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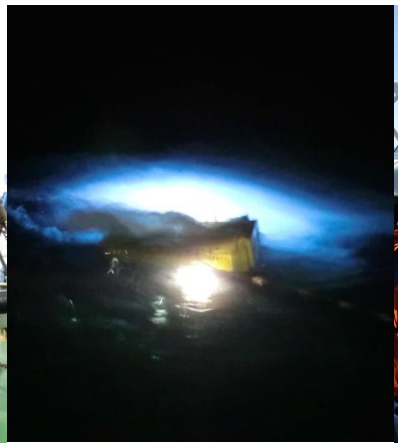
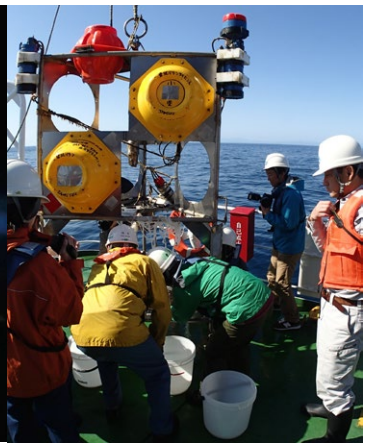
Onboard Report

of the ROV *Hyper-Dolphin 3000* Cruise

off Tohoku

(NT13-21LEG1)

October 6 – 19, 2013

Japan Agency for Marine-Earth Science and Technology

(JAMSTEC)

Cruise ID: NT13-21LEG1

Name of vessel: R/V *Natsushima*

Chief scientist: Yoshihiro FUJIWARA (JAMSTEC)

Representative of the Science Party: Yoshihiro FUJIWARA (JAMSTEC)

Title of proposal: Research on Factors Controlling Open Ocean Benthopelagic Ecosystem Dynamics

Cruise period: October 6-19, 2013

Ports of call: Shiogama Port on October 6, 2013

Shiogama Port on October 19, 2013

Research area: Off Sanriku

Abstract

The ROV *Hyper-Dolphin* dives (dive #1579-1590) were conducted off Tohoku from October 6 to 19, 2013 for understanding of influences of the 2011 Tohoku earthquake on the deep-sea ecosystem as a part of the project "Tohoku Ecosystem-Associated Marine Sciences (TEAMS)." The total numbers of marine tsunami debris were much smaller on flat seafloors than in submarine canyons and the numbers were relatively small deeper than 1,000 m. Fishery resources including *Sebastolobus macrochir*, *Gadus macrocephalus* and *Chionoecetes opilio* were widely distributed in our research areas. Three-dimensional mapping of marine tsunami debris was conducted and the biomass around the debris was measured. Three bio-tracking stations and 10 specimens of snow crabs were deployed on seafloor at a depth of 430 m. A deep-sea lander, which was deployed at a depth of 998 m on August 14, 2012, was safely recovered.

NT13-21 LEG1 onboard report

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1. Dive survey results

1-1. Dive and event list

Dive # Date	Main purposes	Site	Landing Leaving bottom	Latitude (N)	Longitude (E)	Depth (m)
#1579	3D Mapping	Funakoshi submarine canyon	9:05	39-26.220‘N	142-15.2153‘E	428
2013/10/7			11:21	39-26.795‘N	142-14.476‘E	384
#1580	Bio, debris and core sampling	Funakoshi submarine canyon	13:53	39-26.105‘N	142-16.253‘E	543
2013/10/7			16:16	39-26.098‘N	142-16.197‘E	541
#1581	3D Mapping, bio, bris and core sampling	Kamaishi submarine canyon	9:17	39-14.600‘N	142-10.998‘E	438
2013/10/8			11:59	39-14.646‘N	142-10.531‘E	413
#1582	3D Mapping, bio, bris and core sampling	Kamaishi ubmarine canyon	14:12	39-14.707‘N	142-14.440‘E	533
2013/10/8			16:16	39-14.840‘N	142-14.163‘E	532
#1583	Finding of point and bio sampling for biotracking	Off Miyako	8:10	39-36.950‘N	142-15.879‘E	469
2013/10/9			11:17	39-36.994‘N	142-15.601‘E	440
#1584	Finding of point and bio sampling for biotracking	South of Kamaishi submarine canyon	7:58	39-11.406‘N	142-11.422‘E	435
2013/10/11			10:01	39-11.459‘N	142-11.164‘E	425
2013/10/11	Release of biotracking sysytem #1 (3C-1)	South of Kamaishi submarine canyon	Landing 11:22	39-11.717'N	142-11.426'E	452
			position	39-11.566'N	142-11.569'E	445
2013/10/11	Release of biotracking sysytem #2 (1A-1)	South of Kamaishi submarine canyon	Landing 11:43	39-11.618'N	142-11.347'E	444
			position	39-11.733'N	142-11.409'E	434
2013/10/11	Release of biotracking sysytem #3 (2B-1)	South of Kamaishi submarine canyon	Landing 11:54	39-11.444'N	142-11.226'E	447
			position	39-11.532'N	142-11.368'E	439
#1585	Release of samples (*Chinoecetes opilio*) for biotracking and 3D mapping	South of Kamaishi submarine canyon	14:34	39-11.628‘N	142-11.441‘E	435
2013/10/12			16:17	39-11.736‘N	142-11.405‘E	430
#1586	3D Mapping, bio, bris and core sampling	Off Kesen-numa	8:48	38-54.224‘N	141-54.083‘E	155
2013/10/13			16:12	38-54.373‘N	141-54.258‘E	159
#1587	Recovery of lander	Off Ohduchi	8:35	39-19.922‘N	142-27.514‘E	987
2013/10/14			9:35	39-19.992‘N	142-27.500‘E	988
			Recovery 9:41			958
#1588	Recovery of biotracking system (#2)	South of Kamaishi submarine canyon	14:17	39-11.788‘N	142-11.389‘E	430
2013/10/14			15:00	39-11.788‘N	142-11.389‘E	432
#1589	Recovery of biotracking system (#1, #3)	South of Kamaishi submarine canyon	18:13	39-11.602‘N	142-11.569‘E	439
2013/10/14			19:21	39-11.541‘N	142-11.374‘E	432
			Recovery 19:26			432
#1590	3D Mapping, bio, bris and core sampling	Kamaishi submarine canyon	10:07	39-01.009‘N	142-34.955‘E	1228
2013/10/18			15:55	39-10.367‘N	142-33.270‘E	1142

1-2. Preliminary results

Dive number: HD#1579

Date: October 7, 2013

Site: Funakoshi submarine canyon, off Ohtsuchi

Chief observer: Yoshihiro FUJIWARA (JAMSTEC)

Main purposes: Observation and sampling of marine tsunami debris and its associated fauna

Payload equipment:

1.	seaXerocks	1
2.	Suction sampler & multiple canisters	1
3.	Sampling box	2
4.	MBARI corer	3
5.	Marker	3

Dive summary

A little marine tsunami debris was observed. Benthic organisms were sparse and artificial trails, probably due to fishing activities, were observed. The 3D mapping system “seaXerocks” worked well at an altitude of 4 meters. No biological and sediment sampling were conducted.

1-2. Preliminary results

Dive number: HD#1580

Date: October 7, 2013

Site: Funakoshi submarine canyon, off Ohtsuchi

Chief observer: Yoshihiro FUJIWARA (JAMSTEC)

Main purposes: 3D mapping around marine tsunami debris and sampling of the debris and its associated fauna

Payload equipment:

1. seaXerocks	1
2. Suction sampler & multiple canisters	1
3. Sampling box	2
4. MBARI corer	3
5. Marker	3

Dive summary

Several patches of marine tsunami debris were observed, which were composed of wood, clothes, rugs, ropes, cans, and the others. A 3D mapping using seaXerocks was conducted in a range of 30 by 30 meters. Many benthic organisms associated with the debris were collected using a suction sampler. Three MBARI cores were collected; two were collected beside the debris and the other 5 m away from the debris as a reference. Squared lumber, a sheet of plywood, a rubber globe and several beer cans were collected.

1-2. Preliminary results

Dive number: HD#1581

Date: October 8, 2013

Site: Kamaishi Submarine Canyon, off Ohtsuchi

Chief observer: Yoshimi TAKAHASHI (JAMSTEC)

Main purposes: Observation and sampling of marine tsunami debris and its associated fauna

Payload equipment:

1. seaXerocks	1
2. Suction sampler & multiple canisters	1
3. Sampling box	2
4. MBARI corer	3
5. Marker	3

Dive summary

Marine tsunami debris was scattered on seafloor in this canyon. A certain population of Chionoecetes opilio was observed primarily in association with Liponema brevicornis. This location seemed to be a nice place to deploy a bio-tracking system used for tracking of C. opilio but the deployment was canceled due to a relatively new, floating, long rope (>300 meters) found during this dive. No biological and sediment sampling were conducted.

1-2. Preliminary results

Dive number: HD#1582

Date: October 8, 2013

Site: Kamaishi submarine canyon, off Ohtsuchi

Chief observer: Yoshimi TAKAHASHI (JAMSTEC)

Main purposes: Observation and sampling of marine tsunami debris and its associated fauna

Payload equipment:

1. seaXerocks	1
2. Suction sampler & multiple canisters	1
3. Sampling box	2
4. MBARI corer	3
5. Marker	3

Dive summary

Many patches of marine tsunami debris were observed in the Kamaishi Submarine Canyon. The canyon walls were very steep and a dense population of benthic organisms was found around the canyon. A 3D mapping was unable due to the steep topographic structures. Biological sampling was conducted using a suction sampler. No sediment coring was conducted.

1-2. Preliminary results

Dive number: HD#1583

Date: October 9, 2013

Site: off Miyako

Chief observer: Shinji TSUCHIDA (JAMSTEC)

Main purposes: Observation and sampling of marine tsunami debris and its associated fauna

Payload equipment:

1. seaXerocks	1
2. Suction sampler & multiple canisters	1
3. Sampling box	2
4. MBARI corer	3
5. Marker	3

Dive summary

Diving point is a kind of small valley around 6 miles in length from 300 to 600m depths off Miyako. We explored this site for a half-day dive and observed dense patch of ophiuroid starfishes, holothurians, squids, Sebastolobus fish (Kichiji), Godus fish (Madara), and so on, but not snow crabs. Unfortunately this site was not a candidate for bio-tracking survey area because of so many deployed ropes (probably for Haena fishing) were found.

