Temporal changes in environmental health risks and socio-psychological status in areas affected by the 2011 Tsunami in Ishinomaki, Japan

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March 11, 2011, Ishinomaki

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Objectives

- To understand environmental health risks from microbiological and chemical hazards
  - Level of hazard
  - Probability of exposure (whether people live affected areas again)
- To understand socio-psychological status of evacuees
- To advise local government for better policy support

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Materials and methods

- Literature review
- Biological and chemical survey
  - Stratified random sampling of neighborhood associations
  - Sample size based on *Vibrio cholerae* O1 prevalence (3.6% of river water), precision 90%
  - Entomology, rodents, microbiology, ions and heavy metals
  - July and Aug 2011, and Aug 2012

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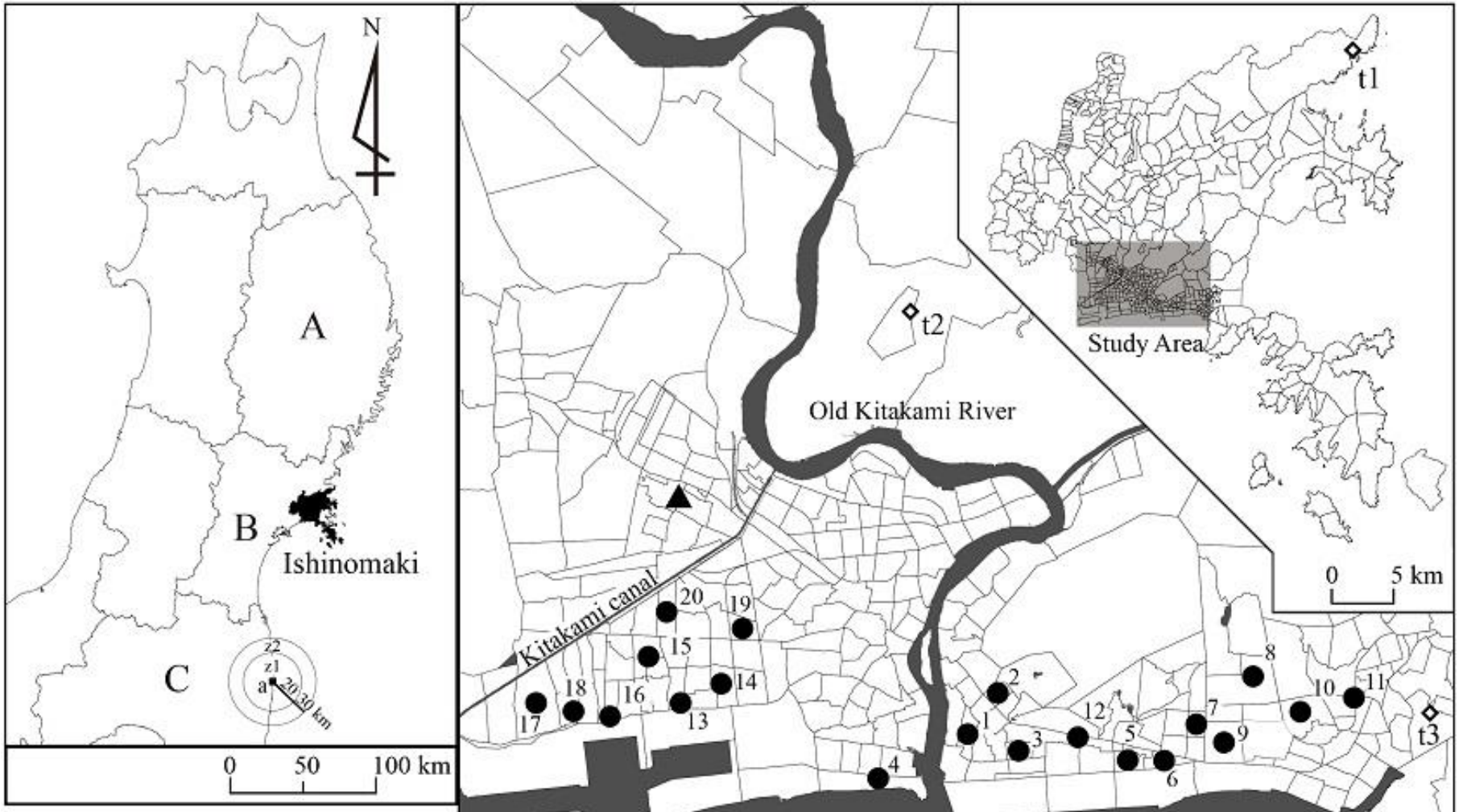
Materials and methods

