HOKKAIDO UNIVERSITY

Title	Establishment of an Amur-Okhotsk Consortium toward Future Sustainability in the Sea of Okhotsk
Author(s)	Shiraiwa, Takayuki
Relation	Sustainability Weeks 2009 Opening Symposium "International Symposium on Sustainable Development -Recommendations for Tackling the 5 Challenges of Global Sustainability-". Session 6, Toward the Creation of a New Framework in the Global Warming Era. 2 November 2009. Sapporo, Japan.
Issue Date	2009-11-02
Doc URL	https://hdl.handle.net/2115/40107
Type	conference presentation
File Information	6-1Shiraiwa.pdf

Hokkaido University Collection of Scholarly and Academic Papers : HUSCAP

Sustainability Weeks 2009
Opening Symposium 091102

Establishment of an *Amur-Okhotsk Consortium* toward Future Sustainability in the Sea of Okhotsk

オホーツク海の未来可能性に向けた国際コンソーシアム構築

Takayuki Shiraiwa

白岩孝行

Research Institute for Humanity and Nature

Inst. Low Temp. Science, Hokkaido Univ.

In collaboration with

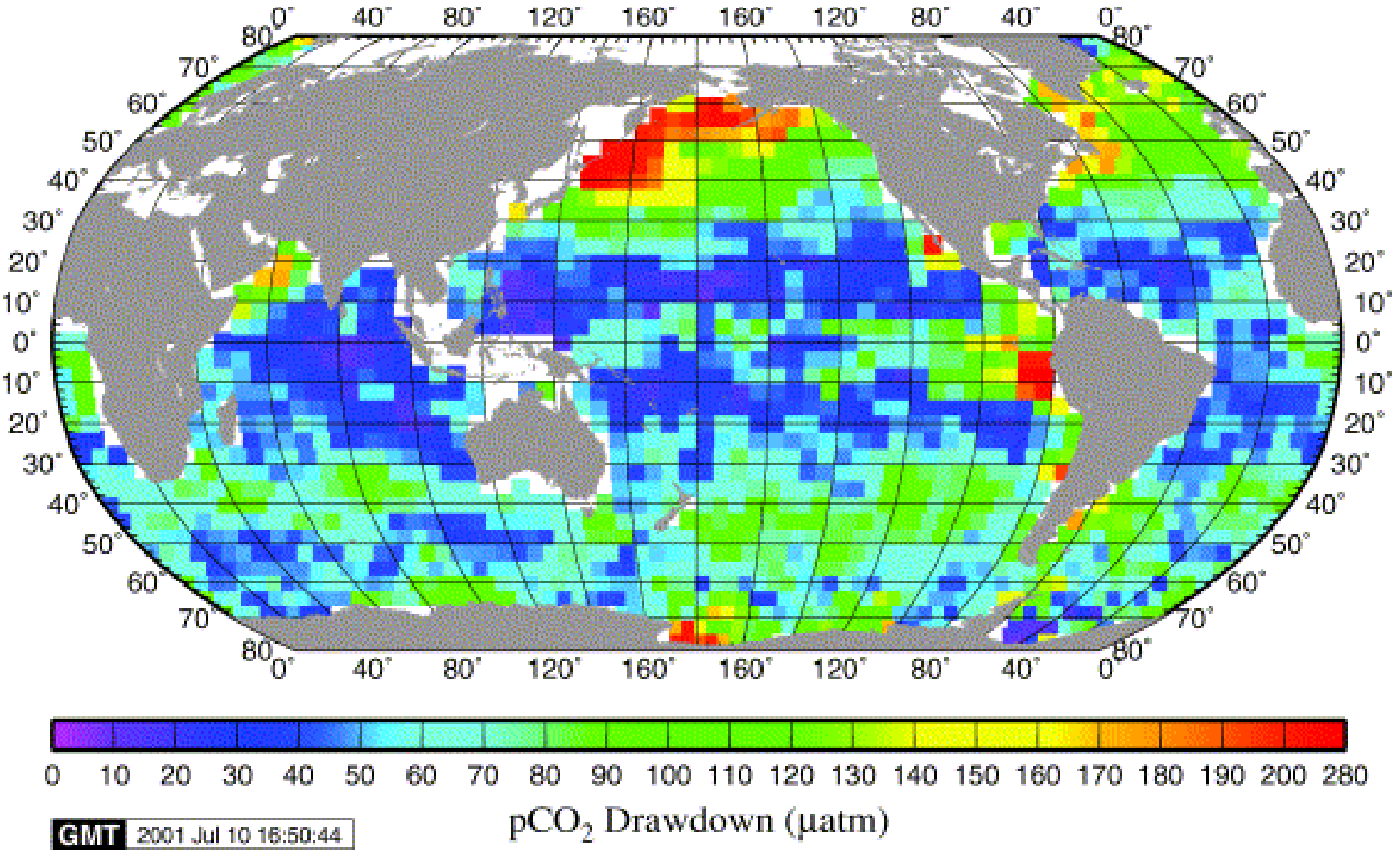
PORC/ILTS and SRC, Hokkaido University

NER, Kitami Inst. Technology

HRDB/MLIT, HUISD

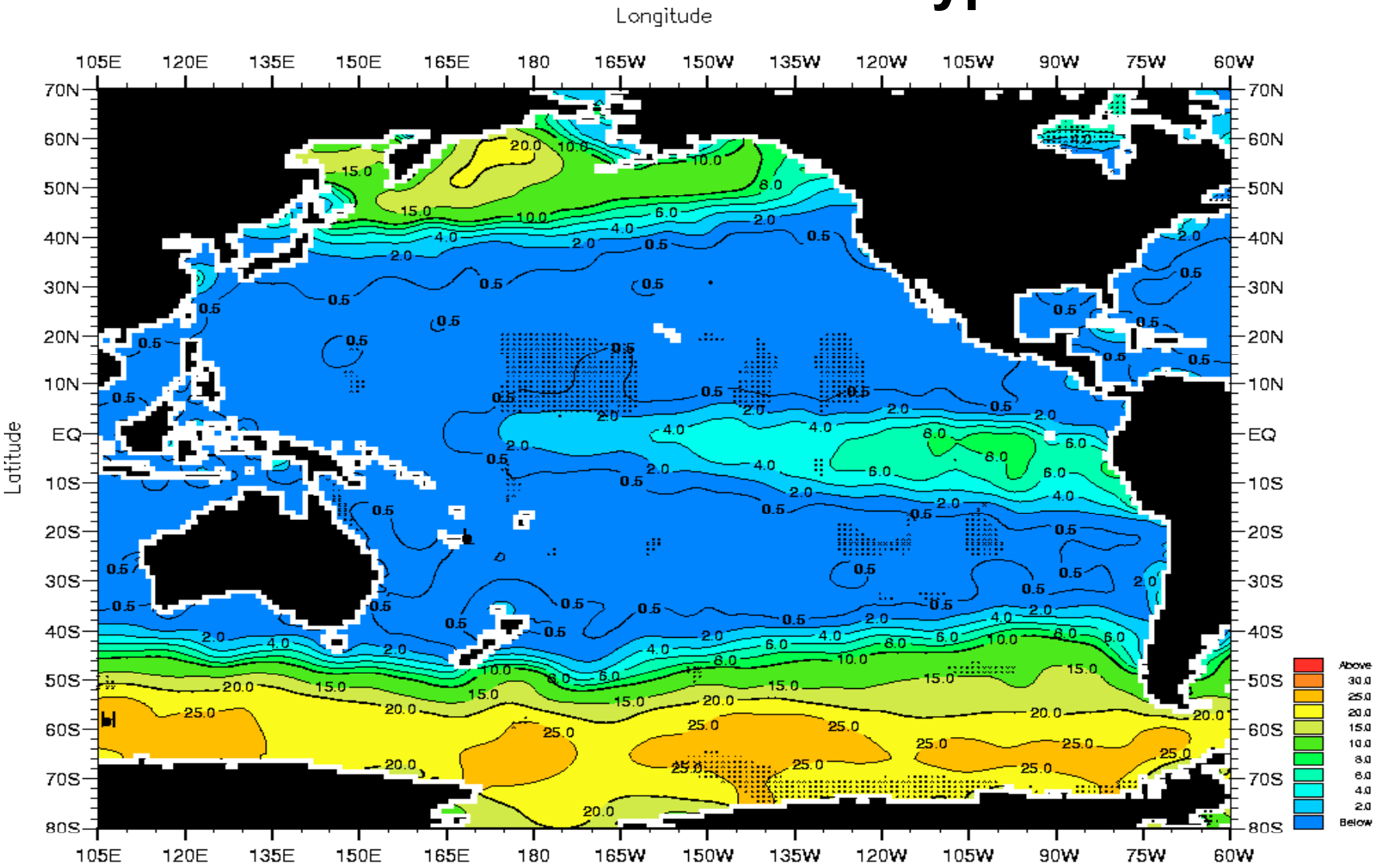
and ISTC/MEXT

The world richest ocean



Takahashi et al., 2002

HNLC and iron limitation hypothesis

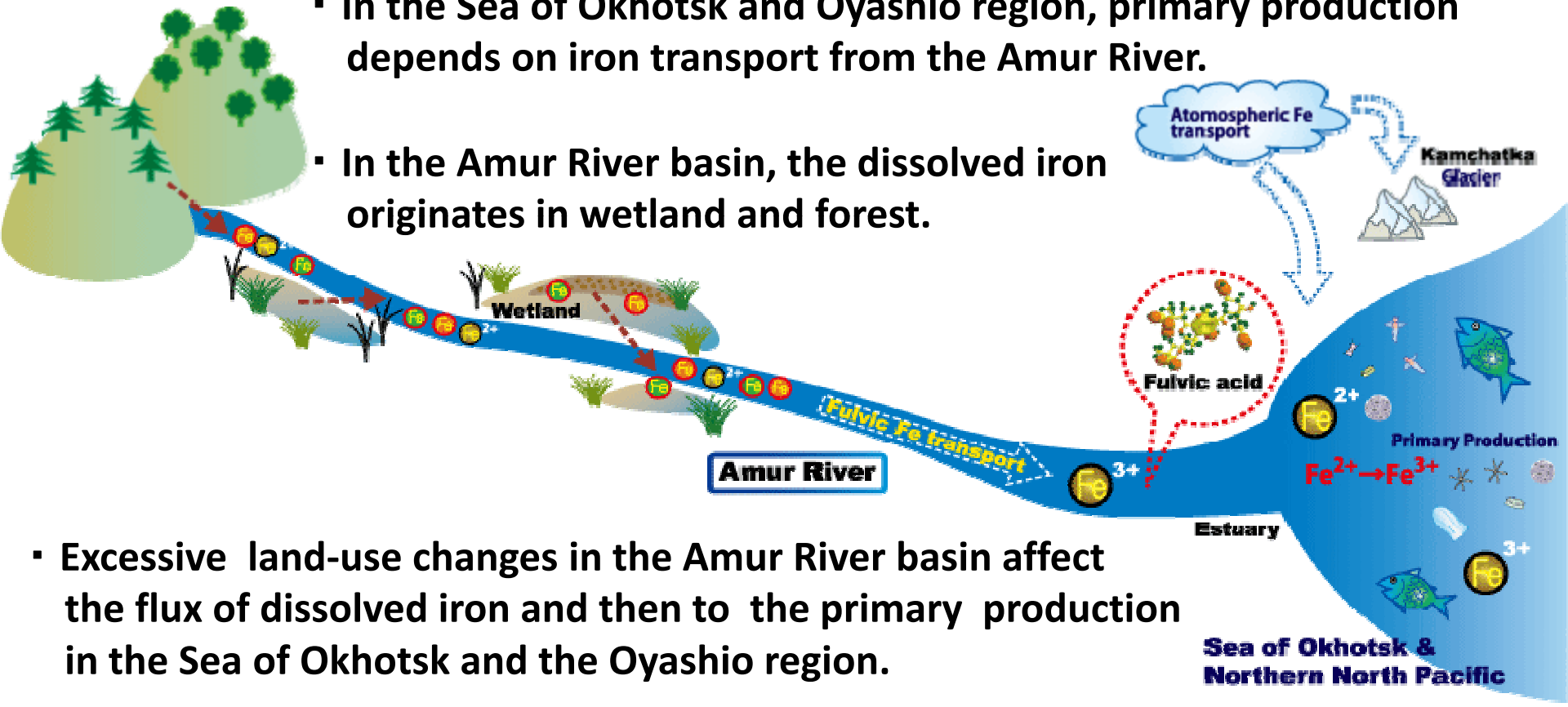


NO_3 Concentration

Giant **F**ish-**B**reeding **F**orest hypothesis

-Ecological linkage between the continent and open waters-

