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## MILESTONE MS3.4

Report of the 2014 Shinsei Maru Research Cruise

KS-14-20

17 October 2014 – 26 October 2014

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(MS3.4) – Report of the 2014 Shinsei Maru Research Cruise

Dissemination level: PU

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Dissemination Level		
<b>PU</b>	Public	PU
<b>RE</b>	Restricted to a group specified by the partners of the [COMET] project	
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## 1 Summary

Researchers of the FRAME (The impact of recent releases from the Fukushima nuclear Accident on the Marine Environment) consortium, within the COMET (COordination and iMplementation of a pan-Europe instrument for radioecology) project, participated in the 2014 Shinsei Maru “KS-14-20” cruise organized by Japan off Fukushima in October 2014. This cruise was planned as part of the activities programmed to understand the sources, fate, transport, bioaccumulation and associated impact of radionuclides from the Fukushima Dai-ichi NPP accident in Japan. In this report we provide the information regarding the sampling activities conducted during the cruise.

The cruise was carried out from 17 October 2014 (Aomori) to 26 October 2014 (Yokosuka) and covered the most heavily impacted area, overlapping with where we have sampled in previous years, allowing a time-series of the changing contamination levels.

At present time, samples are being analyzed by the FRAME partners. Results will be available during 2015. The analysis will consist on the determination of a suite of natural ( $^{234}\text{Th}$  and Ra isotopes) and artificial (Iodine, Strontium, Caesium, Uranium) radionuclides in water, particles and biota samples, as indicated in the Tables included in this report. Cs isotopes will be analysed by gamma spectrometry at WHOI.  $^{90}\text{Sr}$  will be determined at UAB via beta counting of  $^{90}\text{Y}$  after chemical separation. Short-lived radium isotopes ( $^{223}\text{Ra}$  and  $^{224}\text{Ra}$ ) will be determined by delayed coincidence counting, with first measurements already on board the ships and recounted at WHOI and UAB.  $^{226}\text{Ra}$  and  $^{228}\text{Ra}$  will be analysed by gamma spectrometry at both UAB and WHOI. Analyses of  $^{236}\text{U}$ , Pu isotopes and  $^{129}\text{I}$  will be carried out by AMS at ETH-Zurich.

Results will be made available to the COMET partners in due time.

## 2 Report of the 2014 Shinaomaru Research Cruise

**Table 1.** *Sampling stations and types of samples collected during the KS-14-20 cruise.*

Sample ID	Location						CTD-CMS	ORI net	NORPAC net	IKMT	Multi corer	McLane Pump	Ra barrel	Sediment Trap
N04	37	30,0	N	142	0,00	E	○	○	○	○				
N01	37	30,0	N	141	30,00	E	○	○	○	○				
NPE2	37	30,0	N	141	4,75	E	○	○	○				○	
NPE1	37	20,0	N	141	4,75	E	○	○	○				○	
NP0	37	25,0	N	141	3,00	E	○	○	○		○	○	○	
RA6	37	25,0	N	141	4,50	E	○						○	
NP2	37	25,0	N	141	6,00	E	○	○	○	○		○	○	
RA5	37	25,0	N	141	8,35	E	○						○	
NP1	37	25,0	N	141	10,70	E	○	○	○	○	○	○	○	
RA4	37	25,0	N	141	14,35	E	○						○	
NP3	37	25,0	N	141	18,00	E	○	○	○	○	○		○	
RA3'	37	15,0	N	141	4,75	E	○						○	
RA3	37	0,0	N	141	5,00	E	○						○	
RA2N	37	10,0	N	141	5,00	E	○						○	
RA1N	37	5,0	N	141	5,00	E	○						○	
N02	37	0,0	N	141	30,00	E	○	○	○	○				
F01-Trap	36	29,0	N	141	30,00	E	○	○	○	○		○	○	○
N03	36	30,0	N	141	0,00	E	○	○	○	○	○			
FS1	37	20,0	N	142	10,0	E	○				○			
J07	36	47,9	N	141	15,0	E	○				○			
K2	36	0,0	N	141	1,0	E	○				○			

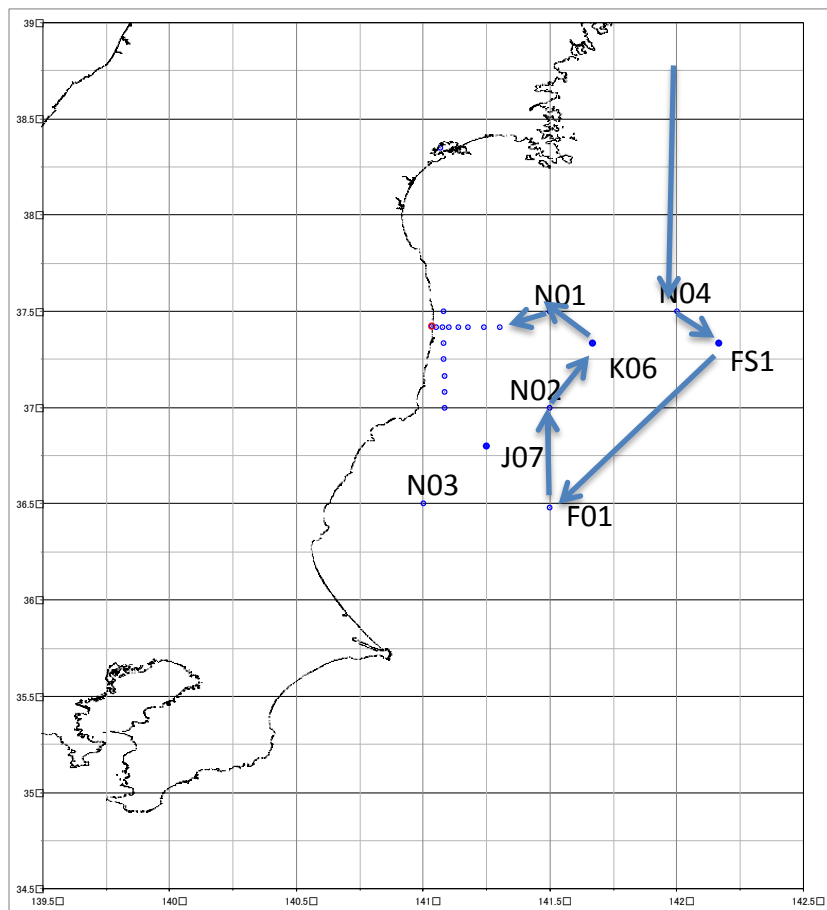
**Table 2.** Water samples collected for the determination of Ra isotopes,  $^{234}\text{Th}$  and artificial radionuclides during the KS14-20 cruise.