- Socio-psychological survey
  - Participatory appraisals
  - Questionnaire surveys: two urban (44 respondents) and one rural (16) temporal housing complexes (Sep 2012)
  - K6 as response variable for mental health
  - Age, sex, health problem, family, friends, amusement, income, environment

Study site



A Iwate Prefecture
B Miyagi Prefecture
C Fukushima Prefecture
a Fukushima Nuclear Power Plant I

z 1 The Evacuation Zone
z 2 The Emergency Evacuation Preparation Zone

◇ Temporary Housing Complex
t1 Aikawa Temporary Housing Complex
t2 Kaisei Temporary Housing Complex
t3 Watanoha Temporary Housing Complex

▲ Control
● Sampling Units
■ Ponds, Moats, River, Sea

0 1 2 km

Phase I: Impact phase (0-4 days)
(Literature review)

- Deaths and missing 3,833: 20% of total casualty 19,139
- 13% of the city flooded (70% lived)
- 31.6% of population dislocated to shelters (51K)
- Health problems
  - Tetanus 7, legionellosis 2 (by Tsunami)
  - Dehydration, vomiting, diarrhea and deep vein thrombosis (over crowded shelters)

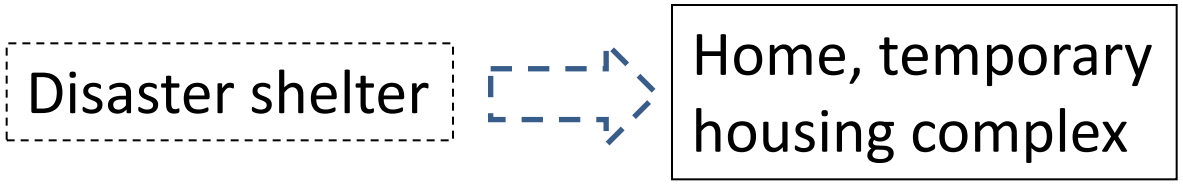
Phase II: Post-impact phase (4 days – 4 weeks)
(Literature review)

- Restoration of affected areas
- Construction of temporary housing complexes
- Diseases in disaster shelters
  - Gastro-intestinal diseases 92, influenza 15, respiratory diseases 788, rash 5, scabies 6 and injury 2
  - Hygiene established
  - A few infectious disease outbreaks

Disaster shelter → Home, temporary housing complex

Phase III: Recovery phase (>4 weeks)
(Literature, volunteer records and participatory methods)

- Closure of disaster shelters (Oct 11, 2011)
- Degradation of environment
  - Fish from damaged processing factories
  - Animal feed concentrate from damaged factories

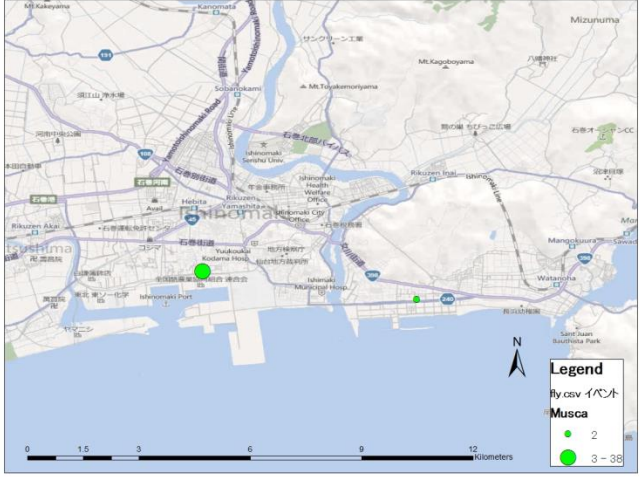


Animal feed concentrates and sludge (June 2011）

Rotten fish and flies (June 2011)