1-2. Preliminary results

Dive number: HD#1584

Date: October 11, 2013

Site: Kamaishi submarine canyon at Sanriku

Chief observer: Yasuo FURUSHIMA (JAMSTEC)

Main purposes: The purposes of this submarine voyage are as follows.

- Retrieval of the base station establishment point of the biotracking system.
- Sampling of the snow crab to use for a biotracking system
- Test of the electronic flash of the 3D mapping system

Payload equipment:

1. seaXerocks	1
1. Suction sampler & multiple canisters	1
2. Sampling box	1
3. MBARI corer	3

Dive summary

The hyper dolphin drifted to the bottom with 435 m depth. The bottom was muddy, and the bottom surface was covered by ophiuroid star fish. Many snow crabs and Liponematid actiniaria were observed. The hyper dolphin went ahead from the grounding point to the west, and collected 12 snow crabs using Suction sampler. While moving, plankton of the intermediate water was sampled with Suction sampler. Finally experimented the electronic flash of seaXerocks in 5m, 4m and 3m depth.

1-2. Preliminary results

Dive number: HD#1585

Date: October 12, 2013

Site: Off Sanriku-oki

Chief observer: Yuya NISHIDA (IIS)

Main purposes: Releasing snow crabs and ballasts with a pinger, observation of three stations, and 3D mapping.

Payload equipment:

1.	seaXerocks	1
2.	Suction sampler & multiple canisters	1
3.	Sampling box	2
4.	MBARI corer	3
5.	Marker	3
6.	Marker with a pinger	10
7.	Snow crab with a pinger	10

- ***Dive summary***

  Ten snow crabs with a pinger were released on the center point of the triangle constructed by three stations which were deployed by free-fall on the bottom at Oct. 11th, 2013. Ten markers with a pinger were dropped on the seafloor near stations. And stations for bio-tracking system were observed by camera mounted on “Hyper-Dolphin”. During navigating between stations, 3D mapping system was worked at an altitude of 4.5m.

1-2. Preliminary results

Dive number: HD#1586

Date: October 13, 2013

Site: Off Kesen-numa

Chief observer: Sakiko ORUI (JAMSTEC)

Main purposes: 3D mapping around marine tsunami debris and sampling of the debris and its associated fauna

1. ***Payload equipment:***
2. seaXerocks 1
3. Suction sampler & multiple canisters 1
4. Sampling box 2
5. MBARI corer 3
6. Marker 3

- ***Dive summary***

Several remarkable structures had been found on the flat seafloor off Kesen-numa using a side-scan sonar in March 2013. Two of them were observed during this dive. Southern most structure was a big rock, which was inhabited by many organisms, like a fish shelter. The other was a long tree. The biomass around the tree was much larger than that in the surrounding environments. 3D mapping were conducted using seaXerocks in several regions but one of the cameras, that took images of a laser line, did not work. Three MBARI cores were collected; one at 2 m away from the tree and two at beside the tree. Organisms associated with the tree were collected on/around the tree using a suction sampler.

1-2. Preliminary results

Dive number: HD#1587

Date: October 14, 2013

Site: Off Otsuchi 1000m Lander points

Chief observer: Yasuo FURUSHIMA (JAMSTEC)

Main purposes: The purposes of this submarine voyage are as follows.

- Recovery of the lander system
- Sea-bottom observation

Payload equipment:

1.	seaXerocks	1
2.	Suction sampler & multiple canisters	1
3.	Sampling box	1
4.	MBARI corer	3

Dive summary

Carried out the recovery of the lander system which we installed in August, 2012. Before the recovery of the lander system, carried out neighboring sea-bottom observation. The bottom was muddy, and the bottom surface was covered by ophiuroid star fish.

1-2. Preliminary results

Dive number: HD#1588

Date: October 14, 2013

Site: off Touni

Chief observer: Shinji TSUCHIDA (JAMSTEC)

Main purposes: Observation and sampling of marine tsunami debris and its associated fauna

Payload equipment:

1. seaXerocks	1
2. Snap shackle with rope	2
3. Weight	1

Dive summary

This dive was performed to recover the bio-tracking base station, which didn't ascend by transponder releasing command. HPD landed at the north about 100m far from the No.2 station. We approached to it using ROV homer and easily found. At the front of the station, we carefully observed the position of buoy, flames, and ropes. Then we fucked the snap shackle with rope on the ring rope attached on the buoy and flame. Finally we succeeded to recover the No.2 bio-tracking base station.

1-2. Preliminary results

Dive number: HD#1589

Date: October 14, 2013

Site: off Touni

Chief observer: Shinji TSUCHIDA (JAMSTEC)

Main purposes: Observation and sampling of marine tsunami debris and its associated fauna

Payload equipment:

1. seaXerocks	1
2. Snap shackle with rope	2
3. Weight	1

Dive summary

This dive was performed to recover the bio-tracking base stations No.1 and 3. HPD landed at the north about 50m far from the No.1 station. We approached to it using ROV homer and easily found. At the front of the station, we carefully observed the position of buoy, flames, and ropes. Then we grasped the rope of the station by HPD manipulator and brought it to the station No.3. Also, we checked the station No.3 carefully put the No.2 beside the No.3. Then we fucked the two shackles with rope on the frame of No.2 and 3 respectively and ascended to the surface. We succeeded to recover the No.1 and 3 stations on the deck of Natsushima.

1-2. Preliminary results

Dive number: HD#1590

Date: October 18, 2013

Site: Kamaishi submarine canyon

Chief observer: Yuya Nishida (IIS)

Main purposes: Observation and sampling of marine creatures.

Payload equipment:

1. seaXerocks	1
2. Suction sampler & multiple canisters	1
3. Sampling box	2
4. MBARI corer	3
5. Marker	3

Dive summary

In this dive, we surveyed oceans trench of about 1,200m depth to find the rubble. The HPD cruised westward along the trench after reaching the seafloor. Although seawater around the seafloor point was muddy by the typhoon, hi-vision camera of the HPD took a clear image of the seafloor in the latter half of the survey. The HPD took the image of several creatures and caught the creatures such as marine sponge and the galatheoidea.

1-3. Payload list with photographs

NT13-21 (Dive 1579) Oct. 7th , 2013

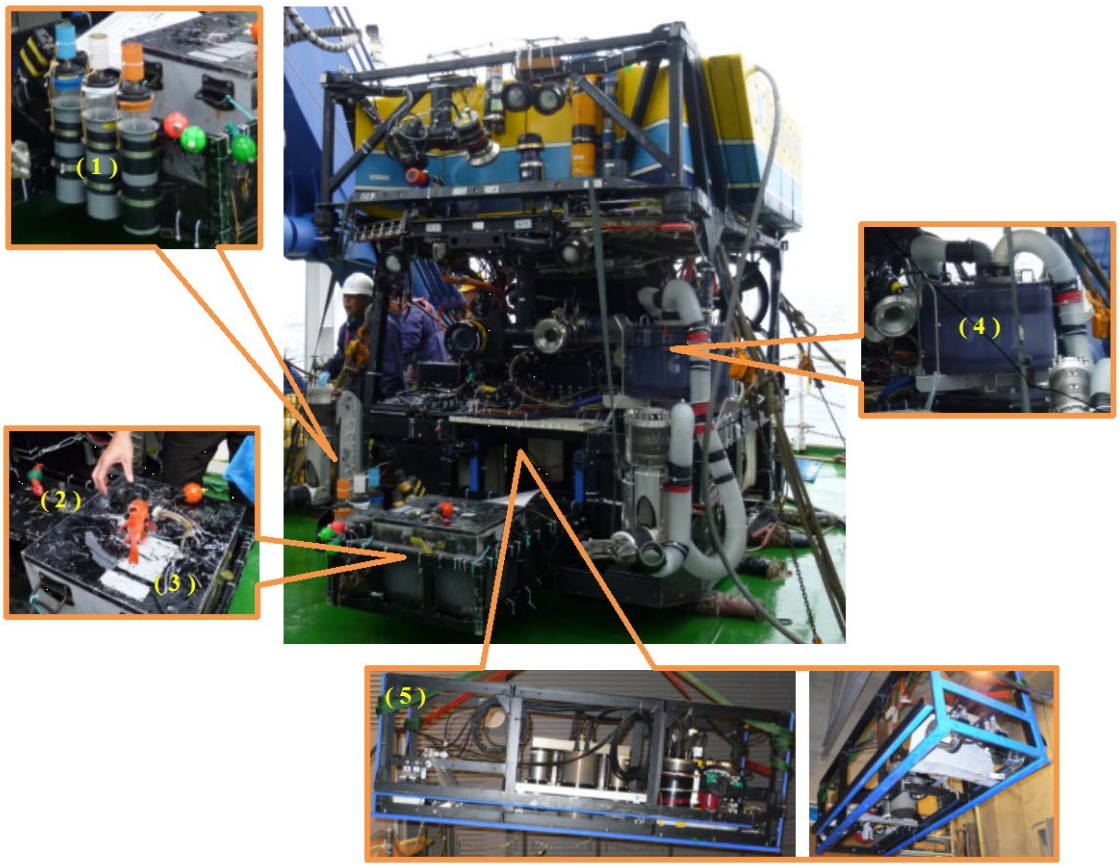

Table Devices mounted on HPD

Payload	QTY.
(1) MBARI-type core sampler	3
(2) Sample box (small)	1
(3) Sample box (big)	1
(4) Suction sampler system	1
(5) 3D mapping system	1

