

NERIS Workshop 2015

27-29 Apr. 2015

Palazzo Greppi, room "Sala Napoleonica"

Via S. Antonio 12 -20122 Milano



環境放射能研究所

INSTITUTE OF ENVIRONMENTAL RADIOACTIVITY

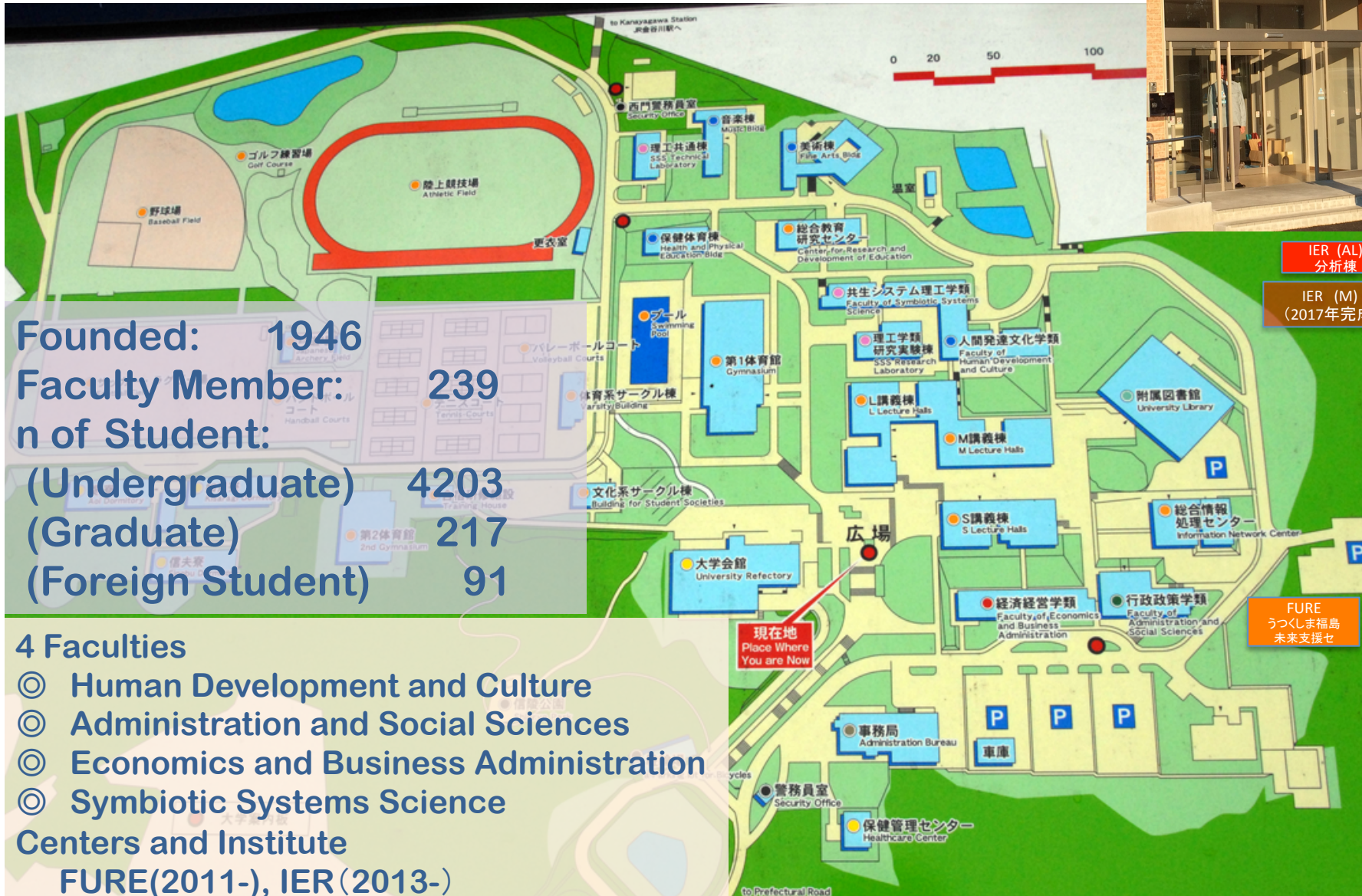
**Fukushima: Four Years of Academic Community support to  
the State Efforts to Improve People's  
Lives in the Post Accidental Conditions**

Institute of Environmental Radioactivity (IER)  
At Fukushima University

Kenji NANBA, Mark Zheleznyak and Thomas Hinton

**IER Buildings:**

**Analytical Lab.(AL)・Main (M)**



IER (AL)  
分析棟

IER (M) 本棟  
(2017年完成予定)

FURE  
うつくしま福島  
未来支援セ

Founded: 1946  
Faculty Member: 239  
Number of Student:  
(Undergraduate) 4203  
(Graduate) 217  
(Foreign Student) 91

**4 Faculties**

- ◎ Human Development and Culture
- ◎ Administration and Social Sciences
- ◎ Economics and Business Administration
- ◎ Symbiotic Systems Science

**Centers and Institute**

FURE(2011-), IER(2013-)

FURE: Fukushima Future Center  
 For Regional Revitalization

## Researchers at IER



Director  
**Kenji Nanba**

Environmental Microbiology  
 Transfer of rCs in freshwater system



Vice director  
 Professor  
**Hirofumi Tsukada**

Radioecology  
 Agricultural env. and products



Vice director  
**Yuichi Onda** (Univ. of Tsukuba)

Hydrology  
 Transfer in forest and aquatic system



Professor  
**Mark Zheleznyak**

Hydrology  
 Modeling of nuclear transfer in water system



Professor  
**Thomas Hinton**

Radioecology  
 Radioecology of wild mammals



Associate Professor  
**Toshihiro Wada**

Fish ecology  
 Fisheries biology and ecology



Senior Assistant Professor  
**Yoshifumi Wakiyama**

Hydrogeomorphology



Project Professor  
**Michio Aoyama**

Marine physics and chemistry



Project professor  
**Alexei Konoplev**

Radiochemistry and radiobiology



Project professor  
**Sergii Kivva**

Statistics and hydrology  
 Environmental modeling



Project professor  
**Vasyly Yoschenko**

Radioecology  
 Forest ecology and products



Project professor  
**Valentin Golosov**

Geomorphology  
 Nuclear transfer in the environment



Project associate professor  
**Tsugiko Takase**

Physical chemistry  
 Development of analytical technique



Project associate professor  
**Alan Cresswell**

Physics  
 Measuring system



Project assistant professor  
**Stefan Bengtsson**

Agriculture  
 Radionuclides transfer in agricultural products



Project assistant professor  
**Olena Pareniuk**

Radiobiology  
 Soil microbiology



Project assistant professor  
**Kei Okuda**  
 Zoology  
 Radioecology of wild mammals

Cooperative researchers

**Ishimaru, Takashi**, Marine ecology, Tokyo Univ. of Marine Sci. and Tech.  
**Hiroaki Kato**, University of Tsukuba  
**Aya Sakaguchi**, University of Tsukuba  
**Junko Takahashi**, University of Tsukuba  
**Shinya Yamasaki**, University of Tsukuba  
**Oguri, Emiko**, Botany, Hiroshima Univ.  
**Shoukamy Ibrahim Mahmoud Ibrahim**, Zoology Hiroshima Univ.  
**Mitsutake, Norisato**, Nagasaki Univ.  
**Ogi, Tomoo**, Nagasaki Univ.

Participating profs from SSS Fukushima Univ.

**Takahashi Takayuki**, Robotics  
**Watanabe, Akira**, Meteorology  
**Yamaguchi, Katsuhiko**, Physics  
**Takagai, Yoshitaka**, Analytical chemistry  
**Yokoo, Yoshiyuki**, Hydrology / Civil eng.  
**Kawagoe, Seiki**, Hydrology of watershed

# Five Divisions of IER at FU and areas of cooperating Universities

- **放射能形態学 Radiation Morphology**

1. Radionuclides Measurement and Reference Material
2. Speciation-Radiochemistry

- **放射地球科学 Radioisotope Geoscience**

1. Atmospheric Radionuclide Dynamics
2. Terrestrial Radionuclide Dynamics
3. Marine Radionuclide Dynamics
4. Radiological Hydrology

- **放射生態学 Radioecological Transfer and Effects**

1. Forest Radioecology
2. Freshwater Radioecology
3. Soil and Plant Dynamics
4. Plant Radioecological Effects
5. Animal Radioecological Effect

- **予測科学・機器開発 Measurements and Forecasting**

1. Radiation and Transfer Modelling
2. Monitoring System Development
3. Mechatronics System Development

- **連携研究部門 Research Coordination**

1. Data Archives and Statistics

- **放射生態学 Radioecological Transfer and Effects**

1. Marine Radiocology (Tokyo Univ. Marine Sci & Tech)
2. Amphibian and Bryophyte Radioecological Effects (Hiroshima Univ.)