Sample ID ETH	Sample ID WHOI	Date (GMT)	Time (GMT)	Location	Latitude N	Longitude E	Depth (m)
Coastal_1	GW 1	14/10/14		Nakoso Bach	36,864	140,790	
Coastal_2	GW 2	14/10/14	5:40	Nakoso Bach	36,864	140,790	
Coastal_3	GW 4	15/10/14	1:00	Nakoso Bach	36,864	140,790	
Coastal_4	GW 5	15/10/14	2:20	Aquamarine Fuk.			
Coastal_5	GW 6	15/10/14	6:30	Yotsukura Beach	37,104	140,992	
Coastal_6	GW 7	15/10/14	6:35	Yotsukura Beach	37,104	140,992	
ShinMaru_1	F5000	18/10/14	4:48	N04	37,494	141,999	surface
ShinMaru_2	F5001	19/10/14	0:13:08	F01	36,285	141,285	surface
ShinMaru_3	F5002	19/10/14	0:13:08	F01	36,285	141,285	20
ShinMaru_4	F5003	19/10/14	0:13:08	F01	36,285	141,285	40
ShinMaru_5	F5004	19/10/14	0:13:08	F01	36,285	141,285	125
ShinMaru_6	F5005	19/10/14	0:13:08	F01	36,285	141,285	1279
ShinMaru_7	F5006	20/10/14	7:10	NP3	37,250	141,180	surface
ShinMaru_8	F5007	20/10/14	12:15	RA4	37,251	141,165	surface
ShinMaru_9	F5008	20/10/14	13:45	NP1	37,250	141,108	surface
ShinMaru_10	F5009	20/10/14	13:45	NP1	37,250	141,108	7
ShinMaru_11	F5010	20/10/14	13:45	NP1	37,250	141,108	30
ShinMaru_12	F5011	20/10/14	13:45	NP1	37,250	141,108	44
ShinMaru_13	F5012	20/10/14	21:10	Ra5	37,251	141,083	surface
ShinMaru_14	F5013	21/10/14	1:39	NPE2	37,302	141,048	surface
ShinMaru_15	F5014	21/10/14	5:44:23	NP2	37,250	141,060	surface
ShinMaru_16	F5015	21/10/14	5:44:23	NP2	37,250	141,060	7/8
ShinMaru_17	F5016	21/10/14	5:44:23	NP2	37,250	141,060	15
ShinMaru_18	F5017	21/10/14	5:44:23	NP2	37,250	141,060	23
ShinMaru_19	F5018	21/10/14	11:50	Ra6	37,250	141,047	surface
ShinMaru_20	F5019	21/10/14	12:40	NPE1	37,201	141,048	surface
ShinMaru_21	F5020	21/10/14	21:05	NP0	37,250	141,030	surface
ShinMaru_22	F5021	21/10/14	21:05	NP0	37,250	141,030	surface
ShinMaru_23	F5022	22/10/14		Ra3'	37,149	141,046	surface
ShinMaru_24	F5023	22/10/14		Ra2N	37,100	141,050	surface
ShinMaru_25	F5024	22/10/14		Ra1N	37,049	141,050	surface
ShinMaru_26	F5025	22/10/14		Ra3	36,599	141,050	surface

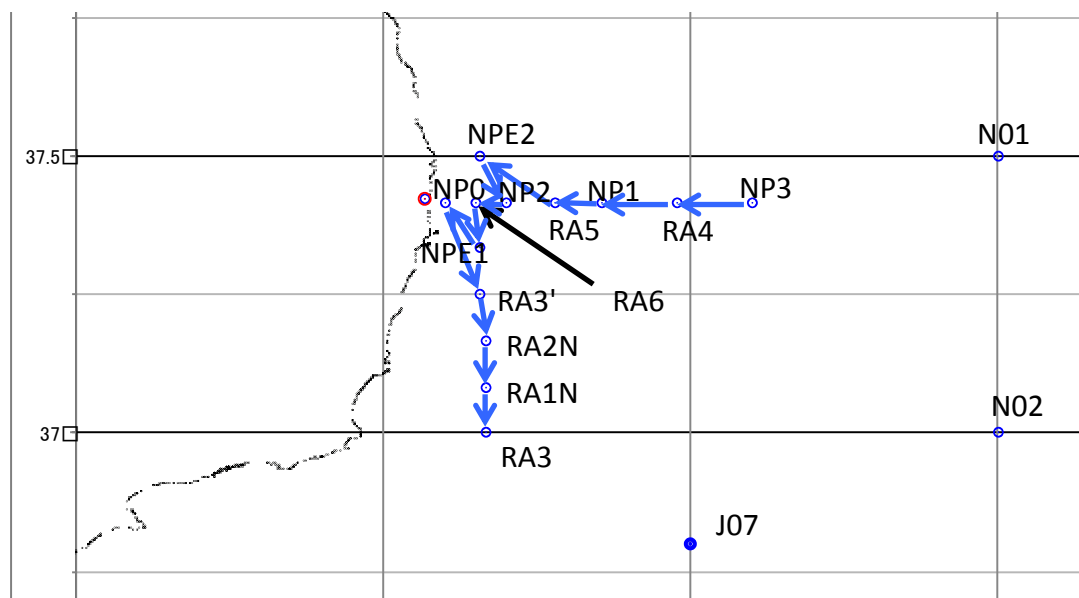
**Table 3.** Water samples filtered for the determination of selected radionuclides in suspended particles during the KS14-20 cruise.