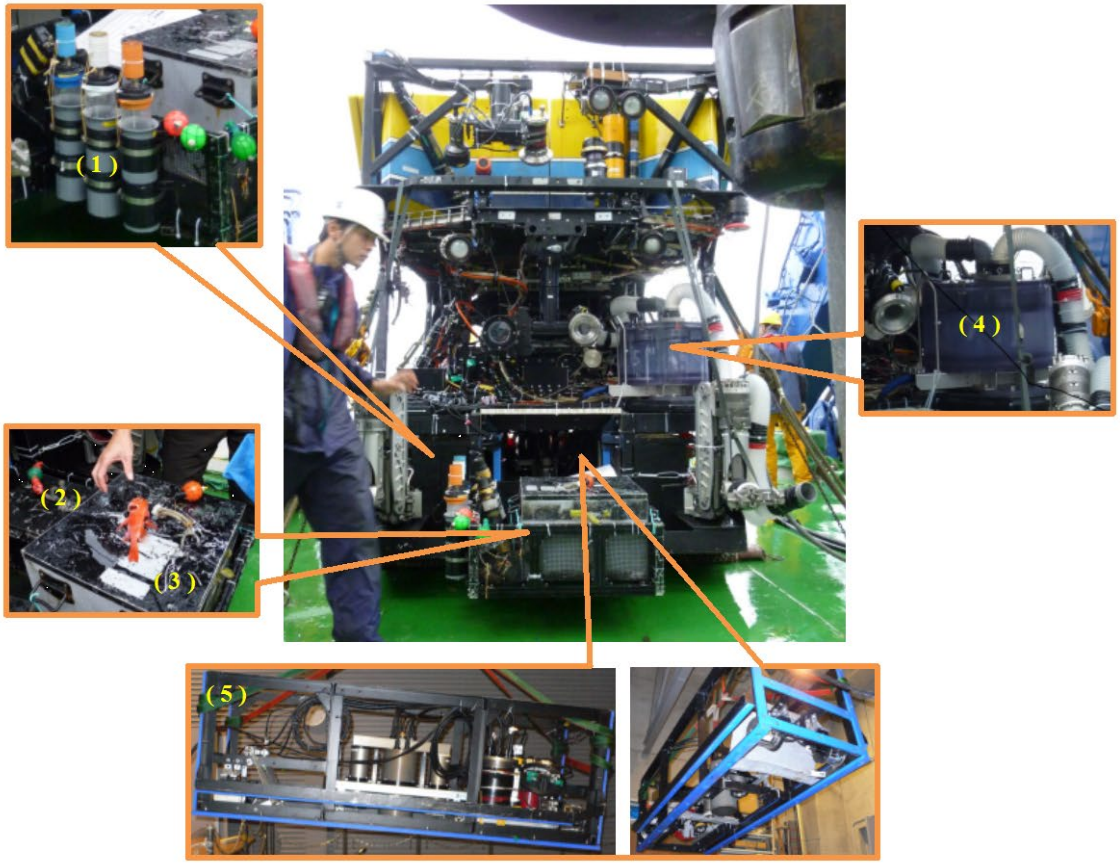

Table Devices mounted on HPD

Payload	QTY.
(1) MBARI-type core sampler	3
(2) Sample box (small)	1
(3) Sample box (big)	1
(4) Suction sampler system	1
(5) 3D mapping system	1

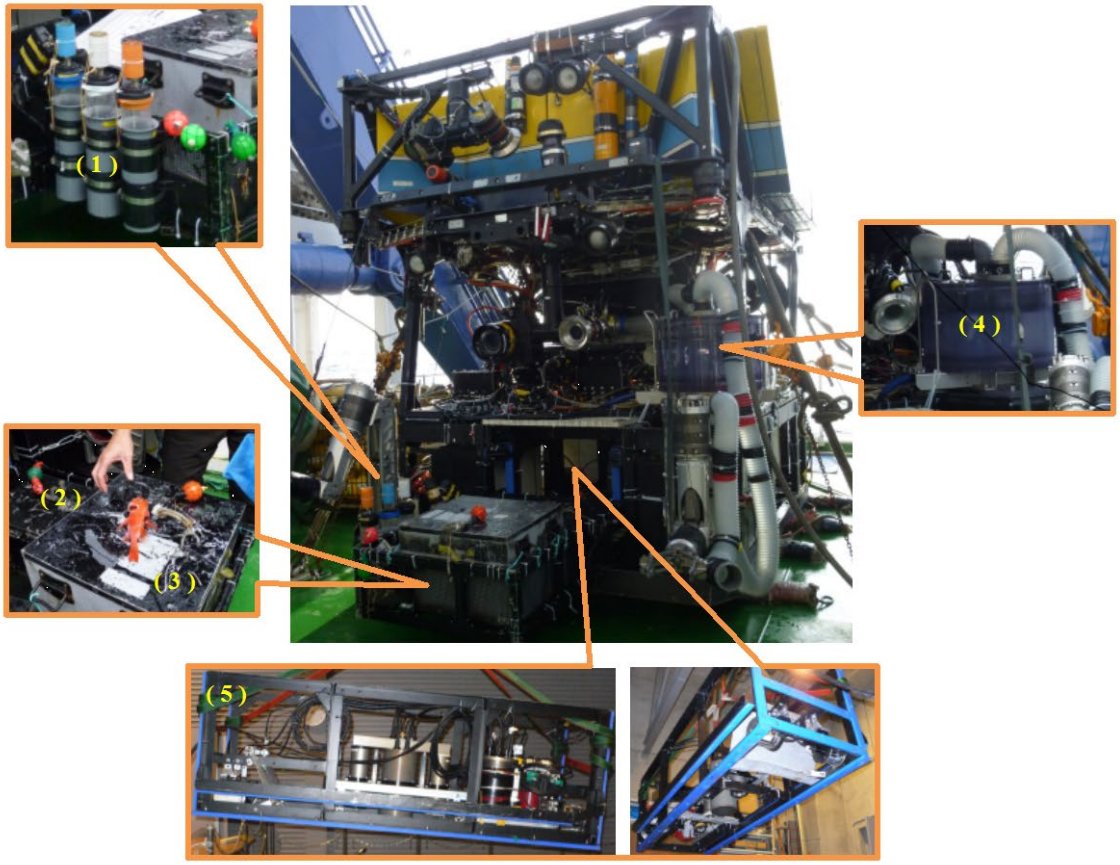

Table Devices mounted on HPD

Payload	QTY.
(1) MBARI-type core sampler	3
(2) Sample box (small)	1
(3) Sample box (big)	1
(4) Suction sampler system	1
(5) 3D mapping system	1

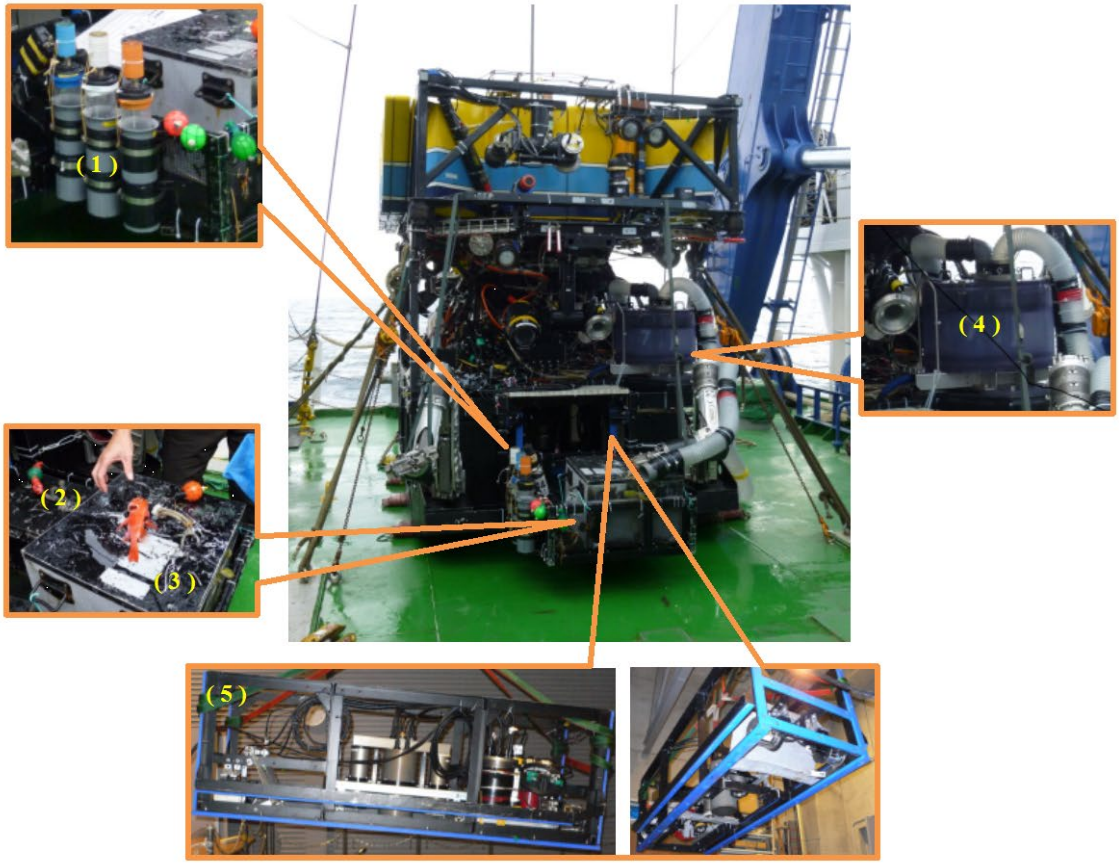

Table Devices mounted on HPD

Payload	QTY.
(1) MBARI-type core sampler	3
(2) Sample box (small)	1
(3) Sample box (big)	1
(4) Suction sampler system	1
(5) 3D mapping system	1

