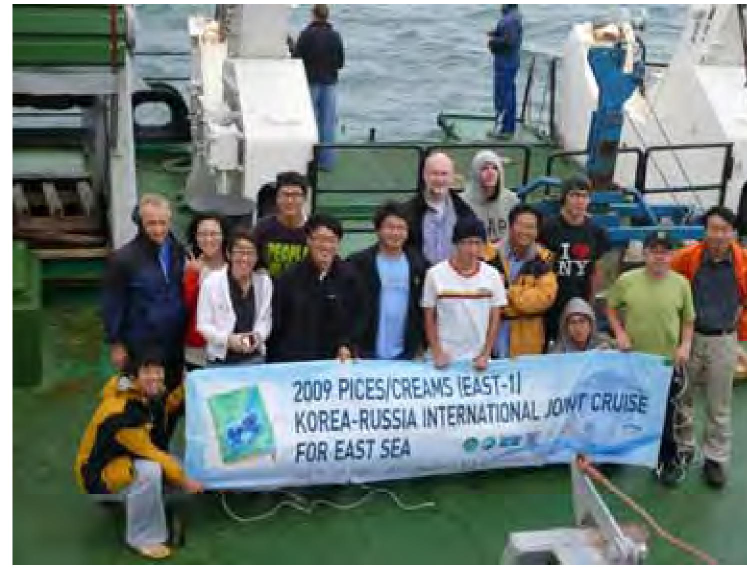
Study objective

To quantify the amount of TEP in the East Sea

To understand the distribution of TEP and its relationship to physical, chemical, and biological properties of water mass

Study area

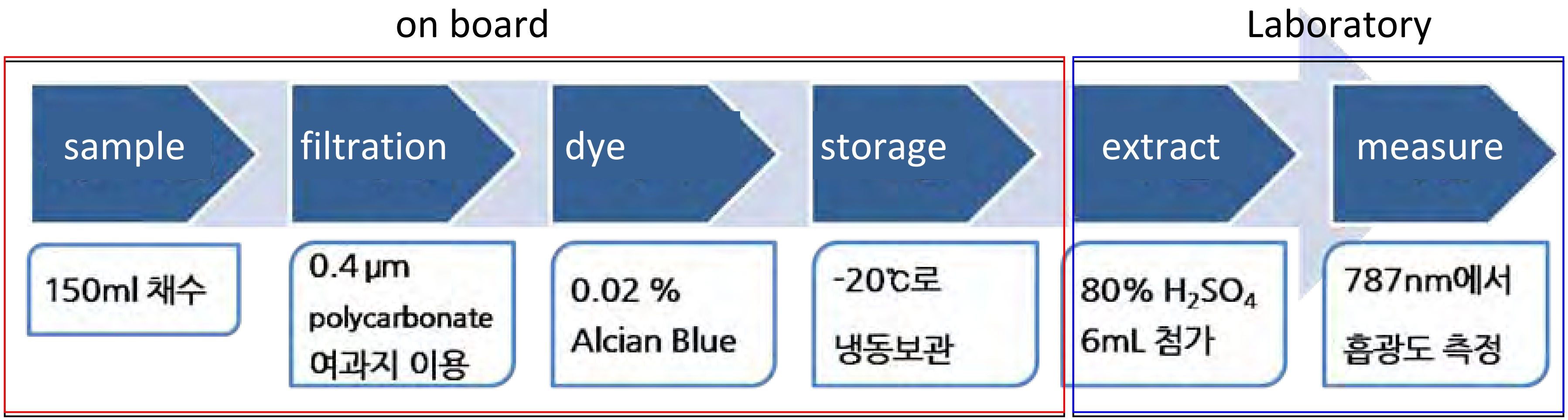




Korea-Russia Joint Cruise (2009. 7.9-19)
in the East Sea (R/V Lavrentyev)