Station	Date (GMT)	Time (GMT)	Latitude N	Longitude E	Depth (m)	Cast	CTD bottle
N04	18/10/14	4:48	37,4937	141,9987	surface	-	-
	18/10/14	4:48	37,4937	141,9987	surface		
	18/10/14	4:48	37,4937	141,9987	50	1	2
	18/10/14	4:48	37,4937	141,9987	400	1	1
F01	19/10/14	0:13	36,2849	141,2850	surface	1	17
	19/10/14	0:13	36,2849	141,2850	40	1	10
	19/10/14	0:13	36,2849	141,2850	1279	1	2
N01	20/10/14	2:15	37,2844	141,2971	surface	1	14
	20/10/14	2:15	37,2844	141,2971	100	1	2
	20/10/14	2:15	37,2844	141,2971	130	1	1
NP3	20/10/14	7:23	37,2500	141,1802	surface	1	17
	20/10/14	7:23	37,2500	141,1802	50	1	1
	20/10/14	7:23	37,2500	141,1802	5ab	1	6
NP1	20/10/14	13:45	37,2500	141,1084	7	1	18
	20/10/14	13:45	37,2500	141,1084	30	1	11
NPE2	21/10/14	1:39	37,3016	141,0475	surface	1	15
	21/10/14	1:39	37,3016	141,0475	10	1	1
NP2	21/10/14	5:44:23	37,2502	141,0599	7	1	11
	21/10/14	5:44:23	37,2502	141,0599	12	1	9
	21/10/14	5:44:23	37,2502	141,0599	23	1	3
NPE1	21/10/14	12:40	37,2007	141,0477	surface	1	2
	21/10/14	12:40	37,2007	141,0477	10	1	13
NP0	22/10/14	21:05	37,2495	141,0299	surface	1	18
N03	24/10/14	10:15	36,3020	140,5970	surface	1	15
	24/10/14	10:15	36,3020	140,5970	50	1	2
	24/10/14	10:15	36,3020	140,5970	200	1	1