- **予測科学・機器開発 Measurements and Forecasting**

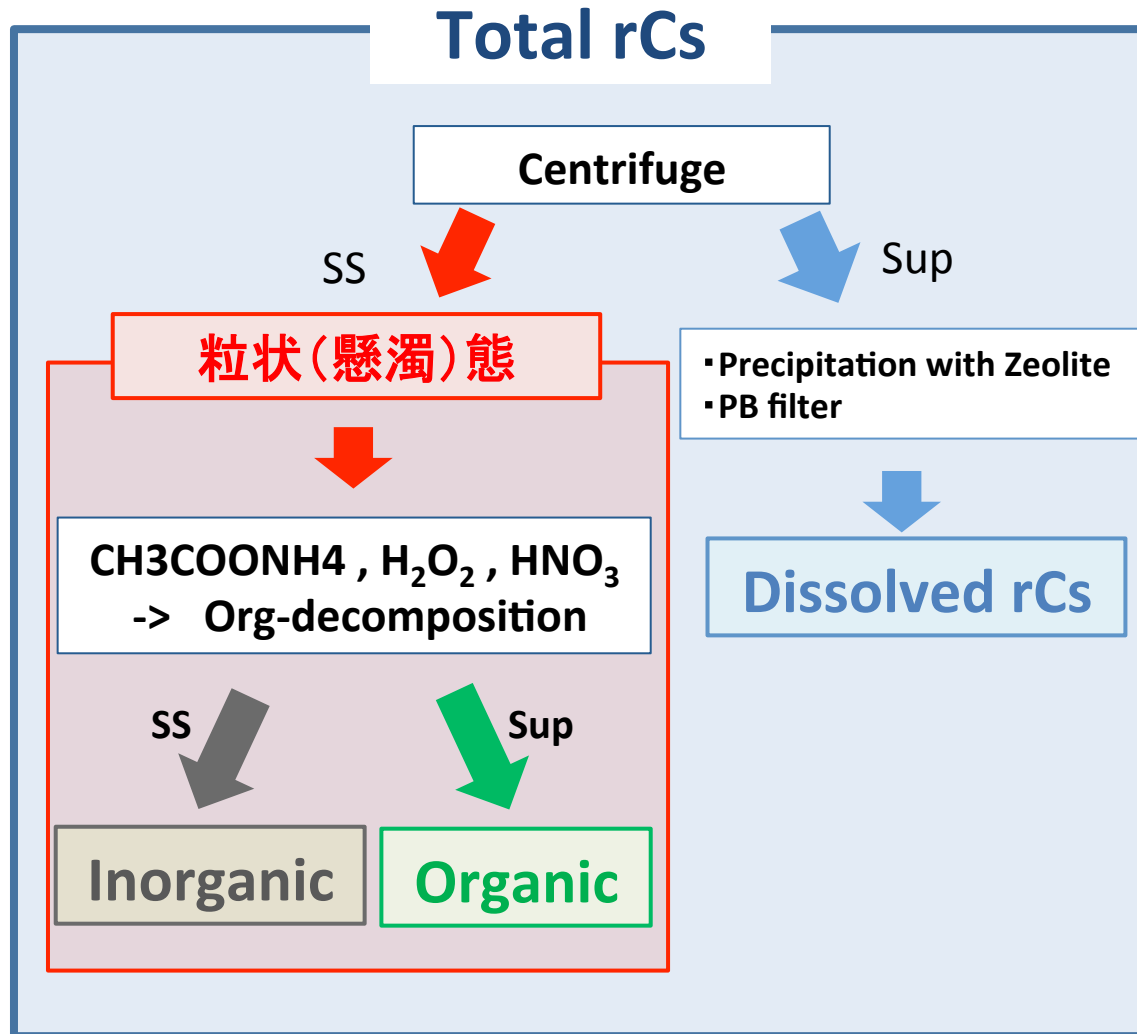
1. Environmental Dynamics and Prediction (U. Tsukuba)

- **連携研究部門 Research Coordination**

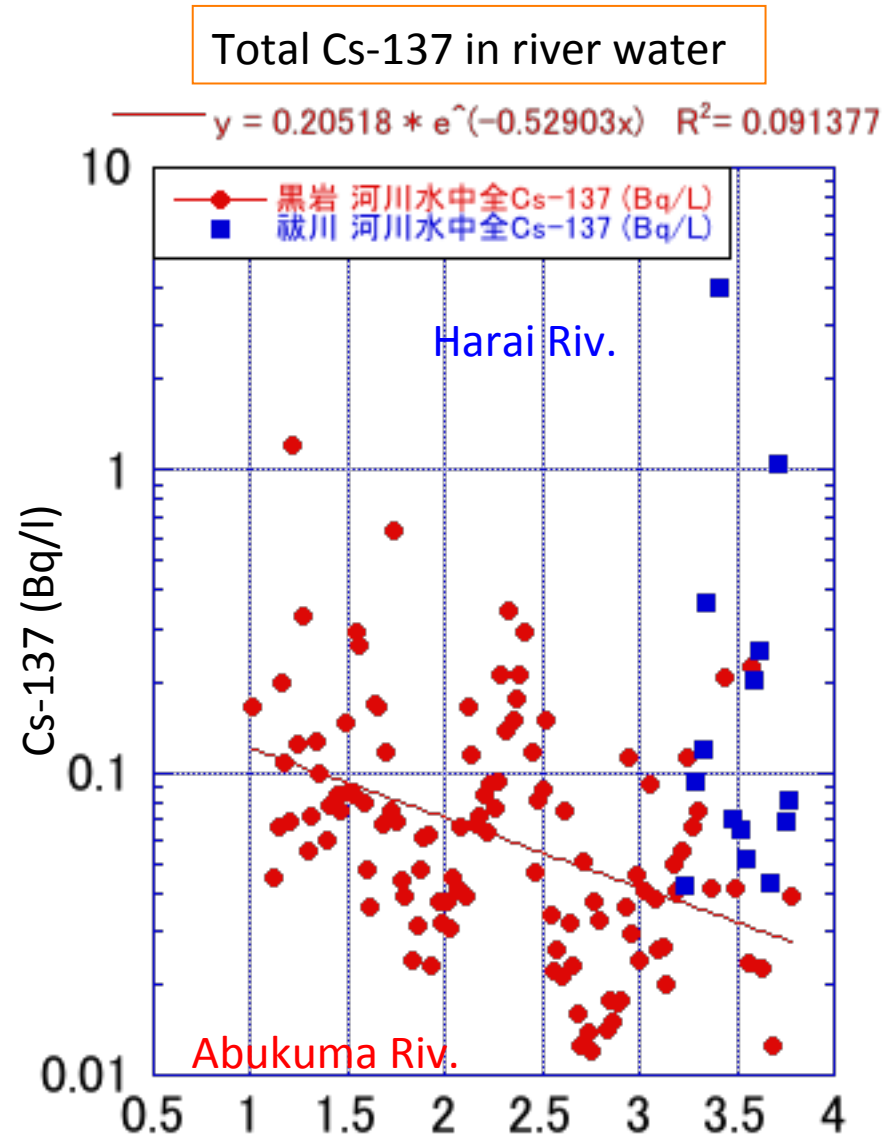
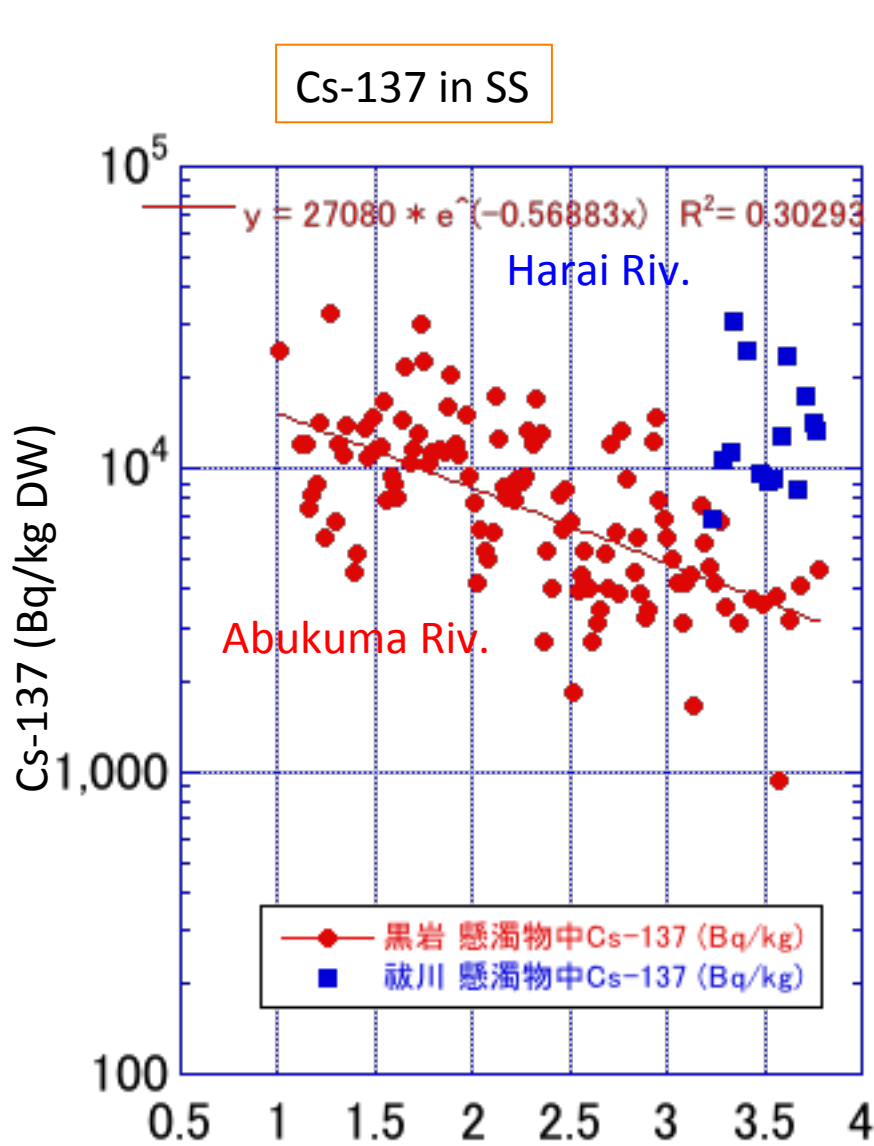
- Data Analysis and Prediction (Univ of Tsukuba)
- Radiation Risk Communication (Nagasaki Univ.)