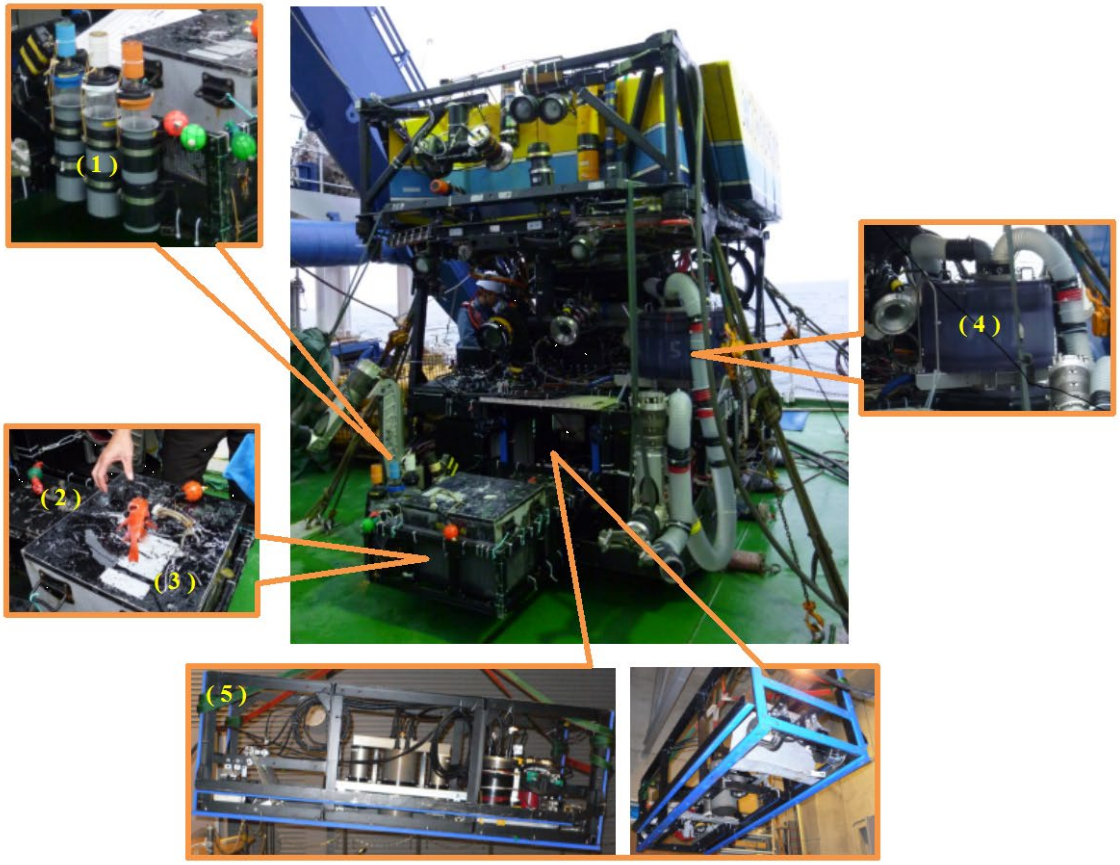

Table Devices mounted on HPD

Payload	QTY.
(1) MBARI-type core sampler	3
(2) Sample box (small)	1
(3) Sample box (big)	1
(4) Suction sampler system	1
(5) 3D mapping system	1

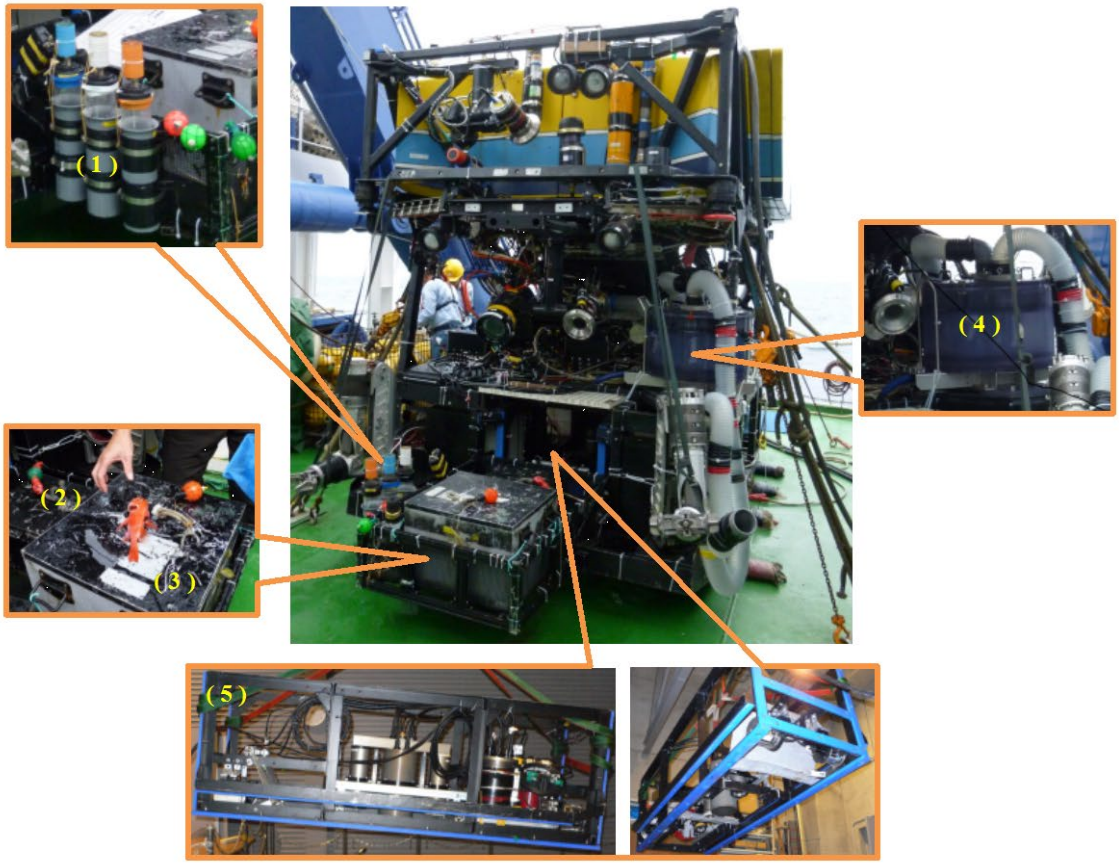

Table Devices mounted on HPD

Payload	QTY.
(1) MBARI-type core sampler	3
(2) Sample box (small)	1
(3) Sample box (big)	1
(4) Suction sampler system	1
(5) 3D mapping system	1

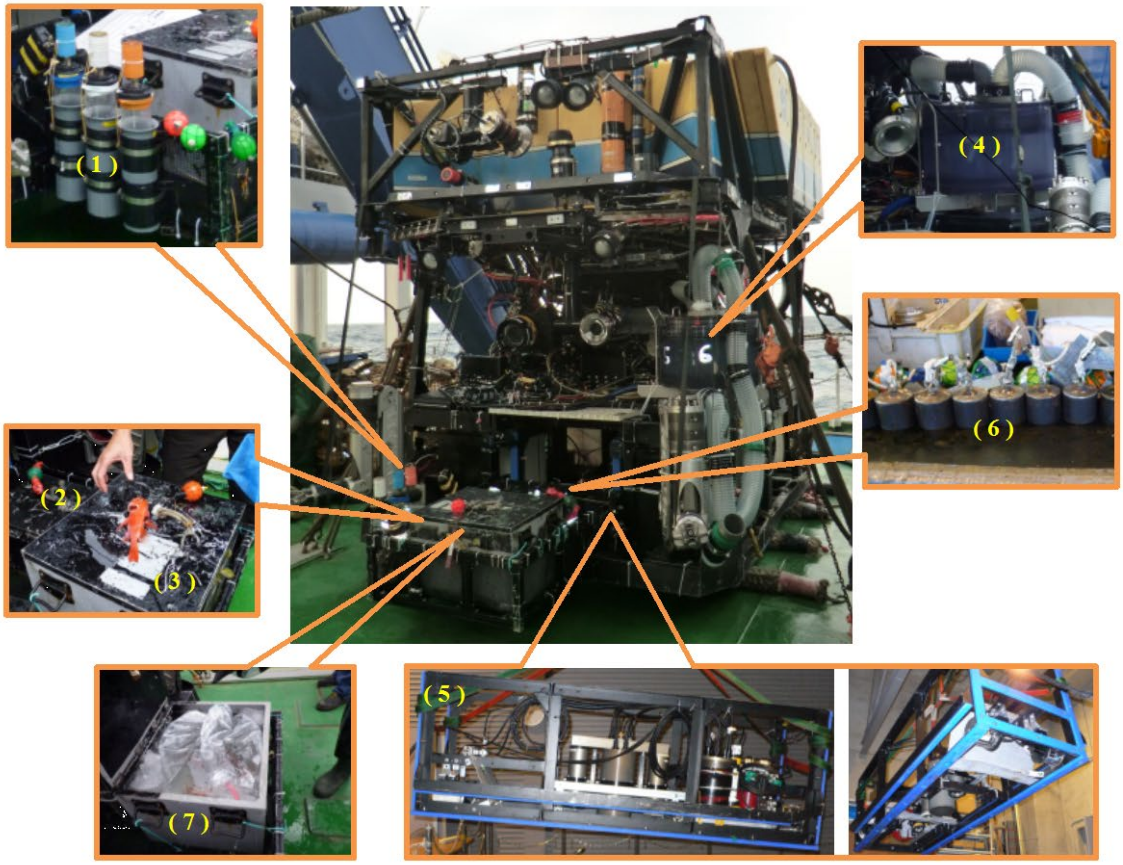

Table Devices mounted on HPD

Payload	QTY.
(1) MBARI-type core sampler	3
(2) Sample box (small)	1
(3) Sample box (big)	1
(4) Suction sampler system	1
(5) 3D mapping system	1
(6) Ballast with a pinger	10
(7) Snow crabs with a pinger	10

Table Devices mounted on HPD

Payload	QTY.
(1) MBARI-type core sampler	3
(2) Sample box (small)	1
(3) Sample box (big)	1
(4) Suction sampler system	1
(5) 3D mapping system	1