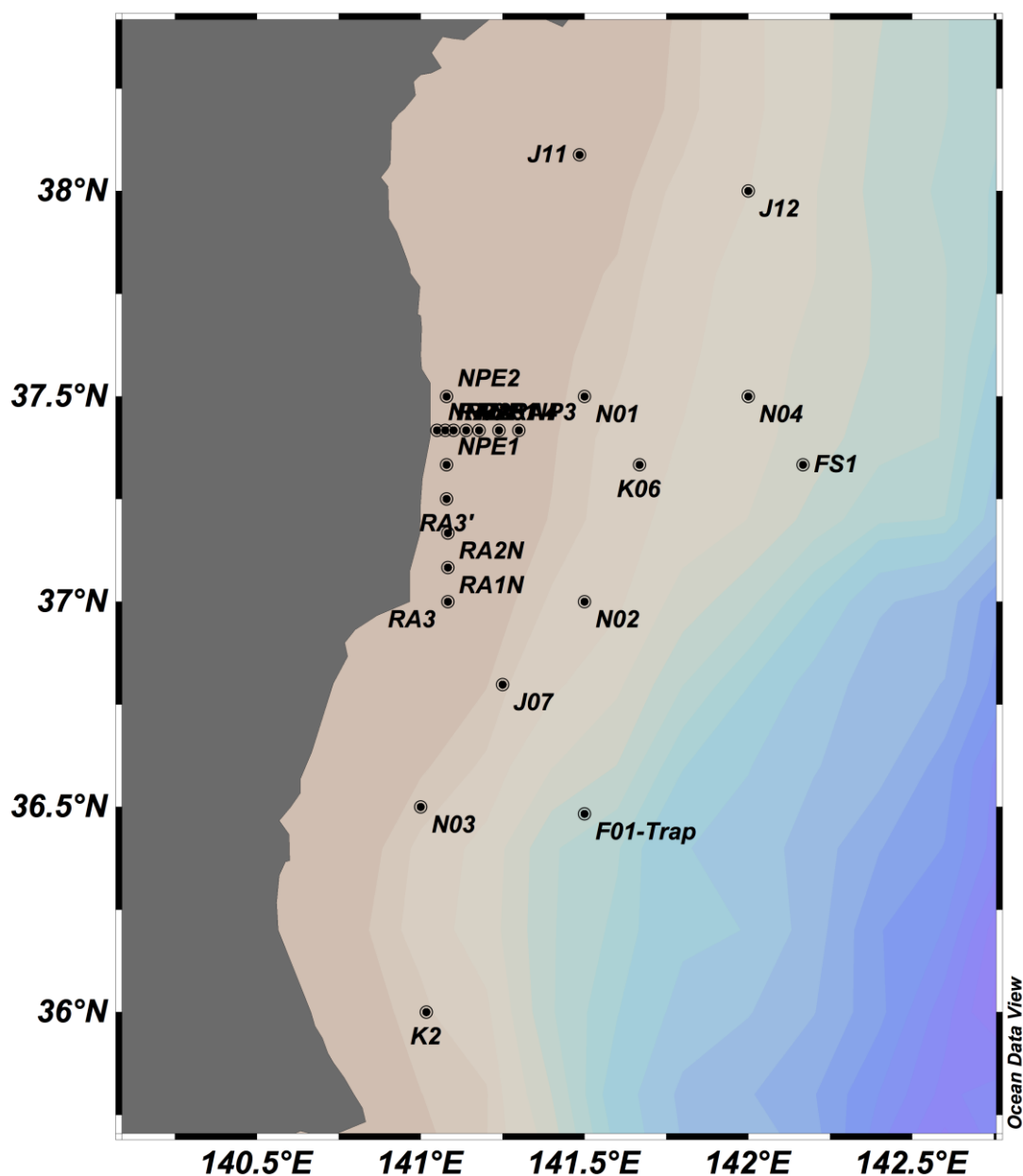




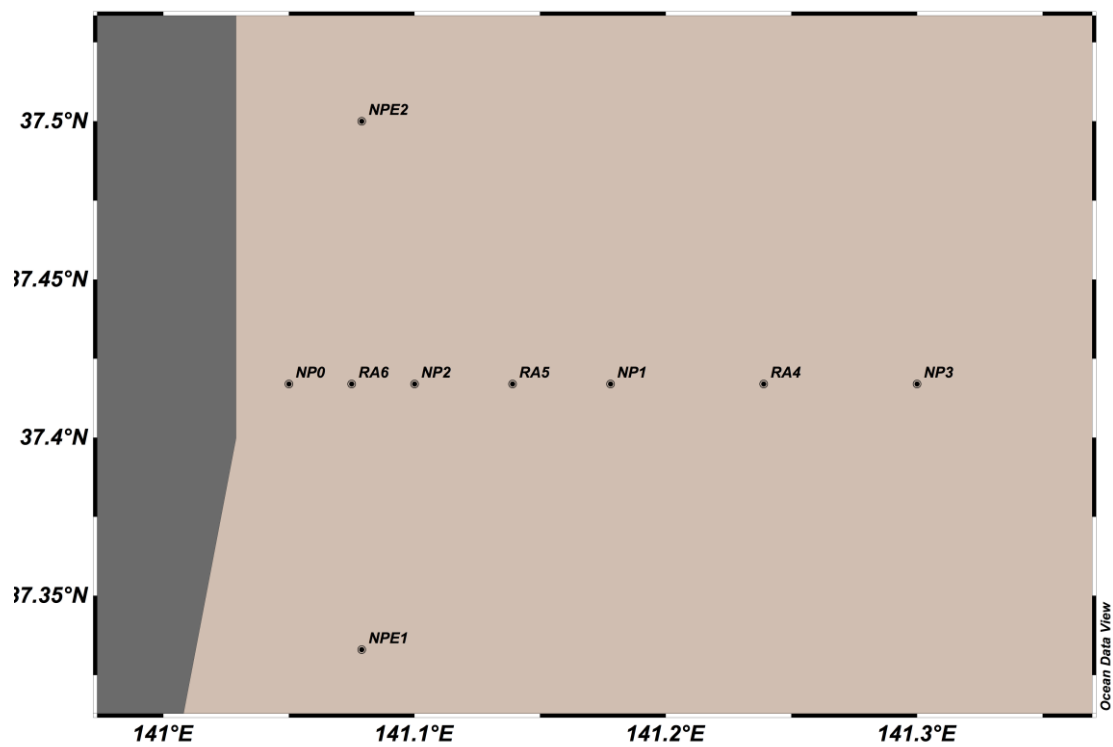
**Figure 1.** Track of the KS14-20 cruise.



**Figure 2.** Detailed track of the KS14-20 cruise.



**Figure 3.** Map of stations sampled for the analyses of radionuclides during the KS14-20 cruise.



**Figure 4.** Zoom of the area of study with stations sampled for the analyses of radionuclides during the KS14-20 cruise.

**Table 4.** *Participants in the KS14-20 cruise.*

Affiliation	Job title	Full name
Tokai University, School of Marine Science and Marine Biology	Professor	Jun Nishikawa (PI)
Tokai University, School of Marine Science and Fisheries,	Graduate student	Yoshihiro Miyamoto
JAMSTEC	Senior technician researcher	Makio Honda
JAMSTEC	Technical researcher	Kazuhiko Matsumoto
Japan Atomic Energy Research Institute, JAEA	Research Sub leader	Shigeyoshi Otsuka
Japan Atomic Energy Research Institute, JAEA	Postdoctoral research fellow	Yuhi Sato
Japan Atomic Energy Research Institute, JAEA	Technician	Erina Takeuchi
Woods Hole Oceanographic Institution, WHOI	Research associate	Paul Henderson
Woods Hole Oceanographic Institution, WHOI	Graduate student	Erin Black
ETH Zurich	Postdoctoral research fellow	Nuria Casacuberta
University of Tokyo-Ocean Research Institute, AORI	Technician	Ryoji Toda
*	Technical observer	1

\* dispatched from the Marine Institute

# 2014 " Shinsei Maru " Research Cruise

KS-14-20

## Procedures Manual

October 2014

Marine engineering center - Operation management section

## 1. Objectives

- The 2014 "Shinsei Maru" joint research cruise
- Subject: Fukushima studies on the distribution of the concentrations of radionuclides concentrations in the food web after the releases to the environment derived from the Fukushima Dai-ichi nuclear power plant accident
- Research proposed by Atsushi Nishikawa (Tokai University Marine Science)

## 2. Dates

- October 17, 2014 (Friday) Aomori Port - October 26, 2014 (Sun) Yokosuka Sumiju. 10 days

## 3. Ship

Name	"Shinsei Maru", 1,629 tons
Ship telephone	090-3023-6867
FAX0	3-6888-5542
Inmarsat	FB 010-870-7731-92757
E-mail address	mail@shinsei.jamstec-rv.jp
Signal marks character	7JOO
IMO ship identification number	IMO9660425

## 4. Sea area (see Attachment 2 survey area Figure)

Tokiwa ocean

## 5. Anchorage site

None

## 6. Organization of the team (see Attachment 4 organization chart)

- (1) Vice President: The research cruise in general
- (2) Chief Researcher: specific plan of investigation, and organization
- (3) Embarked Researcher: obtained data samples, etc., that relating to the implementation of the research that was used.
- (4) Observation technician: Matters related to support of acquisition and research data
- (5) "Shinaomaru" captain and crew: Matters related to operations and support of research work of "Shinaomaru"

## 7. Overview of Research

### *(1) Survey research purposes*

In order to examine the current state of the radioactive contamination that has spread from the Fukushima Dai-ichi nuclear power plant, seabed sediments, plankton, benthos, fish, etc. will be collected and analyzed at the land laboratories. This cruise will focus on analyzing the distribution and behavior of radioactive substances, and investigating settling particles and deposition on the seabed and bioaccumulation through the food web in the autumn off Fukushima waters.

