

The background of the slide is a solid blue color with a faint, semi-transparent image of a sea urchin. The urchin is positioned in the upper right quadrant, with its radial symmetry and spines visible. The text is overlaid on this background.

Inter-annual change of chlorophyll-a in Toyama Bay - Comparison of 1998 and 2003

Genki Terauchi (NPEC) and Joji Ishizaka



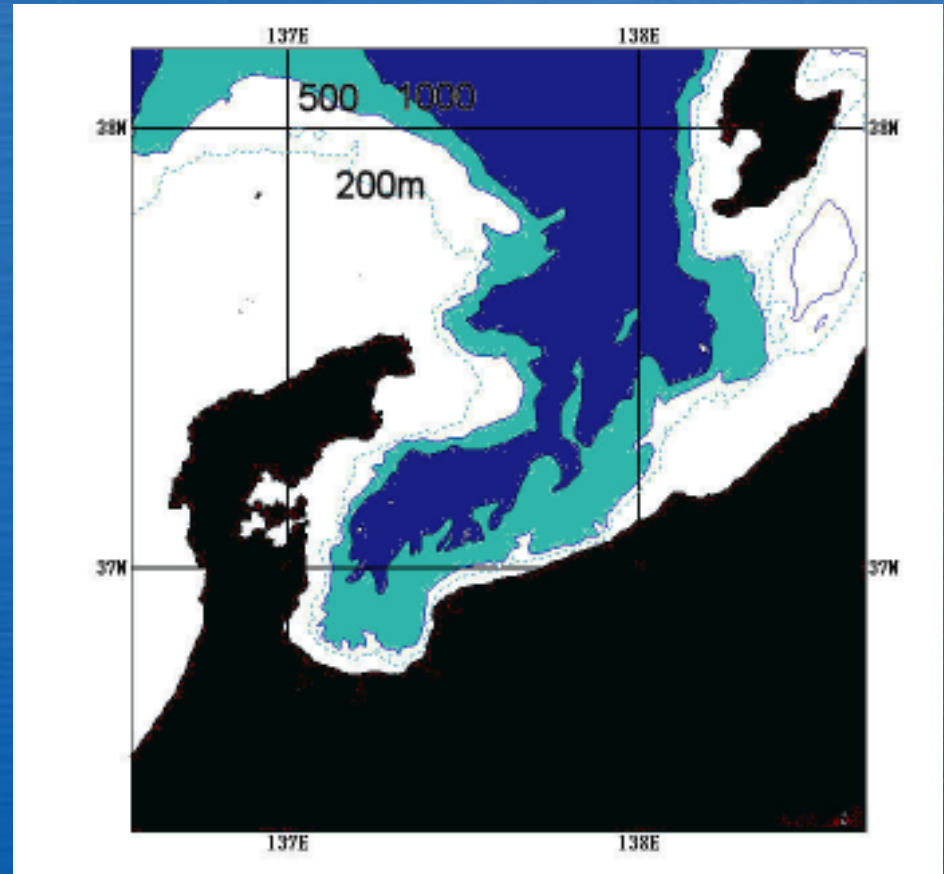
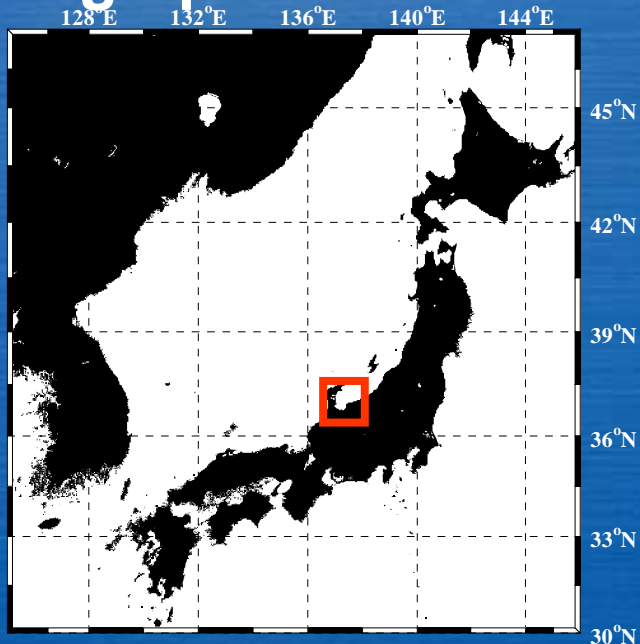
Outline