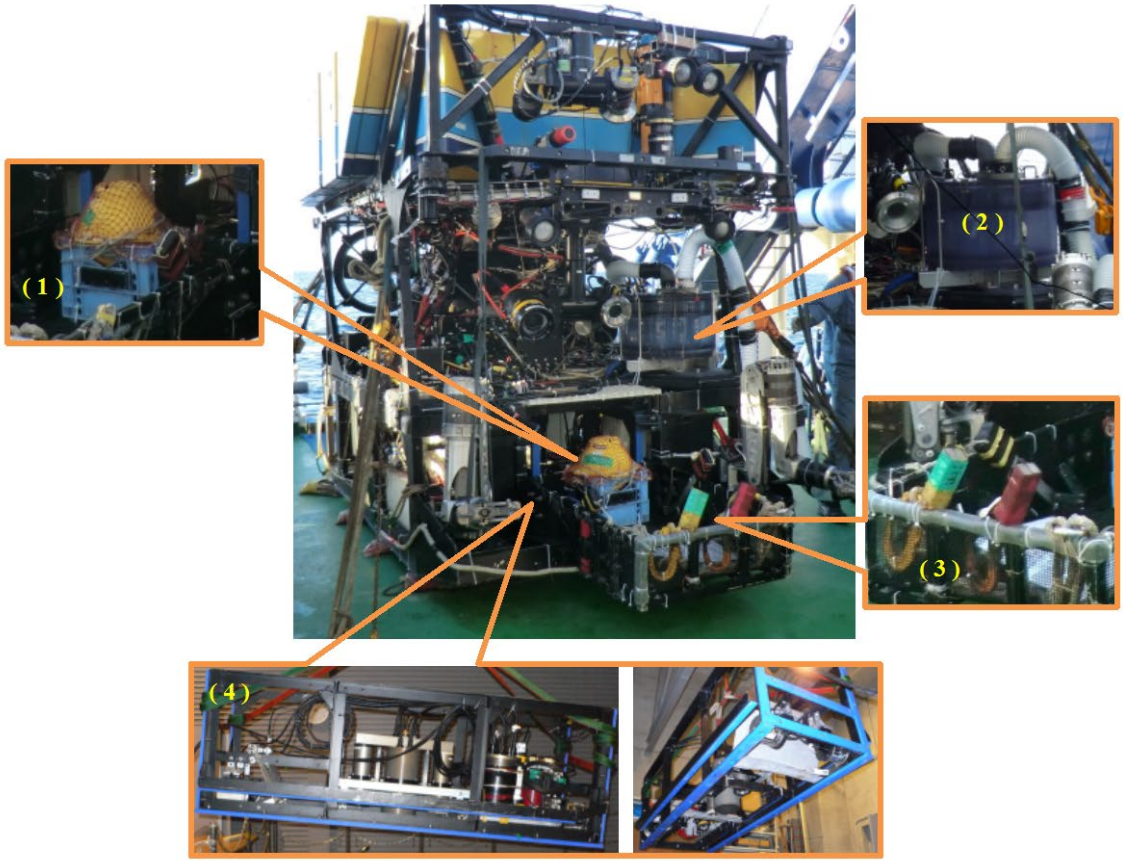

Table Devices mounted on HPD

Payload	QTY.
(1) Floater	3
(2) Suction sampler system	1
(3) Rope for salvage	2
(4) 3D mapping system	1

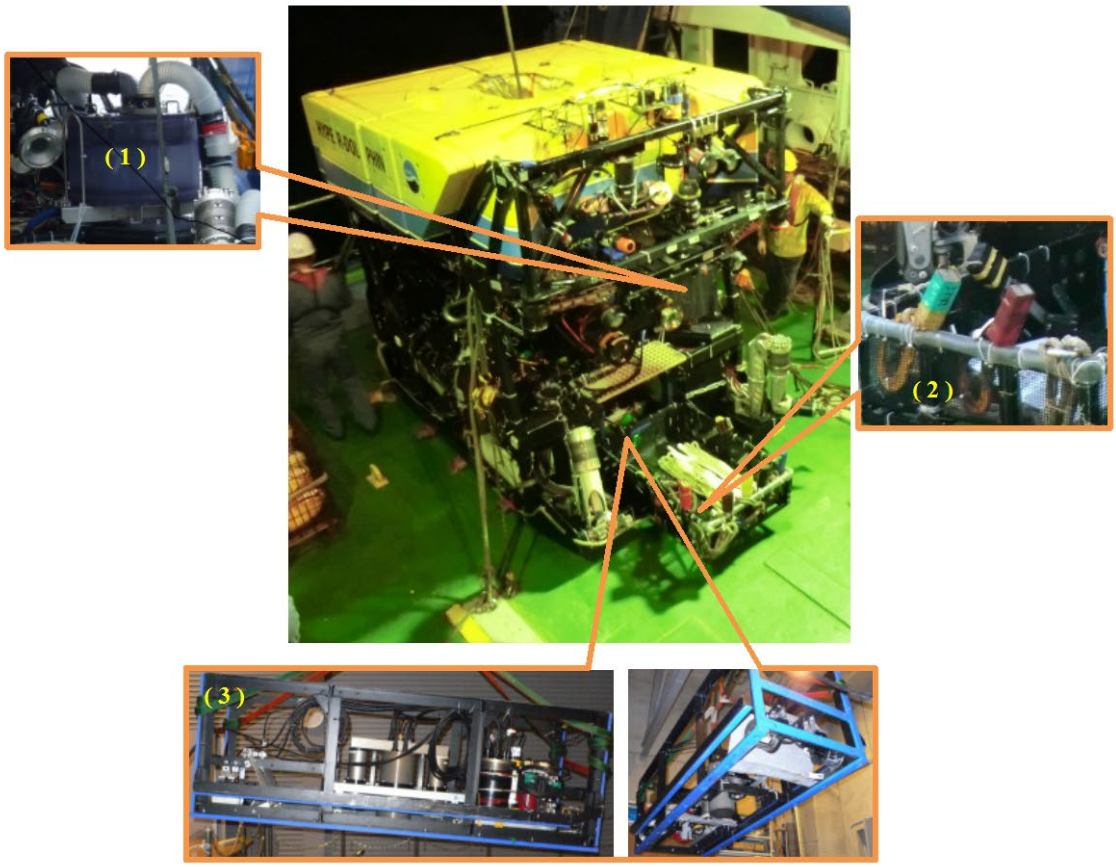

Table Devices mounted on HPD

Payload	QTY.
(1) Suction sampler system	1
(2) Rope for salvage	3
(3) 3D mapping system	1

※潜航前に写真を撮るのを忘れていた

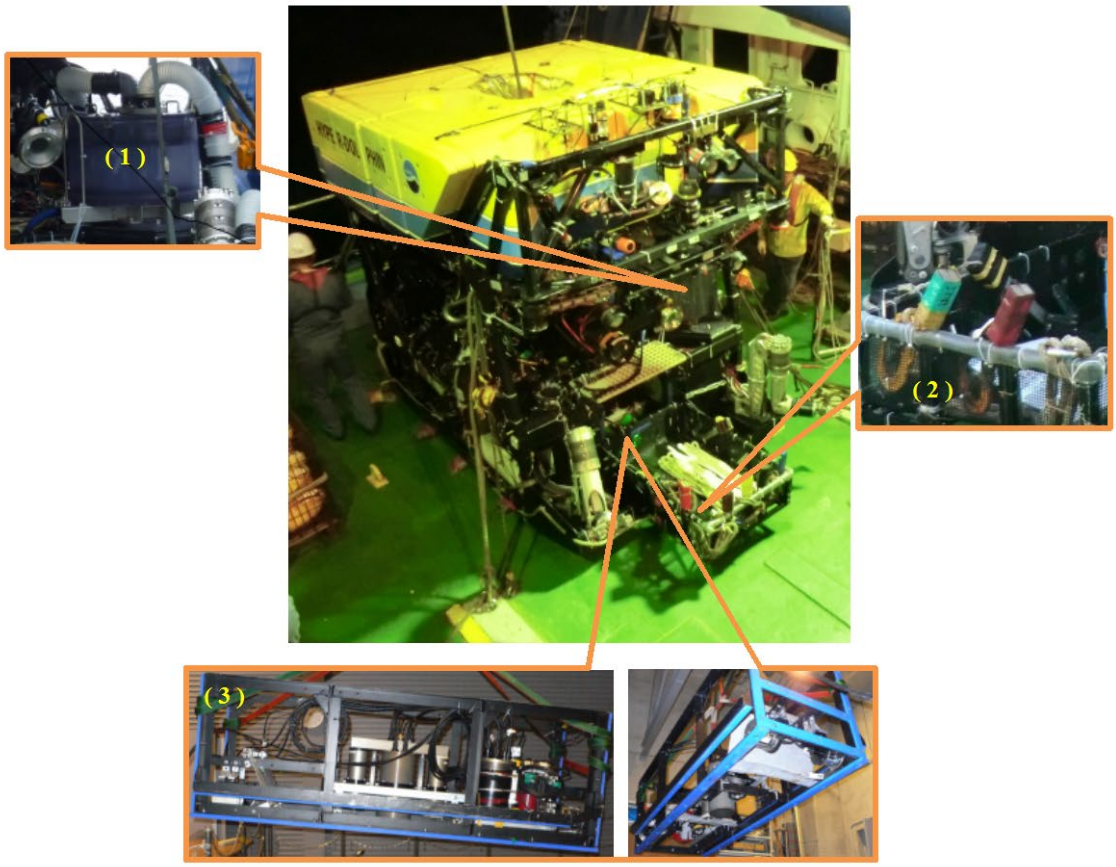

Table Devices mounted on HPD

Payload	QTY.
(1) Suction sampler system	1
(2) Rope for salvage	3
(3) 3D mapping system	1

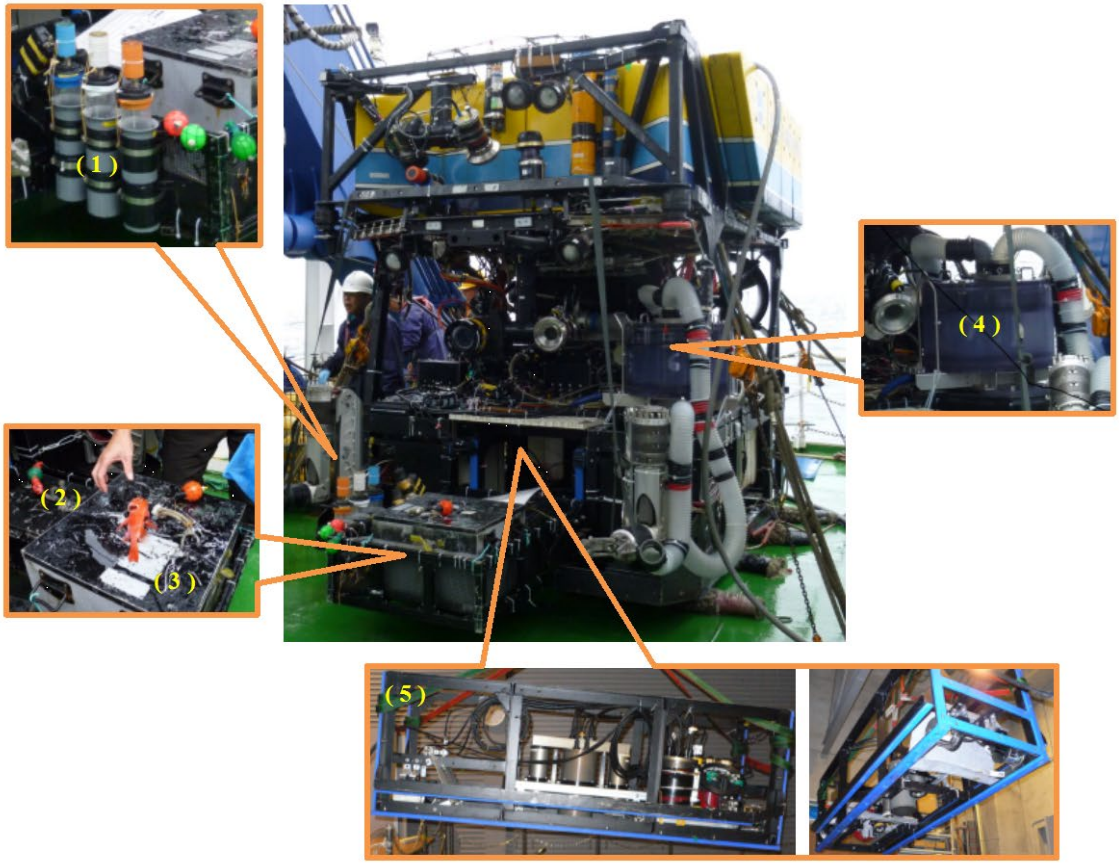

Table Devices mounted on HPD

Payload	QTY.
(1) MBARI-type core sampler	3
(2) Sample box (small)	1
(3) Sample box (big)	1
(4) Suction sampler system	1
(5) 3D mapping system	1