# Analysis of radiocesium in river water

Separation of suspended substances with continuous centrifuge from 1-4 tons of river water

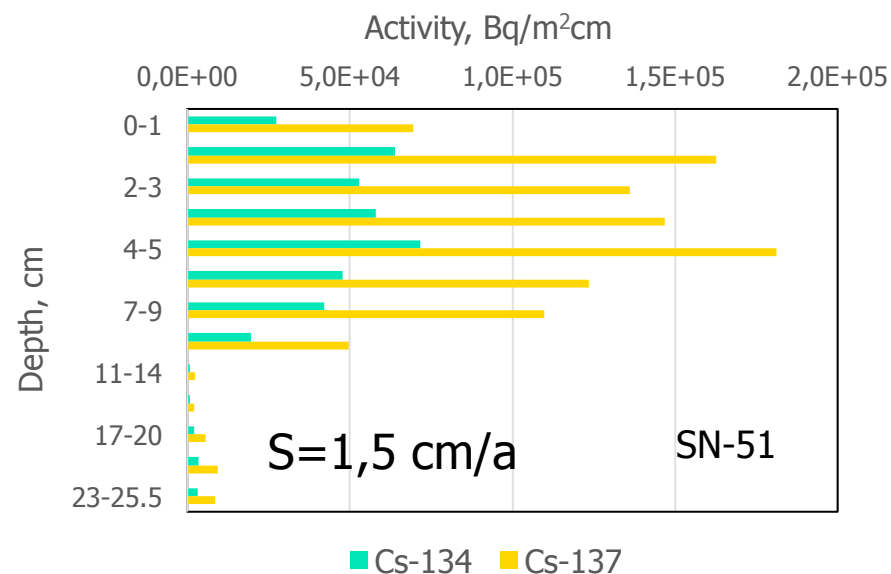
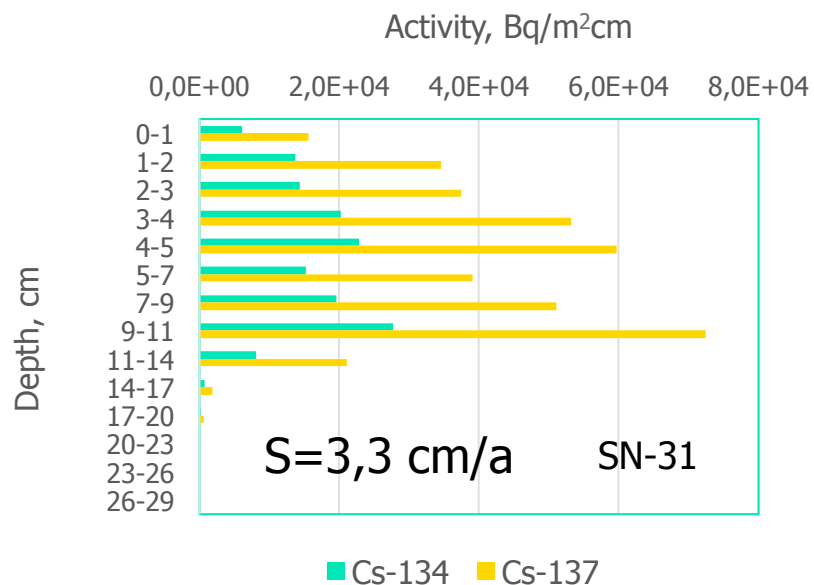
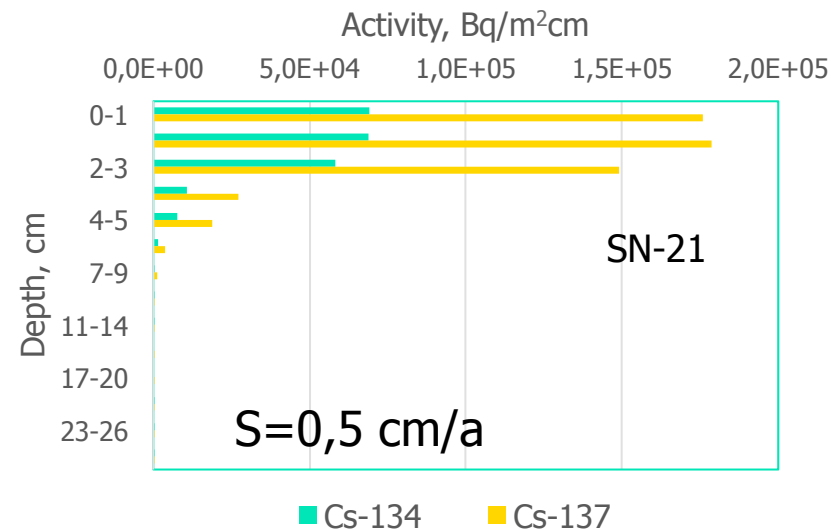
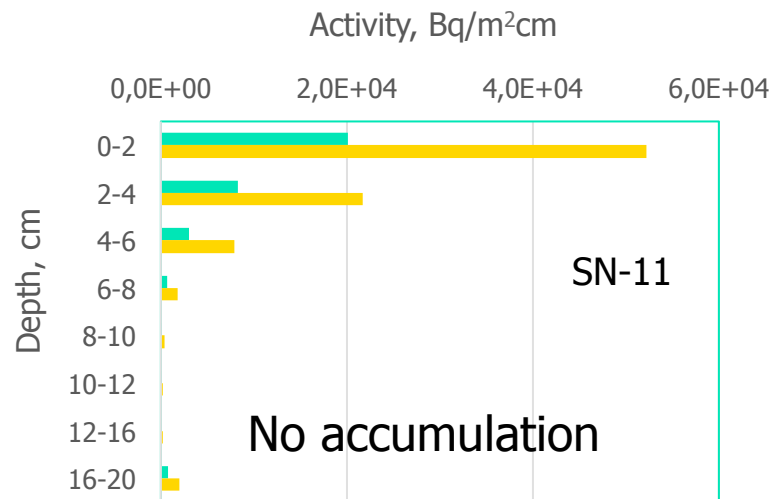