pH, Total Alkalinity(TA)
Chl-a(total and size fractionation)
TEP

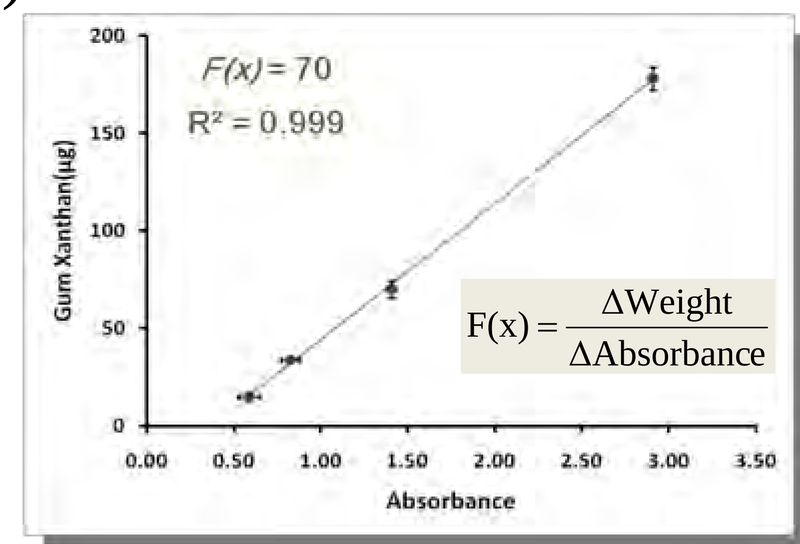
TEP analysis-Colorimetric method



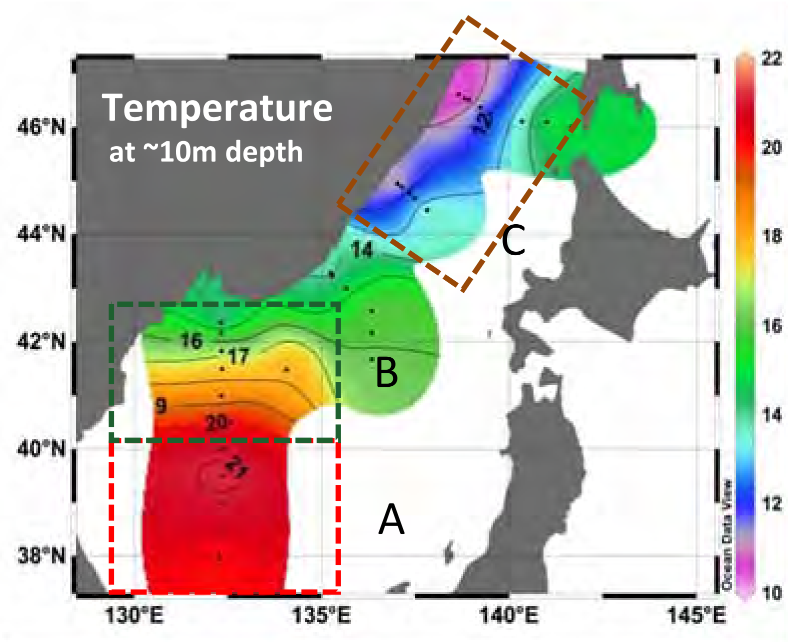
$$\text{TEP}\ (\mu g\ \text{Xeq.L}^{-1}) = \frac{\text{Sample}_{787} - \text{Blank}_{787}}{\text{Volume filtered(L)}} \times F(x)$$