Distributions of flies (July 2011)

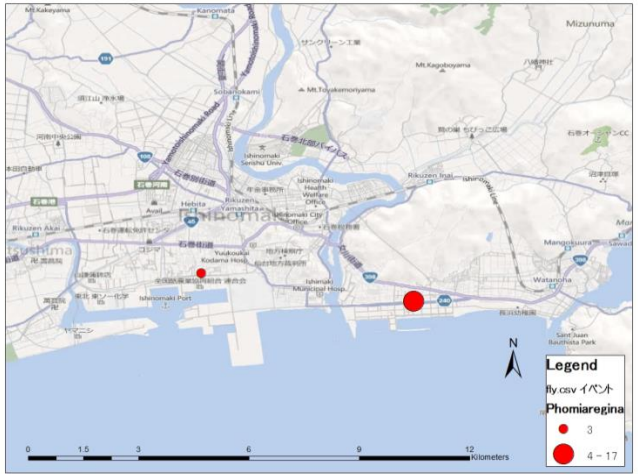
Total bacteria $10^{8.7}$ (95%CI: $10^{7.3}$-$10^{10.1}$)
Enterobactericeae $10^{8.0}$ (95%CI: $10^{6.6}$-$10^{9.5}$)



Musca domestica

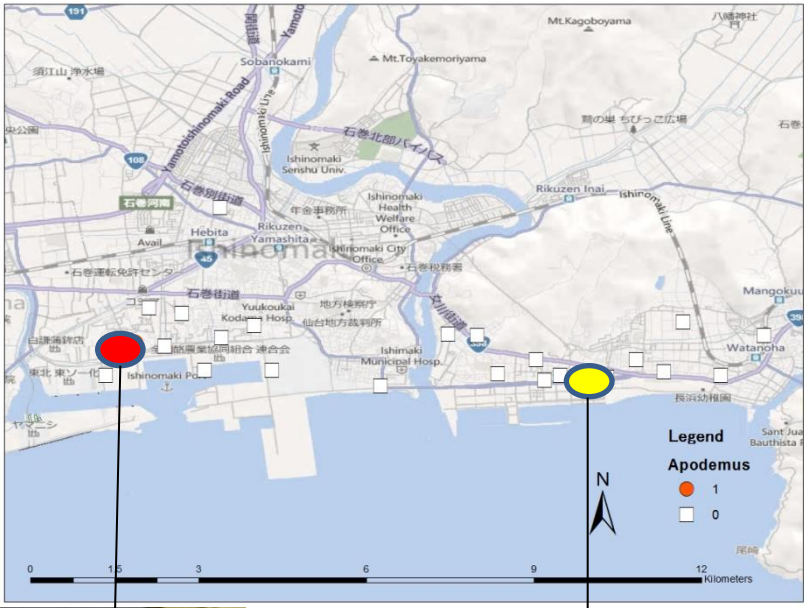
- Piled fish discarded by July 6
- Number of flies decreased by August