- **In the Sea of Okhotsk and Oyashio region, primary production depends on iron transport from the Amur River.**
- **In the Amur River basin, the dissolved iron originates in wetland and forest.**

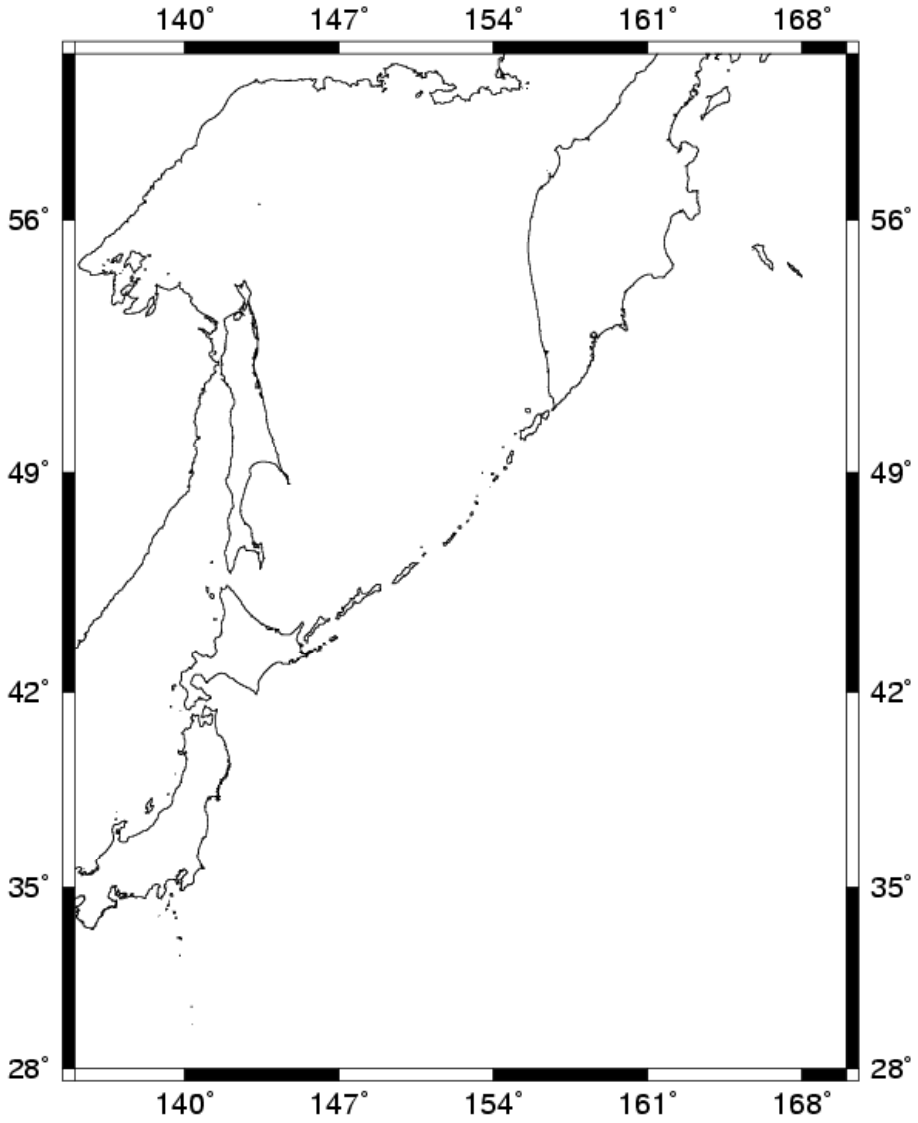


- **Excessive land-use changes in the Amur River basin affect the flux of dissolved iron and then to the primary production in the Sea of Okhotsk and the Oyashio region.**

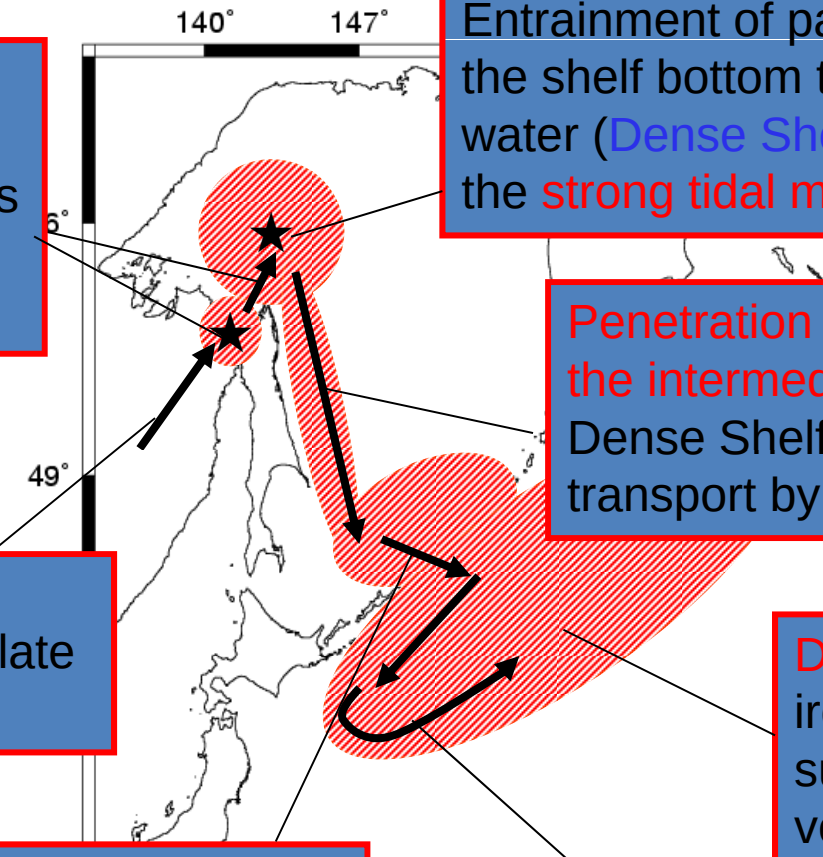
- **International cooperative effort on conservation on the GFBF is necessary for the sustainability of marine ecosystem in the Sea of Okhotsk and Oyashio open water.**

Amur River basin and the Sea of Okhotsk

Intermediate Water Iron Hypothesis (Nakatsuka, Nishioka and others)



Intermediate Water Iron Hypothesis (Nakatsuka, Nishioka and others)



Most of the dissolved iron precipitates in the estuary area and it is transported to the continental shelf area

(2)

Supply of large amount of dissolved and particulate iron from Amur River

(1)

Entrainment of particulate iron from the shelf bottom to sea-ice brine water (Dense Shelf Water) due to the strong tidal mixing there

(3)

(4)

Penetration of particulate iron into the intermediate layer together with Dense Shelf Water and southward transport by East Sakhalin Current

Dissolution of particulate iron and its supply into surface layer by winter vertical mixing
= Uptake by organisms

(7)