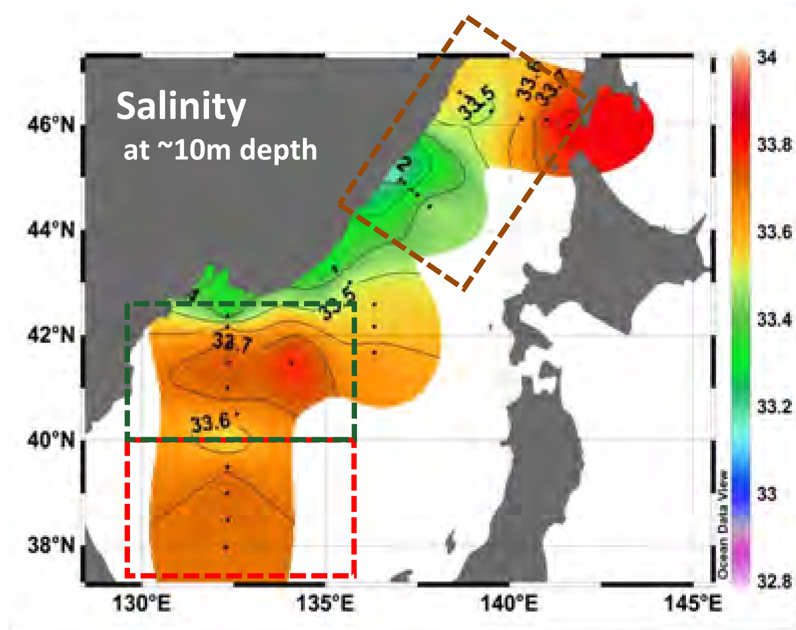
Range of F(x)
$50 \leq F(x) \leq 300$

- Calibration factor (F(x))
- Standard polysaccharide
  - Gum Xanthan



Physical properties at 10m depth



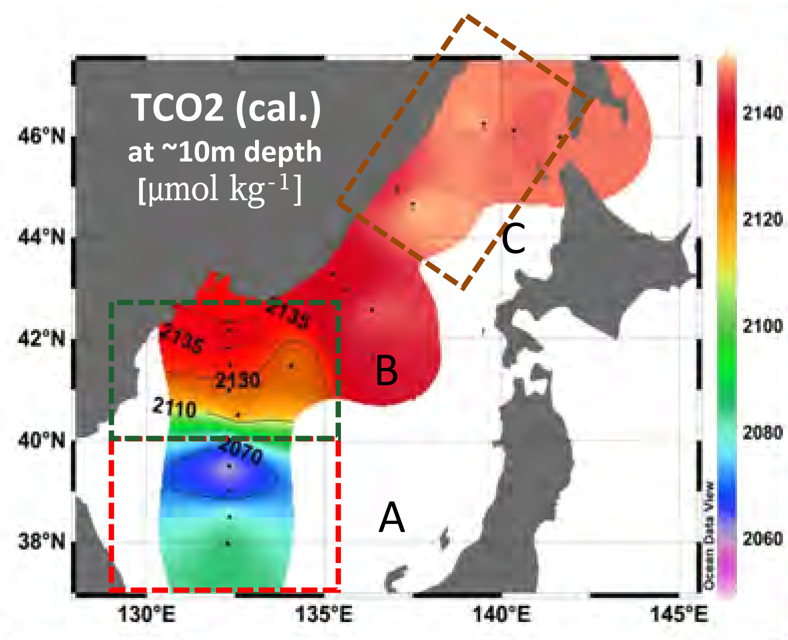


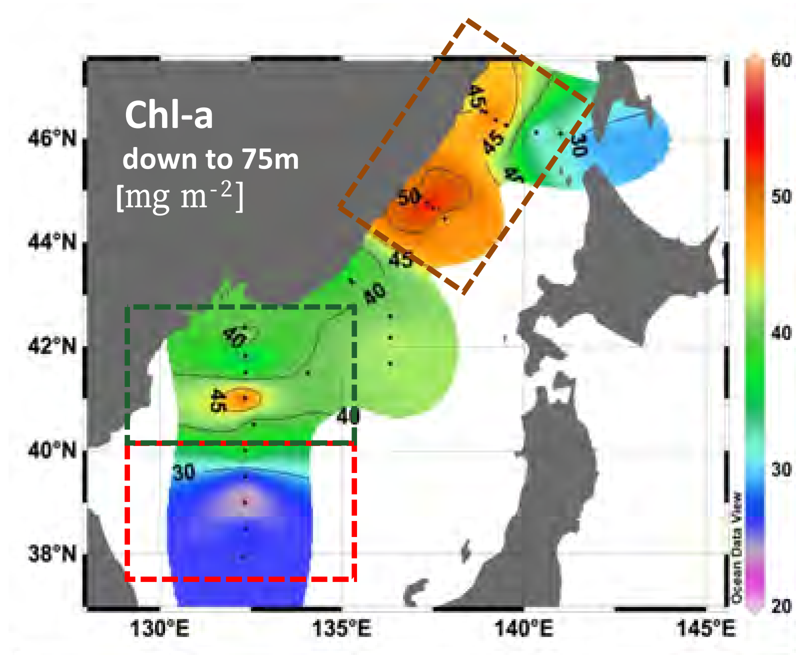
A: T> 20 ^{o}C and S<33.7 (warm and saline surface water)

B: 16 ^{o}C<T< 20 ^{o}C and S~ 33.7 (transition zone)

C: T< 12 ^{o}C and S> 32.7 (cold and less saline surface water)