### *(2) Survey Research*

⊖ A Study on the dynamics of radionuclides in Fukushima surrounding waters (iodine, strontium, cesium, radium, etc.)

⊖ Research on plankton, benthos and the migration and accumulation of radionuclides in fish

## 8. Implementation (see attached equipment documentation for details)

- (1) CTD and Niskin water sampling
- (2) Pump water sampling
- (3) Biological samples collected by Noll Pacnet (Twin)
- (4) ORI and plankton collected by net
- (5) IKMT and plankton collected by net
- (6) Bottom sampler by multiple corer
- (7) MOCNESS and plankton collected by net
- (8) Fish harvested by fishing
- (9) Sediment trap: recovery, re-installation
- (10) Suspended particles collected by filtration

## 9. Past work experience

There is a track record in all observations.

## 10. Record of Safety Working Group

2014: 6th Marine Engineering Center already addressed issues regarding the safety of research and waters at the meeting.

## 11. Risk that is feared

Injury accident by falling in the water or with equipment

Measures: awareness of work risks, set pre-arrangements to perform the work.

## 12. Other

### 1) *Safety measures*

- i. JAMSTEC to perform the work in accordance with the "board of guidance".
- ii. We will comply with maritime collision prevention methods during the underwater work
- iii. To stop work during stormy weather and as appropriate according to sea conditions.
- iv. In case of accidents and trouble, the problem will be addressed in accordance with JAMSTEC-defined "accidents and trouble emergency response procedure". (Contact system see Attachment 5)
- v. Carry out research and work in accordance with JAMSTEC-defined "safety standards related to research and work in the submarine cable neighborhood".
- vi. Chief scientist is to carry out observation work according to the "off Fukushima guidelines marine research".
- vii. Sampling of Seawater, plankton, benthos, fish, micro nekton and seabed sediment following established recommendations
- viii. For bottom observation and sampling, laid a waterproof sheet to recovery space under the rear deck gantry, use the appropriate waterproof sheet, contact to other parts of the deck
- ix. Most researchers onboard have the research vessel work experience of at least more than once off the coast of Fukushima nuclear power plant and are familiar with the handling of radioactive nuclides.
- x. Dosimeter for crew and researchers.

### 2) *Permit and notification, etc.*

- i. Coast Guard Headquarters, that has jurisdiction over the waters
- ii. Foreign Exchange and Foreign Trade Law and the permit and notification about the laws and regulations
- iii. Relevant prefectures, fishermen's union and fishermen.
- iv. University of Tokyo Atmosphere and Ocean Research Institute; a special harvest permit application Fukushima Prefecture, Ibaraki Prefecture.
- v. University of Tokyo Atmosphere and Ocean Research Institute; exploration license applications based on two of the Mining Act Article 100 to the Minister of Economy, Trade and Industry.



### **13. Annex**

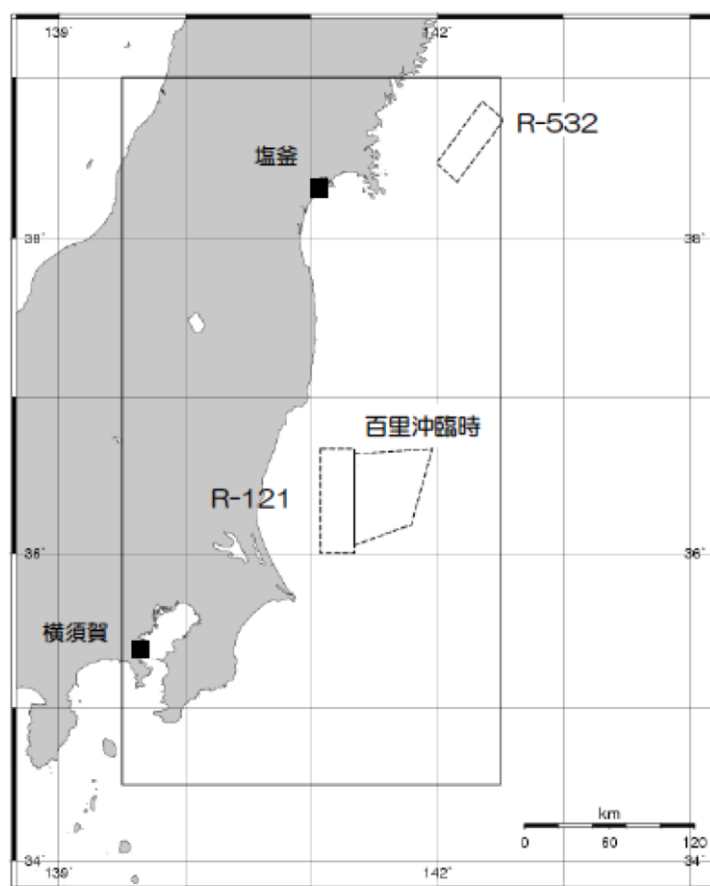
- Attachment 1: Survey Schedule
- Attachment 2: survey area overall view
- Attachment 3: survey area detail view, survey point, implementation content
- Attachment 4: investigation team organization chart
- Attachment 5: Contact system and employees contact list for accidents and trouble
- Attachment 6: passengers roster and contact list
- Reference equipment materials