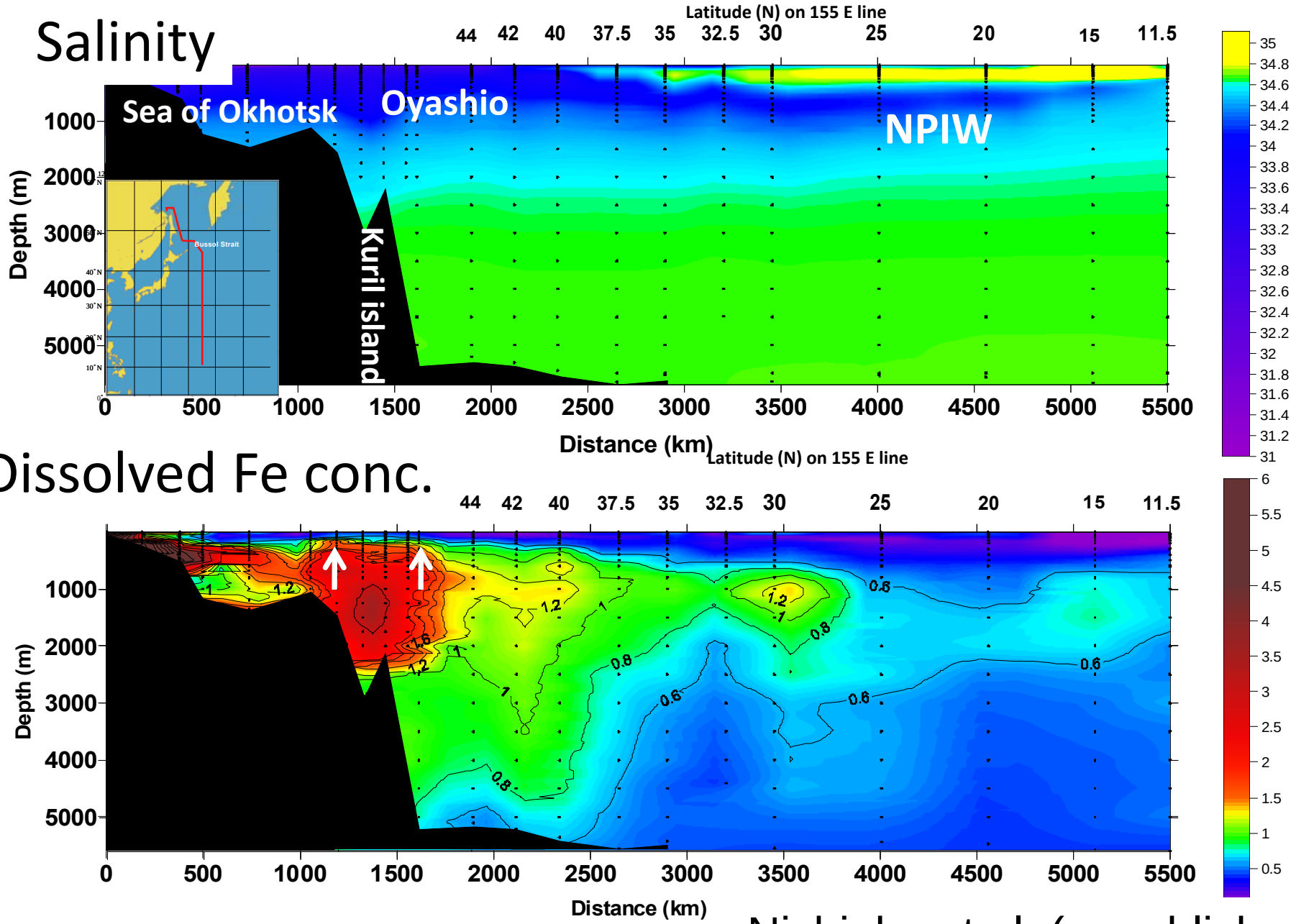
Redistribution of iron into a wide range of intermediate depth by tidal mixing through straits

(5)

Horizontal transport of iron via intermediate layers in the region of Oyashio and Western North Pacific

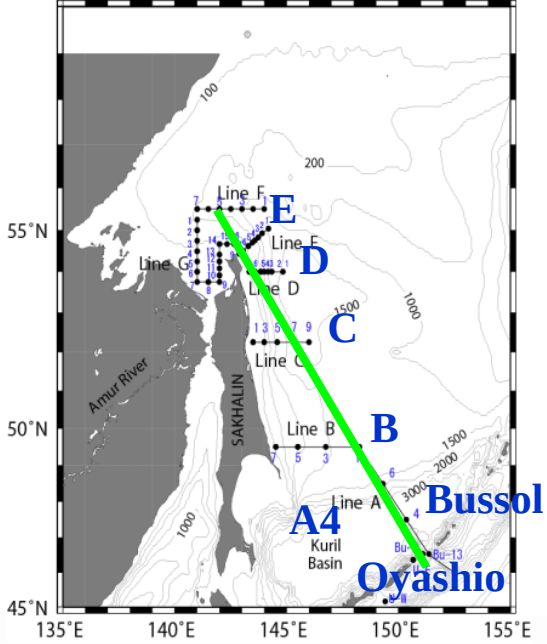
(6)

Transport of the dissolved iron - Intermediate depth water



Nishioka et al. (unpublished)

Summary of total iron (g/yr) transport



Atmospheric

1.2×10^8

Amur R.

1.1×10^{11}

2.2×10^9

2.0×10^7

NPIW

4.7×10^{11}

1.9×10^{10}

6.0×10^9

1.5×10^8

Sea of Okhotsk

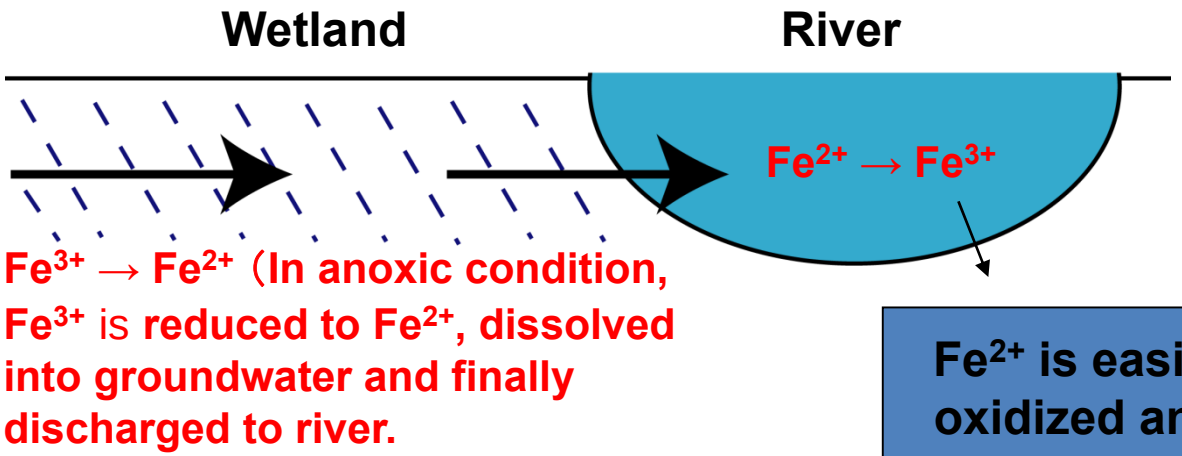
Oyashio

Kuril Islands

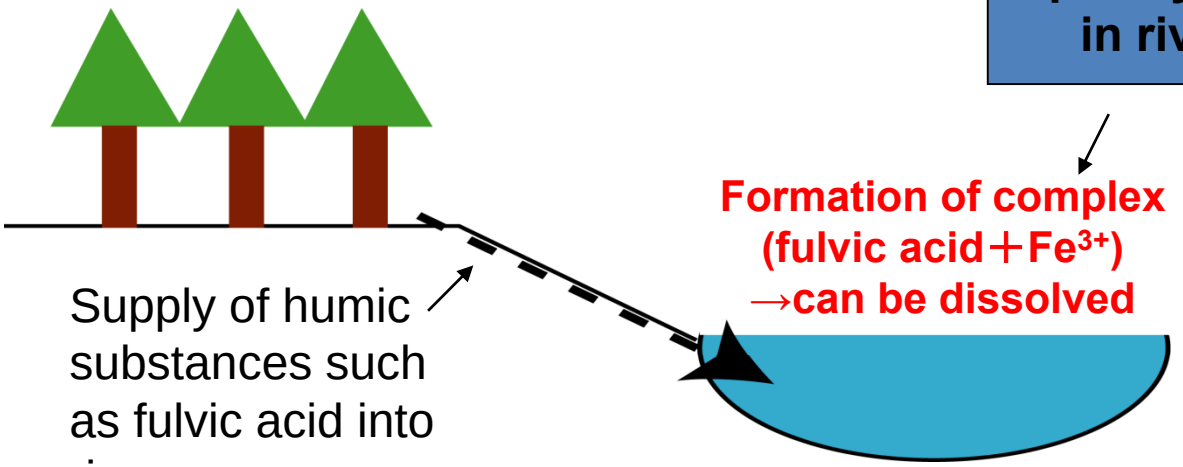
Conditions to dissolve iron (Fe) into river (Amur)

In oxic environment, iron is Fe^{3+}. It cannot be dissolved in water.