Chemical and biological properties



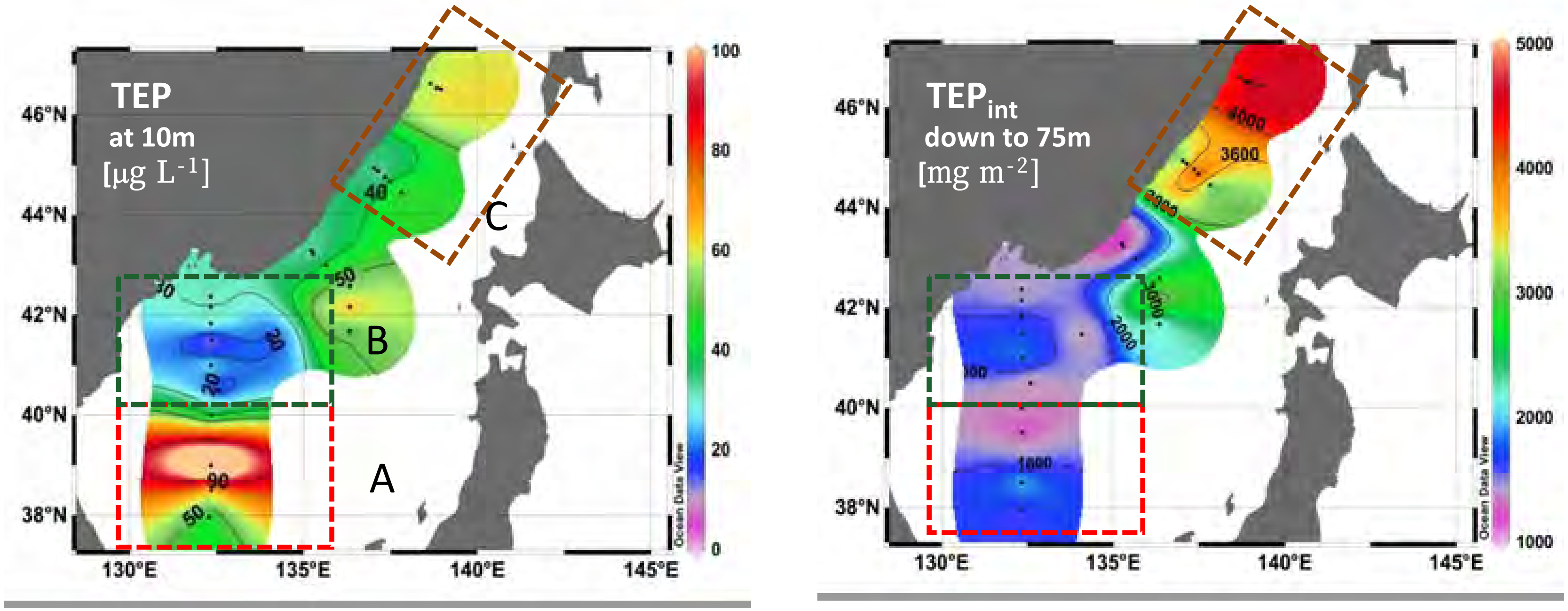


A: TCO_2< 2100 and Chl_{int} <30

B: 2110< TCO_2< 2140 and 30 < Chl_{int}<45

C: TCO_2> 2140 and Chl_{int}>45

TEP at 10m depth and integrated to 75 m depth