**KS-14-20 Survey Schedule**

Date (2014)	Movements	Observation waters	Activities
17 October	14:00 Departure	Aomori Port	
18 October			
19 October			CTD, Multiple corer,
20 October			IKMT Net, ORI Net,
21 October			MOCNESS Net,
22 October			Pump water sampling,
23 October			Sediment trap
24 October			recovery and re-
25 October			installation, In situ
26 October	10:00 Arrival	Shiogama Port	filtration

Subject to changes depending on weather and sea conditions

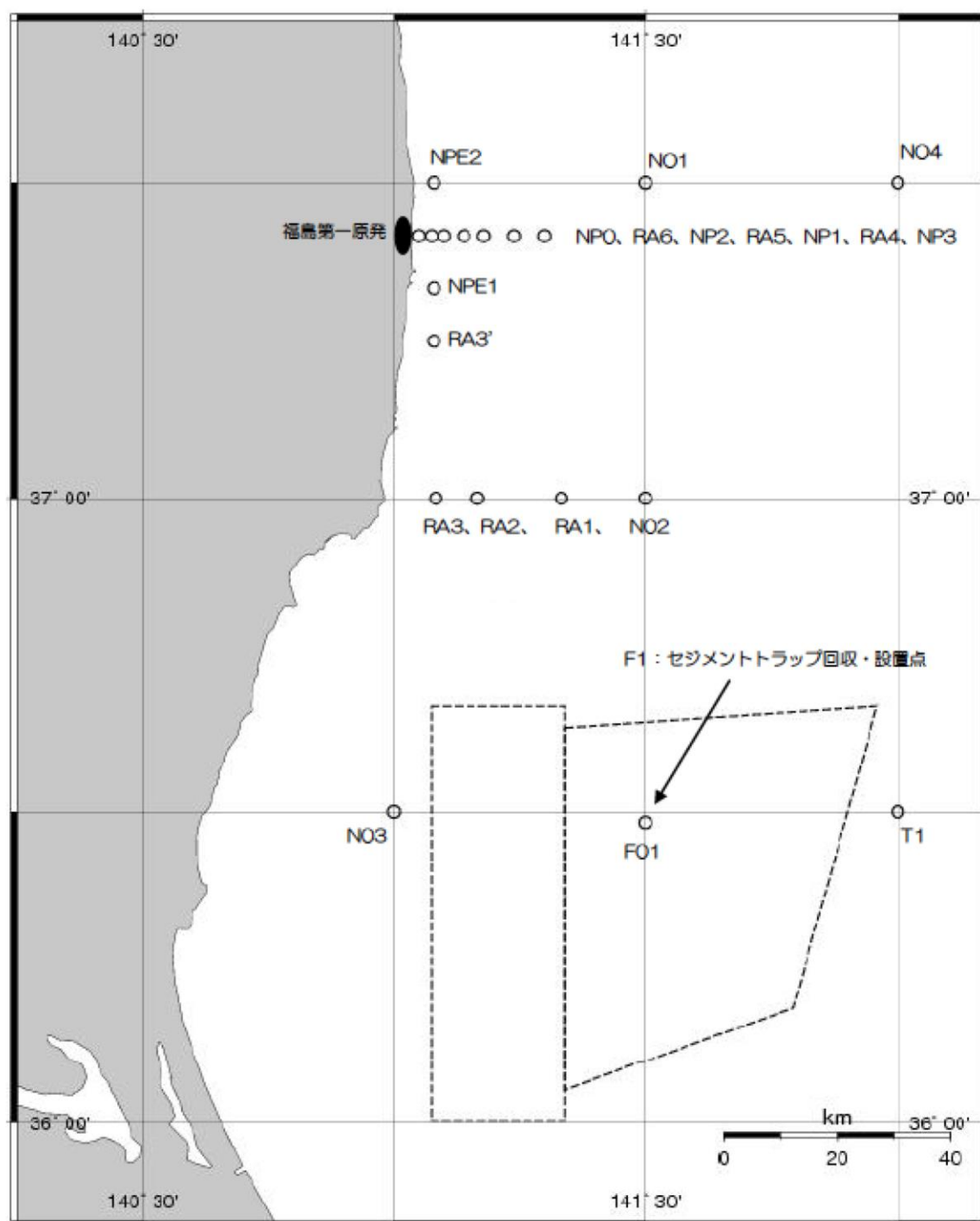
## General view of the survey area



Latitude			Longitude		
34°	30.00	N	139°	30.00	E
34°	30.00	N	142°	30.00	E
39°	00.00	N	142°	30.00	E
39°	00.00	N	139°	30.00	E

Area of work, except for the land and the Sea of Japan within the range surrounded by the above latitude and longitude points. For R-121, R-532 and Baili offshore extraordinary exercise area, study in the waters in the time zone in which exercises are performed is not performed.

## Detail view of the survey area



### Tokiwa offshore survey Stations

Station	Latitude			Longitude			Water depth (m)
N04	37°	30.0	N	142°	0.00	E	518
NO1	37°	30.0	N	141°	30.0	E	155
NPE2	37°	30.0	N	141°	4.75	E	28
NPE1	37°	20.0	N	141°	4.75	E	28
NP0	37°	25.0	N	141°	3.00	E	20
RA6	37°	25.0	N	141°	4.50	E	25
NP2	37°	25.0	N	141°	6.00	E	30
RA5	37°	25.0	N	141°	8.35	E	45
NP1	37°	25.0	N	141°	10.70	E	60
RA4	37°	25.0	N	141°	14.35	E	80
NP3	37°	25.0	N	141°	18.00	E	120
RA3'	37°	15.0	N	141°	4.75	E	30
RA3	37°	0.00	N	141°	5.00	E	90
RA2	37°	0.00	N	141°	10.0	E	129
RA1	37°	0.00	N	141°	20.0	E	166
N02	37°	0.00	N	141°	30.0	E	310
F01	36°	29.0	N	141°	30.0	E	1350
T1	36°	30.0	N	142°	0.00	E	2645
N03	36°	30.0	N	141°	0.00	E	300