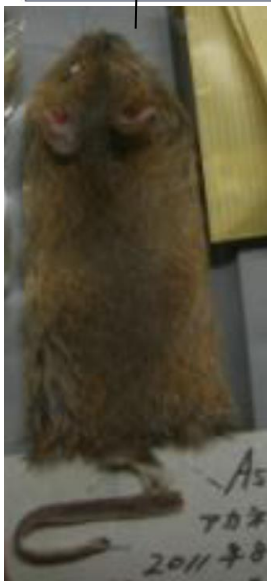
Spaerocerdae



Phomiaregina meigen

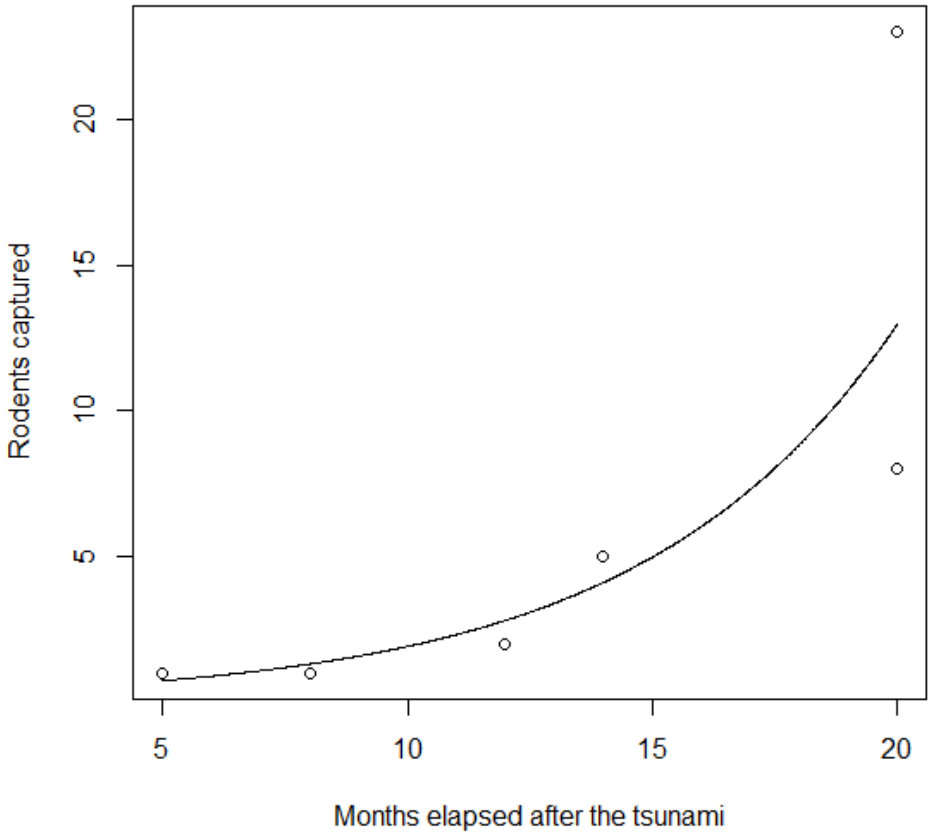
Rodents





Apodemus speciosus

Mus musculus



Slope=0.08 (Log_{10}), p=0.005

Prevalence of *Vibrio* and *Aeromonas*

	July 2011	August 2011	*p*-value
Surface water	n=13	n=14	
*Vibrio cholerae**	3 (23.1%)	3 (21.4%)	1
Vibrio fluvialis	1 (7.7%)	3 (21.4%)	0.60
Aeromonas hydrophila	1 (7.7%)	4 (28.6%)	0.33
Sludge	n=12	n=12	
*Vibrio cholerae**	3 (25.0%)	3 (25.0%)	1
Vibrio fluvialis	4 (33.3%)	4 (33.3%)	1
Aeromonas hydrophila	2 (16.7%)	2 (16.7%)	1