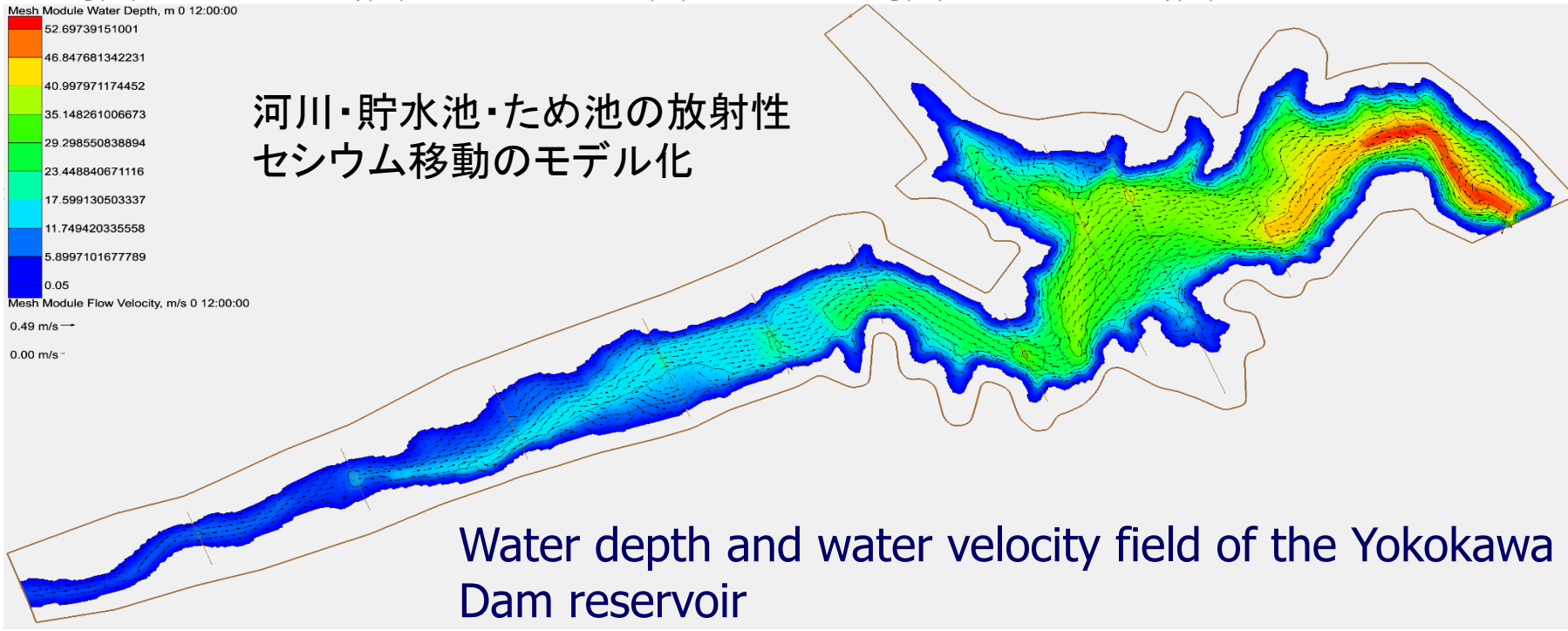
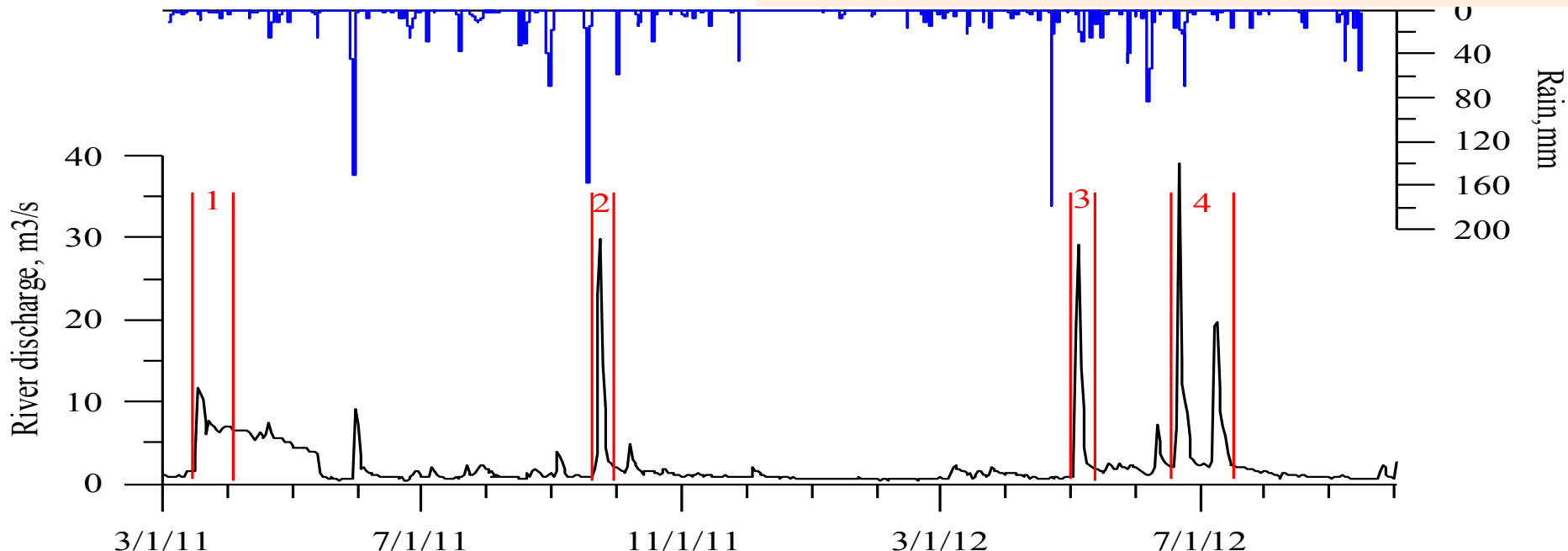
rCs in Abukuma riv. (Kuroiwa Fukushima city) and Harai Riv. (Oyama Fukushima city)



Time (Year from March 11<sup>th</sup>, 2011)

# Radiocesium vertical profiles in soils of Niida river flood plain







## Involvement of Hydrological Study at IER in decision making and establishment of decision making scheme.

IAEA – Fukushima Pref. Gov. Initiative Project (2012-)

Pref. gov. ask advise from IAEA in the management planning of the following area after the accident.

- River, lake and pond
- Forest
- Wastes

IER is contributing the project by sending to

River, lake and pond part:

Alexei Konoplev as an IAEA deligate

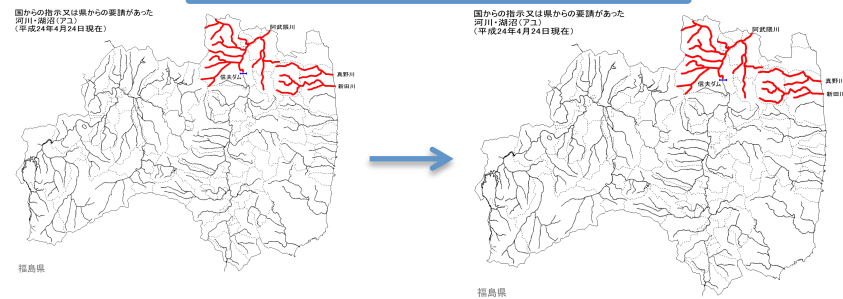
Mark Zheleznyak as an experienced observer  
& Kenji Nanba as a Japanese specialist

Contributing to PREPARE project (2014-)

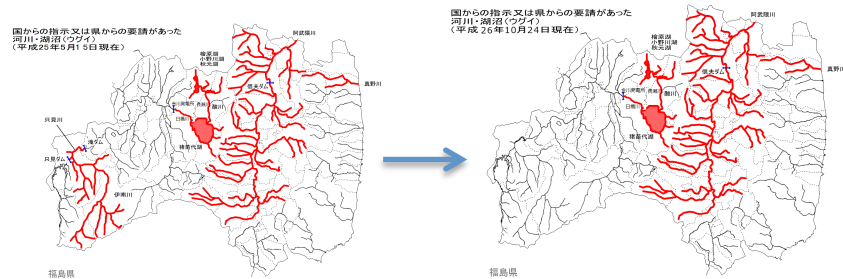
Sep. 2014 → Nov. 2014

Restrictions are lifted based on intensive and extensive monitoring.

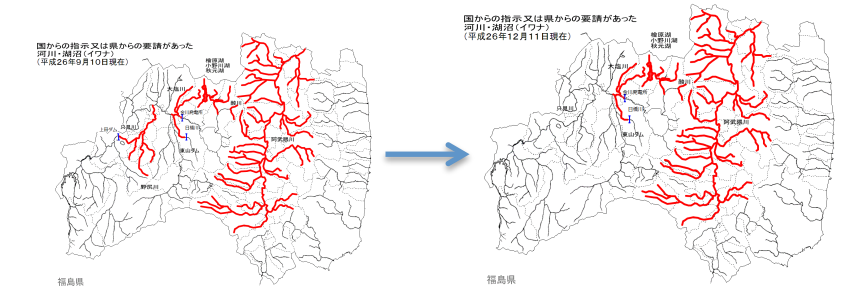
*Ayu (Plecoglossus altivelis altivelis)*