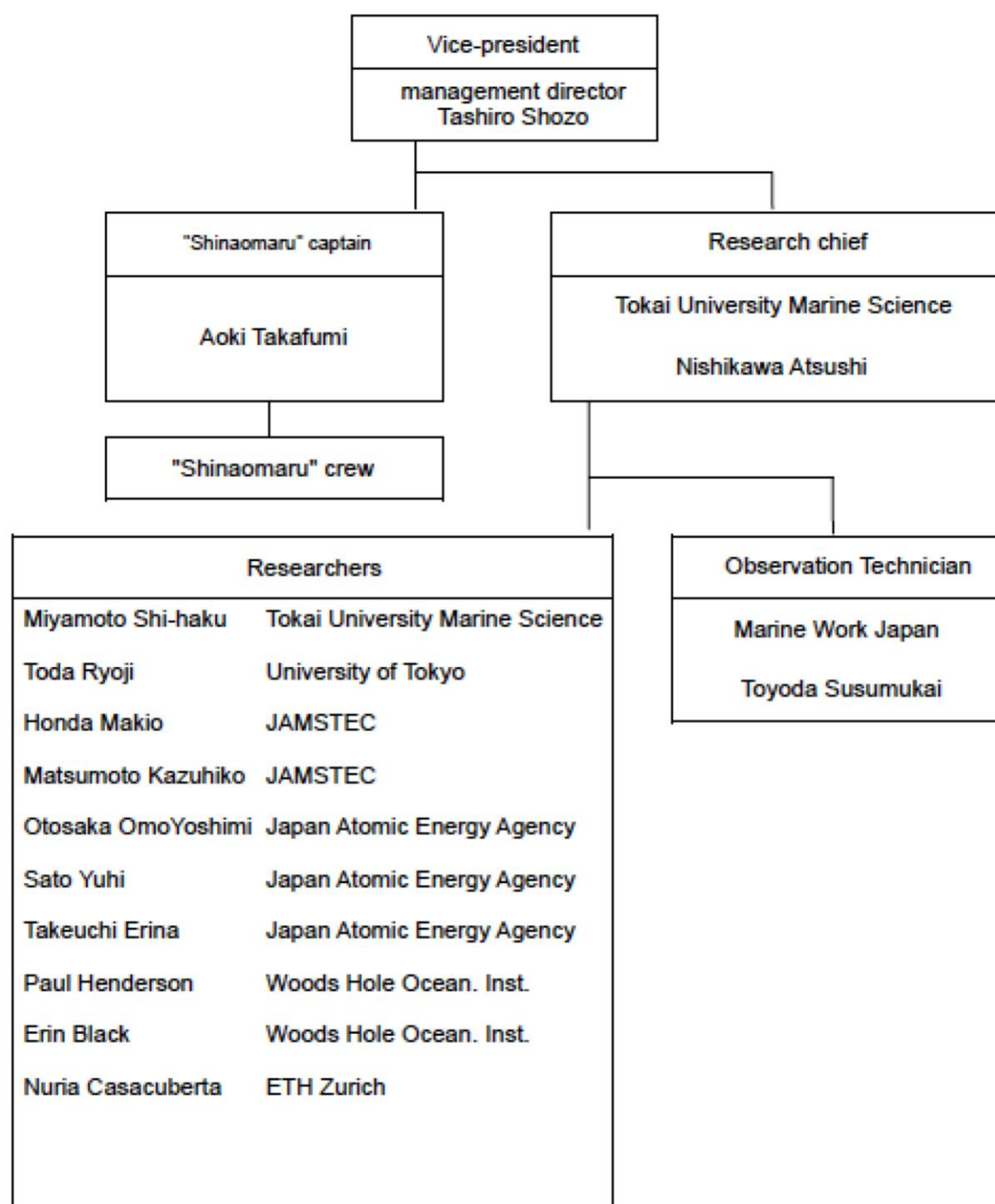
### Sediment trap recovery, re-installation Station

Station	Latitude			Longitude			Water depth (m)
F1	36°	29.0	N	141°	30.00	E	1350

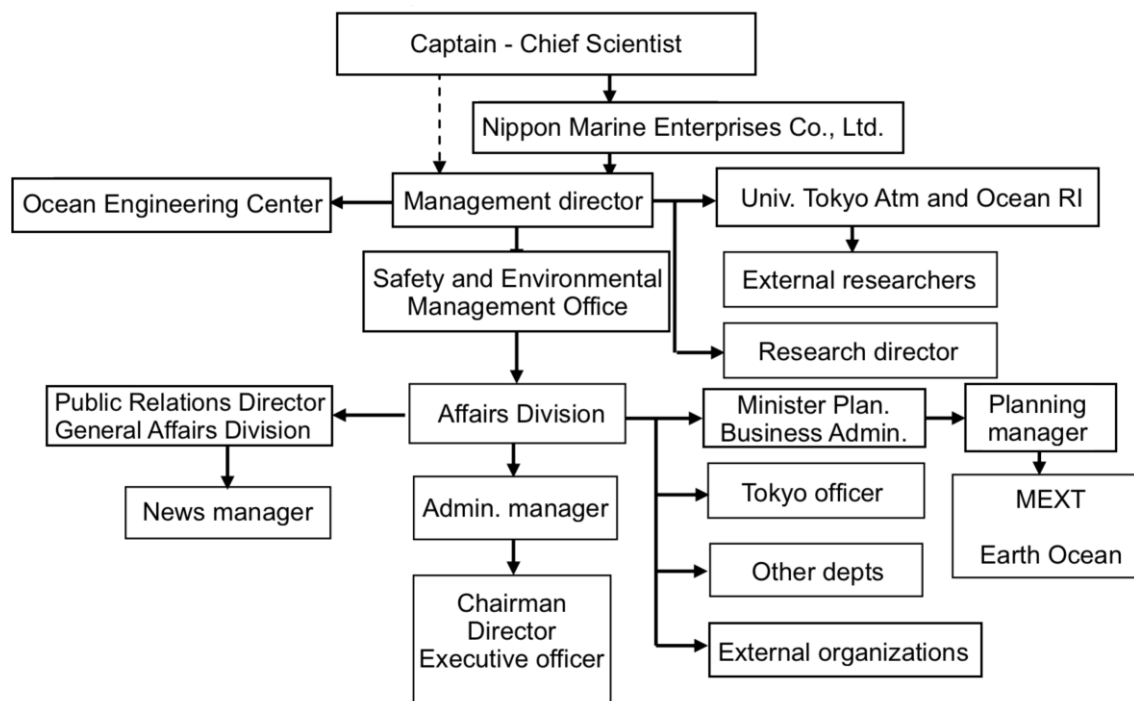
NP0 (water depth 20 m) and nuclear power plant distance of up to (37°25.5N ; 141°02.0E) outside breakwater: 1.100m