* non-O1, O139 *V. cholerae*

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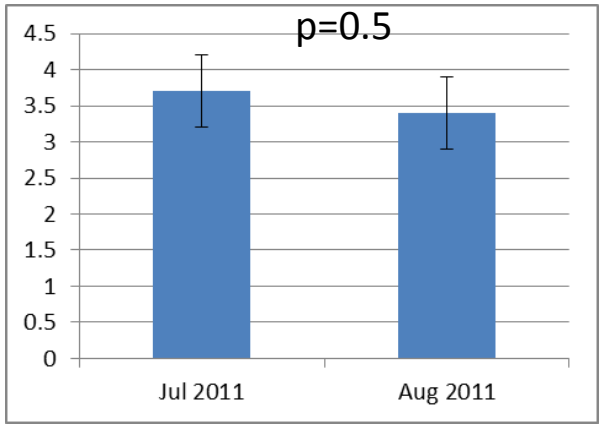
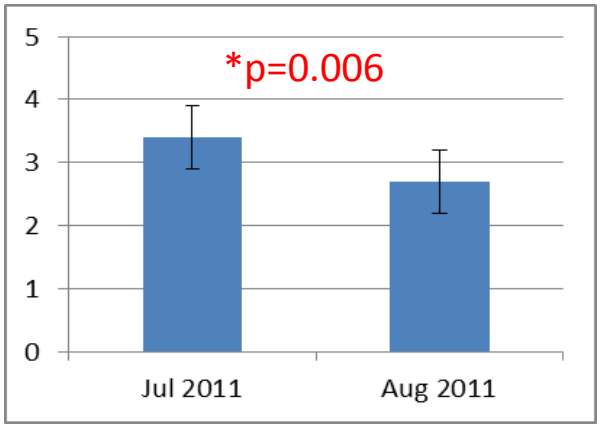
Microbiology for surface water (Log_{10} scale)

Total bacteria



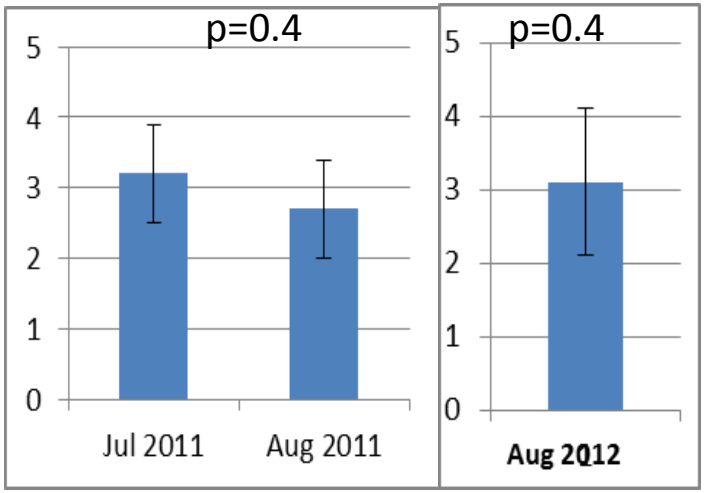
n=14 n=14

Enterobacteriaceae



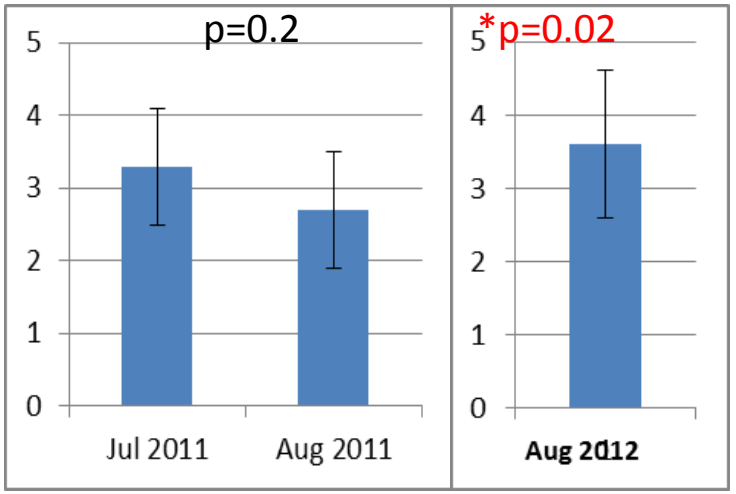
n=14 n=14

Bacillus spp.