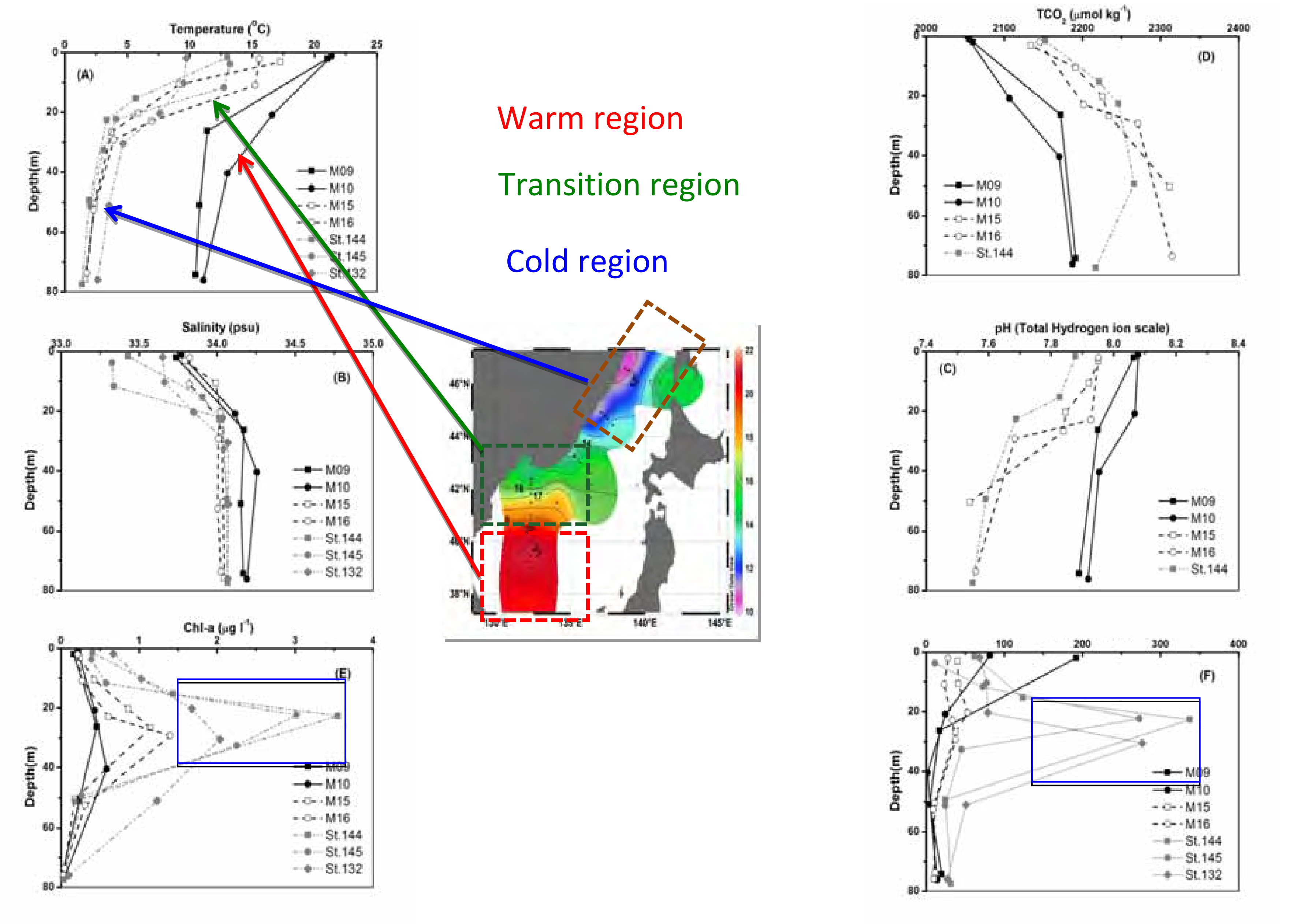


A: 50<TEP< 90 and TEP_{int} ~1600

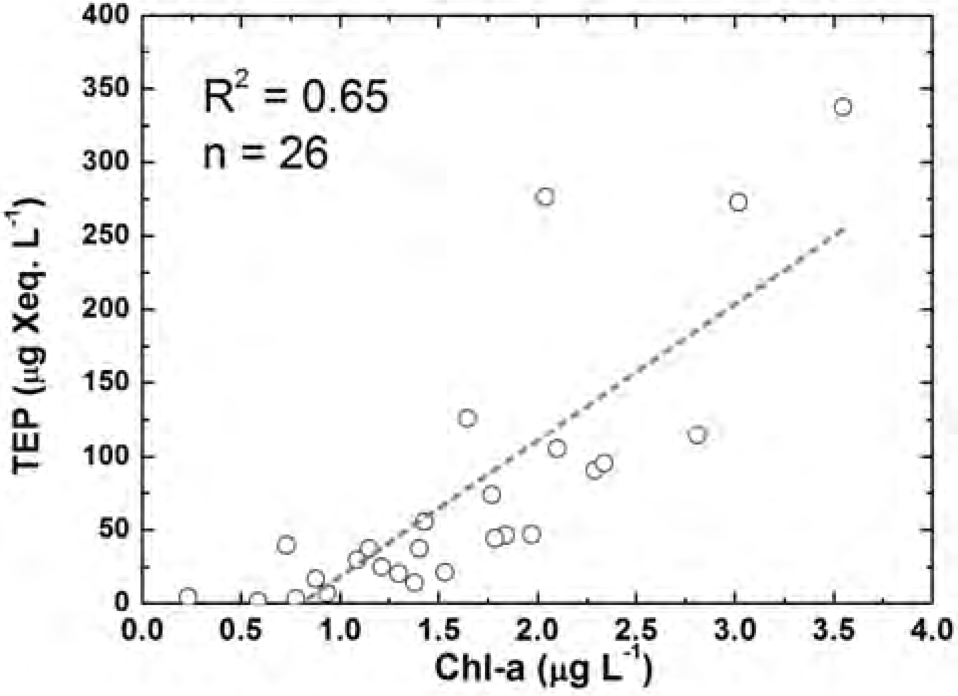
B: TEP< 20 and 1600< TEP_{int}<2000

C: 40<TEP<60 and 3000<TEP_{int}<4500

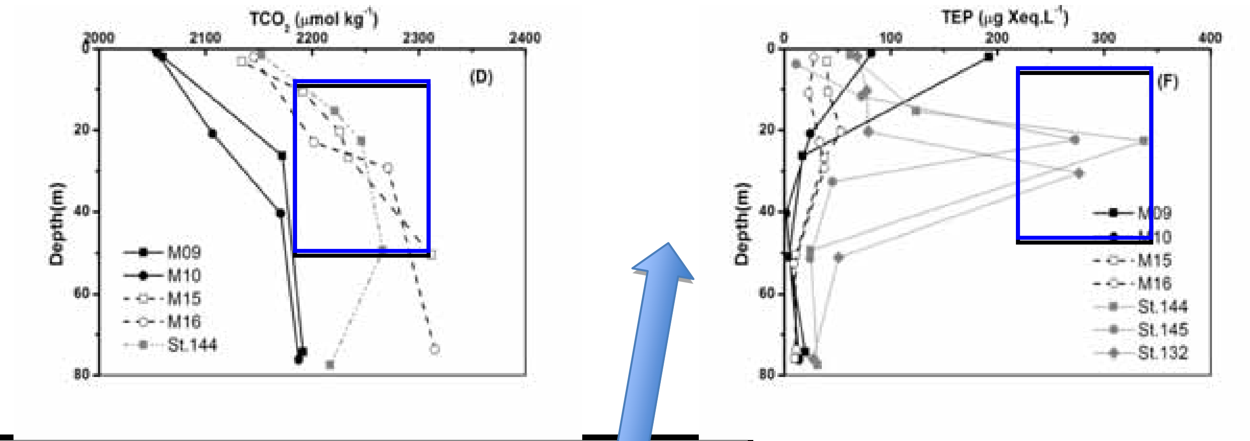
Vertical distribution of physical properties