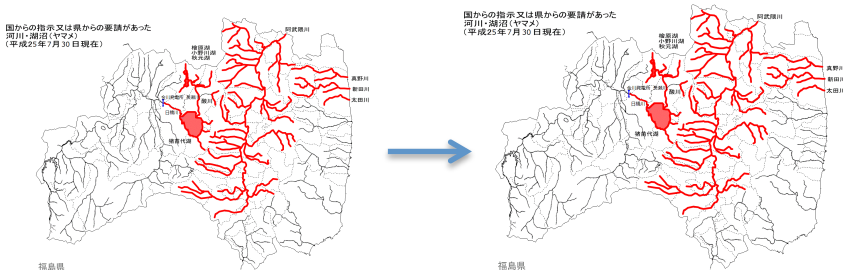
*Ugui (Tribolodon hakonensis)*



*Iwana (Salvelinus leucomaenis)*



*Yamame (Oncorhynchus masou masou)*

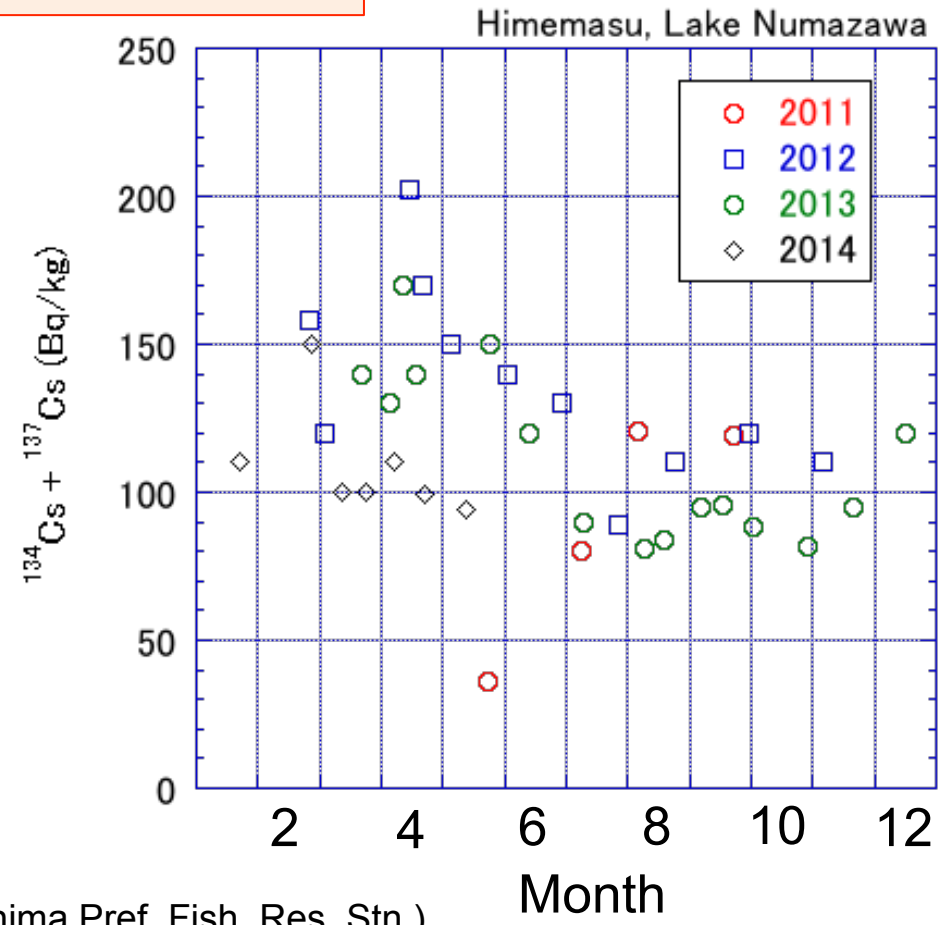
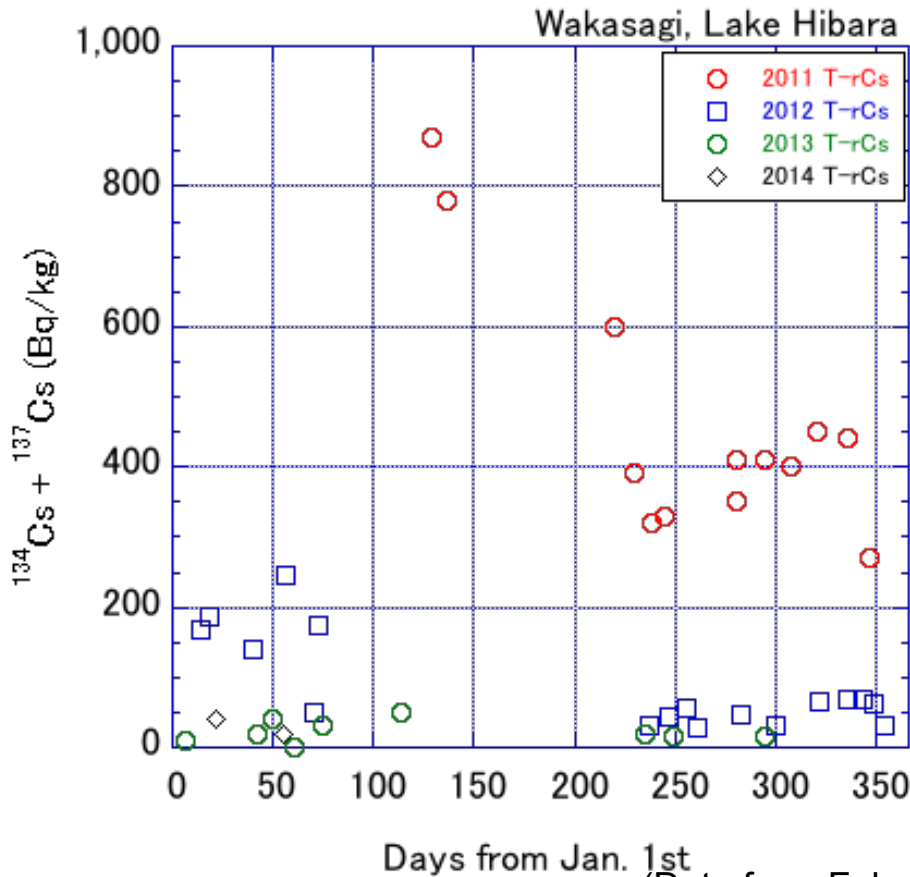


$^{134}\text{Cs} + ^{137}\text{Cs}$  (rCs)  
in Wakasagi (*Hypomesus nipponensis*)  
Lake Hibara

Fresh Water: H. Wada and K. Nanba  
Himemasu (*O. nerka*)  
Lake Numazawa

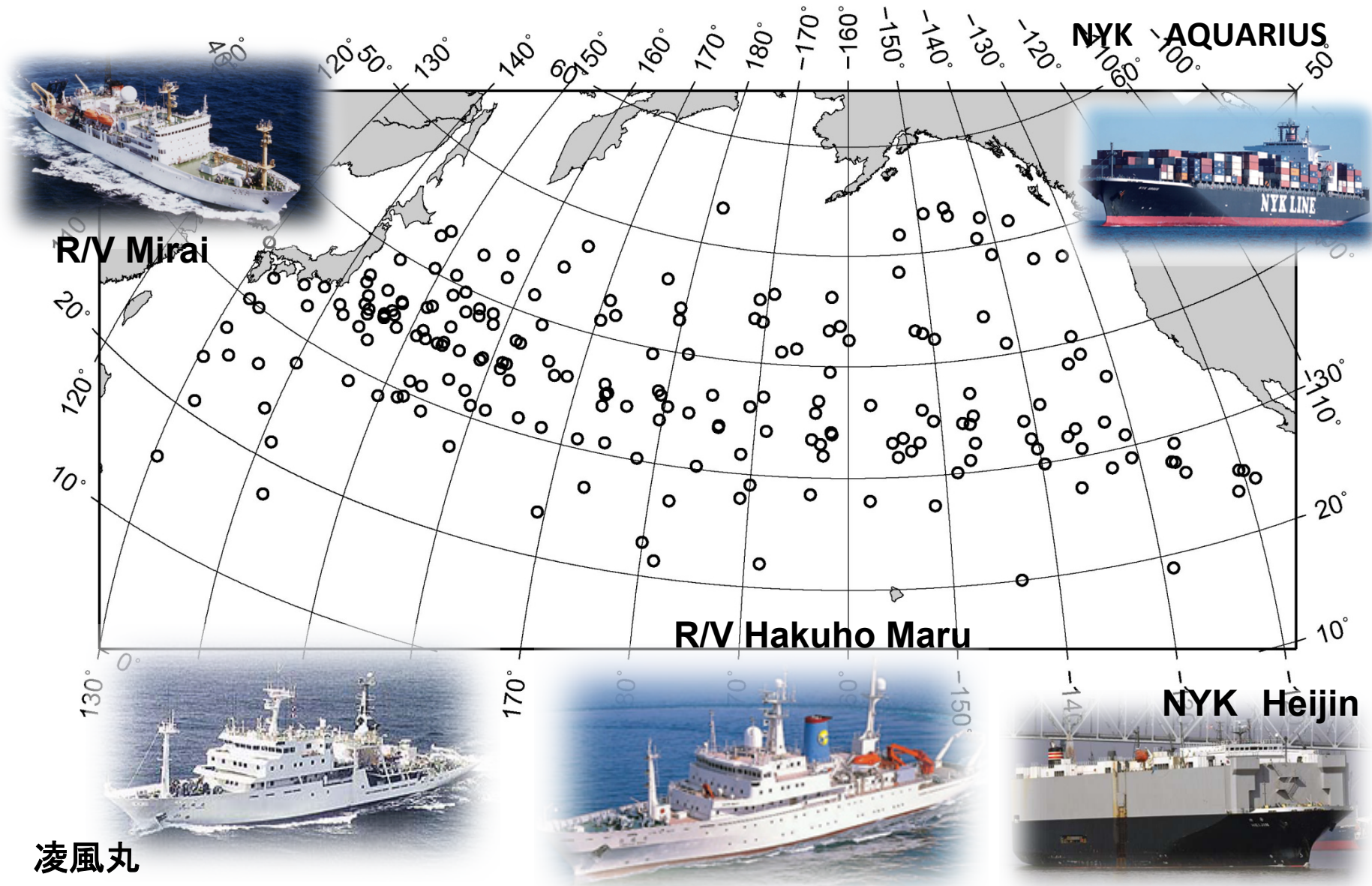


The different rCs trend comes from:  
Hydrological scheme?  
Food? – both are plankton feeder  
Physiological difference?



(Data from Fukushima Pref. Fish. Res. Stn.)

# Sampling locations during the period from March 2011 to Oct. 2012



Test fishery for 3 species started from Jun 22, 2012 in Fukushima.  
- Fishing effort (no. of days \* boats) < 3% of regular fishery

「試験操業」安全が確認された魚種に限定し、小規模な操業と販売を試験的に行い、出荷先での評価を調査して、福島県の漁業再開に向けた基礎情報を得る。

Limited catch of the fish that are confirmed to be safe as food, small scale catch and sale to know the response from the market and consumers. These activities are basis for resume of Fishery. After confirmations, 58 species are now targetted (-Jan. 2015)



Jun. 22, 2012, Matsukawaura Fisheries  
Photos from <[sankei.jp.msn.com/](http://sankei.jp.msn.com/)>



Fukushima Minpo (2013.09.26)

3魚種(ミズダコ, ヤナギダコ, シライトマキバイ), 現在(2015年1月)は58種

# Results of Monitoring of marine fish by Fukushima Pref Fish Res Stn (2015/2/25)

Red bar: n of ind. >100 Bq/kg  
 Blu bar: n of ind. ≤ 100 Bq/kg

Yellow line: ratio of >100 Bq/kg  
 Purple line: ratio of "Not detected"