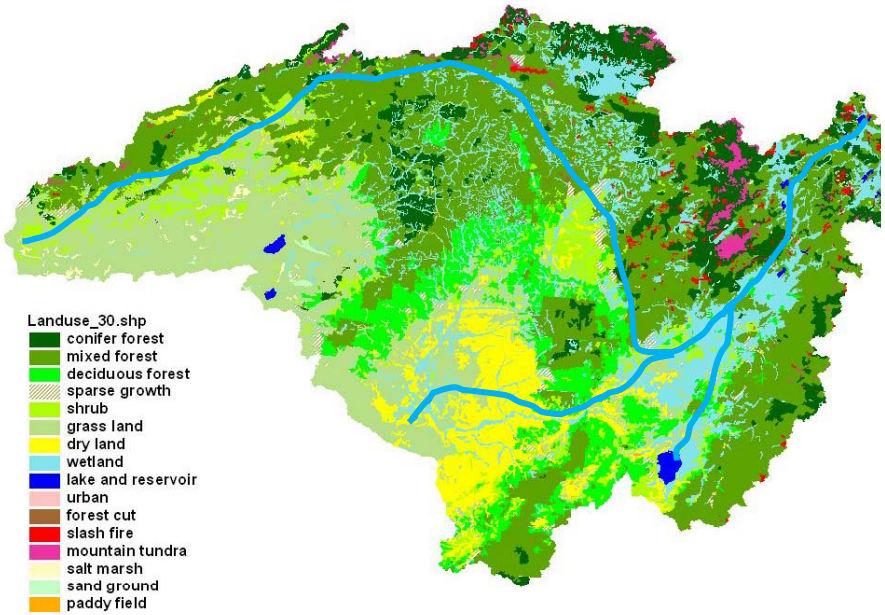
(1) "Water" – environment such as Wetland



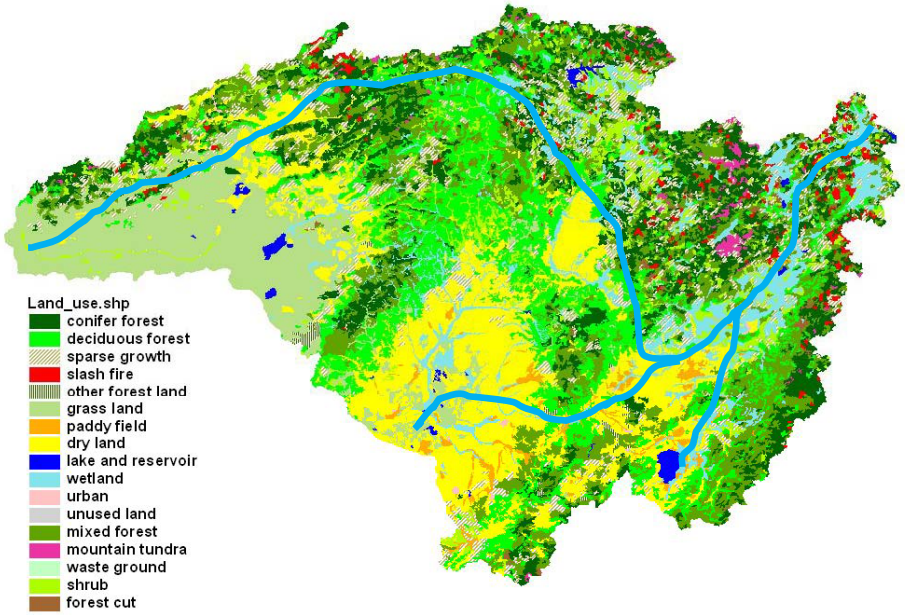
(2) "Forest" – supply of humic substances



Land cover/Land use changes in the Amur River basin between 1930s and 2000



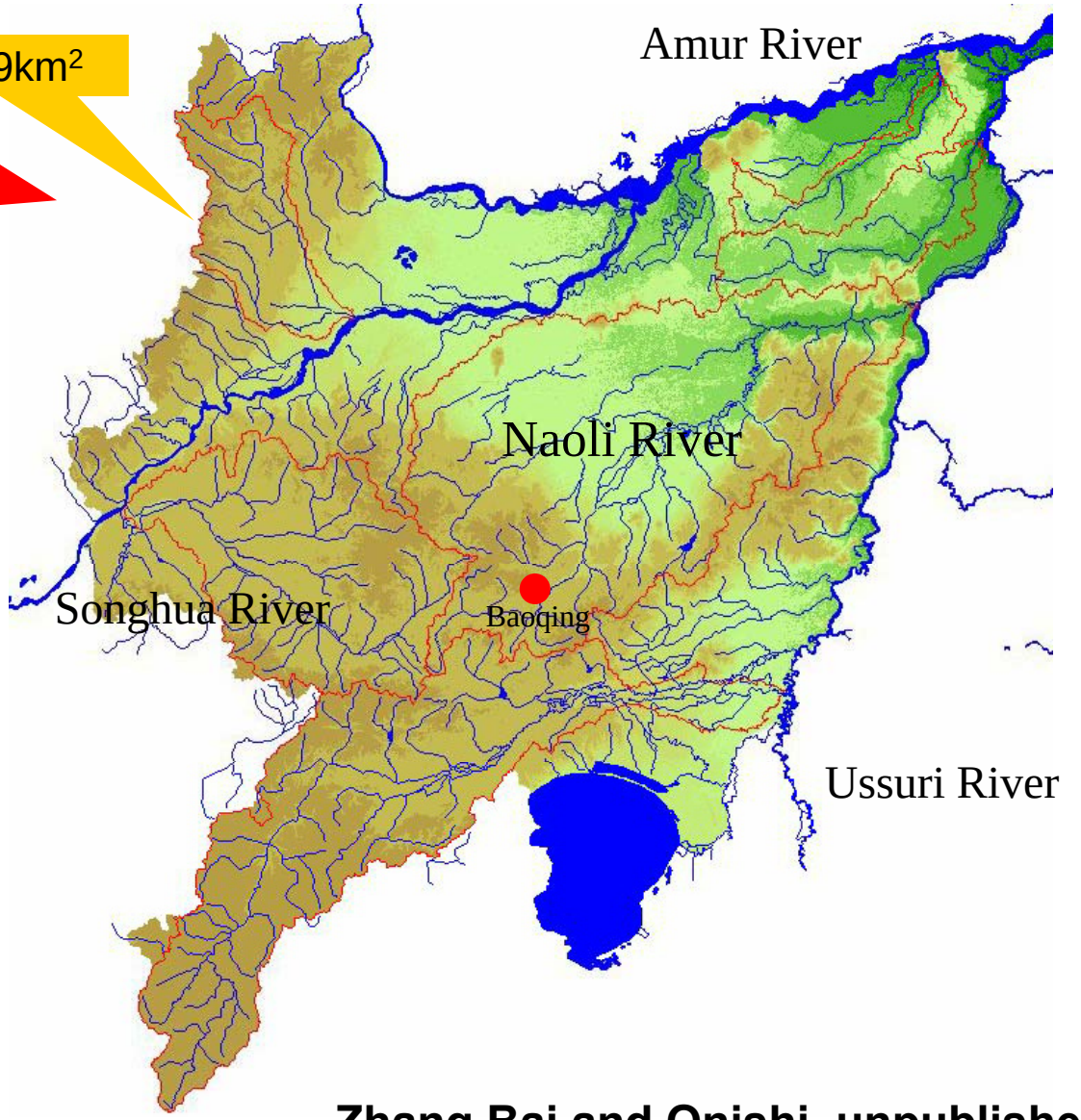
1930s



2000

Ermoshin and Ganzey (2008)