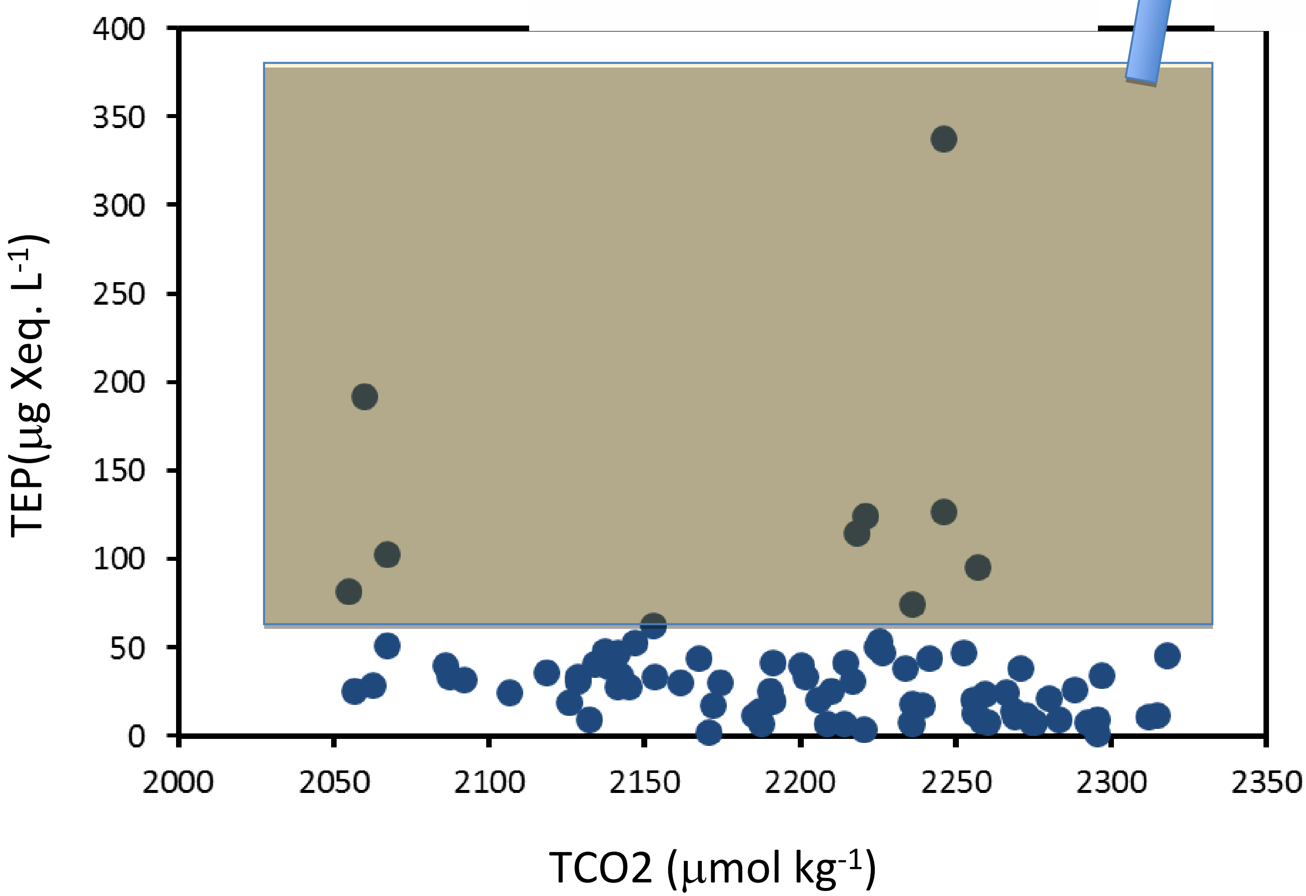


TEP Production by biological processes

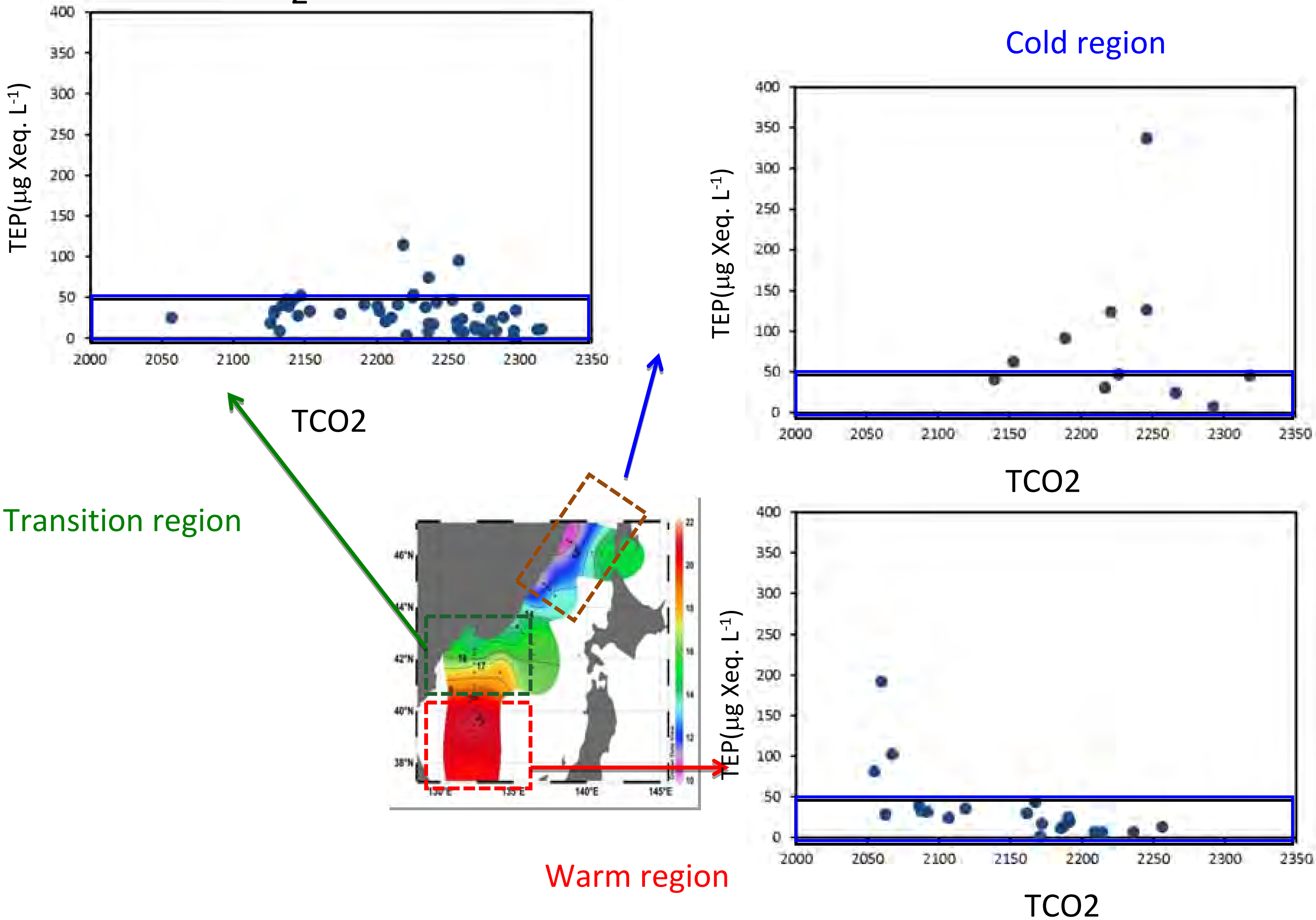


TEP vs TCO_2

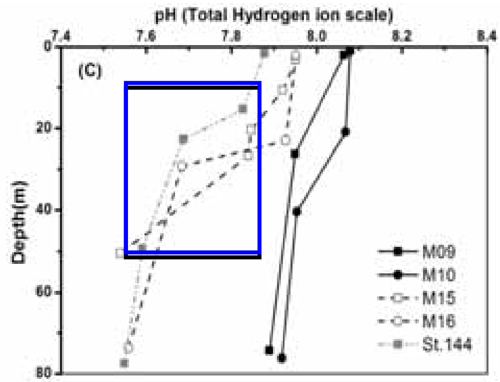

TCO2 (µmol kg-1)
Depth(m)
(D)
M09
M10
M15
M16
St.144
TEP (µg Xeq.L-1)
(F)
St.145
St.132