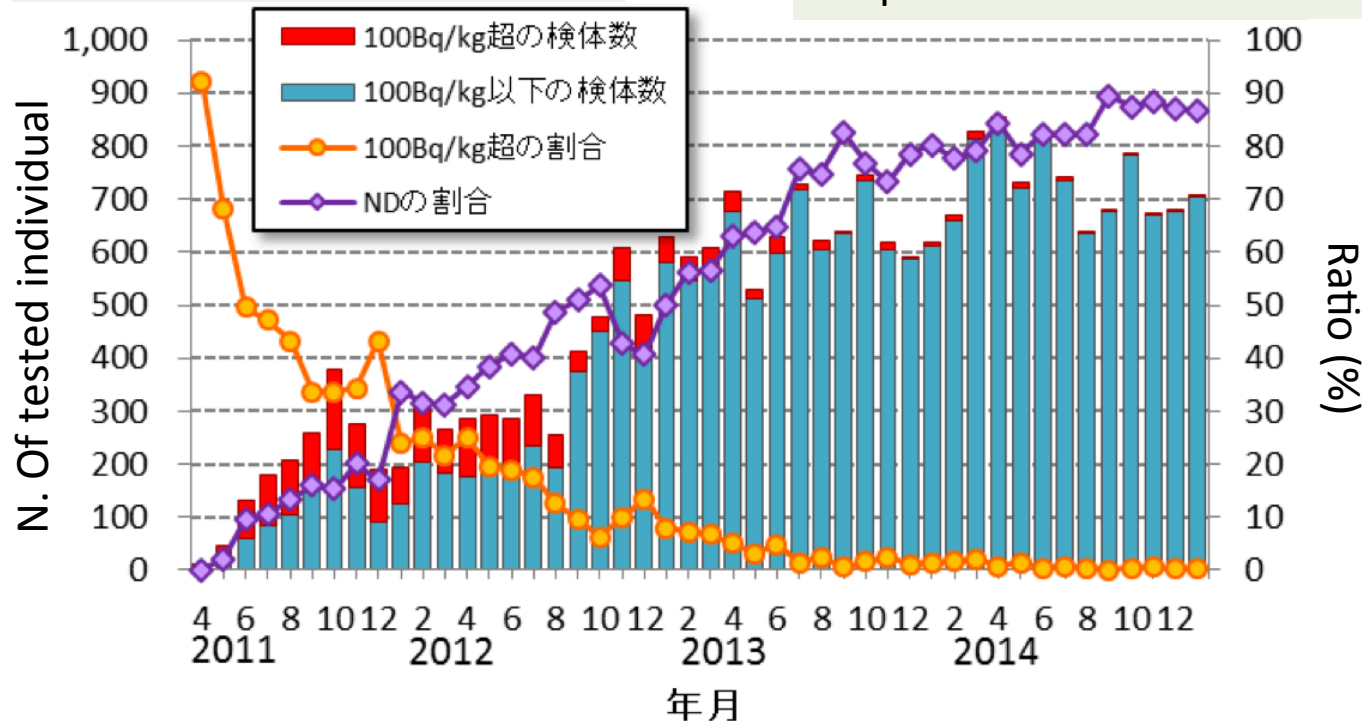


図5 検体数と放射性Csが100Bq/kgを超えた割合・NDの割合

- ✚ 原発事故直後は検体に占める 100Bq/kg 超過の割合が 50%を超えていたが、時間の経過とともに減少し、現在は1%を下回っている。一方、不検出の割合は現在 80%台後半で推移している (図5)。

Feb. 25, 2015

ヒラメ  
 ホシガレイ  
 ババガレイ  
 メイタガレイ  
 メバル類  
 アイナメ  
 カサゴ  
 スズキ  
 クロダイ

など全32魚種に国の出荷制限等指示が出ている。

32 species (including commercially important ones) are still restricted to ship etc. by National govt.

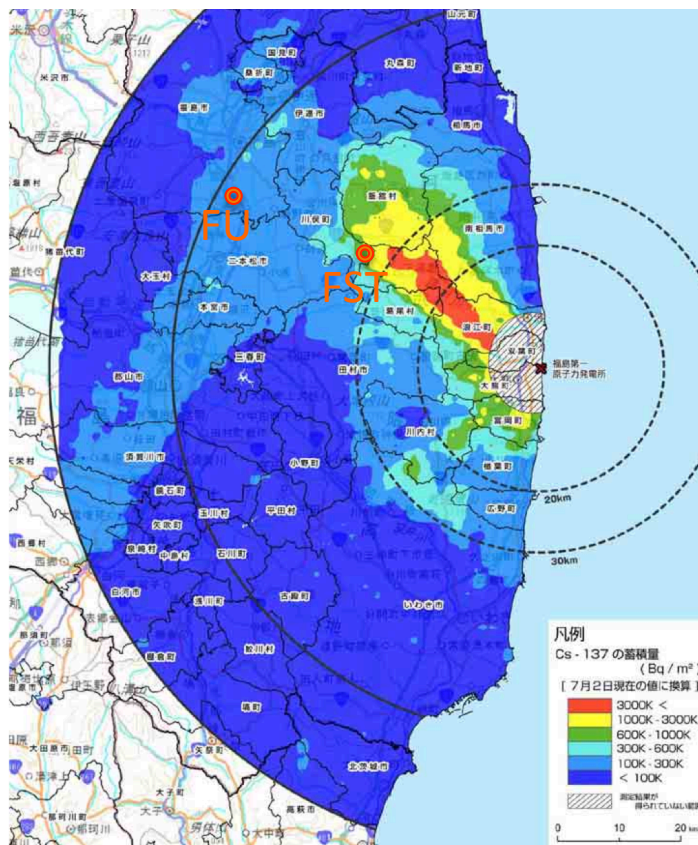
# Prognosis of RN levels in forests: IER Forest Project (started in 2014)

## Aim:

- long-term monitoring and modelling of radiocesium distribution and fluxes in the ecosystem

## Principal approach:

- monitoring of processes in the unsaturated zone for description of RN vertical migration
- quantification of RN uptake into biomass and return fluxes (throughfall, stemflow, litterfall)



Regulation levels of wood

To use for mushroom culture

To build houses

To use as fuels.

Are not decided yet..

# Yamakiya Observatory site

Yamakiya, Kawamata town

Cs-137 inventory 600 -1,000 kBq/m<sup>2</sup>

Forest: Visitors



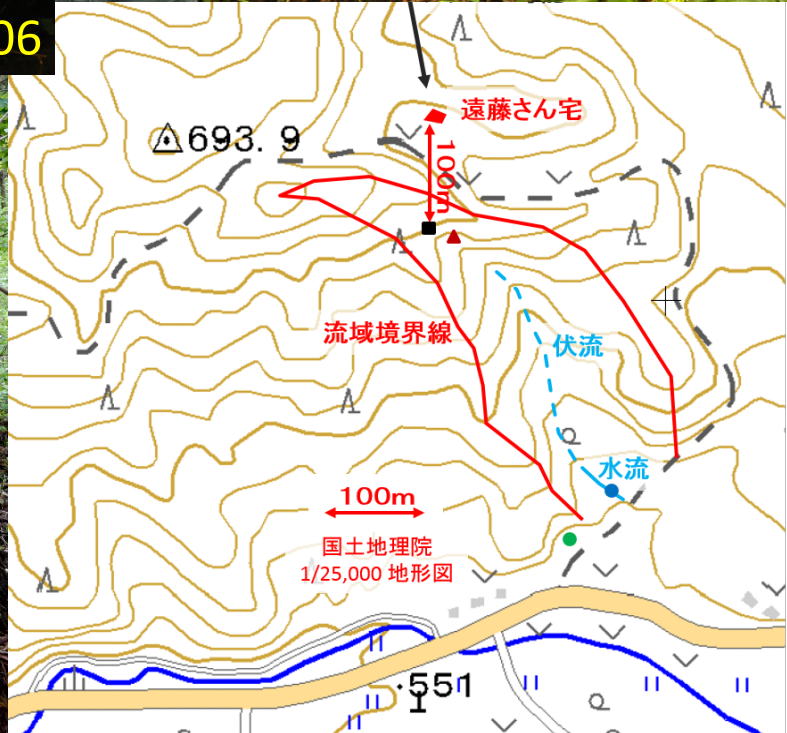
Moss 140905-06



Vascular Plants 140905-06



Mushroom 140920



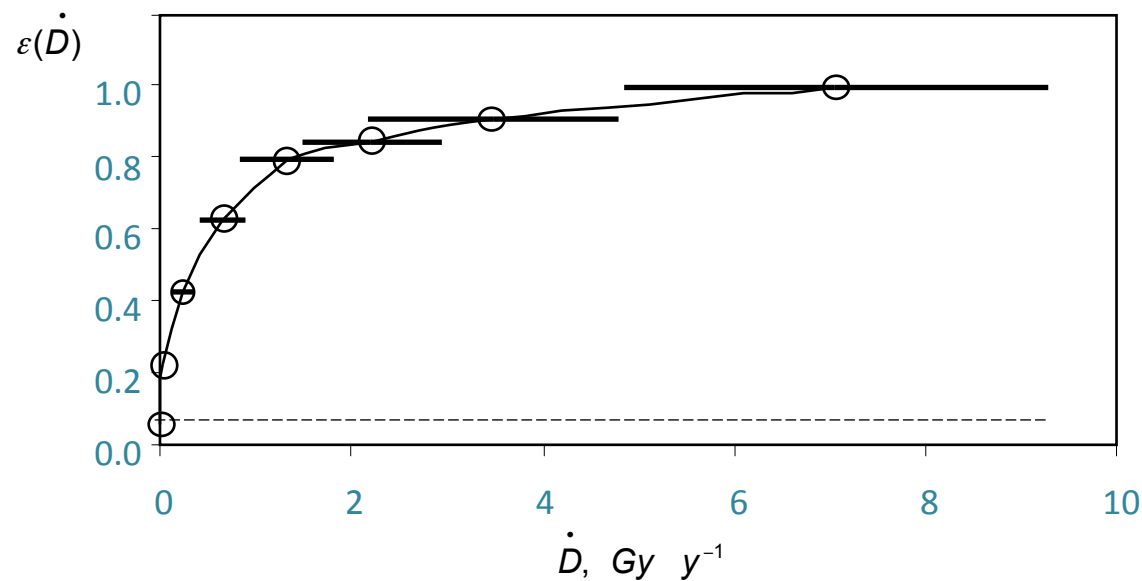


# Radiation effects to plants: Chernobyl vs Fukushima

## CHERNOBYL:

Late stage morphoses in Scots pine –  
chronic radiation  
(by Yoschenko et al, 2011)