Drastic wetland decrease in the Sanjiang plain



Zhang Bai and Onishi, unpublished

Drastic wetland decrease in the Sanjiang plain

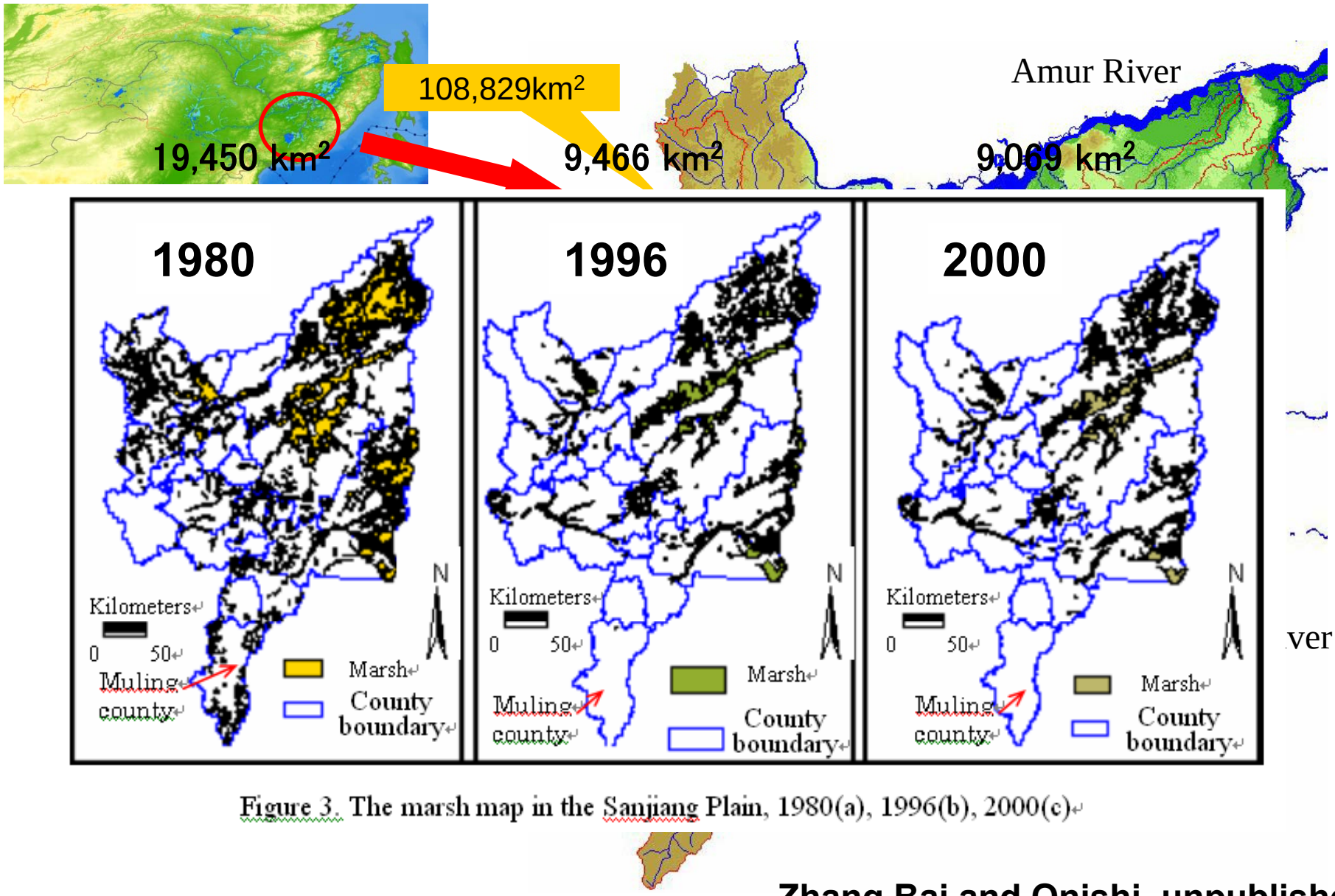
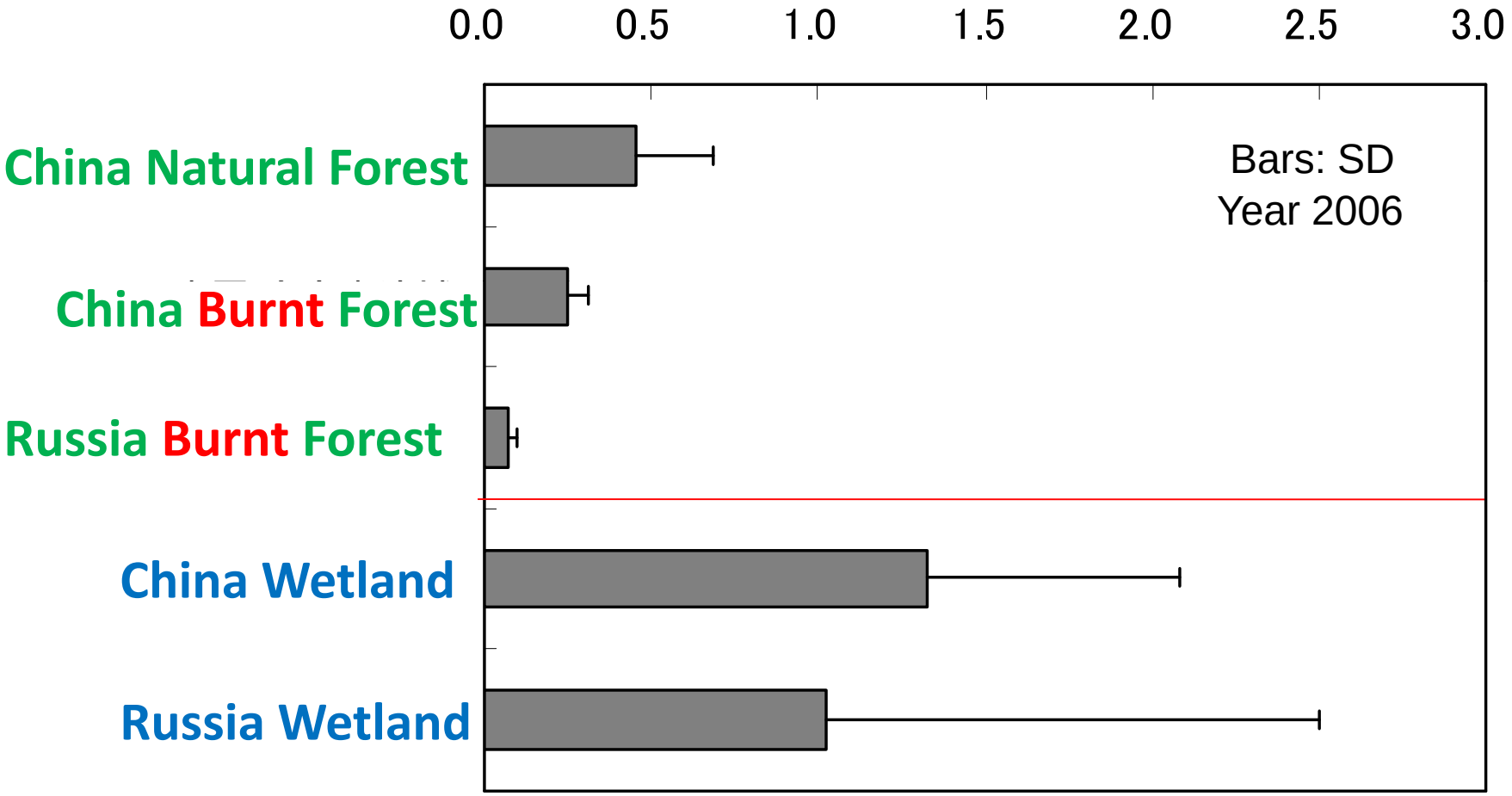


Figure 3. The marsh map in the Sanjiang Plain, 1980(a), 1996(b), 2000(c)

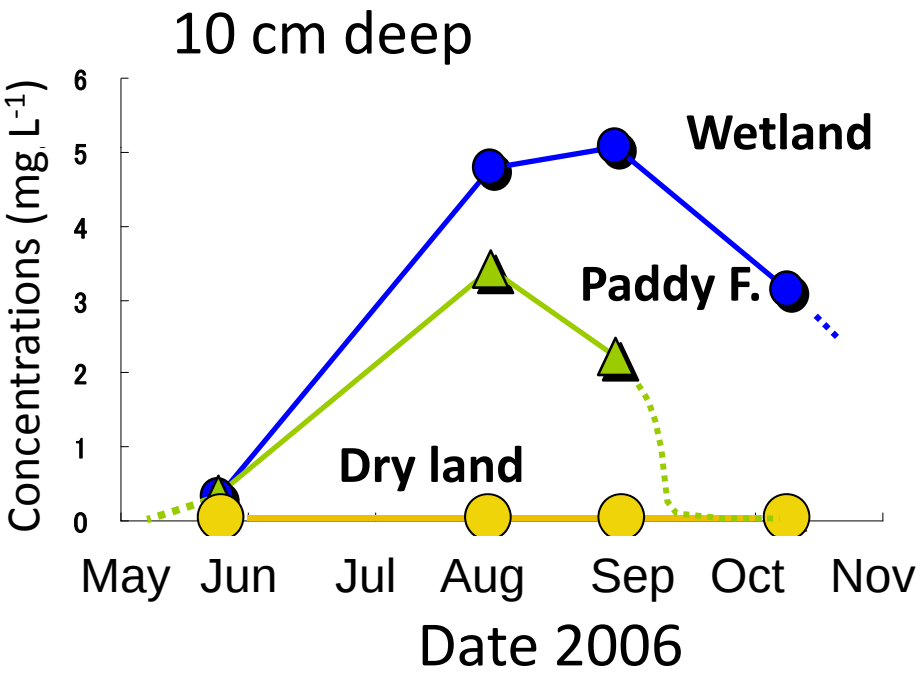
Zhang Bai and Onishi, unpublished

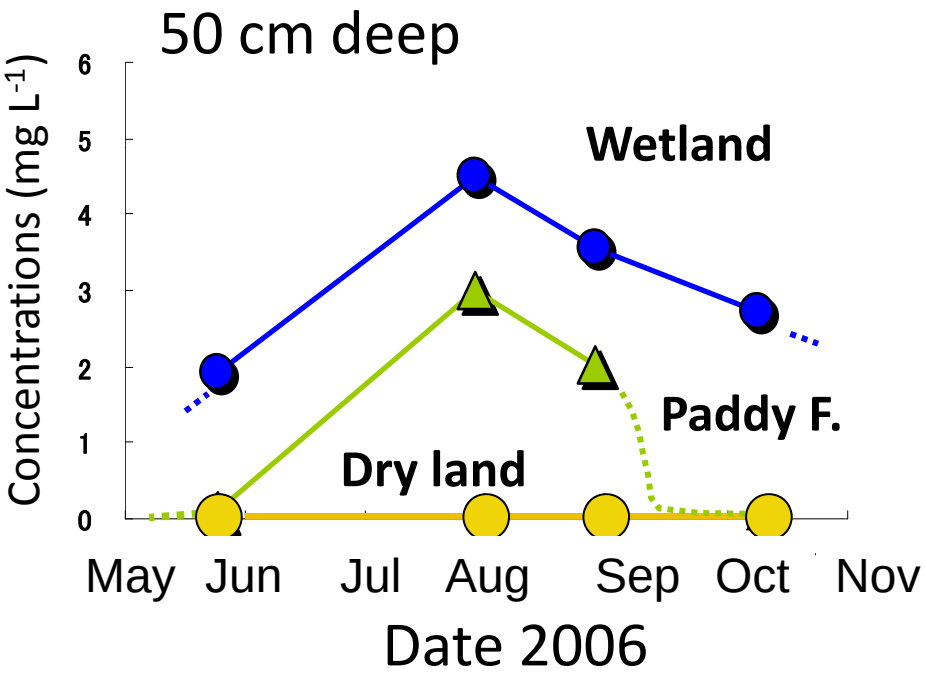
Dissolved iron concentrations (mg L^{-1}) measured at basins having various land-covers



Shibata et al. (unpublished)