2. 3D mapping survey

The 3D image mapping was primarily carried out in four locations during the cruise. On the first dive HPD#1580 on 2013/10/7 a 30mx 30m area with tsunami debris was surveyed. An altitude of 4m meter was maintained during the mapping and a lawnmower pattern survey was made at an average speed of 30cm/s. The survey took about 30min to complete. During the survey one camera was used to capture the sheet laser images at a frame rate of 15fps and another camera was used to capture flash illuminated images are a slow rate of 1 frame every 6seconds. A total of 8 transects were made to cover the 30mx30m area. To assist ROV pilot to make accurate transects and specially developed software called robotstate was used. The robot state program receives the DVL data in real time and updates the position of the ROV on a GUI at a rate of 3Hz. A screen shot of the GUI during the survey is shown in Fig. 1. It is possible to feed in the length and breadth of the area to be surveyed and the program plots the transects on the screen. The expected speed of ROV during survey can be input and the

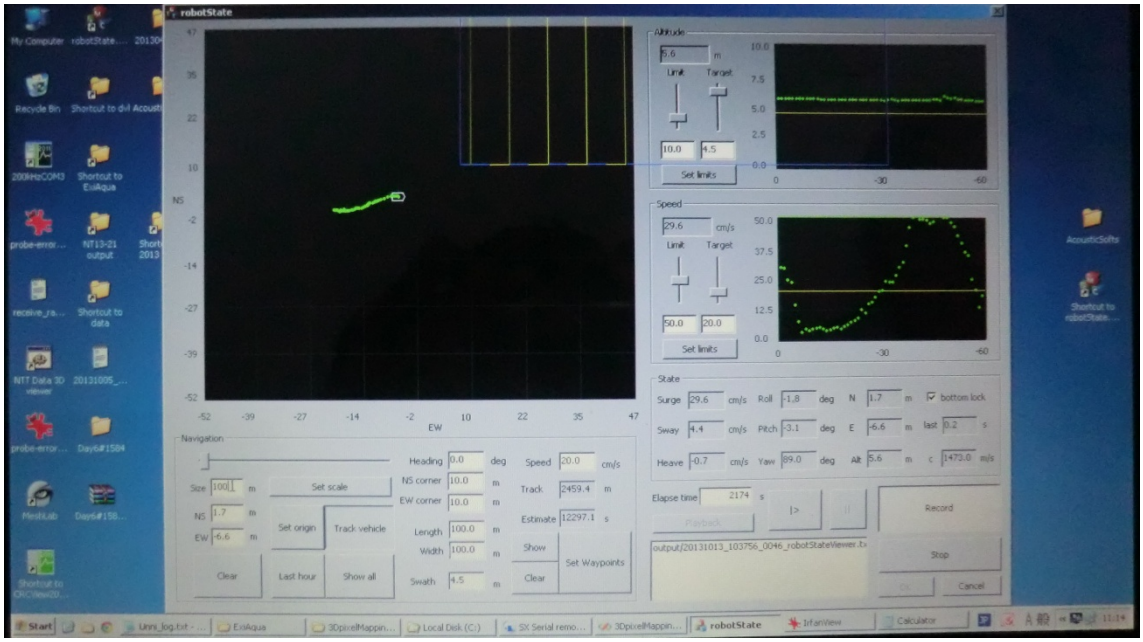

Fig. 1 GUI of the robotstate program

program calculates and displays the time required to complete the transects. The GUI also displays the altitude of the vehicle and speed of the vehicle.

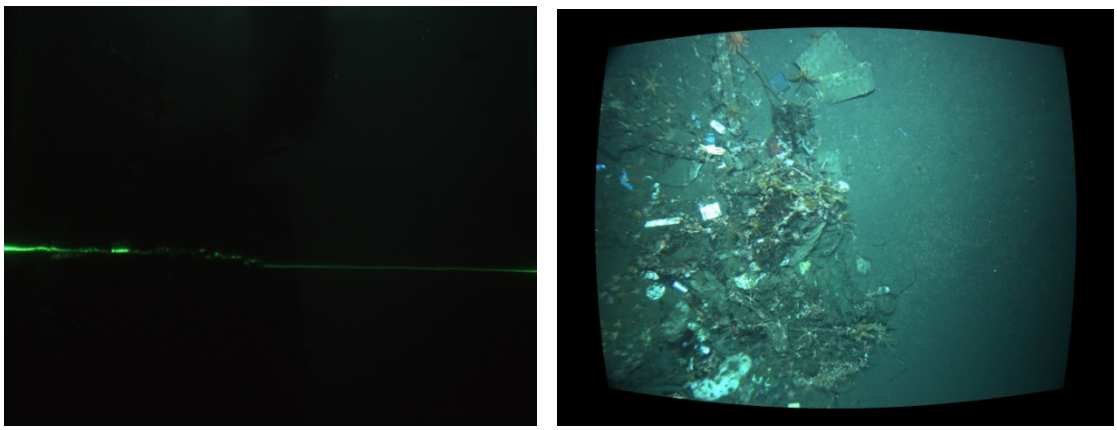

Fig. 2 Laser Profile and Flashed image used to generate 3D map

Target altitude and speed can be represented on the GUI to assist the ROV pilot to maintain the necessary altitude and speed that is ideal for the 3D mapping. The robot state program was run on the laptop of the 3D mapping team and it was also displayed on a screen in front of the ROV pilot. The program was found to be very useful in making accurate lawnmower patterns transects for the 3D mapping.

A 3D map generated from the survey data is shown in Fig. 3. The laser profile image and the illuminated image of the seafloor shown in Fig. 2 is used along with navigation data to generate the 3D map. The map shown

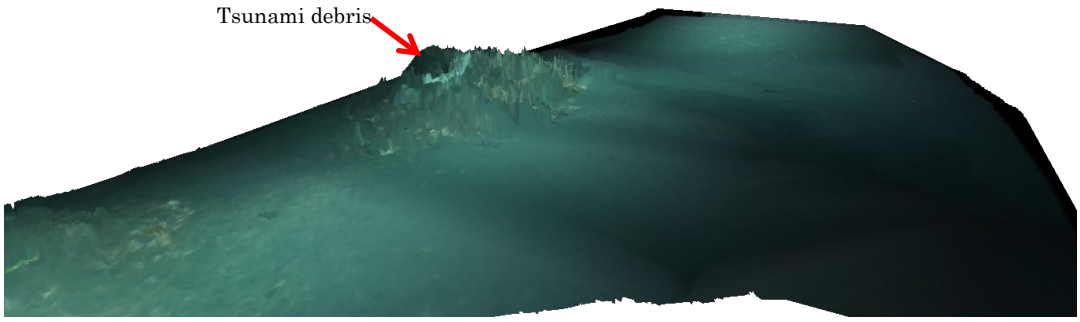

Fig. 3 3D map of the Surveyed area with Tsunami debris visible.

in the image is approximately 14m long and 5m wide. The tsunami debris patch has a height of 1m, length of 4m and width of 2.4m. Such three dimensional measurement can be used to accurately calculate volume of debris and the effect it has on the ecosystem around the area. The 3D data of the tsunami debris reminds us about the strength of natural disasters and sufferings faced by the people of Tohoku region and stresses the importance of preventive safety measures for safe guarding the community living in coastal areas.

During the cruise 3D mapping data was also obtained in several other areas. The data will be processed and used by the scientists to understand the topography of the areas under study and its ecosystem. The data will be also useful to improve the accuracy and efficiency of the mapping system.

3. Long-term measurement (Furushima)

The earth and sand which flowed in by great earthquake from the coastal region would have a serious influence on the environment of bottom topography and the marine surface sediment of the Sanriku offshore area. Simultaneity, would also affect the environment of the biomass in the offing. Therefore we initiated a long-term environmental measurement about the marine organism resources environment using lander systems from last August to monitor a reactivation process of the sea bottom environment with surroundings. Video camera, CTD, RDCP (Recording Doppler Current Profiler), turbidity sensor and DO sensor were put on a lander system.

In this cruise, we recovered using hyper dolphin by the lander system which we established in the Otsuchi offing last year. In addition, we carry out the detailed analysis of obtained data after this.

4. Geophysical survey results

Bathymetric data were collected by a hull-mounted multi-narrow beam mapping system SEABAT8160 aboard R/V Natsushima. The SEABAT system has hydrophone arrays that synthesize narrow,fan-shaped beams. The width of the sea floor mapping in a single swath is generally ca.0.7 times thelocal water depth, and the resolution of the depth measurement is generally within 0.25 % of the water depth. The SEABAT system can collect up to 126 soundings on each ping cycle over depths varying from 10 to 3,000 meters, providing swath width coverage up to 150°. The sound velocity profile of the local water column, which was used for calibration of depth, was estimated from a temperature profile based on in-situ XBT (Expendable Bathythermograph) measurements.

Figure 4-1 shows the mapped areas by the SEABAT system during this cruise. Figure 4-2 and 4-3 shows the mapped areas, which data were compiled in TOHOKU area to obtain in this project cruise (MR12-E01, YK12-12, NT12-12, NT13-21 Leg1, etc.).