n=12 n=17 n=9

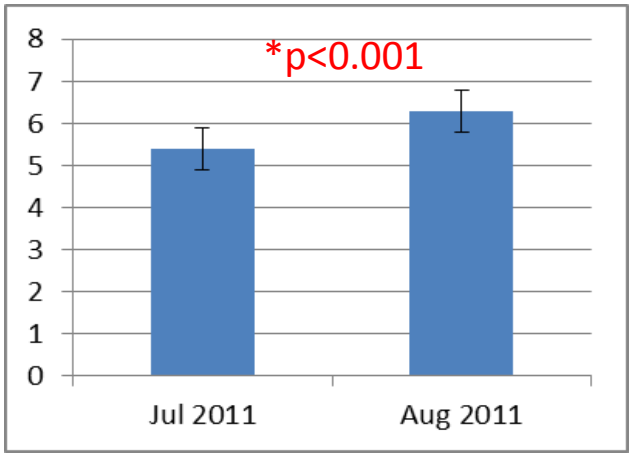
Clostridium spp.



n=12 n=17 n=9

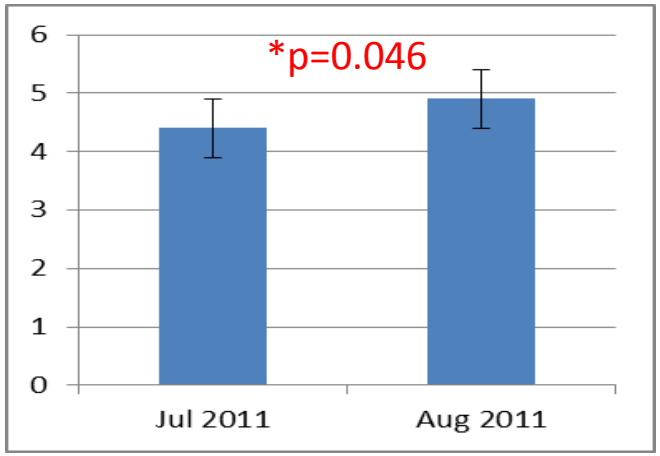
Microbiology for sludge (Log_{10} scale)