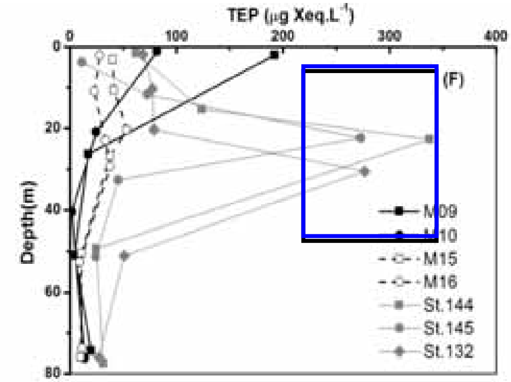

TEP(µg Xeq. L-1)
TCO2 (µmol kg-1)

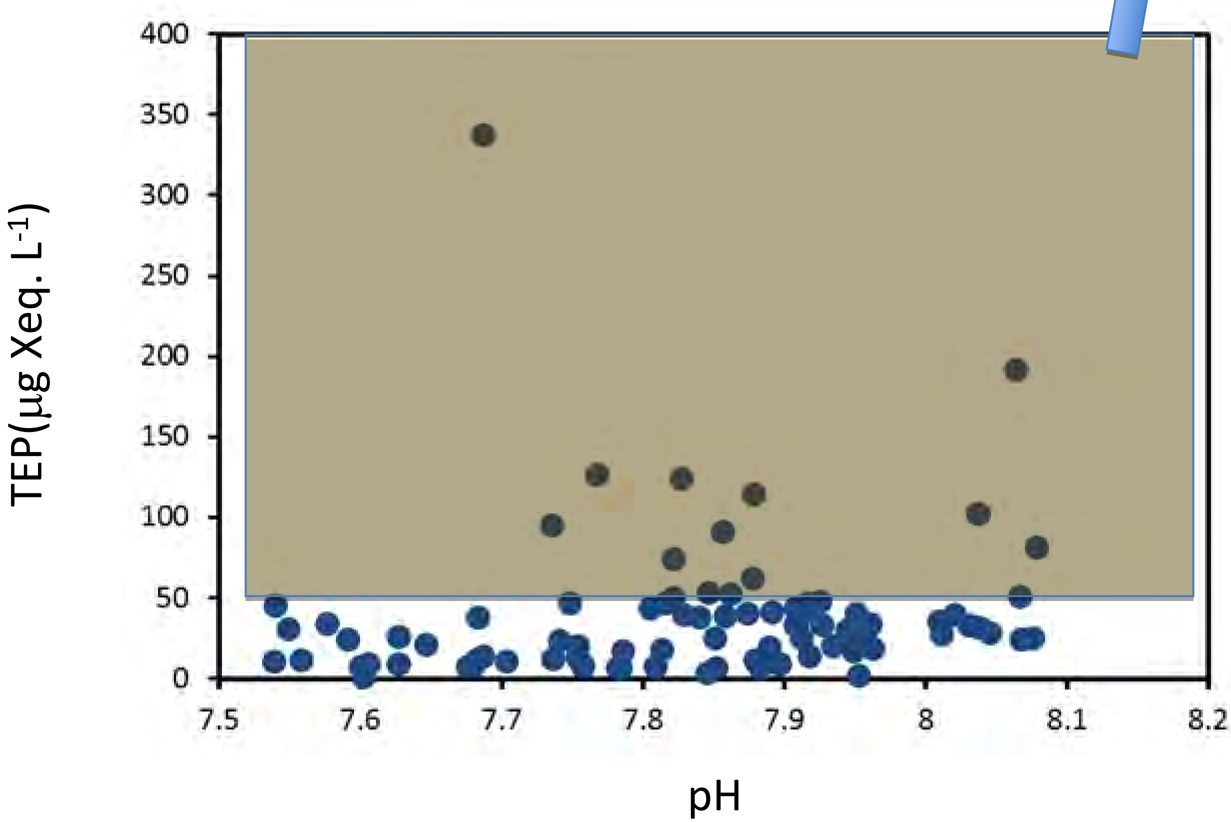
TEP vs TCO_2


TEP(µg Xeq. L-1)
TCO2
Transition region
Cold region
TEP(µg Xeq. L-1)
TCO2
TEP(µg Xeq. L-1)
TCO2
Warm region
400
350
300
250
200
150
100
50
0
2000
2050
2100
2150
2200
2250
2300
2350
46°N
44°N
42°N
40°N
38°N
130°E
135°E
140°E
145°E