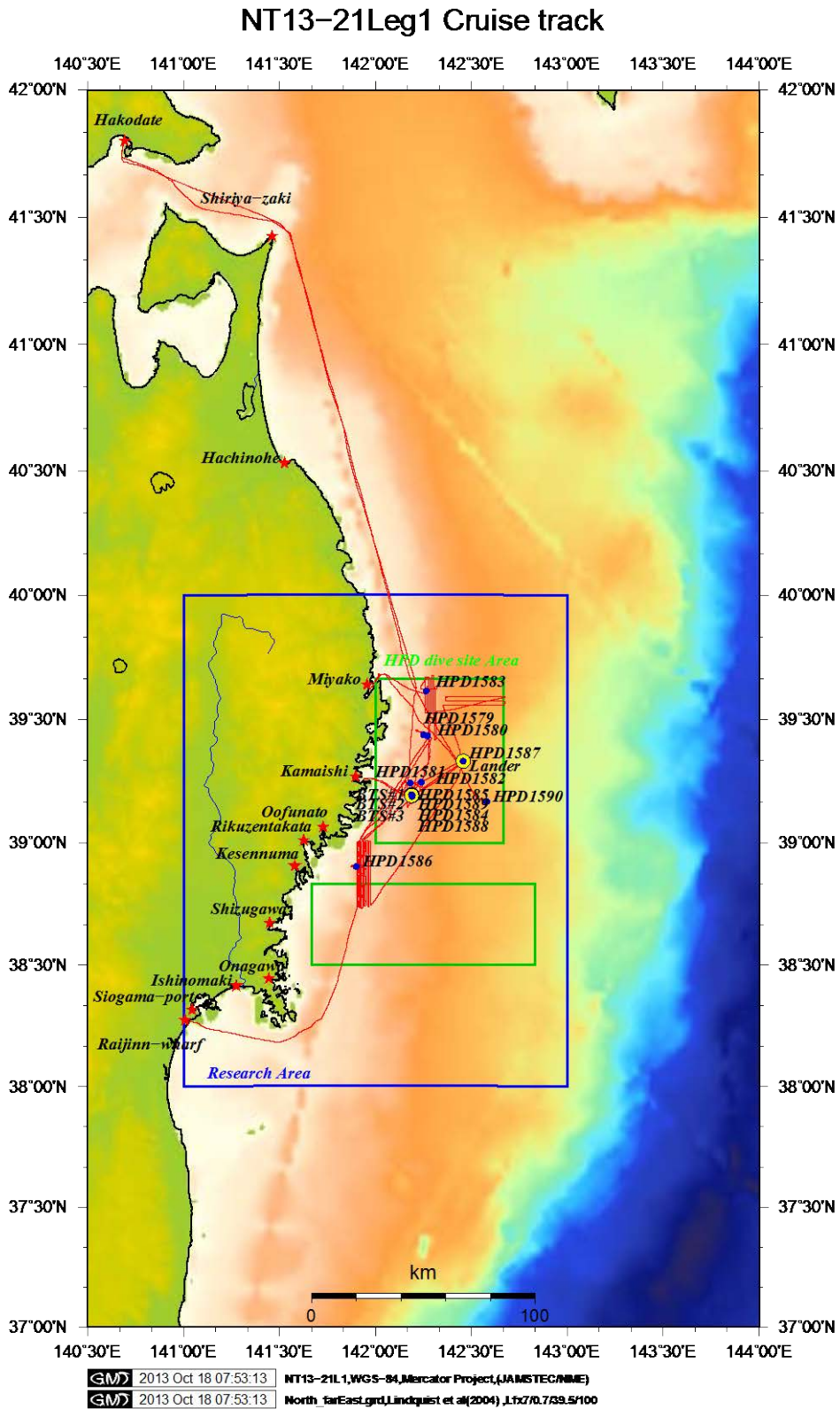
NT13−21Leg1 Cruise track
140°30'E
141°00'E
141°30'E
142°00'E
142°30'E
143°00'E
143°30'E
144°00'E
42°00'N
41°30'N
41°00'N
40°30'N
40°00'N
39°30'N
39°00'N
38°30'N
38°00'N
37°30'N
37°00'N
Hakodate
Shiriya−zaki
Hachinohe
Miyako
HPD dive site Area
HPD1583
HPD1579
HPD1580
HPD1587
Lander
Kamaishi
HPD1581
HPD1582
BTS#1
BTS#2
BTS#3
HPD1585
HPD1590
HPD1589
HPD1584
HPD1588
Oofunato
Rikuzentakata
Kesennuma
HPD1586
Shizugawa
Onagawa
Ishinomaki
Siogama−port
Raijinn−wharf
Research Area
km
0
100
GMT 2013 Oct 18 07:53:13
NT13−21L1,WGS−84,Mercator Project,(JAMSTEC/NME)
GMT 2013 Oct 18 07:53:13
North_farEast.grd,Lindquist et al(2004) ,1:fx7/0.7/39.5/100

Fig. 4-1.

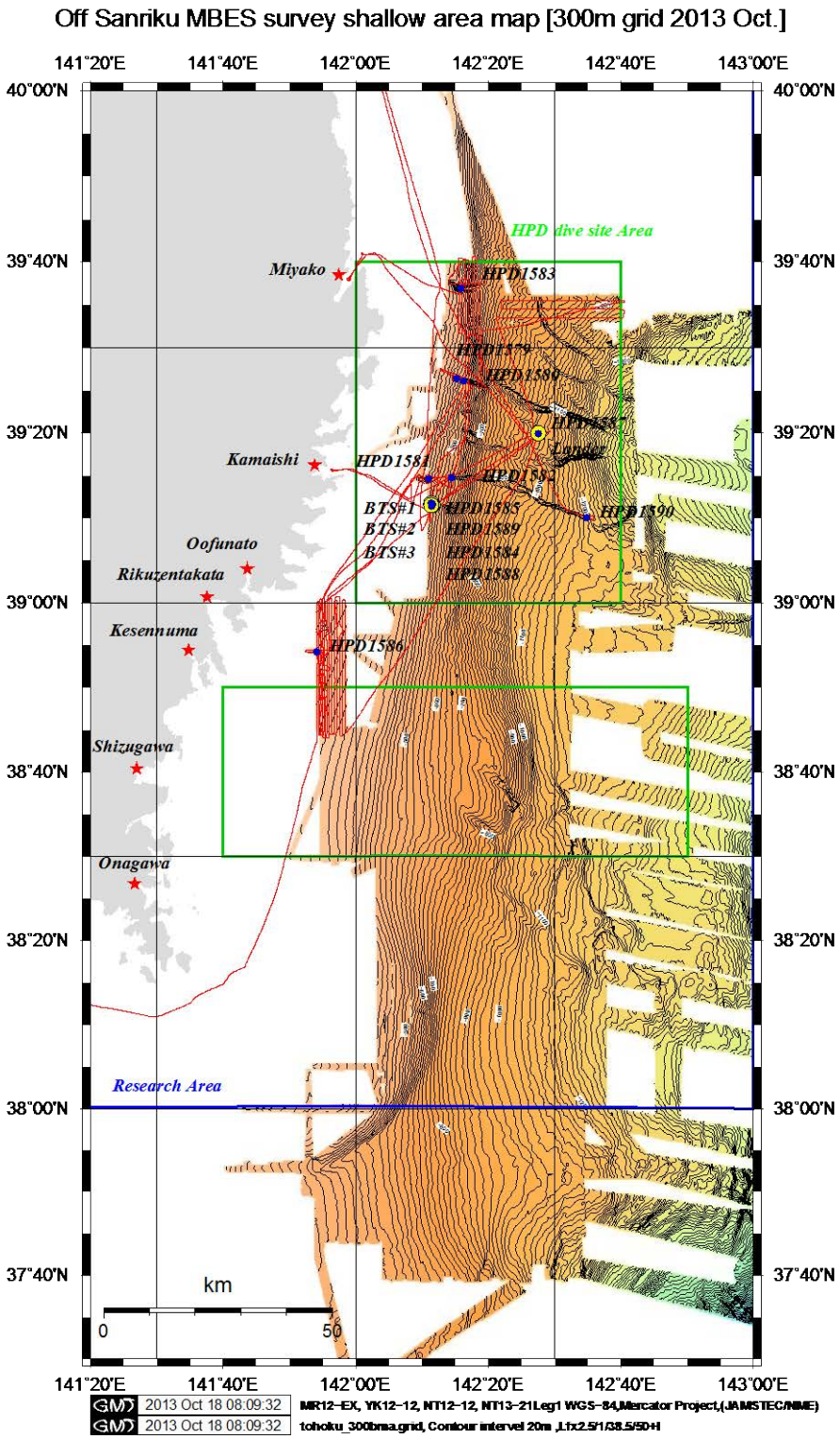
Off Sanriku MBES survey shallow area map [300m grid 2013 Oct.]
141°20'E
141°40'E
142°00'E
142°20'E
142°40'E
143°00'E
40°00'N
39°40'N
39°20'N
39°00'N
38°40'N
38°20'N
38°00'N
37°40'N
HPD dive site Area
Miyako
HPD1583
HPD1579
HPD1580
HPD1587
Unidet
Kamaishi
HPD1581
HPD1582
BTS#1
BTS#2
BTS#3
HPD1585
HPD1589
HPD1584
HPD1588
HPD1590
Oofunato
Rikuzentakata
Kesennuma
HPD1586
Shizugawa
Onagawa
Research Area
km
0
50
2013 Oct 18 08:09:32
MR12-EX, YK12-12, NT12-12, NT13-21Leg1 WGS-84,Mercator Project,(JAMSTEC/NME)
2013 Oct 18 08:09:32
tohoku_300bma.grid, Contour intervel 20m J1fx2.5/1/38.5/50+l

Fig. 4-2.