(KS-14-6: work experience at NP0 point)

## Survey Team Organization Chart



### The contact system for accidents and trouble

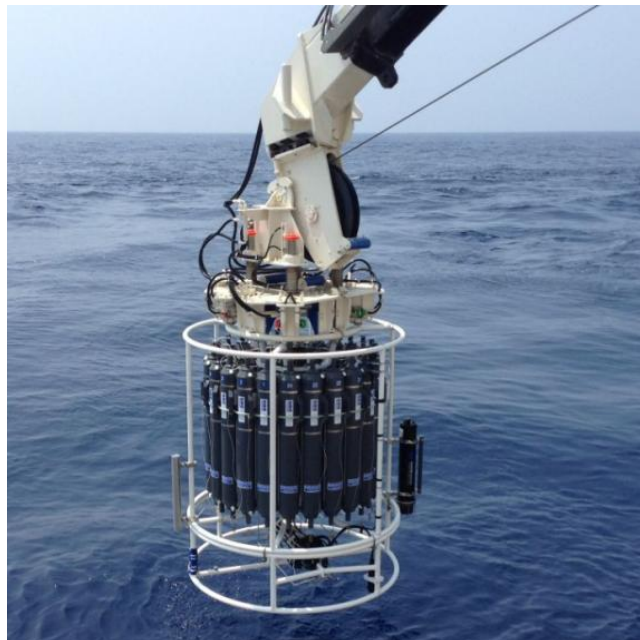


Contact by "officers and employees emergency contact list." If contact department is absent, it may contact the following departments. Also, contact is needed at a later stage.

## Reference equipment

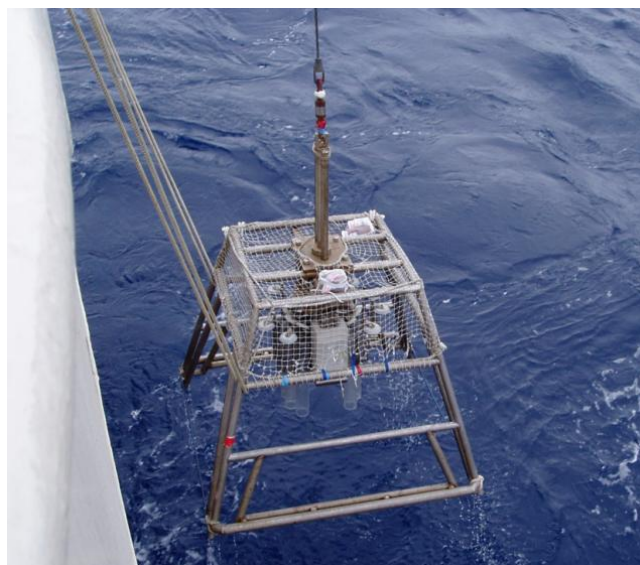
### Material 1

CTD water sampling equipment, CTD cable winch, CTD crane



### Appendix 2

Multiple corer (Air-sea Research ownership), Medium-sized observation wire winch, A-frame crane





### Appendix 3

Noll Pacnet (Twin) (Air-sea Research ownership), Small observation wire winch,  
2 tons crane



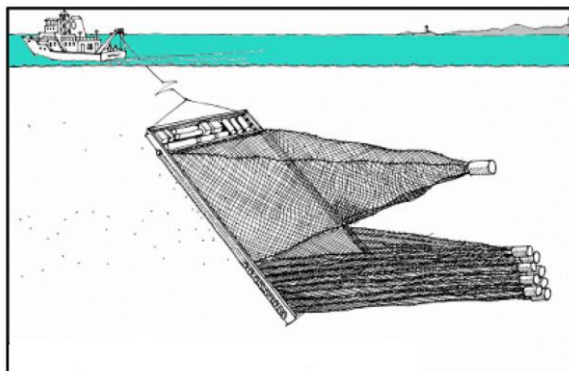
### Appendix 4

ORI net (atmosphere-ocean Research ownership), (0.33 mm / 0.69 mm)  
Medium-sized observation wire winch, A-frame crane



## Appendix 5

MOCNESS net (atmosphere-ocean Research ownership), Medium-sized observation wire winch, A-frame crane



## Appendix 6

IKMT net (atmosphere-ocean Research ownership), Medium-sized observation wire winch, A-frame crane



## Appendix 7

In situ pump (Mutsu-ken Japan Atomic Energy Agency owned), Air weight 51 kg, Water weight 34 kg, Small observation wire winch, 2 tons crane



Sediment trap configuration diagram (MR13-04 voyage in July 2013 installation), Use mooring rope winch