- Introduction and Background
 - Toyama Bay
 - Research by Toyama Prefecture (Local Government)
- Research
 - Research objective and hypothesis
 - Method and data in this study
 - Result
- Summary
- Future Research

Introduction - Toyama Bay

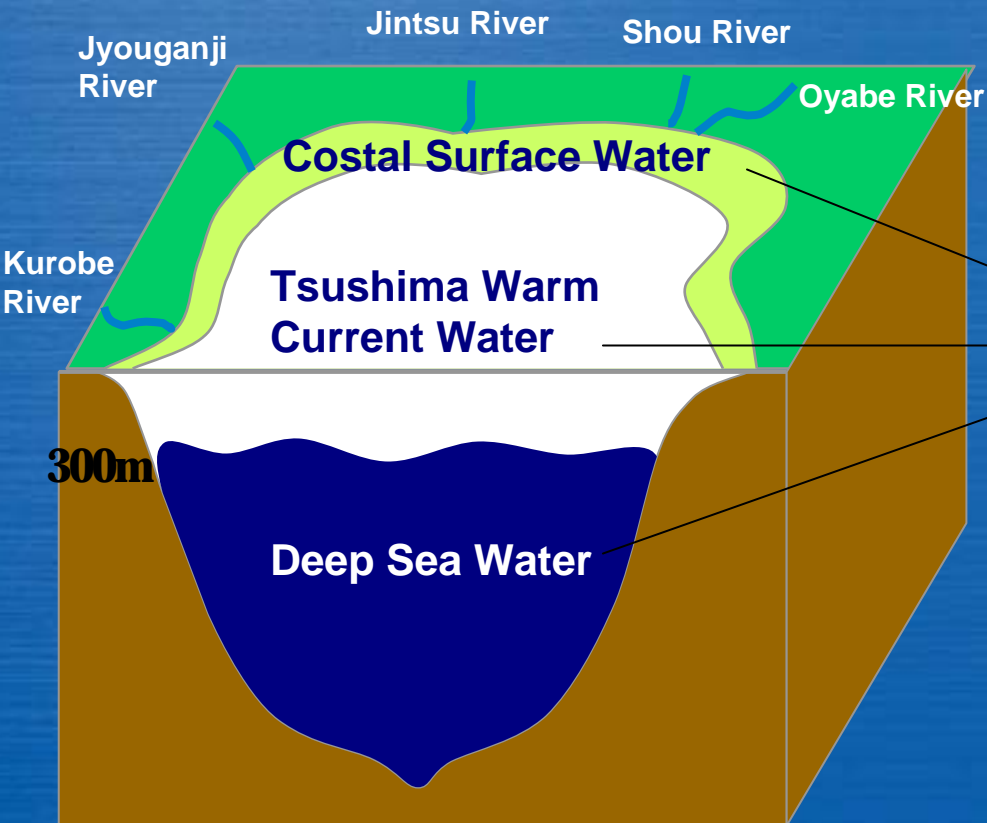
Sea Bottom Topography

Geographical Location



Introduction - Toyama Bay

Characteristic of Toyama Bay



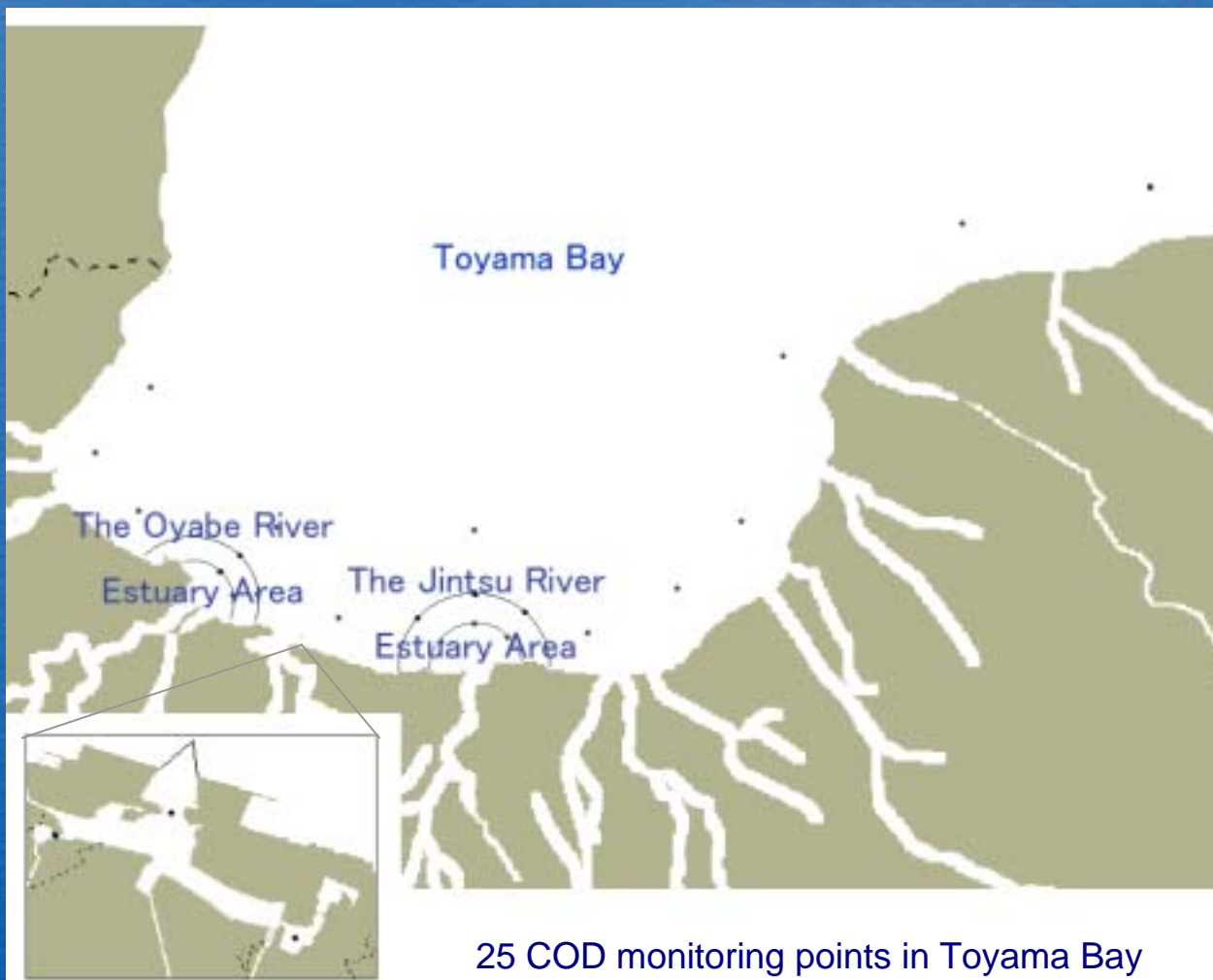
- Many rivers flow into Toyama Bay
- Consisting of three different layers
- Sea bottom landscape sharply drop

Background - Water quality (COD) monitoring points in Toyama Bay Coastal Zone

■COD

The quantity of oxygen used in biological and non-biological oxidation of organic matter in water; a measure of water quality.

Generally, the higher the *chlorophyll-a* concentration, COD tends to become higher



25 COD monitoring points in Toyama Bay

Background - Defining annual COD value

- Monitoring frequency
 - Once per month
- Annual data
 - 75% value defined by the environmental ministry of Japan was used
- Calculating 75% value
 - Laying out monthly data in ascending order
 - Picking up a month data that comes in turns of $0.75 \times$ “number of measurement”

) example

Month	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
COD	1.5	2.0	2.3	2.0	3.2	3.4	2.9	2.1	3.0	2.0	1.7	1.8

1. Layout monthly data in ascending order

COD	1.5	1.7	1.8	2.0	2.0	2.0	2.1	2.3	2.9	3.0	3.2	3.4
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2. Pick out the data that comes in turn of 0.75×12 (number of measurement)