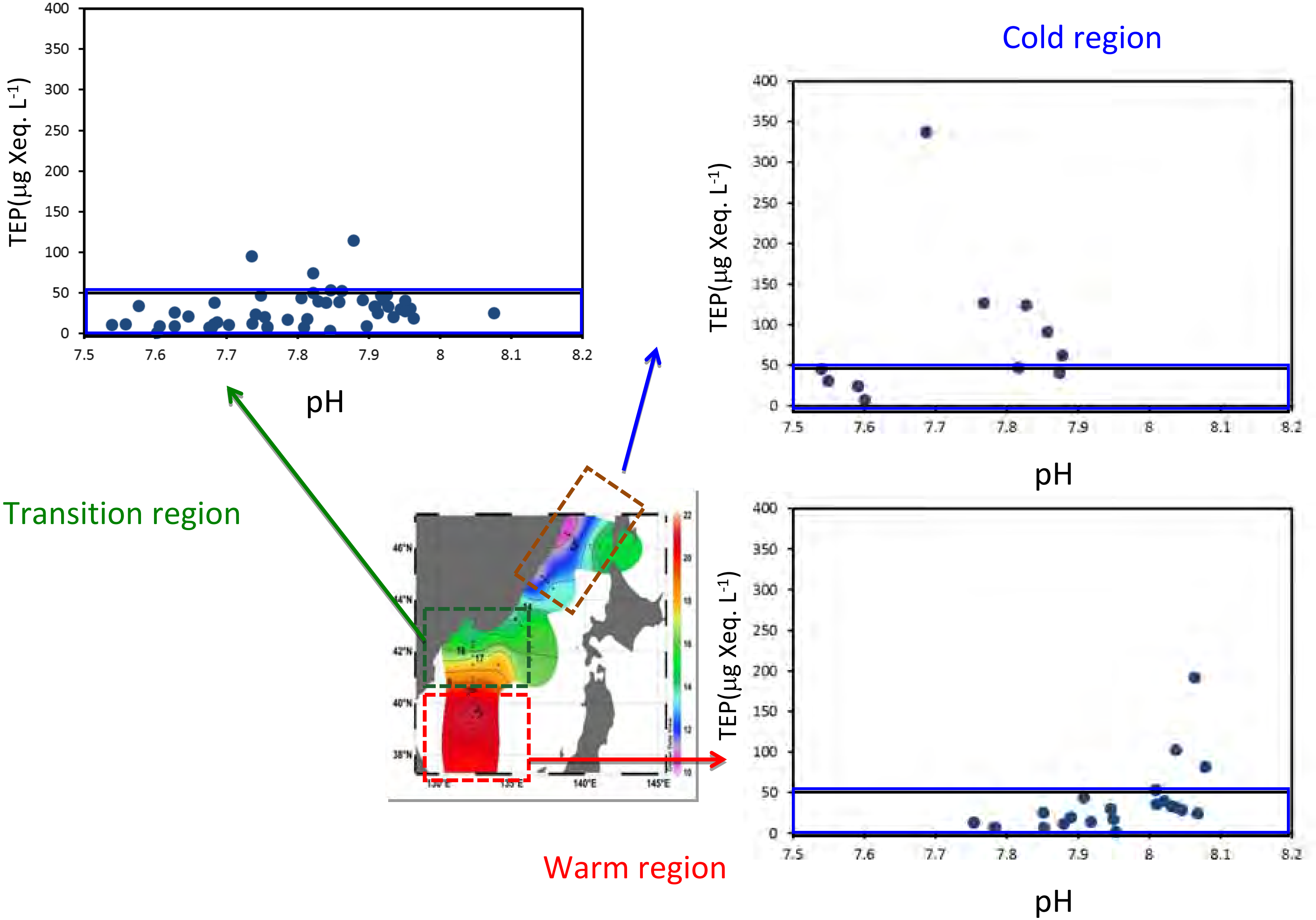
TEP vs pH


pH (Total Hydrogen ion scale)
(C)
Depth(m)
M09
M10
M15
M16
St.144


TEP (µg Xeq.L^{-1})
(F)
Depth(m)
M09
M10
M15
M16
St.144
St.145
St.132


TEP(µg Xeq. L^{-1})
pH

TEP vs pH



TEP(µg Xeq. L-1)
400
350
300
250
200
150
100
50
0
7.5
7.6
7.7
7.8
7.9
8
8.1
8.2
pH
Transition region
Cold region
Warm region

Study areas		Depth	Bloom condition	TEP	TEP/Chl a	References
East Sea (Japan Basin)		**0 – 75m**	**Non-bloom**	**43 (0-338)**	**125 (0-1187)**	**This Study**
SOUTHERN OCEAN	Antarctic Peninsula	0-200m	Non-bloom	15.4 (0-48.9)	40.9 (0-1492)	Ortega-Retuerta *et al.* (2009)
	Anvers Island	Surface		207 (10-407)	123 (12-708)	Passow (pers.comm.)
	Ross Sea	0-150 m	Bloom. Time series	308 (0-2800)	89.1	Hong *et al.* (1997)
	Bransfield Strait	0-100m	Non-bloom	57 (0-346)	51.0	Corzo *et al.* (2005)
	Gerlache Strait	0-100m	Non-bloom	0-283	32.7	Corzo *et al.* (2005)
	Drake Passage	0-100m	Non-bloom	0-157	29.9	Corzo *et al.* (2005)
Mediterranean Sea		0-200m	Non-bloom	21 (5-94)	453 (0-12386)	Ortega-Retuerta unpubl.
sub-Arctic Pacific			Bloom at a coastal site	901 - 1442	125 - 144	Ramaiah *et al.* (2001)
Baltic Sea			Non-bloom	83 (145 – 322)	130	Engel *et al.* (2002)
Northeast Atlantic		10-50m	Different bloom stages	28.5 (10-110)	49-104	Engel (2004)
Strait of Gibraltar		0-200m	Different bloom stages	25-205	42-2708	Prieto *et al.* (2006)

Summary

I. Positive relationship between chlorophyll-a and TEP concentration

II. There was no trend between pH and TEP concentrations within the euphotic layer

III. There was no specific relationship between TCO2 and TEP concentration within the euphotic layer

IV. TEP concentrations ranged about 0~338 μg Xeq. L^{-1} with mean value of 43 μg Xeq. L^{-1}