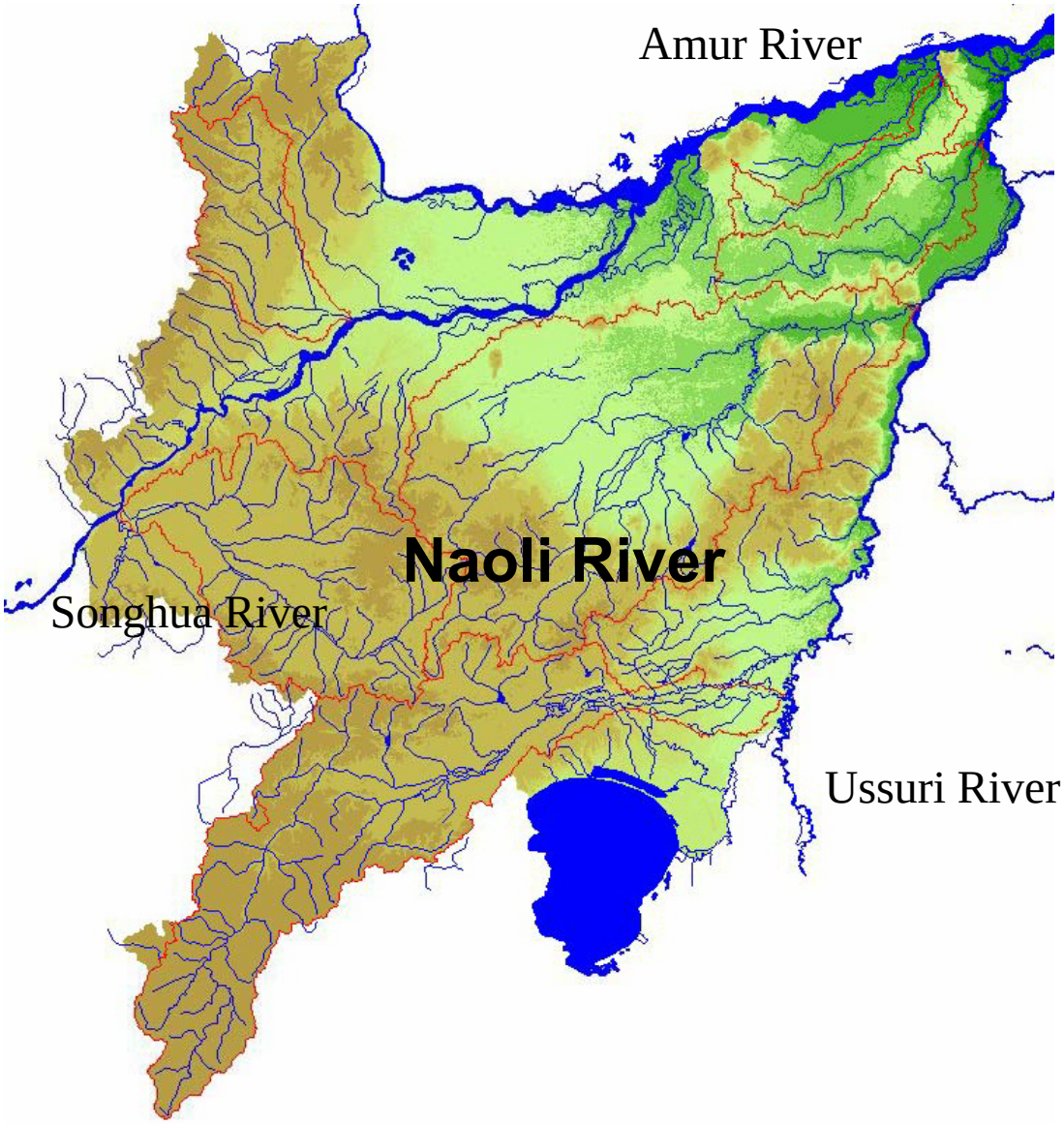
Seasonal changes in dissolved iron concentrations in the interstitial soil water at various land-cover in the Sanjiang Plain 2006



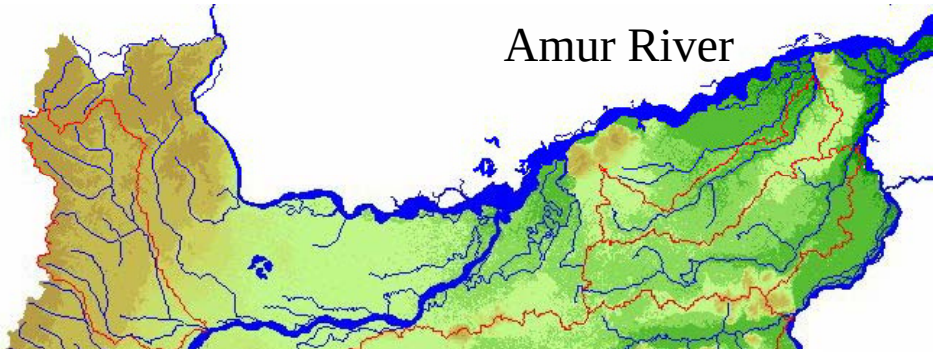


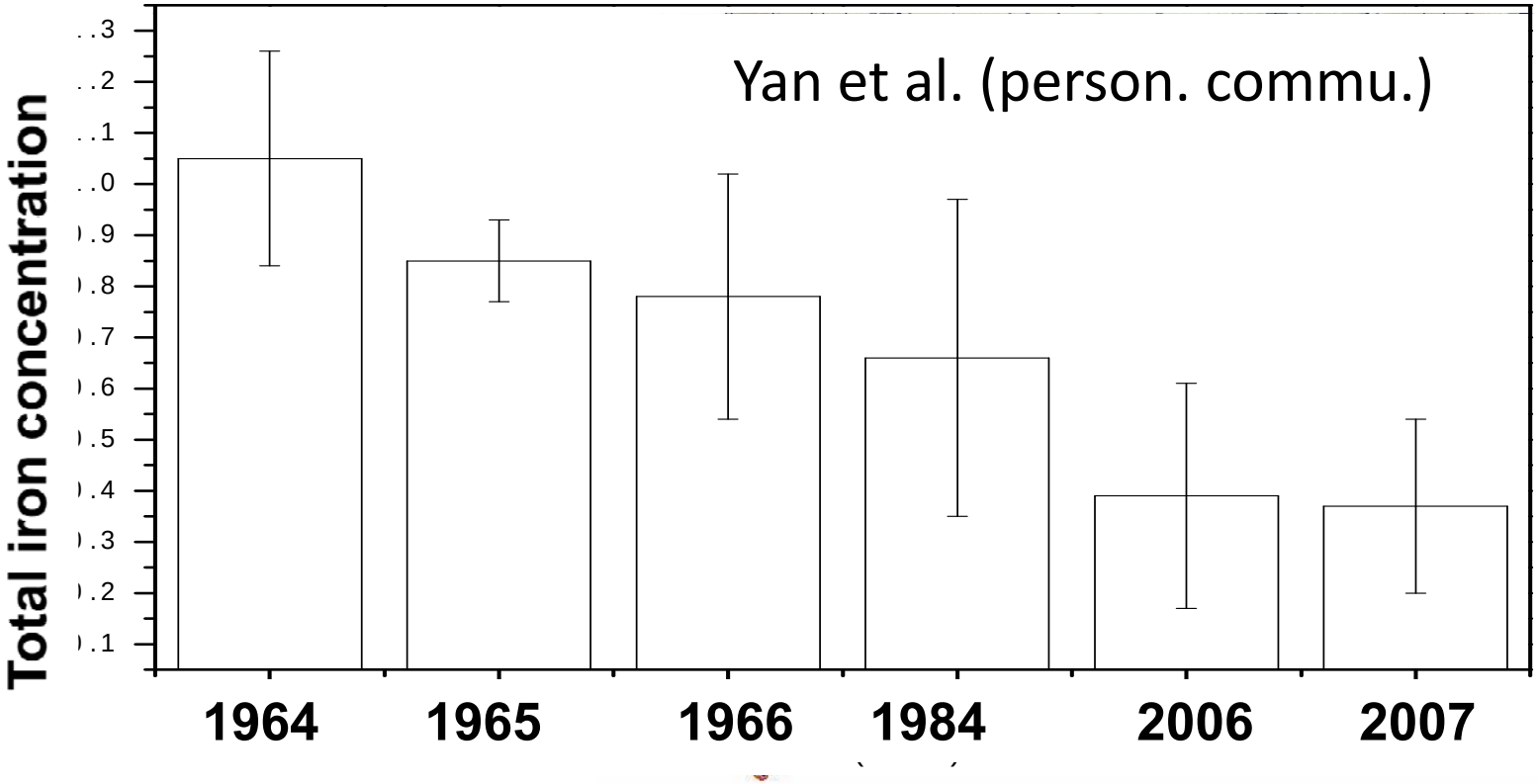
Yoh et al. (unpublished)

Total iron conc. in Naoli River, Sanjiang plain, China (mgL^{-1})



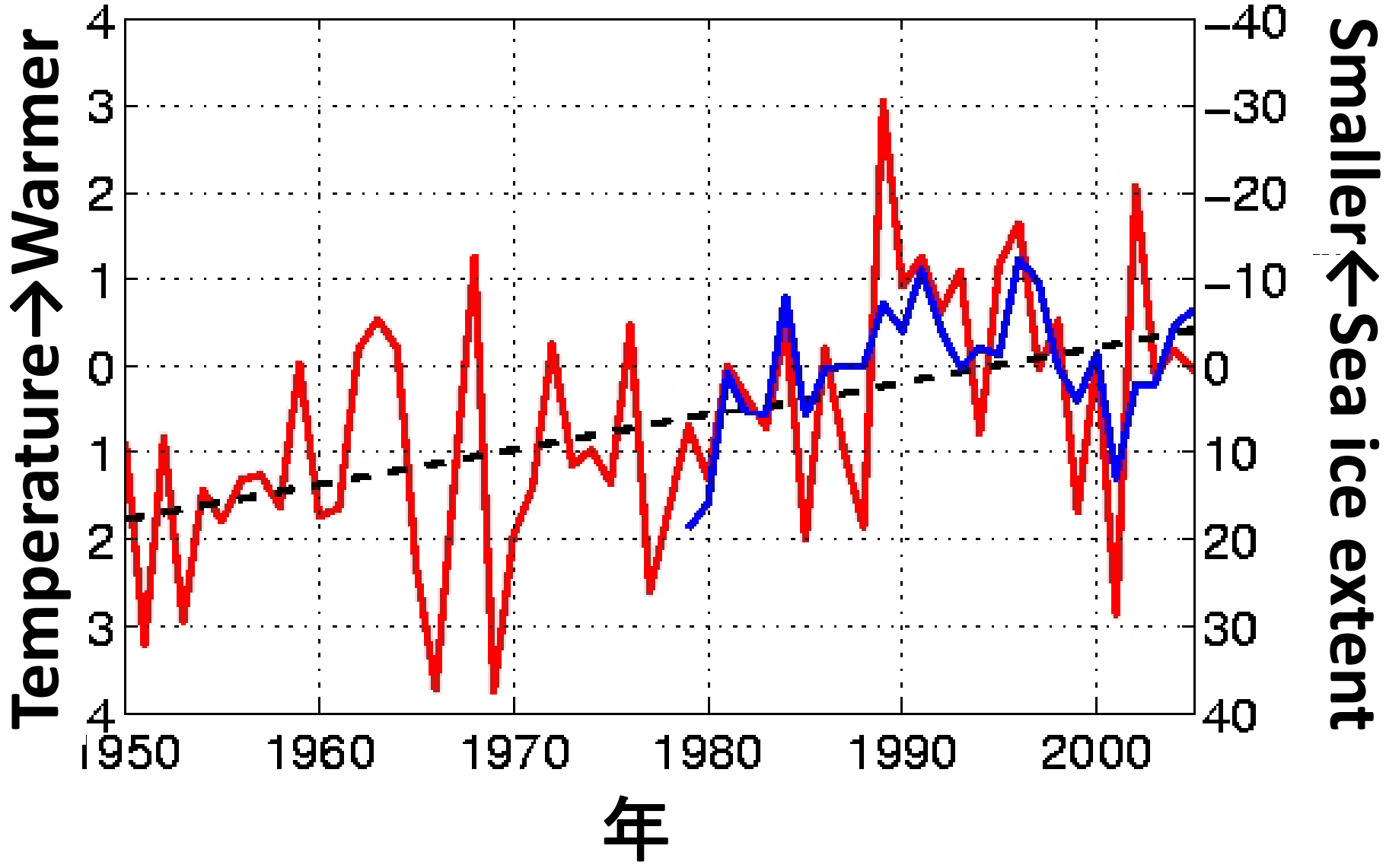
Total iron conc. in Naoli River, Sanjiang plain, China (mgL^{-1})