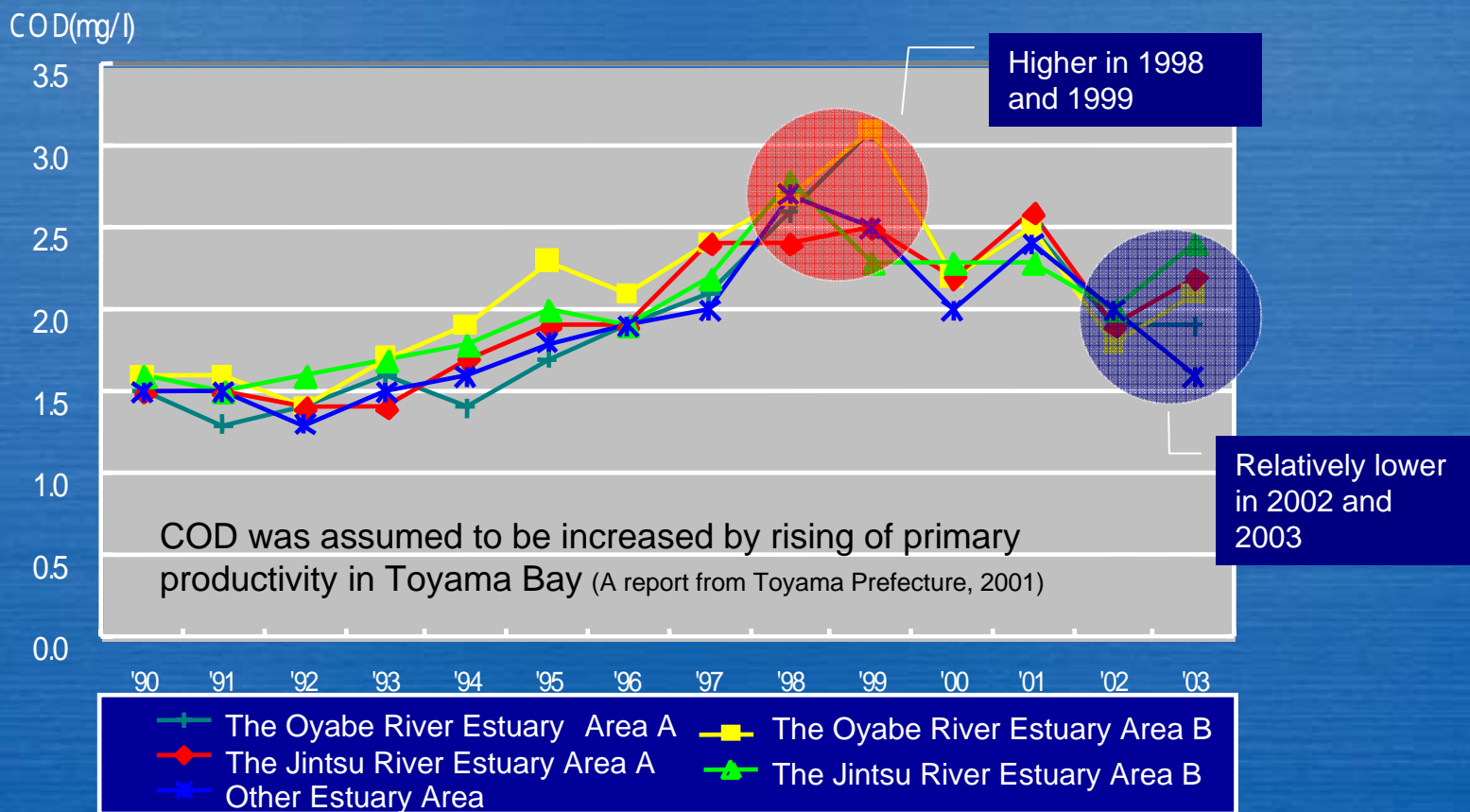
$$0.75 \times 12 = 9$$

	1	2	3	4	5	6	7	8	9			
COD	1.5	1.7	1.8	2.0	2.0	2.0	2.1	2.3	2.9	3.0	3.2	3.4

Background

- Annual Transition of COD

Annual Transition of COD in Toyama Bay



Data Source: Toyama Prefecture



Research

- Objective and Hypothesis

■ Research Objective

- To compare this phenomena with remote sensing data

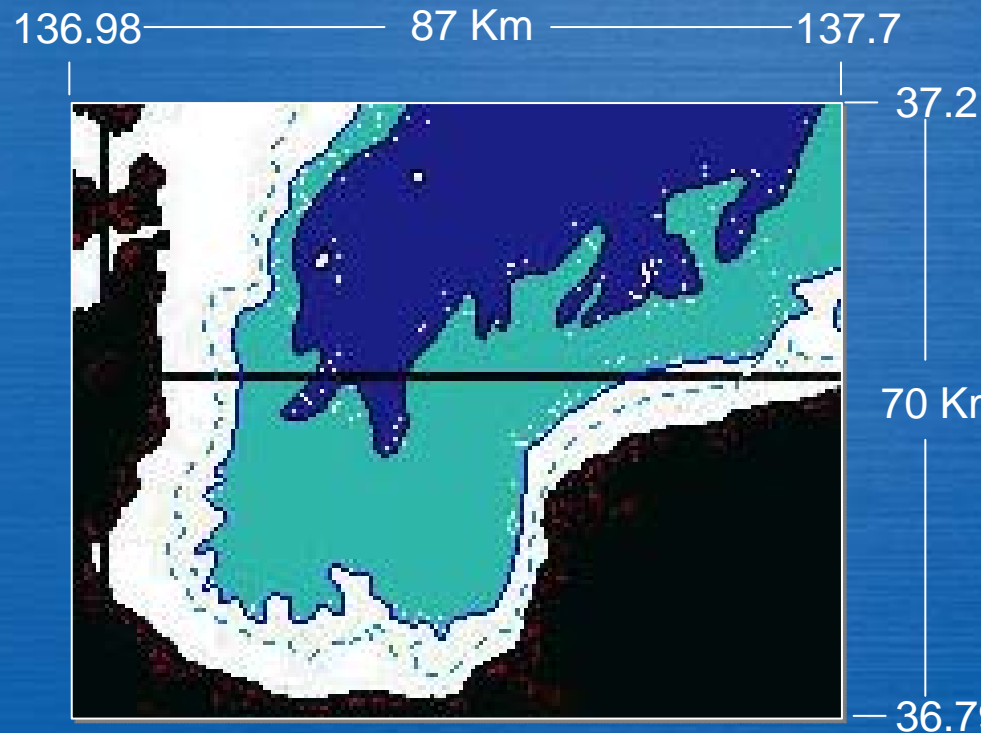
■ Hypothesis

- If RS Chlorophyll-a data is higher in 1998 than 2003, COD is assumed to be increased in 1998 by Chlorophyll-a
- Otherwise, some other factors may be contributing to the increase of COD in Toyama Bay

Research

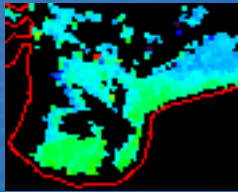
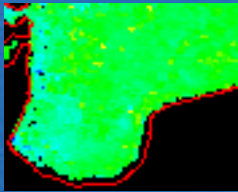
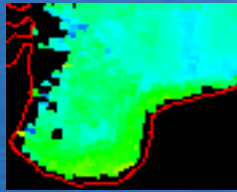
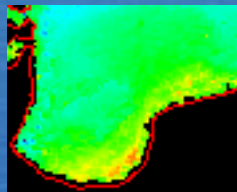