Total bacteria



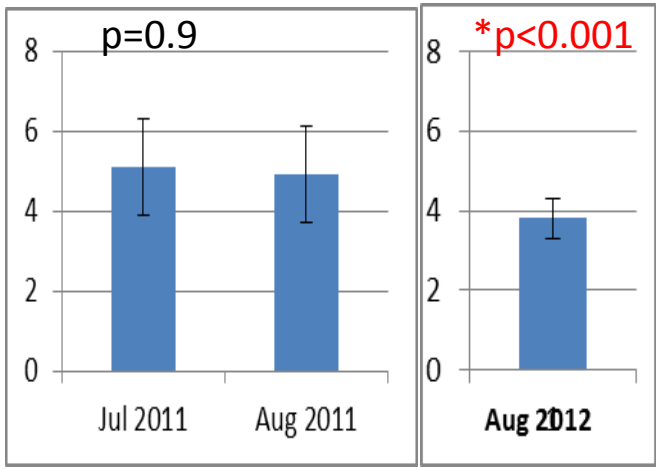
n=15 n=15

Enterobacteriaceae



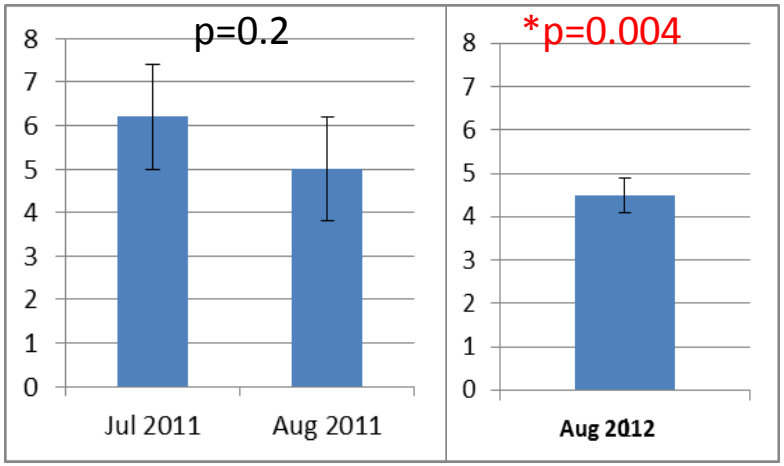
n=15 n=15

Bacillus spp.



n=11 n=15 n=9

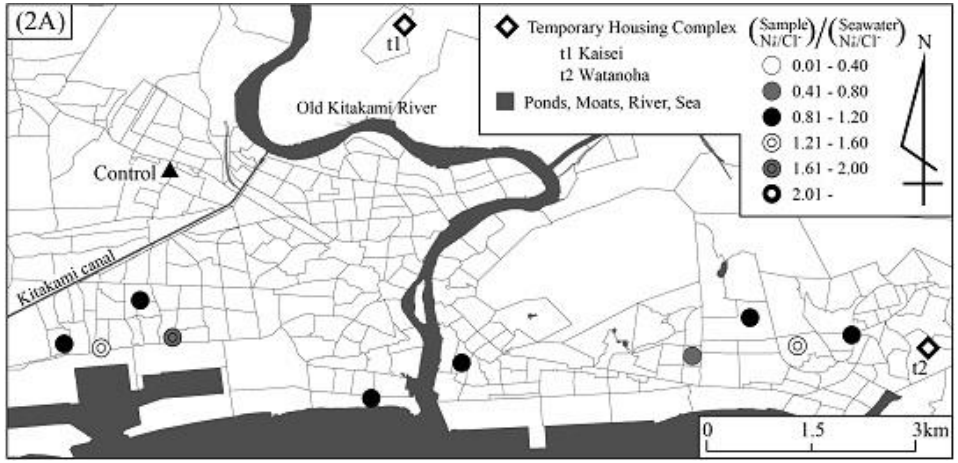
Clostridium spp.