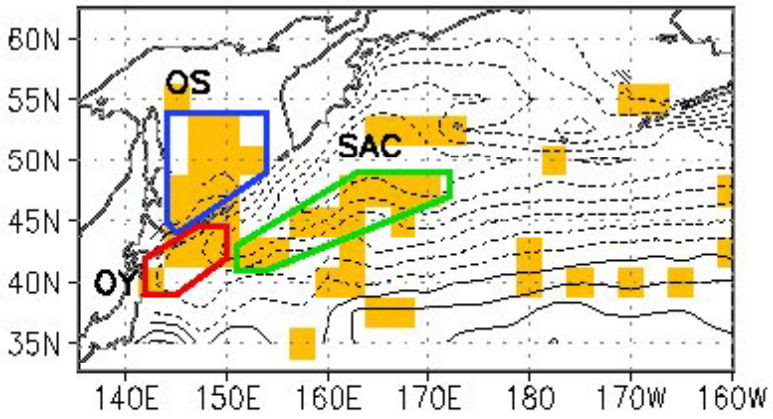




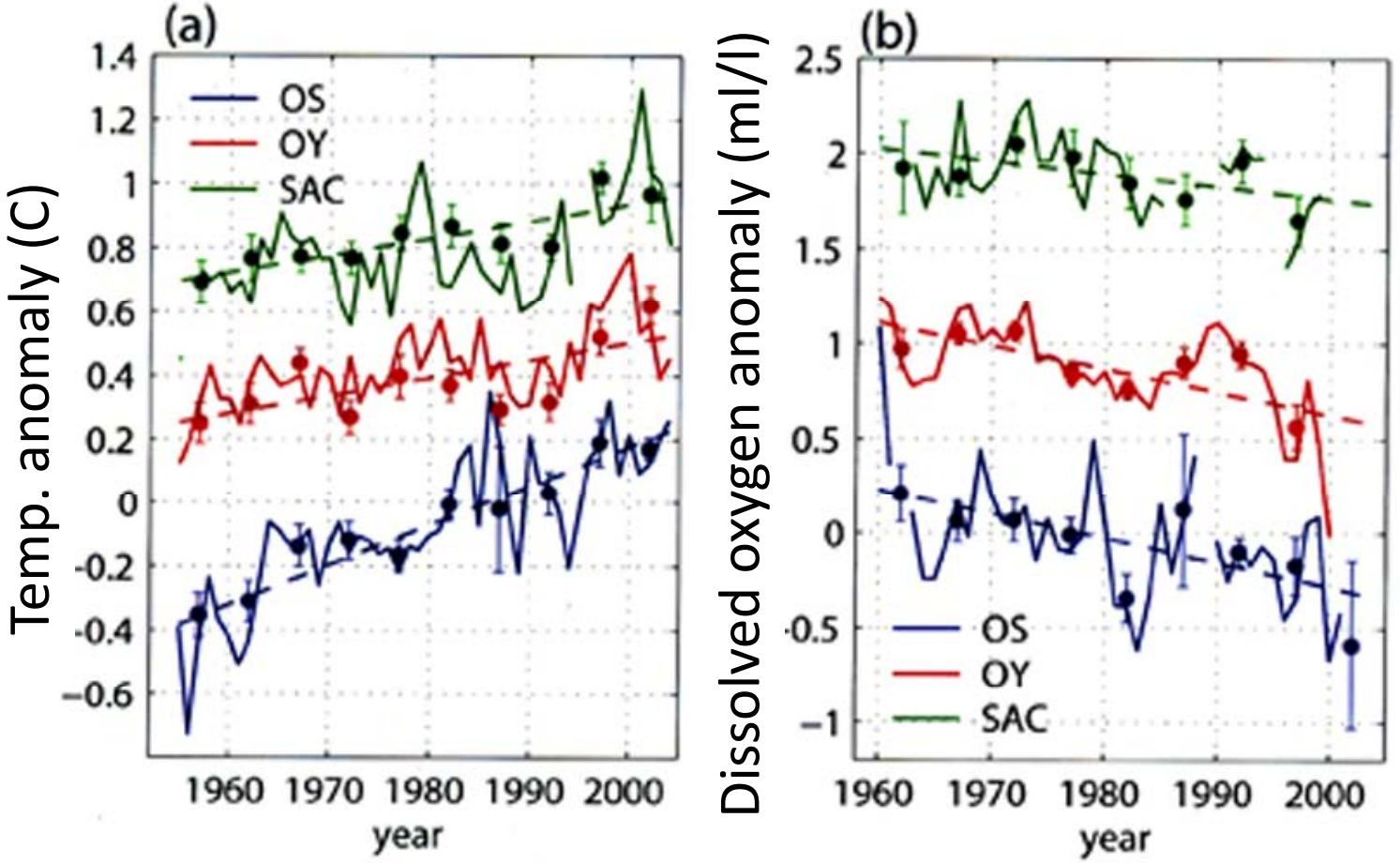
River

Decreasing trend of the sea ice extent in the Sea of Okhotsk (Nakanowatari et al., 2007)



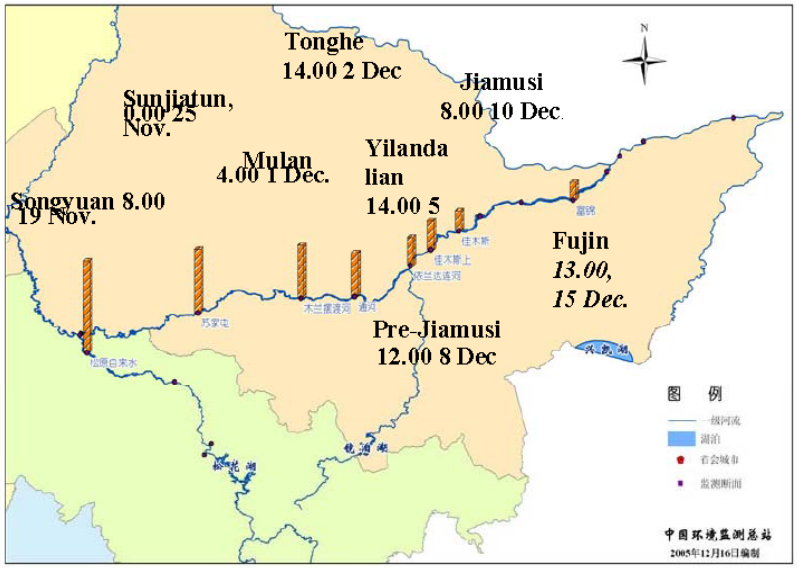


Increasing NPIW temperature and decreasing dissolved oxygen in the NPIW (Nakanowatari et al., 2007)



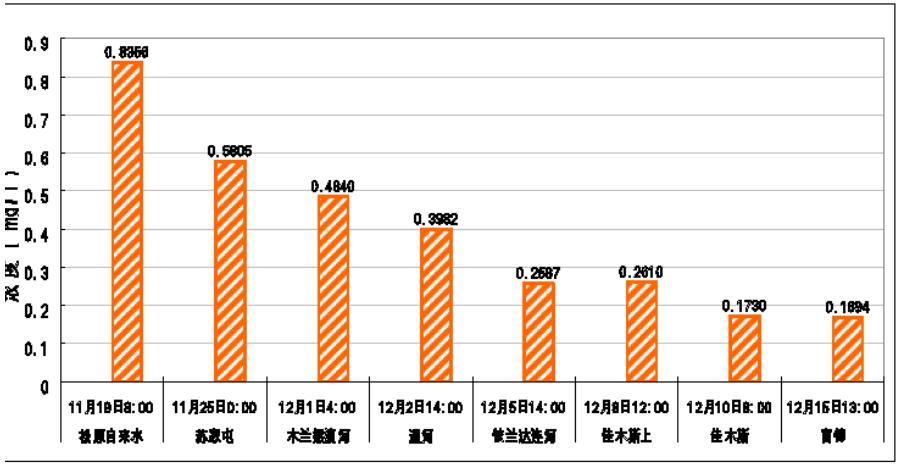
United Nations Environment Programme

The Songhua River Spill
China, December 2005



Source: SEPA, December 2005

Peak Nitrobenzene concentrations measured in the Songhua River.