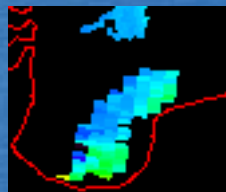
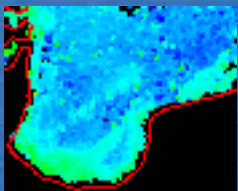
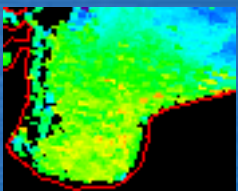
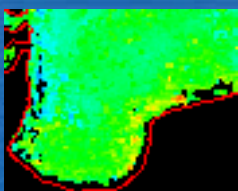
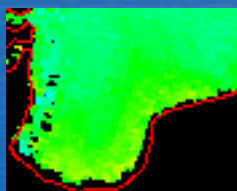
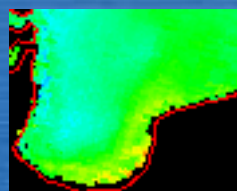
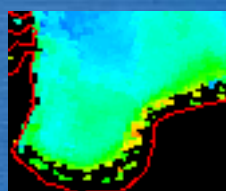
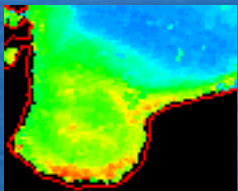
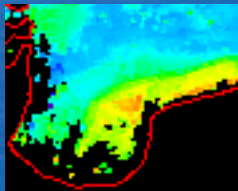
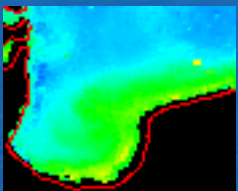
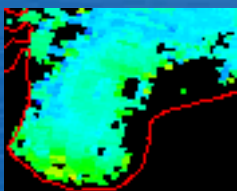
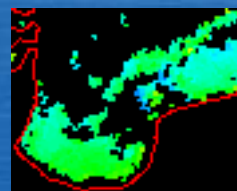
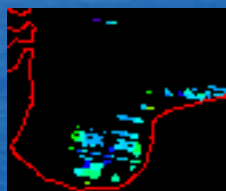
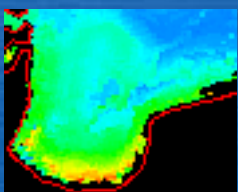
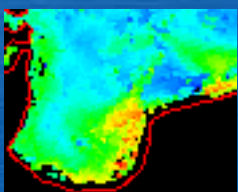
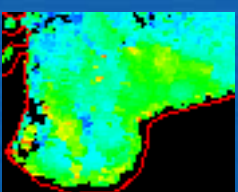
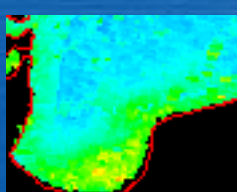
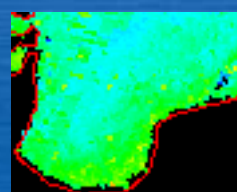
- Method and Data in this study