Typical morphological changes in Scots pine now: cancelling the apical dominance, suppressing the trees' growth



ERICA Tool screening value of  
 $10 \mu\text{Gy h}^{-1}$  corresponds to the  
morphoses frequency of 32%

## FUKUSHIMA:

many coniferous tree species.  
**ARE THE EFFECTS POSSIBLE?**

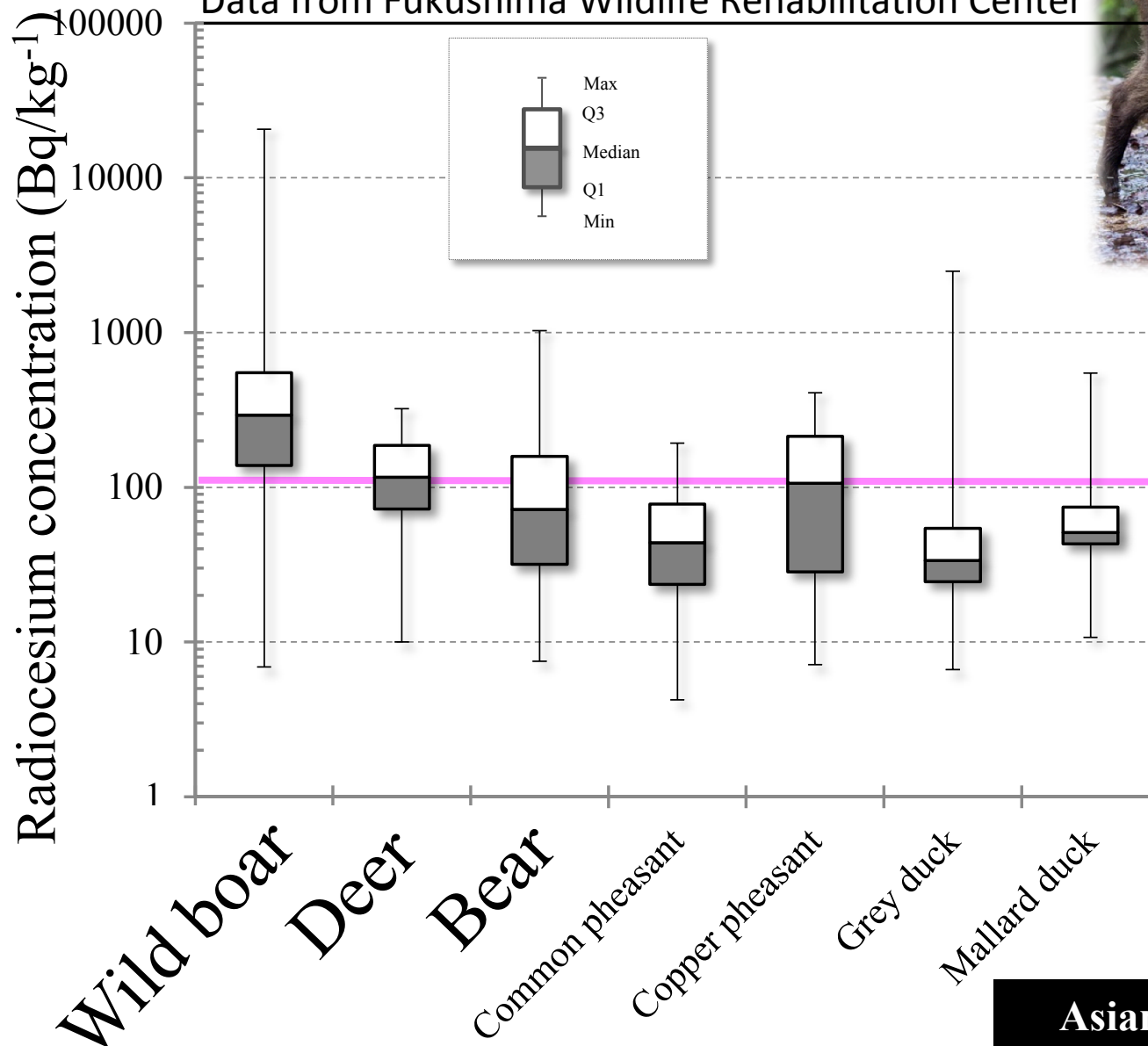


# Wild mammals

Transfer of rCs  
Estimation of Ext.& Int. dose  
Influence

Animal: T. Hinton & K. Okuda

Data from Fukushima Wildlife Rehabilitation Center



Wild boar (*Sus scrofa*)



Sika deer (*Cervus nippon*)



Asian black bear (*Ursus thibetanus*)

# 米の全量全袋検査の流れ①

From 2012 all the rice harvested in Fukushima have been checked according to the scheme by pref. gov.



Among 10 million bags tested every year, the n. of the bag with >100Bq/kg is

- 71 in 2012
- 28 in 2013
- 0 in 2014.

Checking with Belt conveyor- NaI: results on the bag  
Measured with HPGe when excess of regulation value was suspected.

Obtained Trust?



Spring in 2011  
Rice was planted where rCs in  
the soil < 5kBq/kg.

In the harvest season  
Oct. 12<sup>th</sup> pref gov. declared that  
the rice harvested is less than  
the regulation level and safe,  
after screening of  
representative samples.

Cs-134+Cs-137福島県農林水産部 (2011.10.12) (単位：点)

	調査点数	放射性セシウム暫定規制値 (500Bq/kg) 以下					500Bq/kg 超
		ND	100Bq/kg 以下	100Bq/kg 超 200Bq/kg 以下	200Bq/kg 超 300Bq/kg 以下	300Bq/kg 超 500Bq/kg 以下	
合計	1,174	964	203	6	0	1	0

- 「100Bq/kg以下」の点数には、「ND (検出限界以下)」の点数は含まれていません。

# After declaration of safety, brown rice of > 500 Bq/kg was found in Oguni area (Fukushima city).

Pref. gov. checked all the rice bags(2011.11.16- 11.12.18) from this area.

## ○流通状況調査結果

		前日比
JA新ふくしまに販売委託（契約含む）	1, 921袋（57.6トン）	0
自家保有米	2, 198袋（66トン）	+547
縁故米	499袋（15トン）	+188
地元米穀店等に販売	70袋（2トン）	+40
計	4, 688袋（140.6トン）	+775

地元米穀店等に販売した70袋については、販売先に確認したところ、全て保管されており、販売されていない。これらについては販売しないよう要請した。

区 分	結 果		
	農家戸数	分析点数	超過点数
暫定規制値以下	28戸	662点	—
一部が暫定規制値を超過	3戸	105点	34点
全てが暫定規制値を超過	3戸	97点	97点
計	34戸	864点	131点

農 家	検 体 数		超過した検体の最高・最低値 (Bq/kg)	
	総数	超過数	最低値	最高値
A	8	2	700	710
B	67	6	550	750
C	30	26	540	1,110
D	45	45	650	910
E	24	24	970	1,270
F*	28	28	590	670
6戸	202	131	540	1,270