Songyuan	Sunjiatun	Mulan	Tonghe	Yilandalian	Pre-Jiamusi	Jiamusi	Fujin
8.00 19 Nov	0.00 25 Nov	4.00 1 Dec	14.00 2 Dec	14.00 5 Dec	12.00 8 Dec	12.00 8 Dec	13.00 15 Dec

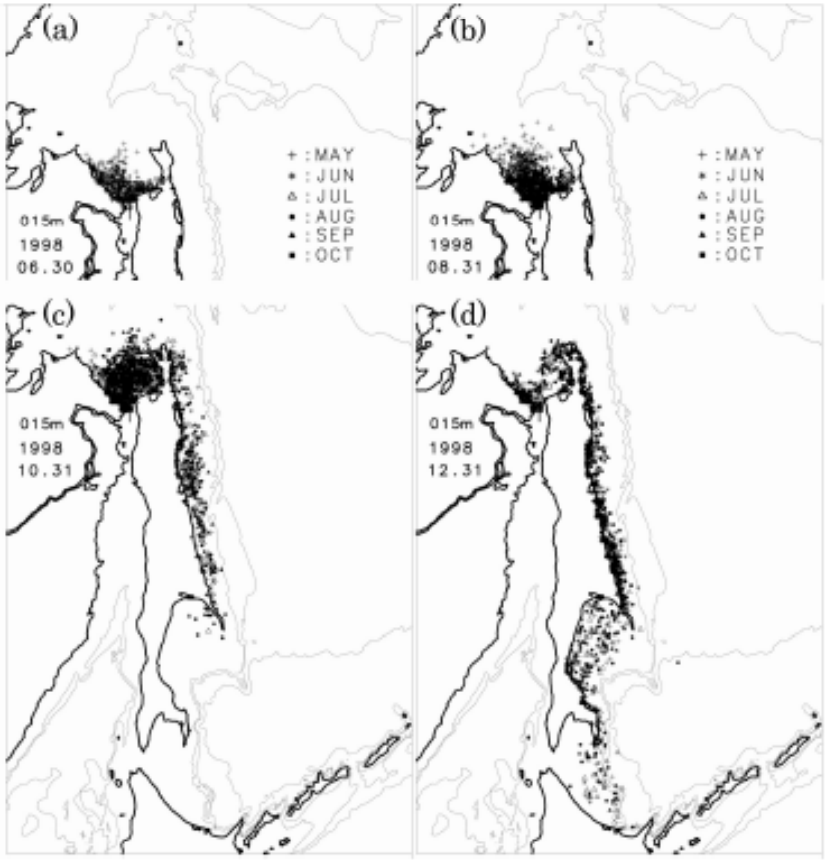
Source: SEPA, December 2005

UNEP (2006)

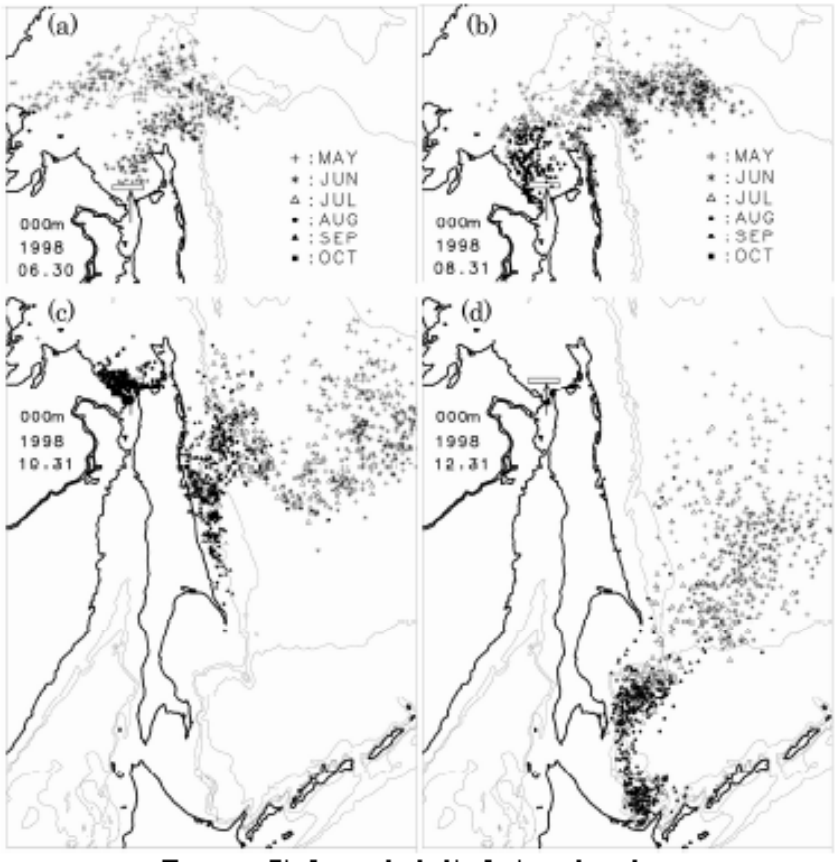
PARTICLE TRACKING EXPERIMENT ON A MODEL OF THE OKHOTSK SEA: SPREADING OF THE AMUR ORIGIN WATER

OHSHIMA KAY I.[1] AND SHIMIZU D.[1]

15 m deep

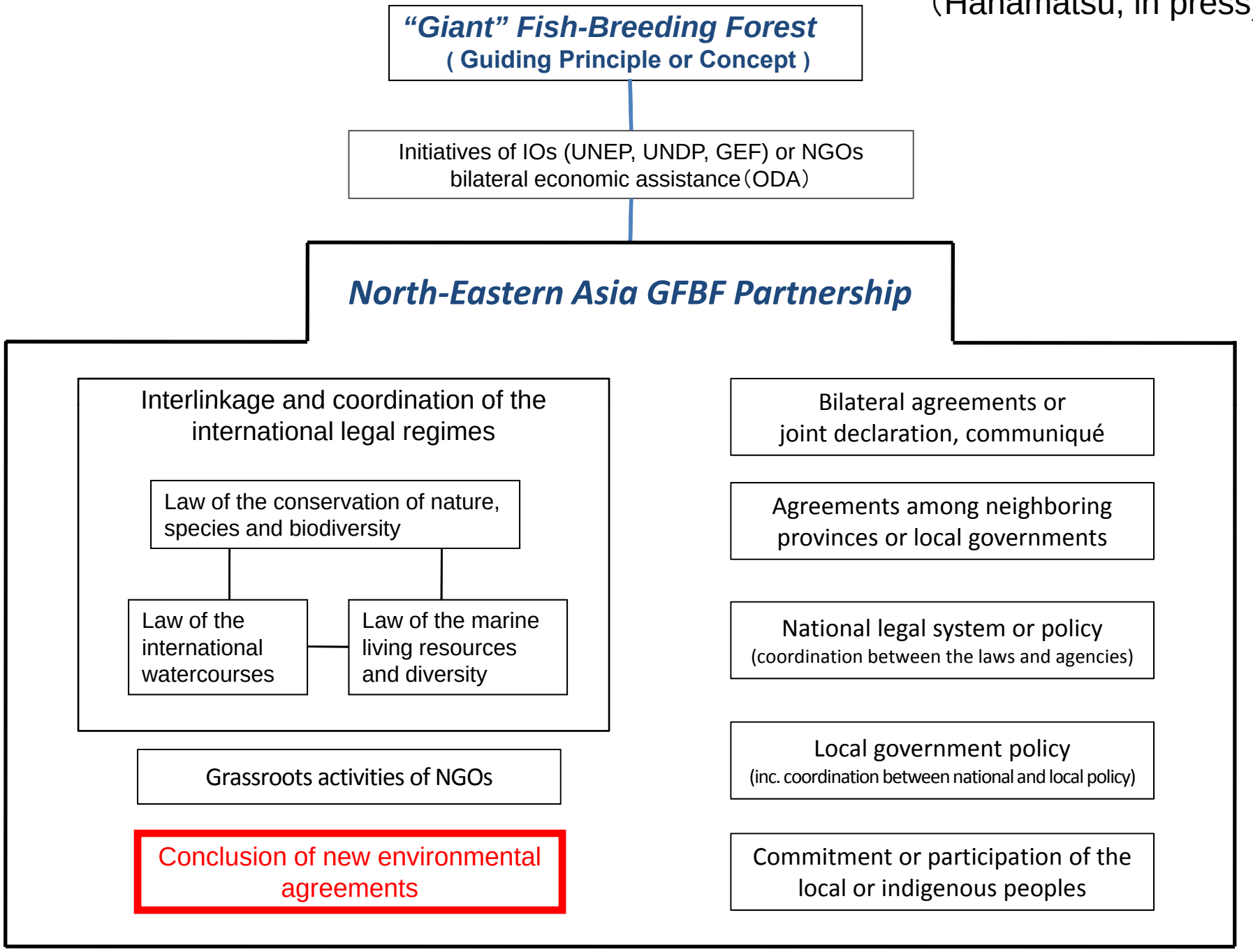


Surface



Ohshima and Shimizu (2007)

（Hanamatsu, in press)



HELCOM
Helsinki Commission

All the coastal states around the Baltic Sea and EU are working together to protect the Baltic marine environment from all sources of pollution, as spelled out in the “Convention on Protection of the Marine Environment of The Baltic Sea Area” (Helsinki Convention).

HLECOM has overall responsibility for the implementation of the Helsinki Convention.

Amur Okhotsk Consortium

Regular meeting: 1 time / 2 years
Network for academic researchers
Information/data exchanges
Japan, China, Russia (Mongolia)

Tentatively based on
Pan-Okhotsk Research Center,
Institute of Low Temp. Science,
Hokkaido University

Kick-off Symposium
November 7-8
at Hokkaido University

Conclusions

1. Amur River transports a total of 10^{11} g/yr dissolved iron to the Sea of Okhotsk/Oyashio region, and it contributes to the primary production in these oceans.

2. The supply of dissolved iron to the Sea of Okhotsk/ Oyashio region is likely to decrease by excessive land use changes and decreasing trend of the sea-ice.

3. Pollutions of the Amur River is the world-wide concern and it is highly probable to affect the Sea of Okhotsk unless any counter-measures are conducted.

4. We propose to establish a multilateral relationship among researchers ***"Amur-Okhotsk Consortium"*** to discuss our future sustainability in the Sea of Okhotsk.