- Method
 - Comparing remote sensing (RS) ocean color data of 1998 and 2003
- Sensor
 - Orbview2/SeaWiFS
- Processing Software
 - SeaDAS 4.6 (standard algorithm)
- Area
 - 36.79 to 37.2 N
 - 136.98 to 137.7 E
- Duration
 - Jan 1 to Dec 31, 1998
 - Jan 1 to Dec 31, 2003
- Resolution
 - 1 km x 1km
- Composite
 - One month



Research Result

- Comparison of monthly composite images

Year	Jan	Feb	Mar	Apr	May	Jun
1998	No reliable data exist					
2003						
Year	Jul	Aug	Sep	Oct	Nov	Dec
1998						
2003						No reliable data exist

Research Result

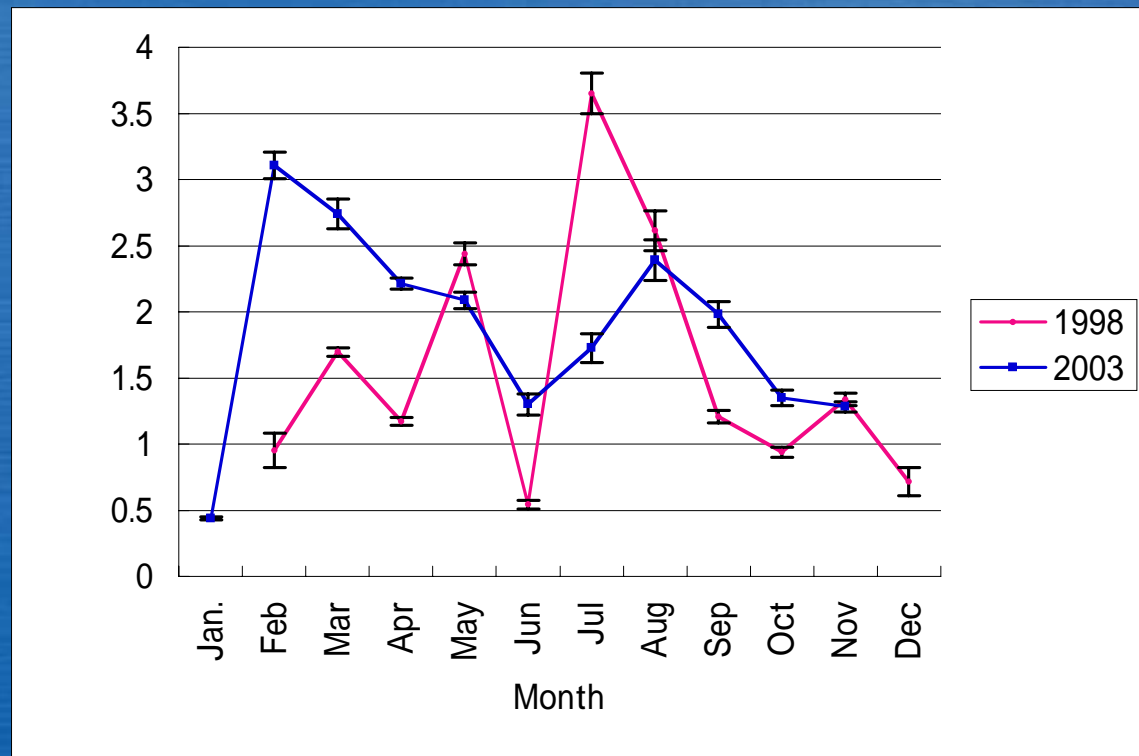
- Comparison of monthly composite data

■ Method

- Averaging the individual value in monthly composite data with 95% CL

■ Result

- Annual average Chl data
 - 1998 - 1.65 $\mu\text{g/l}$
 - 2003 - 2.02 $\mu\text{g/l}$