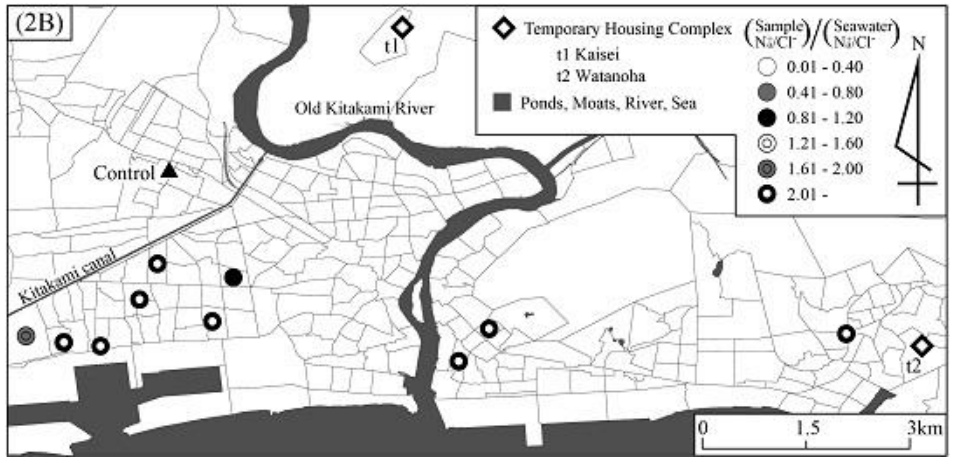
n=11 n=15 n=9

Ions

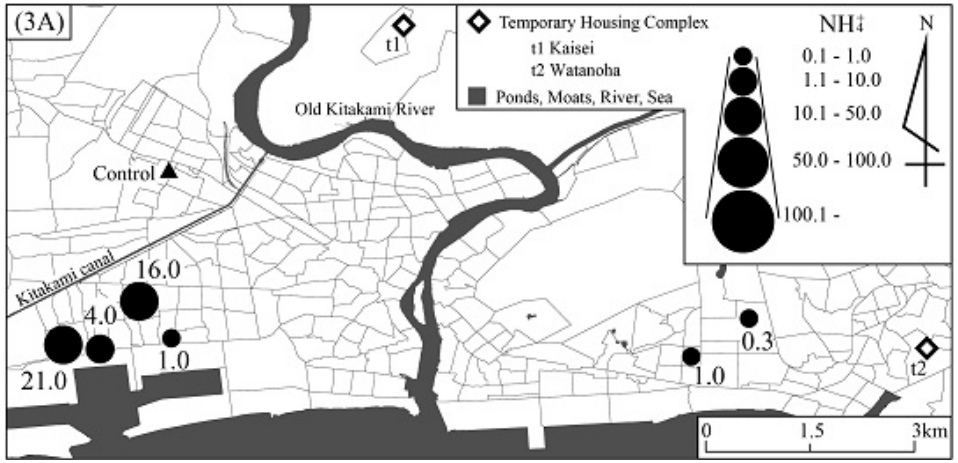
Jul 2011



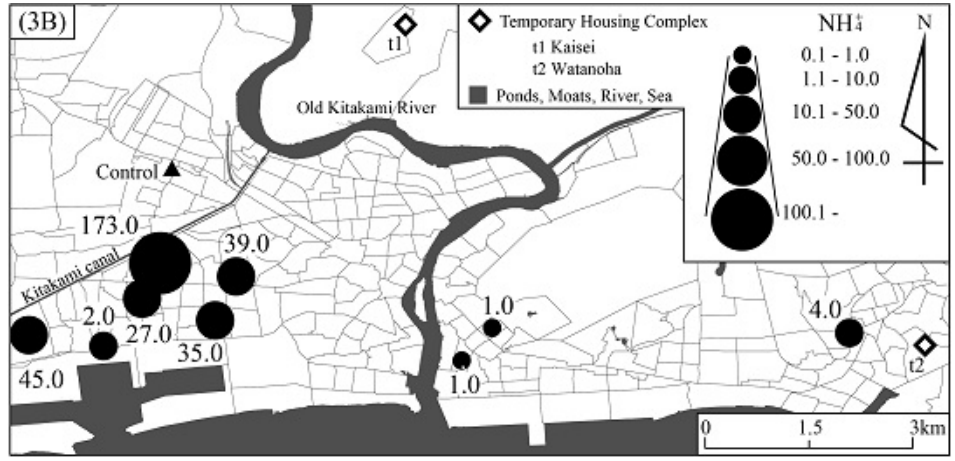
Aug 2011



Jul 2011



Aug 2011



Other findings

- Hepatitis E virus DNA (1/20 samples)
- No high level of heavy metal concentration

Socio-psychological results

- Wish to live in the same place again
  - Urban: 30.6% (11/36)
  - Rural: 64.2% (9/14), others upland relocation *Fisherman village
- Obstruct for making a wish (in urban areas)
  - Financial problem (58.3%, 7/12)

Risk factors for severe mental health (Generalized Linear Models with Poisson errors)

Factors	Attributes	Sample	Percentage	K6	*p*-value
Health problem of the respondent or family	Exist	26	52.0	3.0	<0.001
	Not exist	24		9.9	
Friends in the housing complex	Exist	42	72.4	5.0	0.003
	Not exist	16		10.6	
Trusted person to counsel in the housing complex	Exist	29	56.9	3.3	0.005
	Not exist	22		10.9	

Conclusion

- Infectious diseases were well controlled
- Environmental health risk was low
- Rodents need to be monitored
- Mental care and financial supports are needed for evacuees

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- Participants in the study

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