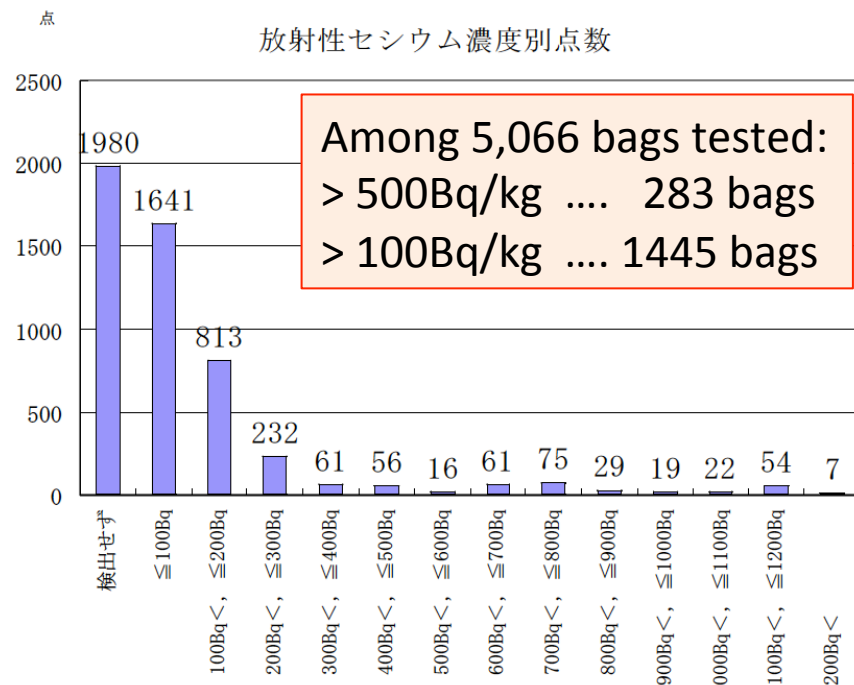
## 前日比

## 1 福島市旧小国村

- (1) 分析を行った農家戸数：135戸（米生産農家戸数135戸）
- (2) 分析済みの検体数：5,066点
- (3) 調査結果

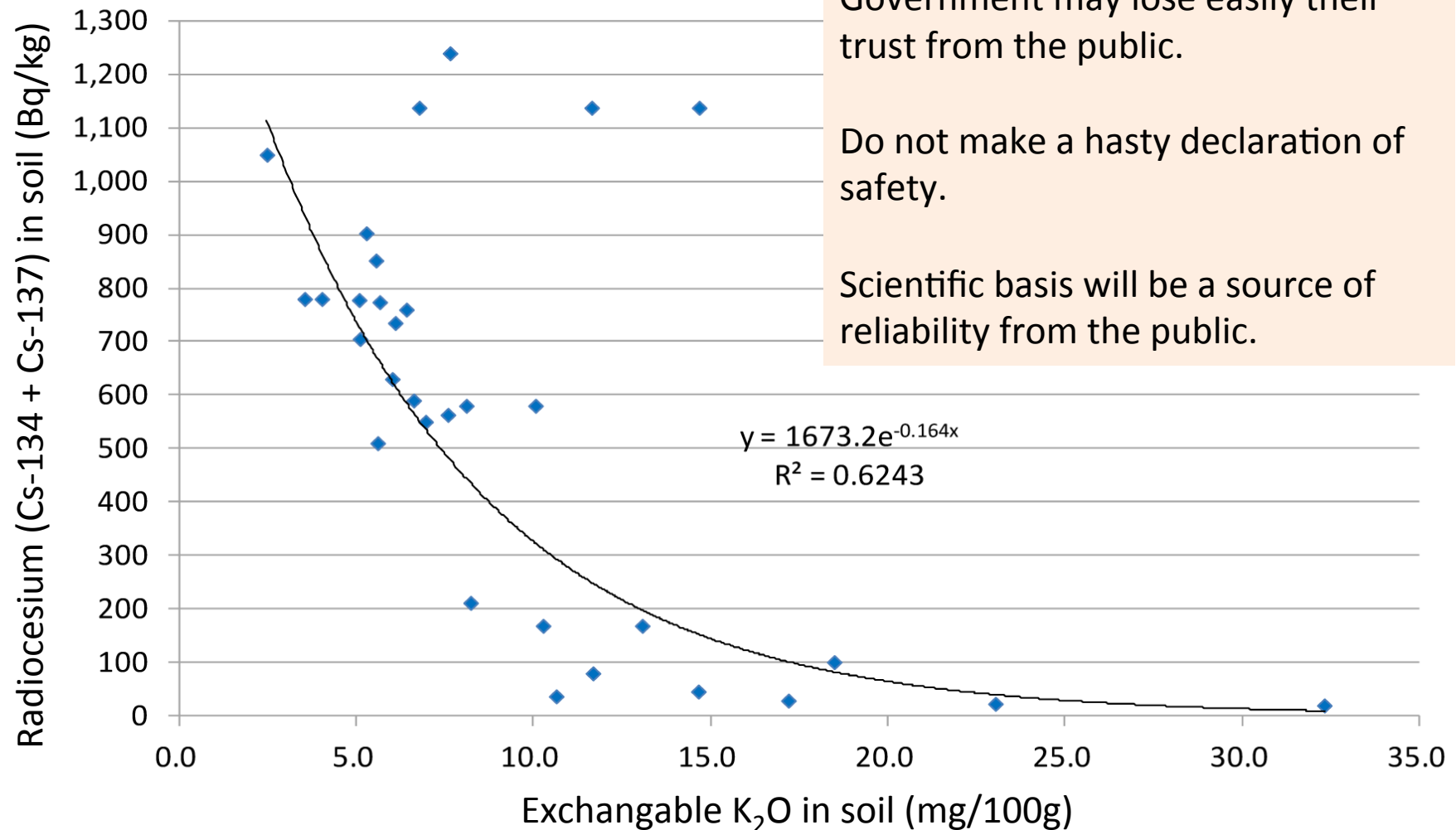
区 分	今回の結果			累 計		
	農家戸数	分析点数	超過点数	農家戸数	分析点数	超過点数
暫定規制値以下	1 (4)	116	0	119	4,515	
暫定規制値超過	1 (2)	53	20	16	551	283
計	2 (6)	169	20	135	5,066	283

※ 農家戸数は新たに調査を行った戸数を記載し、()内は新たに調査を行った戸数と前回までに一部の調査を行っていた戸数の合計を記載



# Soil potassium and rCs in brown rice

(Fukushima Pref. gov. • MAFF, 2011.12.25)

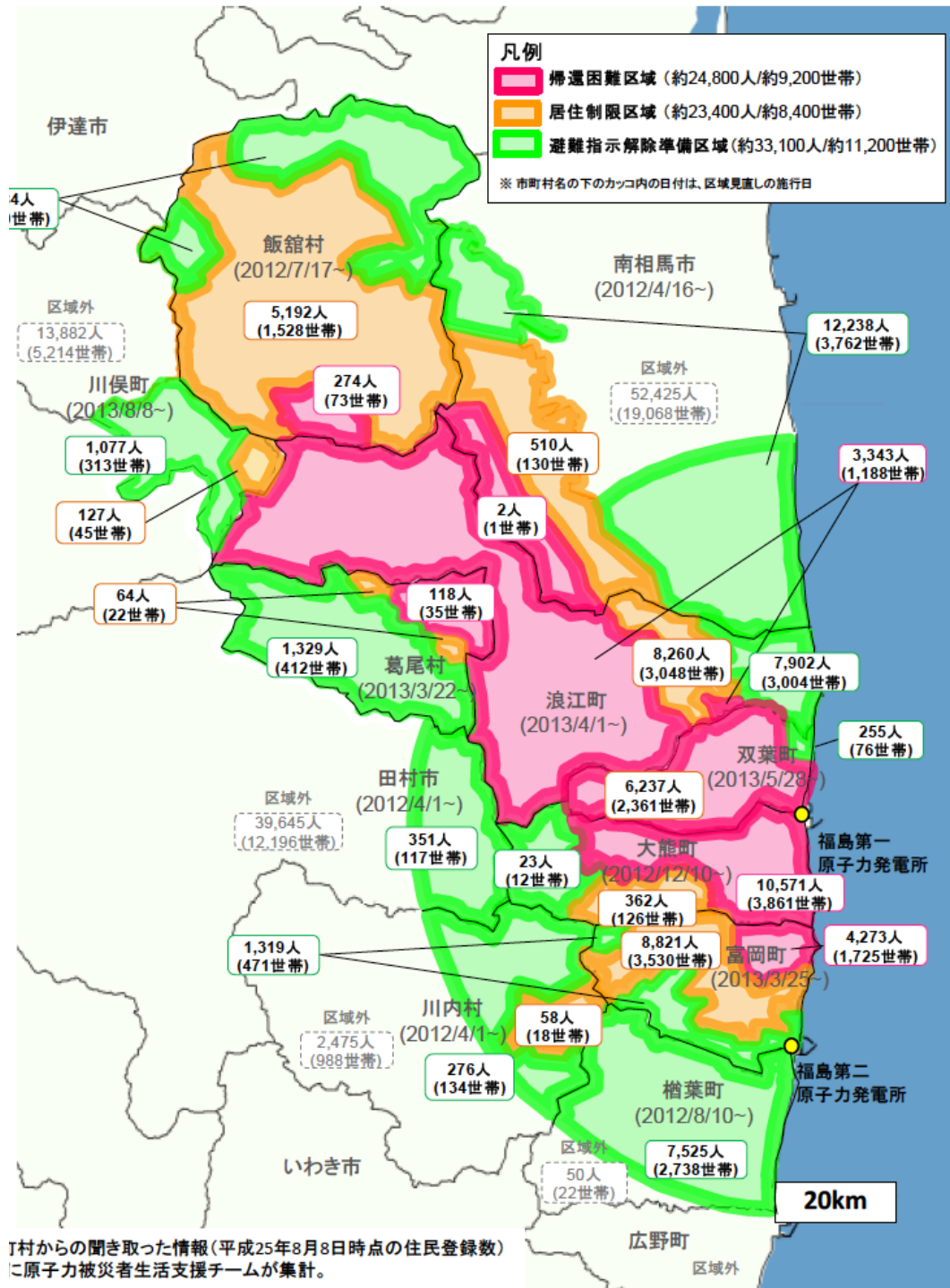


Lessons:

Government may lose easily their trust from the public.

Do not make a hasty declaration of safety.

Scientific basis will be a source of reliability from the public.



## 避難指示区域見直し後の各区域の人口と世帯数

Population (and the number of households) within the areas after rearrangement of the restriction

Red: Difficult to return zone (>50 mSv/y)

Orange: Residence restricted zone (>20 mSv/y)

Green: Evacuation order lift-up preparation zone (≤20 mSv/y)

Oct. 2013

内閣府 The Cabinet Office

Thank you for your attention