Comparison of monthly composite data

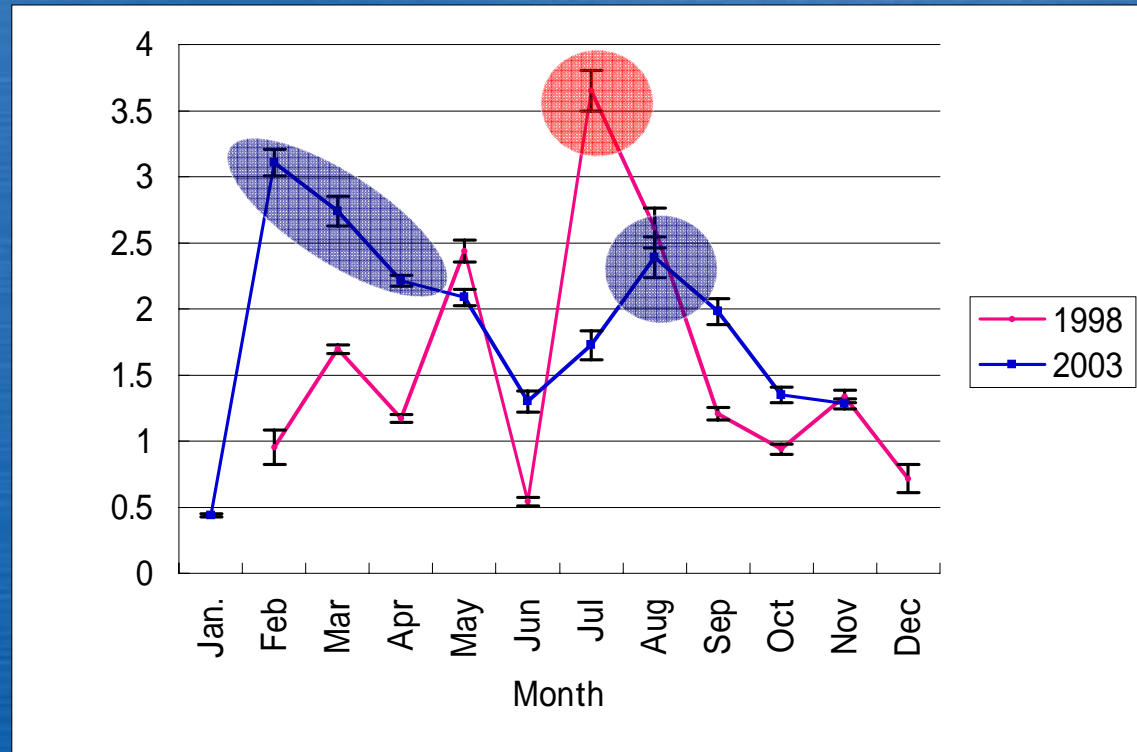
Summary

Summary 1

- There is one peak of Chlorophyll-a concentration in summer 1998, which is considered to be increased by influence of coastal zone

Summary 2

- There are two peaks of Chlorophyll-a concentration in 2003 (Spring and Summer), considered to be increased by influence of outer ocean dynamics in Spring and influence of coastal zone in Summer





Future Research

- Future research should be continued as follows;
 - Analyzing other environmental factors including climate change, river discharge and SST
 - Analyzing co-relation between *in situ* COD and Chlorophyll-a data as well as its inter-annual change
 - Analyzing costal zone and outer ocean are separately
 - Analyzing SeaWiFS data in other year

Thank you for your attention