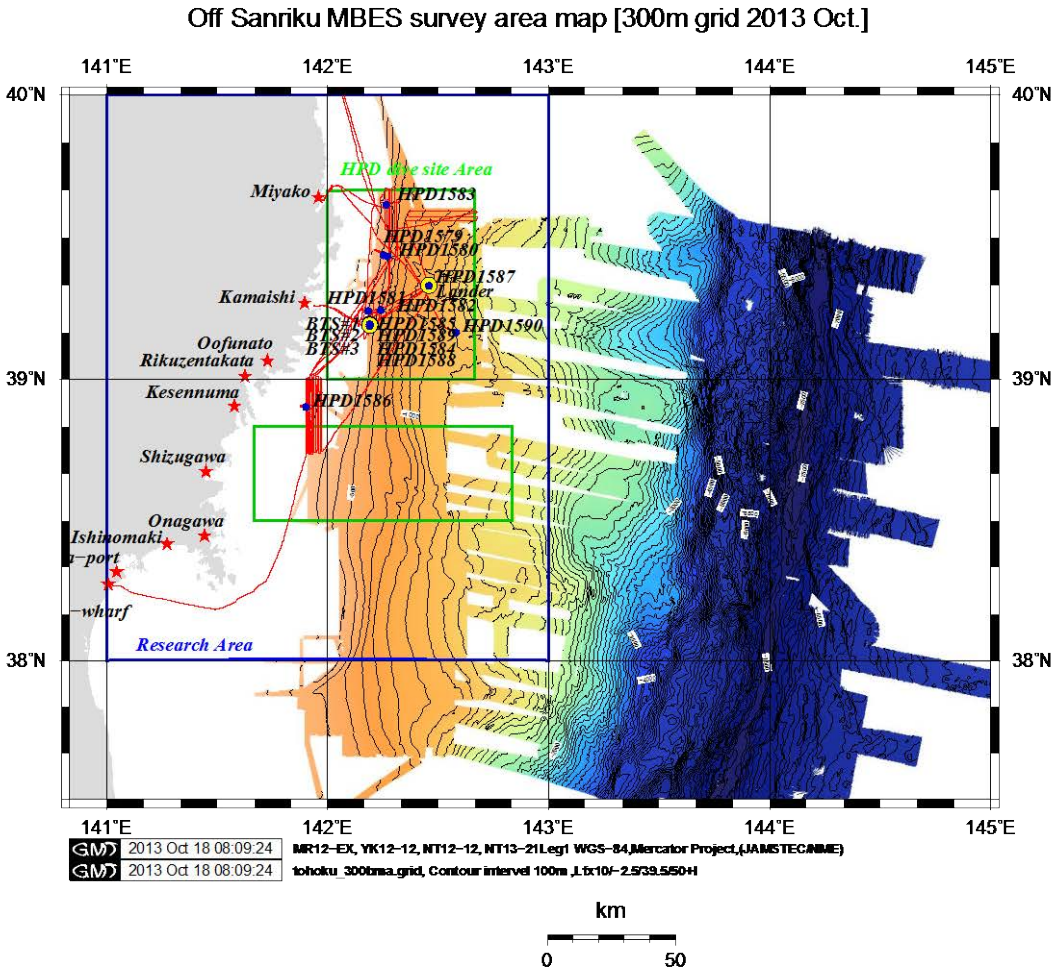
Off Sanriku MBES survey area map [300m grid 2013 Oct.]
141°E
142°E
143°E
144°E
145°E
40°N
39°N
38°N
HPD dive site Area
Miyako
HPD1583
HPD1579
HPD1580
HPD1587
Lander
Kamaishi
HPD1581
HPD1582
BTS#1
BTS#2
BTS#3
HPD1585
HPD1590
HPD1583
HPD1584
HPD1588
Oofunato
Rikuzentakata
Kesennuma
HPD1586
Shizugawa
Onagawa
Ishinomaki
-port
-wharf
Research Area
2013 Oct 18 08:09:24
2013 Oct 18 08:09:24
MR12-EX, YK12-12, NT12-12, NT13-21Leg1 WGS-84,Mercator Project,(JAMSTEC/MBE)
tohoku_300bma.grid, Contour interval 100m ,1:1x10/-2.5/39.5/50+l
km
0
50

Fig. 4-3.

5 Scientific results

The ROV *Hyper-Dolphin* dives (dive #1579-1590) were conducted off Tohoku from October 6 to 19, 2013 for understanding of influences of the 2011 Tohoku earthquake on the deep-sea ecosystem. The main results were as follows:

- Number of marine tsunami debris was small on the deep-sea floor (off Miyagi).
- A large amount of marine tsunami debris was distributed in submarine canyons (off Iwate) (Fig. 5-1-1).
- Total amount of marine debris was relatively small deeper than 1000 m.
- Three-dimensional mapping of deep-sea floors was conducted around marine tsunami debris for understanding of influences of the debris on ecological structures and biomass.
- The first deployment of bio-tracking systems was successfully conducted at a depth of 430 m off Tohoku. A mechanical trouble was occurred during recovery but all were safely retrieved.
- A deep-sea lander, which was deployed at a depth of 998 m on August 14, 2012, was safely recovered. All the instruments worked well for more than a year.
- The most dominant species in this area was ophiuroids like before the earthquake and fishery resources including *Sebastolobus macrochir*, *Gadus macrocephalus* and *Chionoecetes opilio* were widely distributed in our research areas.
- Biological sampling and sediment coring were conducted at each dive site.

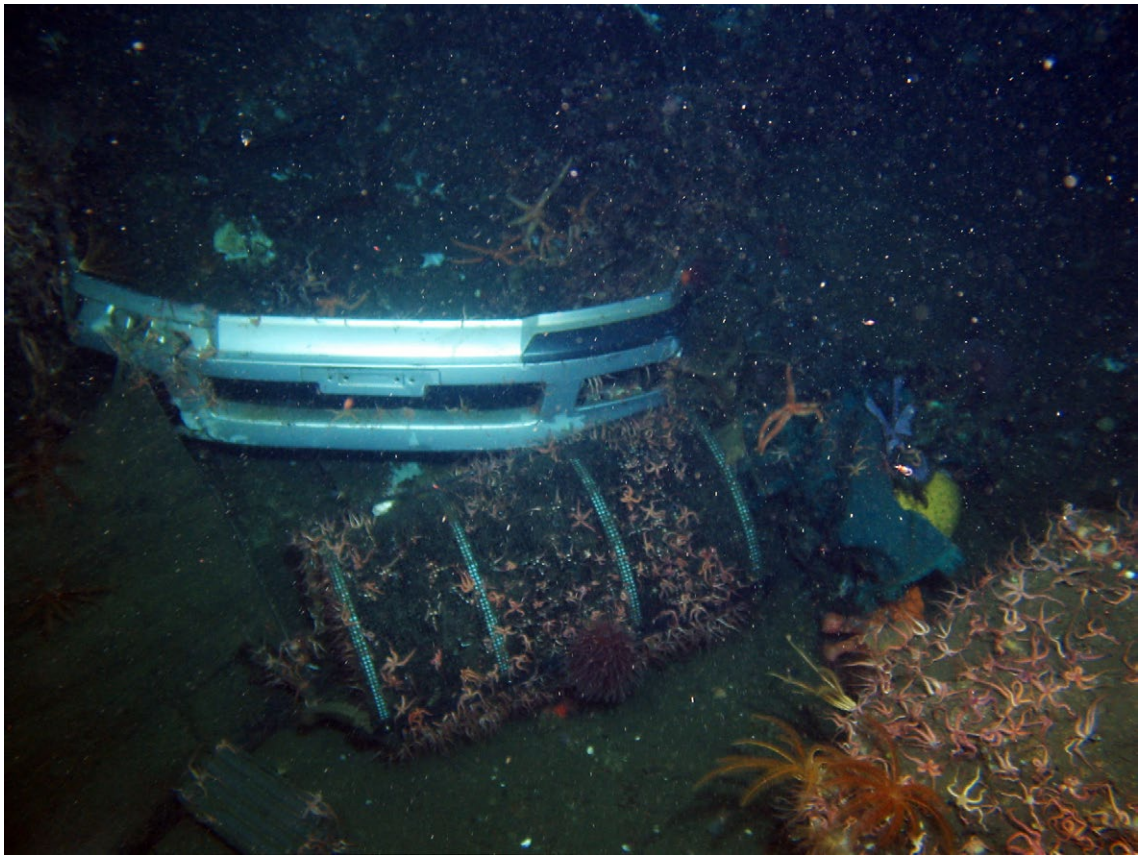

Fig. 5-1-1. A large amount of marine tsunami debris was distributed in submarine canyons (off Iwate).

6. Proposal for the future studies

Yoshihiro FUJIWARA

- Influence of the 2011 Tohoku earthquake on genetic diversity of *Ophiura sarsii*. Fujiwara, Y., Takahashi, Y., Kawato, M., T. Fujita, Kuramochi, T. etc.
- Influence of marine tsunami debris on ecological structures and biomass off Tohoku, Japan. Fujiwara, Y., Takahashi, Y., Tsuchida, S., Furushima, Y., Fujikura, K., Yamakita, T., etc.

Yasuo FURUSHIMA

In this cruise, recovered the lander system which we installed in the 1,000m depth point in the Otsuchi (Iwate prefecture) offing last year, and were able to obtain continuous environmental data for approximately one year. (The lander system which we installed in the point of 300m depth was recovered before this cruise by the bottom fishing trawler.) Carry out analysis of these environmental data, and understand the characteristic of the fishery environmental fluctuation in the Sanriku offing (from sea bottom floor to the surface layer). Furthermore, long-term environmental monitoring continues, and carry out by installing lander systems in the point of the Otsuchi offing again.

Additionally, it is important that we compare the environmental variation in the coastal region with the environmental measurement result provided by a lander system. In the Otsuchi offing, AORI (Atmosphere and Ocean Research Institute University of Tokyo) installs mooring system, and carry out a short-term physical environmental measurement. Therefore we want to try for the understanding of the fishery environmental fluctuation of the Sanriku offing in comparison with the result of AORI. Simultaneously, we want to provide fishermen with effective fishery oceanic conditions information.

P.V. aaUNNIKRISHNAN

3D mapping system

During this cruise we found that in many of the survey areas with relatively shallow depth of 500m, there was lot of marine snow and so the water appeared turbid. Hence visibility was poor and mapping could not be carried out from high altitude. The mapping system used during the present cruise is called Long range mapping system and is specially designed and developed for high altitude mapping from 4m to 10m altitude using strobe lights and high sensitive cameras. However during majority of the survey in this cruise we experienced that it is necessary to survey close to the seafloor at about 1m altitude to search for tsunami debris and to observe the ecosystem in the surrounding areas. Hence we found that it will be more efficient to have a 3D mapping system which is also capable of surveying from close range. We already posses a system called seaXerocks1 which is capable of mapping from about 2meter altitude. Hence in future we propose to develop a hybrid system which has capability of close range as well as long range mapping, so that 3D mapping can be carried out in clear as well as turbid waters and alos during close seafloor observation.